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Final Feasibility Study Report

# Urbana Landfill
# Town Of Urbana, New York

**NYSDEC Site #8-51-007**
**Work Assignment #D002925-12**

Prepared for:

## New York State
## Department Of Environmental Conservation

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October 1997

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# Executive Summary

Camp Dresser & McKee (CDM) has been retained by the New York State Department of Environmental Conservation (NYSDEC) to prepare this Feasibility Study (FS) Report for the Urbana Landfill under the New York State Superfund Standby Contract (Work Assignment #D002925-12). This FS Report discusses the basis and procedures used in identifying remedial alternatives which address contamination at the Urbana landfill site. The primary purpose of the FS is to provide NYSDEC with sufficient data to select a feasible, cost-effective remedial alternative that protects public health and the environment from the potential risks posed by contamination at the landfill.

Because waste in landfills usually is present in large volumes, and is a heterogeneous mixture of municipal waste frequently co-disposed with industrial and/or hazardous waste, treatment is usually impractical. In such a case, EPA generally considers capping, containment, and collection and treatment of leachate and landfill gas to be the appropriate response action or the "presumptive remedy" for municipal landfill sites (EPA, 1993 ).

Presumptive remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection and EPA/NYSDEC scientific and engineering evaluation of performance data on technology application. Presumptive remedies for municipal landfill sites primarily address containment of the landfill mass, source area control, and collection/treatment of landfill leachate and gas, as required. The use of presumptive remedies speeds up cleanup actions by using the program's past experiences to streamline site investigations.

## Site History

The Urbana Landfill is an inactive landfill located in a rural area northwest of the Village of Hammondsport, Steuben County, New York (Figure 1-1). The landfill, which received municipal and industrial wastes, has been classified by the New York State Department of Environmental Conservation (NYSDEC) as a Class 2 inactive hazardous waste disposal site, indicating that the site poses a significant threat to public health or the environment, and that remedial action is required.

The Urbana Landfill is located in a hilly, rural terrain consisting primarily of farmland and wooded areas. Nearby surface water features include an unnamed stream and a pond and wooded area located just beyond the northern end of the site. The pond is located in a dammed gully, and is approximately 100 feet by 175 feet. It is fed by underground springs and an artesian well, and discharges to the unnamed stream. Its depth is estimated to be a maximum of 10 feet. The pond is used for recreational purposes, and could potentially be used for fishing and swimming.

The landfill itself is on a surface water divide. Most of the site drains to the surrounding fields and forest land, however, the northern and western portion of the site drains directly to the unnamed stream west of the landfill. This stream receives flow from the pond, groundwater discharges, and surface runoff. It flows towards the south for 0.5 miles into Cold Brook, a designated trout stream. Cold Brook eventually flows into Keuka Lake, approximately 1.5 miles south of the landfill.

The landfill site encompasses an area of 20 acres with approximately 13 acres dedicated to waste disposal. The site is bounded on the west by an unnamed stream, on the south by Crows Nest

Road, and by a private residence to the east. The pond is located beyond the northern end of the site. The area surrounding the site is rural terrain consisting of farmland and wooded areas.

The landfill is made up of three distinct elevations or terraces. The upper terrace is relatively flat, encompassing approximately 6 acres, with the western portion of the landfill sloping steeply to the west and northwest to the unnamed stream. The middle terrace is the smallest of the three terraces, encompassing approximately 2 acres. The terrace is relatively flat and the western portion of the middle terrace slopes steeply toward the unnamed stream. The lower terrace covers approximately 5 acres of the landfill. The access road divides the lower terrace into two sections. Because of its lower elevation relative to the stream, the slope along the lower terrace on the western side is less steep than that of the upper and middle terraces.

Groundwater wells and spring water are used for domestic supplies in the area surrounding the landfill. There are at least 3 private wells with depths between 30 and 103 feet within one mile southwest of the site. Southeast of the site, there are 7 residents using private wells or ground water springs as their source of drinking water. There are 3 private wells and one spring used as a private source of water located within 1 mile of the site to the south. One homeowner located within 3/4 of a mile north to northwest of the site also has a private well, and several private wells are located within ½ mile of the site to the north/northeast. Further to the south, the Village of Hammondsport uses water from Keuka Lake for its municipal water supply. The lake receives water from the unnamed stream located just to the west of the landfill.

## Contaminants and Pathways of Concern

During 1997, a Remedial Investigation (RI) was carried out by Camp Dresser & McKee to determine the extent of contamination at the site. Based on results from sampling performed during the RI, the shallow subsurface soils were found to contain some metal concentrations that exceed their respective New York State Standards, Criteria, and Guideline concentrations (NYS SCGs). No Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), or pesticides were detected. In general, the metal concentrations detected in the surface/shallow subsurface samples did not vary significantly between samples and the detected concentrations exceeded their respective background and/or NYS SCGs by less than an order of magnitude.

Subsurface soils and waste in several areas of the landfill are contaminated by VOCs, SVOCs, and Pesticides. The RI identified five areas of elevated VOCs, SVOCs, and pesticides within the confines of the landfill that are considered "Hot Spots" because the concentrations of contaminants are clearly higher in these areas than in other areas of the landfill. The Hot Spots are shown in Figure 1-5 of this report.

Other areas show metal concentrations in the subsurface soils that exceed NYS SCGs. These are most frequently found in the samples from the lower terrace and toe of the western slope. These inorganic compounds included arsenic, beryllium, cadmium, calcium, chromium, copper, lead, manganese, and nickel (it should be noted that the highest concentrations of arsenic and beryllium were detected in the background samples). Magnesium, mercury and zinc also exceeded NYS SCGs in subsurface soil samples from the lower terrace. Zinc concentrations in soil samples from the toe of the western slope exceeded NYS SCGs. Most of these same metals exceeded NYS SCGs in the upper terrace and western portion of the landfill, as well. While the concentration of inorganic constituents were typically the highest in the lower terrace and toe of the slope, as previously mentioned, the overall exceedances of NYS SCGs throughout the site indicate that metal contamination is widespread in the subsurface soils.

Several groundwater samples from monitoring wells located within the landfill or at the site perimeter indicate elevated VOCs that exceeded NYS SCGs. Data indicate that semi-volatiles, pesticides, and heavy metals are generally not present in concentrations that exceed NYS SCGs. The most significant VOCs (with concentrations in excess of 1 part per million) are trichloroethylene, 1,1,1-trichloroethane, and 1,2 dichloroethene. During the second round of sampling , concentrations of trichloroethylene and 1,2 dichloroethene were detected above NYS SCGs in offsite monitoring well MW-202 (approximately 150-feet west of the unnamed stream). Concentrations were 26 and 35 parts per billion (ppb), respectively (NYS SCG = 5.0 ppb).

During the soil gas survey rounds, aromatic compounds, a group of volatile organic compounds including toluene, ethylbenzene, and xylenes, were detected in soil gas samples collected in the former trench areas along the lower terrace. The highest concentration was detected in the vicinity of soil vapor probe A-19 (soil vapor probe locations are shown in Figure 1-5 of this report). PCE was detected approximately 50' north and 100' south of A-19 during the second sampling round. Similar constituents were detected in the middle terrace in the vicinity of soil vapor probe A-16. Chlorinated solvents, including c-1,2-DCE and TCE, and aromatic compounds were also detected on the western side slope, whereas only c-1,2-DCE and TCE were consistently detected in soil vapor probes situated at the toe of the western slope. The highest concentration of chlorinated solvents was detected in soil vapor probe A-32, located in the upper terrace in an area suspected of receiving septic wastes. Both chlorinated solvents and aromatic compounds were detected within a distance of 200' south of A-32. These compounds can all potentially be emitted along with landfill gas (primarily carbon dioxide and methane), as the landfill gas is generated and escapes via the landfill surface. Of the compounds detected, only vinyl chloride, 1,1- dichloroethylene, trichloroethene, 1,2 - dichloroethylene, and benzene are at concentrations high enough to warrant further evaluation.

## Remedial Action Objectives and Presumptive/Applicable Technologies

Remedial Action Objectives (RAOs) consist of medium-specific goals for protecting human health and the environment, and focus on the contaminants of concern, exposure routes and receptors, and an acceptable contaminant level or range of levels for each exposure route. Acceptable contaminant levels are determined by qualitative risk assessment and identification of NYS Standards, Criteria, and Guidelines.

The remedial action objectives established for the Urbana Landfill include:

1. Treat or remove the principal threat posed by the site to groundwater and the potential impacts to down gradient groundwater users.

2. Isolate the landfill waste material in order to provide adequate protection to human health and the environment from direct contact or ingestion of hazardous constituents in wastes or surface soil from the landfill.

3. Prevent infiltration of water through the surface of the landfill and eliminate leachate from contaminating the groundwater and/or surface water.

4. Prevent human contact with, inhalation, or ingestion of the hazardous constituents in groundwater beneath and down gradient of the landfill.

5. Eliminate uncontrolled emissions of landfill gases that could pose a risk to offsite receptors.

Using the presumptive remedy approach, a limited number of media specific remedial technologies, including any identified presumptive remedies, are identified. These are then screened for site specific feasibility, technical implementability, and practicability based on readily available information from the site RI and from similar sites.

The first RAO for this site can be addressed by the removal or treatment of Hot Spots (areas of high VOC, SVOCs, and pesticide contamination) within the landfill. Both in-situ and ex-situ treatment technologies such as soil vapor extraction, bioventing, biopiles, and slurry reactors are potentially applicable, as well as removal and offsite disposal of contaminated soils and waste.

The second RAO for this site can be addressed by the construction of a Part 360 (or modified Part 360) landfill cap. Part 360 is the section of New York State regulations governing solid waste landfills. The cap would isolate the landfill waste material and protect human health and the environment from contact with any contaminants from the landfill. In addition, an upgradient french drain was considered. The drain would be designed to intercept groundwater prior to the landfill, thus, potentially lowering the groundwater table within the landfill. The intent would be to limit the contact of groundwater with contaminated soil or waste material.

The third RAO can be met by careful regrading of the landfill to meet setback requirements for the nearby stream, the consolidation of all waste material within the existing limits of the main part of the landfill, and the placement of a Part 360 cap to eliminate surface infiltration and leachate seeps.

The fourth RAO could be met by restricting use of the affected groundwater in the vicinity of the site. This can be accomplished through one of several institutional control measures, including both well permit and deed restrictions that would eliminate the possibility of drilling new water supply wells in the areas downgradient of the landfill. The objective can also be met by natural dilution and attenuation of the contaminated groundwater as it moves offsite, or by groundwater containment using an interceptor trench and groundwater treatment system.

Finally, the fifth RAO can be met by the installation of a Part 360 landfill cap and passive landfill vents. Landfill vents can either be vented directly to the atmosphere, or connected to a manifold and vented via a single onsite stack. Stack monitoring and subsequent air modeling analysis will be required to determine if individual vents can be used without offsite exceedance of relevant Air Guide-1 Annual Guideline Concentrations (AGCs), or whether vents must be connected to a manifold and vented via a single stack.

## Evaluation of Alternatives

A total of three alternatives for remediation were developed through the screening process. They are:

Alternative 1 -No Further Action, Institutional Controls, and Groundwater Monitoring;

Alternative 2 -Part 360 Landfill Cap and Monitoring of Groundwater;

Alternative 3 -Part 360 Landfill Cap, Soil Vapor Extraction of Hot Spot 5, and Groundwater Monitoring.

### *Alternative 1*

The No Action Alternative, which includes institutional controls, does not treat or reduce the landfill contaminants, but does reduce the potential for human exposure to the contaminants. Long-term groundwater monitoring would track any migration of the contaminants in the future. The institutional controls do not actively reduce the volume or toxicity of the contaminants found at the landfill, but only prevent exposure to contaminants. On the other hand, natural attenuation, dispersion and dilution will decrease the contaminant concentration in the groundwater over time.

Institutional controls are not very labor intensive or difficult to implement. They are technically feasible to implement and delays are not expected. Minimum coordination is expected for agency approvals. Multiple vendors are available to provide competitive bidding. Groundwater monitoring can be readily performed on a quarterly basis using the existing groundwater and private wells.

### *Alternative 2*

Alternative 2 includes the regrading and consolidation of the landfill, design and construction of a Part 360 landfill cap, and sampling of existing groundwater monitoring and private wells. The cap will consist of a geomembrane barrier layer ( a synthetic plastic liner designed to prevent water from passing through it), a geomembrane protection layer (a 24 inch layer of soil designed to protect the geomembrane from damage by frost or root penetration), topsoil (to allow vegetative growth), a gas venting layer (to allow movement of landfill gas towards the vents), and passive gas vents spaced at one per acre of landfill cap.

Since no treatment technologies are included, the 360 cap alternative does not significantly reduce the volume or toxicity of the contaminants found at the landfill. However, the cap will reduce the addition of contaminants to the groundwater, because stormwater will run off the sides of the cap rather than percolating through the landfill waste and contaminating the groundwater. In addition, the cap will reduce the production of leachate in the future, although leachate will still be generated through contact of waste with groundwater. Natural processes, such as attenuation, dispersion and biodegradation will dilute the concentration. The cap will also control air emissions from the landfill. An effective landfill cap with passive landfill gas vents will control the release of volatile compounds and landfill gas, as well as eliminate wind blown contaminated dust particles from the landfill.

The cap construction is a large scale construction project. The cap requires readily available equipment, materials and workers. Agency coordination would be required, but is not expected to be significant. Multiple vendors are available to bid on the project and materials are readily available. If necessary, the installation of additional monitoring wells would be included in the cap construction project. Groundwater monitoring services are also readily available.

### *Alternative 3*

Alternative 3 includes the installation of a Part 360 landfill cap and groundwater monitoring, as discussed in Alternative 2. This alternative also includes the treatment of Hot Spot 5 using soil vapor extraction (SVE).

This alternative reduces the concentration of the landfill contaminants. The Hot Spot soils treated through soil vapor extraction will be reduced to concentrations below applicable standards. Depending on whether the off-gas from the SVE is treated or not, VOCs will either be destroyed or dispersed. The cap will prevent airborne exposure to any remaining contaminants located in the landfill waste mass and prevent the infiltration of storm water, thus reducing the amount of leachate generated. Again, the groundwater will continue to flow through the remaining waste mass and be a potential exposure pathway. Continued monitoring of the groundwater and private wells will provide information on the extent of this exposure.

The equipment, materials and workers to construct the cap are readily available. Multiple vendors/contractors are available to bid on the cap construction. Soil vapor extraction equipment is readily available from several vendors.

## Recommendation of Alternative

Seven criteria (as discussed in The Technical and Administrative Guidance Memorandum) were used to perform a detailed analysis of the remaining three alternatives. These were: compliance with Applicable or Relevant and Appropriate Requirements (ARARs); protection of human health and the environment; short term effectiveness; long term effectiveness and permanence; reduction of toxicity, mobility, or volume; implementability; and cost. The alternatives varied widely in the cost to construct and operate each. Alternative 1 was the least expensive technology, with a present worth cost of approximately $804,000. Alternative 3, which is the only alternative that involves the destruction of waste material, was the most expensive of the three technologies. The present worth cost for this alternative is approximately $6.5 million. The present worth cost for Alternative 2 was approximately $5.8 million.

Alternative 1 was not selected because it does not sufficiently address protection of human health and the environment. Both Alternatives 2 and 3 provided significant protection of human health and the environment, were feasible, and easily implemented. Because Alternative 3 involves the destruction of a significant portion of the contaminated media (SVE of Hot Spot 5) at little additional cost over Alternative 2, Alternative 3 is the recommended alternative for remedial action at the Urbana landfill.

# 1 Section One

Section 1

# Section 1
# Site Characterization

## 1.1 Introduction

Camp Dresser & McKee (CDM) has been retained by the New York State Department of Environmental Conservation to prepare this Feasibility Study (FS) Report for the Urbana Landfill under the New York State Superfund Standby Contract (Work Assignment #D002925-12). This FS Report discusses the basis and procedures used in identifying remedial alternatives which address contamination at the Urbana landfill site. The purpose of the FS is to select a feasible cost-effective remedial alternative that protects public health and the environment from the potential risks posed by contamination in the landfill.

Because waste in landfills usually is present in large volumes and is a heterogeneous mixture of municipal waste frequently co-disposed with industrial and/or hazardous waste, treatment usually is impracticable. In such a case, EPA generally considers capping, containment, and collection and treatment of leachate and landfill gas to be the appropriate response action or the "presumptive remedy" for municipal landfill sites (EPA, 1993 ).

Presumptive remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection and EPA/NYSDEC scientific and engineering evaluation of performance data on technology application. Presumptive remedies for municipal landfill sites primarily address containment of the landfill mass, source area control, and collection/treatment of landfill leachate and gas, as required.

A feasible remedy is one that is suitable to site conditions, capable of being successfully carried out with available technology, and that considers, at a minimum, implementability and cost effectiveness. Because the site under consideration is a landfill, there are numerous, comparable FS reports available with information directly applicable to the Urbana Landfill. This available information can help to speed the process of selecting remedial alternatives by focusing on only the most qualified technologies that apply to the media of concern. The use of presumptive remedy guidance can, in this case, provide an immediate focus to the discussion and selection of alternatives. It can help to speed the process by limiting the number of effective alternatives to those technologies that have been selected in the past at similar sites or for similar contaminants. By evaluating technologies that have been consistently selected at similar sites, a presumption can be developed that a particular remedy or set of remedies is appropriate for this specific type of site.

Using this presumptive remedy approach, a limited number of media specific remedial technologies, including any identified presumptive remedies, are identified. These are then screened for site specific feasibility, technical implementability, and practicability based on readily available information from the site RI and from similar sites. Specific technologies may not be applicable to the treatment of contamination in the concentration and form found at the site, or may be impractical due to site constraints and can be eliminated from further consideration. The remaining technologies can then be assembled into a limited number of site-wide remedial alternatives, which are subsequently subjected to a detailed, comparative evaluation.

Based on the findings of the RI and site information available, application of a presumptive remedy approach was judged appropriate by NYSDEC for the Urbana Landfill site.

Section 1 of this report begins with a description and background of the site and details the nature and extent of the contamination, including potential exposure pathways. The Remedial Action Objectives (RAOs) of this FS are discussed in Section 2. A summary of the technologies investigated for remediation of the air, shallow sub-surface soil, subsurface soils and leachate media at the Urbana Landfill are presented in Section 3, followed by a detailed discussion of the development of the three alternatives in Section 4. Section 5 details a comparative analysis of the three alternatives that were evaluated. Section 6 presents a recommended alternative based on the information contained in the previous sections.

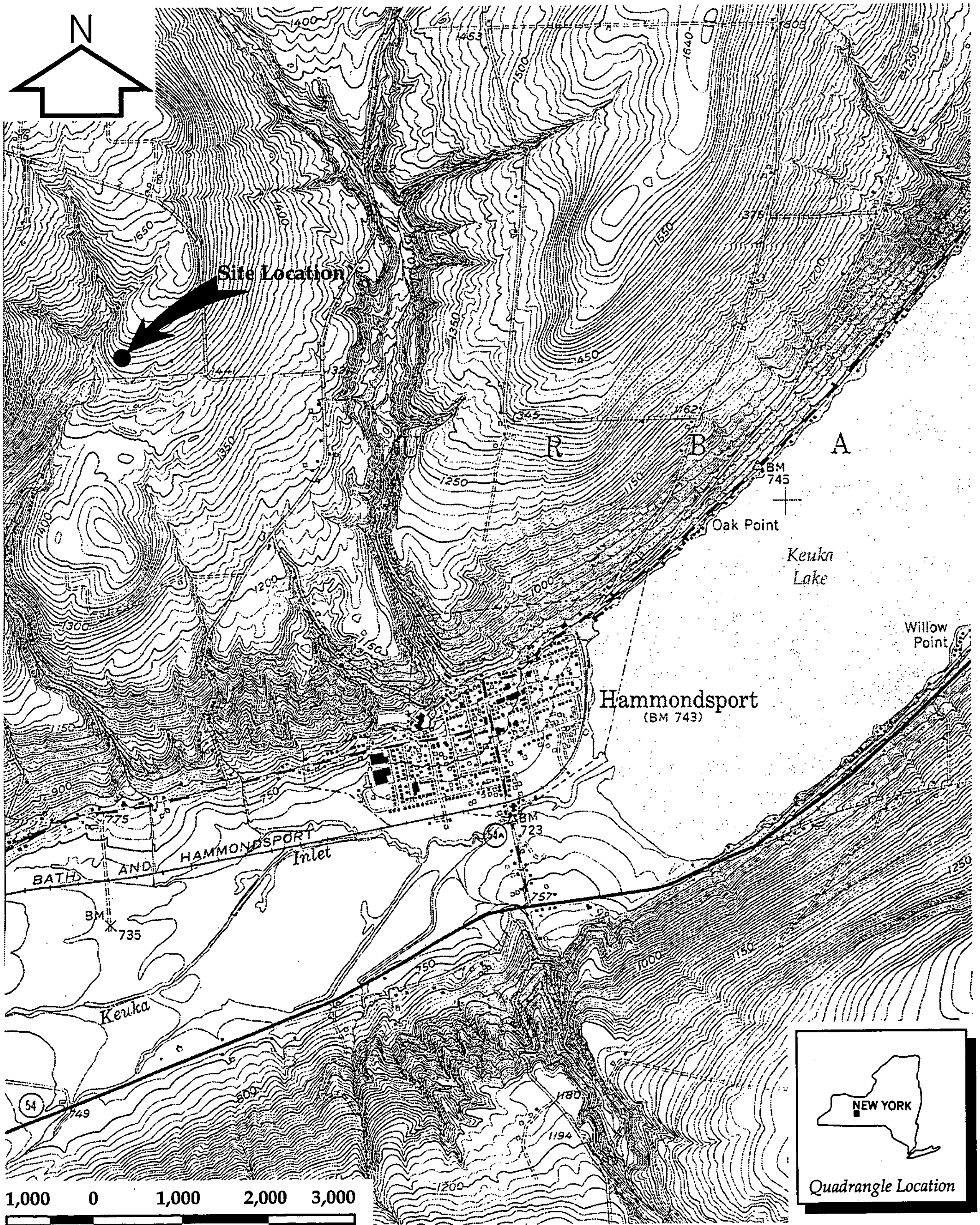
## 1.2 Site Description and Background

The Urbana Landfill is an inactive landfill located in a rural area northwest of the Village of Hammondsport, Steuben County, New York (Figure 1-1). The landfill, which received municipal and industrial wastes, has been classified by the New York State Department of Environmental Conservation (NYSDEC) as a Class 2 inactive hazardous waste disposal site, indicating that the site poses a significant threat to public health or the environment, and that remedial action is required.

The Urbana Landfill is located in a hilly, rural terrain consisting primarily of farmland and wooded areas. Nearby surface water features include an unnamed stream, and a pond and wooded area located just beyond the northern end of the site. The pond is located beyond the northern end of the site in a dammed gully, and is approximately 100 feet by 175 feet in size. It is fed by underground springs and an artesian well, and discharges to the unnamed stream. Its depth is estimated to be a maximum of 10 feet. The pond is used for recreational purposes, and could potentially be used for fishing and swimming.

The landfill itself is on a surface water divide. Most of the site drains to the surrounding fields and forest land, however, the northern and western portion of the site drains directly to the unnamed stream west of the landfill. This stream receives flow from the pond, groundwater discharges and surface runoff, and flows towards the south for 0.5 miles into Cold Brook, a designated trout stream. Cold Brook eventually flows into Keuka Lake, approximately 1.5 miles south of the landfill.

The landfill site encompasses an area of 20 acres, with approximately 13 acres dedicated to waste disposal. The site is bounded on the west by an unnamed stream, on the south by Crows Nest Road, and by a private residence to the east. The landfill is made up of three distinct elevations or terraces. The upper terrace is relatively flat, encompassing approximately 6 acres, with the western portion of the landfill sloping steeply to the west and northwest to the unnamed stream. The middle terrace is the smallest of the three terraces, encompassing approximately 2 acres. The terrace is relatively flat and the western portion of the middle terrace slopes steeply toward the unnamed stream. The lower terrace covers approximately 5 acres of the landfill. The access road divides the lower terrace into two sections. Because of its lower elevation relative to the stream, the slope along the lower terrace on the western side is less steep than that of the upper and middle terraces.




MAP SOURCE: U.S.G.S., Hammondsport, New York Quad, 1953.

**Figure 1-1**
**Location Map**
**Urbana Landfill Feasibility Study**

Groundwater wells and spring water are used for domestic supplies in the area surrounding the landfill. There are at least 3 private wells with depths between 30 and 103 feet within one mile southwest of the site. Southeast of the site, there are 7 residents using private wells or ground water springs as their source of drinking water. There are 3 private wells and one spring used as a private source of water located within 1 mile of the site to the south. One homeowner located within 3/4 of a mile north to northwest of the site also has a private well, and several private wells are located within ½ mile of the site to the north/northeast. Figure 1-2 shows the location of the private wells in relation to the Urbana Landfill. Further to the south, the Village of Hammondsport uses water from Keuka Lake for its municipal water supply. The lake receives water from the unnamed stream located just to the west of the landfill. The hydrogeological setting of the site is characterized by low topography and relatively flat-lying fractured sandstones and shale which are overlain by varying thickness of glacial till. The till is mostly unsorted deposits which may be interbedded with localized deposits of sand and gravel.

## 1.3 Contaminants of Concern

Environmental samples were collected and analyzed during the RI to determine the nature and extent of contamination at the site. Several periods of field sampling took place. One round of sampling occurred in October, 1996, and included 7 surface water samples, 1 leachate sample, 7 sediment samples, and 4 shallow subsurface soil samples. Subsurface soil testing was carried out between August and September 1996. A total of 89 subsurface soil samples were taken, of which 10 samples were selected for laboratory analysis based on soil headspace readings or visible signs of contamination. Two rounds of soil gas surveys were taken, one in June 1996, the second in July 1996. Twenty four successful soil vapor samples were taken in the first round, followed by 26 successful samples during the second round. A total of 24 groundwater samples were collected from 24 newly installed groundwater monitoring wells during the October, 1996 sampling.

Additional sampling occurred during Phase II RI in April, 1997. A total of 28 additional groundwater samples were collected during the Phase II RI. The 28 groundwater samples were collected from the 24 existing and 4 new groundwater monitoring wells. Figure 1-3 shows the location of these wells. Additional surface water (6 surface water samples), leachate (4 leachate samples) and surface soil (4 surface soil samples) samples were obtained during the April, 1997 field sampling.

