ISLIP RESOURCE RECOVERY AGENCY

PRESUMPTIVE REMEDY

FINAL CLOSURE PLAN

SONIA ROAD LANDFILL
WEST BRENTWOOD, NEW YORK

SITE REGISTRY NO. 152013

Dvirka and Bartilucci
Consulting Engineers

DRAFT APRIL 1998
FINAL JANUARY 1999

PRESUMPTIVE REMEDY

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SONIA ROAD LANDFILL
WEST BRENTWOOD, NEW YORK

(SITE REGISTRY No. 152013)

PREPARED FOR

TOWN OF ISLIP
ISLIP RESOURCE RECOVERY AGENCY

BY

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TOWN OF ISLIP
ISLIP RESOURCE RECOVERY AGENCY
SONIA ROAD LANDFILL
FINAL CLOSURE PLAN

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Section 1

1.0 STATEMENT OF PURPOSE

This Presumptive Remedy Report (Engineering Design Report) has been prepared on behalf of the Town of Islip as the Owner of the Sonia Road Landfill, NYSDEC Site No. 152013. This report is intended to address the engineering aspects of designing and constructing a landfill capping/closure system as a presumptive remedy for remediation of the Sonia Road Landfill.

The format of this report is intended to provide general conformance with the requirements of 6 NYCRR Part 360, Section 2.15(c), Final Closure Plan. When appropriate, issues normally associated with a site investigation report and/or conceptual closure plan, which have been identified through the course of the remedial investigation as requiring remediation, will also be addressed in this report.

This report for the design and construction of a Part 360 cap, including a landfill gas control system, is submitted to the NYSDEC for consideration and satisfaction of the Order on Consent as a presumptive remedy. Based on the results of the feasibility study, no additional remedial actions, other than those addressed in this Presumptive Remedy Report, are proposed.

Section 2

2.0 INTRODUCTION

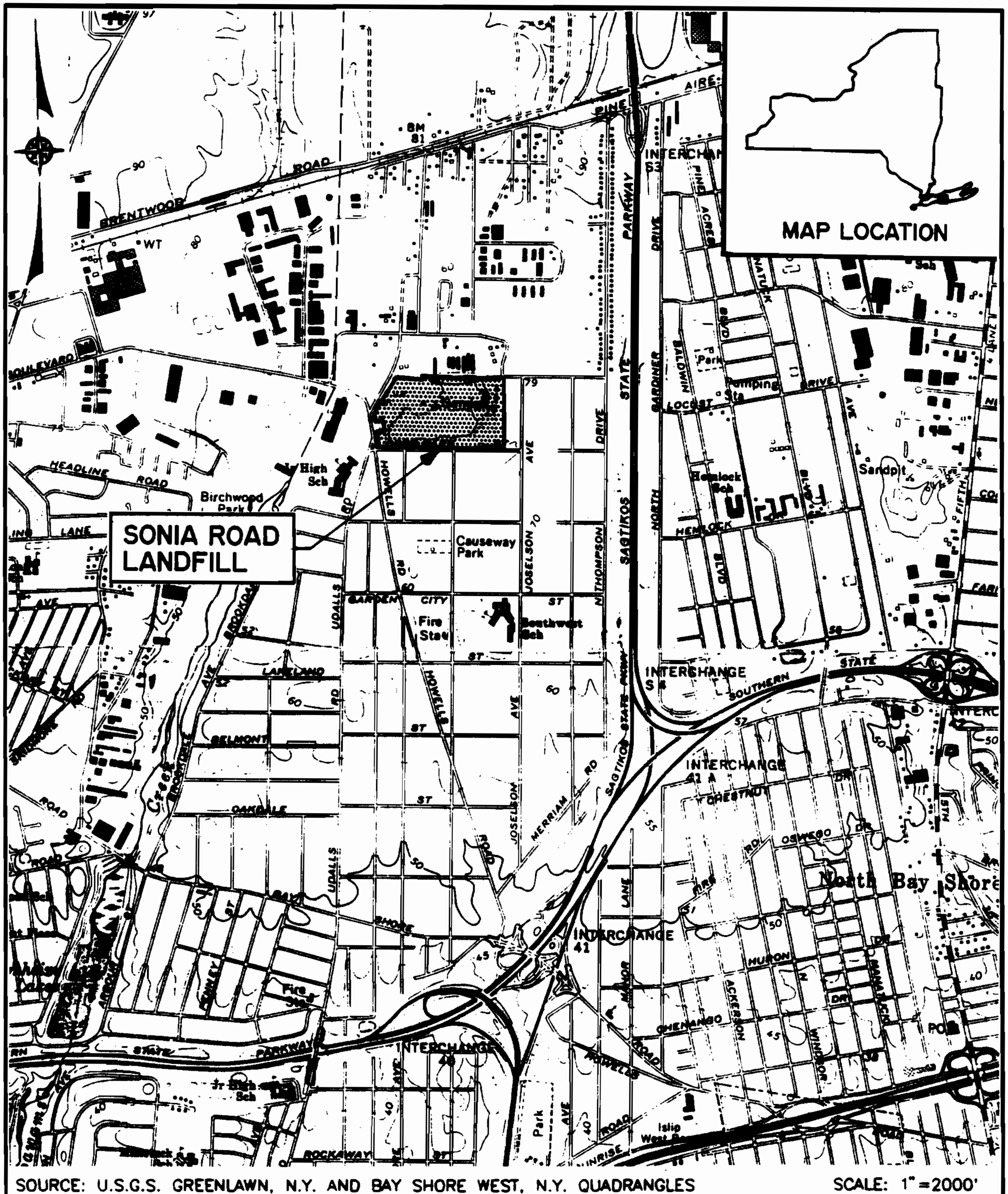
2.1 Site Description

The Sonia Road Landfill is an inactive municipal solid waste landfill owned and operated by the Town of Islip. The landfill is located in the western portion of the Town of Islip in the hamlet of Brentwood and is in close proximity to the western town boundary between the Towns of Islip and Babylon. The location of the Sonia Road Landfill is depicted on Figure 2-1.

The landfill property is approximately 42.2 acres in area and is generally rectangular in shape. The landfill is bounded to the north by industrial properties, to the east by residential properties, to the south by Deer Park Street with residential properties beyond, and to the west by Howell's Road, Secatogue Road and Corbin Avenue with industrial properties beyond. In the vicinity of the southwest corner of the property is one residential parcel (Tax Map No. 221-2-1) which is not part of landfill property described above. At the northwest corner of the property is a 0.5 acre parcel owned by the Town of Islip (Tax Map No. 198-5-7.3) and is identified as a paper street. Given that the waste mass extends onto this parcel, this parcel will be considered as part of the landfill property. Therefore, the overall landfill property shall be considered as 42.7 acres in area. At and abutting the northeast corner of the landfill property is the western extension of Sonia Road for which the facility is named. Table 2-1 provides a listing of the property identification and ownership of parcels immediately abutting the landfill property. The property survey is depicted as Figure 2-2.

The landfill site serves as a break between the industrial areas to the north and west versus the residential area to the east and south. The landfill property itself is zoned Industrial I and Industrial II with a small portion along the southeastern boundary as residential. A zoning map of the site is depicted as Figure 2-3.

To the southwest of the landfill property is the West Brentwood Middle School, which is located on the west side of Howell's Road. Beyond the school property to the south and west is



SONIA ROAD LANDFILL
FINAL CLOSURE PLAN

SITE LOCATION MAP

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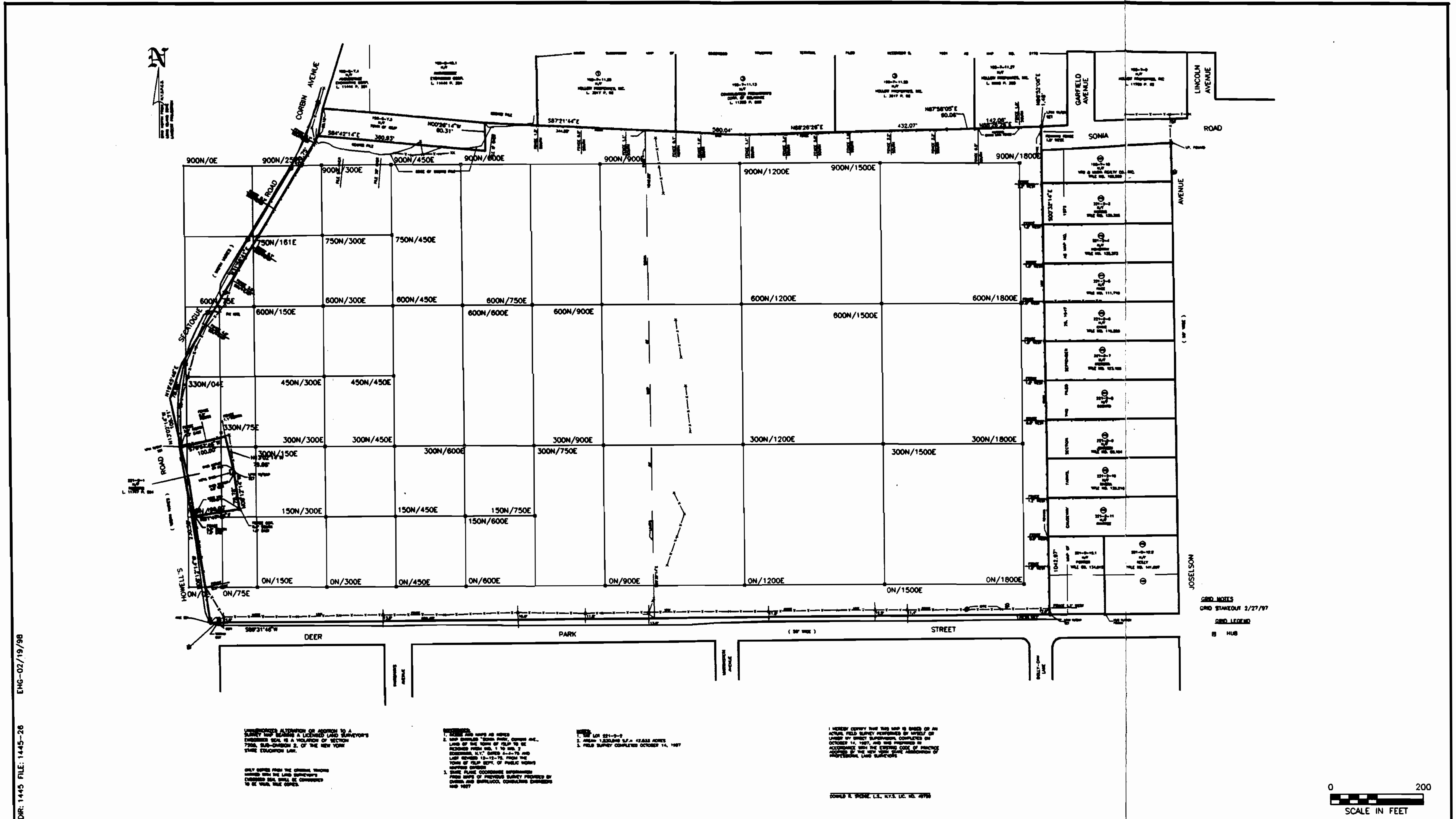
FIGURE 2-1

Table 2-1

SONIA ROAD LANDFILL
IMMEDIATELY ADJACENT PROPERTIES

Tax Map No.	Ownership
221-2-1	N/F Roberts
198-5-7.4	N/F Augusiewicz Excavating Corp.
198-6-12.1	N/F Augusiewicz Excavating Corp.
198-7-11.29	N/F Hollow Properties, Inc.
198-7-11.13	N/F Consolidated Freightways Corp. of Delaware
198-7-11.28	N/F Hollow Properties, Inc.
198-7-11.27	N/F Hollow Properties, Inc.
198-7-10	N/F Vito & Maria Realty Co., Inc.
221-2-3	N/F Morris
221-2-4	N/F Komornik
221-2-5	N/F Pace
221-2-6	N/F Iovine
221-2-7	N/F Mierzwa
221-2-8	N/F Dodard
221-2-9	N/F Johnsen
221-2-10	N/F Rivera
221-2-11	N/F Ramirez
221-2-12.1	N/F Pointer



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SONIA ROAD LANDFILL
FINAL CLOSURE PLAN

PROPERTY SURVEY AND ON-SITE GRID

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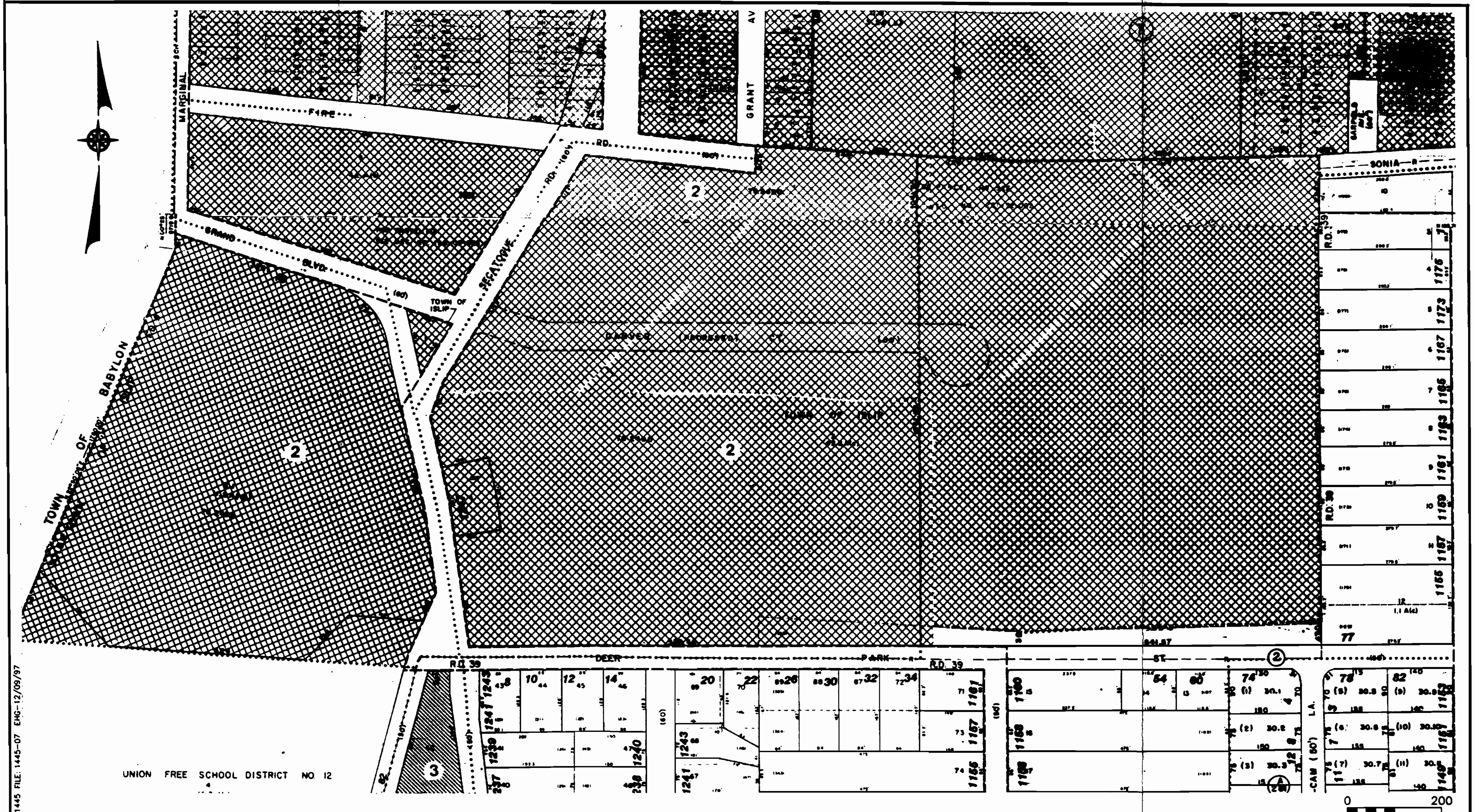
FIGURE 2-2



SOURCE: TOWN OF ISLIP DEPT. OF PLANNING AND DEVELOPMENT

SONIA ROAD LANDFILL
FINAL CLOSURE PLAN

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ZONING MAP OF SITE

FIGURE 2–3

the headwaters of the Sampawams Creek. The Sampawams Creek is fed by groundwater discharge as well as storm water management systems for the surrounding areas. The Sampawams Creek runs from north to south and empties into the Guggenheim Lakes which are located north of the Southern State Parkway. The Sampawams Creek generally describes the western boundary of the Town of Islip and the eastern boundary of the Town of Babylon. The Sampawams Creek ultimately discharges to the Great South Bay.

The Sonia Road Landfill has been identified by the New York State Department of Environmental Conservation (NYSDEC) as an inactive hazardous waste disposal site, Site No. 152013. Prior to this program, the site has been the subject of Phase I and Remedial Investigation/Feasibility Study (RI/FS) investigations and has been categorized as a Class 2 site which, according to the definition provided by NYSDEC, poses a significant threat to the public health or environment for which action is required.

2.2 Site History

The 42.2-acre Sonia Road Landfill site has been owned by the Town of Islip since 1965. Prior to 1965, the site was privately owned and used as a source of mined sand and gravel. As a result of this mining operation, virtually all of the site was disturbed, including the removal of vegetation, topsoil and underlying minerals. The mining operation was extensive with the removal of minerals progressing down to and beyond the water table. Removal of minerals below the water table was accomplished through the use of a dredging operation. This activity resulted in the formation of a groundwater lake over a significant portion of the site, on the order of at least 40 to 50 percent of the site. It is reported that this dredging operation may have removed materials to a depth approaching 50 feet below the water table (Town of Islip, 1982 and NYSDEC, IIWA Rev. July 1994). The depth of dredging below the water table is contradicted by a May 1979 Suffolk County Department of Health Services (SCDHS) report which suggests that, based upon three borings, the limits of dredging are estimated to be 6 to 11 feet below the water table. The written description locating these three borings suggests that they may have been located at the edges of the dredged area. Therefore, there may be some validity to the suggestion that dredging of minerals progressed to 50 feet below the water table. A Golder Associates report dated June 1995 and prepared for the Islip Resource Recovery Agency reports that dredging occurred to a depth of approximately 50 feet below the land surface, rather than 50 feet below the water table, a discrepancy of approximately 20 feet.

Soil borings constructed as part of the Remedial Investigation confirmed that waste lies at least 36 feet into the water table.

For the purpose of this report, it should be sufficient to note that the site was excavated to an appreciable depth below the water table, that municipal solid waste was used to backfill the excavation and that a significant quantity of waste lies below the water table.

In 1965, the Town of Islip took title to the Sonia Road property and began a landfilling operation for the disposal of municipal solid waste. Landfilling of the site occurred between 1965 and 1977. The most active period of landfilling occurred between 1965 and 1974. It has been estimated (Town of Islip 1982) that between 1.5 and 2.0 million cubic yards of waste was disposed of at the site. Given the uncertainty over the lower limits of waste, as discussed above, this estimate should be considered reasonable. There are no weigh records to support or refute this estimate.

The landfill accepted all municipal solid waste delivered to the site. This waste is reported to include wood, concrete, metal, plastic, glass, household waste in the form of refuse, rubbish, demolition materials and yard wastes (particularly leaves). It is also reported that junk automobiles were routinely disposed of at the facility and that underground fires were common. The documentation suggests that the eastern half of the excavation was filled to grade first and that the final stages of landfilling were completed on the western half of the site. Figure 2-4 provides a general site plan of the property.

In the early 1970s, the eastern half of the landfill was converted into a local park consisting of a baseball diamond, soccer/football field, parking lots, a mini-bike track, and a

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SONIA ROAD LANDFILL
FINAL CLOSURE PLAN

SITE PLAN

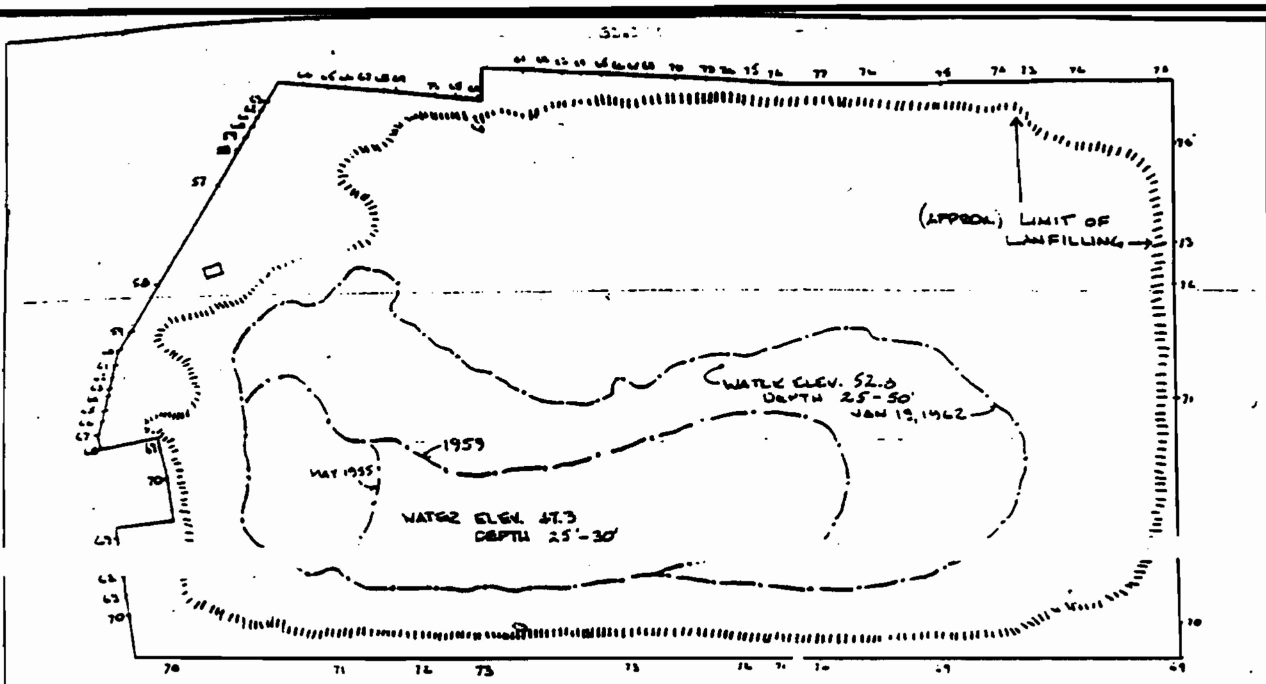
FIGURE 2-4

bathroom facility. Along the east and southern boundaries of the eastern half, earthen berms were constructed of soil and demolition debris to act as a buffer between the landfill and the nearby residences. The earthen berms also served as bleachers for spectators during sporting events. Figure 2-5 is excerpted from the Town of Islip's 1982 report and suggests the limits of waste, depth of dredging and use of the eastern half as a park.

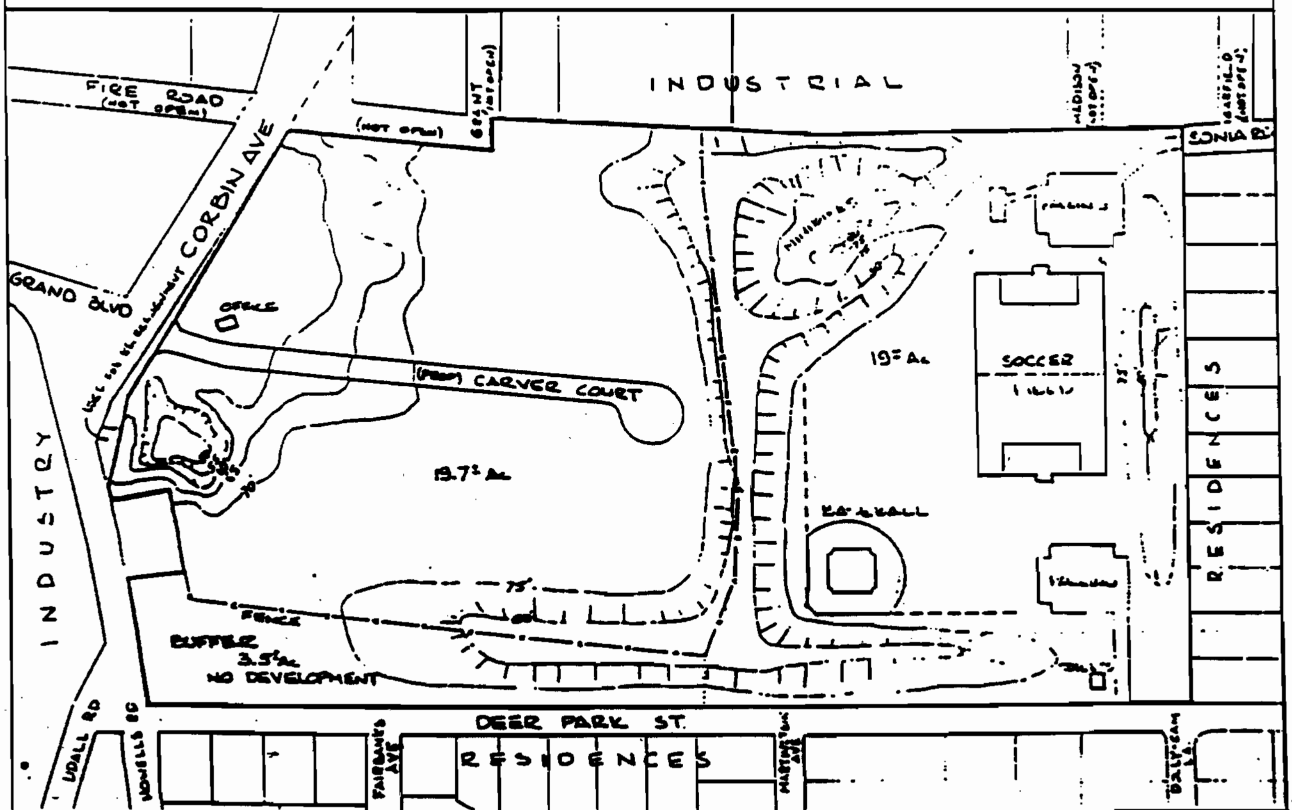
Difficulties experienced by the Town in developing the site as a park included settlement and the occurrence of waste materials, such as tires and mattresses, "floating" to the surface. In the 1982 Town of Islip report, the severe settlement experienced in the 1970s had become almost imperceptible. The reports of buried tires floating to the surface was very common at landfills which received tires due to the nature of the tire carcass to accumulate gas and become buoyant. The Town of Islip utilized the eastern half of the site as a local park through the 1970s and into the early 1980s.

For a period in the early to mid 1970s, the western half of the landfill continued to operate as an active landfill while the eastern half was utilized as a park. In 1973 and 1974, it is alleged that a total of approximately 400 cubic yards of hazardous materials were deposited at the site by Hooker Chemical. Given the fill progression reported, these wastes were most likely deposited in the western half of the landfill. These wastes are reported to consist of gravel containing polyvinyl chloride, trimellitate plasticizers, 2-ethylhexanol and other alcohols. In addition, there have been unconfirmed allegations that trichloroethene and plating sludge may have been disposed of at the landfill.

On the basis of these allegations and the results of a groundwater investigation conducted by the Suffolk County Department of Health Services in 1981 and 1982, the site was identified as an Inactive Hazardous Waste Disposal Site (Site No. 152013) by NYSDEC. A Phase I investigation was performed by Woodward Clyde in 1986 and an Immediate Investigation Work Assignment (IIWA) was performed by NYSDEC in 1994. As a result of these investigations, the Sonia Road Landfill has been categorized as a Class 2 Inactive Hazardous Waste Site which poses a significant threat to the public health or environment and for which action is required.



LANDFILLING LIMITS



FINAL SITE PLAN

0 200 400 600 FEET

N

42.4 ACRES TOTAL

SONIA ROAD LANDFILL

SOURCE: TOWN OF ISLIP REPORT 1982

SONIA ROAD LANDFILL
FINAL CLOSURE PLAN

HISTORICAL DATA

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FIGURE 2-5

A more thorough discussion of prior studies and the results of those studies may be found in the Remedial Investigation Report prepared for the site as well as a discussion of other potential sources of groundwater contamination which exist in the vicinity of the Sonia Road Landfill.

For the purpose of this Engineering Design Report, it should be sufficient to note that the capping/closure of the Sonia Road Landfill shall serve as the minimum remedial action required and is, therefore, pursued as a presumptive remedy. The capping/closure of the landfill will be pursued irrespective of any or all other remedial actions which may be required. This approach is consistent with the guidance offered by the NYSDEC TAGM No. HWR-92-4044, Accelerated Remedial Actions at Class 2, Non-RCRA Regulated Landfills. A copy of the TAGM is enclosed for reference as Appendix A.

2.3 Existing Conditions

The Sonia Road Landfill is inactive and last received waste in the year 1977. The eastern half of the landfill last received waste in the early 1970s and by 1973-1974 had been converted to a local park. The western half of the landfill continued receiving wastes up until 1977. In the early 1980s, the use of the eastern half of the landfill as a local park was discontinued. Since that time, the site has not been utilized for a secondary purpose.

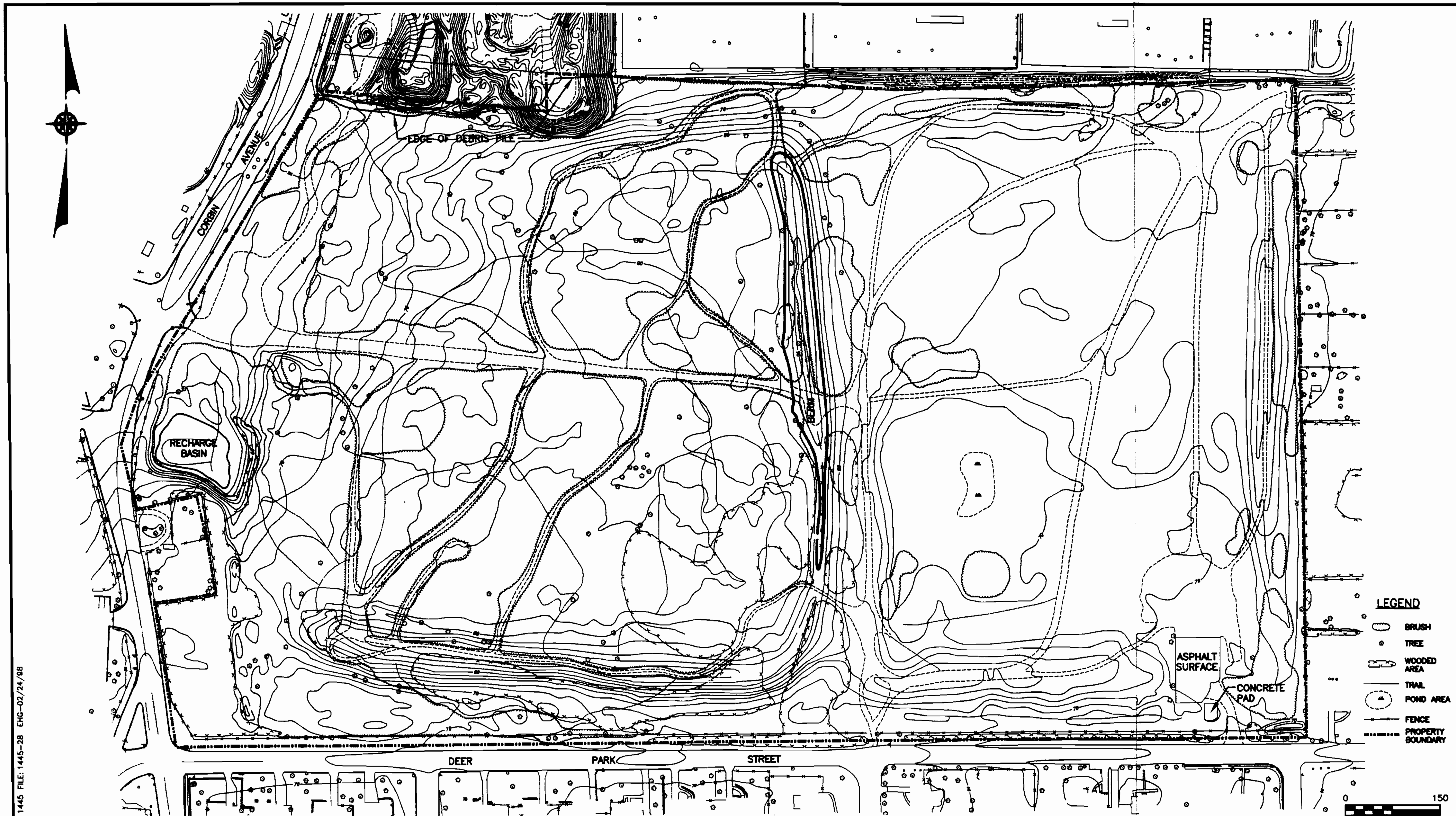
In the 20 plus years since active landfilling was discontinued, natural vegetation has established itself over what was a thoroughly disturbed and filled site.

The site can be categorized as a generally flat to mildly sloping site. The eastern half and the western half of the site are separated by a berm roughly 15 feet in height representing the continued landfilling of the western half after the eastern half was converted to a park. The eastern half of the site is essentially flat with mild interior depressions. During periods of precipitation, these depressions accumulate surface water run-off and may pond the water until dissipated by percolation or evaporation.

There are no structures or obvious features remaining on the eastern half, other than an asphalt area and a concrete pad, which would reflect the use of this area as a park. The ground surface of the eastern half generally ranges in elevation from 76 feet AMSL to 69 feet AMSL with a mild, irregular slope from north to south and from west to east. The topography of the eastern half is punctuated by two screening berms located along the eastern and southern boundaries and serve to limit the view of the landfill property from the adjacent residences. The eastern berm is approximately 450 feet in length (north to south) and achieves a relative height of 6 to 7 feet against the surrounding grades. The southern berm is approximately 400 feet in length (east to west) and achieves a relative height of 9 feet against the surrounding grades. It has been reported that these screening berms were constructed with soil and demolition debris and may also include derelict automobiles and/or automobile parts. The existing site features and topography are depicted on Figure 2-6.

The western half of the site is separated from the eastern half by a central ridge which rises approximately 15 to 18 feet to the higher western half. The western half is also mildly sloping from the center of the landfill towards the southwest and northwest corners of the property. A portion of the western half grades sharply to the north. Along the southern boundary of the western half, a screening berm exists to buffer the residential properties beyond Deer Park Street. This screening berm is approximately 700 feet in length (east to west) and achieves a relative height of approximately 16 feet against the surrounding grades. This southern berm is actually a continuation of the central ridge which runs north-south through the site. There are no permanent surface features located in the western half which would suggest that this area was used for secondary purposes after the landfilling activity ceased.

There are no surface waters or mapped wetlands on or immediately adjacent to the landfill property. Access to the site is limited by a perimeter chain link fence located at or in close proximity to the site property line. A breach in the fencing exists in the northwest corner of



SOURCE: GEOMAPS INTERNATIONAL, MARCH 1995

SONIA ROAD LANDFILL
FINAL CLOSURE PLAN

SITE FEATURES MAP

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FIGURE 2–6

the site where soil and/or processed C&D stockpiles have encroached onto the narrow parcel identified as a paper street as well as onto the landfill property itself. In this area of encroachment, the chain link fence has been removed by others. During the course of the Remedial Investigation, the encroachment of these stockpiles onto the landfill property was realized and the Town issued a directive to the owner to have these stockpiles removed. This removal operation was ongoing as of April 1998. Consequently, the topographic features depicted in the northwest corner as existing conditions (date of aerial photo, March 16 1995) are subject to change as a result of this material removal. However, these revisions to "existing" topography should be considered minor relative to the overall site and will be addressed as part of the plans and specifications for implementation of the capping/closure.

Disturbances to the existing surface vegetation in the form of trails, tracks or dirt roads suggest that the site is used for dirt bikes, 4-wheel drive recreational vehicles and the like. This activity is not sanctioned by the Town of Islip.

As part of the remedial investigation effort, a number of activities routinely associated with a Closure Site Investigation were performed. These activities include a hydrogeologic investigation, explosive gas investigation, surface leachate investigation and a vector investigation. Additionally, a program to define the lateral limits of the waste was performed to more clearly define the areas of the site which must be capped and closed, or addressed through waste excavation and relandfilling.

A discussion of the hydrogeologic investigation and its findings is provided in the Remedial Investigation Report. For the purpose of this report as addressing the presumptive remedy of landfill capping/closure, a detailed discussion of the hydrogeologic setting is not necessary given that it does not have direct implications to the details of the capping system. For this purpose, it should suffice to note that groundwater elevations are on the order of 46 to 50 feet AMSL and range from approximately 6 to 30 feet below the existing ground surface. It is further noted that, as previously discussed, a substantial portion of the waste mass was placed into the groundwater during filling of the groundwater lake which resulted from the prior mining operation. Groundwater movement across the site is in the southeast direction. The installation of a cap over the waste mass will serve to inhibit the vertical percolation of infiltrated precipitation through the unsaturated waste mass situated above the water table. However, installation of the cap will not mitigate the natural movement of groundwater through the waste mass which was deposited below the water table.

The Sonia Road Landfill is located in the northern portion of Hydrogeologic Zone VII as defined in the Long Island Waste Treatment ("208") Management Plan. Hydrogeologic Zone VII is characterized by shallow groundwater flow systems that discharge to streams and marine waters. The transition zone between Hydrogeologic Zones I and VII is located approximately 2,000 feet to the north of the Sonia Road Landfill. Hydrogeologic Zone I is characterized by deep groundwater recharge contributing to the middle and lower portions of the Magothy aquifer.

A discussion of the pertinent findings of the Remedial Investigation as they relate to the construction of a capping system follows. A thorough discussion of the remedial investigation program and its findings may be found in the Remedial Investigation Report.

2.3.1 Waste Material

Based on the four on-site soil borings constructed as part of the remedial investigation, SB-01 through SB-04, the thickness of landfilled waste ranges from 32 feet in SB-01 in the north-central portion of the landfill to 59 feet in SB-03 in the south-central portion of the landfill. Based on groundwater level measurements, waste is between 4 feet and 36 feet below the water table at these locations. Directly beneath the waste at each boring location is gray to dark gray fine to coarse sand. The Soil Boring Logs for SB-01 through SB-04 are contained in the Remedial Investigation report.

The results of the soil borings constructed during this investigation, in general, showed waste to be greater in thickness and deeper into groundwater as compared to the borings constructed as part of the previous study conducted in 1975, which indicated waste to be 29 to 35 feet in thickness and extending from 6 to 11 feet below the water table. However, the location of the earlier soil borings were closer to the perimeter of the landfill as compared to the remedial investigation borings which were located more in the central portion.

Based primarily on observations during construction of the test pits and trenches at the landfill, the waste material consists primarily of plastic bags containing household refuse and decomposed leaves, sand, silt, wood (including plywood, railroad ties, boards, tree trunks and branches), metal (including automobile parts, appliances, scraps and entire automobiles [reported]), plastic, paper, cardboard, glass, and construction and demolition (C&D) debris, comprising mainly concrete and asphalt.

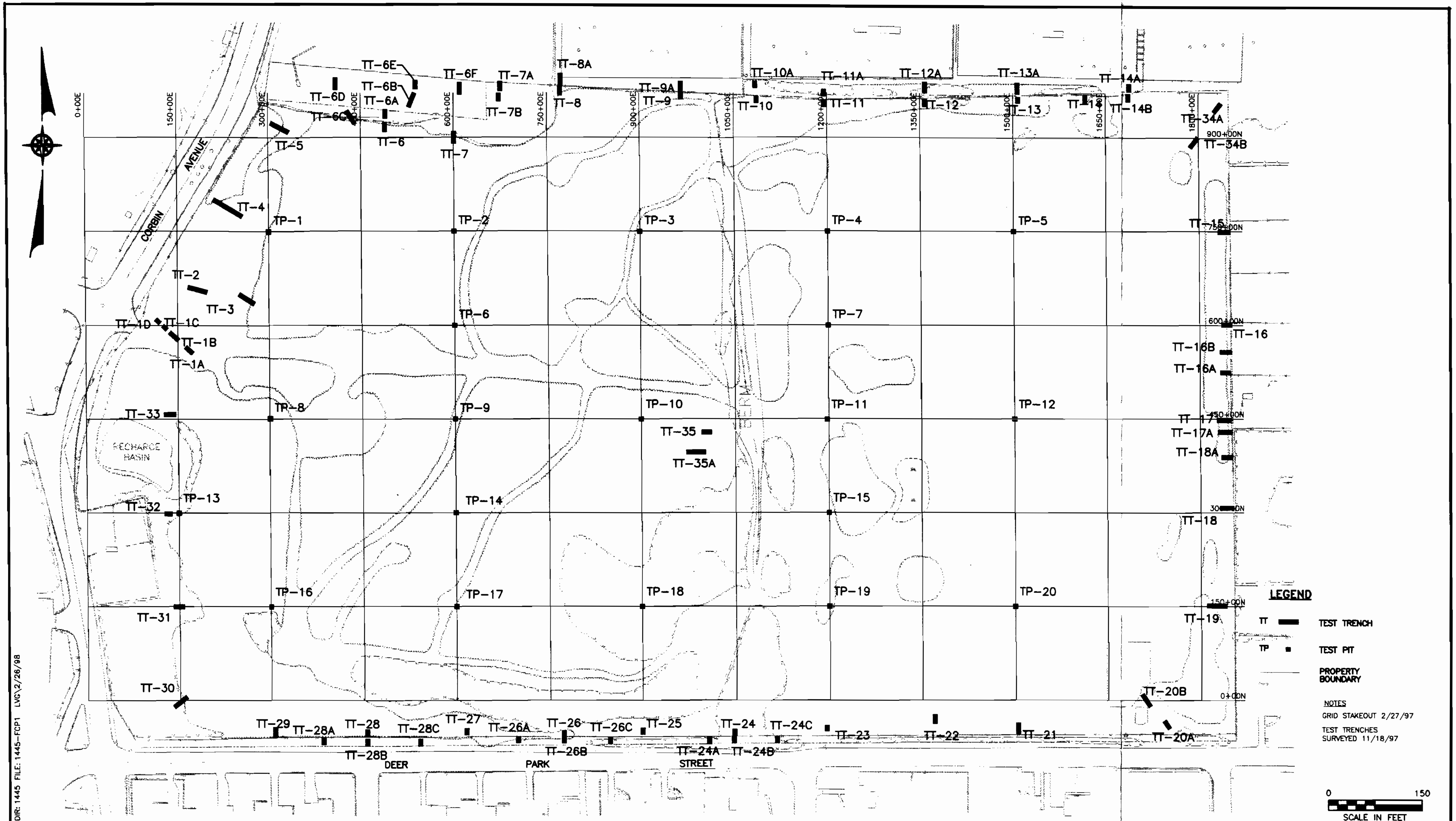
2.3.2 Soil Cover Thickness

Based on 20 test pits (TP-1 through TP-20) constructed throughout the Sonia Road Landfill during the Remedial Investigation, the thickness of the soil cover ranged from approximately 3" at TP-10, located in the central portion of the landfill, to 30" at TP-19, located in the south-central portion of the landfill (see Figure 2-7). However, there are portions of the landfill where waste was observed at the surface. The soil cover thickness measured for each test pit is presented in Table 2-2. In addition, the soil cover thickness was one foot at soil boring location SB-01, two feet at SB-02 and SB-03, and four feet at SB-04.

Based on these results, the average thickness of existing soil cover at the Sonia Road Landfill is about one foot. The thickness of soil cover is greater in the eastern portion of the landfill as compared to the western portion. This is likely the result of development of the former ballfields in the eastern area of the site.

2.3.3 Waste Delineation

Based on 63 test trenches constructed along the perimeter of the Sonia Road Landfill, the approximate horizontal extent of the waste has been delineated, the limits of which are illustrated



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SONIA ROAD LANDFILL
FINAL CLOSURE PLAN

TEST PIT AND TEST TRENCH LOCATIONS

FIGURE 2-7

Table 2-2

SONIA ROAD LANDFILL
EXISTING SOIL COVER THICKNESS

Test Pit Number	Soil Cover Thickness (ft.)
TP-1	½
TP-2	¾
TP-3	½
TP-4	1
TP-5	1
TP-6	1
TP-7	2
TP-8	½
TP-9	1
TP-10	¼
TP-11	2
TP-12	1
TP-13	2
TP-14	½
TP-15	1
TP-16	1
TP-17	¾
TP-18	½
TP-19	2½
TP-20	2
Average	1.1

on the attached drawings. As shown on this drawing, the northern boundary of the landfill waste has been found north of the property line.

Following the initial test trench investigation, two areas required further delineation. Based on test trenches constructed on the eastern boundary of the landfill, waste may have been disposed beyond the landfill boundary adjacent to one residential property. This property is located between test trenches TT-16A and TT-17. The waste thickness was at least three feet at the property boundary at TT-16A and approximately three feet at the property boundary at TT-17. The Town has been unable to gain access to this property for off-site delineation. The second area is located between test trenches TT-5 and TT-7A in the northwestern corner of the property.

In general, waste was found to increase in depth rapidly at the limit of waste and there appears to be little opportunity for waste consolidation to decrease the area/footprint of the landfill cap.

2.3.4 Ecology

This section provides excerpts of the overall habitat based assessment of the Sonia Road Landfill site performed under the remedial investigation. The purpose of this section is to provide a brief description of the pertinent existing ecology of the site. The information contained in this section was obtained during the Remedial Investigation field program and supplemented with data from outside sources, including the NYSDEC, U.S. Fish and Wildlife Service, New York State Historic Preservation Office, Town of Islip and Long Island Regional Planning Board. A complete discussion of this information may be found in the Remedial Investigation Report.

Major Habitat Types

The Sonia Road site is an upland area located approximately 7,000 feet south of Pilgrim State Hospital and 2,500 feet northeast of the headwaters to Sampawams Creek (measured to the central area of the landfill site). The site is bordered on the north and west by industrial facilities and on the south and east by residential communities. The site is characterized by predominantly disturbed lands with vegetated buffers on the eastern and southern site perimeters. Prior to being used as a municipal solid waste landfill, the site was used for mining of sand and gravel and consisted of disturbed lands with uncleared areas along the eastern and western perimeters. The vegetative buffer, which consists primarily of deciduous trees, ranges from 30 feet thick on the eastern and southern perimeters to 100 feet on the southwestern perimeter. Primary successional vegetative woody communities also exist along a berm which bisects the site into an east and west section, and along areas which appear to be historic travel corridors on the western portion of the landfill. Black locust, honey locust and cherry trees are the dominant species in these locations. The majority of the site is characterized as grassland/field habitat where vegetative communities tend to be either monotypic or dominated by a few species. The major habitat types for the site are listed as follows:

- Grassland/Field: Herbaceous, non-woody growth ranging from one to six feet tall;
- Forested/Grassland/Field: Mixture of herbaceous and woody vegetation where trees are present but not dominant;
- Forested: Woody vegetation dominates with trees typically 20 to 35 feet high;
- Field/Wet Area: Herbaceous facultative upland species somewhat stunted due to localized poor drainage; and
- Stressed Habitat: Areas devoid or sparsely vegetated with low growth herbaceous plants surrounded by herbaceous vegetation four to six feet tall.

Habitat types bordering the landfill fall into three categories: paved industrial area; cut/fill lands; and residential cultivated lawns. The eastern and southern borders of the site abut residential developments consisting of single family homes on one quarter to one half acre lots following Sonia Road and Deer Park Street. North of the site is an area predominantly paved to permit loading/off-loading/storage of truck trailers at warehouse type structures. The property west of the site is cut/fill land relatively denude of vegetation as part of a sand mining and aggregate batching plant operation.

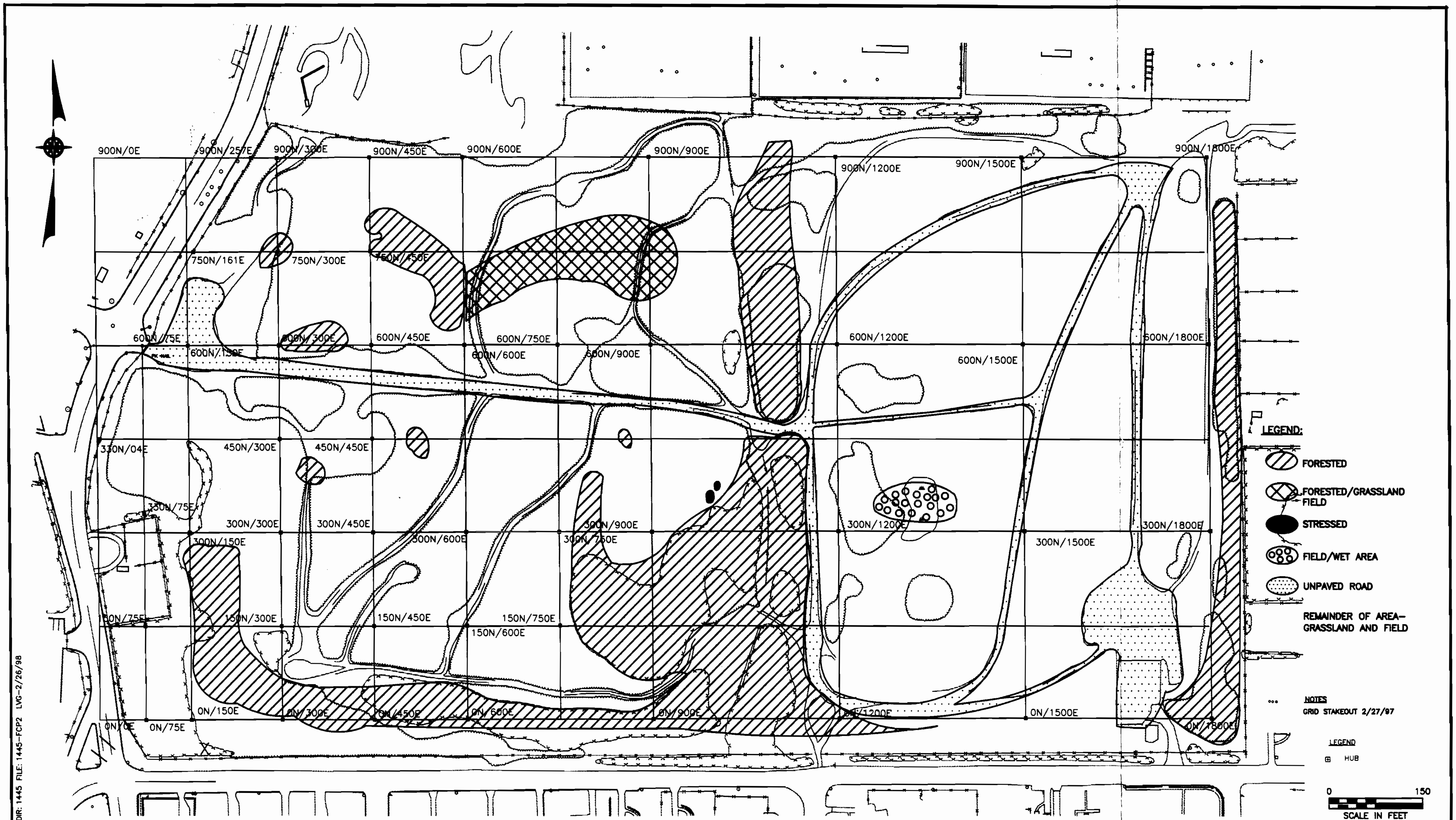
The distribution of habitat types/vegetative cover for the Sonia Road Landfill is displayed on Figure 2-8. Detailed discussion of the major communities found on the site may be found in the Remedial Investigation Report.

Wetlands

There are no New York State or federally regulated wetlands located on or in the vicinity of the Sonia Road Landfill. The nearest wetland is located approximately 2,500 feet to the southwest and is classified by the U.S. Fish and Wildlife Service as a palustrine, broad-leafed forested, seasonally saturated wetland. Wetlands mapped by the U.S. Fish and Wildlife Service as part of the National Wetland Inventory within one mile of the site are displayed on Figure 2-9. The New York State Department of Environmental Conservation maintains no wetland mapping for the site or within one mile of the site. One area within the east section of the landfill shows vegetative stress related to ponding water from rainfall. Vegetation and hydrologic conditions of this area are not indicative of a wetland. Soils analysis indicates that water can be present for extended periods. If left undisturbed, the potential exists that this area, covering roughly 1,100 square feet, could support hydrophytic vegetative species. However, given the location, the area will be capped as part of the landfill closure.

Mammals

The predominantly developed nature of the areas surrounding the Sonia Road Landfill and the existence of this development at the time the landfill was in operation precludes its habitation by mammals which require a large home range. The only mammals observed during the remedial investigation site survey were feral cats and dogs. In addition, tracks, runways and scats were observed that would indicate the presence of white footed mice (Peromyscus leucopus), meadow voles (Microtus pennsylvaticus), cottontail rabbits (Sylvilagus floridanus) and raccoons (Procyon lotor). These mammals will naturally be displaced from the site due to



SONIA ROAD LANDFILL
FINAL CLOSURE PLAN

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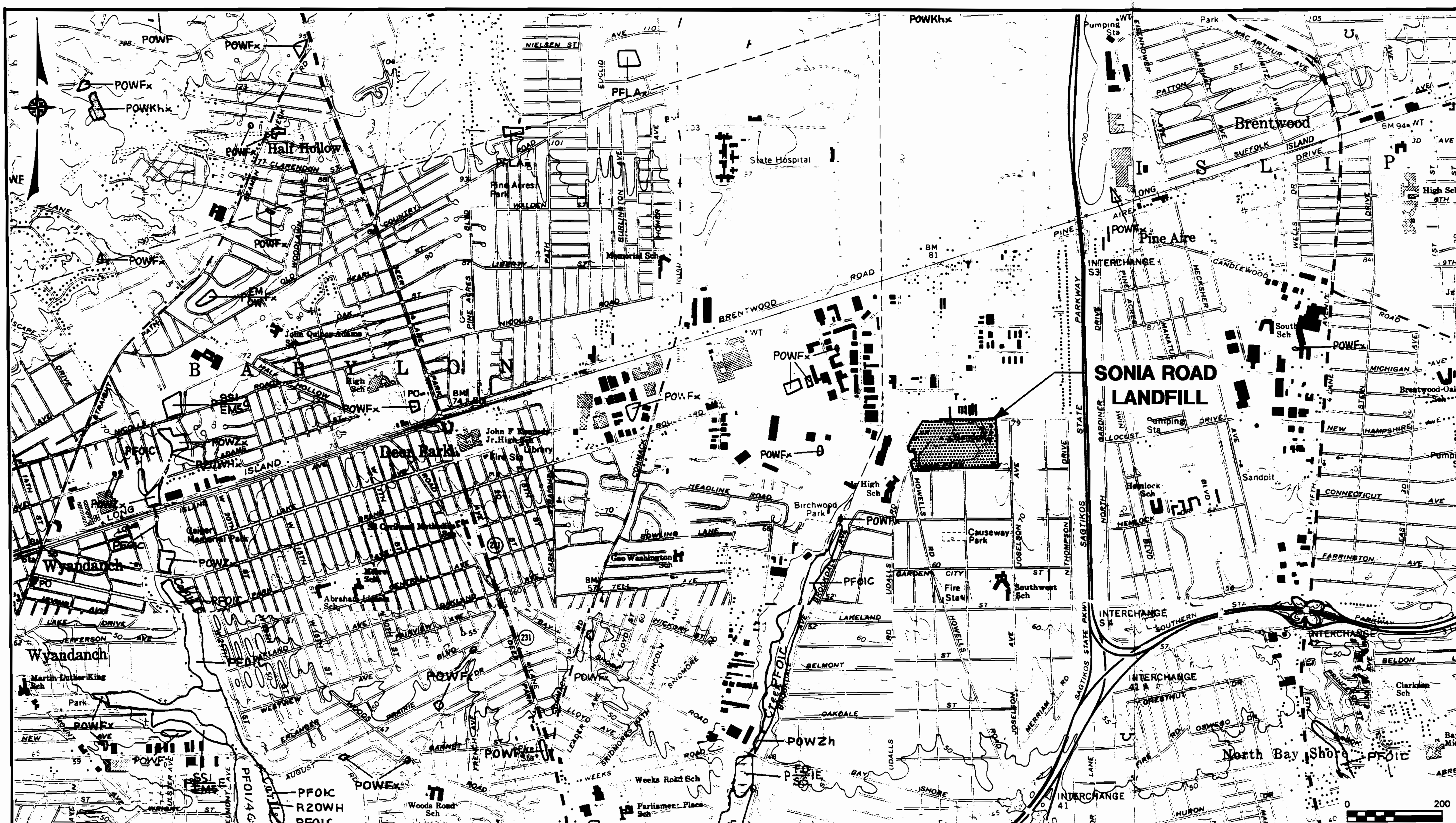
VEGETATIVE COVER TYPES

FIGURE 2-8



SONIA ROAD LANDFILL
FINAL CLOSURE PLAN

NATIONAL WETLAND INVENTORY MAP OF SONIA ROAD SITE AND GENERAL SURROUNDING AREA

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FIGURE 2–9

the construction activity associated with cap construction. No evidence of vectors was observed during the field reconnaissance.

Birds

Birds were noted to be present and actively feeding in the grassland/field, scrub/shrub and deciduous forested habitats. A flock of European starlings (Sturnus vulgaris), numbering approximately 150 individuals, was feeding predominantly in the east section within the grassland/field habitats. When disturbed by human presence, the flock would relocate within the same general area and habitat. Some affinity was shown for the area that was wet because of the accumulation and retention of rainwater. A red-tailed hawk (Buteo jamaicensis) was identified through a series of calls and appeared also to be hunting over the grassland/field habitats of the eastern section. The deciduous forested areas supported numerous finches (Carpodacus sp.), mockingbirds (Mimus polyglottus) and sparrows (Melospiza sp.). No breeding was observed although breeding indications would be limited at the time of the site field survey.

During construction of the landfill cap, this bird population will, in all likelihood, relocate to surrounding areas of the site. No evidence of scavenging birds was observed during the site examination.

Rare Species and Critical Habitats

Based on a review of the New York Natural Heritage files by the NYSDEC Wildlife Resources Center, there are no rare species or critical habitats known to occur on or adjacent to the Sonia Road Landfill Site. In addition, except for occasional transient individuals, no federally listed or proposed endangered or threatened species exist within a two mile radius of the site according to the U.S. Department of the Interior, Fish and Wildlife Service.

Observations of Stress Potentially Related to Site Contaminants

A visibly stressed habitat is limited to approximately 150 square feet in the area indicated on Figure 2-8. The ground surface is completely devoid of vegetation over a rectangular area which changes abruptly to common reed ranging from four to six feet tall. Black locust is also just outside the unvegetated zone. The surface appears to be fine grained soil intermixed with a tar-like compound. This tar-like substance was observed to increase fluidity during the heat of the day. The soil was fully compacted but gave the under foot feel of walking on tires. This soil response was only located in the unvegetated area. The material was sampled and analyzed with only low levels of contaminants detected.

Field observations and surface excavation suggest that the substance was disposed of at the site by others and is not associated with the overall condition of the landfill. Visual observations confirm the substance to be limited to the ground surface and did not permeate upwards from the underlying waste. The suspect material will be left in place to be covered over by the proposed capping system. Based upon sample analysis, removal of this material does not appear to be warranted.

There were no observed discharges of surface leachate or leachate seeps during the field reconnaissance of the site and there is no opportunity for a discharge to surface waters.

2.3.5 Soil Vapor/Explosive Gas

Thirty soil vapor screening points (SVP-1 through SVP-30) were installed at grid locations throughout the landfill and screened for total volatile organic compounds (VOCs) and percent lower explosive limit (LEL). Locations that exhibited elevated LEL measurements were also screened for percent methane, percent carbon dioxide and hydrogen sulfide. The screening was performed to evaluate the presence of these vapors/gases at the landfill and the need for landfill gas control.

Table 2-3

SONIA ROAD LANDFILL
SOIL VAPOR SCREENING RESULTS
MARCH 4-6, 1997

Sample Location	PID Readings (ppm)	Explosive Gas Readings % LEL
SVP-1	0	0
SVP-2	0	1
SVP-3	0	0
SVP-4	0	0
SVP-5	0	1
SVP-6	0	>100
SVP-7	0	>100
SVP-8	0	64
SVP-9	0	>100
SVP-10	0	0
SVP-11	0	0
SVP-12	0	1
SVP-13	0	1
SVP-14	0	1
SVP-15	0	72
SVP-16	0	2
SVP-17	0	2
SVP-18	0	>100
SVP-19	0	0
SVP-20	0	>100
SVP-21	0	>100
SVP-22	0	>100
SVP-23	0	>100
SVP-24	0	0
SVP-25	0	>100
SVP-26	0	>100
SVP-27	0	>100
SVP-28	0	>100
SVP-29	0	>100
SVP-30	0	>100

The results of the initial screening are presented on Table 2-3. As shown, no elevated levels of total VOCs were detected and fourteen of the locations indicated the presence of explosive gas greater than 100% LEL. The fourteen locations exhibiting greater than 100% LEL were screened again, and the results of this second screening are presented on Table 2-4. The results indicate elevated concentrations of methane gas (greater than 5%) at a number of locations throughout the landfill, with most locations being in the eastern section. Figure 2-10 presents the location of the soil vapor monitoring points, the points that exhibit the presence of greater than 100% LEL and the percent methane at these locations.

In addition to the data obtained during this investigation, the Town has performed periodic methane monitoring in ten perimeter gas monitoring wells. Monitoring data is available from September 1992 through November 1994, with two additional rounds conducted in September 1996 and March 1997. The location of these wells are presented on Figure 2-16. The results of this monitoring indicate that methane was only detected in two of the monitoring wells, GMW-1 and GMW-4. Levels in GMW-1 ranged from 0% methane gas by volume to 8% methane gas by volume. Levels in GMW-4 ranged from 0% to 20% methane gas by volume. These results are also presented on Figure 2-10 and may be found in the appendices of the Remedial Investigation Report.

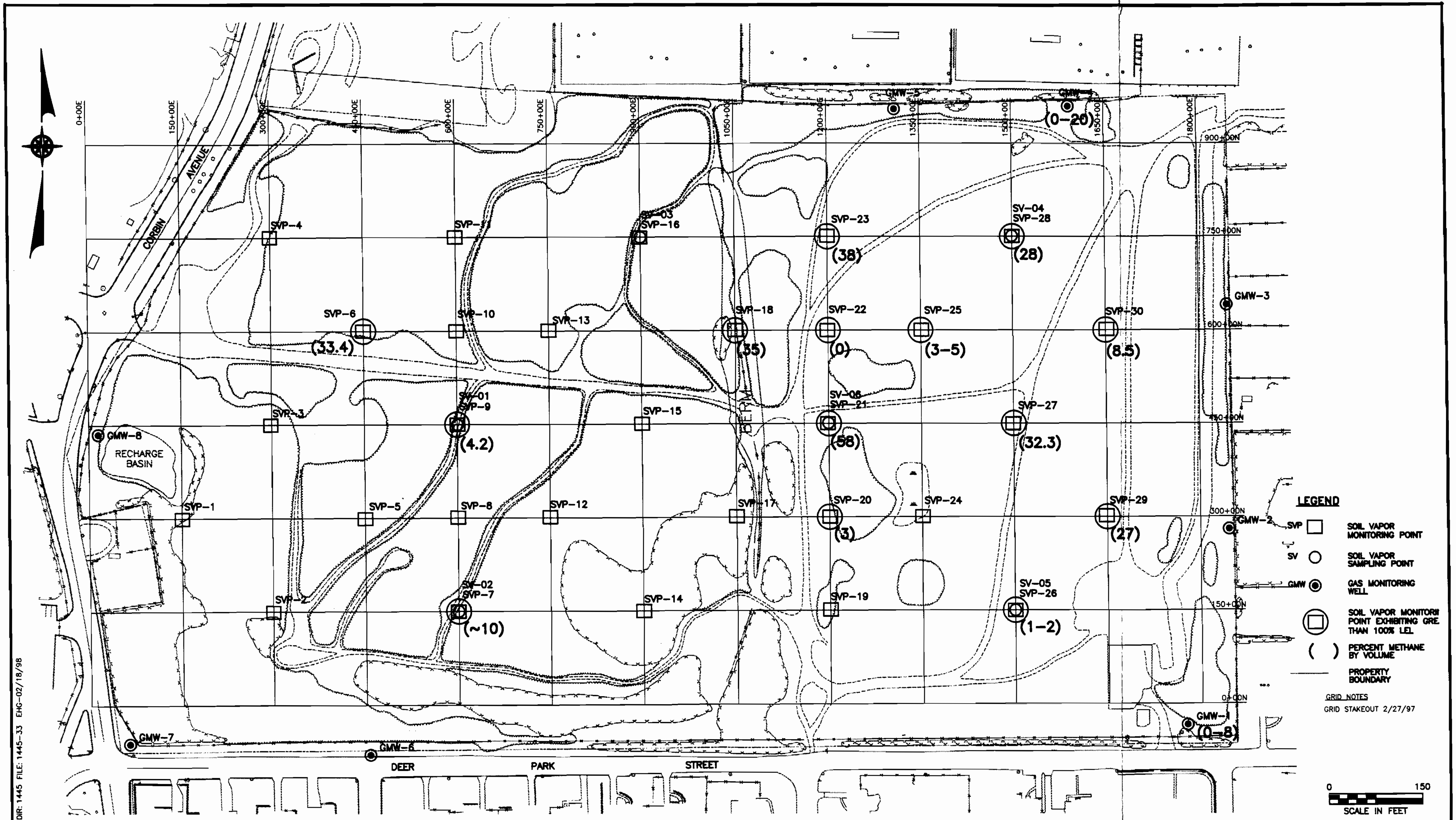
Six of the soil vapor screening locations were selected for the collection of soil vapor samples for VOC analysis. Based upon a comparison to Air Guide-1 annual guideline concentrations, several of the samples indicated the presence of VOCs above the annual guideline concentrations. 1,1-Dichloroethene was detected above the guideline concentration in SV-02 and SV-03. However, 1,1-dichloroethene was also detected above the guideline concentration in the field blank. The blank concentration was greater than the concentration detected in SV-02, but less than that detected in SV-03. Benzene was detected above the guideline concentration in SV-06, but was also detected at a higher concentration in the field blank. However, since the blank result was obtained in the March samples and benzene was detected in the May resample, the result for SV-02 is considered to have been detected as an environmental contaminant. The only constituent detected above the guideline concentration, that

Table 2-4

SONIA ROAD LANDFILL
SOIL VAPOR SCREENING RESULTS
MARCH 19, 1997

Sample Location	PID Readings (ppm)	Explosive Gas Readings (%LEL)	Methane Levels (%Vol.)	Carbon Dioxide Levels (%Vol.)	Hydrogen Sulfide Levels (ppm)
SVP-6	0	>100	33.4	9.6	0
SVP-7	0	>100	Approx. 10*	NA	0
SVP-9	0	>100	4.2	4.2	0
SVP-18	0	>100	35	25.3	19
SVP-20	0	>100	3	NA	0
SVP-21	0	>100	58	17	16
SVP-22	1.1	>100	0	0.2	0
SVP-23	0	>100	38	18	0
SVP-25	0	>100	3-5	0.4	0
SVP-26	0	>100	1-2	NA	0
SVP-27	0	>100	32.3	14	0
SVP-28	0	>100	28	4.4	0
SVP-29	0	>100	27	48.6	0
SVP-30	5.8	>100	8.5	8.2	0

*Water noted in sampling line; reading not steady.



SONIA ROAD LANDFILL
FINAL CLOUSURE PLAN

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SOIL VAPOR POINTS EXHIBITING ELEVATED LEVELS OF METHANE

FIGURE 2–10

was not detected in the field blank, is bromomethane in SV-06 at 7.77 ug/m^3. However, the result for bromomethane is only slightly above the guideline concentration of 5.0 ug/m^3.

Based on the results of screening and analysis of soil vapor samples for volatile organic compounds and comparison to SCGs, only low levels of VOCs are being emitted at the Sonia Road Landfill. These low levels of VOCs detected in subsurface soil would not be expected to impact ambient air and create a potential threat to human health or the environment.

As discussed above, methane gas was detected at elevated levels at a number of locations at the site and could create a potential threat if the gas were to migrate off-site. Methane measurements obtained as a result of previous monitoring of perimeter gas monitoring wells indicate that there is a potential for off-site gas migration.

The levels of methane concentrations measured in the subsurface soils of the Sonia Road Landfill are higher than would normally be expected for a landfill with a waste age of 20 to 30 years. Typically, the organic waste fraction of municipal solid waste would be expected to generate methane as a decomposition byproduct out to about 30 years. The rate of generation is not linear but, rather, follows the shape of a bell curve with a definable peak and generation diminishing asymptotically with advancing years.

There are no obvious reasons to suggest that the Sonia Road Landfill environment would foster a delayed start to the normal methane generation cycle which is triggered by the onset of anaerobic conditions. Clearly, the flat grading of the existing site would not promote the shedding of precipitation thereby robbing the waste of the needed moisture for biological activity. Additionally, the depth of placed waste as a below grade waste mass would not be expected to maintain an extended aerobic environment after waste placement, thereby offsetting the decomposition process.

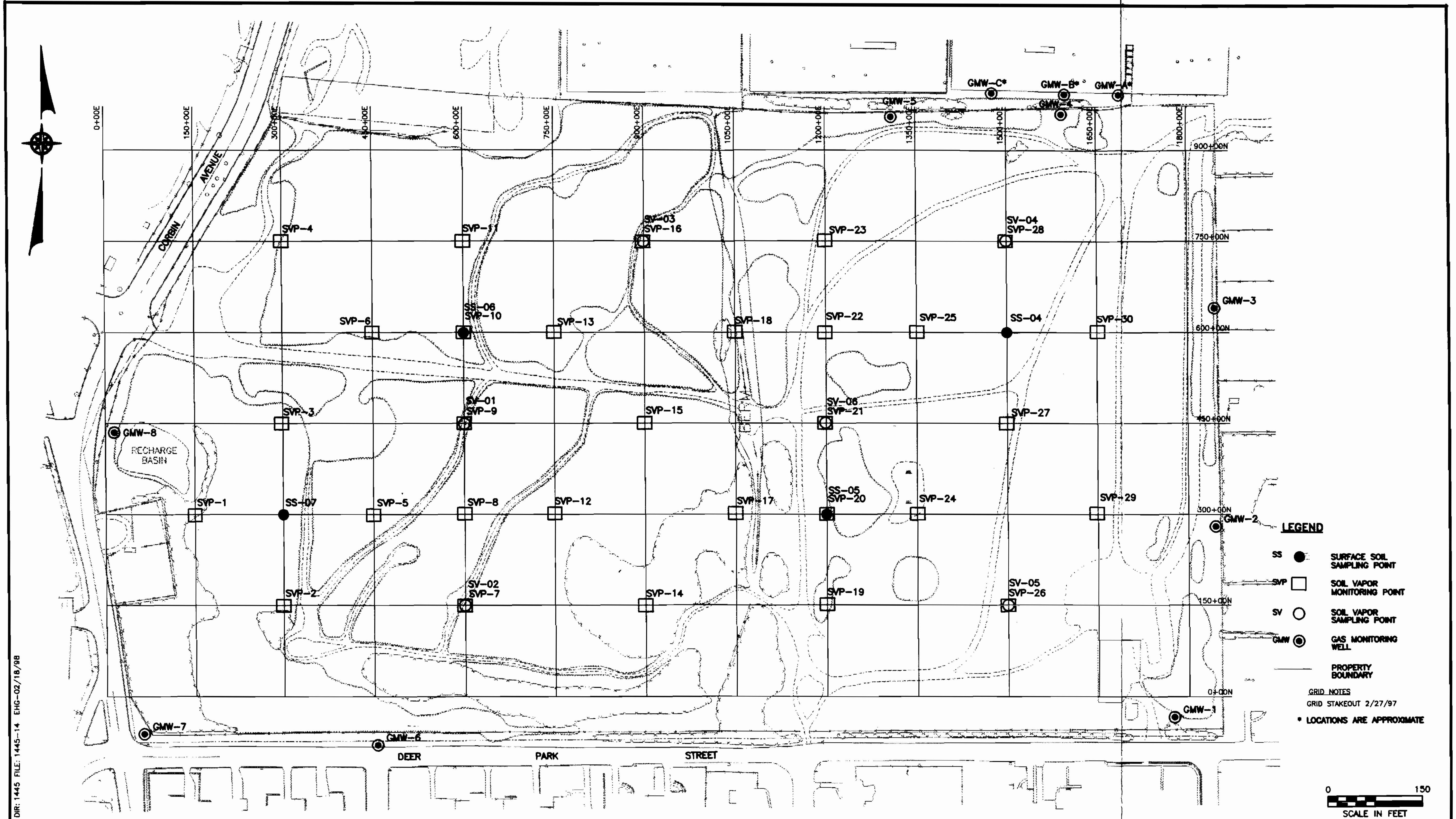
While an explanation of why the measured concentrations of methane appear higher than expected is not readily apparent, it is clear that certain measured locations exhibit conditions which are cause for concern. Given that methane is explosive in the range of 5 to 15 percent by volume, the opportunity exists for the higher concentrations (27 to 58 percent) measured in the center of the landfill to migrate laterally and/or dilute down to the explosive range. The installation of the proposed landfill cap may tend to promote this lateral migration by diminishing the vertical venting of the gas from the landfill surface. This lateral migration after capping would be revealed by increased concentrations at the property perimeter and the adjacent properties beyond.

In order to address the potential for increased migration of methane (landfill gas) beyond the property boundaries after placement of the landfill cap, it is proposed that the landfill cap include the installation of permanent landfill gas monitoring wells at the site perimeter as well as the installation of a center recovery and perimeter collection control system. The migration control system will provide a means of extracting the gas from the waste mass and the subsurface soils and mitigating the potential for off-site migration.

The details of the monitoring wells and migration control system will be discussed in a subsequent section of this report. As a secondary benefit, the perimeter migration control system (collection wells) will also serve to intercept and manage the lateral migration of gaseous volatile organic compounds through the unsaturated soil above the water table.

<u>Surface Soil</u>

Seven surface soil samples were collected and analyzed for target compound list (TCL) +30 organic parameters, target analyte list (TAL) metals and cyanide during the remedial investigation. Three of the surface soil samples were collected off-site and four samples were collected on-site. One of the three off-site samples, SS-01, was collected in the industrial area to the north of the landfill and the remaining two off-site samples, SS-02 and SS-03, were collected in the residential area to the south of the landfill. The four on-site samples were collected from four locations based upon the grid established for the site. The locations of the samples are presented in Figure 2-11.



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SONIA ROAD LANDFILL
FINAL CLOSURE PLAN

SOIL VAPOR MONITORING AND SAMPLING LOCATIONS AND ON-SITE SURFACE SOIL SAMPLING LOCATIONS

FIGURE 2-11

The purpose of the surface soil sampling was to evaluate the quality of the on-site surface soil. In order to evaluate on-site soil quality, the results of the sample analyses were compared to NYSDEC Recommended Soil Cleanup Objectives. The results of the on-site surface soil samples were also compared to the off-site results.

Low levels of VOCs were detected in four of the surface soil samples; however, none of the levels detected were above the soil cleanup objectives.

Six of the seven surface soil samples indicated the presence of semivolatile organic compounds (SVOCs) above the soil cleanup objectives. Benzo(a)pyrene was detected above the cleanup objective of 61 ug/kg in five of the surface soil samples (two off-site and three on-site samples). Levels ranged from 62 ug/kg to 150 ug/kg. Two of the on-site samples, SS-04 and SS-06, and one off-site sample, SS-03, also indicated the presence of dibenzo(a,h)anthracene above the soil cleanup objective of 14 ug/kg. Levels ranged from 29 ug/kg to 45 ug/kg. Benzo(a)pyrene and dibenzo(a,h)anthracene are polycyclic aromatic hydrocarbons (PAHs) which are typically associated with incomplete combustion and are found in asphalt, cinder, coal and tar and are ubiquitous in the environment. None of the samples exceeded the soil cleanup objective of 10,000 ug/kg for total carcinogenic SVOCs/PAHs.

Although benzo(a)pyrene and dibenz(a,h)anthracene were detected above the soil cleanup objectives in the on-site samples, similar and in some cases higher levels of these compounds were detected in the off-site samples indicating that the Sonia Road Landfill is not the source of these contaminants.

One off-site sample collected in the industrial area indicated the presence of an elevated level of bis(2-ethylhexyl)phthalate (78,000 ug/kg). This compound is used as a plasticizer, and it may have been that a piece of plastic was collected with the surface soil sample. Since this sample was collected off-site and none of the on-site samples indicated the presence of bis(2-ethylhexyl)phthalate above the soil cleanup objective, this exceedance is not considered to be significant relative to the Sonia Road Landfill.

Low levels of pesticides were detected in the on-site and off-site samples; however, none of the samples indicated the presence of pesticides above the soil cleanup objectives. Polychlorinated biphenyls (PCBs) were not detected in any of the surface soil samples.

Several metals were detected in the surface soil samples above the soil cleanup objectives. Iron and zinc were detected above the cleanup objective in all of the samples analyzed. The levels detected in the off-site samples were consistent with the levels detected in the on-site samples.

Beryllium was detected above the soil cleanup objective in two of the off-site surface soil samples (one in the industrial area and one in the residential area) and one on-site sample. The level of beryllium detected in the on-site sample is consistent with the off-site samples.

The other exceedances of the soil cleanup objectives were for copper and mercury which were detected in the off-site sample collected in the industrial area.

Based on these results, exceedances of soil cleanup objectives in surface soil are not the result of contamination caused by the Sonia Road Landfill. In addition, the exceedances were not significant, in particular, given the fact that the cleanup objectives are developed for unrestricted/residential land use, and the current and future use of the landfill site, as provided by the Town, will be for industrial purposes. The highest level of surface soil contamination was found in the industrial area to the north of the landfill.

The construction of the proposed landfill capping system will serve to mitigate any concern associated with the existing surface soils given that the existing soils will remain below the proposed cap. Additionally, the proposed cap will be constructed with imported soils from off-site sources due to the lack of available borrow areas on-site. As will be discussed in a subsequent section of this report, on-site borrow, excavation, grading or relandfilling of existing surface soils will be used in the construction of the prepared subgrade for cap construction resulting in these soils being located below the proposed capping system.

The levels of contamination observed in the surface soil samples do not warrant the removal of the existing surface soils from the site as a precursor to the construction of the proposed landfill capping system.

Regarding a preliminary evaluation of the results, surface soil is not a medium of concern at the Sonia Road Landfill, in particular, since capping of the site is planned as a Presumptive Remedy. However, further evaluation of the surface soil results, and potential impacts on human health and the environment, will be addressed in the risk assessment.

The results of the field efforts performed as part of the Remedial Investigation and Feasibility Study indicate that:

- Excavation and off-site disposal of soils, waste or debris will not be required in order to implement remediation of the site.
- There are no sources of surface leachate emanating from the site which require remediation.
- There are no surface waters in the immediate vicinity of the Sonia Road Landfill and there is no threat to surface waters as a result of storm water runoff or surface leachate discharges from the site.
- There are no identifiable vectors inhabiting the Sonia Road landfill site which would be displaced to the surrounding community by construction of the proposed capping system.
- There are no surface soils or sub-surface soils which require excavation and off-site disposal. The minor levels of contamination observed in the surface soils and subsurface soils will be remediated by the construction of the proposed capping system.
- There are no endangered species inhabiting the Sonia Road landfill site which would be adversely impacted by the construction of the proposed capping system.

- Impacts to local groundwater will be remediated by the construction of the proposed capping system to the extent that contamination results from the vertical percolation of infiltrated precipitation through the unsaturated waste mass lying above the groundwater table. The proposed capping system will not significantly influence the movement of local groundwater through the saturated waste mass which was deposited below the water table.

- The construction of the proposed capping system may have an adverse impact on the potential for lateral migration of landfill gas (methane) beyond the site property boundaries. In response to this possibility, the proposed capping system will include construction of perimeter landfill gas monitoring wells and a landfill gas migration control system consisting of center recovery wells and perimeter collection wells.

Section 3

3.0 PROPOSED CLOSURE SYSTEM

3.1 General

The proposed closure system for the capping of the Sonia Road Landfill will consist of a layered system of soils and geosynthetics to provide a cost effective low permeability hydraulic barrier which will mitigate the vertical percolation of precipitation into the underlying waste mass. The primary functions of the layered capping system are as follows:

- Mitigate the vertical percolation of precipitation into the underlying waste mass,
- Mitigate the generation of leachate resulting from contact between precipitation and the waste mass,
- Mitigate the release of leachate to the groundwater system by inhibiting the generation of leachate,
- Reduce the rate of generation of landfill gas (methane) over time by reducing the moisture content of the unsaturated waste mass. As a consequence, the generation period will likely be extended over a longer period of time.
- Control the accumulation of landfill gas below the capping system and mitigate the potential for lateral migration,
- Mitigate the potential for direct contact with waste and contaminated soil.
- Provide control of surface runoff and subsurface drainage to promote the efficiency of the hydraulic barrier,
- Resist the erosional forces of storm events,
- Provide physical protection to the hydraulic barrier layer of the capping system, and
- Provide for an aesthetically acceptable appearance of the completed system, suitable for its intended purpose.

The proposed capping system is intended to achieve the above objectives within the framework of the existing site conditions and constraints.

The proposed capping system is intended to provide general conformance to the regulations and performance criteria of 6 NYCRR Part 360 Solid Waste Management Facilities. The proposed capping system, described from bottom to top, shall be as follows:

- Existing municipal solid waste.
- Contour grading material, thickness varies, minimum thickness of 6 inches.
- Geotextile separation layer, as required.
- Gas venting layer (12 inches).
- 60-mil textured or smooth high density polyethylene (HDPE) geomembrane.
- Geocomposite drainage layer.
- Barrier protection layer (24 inches – 12 inches Barrier Protection Layer Type I and 12 inches Barrier Protection Layer Type II).
- Topsoil or equivalent vegetative growth medium layer (6 inches).
- Vegetation.
- Erosion control blanket, as required.

Certain select materials to be incorporated into the construction of the capping system will be obtained from the Town of Islip Yard Waste Composting Facility. These materials are as follows:

- Compost overs
- Wood mulch/wood chips
- Screened, cured compost
- Unscreened, cured compost

The use of these materials will be presented in the pertinent discussions of the capping system.

A pictorial presentation of the proposed capping system is presented in Figure 3-1.

3.2 Proposed Area of the Cap

As previously discussed, a test trench program was conducted on site to establish the approximate lateral limits of waste in order to establish the area of the landfill property which requires closure. The findings of this program indicate that the waste mass generally extends to or in close proximity of the property boundaries. In certain instances along the north property boundary, the waste was found to extend beyond the property boundary and encroach on the adjacent property.

Along the eastern property boundary, the limits of waste were found to generally coincide with the property line fence. Suggestions that the waste may extend beyond the eastern property boundary were addressed through interviews with property owners who stated that waste materials extending onto their property were previously removed through the efforts of the Town of Islip and/or the property owners.

Along the southern property boundary, the approximate limits of waste were found to vary from 20 feet inside the existing fenceline (eastern half) to 10 feet outside the existing fenceline (western half), but within the Town property line. The irregular shape of the waste line is thought to reflect the lateral limits of the prior, unregulated sand and gravel mining operation.

Along the western property boundary, the limit of waste line is found to be completely within the property boundary with the line approaching the boundaries of the single residential property. The limit of waste line is generally irregular in shape and is, again, thought to reflect the lateral limits of the mining operation.

In most cases, the test trench investigation revealed that the lateral limits of the prior mining operation prescribe the lateral limits of waste. In these cases, the depth or thickness of

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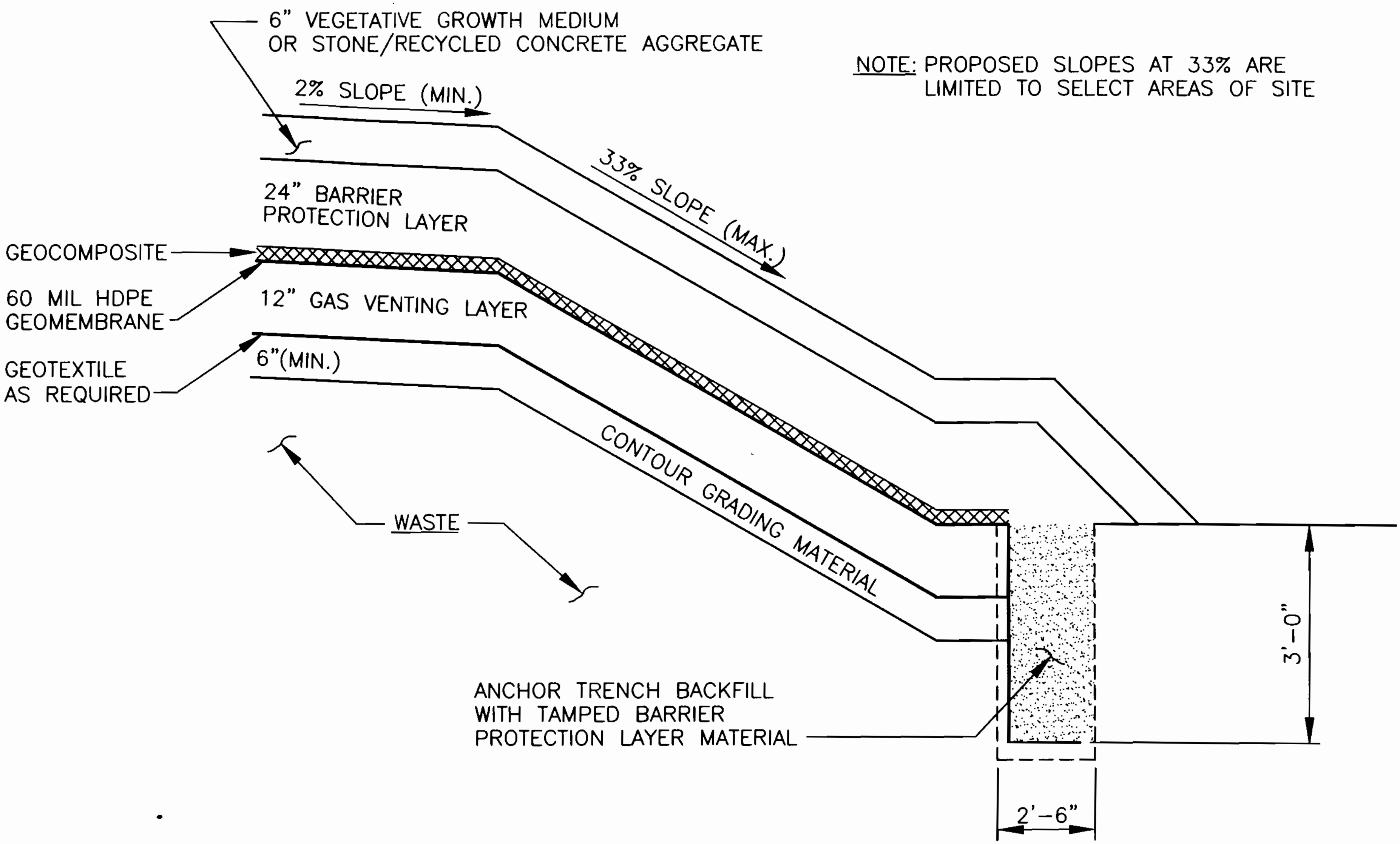

SONIA ROAD LANDFILL
FINAL CLOSURE PLAN

CAP CROSS-SECTION

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FIGURE 3-1

waste, as measured from grade, increases rapidly in relation to horizontal offsets toward the center of the landfill. These observations suggest that the underlying excavation, which resulted from mining, had very steep (one vertical to one horizontal) to near vertical sideslopes. Given these conditions, the practicality and cost effectiveness of reshaping the lateral limits of the waste mass/consolidation to reduce the area of capping are not favorable except in certain select areas.

Along the northern property boundary, in the areas where the limits of waste extend beyond the property line, it is proposed that this waste be excavated and relandfilled on site. This waste is typically found in an embankment along the northern property boundary which slopes downward to the north. After removal of the waste from the embankment, the resulting excavation will be backfilled using compost overs placed in a bulk lift. The extent of waste excavation in this area shall be limited to that necessary to relocate the limit of waste line to coincide with the landfill property boundary. After placement of the compost overs, the resulting slope will be graded to provide a smooth uniform slope and will receive a 12-inch layer of unscreened cured compost to resist erosion. In order to implement this waste relocation, the Town of Islip will have to secure temporary easements from each affected property owner. The maximum extent of encroachment onto the adjacent properties appears to be in the area of Test Trench 12/12A and measures 25 to 30 feet.

In the very northwest corner of the property, the limit of waste was found to extend well into the adjacent Town-owned parcel identified as a paper street. Rather than attempt to remove the waste from this parcel, the Town will take the necessary action to add this parcel to the landfill property, and this parcel will be treated as part of the capping of the landfill.

In the area of the southern property boundary, it has been noted that mature vegetation has established itself in areas where waste exists. This mature vegetation is in close proximity to the fenceline and provides for a visual buffer between the surrounding residential properties and the interior portions of the landfill property. The nature of this vegetation (trees, bushes, underbrush) precludes the opportunity to construct the capping system without clearing the land. Any effort to excavate and relandfill the waste in order to redefine the limits of waste would also necessitate that the land be cleared. In either case, the currently vegetated property line would appear barren after completion of the work and could not be readily rectified. In these select areas, it is suggested that the natural vegetation be protected during construction and be permitted to remain. In lieu of constructing a cap in this area, it is also suggested that a heavy layer (12 inches) of wood chips and wood mulch be applied to the ground surface to promote absorption of precipitation and dissipation through evaporation and transpiration. On this basis, the limits of the proposed capping system have been shown inboard of the actual limits of waste on the attached drawings.

3.3 Proposed Grading Plan

As previously discussed and reflected by the existing topography, the ground surface of the Sonia Road Landfill presents a fairly flat to mildly sloping terrain which is generally consistent with the residential areas to the east and south of the property. The site presents itself more as vacant land rather than an inactive landfill.

The proposed grading plan for this site attempts to make use of the existing terrain to the greatest extent practical in order to minimize the need for gross reshaping of the site. This approach proposes to make use of relatively flat slopes of 2 percent over a majority of the site in lieu of the minimum 4 percent slope stipulated by 6 NYCRR Part 360. Preliminary discussions with NYSDEC regarding the use of 2 percent slopes found this approach to be worthy of consideration. This approach is most applicable to the central core area of the western half, as well as the flat plain area of the eastern half. In areas of the site where the existing grades provide for slopes in excess of 4 percent, the proposed grades will attempt to parallel the existing shape. The proposed maximum slope is approximately 33 percent and complies with the requirements of 6 NYCRR Part 360 for a maximum slope of 33 percent. The proposed areas of 33 percent slope are minimal compared to the overall site and are provided where dictated by existing topography. The proposed grading is presented on the attached drawings.

The reasons to pursue a relatively flat slope of 2 percent as a variance to the requirements of 6 NYCRR Part 360 are several (A copy of the submitted variance application is enclosed in

Appendix B). It is well documented that the site has been inactive for 20 plus years with the eastern half last receiving waste upwards of 25 years ago. During this period of time, primary (rapid) settlement was realized as noted in the Town of Islip 1982 report which discussed the development of the eastern half as a local park. Secondary settlement (consolidation) of the waste will continue to proceed over time however recognizing that 20 to 25 years of the normal 30-year time period considered for fill consolidation has already elapsed.

A review of the existing topography and the limited opportunities for disposal of surface runoff indicates that the general schemes for shaping the landfill for closure are very limited, as evidenced by the long, shallow slope depicted for the western half. At the proposed 2 percent slope, nominal cutting, filling and shaping is required to achieve a prepared subgrade surface suitable for receipt of the proposed capping system. If a 4 percent slope for this area is dictated, essentially all regrading of this slope would be accomplished with fill from off-site sources. The magnitude of additional fill would range from roughly zero at the southwest corner of the site and range up to approximately 18 to 20 feet at the ridge which divides the western half from the eastern half. For this area alone (8 plus acres), it is estimated that the quantity of general fill necessary to steepen the proposed slope from 2 percent to 4 percent would exceed 100,000 cubic yards. Added to this quantity would be the additional fill necessary to transition these increased elevations out to the west, northwest and north perimeter of the site. Adding the eastern half of the site to the equation, the total quantity of fill required to achieve a minimum slope of 4 percent throughout the site could readily approach and/or exceed 200,000 cubic yards.

The benefits of achieving a minimum 4 percent slope rather than a 2 percent slope are diminished by the fact that the additional overburden generated by the wedge of general fill (ranging from 0 feet to 18 to 20 feet) will result in varying and increasing degrees of settlement from the edge of the waste to the center of the site. The net result of this settlement plus the long-term consolidation of the placed deep fill itself would be a rounding of the slope profile and a flattening of the slope in the crown area.

As a separate issue, the overall height of the landfill relative to surrounding grades would be increased significantly if a 4 percent minimum slope were applied to the site. As discussed, the central ridge between the eastern and western halves would be raised approximately 18 to 20 feet plus the thickness of the capping system (3.5 feet). This overall increase in height would significantly impact the visual perception of the site and would necessitate that terraces or benches be constructed to accommodate slope heights in excess of 20 feet. Providing horizontal distance to accommodate benches, as well as flatten slopes which would be steepened as a result of the increased top elevations would then necessitate extensive cutting and reshaping of waste in the north-central area of the site.

The merits of shaping, regrading and importing significant quantities of general fill to achieve minimum 4 percent slopes solely for regulatory compliance appear to be very limited. Conversely, maintaining the site in its general configuration using relatively flat slopes of 2 percent in lieu of 4 percent provides a viable, cost-effective approach to remediating the site and will not place unnecessary demands on the use of natural resources which are in short supply in the Long Island area. Additionally, the use of a 2-percent slope will provide a grading plan which is more suitable for future secondary uses which may be considered by the Town, such as industrial, outdoor storage.

The impacts of using 2 percent slopes in lieu of 4 percent slopes on the effectiveness of the capping system as a hydraulic barrier will be addressed in subsequent sections of this report presenting the results of the HELP model.

3.4 Site Preparation

The first step in preparing the site for construction of the proposed capping system will be the shaping and grading of the existing ground surface to develop a prepared subgrade. Prior to any excavation or filling, the existing vegetation within the area of the cap will be cleared. Woody vegetation such as trees will be cut down, chipped and used on-site in the perimeter areas not being capped. Tree stumps will be excavated and reduced in size for on-site use as wood chips/wood mulch.

Brush and ground cover will be cleared by thoroughly and completely tracking the areas with a bulldozer to grind up the vegetation and incorporate it into the loosened soil. The existing vegetation will be cleared prior to proceeding with any other aspects of the cap construction. However, the contractor will be permitted to phase the clearing and grubbing operation to make use of the existing vegetation for erosion control purposes.

After clearing, the existing ground surface will be cut, graded and/or filled as required to achieve prepared subgrade elevations. Excavated waste materials resulting from cuts or excavations will be relandfilled on site in areas requiring fill. Relandfilled waste shall be spread in lifts up to 2 feet in thickness, covered with a 6-inch lift of general fill and compacted using a landfill compactor or pad-footed vibratory compactor.

At the end of each day, exposed waste in cut areas and/or relandfilled areas will be covered with a 6-inch layer of compost overs as daily cover. The layer of daily cover will be compacted with a landfill compactor or pad-footed vibratory compactor. Open excavations shall be graded and protected from the accumulation of surface runoff.

In areas of the site where the depth of fill required to achieve proposed subgrade is 2 feet or greater, a 6-inch layer of compost overs will be spread over the existing surface prior to proceeding with the placement of relandfilled waste or contour grading material.

Areas requiring fill to attain the proposed prepared subgrade elevations will be constructed with controlled lifts of compacted contour grading material. The fill will be placed and spread in lifts of uniform thickness then compacted to a density of at least 95 percent of the maximum dry density as determined in accordance with ASTM D698. The moisture content of the fill material will be controlled to facilitate compaction and the maximum compacted lift thickness shall be limited to 12 inches. Compacted lifts will be tested to determine the in-place density and moisture content by nuclear methods at a minimum frequency of nine tests per acre per lift.

At a minimum, 6 inches of compacted contour grading material will be placed over the entire surface of the landfill to be capped. Existing ground surfaces which coincide with proposed prepared subgrade elevations and exhibit waste at the surface will be scraped to a depth of 6 inches to allow for placement of the contour grading material. In areas where the existing surface presents itself as being suitable for establishment of the prepared subgrade surface, scraping of the surface will be eliminated and the existing surface will be accepted as the prepared subgrade surface.

The subgrade surface will be proofrolled with a smooth drum vibratory roller to provide a smooth, uniformly sloping, unyielding surface. Depressions, soft spots and yielding areas detected by proofrolling will be remedied by recompaction or excavation and replacement as appropriate. The prepared subgrade surface will be free from protruding rocks, litter, debris and disturbance due to erosion which may inhibit intimate contact with the overlying geotextile or gas venting layer.

The general fill/contour grading material will be obtained from off-site sources subject to inspection, testing and pre-approval. On-site borrow from the excavation of recharge basin(s) will be used as general fill/contour grading material to off-set the quantity of off-site material required to be imported. The general fill/contour grading material will be clean, inert well graded, granular material generally free from any organic material, roots, stumps, chunks of earth or clay, shale or other soft, poor durability particles. Reprocessed or recycled soils containing incidental fractions of concrete and asphalt will be permitted due to the scarcity of virgin soil sources in the Long Island area. The general fill/contour grading material will conform to the following gradation:

Sieve Size	Percent Passing By Weight
4-inch	100
No. 40	0-70
No. 200	0-15

The final (uppermost) 6-inch lift or layer of contour grading material which will serve as the prepared subgrade for the overlying capping system will be constructed with contour grading material in accordance with the above gradation requirements.

The prepared subgrade surface will be surveyed for as-built conditions.

Conformance testing of the general fill/contour grading material will be performed at a minimum frequency of one per 5,000 cubic yards and as the material is perceived to change. Testing will include gradation analysis (ASTM D422) and moisture/density relationships (ASTM D698 - Standard Proctor).

3.5 Geotextile

Immediately above the prepared subgrade surface, the capping system will be constructed in a layered arrangement. In areas where the prepared subgrade surface does not present itself as a competent filter relative to the gas venting layer material, the first layer placed will be a geotextile fabric to separate the underlying contour grading material from the overlying gas venting material. The geotextile will provide for vertical separation of the two soils, allow for vertical migration of landfill gas from the waste mass up to the gas venting layer, allow for vertical percolation and prevent blending of the gas venting layer with the subgrade materials.

The decision as to whether the geotextile separation layer is required will be made on an area by area basis during the construction. The determination will be made by the Engineer in consultation with the Town. The criteria for making this determination will necessitate a visual examination of the prepared subgrade surface and a qualitative assessment as to whether the exposed subgrade soils can adequately provide for separation between the overlying gas venting layer materials and the subgrade soils. In the event that the prepared subgrade surface presents an excessively "porous" appearance which would tend to promote a loss of the gas venting layer materials to the subgrade, then the Contractor will be ordered to place the geotextile in these areas as a separation medium.

The geotextile will be a nominal 8 ounce per square yard continuous filament polyester or polypropylene, nonwoven, needlepunched fabric. The geotextile polymer composition will be at least 95 percent polypropylene or polyester by weight. The geotextile will conform to the properties listed in Table 3-1.

The geotextile will be deployed in the direction of the slope, overlap adjacent panels by 3 inches and will be seamed by a sewn, double thread lockstitch Type 401 or equivalent. The seam will be a "flat" or "prayer" seam. Geotextile deployment will be controlled to ensure that the placed geotextile is not exposed to sunlight for more than 14 days.

Prior to placing the geotextile, the prepared subgrade will be visually inspected to evaluate the suitability of the subgrade and ensure that the surface is properly compacted, smooth and uniform. The surface will be reasonably free of stones, organic matter, irregularities, protrusions, loose soil and any abrupt changes in grade that could damage the geotextile.

Quality control testing will be performed by the geotextile manufacturer. Conformance testing of the delivered material will be performed only if the need is perceived based upon an examination of the materials.

The proposed geotextile, if required to be used, satisfies the filter criteria of 6 NYCRR Part 360. The geotextile has a permeability on the order of 100 times the permeability of the overly gas venting soil and therefore satisfies the requirement that it be at least 10 times the permeability of the soil. The retention criteria prescribed by 6 NYCRR Part 360 is also satisfied. The apparent opening size (O_{95}) of 0.212 mm is sufficient to retain a soil with 15 percent passing a No. 200 sieve with a multiplier of 3. The overlying gas venting layer is limited by regulation to

Table 3-1

GEOTEXTILE

Fabric Property	Test Method	Unit	Specified Value	Qualifier[1]
Fabric Weight	ASTM D3776	oz/sq yd	7.9	MARV
Thickness, t	ASTM D1777	Mils	90	MARV
Grab Strength[2]	ASTM D4632	Lbs	210	MARV
Grab Elongation[2]	ASTM D4632	%	50	MARV
Trapezoid Tear Strength[2]	ASTM D4533	lbs	85	MARV
Puncture Resistance	ASTM D4833	lbs	100	MARV
Mullen Burst Strength	ASTM D3786	psi	320	MARV
Water Flow Rate	ASTM D4491	gpm/sq ft	100	MARV
Permitivity	ASTM D4491	sec^{-1}	1.3	MARV
Permeability	ASTM D4491	cm/sec	0.3	MARV
Apparent Opening Size (AOS)	ASTM D4751	sieve size mm	70 0.212	MARV
Transmissivity @0.3 psi @14.5 psi @29.0 psi	ASTM D4716	 gpm/ft gpm/ft gpm/ft	 0.11 0.07 0.04	MARV
UV Resistance	ASTM D4355	% strength retained	70	MARV
pH Resistance			2-13	Range

[1]MARV - Minimum average roll value.

[2]Values in the weakest principal direction.

a maximum of 10 percent passing the No. 200 sieve. Therefore, the d_{85} (15 percent passing) value of the gas venting soil will be a particle size larger than a No. 200 sieve (0.074 mm). The ratio of the apparent opening size (O_{95}) of the geotextile is between two and three times the d_{85} value of the soil as required.

3.6 Gas Venting Layer

The gas venting layer will be installed as one continuous layer over the area to be capped. The gas venting layer will have a thickness of 12 inches and a coefficient of hydraulic conductivity (permeability) equal to or greater than 1×10^{-3} cm/sec. The soils used to construct the gas venting layer will be imported from off-site sources given the limited opportunity for on-site borrow.

The gas venting layer will serve as a permeable layer of soil which will allow for the lateral transmission of landfill gas which may accumulate below the geomembrane to points of removal at the landfill gas recovery wells. The gas venting layer serves several purposes in the function of the capping system and include the following:

- The uppermost surface of the gas venting layer provides for a smooth, uniformly sloped, well compacted surface for the installation of the overlying geomembrane.
- The gas venting layer serves as a permeable layer of soil which will allow for the lateral movement of landfill gas below the geomembrane. The gas venting layer, in combination with the landfill gas recovery wells, will allow for the removal of landfill gas which vertically migrates to the underside of the geomembrane. The evacuation of landfill gas via the gas venting layer will inhibit the formation of positive gas pressures below the geomembrane. In turn, the relief of these pressures will minimize vertical uplift forces on the geomembrane and reduce the potential for lateral migration of the landfill gas to areas beyond the cap and the property boundaries.
- The gas venting layer serves as a free draining, low fines content, permeable layer below the geomembrane which, in the event of deep frost penetration into the capping system, is not prone to frost heave which would impose stresses on the geomembrane. In general, the average depth of frost penetration for the Long Island area is on the order of 15 to 20 inches as reported by the U.S. Department of Commerce Weather Bureau. Given that the proposed soil layers overlying the geomembrane measure

30 inches, the frost heave resistance of the gas venting layer would not normally come into play and is not a primary design criteria for this case. However, the inherent nature of the gas venting layer as prescribed by 6 NYCRR Part 360 provides this added benefit as a conservative design condition.

The gas venting layer will be installed directly on top of the geotextile separation layer or prepared subgrade surface, as appropriate, as one single lift using low ground pressure machines. The gas venting layer will be placed at a rate corresponding to deployment of the geotextile, when applicable, to ensure that the geotextile is not exposed to the elements for more than 14 calendar days.

Wheeled vehicles will not be permitted to travel directly on the geotextile or on a layer of gas venting material less than 3 feet in thickness (temporary travel ways). Grade control for placement of the gas venting layer will utilize non-intrusive methods such as laser, stanchions, traffic cones, etc., with the selection to be at the discretion of the construction contractor. The in-place layer will have a compacted lift thickness of 12 inches. The layer will be compacted to achieve a minimum of 95 percent maximum dry density in accordance with ASTM D698 (Standard Proctor) and will provide a smooth, regular surface free of protrusions, debris, loose soil, and other conditions which may be deleterious to the geomembrane and/or prevent intimate contact between the geomembrane and the surface of the gas venting layer. The moisture content of the soil will be controlled to facilitate compaction.

The gas venting soil will be natural sand and will consist of hard, strong, durable particles which are free from a coating or any injurious material or other deleterious substances. The soil will be virgin, select, clean, inert, well graded granular material, free of any organic materials, roots, stumps, chunks of earth or clay, shale or other soft, poor durability particles, construction and demolition debris, reprocessed or recycled soils, concrete or other foreign material and have less than 10 percent of the material by weight pass the No. 200 sieve. All other material will pass the 3/8-inch sieve. The minimum coefficient of permeability will be 1×10^{-3} cm/sec as determined by ASTM D2434 - Test for Permeability of Granular Soils (Constant Head).

The source of supply will be subject to prequalification testing and acceptance. During construction, the imported soils will be sampled at a frequency of once per 1,000 cubic yards and tested for gradation analysis (ASTM D422) and once per 5,000 cubic yards and tested for hydraulic conductivity (permeability) ASTM D2434.

The finished surface of the gas venting layer will be examined for its suitability for deployment of the geomembrane.

The in-place thickness of the gas venting layer will be confirmed on a 100-foot by 100-foot grid pattern by hand digging test holes to the geotextile or prepared subgrade surface. A straightedge or board will be used to span the holes to reference the grade surface. The average of three depth measurements will be recorded as the actual depth of the lift. The average thickness of the compacted lift will be no less than 12 inches.

3.7 Geomembrane

The proposed geomembrane to serve as the hydraulic barrier layer in the capping system will be a 60-mil, high density polyethylene (HDPE) sheet or equivalent as provided by 6 NYCRR Part 360. The geomembrane shall be either a textured geomembrane or a smooth geomembrane. The Contract Documents for construction of the capping system will provide for a textured geomembrane as the basis for bidding. In addition, the Contract Documents will provide for the use of a smooth geomembrane as an alternate material in lieu of the textured material. The format of the bidding will allow for a competitive determination of the cost effectiveness of using the smooth geomembrane in lieu of the textured geomembrane. The textured HDPE geomembrane will conform to the physical properties listed in Table 3-2. The smooth HDPE geomembrane will conform to the physical properties listed in Table 3-3.

Table 3-2

60-MIL TEXTURED HDPE GEOMEMBRANE

Property	Test Method	Units	Specified Value	Qualifiers[1]
Thickness	ASTM D5994	Mils	54	Minimum
Density	ASTM D1505	g/cc	0.94	Minimum
Melt Flow Index	ASTM D1238 Condition E (190°C, 2.16 kg.)	g/10 minutes	1.0	Maximum
Carbon Black %	ASTM D1603	%	2-3	
Carbon Black Dispersion	ASTM D3015	Rating	A-1, A-2, B-1	
Tensile Properties	ASTM D638 Type IV, 2" gauge length Dumb-bell @ 2 ipm			
• Strength at Yield		PPI	130	MARV[2]
• Strength at Break		PPI	75	MARV[2]
• Elongation at Yield		%	13	MARV
• Elongation at Break		%	120	MARV
Tear Resistance	ASTM D1004 Die C	Pounds	45	MARV
Puncture Resistance	FTMS 101B Method 2065	Pounds	80	MARV
Environmental Stress Crack	ASTM D1693 10% Igepal, 50°C	Hours	1500	Minimum
Dimensional Stability	ASTM D1204 100°C, 1 hour	% change	±2	Maximum
Thermal Stability OIT	ASTM D3895 200°C, 1 ATM O_2	Minutes	100	Minimum
Low Temperature Brittleness	ASTM D746 Procedure B	Degree F	-107	Maximum
Coefficient of Linear Thermal Expansion	ASTM D696	$x10^{-4}$ cm/cm°C	2.0	Typical
Volatile Loss	ASTM D1203	%	0.3	Maximum

Table 3-2 (continued)

60-MIL TEXTURED HDPE GEOMEMBRANE

Property	Test Method	Units	Specified Value	Qualifiers[1]
Water Absorption	ASTM D570	%	0.1	Maximum
Resistance to Soil Burial	ASTM D3083 (as modified in NSF 54 Appendix A)			
• Tensile Strength at Yield and Break		% change	10	Maximum
• Elongation at Yield and Break		% change	10	Maximum
Hydrostatic Resistance	ASTM D751	PSI	350	MARV
Seam Strengths	ASTM D4437			
• Peel Strength	(Wedge)	PPI	88 & FTB	Minimum
• Peel Strength	(Extrusion)	PPI	63 & FTB	Minimum
• Shear Strength	(Wedge or Extrusion)	PPI	84 & FTB	Minimum

(1) MARV = Minimum average roll values.

(2) The values given correspond to a yield stress of 2,300 psi and a break stress of 1,250 psi for textured HDPE geomembrane.

FTB = Film tearing bond

Table 3-3

60-MIL SMOOTH HDPE GEOMEMBRANE

Property	Test Method	Units	Specified Value	Qualifiers[1]
Thickness	ASTM D751	Mils	54	Minimum
Density	ASTM D1505	g/cc	0.94	Minimum
Melt Flow Index	ASTM D1238 Condition E (190°C, 2.16 kg.)	g/10 minutes	1.0	Maximum
Carbon Black %	ASTM D1603	%	2-3	
Carbon Black Dispersion	ASTM D3015	Rating	A-1, A-2, B-1	
Tensile Properties	ASTM D638 Type IV, 2" gauge length Dumb-bell @ 2 ipm			
• Strength at Yield		PPI	130	MARV[2]
• Strength at Break		PPI	243	MARV[2]
• Elongation at Yield		%	13	MARV
• Elongation at Break		%	560	MARV
Tear Resistance	ASTM D1004 Die C	Pounds	45	MARV
Puncture Resistance	FTMS 101B Method 2065	Pounds	80	MARV
Environmental Stress Crack	ASTM D1693 10% Igepal, 50°C	Hours	1500	Minimum
Dimensional Stability	ASTM D1204 100°C, 1 hour	% change	±2	Maximum
Thermal Stability OIT	ASTM D3895 200°C, 1 ATM O_2	Minutes	100	Minimum
Low Temperature Brittleness	ASTM D746 Procedure B	Degree F	-107	Maximum
Coefficient of Linear Thermal Expansion	ASTM D696	$x10^{-4}$ cm/ cm°C	2.0	Typical
Volatile Loss	ASTM D1203	%	0.3	Maximum

Table 3-3 (continued)

60-MIL SMOOTH HDPE GEOMEMBRANE

Property	**Test Method**	**Units**	**Specified Value**	**Qualifiers**[1]
Water Absorption	ASTM D570	%	0.1	Maximum
Resistance to Soil Burial	ASTM D3083 (as modified in NSF 54 Appendix A)			
• Tensile Strength at Yield and Break		% change	10	Maximum
• Elongation at Yield and Break		% change	10	Maximum
Hydrostatic Resistance	ASTM D751	PSI	350	MARV
Seam Strengths	ASTM D4437			
• Peel Strength	(Wedge)	PPI	98 & FTB	Minimum
• Peel Strength	(Extrusion)	PPI	98 & FTB	Minimum
• Shear Strength	(Wedge or Extrusion)	PPI	121 & FTB	Minimum

(1) MARV = Minimum average roll values.

(2) The values given correspond to a yield stress of 2,300 psi and a break stress of 1,250 psi for textured HDPE geomembrane.

FTB = Film tearing bond

The geomembrane will be in contact with the underlying gas venting layer and the overlying geocomposite drainage layer and/or barrier protection layer. The geomembrane will not be in direct contact with the waste or leachate generated by the waste. Therefore, the chemical compatibility of the geomembrane materials and the waste materials should not be at issue. Nonetheless, HDPE geomembrane is well documented for its use in landfill liner systems as both bottom liner systems and capping systems. For the purpose of this project, site-specific chemical compatibility of the proposed geomembrane is not warranted.

The geomembrane will be installed on the uppermost surface of the gas venting layer. The prepared surface will be inspected, corrected as necessary and accepted prior to the day's deployment of geomembrane.

The geomembrane will be furnished in standard roll widths and standard roll lengths. There will be no special requirements for extra long or custom roll lengths. Geomembrane panels will be deployed in the direction of the slope. Adjacent panels will be seamed by either the fusion weld or extrusion weld process. All seams will be nondestructively tested in total and destructively tested at a frequency no less than once per 500 feet of seam length.

Conformance samples will be obtained at a frequency of once per 100,000 square feet of geomembrane. Testing of the conformance samples will be performed, at the discretion of the certifying engineer, based upon field observation, as well as the geomembrane fabrication quality control data.

Textured geomembrane is proposed to be used throughout the project rather than require that smooth sheet be used in the flatter areas and textured sheet in the steeper areas. The purpose of this approach is to avoid two types of liner material on the job site, confusion during construction over where each is to be used, avoid transition areas in the liner, as well as minimize the generation of scrap and partial roll excess associated with a two-product system. The use of textured geomembrane with an overlying geocomposite will provide an interface between the geomembrane and the geocomposite which exhibits sufficient interface friction to minimize the potential for sliding or displacement during construction. The textured geomembrane also provides for enhanced interface friction with the underlying gas venting layer when compared to a smooth geomembrane.

NYSDEC has raised a concern that the use of textured geomembrane throughout the project (especially in the flatter slope areas) may not provide the most cost-effective design for this site. In order to address this concern, the bidding documents will provide a mechanism to substitute smooth geomembrane in lieu of textured geomembrane in the appropriate areas of the site. This substitution will be determined after bidding and provided that a cost savings is available through the bidding process.

It is anticipated that the difference in the installed cost of textured geomembrane versus smooth geomembrane (considering all related aspects of the cap construction) will be nominal.

Penetrations of the liner material for the construction of landfill gas recovery wells or drainage piping will be sealed with a fabricated pipe boot. The flange of the pipe boot will be welded to the geomembrane. The barrel of the pipe boot will be secured with stainless steel band clamps or batten strips as appropriate and sealed with a neoprene strip.

All geomembrane panels will be uniquely identified with a panel number which is correlated to the roll number and fabrication (production) quality control test data. Quality control test data will be reviewed prior to deployment and any material with questionable or unacceptable test data or documentation will not be utilized. Upon completion, an as-built panel layout will be prepared identifying, as a minimum, panel numbers (correlated to roll numbers), seam numbers, destructive sample numbers and locations, repairs, patches, etc.

The free end of the in-place geomembrane which exists at the perimeter of the capped area shall be secured in an anchor trench. The overlying geocomposite will also be secured in this anchor trench. The anchor trench will be backfilled with barrier protection layer material and tamped to provide a nominal 90 percent Proctor density with the emphasis on not damaging the geosynthetic materials.

3.8 Geocomposite Drainage Layer

A geocomposite drainage layer will be installed immediately above the textured geomembrane over the entire area to be capped. The geocomposite drainage layer will serve as a lateral or horizontal drainage medium to relieve the potential for developing a significant hydraulic head of water above the geomembrane. As will be discussed in subsequent sections regarding the HELP model, the geocomposite drainage layer will mitigate the potential for the barrier protection layer and the topsoil layer from becoming saturated and thereby applying up to 30 inches of hydraulic head to the barrier layer (geomembrane) and compromising the effectiveness of the overall capping system.

The geocomposite drainage layer will consist of a geosynthetic drainage layer (geonet) core with an 8-ounce per square yard geotextile heat fused to both the upper and lower surfaces. The upper geotextile will serve as a separation/filter layer to the overlying barrier protection layer. The lower geotextile will serve to secure the geocomposite to the textured or smooth geomembrane through interface friction. The geocomposite drainage layer will have the physical properties detailed in Tables 3-4 and 3-5.

The geocomposite drainage layer will be installed directly on top of the geomembrane after the prepared surface of the geomembrane has been inspected, tested and accepted. Deployment of the geocomposite drainage layer will be coordinated with the placement of the overlying barrier protection layer to ensure that the geotextiles will not be exposed to the elements for more than 14 calendar days.

The geocomposite drainage layer will be deployed in the direction of the slope. The lower geotextiles of adjacent panels will be overlapped. The drainage net cores will be overlapped and secured by tying with nylon cable ties. The upper geotextiles will be seamed by sewing using a

Table 3-4

GEOCOMPOSITE PROPERTY VALUES

Fabric Property	Test Method	Unit	Specified Value	Qualifier
Geonet Component:				
Polymer Composition		%	95 polyethylene by weight	Minimum
Polymer Specific Gravity	ASTM D1505		0.94	MARV
Polymer Melt Index	ASTM D1238	g/10 min	0.1 – 1.0	MARV
Carbon Black Content	ASTM D1603	%	2-3	Range
Foaming Agents	N/A	%	0.0	Maximum
Nominal Thickness	ASTM D374C	Inches	0.20	MARV
Compressibility @ 20,000 psi		%	50	Maximum
Tensile Strength (machine direction)	ASTM D5034/5035	lbs/in	45	MARV
Transmissivity Gradient of 1 @ 15,000 psf	ASTM D4716	m^2/sec	1×10^{-3}	Minimum
Geotextile Component:	See Table 3-5			
Geocomposite:				
Ply Adhesion	ASTM F904 or ASTM D413	lbs/in	0.5	Average
Transmissivity Gradient of 1 @ 10,000 psf	ASTM D4716	m^2/sec	3.0×10^{-5}	Minimum
Tensile Strength	ASTM D4632	lbs.	500	Minimum

Notes:

1. All values except transmissivity represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table).
2. The geocomposite shall be sandwiched between two steel plates. The minimum test duration shall be 1 hour and the report for the test results shall include measurements at intervals over the entire test duration.
3. Component properties are tested prior to lamination and are not tested on final product.
4. In lieu of testing manufacturing may substitute documentation that geocomposite system properties has friction angle performance suitable to application proposed.

Table 3-5

GEOTEXTILE

Fabric Property	Test Method	Unit	Specified Value	Qualifier[1]
Fabric Weight	ASTM D3776	oz/sq yd	7.9	MARV
Thickness, t	ASTM D1777	Mils	90	MARV
Grab Strength[2]	ASTM D4632	Lbs	210	MARV
Grab Elongation[2]	ASTM D4632	%	50	MARV
Trapezoid Tear Strength[2]	ASTM D4533	Lbs	85	MARV
Puncture Resistance	ASTM D4833	Lbs	100	MARV
Mullen Burst Strength	ASTM D3786	Psi	320	MARV
Water Flow Rate	ASTM D4491	gpm/sq ft	100	MARV
Permitivity	ASTM D4491	sec^{-1}	1.3	MARV
Permeability	ASTM D4491	cm/sec	0.3	MARV
Apparent Opening Size (AOS)	ASTM D4751	sieve size mm	70 0.212	MARV
Transmissivity • @ 0.3 PSI • @14.5 PSI • @29.0 PSI	ASTM D4716	 gpm/ft gpm/ft gpm/ft	 0.11 0.07 0.04	MARV
UV Resistance	ASTM D4355	% strength retained	70	MARV
pH Resistance			2-13	Range

Notes:

1. MARV - Minimum average roll value.
2. Values in the weakest principal direction.

double-thread lockstitch Type 401 or equivalent. The seam will be a "flat" or "prayer" seam. The terminal ends or edges of the geocomposite will be finished by seaming the upper and lower geotextiles by sewing as described above, where it is appropriate to mitigate the potential for fouling or clogging of the geonet core through the infiltration of soil materials.

The geocomposite drainage layer will convey subsurface flow resulting from precipitation which has infiltrated the topsoil and barrier protection layers. The direction of flow will follow the direction of the slope and convey the water to and into the storm water drainage swales. The geocomposite drainage layer will also be installed in all of the drainage swales to reduce the potential for saturation of the overlying soils. At the terminal or downstream ends of the drainage swales where they intersect drainage structures, a perforated relief pipe will be installed to minimize the potential for quick conditions to occur in the soils above the geocomposite. The relief pipe will penetrate the structure at the invert of the swale (geocomposite elevation) and will extend 5 feet upstream along the swale centerline. The perforated pipe will be geotextile wrapped to prevent the entrance of soil particles. The relief pipe will allow the swale soils below the drainage structure opening to drain between storm events.