Sample analysis results for all media are presented in detail in the RI reports, and are not reproduced in this FS report. Only contaminants that have been identified as cause for concern for the environment, or health and human safety, are summarized in this section. Based upon the detected compounds in each medium, a screening process was used to determine the contaminants of concern. All contaminants detected above the relevant New York State Standards, Criteria, and Guidelines (NYS SCGs) in shallow subsurface soil, subsurface soil, and groundwater samples were designated as contaminants of concern. These compounds are listed in Table 1-1 (shallow subsurface soil), Table 1-2 (subsurface soil), and Table 1-3 (groundwater). Since SCGs do not exist for soil gas, all detected compounds in soil gas were preliminarily designated as contaminants of concern due to the eventual emission of soil gas to the atmosphere. Each contaminant was subsequently modeled to assess its potential risk. The risk for each compound was evaluated

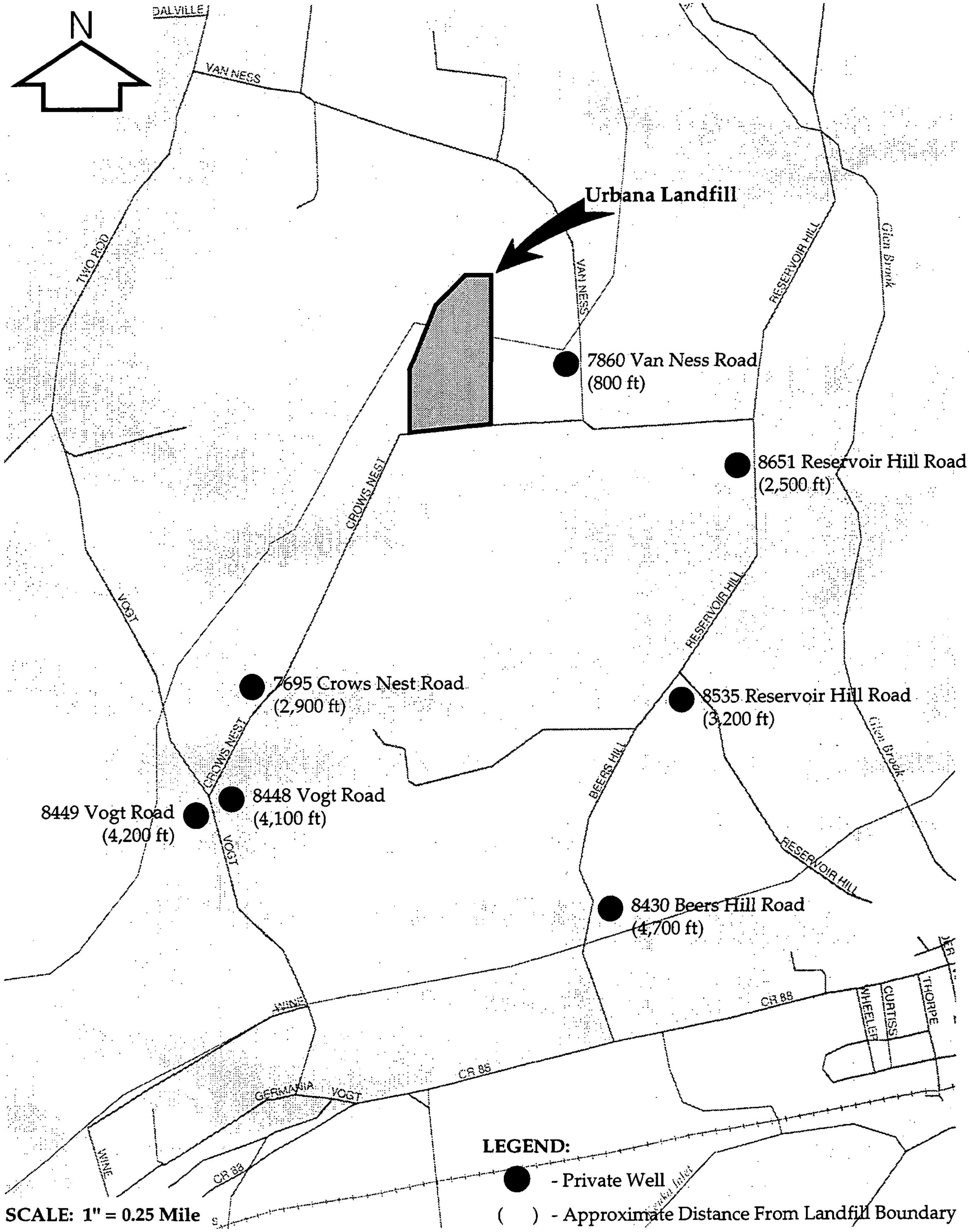



**Figure 1-2**
**Private Well Location Map**
**Urbana Landfill Feasibility Study**

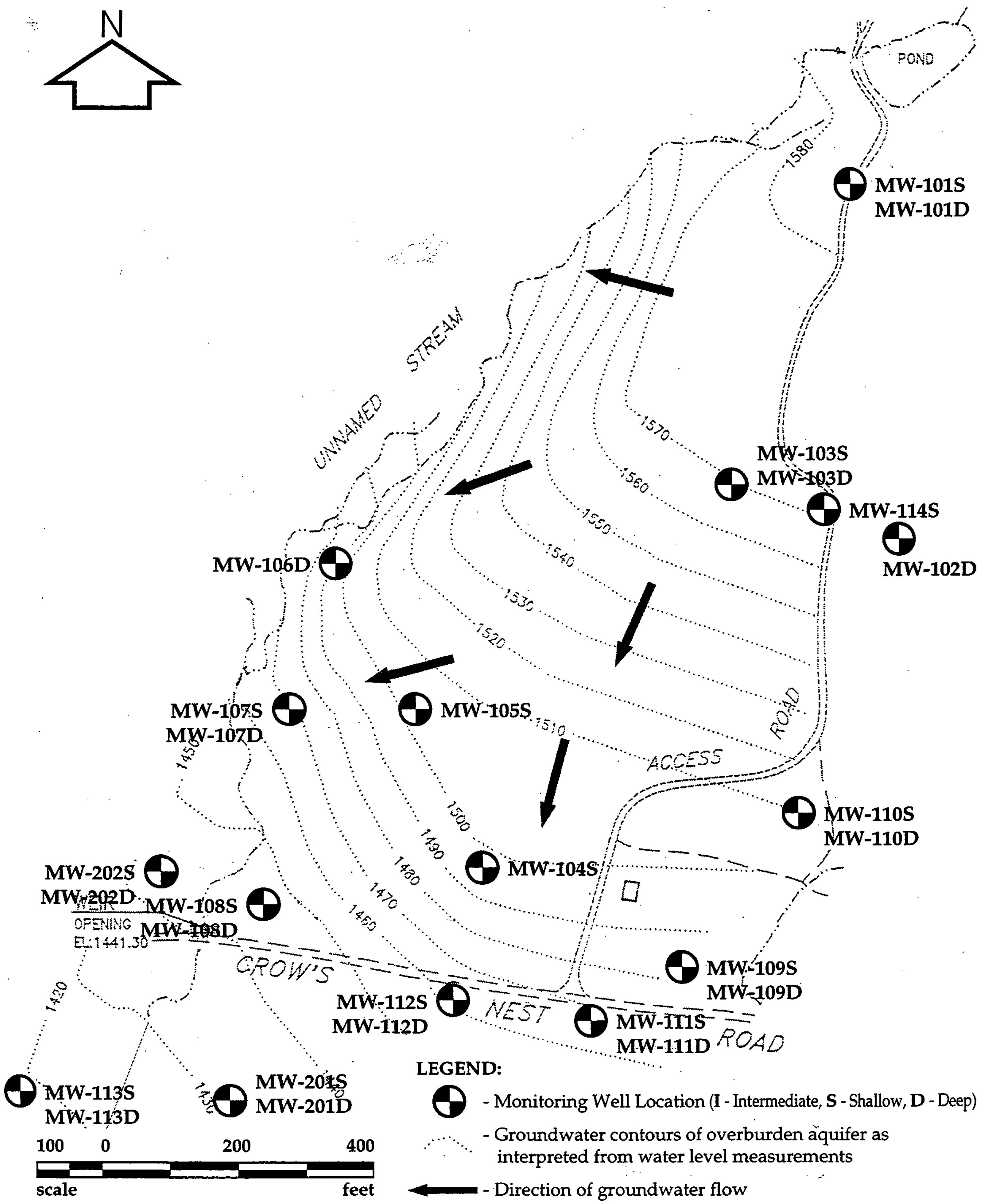



**Figure 1-3**
**Groundwater Monitoring Well Locations**
**Urbana Landfill Feasibility Study**

**Table 1-1**
**Contaminants of Concern in Surface and Shallow- SubSurface Soil**
Urbana Landfill Feasibility Study
Steuben County, NY
NYSDEC Site No. 8-51-007

| Parameter | Range of Detected Concentrations Minimum -Maximum | Location of Maximum Concentration | NYS SCG (1) (2) | Units (3) (4) |
|---|---|---|---|---|
| **Volatile Organics** | | | | ug/kg |
| Acetone | 4 - 9 | SS2 | 0.2 | |
| **Semi Volatiles** | | | | ug/kg |
| bis(2-ethylhexyl)phthalate | 48 - 420 | SS1 | 50 | |
| **Pesticides/PCBs** | | | | ug/kg |
| None | | | | |
| **Inorganics** | | | | mg/kg |
| Arsenic | 4.8 - 9.8 | SS-4 | 7.50 | |
| Beryllium | 0.33 - 0.52 | SS-4 | 0.16 | |
| Chromium | 14.2 - 23 | SS-4 | 10.00 | |
| Lead | 14.2 - 23.8 | SS-4 | 15.1 | |
| Nickel | 17 - 30.5 | SS-4 | 13.00 | |
| Zinc | 63.3 - 81.4 | SS4 | 63.3 | |

Notes:
(1) NYSDEC TAGM, HWR-94-4046, January 24, 1994.
(2) NYSDEC criteria specified in this table is based on soil organic content of 1%.
(3) ug/kg = micrograms per kilogram
(4) mg/kg = milligrams per kilogram

**Table 1-2**
**Contaminants of Concern in Subsurface Soils**
Urbana Landfill Feasibility Study
Steuben County, NY
NYSDEC Site No. 8-51-007

| Parameter | Range of Detected Concentrations Minimum -Maximum | Location of Maximum Concentration | NYS SCG (1) | Units (2) |
|---|---|---|---|---|
| **Volatile Organics** | | | | ug/kg |
| Acetone | 11 - 1,400 | TP-10, 9ft | 200 | |
| Total 1,2 Dichloroethene | 8 - 22,000 | TP-11, 18ft | -- | |
| 2 Butanone | 48 - 890 | TP-10, 9ft | 300 | |
| 1,1,1 Trichloroethane | 1 - 1,800 | TP-10, 9ft | 800 | |
| Trichloroethene | 4 - 15,000 | TP-10, 9ft | 700 | |
| 2-Hexanone | 1,200 | TP-11, 18ft | -- | |
| Toluene | 2 - 12,000 | TP-11, 18ft | 1,500 | |
| Total Xylenes | 660 - 14,000 | TP-11, 18ft | 1,200 | |
| Bromomethane | 2J | MW 110, 10ft | -- | |
| **BNAs** | | | | ug/kg |
| bis (2-ethylhexyl) phthalate | 22 - 110,000 | MW 104, 10ft | 50,000 | |
| **Pesticides/PCBs** | | | | ug/kg |
| Aldrin | 280J | MW 104, 10ft | 41 | |
| Heptachlor Epoxide | 97J | MW 104 | 20 | |
| alpha Chlordane | 210J | MW 104 | -- | |
| Arochlor 1248 | 15,000 | MW 104 | -- | |
| Arochlor 1260 | 1,300 | MW 104 | -- | |

Notes:
(1) NYSDEC TAGM, HWR-94-4046, January 24, 1994.
(2) ug/kg = microgram/kilogram
J = estimated

## Table 1-3
## Contaminants of Concern in Groundwater
Urbana Landfill Feasibility Study
Steuben County, NY
NYSDEC Site No. 8-51-007

| Parameter | Range of Detected Concentrations Minimum -Maximum | Location of Maximum Concentration (1) (2) | NYS DEC Criteria (3) | Units (4) |
|---|---|---|---|---|
| **Volatile organics** | | | | ug/l |
| Vinyl Chloride | 8 -150 | MW107S | 2.0 | |
| Chloroethane | 17 | MW103D | 5.0 | |
| 1,1 Dichloroethene | 2 - 590 | MW103S | 5.0 | |
| 1,1 Dichloroethane | 91 -170 | MW103S | 5.0 | |
| 1,2 Dichloroethene | 27 -1200 | MW103S | 5.0 | |
| 1,1,1 Trichloroethane | 4 - 3900 | MW103S | 5.0 | |
| Trichloroethylene | 14 - 3600 | MW103S | 5.0 | |
| Benzene | 4 - 12 | MW104S | 0.7 | |
| Tetrachloroethene | 20 | MW107S | 5.0 | |
| Toluene | 10 | MW104S | 5.0 | |
| Styrene | 17 | MW107S | 5.0 | |
| Xylene (Total) | 150 | MW104S | 5.0 | |
| **Semi-Volatile Organics** | | | | ug/l |
| 4-Methylphenol | 52 | MW104S | 50 | |
| 2,4 Dimethylphenol | 1 | MW107D | -- | |
| **Pesticides/PCBs** | | | | |
| None | | | | |
| **Inorganics** | | | | ug/l |
| Antimony | 3.4 | MW113S | 3.0 | |
| Lead | 1.5 - 71.1 | MW104S | 25 | |
| Manganese | 2.2 -9690 | MW114S | 300 | |
| Thallium | 7.3 | MW114S | 4.0 | |

Note:
(1) MW107S = monitoring well 107, shallow sample
(2) MW103D = monitoring well 103, deep sample
(3) NYSDEC Division of Water, Technical and Operational Guidance Series (TOGS) 1.1.1/Ambient Water Quality Standards and Guidance Values, November 15, 1991, and 1.1.2/Groundwater Effluent Limitations, August 1, 1994.
(4) ug/l = micrograms per liter

**Table 1-4**
**Contaminants of Concern in Soil Gas** *
Urbana Landfill Feasibility Study
Steuben County, NY
NYSDEC Site No. 8-51-007

| Parameter | Range of Detected Concentrations Minimum -Maximum | Location of Maximum Concentration | Units |
|---|---|---|---|
| Vinyl chloride | 11,539 | B-14 | ppbv/v |
| Chloroethane | 580 | A-16 | |
| 1,1 Dichloroethene | 10 - 8928 | A-32 | |
| 1,1 Dichloroethane | 29 -75 | B-13 | |
| 1,2 Dichloroethene | 22 - 9,200 | B-2 | |
| 1,1,1 Trichloroethane | 6,307 -21,624 | A-32 | |
| Trichloroethene | 5 - 38,452 | A-32 | |
| Tetrachloroethene | 6 - 30 | A-18 | |
| Benzene | 26 -111 | A-20 | |
| Toluene | 16 - 965 | B-14 | |
| Chlorobenzene | 24 - 619 | B-7 | |
| Ethylbenzene | 14 - 1245 | A-19 | |
| m&p Xylene | 9 -33,964 | A-19 | |
| o Xylene | 14 - 294 | A-19 | |
| 1,3,5 trimethylbenzene | 13 | A-16 | |
| 1,2,4 trimethylbenzene | 31-120 | A-16 | |
| 1,4 Dichlorobenzene | 51 | A-16 | |
| Freon 12 | 47 -51 | A-3 | |
| Freon 11 | 150 | B-2 | |
| Freon 113 | 370 | A-32 | |
| Methylene chloride | 200 | B-2 | |

* Selected for inclusion in an air pathway risk assessment
ppbv/v = parts per billion measured as volume

assuming soil gas is released to the atmosphere. These contaminants are listed in Table 1-4. Detected compounds in the surface water and sediment of the adjacent unnamed stream were not included in the contaminants of concern list, because contaminants in these media did not exceed their respective NYS SCGs during either round of sampling.

Table 1-1 shows that shallow subsurface soil contains some metal concentrations that exceed their respective NYS SCGs. This list of metals represent the contaminants of concern for the shallow subsurface soils. Acetone, a volatile organic compound (VOC), and bis(2-ethylhexyl)phthalate, a semi-volatile organic compound (SVOC), were detected at concentrations that exceed NYSSCGs. The areal extent of this contamination is minimal. No pesticides were detected within the shallow subsurface soils. In general, the metal concentrations detected in the surface/shallow subsurface samples did not vary significantly between samples, and the detected concentrations exceeded their respective background and/or NYS SCGs by less than an order of magnitude.

Table 1-2 indicates that subsurface soils and waste in several areas of the landfill are contaminated by VOCs, SVOCs, and pesticides. Metal concentrations in the subsurface soils exceeded NYS SCGs most frequently in the samples from the lower terrace and toe of the western slope. These inorganic compounds included arsenic, beryllium, cadmium, calcium, chromium, copper, lead, manganese, and nickel (it should be noted that the highest concentrations of arsenic and beryllium were detected in the background samples). Magnesium, mercury and zinc also exceeded NYS SCGs in subsurface soil samples from the lower terrace, and zinc concentrations in soil samples from the toe of the western slope exceeded NYS SCGs. The concentration of most of these same metals exceeded NYS SCGs in the upper terrace and western portion of the landfill, as well. While the concentration of inorganic constituents were typically the highest in the lower terrace and toe of the slope, the overall exceedances of NYS SCGs throughout the site indicate that metal contamination is widespread in the subsurface soils. As defined previously in the RI report, the areas with highest NYS SCG exceedances and frequency of NYS SCG exceedances were defined as Hot Spots. There have been five subsurface areas defined as Hot Spots. The delineation of the Hot Spots, which was also based on soil vapor values, will be discussed in more detail in section 3.3.

Table 1-3 summarizes the results of the groundwater samples from monitoring wells located within the landfill or at the site perimeter. Figure 1-3 shows the location of the groundwater monitoring wells, the groundwater contours, and the general direction of groundwater flow in the overburden materials. Several wells indicate elevated VOCs that exceeded NYS SCGs. Data indicate that semi-volatiles, pesticides, and heavy metals are generally not present in concentrations that exceed NYS SCGs. The VOCs with concentrations in excess of 1 part per million are trichloroethylene, 1,1,1-trichloroethane, and 1,2 dichloroethene.

Table 1-4 lists all the compounds detected during the soil gas survey rounds. Aromatic compounds, including toluene, ethylbenzene, and xylenes, were detected in soil gas samples collected in the former trench areas along the lower terrace. The highest concentration was detected in the vicinity of soil vapor probe A-19. PCE was detected approximately 50 feet north and 100 feet south of A-19 during the second sampling round. Similar constituents were detected in the middle terrace in the vicinity of soil vapor probe A-16. Chlorinated solvents, including c-1,2-DCE and TCE, and aromatic compounds were also detected on the western side slope, whereas only c-1,2-DCE and TCE were consistently detected in soil vapor probes situated at the toe of the western slope. The highest concentration of chlorinated solvents was detected in soil vapor probe A-32, located in the upper terrace in an area suspected of receiving septic wastes. Both chlorinated solvents and aromatic compounds were detected within a distance of 200 feet south of A-32. These compounds can all potentially be emitted along with the landfill gas (primarily carbon dioxide and methane), which is generated as the waste decomposes and escapes via the landfill surface. Of the compounds detected, it was determined during the RI evaluation that only vinyl chloride, 1,1-dichloroethylene, trichloroethane, 1,2 -dichloroethylene, and benzene are at concentrations high enough to warrant further evaluation. As discussed in the RI Report for the Urbana Landfill, the risk is considered unacceptable if the concentration limits that define a risk are exceeded at the exposure point.

## 1.4 Nature and Extent of Contamination

The following provides a brief summary of the nature and extent of contamination. A more detailed description is contained in the RI report. Figure 1-4 provides a site plan of the existing landfill.

### *Soil Gas*

Aromatic compounds, including toluene, ethylbenzene, and xylenes, were detected in soil gas samples collected in the former trench areas along the lower terrace. Figure 1-5 shows the locations of the soil vapor probes and other sampling locations. The highest concentration was detected in the vicinity of soil vapor probe A-19. PCE was detected approximately 50 feet north and 100 feet south of A-19 during the second sampling round. Similar constituents were detected in the middle terrace in the vicinity of soil vapor probe A-16 and the perimeter probe PP-7. Chlorinated solvents, including c-1,2-DCE and TCE, and aromatic compounds were also detected on the western side slope, whereas only c-1,2-DCE and TCE were consistently detected in soil vapor probes situated at the toe of the western slope. The highest concentration of chlorinated solvents was detected in soil vapor probe A-32, located in the upper terrace in an area suspected of receiving septic wastes. Both chlorinated solvents and aromatic compounds were detected within a distance of 200 feet south of A-32.

Based upon a landfill gas generation model developed by CDM, gas generation in 1996 was estimated at 4 million cubic feet per year. Gas generation is projected to decrease to 1 million cubic feet per year by the year 2021.

### *Test Pits*

Eleven test pits were excavated as part of the RI. While soil and waste samples collected from the test pits did not exhibit hazardous waste characteristics, volatile organics were detected in six samples. Soil and waste samples collected from the upper terrace and toe of the western slope reveal similar contaminants as those detected in the soil vapor probes within the same area of the landfill.

## Surface/Shallow Subsurface Soils

Volatile organic contaminants were not detected in surface/shallow subsurface samples from the landfill. However, the concentration of several metals exceeded background levels and/or NYS SCGs. Contaminants detected most frequently included beryllium, calcium, chromium, iron, magnesium, manganese, nickel and zinc. Background concentrations of beryllium, chromium and nickel, however, also exceeded NYS SCGs. Aluminum, arsenic, and lead were also detected in one or both of the surface/shallow subsurface samples from the middle terrace, but were not detected in the lower terrace. In general, the metal concentrations detected in the surface/shallow subsurface samples did not vary significantly between samples, and the detected concentrations exceeded their respective background and/or NYS SCGs by less than an order of magnitude.

## Subsurface Soils

Xylenes were the only volatile organic compounds detected in subsurface soils at the site. Xylenes were detected in one sample from the lower terrace (MW-104S), and from the western portion of the landfill (MW-105S). One semi-volatile, bis(2-ethylhexylphthalate), several pesticides, and PCBs were also detected in the same sample (MW-104S) collected from the lower terrace. Figure 1-3 shows the locations of the monitoring wells where subsurface soil samples were taken.

Metal concentrations in the subsurface soils exceeded NYS SCGs most frequently in the samples from the lower terrace and toe of the western slope. These inorganic compounds included arsenic, beryllium, cadmium, calcium, chromium, copper, lead, manganese, and nickel (it should be noted that the highest concentrations of arsenic and beryllium were detected in the background samples). Magnesium, mercury and zinc also exceeded NYS SCGs in subsurface soil samples from the lower terrace, and zinc concentrations in soil samples from the toe of the western slope exceeded NYS SCGs. The concentration of most of these same metals also exceeded NYS SCGs in the upper terrace and western portion of the landfill. While the concentration of inorganic constituents were typically the greatest in the lower terrace and toe of the slope, the overall exceedances of NYS SCGs throughout the site indicate that metal contamination is widespread in the subsurface soils.

## Groundwater

Volatile organics, specifically chlorinated solvents, were detected in groundwater samples in shallow and deep wells situated within the upper terrace. Similar chlorinated solvents, were detected at lower concentrations, but above the NYS SCGs, in the shallow and deep wells located at the toe of the western slope. The aromatic compound, styrene, was also detected in a shallow well located at the toe of the western slope. Aromatic compounds, benzene, toluene, and xylenes, were detected in a shallow well situated in the lower terrace, in addition to one semi-volatile, 4-methylphenol. TCE was the only volatile organic compound detected above NYS SCGs in a shallow well located in the western portion of the site. The distribution of organic contamination in the groundwater supports earlier findings that the upper terrace represents the primary potential source area of chlorinated solvents and the lower terrace represents the primary potential source area of aromatic compounds.

Metals, principally calcium, cobalt, manganese, and nickel exceed the background concentration or NYS SCG in wells located in the lower and upper terraces, toe of the western slope, western portion of the landfill, and off-site. The concentrations of most metals are typically the highest in shallow ground water samples from the upper terrace and in shallow and deep wells from the lower terrace. Aluminum, antimony, and magnesium exceeded background and/or NYS SCGs only in shallow wells of the lower terrace. Thallium was detected in only one shallow well of the upper terrace at a concentration exceeding the NYS SCG.

While several metals exceeded background concentrations and/or NYS SCGs, the metal of most concern in the ground water is nickel, due to the elevated concentrations relative to that of the background sample.

Results from round two of the sampling performed as part of the RI report, conducted in April 1997, indicate that offsite wells (MW-201 and MW 202) contained the following contaminants; metal concentrations for MW-201 were above SCGs or background metal concentrations, for the following parameters: aluminum, calcium, chromium, cobalt, iron, manganese, nickel, potassium and vanadium. The metal concentrations are considered typical for most of the parameters except for nickel, which was found at a concentration of 90.7 ug/l, compared to a background concentration of approximately 15 ug/l. Concentrations of these metals were again higher in the shallow ground water samples than those from the deep well. The results of the groundwater sampling showed that MW-202, which is northwest of MW-201, has lower metal concentrations than the MW-201. Aluminum, cobalt, manganese and cobalt were the only parameters that exceeded SCGs and/or background conditions. Groundwater results showed that MW-202 did exceed SCGs for 1,2 dichloroethene (35 ug/l) and trichloroethene (26 ug/l) in the shallow groundwater sampling results.

### *Leachate*

One leachate sample was collected on the east side of the landfill along the slope of the middle terrace. No organic compounds were detected in the leachate sample. Iron (2,440 J ug/l) was the only inorganic compound that exceeded the NYS SCG, and the concentration of calcium (51,700 ug/l) exceeded that of the background sample (MW101S/D). Water quality parameters, specifically alkalinity and total hardness, exceeded the NYS SCG.

Results from round two of the sampling show that the leachate sample collected from LE-2 has metal concentrations exceeding SCGs and/or background conditions for the following parameters: calcium, cobalt, iron, manganese, potassium and thallium. The majority of these exceedances are high enough to indicate some possible influence from the landfill. In addition, acetone (50 ug/l) was also found at this sampling location.

### *Surface Water and Sediment*

Volatile organic contaminants were detected in surface water in trace concentrations from the adjacent unnamed stream located west of the landfill. The two VOCs detected in the surface water were 1,2-DCE and TCE. Surface water sample SW-5 is the farthest downstream sample point from the landfill and exhibited the highest concentration. The VOC concentrations were 8 ug/l and

2 ug/l for 1,2 DCE and TCE, respectively. Neither of these concentrations exceed the surface water SCGs.

The sediment samples , with the exception of sediment sample SD-1 located southwest of the site, in which acetone was detected, also reported no exceedance of SCGs. Results from the second round of inorganic surface water sampling show no significant difference between upstream water quality and the four downstream sample locations. This suggests only minimal discharge of landfill leachate impacted groundwater to the unnamed creek. No heavy metals such as cadmium, chromium, lead, mercury or selenium were detected at concentrations above the surface water SCGs.

Inorganic analysis of surface water sample SW-7 suggests leachate-impacted groundwater is being discharged to the small drainage swale southeast of the site, adjacent to Crows Nest Road. The concentrations of iron, magnesium, calcium and potassium are approximately twice the background sample, SW-1. The concentration of metals in the sediments of the unnamed stream showed a slight increase in concentration from the upstream samples to those collected south of Crow's Nest Road.

### *Hot Spots*

Five areas of elevated VOCs, SVOCs, and pesticides in soils and waste samples from within the landfill have been identified during the RI and were designated as Hot Spots. These Hot Spots are delineated in Figure 1-5 and described in greater detail in Section 3.3.

Hot Spot 1 is located in the vicinity of MW-105. The major contaminants in soil or waste samples from this Hot Spot are VOCs (xylenes) and metals (arsenic, beryllium, chromium). The depth of the contaminated media is between 10 to 20 feet.

Hot Spot 2 is located in the area surrounding MW-104. The major contamination in soil or waste samples from this Hot Spot consists of VOCs (xylenes), SVOCs, pesticides (Aldrin, Heptachlor and Chlordane), PCBs and metals (arsenic, cadmium, chromium, lead). The approximate depth of the contaminated media is between 4 to 6 feet for the VOCs, and 6 to 10 feet for all other contaminants.

Hot Spot 3 is located in the area surrounding TP-11. The major contamination in soil or waste samples from this Hot Spot consists of VOCs (xylenes, toluene, etc.). The approximate depth of the contaminated media is between 18 to 20 feet.

Hot Spot 4 is located in the area surrounding soil vapor Probe A-19. The major contamination in this Hot Spot consists of VOCs (xylenes, ethylbenzene, toluene, etc.). The approximate depth of the contaminated media is between 0 to 5 feet.

Hot Spot 5 is located in the area surrounding soil vapor Probe A-32. The major contamination in this Hot Spot consists of chlorinated VOCs (TCE, 1,1,1-TCA, 1-1-DCE). The approximate depth of the contaminated media is between 0 to 5 feet.

# 1.5 Fate and Transport

The primary sources of contamination at the Urbana Landfill are chemical contaminants which have been detected in isolated areas (Hot Spots) as indicated in the RI report. The focus of this FS is the fate and transport of the identified contaminants in various media including air, groundwater, surface water, sediment and surface soils. Potential migration pathways may include:

- migration of chemical contaminants from soil (dust and volatilization) and landfill gas potentially to the air
- leaching of chemical contaminants from waste and soils into underlying groundwater
- transport of chemical contaminants to surface water and sediments via surface runoff
- transport of chemical contaminants from groundwater or leachate into surface water

Sections 4 and 5 of the RI Report present the analytical data and evaluate the extent of contamination in the various media. A more detailed discussion of the conceptual contaminant transport can be found in the RI Report, dated March 1997.

## *1.5.1 Air*

Landfill chemical contaminants could migrate into the air through volatilization, the generation and movement of landfill gas, or entrainment in fugitive dusts. The contaminants are then transported by air and wind and are subject to inhalation by onsite and offsite human receptors. Dust particles which have been transported by the wind may also be ingested.

The Urbana Landfill has a mixture of chemical, municipal and sanitary wastes. Landfill gases, created through the decomposition of waste, may contain toxic vapors. The gases pass through the waste accelerating the volatilization of the chemical contaminants. As discussed in the RI Report, a landfill gas generation model indicates that an estimated 4 million cubic feet per year of landfill gas is still being generated as of 1996.

## *1.5.2 Groundwater*

Due to the shallow depth to groundwater throughout the landfill, the leaching of chemical contaminants into the underlying groundwater represents a potentially important contaminant pathway. The groundwater at the site has been contaminated either through infiltration of rain water from the surface or directly by groundwater flowing through the contaminated wastes.

Groundwater contamination was detected in several monitoring wells at the site, and sampling results from round two indicate that contaminants in the groundwater are reaching monitoring wells downgradient of the site (MW-201 and MW-202). Private well testing has shown no evidence of contamination, but due to the uncertainty of groundwater flow direction in the local bedrock aquifer, the potential for contaminated groundwater to be transported offsite both to surface water bodies (unnamed stream) and water supply wells must be considered. A groundwater monitoring program will be initiated to further study and evaluate the potential impacts to the groundwater in the vicinity of the site.

### 1.5.3 Surface Water

Currently, surface water contamination may result via two pathways:

- transport of surface water runoff from the landfill itself into the unnamed stream
- contact with contaminated groundwater or leachate.

Surface water runoff from the northern and western portions of the landfill currently drain into the unnamed stream. As indicated in the RI Report, concentrations of inorganic compounds detected in surface/shallow subsurface soil samples that exceeded the NYSSCGs were similar to those found in sediment samples taken in the unnamed stream. This indicates that surface runoff from the landfill must be considered as a potential contaminant pathway.

The RI Report indicated that groundwater in both the overburden and bedrock aquifers (See Figure 1-3) beneath the landfill generally flow to the south and southwest, and that groundwater in the bedrock aquifer also discharges to the unnamed stream. Results of the second round of sampling, performed in April 1997, indicate that the groundwater beneath the landfill and leachate are impacting the water quality in the unnamed stream west of the site. Once the surface water bodies are contaminated by either runoff from the landfill or through discharge of contaminated groundwater, they become a potential pathway for contamination to downgradient water supply wells and other surface water bodies.

## 1.6 Risk Evaluation

A qualitative evaluation of the potential risks and hazards to human health from the Urbana landfill was presented in Section 6 of the RI report. Table 1-5 is reproduced here from the RI report to summarize potential risks for outside ambient air, indoor air, groundwater, surface/shallow subsurface soil, and surface water. The table indicates some potential risk for each medium.

In this FS report, the risk assessment presented in the RI has been updated for the air pathway. This was done to assess the effect on the risk via the air pathway after capping the landfill and installing landfill gas vents.

As described in the RI, the uncapped landfill poses a potential risk due to VOC air contamination. The pathways by which these contaminants pose a threat to offsite receptors consist of a source and mechanism of chemical release, a transport medium, an exposure point or point of potential human contact with the contaminated medium, and an exposure route (such as ingestion) at the contact point.

Volatile organic compounds at this site are generated because of the presence of chemical/industrial waste material co-disposed with municipal solid waste in the landfill. Volatilization of VOC

# Table 1-5
## Potential Risk Characterization

Urbana Landfill Remedial Investigation / Feasibility Study
Steuben County, NY
NYSDEC Site No. 8-51-007
July 1997

| Media | Receptor Population | Exposure Route | Contaminant | Receptor (Conc.) | Risk (Conc.) | AirGuide1 (AGC) | Unacceptable Risk |
|---|---|---|---|---|---|---|---|
| | | | | ( ug/m$^3$) | ( ug/m$^3$) | ( ug/m$^3$) | |
| Air | Offsite Residents | Inhalation | Vinyl chloride | 1.87 | 0.021 | 0.02 | Yes |
| | | | 1,1 Dichloroethene | 2.24 | 0.036 | 0.02 | Yes |
| | | | Trichloroethene | 13.1 | 1 | 0.45 | Yes |
| | | | 1,2 Dichloroethene | 2.31 | 33 | 1900 | No |
| | | | 111 trichloroethane | 7.48 | 1000 | 1000 | No |
| | | | Chlorobenzene | 0.18 | 21 | 20 | No |
| | | | Benzene | 0.022 | 0.22 | 0.12 | No |
| | | | m&p Xylene | 9.36 | 310 | 300 | No |
| | | | Methylene Chloride | 0.044 | 3.8 | 27 | No |
| | | | Tetrachloroethene | 0.013 | 3.1 | 0.075 | No |
| | | | | (ug/l) | (ug/l) | | |
| Groundwater | Offsite Residents | Ingestion Inhalation | Vinyl Chloride | 150 | 0.019 | | Yes |
| | | | 1,1 Dichloroethene | 590 | 0.044 | | Yes |
| | | | 1,1 Dichloroethane | 170 | 810 | | Yes |
| | | | 1,2 Dichloroethene | 1200 | 55 | | Yes |
| | | | 1,1,1 Trichloroethane | 3900 | 1300 | | Yes |
| | | | Trichloroethylene | 3600 | 1.6 | | Yes |
| | | | Benzene | 12 | 0.36 | | Yes |
| | | | Arsenic | 7.2 | 0.045 | | Yes |
| | | | Cadmium | 1.9 | 18 | | No |
| | | | Chromium | 20.5 | 180(VI) | | No |
| | | | Lead | 71.1 | 15 | | Yes |
| | | | Manganese | 9690 | 180 | | Yes |
| | | | | (ug/kg) | (ug/kg) | | |
| Surface/Shallow Subsurface Soil | Offsite Residents | Ingestion Inhalation | Dieldrin | 14 | 40 | | No |
| | | | 4,4,DDE | 15 | 1900 | | No |
| | | | 4,4,DDT | 12 | 1900 | | No |
| | | | Arsenic | 9800 | 430 | | Yes |
| | | | Beryllium | 520 | 150 | | Yes |
| | | | Cadmium | 210 | 39000 | | No |
| | | | Lead | 23800 | NA | | *NA* |
| | | | Selenium | 670 | 390000 | | No |
| | | | Thallium | 850 | 6300 | | No |
| | | | | (ug/l) | (ug/l) | | |
| Surface Water | Offsite Residents | Ingestion Inhalation | 1,2 Dichloroethene | 8 | 0.044 | | Yes |
| | | | Manganese | 214 | 180 | | Yes |
| | | | Lead | 2.8 | 15 | | No |
| | | | Chromium | 1.4 | 180 | | No |
| | | | Selenium | 3,3 | 180 | | No |
| | | | Vanadium | 2.9 | 260 | | No |

AirGuide1 = Guidelines for the Control of Toxic Ambient Air Contaminants contaminant compounds and subsequent movement of these compounds through the soil system are the major transport mechanisms and mediums for the contaminants.

In the initial analysis of the air pathway presented in the RI Report, dated March , 1997, vinyl chloride, 1,1 dichloroethylene, trichloroethane, 1,2 dichloroethylene, and benzene were considered potential health risks at the site due to uncontrolled emissions from the landfill surface. Application of a landfill cap, however, will control gas emissions by the installation of passive gas vents, and potentially reduce the risk. Therefore, a preliminary screening model run was performed using the USEPA SCREEN3 Air Dispersion model to assess whether additional remedial approaches for the air pathway will be needed following the installation of the cap. To perform the air modeling analysis, the landfill was divided into segments as follows:

- Toe of Western Slope (15 percent of total landfill area)
- Western Side Slope (15 percent of total landfill area)
- Lower Terrace (10 percent of total landfill area)
- Upper Terrace (40 percent of total landfill area)

Each landfill segment represents a landfill gas source area with varying concentrations of VOCs, based on soil gas results taken at the landfill.

The highest soil gas reading for each of the contaminants for each landfill section was input into the USEPA SCREEN3 model, and two scenarios were tested. The first scenario modeled uncontrolled releases from individual passive vents. In this scenario, a potential health risk at the site boundary was identified due to emission from the vents located on the upper terrace where maximum contaminant levels have been identified. The second scenario modeled the situation where all the vents are connected to a manifold, and passive venting of landfill gas occurs from a single stack, located onsite. This arrangement dilutes the contaminant concentrations, and provides for greater dispersion. In the second scenario, no potential health risks were identified.

Ingestion of groundwater and surface water, and ingestion or inhalation of surface/shallow subsurface soil and subsurface soil were also identified as unacceptable risks to current and future residents of the landfill site. Contaminants of concern for these pathways include the previously listed VOCs and 1,1,1 trichloroethane, trichloroethylene, 1,1 dichloroethane, and arsenic for groundwater, and 1,2 dichloroethene and manganese for surface water.

VOCs in these media and heavy metals become mobile through movement from groundwater to surface water (and vice versa). Contaminants are also sorbed onto soil particles. Routes of human exposure include inhalation or ingestion of wind borne dust, dirt and water (aerosol) particles and ingestion of water from residential groundwater wells.

## 1.7 Applicable or Relevant and Appropriate Requirements and New York State Standards, Criteria, and Guidelines (ARARs/SCGs)

The NYSDEC Technical Assistance Guidance Manual (TAGM), "Selection of Remedial Action Alternatives at Inactive Hazardous Waste Sites", requires consideration of Applicable or Relevant and Appropriate Requirements (ARARs). SCGs and ARARs for the Urbana landfill site are categorized as chemical-specific, action-specific or location-specific. Because New York State does not have ARARs in its statute, and to avoid misrepresentation of New York State's requirements, ARARs are replaced with New York State Standards, Criteria and Guidance (NYS SCGs), referenced hereafter, which also include the more stringent federal requirements.

Applicable requirements pertain to cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or state law specifically addressing a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a site. In particular, USEPA Drinking Water Standard Maximum Contaminant Levels, NYSDEC Class GA groundwater standards, and NYSDOH Drinking Water Standard Maximum Contaminant Levels are identified as applicable requirements.

Relevant and appropriate NYS SCGs pertain to cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under New York State law that, while not "applicable", address problems or situations sufficiently similar to those encountered at a site.

SCGs must be determined on a site by site basis, and are identified with increasing certainty as the RI/FS study for the site progresses. For this identification process, it is useful to group SCGs into the following three general categories:

*Chemical-specific*

These requirements are usually health or risk-based numbers limiting the concentration or amount of a chemical that may be discharged into the environment. They are independent of the location of the discharge, but may be related to the intended use of the environmental medium.

*Action-specific*

These requirements will be triggered by the remedial actions selected for the site. They are based on the implementation and limitations of particular technologies or actions.

*Location-specific*

These restrictions are generally placed upon chemical concentrations releases, or activities solely because they are in a particular location.

### 1.7.1 Chemical-Specific

Several federal and state chemical-specific criteria are applicable to the Urbana landfill site. Table 1-6 summarizes the chemical-specific ARARs and SCGs identified during the FS. Criteria considered include regulations pertaining to both solid and liquid media. Of importance to the site are cleanup criteria established by New York State for groundwater, leachate, air and soils.

### 1.7.2 Action-Specific

All the remedial alternatives to be evaluated for this project have been analyzed for compliance with action-specific SCGs developed for the Urbana landfill site. Table 1-7 summarizes action-specific SCGs that were reviewed, and their applicability to the site. Action-specific SCGs address not only

Table 1-6

# Potentially Applicable Chemical-Specific SCGs

Urbana Landfill, New York

| Standard, Requirement Criteria or Limitation | Citation or Reference | Description | Comments |
|---|---|---|---|
| *Federal* | | | |
| ** Groundwater* | | | |
| National Primary Drinking Water Standards | 40 CFR Part 141 | Applicable to the use of public water systems; establishes maximum contaminant levels (MCLs), monitoring requirements and treatment techniques. | Potentially applicable to offsite groundwater. |
| National Secondary Drinking Water Standards | 40 CFR Part 143 | Applicable to the use of public water systems; controls contaminants in drinking water that primarily effect the aesthetic qualities relating to public acceptance of drinking water. | Potentially applicable to offsite groundwater. |
| Safe Drinking Water Act | Pub. L 95-523, as amended by Pub. L. 96502, 22 USC 300 et. seq. | Sets limits to the maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs). | Potentially applicable to offsite groundwater. |
| SDWA MCL Goals | 40 CFR 141.50 FR 46936 | Established drinking water quality goals set at levels of anticipated adverse health effects with an adequate margin of safety. | Potentially applicable to offsite groundwater. |
| USEPA Office of Drinking Water Health Advisories | | Standards issued by the USEPA Office of Drinking Water. | |
| **Surface Water* | | | |
| Clean Water Act (CWA) | 33 USC 1251 et.seq. | Applicable for alternatives involving treatment with point source discharges to surface water. | Criteria available for water and fish ingestion, and fish consumption for human health. Not applicable to site remedial alternatives. |

Table 1-6
## Potentially Applicable Chemical-Specific SCGs
Urbana Landfill, New York

| Standard, Requirement Criteria or Limitation | Citation or Reference | Description | Comments |
|---|---|---|---|
| Toxic Pollutant Effluent Standards | 40 CFR Part 129 | Applicable to the discharge of toxic pollutants into navigable waters. | Not applicable to the site. |
| General Provisions for Effluent Guidelines and Standards | 40 CFR 401 | Establishes legal authority and general definitions that apply to all regulations issued concerning specific classes and categories of point sources. | Provides for point source identification. Applicable to remedial action with effluent discharge. |
| * Air | | | |
| Clean Air Act | 42 USC 7401 Section 112 (as amended 1993) | Establishes upper limits on parameter emissions to atmosphere. | Pollutants deemed hazardous or non-hazardous based on public health. |
| National Primary and Secondary Ambient Air Quality Standards | 40 CFR 50 | Establishes primary and secondary NAAQS under Section 109 of the Clean Air Act. | Primary NAAQS define levels of air quality necessary to protect public health. Secondary NAAQS define levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Applicable to remedial action alternatives that may emit pollutants to the atmosphere. |
| National Emissions Standards for Hazardous Air Pollutants | 40 CFR 61 | Establishes NESHAPs. | |
| **RCRA* | | | |
| Resource Conservation and Recovery Act- Identification and Listing of Hazardous Wastes | 40 CFR 264.1 | Defines those wastes which are subject to regulations as hazardous wastes under 40 CFR Parts 262-265 and Parts 124, 270,271. | |

Table 1-6
## Potentially Applicable Chemical-Specific SCGs
Urbana Landfill, New York

| Standard, Requirement Criteria or Limitation | Citation or Reference | Description | Comments |
|---|---|---|---|
| RCRA Maximum Concentration Limits | 40 CFR 264 | Ground Water protection standards for toxic metals and pesticides. | These provisions are applicable to RCRA regulated units that are subject to permitting. |
| ***Other** | | | |
| USEPA Office of Research and Development Reference Doses | | Reference dose issued by USEPA. | To Be Considered. |
| USEPA Environmental Criteria and Assessment Office- Carcinogenic Potency Factors | | As developed by USEPA. | To Be Considered. |
| ***New York State*** | | | |
| ** Soil* | | | |
| NYSDEC Soil Cleanup Objectives | NYSDEC TAGM, HWR-94-4046, January 24, 1994. | Applicable to the cleanup of contaminated soils. Cleanup goals recommended based on human health criteria, ground water protection, background levels, and laboratory quantification levels. | These objectives provide the maximum values for determining soil cleanup levels. |
| ** Air* | | | |
| NYSDEC Division of Air Guidelines for the Control of Toxic Ambient Air Contaminants | Air Guide 1 | Establishes air quality standards. | Applicable to remedial alternatives which include discharge to air. |
| New York Ambient Air Quality Standards | 6 NYCRR 256-257 | Establishes air quality standards. | Applicable to remedial alternatives which include discharge to air. |

Table 1-6
## Potentially Applicable Chemical-Specific SCGs
Urbana Landfill, New York

| Standard, Requirement Criteria or Limitation | Citation or Reference | Description | Comments |
|---|---|---|---|
| * *Surface Water & Ground Water* | | | |
| NYSDEC Ground Water Quality Regulations | 6 NYCRR Part 702 | Applicable to existing surface water quality and the discharge of runoff and contaminated groundwater into surface waters. | The nearest surface water body is the unnamed stream located west of the landfill, classified as Class C (Protection for fish propagation or wildlife consumption of fish and human consumption of fish). |
| NYSDEC Ground Water Quality Regulations | 6 NYCRR Part 703 | Applicable to the groundwater quality of both the shallow and deep aquifers; sets forth criteria for the consumption of potable water. | The nearby aquifers are classified as Class GA potable groundwater. |
| Ambient Water Quality Standards and Guidance Values | TOGS 1.1.1, October 22, 1993 | Establishes groundwater quality standards. | |
| New York Water Classifications and Quality Standards | 6 NYCRR Parts 609, 700-704 | Describes classification system for surface water and groundwater. Establishes standards of Quality and Purity. | Establishes required clean-up criteria based on water classification. |
| NYSDEC Standards Raw Water Quality | 10 NYCRR 170.4 | Provides water quality standards. | May be applicable to groundwater clean-up levels. |
| * *NYSDOH Sanitary Code* | | | |
| Drinking Water Supplies | 10 NYCRR Sub Part 5-1 | Applicable for consumption of potable water from public water supplies. | |
| **Hazardous Waste* | | | |
| New York Identification and Listing of Hazardous Waste Regulations | 6 NYCRR part 371 | Identifies hazardous wastes. | May be applicable if hazardous wastes are generated, stored or transported during remediation. |
| NYSDEC Land Disposal Restrictions | 6 NYCRR Part 376 | Identifies hazardous wastes that are subject to land disposal restrictions. | May be applicable if site remediation involves land disposal of contaminated soils. |

Table 1-7
# Potentially Applicable Action-Specific SCGs
Urbana Landfill, New York

| Standard, Requirement Criteria or Limitation | Citation or Reference | Description | Comments |
|---|---|---|---|
| *Federal* | | | |
| Clean Air Act | 42 U.S.C. 7401 | Applicable if alternatives will impact ambient air quality. | Relevant if remedial action causes air pollution above primary or secondary ambient air quality standards. |
| National Ambient Air Quality Standards | 40 CFR Part 50 | Applicable to alternatives that may emit pollutants to the air; establishes standards to protect public health and welfare. | May be relevant and appropriate if treatment of groundwater or soils involves air emissions. |
| Resource Conservation and Recovery Act (RCRA) | 42 USC 6901-6987<br>40 CFR part 264<br>RCRA Subtitle C | Applicable to the treatment, storage, transportation and disposal of hazardous wastes and wastes listed under 6 NYCRR Part 371. | May be required for contaminated soil disposal options. |
| | 40 CFR Part 264<br>RCRA Subtitle D | Applicable to management and disposal of non-hazardous wastes. | |
| | 40 CFR Part 265 | Interim standards for owners of hazardous waste facilities. | Includes design requirements for capping, treatment, and post closure care. |
| | 40 CFR Part 262 and 263 | Applicable to generators and transporters of hazardous waste. | Applicable to off-site disposal or treatment of hazardous material. Soils on-site may be deemed hazardous. |
| | 40 CFR Part 268 | Applicable to alternatives involving off-site disposal of hazardous waste; requires treatment to diminish waste toxicity. | May be required for soil disposal options. |

Table 1-7
# Potentially Applicable Action-Specific SCGs
Urbana Landfill, New York

| Standard, Requirement Criteria or Limitation | Citation or Reference | Description | Comments |
|---|---|---|---|
| CERCLA/SARA/NCP | 40 CFR Part 300 | Applicable to remedial actions at CERCLA and NYS Superfund Sites. | The Urbana LF is a designated NYS Superfund Site. |
| | 40 CFR 270,124 | EPA administers hazardous waste permit program for CERCLA/Superfund Sites. | Covers basic permitting, application, monitoring, and reporting, requirements for off-site hazardous waste management facilties. |
| Clean Water Act | 33 USC 1251 | Restoration and maintenance of the chemical, physical and biological integrity of the nation's water. | May be applicable if groundwater and surface water are found to be negatively impacted by the site. |
| Safe Drinking Act Underground Injection | 40 CFR Parts 144 and 146 | Applicable to waste water treatment alternatives involving underground injections that may endanger drinking water sources. | Not applicable to site remedial alternatives. |
| Wetlands Permit | 40 CFR Part 232 | Applicable to remedial actions in and around wetlands. | There are no wetlands in and around the site. |
| Occupational Safety and Health Act | 29 CFR Part 1910 and 300.38 | Applicable to workers and the work place during remediation of the site. | Applies to all response activities under the NCP. |
| Hazardous Materials Transportation Act | 49 USC ss 1801-1813, 49 CFR Parts 107, 171 | Applicable to transporters of hazardous materials. | May be relevant if action results in sludge, waste or soil being transported off-site. |

Table 1-7
Potentially Applicable Action-Specific SCGs
Urbana Landfill, New York

| Standard, Requirement Criteria or Limitation | Citation or Reference | Description | Comments |
|---|---|---|---|
| *New York State* | | | |
| NYSDEC TAGM | HWR-90-4030 | Guidance for Selection of Remedial Actions at Inactive Hazardous Waste Sites. | Issued May 15, 1990. |
| Hazardous Waste Management | 6 NYCRR Part 373 | Standards for owners of hazardous waste facilities. | Includes design requirements for soil capping and treatment options, and post-closure care. |
| Transportation of Hazardous Materials | 6 NYCRR Part 364 | Regulates transportation of hazardous materials. | May be relevant if action results in off-site transport of hazardous soils. |
| **Air* | | | |
| New York State Air Regulations | ( 6 NYCRR Parts 200 through 207,210,211,212 and 219) | | |
| | 6 NYCRR Part 212 | General process emission sources. | Sets allowable emissions for remedial options resulting in air emissions. |
| | 6 NYCRR Part 201, 202 | Permits for construction/operations of air pollution sources. | Describes permit requirements to construct and operate the above options. |
| | 6NYCRR Part 219 | Particulate emission limits. | Limits are based on the refuse charged (lb/hr) for the above options. |

Table 1-7

## Potentially Applicable Action-Specific SCGs

Urbana Landfill, New York

| Standard, Requirement Criteria or Limitation | Citation or Reference | Description | Comments |
|---|---|---|---|
| New York State Air Regulations (cont.) | 6NYCRR Part 211 | Regulates fugitive dust emissions. | Requires control of fugitive dust emissions from excavations and transport. |
| | 6 NYCRR Part 257 | Air quality standards. | Requires control for on-site treatment |
| NYSDEC Draft Air guidelines-1: Guidelines for Control of Toxic Ambient air Contaminants | New York State Division of Air Resources Guidelines | Provides guidance on permit process review, gives AGCs and SCGs for ambient air based human health criteria. | Applicable to ambient air in the vicinity of the Urbana Landfill. |
| Transportation of Hazardous Materials | 6 NYCRR Part 364 | Regulates transportation of hazardous materials. | May be relevant if action results in off-site transport of hazardous materials. |
| *Local* | | | |
| Building Codes<br>Sanitary Codes<br>Fire Codes<br>Plans Protecting Sensitive Areas | | | The feasibility of each remedial alternative will be evaluated in light of applicable local codes. |

regulations to consider during the actual implementation of the remedial plan, but also include secondary actions such as wetlands mitigation and wildlife preservation which could play an important role during implementation.

### 1.7.3 Location-Specific

Depending on the location of the site, several SCGs require consideration during remedial alternative evaluation. These SCGs often give criteria that provide protection for any sensitive flood plains, wetlands, and natural preserves with endangered species. Table 1-8 summarizes the SCGs that were considered, and their applicability to this site.

### 1.7.4 NYS SCGs Appropriate to the Site

Based on the second round of the Phase II RI sampling results, performed in April 1997, on the recently installed offsite monitoring wells (MW-201 and MW-202, see Figure 1-3), it appears that there is some low level contamination that has migrated from the site. However, because there is no contamination in the downstream private wells further off-site, a monitoring program will be implemented. If a significant contaminant plume in the groundwater is identified as coming from the landfill, groundwater and potable water standards and criteria will have to be considered applicable, and appropriate response actions will be developed at that time. Groundwater standards and criteria will be used as SCGs when evaluating and monitoring the groundwater during this period.

Results from April 1997 surface water sampling indicate that the unnamed stream near the site is being impacted by the landfill. Surface water standards and criteria will be used as SCGs when evaluating and monitoring the surface water following landfill remediation.

Soil SCGs will be applied in the case of Hot Spot remediation at the landfill. In those areas where VOCs, pesticides, and SVOCs are present, NYS Soil Cleanup Guidelines will be used, as appropriate, to set soil cleanup target levels.

Although the air pathway is not expected to be a significant potential threat to human health and the environment, New York State Annual Guideline Concentrations (AGCs) and SGCs (found in Air Guide-1) will be applied to determine an appropriate level of response to potential landfill gas emissions.

A review of NYSDEC maps and files indicate that there are no sensitive environmental areas, wetlands, floodplains, or natural preserves with endangered species present near the landfill. For this reason, no location-specific SCGs will be applied.

Table 1-8

Potentially Applicable Location-Specific SCGs

Urbana Landfill, New York

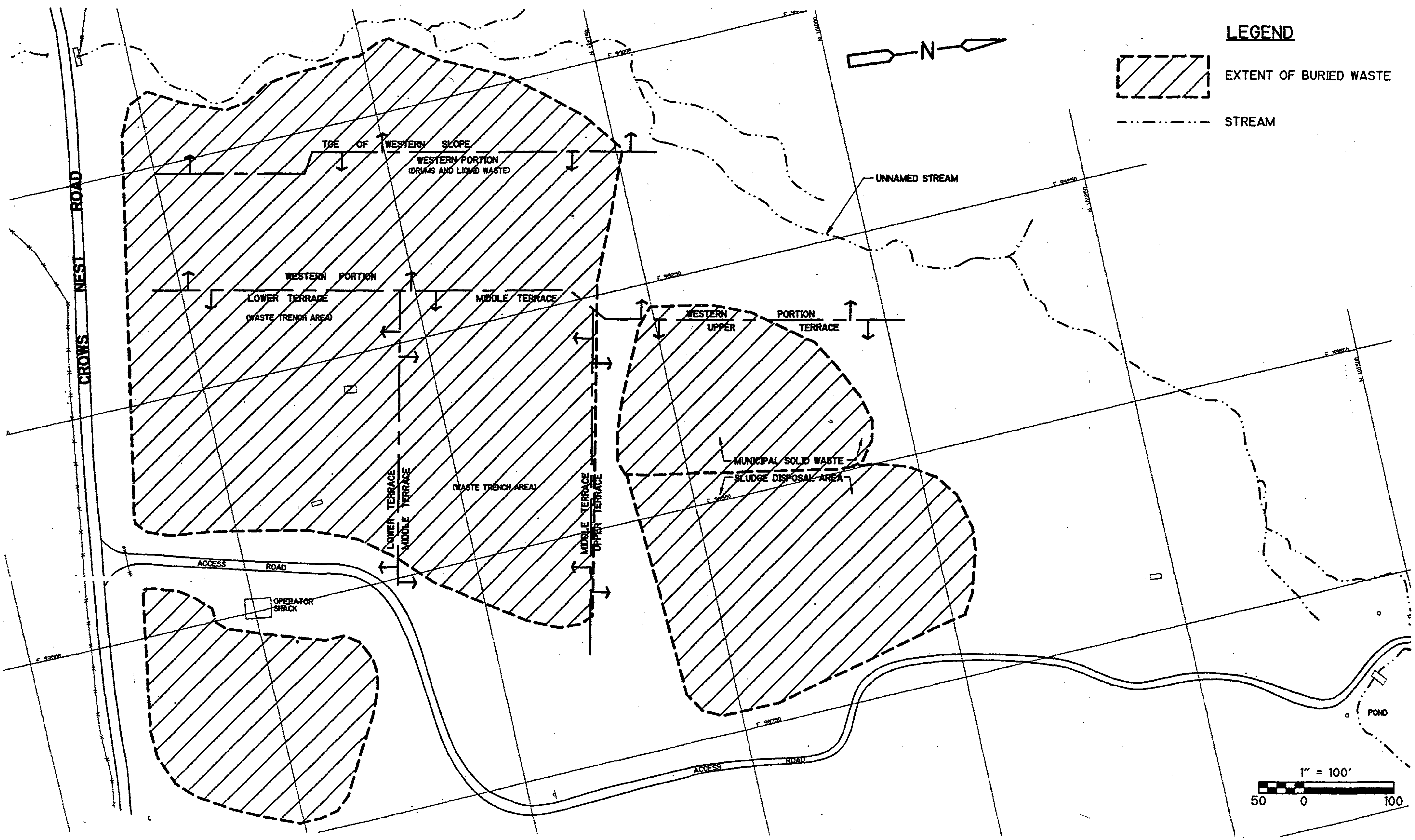
| Standard, Requirement Criteria or Limitation | Citation or Reference | Description | Comments |
|---|---|---|---|
| *Federal* | | | |
| Fish and Wildlife Coordination Act | 16 USC | Requires consultation when Federal department or agency proposes or authorizes any modification of any stream or other water body and adequate provision for protection of fish and wildlife resources. | Not applicable to site remedial alternatives. |
| Endangered Species Act | 40 CFR 6.302 (g) | Requires Federal agencies to ensure that actions they authorize, fund or carry out are most likely to jeapordize the continued existence of endangered/threatened species or adversely modify the critical habitats of such species. | No endangered species are present in the study area. |
| Executive Order On Floodplain Management | Execuitive Order No. 11988 40 CFR 6.302(a) and Appendix A | Requires Federal agencies to evaluate potential effects of actions that may take place in a floodplain to avoid, to the maximum extent possible, the adverse impacts associated with direct and indirect development of a floodplain. | No floodplain is located in the vicinity of the site. |
| Wetland Executive Order | Executive Order No. 11990 | Details requirements for the preservation of wetlands. | No wetlands are located in the vicinity of the site. |
| Farmlands Protection | 7 USC 4201 et. seq. | Protects significant or important agricultural lands from irreversible conversion to uses which result in loss of an environmental or essential food production resource. | No farmlands are located in the vicinity of the site. |