3.9 Barrier Protection Layer

The barrier protection layer will be installed directly above the geocomposite drainage layer over the entire area to be capped. The barrier protection layer will be installed as two compacted lifts of 12 inches in thickness to achieve an overall thickness of 24 inches. The lower 12-inch lift of the barrier protection layer shall be constructed with soil materials hereinafter referred to as Barrier Protection Layer Type I material (BPL – Type I). The upper 12-inch lift of the barrier protection layer shall be constructed with a fabricated mixture of BPL – Type I soils and wood mulch/wood chips, hereinafter referred to as Barrier Protection Layer Type II material (BPL - Type II).

The barrier protection layer is intended to provide physical protection to the hydraulic barrier (geomembrane) against the effects of frost penetration, roots, erosion, burrowing animals and the elements. The proposed 24-inch thickness of the barrier protection layer combined with the proposed 6-inch thickness of topsoil will provide adequate frost protection for the hydraulic barrier. The average depth of frost penetration in the Long Island area during a normal winter is on the order of 15 to 20 inches.

The barrier protection layer material (BPL – Type I and BPL – Type II) will be imported to the site from approved off-site sources. Each proposed source will be subject to prequalification testing and acceptance.

The barrier protection layer Type I material will be clean, inert, well graded granular material free from any organic materials, roots, stumps, chunks of earth or clay, shale or other soft, poor durability particles, construction and demolition debris, reprocessed or recycled soils, concrete, asphalt or other foreign material and shall conform to the following gradation.

Sieve Size	Percent Passing By Weight
1 inch	100
No. 40	0-70
No. 200	0-15

The minimum coefficient of permeability of the BPL – Type I soil will be 1×10^{-3} cm/sec as measured in accordance with ASTM D2434 - Permeability of Granular Soils (Constant Head).

The BPL – Type II material shall be a mixture of BPL – Type I soils and wood mulch/wood chips. The wood mulch/wood chips shall be obtained from the Town of Islip Yard Waste Composting Facility. The Construction Contractor will prepare the BPL Type II material by mixing and thoroughly blending BPL – Type I soils with the wood mulch/wood chips. The approximate mixture will be 3 parts by volume BPL – Type I soils with 1 part by volume of wood mulch/wood chips. The BPL – Type II material will promote moisture retention to aid in establishing and maintaining the vegetation layer.

A coarse grained, granular soil has been selected for the barrier protection layer – Type I to provide a stable, non-yielding surface suitable for potential secondary uses of the site such as outdoor storage. Fine grained soils containing substantial quantities of silt and/or clay would be prone to moisture retention, capillary action and ultimately, pumping or displacement under load. Shifting of the barrier protection layer under load could then result in damage or stresses imposed on the underlying geosynthetics.

The first lift of barrier protection soil will be placed as a loose lift 12 inches in thickness. The material will be placed by low ground pressure machines. Construction equipment will not be permitted to travel directly on the geocomposite drainage layer. Rubber tired vehicles will only be permitted to operate on a layer of soil at least 3 feet in thickness over the liner as a temporary access way. The first lift of material will be compacted by making several passes with the low ground pressure spreading/placing equipment. The moisture content of the soil will be controlled to facilitate compaction; however, a minimum degree of compaction will not be specified for the first lift.

The second 12-inch lift will be placed with low ground pressure equipment and compacted in-place to achieve a minimum of 95 percent maximum dry density (ASTM D698 - Standard Proctor) as measured by nuclear means. The moisture content of the placed material will be controlled to facilitate compaction. The compactive effort imposed on the second lift will also serve to improve the compaction of the first lift to some degree.

Prior to placement of the barrier protection layer lifts, the exposed surface of the geocomposite drainage layer will be inspected to ensure that it is clean, free of debris and defects, flat and in intimate contact with the geomembrane. Placement of the barrier protection layer in the flat (2 percent) areas may proceed either upslope or downslope with care taken to ensure that displacement of the geocomposite does not occur. Placement of the barrier protection layer in the steeper slope areas (7 percent and greater) will only be permitted to progress upslope (pushing up the side slopes) to prevent undo stress from being imposed on the geomembrane or geocomposite.

Grade control for placement of the barrier protection layer will utilize non-intrusive means such as laser, stanchions, traffic cones, etc. to prevent damage to or penetration of the underlying geosynthetics.

Testing of the barrier protection layer material during construction will be performed at a frequency of once per 1,000 cubic yards for gradation analysis (ASTM D422) and once per 5,000 cubic yards for permeability (ASTM D2434) of the BPL – Type I soils and soil fraction of BPL – Type II. In-place moisture/density measurements of the second lift will be performed at a frequency of nine tests per acre per lift utilizing nuclear methods (ASTM D3017 and D2922, respectively).

The in-place thickness of the barrier protection layer will be confirmed by hand excavating a test hole on a 100-foot grid pattern. A board or straight edge will be used to reference grade and three measurements of the in-place depth will be made. The average of the three readings will be considered the depth of the material. The average thickness of the compacted barrier protection layer will be no less than 24 inches.

3.10 Topsoil and Vegetation

The topsoil layer shall be the uppermost layer of soil in the capping system and shall be suitable for establishing and growing surface vegetation. The topsoil layer shall be 6 inches in thickness and shall be placed over the entire area to be capped. For the purpose of this discussion, the term "topsoil" shall refer to a fabricated (processed) vegetative growth medium.

A review of existing site conditions suggests that there is no appreciable or salvageable quantities of topsoil on-site which would serve to satisfy the need for cap construction. Therefore, all topsoil requirements for the site must be satisfied by the import of topsoil from approved off-site sources.

Natural topsoil shall be defined as fertile, friable, natural topsoil of loamy character, without admixtures of subsoil and shall be uniform in quality. Natural topsoil shall be free from debris and waste of any kind, clay, hard pan, rocks, pebbles larger than 2 inches in diameter, plants, sod, noxious weeds, roots, sticks, brush and other rubbish. Muck soils shall not be considered natural topsoil.

Natural topsoil shall have an organic content of no less than 5 percent nor more than 20 percent as determined by loss on ignition of oven-dried samples tested in accordance with ASTM D2974. The pH of the topsoil shall not be less than 5.5 and not more than 6.8. The natural topsoil shall have a gradation which conforms to the following:

Sieve Size	Percent Passing By Weight
2 inch	100
1 inch	85-100
1/4 inch	65-100
No. 200	20-80

Fabricated or processed topsoil will be defined as a blend of natural soils and yard waste compost material in prescribed proportions to provide an equivalent vegetative growth medium. The fabricated topsoil will be a mixture of sand or silty sand and screened yard waste compost. The approximate mixture will be on the order of 70 to 80 percent sand or silty sand and 20 to 30 percent compost. For this project, the source of yard waste compost is proposed to be the Town of Islip Yard Waste Composting Facility. The Town of Islip Yard Waste Composting Facility is a Town-owned and operated facility and is permitted by NYSDEC.

The actual mixture of soil and compost will be proposed by the construction contractor. The contractor will retain the services of an experienced agronomist who will provide a written opinion of the proposed mixture, its suitability as an equivalent vegetative growth medium, its compatibility with the specified seed mixtures, any erosion control measures which differ from the specified requirements and are necessitated by the fabricated material and any soil amendments or fertilizers which may be required to provide a suitable material.

The yard waste compost will be mature and stable, not phytotoxic (not toxic to plants) and will be free of any traces of municipal solid waste, sewage sludge, construction and demolition debris, animal offal or manure, bulking agents or any other objectionable or deleterious materials. The compost material will be free of particles larger than 2 inches and will be generally free of plastics.

Due to the difficulties in obtaining substantial quantities of natural topsoil in the Long Island area, the use of natural topsoil is not proposed for this project in order to preserve the limited natural resource.

The topsoil layer will be placed as one lift 6 inches in depth over the exposed surface of the barrier protection layer (or general fill). The topsoil layer will be raked and cleaned and rolled with a roller weighing between 40 and 65 pounds per foot of width. During rolling, all depressions caused by settlement will be filled with topsoil and the surface shall be regraded and rolled until a smooth, even finished grade is achieved.

The placement and spreading of topsoil shall be coordinated with the planting and seeding operation to allow for planting and seeding within 7 days of placement. Soil amendments such as fertilizer, lime, etc., will be applied as required based upon test data.

The proposed vegetation for the capped area of the site will be a mixture of turf grasses which will provide for rapid establishment to minimize erosion, as well as slower growing species to minimize long-term maintenance. The seed mixture will include:

- Crown Vetch;
- Birdsfoot Trefoil;
- Palmer Perennial Ryegrass (fall planting);
- Chewings Red Fescue;

- Kentucky 31 Tall Fescue;
- Redtop;
- Spring Oats (spring planting);
- or equivalent species.

The seed mixture will be applied by hydroseeding onto the loosened surface of the topsoil layer. The hydroseeding operation will include the application of a hydromulch and hydromulch adhesive to secure and protect the seeding sufficiently to allow for the placement of the overlying erosion control fabric.

The in-place depth of the topsoil will be confirmed using the procedures for test pits discussed for the gas venting layer and barrier protection layer soils.

The finished surface of the topsoil layer will be surveyed for as-built conditions.

In the area of the planting beds proposed along the southern and eastern property boundaries, low level bushes will be planted in addition to the turf grasses to enhance the visual appearance of the berms as a buffer to the adjacent residential properties.

3.11 Erosion Control

Erosion control will be implemented during construction of the capping system and incorporated as part of the final capping system. During construction, the contractor will be required to install an maintain erosion control measures which will include, but not necessarily be limited to, silt fences, hay bales, grade and excavation control, stockpile maintenance and control measures and surface runoff controls. Construction-related erosion control measures will be initiated prior to disturbance of the affected area and shall be maintained through the course of the construction. Vehicle tracking pads will be constructed at all exits from the construction site to minimize the carryover of construction soils from the site to surrounding roads by way of vehicle tires. Surface runoff from the site will not be permitted to run off onto adjacent roads or properties.

A detailed construction erosion control plan will be provided in the construction plans and specifications. Typical details to be used in formulating the erosion control plan are presented on the attached drawings.

The final capping system will provide for erosion control through the inclusion of erosion control materials on the exposed finished surfaces. Erosion control blankets will be installed, to the extent required, on the seeded landfill surfaces to provide temporary soil erosion resistance. Erosion control fabrics will be installed in the seeded drainage channels and swales to provide permanent soil erosion resistance and vegetation reinforcement. Each product will assist in establishing the permanent vegetation by shielding the seeded areas from direct impact by precipitation, direct exposure to sunlight, and surface runoff, as well as improving the moisture conditions of the seed bed which are necessary for proper germination.

In accordance with comments provided by NYSDEC, the erosion control blanket will be installed on an as-needed basis to address areas of the site where erosion may be prevalent and also to address areas of the site where, due to construction scheduling, planting may occur outside the normal periods for planting. The erosion control blanket will be included in the bid documents as a contingency item. The actual quantity of material utilized will be determined during the construction.

A distinction is made between the erosion control blanket and the erosion control fabric based upon its materials, construction, durability and permanence.

The erosion control blanket will be a fabricated machine-produced mat consisting of 70 percent agricultural straw and 30 percent coconut fiber. The upper surface of the mat will be covered with UV stabilized black polypropylene netting having approximately a 5/8 inch by 5/8-inch mesh size. The bottom surface of the mat will be a lightweight, photodegradable netting with approximately 1/2 by 1/2-inch mesh size. The components of the blanket will be factory sewn together using biodegradable thread.

The erosion control blanket will be installed directly over the prepared seed bed and secured in place using heavy duty staples. Anchor trenches and check slots will be installed as appropriate to anchor the material and minimize erosion from occurring below the blanket. The erosion control blankets will be installed in the direction of the slope. The erosion control blanket will remain viable for two to three growing seasons.

The erosion control fabric will be a fabricated machine-produced mat suitable as a permanent channel lining and turf reinforcement mat. The mat will be fabricated from 100 percent UV stabilized polypropylene. The fiber matrix core will have a minimum of 0.70 lb./sq. yd. of high denier UV stabilized polypropylene fiber. The top netting and bottom netting will be UV stabilized polypropylene netting with approximately 1/2 inch by 1/2-inch and 5/8 inch by 5/8-inch mesh, respectively. The netting and core will be secured in relative position by sewing using UV stabilized polypropylene thread.

The erosion control fabric will be installed in the drainage swales on top of the prepared seed bed and will be positioned longitudinally with the channel. The fabric will be secured in place using anchor slots, check slots and heavy duty staples. Adjacent panels will overlap a minimum of 6 inches. The fabric will be installed to ensure intimate contact with the ground surface. Trampolining of the material above the ground surface will not be permitted.

The erosion control materials will serve to protect the site, promote the establishment of the vegetation layer and minimize the loss of topsoil due to the erosional forces of surface runoff. During construction, a bare, exposed topsoil surface presents the most susceptible condition for erosion prior to establishment of the vegetation. During the period of establishing the vegetation from seed, erosion of the topsoil surface will disturb the prepared seedbed and transport the seeds from their intended location. Repair efforts requiring heavy equipment will typically disturb additional areas while accessing the area of concern thereby further setting back the overall establishment of vegetation. In addition, landfill capping construction projects typically near completion toward the latter part of the construction season, considered late fall to early winter. For a project the size of the Sonia Road Landfill, it is unlikely that seeding of the topsoil surface can occur during the normal windows of the growing season, suggesting that the topsoil surface may lay bare and exposed for an extended period.

The Universal Soil Loss Equation (USLE) provides an opportunity to assess the impacts of erosion to the topsoil surface, as well as gauge the apparent effectiveness of an included erosion control material. The USLE is used to calculate the loss of topsoil in terms of tons per acre per year. The loss of surface soils is most directly dependent on the texture and erodability of the surface soil, the geographic location of the site in terms of rainfall events, the slope angle or gradient, and the unbroken length of slope. The USLE integrates these factors in the following equation:

$$A = (R)(K)(LS)$$

where:

A = Soil loss in tons/acre/year

R = Rainfall intensity factor. For the Sonia Road Landfill, the R value is taken as 175. See Figure 3-2.

K = Soil erodability factor. For this project, the K value is taken as 0.30 representing a silty loam.

LS = Slope length - slope gradient factor. As an example, a 2 percent slope with a slope length of 1,000 feet exhibits an LS factor of 0.4. For steeper slopes on the site, the LS factor will increase.

Substituting the above values into the equation yields the following:

$$A = 21 \text{ tons/acre/year}$$

This value represents the potential loss of soil from the mildest slopes on the project at a point in time where the slopes have been constructed but the vegetation has not become

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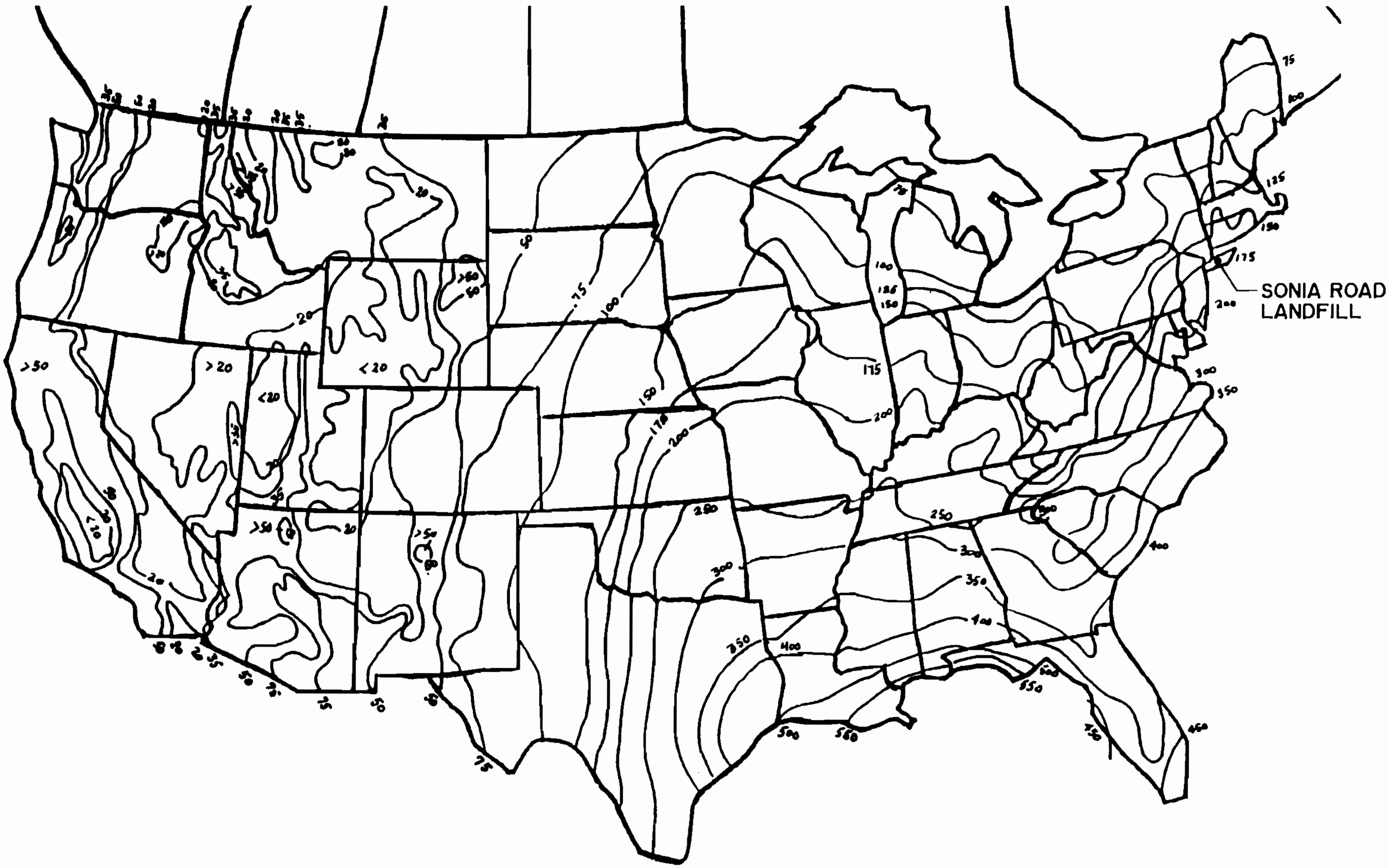


SOURCE: NORTH AMERICAN GREEN

SONIA ROAD LANDFILL
FINAL CLOSURE PLAN

RAINFALL INTENSITY "R" FACTORS

Dvirka and Bartilucci
Consulting Engineers
A Division of William F. Cosulich Associates, P.C.

FIGURE 3-2

established (i.e., bare ground). The addition of the erosion control materials allows for the equation to be expanded to include a C factor for cover management as follows:

A = (R)(K)(LS)(C)

where:

C = Cover management factor. For the proposed erosion control blanket (coconut/straw), the C factor is 0.015 based upon information provided by North American Green.

Recalculating:

A = 0.32 tons/acre/year

The above value represents less than 6 cubic feet per year per acre. This quantity of soil is negligible given that a 6-inch layer of soil over 1 acre equals 21,780 cubic feet. The proposed erosion control blanket should provide 2 to 3 years of surface protection before it naturally decomposes. This period should be more than ample to allow the ultimate vegetation to establish. The proposed erosion control fabric for the drainage swales is considered a permanent material and should provide long-term utility.

Section 4

4.0 SLOPE STABILITY

4.1 General

A critical element in the design of a landfill capping system is the assessment of the lining system to remain stable and to not impose undue stresses in the components of the system. These stresses may be imparted through the sliding action of one surface against another. Typically, the focus of concern is addressed to the interface or contact plane between the soil components of the systems against the geosynthetic components of the system and also the interface between two contacting geosynthetics.

The design requirements prescribed by 6 NYCRR Part 360 place restrictions on the maximum slope angle permitted. The maximum prescribed slope angle may be considered to be 1 vertical to 3 horizontal (1V:3H), 33 percent or 18.4 degrees. In instances where the interface friction angle (resistance) is not sufficiently large to counteract the tendency of the lining materials to progress downslope (driving force) the difference in forces must be assumed by the tensile properties of the lining components. In instances where the resistive forces of friction exceed the driving forces, the forces acting across the interface are considered to be neutral and no tensile contribution is required of the geosynthetics.

The typical landfill capping system is constructed in a succession of layers, each of a generally uniform and definable cross section. Each layer may be equated to a thin veneer separated from underlying and overlying layers or veneers by identifiable boundaries or interfaces. An examination of the forces acting at the critical interfaces is referred to as a Veneer Stability Analysis.

For landfill which project upwards as a mound above surrounding grades and impart unbalanced loads through the waste and/or underlying and adjacent soils, the issue of global or slope stability is an area of concern. In these instances, failure through the waste as a rotating wedge is a possibility. In the case of the Sonia Road Landfill, it is clear that the waste mass is essentially below grade and the upper surfaces are consistent with the surrounding natural grades. There is very little relief across the site as exhibited by the generally flat topography. On this basis, an analysis of the global stability of the site is not warranted.

Given that the proposed grading plan for the Sonia Road Landfill generally includes mildly sloping terrain with minimal areas of appreciable slope inclination or length, an examination of the seismic stability of the proposed capping system is also not warranted.

4.2 Veneer Stability

The veneer stability of the proposed capping system for the Sonia Road Landfill was analyzed to assess the potential for a sliding failure of the cap components and to confirm the capacity to achieve the required factors of safety. 6 NYCRR Part 360, dated October 9, 1993, prescribes a factor of safety of 1.5 for capping systems. The December 31, 1988 edition of Part 360 did not specify a minimum factor of safety for capping systems. However, a value of 1.25 was routinely used for designs regulated under this earlier version. For the purpose of this report, a factor of safety of 1.50 has been utilized for the veneer stability analysis.

The calculations for the veneer stability analysis can be found in Appendix C.

The analysis makes use of the following equation to calculate the factor of safety.

$$F.S. = \frac{c}{\Upsilon d \cos\beta \sin\beta} + \frac{\tan\delta}{\tan\beta}\left[1 - \frac{(\Upsilon w)h}{\Upsilon d \cos^2\beta}\right]$$

where:

F.S.	=	Factor of Safety
c	=	cohesion intercept
d	=	thickness of soil layer(s)
Υ	=	density of soil(s)

β = slope angle

δ = interface friction angle

Υw = density of water

The first term of the equation accounts for the cohesive forces at the subject interface. The bracketed term accounts for the seepage forces associated with soils which are partially or fully saturated. The seepage forces tend to destabilize the soils by applying a buoyant force to the soils.

As previously discussed, the proposed grading plan provides for relatively flat slopes over the majority of the site, with steepened slopes in select areas to accommodate existing topography and minimize the need to excavate and relandfill excessive quantities of waste. The range of proposed slopes is from 2 percent to 33 percent. In the area of flatter slopes (less than 10 percent), the Hydrologic Evaluation of Landfill Performance (HELP) model suggests that the barrier protection layer will become partially saturated during periods of peak precipitation. The HELP model further suggests that in areas of steeper slopes (greater than 10 percent), the barrier protection layer will not become saturated and that the accumulation of water will be limited to the thickness of the geocomposite drainage layer. A detailed description of the HELP model is provided in Section 5.0.

In order to address these two extremes, the veneer stability was analyzed separately for flatter areas and for steeper areas. In each case, the analysis was performed as a sensitivity analysis to establish the minimum required interface friction angles necessary to attain the prescribed factor of safety. Worse case assumptions were used in each analysis.

Given the generally flat slopes proposed for the Sonia Road Landfill, the critical interface was considered to exist at, or around the geomembrane in the form of the barrier protection layer/geocomposite drainage layer interface, the geocomposite drainage layer/geomembrane interface and the geomembrane/gas venting layer interface. Each interface is considered to be under equal conditions of overburden, namely 6 inches of topsoil and 24 inches of barrier protection layer. Soil to soil interfaces were not considered critical interfaces due to the flatness of the proposed slopes and the general nature of the proposed soils to have internal friction angles which far exceed the proposed slope angles.

In the analysis of the flatter slopes, the required interface friction angle necessary to satisfy the factor of safety was found to be 11.13 degrees. In this analysis the seepage forces were found to have some impact, but not to a significant extent. In the analysis of the steeper slopes, the required interface friction angle necessary to satisfy the factor of safety was found to be 26.5 degrees. In this case, seepage forces were not a factor.

In both cases, the required interface friction angles should be readily attainable using construction materials routinely utilized for the landfill caps. A review of the literature, as well as site specific test data from other sites, support that these conditions can be readily met. On this basis, site specific testing of the capping components for the Sonia Road Landfill is not warranted.

The veneer stability analysis further notes that areas less severe than the worse case scenarios will exhibit a factor of safety greater than the prescribed value. As an example, an area of 10 percent slope will exhibit a factor of safety of 5.04.

Clearly, the results of the veneer stability analysis support that the proposed capping system will provide a stable and durable cap capable of being maintained for the post closure monitoring and maintenance period.

Section 5

5.0 HYDRAULIC EFFICIENCY

The hydraulic efficiency of the proposed capping system is a measure of the ability of the cap to inhibit the percolation of infiltrated precipitation into the waste mass and the cause of the generation of leachate. In order to assess this efficiency, the proposed capping system was modeled using the Hydrologic Evaluation of Landfill Performance (HELP) model developed by the U.S. Army Corps of Engineers Waterways Experiment Station. The HELP model, Version 3, September 1994 was utilized.

The HELP model is a quasi-two dimensional model of water movement across, into, through and out of landfills. The model accepts weather, soil and design data, and uses solution techniques that account for the effects of surface storage, snow melt, runoff, infiltration, evapotranspiration, vegetative growth, soil moisture storage, lateral subsurface drainage, unsaturated vertical drainage and leakage through geomembrane liners. The model may be used to evaluate the efficiency of bottom lined landfills as well as landfill caps over lined and unlined landfills. In the case of the Sonia Road Landfill as an unlined landfill, the examination is limited to the efficiency of the proposed cap.

The level of hydraulic efficiency for a single hydraulic barrier landfill cap was characterized by the NYSDEC in the preparation of the Draft Environmental Impact Statement (DEIS) for revisions to 6 NYCRR Part 360 - Solid Waste Management Facilities, dated April 1988. The NYSDEC found that the proposed capping system would provide an acceptable hydraulic efficiency of 94.40 percent in terms of inhibiting the vertical percolation of infiltrated precipitation through the cap and entering the underlying waste. The capping system analyzed by NYSDEC is generally consistent with the proposed capping system for the Sonia Road Landfill with the noted difference that NYSDEC modeled 18 inches of low permeability soil (permeability less than $1x10^{-7}$ cm/sec) as the hydraulic barrier. The NYSDEC further notes that a synthetic geomembrane may be substituted for the low permeability soil liner.

For the purpose of this report, the calculated efficiency of 94.40 percent, which NYSDEC considered acceptable in 1988, will be used as a reference to gauge the minimum efficiency of the proposed capping system for the Sonia Road Landfill.

In order to utilize the HELP model, certain variables must be selected or defined. Where appropriate, default values and data contained within the model may be utilized in lieu of developing site-specific data. For the Sonia Road Landfill, evapotranspiration and weather data for New York, New York was utilized as being geographically representative of the site. The evaporative zone depth was selected as 20 inches, representative of a humid area with surface vegetation. The maximum leaf area index was selected as 2.0, representing a fair stand of grass which should be appropriate for a typical landfill cap which received nominal maintenance. The start and end of the growing area was selected to coincide with the period of the middle of April through the middle of October.

In order to provide an accurate appraisal of the proposed capping system, a finite number of defects were assumed to exist in the completed geomembrane hydraulic barrier. The size and frequency of the defects is considered consistent with good construction quality assurance/ quality control (CQA/CQC). For a good installation, the geomembrane defects are defined as one pinhole per acre and three installation defects per acre, again being consistent with good CQA/CQC. The HELP guidance document suggests that an excellent installation quality (one defect per acre) is achieved only 10 percent of the time, as opposed to a good installation, which is routinely achieved 40 percent of the time. The geomembrane placement quality was also selected as "good," representing a good field installation with a well prepared, smooth soil surface and geomembrane wrinkle control to ensure good contact between the geomembrane and the underlying soil.

The following discussion of the HELP model results will relate to the proposed use of a two percent slope as a minimum slope in lieu of a four percent slope and also present the proposed capping system and its hydraulic efficiency.

Previous sections of this report have discussed the merits of constructing the Sonia Road Landfill capping system with a minimum slope of two percent in lieu of the prescribed four percent. The prior discussion was based upon the economics of constructing the cap, the visual impacts of the completed cap and the unnecessary use of a natural resource (soil fill) in achieving the greater slope with little obvious benefit. In this section, the discussion will address the relative impact of using a flatter slope on the overall efficiency of the system. In order to present this discussion, four separate runs of the HELP model were prepared to represent the following conditions:

- Two percent slope, no geocomposite drainage layer
- Four percent slope, no geocomposite drainage layer
- Two percent slope with a geocomposite drainage layer
- Four percent slope with a geocomposite drainage layer

The output from these four runs is included as Appendix D. With the exception of the variables noted above, all other parameters remained the same for this analysis. The period of analysis was selected as five years to coincide with the climate data available from the model for the calendar years 1974 through 1978. For each of the four runs, the section "Average Annual Totals for Years 1974 through 1978" has been excerpted and presented as Tables 5-1 through 5-4.

Tables 5-1 and 5-2 present the results for a two percent slope without a geocomposite and four percent without a geocomposite, respectively. For each example, the values for surface runoff, evapotranspiration and percolation/leakage through layer 3 (geomembrane) are virtually the same. For each parameter, the difference between the two scenarios is less than one percent.

The hydraulic efficiency for each capping system is calculated as the percentage of annual precipitation which is prevented from entering the waste mass to generate leachate. The equation for hydraulic efficiency follows:

Table 5-1

SONIA ROAD LANDFILL
HELP MODEL
2% SLOPE, NO GEOCOMPOSITE

AVERAGE ANNUAL TOTALS FOR YEARS 1974 THROUGH 1978

	Inches	Percent
Precipitation	44.79	100.00
Runoff	5.01	11.19
Evapotranspiration	34.31	76.59
Lateral Drainage Collected from Layer 2 (Barrier Protection Layer)	0.37	0.82
Percolation/Leakage Through from Layer 3 (Geomembrane)	5.12	11.43
Average Head Across Top of Layer 3 (Geomembrane)	17.35	

Hydraulic Efficiency = 88.6%

Table 5-2

SONIA ROAD LANDFILL
HELP MODEL
4% SLOPE, NO GEOCOMPOSITE

AVERAGE ANNUAL TOTALS FOR YEARS 1974 THROUGH 1978

	Inches	Percent
Precipitation	44.79	100.00
Runoff	4.83	10.79
Evapotranspiration	34.14	76.21
Lateral Drainage Collected from Layer 2 (Barrier Protection Layer)	0.83	1.84
Percolation/Leakage Through from Layer 3 (Geomembrane)	5.03	11.22
Average Head Across Top of Layer 3 (Geomembrane)	17.01	

Hydraulic Efficiency = 88.8%

$$\text{Hydraulic Efficiency} = \frac{P - L}{P} x\, 100$$

where:

P = total inches of precipitation per year.

L = percolation/leakage through the hydraulic barrier (measured in inches of precipitation).

For a two percent slope without a geocomposite drainage layer, the hydraulic efficiency is calculated to be 88.6 percent. For a four percent slope without a geocomposite drainage layer, the hydraulic efficiency is calculated to be 88.8 percent. Clearly, there is only a nominal improvement in the system efficiency if a four percent slope is mandated. However, and more importantly, neither scenario will provide an overall system efficiency which meets or exceeds an acceptable efficiency as prescribed by NYSDEC. In each case, the poor performance is the result of the average hydraulic head which will develop on top of the geomembrane. In each case, the average annual head will result in approximately 70 percent of the barrier protection layer being saturated. This condition is not acceptable from a design perspective and would also forfeit any opportunity to use the site for a secondary purpose due to the potential for saturated soils to be displaced under load.

In light of these conditions, the proposed capping system incorporates the use of a geocomposite drainage layer above the geomembrane to facilitate lateral drainage and minimize the accumulation of head on the hydraulic barrier. Tables 5-3 and 5-4 present the results for a two percent slope with a geocomposite drainage layer and a four percent slope with a geocomposite drainage layer, respectively. In each example, the values for surface runoff, evapotranspiration and lateral drainage through the geocomposite are, again, virtually the same. As before, the difference in each parameter is less than one percent and suggests little advantage in providing a minimum slope of four percent.

The obvious benefit of incorporating a geocomposite drainage layer into the system is reflected in the improvement of the hydraulic efficiency for each scenario. In both the 2 percent and 4 percent examples, the calculated efficiency has been increased to at least 99 percent and

Table 5-3

SONIA ROAD LANDFILL
HELP MODEL
2% SLOPE WITH GEOCOMPOSITE

AVERAGE ANNUAL TOTALS FOR YEARS 1974 THROUGH 1978

	Inches	Percent
Precipitation	44.79	100.00
Runoff	1.84	4.10
Evapotranspiration	26.04	58.12
Lateral Drainage Collected from Layer 3 (Geocomposite)	16.73	37.34
Percolation/Leakage Through from Layer 4 (Geomembrane)	0.04	0.09
Average Head Across Top of Layer 4 (Geomembrane)	0.09	

Hydraulic Efficiency = 99.90%

Table 5-4

SONIA ROAD LANDFILL
HELP MODEL
4% SLOPE WITH GEOCOMPOSITE

AVERAGE ANNUAL TOTALS FOR YEARS 1974 THROUGH 1978

	Inches	Percent
Precipitation	44.79	100.00
Runoff	1.83	4.09
Evapotranspiration	26.41	58.95
Lateral Drainage Collected from Layer 3 (Geocomposite)	16.39	36.59
Percolation/Leakage Through from Layer 4 (Geomembrane)	0.013	0.03
Average Head Across Top of Layer 4 (Geomembrane)	0.02	

Hydraulic Efficiency = 99.97%

more than satisfies the NYSDEC criteria of 94.40 percent. As shown in the tables, the difference in efficiency between the two examples is less than 0.1 percent, a value which should be considered theoretical at best.

Clearly, the benefits of a geocomposite drainage layer in the capping system overshadow any marginal gains realized by mandating the minimum slope of four percent. It is on this basis that a minimum two percent slope has been proposed and should be considered acceptable.

To complete the discussion on system hydraulic efficiency, HELP model runs for slopes of 7 percent, 10 percent, 20 percent and 33 percent are included in Appendix E. In each case, the assumptions and details of the system discussed previously have been reused. The results of this modeling provides the following hydraulic efficiencies:

Slope	Hydraulic Efficiency
7%	97.7%
10%	99.0%
20%	99.6%
33%	99.8%

Clearly, these values exceed the criteria established by NYSDEC and should be considered acceptable.

Section 6

6.0 SITE DRAINAGE

At the present time, site drainage for the Sonia Road Landfill is managed through infiltration and percolation of precipitation into and through the waste mass with discharge to the groundwater system. Existing grading patterns suggest that storm water runoff does not leave the site to any appreciable extent. The existing site is not connected or tributary to any local or regional storm water management system.

With the construction of the proposed capping system, the opportunity for infiltration to occur over the entire site will be mitigated as a basic function of the cap. Therefore, management of storm water runoff after cap construction will require use of facilities which do not presently exist.

In order to develop a basic storm water management approach for the property, an examination of the property and its surroundings must be considered. The first step involves a determination of the potential for existing facilities to accommodate, with or without modifications, flow from a source which is not currently tributary to it. Absent any existing facilities, consideration is then given to developing new facilities specifically to satisfy the need.

The effort to define available opportunities to manage storm water runoff from the site has considered facilities located both on-site and off-site. An examination of the local area surrounding the landfill and consultation with the Town of Islip reveals that storm water management is difficult. The Town of Islip reports that the industrial areas to the north and west of the site have occasionally experienced flooding of roads due to the fact that these areas are low lying with grades close to the groundwater table. The Town also reports that the residential areas to the east and south of the site are managed by isolated collection systems discharging to dry wells. A regional system for the residential area does not exist. A review of aerial photographs also confirms that there are no recharge basins in the surrounding areas and the opportunity to construct one or more is limited by the existing degree of development.

The result of the off-site investigations reveals that there are no existing storm water management facilities in the surrounding area which could accommodate or be modified to accommodate the storm water runoff, in whole or in part, from the completed landfill cap.

In an effort to further the off-site investigation, consideration was given to discharging storm water runoff to surface waters as a means of disposal. As previously discussed, the headwaters of the Sampawams Creek are located to the southwest of the landfill site at a straight line distance of approximately 1,400 feet from the very southwest corner of the landfill property or approximately 2,500 feet from the central portion of the landfill site . The Sampawams Creek is a natural stream which is groundwater fed. The creek flows north to south beginning at the headwaters located southwest of the landfill. The creek ultimately discharges to the Great South Bay at the south shore of Long Island. Along its course, the creek feeds a number of lakes, including the Guggenheim Lakes near Southern State Parkway, and passes under a number of roads by means of culvert pipes. In addition to being groundwater fed, the creek serves as the disposal point for a number of storm water systems discharging directly to the stream bed. These tributary systems originate in both the Town of Islip and the Town of Babylon given that the creek roughly delineates the common Town boundaries.

The Sampawams Creek and the surrounding fresh water wetlands are regulated by the NYSDEC. The Sampawams Creek was the subject of a Flow Augmentation Needs Study (FANS) conducted by Suffolk County in 1980 to assess the impacts to the stream which may be caused by the installation of regional sanitary sewers. The findings of the FANS report indicate that the average dry weather flow rate of the creek at the downstream outlet (Great South Bay) is in the range of 6 to 8 cubic feet per second (CFS) with seasonal variation due to precipitation. The study did not quantify wet weather flows.

The Sampawams Creek is the only surface waters in the vicinity of the site. In order to give further consideration to discharging storm water to the Sampawams Creek, a meeting was conducted with NYSDEC - Region I to assess the practical limitations that would be placed on the discharge. The basic restrictions proposed by NYSDEC for the discharge would require that some form of detention be provided for a storm event discharge in order to allow the discharge to the stream to be metered out or released over an extended period of time. This control on maximum flow rate would be necessary to prevent scouring of the stream bed and "flash flooding" of the creek.

In order to accommodate these restrictions, a basin(s) would be required to receive and contain the site storm water discharge prior to release to the creek. A review of the surrounding area indicates that there is little or no vacant land which would provide the opportunity for construction of this off-site storage capacity. Consequently, attention was directed back to the landfill property as the only means to satisfy these needs.

The only area of the site which offers any opportunity for the construction of a basin(s) (other than on top of the waste mass itself) is along the western property boundary. In this area, the land between the limits of the waste and the western property line provides a narrow band of land not occupied by waste. This corridor of land slopes from the southwest corner of the property to the northwest corner of the property and is interrupted by the inset residential property discussed previously. The existing grading of this corridor is in a direction away from the headwaters of the Sampawams Creek. If a series of basins were constructed within this corridor to contain (detain) the volume of storm water runoff from the site with the intention of providing a dedicated, piped discharge to the creek, the elevations of lowest basin would govern the profile of the pipeline and result in relatively deep trench depths.

However, if these same basins could be located in areas where the bottoms of the basins did not overlie waste, the basins could serve as recharge basins and avoid the need for direct dedicated discharge to the creek.

In light of the fact that an equal basin(s) volume would be required for either the detention basin(s) or recharge basin(s) scenarios, the prospect for constructing a recharge basin(s) was pursued as the more cost effective approach. In this way, the cost of constructing a discharge pipeline approximately 2,100 feet in length (following roadways) could be avoided.

In order to establish the needed capacity for an on-site recharge basin(s), a hydraulic analysis of the site was conducted. In accordance with 6 NYCRR Part 360, the storm water management system must be sufficient to accommodate a 25-year storm event with a 24-hour duration. For the Long Island area, this storm event is equivalent to 6 inches of rainfall with an intensity distribution for a Type III coastal setting (see Appendix F).

A review of the proposed Final Grading Plan indicates that there are eight subareas with definable flow paths. These areas are identified as areas SL-1 through SL-8 on the attached Drainage Plan. The analysis of the storm water discharge from each of these areas was performed using Hydrocad 4.0. Hydrocad 4.0 is a computer model which makes use of the SCS TR-20 and TR-55 methods to develop linked hydrographs for the drainage areas, conveyance systems and impoundments. Several of the parameters which are input for each subarea include, storm frequency (25-year storm), storm duration (24 hours) rainfall intensity distribution (Type III - coastal setting) plan area of the subarea (acres), slope, slope length, quality and nature of vegetative cover (fair, brush-weed-grass mixture to reflect long term conditions after closure) and a soil group to reflect the nature of the soil.

The output from the model provides data on the total quantity of runoff from each area as well as the time distribution and peak flow rate for each subarea. Conveyance systems are analyzed for their capacity to transmit the flow and impoundments are analyzed for their capacity to receive, contain and dispose of the discharge. Recharge from the basins to the groundwater system is assumed to occur only from the bottom area of the basins, (no allowance for submerged side slopes) at a rate of 5 gallons per day per square foot. This rate is typical for recharge basins in the Long Island Area. A copy of this analysis is provided in Appendix F.

As discussed previously, the opportunities for on-site disposal are limited by the available free space at the perimeter of the site, beyond the limits of waste. In order to provide on-site disposal capacity, two recharge basins have been proposed. Both basins are located along the western property boundary. Basin 1 is located immediately to the north of the inset residential parcel and is achieved through regrading of an existing shallow depression. The inboard (eastern) wall of Basin 1 will be formed through regrading, excavation and relandfilling of existing waste. The details of this construction will be discussed later in this section. Basin 2 is located in the extreme southwest corner of the property and is achieved through excavation of virgin ground.

In general, the western half of the landfill property will be tributary to Basin 1, and the eastern half of the landfill will be tributary to Basin 2. Basin 1 has a proposed bottom elevation of 50 feet AMSL and a top elevation of 58 feet AMSL. Allowing for 1.8 foot of freeboard, Basin 1 provides a storage volume of 3.47 acre feet. Basin 2 has a proposed bottom elevation of 60 feet AMSL and a top elevation of 70 feet AMSL. Allowing for 1.6 feet of freeboard, Basin 2 provides a storage volume of 1.75 acre feet. Under the design storm of a 25-year storm with a 24-hour duration, the capacity of Basin 2 is not sufficient to satisfy the discharge from its tributary area. Under the same event, the capacity of Basin 1 is more than sufficient for its tributary area.

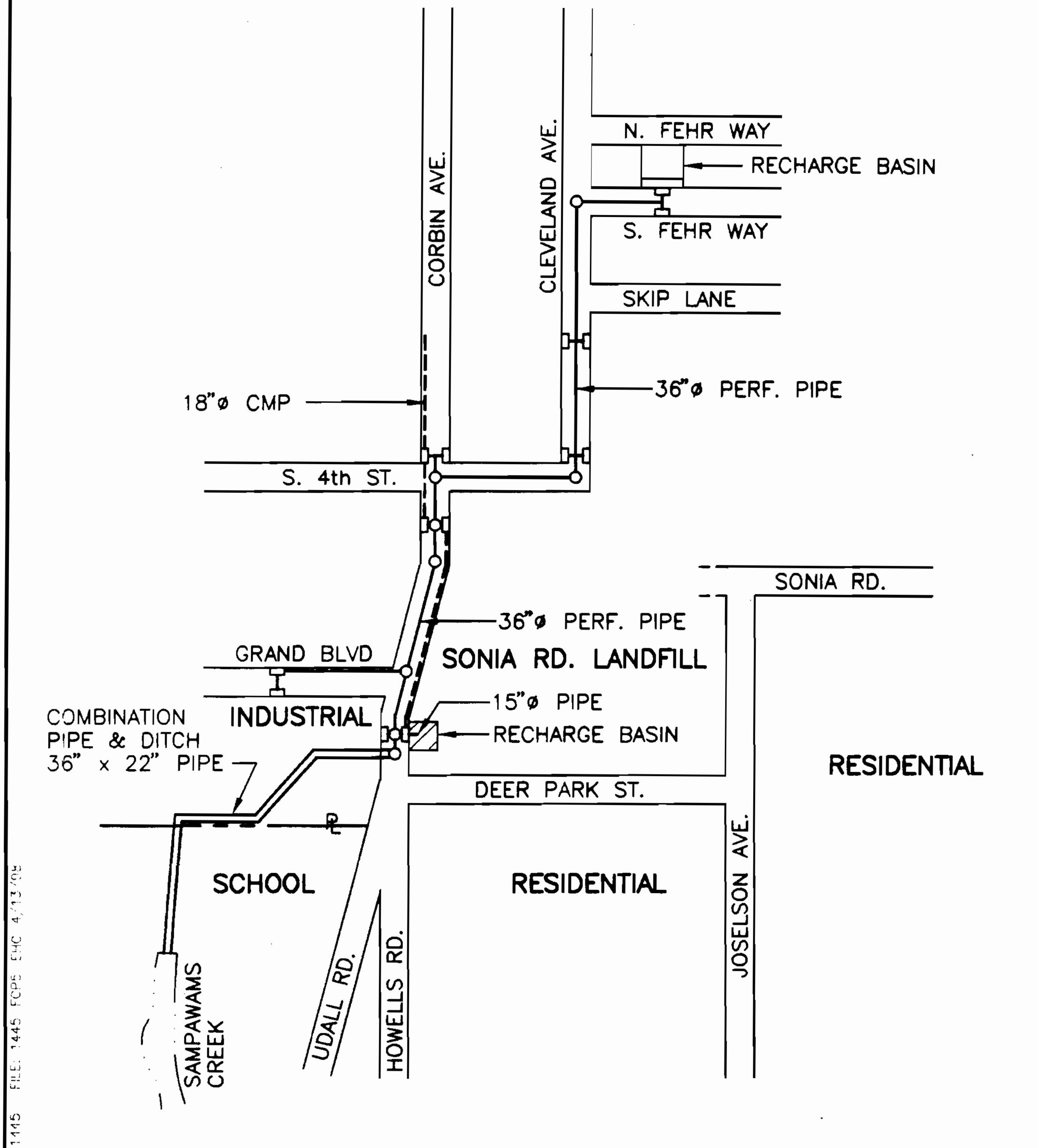
Due to elevational differences between the two basins, the basins cannot be directly connected to each other to allow for distribution of flows. Instead, an overflow structure is proposed for Basin 2 to allow for peak discharges to the basin to be conveyed to Basin 1 and make use of the excess capacity in Basin 1. The overflow system will only allow for flow to be conveyed from Basin 2 to Basin 1 and not vice versa. The overflow weir in Basin No. 2 is set at an elevation of 68.0 to maintain the freeboard in the basin at 1.6 feet under flowing conditions.

As noted, the overflow from Basin No. 2 to Basin No 1 can be accommodated by Basin No. 1 during the design storm event assuming that Basin No. 1 is empty (drained) at the start of the storm. In order to provide an added degree of protection, it is proposed to construct an overflow structure in Basin No. 1 rather than an overflow spillway. The proposed overflow structure will be piped to an existing Town of Islip drainage system which discharges to the headwaters of Sampawams Creek. This Town system services the industrial area to the north and west of the landfill property to alleviate the flooding conditions noted previously. The existing system was analyzed and was found to not have the capacity to service the landfill as the primary means of storm water disposal. However, this system can serve as an emergency backup to the proposed on-site system. A schematic of the Town's existing system is shown in Figure 6-1. Piping the Basin No. 1 overflow system will minimize the potential for Basin No. 1 to overtop. The proposed overflow weir in Basin No. 1 is set at elevation 56.5 and the discharge will be piped into the existing Town system.

Surface runoff will be conveyed to the basins by means of open drainage swales and buried storm water sewers. As shown on the Drainage Plan, the lower portion of the western half of the landfill and the northern portion of the eastern half will be conveyed to Basin No. 1 by drainage swales. The upper portion of the western half will be conveyed to Basin 2 by drainage swales. The majority of the eastern half of the site is also tributary to Basin 2. However, due to the distances between this eastern half and the basin and the flat terrain, the water must be conveyed to the basin by means of underground storm water piping.

As shown on the Drainage Plan, the eastern half of the landfill will drain to two open drainage swales running in a north-south direction. Due to the existing berms along the southern boundary, these swales cannot reach the southern property boundary. Instead, each swale will discharge to a concrete transition structure which will allow for the flow to transition from an open swale to a buried pipe and be conveyed by a 24-inch SDR 17.0 HDPE pipe out to a storm water interceptor located inside the southern property line and running parallel to Deer Park Street. The geomembrane of the capping system shall be booted to and secured to the transition structure to prevent leakage. The proposed storm water interceptor will be a 36-inch SDR 17.0 HDPE pipe to convey flow to Basin 2.

The combination of Basin 1, and Basin 2 will provide sufficient recharge capacity to allow for all storm water to be disposed of on-site.



SOURCE: TOWN OF ISLIP ENGINEERING DEPARTMENT

NOT TO SCALE

SONIA ROAD LANDFILL
FINAL CLOSURE PLAN

Dvirka and Bartilucci
Consulting Engineers
A Division of William F. Cosulich Associates, P.C.

STORMWATER DRAINAGE SYSTEM DIAGRAM IN VICINITY OF SITE

FIGURE 6–1

As previously discussed, the construction of Basin 1 will result in the inboard (eastern) slope of the basin being constructed on waste. The bottom area of the basin is outside the limit of waste and will provide for recharge from the basin. To prevent the eastern wall of the basin from allowing storm water to enter the waste mass, a modification of the capping system is proposed. In this area, a double liner composite cap is proposed in lieu of the single membrane system. A detail of this area is provided on the attached drawings. The double liner composite will include a contour grading layer, geotextile (if necessary), gas venting layer and 60 mil textured HDPE geomembrane. Above the first membrane, a geosynthetic clay liner (GCL) and a second 60 mil textured HDPE geomembrane will be installed. The upper membrane will be welded to the lower membrane at the crest of the slope to provide a sealed geomembrane/GCL/geomembrane composite. The geocomposite drainage layer will continue from the landfill area over the second membrane and extend to the base of the basin. The geomembrane composite system will be ballasted by the placement of a 1-foot thick layer of stone fill above the geocomposite to provide for free drainage. The lower end of the geomembranes and the GCL shall be secured in an anchor trench at the bottom of the basin.

Section 7

7.0 LANDFILL GAS CONTROL

7.1 General

As discussed in Section 2, the Sonia Road Landfill is generating landfill gas (methane) through the natural, anaerobic decomposition of organic waste materials. Landfill gas monitoring performed by the Town of Islip plus monitoring performed as part of the Remedial Investigation reveal that measurable concentrations of methane have been observed within the site. Historical readings performed by the Town of Islip reveal a repeated observance of methane in the northeast corner of the site (GMW-4) and sporadic positive readings at the southeast corner of the site (GMW-1).

Measurements taken during a bar hole examination conducted as part of the Remedial Investigation clearly reveal measurable concentrations of methane below the ground surface and within the limits of waste. These readings range from low readings below the lower explosive limit (5 percent by volume) through the explosive range (5 to 15 percent by volume) to high readings well beyond the explosive range. The highest recorded reading was 58 percent methane by volume in the central area of the eastern half.

The historic readings performed by the Town of Islip at the site perimeter using formal gas monitoring wells would suggest that subsurface perimeter migration is not likely other than at the northeast corner. However, the bar hole readings suggest that methane is still being actively produced and that methane is being stored in the void volume of the waste and venting through the surface of the landfill site. Given the age of the in-place waste mass at 20 plus years, it would normally be expected that the rate of methane generation for typical municipal solid waste has passed the peak and entered the declining rate of generation phase. This assumption may not be borne out for the Sonia Road Landfill where such an appreciable percentage of the waste mass lies below the water table. The mechanics for decomposition under these circumstances is not well documented in the literature since it is not representative of normal landfill construction. In addition, the waste mass may contain a large percentage of slowly degrading material such as wood, trees, etc., which would result in an extended period of generation.

Based upon the monitoring data available, it must be assumed that the landfill is still actively generating methane as a result of decomposition of organic waste materials. It must further be assumed that this generation will continue for a period of time after the construction of the cap while the unsaturated waste dries out. It is not clear what amount of methane generation is attributable to the saturated waste mass lying below the water table but it is unlikely that this mode of generation will be impacted by the placement of the landfill cap.

Given these conditions, it appears prudent to assume that the installation of the landfill cap may have a tendency to contain the existing vertical surface venting of landfill gas from the ground surface and promote lateral migration of landfill gas beyond the limits of the waste. Since the limits of waste roughly coincide with the property boundaries, lateral migration beyond the property lines is a distinct possibility.

In order to address this potential, a system of perimeter monitoring and a combination of center recovery and perimeter collection is proposed.

Under normal circumstances, a typical landfill capping system would include a series of landfill gas relief vents constructed as part of the cap. These vents would provide for passive relief of landfill gas which has accumulated below the geomembrane in the void space of the gas venting layer. A typical relief vent detail would provide for a perforated or slotted cross arm embedded in the gas venting layer and a vertical perforated or slotted riser pipe extending downwards at least 5 feet into the waste mass. In accordance with 6 NYCRR Part 360, the passive relief vents should be spaced at a frequency of one per acre. A passive relief vent will function based upon differential pressure between the underside of the geomembrane where positive gas pressures may accumulate and atmospheric pressure at the exposed, open end of the vent. By necessity, the open end of the vent (above grade gooseneck fitting) is constructed above grade with at least 3 feet of clearance to the ground surface to promote unobstructed conditions at all times. The typical relief vent is not considered to have the ability to draw or actively extract landfill gas out of the waste mass and, therefore, will have a minimal radius of influence.

In the case of the Sonia Road Landfill, the prudence of constructing above grade, passive relief vents must be questioned. The predominant issue is that the landfill has been closed (i.e., unattended) for a number of years and, after cap construction, will continue as a closed, unattended landfill site. An examination of the existing site conditions, most notably trails and paths traversing the site, suggests that the site is routinely used by unauthorized persons for activities not sanctioned by the Town. Even though the site is fenced, unauthorized entry to the site appears to occur.

Following the construction of the capping system, it is likely that this unauthorized access will continue. The typical landfill gas relief vent is quite prone to vandalism and could pose a safety hazard to unauthorized persons who may attempt to damage it or tamper with it, such as attempting to light it afire. As a secondary issue, the above grade projections of the typical relief vent will serve to create obstacles which will bisect the land surface and minimize the potential for future secondary uses of the site.

In lieu of constructing passive relief vents as part of the cap construction, it is proposed to construct subsurface recovery wells in the locations which would normally be designated for passive relief wells. The subsurface recovery wells will be linked by a subsurface collection manifold which is piped to the perimeter landfill gas migration system collection header. Individual recovery wells will be piped to the collection manifold using flexible, corrugated PVC tubing. Individual wellheads will not be valved but the collection manifold connection to the perimeter collection header will be fitted with a throttling valve to allow modulation of flow.

The locations of the proposed center recovery wells is shown on the drawing entitled, "Landfill Gas Control Plan." Each center recovery well will be operated at a flow rate of approximately 25 cubic feet per minute (cfm). The details for a typical recovery well is shown on the attached drawings.

The recovery well will be constructed using 4-inch Schedule 40 PVC piping. The vertical, screened leg of the well will extend into the underlying waste mass to within 10 feet of groundwater. The cross arms of the recovery well will extend laterally 10 feet into the gas venting layer. These recovery wells will provide for the active withdrawal of landfill gas from below the geomembrane and directly from the waste mass.

A total of 37 center recovery wells have been proposed for incorporation into the capping system. The locations for each have been shown on the attached drawing entitled, "Landfill Gas Control Plan." In general, the spacing of the recovery wells provides for a frequency of approximately one per acre.

7.2 Perimeter Monitoring Wells

In order to monitor the potential migration of landfill gas from the waste mass towards and beyond the site property boundaries, a series of 17 perimeter landfill gas monitoring wells have been proposed. The location for each well has been shown on the attached drawing entitled, "Landfill Gas Control Plan." Each well will be positioned at or in the vicinity of the limits of waste and the property boundary to allow measurement of the subsurface methane concentrations.

Each monitoring well will be constructed in a drilled borehole approximately 12 inches in diameter. Drilling will be performed with hollow stem augers. The screened interval for each well will begin 5 feet below the ground surface and extend to within 10 feet of the water table. The screened length shall be in increments of 5 feet. The casing and screen shall be 4-inch diameter, Schedule 40 PVC joined with internally threaded flush joints. The bottom of the screen shall be sealed with a threaded plug. The screen slot shall be 0.125 inch and the annulus between the screen and the borehole shall be filled with coarse well gravel. The upper 3 feet of annulus will be sealed with bentonite. The wellhead will be enclosed in a steel protective surface casing with a bolted cover. The top of the casing will be closed with an end of pipe, lockable compression plug and a sampling cock will be provided. The steel protective surface casing is intended to prevent vandalism.

The perimeter monitoring wells are spaced on approximately 250-foot centers and straddle the placement of the perimeter collection wells in order to allow monitoring of their effectiveness.

7.3 Migration Control System

In order to address the potential for lateral migration of landfill gas from the site after the landfill cap is in place, a perimeter migration control (collection) system in conjunction with the center gas recovery system is proposed. The construction of the perimeter control system would coincide with the construction of the landfill cap.

The proposed control system will be an active system intended to extract subsurface landfill gas from the waste mass and at the property boundary. The proposed system will include a series of center recovery and perimeter collection wells, a collection header(s), gas blower(s) and appurtenances, and a flare unit for thermal destruction of combustible compounds prior to discharge to the atmosphere.

The basic premise of the control system is to create a negative pressure zone around each of the wells sufficient to induce the movement of landfill gas towards the wells rather than beyond the property line. Under normal conditions, the generation of landfill gas through the decomposition of organic waste materials results in the formation of a slight positive gas pressure within the waste mass. The movement of landfill gas through and out of the waste mass will typically follow the path of least resistance with the positive pressure providing the driving force. When a landfill is uncapped, the entire exposed landfill surface offers the opportunity for free venting to the atmosphere with lateral, subsurface movement providing an alternate path. This uncontrolled surface venting is a function of site surface conditions, as well as the differential pressure existing between the positive pressure of the waste mass and atmospheric or barometric pressure. When surface venting is inhibited due to surface tightening by precipitation filling soil voids or surface ice formation, lateral migration is normally expected to increase. The degree of migration is also coupled to the lower barometric pressures associated with storm events.

After construction of the landfill cap, the equivalent of surface sealing can be expected to occur to some undefinable extent which may promote increased lateral migration. The center recovery wells incorporated as part of the landfill cap will provide an opportunity to relieve gas from the underside of the geomembrane, the void space of the gas venting layer and, to some extent, from the waste mass.

The proposed perimeter collection wells will generally be installed in the vicinity of the site property line with the preference being that they are located beyond the limits of waste and placed in virgin ground. In the case of the Sonia Road Landfill, the defined limits of waste will necessitate that certain collection wells be located in areas that penetrate a strata of waste or are located wholly within the waste. Along the northern property line where embankments exist to transition from landfill elevations to adjacent property elevations, the recovery wells and collection wells have been placed inboard of the property line to minimize the potential for air intrusion during operation.

Each perimeter migration control (collection) well will be constructed in similar fashion to the perimeter monitoring wells. The well casing and screen shall be fabricated with 4-inch Schedule 40 PVC pipe joined with internally-threaded flush joints. The screened interval shall begin 10 feet below ground surface and extend to within 10 feet of the groundwater surface. The screen slot shall be 0.125 inch and the borehole annulus in the screened interval will be filled with a coarse well gravel. The wellhead will be fitted with a 4-inch PVC butterfly valve to allow for flow modulation. Sampling taps will be provided to allow measurements of gas quality and wellhead pressure. The wellhead will be enclosed in a precast concrete structure with the top slab of the structure elevated approximately 6 inches above adjacent grades. The top of the structure will be fitted with a flush-mount manhole casting to provide access to the chamber.

Each well will operate under vacuum conditions generated by a gas blower located at the Landfill Gas Management Compound. The design flow rate for each well will be 50 cubic feet per minute (cfm) with a wellhead vacuum of 6 inches water column (w.c.).

The wellhead connection to the collection header shall be constructed with 4-inch diameter, corrugated PVC tubing to provide flexibility and accommodate movement of the header relative to the wellhead. This connection will be backpitched to the wellhead to allow condensate to drain to the well. The collection header shall be constructed of solid wall HDPE piping, SDR 17. Lengths of HDPE piping will be jointed by the butt fusion process. The collection header will be installed above the geomembrane hydraulic barrier and be bedded in the barrier protection layer. The collection header will be located above the geomembrane to allow future access for service or repairs without requiring disturbance of the geomembrane. Straight lengths of collection header will be installed with a snaked or sinusoidal pattern (plan view) to allow for thermal expansion and contraction.

The collection header will form a continuous ring along the perimeter of the site and will include an inline isolation butterfly valve at the approximate midpoint (opposite the Landfill Gas Management Compound) to allow the ring to operate as two separate headers. This arrangement will shorten the distance from the farthest well to the blower and result in lower head loss due to friction. The collection header will vary in size from 4-inch to 10-inch. At the farthest points from the compound, the header will be 4 inches in diameter. As the flow in the header increases due to the contribution of additional flow from successive wells, the header size will increase to 6 inches, 8 inches or 10 inches to manage the in-pipe velocities and minimize the head loss associated with the gas flow. The collection header will be installed below the ground surface in all areas of the site, except the compound, to minimize the potential for vandalism.

The Landfill Gas Management Compound will be a fenced compound located at the western edge of the property. The compound will include two rotary lobe, positive displacement gas blowers and appurtenances. Each blower is intended to service one half of the collection header ring. The two blowers will operate in parallel and will discharge to a common header feeding an above grade utility (candle) flare. Each blower will be fitted with an inlet water separator/silencer, valving, pressure gauge taps, discharge silencer, check valve and flame arrester. Each blower will be driven by an explosion-proof, electric motor through a belt and sheave arrangement. The blowers will operate at a single, pre-selected speed to provide the required displacement and throughput. Blower speed control, should it be necessary, will be accomplished by changing belts and sheaves to change the blower rotational speed. Each blower will also be fitted with a valved, bypass piping arrangement to allow a variable portion of the blower discharge to be recirculated to the blower inlet to allow for the equivalent of variable speed control.

The two blowers will discharge to a common header feeding a single, elevated utility flare for the thermal destruction of landfill gas and related compounds. The flare shall be suitable for 98 percent thermal destruction efficiency when sufficiently combustible concentrations of gas are available. Given the age of the existing waste, it is possible that the static concentrations of methane measured during the Remedial Investigation will not be realized under the dynamic effects of active withdrawal. To allow for continued operation of the flare at reduced concentrations of landfill gas, provisions will be made to allow for the future supply of supplemental utility gas to raise the BTU content and support combustion. Provisions will also be made to allow for the future use of a utility gas pilot system to provide sustained combustion. The elevated flare will be provided with a thermocouple mounted in close proximity to the combustion zone to provide confirmation of combustion. In the event the unit flames out due to high wind, low combustible concentrations or other events, the flare will automatically attempt to relight. If a relight is not accomplished, the temperature controller will automatically shut down the operating blower(s) to stop the forced flow of landfill gas and cause an electrically-operated butterfly valve(s) (EOBV) on the blower discharge to close. The automatic closing of the EOBV is necessary to prevent the natural venting of landfill gas through the flare to the atmosphere without combustion.

The flare will be constructed of corrosion-resistant stainless steel in the combustion zone and carbon steel for non-critical elements. The flare inlet connection will be fitted with an inline flame arrester to minimize the potential for a flame to travel up the pipeline and reach back to the waste mass.

Section 8

8.0 CONSTRUCTION COST ESTIMATE

A cost estimate for the construction of the Sonia Road Landfill capping system and landfill gas control system is presented in Table 8-1. The estimate has been prepared based upon the scope of proposed work detailed in this report. The unit costs used to develop this estimate are representative of comparable work performed in the Long Island area.

The total cost for the construction of the landfill capping system and appurtenances is estimated to be $12,416,000.

Table 8-1

SONIA ROAD LANDFILL
FINAL CLOSURE PLAN
CONSTRUCTION COST ESTIMATE

Item	Total
Premobilization (4%)	$350,000
Mobilization, Maintain and Demobilize (2%)	176,000
Clearing and Grubbing 40 acres @ $2,800/acre	112,000
Unclassified Excavation and Relandfilling 56,000 cy @ $6/cy	336,000
Contour Grading Material, General Fill 40,000 cy @ $12/cy	480,000
Geotextile 190,000 sy @ $1.50/sy	285,000
Gas Venting Layer 63,500 cy @ $18/cy	1,143,000
Geomembrane 195,000 sy @ $6.75/sy	1,316,250
Geocomposite Drainage Layer 190,000 sy @ $5.85/sy	1,111,500
Barrier Protection Layer 140,000 cy @ $12/cy	1,680,000
Topsoil 33,000 cy @ $18/cy	594,000
Hydroseeding 190,000 sy @ $0.90/sy	171,000
Erosion Control Blanket 185,000 sy @ $1.50/sy	277,500
Erosion Control Fabric 7,700 sy @ $5/sy	38,500
4" dia. Perforated Drain Piping 6,000 lf @ $4/lf	24,000
Drainage Structures Inlet (2), Headwalls, Overflow L.S.	25,000

Table 8-1 (continued)

SONIA ROAD LANDFILL
FINAL CLOSURE PLAN
CONSTRUCTION COST ESTIMATE

Item	Total
Drainage Manholes 5 MH @ $5,000/MH	25,000
24" dia. HDPE Pipe 725 lf @ $50/lf	36,250
36" dia. HDPE Pipe 1,700 lf @ $60/lf	102,000
Fencing 6' clf w/Barbed Wire 2,500 lf @ $18/lf	45,000
Temporary Fencing - 6' Stockade 1,200 lf @ $15/lf	18,000
Landscaping L.S.	10,000
Perimeter Road, 12' Wide 4,650 lf @ $14/lf	65,100
Extraction Wells 37 wells @ $3,500/well	129,500
Perimeter Migration Wells 16 wells @ $5,500/well	88,000
Perimeter Monitoring Wells 17 wells @ $4,500/well	76,500
LFG Extraction Manifolds 6,800 lf @ $25/lf	170,000
LFG Collection Header 5,700 lf @ $35/lf	199,500
LFG Compound and Flare L.S.	200,000
Stone Fill Say 2,500 cy @ $40/cy	10,000
Geosynthetic Clay Liner Say 5,000 sy @ $6.75/sy	33,750

Table 8-1 (continued)

SONIA ROAD LANDFILL
FINAL CLOSURE PLAN
CONSTRUCTION COST ESTIMATE

SUBTOTAL	9,328,350
10% OVERHEAD	932,835
SUBTOTAL	10,261,185
10% PROFIT	1,026,119
TOTAL	11,287,304
10% CONTINGENCY	1,128,730
TOTAL	12,416,034

Section 9

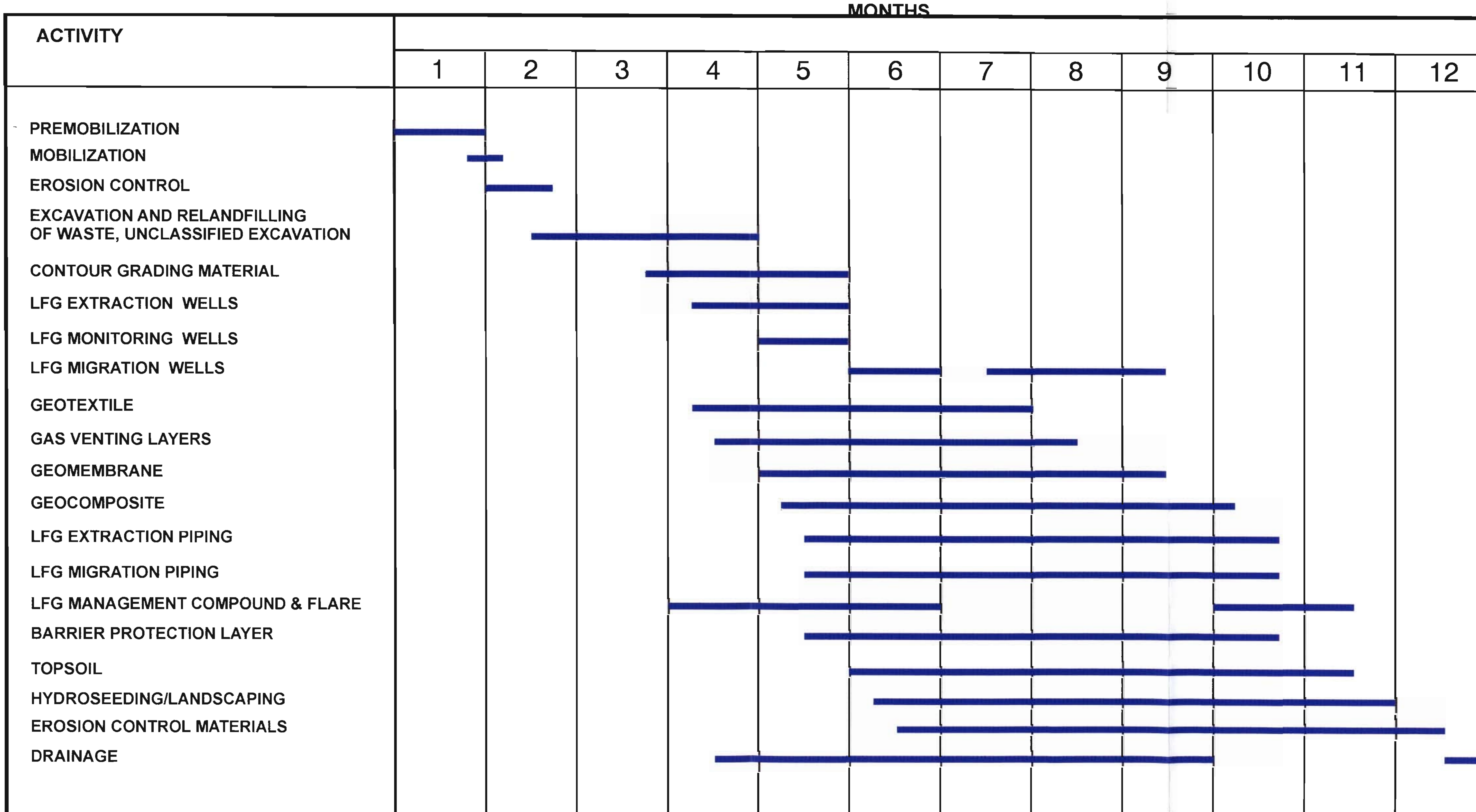
9.0 CONSTRUCTION SCHEDULE

A Construction Schedule for the construction of the Sonia Road Landfill capping system and landfill gas control system has been prepared and is presented as Figure 9-1. The schedule addresses the physical construction effort for the project and would follow the preparation of plans and specifications, reviews, competitive bidding, award of bid and execution of contracts. The schedule projects the work to be performed in a twelve-month period provided there are no interruptions of the work due to weather delays or need to shut down for winter conditions.

The proposed schedule is predicated on an aggressive approach providing for multiple operations to be performed concurrently. This approach is not uncommon for landfill construction projects given the size of the site, the ability to spatially separate activities and the need to perform the activities in a prescribed succession.

TOWN OF ISLIP
SONIA ROAD LANDFILL
PRESUMPTIVE REMEDY FINAL CLOSURE PLAN
CONSTRUCTION SCHEDULE

Dvirka and Bartilucci
CONSULTING ENGINEERS



RLA/IR1445PS(2/27/98)

FIGURE 9-1

Appendix A

New York State Department of Environmental Conservation

MEMORANDUM

TO: Reg. Haz. Waste Remediation Engineers, Bur. Dir., & Section Chiefs
FROM: Michael J. O'Toole, Jr., Director, Div. of Haz. Waste Remediation
SUBJECT: DIVISION TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM: ACCELERATED REMEDIAL ACTIONS AT CLASS 2, NON-RCRA REGULATED LANDFILLS
DATE:

MAR - 9 1992

On January 14, 1992, Deputy Commissioner Sullivan signed the Strategic Plan: Accelerated Remedial Actions which provides guidance concerning Class 2, non-RCRA regulated landfills.

Since this Strategic Plan is an important element in the Division's program, it is also being issued as a Technical and Administrative Guidance Memorandum.

Attachment
cc: E. Sullivan
D. Markell
J. Eckl
R. Davies
R. Dana
C. Goddard
A. Carlson
E. McCandless
P. Counterman
A. Fossa
J. Kelleher
J. Colquhoun
D. Persson
M. Birmingham
D. Johnson
D. Ritter
Regional Directors
Regional Engineers
Regional Solid and Hazardous Waste Engineers
Regional Citizen Participation Specialists

January 14, 1992

STRATEGIC PLAN: ACCELERATED REMEDIAL ACTIONS

Issue: Accelerated Remedial Actions at Class 2, Non-RCRA Regulated Landfills

Priority: High

Responsible Person: Michael J. O'Toole, Jr.

OBJECTIVES:

The Department has adopted a policy favoring permanent remedies whenever feasibile at inactive hazardous waste sites. However, it is often obvious that major mixed waste landfills will not be amenable to complete permanent remedies and that a cap will be called for. In such cases, it may be appropriate to proceed rapidly to the design phase.

To mitigate the major source of contamination posed by Class 2 landfills as early as possible. The Remedial Investigation/Feasibility Study (RI/FS) process for Class 2 sites requires the identification of feasible remedial technologies which are screened and then organized into various remedial alternatives. For source control options at Class 2, non-RCRA regulated landfills, this process may be somewhat simplified and accelerated due to the typical large size and the composition of these landfills. Most Class 2 landfills are composed of substantial quantities of municipal solid waste (MSW) mixed with smaller quantities of hazardous waste (this is not true of pre-RCRA industrial landfills which are not addressed in this guidance). While a complete RI/FS is warranted at these sites to determine the full extent of contamination and any risks posed to human health and/or the environment, certain remedial measures should be evaluated very early in the RI/FS process for possible accelerated implementation based on historic data, early treatability tests, risk assessment or technologically based results with a bias for initiating appropriate remedial actions as early as possible in the remedial process.

STRATEGY:

Identify several remedial measures for Class 2, non-RCRA regulated landfills which would be evaluated, on a site-specific basis, for accelerated implementation. This document describes technical considerations which must be included in this evaluation. It is not intended to describe all remedial design considerations for these remedial actions, but rather to aid in making the decision to proceed with design. If accelerated remedial actions are identified prior to consent order negotiations, these remedial actions should be negotiated into the consent order with the appropriate timeframes for a focused FS or a Departmental analysis of alternatives, opportunity for public input including a public comment period, as appropriate, and Record of Decision.

GUIDANCE:

At some landfills, at least the first phase of RI work may need to be completed to evaluate the following technologies. In many instances, it may be possible to evaluate these technologies at the very onset of the RI. If any accelerated remedial actions are implemented within the context of this document, those actions must be assessed in a focused Feasibility Study or Departmental analysis of alternatives.

I. Source Control Technology #1:

A. Placement of a final cover (capping) in accordance with 6NYCRR Part 360 will be a minimum requirement for all Class 2, non-RCRA regulated landfills unless the variance requirements under Part 360-1.7(c) are met. Since one component of the Part 360 cap is a gas venting system, these emissions must be addressed in the design of that cap.

B. Technical considerations to be evaluated under capping option:

1. RCRA capping requirements will be sufficiently addressed by a properly designed cap which, at a minimum, would meet the Part 360 capping requirements for a typical, non-RCRA regulated landfill. RCRA capping requirements are applicable or relevant to landfills which accept RCRA hazardous waste. Typical Class 2, non-RCRA regulated landfills accepted predominantly municipal/commercial waste along with a lesser amount of RCRA hazardous waste. Therefore, for most Class 2, non-RCRA regulated landfills, a properly designed cap which meets or exceeds the Part 360 capping requirements is appropriate but must consider the appropriateness of RCRA capping requirements. The design engineer must also consider frost penetration and its effect on the low permeability barrier, subsidence of the waste material, and run-off controls to minimize water erosion problems. NOTE: EPA handbook, "Remedial Action at Waste Disposal Sites", Sections 3.1, 3.3, 3.4 and 3.5 should be used as guidance for proper cap design.

2. Any areas or potential areas within the landfill mass (hot spots) which are amenable to on-site treatment or removal and treatment must be addressed prior to capping. Hot spots may be identified by past disposal practices (discrete areas for drum disposal), geophysical testing, soil gas surveys, soil borings/testing, test pits, etc. If hot spots are identified they should be evaluated to determine the feasibility of remediating them.

3. Any on-site or off-site areas (contaminated soils or sediments) which have the potential for consolidation into the main landfill must be addressed prior to

capping. These areas would be identified by geophysical testing, test pits, soil borings, and soil/sediment testing.

4. The entire landfill area must be adequately defined to allow the determination of final grades and elevations. This may be determined by past disposal practices, geophysical testing, test pits, and soil borings.

5. The capping should be phased to allow deposition onto an uncapped area of drilling/trench spoils from monitoring well installation, groundwater recovery well installation, or leachate/groundwater collection trench excavations providing the phasing doesn't prolong the overall capping schedule. This will be influenced by the size of the landfill and the timing and duration of remedial design.

II. Source Control Technology #2:

A. A leachate collection system will be required at most Class 2, non-RCRA regulated landfills. The design and construction of this system must be integrated with the design and construction of the cap.

B. Technical considerations to be evaluated under leachate collection option:

1. The depth of waste and areal extent of waste must be adequately defined to allow determination of final elevations and location of leachate collection system.

2. Any potential for on-site consolidation of wastes which may affect the final location of the leachate collection system must be considered.

3. The pathways for leachate must be adequately defined to aid in total capture.

4. The need for a vertical barrier to minimize the collection of uncontaminated groundwater must be assessed.

5. All reasonable steps should be taken to prevent or control the impacts of leachate on human health.

III. Treatment Technology #1:

A. Treatment of collected leachate to meet discharge standards will be required at all Class 2, non-RCRA regulated landfills which require a leachate collection system. The reason it is considered separately from the leachate collection system in this guidance is due to the sequencing of events. While the design and construction of leachate collection systems must be integrated with the design and construction of the cap, the selection, design, and construction of a leachate treatment system may need to be done subsequent to cap construction. If a leachate treatment system is needed to coincide with the construction of the leachate collection system, the design and construction of a leachate treatment system should be concurrent with the cap design.

B. Technical considerations to be evaluated under leachate treatment option:

1. The leachate may have to be handled as a hazardous waste or it may be handled as any other non-hazardous, landfill leachate. If chemical analysis of the leachate reveals that there are no hazardous constituents in it which could have leached from or been derived from the known hazardous waste in the landfill and the leachate does not fail any RCRA characteristic tests (ignitable, corrosive, reactive, TCLP) or the leachate can be pretreated on site to those levels, then the leachate may be able to be handled as any other non-hazardous, landfill leachate.

2. The collected leachate should be economically treated in an environmentally sound manner in the short term until the final leachate/groundwater remedy is selected. One possibility would be to use a POTW for treatment if the POTW is willing to accept the leachate and can treat the contaminants contained in the leachate.

3. Leachate treatment options may need to be thoroughly evaluated in a feasibility study. This is perhaps the most important consideration in evaluating whether to proceed with the design of a leachate treatment option prior to completion of the RI/FS. Selection of a treatment technology which has been successful at other sites at the exclusion of other options could result in inefficiency or higher costs due to site-specific conditions and would not properly consider all available treatment technologies.

4. If treatment of contaminated groundwater is a strong possibility, it may make more sense to design one treatment system (after the Record of Decision) for both leachate and groundwater unless a modular leachate treatment system can be constructed such that it is easily expanded to treat groundwater or the leachate/groundwater contaminants and their concentrations are sufficiently different to warrant different treatment technologies.

5. The quantity of leachate requiring treatment must be considered along with available discharge points.

6. Provisions to reinject stabilized sludge from the leachate treatment system back into the landfill should be considered within the applicable regulatory and legal constraints.

IMPLEMENTATION PROCESS:

Source control measures described in this guidance when implemented must follow a clear, documented decision process as described below:

1. Recommendation of any or all of the above accelerated remedial actions will be made based on a careful evaluation of all technical considerations (at a minimum, the technical considerations in this guidance must be addressed).

2. A focused FS or Departmental analysis of alternatives must be performed to evaluate the feasibility of accelerating the construction of a cap/leachate system.

3. Any viable remedial actions which are identified in the focused FS or Departmental analysis of alternatives must be presented for public comment through the normal PRAP/ROD process in accordance with DHWR TAGM 4022 to the fullest extent possible.

The design of the early remedial measures should proceed as soon as possible after the responsiveness summary is mailed. Public participation during design and construction must, at a minimum, meet the requirements of the New York State Inactive Hazardous Waste Site Citizen Participation Plan.

An accelerated remedial action which is documented by a ROD must be tracked as a separate operable unit for that site, not as an IRM. However, the ROD will not be tracked as an RI/FS completion since there would only be a design and construction phase associated with that operable unit.

This Strategic Plan is hereby approved for use by the Division of Hazardous Waste Remediation.

Edward O. Sullivan

Appendix B

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

APPLICATION FOR VARIANCE FROM 6 NYCRR 360

See Application Instructions on Reverse Side

FOR STATE USE ONLY	
PROJECT NO.	DATE RECEIVED
DEPARTMENT ACTION ☐Approved ☐Disapproved	DATE

1. OWNER'S NAME Town of Islip	2. ADDRESS (Street, City, State, Zip Code) 655 Main Street, Islip, NY 11751	3. Telephone No. (516) 224-5691
4. OPERATOR'S NAME Town of Islip	5. ADDRESS (Street, City, State, Zip Code) 655 Main Street, Islip, NY 11751	6. Telephone No. (516) 224-5691
7. ENGINEER'S NAME Dvirka and Bartilucci Consulting Engineers	8. ADDRESS (Street, City, State, Zip Code) 330 Crossways Park Drive Woodbury, NY 11797	9. Telephone No. (516) 364-9890

10. PROJECT/FACILITY NAME
Capping/Closure of the Sonia Road Landfill NYSDEC Site No. 152013

11. PROJECT STATUS ☐Public ☐Private ☐ Proposed ☒Existing	12. COUNTY IN WHICH FACILITY IS LOCATED Suffolk	13. ENVIRONMENTAL CONSERVATION REGION Region 1

14. DESCRIBE SPECIFIC LOCATION OF FACILITY

The Sonia Road Landfill is a 42.5-acre municipal solid waste landfill located at the northeast corner of the intersection of Corbin Avenue (Holdell's Road) and Deer Park Street, West Brentwood, Suffolk County, New York.

15. TYPE OF PROJECT FACILITIES: ☐ Composting ☐ Transfer ☐ Shredding ☐ Bailing ☒ Sanitary Landfill ☐ Incineration ☐ Pyrolysis ☐ Resource Recovery-Energy ☐ Resource Recovery-Materials ☐ Other

16. BRIEFLY DESCRIBE THE PROJECT INCLUDING THE BASIC PROCESS AND MAJOR COMPONENTS

Capping/closure of the Sonia Road Landfill as an inactive hazardous waste site, NYSDEC Registry No. 152013. Capping details in accordance with 6 NYCRR Part 360. NYSDEC Division of Hazardous Waste Remediation Project No. C300428.

17. SPECIFIC PROVISION OF 6 NYCRR FROM WHICH A VARIANCE IS REQUESTED: Section 6 NYCRR Part 360-2.13	Paragraph (r)(2)(ii)	Variance Request No. 1

18. BRIEFLY DESCRIBE PROPOSED VARIANCE

Grading and capping portions of the landfill using slopes of 2 percent in lieu of the minimum 4 percent slopes required by 6 NYCRR Part 360-2.13(r)(2)(ii).

19. IMPACTS OF VARIANCE APPROVAL OR DISAPPROVAL

a. Environmental Impact:

The proposed use of 2 percent slopes in lieu of 4 percent slopes will have no detrimental environmental impacts. The landfill last received waste approximately 20 years ago and has experienced primary settlement. The proposed capping system provides an hydraulic efficiency at least equal to that provided by compliance with 6 NYCRR Part 360-2.13(r)(2)(ii).

The proposed variance has a positive environmental impact of minimizing the commitment of nonrecoverable imported natural resources (soil) in the construction. The use of approximately 200,000 cubic yards of imported soil is avoided through implementation of the proposed variance.

Further discussion regarding the merits of the proposed variance may be found in the Presumptive Remedy – Final Closure Plan for the Sonia Road Landfill Site Registry No. 152013, Draft, dated April 1998.

b. Economic Impact:

The proposed variance has a positive economic impact in the capital construction cost of capping/closure. The estimated value of 200,000 cubic yards of imported soils placed and compacted at a unit price of $14.40 per cubic yard is $2,880,000.

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.

Eric M. Hofmeister, Commissioner
Town of Islip, Department of Environmental Control

Date | Signature and Title

CENTRAL OFFICE COPY

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

APPLICATION FOR VARIANCE FROM 6 NYCRR 360

FOR STATE USE ONLY	
PROJECT NO.	DATE RECEIVED
DEPARTMENT ACTION ☐Approved ☐Disapproved	DATE

See Application Instructions on Reverse Side

1. OWNER'S NAME Town of Islip	2. ADDRESS (Street, City, State, Zip Code) 655 Main Street, Islip, NY 11751	3. Telephone No. (516) 224-5691
4. OPERATOR'S NAME Town of Islip	5. ADDRESS (Street, City, State, Zip Code) 655 Main Street, Islip, NY 11751	6. Telephone No. (516) 224-5691
7. ENGINEER'S NAME Dvirka and Bartilucci Consulting Engineers	8. ADDRESS (Street, City, State, Zip Code) 330 Crossways Park Drive Woodbury, NY 11797	9. Telephone No. (516) 364-9890

10. PROJECT/FACILITY NAME
Capping/Closure of the Sonia Road Landfill NYSDEC Site No. 152013

11. PROJECT STATUS ☐Public ☐Private ☐ Proposed ☒Existing	12. COUNTY IN WHICH FACILITY IS LOCATED Suffolk	13. ENVIRONMENTAL CONSERVATION REGION Region 1

14. DESCRIBE SPECIFIC LOCATION OF FACILITY

The Sonia Road Landfill is a 42.5-acre municipal solid waste landfill located at the northeast corner of the intersection of Corbin Avenue (Holdell's Road) and Deer Park Street, West Brentwood, Suffolk County, New York.

15. TYPE OF PROJECT FACILITIES: ☐ Composting ☐ Transfer ☐ Shredding ☐ Bailing ☒ Sanitary Landfill ☐ Incineration ☐ Pyrolysis ☐ Resource Recovery-Energy ☐ Resource Recovery-Materials ☐ Other

16. BRIEFLY DESCRIBE THE PROJECT INCLUDING THE BASIC PROCESS AND MAJOR COMPONENTS

Capping/closure of the Sonia Road Landfill as an inactive hazardous waste site, NYSDEC Registry No. 152013. Capping details in accordance with 6 NYCRR Part 360. NYSDEC Division of Hazardous Waste Remediation Project No. C300428.

17. SPECIFIC PROVISION OF 6 NYCRR FROM WHICH A VARIANCE IS REQUESTED: Section	Paragraph	Variance Request No.
6 NYCRR Part 360-2.13	(p)	2

18. BRIEFLY DESCRIBE PROPOSED VARIANCE

The proposed variance involves the construction of active landfill gas recovery wells at a spacing of one well per acre in lieu of passive landfill gas vents (gas venting risers) at a spacing of one vent per acre.

19. IMPACTS OF VARIANCE APPROVAL OR DISAPPROVAL

a. Environmental Impact:

The proposed variance will have a positive environmental impact by allowing for recovered (extracted) landfill gas to be managed as part of the overall landfill gas management system for the site (including thermal destruction by flaring) as opposed to atmospheric venting. Methane, the primary component of concern in landfill gas, is considered a greenhouse gas.

The active landfill gas recovery wells will be constructed of 4-inch diameter pipe in lieu of 6-inch diameter pipe to facilitate drilling and construction of the vertical well screen to a depth in the waste within 10 feet of the water table rather than 5 feet into the waste mass.

The active withdrawal of landfill gas from the waste in conjunction with perimeter collection wells will facilitate the control of off-site migration of landfill gas.

A further discussion of the proposed landfill gas management system may be found in the Presumptive Remedy – Final Closure Plan for the Sonia Road Landfill Site Registry No. 152013, Draft, dated April 1998.

b. Economic Impact:

The proposed variance will increase the capital cost of construction by requiring the construction of a piping manifold(s) to incorporate the landfill gas recovery wells into the landfill gas management system. The cost of constructing the buried manifolds is approximately $225,000. The proposed variance will minimize the potential for vandalism to exposed vents or the potential to ignite the atmospheric venting of landfill gas at each location.

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.

Eric M. Hofmeister, Commissioner
Town of Islip, Department of Environmental Control

Date ____________ Signature and Title ____________

CENTRAL OFFICE COPY

♦ 1594\g1203803.doc

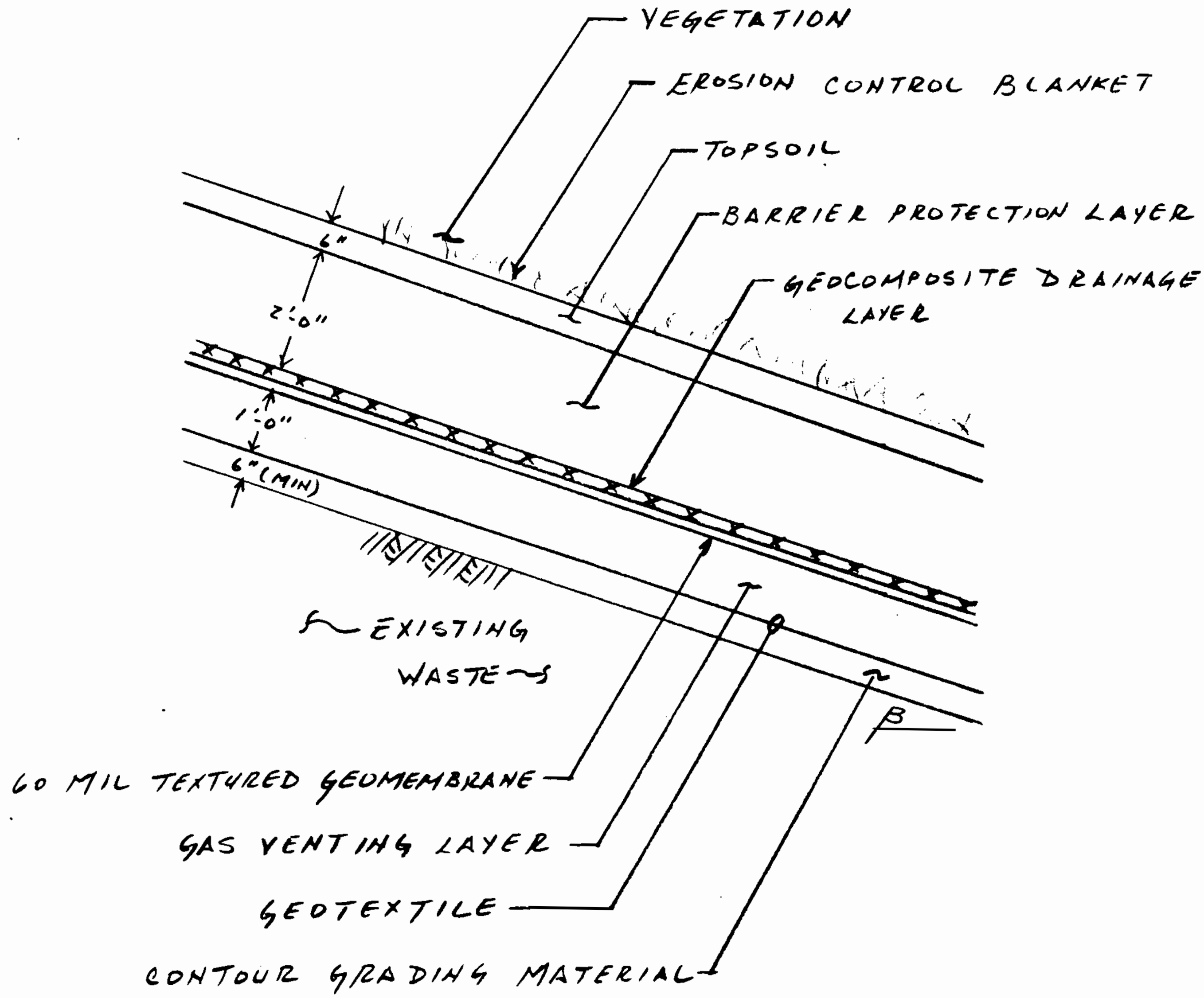
Appendix C

Dvirka and Bartilucci
CONSULTING ENGINEERS

Sheet No. 1 of ____
By EJR Date ____
Chkd. by ____ Date ____

Project: SONIA ROAD LANDFILL Job No. 1445
Subject: VENEER STABILITY

PROPOSED CAPPING SYSTEM



β = ANGLE OF INCLINATION

β = VARIES FROM 1.1° (2%) TO 18.4° (33%)

Dvirka and Bartilucci
CONSULTING ENGINEERS

By EJR Date ____
Chkd. by ____ Date ____

Project: SONIA ROAD LANDFILL Job No 1445
Subject: VENEER STABILITY

REQUIRED: ANALYZE THE VENEER STABILITY OF THE PROPOSED CAPPING SYSTEM TO ESTABLISH THE FACTOR OF SAFETY

METHOD: USE THE INFINITE SLOPE METHOD, IGNORING THE EFFECTS OF TOE BUTTRESSING.

EQUATION:

$$FS = \frac{C}{\gamma d \cos\beta \sin\beta} + \frac{\tan\delta}{\tan\beta}\left[1 - \frac{\gamma_\omega h}{\gamma d \cos^2\beta}\right]$$

WHERE:

FS = FACTOR OF SAFETY

C = COHESION INTERCEPT ALONG CRITICAL INTERFACE

γ = DENSITY OF SOIL COVER ($\#/ft^3$)

d = THICKNESS (DEPTH) OF SOIL COVER (ft)

β = SLOPE ANGLE (DEGREES)

δ = INTERFACE FRICTION ANGLE

γ_ω = DENSITY OF WATER ($62.4\#/ft^3$)

h = HEAD OF WATER ON INTERFACE (ft)

ASSUME:

1) $\gamma = 110\ \#/ft^3$ FOR TOPSOIL, BARRIER PROTECTION LAYER AND GAS VENTING LAYER

2) C = 0 PROPOSED SOILS ARE NOT COHESIVE THEREFORE, COHESHION TERM DROPS OUT

3) BASED UPON A REVIEW OF THE HELP MODEL WITH A GEOCOMPOSITE DRAINAGE LAYER INSTALLED ABOVE THE 60 MIL TEXTURED HDPE GEOMEMBRANE, THE PEAK HEAD ACROSS THE GEOMEMBRANE DECREASES AS THE SLOPE ANGLE (β) INCREASES. FOR SLOPES EQUAL TO OR GREATER THAN 10%, THE PEAK HEAD ACROSS THE GEOMEMBRANE IS FOUND TO BE 0.019 INCHES OR LESS. GIVEN THAT THE GEOCOMPOSITE DRAINAGE LAYER IS APPROXIMATELY 1/4 INCH OR 0.25 INCHES. THE HEAD ON THE LINER IS LIMITED TO THE THICKNESS OF THE GEOCOMPOSITE. THEREFORE, THE SEEPAGE FORCES TERM FOR THE SOIL DROPS OUT OF THE EQUATION AS UNITY.

THEREFORE:

FOR SLOPES LESS THAN 10%, THE EQUATION MAY BE WRITTEN AS FOLLOWS

$$F.S. = \frac{\tan\delta}{\tan\beta}\left[1 - \frac{\gamma_w h}{\gamma d \cos^2\beta}\right]$$

THE BRACKETED TERM APPLIES TO SEEPAGE FORCES.

Dvirka and Bartilucci CONSULTING ENGINEERS

Sheet No. 4 of ____
By EJR Date ____
Chkd. by ____ Date ____

Project: SONIA ROAD LANDFILL Job No. 1445
Subject: VENEER STABILITY

FOR SLOPES GREATER THAN 10%, THE EQUATION MAY BE WRITTEN AS FOLLOWS:

$$F.S. = \frac{\tan \delta}{\tan \beta}$$

IT IS ASSUMED THAT THE CRITICAL INTERFACE WILL OCCUR AT THE GEOMEMBRANE LEVEL OF THE CAPPING SYSTEM IN THE FORM OF THE BARRIER PROTECTION LAYER/GEOCOMPOSITE DRAINAGE LAYER INTERFACE, THE GEOCOMPOSITE DRAINAGE LAYER/GEOMEMBRANE INTERFACE OR THE GEOMEMBRANE/GAS VENTING LAYER INTERFACE. FOR EACH OF THESE THREE INTERFACES, THE OVERBURDEN CONDITIONS ARE ESSENTIALLY THE SAME (6" OF TOPSOIL + 24" BARRIER PROTECTION LAYER) WHERE THE UNIT WEIGHTS OF THE GEOSYNTHETICS ARE CONSIDERED INSIGNIFICANT.

APPLYING THE VALUES DISCUSSED ABOVE, THE MINIMUM INTERFACE FRICTION ANGLE CAN BE CALCULATED TO ACHIEVE A MINIMUM FACTOR OF SAFETY OF 1.50 FOR CAPPING SYSTEMS AS PRESCRIBED BY 6 NYCRR PART 360. (OCTOBER 9, 1993). FOR LANDFILL CLOSURES SUBJECT TO 6 NYCRR PART 360 (DEC. 31, 1988) A FACTOR OF SAFETY OF 1.25 HAS BEEN UTILIZED AT OTHER SITES.

__FOR SLOPES LESS THAN 10%__

USE PEAK HEAD ON GEOMEMBRANE FOR A 2% SLOPE AS A WORST CASE (h = 12.87 inches = 1.07 feet). USE $\beta = 5.7°$ (10%)

$$F.S. = 1.50 = \frac{0}{110(2.5)\cos 5.7° \sin 5.7°} + \frac{\tan \delta}{\tan 5.7°}\left[1 - \frac{62.4\,(1.07)}{110(2.5)\cos^2 5.7°}\right]$$

$$= 0 + \frac{\tan \delta}{0.099}\left[1 - 0.245\right]$$

Dvirka and Bartilucci CONSULTING ENGINEERS

Sheet No. 5 of ____
By EJR Date ____
Chkd. by ____ Date ____

Project: SONIA ROAD LANDFILL Job No. 1445
Subject: VENEER STABILITY

$$F.S. = 1.50 = \frac{\tan \delta}{0.099} [0.755]$$

$$0.197 = \tan \delta$$

$$\tan^{-1} 0.197 = \delta$$

$$11.13^\circ = \delta$$

IN ORDER TO ACHIEVE A MINIMUM FACTOR OF SAFETY OF 1.50, A MINIMUM INTERFACE FRICTION ANGLE OF 11.13° MUST BE EXHIBITED AT EACH OF THE THREE GEOSYNTHETIC/SOIL AND GEOSYNTHETIC/GEOSYNTHETIC INTERFACES. BASED UPON A REVIEW OF THE LITERATURE AND TEST DATA FROM OTHER SITES, THESE VALUES ARE READILY ATTAINABLE. SITE SPECIFIC TESTING TO CONFIRM THESE VALUES IS CLEARLY NOT WARRANTED.

FOR SLOPES GREATER THAN 10%

USE SLOPE ANGLE OF $\beta = 18.4^\circ$ (33%)

ASSUME SEEPAGE FORCES TO BE ZERO (0) AND THE BRACKETED TERM TO EQUAL UNITY.

$$\therefore F.S. = 1.50 = \frac{\tan \delta}{\tan \beta}$$

$$= \frac{\tan \delta}{\tan 18.4}$$

$$= \frac{\tan \delta}{0.333}$$

$$1.50(0.333) = \tan \delta$$

$$\tan^{-1} 0.499 = \delta$$

$$26.5^\circ = \delta$$

IN ORDER TO ACHIEVE A MINIMUM FACTOR OF SAFETY OF 1.50, A MINIMUM INTERFACE FRICTION ANGLE OF 26.5° MUST BE EXHIBITED AT EACH OF THE THREE GEOSYNTHETIC/SOIL AND GEOSYNTHETIC/GEOSYNTHETIC INTERFACES. A REVIEW OF THE LITERATURE AND TEST DATA FROM OTHER SITES SUGGESTS THAT THESE VALUES ARE READILY ATTAINABLE. SITE SPECIFIC TESTING TO CONFIRM THESE VALUES IS NOT WARRANTED.

THE CONTRACT SPECIFICATIONS FOR CONSTRUCTION OF THE PROPOSED CAPPING SYSTEM WILL REQUIRE THAT A MINIMUM INTERFACE FRICTION ANGLE OF 26.5° BE EXHIBITED BY EACH OF THE PROPOSED GEOSYNTHETICS AND FOR EACH OF THE IMPORTED SOILS FOR THE BARRIER PROTECTION LAYER AND THE GAS VENTING LAYER.

FOR SLOPES LESS THAN 33%, THE INHERENT FACTOR OF SAFETY WILL BE GREATER THAN 1.50

AS AN EXAMPLE

AT $\beta = 5.7^\circ$ (10%)

$$F.S. = \frac{\tan 26.5}{\tan 5.7}$$

$$= \frac{0.499}{0.099}$$

$$F.S. = 5.04$$

Appendix D

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**************************************************************************
**************************************************************************
**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE           **
**               HELP MODEL VERSION 3.01   (14 OCTOBER 1994)            **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY               **
**                    USAE WATERWAYS EXPERIMENT STATION                 **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY         **
**                                                                      **
**                                                                      **
**************************************************************************
**************************************************************************


PRECIPITATION DATA FILE:      C:\HELP3\DATA4.D4
TEMPERATURE DATA FILE:        C:\HELP3\DATA7.D7
SOLAR RADIATION DATA FILE:    C:\HELP3\DATA13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP3\DATA11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP3\SONIA2.D10
OUTPUT DATA FILE:             C:\HELP3\SONIA2.OUT


TIME:  14:26     DATE:  12/29/1997


**************************************************************************

     TITLE:  SONIA ROAD LANDFILL,2% SLOPE, NO GEOCOMPOSITE,BPL 5

**************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
            COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                    LAYER  1
                                    --------

                        TYPE 1 - VERTICAL PERCOLATION LAYER
                            MATERIAL TEXTURE NUMBER   6
           THICKNESS                     =       6.00    INCHES
           POROSITY                      =       0.4530 VOL/VOL
```

```
   FIELD CAPACITY                    =       0.1900 VOL/VOL
   WILTING POINT                     =       0.0850 VOL/VOL
   INITIAL SOIL WATER CONTENT        =       0.2001 VOL/VOL
   EFFECTIVE SAT. HYD. COND.         =  0.720000011000E-03 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                              LAYER  2
                              --------

                  TYPE 2 - LATERAL DRAINAGE LAYER
                   MATERIAL TEXTURE NUMBER   5
   THICKNESS                         =      24.00   INCHES
   POROSITY                          =       0.4570 VOL/VOL
   FIELD CAPACITY                    =       0.1310 VOL/VOL
   WILTING POINT                     =       0.0580 VOL/VOL
   INITIAL SOIL WATER CONTENT        =       0.3715 VOL/VOL
   EFFECTIVE SAT. HYD. COND.         =  0.100000005000E-02 CM/SEC
   SLOPE                             =       2.00   PERCENT
   DRAINAGE LENGTH                   =    1000.0    FEET


                              LAYER  3
                              --------

                  TYPE 4 - FLEXIBLE MEMBRANE LINER
                   MATERIAL TEXTURE NUMBER  35
   THICKNESS                         =       0.06   INCHES
   POROSITY                          =       0.0000 VOL/VOL
   FIELD CAPACITY                    =       0.0000 VOL/VOL
   WILTING POINT                     =       0.0000 VOL/VOL
   INITIAL SOIL WATER CONTENT        =       0.0000 VOL/VOL
   EFFECTIVE SAT. HYD. COND.         =  0.199999996000E-12 CM/SEC
   FML PINHOLE DENSITY               =       1.00   HOLES/ACRE
   FML INSTALLATION DEFECTS          =       3.00   HOLES/ACRE
   FML PLACEMENT QUALITY             =  3 - GOOD


                              LAYER  4
                              --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER   5
   THICKNESS                         =       6.00   INCHES
```

POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2086 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	240.00 INCHES
POROSITY	=	0.6710 VOL/VOL
FIELD CAPACITY	=	0.2920 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2579 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
SOIL DATA BASE USING SOIL TEXTURE # 6 WITH A
FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.%
AND A SLOPE LENGTH OF 1000. FEET.

SCS RUNOFF CURVE NUMBER	=	66.60	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	5.546	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	9.116	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.322	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	73.266	INCHES
TOTAL INITIAL WATER	=	73.266	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
NEW YORK NEW YORK

MAXIMUM LEAF AREA INDEX = 2.00
START OF GROWING SEASON (JULIAN DATE) = 108
END OF GROWING SEASON (JULIAN DATE) = 302
AVERAGE ANNUAL WIND SPEED = 12.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 72.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA FOR NEW YORK NEW YORK

WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW YORK NEW YORK

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.80	33.30	41.00	51.90	61.70	71.00
76.40	75.30	68.20	57.50	47.10	36.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW YORK NEW YORK

STATION LATITUDE = 40.47 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.83	1.41	4.60	2.33	2.69	2.38

	1.29	4.24	5.97	2.19	1.10	6.07
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.006
EVAPOTRANSPIRATION	1.489	1.918	2.793	2.903	2.835	4.641
	2.331	2.846	3.620	3.721	1.677	1.308
LATERAL DRAINAGE COLLECTED	0.0309	0.0294	0.0313	0.0344	0.0330	0.0263
FROM LAYER 2	0.0188	0.0174	0.0231	0.0222	0.0182	0.0240
PERCOLATION THROUGH	0.4509	0.4302	0.4574	0.5047	0.4822	0.3805
LAYER 3	0.2630	0.2405	0.3301	0.3161	0.2548	0.3430
PERCOLATION THROUGH	0.5296	0.4715	0.5221	0.4997	0.5083	0.4966
LAYER 5	0.5092	0.4904	0.4622	0.4648	0.4434	0.4481

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	18.126	19.239	18.413	21.194	19.493	15.597
LAYER 3	9.881	8.899	13.313	12.213	9.891	13.394
STD. DEVIATION OF DAILY	1.607	0.419	0.665	1.165	0.557	1.669
HEAD ON LAYER 3	0.649	0.226	2.670	1.779	0.187	4.306

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.10	134673.031	100.00
RUNOFF	0.006	22.016	0.02
EVAPOTRANSPIRATION	32.081	116453.594	86.47
DRAINAGE COLLECTED FROM LAYER 2	0.3090	1121.747	0.83
PERC./LEAKAGE THROUGH LAYER 3	4.453420	16165.915	12.00
AVG. HEAD ON TOP OF LAYER 3	14.9710		

PERC./LEAKAGE THROUGH LAYER 5	5.845871	21220.514	15.76
CHANGE IN WATER STORAGE	-1.142	-4144.900	-3.08
SOIL WATER AT START OF YEAR	74.576	270710.594	
SOIL WATER AT END OF YEAR	73.434	266565.687	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.068	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.05	3.57	3.50	3.13	3.52	7.06
	7.86	3.54	9.65	3.25	4.02	3.03
RUNOFF	0.057	3.039	0.875	0.000	0.000	0.026
	0.000	0.000	2.953	0.000	0.664	0.968
EVAPOTRANSPIRATION	1.131	1.170	2.791	3.074	4.180	6.287
	7.169	3.937	2.982	3.485	1.451	1.175
LATERAL DRAINAGE COLLECTED	0.0282	0.0164	0.0291	0.0411	0.0398	0.0404
FROM LAYER 2	0.0347	0.0291	0.0332	0.0470	0.0509	0.0517
PERCOLATION THROUGH	0.4056	0.2275	0.3968	0.5773	0.5728	0.5675
LAYER 3	0.5047	0.4237	0.4580	0.6311	0.6472	0.6647
PERCOLATION THROUGH	0.4486	0.3766	0.4299	0.4127	0.3109	0.2977
LAYER 5	0.3136	0.4262	0.4619	0.4685	0.3686	0.3681

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	16.132	9.393	15.701	24.418	23.404	23.977
LAYER 3	20.460	16.937	19.057	25.884	27.463	27.304
STD. DEVIATION OF DAILY	4.045	0.220	8.356	1.332	1.138	1.986
HEAD ON LAYER 3	2.536	1.911	4.973	1.480	2.408	0.907

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	57.18	207563.406	100.00
RUNOFF	8.582	31153.221	15.01
EVAPOTRANSPIRATION	38.831	140956.281	67.91
DRAINAGE COLLECTED FROM LAYER 2	0.4415	1602.620	0.77
PERC./LEAKAGE THROUGH LAYER 3	6.077032	22059.627	10.63
AVG. HEAD ON TOP OF LAYER 3	20.8442		
PERC./LEAKAGE THROUGH LAYER 5	4.683258	17000.225	8.19
CHANGE IN WATER STORAGE	4.642	16850.924	8.12
SOIL WATER AT START OF YEAR	73.434	266565.687	
SOIL WATER AT END OF YEAR	78.076	283416.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.126	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.11	2.60	2.30	2.26	3.56	3.97
	3.50	8.30	2.24	4.06	0.32	2.02
RUNOFF	2.728	1.156	0.000	0.000	0.000	0.000
	0.000	0.528	0.000	0.000	0.000	0.004
EVAPOTRANSPIRATION	1.508	1.808	2.531	2.413	4.051	4.283
	6.664	3.363	1.706	3.224	1.341	1.050
LATERAL DRAINAGE COLLECTED	0.0615	0.0495	0.0472	0.0381	0.0347	0.0268
FROM LAYER 2	0.0214	0.0303	0.0295	0.0275	0.0262	0.0265
PERCOLATION THROUGH	0.7413	0.6193	0.6329	0.5504	0.5077	0.3877
LAYER 3	0.3039	0.4402	0.4309	0.3984	0.3788	0.3826
PERCOLATION THROUGH	0.3890	0.3492	0.4370	0.5027	0.5899	0.5696
LAYER 5	0.5724	0.5570	0.5237	0.5361	0.5129	0.5189

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	29.541	28.185	25.962	23.228	20.600	15.920
LAYER 3	11.676	17.639	17.880	15.828	15.523	15.137
STD. DEVIATION OF DAILY	0.466	1.021	1.069	1.194	0.687	2.970
HEAD ON LAYER 3	1.609	5.235	0.862	0.475	0.241	1.265

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.24	146071.281	100.00
RUNOFF	4.417	16033.270	10.98

EVAPOTRANSPIRATION	33.941	123205.445	84.35
DRAINAGE COLLECTED FROM LAYER 2	0.4192	1521.630	1.04
PERC./LEAKAGE THROUGH LAYER 3	5.774071	20959.879	14.35
AVG. HEAD ON TOP OF LAYER 3	19.7598		
PERC./LEAKAGE THROUGH LAYER 5	6.058411	21992.033	15.06
CHANGE IN WATER STORAGE	-4.595	-16681.129	-11.42
SOIL WATER AT START OF YEAR	78.076	283416.625	
SOIL WATER AT END OF YEAR	73.481	266735.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.023	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.67	2.41	4.70	3.62	2.29	3.25
	2.30	4.84	6.70	4.41	6.23	5.16
RUNOFF	0.998	0.000	0.014	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.064	3.603
EVAPOTRANSPIRATION	1.259	1.745	2.567	2.600	3.465	5.351
	3.539	4.694	3.121	3.532	1.646	1.222
LATERAL DRAINAGE COLLECTED	0.0183	0.0177	0.0309	0.0410	0.0375	0.0294
FROM LAYER 2	0.0193	0.0176	0.0166	0.0250	0.0442	0.0586
PERCOLATION THROUGH	0.2548	0.2491	0.4468	0.5762	0.5475	0.4292

LAYER 3	0.2713	0.2433	0.2288	0.3597	0.5770	0.7117
PERCOLATION THROUGH	0.5122	0.4440	0.4826	0.4671	0.3928	0.3893
LAYER 5	0.4973	0.4880	0.4504	0.4571	0.4361	0.4152

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	9.520	10.444	17.928	24.366	22.315	17.802
LAYER 3	10.244	9.021	8.723	14.128	24.350	29.273
STD. DEVIATION OF DAILY	0.246	1.689	3.731	1.621	1.181	1.772
HEAD ON LAYER 3	1.165	0.212	0.849	1.800	5.253	0.439

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.58	176345.422	100.00
RUNOFF	4.680	16986.627	9.63
EVAPOTRANSPIRATION	34.742	126113.562	71.52
DRAINAGE COLLECTED FROM LAYER 2	0.3562	1293.015	0.73
PERC./LEAKAGE THROUGH LAYER 3	4.895364	17770.170	10.08
AVG. HEAD ON TOP OF LAYER 3	16.5095		
PERC./LEAKAGE THROUGH LAYER 5	5.432185	19718.830	11.18
CHANGE IN WATER STORAGE	3.370	12233.316	6.94
SOIL WATER AT START OF YEAR	73.481	266735.500	
SOIL WATER AT END OF YEAR	76.816	278841.281	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.035	127.519	0.07

ANNUAL WATER BUDGET BALANCE	0.0000	0.073	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	7.86	1.74	2.38	2.10	6.33	1.35
	3.05	3.83	3.61	1.68	1.74	5.20
RUNOFF	6.070	1.006	0.282	0.000	0.007	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.191	1.524	1.739	2.691	4.560	3.771
	5.966	3.476	2.574	2.801	0.608	1.036
LATERAL DRAINAGE COLLECTED	0.0426	0.0163	0.0347	0.0375	0.0419	0.0354
FROM LAYER 2	0.0245	0.0181	0.0165	0.0161	0.0148	0.0174
PERCOLATION THROUGH	0.5406	0.2258	0.4939	0.5471	0.5801	0.5160
LAYER 3	0.3513	0.2521	0.2265	0.2204	0.2005	0.2404
PERCOLATION THROUGH	0.2833	0.2698	0.4933	0.4454	0.4163	0.4369
LAYER 5	0.4549	0.5076	0.4740	0.4747	0.4414	0.4464

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	21.900	9.311	19.952	23.082	23.699	21.697
LAYER 3	13.761	9.404	8.620	8.025	7.459	8.908
STD. DEVIATION OF DAILY	8.825	0.218	6.708	0.693	2.822	1.959
HEAD ON LAYER 3	2.626	0.241	0.219	0.117	0.194	2.209

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.87	148358.094	100.00
RUNOFF	7.365	26736.676	18.02
EVAPOTRANSPIRATION	31.938	115933.906	78.14
DRAINAGE COLLECTED FROM LAYER 2	0.3157	1146.126	0.77
PERC./LEAKAGE THROUGH LAYER 3	4.394791	15953.090	10.75
AVG. HEAD ON TOP OF LAYER 3	14.6516		
PERC./LEAKAGE THROUGH LAYER 5	5.143954	18672.553	12.59
CHANGE IN WATER STORAGE	-3.893	-14131.179	-9.53
SOIL WATER AT START OF YEAR	76.816	278841.281	
SOIL WATER AT END OF YEAR	72.958	264837.625	
SNOW WATER AT START OF YEAR	0.035	127.519	0.09
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.012	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1974 THROUGH 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.70	2.35	3.50	2.69	3.68	3.60
	3.60	4.95	5.63	3.12	2.68	4.30

STD. DEVIATIONS	2.12	0.84	1.16	0.66	1.58	2.17
	2.52	1.94	2.87	1.17	2.42	1.70

RUNOFF

TOTALS	1.971	1.040	0.234	0.000	0.001	0.005
	0.000	0.106	0.591	0.000	0.146	0.916
STD. DEVIATIONS	2.543	1.242	0.378	0.000	0.003	0.012
	0.000	0.236	1.321	0.000	0.291	1.559

EVAPOTRANSPIRATION

TOTALS	1.316	1.633	2.484	2.736	3.818	4.867
	5.134	3.663	2.801	3.353	1.344	1.158
STD. DEVIATIONS	0.173	0.296	0.434	0.258	0.676	0.980
	2.096	0.695	0.717	0.356	0.435	0.116

LATERAL DRAINAGE COLLECTED FROM LAYER 2

TOTALS	0.0363	0.0258	0.0346	0.0384	0.0374	0.0317
	0.0237	0.0225	0.0238	0.0276	0.0309	0.0356
STD. DEVIATIONS	0.0165	0.0143	0.0073	0.0028	0.0036	0.0061
	0.0065	0.0066	0.0075	0.0117	0.0159	0.0183

PERCOLATION/LEAKAGE THROUGH LAYER 3

TOTALS	0.4786	0.3504	0.4856	0.5511	0.5381	0.4562
	0.3389	0.3200	0.3348	0.3851	0.4117	0.4685
STD. DEVIATIONS	0.1796	0.1729	0.0894	0.0296	0.0422	0.0823
	0.0990	0.1025	0.1088	0.1527	0.1956	0.2078

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS	0.4325	0.3822	0.4730	0.4655	0.4436	0.4380
	0.4695	0.4939	0.4744	0.4802	0.4405	0.4393
STD. DEVIATIONS	0.1003	0.0799	0.0389	0.0379	0.1078	0.1034
	0.0968	0.0469	0.0288	0.0319	0.0511	0.0550

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ACROSS LAYER 3

AVERAGES	19.0439	15.3141	19.5912	23.2577	21.9021	18.9986
	13.2045	12.3801	13.5185	15.2154	16.9372	18.8032
STD. DEVIATIONS	7.3886	8.3049	3.8730	1.3099	1.8135	3.6928
	4.3331	4.4910	4.9177	6.6348	8.7640	8.9794

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1974 THROUGH 1978

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.79	(8.110)	162602.2	100.00
RUNOFF	5.010	(3.3094)	18186.36	11.185
EVAPOTRANSPIRATION	34.306	(2.8000)	124532.55	76.587
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0.36833	(0.05994)	1337.028	0.82227
PERCOLATION/LEAKAGE THROUGH FROM LAYER 3	5.11894	(0.76884)	18581.736	11.42772
AVERAGE HEAD ACROSS TOP OF LAYER 3	17.347	(2.814)		
PERCOLATION/LEAKAGE THROUGH FROM LAYER 5	5.43274	(0.54938)	19720.830	12.12826
CHANGE IN WATER STORAGE	-0.324	(4.1821)	-1174.59	-0.722

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.77	13685.100
RUNOFF	2.795	10146.0576

DRAINAGE COLLECTED FROM LAYER 2	0.00198	7.17266
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.023522	85.38402
AVERAGE HEAD ACROSS LAYER 3	30.000	
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.023810	86.43085
SNOW WATER	4.52	16420.7617

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4558
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0571

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FINAL WATER STORAGE AT END OF YEAR 1978

LAYER	(INCHES)	(VOL/VOL)
1	1.1808	0.1968
2	8.8861	0.3703
3	0.0000	0.0000
4	1.2162	0.2027
5	60.3648	0.2515
SNOW WATER	0.000	

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**             HELP MODEL VERSION 3.01    (14 OCTOBER 1994)                 **
**                DEVELOPED BY ENVIRONMENTAL LABORATORY                     **
**                  USAE WATERWAYS EXPERIMENT STATION                       **
**           FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\HELP3\DATA4.D4
TEMPERATURE DATA FILE:        C:\HELP3\DATA7.D7
SOLAR RADIATION DATA FILE:    C:\HELP3\DATA13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP3\DATA11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP3\SONIA4.D10
OUTPUT DATA FILE:             C:\HELP3\SONIA4.OUT
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TIME: 14:31   DATE: 12/29/1997

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     TITLE:  SONIA ROAD LANDFILL, 4% SLOPE,NO GEOCOMPOSITE, BPL 5

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NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

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THICKNESS                 =       6.00   INCHES
POROSITY                  =       0.4530 VOL/VOL
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   FIELD CAPACITY                    =       0.1900 VOL/VOL
   WILTING POINT                     =       0.0850 VOL/VOL
   INITIAL SOIL WATER CONTENT        =       0.2003 VOL/VOL
   EFFECTIVE SAT. HYD. COND.         =  0.720000011000E-03 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
        FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                            LAYER  2
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                 TYPE 2 - LATERAL DRAINAGE LAYER
                   MATERIAL TEXTURE NUMBER   5
   THICKNESS                         =      24.00   INCHES
   POROSITY                          =       0.4570 VOL/VOL
   FIELD CAPACITY                    =       0.1310 VOL/VOL
   WILTING POINT                     =       0.0580 VOL/VOL
   INITIAL SOIL WATER CONTENT        =       0.3678 VOL/VOL
   EFFECTIVE SAT. HYD. COND.         =  0.100000005000E-02 CM/SEC
   SLOPE                             =       4.00   PERCENT
   DRAINAGE LENGTH                   =    1000.0    FEET


                            LAYER  3
                            --------

                 TYPE 4 - FLEXIBLE MEMBRANE LINER
                   MATERIAL TEXTURE NUMBER  35
   THICKNESS                         =       0.06   INCHES
   POROSITY                          =       0.0000 VOL/VOL
   FIELD CAPACITY                    =       0.0000 VOL/VOL
   WILTING POINT                     =       0.0000 VOL/VOL
   INITIAL SOIL WATER CONTENT        =       0.0000 VOL/VOL
   EFFECTIVE SAT. HYD. COND.         =  0.199999996000E-12 CM/SEC
   FML PINHOLE DENSITY               =       1.00   HOLES/ACRE
   FML INSTALLATION DEFECTS          =       3.00   HOLES/ACRE
   FML PLACEMENT QUALITY             =  3 - GOOD


                            LAYER  4
                            --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER   5
   THICKNESS                         =       6.00   INCHES
```

```
POROSITY                      =       0.4570 VOL/VOL
FIELD CAPACITY                =       0.1310 VOL/VOL
WILTING POINT                 =       0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT    =       0.2083 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.100000005000E-02 CM/SEC
```