Table 1-8
Potentially Applicable Location-Specific SCGs
Urbana Landfill, New York

| Standard, Requirement Criteria or Limitation | Citation or Reference | Description | Comments |
|---|---|---|---|
| *New York State* | | | |
| ** Air* | | | |
| New York Environmental Conservation Law | New York Consolidated Laws Service: Environmental Conservation Law, Articles 1,3,5,7-8,19,38,70-72 | Establishes requirements for the protection of air quality | Applicable if remedial activities include discharge to air. |
| New York Air Pollution Control Regulations | 6 NYCRR Parts 220-221 | Provides provisions for the prevention and control of air contamination and air pollution. | Applicable if remedial activities include discharge to air. |
| ** Fish and Wildlife* | | | |
| Endangered and Threatened Species of Fish and Wildlife | 6 NYCRR Part 182 | Designates endangered and threatened species for protection. | No endangered and/or threatened species are present in the vicinity of the site. |
| New York Wetlands Laws | NYCRR Articles 24, 25 | Establishes requirements for the protection of freshwater and tidal wetlands. | No wetlands are present in the vicinity of the site. |
| Environmental Conservation Law | New York Environmental Law: Articles 17, 37, 71, 72 | Establishes requirements for the protection of New York State waters. | Applicable to remedial activities which include discharge to groundwater or surface water. |
| Use and Protection of Waters | 6 NYCRR Part 608 | Establishes standards for use and protection of waters | Applicable to remedial activities which affect waters. |

# 2

# Section Two

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CDM Camp Dresser & McKee

Figure 1-4
Existing Landfill Site Plan
Urbana Landfill Feasibility Study

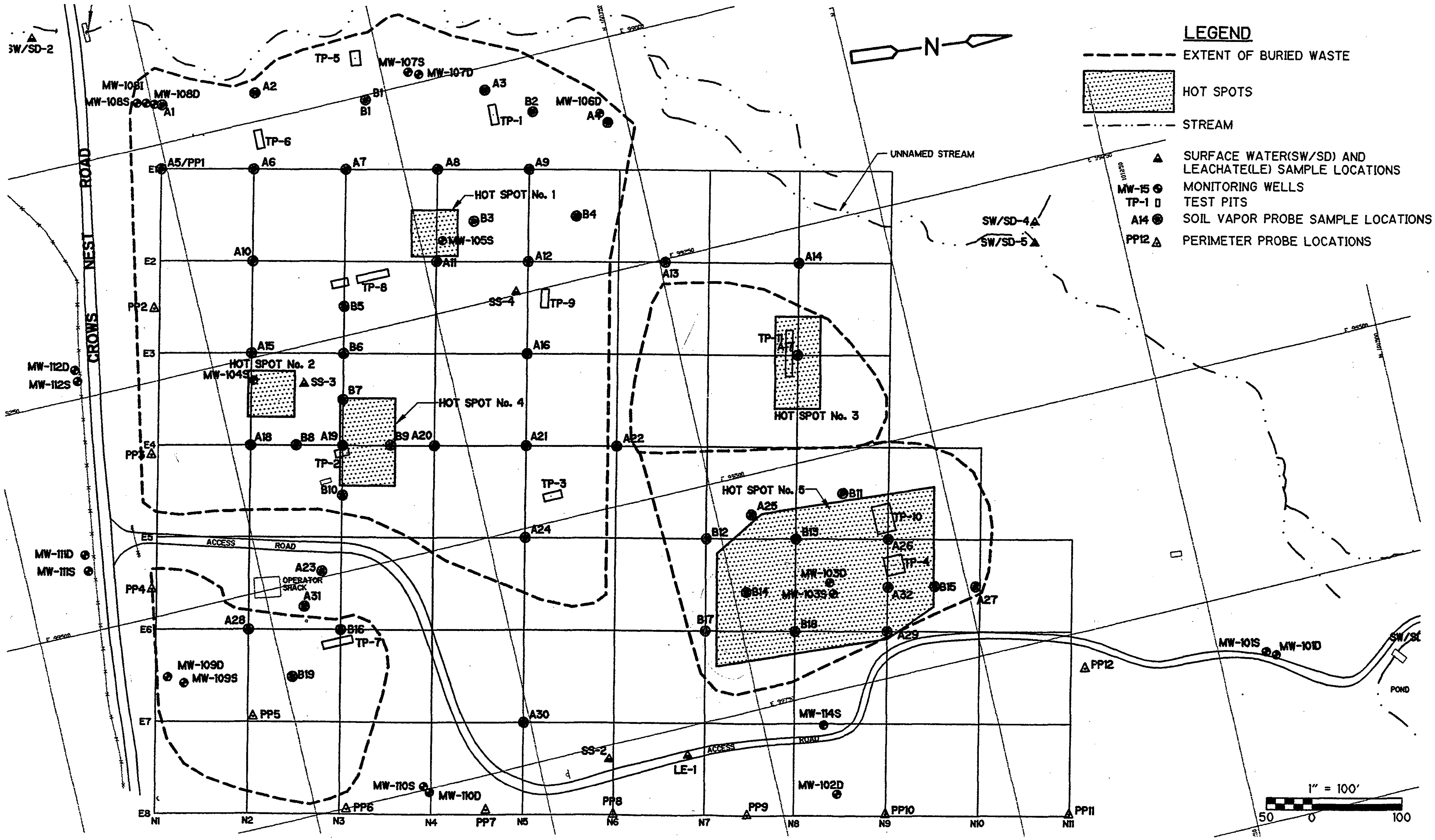


**Figure 1-5**
**Sample Locations**
**Urbana Landfill Feasibility Study**

**CDM** Camp Dresser & McKee

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# Section 2
# Remedial Action Objectives

## 2.1 Introduction

Remedial Action Objectives (RAOs) are developed to protect human health and the environment, which includes terrestrial and aquatic biota, sensitive or critical habitats, and endangered species. The potential environmental and human health threats are reviewed below, based on data from the Remedial Investigation. Based on the potential pathways by which contaminants could reach sensitive receptors, RAOs are listed for each medium of concern.

## 2.2 Medium-Specific Objectives

Remedial Action Objectives (RAOs) consist of medium-specific goals for protecting human health and the environment and focus on the contaminants of concern, exposure routes and receptors, and an acceptable contaminant level or range of levels for each exposure route. Acceptable contaminant levels are determined by a qualitative risk assessment and identification of NYS Standards, Criteria, and Guidelines.

The remedial action objectives established for the Urbana Landfill include:

1. Treat or remove the principal threat posed by the site to groundwater and the potential impacts to down gradient groundwater users.

2. Isolate the landfill waste material in order to provide adequate protection to human health and the environment from direct contact or ingestion of hazardous constituents in wastes or surface soil from the landfill.

3. Prevent infiltration of water through the surface of the landfill and eliminate leachate from contaminating the groundwater and/or surface water.

4. Prevent human contact with, inhalation, or ingestion of the hazardous constituents in groundwater beneath and down gradient of the landfill.

5. Eliminate uncontrolled emissions of landfill gases that could pose a risk to current and/or future residents.

## 2.3 Potential Exposure Pathways

A potential contaminant exposure pathway is the consumption of surface water, groundwater or the inhalation of volatile organic compounds during showering for those homes using groundwater from private wells down gradient of the site. Results from the Phase II investigation, performed in April 1997, indicate that low level groundwater contamination has migrated from the site. Results from the shallow monitoring well MW-202 (southwest of the site) indicate exceedances of volatile organic standards for trichloroethene (26 ug/l; Std.=5 ug/l) and 1,2 dichloroethene (35 ug/l; Std =5ug/l). There are no reports of contamination in the private wells which are much further down stream.

Another potential contaminant exposure pathway is the consumption of water from Keuka Lake that has could potentially receive contaminated water from the unnamed stream near the landfill. This exposure pathway is not considered to be significant because most surface water sampling of the unnamed stream performed to date shows no significant VOC contamination. The sporadic indications of low level VOCs found in the stream would not likely be detectable in the lake due to volatilization of compounds during transport in the stream and the dilution and volatilization of compounds once the stream flows into the lake.

A third potential exposure pathway is through inhalation of VOCs emitted in the landfill gas. The waste material in the landfill decomposes and naturally forms methane and carbon dioxide, which are presently emitted from the surface of the landfill. Soil gas surveys have shown, however, that in a few limited areas of the upper terrace and the western section of the landfill, VOCs are detected in the landfill gas. These VOCs are presently being emitted at the landfill and could possibly present a long term exposure risk at the site boundary. Therefore, this exposure pathway will be addressed in this FS.

A fourth potential exposure pathway is direct ingestion of contaminants found in shallow sub-surface soils at the landfill.

Finally, seepage of landfill leachate could potentially impact the surface water nearby, in particular the unnamed stream located just west of the landfill. Seeps have been detected at the landfill and initial results from the second round of sampling at the Urbana site indicate that seeps from the landfill are impacting the stream.

## 2.4 Presumptive Remedial Approach and Technologies

The RAOs developed for the Urbana landfill serve as the primary basis upon which the remedial alternatives are developed and evaluated. Using the presumptive remedy approach, a limited number of media specific remedial technologies, including any identified presumptive remedies, are identified. These are then screened for site specific feasibility, technical implementability, and practicability based on readily available information from the site RI and from similar sites.

Using the presumptive remedy approach, a number of technologies are clearly applicable to the site. These are listed below according to the remedial action objective being addressed by that technology.

The first RAO for this site can be addressed by the removal or treatment of Hot Spots (areas of high VOC, SVOCs, and pesticide contamination) within the landfill. Both in-situ and ex-situ treatment technologies such as soil vapor extraction, bioventing, biopiles, and slurry reactors are potentially applicable, as well as removal and offsite disposal of contaminated soils and waste. Additionally, the installation of a french drain, upgradient of the landfill, which would potentially lower the groundwater elevations and therefore, prevent interaction with the Hot Spot soils, is a treatment technology alternative.

The second RAO for this site can be addressed by the construction of a Part 360 (or modified Part 360) landfill cap. The cap would isolate the landfill waste material and protect human health and the environment from contact with any contaminants from the landfill. Landfill cap alternatives are included in this evaluation.

The third RAO can be met by careful regrading of the landfill to meet setback requirements for the nearby stream, and placement of a Part 360 cap to eliminate surface infiltration and leachate seeps.

The fourth RAO could be met by restricting use of the affected groundwater in the vicinity of the site. This can be accomplished through one of several institutional control measures, including both well permit and deed restrictions. The objective can also be met by natural dilution and attenuation of the plume as it moves offsite, or by groundwater containment using an interceptor trench and groundwater treatment system.

Finally, the fifth RAO can be met by the installation of a Part 360 landfill cap and passive landfill vents. Landfill vents can either be vented directly to the atmosphere, or connected to a manifold and vented via a single onsite stack. Stack monitoring and subsequent air modeling analysis will be required to determine if individual vents can be used without offsite exceedance of relevant AGCs, or whether vents must be connected to a manifold and vented via a single stack.

# 3 Section Three

Section 3

# Section 3
# Remediation Alternatives

A limited number of remediation alternatives are available for the Urbana landfill based on existing site conditions and the conceptual contaminant migration pathways identified in the Remedial Investigation Report. In accordance with the presumptive remedy approach, an extensive discussion of general response actions is not presented here. The limited number of alternatives available for the Urbana landfill can be focused within the general categories of:

- No Further Action
- Institutional Controls
- Containment of Contaminant Migration
  - Land fill Cap/Regrading
  - French Drain
- Treatment of In Situ Contaminated Media
  - Soil Vapor Extraction
  - Bioventing
- Treatment of Removed Contaminated Media
  - Biopiles
  - Slurry Bio-Reactor
- Disposal of Removed Contaminated Media
  - Hot Spot Excavation and Off-Site Disposal

For all of the migration pathways, a No Further Action remediation alternative was considered. This alternative is the base-line action against which all other remediation actions are compared. The No Further Action alternative includes quarterly groundwater monitoring and the adoption of institutional controls for the Urbana Landfill Site. Institutional controls include actions such as limiting access to the site and imposing restrictions on future uses of the site.

Potential remedial actions identified as part of the presumptive remedy approach for each medium are described below. Potential actions are identified for air, shallow subsurface soil, subsurface soil and waste, leachate and groundwater. These actions are screened for technical applicability, practicality, and feasibility for each of the potential pathways or media. Only those actions that could be practically and effectively implemented at the site are assembled into three remedial alternatives in section 3.6 for further, detailed evaluation in Section 4.

## 3.1 Air

Chemical contaminants may migrate from surface soil and landfill materials into the ambient air at the site. Volatile organic compound (VOC) emissions, landfill gas and wind blown dust are identified contaminant release mechanisms for this site. In order to effectively control emissions of gas and dust from the landfill, a containment system consisting of a landfill cap and gas venting mechanism are required.

### *3.1.1 Standard Part 360 Cap with Passive Vents*

A low permeability landfill cap is the only effective method available to control air emissions from the landfill, and is considered a presumptive remedy for this site. An effective landfill cap with passive landfill gas vents will control the release of volatile compounds and landfill gas, as well as eliminate wind blown contaminated dust particles from the landfill.

The specifications of a "Part 360" landfill cap are detailed in 6 NYCRR 360-2.13. The following provides an outline of the requirements of a Part 360 cap:

*Gas Venting Layer*

The gas venting layer is located above the compacted waste layer or intermediate fill layer. Its purpose is to promote gas migration to the gas vents. This layer must have a minimum thickness of 12 inches, a minimum coefficient of permeability (k) of $10^{-3}$ cm/s, and a maximum of 10% by weight passing the no. 200 sieve. It is bounded on its upper and lower surfaces with a filter layer; except where its upper surface is directly overlain by a geomembrane. In that case, an upper filter is not required.

As an alternative to this type of gas venting layer, a combination geonet/geotextile layer can be implemented. The geonet is a synthetic plastic material (usually HDPE) that is usually used as a drainage layer but can also be used as a gas venting layer. The main advantage is that this requires less space. When used as a gas venting layer, soil intrusion should be prevented. For this reason, a geotextile layer is placed between the geonet and the soil layer. When used in this fashion the cost differential between a sand gas venting layer and a combination geonet/geotextile layer is minimal.

*Barrier Layer*

The barrier layer is the low permeability layer of the landfill cap. Its purpose is to prevent precipitation from infiltrating into the waste mass. This layer must have a maximum coefficient of permeability (k) of $10^{-7}$ cm/s, and an 18-inch minimum compacted thickness. In addition, the soil material must be able to pass a one-inch screen. This layer must be placed on a 4 percent minimum slope to promote gravity drainage, and a 33 percent maximum slope to ensure stability of the capping system.

*Geomembrane*

As an alternative to the low permeability barrier layer, a geomembrane may be substituted to prevent precipitation migration into the landfill. The geomembrane must have a minimum thickness of 60 mils if the material is high density polyethylene polymer. The geomembrane must be placed on a 4 percent minimum slope to promote gravity drainage, and a 33 percent maximum slope to ensure stability of the capping system.

Based upon budgetary cost estimates and extensive experience at other landfills, the cost of the construction of an 18-inch thick low permeability barrier layer is more than twice that of a geomembrane. Therefore, the presumptive remedy for the barrier layer will employ a geomembrane for impermeability.

*Barrier Protection Layer*

A barrier protection layer of soil must be installed on top of the low permeability soil layer or geomembrane. Material specifications, installation methods and compaction specifications for this layer must be adequate to protect the barrier layer or geomembrane from cracking, frost, and root penetration; as well as to resist erosion and be stable on the final design slopes of the landfill cover. This layer must have a minimum thickness of 24 inches.

*Topsoil*

Above the barrier protection layer, a minimum 6-inch layer of topsoil is necessary to maintain vegetative growth over the landfill.

*Passive Gas Vents*

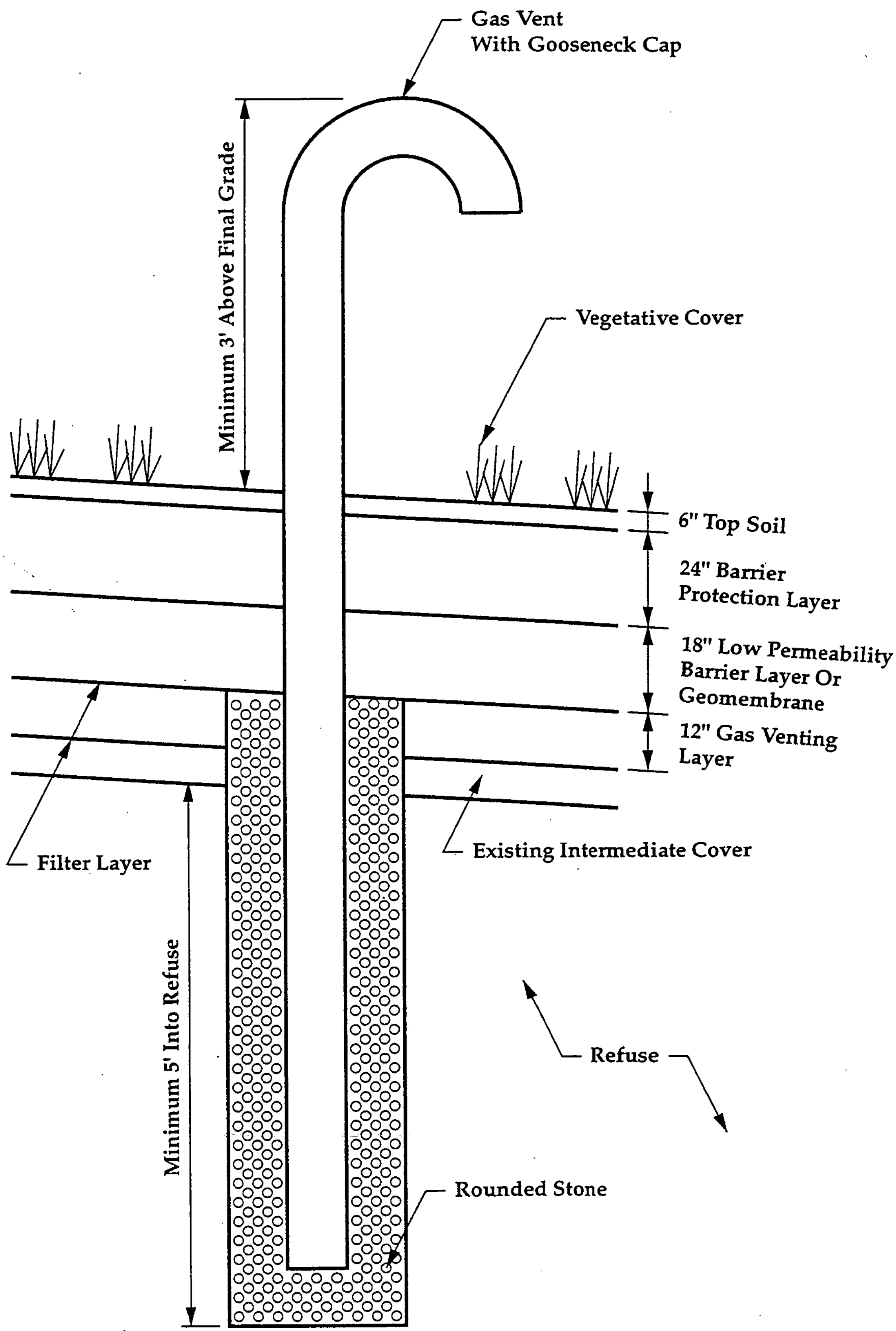
Passive gas vents must be spaced at a maximum separation of one vent per acre, and installed at least five feet into the refuse. Each gas vent must be backfilled with rounded stone or another porous media, and must be exposed at least three feet above the final elevation of the cover system. Gas vents must be fitted with a goose neck, or equivalent, cap. Figure 3-1 illustrates the cross-section of a typical Part 360 landfill cap.

Regrading of the landfill will be necessary in order to meet several requirements of Part 360. All buried waste within 100 feet of the unnamed stream and Crows Nest Road must be set back prior to capping. Furthermore the flat and steep slopes within the landfill must be regraded to comply with the minimum and maximum slope requirements (4% and 33%). Figure 3-2 shows the present extent of buried waste and the potential final limits of the landfill cap after regrading.

### 3.1.2 Alternative Landfill Cap with Passive Vents

A variance may be applied for with respect to each component of the Part 360 cap, under the Local Government Regulatory Relief Initiative - Guidance on Landfill Closure Regulatory Relief, February 26, 1993, NYSDEC. In general, each variance allows for the use of an alternative material and/or a reduction in the thickness of each layer, if certain criteria are met. Of all the possible variances to the landfill cap requirements, only one was found to be potentially applicable to the Urbana Landfill. The options that were not considered applicable are discussed first.

The six-inch topsoil layer may be replaced with a layer of an alternative material capable of sustaining plant growth, controlling erosion and promoting evapotranspiration. Such alternatives include naturally occurring soils and construction and demolition debris. This variance was




Not To Scale

**Figure 3-1**
**Typical Part 360 Landfill Cap Cross Section With Gas Vent**
**Urbana Landfill Feasibility Study**

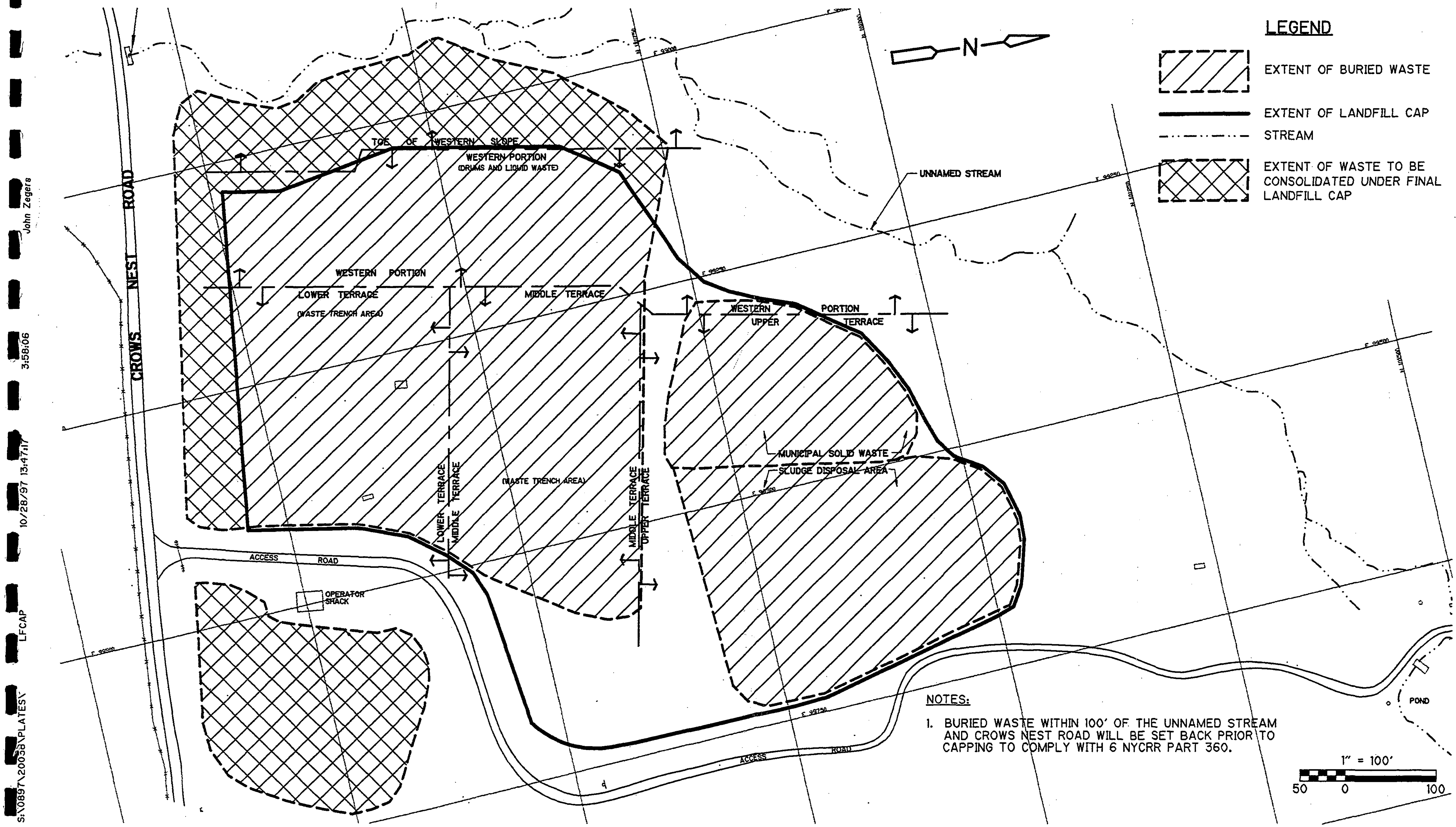



**Figure 3-2**
**Extent of Buried Waste and Part 360 Cap**
**Urbana Landfill Feasibility Study**

eliminated due to the uncertainties associated with the availability and economic feasibility of such alternative materials.

The variance to the barrier layer allows the possible use of a soil with a maximum hydraulic conductivity of $10^{-5}$ cm/sec as opposed to $10^{-7}$ cm/sec. Since one of the key purposes of the landfill cap is to prevent leachate from infiltrating through the waste and contaminating the groundwater, this variance was not considered.

The variance to the barrier protection layer allows the possible reduction in the thickness of this layer from 24 inches to 12 inches. However, it is uncertain if a 12 inch layer could prevent frost from impacting the barrier layer during the winter months. A potential variance limiting the thickness of the barrier layer to 18 inches could be considered during the design phase, but is not considered here. In addition, this variance allows the possible use of alternative materials such as construction and demolition debris, and crushed glass. The uncertainties associated with the availability and economic feasibility of alternative materials also resulted in the rejection of this variance.

Two variances involve the reduction in the frequency of the groundwater, surface water and leachate monitoring at the site. Since groundwater and surface water contamination are primary concerns at the site, this variance was not considered.

The one alternative deemed potentially applicable to the Urbana landfill, involves a variance to the gas venting layer. This alternative cap is identical to the standard Part 360 cap except that it does not contain a gas venting layer. Instead, at least four gas vents are installed per acre of landfill cap, as opposed to one vent per acre. This alternative cap is considered equally effective to the standard Part 360 Cap in venting the landfill gas quantities generated at the Urbana Landfill.

### *3.1.3 Landfill Gas Collection Alternative*

Certain gas collection specifications can be established at the Feasibility Study level. The following provides a discussion of two such alternative design specifications.

As described in section 1.5, preliminary air modeling using the SCREEN3 air dispersion model indicates that a system of passive vents at the Urbana landfill could result in VOC concentrations in excess of NYS AGCs at the property boundary. A potential solution to this problem is to connect the gas vents via a manifold system, and discharge the gas through a common stack located on the upper terrace of the landfill. This alternative has the advantage of better dispersion and dilution of the non methane organic compounds (NMOCs) found in the landfill gas.

Figure 3-3 illustrates this arrangement of gas vents, with manifold pipes collecting the gas from each vent and discharging it through a single stack. The collection system would consist of a matrix of PVC piping connecting each vent to a central manifold. The interconnecting PVC piping would be placed under approximately 18-inches of soil cover to prevent condensation in the pipes (which could restrict air flow). There would be one stack that would centrally emit the collected landfill gas. This alternative limits the number of pipe penetrations (one per acre compared to the Landfill Cap variance of four per acre) through the impermeable layer in the landfill, thus lowering the potential for infiltration.

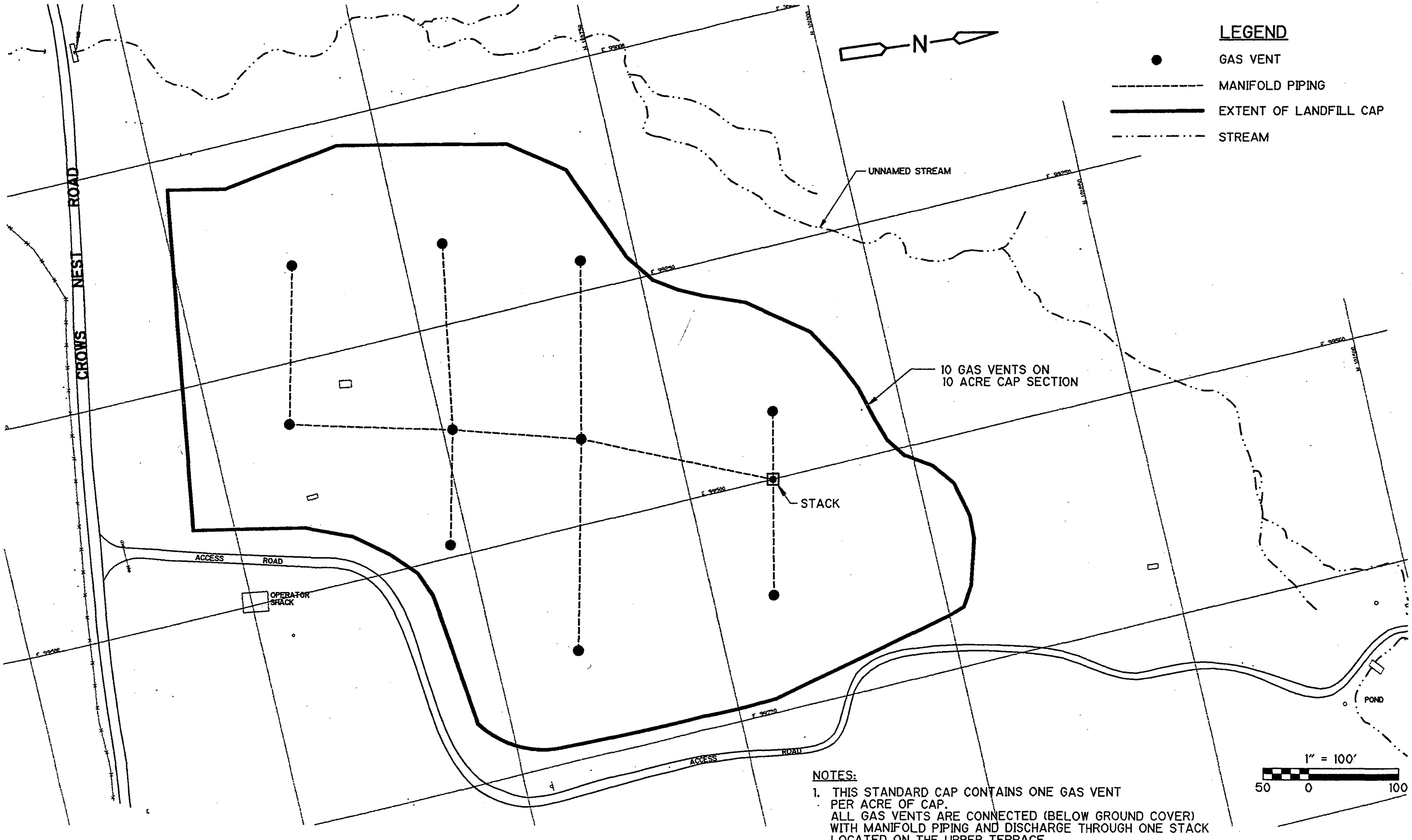





**Figure 3-3**
**Conceptual Design of Gas Vent Grid**
**Urbana Landfill Feasibility Study**

### 3.1.4 Landfill Cap Alternative Selection

The standard Part 360 cap and the alternative cap (without the gas venting layer) would be equally effective at isolating the waste. The standard Part 360 cap would limit the potential for rainwater infiltration because of the limited number of pipe penetrations through the impermeable membrane. Either alternative is equally implementable at the Urbana Landfill. The determining factors in selecting one alternative over the other are cost and effectiveness.

The construction cost of a gas venting layer covering the entire landfill cap exceeds the cost of installing four (4) gas vents per acre (as opposed to one per acre) and additional manifold piping. Although the alternative cap contains four times as many gas vents as the standard cap, and therefore more manifold piping and penetrations through the cap, the cost of these additional items is not significant in comparison to the cost of the gas venting layer. The significant benefit of the standard cap without the four penetrations per acre is limiting the penetrations through the landfill cap, thus preventing infiltration into the landfill and possibly through the Hot Spots.

Because both caps would be equally effective at collecting gas forming under the cap, cost and number of pipe penetrations through the impermeable layers become the deciding factor in the selection of the two alternative cap designs. The alternative cap is not recommended for the Urbana landfill due to the increased opportunity of water infiltration through the landfill. Therefore, the standard Part 360 cap is selected for further evaluation in this Feasibility Study. This is the design cap used in the development of the remedial alternatives. All further references to the landfill cap are understood to be a Standard Part 360 Cap design.

## 3.2 Shallow Subsurface Soil

Shallow subsurface soil samples were collected in the lower and middle terrace of the landfill as part of the Remedial Investigation. Sample analysis results indicated that organic compounds were not present at detectable concentrations in the shallow subsurface soil and background samples. However, metals were detected in the shallow subsurface soil samples at concentrations exceeding the corresponding NYS SCGs and/or background concentrations. Contaminants detected most frequently included beryllium, calcium, chromium (total), iron, magnesium, manganese, nickel and zinc.

Although metal concentrations exceed the NYS SCGs in the shallow subsurface soils, because of the relatively low mobility of the contaminants, no soil removal or treatment will be required to protect human health or the environment. Isolation and containment approaches are more appropriate.

To prevent the infiltration of precipitation through the waste and into the groundwater, a low permeability landfill cap is the only effective remediation alternative. An effective landfill cap will greatly minimize the infiltration of rainwater, diverting most of the precipitation to the perimeter of the landfill as surface runoff. Since portions of the waste mass are below the groundwater table, groundwater contamination cannot be eliminated entirely. However, groundwater contamination caused by infiltration through the refuse placed above the groundwater table will be reduced with the construction of a landfill cap. The landfill cap will thus serve as both a remediation alternative for controlling the release of volatile organic contamination from the landfill into the ambient air and for controlling the migration of heavy metal contamination in the shallow subsurface soils. Details concerning the landfill cap system are contained in section 3.1.

## 3.3 Subsurface Soils

The presumptive remedy for contamination of subsurface soils and the presence of subsurface waste material is containment and isolation of the landfill material. To this end, the landfill capping alternatives described in section 3.1 are applicable.

In addition to the municipal waste material found throughout the landfill, however, several areas of elevated VOCs, SVOCs, and pesticides ("Hot Spots") have been identified during the RI. A Hot Spot was defined by two general criteria:

- soil vapor sampling results with VOC concentrations greater than 10,000 ppbv
- soil boring sampling results with VOC, SVOC, Pesticides/PCB concentrations above NYS SCG levels

In order to protect the groundwater from further contamination, these Hot Spots may need to be remediated. Therefore, the discussion of subsurface soils in this section of the report focuses on the five identified hot-spots. These hot-spots were identified through the initial sampling performed during the Remedial Investigation. The estimated extent of each Hot Spot is shown in figure 1-5. Actual dimensions of all Hot Spots will be determined during remediation. The five Hot Spots are as follows:

*Hot Spot 1*

This Hot Spot is located in an area surrounding MW-105 in the western portion and is conservatively estimated as a 50 foot by 50 foot area that encompasses this monitoring well. This area was selected as the buffer zone around the contaminated media in MW-105. The major contaminants at this hot-spot are VOCs (xylenes) and metals. The location of the contaminated media is between the depth of 10 and 20 feet. The depth to the groundwater table is approximately 12-feet below the ground surface.

*Hot Spot 2*

This Hot Spot is located in the area surrounding MW-104 in the lower terrace and is conservatively estimated as a 50 by 50 foot area that encompasses this monitoring well. This area was selected as the buffer zone around the contaminated media in MW-104. The contamination at this hot-spot includes VOCs (xylenes), SVOCs, pesticides (aldrin, heptachlor and chlordane), PCBs and metals. The approximate location of the contaminated media is between a depth of 4 and 6 feet for the VOCs, and 6 and 10 feet for all other contaminants. The depth to the groundwater table is approximately 6-feet below the ground surface.

*Hot Spot 3*

This Hot Spot is located in the area surrounding TP-11 in the upper terrace. Due to a lack of data outside the test pit area, the approximate dimensions of this Hot Spot are conservatively estimated as a 50 by 100-foot area that encompasses this test pit. These dimensions provide an approximate ten foot buffer surrounding this test pit. The major contamination at this Hot Spot consists of VOCs (xylenes, toluene, etc.). The approximate location of the contaminated media is between a depth of 18 and 20 feet. The groundwater table was not encountered during the excavation and sampling of this test pit.

*Hot Spot 4*

This Hot Spot is located in the area surrounding soil vapor Probe A-19 in the lower terrace. The approximate dimensions of this Hot Spot were estimated using results from other soil-vapor probes in the area. If a neighboring soil vapor probe showed little to no contamination, then the extent of the Hot Spot was limited to half-way between the two soil vapor probes. By this method, the total area for this hot-spot is estimated to be a 50 by 100-foot parcel surrounding soil vapor probe A-19. The major contamination in this hot-spot consists of VOCs (xylenes, ethylbenzene, toluene, etc.). The approximate location of the contaminated media is in the first five feet of media. The depth to the groundwater table at this location is approximately 6-feet below the ground surface.

*Hot Spot 5*

This Hot Spot, the largest of the five, is located in the area surrounding soil vapor Probe A-32 in the upper terrace. The approximate dimensions of this Hot Spot have been determined in the same manner as Hot Spot 4. The total area for this Hot Spot is estimated to be approximately 250 by 150-foot surrounding soil vapor probe A-32. The major contamination in this Hot Spot consists of chlorinated VOCs (TCE, 1,1,1-TCA, 1-1-DCE). The approximate location of the contaminated media is in the first five feet of media. The depth to the groundwater table is approximately 5 to 6 feet below the ground surface.

There are a number of potentially applicable technologies for dealing with the Hot Spots at the Urbana landfill. Each potentially applicable soil remediation technology is discussed and summarized in the following sections, followed by an initial screening in section 3.3.6

## 3.3.1 Hot Spot Removal and Off-site Disposal

This technology involves the excavation of the affected subsurface soils from the Hot Spots and the assumption that all the contaminated media will be disposed of in a RCRA-approved landfill. This disposal technology is appropriate for soils containing high contaminant concentrations that may migrate off-site due to percolation from rainfall or from the movement of groundwater through the zone or area of contamination.

The material from each Hot Spot would be excavated and, if wet, would be placed in a temporary staging area so that all water could evaporate, be decanted for treatment or allowed to drain on the ground. Once "dry", the excavated material would then be loaded into roll-offs and carted to a RCRA- approved disposal facility.

The volume of material from Hot Spot 1 that would require excavation and disposal, pending additional sampling to more clearly define the extent of contamination, is estimated to be approximately 925 cubic yards (cy). This volume of material was calculated from the available soil data collected during the installation of MW-105. Based on the depth at which contamination was found (10 to 20 feet below ground surface) the total volume of soil that would have to be excavated is estimated to be approximately 1850 cy. The top ten feet of soil would be excavated and temporarily stored onsite, and eventually placed back into the landfill. The water table recorded during the sampling was approximately 12-feet below ground surface. Therefore, it is expected that a staging period would be necessary to allow for the excavated material to dry. It has been assumed for cost estimating purposes, that all water would be allowed to drain back into the landfill. Due to the uncertainty of the degree of soil contamination, it has been assumed that all soil disposal will require a RCRA approved landfill.

Hot Spot 2 has VOC, PCB and metals contamination. If Hot Spot 2 is remediated with this technology, the volume of material that would require excavation and disposal is estimated to be approximately 560 cy. This volume was calculated from the available soil data collected during the installation of monitoring well MW-104. The total volume of soil that would have to be excavated, pending additional sampling to more clearly define the extent of contamination, is estimated to be approximately 925 cy. The source of contamination in the soil is found between the depths of 4 and 10-feet below the ground surface. Therefore the top four feet of soil would be placed back into the ground. The water table recorded during the sampling was approximately 6-feet below ground surface. Therefore, it is expected that a staging period would be necessary to allow for the excavated material to dry.

Note that it is not expected that this Hot Spot will require excavation and disposal of material. Isolation and containment alone, however, may sufficiently remedy this Hot Spot. If excavation occurred during the cap installation, it is expected that the majority of the VOC contamination would dissipate at that time. Additionally, it is not likely that the remaining pesticides, PCBs or metals would migrate significantly from this location. These contaminants have a high octanol-water partition coefficient and are therefore likely to remain bound in the soil. Therefore, while this technology is applicable, isolation and containment through the application of a landfill cap, is a viable alternative.

The volume of material from Hot Spot 3 that would require excavation and disposal, pending further field sampling to more clearly define the extent of contamination, is estimated to be approximately 370 cy. This volume was calculated from the limited available soil data collected from test pit TP-11. The total volume of soil that would have to be excavated is estimated to be approximately 3,700 cy. The source of contamination in the soil is found between the depths of 18 and 20-feet below the ground surface. Therefore the top eighteen feet of soil could be placed back into the ground after the Hot Spot has been removed. During the excavation of this test-pit, the water table was not encountered. Therefore, it is not expected that a staging period would be necessary. Due to the uncertain nature of the extent of the contamination at TP-11 it has been conservatively assumed that all contaminated soil will be disposed of in a RCRA-approved landfill.

The volume of material from Hot Spot 4 that would require excavation and disposal, pending additional sampling to more clearly define the extent of contamination, is estimated to be approximately 925 cy. This volume was calculated from the available soil vapor data collected for soil gas probe A19. Since the gas probe detected contamination to a depth of five feet, all soil from the surface to a depth of five feet would have to be excavated and disposed of from this Hot Spot. During the sampling for this soil gas probe, the water table was not encountered. Therefore, it is not expected that a staging period would be necessary if it is determined that contamination extends only five feet into the ground. It has been assumed that soil contamination does not extend below five feet in this area. If field sampling during the remediation determines otherwise, then a staging area for the additional material may be required. In addition, a dewatering and shoring allowance may be required.

Hot spot 5 was the largest Hot Spot. It encompasses soil gas probes A32, B13 and B14 as well as test-pit 10. The volume of material that would require excavation and disposal, pending an additional field sampling effort to further define the extent of contamination, is estimated to be approximately 6,250 cy. This volume was determined from available soil gas and test-data collected from these sampling points. Since the gas probe detected contamination to a depth of five feet, all soil from the surface to a depth of five feet would have to be excavated and disposed of from this Hot Spot. Because groundwater was not encountered during the soil gas sampling at this location, it is not expected that a staging period would be necessary if it is determined that contamination extends only five feet into the ground.

Excavation is moderately easy to implement at the majority of the depths encountered. Depths greater than fifteen feet start to pose a problem (shoring may become necessary) and should be considered during the evaluation of this technology. Additionally, due to the shallow depth to water at the site, shoring and dewatering may add significant costs to the excavation of this task. Soil below the water table will also require dewatering (staging area) prior to disposal. The cost to excavate, temporarily stage the contaminated media, and then transport and dispose of this soil will be discussed in a later section.

### 3.3.2 Soil Vapor Extraction

Soil vapor extraction (SVE) is a technology that involves the installation of extraction wells typically screened in the unsaturated zone and connected to vacuum blowers to induce gaseous flow through the subsurface. VOCs and some SVOCs are withdrawn from the soil matrix in the vapor phase, induced by air flow through the interstices. Soil vapor extraction systems have been demonstrated in both pilot tests and in full-scale field applications with durations as long as several years. The soil vapor extraction system or process can be used to treat large volumes of soil in situ, which makes this process typically more practical and less expensive than excavation and disposal of contaminated soils.

The efficiency of an SVE system is dependent on several factors including, vapor pressure, soil heterogeneity and the moisture content of the soil. The higher the moisture content of the soil, the less effective a soil vapor extraction system. Therefore, contaminated soil at the site below the water table will require dewatering prior to SVE. Another factor affecting the efficiency of a soil vapor extraction system is the permeability of the soil. A SVE system will be less successful with soil of low permeability. A SVE system is effective for removing VOCs, but will have limited success removing SVOCs, and will have no effect on pesticides, metals and PCBs.

The design of a soil vapor extraction system is relatively simple. The equipment that comprises the system consists of commonly-used and widely-available devices such as PVC piping, valves, and blower(s). These factors impart an advantage to soil vapor extraction over some other techniques (e.g., biotreatment or soil flushing) that may require more complex design or single-purpose equipment.

In the vicinity of the Hot Spots, the ground water table is approximately 6 to 10-feet below the ground surface. Because of the shallow depth to water, trenches or horizontal wells may be used to improve the effectiveness of an SVE system. Horizontal wells minimize the upwelling of the groundwater and allow coverage of a greater area than vertical wells. Installation of this type of well is accomplished quickly and easily where no surface or subsurface impediments exist. A PVC drain pipe, wrapped in filter fabric to prevent fine material from clogging the drain, is placed at the base of the trench and backfilled with gravel. The ground surface is typically sealed with bentonite, asphalt, or a man-made liner to prevent air short-circuiting, to increase the radius of influence of the trench or wells, to prevent fugitive gas emissions and to prevent the infiltration of rainwater. The result is simply a dry trench or french drain as shown in Figure 3-4.

To design an SVE system, the number of wells required and their proper spacing and placement must be determined. Then the extraction vents need to be sized and placed for optimal removal. Each of these topics is considered below.

The number and location of extraction wells required at a remediation site is highly site-specific and depends on many factors, including the extent of the zone of contamination, the physical/chemical properties of the contaminants, the soil type and characteristics (especially the air permeability of the soil), the depth of contamination, and discontinuities in the subsurface. The radius of influence is the primary design variable and incorporates many of the above parameters. The radius of influence is the zone in which the effect of the vacuum is felt.

The initial step in placing extraction wells is to determine the radius of influence of one well. This is done by performing a field vacuum air permeability test. Air permeability is the fundamental design parameter and is required to predict the effective area influenced by that well.

The basic equipment for SVE systems is fairly standard. It consists of pumps or blowers to provide the motive force for the applied vacuum, piping, valves, and instrumentation. It also usually requires vapor pre-treatment to remove soil and water from the vapor stream, and an emission-control unit to concentrate or destroy the vapor phase contaminants. Figure 3-5 shows a schematic diagram of a typical SVE system. This equipment is discussed below.

The driving force for the creation of a vacuum in the soil is a positive displacement blower, a centrifugal blower, or a vacuum pump. Centrifugal blowers are about twice as common as vacuum pumps in SVE applications. The piping used to connect the wells to the blower and emission-control device is termed the manifold. Manifold piping may be very simple for a single well SVE

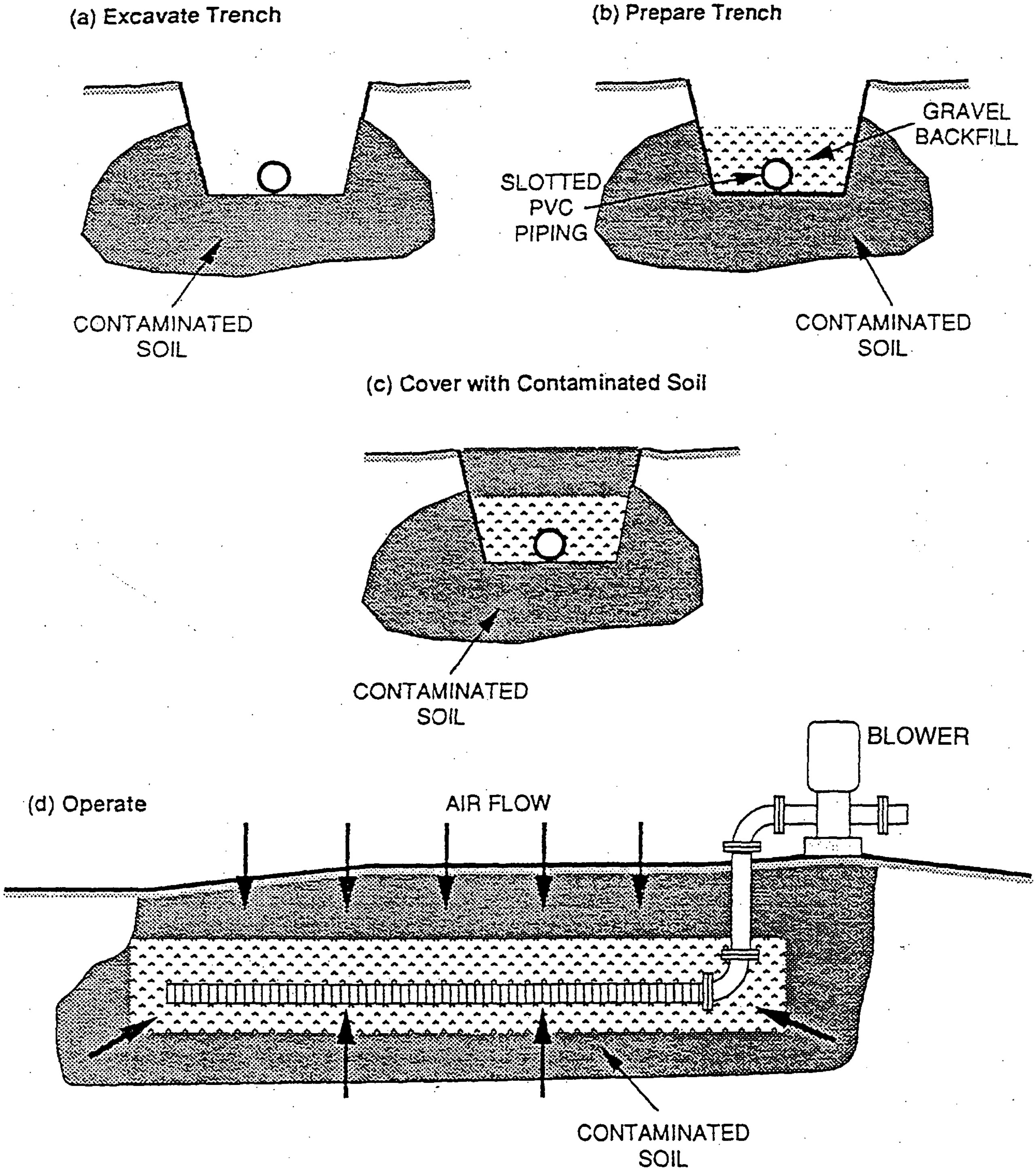
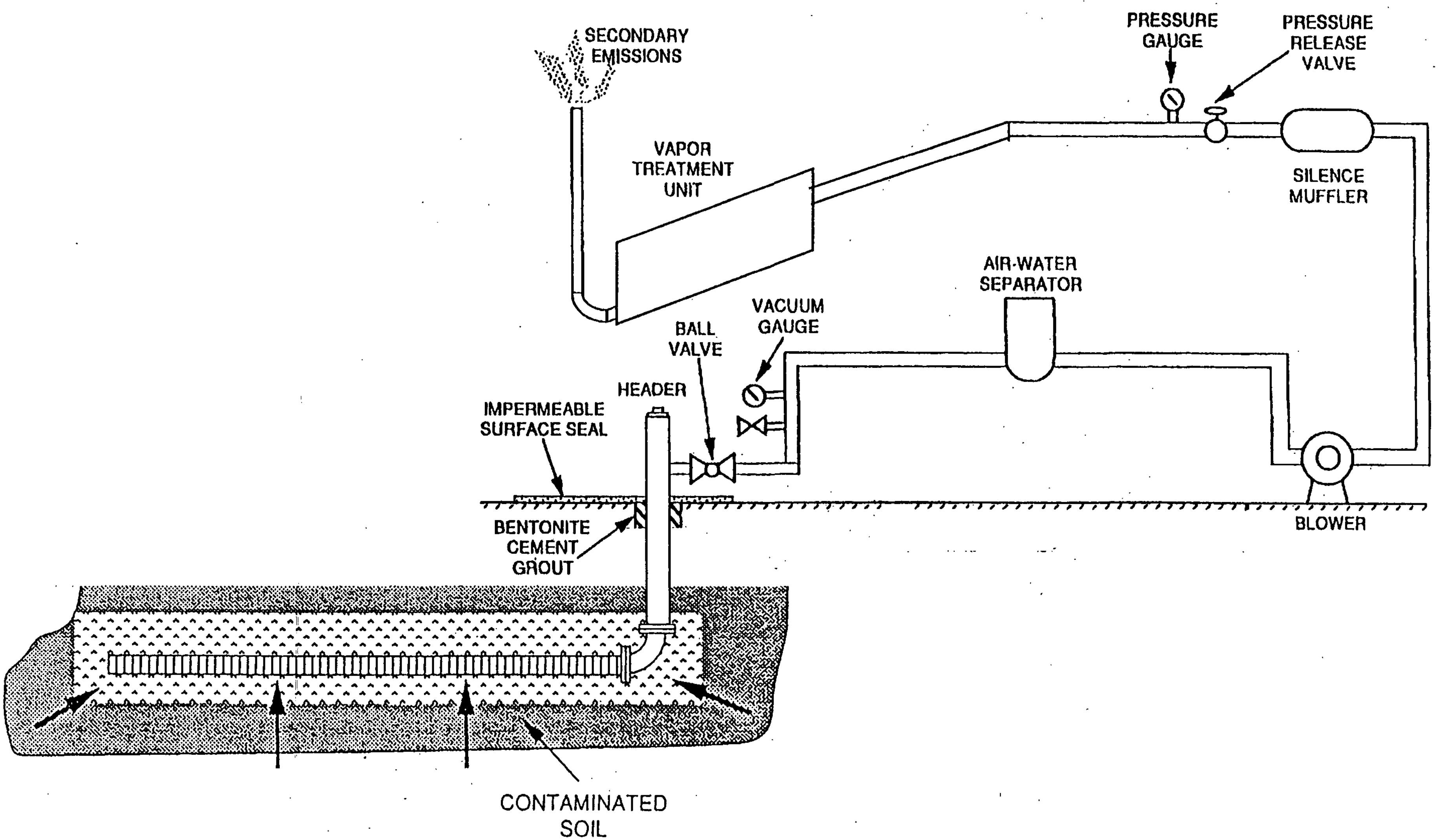



**Figure 3-4**
**Trench Construction For Soil Vapor Extraction System**
**Urbana Landfill Feasibility Study**




**CDM** Camp Dresser & McKee

**Figure 3-5**
**Typical Soil Vapor Extraction System Schematic**
**Urbana Landfill Feasibility Study**

system, but becomes increasingly complex for systems employing several extraction wells or systems with injection wells.

Manifold piping is constructed of either polyvinyl chloride (PVC) (Schedule 40 or Schedule 80), polypropylene, HDPE, or stainless steel. The pipe diameter depends on the total flow from all wells; six-inch piping is common. The piping can be above-ground or buried, and may be insulated to prevent freezing of condensed water. The manifold system should also contain flow and pressure meters, to allow measurement during system operation, and flow-control valves.

Vapors exiting the extraction wells may contain moisture and fine silt particles that may impair mechanical devices and vapor treatment operations. Air/water separators (knock-out drums and condensers), which often use demisting fabric and centrifugal force, are used to reduce moisture entering the vacuum pump and vapor treatment unit.

A soil vapor extraction system for the Urbana Landfill is potentially applicable at three of the five Hot Spots. Hot Spots 1 and 2 would not be amenable to a SVE system. Hot Spot 1 has a high ground water table (12-feet) in relation to the depth of the contamination (10-20 feet.). Additionally, besides VOCs, there are heavy metals in the soil which would not be remediated by this technology. Hot Spot 2 is also not amenable to the SVE technology. The majority of the contamination in this Hot Spot is comprised of SVOCs, pesticides, PCBs and metals, which cannot be removed from the soil using this technique.

The SVE system could be used to treat Hot Spots 3, 4 and 5, however, since only chlorinated solvents have been observed migrating off-site, remediating Hot Spots 3 and 4 would not improve off-site groundwater. Treatment of Hot Spot's 3 and 4 via an SVE system is also not warranted due to their depth and/or location and volume of contamination. It is expected that the SVE system would be most effective in treating Hot Spot 5. Hot Spot 5 is the largest Hot Spot. Additionally the contaminated media is amenable to a SVE treatment system. An individual SVE system equipped with a blower and air/water separator would be connected and fed to either a carbon vapor phase unit or catalytic oxidation system as shown in Figure 3-6. The network of piping, as shown in Figure 3-6, would connect to a PVC lateral and run northward so that the capping of the landfill could occur during this remediation process. No odors are expected to be emitted by use of this technology due to the use of a carbon vapor phase unit or catalytic oxidation system. The expected duration of this remediation effort is approximately one year, depending on the extent of the contamination.

### 3.3.3 Bioventing for Treatment of Hot Spots

Bioventing is the process of aerating subsurface soils to stimulate in-situ biological activity and promote bioremediation. Although similar in design to an SVE system, bioventing is typically designed to maximize biodegradation of aerobically biodegradable compounds, regardless of molecular weight, with minimal volatilization. Bioventing is similar to the process of soil vapor extraction except that biological degradation, not volatilization is the primary mechanism for contaminant removal. Additionally, if operated properly, off gas treatment can be avoided.