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                         LAYER  5
                         --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER  18
THICKNESS                     =     240.00   INCHES
POROSITY                      =       0.6710 VOL/VOL
FIELD CAPACITY                =       0.2920 VOL/VOL
WILTING POINT                 =       0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT    =       0.2577 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.100000005000E-02 CM/SEC
```

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            GENERAL DESIGN AND EVAPORATIVE ZONE DATA
            ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =      66.60
FRACTION OF AREA ALLOWING RUNOFF   =     100.0     PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =       1.000   ACRES
EVAPORATIVE ZONE DEPTH             =      20.0     INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =       5.460   INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =       9.116   INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE =       1.322   INCHES
INITIAL SNOW WATER                 =       0.000   INCHES
INITIAL WATER IN LAYER MATERIALS   =      73.136   INCHES
TOTAL INITIAL WATER                =      73.136   INCHES
TOTAL SUBSURFACE INFLOW            =       0.00    INCHES/YEAR
```

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             EVAPOTRANSPIRATION AND WEATHER DATA
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 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
           NEW YORK             NEW YORK
```

MAXIMUM LEAF AREA INDEX = 2.00
START OF GROWING SEASON (JULIAN DATE) = 108
END OF GROWING SEASON (JULIAN DATE) = 302
AVERAGE ANNUAL WIND SPEED = 12.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 72.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA FOR NEW YORK NEW YORK
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW YORK NEW YORK

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.80	33.30	41.00	51.90	61.70	71.00
76.40	75.30	68.20	57.50	47.10	36.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW YORK NEW YORK

STATION LATITUDE = 40.47 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.83	1.41	4.60	2.33	2.69	2.38
	1.29	4.24	5.97	2.19	1.10	6.07
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000

	0.000	0.000	0.000	0.000	0.000	0.006
EVAPOTRANSPIRATION	1.487	1.916	2.791	2.902	2.834	4.642
	2.081	2.847	3.645	3.678	1.612	1.289
LATERAL DRAINAGE COLLECTED	0.0692	0.0655	0.0698	0.0753	0.0733	0.0598
FROM LAYER 2	0.0463	0.0436	0.0542	0.0528	0.0450	0.0564
PERCOLATION THROUGH	0.4409	0.4222	0.4453	0.4926	0.4731	0.3692
LAYER 3	0.2602	0.2379	0.3256	0.3097	0.2527	0.3396
PERCOLATION THROUGH	0.5238	0.4671	0.5178	0.4962	0.5089	0.4880
LAYER 5	0.5031	0.4879	0.4563	0.4611	0.4398	0.4435

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	17.688	18.849	17.886	20.657	19.095	15.087
LAYER 3	9.758	8.787	13.110	11.929	9.799	13.245
STD. DEVIATION OF DAILY	1.512	0.448	0.726	1.153	0.738	1.718
HEAD ON LAYER 3	0.460	0.253	2.646	1.845	0.141	4.255

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.10	134673.031	100.00
RUNOFF	0.006	22.356	0.02
EVAPOTRANSPIRATION	31.723	115155.812	85.51
DRAINAGE COLLECTED FROM LAYER 2	0.7112	2581.818	1.92
PERC./LEAKAGE THROUGH LAYER 3	4.369053	15859.664	11.78
AVG. HEAD ON TOP OF LAYER 3	14.6574		
PERC./LEAKAGE THROUGH LAYER 5	5.793590	21030.730	15.62
CHANGE IN WATER STORAGE	-1.134	-4117.731	-3.06

SOIL WATER AT START OF YEAR	74.446	270237.219	
SOIL WATER AT END OF YEAR	73.311	266119.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.052	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.05	3.57	3.50	3.13	3.52	7.06
	7.86	3.54	9.65	3.25	4.02	3.03
RUNOFF	0.053	2.995	0.871	0.000	0.000	0.025
	0.000	0.000	2.729	0.000	0.557	0.909
EVAPOTRANSPIRATION	1.128	1.165	2.778	3.065	4.171	6.287
	7.169	3.936	2.980	3.485	1.450	1.174
LATERAL DRAINAGE COLLECTED	0.0643	0.0407	0.0661	0.0886	0.0856	0.0866
FROM LAYER 2	0.0755	0.0652	0.0729	0.1010	0.1081	0.1099
PERCOLATION THROUGH	0.3991	0.2263	0.3933	0.5731	0.5641	0.5591
LAYER 3	0.4900	0.4090	0.4452	0.6288	0.6445	0.6611
PERCOLATION THROUGH	0.4402	0.3792	0.4236	0.4097	0.3069	0.2940
LAYER 5	0.3122	0.4262	0.4588	0.4614	0.3594	0.3573

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	15.850	9.334	15.551	24.230	23.029	23.606

LAYER 3	19.824	16.291	18.479	25.784	27.345	27.153
STD. DEVIATION OF DAILY	3.935	0.241	8.315	1.267	1.129	1.980
HEAD ON LAYER 3	2.484	1.963	5.155	1.473	2.534	0.965

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	57.18	207563.406	100.00
RUNOFF	8.140	29547.389	14.24
EVAPOTRANSPIRATION	38.789	140805.500	67.84
DRAINAGE COLLECTED FROM LAYER 2	0.9645	3501.291	1.69
PERC./LEAKAGE THROUGH LAYER 3	5.993575	21756.678	10.48
AVG. HEAD ON TOP OF LAYER 3	20.5396		
PERC./LEAKAGE THROUGH LAYER 5	4.628945	16803.072	8.10
CHANGE IN WATER STORAGE	4.657	16906.092	8.15
SOIL WATER AT START OF YEAR	73.311	266119.500	
SOIL WATER AT END OF YEAR	77.968	283025.594	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.057	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.11	2.60	2.30	2.26	3.56	3.97
	3.50	8.30	2.24	4.06	0.32	2.02
RUNOFF	2.658	1.145	0.000	0.000	0.000	0.000
	0.000	0.529	0.000	0.000	0.000	0.004
EVAPOTRANSPIRATION	1.508	1.808	2.531	2.413	4.051	4.283
	6.449	3.374	1.710	3.243	1.353	1.052
LATERAL DRAINAGE COLLECTED	0.1302	0.1052	0.1006	0.0826	0.0760	0.0608
FROM LAYER 2	0.0510	0.0690	0.0670	0.0635	0.0598	0.0606
PERCOLATION THROUGH	0.7406	0.6176	0.6277	0.5436	0.4952	0.3773
LAYER 3	0.2953	0.4400	0.4267	0.3956	0.3699	0.3720
PERCOLATION THROUGH	0.3765	0.3379	0.4235	0.4944	0.5825	0.5602
LAYER 5	0.5693	0.5484	0.5221	0.5294	0.5097	0.5125

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	29.512	28.104	25.740	22.925	20.057	15.450
LAYER 3	11.296	17.628	17.693	15.707	15.119	14.668
STD. DEVIATION OF DAILY	0.495	1.070	1.084	1.222	0.511	2.984
HEAD ON LAYER 3	1.364	5.248	0.895	0.468	0.193	1.166

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.24	146071.281	100.00
RUNOFF	4.337	15742.480	10.78
EVAPOTRANSPIRATION	33.773	122597.578	83.93

DRAINAGE COLLECTED FROM LAYER 2	0.9264	3362.677	2.30
PERC./LEAKAGE THROUGH LAYER 3	5.701297	20695.707	14.17
AVG. HEAD ON TOP OF LAYER 3	19.4916		
PERC./LEAKAGE THROUGH LAYER 5	5.966387	21657.986	14.83
CHANGE IN WATER STORAGE	-4.763	-17289.525	-11.84
SOIL WATER AT START OF YEAR	77.968	283025.594	
SOIL WATER AT END OF YEAR	73.206	265736.062	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.080	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.67	2.41	4.70	3.62	2.29	3.25
	2.30	4.84	6.70	4.41	6.23	5.16
RUNOFF	0.991	0.000	0.012	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.060	3.310
EVAPOTRANSPIRATION	1.261	1.747	2.570	2.601	3.466	5.351
	3.236	4.742	3.184	3.536	1.663	1.226
LATERAL DRAINAGE COLLECTED	0.0455	0.0431	0.0671	0.0863	0.0799	0.0646
FROM LAYER 2	0.0472	0.0439	0.0406	0.0570	0.0914	0.1242
PERCOLATION THROUGH	0.2537	0.2437	0.4239	0.5619	0.5257	0.4079
LAYER 3	0.2666	0.2399	0.2207	0.3427	0.5579	0.7109
PERCOLATION THROUGH	0.5018	0.4425	0.4765	0.4626	0.3956	0.4002

LAYER 5	0.4871	0.4708	0.4478	0.4439	0.4278	0.4152

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	9.474	10.181	16.929	23.737	21.376	16.838
LAYER 3	10.038	8.872	8.361	13.379	23.510	29.238
STD. DEVIATION OF DAILY	0.269	1.510	3.711	1.492	1.052	1.787
HEAD ON LAYER 3	0.969	0.240	0.540	1.721	5.168	0.469

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.58	176345.422	100.00
RUNOFF	4.374	15876.163	9.00
EVAPOTRANSPIRATION	34.585	125543.031	71.19
DRAINAGE COLLECTED FROM LAYER 2	0.7908	2870.656	1.63
PERC./LEAKAGE THROUGH LAYER 3	4.755407	17262.129	9.79
AVG. HEAD ON TOP OF LAYER 3	15.9944		
PERC./LEAKAGE THROUGH LAYER 5	5.371720	19499.344	11.06
CHANGE IN WATER STORAGE	3.459	12556.292	7.12
SOIL WATER AT START OF YEAR	73.206	265736.062	
SOIL WATER AT END OF YEAR	76.629	278164.844	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.035	127.519	0.07
ANNUAL WATER BUDGET BALANCE	0.0000	-0.068	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	7.86	1.74	2.38	2.10	6.33	1.35
	3.05	3.83	3.61	1.68	1.74	5.20
RUNOFF	6.012	1.005	0.281	0.000	0.003	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.194	1.527	1.740	2.693	4.563	3.771
	5.777	3.469	2.611	2.806	0.619	1.042
LATERAL DRAINAGE COLLECTED	0.0924	0.0405	0.0763	0.0816	0.0893	0.0772
FROM LAYER 2	0.0568	0.0451	0.0411	0.0436	0.0483	0.0465
PERCOLATION THROUGH	0.5380	0.2244	0.4887	0.5423	0.5690	0.5072
LAYER 3	0.3421	0.2502	0.2231	0.2148	0.1925	0.2277
PERCOLATION THROUGH	0.2755	0.2487	0.4813	0.4408	0.4021	0.4302
LAYER 5	0.4433	0.4997	0.4660	0.4642	0.4425	0.4341

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	21.790	9.245	19.729	22.870	23.226	21.303
LAYER 3	13.355	9.322	8.465	7.786	7.105	8.357
STD. DEVIATION OF DAILY	8.757	0.239	6.652	0.596	2.799	2.000
HEAD ON LAYER 3	2.492	0.266	0.237	0.154	0.217	2.036

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.87	148358.094	100.00
RUNOFF	7.301	26501.936	17.86
EVAPOTRANSPIRATION	31.811	115473.492	77.83
DRAINAGE COLLECTED FROM LAYER 2	0.7389	2682.104	1.81
PERC./LEAKAGE THROUGH LAYER 3	4.320019	15681.670	10.57
AVG. HEAD ON TOP OF LAYER 3	14.3793		
PERC./LEAKAGE THROUGH LAYER 5	5.028408	18253.119	12.30
CHANGE IN WATER STORAGE	-4.009	-14552.581	-9.81
SOIL WATER AT START OF YEAR	76.629	278164.844	
SOIL WATER AT END OF YEAR	72.656	263739.781	
SNOW WATER AT START OF YEAR	0.035	127.519	0.09
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.029	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1974 THROUGH 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.70	2.35	3.50	2.69	3.68	3.60
	3.60	4.95	5.63	3.12	2.68	4.30
STD. DEVIATIONS	2.12	0.84	1.16	0.66	1.58	2.17
	2.52	1.94	2.87	1.17	2.42	1.70

RUNOFF

TOTALS	1.943	1.029	0.233	0.000	0.001	0.005
	0.000	0.106	0.546	0.000	0.123	0.846
STD. DEVIATIONS	2.516	1.224	0.377	0.000	0.001	0.011
	0.000	0.236	1.220	0.000	0.244	1.432

EVAPOTRANSPIRATION

TOTALS	1.316	1.632	2.482	2.735	3.817	4.867
	4.942	3.674	2.826	3.350	1.339	1.157
STD. DEVIATIONS	0.173	0.297	0.431	0.255	0.676	0.980
	2.181	0.712	0.727	0.342	0.422	0.108

LATERAL DRAINAGE COLLECTED FROM LAYER 2

TOTALS	0.0803	0.0590	0.0760	0.0829	0.0808	0.0698
	0.0554	0.0534	0.0552	0.0636	0.0705	0.0795
STD. DEVIATIONS	0.0325	0.0278	0.0143	0.0051	0.0066	0.0117
	0.0120	0.0126	0.0147	0.0221	0.0279	0.0350

PERCOLATION/LEAKAGE THROUGH LAYER 3

TOTALS	0.4745	0.3468	0.4758	0.5427	0.5254	0.4441
	0.3309	0.3154	0.3283	0.3783	0.4035	0.4623
STD. DEVIATIONS	0.1806	0.1726	0.0917	0.0308	0.0420	0.0845
	0.0947	0.1003	0.1072	0.1547	0.1938	0.2119

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS	0.4236	0.3751	0.4646	0.4608	0.4392	0.4345
	0.4630	0.4866	0.4702	0.4720	0.4358	0.4325
STD. DEVIATIONS	0.1007	0.0872	0.0407	0.0367	0.1075	0.0995
	0.0957	0.0444	0.0297	0.0331	0.0534	0.0558

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ACROSS LAYER 3

AVERAGES	18.8628	15.1424	19.1670	22.8839	21.3564	18.4569
	12.8542	12.1800	13.2214	14.9168	16.5757	18.5321

STD. DEVIATIONS	7.4261	8.2895	3.9761	1.3693	1.8094	3.7956
	4.1463	4.3932	4.8451	6.7240	8.6865	9.1565

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1974 THROUGH 1978

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.79	(8.110)	162602.2	100.00
RUNOFF	4.831	(3.1930)	17538.06	10.786
EVAPOTRANSPIRATION	34.136	(2.8816)	123915.09	76.207
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0.82637	(0.11321)	2999.709	1.84481
PERCOLATION/LEAKAGE THROUGH FROM LAYER 3	5.02787	(0.77385)	18251.170	11.22443
AVERAGE HEAD ACROSS TOP OF LAYER 3	17.012	(2.833)		
PERCOLATION/LEAKAGE THROUGH FROM LAYER 5	5.35781	(0.54777)	19448.850	11.96100
CHANGE IN WATER STORAGE	-0.358	(4.2737)	-1299.49	-0.799

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.77	13685.100
RUNOFF	2.575	9346.3730
DRAINAGE COLLECTED FROM LAYER 2	0.00417	15.15207
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.023522	85.38402

AVERAGE HEAD ACROSS LAYER 3	30.000	
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.024010	87.15486
SNOW WATER	4.52	16420.7617

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4558
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0574

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FINAL WATER STORAGE AT END OF YEAR 1978

LAYER	(INCHES)	(VOL/VOL)
1	1.1802	0.1967
2	8.7093	0.3629
3	0.0000	0.0000
4	1.2085	0.2014
5	60.2476	0.2510
SNOW WATER	0.000	

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**                                                                          **
**                                                                          **
**          HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                   **
**          HELP MODEL VERSION 3.01   (14 OCTOBER 1994)                     **
**          DEVELOPED BY ENVIRONMENTAL LABORATORY                           **
**          USAE WATERWAYS EXPERIMENT STATION                               **
**          FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                 **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     C:\HELP3\DATA4.D4
TEMPERATURE DATA FILE:       C:\HELP3\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\HELP3\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP3\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP3\SONIA2G.D10
OUTPUT DATA FILE:            C:\HELP3\SONIA2G.OUT
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TIME: 13:45 DATE: 2/19/1998

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TITLE: SONIA ROAD LANDFILL, 2% SLOPE, GEOCOMPOSITE, BPL 5

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NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	6.00	INCHES
POROSITY	=	0.4530	VOL/VOL

```
 FIELD CAPACITY              =       0.1900 VOL/VOL
 WILTING POINT               =       0.0850 VOL/VOL
 INITIAL SOIL WATER CONTENT  =       0.1944 VOL/VOL
 EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                               LAYER  2
                               --------

                   TYPE 1 - VERTICAL PERCOLATION LAYER
                       MATERIAL TEXTURE NUMBER   5
 THICKNESS                   =      24.00   INCHES
 POROSITY                    =       0.4570 VOL/VOL
 FIELD CAPACITY              =       0.1310 VOL/VOL
 WILTING POINT               =       0.0580 VOL/VOL
 INITIAL SOIL WATER CONTENT  =       0.1390 VOL/VOL
 EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                               LAYER  3
                               --------

                     TYPE 2 - LATERAL DRAINAGE LAYER
                       MATERIAL TEXTURE NUMBER  34
 THICKNESS                   =       0.24   INCHES
 POROSITY                    =       0.8500 VOL/VOL
 FIELD CAPACITY              =       0.0100 VOL/VOL
 WILTING POINT               =       0.0050 VOL/VOL
 INITIAL SOIL WATER CONTENT  =       0.0434 VOL/VOL
 EFFECTIVE SAT. HYD. COND.   =   33.0000000000      CM/SEC
 SLOPE                       =       2.00   PERCENT
 DRAINAGE LENGTH             =   1000.0     FEET


                               LAYER  4
                               --------

                     TYPE 4 - FLEXIBLE MEMBRANE LINER
                       MATERIAL TEXTURE NUMBER  35
 THICKNESS                   =       0.06   INCHES
 POROSITY                    =       0.0000 VOL/VOL
 FIELD CAPACITY              =       0.0000 VOL/VOL
 WILTING POINT               =       0.0000 VOL/VOL
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INITIAL SOIL WATER CONTENT   =       0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY          =       1.00   HOLES/ACRE
FML INSTALLATION DEFECTS     =       3.00   HOLES/ACRE
FML PLACEMENT QUALITY        =   3 - GOOD
```

LAYER 5

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          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   5
THICKNESS                    =       6.00   INCHES
POROSITY                     =       0.4570 VOL/VOL
FIELD CAPACITY               =       0.1310 VOL/VOL
WILTING POINT                =       0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.1300 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   0.100000005000E-02 CM/SEC
```

LAYER 6

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          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  18
THICKNESS                    =     240.00   INCHES
POROSITY                     =       0.6710 VOL/VOL
FIELD CAPACITY               =       0.2920 VOL/VOL
WILTING POINT                =       0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.2524 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   0.100000005000E-02 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

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NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
         SOIL DATA BASE USING SOIL TEXTURE # 6 WITH A
         FAIR STAND OF GRASS, A SURFACE SLOPE OF  2.%
         AND A SLOPE LENGTH OF 1000. FEET.

SCS RUNOFF CURVE NUMBER              =     66.60
FRACTION OF AREA ALLOWING RUNOFF     =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE   =      1.000  ACRES
```

EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.339	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	9.116	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.322	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	65.867	INCHES
TOTAL INITIAL WATER	=	65.867	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
NEW YORK NEW YORK

MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	108
END OF GROWING SEASON (JULIAN DATE)	=	302
AVERAGE ANNUAL WIND SPEED	=	12.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA FOR NEW YORK NEW YORK

WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW YORK NEW YORK

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.80	33.30	41.00	51.90	61.70	71.00
76.40	75.30	68.20	57.50	47.10	36.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW YORK NEW YORK

STATION LATITUDE = 40.47 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.83	1.41	4.60	2.33	2.69	2.38
	1.29	4.24	5.97	2.19	1.10	6.07
RUNOFF	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	1.580	1.920	2.521	2.749	2.015	2.087
	1.126	2.613	3.139	1.898	0.976	1.682
LATERAL DRAINAGE COLLECTED	1.1650	0.4984	0.5153	1.4396	0.7055	0.2800
FROM LAYER 3	0.2401	0.4018	3.4675	0.5627	0.3880	2.0782
PERCOLATION THROUGH	0.0012	0.0006	0.0006	0.0014	0.0008	0.0004
LAYER 4	0.0004	0.0005	0.0131	0.0007	0.0005	0.0019
PERCOLATION THROUGH	0.4440	0.3781	0.3981	0.3644	0.3607	0.3302
LAYER 6	0.3238	0.3103	0.2875	0.2849	0.2643	0.2622

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.010	0.005	0.004	0.013	0.006	0.002
LAYER 4	0.002	0.003	0.409	0.005	0.003	0.018
STD. DEVIATION OF DAILY	0.009	0.003	0.004	0.006	0.004	0.001
HEAD ON LAYER 4	0.001	0.002	1.447	0.004	0.001	0.011

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.10	134673.031	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	24.306	88231.461	65.52
DRAINAGE COLLECTED FROM LAYER 3	11.7421	42623.816	31.65
PERC./LEAKAGE THROUGH LAYER 4	0.022193	80.562	0.06
AVG. HEAD ON TOP OF LAYER 4	0.0401		
PERC./LEAKAGE THROUGH LAYER 6	4.008658	14551.430	10.81
CHANGE IN WATER STORAGE	-2.957	-10733.746	-7.97
SOIL WATER AT START OF YEAR	66.653	241950.062	
SOIL WATER AT END OF YEAR	63.696	231216.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.073	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.05	3.57	3.50	3.13	3.52	7.06
	7.86	3.54	9.65	3.25	4.02	3.03
RUNOFF	0.013	2.099	0.613	0.000	0.000	0.000
	0.000	0.000	0.190	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.190	1.273	3.051	3.101	3.486	5.097

	4.864	1.744	2.413	2.833	1.562	1.273
LATERAL DRAINAGE COLLECTED	1.5535	0.3003	1.1049	1.1087	2.0698	1.8999
FROM LAYER 3	2.7529	1.4889	4.3136	3.3314	1.4516	0.4424
PERCOLATION THROUGH	0.0014	0.0004	0.0010	0.0011	0.0018	0.0017
LAYER 4	0.0021	0.0013	0.0501	0.0080	0.0013	0.0006
PERCOLATION THROUGH	0.2535	0.2210	0.2341	0.2219	0.2213	0.2046
LAYER 6	0.2074	0.2011	0.1883	0.1890	0.1776	0.1791

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.013	0.003	0.010	0.010	0.018	0.017
LAYER 4	0.024	0.013	1.764	0.213	0.013	0.004
STD. DEVIATION OF DAILY	0.022	0.001	0.015	0.005	0.012	0.017
HEAD ON LAYER 4	0.036	0.018	3.448	1.039	0.022	0.002

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	57.18	207563.406	100.00
RUNOFF	2.916	10584.426	5.10
EVAPOTRANSPIRATION	31.886	115745.711	55.76
DRAINAGE COLLECTED FROM LAYER 3	21.8180	79199.180	38.16
PERC./LEAKAGE THROUGH LAYER 4	0.070704	256.654	0.12
AVG. HEAD ON TOP OF LAYER 4	0.1751		
PERC./LEAKAGE THROUGH LAYER 6	2.498830	9070.751	4.37
CHANGE IN WATER STORAGE	-1.938	-7036.656	-3.39
SOIL WATER AT START OF YEAR	63.696	231216.312	

SOIL WATER AT END OF YEAR	61.757	224179.656	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.004	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.11	2.60	2.30	2.26	3.56	3.97
	3.50	8.30	2.24	4.06	0.32	2.02
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.384	0.000	0.000	0.000	0.002
EVAPOTRANSPIRATION	1.598	1.900	1.851	1.747	2.419	0.917
	3.975	3.212	1.230	2.424	0.901	1.067
LATERAL DRAINAGE COLLECTED	3.4814	2.7200	1.0986	0.5777	0.9745	0.8434
FROM LAYER 3	1.8730	4.6526	0.4166	1.0186	0.5876	0.2290
PERCOLATION THROUGH	0.0027	0.0020	0.0011	0.0007	0.0010	0.0008
LAYER 4	0.0016	0.0508	0.0006	0.0011	0.0007	0.0004
PERCOLATION THROUGH	0.1792	0.1536	0.1646	0.1561	0.1572	0.1487
LAYER 6	0.1503	0.1454	0.1382	0.1396	0.1327	0.1344

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.029	0.026	0.009	0.005	0.008	0.008
LAYER 4	0.016	1.728	0.004	0.009	0.005	0.002
STD. DEVIATION OF DAILY	0.022	0.040	0.009	0.002	0.008	0.022

HEAD ON LAYER 4	0.022	3.646	0.001	0.005	0.003	0.001

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.24	146071.281	100.00
RUNOFF	0.386	1401.463	0.96
EVAPOTRANSPIRATION	23.241	84363.578	57.76
DRAINAGE COLLECTED FROM LAYER 3	18.4730	67057.125	45.91
PERC./LEAKAGE THROUGH LAYER 4	0.063481	230.436	0.16
AVG. HEAD ON TOP OF LAYER 4	0.1541		
PERC./LEAKAGE THROUGH LAYER 6	1.800096	6534.350	4.47
CHANGE IN WATER STORAGE	-3.660	-13285.287	-9.10
SOIL WATER AT START OF YEAR	61.757	224179.656	
SOIL WATER AT END OF YEAR	58.098	210894.375	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.042	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC

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PRECIPITATION	2.67	2.41	4.70	3.62	2.29	3.25
	2.30	4.84	6.70	4.41	6.23	5.16
RUNOFF	0.919	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.027	0.000
EVAPOTRANSPIRATION	1.090	1.711	2.683	2.576	2.200	2.540
	1.699	3.840	2.258	3.283	2.088	1.413
LATERAL DRAINAGE COLLECTED	0.1581	0.0759	2.9574	1.6051	0.6226	0.4518
FROM LAYER 3	0.4547	1.2290	3.1565	1.6239	2.8597	4.5243
PERCOLATION THROUGH	0.0003	0.0001	0.0023	0.0015	0.0008	0.0006
LAYER 4	0.0006	0.0012	0.0153	0.0015	0.0104	0.0107
PERCOLATION THROUGH	0.1318	0.1167	0.1272	0.1196	0.1220	0.1156
LAYER 6	0.1175	0.1149	0.1103	0.1105	0.1053	0.1083

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.026	0.014	0.005	0.004
LAYER 4	0.004	0.011	0.492	0.014	0.319	0.293
STD. DEVIATION OF DAILY	0.000	0.000	0.031	0.015	0.003	0.002
HEAD ON LAYER 4	0.001	0.008	1.600	0.010	1.225	1.018

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.58	176345.422	100.00
RUNOFF	0.946	3433.282	1.95
EVAPOTRANSPIRATION	27.382	99397.266	56.37
DRAINAGE COLLECTED FROM LAYER 3	19.7189	71579.648	40.59
PERC./LEAKAGE THROUGH LAYER 4	0.045302	164.445	0.09

AVG. HEAD ON TOP OF LAYER 4	0.0986		
PERC./LEAKAGE THROUGH LAYER 6	1.399765	5081.146	2.88
CHANGE IN WATER STORAGE	-0.867	-3145.954	-1.78
SOIL WATER AT START OF YEAR	58.098	210894.375	
SOIL WATER AT END OF YEAR	57.196	207620.891	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.035	127.519	0.07
ANNUAL WATER BUDGET BALANCE	0.0000	0.026	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	7.86	1.74	2.38	2.10	6.33	1.35
	3.05	3.83	3.61	1.68	1.74	5.20
RUNOFF	4.007	0.758	0.177	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.324	1.673	2.031	2.362	4.036	1.247
	2.355	2.362	2.403	1.301	0.734	1.530
LATERAL DRAINAGE COLLECTED	0.5466	0.1556	0.6306	0.7431	2.9943	0.5236
FROM LAYER 3	0.6677	1.1185	1.3380	0.5087	0.1459	2.5161
PERCOLATION THROUGH	0.0007	0.0003	0.0007	0.0008	0.0024	0.0007
LAYER 4	0.0008	0.0011	0.0012	0.0006	0.0003	0.0020
PERCOLATION THROUGH	0.1051	0.0935	0.1019	0.0971	0.0980	0.0940
LAYER 6	0.0957	0.0943	0.0906	0.0914	0.0871	0.0882

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON LAYER 4	0.005	0.001	0.005	0.007	0.026	0.005
	0.006	0.010	0.012	0.004	0.001	0.022
STD. DEVIATION OF DAILY HEAD ON LAYER 4	0.002	0.000	0.005	0.004	0.019	0.003
	0.005	0.012	0.024	0.002	0.000	0.024

ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.87	148358.094	100.00
RUNOFF	4.942	17939.227	12.09
EVAPOTRANSPIRATION	23.358	84789.406	57.15
DRAINAGE COLLECTED FROM LAYER 3	11.8885	43155.258	29.09
PERC./LEAKAGE THROUGH LAYER 4	0.011550	41.928	0.03
AVG. HEAD ON TOP OF LAYER 4	0.0086		
PERC./LEAKAGE THROUGH LAYER 6	1.136889	4126.906	2.78
CHANGE IN WATER STORAGE	-0.455	-1652.680	-1.11
SOIL WATER AT START OF YEAR	57.196	207620.891	
SOIL WATER AT END OF YEAR	56.776	206095.734	
SNOW WATER AT START OF YEAR	0.035	127.519	0.09
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.023	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1974 THROUGH 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.70	2.35	3.50	2.69	3.68	3.60
	3.60	4.95	5.63	3.12	2.68	4.30
STD. DEVIATIONS	2.12	0.84	1.16	0.66	1.58	2.17
	2.52	1.94	2.87	1.17	2.42	1.70
RUNOFF						
TOTALS	0.988	0.571	0.158	0.000	0.000	0.000
	0.000	0.077	0.038	0.000	0.005	0.000
STD. DEVIATIONS	1.734	0.915	0.266	0.000	0.000	0.000
	0.000	0.172	0.085	0.000	0.012	0.001
EVAPOTRANSPIRATION						
TOTALS	1.356	1.695	2.427	2.507	2.831	2.378
	2.804	2.754	2.289	2.348	1.252	1.393
STD. DEVIATIONS	0.228	0.260	0.488	0.504	0.882	1.652
	1.570	0.804	0.684	0.777	0.562	0.236
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	1.3809	0.7500	1.2613	1.0948	1.4733	0.7997
	1.1977	1.7782	2.5384	1.4091	1.0866	1.9580
STD. DEVIATIONS	1.2923	1.1129	0.9851	0.4389	1.0285	0.6480
	1.0752	1.6566	1.6077	1.1642	1.1067	1.7463
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0012	0.0007	0.0011	0.0011	0.0014	0.0008
	0.0011	0.0110	0.0161	0.0024	0.0026	0.0031
STD. DEVIATIONS	0.0009	0.0008	0.0007	0.0003	0.0007	0.0005
	0.0007	0.0222	0.0202	0.0031	0.0044	0.0043

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.2227	0.1926	0.2052	0.1919	0.1919	0.1786
	0.1789	0.1732	0.1630	0.1631	0.1534	0.1544
STD. DEVIATIONS	0.1359	0.1144	0.1188	0.1074	0.1052	0.0944
	0.0913	0.0866	0.0787	0.0774	0.0708	0.0692

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ACROSS LAYER 4

AVERAGES	0.0117	0.0072	0.0109	0.0098	0.0127	0.0071
	0.0103	0.3529	0.5360	0.0490	0.0683	0.0677
STD. DEVIATIONS	0.0108	0.0106	0.0085	0.0039	0.0089	0.0058
	0.0093	0.7688	0.7218	0.0918	0.1400	0.1263

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1974 THROUGH 1978

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.79	(8.110)	162602.2	100.00
RUNOFF	1.838	(2.0663)	6671.68	4.103
EVAPOTRANSPIRATION	26.035	(3.6746)	94505.49	58.121
LATERAL DRAINAGE COLLECTED FROM LAYER 3	16.72810	(4.64161)	60723.004	37.34451
PERCOLATION/LEAKAGE THROUGH FROM LAYER 4	0.04265	(0.02556)	154.805	0.09520
AVERAGE HEAD ACROSS TOP OF LAYER 4	0.095	(0.071)		
PERCOLATION/LEAKAGE THROUGH FROM LAYER 6	2.16885	(1.14959)	7872.917	4.84183
CHANGE IN WATER STORAGE	-1.975	(1.3548)	-7170.86	-4.410

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.77	13685.100
RUNOFF	1.826	6627.0322
DRAINAGE COLLECTED FROM LAYER 3	0.70482	2558.48193
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.011638	42.24577
AVERAGE HEAD ACROSS LAYER 4	12.859	
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.016978	61.63128
SNOW WATER	4.52	16420.7617

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3000
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0605

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FINAL WATER STORAGE AT END OF YEAR 1978

LAYER	(INCHES)	(VOL/VOL)
1	1.1674	0.1946
2	4.0596	0.1691
3	0.0403	0.1680
4	0.0000	0.0000
5	0.7731	0.1288

6	49.9493	0.2081

SNOW WATER   0.000

****
****

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**             HELP MODEL VERSION 3.01    (14 OCTOBER 1994)                  **
**                DEVELOPED BY ENVIRONMENTAL LABORATORY                      **
**                  USAE WATERWAYS EXPERIMENT STATION                        **
**           FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                 **
**                                                                          **
**                                                                          **
******************************************************************************
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```

```
PRECIPITATION DATA FILE:     C:\HELP3\DATA4.D4
TEMPERATURE DATA FILE:       C:\HELP3\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\HELP3\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP3\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP3\SONIA4G.D10
OUTPUT DATA FILE:            C:\HELP3\SONIA4G.OUT
```

TIME: 14:25   DATE: 2/19/1998

```
******************************************************************************

     TITLE:  SONIA ROAD LANDFILL, 4% SLOPE, GEOCOMPOSITE, BPL 5

******************************************************************************
```

NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

```
                          LAYER  1
                          --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER   6
     THICKNESS                   =       6.00   INCHES
     POROSITY                    =       0.4530 VOL/VOL
```

```
   FIELD CAPACITY              =       0.1900 VOL/VOL
   WILTING POINT               =       0.0850 VOL/VOL
   INITIAL SOIL WATER CONTENT  =       0.1944 VOL/VOL
   EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
       FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                         LAYER  2
                         --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER   5
   THICKNESS                   =      24.00   INCHES
   POROSITY                    =       0.4570 VOL/VOL
   FIELD CAPACITY              =       0.1310 VOL/VOL
   WILTING POINT               =       0.0580 VOL/VOL
   INITIAL SOIL WATER CONTENT  =       0.1390 VOL/VOL
   EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                         LAYER  3
                         --------

               TYPE 2 - LATERAL DRAINAGE LAYER
                MATERIAL TEXTURE NUMBER  34
   THICKNESS                   =       0.24   INCHES
   POROSITY                    =       0.8500 VOL/VOL
   FIELD CAPACITY              =       0.0100 VOL/VOL
   WILTING POINT               =       0.0050 VOL/VOL
   INITIAL SOIL WATER CONTENT  =       0.0266 VOL/VOL
   EFFECTIVE SAT. HYD. COND.   =   33.0000000000      CM/SEC
   SLOPE                       =       4.00   PERCENT
   DRAINAGE LENGTH             =   1000.0     FEET


                         LAYER  4
                         --------

               TYPE 4 - FLEXIBLE MEMBRANE LINER
                MATERIAL TEXTURE NUMBER  35
   THICKNESS                   =       0.06   INCHES
   POROSITY                    =       0.0000 VOL/VOL
   FIELD CAPACITY              =       0.0000 VOL/VOL
   WILTING POINT               =       0.0000 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT   =       0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY          =       1.00    HOLES/ACRE
FML INSTALLATION DEFECTS     =       3.00    HOLES/ACRE
FML PLACEMENT QUALITY        =  3 - GOOD
```

```
                       LAYER  5
                       --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   5
THICKNESS                    =       6.00    INCHES
POROSITY                     =       0.4570 VOL/VOL
FIELD CAPACITY               =       0.1310 VOL/VOL
WILTING POINT                =       0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.1259 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
```

```
                       LAYER  6
                       --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER  18
THICKNESS                    =     240.00    INCHES
POROSITY                     =       0.6710 VOL/VOL
FIELD CAPACITY               =       0.2920 VOL/VOL
WILTING POINT                =       0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.2524 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
```

```
           GENERAL DESIGN AND EVAPORATIVE ZONE DATA
           ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER            =      66.60
FRACTION OF AREA ALLOWING RUNOFF   =     100.0     PERCENT
AREA PROJECTED ON HORIZONTAL PLANE =       1.000   ACRES
EVAPORATIVE ZONE DEPTH             =      20.0     INCHES
INITIAL WATER IN EVAPORATIVE ZONE  =       2.339   INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE =       9.116   INCHES
```

LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.322	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	65.839	INCHES
TOTAL INITIAL WATER	=	65.839	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
NEW YORK NEW YORK

MAXIMUM LEAF AREA INDEX	= 2.00
START OF GROWING SEASON (JULIAN DATE)	= 108
END OF GROWING SEASON (JULIAN DATE)	= 302
AVERAGE ANNUAL WIND SPEED	= 12.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	= 65.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	= 68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	= 72.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	= 68.00 %

NOTE: PRECIPITATION DATA FOR NEW YORK NEW YORK

WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW YORK NEW YORK

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.80	33.30	41.00	51.90	61.70	71.00
76.40	75.30	68.20	57.50	47.10	36.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW YORK NEW YORK

STATION LATITUDE = 40.47 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.83	1.41	4.60	2.33	2.69	2.38
	1.29	4.24	5.97	2.19	1.10	6.07
RUNOFF	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	1.580	1.920	2.521	2.749	2.015	2.087
	1.126	2.613	3.139	1.898	0.976	1.682
LATERAL DRAINAGE COLLECTED	1.1654	0.4955	0.5221	1.4344	0.7050	0.2797
FROM LAYER 3	0.2400	0.4061	3.4764	0.5645	0.3856	2.0823
PERCOLATION THROUGH	0.0007	0.0004	0.0004	0.0008	0.0005	0.0002
LAYER 4	0.0002	0.0003	0.0014	0.0004	0.0003	0.0011
PERCOLATION THROUGH	0.4447	0.3805	0.3961	0.3644	0.3608	0.3307
LAYER 6	0.3241	0.3069	0.2875	0.2864	0.2652	0.2616

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.002	0.002	0.006	0.003	0.001
LAYER 4	0.001	0.002	0.016	0.002	0.002	0.009
STD. DEVIATION OF DAILY	0.005	0.001	0.002	0.003	0.002	0.000
HEAD ON LAYER 4	0.000	0.001	0.027	0.002	0.001	0.006

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT

PRECIPITATION	37.10	134673.031	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	24.306	88231.461	65.52
DRAINAGE COLLECTED FROM LAYER 3	11.7570	42678.020	31.69
PERC./LEAKAGE THROUGH LAYER 4	0.006747	24.493	0.02
AVG. HEAD ON TOP OF LAYER 4	0.0043		
PERC./LEAKAGE THROUGH LAYER 6	4.008833	14552.063	10.81
CHANGE IN WATER STORAGE	-2.972	-10788.582	-8.01
SOIL WATER AT START OF YEAR	66.625	241847.812	
SOIL WATER AT END OF YEAR	63.653	231059.219	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.069	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.05	3.57	3.50	3.13	3.52	7.06
	7.86	3.54	9.65	3.25	4.02	3.03
RUNOFF	0.013	2.099	0.613	0.000	0.000	0.000
	0.000	0.000	0.190	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.190	1.273	3.051	3.101	3.486	5.097
	4.864	1.744	2.376	2.733	1.570	1.274
LATERAL DRAINAGE COLLECTED	1.5528	0.2980	1.1126	1.1015	2.0725	1.9002

FROM LAYER 3	2.7646	1.4814	5.9640	1.8986	1.4086	0.4523
PERCOLATION THROUGH	0.0008	0.0002	0.0006	0.0007	0.0011	0.0010
LAYER 4	0.0012	0.0008	0.0070	0.0010	0.0007	0.0003
PERCOLATION THROUGH	0.2524	0.2206	0.2341	0.2196	0.2219	0.2066
LAYER 6	0.2041	0.2000	0.1897	0.1868	0.1780	0.1799

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.001	0.005	0.005	0.009	0.008
LAYER 4	0.012	0.006	0.209	0.008	0.006	0.002
STD. DEVIATION OF DAILY	0.011	0.001	0.007	0.003	0.006	0.008
HEAD ON LAYER 4	0.018	0.009	0.792	0.012	0.011	0.001

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	57.18	207563.406	100.00
RUNOFF	2.916	10584.426	5.10
EVAPOTRANSPIRATION	31.758	115280.836	55.54
DRAINAGE COLLECTED FROM LAYER 3	22.0072	79886.141	38.49
PERC./LEAKAGE THROUGH LAYER 4	0.015329	55.645	0.03
AVG. HEAD ON TOP OF LAYER 4	0.0232		
PERC./LEAKAGE THROUGH LAYER 6	2.493818	9052.561	4.36
CHANGE IN WATER STORAGE	-1.995	-7240.572	-3.49
SOIL WATER AT START OF YEAR	63.653	231059.219	
SOIL WATER AT END OF YEAR	61.658	223818.656	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00

SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.005	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.11	2.60	2.30	2.26	3.56	3.97
	3.50	8.30	2.24	4.06	0.32	2.02
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.353	0.000	0.000	0.000	0.002
EVAPOTRANSPIRATION	1.599	1.901	1.852	1.738	2.459	0.945
	3.710	3.058	1.393	2.428	1.332	0.982
LATERAL DRAINAGE COLLECTED	3.5061	2.6920	1.0947	0.5819	0.9679	0.8243
FROM LAYER 3	1.9770	5.0774	0.2472	0.5582	0.5037	0.3330
PERCOLATION THROUGH	0.0016	0.0012	0.0006	0.0004	0.0006	0.0004
LAYER 4	0.0010	0.0192	0.0002	0.0004	0.0004	0.0003
PERCOLATION THROUGH	0.1773	0.1530	0.1637	0.1571	0.1559	0.1476
LAYER 6	0.1486	0.1458	0.1377	0.1395	0.1317	0.1340

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.015	0.013	0.005	0.003	0.004	0.004
LAYER 4	0.009	0.640	0.001	0.002	0.002	0.001
STD. DEVIATION OF DAILY	0.011	0.021	0.005	0.001	0.004	0.012
HEAD ON LAYER 4	0.010	2.218	0.000	0.001	0.001	0.000

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.24	146071.281	100.00
RUNOFF	0.355	1288.261	0.88
EVAPOTRANSPIRATION	23.397	84930.789	58.14
DRAINAGE COLLECTED FROM LAYER 3	18.3633	66658.750	45.63
PERC./LEAKAGE THROUGH LAYER 4	0.026369	95.718	0.07
AVG. HEAD ON TOP OF LAYER 4	0.0582		
PERC./LEAKAGE THROUGH LAYER 6	1.791779	6504.158	4.45
CHANGE IN WATER STORAGE	-3.667	-13310.738	-9.11
SOIL WATER AT START OF YEAR	61.658	223818.656	
SOIL WATER AT END OF YEAR	57.991	210507.922	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.053	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.67	2.41	4.70	3.62	2.29	3.25

	2.30	4.84	6.70	4.41	6.23	5.16
RUNOFF	0.918	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.021	0.000
EVAPOTRANSPIRATION	1.095	1.721	2.697	2.680	2.738	2.542
	1.680	4.110	2.699	3.278	2.039	1.357
LATERAL DRAINAGE COLLECTED	0.1670	0.0755	1.7072	2.1136	0.6444	0.5841
FROM LAYER 3	0.3731	1.0111	2.8413	1.4753	2.9212	4.5904
PERCOLATION THROUGH	0.0002	0.0001	0.0009	0.0011	0.0005	0.0004
LAYER 4	0.0003	0.0006	0.0011	0.0008	0.0023	0.0019
PERCOLATION THROUGH	0.1300	0.1158	0.1260	0.1194	0.1205	0.1135
LAYER 6	0.1163	0.1141	0.1088	0.1102	0.1042	0.1051

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.000	0.007	0.009	0.003	0.003
LAYER 4	0.002	0.004	0.013	0.006	0.052	0.020
STD. DEVIATION OF DAILY	0.000	0.000	0.005	0.005	0.001	0.002
HEAD ON LAYER 4	0.001	0.003	0.031	0.005	0.235	0.024

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.58	176345.422	100.00
RUNOFF	0.938	3406.130	1.93
EVAPOTRANSPIRATION	28.634	103941.719	58.94
DRAINAGE COLLECTED FROM LAYER 3	18.5041	67169.703	38.09
PERC./LEAKAGE THROUGH LAYER 4	0.010250	37.208	0.02
AVG. HEAD ON TOP OF LAYER 4	0.0100		

PERC./LEAKAGE THROUGH LAYER 6	1.383950	5023.738	2.85
CHANGE IN WATER STORAGE	-0.880	-3195.818	-1.81
SOIL WATER AT START OF YEAR	57.991	210507.922	
SOIL WATER AT END OF YEAR	57.076	207184.578	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.035	127.519	0.07
ANNUAL WATER BUDGET BALANCE	0.0000	-0.056	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	7.86	1.74	2.38	2.10	6.33	1.35
	3.05	3.83	3.61	1.68	1.74	5.20
RUNOFF	4.008	0.765	0.179	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.283	1.632	2.035	2.421	4.596	1.216
	2.378	2.429	2.418	1.314	0.723	1.490
LATERAL DRAINAGE COLLECTED	0.5556	0.1681	0.6814	0.6963	2.1087	0.8414
FROM LAYER 3	0.7013	1.0293	1.3355	0.4924	0.1434	2.5833
PERCOLATION THROUGH	0.0004	0.0002	0.0004	0.0005	0.0011	0.0005
LAYER 4	0.0005	0.0006	0.0007	0.0004	0.0001	0.0012
PERCOLATION THROUGH	0.1051	0.0922	0.1008	0.0962	0.0971	0.0929
LAYER 6	0.0944	0.0930	0.0885	0.0896	0.0859	0.0883

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON LAYER 4	0.002	0.001	0.003	0.003	0.009	0.004
	0.003	0.004	0.006	0.002	0.001	0.011
STD. DEVIATION OF DAILY HEAD ON LAYER 4	0.001	0.000	0.003	0.002	0.006	0.004
	0.003	0.005	0.011	0.001	0.000	0.013

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.87	148358.094	100.00
RUNOFF	4.953	17979.426	12.12
EVAPOTRANSPIRATION	23.935	86884.602	58.56
DRAINAGE COLLECTED FROM LAYER 3	11.3366	41151.859	27.74
PERC./LEAKAGE THROUGH LAYER 4	0.006619	24.028	0.02
AVG. HEAD ON TOP OF LAYER 4	0.0041		
PERC./LEAKAGE THROUGH LAYER 6	1.124023	4080.204	2.75
CHANGE IN WATER STORAGE	-0.479	-1737.966	-1.17
SOIL WATER AT START OF YEAR	57.076	207184.578	
SOIL WATER AT END OF YEAR	56.632	205574.125	
SNOW WATER AT START OF YEAR	0.035	127.519	0.09
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.030	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1974 THROUGH 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.70	2.35	3.50	2.69	3.68	3.60
	3.60	4.95	5.63	3.12	2.68	4.30
STD. DEVIATIONS	2.12	0.84	1.16	0.66	1.58	2.17
	2.52	1.94	2.87	1.17	2.42	1.70
RUNOFF						
TOTALS	0.988	0.573	0.158	0.000	0.000	0.000
	0.000	0.071	0.038	0.000	0.004	0.000
STD. DEVIATIONS	1.734	0.915	0.266	0.000	0.000	0.000
	0.000	0.158	0.085	0.000	0.009	0.001
EVAPOTRANSPIRATION						
TOTALS	1.349	1.689	2.431	2.538	3.059	2.377
	2.752	2.791	2.405	2.330	1.328	1.357
STD. DEVIATIONS	0.229	0.262	0.488	0.509	1.012	1.651
	1.526	0.876	0.642	0.757	0.513	0.260
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	1.3894	0.7458	1.0236	1.1855	1.2997	0.8860
	1.2112	1.8011	2.7729	0.9978	1.0725	2.0082
STD. DEVIATIONS	1.2987	1.0993	0.4607	0.6193	0.7323	0.6110
	1.1074	1.8710	2.1868	0.6473	1.1390	1.7486
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0007	0.0004	0.0006	0.0007	0.0007	0.0005
	0.0006	0.0043	0.0021	0.0006	0.0008	0.0010
STD. DEVIATIONS	0.0006	0.0004	0.0002	0.0003	0.0003	0.0003
	0.0004	0.0083	0.0028	0.0003	0.0009	0.0007
PERCOLATION/LEAKAGE THROUGH LAYER 6						
TOTALS	0.2219	0.1924	0.2041	0.1913	0.1912	0.1783
	0.1775	0.1720	0.1624	0.1625	0.1530	0.1538

STD. DEVIATIONS	0.1366	0.1158	0.1185	0.1074	0.1058	0.0954
	0.0918	0.0855	0.0796	0.0783	0.0717	0.0696

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ACROSS LAYER 4

AVERAGES	0.0059	0.0036	0.0044	0.0053	0.0056	0.0040
	0.0052	0.1313	0.0488	0.0043	0.0125	0.0087
STD. DEVIATIONS	0.0054	0.0053	0.0020	0.0028	0.0032	0.0027
	0.0048	0.2842	0.0896	0.0028	0.0220	0.0075

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1974 THROUGH 1978

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.79	(8.110)	162602.2	100.00
RUNOFF	1.832	(2.0768)	6651.65	4.091
EVAPOTRANSPIRATION	26.406	(3.6461)	95853.87	58.950
LATERAL DRAINAGE COLLECTED FROM LAYER 3	16.39363	(4.66147)	59508.895	36.59783
PERCOLATION/LEAKAGE THROUGH FROM LAYER 4	0.01306	(0.00824)	47.419	0.02916
AVERAGE HEAD ACROSS TOP OF LAYER 4	0.020	(0.023)		
PERCOLATION/LEAKAGE THROUGH FROM LAYER 6	2.16048	(1.15550)	7842.545	4.82315
CHANGE IN WATER STORAGE	-1.999	(1.3501)	-7254.74	-4.462

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.77	13685.100
RUNOFF	1.826	6628.4194
DRAINAGE COLLECTED FROM LAYER 3	1.56922	5696.26514
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.008305	30.14697
AVERAGE HEAD ACROSS LAYER 4	8.939	
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.016577	60.17329
SNOW WATER	4.52	16420.7617

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3000

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0605

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FINAL WATER STORAGE AT END OF YEAR 1978

LAYER	(INCHES)	(VOL/VOL)
1	1.1708	0.1951
2	4.0615	0.1692
3	0.0206	0.0860
4	0.0000	0.0000
5	0.7254	0.1209
6	49.8676	0.2078

SNOW WATER 0.000

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Appendix E

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**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**             HELP MODEL VERSION 3.01    (14 OCTOBER 1994)                 **
**                DEVELOPED BY ENVIRONMENTAL LABORATORY                     **
**                  USAE WATERWAYS EXPERIMENT STATION                       **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
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PRECIPITATION DATA FILE:     C:\HELP3\DATA4.D4
TEMPERATURE DATA FILE:       C:\HELP3\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\HELP3\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP3\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP3\SONIA7.D10
OUTPUT DATA FILE:            C:\HELP3\SONIA7.OUT


TIME:  11:42     DATE:   2/19/1998


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     TITLE:  SONIA ROAD LANDFILL, 7% SLOPE, GEOCOMPOSITE, BPL 5

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                   LAYER  1
                                   --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER   6
           THICKNESS                     =       6.00   INCHES
           POROSITY                      =       0.4530 VOL/VOL
```

```
FIELD CAPACITY               =       0.1900 VOL/VOL
WILTING POINT                =       0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.1944 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                        LAYER  2
                        --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER   5
THICKNESS                    =      24.00   INCHES
POROSITY                     =       0.4570 VOL/VOL
FIELD CAPACITY               =       0.1310 VOL/VOL
WILTING POINT                =       0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.1390 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                        LAYER  3
                        --------

               TYPE 2 - LATERAL DRAINAGE LAYER
                MATERIAL TEXTURE NUMBER  34
THICKNESS                    =       0.24   INCHES
POROSITY                     =       0.8500 VOL/VOL
FIELD CAPACITY               =       0.0100 VOL/VOL
WILTING POINT                =       0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.0131 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   33.0000000000      CM/SEC
SLOPE                        =       7.00   PERCENT
DRAINAGE LENGTH              =     360.0    FEET


                        LAYER  4
                        --------

               TYPE 4 - FLEXIBLE MEMBRANE LINER
                MATERIAL TEXTURE NUMBER  35
THICKNESS                    =       0.06   INCHES
POROSITY                     =       0.0000 VOL/VOL
FIELD CAPACITY               =       0.0000 VOL/VOL
WILTING POINT                =       0.0000 VOL/VOL
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INITIAL SOIL WATER CONTENT   =       0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY          =       1.00    HOLES/ACRE
FML INSTALLATION DEFECTS     =       3.00    HOLES/ACRE
FML PLACEMENT QUALITY        =  3 - GOOD
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

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NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
         SOIL DATA BASE USING SOIL TEXTURE # 6 WITH A
         FAIR STAND OF GRASS, A SURFACE SLOPE OF  7.%
         AND A SLOPE LENGTH OF  360. FEET.

SCS RUNOFF CURVE NUMBER                =     69.90
FRACTION OF AREA ALLOWING RUNOFF       =    100.0     PERCENT
AREA PROJECTED ON HORIZONTAL PLANE     =      6.200   ACRES
EVAPORATIVE ZONE DEPTH                 =     20.0     INCHES
INITIAL WATER IN EVAPORATIVE ZONE      =      2.337   INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE     =      9.116   INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE     =      1.322   INCHES
INITIAL SNOW WATER                     =      0.000   INCHES
INITIAL WATER IN LAYER MATERIALS       =      4.506   INCHES
TOTAL INITIAL WATER                    =      4.506   INCHES
TOTAL SUBSURFACE INFLOW                =      0.00    INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

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NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         NEW YORK              NEW YORK

    MAXIMUM LEAF AREA INDEX                    =  2.00
    START OF GROWING SEASON (JULIAN DATE)      =   108
    END OF GROWING SEASON (JULIAN DATE)        =   302
    AVERAGE ANNUAL WIND SPEED                  = 12.20 MPH
    AVERAGE 1ST QUARTER RELATIVE HUMIDITY      = 65.00 %
    AVERAGE 2ND QUARTER RELATIVE HUMIDITY      = 68.00 %
    AVERAGE 3RD QUARTER RELATIVE HUMIDITY      = 72.00 %
    AVERAGE 4TH QUARTER RELATIVE HUMIDITY      = 68.00 %

NOTE:  PRECIPITATION DATA FOR     NEW YORK                 NEW YORK
```

WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW YORK NEW YORK

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.80	33.30	41.00	51.90	61.70	71.00
76.40	75.30	68.20	57.50	47.10	36.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW YORK NEW YORK

STATION LATITUDE = 40.47 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.83	1.41	4.60	2.33	2.69	2.38
	1.29	4.24	5.97	2.19	1.10	6.07
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.009
EVAPOTRANSPIRATION	1.580	1.868	2.404	2.742	2.007	2.084
	1.239	2.618	3.135	1.345	0.992	1.586
LATERAL DRAINAGE COLLECTED	1.0800	0.4604	0.6458	1.2983	0.6300	0.2401
FROM LAYER 3	0.1632	0.3063	3.3046	1.1287	0.2544	3.0994
PERCOLATION THROUGH	0.0891	0.0589	0.0710	0.1002	0.0722	0.0470
LAYER 4	0.0394	0.0511	0.1374	0.0854	0.0484	0.1474

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.000	0.001	0.001	0.001	0.000
LAYER 4	0.000	0.000	0.003	0.001	0.000	0.003
STD. DEVIATION OF DAILY	0.001	0.000	0.001	0.001	0.000	0.000
HEAD ON LAYER 4	0.000	0.000	0.005	0.002	0.000	0.004

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.10	834972.812	100.00
RUNOFF	0.009	211.634	0.03
EVAPOTRANSPIRATION	23.601	531169.062	63.62
DRAINAGE COLLECTED FROM LAYER 3	12.6113	283829.812	33.99
PERC./LEAKAGE THROUGH LAYER 4	0.947635	21327.473	2.55
AVG. HEAD ON TOP OF LAYER 4	0.0010		
CHANGE IN WATER STORAGE	-0.070	-1565.358	-0.19
SOIL WATER AT START OF YEAR	4.508	101459.070	
SOIL WATER AT END OF YEAR	4.439	99893.711	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.215	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.05	3.57	3.50	3.13	3.52	7.06
	7.86	3.54	9.65	3.25	4.02	3.03
RUNOFF	0.009	1.957	0.578	0.000	0.000	0.000
	0.001	0.001	0.295	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.188	1.270	3.043	3.096	2.870	4.786
	4.075	1.748	2.719	2.747	1.593	1.293
LATERAL DRAINAGE COLLECTED	1.7513	0.2463	1.1162	0.8828	1.5135	1.9986
FROM LAYER 3	3.4471	0.8628	5.9306	1.7066	1.3713	0.3720
PERCOLATION THROUGH	0.0985	0.0452	0.0766	0.0842	0.1096	0.1224
LAYER 4	0.1346	0.0826	0.1512	0.1141	0.0912	0.0550

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.000	0.001	0.001	0.001	0.002
LAYER 4	0.003	0.001	0.005	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.003	0.000	0.001	0.000	0.001	0.002
HEAD ON LAYER 4	0.006	0.001	0.012	0.002	0.002	0.000

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	57.18	1286893.000	100.00
RUNOFF	2.841	63945.891	4.97
EVAPOTRANSPIRATION	30.428	684810.375	53.21

DRAINAGE COLLECTED FROM LAYER 3	21.1992	477108.625	37.07
PERC./LEAKAGE THROUGH LAYER 4	1.165303	26226.311	2.04
AVG. HEAD ON TOP OF LAYER 4	0.0016		
CHANGE IN WATER STORAGE	1.546	34801.766	2.70
SOIL WATER AT START OF YEAR	4.439	99893.711	
SOIL WATER AT END OF YEAR	5.985	134695.484	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.121	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.11	2.60	2.30	2.26	3.56	3.97
	3.50	8.30	2.24	4.06	0.32	2.02
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.559	0.000	0.000	0.000	0.002
EVAPOTRANSPIRATION	1.617	1.920	1.825	1.820	2.434	0.946
	3.990	2.568	1.476	2.431	1.323	1.057
LATERAL DRAINAGE COLLECTED	3.3161	2.5463	1.0127	0.4634	0.8743	0.8029
FROM LAYER 3	1.6688	5.1588	0.1672	0.4687	0.4020	0.2370
PERCOLATION THROUGH	0.1640	0.1211	0.0864	0.0622	0.0841	0.0612
LAYER 4	0.1090	0.1338	0.0395	0.0632	0.0565	0.0471

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON LAYER 4	0.003	0.003	0.001	0.000	0.001	0.001
	0.001	0.005	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON LAYER 4	0.002	0.004	0.001	0.000	0.001	0.003
	0.002	0.014	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.24	905641.875	100.00
RUNOFF	0.576	12972.585	1.43
EVAPOTRANSPIRATION	23.407	526802.000	58.17
DRAINAGE COLLECTED FROM LAYER 3	17.1182	385261.812	42.54
PERC./LEAKAGE THROUGH LAYER 4	1.028219	23141.088	2.56
AVG. HEAD ON TOP OF LAYER 4	0.0013		
CHANGE IN WATER STORAGE	-1.890	-42536.219	-4.70
SOIL WATER AT START OF YEAR	5.985	134695.484	
SOIL WATER AT END OF YEAR	4.095	92159.258	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.612	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.67	2.41	4.70	3.62	2.29	3.25
	2.30	4.84	6.70	4.41	6.23	5.16
RUNOFF	0.917	0.000	0.012	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.069	0.005
EVAPOTRANSPIRATION	1.099	1.715	2.709	2.568	1.716	2.542
	1.663	3.881	2.393	3.276	2.104	1.426
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.1162	0.0578	2.7773	1.4896	1.0000	0.4118
	0.3782	1.1649	3.0441	1.3975	2.6901	4.3449
PERCOLATION THROUGH LAYER 4	0.0333	0.0206	0.1437	0.0998	0.0882	0.0587
	0.0590	0.0962	0.1194	0.1066	0.1201	0.1783

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON LAYER 4	0.000	0.000	0.002	0.001	0.001	0.000
	0.000	0.001	0.003	0.001	0.002	0.004
STD. DEVIATION OF DAILY HEAD ON LAYER 4	0.000	0.000	0.003	0.002	0.001	0.000
	0.000	0.001	0.007	0.001	0.005	0.005

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.58	1093341.620	100.00
RUNOFF	1.004	22599.586	2.07
EVAPOTRANSPIRATION	27.093	609753.062	55.77

DRAINAGE COLLECTED FROM LAYER 3	18.8725	424744.156	38.85
PERC./LEAKAGE THROUGH LAYER 4	1.123885	25294.162	2.31
AVG. HEAD ON TOP OF LAYER 4	0.0014		
CHANGE IN WATER STORAGE	0.487	10950.367	1.00
SOIL WATER AT START OF YEAR	4.095	92159.258	
SOIL WATER AT END OF YEAR	4.546	102319.016	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.035	790.615	0.07
ANNUAL WATER BUDGET BALANCE	0.0000	0.228	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	7.86	1.74	2.38	2.10	6.33	1.35
	3.05	3.83	3.61	1.68	1.74	5.20
RUNOFF	4.006	0.757	0.176	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.333	1.683	2.035	2.367	4.522	1.349
	2.365	2.435	2.414	1.253	0.709	1.491
LATERAL DRAINAGE COLLECTED	0.4685	0.1203	0.5565	0.6666	1.9793	0.6951
FROM LAYER 3	0.6465	0.9440	1.2538	0.4690	0.1368	2.4727
PERCOLATION THROUGH	0.0653	0.0322	0.0595	0.0742	0.1272	0.0748
LAYER 4	0.0711	0.0841	0.0843	0.0656	0.0353	0.1308

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.001	0.002	0.001
LAYER 4	0.001	0.001	0.001	0.000	0.000	0.002
STD. DEVIATION OF DAILY	0.000	0.000	0.001	0.000	0.001	0.001
HEAD ON LAYER 4	0.001	0.001	0.002	0.000	0.000	0.003

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.87	919820.187	100.00
RUNOFF	4.939	111151.836	12.08
EVAPOTRANSPIRATION	23.957	539183.750	58.62
DRAINAGE COLLECTED FROM LAYER 3	10.4092	234270.047	25.47
PERC./LEAKAGE THROUGH LAYER 4	0.904586	20358.615	2.21
AVG. HEAD ON TOP OF LAYER 4	0.0008		
CHANGE IN WATER STORAGE	0.660	14855.878	1.62
SOIL WATER AT START OF YEAR	4.546	102319.016	
SOIL WATER AT END OF YEAR	5.242	117965.508	
SNOW WATER AT START OF YEAR	0.035	790.615	0.09
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.047	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1974 THROUGH 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.70	2.35	3.50	2.69	3.68	3.60
	3.60	4.95	5.63	3.12	2.68	4.30
STD. DEVIATIONS	2.12	0.84	1.16	0.66	1.58	2.17
	2.52	1.94	2.87	1.17	2.42	1.70
RUNOFF						
TOTALS	0.987	0.543	0.153	0.000	0.000	0.003
	0.000	0.112	0.059	0.000	0.014	0.003
STD. DEVIATIONS	1.734	0.856	0.249	0.000	0.000	0.007
	0.001	0.250	0.132	0.000	0.031	0.004
EVAPOTRANSPIRATION						
TOTALS	1.363	1.691	2.403	2.518	2.710	2.342
	2.666	2.650	2.428	2.211	1.344	1.371
STD. DEVIATIONS	0.231	0.256	0.493	0.474	1.103	1.501
	1.310	0.772	0.611	0.886	0.540	0.205
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	1.3464	0.6862	1.2217	0.9601	1.1994	0.8297
	1.2608	1.6874	2.7401	1.0341	0.9709	2.1052
STD. DEVIATIONS	1.2648	1.0511	0.9012	0.4283	0.5423	0.6905
	1.3516	1.9662	2.2034	0.5550	1.0780	1.7772
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0901	0.0556	0.0875	0.0841	0.0963	0.0728
	0.0826	0.0895	0.1064	0.0870	0.0703	0.1117
STD. DEVIATIONS	0.0484	0.0393	0.0329	0.0164	0.0219	0.0294
	0.0386	0.0298	0.0450	0.0231	0.0347	0.0580

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ACROSS LAYER 4

AVERAGES	0.0012	0.0007	0.0011	0.0009	0.0011	0.0008
	0.0011	0.0015	0.0025	0.0009	0.0009	0.0019
STD. DEVIATIONS	0.0011	0.0010	0.0008	0.0004	0.0005	0.0006
	0.0012	0.0018	0.0020	0.0005	0.0010	0.0016

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1974 THROUGH 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.79 (8.110)	1008133.9	100.00
RUNOFF	1.874 (2.0153)	42176.30	4.184
EVAPOTRANSPIRATION	25.697 (3.0411)	578343.56	57.368
LATERAL DRAINAGE COLLECTED FROM LAYER 3	16.04207 (4.45152)	361042.875	35.81299
PERCOLATION/LEAKAGE THROUGH FROM LAYER 4	1.03393 (0.11131)	23269.529	2.30818
AVERAGE HEAD ACROSS TOP OF LAYER 4	0.001 (0.000)		
CHANGE IN WATER STORAGE	0.147 (1.2780)	3301.29	0.327

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.77	84847.617
RUNOFF	1.825	41084.1094

DRAINAGE COLLECTED FROM LAYER 3	2.56695	57771.87890
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.028613	643.96021
AVERAGE HEAD ACROSS LAYER 4	0.071	
SNOW WATER	4.52	101808.7270

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.2552
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0606

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FINAL WATER STORAGE AT END OF YEAR 1978

LAYER	(INCHES)	(VOL/VOL)
1	1.1714	0.1952
2	4.0618	0.1692
3	0.0059	0.0244
4	0.0000	0.0000
SNOW WATER	0.000	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**               HELP MODEL VERSION 3.01   (14 OCTOBER 1994)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**            FOR USEPA RISK REDUCTION ENGINEERING LABORATORY               **
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```
PRECIPITATION DATA FILE:     C:\HELP3\DATA4.D4
TEMPERATURE DATA FILE:       C:\HELP3\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\HELP3\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP3\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP3\SONIA10.D10
OUTPUT DATA FILE:            C:\HELP3\SONIA10.OUT
```

TIME: 11:30   DATE: 2/19/1998

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TITLE: SONIA ROAD LANDFILL, 10 % SLOPE, GEOCOMPOSITE , BPL 5

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NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 6

```
THICKNESS                 =      6.00    INCHES
POROSITY                  =      0.4530 VOL/VOL
```

```
     FIELD CAPACITY                 =       0.1900 VOL/VOL
     WILTING POINT                  =       0.0850 VOL/VOL
     INITIAL SOIL WATER CONTENT     =       0.1953 VOL/VOL
     EFFECTIVE SAT. HYD. COND.      =  0.720000011000E-03 CM/SEC
   NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
          FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                  LAYER  2
                                  --------

                   TYPE 1 - VERTICAL PERCOLATION LAYER
                       MATERIAL TEXTURE NUMBER   5
     THICKNESS                      =      24.00    INCHES
     POROSITY                       =       0.4570 VOL/VOL
     FIELD CAPACITY                 =       0.1310 VOL/VOL
     WILTING POINT                  =       0.0580 VOL/VOL
     INITIAL SOIL WATER CONTENT     =       0.1391 VOL/VOL
     EFFECTIVE SAT. HYD. COND.      =  0.100000005000E-02 CM/SEC


                                  LAYER  3
                                  --------

                     TYPE 2 - LATERAL DRAINAGE LAYER
                       MATERIAL TEXTURE NUMBER  34
     THICKNESS                      =       0.24    INCHES
     POROSITY                       =       0.8500 VOL/VOL
     FIELD CAPACITY                 =       0.0100 VOL/VOL
     WILTING POINT                  =       0.0050 VOL/VOL
     INITIAL SOIL WATER CONTENT     =       0.0107 VOL/VOL
     EFFECTIVE SAT. HYD. COND.      =   33.0000000000       CM/SEC
     SLOPE                          =      10.00    PERCENT
     DRAINAGE LENGTH                =     100.0     FEET


                                  LAYER  4
                                  --------

                     TYPE 4 - FLEXIBLE MEMBRANE LINER
                       MATERIAL TEXTURE NUMBER  35
     THICKNESS                      =       0.06    INCHES
     POROSITY                       =       0.0000 VOL/VOL
     FIELD CAPACITY                 =       0.0000 VOL/VOL
     WILTING POINT                  =       0.0000 VOL/VOL
```

INITIAL SOIL WATER CONTENT	=	0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 6 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 10.% AND A SLOPE LENGTH OF 100. FEET.

SCS RUNOFF CURVE NUMBER	=	72.50	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	5.700	ACRES
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.351	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	9.116	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.322	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	4.513	INCHES
TOTAL INITIAL WATER	=	4.513	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
NEW YORK NEW YORK

MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	108
END OF GROWING SEASON (JULIAN DATE)	=	302
AVERAGE ANNUAL WIND SPEED	=	12.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA FOR NEW YORK NEW YORK

WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW YORK NEW YORK

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.80	33.30	41.00	51.90	61.70	71.00
76.40	75.30	68.20	57.50	47.10	36.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW YORK NEW YORK

STATION LATITUDE = 40.47 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.83	1.41	4.60	2.33	2.69	2.38
	1.29	4.24	5.97	2.19	1.10	6.07
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.005	0.000	0.000	0.037
EVAPOTRANSPIRATION	1.572	1.919	2.422	2.740	2.024	2.104
	1.254	2.618	3.143	1.895	0.981	1.697
LATERAL DRAINAGE COLLECTED	1.1419	0.4688	0.6438	1.3422	0.6724	0.2561
FROM LAYER 3	0.1716	0.3419	3.3566	0.5368	0.3574	3.0797
PERCOLATION THROUGH	0.0391	0.0257	0.0301	0.0445	0.0332	0.0214
LAYER 4	0.0177	0.0235	0.0582	0.0274	0.0247	0.0617

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON LAYER 4	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.001	0.000	0.000	0.001
STD. DEVIATION OF DAILY HEAD ON LAYER 4	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.001	0.000	0.000	0.001

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.10	767636.250	100.00
RUNOFF	0.042	871.123	0.11
EVAPOTRANSPIRATION	24.369	504228.375	65.69
DRAINAGE COLLECTED FROM LAYER 3	12.3690	255927.500	33.34
PERC./LEAKAGE THROUGH LAYER 4	0.407186	8425.088	1.10
AVG. HEAD ON TOP OF LAYER 4	0.0002		
CHANGE IN WATER STORAGE	-0.088	-1816.285	-0.24
SOIL WATER AT START OF YEAR	4.515	93427.719	
SOIL WATER AT END OF YEAR	4.428	91611.437	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.478	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.05	3.57	3.50	3.13	3.52	7.06
	7.86	3.54	9.65	3.25	4.02	3.03
RUNOFF	0.009	1.956	0.578	0.000	0.000	0.008
	0.014	0.013	0.398	0.000	0.002	0.000
EVAPOTRANSPIRATION	1.189	1.272	3.047	3.098	2.881	4.934
	4.644	1.755	2.309	2.475	1.558	1.288
LATERAL DRAINAGE COLLECTED	1.7943	0.2702	1.1574	0.9233	1.5661	1.9226
FROM LAYER 3	3.0654	1.3030	6.4507	1.3810	1.6325	0.2753
PERCOLATION THROUGH	0.0442	0.0210	0.0338	0.0356	0.0476	0.0509
LAYER 4	0.0556	0.0401	0.0647	0.0439	0.0397	0.0185

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
LAYER 4	0.001	0.000	0.001	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.000	0.000
HEAD ON LAYER 4	0.001	0.000	0.003	0.000	0.001	0.000

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	57.18	1183111.370	100.00
RUNOFF	2.979	61628.289	5.21
EVAPOTRANSPIRATION	30.449	630019.000	53.25

DRAINAGE COLLECTED FROM LAYER 3	21.7418	449859.781	38.02
PERC./LEAKAGE THROUGH LAYER 4	0.495447	10251.293	0.87
AVG. HEAD ON TOP OF LAYER 4	0.0003		
CHANGE IN WATER STORAGE	1.515	31352.918	2.65
SOIL WATER AT START OF YEAR	4.428	91611.437	
SOIL WATER AT END OF YEAR	5.943	122964.359	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.028	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.11	2.60	2.30	2.26	3.56	3.97
	3.50	8.30	2.24	4.06	0.32	2.02
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.048
	0.000	0.763	0.000	0.000	0.000	0.002
EVAPOTRANSPIRATION	1.613	1.916	1.852	1.762	2.421	0.944
	3.964	2.561	1.439	2.417	1.321	1.048
LATERAL DRAINAGE COLLECTED	3.3712	2.6155	1.0369	0.5419	0.9357	0.8306
FROM LAYER 3	1.7227	5.0586	0.2216	0.5888	0.3813	0.2391
PERCOLATION THROUGH	0.0700	0.0533	0.0372	0.0297	0.0379	0.0277
LAYER 4	0.0486	0.0570	0.0196	0.0305	0.0237	0.0204

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.000	0.000	0.000	0.000
LAYER 4	0.000	0.001	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.001	0.000	0.000	0.000	0.001
HEAD ON LAYER 4	0.000	0.003	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.24	832606.250	100.00
RUNOFF	0.812	16802.441	2.02
EVAPOTRANSPIRATION	23.258	481221.437	57.80
DRAINAGE COLLECTED FROM LAYER 3	17.5440	363002.187	43.60
PERC./LEAKAGE THROUGH LAYER 4	0.455619	9427.203	1.13
AVG. HEAD ON TOP OF LAYER 4	0.0003		
CHANGE IN WATER STORAGE	-1.829	-37847.574	-4.55
SOIL WATER AT START OF YEAR	5.943	122964.359	
SOIL WATER AT END OF YEAR	4.114	85116.781	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.516	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.67	2.41	4.70	3.62	2.29	3.25
	2.30	4.84	6.70	4.41	6.23	5.16
RUNOFF	0.917	0.000	0.039	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.138	0.024
EVAPOTRANSPIRATION	1.098	1.713	2.706	2.527	1.724	2.547
	1.721	3.992	2.130	2.882	2.079	1.426
LATERAL DRAINAGE COLLECTED	0.1442	0.0601	2.8518	1.5960	1.0330	0.4429
FROM LAYER 3	0.4045	1.0482	3.8537	1.5026	2.5958	4.4233
PERCOLATION THROUGH	0.0164	0.0091	0.0626	0.0433	0.0389	0.0262
LAYER 4	0.0267	0.0395	0.0553	0.0484	0.0498	0.0769

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
LAYER 4	0.000	0.000	0.001	0.000	0.000	0.001
STD. DEVIATION OF DAILY	0.000	0.000	0.001	0.000	0.000	0.000
HEAD ON LAYER 4	0.000	0.000	0.002	0.000	0.001	0.001

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.58	1005168.870	100.00
RUNOFF	1.119	23155.404	2.30
EVAPOTRANSPIRATION	26.544	549229.062	54.64

DRAINAGE COLLECTED FROM LAYER 3	19.9561	412911.781	41.08
PERC./LEAKAGE THROUGH LAYER 4	0.493077	10202.254	1.01
AVG. HEAD ON TOP OF LAYER 4	0.0003		
CHANGE IN WATER STORAGE	0.467	9670.195	0.96
SOIL WATER AT START OF YEAR	4.114	85116.781	
SOIL WATER AT END OF YEAR	4.546	94060.117	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.035	726.856	0.07
ANNUAL WATER BUDGET BALANCE	0.0000	0.147	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	7.86	1.74	2.38	2.10	6.33	1.35
	3.05	3.83	3.61	1.68	1.74	5.20
RUNOFF	4.007	0.757	0.176	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.333	1.683	2.035	2.367	4.516	1.425
	2.272	2.430	2.933	1.322	0.716	1.470
LATERAL DRAINAGE COLLECTED	0.5023	0.1357	0.5975	0.7088	2.0603	0.7335
FROM LAYER 3	0.7036	0.9949	0.6078	0.6237	0.1379	2.5748
PERCOLATION THROUGH	0.0290	0.0152	0.0258	0.0308	0.0539	0.0341
LAYER 4	0.0321	0.0363	0.0283	0.0327	0.0151	0.0562

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
LAYER 4	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON LAYER 4	0.000	0.000	0.000	0.000	0.000	0.001

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.87	845641.125	100.00
RUNOFF	4.939	102201.914	12.09
EVAPOTRANSPIRATION	24.501	506954.719	59.95
DRAINAGE COLLECTED FROM LAYER 3	10.3808	214788.203	25.40
PERC./LEAKAGE THROUGH LAYER 4	0.389483	8058.786	0.95
AVG. HEAD ON TOP OF LAYER 4	0.0002		
CHANGE IN WATER STORAGE	0.659	13637.271	1.61
SOIL WATER AT START OF YEAR	4.546	94060.117	
SOIL WATER AT END OF YEAR	5.240	108424.242	
SNOW WATER AT START OF YEAR	0.035	726.856	0.09
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.204	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1974 THROUGH 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.70	2.35	3.50	2.69	3.68	3.60
	3.60	4.95	5.63	3.12	2.68	4.30
STD. DEVIATIONS	2.12	0.84	1.16	0.66	1.58	2.17
	2.52	1.94	2.87	1.17	2.42	1.70
RUNOFF						
TOTALS	0.987	0.543	0.159	0.000	0.000	0.011
	0.003	0.155	0.081	0.000	0.028	0.013
STD. DEVIATIONS	1.734	0.856	0.245	0.000	0.000	0.021
	0.006	0.340	0.177	0.000	0.062	0.017
EVAPOTRANSPIRATION						
TOTALS	1.361	1.700	2.412	2.499	2.713	2.391
	2.771	2.671	2.391	2.198	1.331	1.386
STD. DEVIATIONS	0.228	0.264	0.486	0.495	1.098	1.549
	1.465	0.815	0.678	0.602	0.527	0.239
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	1.3908	0.7101	1.2575	1.0224	1.2535	0.8371
	1.2135	1.7493	2.8981	0.9266	1.0210	2.1184
STD. DEVIATIONS	1.2738	1.0764	0.9237	0.4388	0.5559	0.6484
	1.1926	1.8836	2.5570	0.4733	1.0587	1.8285
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0397	0.0249	0.0379	0.0368	0.0423	0.0321
	0.0361	0.0393	0.0452	0.0366	0.0306	0.0467
STD. DEVIATIONS	0.0200	0.0171	0.0144	0.0069	0.0083	0.0115
	0.0157	0.0119	0.0199	0.0091	0.0139	0.0260

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ACROSS LAYER 4

AVERAGES	0.0002	0.0001	0.0002	0.0002	0.0002	0.0002
	0.0002	0.0003	0.0005	0.0002	0.0002	0.0004
STD. DEVIATIONS	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001
	0.0002	0.0003	0.0005	0.0001	0.0002	0.0003

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1974 THROUGH 1978

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.79	(8.110)	926832.7	100.00
RUNOFF	1.978	(1.9759)	40931.84	4.416
EVAPOTRANSPIRATION	25.824	(2.8443)	534330.56	57.651
LATERAL DRAINAGE COLLECTED FROM LAYER 3	16.39833	(4.87262)	339297.875	36.60832
PERCOLATION/LEAKAGE THROUGH FROM LAYER 4	0.44816	(0.04856)	9272.925	1.00050
AVERAGE HEAD ACROSS TOP OF LAYER 4	0.000	(0.000)		
CHANGE IN WATER STORAGE	0.145	(1.2447)	2999.30	0.324

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.77	78005.070
RUNOFF	1.826	37774.1797

DRAINAGE COLLECTED FROM LAYER 3	2.46900	51086.13670
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.011516	238.26917
AVERAGE HEAD ACROSS LAYER 4	0.014	
SNOW WATER	4.52	93598.3359

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.2552
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0575

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FINAL WATER STORAGE AT END OF YEAR 1978

LAYER	(INCHES)	(VOL/VOL)
1	1.1726	0.1954
2	4.0622	0.1693
3	0.0029	0.0122
4	0.0000	0.0000
SNOW WATER	0.000	

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**              HELP MODEL VERSION 3.01   (14 OCTOBER 1994)                 **
**                DEVELOPED BY ENVIRONMENTAL LABORATORY                     **
**                  USAE WATERWAYS EXPERIMENT STATION                       **
**          FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                 **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\HELP3\DATA4.D4
TEMPERATURE DATA FILE:        C:\HELP3\DATA7.D7
SOLAR RADIATION DATA FILE:    C:\HELP3\DATA13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP3\DATA11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP3\SONIA51.D10
OUTPUT DATA FILE:             C:\HELP3\SONIA51.OUT


TIME:  11:36     DATE:   2/19/1998


******************************************************************************

     TITLE:  SONIA ROAD LANDFILL, 20% SLOPE, GEOCOMPOSITE, BPL 5

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
                                  --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER   6
           THICKNESS                      =       6.00   INCHES
           POROSITY                       =       0.4530 VOL/VOL
```

```
   FIELD CAPACITY               =       0.1900 VOL/VOL
   WILTING POINT                =       0.0850 VOL/VOL
   INITIAL SOIL WATER CONTENT   =       0.1945 VOL/VOL
   EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
          FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                            LAYER  2
                            --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   5
   THICKNESS                    =     24.00   INCHES
   POROSITY                     =       0.4570 VOL/VOL
   FIELD CAPACITY               =       0.1310 VOL/VOL
   WILTING POINT                =       0.0580 VOL/VOL
   INITIAL SOIL WATER CONTENT   =       0.1390 VOL/VOL
   EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                            LAYER  3
                            --------

                  TYPE 2 - LATERAL DRAINAGE LAYER
                    MATERIAL TEXTURE NUMBER  34
   THICKNESS                    =       0.24   INCHES
   POROSITY                     =       0.8500 VOL/VOL
   FIELD CAPACITY               =       0.0100 VOL/VOL
   WILTING POINT                =       0.0050 VOL/VOL
   INITIAL SOIL WATER CONTENT   =       0.0109 VOL/VOL
   EFFECTIVE SAT. HYD. COND.    =   33.0000000000      CM/SEC
   SLOPE                        =     20.00   PERCENT
   DRAINAGE LENGTH              =     80.0    FEET


                            LAYER  4
                            --------

                  TYPE 4 - FLEXIBLE MEMBRANE LINER
                    MATERIAL TEXTURE NUMBER  35
   THICKNESS                    =       0.06   INCHES
   POROSITY                     =       0.0000 VOL/VOL
   FIELD CAPACITY               =       0.0000 VOL/VOL
   WILTING POINT                =       0.0000 VOL/VOL
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INITIAL SOIL WATER CONTENT	=	0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 6 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 20.% AND A SLOPE LENGTH OF 80. FEET.

SCS RUNOFF CURVE NUMBER	=	73.50	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	7.400	ACRES
EVAPORATIVE ZONE DEPTH	=	20.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.339	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	9.116	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.322	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	4.506	INCHES
TOTAL INITIAL WATER	=	4.506	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM NEW YORK NEW YORK

MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	108
END OF GROWING SEASON (JULIAN DATE)	=	302
AVERAGE ANNUAL WIND SPEED	=	12.20 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA FOR NEW YORK NEW YORK

WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW YORK NEW YORK

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.80	33.30	41.00	51.90	61.70	71.00
76.40	75.30	68.20	57.50	47.10	36.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW YORK NEW YORK

STATION LATITUDE = 40.47 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.83	1.41	4.60	2.33	2.69	2.38
	1.29	4.24	5.97	2.19	1.10	6.07
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.010	0.000	0.000	0.052
EVAPOTRANSPIRATION	1.579	1.868	2.526	2.741	2.001	2.063
	1.244	2.581	3.134	1.888	0.976	1.687
LATERAL DRAINAGE COLLECTED	1.1543	0.5085	0.5845	1.3810	0.7021	0.2777
FROM LAYER 3	0.2157	0.3973	3.4010	0.5658	0.3782	3.1107
PERCOLATION THROUGH	0.0143	0.0096	0.0101	0.0163	0.0120	0.0079
LAYER 4	0.0071	0.0089	0.0213	0.0102	0.0092	0.0227

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON LAYER 4	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON LAYER 4	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.001	0.000	0.000	0.001

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ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.10	996580.500	100.00
RUNOFF	0.062	1661.025	0.17
EVAPOTRANSPIRATION	24.291	652502.750	65.47
DRAINAGE COLLECTED FROM LAYER 3	12.6768	340524.156	34.17
PERC./LEAKAGE THROUGH LAYER 4	0.149495	4015.735	0.40
AVG. HEAD ON TOP OF LAYER 4	0.0001		
CHANGE IN WATER STORAGE	-0.079	-2123.494	-0.21
SOIL WATER AT START OF YEAR	4.508	121099.352	
SOIL WATER AT END OF YEAR	4.429	118975.859	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.306	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.05	3.57	3.50	3.13	3.52	7.06
	7.86	3.54	9.65	3.25	4.02	3.03
RUNOFF	0.009	1.956	0.577	0.000	0.000	0.016
	0.022	0.022	0.445	0.000	0.006	0.000
EVAPOTRANSPIRATION	1.189	1.273	3.050	3.101	2.923	5.024
	4.558	1.785	2.483	2.181	1.220	1.272
LATERAL DRAINAGE COLLECTED	1.8230	0.2835	1.1731	0.9369	1.5611	1.7191
FROM LAYER 3	3.4203	0.9776	6.4789	1.9986	1.6796	0.2907
PERCOLATION THROUGH	0.0162	0.0077	0.0125	0.0133	0.0174	0.0179
LAYER 4	0.0229	0.0136	0.0238	0.0182	0.0146	0.0068

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
LAYER 4	0.000	0.000	0.001	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON LAYER 4	0.001	0.000	0.002	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	57.18	1535969.250	100.00
RUNOFF	3.055	82059.648	5.34
EVAPOTRANSPIRATION	30.058	807421.937	52.57

DRAINAGE COLLECTED FROM LAYER 3	22.3425	600163.750	39.07
PERC./LEAKAGE THROUGH LAYER 4	0.184864	4965.804	0.32
AVG. HEAD ON TOP OF LAYER 4	0.0002		
CHANGE IN WATER STORAGE	1.540	41358.332	2.69
SOIL WATER AT START OF YEAR	4.429	118975.859	
SOIL WATER AT END OF YEAR	5.969	160334.187	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.312	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.11	2.60	2.30	2.26	3.56	3.97
	3.50	8.30	2.24	4.06	0.32	2.02
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.065
	0.000	0.965	0.000	0.000	0.000	0.002
EVAPOTRANSPIRATION	1.597	1.900	1.849	1.820	2.850	0.949
	3.954	3.393	1.087	2.418	1.306	0.981
LATERAL DRAINAGE COLLECTED	3.4588	2.6442	1.0810	0.5114	0.5840	0.7693
FROM LAYER 3	1.7759	3.9337	0.5139	0.8247	0.3825	0.2773
PERCOLATION THROUGH	0.0269	0.0195	0.0138	0.0103	0.0113	0.0097
LAYER 4	0.0182	0.0224	0.0105	0.0131	0.0086	0.0078

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
LAYER 4	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.001	0.000	0.000	0.000	0.000
HEAD ON LAYER 4	0.000	0.001	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.24	1080927.500	100.00
RUNOFF	1.032	27712.088	2.56
EVAPOTRANSPIRATION	24.106	647526.250	59.90
DRAINAGE COLLECTED FROM LAYER 3	16.7566	450116.750	41.64
PERC./LEAKAGE THROUGH LAYER 4	0.172167	4624.746	0.43
AVG. HEAD ON TOP OF LAYER 4	0.0002		
CHANGE IN WATER STORAGE	-1.826	-49053.270	-4.54
SOIL WATER AT START OF YEAR	5.969	160334.187	
SOIL WATER AT END OF YEAR	4.143	111280.922	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.903	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.67	2.41	4.70	3.62	2.29	3.25
	2.30	4.84	6.70	4.41	6.23	5.16
RUNOFF	0.920	0.000	0.055	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.162	0.035
EVAPOTRANSPIRATION	1.087	1.705	2.676	2.550	2.202	2.560
	1.664	3.333	2.298	3.278	2.080	1.413
LATERAL DRAINAGE COLLECTED	0.1705	0.0759	2.9188	1.5849	0.6171	0.4404
FROM LAYER 3	0.4243	1.7796	3.2440	1.4828	2.7338	4.4656
PERCOLATION THROUGH	0.0063	0.0036	0.0235	0.0165	0.0114	0.0093
LAYER 4	0.0098	0.0171	0.0200	0.0169	0.0193	0.0288

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
LAYER 4	0.000	0.000	0.000	0.000	0.000	0.001
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON LAYER 4	0.000	0.000	0.001	0.000	0.001	0.001

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.58	1304956.120	100.00
RUNOFF	1.172	31483.131	2.41
EVAPOTRANSPIRATION	26.846	721143.062	55.26

DRAINAGE COLLECTED FROM LAYER 3	19.9376	535564.000	41.04
PERC./LEAKAGE THROUGH LAYER 4	0.182545	4903.537	0.38
AVG. HEAD ON TOP OF LAYER 4	0.0002		
CHANGE IN WATER STORAGE	0.442	11862.294	0.91
SOIL WATER AT START OF YEAR	4.143	111280.922	
SOIL WATER AT END OF YEAR	4.549	122199.578	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.035	943.638	0.07
ANNUAL WATER BUDGET BALANCE	0.0000	0.097	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	7.86	1.74	2.38	2.10	6.33	1.35
	3.05	3.83	3.61	1.68	1.74	5.20
RUNOFF	4.007	0.758	0.177	0.000	0.001	0.000
	0.000	0.000	0.000	0.000	0.000	0.002
EVAPOTRANSPIRATION	1.323	1.673	2.030	2.362	4.453	1.239
	2.370	2.368	2.478	1.278	0.729	1.509
LATERAL DRAINAGE COLLECTED	0.5252	0.1479	0.6282	0.7290	2.4815	0.5842
FROM LAYER 3	0.6672	1.0816	1.3031	0.4729	0.1393	2.5562
PERCOLATION THROUGH	0.0108	0.0056	0.0098	0.0115	0.0220	0.0111
LAYER 4	0.0115	0.0135	0.0134	0.0103	0.0054	0.0207

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON LAYER 4	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON LAYER 4	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.87	1097849.870	100.00
RUNOFF	4.945	132828.266	12.10
EVAPOTRANSPIRATION	23.812	639636.187	58.26
DRAINAGE COLLECTED FROM LAYER 3	11.3163	303978.094	27.69
PERC./LEAKAGE THROUGH LAYER 4	0.145654	3912.558	0.36
AVG. HEAD ON TOP OF LAYER 4	0.0001		
CHANGE IN WATER STORAGE	0.651	17494.643	1.59
SOIL WATER AT START OF YEAR	4.549	122199.578	
SOIL WATER AT END OF YEAR	5.236	140637.859	
SNOW WATER AT START OF YEAR	0.035	943.638	0.09
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.134	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1974 THROUGH 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.70	2.35	3.50	2.69	3.68	3.60
	3.60	4.95	5.63	3.12	2.68	4.30
STD. DEVIATIONS	2.12	0.84	1.16	0.66	1.58	2.17
	2.52	1.94	2.87	1.17	2.42	1.70
RUNOFF						
TOTALS	0.987	0.543	0.162	0.000	0.000	0.016
	0.004	0.197	0.091	0.000	0.034	0.018
STD. DEVIATIONS	1.734	0.856	0.243	0.000	0.001	0.028
	0.010	0.429	0.198	0.000	0.072	0.024
EVAPOTRANSPIRATION						
TOTALS	1.355	1.684	2.426	2.515	2.886	2.367
	2.758	2.692	2.296	2.209	1.262	1.373
STD. DEVIATIONS	0.229	0.250	0.488	0.475	0.963	1.618
	1.441	0.679	0.747	0.734	0.509	0.266
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	1.4264	0.7320	1.2771	1.0286	1.1892	0.7581
	1.3007	1.6340	2.9882	1.0690	1.0627	2.1401
STD. DEVIATIONS	1.2992	1.0816	0.9546	0.4470	0.8275	0.5669
	1.3290	1.3761	2.3120	0.6526	1.1132	1.8312
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0149	0.0092	0.0139	0.0136	0.0148	0.0112
	0.0139	0.0151	0.0178	0.0137	0.0114	0.0174
STD. DEVIATIONS	0.0077	0.0062	0.0056	0.0028	0.0047	0.0039
	0.0065	0.0050	0.0056	0.0037	0.0055	0.0096

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ACROSS LAYER 4

AVERAGES	0.0002	0.0001	0.0002	0.0001	0.0001	0.0001
	0.0002	0.0002	0.0004	0.0001	0.0001	0.0003
STD. DEVIATIONS	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001
	0.0002	0.0002	0.0003	0.0001	0.0001	0.0002

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1974 THROUGH 1978

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.79	(8.110)	1203256.6	100.00
RUNOFF	2.053	(1.9462)	55148.83	4.583
EVAPOTRANSPIRATION	25.823	(2.6610)	693646.06	57.647
LATERAL DRAINAGE COLLECTED FROM LAYER 3	16.60596	(4.67571)	446069.312	37.07184
PERCOLATION/LEAKAGE THROUGH FROM LAYER 4	0.16694	(0.01837)	4484.476	0.37269
AVERAGE HEAD ACROSS TOP OF LAYER 4	0.000	(0.000)		
CHANGE IN WATER STORAGE	0.145	(1.2475)	3907.70	0.325

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.77	101269.742
RUNOFF	1.826	49039.9062

DRAINAGE COLLECTED FROM LAYER 3	2.17715	58482.61720
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.004023	108.05974
AVERAGE HEAD ACROSS LAYER 4	0.008	
SNOW WATER	4.52	121513.6410

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.2552
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0569

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FINAL WATER STORAGE AT END OF YEAR 1978

LAYER	(INCHES)	(VOL/VOL)
1	1.1692	0.1949
2	4.0616	0.1692
3	0.0024	0.0100
4	0.0000	0.0000
SNOW WATER	0.000	

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**              HELP MODEL VERSION 3.01    (14 OCTOBER 1994)                **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                   USAE WATERWAYS EXPERIMENT STATION                      **
**            FOR USEPA RISK REDUCTION ENGINEERING LABORATORY               **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\HELP3\DATA4.D4
TEMPERATURE DATA FILE:        C:\HELP3\DATA7.D7
SOLAR RADIATION DATA FILE:    C:\HELP3\DATA13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP3\DATA11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP3\SONIA33.D10
OUTPUT DATA FILE:             C:\HELP3\SONIA33.OUT


TIME:  12: 0     DATE:   2/19/1998


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     TITLE:  SONIA ROAD LANDFILL, 33% SLOPE, GEOCOMPOSITE, BPL 5

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                       LAYER  1
                                       --------

                          TYPE 1 - VERTICAL PERCOLATION LAYER
                              MATERIAL TEXTURE NUMBER   6
           THICKNESS                     =       6.00   INCHES
           POROSITY                      =       0.4530 VOL/VOL
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   FIELD CAPACITY               =      0.1900 VOL/VOL
   WILTING POINT                =      0.0850 VOL/VOL
   INITIAL SOIL WATER CONTENT   =      0.1940 VOL/VOL
   EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
       FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                        LAYER  2
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   5
   THICKNESS                    =     24.00    INCHES
   POROSITY                     =      0.4570 VOL/VOL
   FIELD CAPACITY               =      0.1310 VOL/VOL
   WILTING POINT                =      0.0580 VOL/VOL
   INITIAL SOIL WATER CONTENT   =      0.1391 VOL/VOL
   EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                        LAYER  3
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER  34
   THICKNESS                    =      0.24    INCHES
   POROSITY                     =      0.8500 VOL/VOL
   FIELD CAPACITY               =      0.0100 VOL/VOL
   WILTING POINT                =      0.0050 VOL/VOL
   INITIAL SOIL WATER CONTENT   =      0.0100 VOL/VOL
   EFFECTIVE SAT. HYD. COND.    =   33.0000000000      CM/SEC
   SLOPE                        =     33.00    PERCENT
   DRAINAGE LENGTH              =     50.0     FEET


                        LAYER  4
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  35
   THICKNESS                    =      0.06    INCHES
   POROSITY                     =      0.0000 VOL/VOL
   FIELD CAPACITY               =      0.0000 VOL/VOL
   WILTING POINT                =      0.0000 VOL/VOL
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INITIAL SOIL WATER CONTENT   =       0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY          =       1.00   HOLES/ACRE
FML INSTALLATION DEFECTS     =       3.00   HOLES/ACRE
FML PLACEMENT QUALITY        =  3 - GOOD
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GENERAL DESIGN AND EVAPORATIVE ZONE DATA

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NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
         SOIL DATA BASE USING SOIL TEXTURE # 6 WITH A
         FAIR STAND OF GRASS, A SURFACE SLOPE OF 33.%
         AND A SLOPE LENGTH OF   50. FEET.

SCS RUNOFF CURVE NUMBER              =     74.60
FRACTION OF AREA ALLOWING RUNOFF     =    100.0     PERCENT
AREA PROJECTED ON HORIZONTAL PLANE   =      1.000   ACRES
EVAPORATIVE ZONE DEPTH               =     20.0     INCHES
INITIAL WATER IN EVAPORATIVE ZONE    =      2.334   INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE   =      9.116   INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE   =      1.322   INCHES
INITIAL SNOW WATER                   =      0.000   INCHES
INITIAL WATER IN LAYER MATERIALS     =      4.504   INCHES
TOTAL INITIAL WATER                  =      4.504   INCHES
TOTAL SUBSURFACE INFLOW              =      0.00    INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

```
NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         NEW YORK             NEW YORK

    MAXIMUM LEAF AREA INDEX                  =  2.00
    START OF GROWING SEASON (JULIAN DATE)    =   108
    END OF GROWING SEASON (JULIAN DATE)      =   302
    AVERAGE ANNUAL WIND SPEED                = 12.20 MPH
    AVERAGE 1ST QUARTER RELATIVE HUMIDITY    = 65.00 %
    AVERAGE 2ND QUARTER RELATIVE HUMIDITY    = 68.00 %
    AVERAGE 3RD QUARTER RELATIVE HUMIDITY    = 72.00 %
    AVERAGE 4TH QUARTER RELATIVE HUMIDITY    = 68.00 %