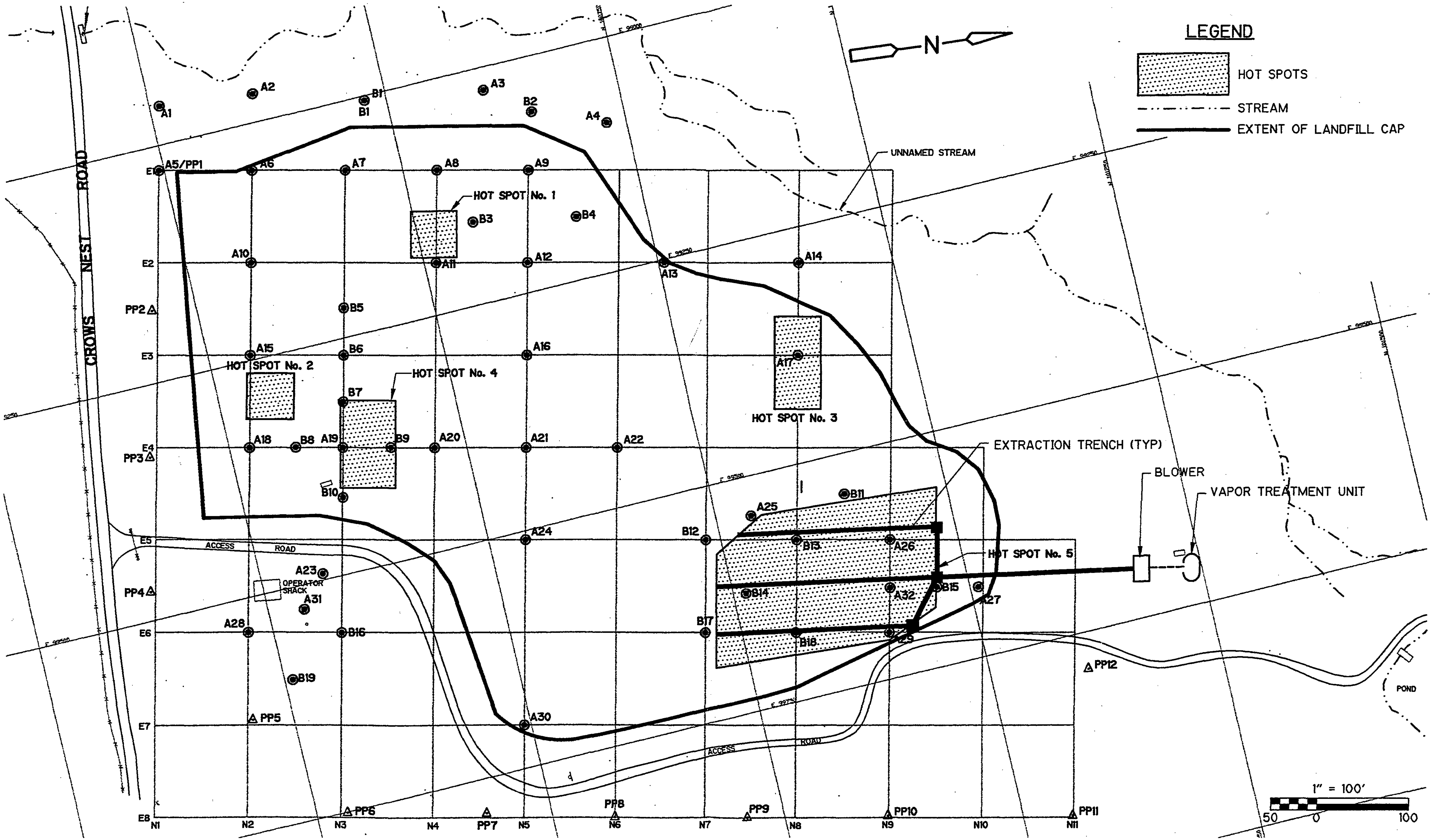



**Figure 3-6**
**Soil Vapor Extraction System Conceptual Design**
**Urbana Landfill Feasibility Study**

Air is continuously drawn through the contaminated soil system either directly from the atmosphere or from air injection wells. Nutrients and moisture may be added to the system to increase biological degradation rates. A simplified schematic diagram of a bioventing system is shown in Figure 3-7.

Bioventing requires the installation of air extraction and (if necessary) air injection wells, a blower (air pump) system for air movement, appurtenant piping, valves and fittings, and a system of probes and instrumentation for monitoring the operation of the system. Additional piping systems may be necessary for feeding nutrient solution and moisture to the soil system.

Bioventing is suitable for treatment of contaminated soils in the saturated zone, but not for soils below the water table. In addition, the porosity of the soil must be suitable for the movement of air. Pilot testing is necessary to fully develop a successful, comprehensive bioventing system.

Bioventing is suitable for the biological remediation of soils contaminated with SVOCs, and aromatic hydrocarbons. Bioventing is not suitable for remediation of soils with chlorinated VOCs, PCBs, pesticides or heavy metals. Bioventing may be a suitable remediation technique for Hot Spots 3 and 4. Hot spots 1 and 2 are not appropriate for bioventing because most of the contaminated soil in these areas is located below the water table. Hot spot 5 is not appropriate for remediation through bioventing because at that location, chlorinated VOCs predominate.

### *3.3.4 Excavation, Stockpiling, Biopile Treatment of Hot Spots*

Biopile treatment of subsurface soils is a biological process for removing organic contaminants. Contaminated soil requiring treatment is excavated and shaped into mounds, covered in plastic to prevent infiltration of rain water, and equipped with piping for the addition of air and water. If necessary, the excavated soil is processed prior to mounding by screening or milling to enhance air flow. Materials such as sand or vermiculite can also be added during the processing phase to aid air flow during treatment. A simplified schematic diagram of a biopile is shown in Figure 3-8.

Air is continuously added to the biopile system and water and nutrients (if necessary) are added on an intermittent basis to maintain proper conditions for a high level of biological activity within the pile. Pile biological activity parameters such as temperature and moisture are continuously monitored to maintain maximum degradation of organics. Regular sampling of the pile is conducted to ascertain rates and levels of organic component degradation. Because biopiles are an aerobic biological treatment method, soil temperatures will rise slightly above ambient air temperatures during treatment. In order to determine the level of soil processing and inputs of air, water and nutrients necessary for proper treatment of soils from a specific site, pilot testing of the biopile system is required.

Biopiles are constructed on impervious pads and covered with impervious plastic to prevent infiltration of precipitation into the pile and eliminate wind borne dust. Storm water runoff is channeled away from the biopile and need not be treated as a contaminated material.

Because air is continuously forced through a biopile, VOCs (if present in the soil being treated) are driven off relatively quickly during the treatment process. Depending upon the amounts and rates

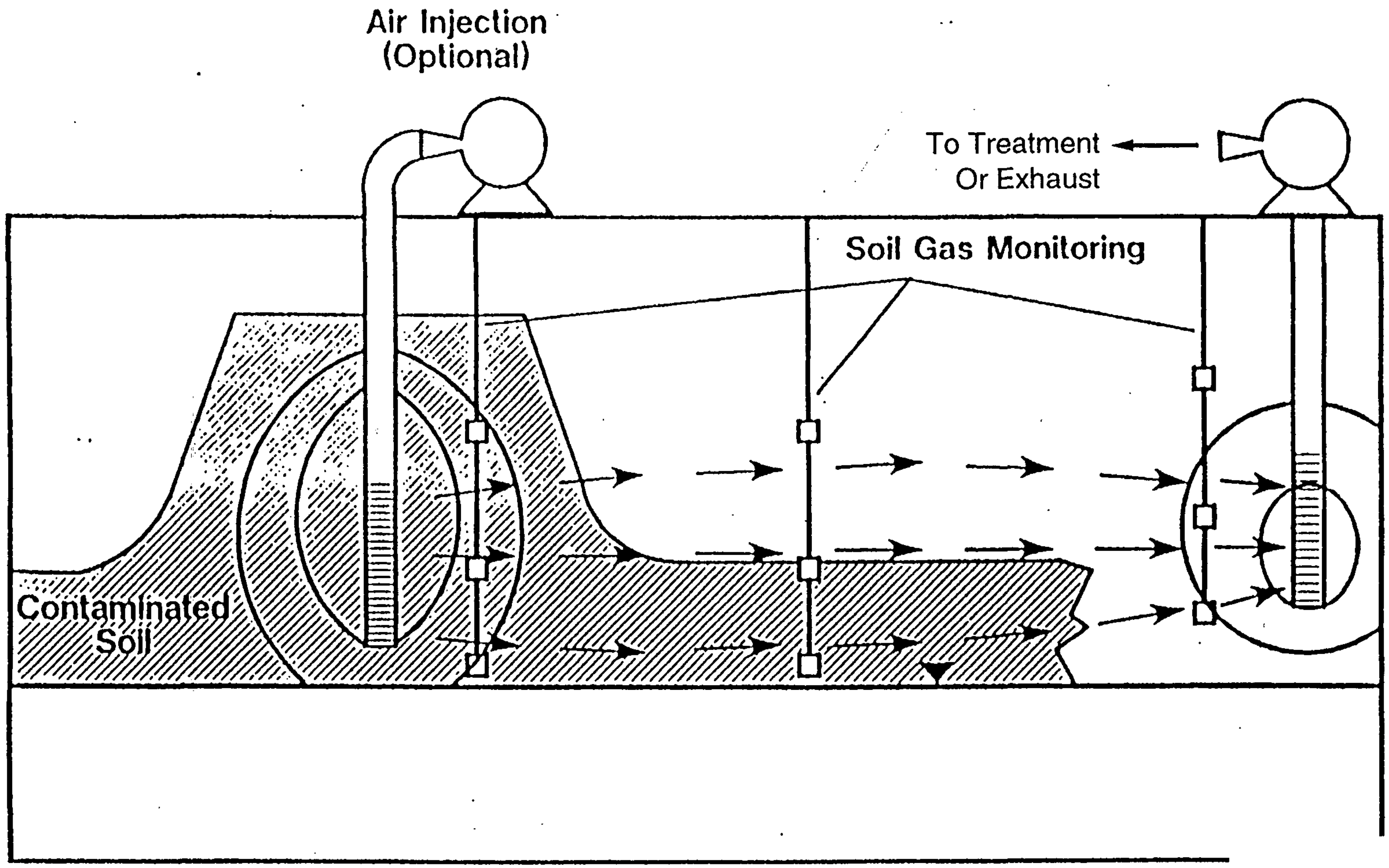



**Figure 3-7**
**Bioventing System**
**Urbana Landfill Feasibility Study**

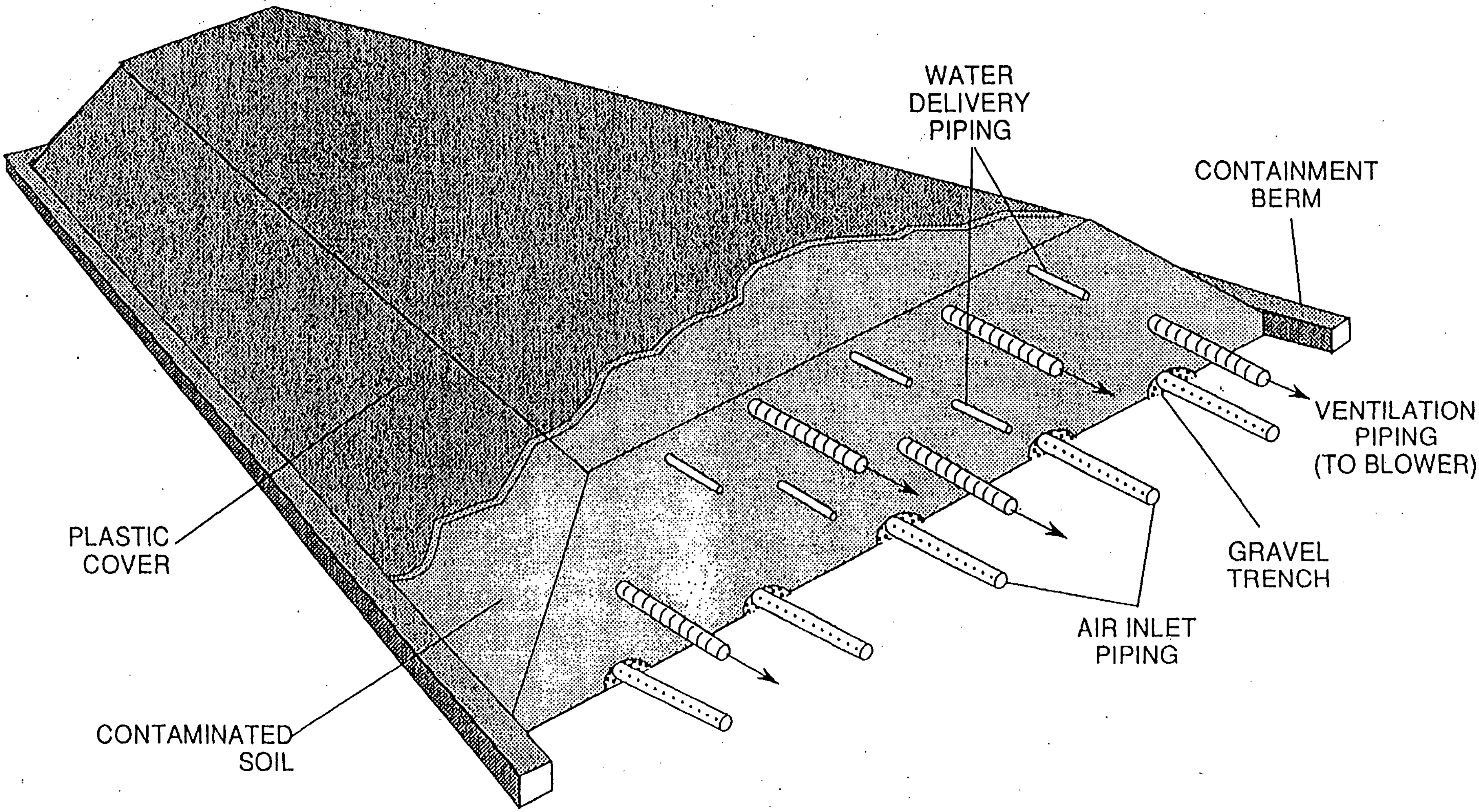



**Figure 3-8**
**Typical Schematic Biopile Cross Section**
**Urbana Landfill Feasibility Study**

at which VOCs are driven off, additional waste air stream treatment, such as activated carbon treatment, may be required. Excavation and processing of soils as part of preparation for construction of biopiles will tend to lower VOC concentration in soils, as VOCs will volatilize and escape to the atmosphere. Pilot studies are necessary to provide site specific data for VOC removal rates in biopiles.

Biopiles can be an effective treatment method for the remediation of soils contaminated with VOCs, SVOCs and aromatic hydrocarbons. Biopiles are not an effective treatment method for heavy metals, PCBs or pesticides. Biopiles may be suitable for treatment of contaminated soils from Hot Spots 1, 3 and 4. Biopiles are not an appropriate technology for Hot Spot 2 because of the heavy metals and pesticides in the soil at this location or for Hot Spot 5 because chlorinated VOCs are not conducive to bioremediation.

### 3.3.5 Excavation, Stockpile, Slurry Bio-Reactor Treatment of Hot Spots

Slurry-phase biological treatment of sub-surface soils is an existing biological process that uses soil microorganisms to chemically degrade organic constituents. An aqueous slurry is produced by combining the soils with water and other chemical additives. The biodegradation process is enhanced by the control of parameters such as pH, oxygen, and nutrients in the reactor. The slurry is mixed in a reactor to keep the solids in suspension and, therefore, the microorganisms in contact with the soil contaminants. The slurry is continuously aerated for a sufficient time to degrade the target waste constituents. The process may be varied depending on the characteristics of the soil. It can either be operated in a batch or continuous treatment mode. Due to the volume of soil being considered for treatment at the Urbana Landfill (9,000 - 10,000 cubic yards), the process would be constructed using a tank-based system. The system would consist of a reactor which is aerated using coarse bubble diffusers. The soils would be kept in contact with the microorganisms through the use of a mixer. The oxygen and pH would be constantly monitored to provide a stable environment, which will enhance biodegradation. In addition, an antifoaming and temperature control system may be added for process control. A simplified schematic diagram of a slurry reactor system is shown in Figure 3-9.

A concern during the biological reactor treatment process is the volatilization of the contaminants and the potential for VOC emissions. Carbon absorption or some other technology to control emissions may be required. For evaluation of the slurry reactor process it will be assumed that carbon absorption of emissions is necessary. In addition, the solids must be dewatered once they have been treated.

Biological slurry reactor processes are generally designed to treat non-halogenated volatile organics and fuel hydrocarbons. Treatment of halogenated, semi-volatiles and pesticides may be less effective and may not be applicable to certain compounds. Chlorinated organics and pesticides are more difficult to biodegrade and, therefore, this technology would not be applicable.

The cost of a biological slurry reactor treatment system varies widely based upon the extent of pre- and post treatment equipment required. Typical equipment required include pre-treatment soil segregation, post-treatment soil dewatering and air emission control equipment.

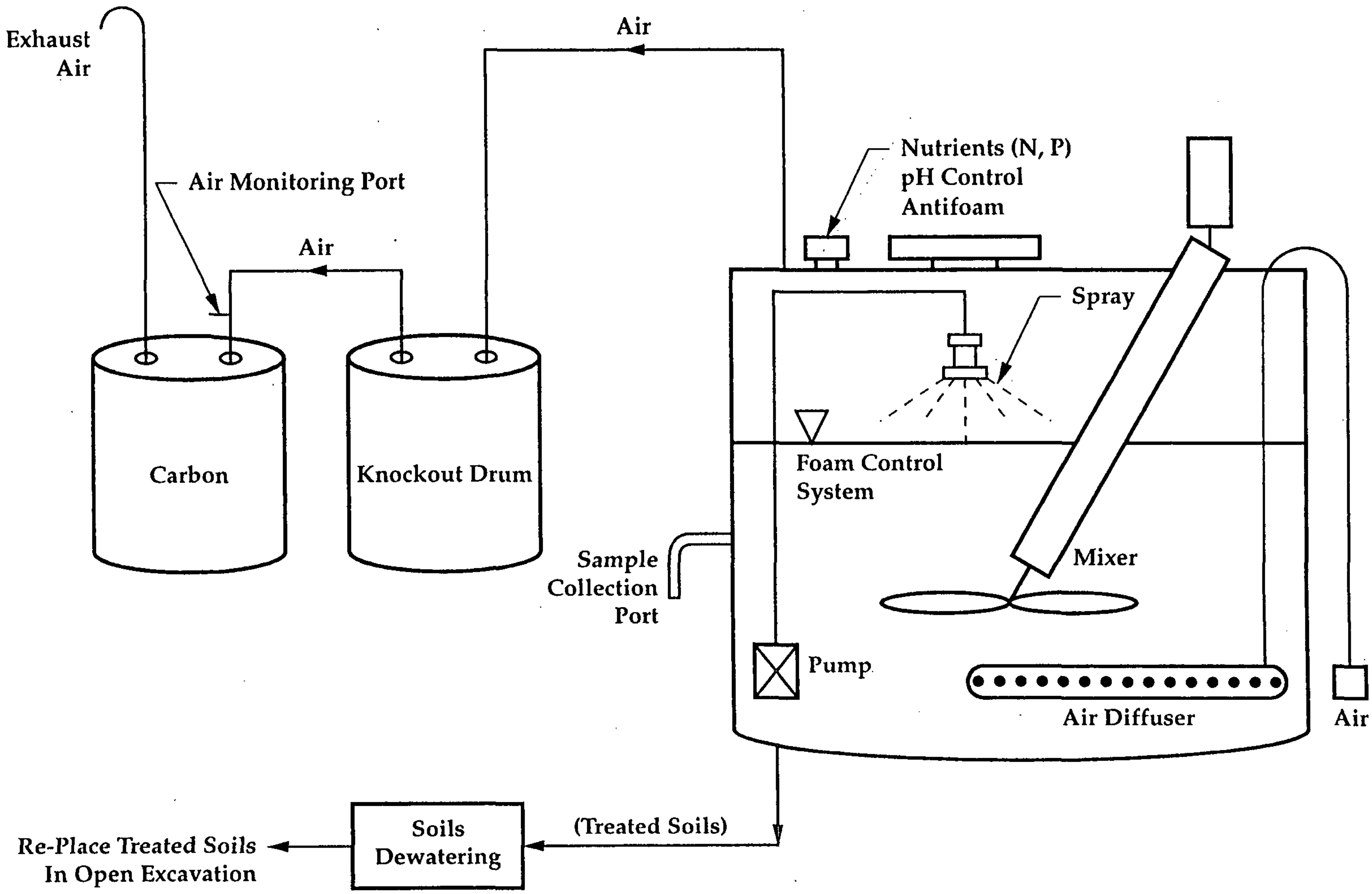



**Figure 3-9**
**Slurry Bio-Reactor System**
**Urbana Landfill Feasibility Study**

### 3.3.6 Initial Screening of Alternatives

The technologies described for the remediation of subsurface soils are listed in Table 3-1. This table lists each technology and its corresponding effectiveness in meeting the RAOs for subsurface soil as it pertains to individual Hot Spots.

The Hot Spot removal and off-site disposal technology will effectively remediate all five of the Hot Spots. This technology effectively removes the contaminated media from the Urbana landfill but does not actually reduce the toxicity of the material. This technology simply transfers the contaminated waste from the Urbana landfill to a more secure landfill in another location.

The technology of Hot Spot removal and off-site disposal is probably not necessary for Hot Spot 2. At this location, the VOC contamination is not substantially higher than the NYS SCGs and may volatilize to the point of non-exceedance of the NYS SCGs during excavation. The remainder of the contamination in Hot Spot 2 is comprised of SVOCs, PCBs, pesticides and metals. These contaminants are not expected to migrate from this location and, as such, do not pose a significant threat to the downstream receptors. For these reasons, excavation and offsite disposal of contaminated soils is considered a viable technology for Hot Spots 1, 3, 4 and 5.

The cost of excavation and off-site disposal of approximately 9,000 cubic yards (4,500 tons) of contaminated material is estimated to be several million dollars. This is the most expensive of the technologies that address the removal of the contaminated subsurface soil Hot Spots.

The soil vapor extraction technology is effective in removing VOCs from unsaturated or minimally saturated soils. This technology is an in-situ treatment of the vapor phase contaminants in the soil matrix, as well as the volatile contaminants adsorbed to the soil particles in the unsaturated zone. The contamination is removed from the interstices of the soil by applying a vacuum inducing forced air flow, and are then captured in a carbon filter unit. The contaminated media is then destroyed during the regeneration of the carbon by the carbon vendor.

Although this technology was considered as a remediation alternative for each of the Hot Spots, it is only potentially effective for Hot Spots 3, 4 and 5. Due to the combination of an elevated water table and "deep" contamination (i.e., waste located predominantly in the saturated soil), Hot Spot 1 is not amenable to the SVE technology. The majority of contamination in Hot Spot 2 cannot be removed using the SVE technology. Some SVOCs can be removed but pesticides, metals and PCBs are not removed from the soil using this technique. The majority of contamination in Hot Spots 3, 4 and 5 consists of VOCs that appear to be in the unsaturated zone. Therefore the remediation of these Hot Spots could be accomplished effectively with this technology.

The cost to implement the SVE technology is more cost effective in comparison to the removal and disposal option. It is estimated that the cost to implement this technology will be less than a million dollars depending on the extent of off-gas treatment. The expected duration of this treatment process will be approximately one year.

The bioventing technology is suitable for treatment of contaminated soils in the unsaturated zone where the porosity of the soil is suitable for the movement of air. Bioventing is the process of

Table 3-1
## Initial Screening of Potentially Applicable Technologies for Subsurface Soil Contamination
Urbana Landfill, New York

| Technology | Effectiveness | Implementability | Cost * | Screening Result |
|---|---|---|---|---|
| **No-Further Action**<br><br>No-Action involve institutional controls and site-access restrictions | The No-Further Action technology limits access to the site. This technology does not contain, remove or treat the on-site contamination. | The No-Further Action technology is simple to implement. The action would require the installation of a fence surrounding the site that would restrict access. | The cost to implement the No-Further Action Technology would be minimal. | Evaluate Further |
| **Hot-Spot Removal & Off-Site Disposal**<br><br>Excavation of Hot-spots and Off-site Disposal of contaminated material from Hot-spots 1, 3, 4, and 5.<br>*Note: Hot-spot 2 is not identified as a hot-spot candidate for excavation due to the limited VOC contamination and the presence of contamination that is not expected to migrate from the site.* | The removal of Hot-spots 1, 3, 4 & 5 is an effective technology which will remove the source of contamination and therefore prevent migration to downstream receptors.<br><br>This technology does not treat the contaminated material but instead transports and disposes of it at a secure landfill elsewhere. | This technology is relatively simple to implement. The action would require the excavation and staging of the contaminated material from hot-spots 1, 3, 4 & 5. Once dry, the contaminated media would be transported and disposed off at a secure landfill. | The cost to implement this technology is relatively expensive. Hot-spots 1, 3, 4, and 5 have approximately 9,000 c.y. of contaminated media. The cost for this technology is estimated to be several million dollars. | Not Selected due to non-treatment of soils Technology simply transfers contaminated soil |
| **Soil Vapor Extraction**<br><br>In-situ treatment of VOCs and some SVOCs. The SVE system withdraws vapor phase contaminants from the soil matrix induced by the air flow through the interstices, and includes carbon filters and offsite destruction of contaminants. | The effectiveness of a SVE system is dependent on several factors including moisture content and permeability of the soil.<br><br>Depending on the results of a pilot study, an SVE system may be amenable for the removal of VOCs from hot-spots 3, 4, and 5. Hot-spot 1 is not a likely candidate for the SVE technology because of the high groundwater table in addition to metals not being removed by this technology.<br><br>This technology effectively removes and destroys the contamination in the affected media. A carbon vapor phase unit would collect the flow of air and capture the contaminants. The carbon would later be destroyed, thus eliminating the contamination. | Depending on the in-situ parameters, the SVE technology can be a relatively simple process. Typically, a pilot facility would be installed to determine the design parameters and effectiveness of the full scale unit. | The overall cost to construct and operate a SVE system is relatively low in comparison to the option of excavation and disposal. The cost to construct and operate a SVE system is estimated to be less than a million dollars. | Evaluate Further |

* - Note: Cost include in screening only as a means of choosing between two, otherwise comparable options

Table 3-1
## Initial Screening of Potentially Applicable Technologies for Subsurface Soil Contamination
Urbana Landfill, New York

| Technology | Effectiveness | Implementability | Cost * | Screening Result |
|---|---|---|---|---|
| **Bioventing**<br><br>Bioventing is the process of aerating subsurface soils to stimulate in-situ biological activity to bioremediate the contaminated media. Air is continuously drawn through the soil system either directly from the atmosphere or from air injection wells. Nutrients and moisture may be added to the system to increase degradation. | Bioventing is suitable for the remediation of some VOCs or SVOCs. It is not suitable for the remediation of soils contaminated with metals, PCBs, pesticides or chlorinated VOCs.<br><br>Bioventing is considered a feasible option for Hot Spots 3 and 4.<br><br>Hot Spot 1 and 2 have most of the affected media located in the saturated zones and are therefore not suitable for bioventing. Bioventing is not a suitable treatment of contaminated soils in the saturated zone.<br><br>Hot Spot 5 is not appropriate for remediation because chlorinated VOCs are not remediated with this process. | Bioventing is similar to the SVE technology. Depending on the in-situ parameters ( soil moisture and permeability) the construction and operation of a bioventing system is relatively simple. The system requires more attention than a SVE system due to the requirement of adding water and/or nutrients. | The overall cost to construct and operate a bioventing system is relatively low in comparison to the option of excavation and disposal. The cost to construct and operate a bioventing system is comparable to the SVE system. | Not selected, the bioventing technology requires more attention than a SVE system due to the requirement of adding water and/or nutrients. The SVE system is as effective with lower maintenance. |
| **Biopile Treatment of Hot-Spots**<br><br>Biopile treatment of sub-surface soils is a biological process for removing organic contaminants from the soil. The contaminated media is excavated and shaped into mounds and equipped with piping for air and water. | Biopiles are typically suitable for the remediation of VOCs and SVOCs. It is not suitable for the remediation of soils contaminated with metals, PCBs, pesticides or chlorinated VOCs.<br><br>Biopiles are considered a feasible option for hot spots 1 (non-metals), 3 and 4.<br><br>Biopiles are not suitable for hot spots 2 and 5 because most of the contamination in these hot spots are comprised of metals or chlorinated VOCs, respectively. | Biopiles are an ex-situ variant to Bioventing. The excavated soil is sometimes processed prior to mounding to enhance air flow. This typically will ensure a suitable air flow through the media. The construction of the piles is relatively simple. They are constructed on impervious pads and covered with impervious plastic to prevent infiltration of rainwater and eliminate wind borne dust. | The overall cost to construct and operate biopiles is similar to the costs for the bioventing and SVE technologies. These technologies are less expensive than the option of excavation and disposal. | Not selected, the biopile technology is not selected for similar reasons given for the bioventing technology. |
| **Slurry Reactor Treatment of Hot Spots**<br><br>The excavated hot spots are combined with water and other chemical additives that use the microorganisms in the soil to chemically degrade the organic constituents in the soil. The slurry is mixed in a reactor to maintain contact between the soil contaminants and the microorganisms. The slurry is continuously aerated for a sufficient time to degrade the waste constituents. | Slurry Reactors are suitable for the remediation of VOCs and SVOCs. Typically, they are not suitable for the remediation of soils contaminated with metals, PCBs, pesticides or chlorinated VOCs.<br><br>Slurry Reactors may be a feasible option for hot spots 1 (non-metals), 3 and 4.<br><br>A bioslurry is not suitable for hot spots 2 and 5 because most of the contamination in these hot spots are comprised of metals and chlorinated VOCs, respectively. | The implementation of a bioslurry in a reactor would be relatively simple to construct. The disadvantage to this technology is that this technology would require daily operation and oversight to control the necessary parameters required for biological degradation. | The cost of a biological slurry reactor system varies widely based upon the extent of pre- and post treatment required. The operation and maintenance costs are estimated to be higher for this technology than for the other technologies. | Not selected, due to operational complexity and existence of otherwise comparable technology options. |

* - Note: Cost include in screening only as a means of choosing between two, otherwise comparable options

aerating subsurface soils to stimulate in-situ biological activity to bioremediate the contaminated media. Bioventing is similar to the SVE technology, but typically also involves the injection of nutrients and moisture to increase degradation. Bioventing is suitable for the biological remediation of soils contaminated with SVOCs, and aromatic hydrocarbons. Bioventing is not suitable for remediation of soils with chlorinated VOCs, PCBs, pesticides or heavy metals. Bioventing may be a suitable remediation technique for Hot Spots 3 and 4. Hot Spots 1 and 2 are not appropriate for bioventing because most of the contaminated soil in these Hot Spots is located in the saturated zone. Hot Spot 5 is not appropriate for remediation through bioventing because chlorinated VOCs are the predominate constituent in this Hot Spot.

Depending on the final determination of the Hot Spot volume, the cost to implement the bioventing technology is similar to the SVE technology. The duration of the treatment is expected to be approximately one year. The bioventing system requires more operational attention than a SVE system due to the addition of water and nutrients.

The biopile technology is an ex-situ variant to the bioventing technology. Biopiles can be an effective treatment method for remediation of soils contaminated with VOCs, SVOCs and aromatic hydrocarbons. The biopile process involves the removal of contaminated soil, the subsequent shaping of the piles into mounds (covered to prevent infiltration and wind erosion) which are equipped with piping for the addition of air and water. Biopiles are not an effective treatment method for heavy metals, PCBs or pesticides. Biopiles may be suitable for treatment of contaminated soils from Hot Spots 1, 3 and 4, but are not an appropriate technology for Hot Spot 2 because of the heavy metals and pesticides in this soil, or for Hot Spot 5 because chlorinated VOCs are not conducive to bioremediation.

The overall cost to construct and operate the biopiles is similar to the SVE and bioventing technologies, which are expected to be lower than the Hot Spot removal and disposal option.

The bioslurry technology involves the excavation and placement of contaminated soils in a tank or reactor with water and other chemical additives. The reactor uses the microorganisms in the soil to chemically degrade the contaminants. The slurry must be continuously aerated for a sufficient time to degrade the waste constituents. Although the bioslurry technology is relatively simple to construct, the technology is labor intensive. Although this technology is potentially suitable to remediate Hot Spot 1, Hot Spot 3 and Hot Spot 4, the difficulty of operating this technology at a remote site like the Urbana landfill is the reason that this technology has been removed from further consideration.

Summarizing the effectiveness of each technology for the individual Hot Spots shows that the excavation and disposal of the Hot Spots is potentially effective for remediation of four of the five Hot Spots (1, 3, 4 and 5). The soil vapor extraction and the biopile technologies are potentially effective for remediation of three of the five Hot Spots. Finally, the bioventing technology is potentially effective for the remediation of two Hot Spots (3 and 4). The technologies were further screened to evaluate which of the technologies would be potentially most effective in remediating the site with particular attention to the cost of the technology and the ease of implementation. An in-situ technology was considered to be easier to implement than an ex-situ (a technology that involves excavation of the contaminated media prior to treatment) technology. A single technology at the site was considered to be more implementable and efficient than various technologies applied to the different Hot Spots.

Using those guidelines, three technologies, Hot Spot removal with off-site disposal, soil vapor extraction, and bioventing were selected as the technologies that would potentially be the most effective at the Urbana landfill site. The biopile and bioslurry technologies were determined to be to labor intensive and therefore were not evaluated further. The bioventing technology, although in-situ and relatively simple, is not suitable for remediation of three of the five Hot Spots (compared to the SVE system being incompatible for only two of the Hot Spots). Additionally, this technology is more labor intensive than the SVE technology. Therefore this technology was removed from further consideration in favor of the comparable SVE system. The Hot Spot removal technology was also not considered to be a suitable technology. The cost for this technology outweighs the apparent benefits. Additionally, this technology does not destroy the contamination but rather simply transports it to another location.

## 3.4 Leachate

During the Phase I RI, only one leachate seep was identified, therefore, only one sample was taken at the site. The sample was located on the access road above the middle terrace, midway to the top of the slope. In fact, the presence of a clay lens, observed during the sampling, may be evidence that this sample may have been perched groundwater rather than leachate. Sample analysis results tended to confirm this being perched groundwater because organic compounds were not detected. Iron was the only metal that exceeded the NYS SCGs, and the concentration of calcium exceeded that of the background sample. Alkalinity and total hardness also exceeded the NYS SCGs.

Data obtained from leachate samples collected in various locations during the April 1997 sampling event indicate low levels of VOC contamination, and may signify, depending on the season and weather conditions, that leachate seeps may be a seasonal occurrence. During the wet months, which typically occur in the spring, leachate seeps may occur. This would explain why the low level of VOC contamination found in the second round of sampling which took place in April, 1997 was not found in the first round of sampling, October, 1996.

Leachate seepage could impact the surface water in surrounding areas. Any future remediation alternatives must incorporate methods for the elimination of leachate seeps.

The primary mechanism for the formation of leachate is through the contact of landfill waste with surface water/precipitation infiltrating the landfill surface, or with groundwater flowing through the base of the landfill. Because the landfill does not have a base liner system and it is physically impossible to prevent groundwater from infiltrating the base of the landfill, the main objective is to prevent the creation of new leachate through surface infiltration.

The following remediation alternatives will be considered to prevent the infiltration of surface water/precipitation through the waste and eventually into the groundwater.

### 3.4.1 Part 360 Landfill Cap

Installation of a Part 360 landfill cap over the surface of the landfill will minimize exposure, reduce infiltration, and provide surface controls which will alter the surface runoff and evaporation at the site. Part 360 cap technology is technically implementable for the Urbana landfill. The specifications of a 360 landfill cap are detailed in 6 NYCRR 360-2.13 and have previously been outlined in section 3.1 of this report. As noted above, the barrier layer will consist of a geomembrane.

### 3.4.2 Regrading to Prevent Leachate Seeps

Regrading of the landfill to prevent leachate seeps is another alternative to prevent leachate from contaminating nearby surface waters, such as the stream immediately west of the landfill. Regrading during the installation of a landfill cap may create new seeps. The potential for these seeps will be considered during the design of the landfill cap, and the necessary controls implemented in order to avoid or contain such seeps.

### 3.4.3 Subsurface Leachate Collection

Due to the fact that the landfill has no base liner and portions of the waste are below the groundwater table, subsurface leachate collection is not feasible.

## 3.5 Groundwater

### 3.5.1 French Drain

By use of a French Drain located in the upgradient direction of groundwater flow, the water table within the landfill may be lowered. By providing an outlet for the water flowing into the unnamed stream west of the landfill, the groundwater that typically flows through the landfill can be diverted. When used in conjunction with a landfill cap, the French Drain would prevent recharge in the landfill. Thus, the water table could potentially be lowered. By lowering the water table, the potential interaction of the migrating water with the contaminated media within the Hot Spots is reduced, thus minimizing the offsite migration of contamination from the landfill.

The French Drain system would involve constructing a trench upstream of the landfill (north of the landfill boundary). The required depth of this trench is estimated to be approximately 15-feet. The piping system would consist of perforated PVC pipe placed within a gravel covering at the base of the trench. Groundwater that has migrated towards the landfill would discharge into the trenched area and be conveyed to the unnamed stream via the french drain piping system. A typical arrangement of a french drain system is shown in Figure 3-10.

To determine the potential effectiveness of a French Drain system, a groundwater model was used. The system was modeled with recharge on the north side of the landfill and an impermeable landfill cap to the south of the french drain. The results of this modeling effort are discussed in Appendix B. It was determined through the modeling effort that a French Drain system would not be an effective remedial solution. The groundwater table would not be lowered significantly by implementing this system.

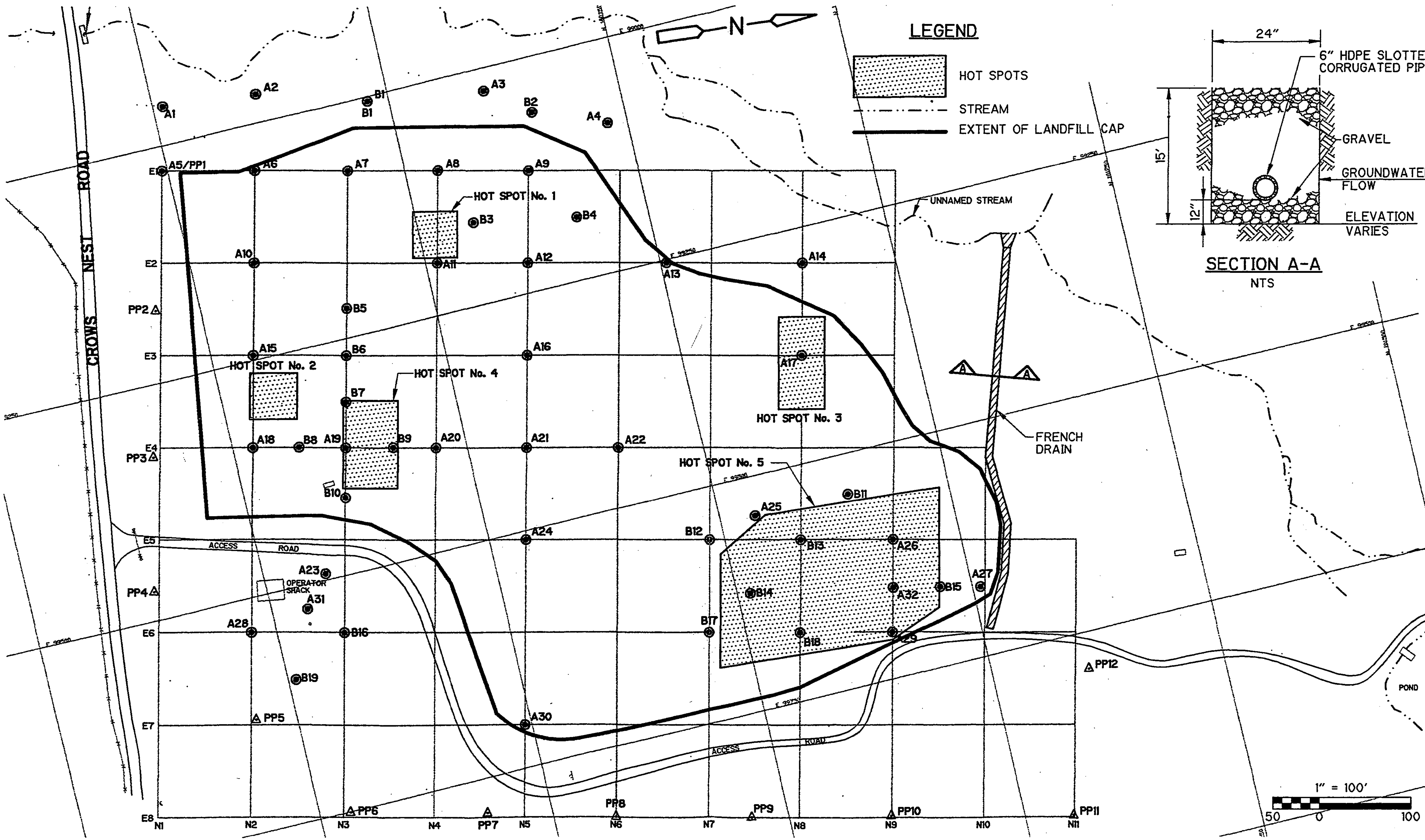



Figure 3-10
French Drain Conceptual Design
Urbana Landfill Feasibility Study

The cost of a French Drain system at this location would be minimal for the materials involved. The major cost for this system would be trenching through the bedrock. The depth to bedrock in the proposed area of the French Drain is approximately 8 - 10 feet. Therefore, the construction of the French Drain system would involve the removal of 5 - 7 feet of bedrock along the entire length (approximately 400 feet). This type of construction, coupled with the limited water table drawdown, make this an expensive technology with minimal advantages. For this reason this technology is not being evaluated for further consideration.

### *3.5.2 Monitoring of Monitoring Wells and Private Wells*

Groundwater monitoring is technically feasible at the site. Groundwater monitoring could be implemented at the site to augment the existing site database obtained from the remedial investigation and to evaluate changes in site conditions over time. Continued monitoring of groundwater at and in the vicinity of the site will enable the determination of restoration rates occurring through natural attenuation (included in the "No Action" alternative.). Also, because of the presence of groundwater within the fill material, continual groundwater contamination cannot be completely controlled. Therefore, a groundwater monitoring program must be implemented at the site to track potential future off-site migration of contaminants.

Twenty-eight monitoring wells and several private wells are already in-place and, if necessary, more wells could be installed at and/or in the vicinity of the site. Figure 1-2 shows the location of the private wells in relation to the landfill. The contamination and site characteristics would not affect groundwater monitoring, but would dictate the parameters to be analyzed and the wells to be sampled, potentially requiring long-term management efforts (the groundwater monitoring program is expected to last for 30 years) . This technology will be retained for further evaluation in the Feasibility Study.

### *3.5.3 Treatment of Hot Spots and Landfill Cap*

The RI investigation identified some VOC groundwater contamination downgradient of the site. Because most of the landfill does not appear to be a significant source of VOC contamination to the groundwater, the remediation of those Hot Spots containing high levels of VOCs has the potential benefit of limiting future contamination of the groundwater. By treating the VOC contaminated Hot Spots, and capping the landfill to eliminate the infiltration of water through the landfill material, it is expected that the levels of VOCs in the groundwater beneath the landfill will be reduced. As the groundwater moves offsite, additional reductions in the contaminant levels in the groundwater are expected through dilution and natural attenuation. Both landfill capping and Hot Spot remediation are effective technologies for limiting groundwater contamination and are retained in this study for further evaluation.

## 3.6 Development of Candidate Remedial Alternatives

Based on the review of the technologically feasible alternatives for the Urbana Landfill Site presented in this section, and the elimination of those technologies that are not feasible, practical, or cost-effective, three alternatives have been developed for more detailed evaluation.

*Alternative 1*

The no action alternative is usually included in an Feasibility Study to provide a baseline for comparison to other remedial actions. The no action alternative typically includes only future monitoring at the site. However, since the NYSDEC has already judged that a presumptive remedy approach is appropriate for the Urbana Landfill site, institutional controls were incorporated into the no action alternative. The no action alternative would accomplish the following:

- Land use controls would prohibit well installations near the landfill and consequently limit exposure to landfill solids and sediments.
- Access restrictions place physical barriers around the landfill property to prohibit entry on the site by the general public. The fence access restriction would include maintaining the fence located at the site, and written warnings to warn the public of hazards associated with the landfill.
- Well permit regulations restrict potential exposure by the public to hazards associated with drilling new wells or coming into contact with affected groundwater.

*Alternative 2*

Alternative 2 includes the consolidation of the waste away from the stream along the western slope of the landfill, the consolidation of the waste contained in the southeastern cell south of the access road into the main part of the landfill, and the design and construction of a Standard Part 360 landfill cap over the consolidated waste. It also includes the monitoring of existing groundwater monitoring and private wells. The five site Hot Spots would be left undisturbed. This Alternative would minimize human and environmental exposure to site contaminants. An engineered gas collection system beneath the cap and a gas venting system will reduce exposure to VOCs to acceptable emission levels.

*Standard Part 360 Landfill Cap*

The cap will consist of a geomembrane barrier layer, a geomembrane protection layer, a geonet gas venting layer, topsoil, and passive gas vents spaced at one per acre of landfill cap. Once the cap is in place, stormwater infiltration through the landfill mass will be significantly reduced and leachate produced by stormwater is expected to be virtually eliminated. (This will not eliminate the leachate produced by groundwater flow through the landfill waste mass). The stormwater run-off will be diverted by a system of drainage channels and piping to the unnamed stream.

The consolidation of the waste to set it back from the unnamed stream, and the placement of all waste beneath the cap will eliminate the contamination of stormwater runoff which may affect nearby surface water bodies, particularly the unnamed stream. The cap will also control air emissions from the landfill. An effective landfill cap with passive landfill gas vents will control the release of volatile compounds and landfill gas, as well as eliminate wind blown contaminated dust particles from the landfill.

As part of the remediation design, the feasibility of consolidating the landfill waste material contained in the one acre southeast quadrant will be determined. This waste is separated from the main landfill by the access road. It is expected that this waste can be moved during the regrading and capping of the landfill, and will be combined with the main landfill to limit the lateral extent of the landfill cap and eliminate the necessity of designing two caps.

*Groundwater Monitoring*

Periodic monitoring of existing groundwater monitoring wells in and around the landfill, as well as private wells in the vicinity of the site, will be conducted as part of this alternative. The need for additional well installations based upon findings of the Phase II RI may also need to be considered, but it is not considered in this Feasibility Study.

Monitoring of the wells will be used to augment the existing site data base from the RI and evaluate changes in site conditions over time. The groundwater monitoring program will be implemented to track potential future off-site migration of contaminants. The program will be developed based upon a quarterly sampling schedule for the first five years and yearly monitoring for the next twenty-five years.

*Alternative 3*

Alternative 3 includes the consolidation of the landfill along the unnamed stream to the west, the consolidation of the southeast quadrant of the landfill with the main part of the landfill, the installation of a Standard Part 360 landfill cap and monitoring of groundwater and private wells as discussed in Alternative 2 (Section 4.3). This alternative also includes the treatment of Hot Spot 5 using soil vapor extraction treatment technologies. Hot spots 1, 2, 3 and 4 would be left undisturbed.

Alternative 3 combines several identified feasible technologies to bring an enhanced level of exposure prevention and contaminant clean-up. It is expected that greater costs will be associated with this greater level of clean-up. This alternative provides for minimization of human and environmental exposure through landfill consolidation and permanent capping of the site surface, in addition to remediation of a specific Hot Spot for reduction of contaminant levels. Although this alternative provides the greatest level of site clean-up, Hot Spots, would remain. The remaining Hot Spots are smaller in total volume than Hot Spot 5 and interact with the groundwater to a lesser extent than Hot Spot 5. Therefore, the remediation of these remaining Hot Spots would best be accomplished through the implementation of a landfill cap.

# 4 Section Four

# Section 4
# Detailed Analysis of Alternatives

## 4.1 Criteria

A total of three alternatives for remediation were developed through the screening process presented in Section 3. They are:

| | |
|---|---|
| Alternative 1 - | No Further Action, Institutional Controls, and Groundwater Monitoring; |
| Alternative 2 - | Part 360 Landfill Cap and Monitoring of Groundwater; |
| Alternative 3 - | Part 360 Landfill Cap, Soil Vapor Extraction of Hot Spot 5, and Groundwater Monitoring. |

The purpose of this section is to analyze these alternatives in sufficient detail to objectively compare them. In Section 5 - Comparative Analysis, the alternatives will be compared against each other.

The Technical and Administrative Guidance Memorandum (TAGM) identifies seven evaluation criteria to address technical and policy considerations that have proven to be important for selecting remedial alternatives. These criteria are listed and briefly described below. These seven criteria are used to perform a detailed analysis of the remaining three alternatives.

### *4.1.1 Compliance With Applicable or Relevant and Appropriate Requirements, and Standards Criteria and Guidelines (ARARS/SCGs)*

Alternatives are evaluated to determine whether they comply with all applicable or relevant and appropriate requirements, or if a waiver is required, how it is justified. The alternatives are evaluated against three categories of SCGs, chemical-, action-, and location-specific. These SCGs are listed in Tables 1-6 through 1-8.

### *4.1.2 Protection of Human Health and the Environment*

Alternatives are evaluated to determine whether they can adequately protect human health and the environment, especially after the remediation has been completed. The analysis indicates how much risk at the site is eliminated, reduced, or controlled, and considers exposure levels established during the development of the remediation goals.

### *4.1.3 Short-Term Effectiveness*

The short-term impacts of each alternative are evaluated, concentrating on: (1) the risks that may result during construction; (2) the time until remedial response objectives are achieved; (3) the potential impacts on workers during remedial action, the effectiveness and reliability of protective measures available to workers; and (4) the potential environmental impacts of the remedial action and the effectiveness of mitigative measures during construction.

### 4.1.4 Long-Term Effectiveness and Permanence

Alternatives are also assessed for the long-term effectiveness and permanence they provide, along with the degree of certainty that the alternative will be successful. This evaluation concerns the time period during the operation of the remedial action and after the operation of the remedial action. Other long-term effectiveness and permanence factors include the magnitude of residual risk from untreated waste or treatment residuals remaining at the conclusion of the remedial activities. Also, the adequacy and reliability of controls such as containment systems and institutional controls that are necessary to manage treatment residuals and/or untreated waste will be evaluated. This criterion should include assessment of the potential need to replace components of the alternative and associated risks.

### 4.1.5 Reduction of Toxicity, Mobility, or Volume

The degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume shall be assessed, including how treatment is used to address the principal threats posed by the site. Factors that shall be considered include: (1) the amount of hazardous contaminants that will be destroyed, treated, or recycled; (2) the degree to which treatment reduces the inherent hazards posed by principal threats at the site; (3) the degree to which the treatment is irreversible; and (4) the type and quantity of residuals that will remain following treatment.

### 4.1.6 Implementability

The ease or difficulty of implementing the alternatives shall be assessed by considering the technical and administrative feasibility of a technology and the availability of services and materials. The technical feasibility includes: (1) difficulties and unknowns associated with the construction and operation of a technology; (2) the reliability of the technology; (3) the ease of undertaking additional remedial actions; and (4) the ability to monitor the effectiveness of the remedy. The administration factors include coordination with other offices and agencies. The assessment of availability of services and materials includes: (1) the availability of adequate off-site treatment, storage capacity, and disposal capacity and services; (2) the availability of necessary equipment, specialists and skilled operators, and provisions to ensure any necessary additional resources; and (3) the availability of services and materials with competitive bidding.

### 4.1.7 Cost

The types of costs that are evaluated include capital costs, including both direct and indirect costs; annual operation and maintenance costs; future capital costs, and cost of future land use as described below:

- Capital Costs - Capital costs consist of direct (construction) and indirect (non-construction and overhead) costs.
  - Equipment Costs - Equipment necessary for the remedial action; (these materials remain until the site remedy is complete).
  - Land and Site-Development Costs - Purchase of land and site preparation of existing property.

- Building and Services Costs - Buildings, utilities, and purchased services.
- Disposal Costs - Transporting and disposing of waste material.
- Engineering Expenses - Administration, design, construction supervision, drafting, and treatability testing.
- Legal Fees and License or Permit Costs
- Start Up and Shakedown Costs
- Contingency Allowances - To cover unforeseen circumstances.

- Operation and Maintenance Costs - Annual post-construction costs necessary to ensure the continued effectiveness of a remedial action. The following annual cost components should be considered:
  - Operating Labor Costs - Wages, salaries, training, overhead, and fringe benefits associated with post-construction operation
  - Maintenance Material and Labor Costs
  - Auxiliary Materials and Energy - Chemicals, electricity, water, and sewer, etc.
  - Disposal of Residues - To treat or dispose of residuals such as sludges from treatment processes or spent activated carbon.
  - Purchased Services - Sampling costs, laboratory fees, and professional fees which can be predicted.
  - Administrative Costs
  - Insurance, Taxes, and Licensing Costs
  - Replacement Costs
  - Costs of Periodic Site Reviews - Reviews to be conducted every five years if a remedial action leaves any hazardous substances, pollutants, or contaminants at the site.
- Future Capital Costs - Costs for future remedial actions should be evaluated when there is the potential for a major component of the remedial alternative to break down or need replacement.
- Cost of Future Land Use - Potential future land use of the site is normally considered with regards to future zoning or residential development which may be restricted if hazardous waste is left at the site or if groundwater use is impacted. However, for this study it was not considered because each alternative will have similar impacts on surrounding land use. Once

the site is remediated so that it no longer presents a significant threat to human health or the environment, the future use and property value of surrounding properties will be enhanced.

A present worth analysis is performed to bring all future costs to the current year (1997) for easy comparison. The total present worth cost of the alternative includes the direct and indirect capital costs and the present worth of the annual and periodic costs over the design life of the alternative at an annual rate of six percent. A cost sensitivity analysis may evaluate any uncertainties concerning specific assumptions made for individual costs, if necessary. At this stage of the Feasibility Study, costs are expected to be within -30 to +50 percent.

## 4.2 Alternative 1 - No Further Action, Institutional Controls and Groundwater Monitoring

### *4.2.1 Evaluation*

The evaluation of this alternative and the other remaining alternatives is presented in Table 4 -1. This evaluation analyzes each of the final three alternatives against the TAGM criteria discussed in Section 4.1. These criteria serve as a tool in analyzing the alternatives during the detailed analysis.

#### *4.2.1.1 Compliance with ARARs/SCGs*

Three types of ARARs/SCGs have been evaluated in this Feasibility Study. One is chemical-specific, another is action-specific, and the third one is location-specific.

The chemical-specific ARARs/SCGs address whether the site impacts to the groundwater, surface water, air and soil exceed the Federal, State or Local standards. For example, in order to comply with the chemical-specific ARARs/SCGs the groundwater should comply with Part 703 of the NYSDEC Ground Water Quality regulations, as well as all other applicable standards listed in Table 1-6. In Alternative 1, no active remediation is considered, only Institutional Controls. Institutional Controls consist of physical or zoning restrictions in the landfill property. Although they limit the public access to the site, these restrictions do not result in compliance with the chemical-specific ARARs/SCGs for air, soil, surface and ground water at this site.

The action-specific ARARs/SCGs address whether the activities at the site related to the remedial action performed as part of the alternative is negatively impacting the site area. Table 1-7 lists all regulations that this alternative must be in compliance with. Because institutional controls (i.e. fencing) and groundwater monitoring involve no construction, removal and/or transportation of contaminated media or residual produced at the site, this alternative complies with most of the applicable action-specific ARARs/SCGs. This alternative would not comply with the action-specific requirement to close the landfill in accordance with Parts 373 and 360.

The third category of ARARs/SCGs relates to location-specific ARARs/SCGs. These standards apply to remedial activities which might affect natural preserves with endangered species, wetlands and sensitive flood plains, or coastal zone areas. Also included are regulations governing potential air emissions resulting from the proposed remedial action in areas governed by special air regulations. Because this alternative does not effect any wetlands, is not located in a flood plain or

| | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|
| **Assessment Factor** | - No Action<br>- Long-term groundwater monitoring<br>- Institutional Controls | - Capping<br>- Long-term groundwater monitoring<br>- Institutional Controls | - Capping<br>- Long-term groundwater monitoring<br>- Institutional controls<br>- Soil vapor extraction treatment of Hot Spot 5 |
| **1. Compliance with ARARs** | Does not meet chemical-specific ARARs. Action and location-specific ARARs are met. | Meets chemical-specific ARARs for all media except groundwater and potentially surface water. Action-specific ARARs will be met. Location-specific ARARs for surface waters are met. | Meets chemical-specific ARARs for all media except groundwater and potentially surface water. Partially meets chemical-specific ARARs for groundwater. Location- and action-specific ARARs are met for groundwater. |
| **2. Protection of Human Health and the Environment** | Minor reduction in risks to human health and the environment. | Greatly reduces risk from air and soils exposure pathways. The magnitude of residual risk at the site is low but contamination is still present and groundwater will continue to flow through the waste mass. | Greatly reduces risk from all exposure pathways. The magnitude of residual risk at the site is low but groundwater will continue to flow through the waste mass. |
| **3. Short-term effectiveness** | No potential risks associated with construction. | Potential risks are associated with airborne contaminants during construction of the cap, but mitigation measures would minimize risks.<br><br>This alternative will require approximately 6 months to design and 1.5 years to implement. | Potential risks are associated with airborne contaminants during construction of the cap and soil vapor extraction system but mitigation measures would minimize risks.<br><br>This alternative will require approximately 6 months to design and 1.5 years to implement. |



**Table 4-1**
**Detailed Comparison Of Selected Remedial Alternatives**
**Urbana Landfill Feasibility Study**

| | *Alternative 1* | *Alternative 2* | *Alternative 3* |
|---|---|---|---|
| **4. Long-term effectiveness and permanence.** | High residual risk. Control of risk through groundwater sampling is minimal. | Risk from landfill soils and air would remain low since design life of cap is 30 years. Risks associated with the migration of contaminated groundwater still remain since it will continue to flow through the undisturbed waste mass. Long-term monitoring offers minimal risk control. | Risk from landfill soils and air would remain low since design life of cap is 30 years. Soil vapor extraction hot spots reduces the future potential for groundwater contamination. Long-term monitoring offers minimal risk control. |
| **5. Reduction in Toxicity, Mobility and Volume** | There is no treatment process involved and subsequently no reduction in toxicity, mobility and volume of contaminated media. The volume of contaminated groundwater may increase. | Does not reduce toxicity of the contamination; contaminant mobility is reduced by the cap. Volume of contaminants is unaffected. | Reduces toxicity and volume of the contamination through soil vapor extraction. Contaminant mobility reduced by the cap. |
| **6. Implementability** | Necessary equipment and labor force readily available. Coordination and approvals from regulatory agencies should not be difficult to obtain. | Necessary equipment and labor force are readily available. Once in place, the cap and groundwater monitoring offer reliable technologies. | Necessary equipment and labor force are readily available. The cap and SVE remediation are reliable technologies. |
| **7. Cost (Capital And Present Worth)** | $ 89,000 (Capital)<br>$804,000 (Present Worth) | $4,790,000<br>$5,770,000 | $5,380,000<br>$6,460,000 |



**Table 4-1**
**Detailed Comparison Of Selected Remedial Alternatives**
**Urbana Landfill Feasibility Study**

coastal zone, and is not in a non-compliance area for air regulations, it complies with location-specific ARARs/SCGs.