NOTE:  PRECIPITATION DATA FOR     NEW YORK                NEW YORK
```

WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW YORK NEW YORK

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
31.80	33.30	41.00	51.90	61.70	71.00
76.40	75.30	68.20	57.50	47.10	36.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW YORK NEW YORK

STATION LATITUDE = 40.47 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1974

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.83	1.41	4.60	2.33	2.69	2.38
	1.29	4.24	5.97	2.19	1.10	6.07
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.018	0.001	0.000	0.073
EVAPOTRANSPIRATION	1.583	1.927	2.514	2.751	2.028	1.956
	1.244	2.624	3.140	1.864	0.974	1.681
LATERAL DRAINAGE COLLECTED	1.1613	0.4861	0.5193	1.4238	0.6973	0.3134
FROM LAYER 3	0.2663	0.3415	3.4409	0.5952	0.3798	2.5748
PERCOLATION THROUGH	0.0059	0.0039	0.0039	0.0071	0.0050	0.0034
LAYER 4	0.0032	0.0035	0.0088	0.0043	0.0037	0.0086

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON LAYER 4	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON LAYER 4	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.001	0.000	0.000	0.001

ANNUAL TOTALS FOR YEAR 1974

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.10	134673.031	100.00
RUNOFF	0.091	331.679	0.25
EVAPOTRANSPIRATION	24.287	88162.477	65.46
DRAINAGE COLLECTED FROM LAYER 3	12.1997	44285.016	32.88
PERC./LEAKAGE THROUGH LAYER 4	0.061176	222.070	0.16
AVG. HEAD ON TOP OF LAYER 4	0.0001		
CHANGE IN WATER STORAGE	0.461	1671.739	1.24
SOIL WATER AT START OF YEAR	4.506	16358.221	
SOIL WATER AT END OF YEAR	4.967	18029.959	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.055	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1975

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.05	3.57	3.50	3.13	3.52	7.06
	7.86	3.54	9.65	3.25	4.02	3.03
RUNOFF	0.011	2.007	0.589	0.000	0.000	0.027
	0.034	0.036	0.507	0.000	0.013	0.000
EVAPOTRANSPIRATION	1.190	1.273	3.051	3.101	2.042	4.823
	4.579	1.716	2.337	2.474	1.611	1.304
LATERAL DRAINAGE COLLECTED	1.6852	0.2908	1.1712	1.9433	2.1185	2.0359
FROM LAYER 3	3.2529	1.2594	6.3487	1.4173	1.4467	0.4027
PERCOLATION THROUGH	0.0068	0.0032	0.0051	0.0074	0.0080	0.0078
LAYER 4	0.0088	0.0058	0.0089	0.0067	0.0059	0.0035

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
LAYER 4	0.000	0.000	0.001	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON LAYER 4	0.001	0.000	0.003	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1975

	INCHES	CU. FEET	PERCENT
PRECIPITATION	57.18	207563.406	100.00
RUNOFF	3.224	11704.205	5.64
EVAPOTRANSPIRATION	29.500	107086.562	51.59

DRAINAGE COLLECTED FROM LAYER 3	23.3726	84842.687	40.88
PERC./LEAKAGE THROUGH LAYER 4	0.077841	282.562	0.14
AVG. HEAD ON TOP OF LAYER 4	0.0003		
CHANGE IN WATER STORAGE	1.005	3647.363	1.76
SOIL WATER AT START OF YEAR	4.967	18029.959	
SOIL WATER AT END OF YEAR	5.972	21677.322	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.021	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1976

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.11	2.60	2.30	2.26	3.56	3.97
	3.50	8.30	2.24	4.06	0.32	2.02
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.088
	0.000	0.956	0.000	0.000	0.000	0.002
EVAPOTRANSPIRATION	1.628	1.932	1.857	1.746	2.447	0.963
	4.288	2.544	1.480	2.415	1.296	1.042
LATERAL DRAINAGE COLLECTED	3.4534	2.6437	1.0572	0.5789	0.9590	0.5791
FROM LAYER 3	1.5857	4.9899	0.2008	0.6938	0.3662	0.2401
PERCOLATION THROUGH	0.0109	0.0079	0.0056	0.0044	0.0056	0.0040
LAYER 4	0.0074	0.0088	0.0028	0.0049	0.0034	0.0030

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
LAYER 4	0.000	0.001	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.001	0.000	0.000	0.000	0.000
HEAD ON LAYER 4	0.000	0.002	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1976

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.24	146071.281	100.00
RUNOFF	1.045	3793.459	2.60
EVAPOTRANSPIRATION	23.638	85804.625	58.74
DRAINAGE COLLECTED FROM LAYER 3	17.3479	62972.773	43.11
PERC./LEAKAGE THROUGH LAYER 4	0.068626	249.113	0.17
AVG. HEAD ON TOP OF LAYER 4	0.0002		
CHANGE IN WATER STORAGE	-1.859	-6748.716	-4.62
SOIL WATER AT START OF YEAR	5.972	21677.322	
SOIL WATER AT END OF YEAR	4.113	14928.605	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.018	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1977

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.67	2.41	4.70	3.62	2.29	3.25
	2.30	4.84	6.70	4.41	6.23	5.16
RUNOFF	0.919	0.000	0.073	0.000	0.000	0.000
	0.000	0.000	0.002	0.000	0.167	0.050
EVAPOTRANSPIRATION	1.090	1.712	2.685	2.446	1.758	1.970
	1.730	3.286	2.230	3.262	2.146	1.439
LATERAL DRAINAGE COLLECTED	0.1552	0.0812	2.2711	2.3095	1.0540	1.0545
FROM LAYER 3	0.4127	1.7882	3.3131	1.5168	2.6701	4.4499
PERCOLATION THROUGH	0.0025	0.0015	0.0089	0.0079	0.0057	0.0053
LAYER 4	0.0039	0.0070	0.0084	0.0069	0.0082	0.0115

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
LAYER 4	0.000	0.000	0.000	0.000	0.000	0.001
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON LAYER 4	0.000	0.000	0.001	0.000	0.000	0.001

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ANNUAL TOTALS FOR YEAR 1977

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.58	176345.422	100.00
RUNOFF	1.211	4396.368	2.49
EVAPOTRANSPIRATION	25.753	93484.680	53.01

DRAINAGE COLLECTED FROM LAYER 3	21.0762	76506.664	43.38
PERC./LEAKAGE THROUGH LAYER 4	0.077639	281.830	0.16
AVG. HEAD ON TOP OF LAYER 4	0.0002		
CHANGE IN WATER STORAGE	0.462	1675.898	0.95
SOIL WATER AT START OF YEAR	4.113	14928.605	
SOIL WATER AT END OF YEAR	4.539	16476.986	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.035	127.519	0.07
ANNUAL WATER BUDGET BALANCE	0.0000	-0.018	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	7.86	1.74	2.38	2.10	6.33	1.35
	3.05	3.83	3.61	1.68	1.74	5.20
RUNOFF	4.006	0.755	0.175	0.000	0.005	0.000
	0.000	0.000	0.000	0.000	0.000	0.005
EVAPOTRANSPIRATION	1.342	1.692	1.975	2.452	4.518	1.381
	1.728	2.420	2.890	1.323	0.711	1.497
LATERAL DRAINAGE COLLECTED	0.5264	0.1471	0.6670	0.6552	2.0849	0.7586
FROM LAYER 3	1.3208	1.0413	0.6698	0.6549	0.1595	3.0518
PERCOLATION THROUGH	0.0045	0.0023	0.0042	0.0045	0.0082	0.0051
LAYER 4	0.0058	0.0056	0.0045	0.0049	0.0024	0.0089

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
LAYER 4	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON LAYER 4	0.000	0.000	0.000	0.000	0.000	0.001

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ANNUAL TOTALS FOR YEAR 1978

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.87	148358.094	100.00
RUNOFF	4.947	17956.094	12.10
EVAPOTRANSPIRATION	23.929	86862.242	58.55
DRAINAGE COLLECTED FROM LAYER 3	11.7372	42606.148	28.72
PERC./LEAKAGE THROUGH LAYER 4	0.060858	220.914	0.15
AVG. HEAD ON TOP OF LAYER 4	0.0001		
CHANGE IN WATER STORAGE	0.196	712.723	0.48
SOIL WATER AT START OF YEAR	4.539	16476.986	
SOIL WATER AT END OF YEAR	4.771	17317.227	
SNOW WATER AT START OF YEAR	0.035	127.519	0.09
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.022	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1974 THROUGH 1978

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.70	2.35	3.50	2.69	3.68	3.60
	3.60	4.95	5.63	3.12	2.68	4.30
STD. DEVIATIONS	2.12	0.84	1.16	0.66	1.58	2.17
	2.52	1.94	2.87	1.17	2.42	1.70
RUNOFF						
TOTALS	0.987	0.552	0.167	0.000	0.001	0.023
	0.007	0.198	0.105	0.000	0.036	0.026
STD. DEVIATIONS	1.733	0.876	0.247	0.000	0.002	0.038
	0.015	0.424	0.225	0.000	0.073	0.033
EVAPOTRANSPIRATION						
TOTALS	1.367	1.707	2.416	2.499	2.559	2.219
	2.714	2.518	2.415	2.268	1.348	1.393
STD. DEVIATIONS	0.237	0.268	0.498	0.499	1.123	1.516
	1.586	0.560	0.645	0.726	0.560	0.238
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	1.3963	0.7298	1.1371	1.3821	1.3827	0.9483
	1.3677	1.8840	2.7947	0.9756	1.0045	2.1439
STD. DEVIATIONS	1.2911	1.0811	0.6885	0.7665	0.6693	0.6651
	1.1968	1.8121	2.4779	0.4514	1.0585	1.8017
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0061	0.0037	0.0055	0.0063	0.0065	0.0051
	0.0058	0.0061	0.0067	0.0055	0.0047	0.0071
STD. DEVIATIONS	0.0031	0.0025	0.0020	0.0017	0.0015	0.0017
	0.0023	0.0020	0.0028	0.0012	0.0023	0.0037

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ACROSS LAYER 4

AVERAGES	0.0002	0.0001	0.0001	0.0002	0.0002	0.0001
	0.0002	0.0002	0.0004	0.0001	0.0001	0.0003
STD. DEVIATIONS	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001
	0.0002	0.0002	0.0005	0.0001	0.0001	0.0002

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1974 THROUGH 1978

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.79	(8.110)	162602.2	100.00
RUNOFF	2.104	(1.9561)	7636.36	4.696
EVAPOTRANSPIRATION	25.422	(2.4210)	92280.12	56.752
LATERAL DRAINAGE COLLECTED FROM LAYER 3	17.14674	(5.19564)	62242.660	38.27909
PERCOLATION/LEAKAGE THROUGH FROM LAYER 4	0.06923	(0.00837)	251.298	0.15455
AVERAGE HEAD ACROSS TOP OF LAYER 4	0.000	(0.000)		
CHANGE IN WATER STORAGE	0.053	(1.1086)	191.80	0.118

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PEAK DAILY VALUES FOR YEARS 1974 THROUGH 1978

	(INCHES)	(CU. FT.)
PRECIPITATION	3.77	13685.100
RUNOFF	1.825	6625.9546

DRAINAGE COLLECTED FROM LAYER 3	2.36747	8593.92871
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.001743	6.32857
AVERAGE HEAD ACROSS LAYER 4	0.014	
SNOW WATER	4.52	16420.7617

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.2694
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0584

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FINAL WATER STORAGE AT END OF YEAR 1978

LAYER	(INCHES)	(VOL/VOL)
1	1.0172	0.1695
2	3.7480	0.1562
3	0.0030	0.0125
4	0.0000	0.0000
SNOW WATER	0.000	

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Appendix F

Appendix B: Synthetic rainfall distributions and rainfall data sources

The highest peak discharges from small watersheds in the United States are usually caused by intense, brief rainfalls that may occur as distinct events or as part of a longer storm. These intense rainstorms do not usually extend over a large area and intensities vary greatly. One common practice in rainfall-runoff analysis is to develop a synthetic rainfall distribution to use in lieu of actual storm events. This distribution includes maximum rainfall intensities for the selected design frequency arranged in a sequence that is critical for producing peak runoff.

Synthetic rainfall distributions

The length of the most intense rainfall period contributing to the peak runoff rate is related to the time of concentration (T_c) for the watershed. In a hydrograph created with SCS procedures, the duration of rainfall that directly contributes to the peak is about 170 percent of the T_c. For example, the most intense 8.5-minute rainfall period would contribute to the peak discharge for a watershed with a T_c of 5 minutes; the most intense 8.5-hour period would contribute to the peak for a watershed with a 5-hour T_c.

Different rainfall distributions can be developed for each of these watersheds to emphasize the critical rainfall duration for the peak discharges. However, to avoid the use of a different set of rainfall intensities for each drainage area size, a set of synthetic rainfall distributions having "nested" rainfall intensities was developed. The set "maximizes" the rainfall intensities by incorporating selected short duration intensities within those needed for longer durations at the same probability level.

For the size of the drainage areas for which SCS usually provides assistance, a storm period of 24 hours was chosen for the synthetic rainfall distributions. The 24-hour storm, while longer than that needed to determine peaks for these drainage areas, is appropriate for determining runoff volumes. Therefore, a single storm duration and associated synthetic rainfall distribution can be used to represent not only the peak discharges but also the runoff volumes for a range of drainage area sizes.

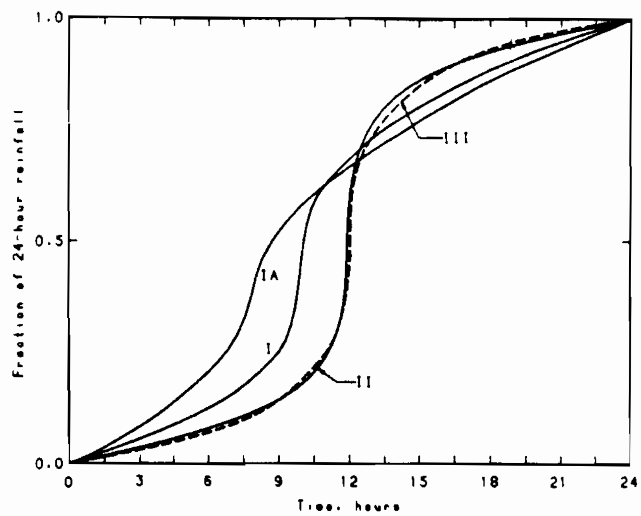


Figure B-1.—SCS 24-hour rainfall distributions.

The intensity of rainfall varies considerably during a storm as well as over geographic regions. To represent various regions of the United States, SCS developed four synthetic 24-hour rainfall distributions (I, IA, II, and III) from available National Weather Service (NWS) duration-frequency data (Hershfield 1961; Frederick et al., 1977) or local storm data. Type IA is the least intense and type II the most intense short duration rainfall. The four distributions are shown in figure B-1, and figure B-2 shows their approximate geographic boundaries.

Types I and IA represent the Pacific maritime climate with wet winters and dry summers. Type III represents Gulf of Mexico and Atlantic coastal areas where tropical storms bring large 24-hour rainfall amounts. Type II represents the rest of the country. For more precise distribution boundaries in a state having more than one type, contact the SCS State Conservation Engineer.

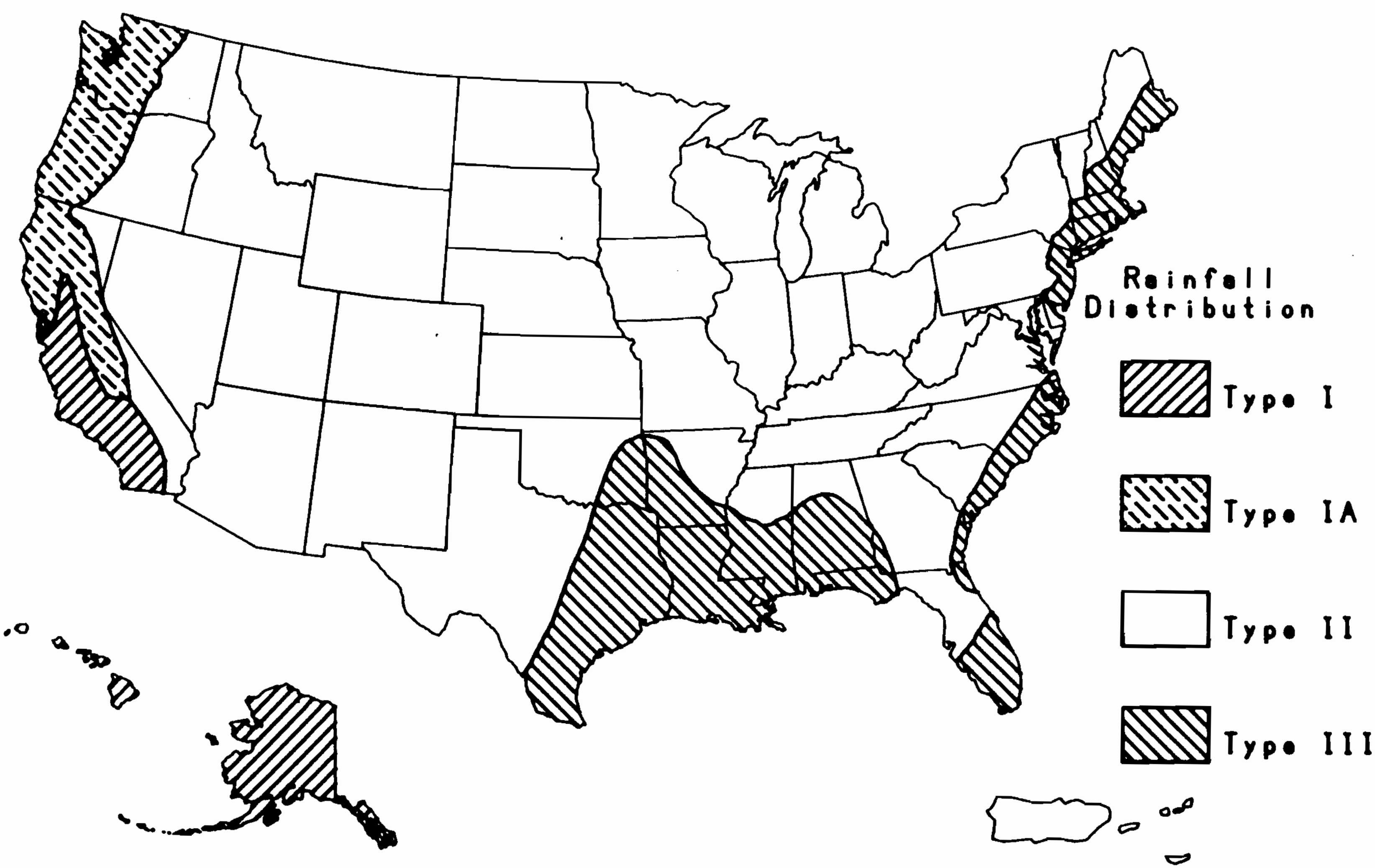


Figure B-2.—Approximate geographic boundaries for SCS rainfall distributions.

Rainfall data sources

This section lists the most current 24-hour rainfall data published by the National Weather Service (NWS) for various parts of the country. Because NWS Technical Paper 40 (TP-40) is out of print, the 24-hour rainfall maps for areas east of the 105th meridian are included here as figures B-3 through B-8. For the area generally west of the 105th meridian, TP-40 has been superseded by NOAA Atlas 2, the Precipitation-Frequency Atlas of the Western United States, published by the National Oceanic and Atmospheric Administration.

East of 105th meridian

Hershfield, D. M. 1961. Rainfall frequency atlas of the United States for durations from 30 minutes to 24 hours and return periods from 1 to 100 years. U.S. Dep. Commerce, Weather Bur. Tech. Pap. No. 40. Washington, DC. 115 p.

West of 105th meridian

Miller, J.F., R.H. Frederick, and R.J. Tracey. 1973. Precipitation-frequency atlas of the Western United States. Vol. I, Montana; Vol. II, Wyoming; Vol. III, Colorado; Vol. IV, New Mexico; Vol. V, Idaho; Vol. VI, Utah; Vol. VII, Nevada; Vol. VIII, Arizona; Vol. IX, Washington; Vol. X, Oregon; Vol. XI, California. U.S. Dep. Commerce, National Weather Service, NOAA Atlas 2. Silver Spring, MD.

Alaska

Miller, John F. 1963. Probable maximum precipitation and rainfall-frequency data for Alaska for areas to 400 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dep. Commerce, Weather Bur. Tech. Pap. No. 47. Washington, DC. 69 p.

Hawaii

Weather Bureau. 1962. Rainfall-frequency atlas of the Hawaiian Islands for areas to 200 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dep. Commerce, Weather Bur. Tech. Pap. No. 43. Washington, DC. 60 p.

Puerto Rico and Virgin Islands

Weather Bureau. 1961. Generalized estimates of probable maximum precipitation and rainfall-frequency data for Puerto Rico and Virgin Islands for areas to 400 square miles, durations to 24 hours, and return periods from 1 to 100 years. U.S. Dep. Commerce, Weather Bur. Tech. Pap. No. 42. Washington, DC. 94 p.

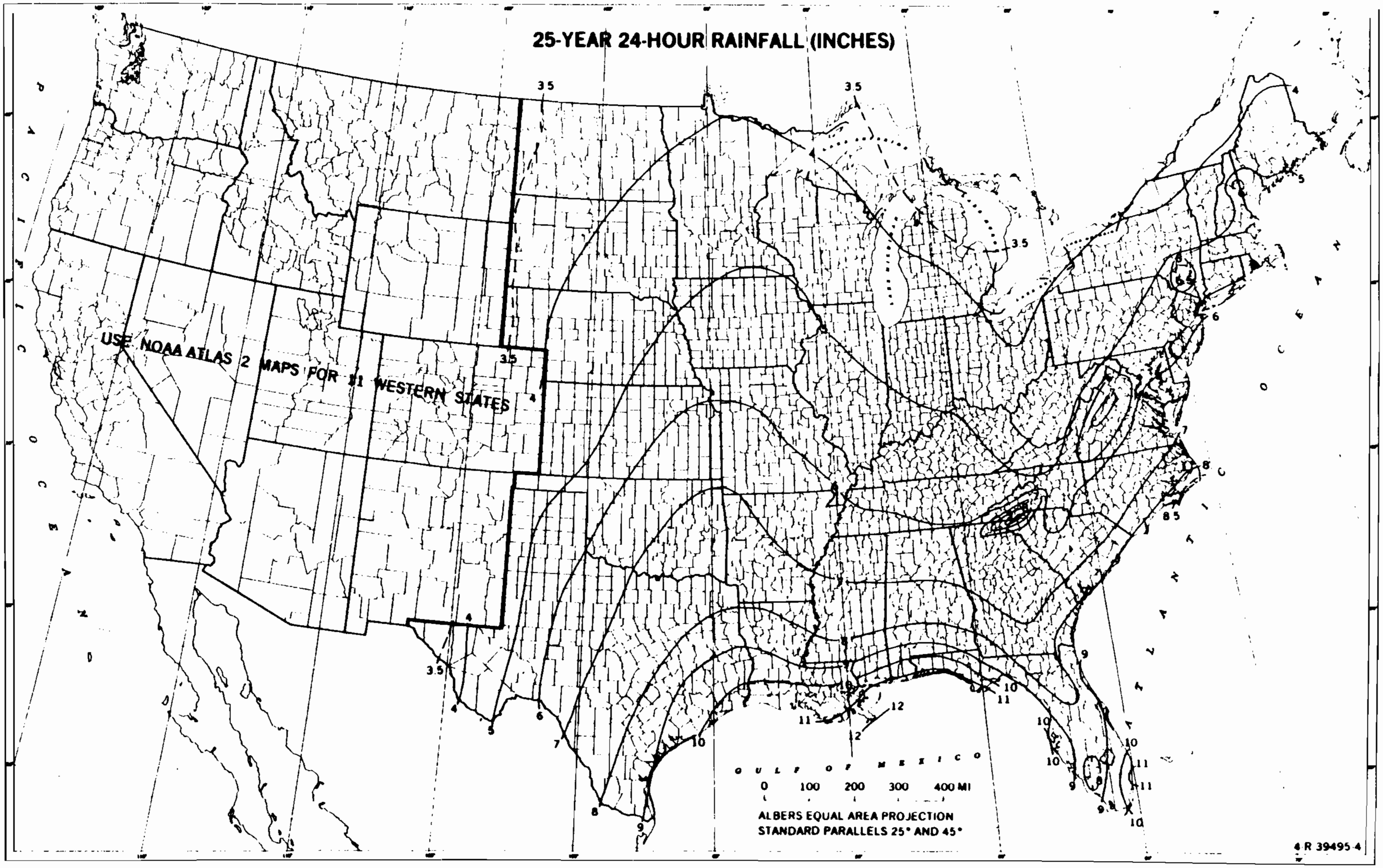
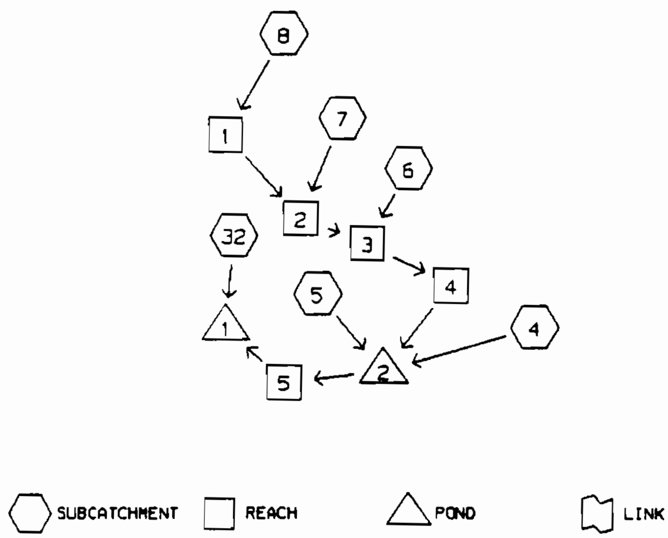


Figure B-6.—Twenty-five-year, 24-hour rainfall.

WATERSHED ROUTING ==



SUBCATCHMENT 4	= SL-4, SONIA ROAD LANDFILL	->	POND 2
SUBCATCHMENT 5	= SL-5, SONIA ROAD LANDFILL	->	POND 2
SUBCATCHMENT 6	= SL-6 SONIA ROAD LANDFILL	->	REACH 3
SUBCATCHMENT 7	= SL-7, SONIA ROAD LANDFILL	->	REACH 2
SUBCATCHMENT 8	= SL-8 SONIA ROAD LANDFILL	->	REACH 1
SUBCATCHMENT 32	= SL-32, SONIA ROAD LANDFILL	->	POND 1
REACH 1	= PROP. STORM DRAIN ON DEERPARK ST	->	REACH 2
REACH 2	= PROP. STORM DRAIN IN DEEPARK ST. SONIA ROA	->	REACH 3
REACH 3	= PROP. STORM DRAIN ON DEERPARK ST. SONIA RO	->	REACH 4
REACH 4	= PROP. STORM DRAIN IN DEERPARK ST. SONIA RD	->	POND 2
REACH 5	= OUTFALL FROM POND 2 TO POND 1	->	POND 1
POND 1	= EXISTING BASIN 1 SONIA ROAD LANDFILL	->	
POND 2	= PROP. RECHARGE BASIN 2	->	REACH 5

RUNOFF BY SCS TR-20 METHOD: TYPE III 24-HOUR RAINFALL= 6.0 IN, SCS U.H.

RUNOFF SPAN = 10-20 HRS, dt= .10 HRS, 101 POINTS

SUBCAT NUMBER	AREA (ACRE)	Tc (MIN)	--GROUND	COVERS	(%CN)--		WGT'D CN	C	PEAK (CFS)	Tpeak (HRS)	VOL (AF)
4	4.40	37.3	100%56	-	-	-	56	-	3.8	12.53	.52
5	7.30	37.5	100%56	-	-	-	56	-	6.2	12.54	.87
6	3.60	17.2	100%56	-	-	-	56	-	4.3	12.23	.43
7	12.70	31.2	100%56	-	-	-	56	-	11.9	12.44	1.51
8	5.90	33.4	100%56	-	-	-	56	-	5.3	12.48	.70
32	8.10	17.7	85%56	15%98	-	-	62	-	13.3	12.22	1.29

REACH ROUTING BY STOR-IND+TRANS METHOD

REACH NO.	DIAM (IN)	BOTTOM WIDTH (FT)	DEPTH (FT)	SIDE SLOPES (FT/FT)		n	LENGTH (FT)	SLOPE (FT/FT)	PEAK VEL. (FPS)	TRAVEL TIME (MIN)	PEAK Qout (CFS)
1	36.0	-	-	-	-	.010	300	.0015	3.5	1.4	5.3
2	36.0	-	-	-	-	.010	1050	.0015	4.9	3.6	16.5
3	36.0	-	-	-	-	.010	240	.0015	5.0	.8	18.7
4	36.0	-	-	-	-	.010	60	.0015	5.0	.2	18.7
5	36.0	-	-	-	-	.010	230	.0015	4.6	.8	12.4

POND ROUTING BY STOR-IND METHOD

POND NO.	START ELEV. (FT)	FLOOD ELEV. (FT)	PEAK ELEV. (FT)	PEAK STORAGE (AF)	------ PEAK FLOW -------- Qin (CFS)	Qout (CFS)	Qpri (CFS)	Qsec (CFS)	---Qout--- ATTEN. (%)	LAG (MIN)
1	50.0	58.0	56.2	3.47	14.6	.1			99	0.0
2	60.0	70.0	68.4	1.75	28.6	12.3	12.2	.1	57	39.4

LINK NO.	NAME	SOURCE	Qout (CFS)

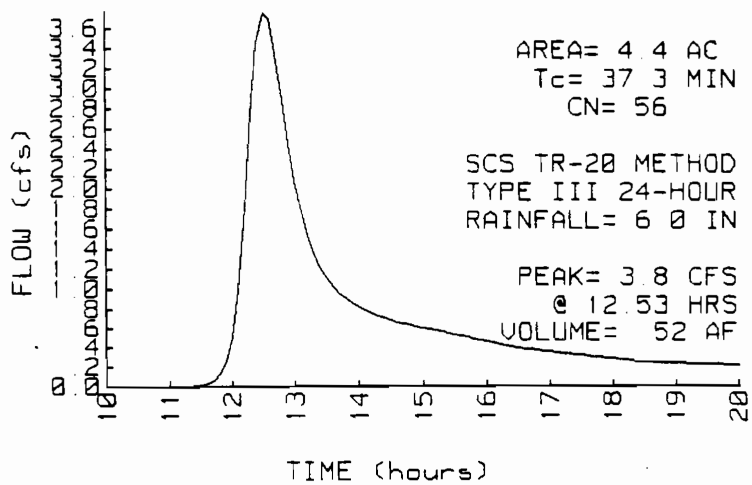
SUBCATCHMENT 4 **SL-4, SONIA ROAD LANDFILL**

PEAK= 3.8 CFS @ 12.53 HRS, VOLUME= .52 AF

ACRES	CN		
4.40	56	BRUSH/WEED/GRASS (GROUP B) FAIR	SCS TR-20 METHOD TYPE III 24-HOUR RAINFALL= 6.0 IN SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**Segment ID:AB**	33.8
Grass: Dense n=.24 L=300' P2=3.3 in	s=.02 '/'	
SHALLOW CONCENTRATED/UPLAND FLOW	**Segment ID:BC**	1.8
Unpaved Kv=16.1345 L=250' s=.02 '/'	V=2.28 fps	
RECT/VEE/TRAP CHANNEL	**Segment ID:CD**	1.7
W=2' D=2' SS= 1 & 2.5 '/' a=6.8 sq-ft	Pw=7' r=.974'	
s=.015 '/' n=.033 V=5.42 fps L=560'	Capacity=36.8 cfs	
	Total Length= 1110 ft Total Tc=	37.3

SUBCATCHMENT 4 RUNOFF
SL-4, SONIA ROAD LANDFILL



SUBCATCHMENT 4 RUNOFF PEAK= 3.8 CFS @ 12.53 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.1	.3
12.00	.5	1.0	1.8	2.7	3.4	3.8	3.7	3.3	2.9	2.4
13.00	2.1	1.8	1.5	1.3	1.2	1.1	1.0	1.0	.9	.9
14.00	.8	.8	.8	.7	.7	.7	.7	.6	.6	.6
15.00	.6	.6	.6	.6	.5	.5	.5	.5	.5	.5
16.00	.5	.4	.4	.4	.4	.4	.4	.4	.4	.4
17.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
18.00	.3	.3	.3	.3	.3	.2	.2	.2	.2	.2
19.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
20.00	.2									

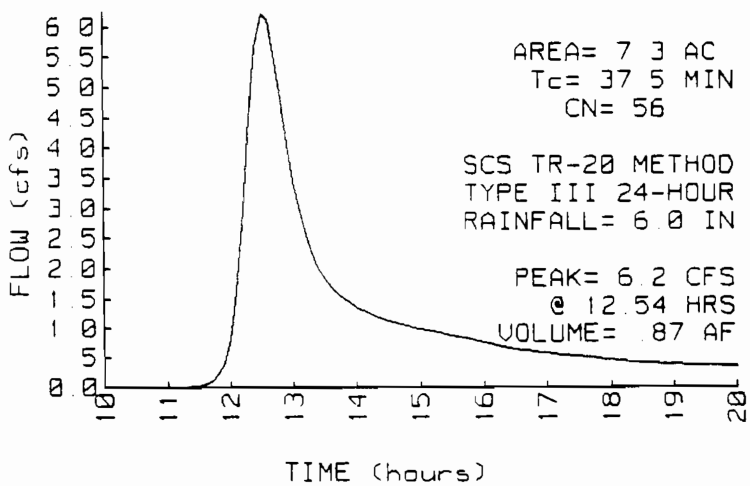
SUBCATCHMENT 5 **SL-5, SONIA ROAD LANDFILL**

PEAK= 6.2 CFS @ 12.54 HRS, VOLUME= .87 AF

ACRES	CN		
7.30	56	BRUSH/WEED/GRASS (GROUP B) FAIR	SCS TR-20 METHOD TYPE III 24-HOUR RAINFALL= 6.0 IN SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**Segment ID:AB**	33.8
Grass: Dense n=.24 L=300' P2=3.3 in	s=.02 '/'	
SHALLOW CONCENTRATED/UPLAND FLOW	**Segment ID:BC**	2.3
Unpaved Kv=16.1345 L=320' s=.02 '/'	V=2.28 fps	
RECT/VEE/TRAP CHANNEL	**Segment ID:CD**	1.4
W=2' D=2' SS= 1 & 2.5 '/' a=6.8 sq-ft	Pw=7' r=.974'	
s=.015 '/' n=.033 V=5.42 fps L=440'	Capacity=36.8 cfs	
	Total Length= 1060 ft Total Tc=	37.5

SUBCATCHMENT 5 RUNOFF
SL-5, SONIA ROAD LANDFILL



SUBCATCHMENT 5 RUNOFF PEAK= 6.2 CFS @ 12.54 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.2	.4
12.00	.8	1.6	3.0	4.5	5.7	6.2	6.1	5.5	4.8	4.1
13.00	3.4	2.9	2.5	2.2	2.0	1.8	1.7	1.6	1.5	1.4
14.00	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.1	1.0	1.0
15.00	1.0	1.0	.9	.9	.9	.9	.9	.8	.8	.8
16.00	.8	.7	.7	.7	.7	.6	.6	.6	.6	.6
17.00	.6	.6	.5	.5	.5	.5	.5	.5	.5	.5
18.00	.5	.4	.4	.4	.4	.4	.4	.4	.4	.4
19.00	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4
20.00	.3									

SUBCATCHMENT 6 **SL-6 SONIA ROAD LANDFILL**

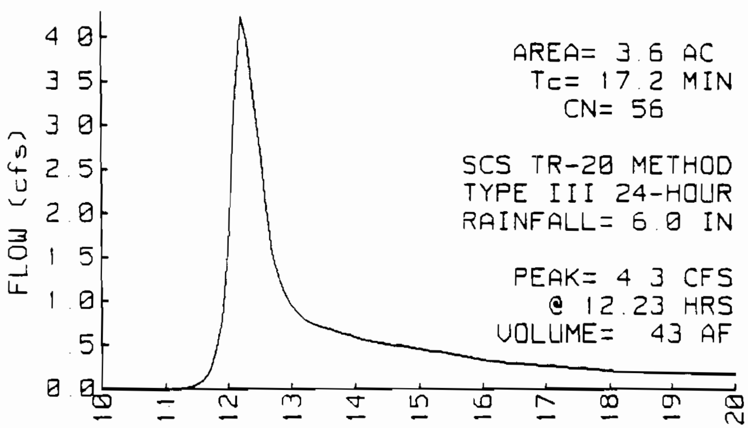
PEAK= 4.3 CFS @ 12.23 HRS, VOLUME= .43 AF

ACRES	CN		
3.60	56	BRUSH/WEED/GRASS (GROUP B) FAIR	

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.0 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**Segment ID:AB**	14.8
Grass: Dense n=.24 L=200' P2=3.3 in	s=.07 '/'	
RECT/VEE/TRAP CHANNEL	**Segment ID:BC**	2.4
W=2' D=2' SS= 1 & 2.5 '/' a=6.8 sq-ft	Pw=7' r=.974'	
s=.015 '/' n=.033 V=5.42 fps L=775'	Capacity=36.8 cfs	
	Total Length= 975 ft Total Tc=	17.2

SUBCATCHMENT 6 RUNOFF
SL-6 SONIA ROAD LANDFILL



SUBCATCHMENT 6 RUNOFF PEAK= 4.3 CFS @ 12.23 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	.1	.1	.2	.4	.8
12.00	1.6	3.2	4.2	4.0	3.3	2.7	2.0	1.5	1.2	1.1
13.00	1.0	.9	.8	.7	.7	.7	.7	.7	.6	.6
14.00	.6	.6	.5	.5	.5	.5	.5	.5	.5	.5
15.00	.5	.4	.4	.4	.4	.4	.4	.4	.4	.3
16.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
17.00	.3	.3	.3	.2	.2	.2	.2	.2	.2	.2
18.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
19.00	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
20.00	.2									

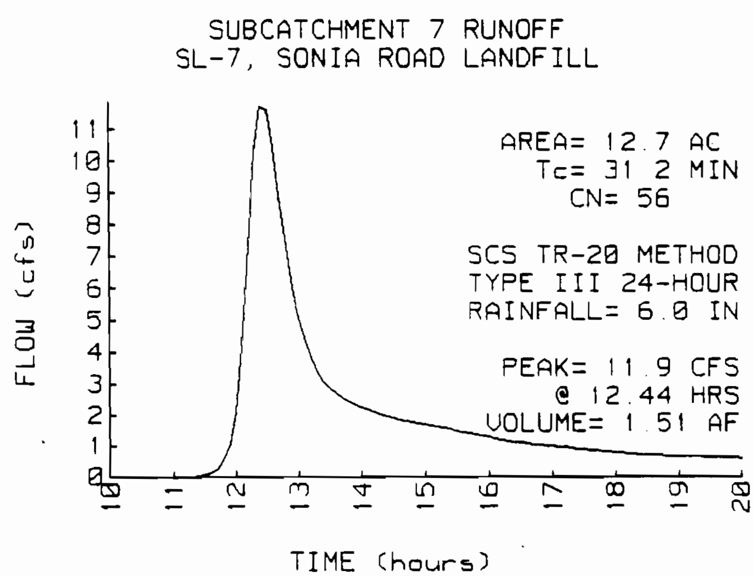
SUBCATCHMENT 7 **SL-7, SONIA ROAD LANDFILL**

PEAK= 11.9 CFS @ 12.44 HRS, VOLUME= 1.51 AF

ACRES	CN	
12.70	56	BRUSH/WEED/GRASS (GROUP B) FAIR

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.0 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**FLOW PATH**	26.2
Grass: Dense n=.24 L=255' P2=3.3 in s=.0275 '/'		
SHALLOW CONCENTRATED/UPLAND FLOW	**Segment ID:BC**	2.0
Unpaved Kv=16.1345 L=250' s=.016 '/' V=2.04 fps		
RECT/VEE/TRAP CHANNEL	**Segment ID:CD**	3.0
W=2' D=2' SS= 1 & 2.5 '/' a=6.8 sq-ft Pw=7' r=.974'		
s=.015 '/' n=.033 V=5.42 fps L=960' Capacity=36.8 cfs		
	Total Length= 1465 ft Total Tc=	31.2



SUBCATCHMENT 7 RUNOFF PEAK= 11.9 CFS @ 12.44 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	.1	.1	.3	.5	1.1
12.00	2.1	4.2	7.3	10.3	11.7	11.6	10.4	8.9	7.3	6.0
13.00	5.0	4.3	3.8	3.4	3.1	2.8	2.7	2.5	2.4	2.3
14.00	2.2	2.2	2.1	2.0	2.0	1.9	1.9	1.8	1.8	1.7
15.00	1.7	1.6	1.6	1.6	1.5	1.5	1.4	1.4	1.4	1.3
16.00	1.3	1.2	1.2	1.1	1.1	1.1	1.1	1.0	1.0	1.0
17.00	1.0	1.0	.9	.9	.9	.9	.9	.8	.8	.8
18.00	.8	.8	.7	.7	.7	.7	.7	.7	.7	.7
19.00	.7	.7	.6	.6	.6	.6	.6	.6	.6	.6
20.00	.6									

SUBCATCHMENT 8 **SL-8 SONIA ROAD LANDFILL**

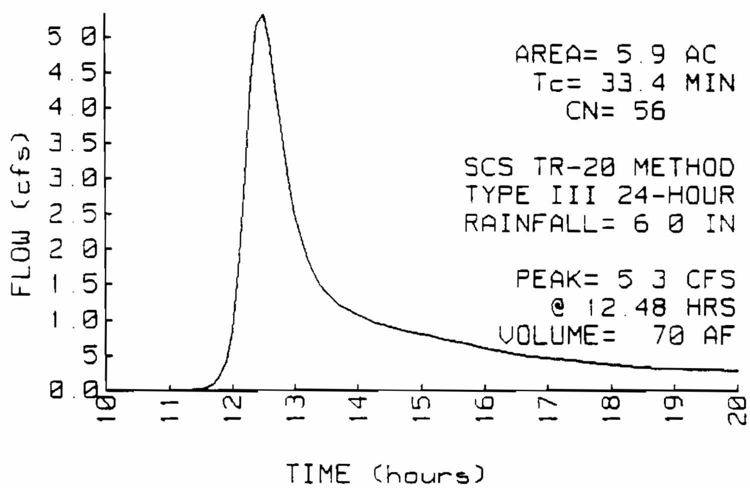
PEAK= 5.3 CFS @ 12.48 HRS, VOLUME= .70 AF

ACRES	CN	
5.90	56	BRUSH/WEED/GRASS (GROUP B)FAIR

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.0 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**SEGMENT ID:AB**	30.6
Grass: Dense n=.24 L=265' P2=3.3 in s=.02 '/'		
RECT/VEE/TRAP CHANNEL	**Segment ID:BC**	2.8
W=2' D=2' SS= 1 & 2.5 '/' a=6.8 sq-ft Pw=7' r=.974'		
s=.015 '/' n=.033 V=5.42 fps L=900' Capacity=36.8 cfs		
	Total Length= 1165 ft Total Tc=	33.4

SUBCATCHMENT 8 RUNOFF
SL-8 SONIA ROAD LANDFILL



SUBCATCHMENT 8 RUNOFF PEAK= 5.3 CFS @ 12.48 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.2	.4
12.00	.8	1.7	3.0	4.4	5.2	5.3	4.9	4.3	3.6	3.0
13.00	2.5	2.1	1.9	1.6	1.5	1.4	1.3	1.2	1.2	1.1
14.00	1.1	1.0	1.0	.9	.9	.9	.9	.8	.8	.8
15.00	.8	.8	.8	.7	.7	.7	.7	.7	.6	.6
16.00	.6	.6	.6	.5	.5	.5	.5	.5	.5	.5
17.00	.5	.4	.4	.4	.4	.4	.4	.4	.4	.4
18.00	.4	.4	.3	.3	.3	.3	.3	.3	.3	.3
19.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
20.00	.3									

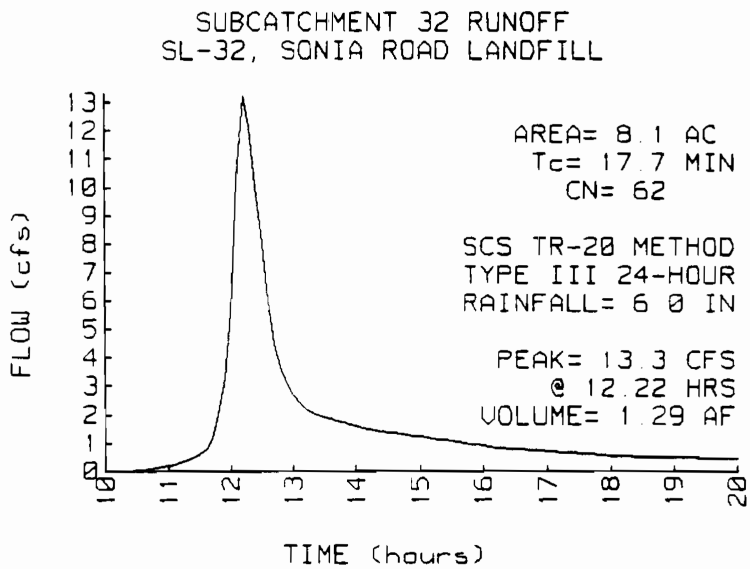
SUBCATCHMENT 32 **SL-32, SONIA ROAD LANDFILL**

PEAK= 13.3 CFS @ 12.22 HRS, VOLUME= 1.29 AF

ACRES	CN	
6.90	56	BRUSH/WEED/GRASS (GROUP B) FAIR
1.20	98	POND 1
8.10	62	

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 6.0 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	**Segment ID:AB**	13.8
Grass: Dense n=.24 L=150' P2=3.3 in	s=.047 '/'	
RECT/VEE/TRAP CHANNEL	**Segment ID:BC**	3.9
W=2' D=2' SS= 1 & 2.5 '/' a=6.8 sq-ft	Pw=7' r=.974'	
s=.015 '/' n=.033 V=5.42 fps L=1260'	Capacity=36.8 cfs	
	Total Length= 1410 ft Total Tc=	17.7



SUBCATCHMENT 32 RUNOFF PEAK= 13.3 CFS @ 12.22 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.1	.1
11.00	.2	.2	.3	.4	.5	.6	.8	1.2	2.0	3.3
12.00	5.6	10.3	13.2	12.1	10.0	8.0	6.0	4.5	3.6	3.0
13.00	2.7	2.4	2.2	2.1	2.0	1.9	1.8	1.8	1.7	1.7
14.00	1.6	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.3
15.00	1.2	1.2	1.2	1.1	1.1	1.1	1.0	1.0	1.0	.9
16.00	.9	.9	.8	.8	.8	.8	.8	.7	.7	.7
17.00	.7	.7	.7	.7	.6	.6	.6	.6	.6	.6
18.00	.6	.5	.5	.5	.5	.5	.5	.5	.5	.5
19.00	.5	.5	.5	.5	.5	.5	.5	.4	.4	.4
20.00	.4									

REACH 1 **PROP. STORM DRAIN ON DEERPARK ST**

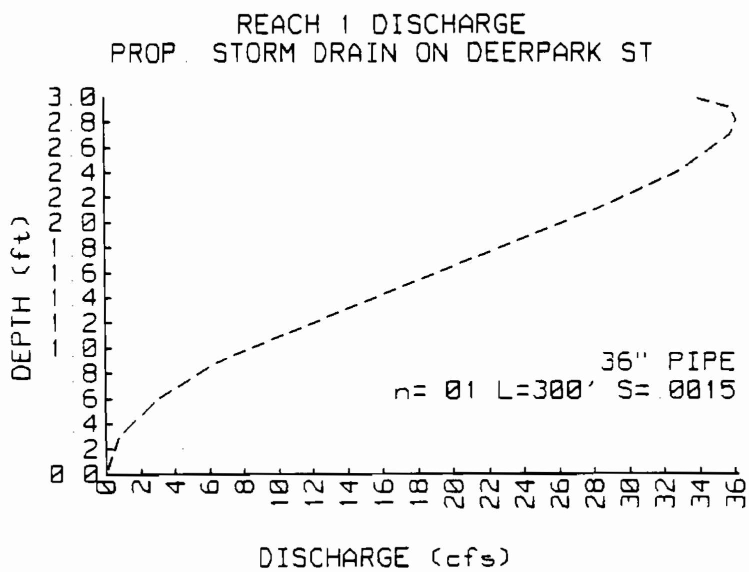
Qin = 5.3 CFS @ 12.48 HRS, VOLUME= .70 AF
Qout= 5.3 CFS @ 12.52 HRS, VOLUME= .70 AF, ATTEN= 1%, LAG= 2.6 MIN

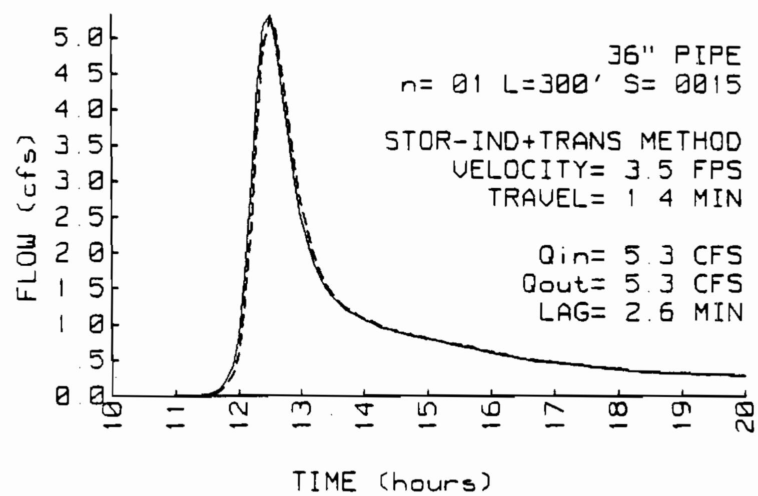
DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.0	0.0	0.0
.3	.4	.7
.6	1.0	2.9
.9	1.8	6.6
2.1	5.3	28.1
2.4	6.1	32.8
2.7	6.7	35.8
2.8	6.9	36.1
2.9	7.0	35.8
3.0	7.1	33.6

36" PIPE

n= .01
LENGTH= 300 FT
SLOPE= .0015 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .80 FT
PEAK VELOCITY= 3.5 FPS
TRAVEL TIME = 1.4 MIN
SPAN= 10-20 HRS, dt=.1 HRS





REACH 1 INFLOW PEAK= 5.3 CFS @ 12.48 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.2	.4
12.00	.8	1.7	3.0	4.4	5.2	5.3	4.9	4.3	3.6	3.0
13.00	2.5	2.1	1.9	1.6	1.5	1.4	1.3	1.2	1.2	1.1
14.00	1.1	1.0	1.0	.9	.9	.9	.9	.8	.8	.8
15.00	.8	.8	.8	.7	.7	.7	.7	.7	.6	.6
16.00	.6	.6	.6	.5	.5	.5	.5	.5	.5	.5
17.00	.5	.4	.4	.4	.4	.4	.4	.4	.4	.4
18.00	.4	.4	.3	.3	.3	.3	.3	.3	.3	.3
19.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
20.00	.3									

REACH 1 OUTFLOW PEAK= 5.3 CFS @ 12.52 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.1	.3
12.00	.6	1.3	2.4	3.8	4.8	5.3	5.1	4.5	3.9	3.2
13.00	2.7	2.3	2.0	1.7	1.6	1.4	1.3	1.2	1.2	1.1
14.00	1.1	1.0	1.0	1.0	.9	.9	.9	.9	.8	.8
15.00	.8	.8	.8	.7	.7	.7	.7	.7	.7	.6
16.00	.6	.6	.6	.6	.5	.5	.5	.5	.5	.5
17.00	.5	.5	.4	.4	.4	.4	.4	.4	.4	.4
18.00	.4	.4	.4	.3	.3	.3	.3	.3	.3	.3
19.00	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
20.00	.3									

REACH 2 **PROP. STORM DRAIN IN DEEPARK ST. SONIA ROA**

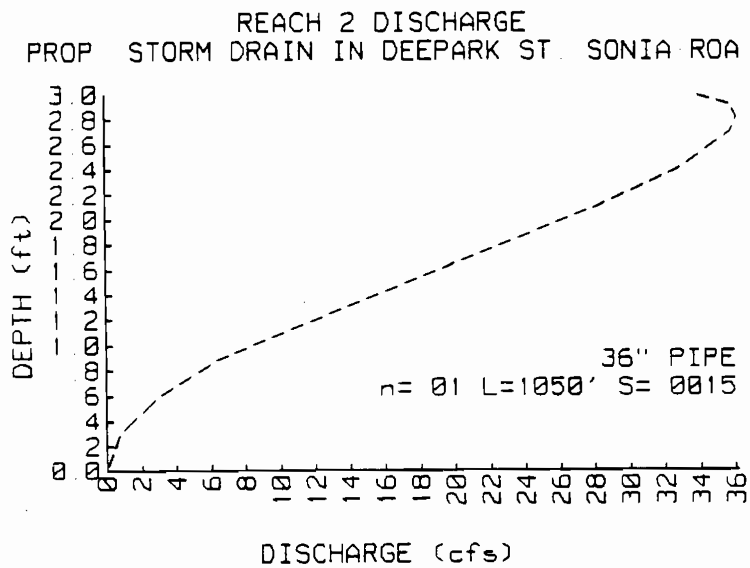
Qin = 17.0 CFS @ 12.47 HRS, VOLUME= 2.21 AF
Qout= 16.5 CFS @ 12.59 HRS, VOLUME= 2.20 AF, ATTEN= 2%, LAG= 7.0 MIN

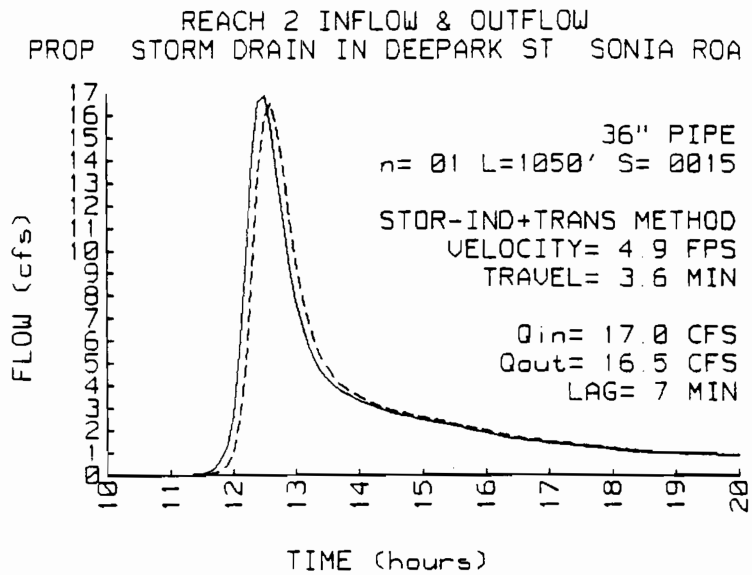
DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.0	0.0	0.0
.3	.4	.7
.6	1.0	2.9
.9	1.8	6.6
2.1	5.3	28.1
2.4	6.1	32.8
2.7	6.7	35.8
2.8	6.9	36.1
2.9	7.0	35.8
3.0	7.1	33.6

36" PIPE

n= .01
LENGTH= 1050 FT
SLOPE= .0015 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.47 FT
PEAK VELOCITY= 4.9 FPS
TRAVEL TIME = 3.6 MIN
SPAN= 10-20 HRS, dt=.1 HRS





REACH 2 INFLOW PEAK= 17.0 CFS @ 12.47 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	.1	.2	.3	.7	1.3
12.00	2.7	5.5	9.7	14.1	16.6	16.9	15.5	13.4	11.2	9.2
13.00	7.8	6.6	5.8	5.1	4.6	4.3	4.0	3.8	3.6	3.5
14.00	3.3	3.2	3.1	3.0	2.9	2.8	2.7	2.7	2.6	2.5
15.00	2.5	2.4	2.4	2.3	2.3	2.2	2.1	2.1	2.0	1.9
16.00	1.9	1.8	1.8	1.7	1.6	1.6	1.6	1.5	1.5	1.5
17.00	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.2
18.00	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0
19.00	1.0	1.0	.9	.9	.9	.9	.9	.9	.9	.9
20.00	.9									

REACH 2 OUTFLOW PEAK= 16.5 CFS @ 12.59 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.2	.5
12.00	1.1	2.4	5.0	9.2	13.4	15.9	16.5	15.5	13.5	11.4
13.00	9.5	7.9	6.8	5.9	5.3	4.8	4.4	4.1	3.8	3.7
14.00	3.5	3.4	3.2	3.1	3.0	2.9	2.8	2.8	2.7	2.6
15.00	2.6	2.5	2.5	2.4	2.3	2.3	2.2	2.2	2.1	2.0
16.00	2.0	1.9	1.8	1.8	1.7	1.7	1.6	1.6	1.5	1.5
17.00	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2
18.00	1.2	1.2	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0
19.00	1.0	1.0	1.0	1.0	.9	.9	.9	.9	.9	.9
20.00	.9									

REACH 3 **PROP. STORM DRAIN ON DEERPARK ST. SONIA RO**

Qin = 18.9 CFS @ 12.55 HRS, VOLUME= 2.63 AF
Qout= 18.7 CFS @ 12.57 HRS, VOLUME= 2.63 AF, ATTEN= 1%, LAG= 1.7 MIN

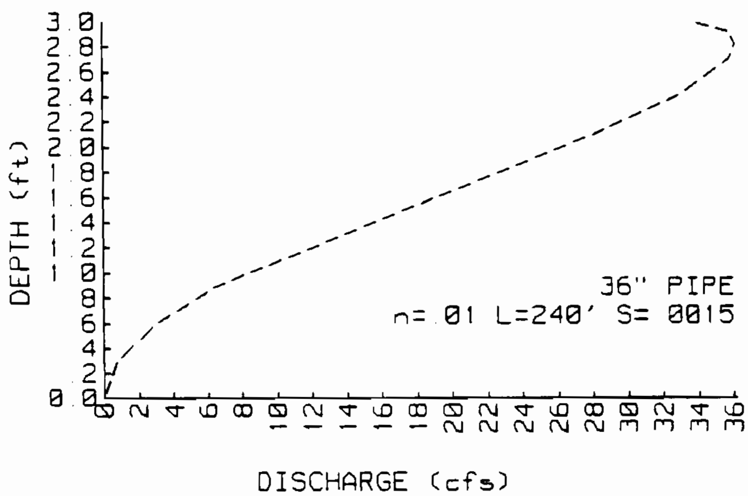
DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.0	0.0	0.0
.3	.4	.7
.6	1.0	2.9
.9	1.8	6.6
2.1	5.3	28.1
2.4	6.1	32.8
2.7	6.7	35.8
2.8	6.9	36.1
2.9	7.0	35.8
3.0	7.1	33.6

36" PIPE

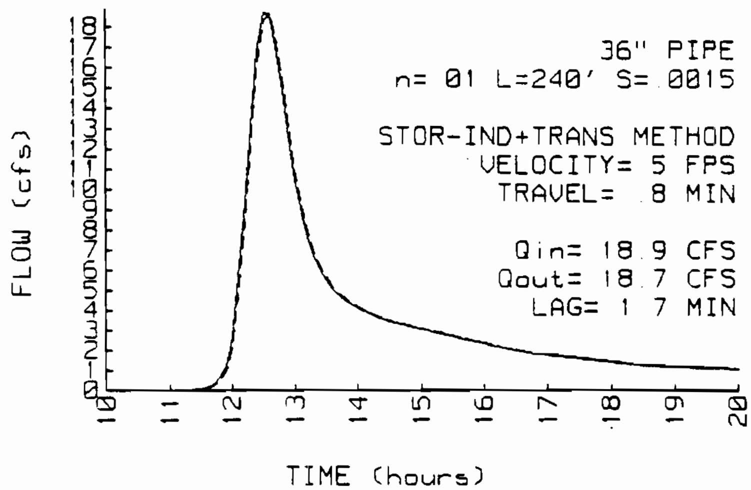
n= .01
LENGTH= 240 FT
SLOPE= .0015 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.57 FT
PEAK VELOCITY= 5.0 FPS
TRAVEL TIME = .8 MIN
SPAN= 10-20 HRS, dt=.1 HRS

REACH 3 DISCHARGE
PROP. STORM DRAIN ON DEERPARK ST. SONIA RO



REACH 3 INFLOW & OUTFLOW
PROP STORM DRAIN ON DEERPARK ST SONIA RD



REACH 3 INFLOW PEAK= 18.9 CFS @ 12.55 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	.1	.1	.3	.6	1.2
12.00	2.6	5.6	9.3	13.1	16.7	18.7	18.6	17.0	14.8	12.5
13.00	10.4	8.8	7.6	6.7	6.0	5.5	5.1	4.7	4.5	4.3
14.00	4.1	3.9	3.8	3.6	3.5	3.4	3.3	3.3	3.2	3.1
15.00	3.0	3.0	2.9	2.8	2.7	2.7	2.6	2.5	2.5	2.4
16.00	2.3	2.2	2.2	2.1	2.0	2.0	1.9	1.9	1.8	1.8
17.00	1.7	1.7	1.7	1.6	1.6	1.6	1.5	1.5	1.5	1.4
18.00	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2
19.00	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
20.00	1.1									

REACH 3 OUTFLOW PEAK= 18.7 CFS @ 12.57 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	.1	.2	.5	1.0
12.00	2.2	4.7	8.4	12.2	15.9	18.2	18.6	17.4	15.3	13.0
13.00	10.9	9.2	7.9	6.9	6.2	5.6	5.2	4.8	4.5	4.3
14.00	4.1	4.0	3.8	3.7	3.6	3.5	3.4	3.3	3.2	3.1
15.00	3.0	3.0	2.9	2.8	2.8	2.7	2.6	2.6	2.5	2.4
16.00	2.3	2.3	2.2	2.1	2.0	2.0	1.9	1.9	1.8	1.8
17.00	1.8	1.7	1.7	1.7	1.6	1.6	1.5	1.5	1.5	1.4
18.00	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2
19.00	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
20.00	1.1									

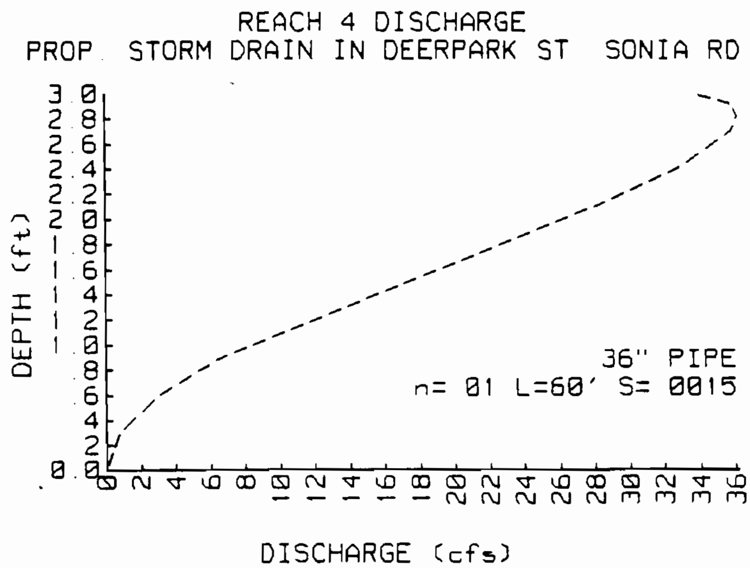
REACH 4 **PROP. STORM DRAIN IN DEERPARK ST. SONIA RD**

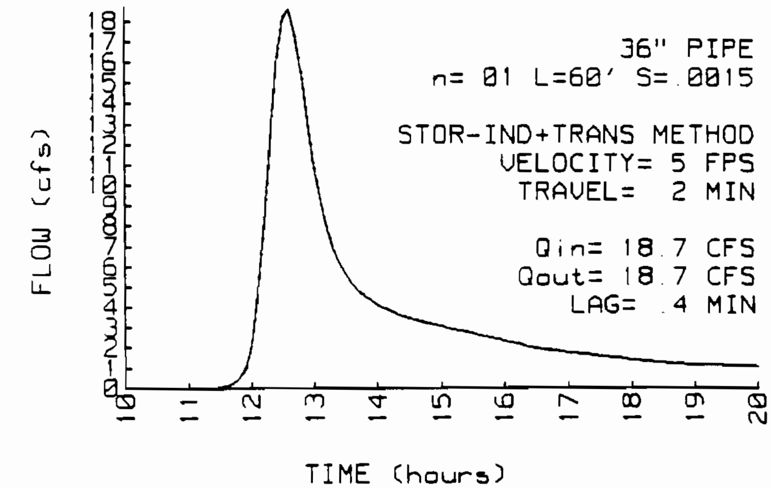
Qin = 18.7 CFS @ 12.57 HRS, VOLUME= 2.63 AF
Qout= 18.7 CFS @ 12.58 HRS, VOLUME= 2.62 AF, ATTEN= 0%, LAG= .4 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.0	0.0	0.0
.3	.4	.7
.6	1.0	2.9
.9	1.8	6.6
2.1	5.3	28.1
2.4	6.1	32.8
2.7	6.7	35.8
2.8	6.9	36.1
2.9	7.0	35.8
3.0	7.1	33.6

36" PIPE
n= .01
LENGTH= 60 FT
SLOPE= .0015 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.57 FT
PEAK VELOCITY= 5.0 FPS
TRAVEL TIME = .2 MIN
SPAN= 10-20 HRS, dt=.1 HRS





REACH 4 INFLOW PEAK= 18.7 CFS @ 12.57 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	.1	.2	.5	1.0
12.00	2.2	4.7	8.4	12.2	15.9	18.2	18.6	17.4	15.3	13.0
13.00	10.9	9.2	7.9	6.9	6.2	5.6	5.2	4.8	4.5	4.3
14.00	4.1	4.0	3.8	3.7	3.6	3.5	3.4	3.3	3.2	3.1
15.00	3.0	3.0	2.9	2.8	2.8	2.7	2.6	2.6	2.5	2.4
16.00	2.3	2.3	2.2	2.1	2.0	2.0	1.9	1.9	1.8	1.8
17.00	1.8	1.7	1.7	1.7	1.6	1.6	1.5	1.5	1.5	1.4
18.00	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2
19.00	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
20.00	1.1									

REACH 4 OUTFLOW PEAK= 18.7 CFS @ 12.58 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	.1	.2	.4	.9
12.00	2.1	4.5	8.1	11.9	15.6	18.1	18.6	17.5	15.5	13.2
13.00	11.0	9.3	7.9	7.0	6.2	5.7	5.2	4.8	4.6	4.3
14.00	4.2	4.0	3.8	3.7	3.6	3.5	3.4	3.3	3.2	3.1
15.00	3.1	3.0	2.9	2.8	2.8	2.7	2.6	2.6	2.5	2.4
16.00	2.3	2.3	2.2	2.1	2.1	2.0	1.9	1.9	1.8	1.8
17.00	1.8	1.7	1.7	1.7	1.6	1.6	1.6	1.5	1.5	1.4
18.00	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2
19.00	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
20.00	1.1									

REACH 5 **OUTFALL FROM POND 2 TO POND 1**

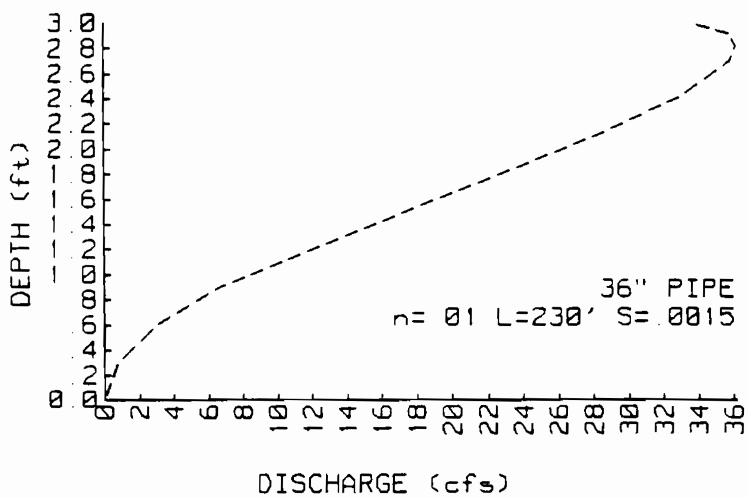
Qin = 12.2 CFS @ 13.22 HRS, VOLUME= 2.29 AF
Qout= 12.4 CFS @ 13.24 HRS, VOLUME= 2.29 AF, ATTEN= 0%, LAG= .9 MIN

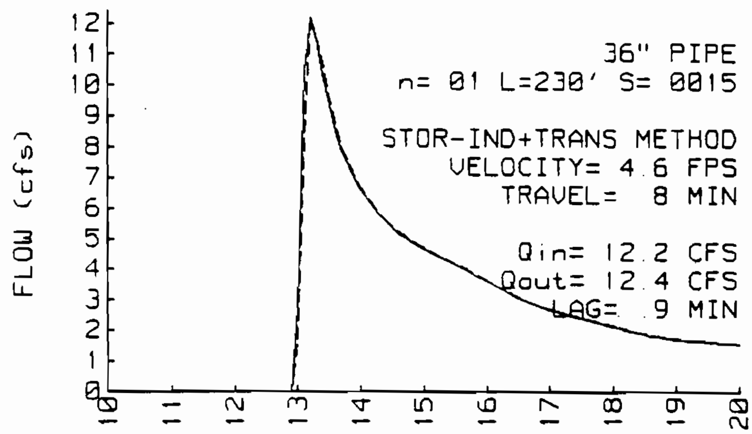
DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.0	0.0	0.0
.3	.4	.7
.6	1.0	2.9
.9	1.8	6.6
2.1	5.3	28.1
2.4	6.1	32.8
2.7	6.7	35.8
2.8	6.9	36.1
2.9	7.0	35.8
3.0	7.1	33.6

36" PIPE
n= .01
LENGTH= 230 FT
SLOPE= .0015 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.23 FT
PEAK VELOCITY= 4.6 FPS
TRAVEL TIME = .8 MIN
SPAN= 10-20 HRS, dt=.1 HRS

REACH 5 DISCHARGE
OUTFALL FROM POND 2 TO POND 1





REACH 5 INFLOW PEAK= 12.2 CFS @ 13.22 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	-0.0
12.00	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
13.00	2.8	10.5	12.2	11.5	10.4	9.4	8.5	7.9	7.4	6.9
14.00	6.6	6.3	6.0	5.8	5.6	5.4	5.2	5.0	4.9	4.8
15.00	4.7	4.6	4.4	4.4	4.3	4.2	4.0	3.9	3.8	3.7
16.00	3.6	3.5	3.4	3.3	3.2	3.1	3.0	2.9	2.8	2.7
17.00	2.7	2.6	2.6	2.5	2.4	2.4	2.3	2.3	2.2	2.2
18.00	2.1	2.1	2.0	2.0	1.9	1.9	1.8	1.8	1.8	1.7
19.00	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6
20.00	1.5									

REACH 5 OUTFLOW PEAK= 12.4 CFS @ 13.24 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13.00	1.6	8.3	12.1	11.5	10.7	9.5	8.8	8.0	7.5	7.0
14.00	6.7	6.4	6.1	5.8	5.6	5.4	5.2	5.1	4.9	4.8
15.00	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8
16.00	3.6	3.5	3.4	3.3	3.2	3.1	3.0	2.9	2.8	2.8
17.00	2.7	2.6	2.6	2.5	2.5	2.4	2.4	2.3	2.2	2.2
18.00	2.1	2.1	2.0	2.0	1.9	1.9	1.8	1.8	1.8	1.7
19.00	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6
20.00	1.6									

POND 1 **EXISTING BASIN 1 SONIA ROAD LANDFILL**

Qin = 14.6 CFS @ 13.23 HRS, VOLUME= 3.57 AF
Qout= .1 CFS @ 11.90 HRS, VOLUME= .10 AF, ATTEN= 99%, LAG= 0.0 MIN

ELEVATION (FT)	AREA (AC)	INC.STOR (AF)	CUM.STOR (AF)
50.0	.42	0.00	0.00
54.0	.58	2.00	2.00
58.0	.75	2.66	4.66

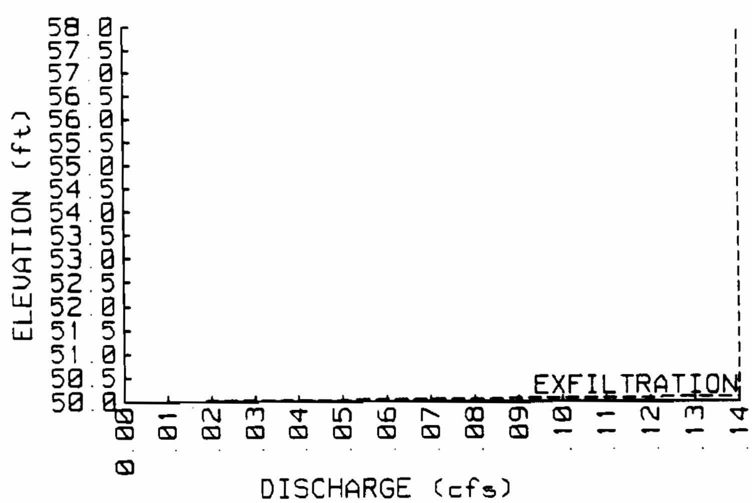
STOR-IND METHOD
PEAK STORAGE = 3.47 AF
PEAK ELEVATION= 56.2 FT
FLOOD ELEVATION= 58.0 FT
START ELEVATION= 50.0 FT
SPAN= 10-20 HRS, dt=.1 HRS

#	ROUTE	INVERT	OUTLET DEVICES
1	P	50.0'	**EXFILTRATION** Q= .14 CFS at and above 50.1'

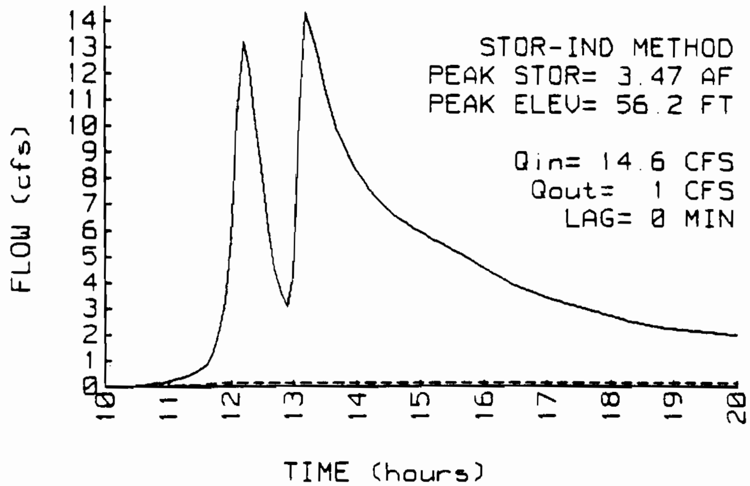
POND 1 TOTAL DISCHARGE (CFS) vs ELEVATION

FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
50.0	0.00	.14	.14	.14	.14	.14	.14	.14	.14	.14
51.0	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14
52.0	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14
53.0	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14
54.0	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14
55.0	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14
56.0	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14
57.0	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14
58.0	.14									

POND 1 DISCHARGE
EXISTING BASIN 1 SONIA ROAD LANDFILL



POND 1 INFLOW & OUTFLOW
EXISTING BASIN 1 SONIA ROAD LANDFILL



POND 1 INFLOW PEAK= 14.6 CFS @ 13.23 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.1	.1
11.00	.2	.2	.3	.4	.5	.6	.8	1.2	2.0	3.3
12.00	5.6	10.3	13.2	12.1	10.0	8.0	6.0	4.5	3.6	3.0
13.00	4.3	10.7	14.3	13.6	12.7	11.4	10.6	9.8	9.2	8.7
14.00	8.3	7.9	7.6	7.3	7.0	6.8	6.6	6.4	6.2	6.1
15.00	5.9	5.8	5.6	5.5	5.4	5.2	5.1	5.0	4.8	4.7
16.00	4.5	4.4	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5
17.00	3.4	3.3	3.2	3.2	3.1	3.0	3.0	2.9	2.8	2.8
18.00	2.7	2.6	2.6	2.5	2.4	2.4	2.3	2.3	2.3	2.2
19.00	2.2	2.2	2.1	2.1	2.1	2.1	2.1	2.0	2.0	2.0
20.00	2.0									

POND 1 TOTAL OUTFLOW PEAK= .1 CFS @ 11.90 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	.1	.1	.1	.1
12.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
13.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
14.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
15.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
16.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
17.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
18.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
19.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
20.00	.1									

POND 2 **PROP. RECHARGE BASIN 2**

Qin = 28.6 CFS @ 12.56 HRS, VOLUME= 4.01 AF
Qout= 12.3 CFS @ 13.22 HRS, VOLUME= 2.36 AF, ATTEN= 57%, LAG= 39.4 MIN
Qpri= 12.2 CFS @ 13.22 HRS, VOLUME= 2.29 AF
Qsec= .1 CFS @ 11.90 HRS, VOLUME= .07 AF

ELEVATION (FT)	AREA (AC)	INC.STOR (AF)	CUM.STOR (AF)
60.0	.10	0.00	0.00
64.0	.20	.60	.60
68.0	.31	1.02	1.62
70.0	.36	.67	2.29

STOR-IND METHOD
PEAK STORAGE = 1.75 AF
PEAK ELEVATION= 68.4 FT
FLOOD ELEVATION= 70.0 FT
START ELEVATION= 60.0 FT
SPAN= 10-20 HRS, dt=.1 HRS

#	ROUTE	INVERT	OUTLET DEVICES
1	S	60.0'	**EXFILTRATION** Q= .1 CFS at and above 60.1'
2	P	68.0'	**16' BROAD-CRESTED RECTANGULAR WEIR** Q=C L H^1.5 C=3.1, 3.1, 3.1, 3.1, 3.1, 3.1, 3.1, 3.1

Primary Discharge
└─2=Broad-Crested Rectangular Weir

Secondary Discharge
└─1=Exfiltration

POND 2 TOTAL DISCHARGE (CFS) vs ELEVATION

FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
60.0	0.0	.1	.1	.1	.1	.1	.1	.1	.1	.1
61.0	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
62.0	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
63.0	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
64.0	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
65.0	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
66.0	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
67.0	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
68.0	.1	1.7	4.5	8.3	12.6	17.6	23.2	29.1	35.6	42.4
69.0	49.7	57.3	65.3	73.6	82.3	91.2	100.5	110.0	119.9	130.0
70.0	140.4									

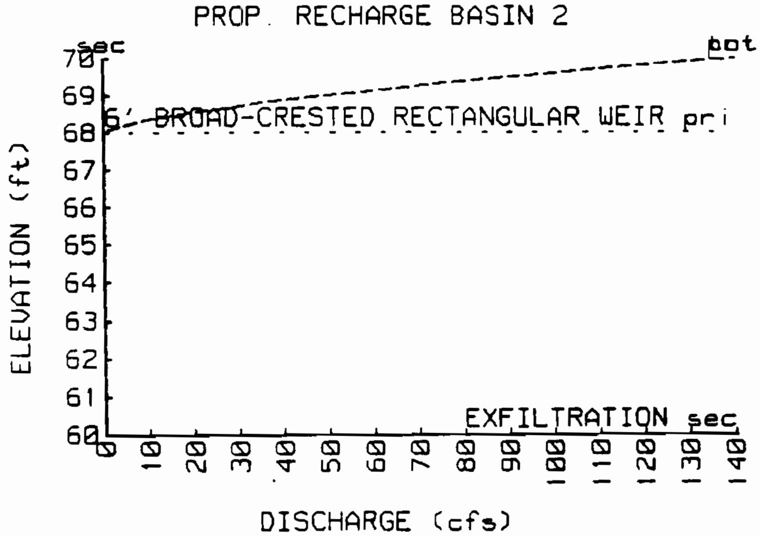
POND 2 PRIMARY DISCHARGE (CFS) vs ELEVATION

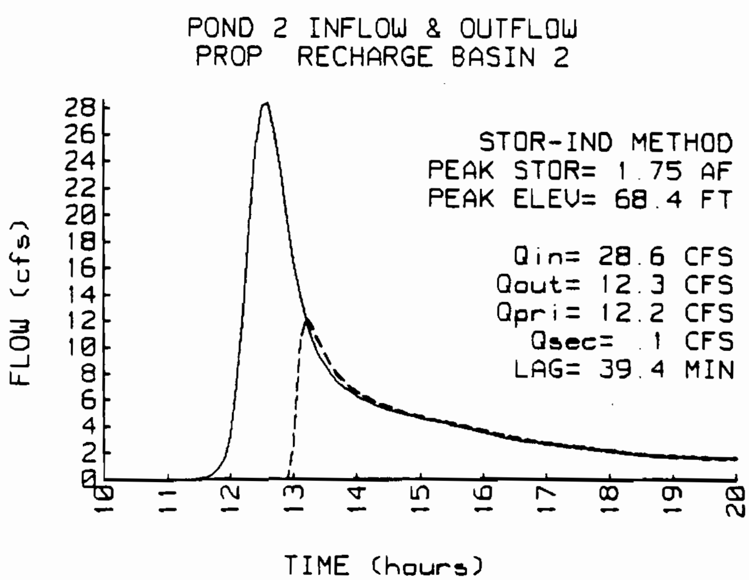
FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
62.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
63.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
64.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
66.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
67.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
68.0	0.0	1.6	4.4	8.2	12.5	17.5	23.1	29.0	35.5	42.3
69.0	49.6	57.2	65.2	73.5	82.2	91.1	100.4	109.9	119.8	129.9
70.0	140.3									

POND 2 SECONDARY DISCHARGE (CFS) vs ELEVATION

FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
60.0	0.00	.10	.10	.10	.10	.10	.10	.10	.10	.10
61.0	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
62.0	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
63.0	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
64.0	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
65.0	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
66.0	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
67.0	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
68.0	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
69.0	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
70.0	.10									

POND 2 DISCHARGE
PROP. RECHARGE BASIN 2





POND 2 INFLOW PEAK= 28.6 CFS @ 12.56 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	.1	.2	.4	.8	1.6
12.00	3.4	7.1	12.9	19.2	24.8	28.1	28.4	26.4	23.1	19.7
13.00	16.5	14.0	12.0	10.5	9.5	8.6	7.9	7.4	7.0	6.6
14.00	6.3	6.1	5.8	5.6	5.4	5.3	5.1	5.0	4.9	4.8
15.00	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7
16.00	3.5	3.4	3.3	3.2	3.1	3.0	2.9	2.9	2.8	2.7
17.00	2.7	2.6	2.6	2.5	2.5	2.4	2.4	2.3	2.3	2.2
18.00	2.1	2.1	2.0	2.0	1.9	1.9	1.9	1.8	1.8	1.8
19.00	1.8	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6
20.00	1.6									

POND 2 TOTAL OUTFLOW PEAK= 12.3 CFS @ 13.22 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.1
12.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
13.00	2.9	10.6	12.3	11.6	10.5	9.5	8.6	8.0	7.5	7.0
14.00	6.7	6.4	6.1	5.9	5.7	5.5	5.3	5.1	5.0	4.9
15.00	4.8	4.7	4.5	4.5	4.4	4.3	4.1	4.0	3.9	3.8
16.00	3.7	3.6	3.5	3.4	3.3	3.2	3.1	3.0	2.9	2.8
17.00	2.8	2.7	2.7	2.6	2.5	2.5	2.4	2.4	2.3	2.3
18.00	2.2	2.2	2.1	2.1	2.0	2.0	1.9	1.9	1.9	1.8
19.00	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.7	1.7
20.00	1.6									

POND 2 PRIMARY OUTFLOW PEAK= 12.2 CFS @ 13.22 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	-0.0
12.00	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
13.00	2.8	10.5	12.2	11.5	10.4	9.4	8.5	7.9	7.4	6.9
14.00	6.6	6.3	6.0	5.8	5.6	5.4	5.2	5.0	4.9	4.8
15.00	4.7	4.6	4.4	4.4	4.3	4.2	4.0	3.9	3.8	3.7
16.00	3.6	3.5	3.4	3.3	3.2	3.1	3.0	2.9	2.8	2.7
17.00	2.7	2.6	2.6	2.5	2.4	2.4	2.3	2.3	2.2	2.2
18.00	2.1	2.1	2.0	2.0	1.9	1.9	1.8	1.8	1.8	1.7
19.00	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6
20.00	1.5									

POND 2 SECONDARY OUTFLOW PEAK= .1 CFS @ 11.90 HOURS

HOUR	0.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	.1
12.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
13.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
14.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
15.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
16.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
17.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
18.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
19.00	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
20.00	.1									

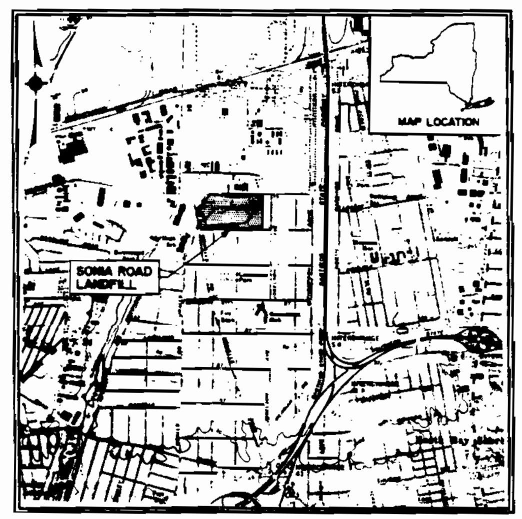
ATTACHMENTS

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
SITE NUMBER 152013

PRESUMPTIVE REMEDY
FINAL CLOSURE PLAN
SONIA ROAD LANDFILL

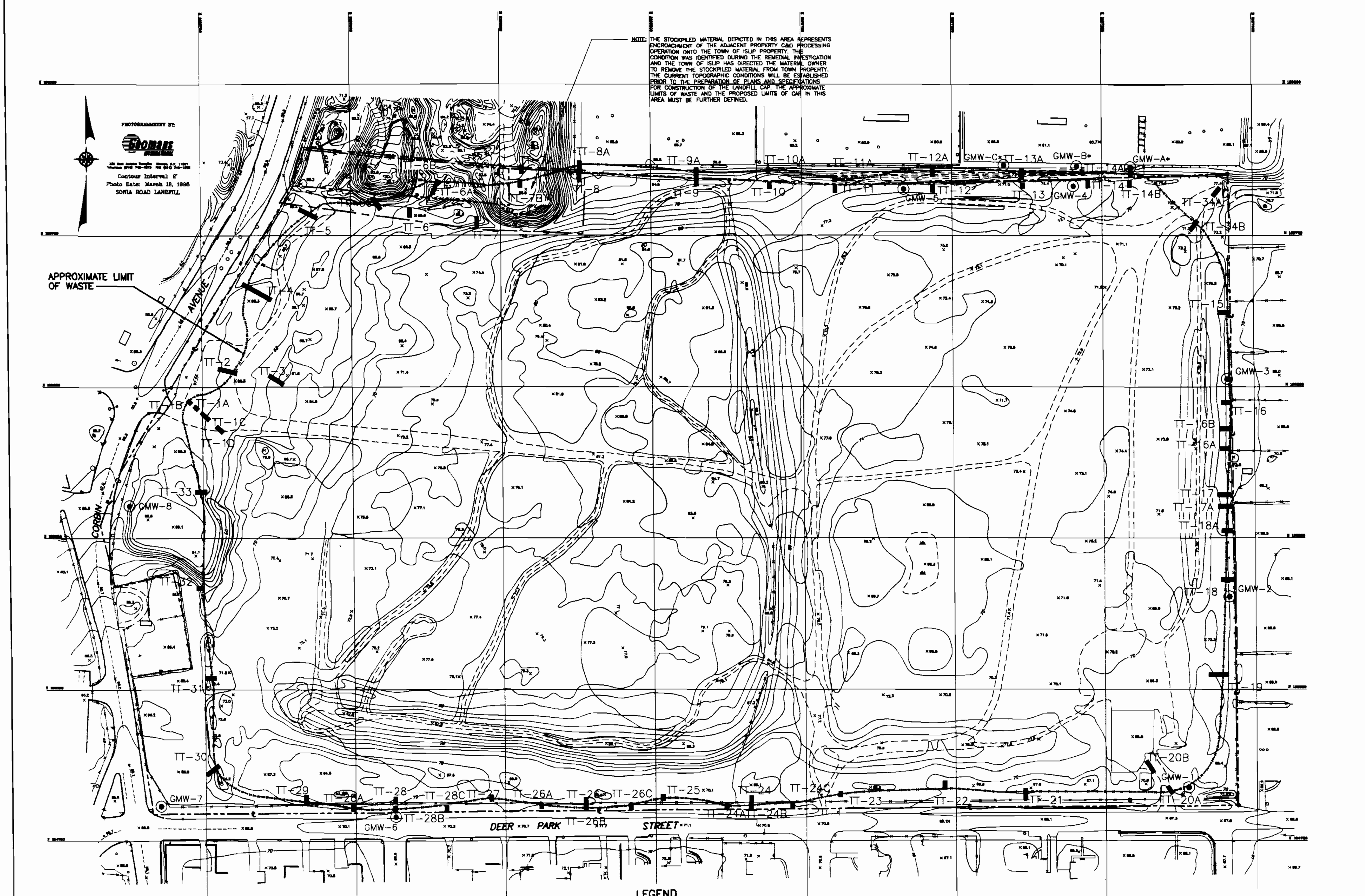
TOWN OF ISLIP IRRA
SUFFOLK COUNTY, NEW YORK

APRIL 1998



LOCATION MAP

DVIRKA AND BARTILUCCI
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.



LEGEND

- TT-28 WASTE INVESTIGATION TRENCH & NUMBER
- GMW-6 EXISTING GAS MONITORING WELL & NUMBER

DVIRKA AND BARTILUCCI
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

NYSDEC SITE NUMBER 152013
PRESUMPTIVE REMEDY
FINAL CLOSURE PLAN
ISLIP RESOURCE RECOVERY AGENCY
SONIA ROAD LANDFILL

EXISTING TOPOGRAPHY AND LIMITS OF WASTE

SYMBOLS

	— APPROXIMATE LIMITS OF WASTE
	— PROPERTY LINE
	— PROPOSED LIMIT OF CAP
80	— PROPOSED CONTOUR
78.5	— PROPOSED SPOT ELEVATION
	— PROPOSED LANDFILL GAS MONITORING WELL
	— PROPOSED LANDFILL GAS RECOVERY WELL
	— PROPOSED LANDFILL GAS COLLECTION WELL WITH CONTROL VALVE
	— PROPOSED LANDFILL GAS FLARE
	— PROPOSED BUTTERFLY VALVE
TT-28	— WASTE INVESTIGATION TRENCH AND NUMBER
LP	— LEACHING POOL
MH	— MANHOLE
	— LIMITS OF CONTRIBUTING AREA
	— 4"ø PERFORATED CORRUGATED HDPE PIPE
	— 24"ø OR 36"ø PERFORATED CORRUGATED HDPE PIPE
	— 24"ø OR 36"ø CORRUGATED HDPE PIPE
	— PROPOSED PERIMETER ROAD
SL6	— CONTRIBUTING AREA DESIGNATION
A / C1 C4	— CROSS SECTION MARKER
	— N.Y.S. GRID SYSTEM
GMW-6	— EXISTING GAS MONITORING WELL & NUMBER
	— EXISTING STRUCTURE
	— EXISTING STONE WALL
	— EXISTING TRAIL OR DIRT ROAD
	— EXISTING FENCE
	— DRAINAGE WAY
	— STREAM
	— SWAMP
	— EXISTING TREE LINE
	— EXISTING TREES
S and	— EXISTING ROAD SIGN
	— EXISTING POLE
70	— EXISTING CONTOUR
× 70.5	— EXISTING ELEVATION
	— EXISTING CULVERT PIPE

ABBREVIATIONS

ALT.	ALTERNATE
APPROX.	APPROXIMATELY
ASPH.	ASPHALT
@	AT
AUX.	AUXILIARY
B / BOTT.	BOTTOM
BD	BOTTOM OF DITCH
BLDG.	BUILDING
B.M.	BENCH MARK
c/c	CENTER TO CENTER
CMP	CORRUGATED METAL PIPE
CO	CLEAN OUT
CONC.	CONCRETE
CONT	CONTINUOUS
COORD.	COORDINATE
CPS	CENTIMETERS PER SECOND
CM/SEC	CENTIMETERS PER SECOND
CY	CUBIC YARDS
DIST.	DISTANCE
DIA. or ϕ	DIAMETER
DWG.	DRAWING
EF	EACH FACE
EL.	ELEVATION
EW	EACH WAY
EX./EXIST.	EXISTING
FH	FIRE HYDRANT
FIN.FL.	FINISH FLOOR
FM	FORCE MAIN
FOUND.	FOUNDATION
FT.	FEET
FTG.	FOOTING
FW	FIRE WATER
GND	GROUND
HDPE	HIGH DENSITY POLYETHYLENE
HGT	HEIGHT
HOR	HORIZONTAL
H.P.	HIGH POINT
ID	INSIDE DIAMETER
IN	INCH
INCL.	INCLUDE/INCLUDING
INV.	INVERT
K	CURVE COEFFICIENT
L	LENGTH
LF	LINEAR FOOT
L.P.	LOW POINT
MAX.	MAXIMUM
MH	MANHOLE
MIN.	MINIMUM
MISC	MISCELLANEOUS
MSL	MEAN SEA LEVEL
NTS	NOT TO SCALE
NO.	NUMBER
OZ.	OUNCE
OD	OUTSIDE DIAMETER
P.C.	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVE
PERM.	PERMEABLE
PP	POWER POLE
PROP	PROPOSED
PSI	POUNDS PER SQUARE INCH
PSF	POUNDS PER SQUARE FOOT
P.T.	POINT OF TANGENCY
P.V.C.	POINT OF VERTICAL CURVATURE
P.V.I.	POINT OF VERTICAL INTERSECTION
P.V.T.	POINT OF VERTICAL TANGENCY
PRVT	PRIVATE
PVC PIPE	POLYVINYL CHLORIDE PIPE
R	RADIUS
RCP	REINFORCED CONCRETE PIPE
REQD	REQUIRED
REV	REVISION
ROB	RUN OF BANK
R.O.W.	RIGHT OF WAY
RR	RAILROAD SPIKE
S	SANITARY
SCH	SCHEDULE
SD	STORM/WASH DRAIN
SDR	STANDARD DIMENSIONAL RATIO
SF	SQUARE FOOT
SPECS	SPECIFICATIONS
STA	STATION
STD	STANDARD
SW	SERVICE WATER
SYM	SYMBOL
SQ.	SQUARE
T	TOP
TYP.	TYPICAL
UG	UNDERGROUND
VAR	VARIES
V.C.	VERTICAL CURVE
VERT	VERTICAL
YD.	YARD
YR.	YEAR
w/	WITH
w/o	WITHOUT
WS	WATER SURFACE

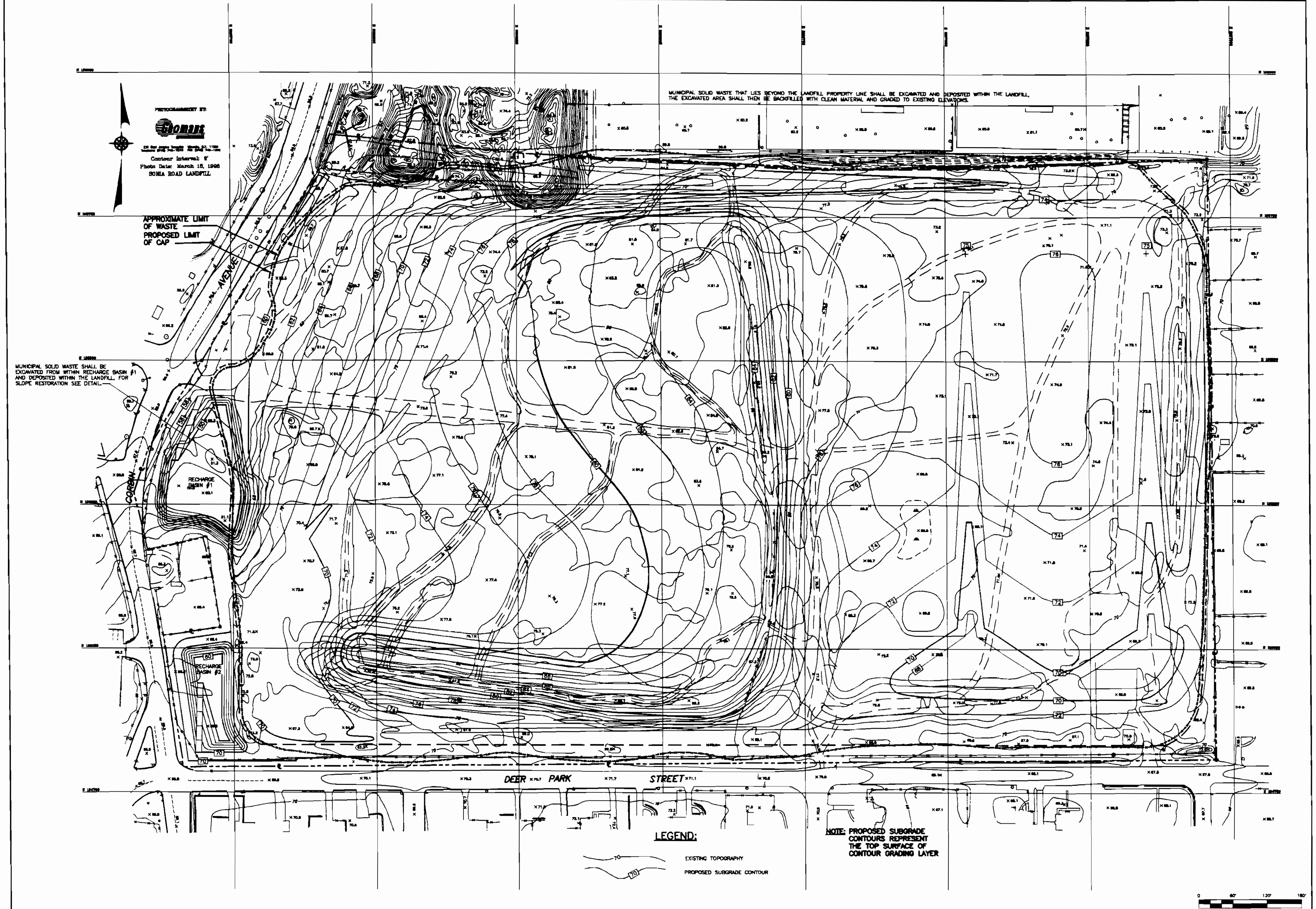
INDEX OF DRAWINGS

DRAWING TITLE

DVIRKA AND BARTILUCCI
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

NYSDEC SITE NUMBER 152013
PRESUMPTIVE REMEDY
FINAL CLOUSER PLAN
ISLIP RESOURCE RECOVERY AGENCY
SONIA ROAD LANDFILL

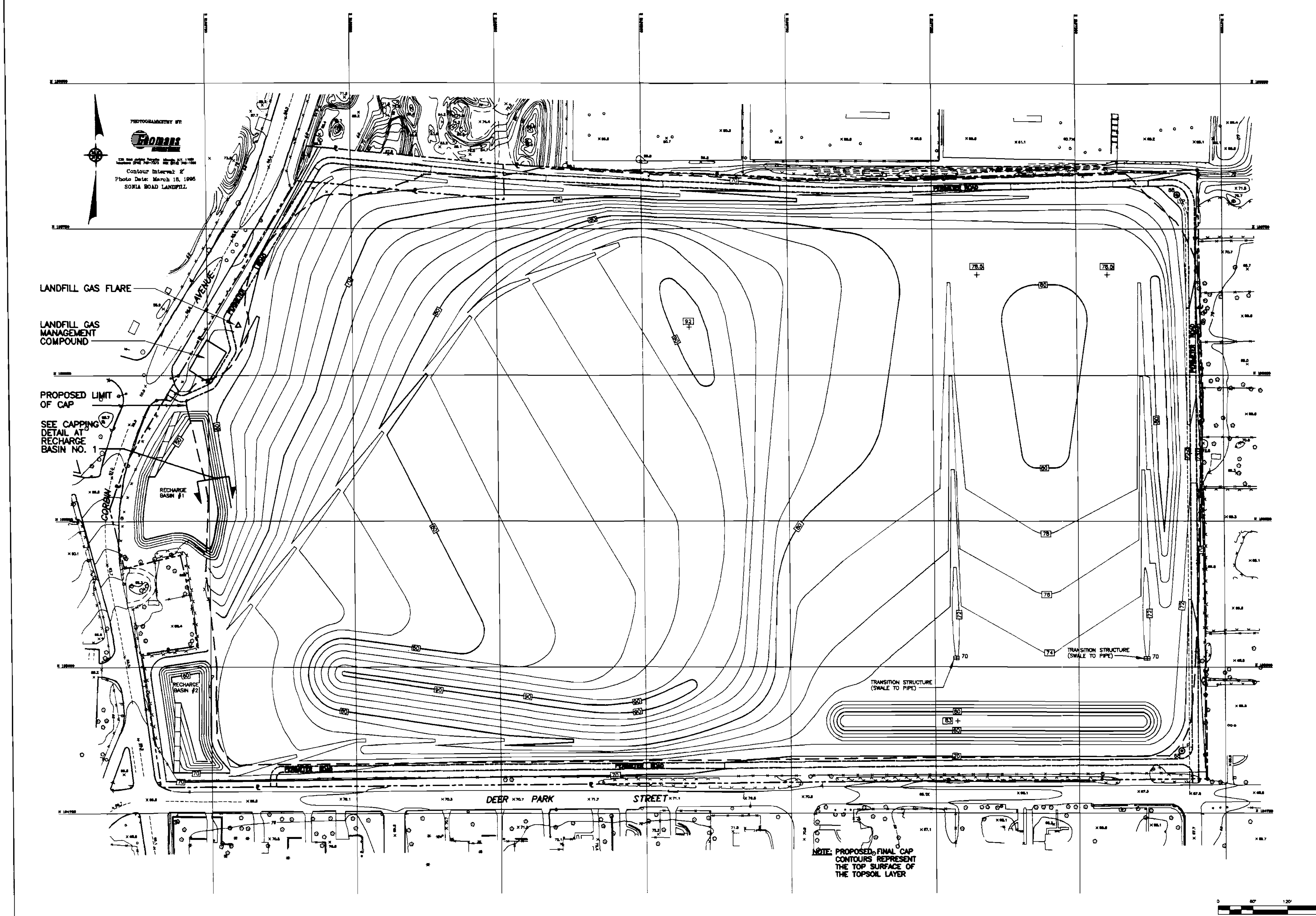
SYMBOLS, ABBREVIATIONS AND INDEX OF DRAWINGS



NYSDEC SITE NUMBER 152013
PRESUMPTIVE REMEDY
FINAL CLOSURE PLAN
ISLIP RESOURCE RECOVERY AGENCY
SONIA ROAD LANDFILL

SUBGRADE GRADING PLAN

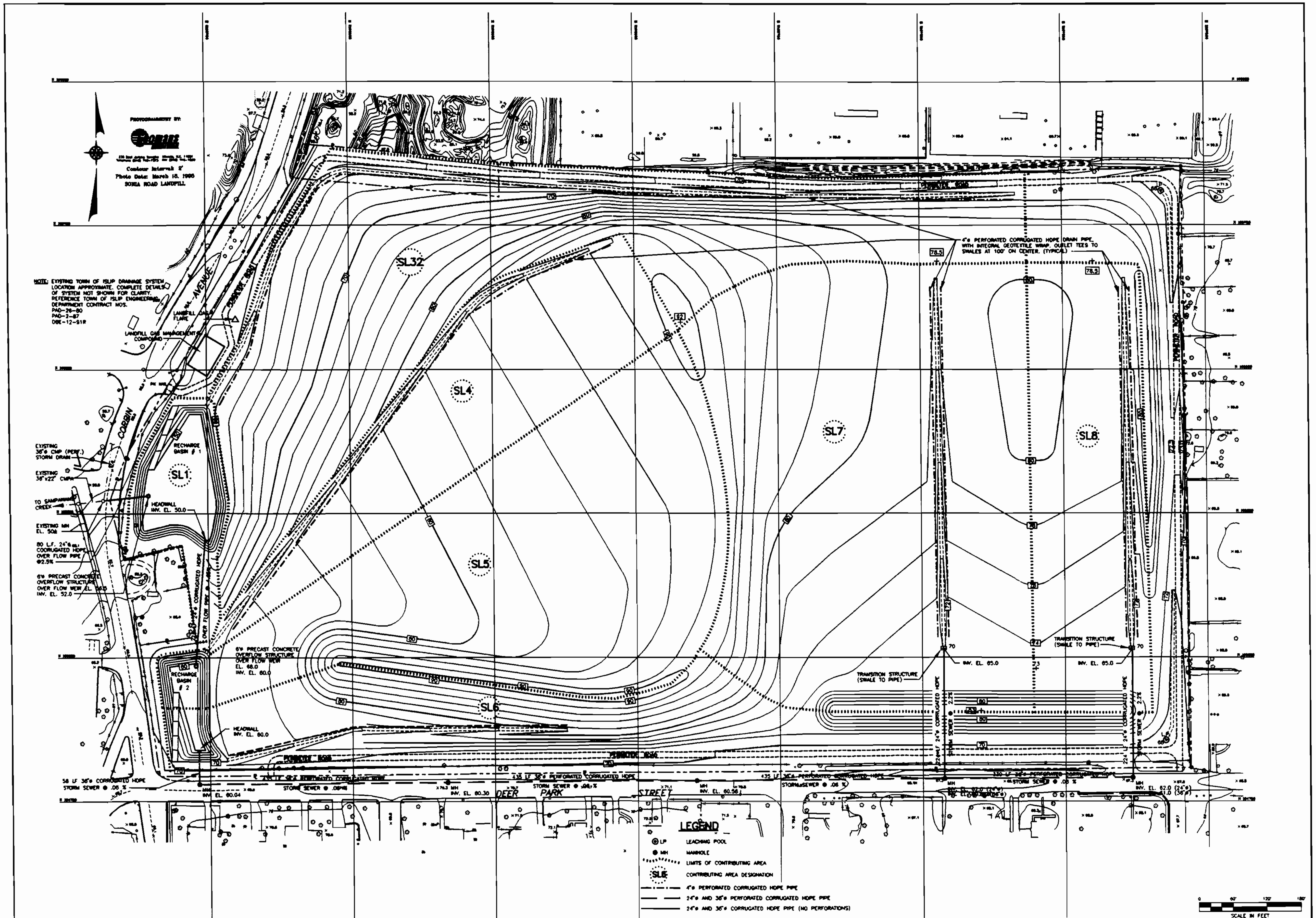
DVIRKA AND BARTILUCCI
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.



NYSDEC SITE NUMBER 152013
PRESUMPTIVE REMEDY
FINAL CLOSURE PLAN
ISLIP RESOURCE RECOVERY AGENCY
SONIA ROAD LANDFILL

DVIRKA AND BARTILUCCI
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

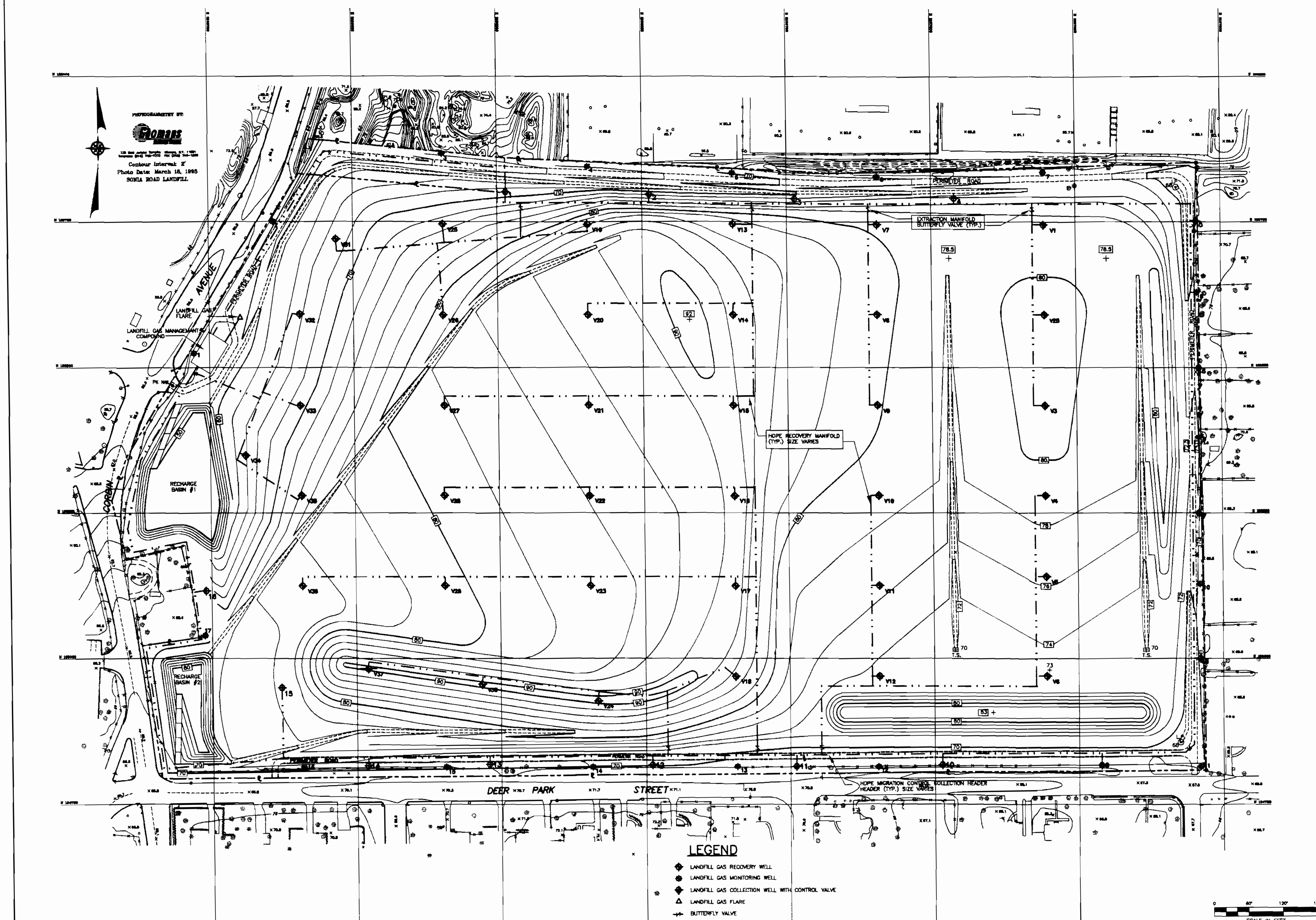
FINAL CAP GRADING PLAN



NYSDEC SITE NUMBER 152013
PRESUMPTIVE REMEDY
FINAL CLOSURE PLAN
ISLIP RESOURCE RECOVERY AGENCY
SONIA ROAD LANDFILL

DRAINAGE PLAN

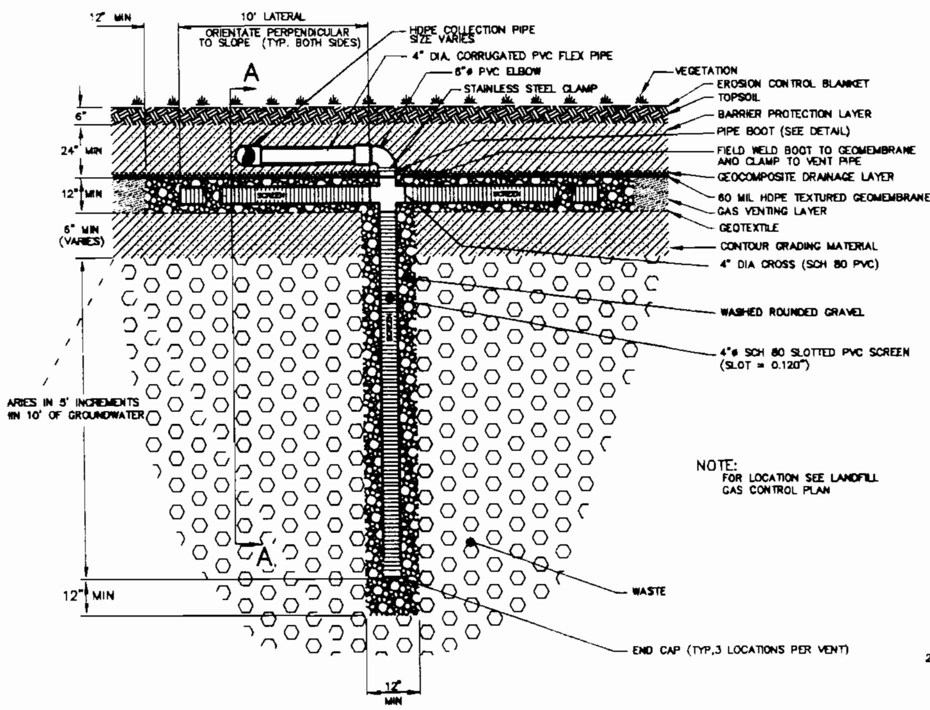
DVIRKA AND BARTILUCCI
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.



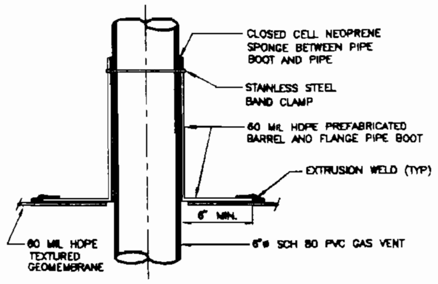
DVIRKA AND BARTILUCCI
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

NYSDEC SITE NUMBER 152013
PRESUMPTIVE REMEDY
FINAL CLOSURE PLAN
ISLIP RESOURCE RECOVERY AGENCY
SONIA ROAD LANDFILL

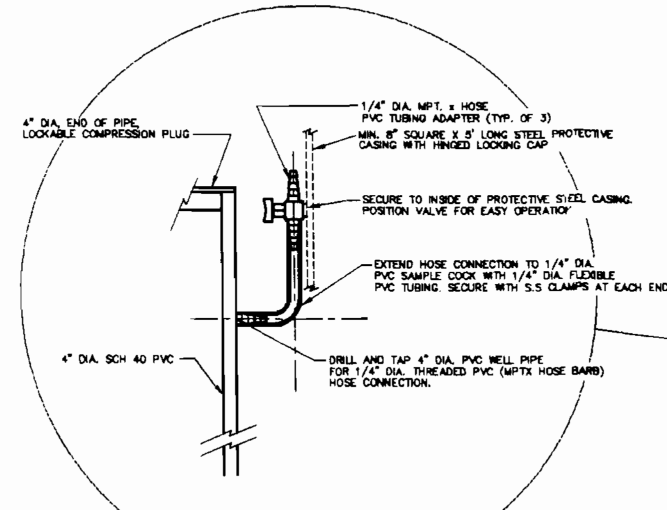
LANDFILL GAS CONTROL PLAN



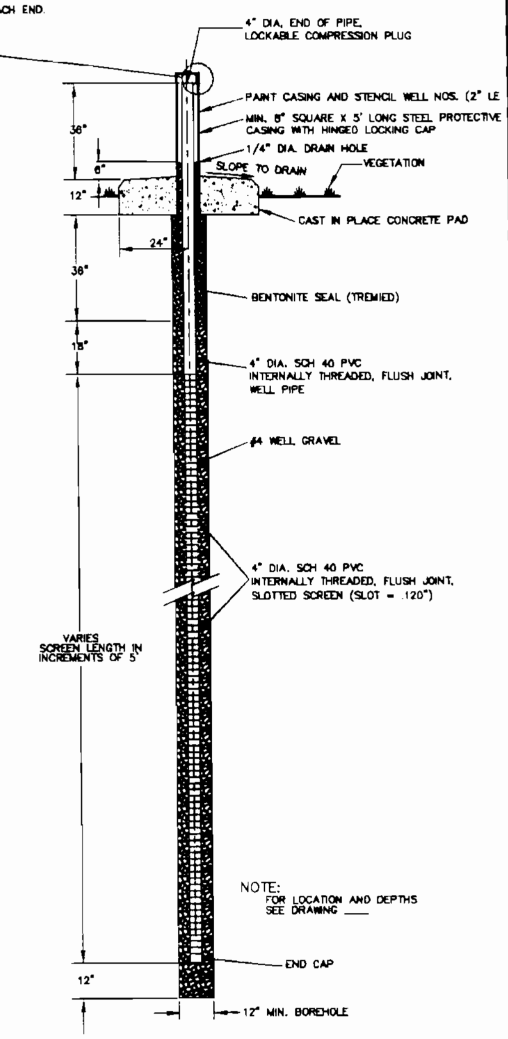
RECOVERY WELL DETAIL
N.T.S.



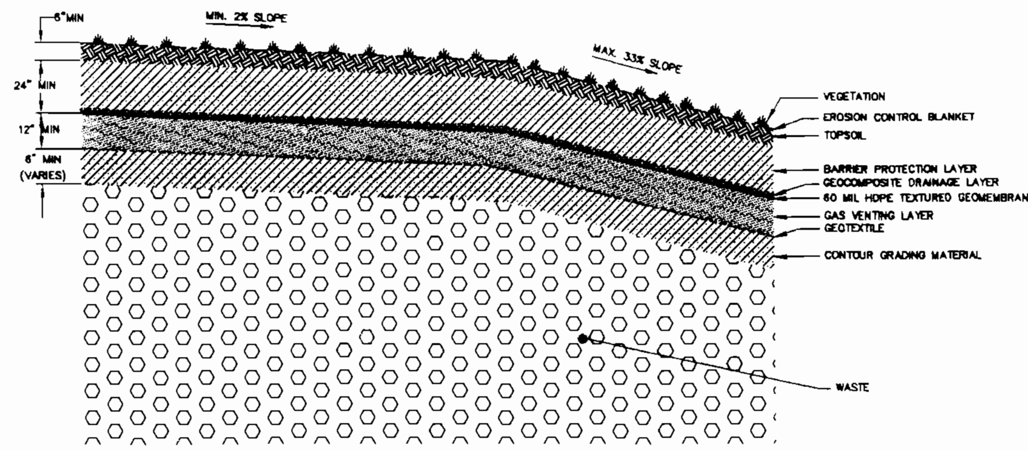
TYPICAL PIPE BOOT DETAIL
N.T.S.



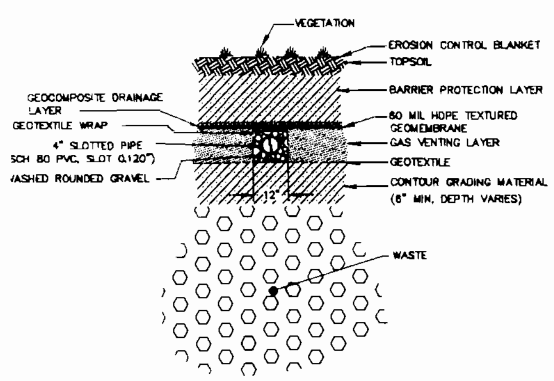
SAMPLING VALVE DETAIL
N.T.S.



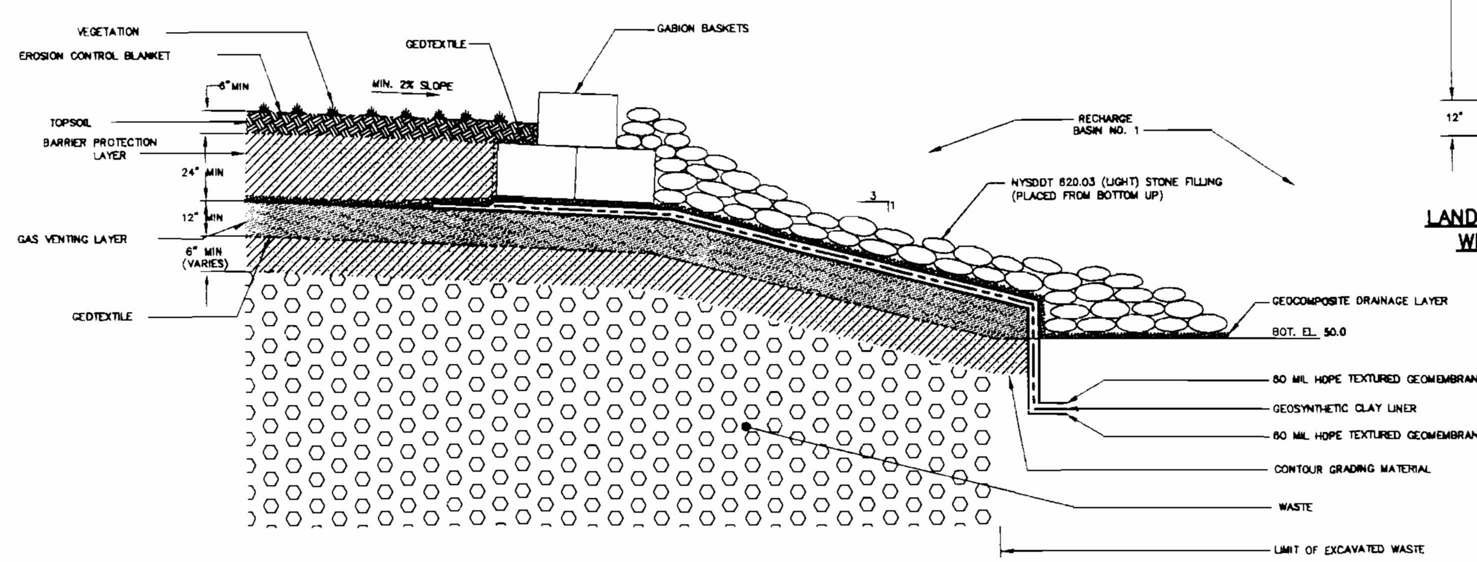
LANDFILL GAS MONITORING WELL CONSTRUCTION DETAIL



TYPICAL CAPPING DETAIL
N.T.S.



SECTION A-A'

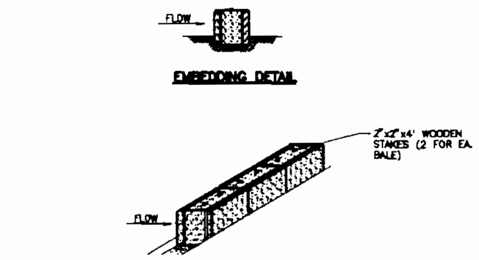


LOOKING SOUTH
CAPPING DETAIL AT RECHARGE BASIN #1
N.T.S.

NYSDEC SITE NUMBER 152013
PRESUMPTIVE REMEDY
FINAL CLOSURE PLAN
ISLIP RESOURCE RECOVERY AGENCY
SONIA ROAD LANDFILL

DVIRKA AND BARTILUCCI
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

MISCELLANEOUS DETAILS



HAY OR STRAW BALE SILT FILTERS
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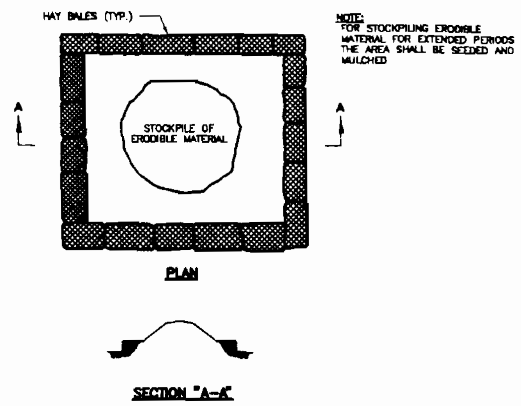

SEDIMENT CONTROL DETAIL FOR STOCKPILING OF ERODIBLE MATERIAL
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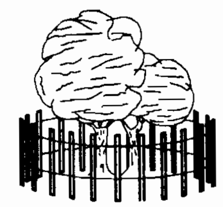
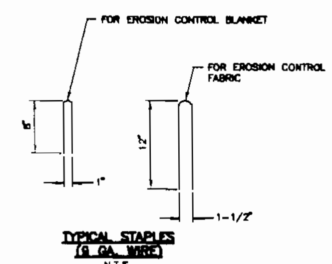
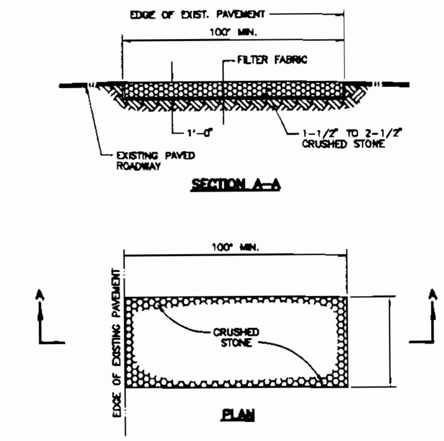


FENCING FOR TREE PROTECTION
N.T.S.



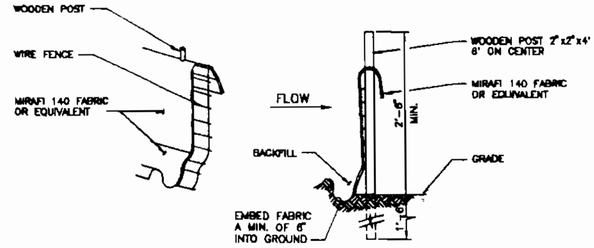
TYPICAL STAPLES
(9 GA. WIRE)
N.T.S.



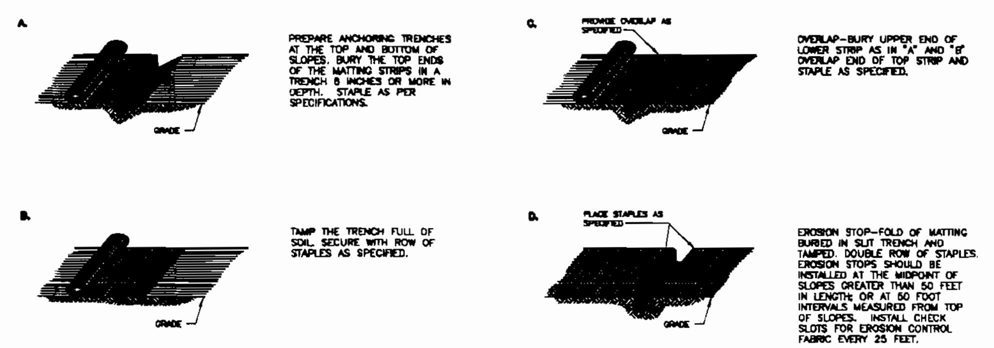
CONSTRUCTION SITE TRACKING PAD
N.T.S.

NOTE:
EXISTING GRADE OF GRAVEL SURFACE VARIES. LEVEL SUBGRADE BENEATH FABRIC FILTER AND CRUSHED STONE WEARING COURSE TO MEET EXISTING PAVED ROADWAY ON EITHER SIDE OF TRACKING PAD.

NOTE:
1. SECURE WIRE FENCE FABRIC TO POSTS WITH WIRE TIES OR STAPLES.
2. SECURE FILTER FABRIC TO WIRE FENCE FABRIC WITH TIES SPACED EVER 24" AT TOP AND MIDSECTION.
3. PREFABRICATED MIRAFI ENVIROFENCE, OR EQUAL, WITH NET BACKING MAY BE SUBSTITUTED FOR FIELD FABRICATED SILT FENCE. INSTALL PER MANUFACTURER'S INSTRUCTION.

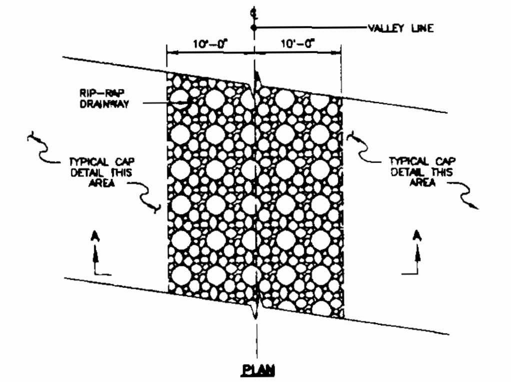


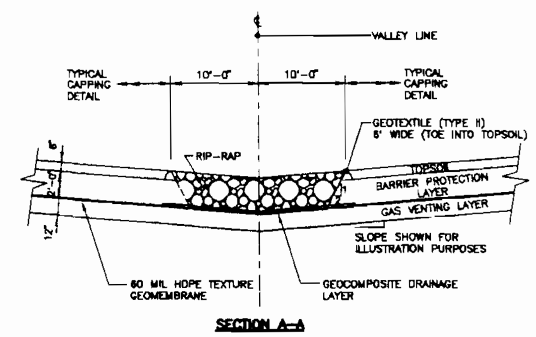
TYPICAL SITE BUILT SILT FENCE DETAIL
N.T.S.



EROSION PROTECTION WITH SOIL STABILIZATION MATTING
N.T.S.

NOTES:
APPLICABLE FOR EROSION CONTROL BLANKET AND EROSION CONTROL FABRIC.





RIP-RAP DRAINWAY
N.T.S.

SOIL EROSION AND SEDIMENT CONTROL NOTES:

1. ALL SOIL EROSION AND SEDIMENT CONTROL PRACTICES TO BE INSTALLED PRIOR TO ANY MAJOR SOIL DISTURBANCE, OR IN THEIR PROPER SEQUENCE, AND MAINTAINED UNTIL PERMANENT PROTECTION IS ESTABLISHED.
2. ANY DISTURBED AREAS THAT WILL NOT RECEIVE PERMANENT RESTORATION WITHIN TEN (10) DAYS AFTER FINAL GRADING, AND NOT SUBJECT TO CONSTRUCTION TRAFFIC, WILL IMMEDIATELY RECEIVE A TEMPORARY COVER. THE DISTURBED AREAS WILL BE MULCHED WITH STRAW, OR EQUIVALENT MATERIAL, AT A RATE OF TWO (2) TONS PER ACRE.
3. PERMANENT VEGETATION TO BE SEEDED ON ALL EXPOSED AREAS WITHIN TEN (10) DAYS AFTER FINAL GRADING. MULCH TO BE USED AS NECESSARY FOR PROTECTION UNTIL SEEDING IS ESTABLISHED.
4. ALL WORK TO BE DONE IN ACCORDANCE WITH THE STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW YORK.
5. IMMEDIATELY FOLLOWING INITIAL DISTURBANCE OR ROUGH GRADING, ALL CRITICAL AREAS SUBJECT TO EROSION (I.E.; STEEP SLOPES AND EMBANKMENTS) WILL RECEIVE A TEMPORARY COVER OF STRAW MULCH OR A SUITABLE EQUIVALENT. AT A RATE OF TWO (2) TONS PER ACRE.
6. ANY STEEP SLOPES INSTALLATION WILL BE BACKFILLED AND STABILIZED DAILY, AS THE INSTALLATION PROCEEDS (I.E.; SLOPES GREATER THAN 3:1).
7. THE ENGINEER SHALL BE NOTIFIED 72 HOURS IN ADVANCE OF ANY LAND DISTURBING ACTIVITY.
8. THE CONTRACTOR SHALL TAKE NECESSARY MEASURES TO MAINTAIN DUST CONTROL. DIRT HAUL ROADS SHALL BE SPRINKLED WITH WATER OR GIVEN A SURFACE OF CRUSHED STONES OR WOODCHIPS AS REQUIRED. VEHICLES SHALL BE CLEANED, AS NECESSARY, PRIOR TO USING PUBLIC STREETS. CONSTRUCTION SITE TRACKING PADS SHALL BE CONSTRUCTED AND MAINTAINED AT ALL ACTIVE SITE ACCESS LOCATIONS.
9. ALL SOIL EROSION AND SEDIMENT CONTROL DEVICES SHALL BE LOCATED IN THE FIELD AS REQUIRED OR AT THE DIRECTION OF THE ENGINEER. THE CONTRACT DRAWINGS ARE NOT INTENDED TO SHOW THE LOCATION AND DETAILS FOR ALL SUCH DEVICES BUT ARE TO BE USED AS A REASONABLE GUIDE.
10. ANY CHANGES TO THE SOIL EROSION AND SEDIMENT CONTROL PLANS WILL REQUIRE THE SUBMISSION OF REVISED SOIL EROSION AND SEDIMENT CONTROL PLANS TO THE ENGINEER. THE REVISED PLANS MUST BE PREPARED BY THE CONTRACTOR AND MUST MEET ALL CURRENT STATE SOIL EROSION AND SEDIMENT CONTROL PRACTICES.
11. CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS.
12. UPON COMPLETION OF CONSTRUCTION WORK AND AFTER FINAL GRADING AND WHEN PERMANENT STABILIZATION HAS BEEN ESTABLISHED, THE BALES, SILT FENCES AND ALL OTHER SOIL PLAN APPURTENANCES WILL BE REMOVED AND DISPOSED OF BY THE CONTRACTOR.
13. THE CONTRACTOR SHALL PROVIDE A DETAILED SEQUENCE OF CONSTRUCTION OPERATIONS FOR REVIEW AND SUBMITTAL TO THE ENGINEER.
14. THE CONTRACTOR SHALL MEET ENGINEER ON-SITE TO DEFINE THOSE AREAS WHICH WILL REQUIRE SOIL EROSION AND SEDIMENT CONTROL FACILITIES, DISCUSS THEIR CONSTRUCTION AND THEREAFTER PROVIDE DETAILED PLANS FOR REVIEW OF SUCH FACILITIES BY THE ENGINEER.
15. ALL SOIL EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE IN PLACE PRIOR TO SITE AND ACCESS CLEARING.
16. ALL SOIL EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE LEFT IN PLACE AND MAINTAINED; INCLUDING SILT AND SEDIMENT REMOVAL, UNTIL CONSTRUCTION IS COMPLETED, AREA STABILIZED AND THE ENGINEER SO DIRECTS.
17. THE CONTRACTOR SHALL CONFINE SOIL DISTURBANCE ACTIVITY TO THE MINIMUM AREAS POSSIBLE.
18. SOIL STABILIZATION METHODS SHALL BE UNDERTAKEN COINCIDENTALLY WITH ALL MAJOR SITE IMPROVEMENTS AND CONTINUE DURING THE ENTIRE CONSTRUCTION ACTIVITY PERIOD.

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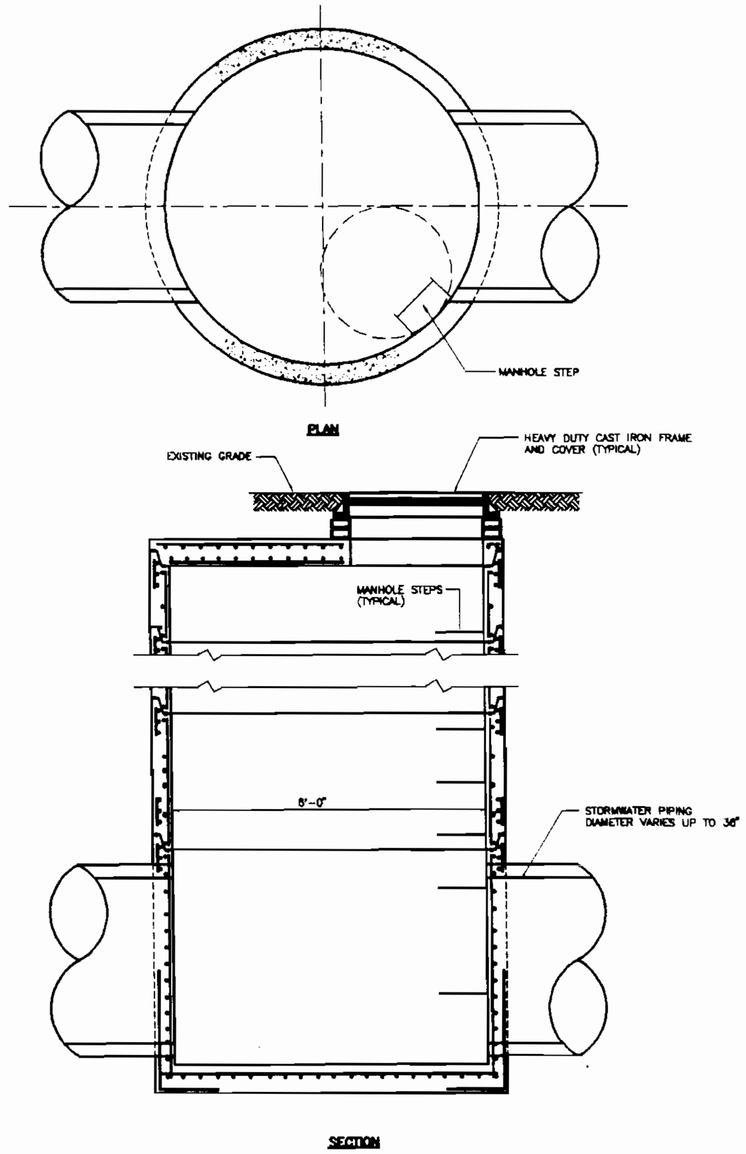
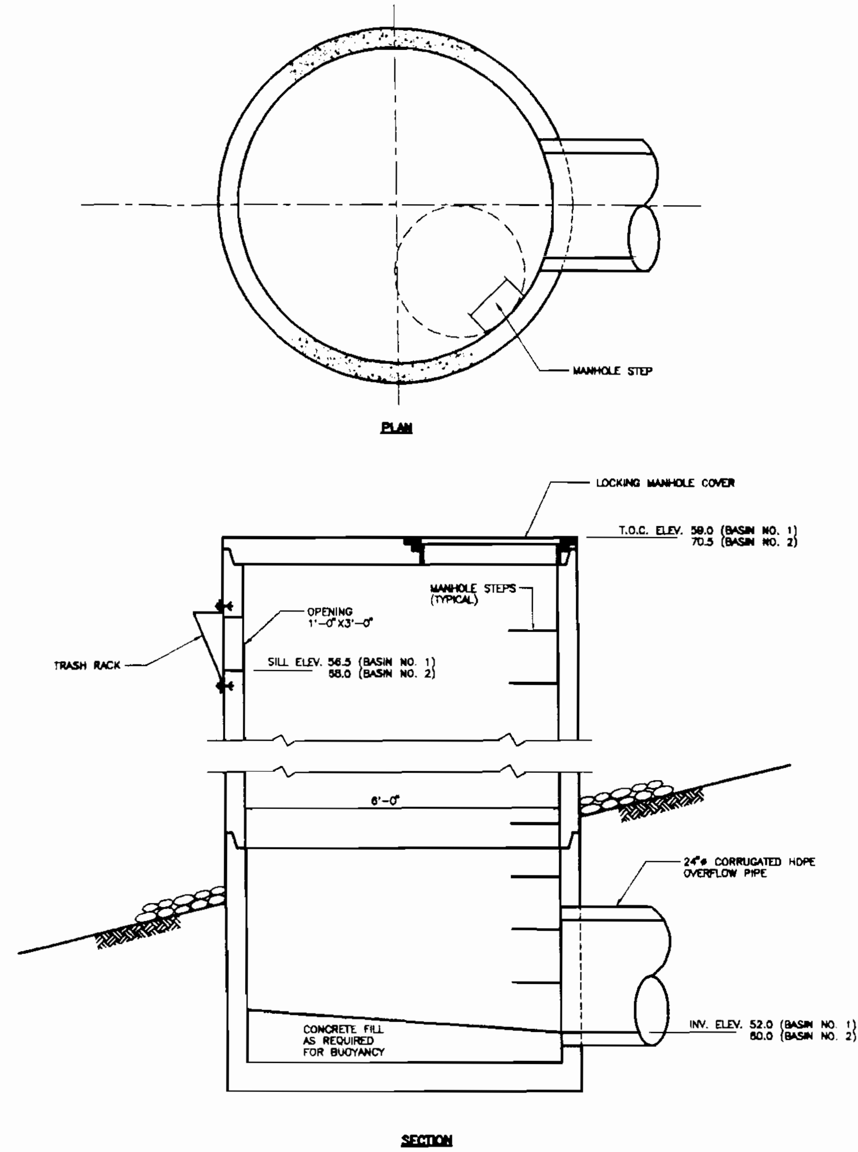
PRESUMPTIVE REMEDY
FINAL CLOSURE PLAN
ISLIP RESOURCE RECOVERY AGENCY
SONIA ROAD LANDFILL

EROSION CONTROL DETAILS



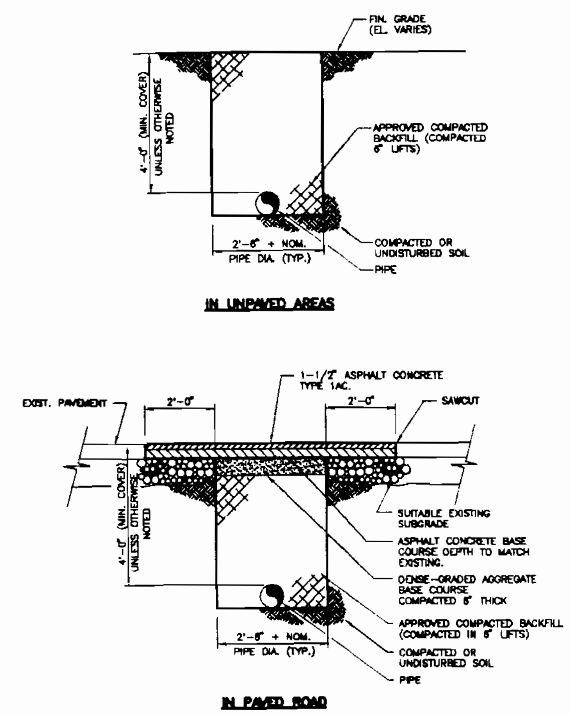
TYPICAL STORMWATER MANHOLE DETAIL

SCALE:3/4"=1'-0"



TYPICAL OVERFLOW STRUCTURE DETAIL

SCALE:3/4"=1'-0"



TYPICAL TRENCH SECTIONS

NTS

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MISCELLANEOUS DETAILS