#### 4.2.1.2 Protection of Human Health and the Environment

Institutional controls consist of warning signs and fencing around the landfill property. This restricts the public's access to the landfill, which protects human health and the environment. Similarly, for property downgradient of the groundwater flow, placing deed restrictions on groundwater use, and monitoring groundwater quality both off-site and on-site will protect human health.

The institutional controls alone do not address protection of the environment. Institutional Controls place physical or zoning restrictions on land or water use, but do not actively remediate site contaminants. Naturally occurring processes will serve to eventually decrease the size and concentration of the contamination, however emissions of contaminant to air and groundwater will occur. Therefore, the residual risk remaining at the site is classified as moderate.

#### 4.2.1.3 Short-Term Effectiveness

The institutional controls contained in Alternative 1 do not pose short-term risks to the community. Institutional controls consist of mostly administrative changes to zoning or well permitting. There is no heavy construction (only the installation of property fencing) associated with institutional controls. These control measures are not expected to take more than a few months to execute. The second part of this alternative, groundwater monitoring, also does not pose any short-term risks.

#### 4.2.1.4 Long-Term Effectiveness and Permanence

Alternative 1 does not treat or reduce the landfill contaminants and therefore it can not be considered to be effective over the long term. The institutional controls do reduce the potential for human exposure to the contaminants. Long-term groundwater monitoring will track any migration of the contaminants in the future.

#### 4.2.1.5 Reduction of Toxicity, Mobility or Volume

The institutional controls do not actively reduce the volume or toxicity of the contaminants found at the landfill, but only limit exposure to contaminants. On the other hand, natural attenuation, dispersion and dilution will decrease the contaminant concentration over time. Therefore, these actions and processes serve to reduce the concentration of the plume in the future, but the volume of contaminated groundwater may increase as contamination moves offsite.

#### 4.2.1.6 Implementability

As previously discussed, institutional controls are not labor intensive or difficult to implement. They are technically feasible to implement and delays are not expected. Minimum coordination is expected for agency approvals. Multiple vendors are available to provide competitive bidding. Groundwater monitoring can be readily performed on a quarterly basis using the existing groundwater and private wells.

#### 4.2.1.7 Cost

The costs for the Institutional Controls include:

| | |
|---|---|
| ■ Capital Cost | $88,900 |
| ■ Operations and Maintenance Cost | $107,580 (year 1- 5); $27,395 (year 6 - 30) |
| ■ Future Capital Cost | $0 |
| ■ Present Worth | $803,800 |

These costs are further detailed in Appendix A.

The capital cost includes the materials needed to construct the fencing and to place warning signs around the landfill.

The operations and maintenance costs include maintaining the fencing at the site, and groundwater monitoring costs for a period of 30 years.

The total present worth costs of this alternative includes the direct and indirect capital costs and the present worth of the annual and periodic costs over the design life of the alternative at an annual rate of six percent.

## 4.3 Alternative 2 - Part 360 Landfill Cap and Groundwater Monitoring

### 4.3.1 Evaluation

The evaluation of Alternative 2 includes the Part 360 Landfill Cap and quarterly monitoring of existing monitoring and private wells.

#### 4.3.1.1 Compliance with ARARs/SCGs

Alternative 2 partially addresses the air and surface soil chemical-specific ARARs/SCGs with the installation of the cap, which contains the soil contamination and controls the landfill gas emissions. Alternative 2 does not eliminate the potential for future groundwater and surface water contamination. Because part of the waste mass is placed below the groundwater table, there remains the possibility that groundwater will continue to become contaminated through contact with contaminated soils and wastes in the landfill, and that groundwater discharges to the unnamed stream will continue to discharge low levels of contamination to the surface water. For this reason, Alternative 2 may only partially comply with chemical specific ARARs/SCGs for ground water or surface water.

The placement of a cap should prevent infiltration into the landfill area as well as prevent leachate seeps. As a result, this alternative will improve compliance with the chemical-specific ARARs/SCGs for surface waters.

The second evaluation concerns action-specific ARARs/SCGs. These regulations include Federal and State air quality standards for air emissions, OSHA standards for construction activities, and 6NYCRR Part 360 regulations for capping. During the construction of the landfill cap, there is a potential for air emissions to exceed relevant SCGs for short periods of time as the waste mass is regraded and consolidated, and thus, action-specific ARARs/SCGs for air may not be met. The construction health and safety plan will include air monitoring, and all engineering controls will be used to prevent significant releases of air borne contaminants. Because all relevant standards will be complied with during design and construction of the landfill cap, it is expected that this alternative will comply with all action-specific ARARs/SCGs other than air.

The final evaluation relates to the location specific ARARs/SCGs. These standards apply to remedial activities which might affect natural preserves with endangered species, wetlands and sensitive flood plains. Also included are regulations governing potential air emissions resulting from the proposed remedial action in areas governed by special air regulations. Because this alternative will not effect any wetlands, is not located in a flood plain, and is not in a non-compliance area for air regulations, it will comply with location-specific ARARs/SCGs.

#### *4.3.1.3 Protection of Human Health and The Environment*

Alternative 2 partially protects human health and the environment. Consolidation of the waste mass under a single cap prevents contact by the public with the landfill contents both through air and surface soils. The cap virtually eliminates the amount of storm water infiltrating the landfill and reduces the generation of leachate and contact with contaminated soils. Seeps along the western side towards the unnamed stream will be eliminated by consolidation and capping. The cap will not eliminate groundwater contamination and the generation of leachate, since the groundwater will continue to flow through the waste mass.

The cap's landfill gas venting system will collect gases and discharge them in a manner which will protect the public health and the environment from the potential exposure to concentrations of contaminants that could pose a risk via the inhalation pathway.

Groundwater monitoring will serve to identify future risks to human health and the environment via the groundwater pathway, but future exposure could potentially result because the landfill waste (including the Hot Spots) will still be present at the site, and groundwater will continue to be in contact with the waste mass.

The landfill consolidation and capping will significantly reduce the potential exposure of the public to contaminants but will not allow unrestricted future use of the site. Future development could not be planned on the landfill because constructing any facilities or placing weight on the landfill could impact the integrity of the cap.

The residual risk at the site is classified as low to moderate.

#### *4.3.1.4 Short-Term Effectiveness*

Dust may be generated when moving waste from the western slopes, and while moving waste from the southeastern cell to the main part of the landfill. It may also be generated during the regrading and construction of the cap, thereby subjecting workers to airborne contaminants. Suppression measures, such as water or chemical dust suppressants will decrease the generation of dust, but these measures are not expected to completely remove the airborne contaminants. Air quality monitoring will measure the levels of airborne contaminants, and workers may be required to upgrade their personal protective equipment if action levels are exceeded.

During consolidation of the waste material, waste that is presently below the water table may be moved. A short term exposure of contaminated groundwater may result, and measures will have to be taken to control runoff into the unnamed stream. Construction will include necessary de-watering of the areas to be consolidated. Clean groundwater will be pumped back to the main part of the landfill, and any contaminated groundwater will be collected for treatment and appropriate disposal.

It is expected that the remedial measures for this alternative could be implemented within two years. This includes approximately 6 months to design and 1.5 years to construct the cap.

#### *4.3.1.5 Long-Term Effectiveness and Permanence*

This alternative does not reduce the volume or concentration of the landfill contaminants. However, the cap will prevent contaminant exposure as well as storm water infiltration into the waste. Therefore the long term risk at the site is considered to be moderate.

Isolation of the waste in the landfill will be addressed by the consolidation of the waste mass into the main part of the landfill and the construction of a Part 360 cap. The cap will be designed to withstand erosion and settling of fill material. Some environmental controls are required and the cap should be examined on a periodic basis for integrity. However these tasks will not be labor intensive.

This alternative does not entirely eliminate the potential for continued future groundwater contamination since the sources of contamination are not remediated.

#### *4.3.1.6 Reduction of Toxicity, Mobility or Volume*

Since no treatment technologies are included, waste consolidation and construction of the 360 cap alternative does not significantly reduce the volume or toxicity of the contaminants found at the landfill. It does, however, reduce the mobility of the contaminants in the ground and surface water. The cap will result in a reduction of contaminants entering the groundwater system, because storm water will run off the sides of the cap rather than percolating through the landfill waste and contaminating the groundwater. In addition, the cap will reduce the production of leachate in the future, although leachate will still be generated through contact of waste with groundwater. Natural processes, such as attenuation, dispersion and biodegradation will dilute the concentration of contaminants over time.

#### *4.3.1.7 Implementability*

The consolidation of the waste along the western boundary, and the movement of waste now located in the southeast cell to the main part of the landfill will entail the use of heavy equipment and some groundwater dewatering. The cap construction will also be a large scale project. The consolidation and capping require only readily available equipment, materials and workers. Agency coordination will be required, but will not be expected to be significant. Multiple vendors are available to bid on the project and materials are readily available. If necessary, the installation of additional monitoring wells will be included in the cap construction project. Groundwater monitoring is also easy to implement.

#### 4.3.1.8 Cost

The cost presented here include construction of the cap and quarterly and/or annual monitoring of the groundwater and private wells.

- Capital Cost $4,788,900
- Operations and Maintenance Cost $126,730 (year 1- 5); $46,550 (year 6 - 30)
- Future Capital Cost $0
- Present Worth $5,767,000

These costs are further detailed in Appendix A.

## 4.4 Alternative 3 - Standard Part 360 Landfill Cap, Soil Vapor Extraction of Hot Spot 5 and Groundwater Monitoring

### 4.4.1 Evaluation

The evaluation of Alternative 3 includes the already discussed landfill waste consolidation and cap, groundwater monitoring and soil vapor extraction. This evaluation will focus on the on-site treatment of Hot Spot 5 through the use of soil vapor extraction.

#### 4.4.1.1 Compliance with ARARs/SCGs

Alternative 3 partially meets the chemical-specific ARARs/SCGs for both soil and groundwater. Hot Spot 5, the largest of the Hot Spots, will be remediated through SVE. Since the offsite groundwater contamination is primarily made up of VOCs, remediation of Hot Spot 5 should significantly decrease offsite groundwater contamination in the future. The remaining Hot Spots will be contained by the installation of the standard Part 360 cap. After treatment, soil concentrations in Hot Spot 5 will be in compliance with the applicable chemical ARARs/SCGs. The remaining Hot Spots will not be in compliance. However, this does not eliminate the continued future potential for groundwater and possibly surface water contamination. Because part of the waste mass is placed below the groundwater table, the future potential for groundwater to become contaminated through contact with contaminated soils and wastes in the landfill will still exist. The placement of a cap should prevent infiltration into the landfill area as well as prevent leachate seeps. As a result, this alternative will potentially comply with the chemical-specific ARARs/SCGs for surface waters. It is expected that surface water and air emissions will be in compliance. In summary, this alternative will comply with the chemical-specific ARARs/SCGs for surface water and air emissions, and partially comply for soil and groundwater.

The next evaluation concerns action-specific ARARs/SCGs. This remedial action alternative consists of the waste consolidation, a landfill cap and treatment of the Hot Spot 5 through soil vapor extraction. As outlined in Section 4.3.1.1, the cap will be constructed in accordance with all the appropriate standards. In addition, installation and operation of the soil vapor extraction remediation will comply with action-specific ARARs/SCGs.

The last evaluation concerns location-specific ARARs/SCGs. As discussed in Section 4.3.1.1, the landfill cap design and construction, as well as groundwater monitoring, will comply with local ARARs/SCGs. Because this alternative will not effect any wetlands, is not located in a flood plain or coastal zone, and is not in a non-compliance area for air regulations, it will be in compliance with location-specific ARARs/SCGs..

### 4.4.1.2 Protection of Human Health and the Environment

Alternative 3 significantly reduces the potential exposure of contaminants to humans and the surrounding environment. Offsite groundwater contamination is primarily made up of low levels of VOCs. With the treatment of Hot Spot 5 using the soil vapor extraction technology, the main source of VOC contamination of the groundwater will be eliminated, and the potential for exposure to contaminated groundwater is greatly reduced. However, due to the fact that the groundwater still flows through the waste mass, and does discharge to the unnamed stream, the surface water/groundwater pathway remains a potential exposure pathway.

The potential for exposure to humans and the surrounding environment via the soils and air pathways will be eliminated with the consolidation of waste and the installation of the cap. The remedial activities included in Alternative 3 will not provide unrestricted use of the site in the future due to the previously mentioned concerns with cap integrity.

The residual risk at the site is classified as low. The cap and gas vents are reliable technologies, and future contaminant exposure through the groundwater will be substantially decreased with treatment of Hot Spot 5.

### 4.4.1.3 Short-Term Effectiveness

As indicated for Alternative 2, during waste consolidation and construction of the landfill cap, dust may be generated and may migrate around the site causing potential risks to the workers via the inhalation pathway. Suppression measures will be used to decrease the generation of dust, and air quality monitoring will be used to determine if additional personal protective equipment is necessary.

Soil vapor extraction of Hot Spot 5 will provide minimal short term risk to the community and the environment. The workers who install the system and operate it may be subject to minor short term risks, but these risks will be mitigated through the use of air quality monitoring and personal protective equipment.

During consolidation of the waste material, waste that is presently below the water table may be moved. A short term exposure of contaminated groundwater may result, and measures will have to be taken to control runoff into the unnamed stream. Construction will include necessary de-watering of the areas to be consolidated. Clean groundwater will be pumped back to the main part of the landfill, and any contaminated groundwater will be collected for treatment and appropriate disposal.

The remedial measure for Alternative 3 will be implemented in less than 2 years.

### *4.4.1.4 Long-Term Effectiveness and Permanence*

This alternative reduces the concentration of the landfill contaminants. The concentration of contaminants in the Hot Spot soils treated through soil vapor extraction will be reduced to below applicable standards. The cap will prevent airborne exposure to any remaining contaminants located in the landfill waste mass and prevent the infiltration of storm water, thus reducing the amount of leachate generated. Consolidation of the waste away from the unnamed stream will eliminate the overland movement of contaminated leachate from the landfill slopes to the stream. The groundwater will continue to flow through the remaining waste mass and be a potential exposure pathway. Continued monitoring of the groundwater and private wells will provide an early warning system to prevent exposure of contaminated groundwater.

### *4.4.1.5 Reduction of Toxicity, Mobility or Volume*

Soil vapor extraction of the soils in Hot Spot 5 will reduce the toxicity of the contaminated soils. The installation of the cap will greatly reduce the mobility of the remaining on-site waste. Mobility of remaining contaminants will be limited to the groundwater flow through the remaining waste mass and the potential of the groundwater to affect the local surface waters and private wells.

### *4.4.1.6 Implementability*

As previously indicated, the equipment, materials and workers required to consolidate the waste and construct the cap are readily available. Multiple vendors/contractors are available to bid on the cap construction. Soil vapor extraction equipment is readily available from several vendors.

### *4.4.1.7 Cost*

This alternative includes the costs previously discussed in Alternative 2. Also included are the capital/O&M costs (1 year duration) involved in the soil vapor extraction remediation activities.

- Capital Cost — $ 5,379,000
- Operations and Maintenance Cost — $ 242,730 (year 1); $126,730 (year 2-5); $ 46,545 (year 6-30)
- Future Capital Cost — $ 0
- Present Worth — $ 6,457,000

These cost are explained further in Appendix A.

# 5

# Section Five

Section 5

# Section 5
# Comparative Analysis

The previous section described each of the three alternatives and evaluated them individually against the seven criteria specified in the NYSDEC Technical and Administrative Guidance Memorandum (TAGM). This section compares the three alternatives to each other according to the seven TAGM criteria. This comparison will identify the strengths and weaknesses of each alternative relative to each other.

## 5.1 Compliance with ARARS/SCGs

The chemical specific ARARs/SCGs will be discussed first. The No Further Action alternative does not address the chemical specific standards because this alternative does not reduce or remediate the constituents of concern in any media. Alternative 2 partially addresses the chemical specific ARARs by eliminating the potential emissions of air contaminants. Groundwater contamination caused by rainwater infiltrating through the landfill mass will be eliminated by the consolidation of waste and the construction of the landfill cap and gas venting system, however, some groundwater contamination will continue to occur through contact of groundwater with the Hot Spots. Chemical specific ARARs for soil will be partially met by capping the Hot Spots. Alternative 3 will partially satisfy non-groundwater chemical specific standards (air and soil), but represents an improvement over Alternative 2, since source (i.e., Hot Spot) remediation is included in this alternative along with capping of the landfill. The third alternatives also partially satisfies the chemical specific ARARs for groundwater, both onsite and offsite, and surface water. By eliminating the most significant Hot Spots and capping the landfill, future groundwater contamination will be reduced.

The action specific standards include OSHA health and safety protocols, CERCLA/SARA regulations for hazardous wastes, and air quality standards for air emissions. These standards will be addressed during the design of each remedial action when site specific conditions must be considered. It is believed that all of the alternatives can meet these SCGs.

The location specific standards apply to surface water bodies, wetlands, coastal zones, endangered species and floodplains. These standards are not applicable to the site since no wetlands, endangered species habitats or floodplains have been located near the landfill, and the site is not near the coast. Contamination in the unnamed stream has been shown to be minimal through the sampling conducted during the Remedial Investigation. Although this stream eventually discharges to Keuka Lake, a source for drinking water, the concentrations of contaminants, upon reaching Keuka Lake, are expected to be non-detectable due to volatilization and dilution.

## 5.2 Protection of Human Health and the Environment

The No Further Action alternative is ineffective in reducing the exposure to contaminants in all affected media. The magnitude of the risk to human health and the environment under the No Further Action alternative was determined to be moderate. Alternative 2 results in minimal exposure to contaminants via the air and soils pathway. Although the waste consolidation and the construction of the landfill cap will restrict the generation of leachate, this solution was less effective at controlling groundwater exposure, since the waste lying below the water table will continue to be a source of contamination.

Alternatives 3 is equally effective as Alternative 2 at controlling potential exposure via soil and air pathways. It is more effective at reducing groundwater exposure due to the remediation of Hot Spot 5. Hot Spot 5 is the primary source of VOC contamination in offsite groundwater. This alternative was given a partially acceptable rating for surface water/groundwater remediation, since the largest hot-spot is being remediated, but groundwater treatment is not proposed.

## 5.3 Short Term Effectiveness

The No Further Action alternative presents moderate short term risks to the community and the environment associated with all contaminated media. The other two alternatives present potential short term risks to the community during the construction activity associated with moving the waste away from the unnamed stream, consolidating the waste in the southeastern cell, and constructing the landfill cap, because waste material will be temporarily exposed during regrading activities. The potential for generation of dust and airborne contaminants may be marginally increased in alternative 3, which includes the soil vapor extraction of Hot Spot 5, during the installation of the extraction wells and associated piping.

Short term risk mitigation methods are available for landfill regrading activities (such as dust control measures), and for the vapor emissions during the operation of soil vapor extraction (alternative 3). All three alternatives are expected to take less than two years to complete.

## 5.4 Long Term Effectiveness and Permanence

Alternative 3 was rated the highest for long term effectiveness and permanence because remediation is done on-site, and the SVE system includes destruction of contaminants at Hot Spot 5. Alternatives 1 and 2 were not considered permanent remedies since the contaminants of concern are not being treated.

Alternative 3 was deemed partially permanent, since the waste deposited below the groundwater table may continue to be a source of low level contamination to the groundwater, and groundwater treatment is not proposed.

Alternatives 1 and 2 do not create a treated residual. Alternative 3 will result in the creation of treatment residual (carbon from the SVE system), however no residuals from alternative 3 are left on-site. The contamination extracted via the carbon system will be destroyed offsite. Alternatives 1, 2 and 3 all require moderate long-term monitoring.

## 5.5 Reduction of Toxicity, Mobility or Volume

The No Further Action alternative does not reduce the toxicity, mobility or volume of any contaminated media. By consolidating the waste and capping the landfill, Alternatives 2 and 3 will prevent the generation of leachate in the future, and will significantly reduce the mobility of contaminants in the surface water.

Alternatives 1 and 2 do not treat or destroy any of the hazardous waste (defined as contaminated soil in the five Hot Spots). Alternative 3 treats 70-80% of the hazardous waste. Untreated or concentrated wastes are not produced in alternatives 1 and 2. The untreated or concentrated waste potentially generated in alternative 3 is the VOC-contaminated carbon used in air stripping. If this vapor phase treatment unit is used instead of a catalytic oxidation unit then the carbon will be destroyed off-site during the carbon regeneration process.

The No Further Action Alternative does not result in any immobilization of contaminated media. Alternatives 2 and 3 are very effective in reducing the mobility of hazardous chemicals due to the construction of the landfill cap over the entire waste area. While alternative 2 and 3 immobilize the waste by containment, alternative 3 also produces partial reduction in toxicity by treatment. Through SVE and carbon regeneration, Alternative 3 is considered to be an irreversible treatment for Hot Spot 5.

## 5.6 Implementability

Consolidating the waste, regrading the landfill and constructing the landfill cap are all technically feasible remedial actions for the landfill. The construction of the soil vapor extraction system is also considered technically feasible. The technologies and equipment employed in alternatives 2, and 3 were considered to be equally available.

## 5.7 Cost

The present worth of the three alternatives are summarized below:

| | |
|---|---|
| Alternative 1 | $ 804,000 |
| Alternative 2 | $5,767,000 |
| Alternative 3 | $6,457,000 |

# 6

# Section Six

# Section 6
# Recommendation of Alternative

The previous sections described each of the three alternatives and evaluated them individually against the seven criteria specified in the NYSDEC Technical and Administrative Guidance Memorandum (TAGM). In section 5, the three alternatives were compared with each other using the seven TAGM criteria. This final section uses the information and conclusions from the previous sections in order to recommend the most appropriate alternative for remedial action at the Urbana landfill site.

## 6.1 Alternative 1

The no action alternative, as discussed in Section 3, is included to provide a baseline for comparison to other remedial actions. The no action alternative includes future monitoring at the site and some institutional controls. Institutional controls consist of warning signs and fencing around the landfill property. This restricts the public's access to the landfill, which protects human health and the environment. Similarly, placing deed restrictions on the use of groundwater on properties downgradient of groundwater flow from the landfill will also protect human health. The institutional controls alone do not address protection of the environment. Institutional Controls place physical or zoning restrictions on land or water use, but do not actively remediate site contaminants.

There is no active removal or destruction of contaminants in this alternative. The institutional controls only minimize potential exposure to contaminants. On the other hand, natural attenuation, dispersion and dilution will decrease the contaminant concentration in the groundwater over time. Therefore, these actions and processes serve to reduce the concentration of the groundwater contaminant plume in the future.

This alternative also includes long-term groundwater monitoring of existing monitoring wells that will serve as an initial warning for the off-site migration of contaminated groundwater, as well as monitoring of private wells. The present worth of this alternative is approximately $804,000. Alternative 1 is the least desirable of the three alternatives considered because of its inability to meet the majority of RAOs.

## 6.2 Alternative 2

Alternative 2 includes institutional controls, the consolidation of waste by moving waste back away from the unnamed stream and nearby road, the placement of waste in the southeastern cell onto the main part of the landfill, the design and construction of a Standard Part 360 landfill cap, and periodic sampling of existing groundwater monitoring and private wells. The five site Hot Spots will be left undisturbed. This alternative will minimize human and environmental exposure to site contaminants.

Waste consolidation and the construction of a Part 360 Landfill Cap will significantly reduce stormwater infiltration through the landfill mass, and leachate produced by stormwater is expected to be virtually eliminated. The clean stormwater run-off will be diverted by a system of drainage channels and piping to the unnamed stream. Waste consolidation and capping will eliminate the contamination of stormwater runoff which may affect nearby surface water bodies, particularly the unnamed stream. The cap will also control air emissions from the landfill. An effective landfill cap with passive landfill gas vents will control the release of volatile compounds and landfill gas, as well as eliminate wind blown contaminated dust particles from the landfill.

Since no treatment technologies are included, Alternative 2 does not reduce the volume or toxicity of the contaminants found at the landfill. However, the cap will reduce the addition of contaminants to the groundwater, because storm water will run off the sides of the cap rather than percolating through the landfill waste. Some degree of groundwater contamination will continue to occur through contact of waste with groundwater. Natural processes, such as attenuation, dispersion and biodegradation will decrease the concentration of contaminants found in the groundwater as the contaminant plume moves offsite.

The capital costs for this alternative are estimated to be approximately $4.8 million. These costs are based on the ability to divert all water from de-watering activities back into the landfill. An additional capital cost of approximately $800,000 is estimated for disposal of all water from de-watering activities liquid. The total present worth cost of this alternative is estimated to be approximately $5.77 million. This cost includes all O&M costs associated with the groundwater monitoring and the maintenance on the cap.

Alternative two represents a significant reduction in risk when compared to the No Action Alternative, however, it does not destroy any of the contaminants within the Urbana landfill. The majority of the cost for this alternative is attributed to the presumptive remedy of the landfill cap, and its cost is similar to the cost of Alternative 3. This alternative, although preferred over Alternative 1, is not recommended because Alternative 3 offers benefits of toxicity reduction for relatively little additional cost.

## 6.3 Alternative 3

Alternative 3 includes waste consolidation, the installation of a Standard Part 360 landfill cap and groundwater monitoring of groundwater and private wells as discussed in Alternative 2. This alternative also includes the treatment of Hot Spot 5 using soil vapor extraction. Hot Spots 1, 2, 3 and 4 will be isolated by the landfill cap, but will not be treated.

Alternative 3 combines several identified feasible technologies to bring an enhanced level of exposure prevention and contaminant clean-up. Somewhat higher costs will be associated with this greater level of clean-up. This alternative provides for minimization of human and environmental exposure through waste consolidation and permanent capping of the landfill, control of landfill gas emissions, and remediation of the largest Hot Spot identified during the RI. This alternative provides the greatest level of site clean-up.

The cost to implement and maintain this alternative is the highest of the three alternatives evaluated. The present worth cost of this alternative is estimated to be approximately $6,457,000. This cost is approximately $700,000 higher than the present worth cost of Alternative 2.

Alternative 3 is recommended for implementation at the Urbana Landfill. It is the only alternative that actively destroys contaminated media, treating an estimated 70-80% of the VOC contaminated waste in the landfill. It significantly reduces the risk potential in all media (air, soil and water) at a relatively small increase in cost over Alternative 2.

# 7

# Section Seven

# Section 7
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# Appendix A

## Capital Costs

## Institutional Controls

### Urbana Landfill Feasibility Study
### Steuben County, New York

Screening of Remedial Action Alternatives
Cost Estimating Worksheet
(+50% to -30% level)

| DIRECT CAPITAL COSTS: | unit cost ($) | quantity | cost ($) |
|---|---|---|---|
| Chain Link Fence and Gates | $24.00 | 3,600 LF | $86,400 |
| Warning Signs | $50.00 | 50 EACH | $2,500 |
| SUBTOTAL | | | $88,900 |
| **TOTAL DIRECT CAPITAL COSTS** | | | **$89,000** |

## Capital Costs

## Standard Part 360 Cap

## Urbana Landfill Feasibility Study
## Steuben County, New York

Screening of Remedial Action Alternatives
Cost Estimating Worksheet
(+50% to -30% level)

| DIRECT CAPITAL COSTS: equipment or process | unit cost ($) | quantity | cost ($) |
|---|---|---|---|
| Site Preparation | | | |
| Excavation for 100 ft Setback | $5 | 55,000 CY | $275,000 |
| Regrading | $10 | 55,000 CY | $550,000 |
| Common Fill for Intermediate Cover | $12 | 16,133 CY | $193,596 |
| Leachate Collection and Disposal | | | |
| Stockpiling of Wet Garbage & Trench Dewatering | $200,000 | 1 LS | $200,000 |
| Leachate Testing and Disposal Permits | $5,000 | 1 LS | $5,000 |
| Trucking of Leachate (to Ithaca WWTP) | $0.07 | 2,800,000 GAL | $196,000 |
| Leachate Treatment | $0.07 | 2,800,000 GAL | $196,000 |
| Capping | | | |
| Hydroseeding | $4,000 | 10 ACRE | $40,000 |
| Topsoil | $22 | 8,000 CY | $176,000 |
| Select Fill (Barrier Protection Layer) | $16 | 30,000 CY | $480,000 |
| Geomembrane (textured HDPE) | $0.6 | 402,000 SF | $241,200 |
| Geonet/Geotextile in place of Gas Venting Layer | $0.80 | 435,600 SF | $348,480 |
| Erosion Control Matting | $1.15 | 108,900 SF | $125,235 |
| Erosion Control | $40,000 | 1 LS | $40,000 |
| Geotextile | $0.25 | 402,000 SF | $100,500 |
| Geonet Composite for Steep Slopes | $0.80 | 100,500 SF | $80,400 |
| Drainage System & Retention Basin | $300,000 | 1 LS | $300,000 |
| Gas Venting System | | | |
| Type I Gas Vent | $3,000 | 10 EACH | $30,000 |
| 6" HDPE Manifold Piping & Gravel | $25 | 1,800 LF | $45,000 |
| Valves and Appurtenances | $15,000 | 1 LS | $15,000 |
| 15 HP Blower & Electrical Allowance | $30,000 | 1 LS | $30,000 |
| Miscellaneous | | | |
| Test Pits | $8,000 | 1 LS | $8,000 |
| Survey | $50,000 | 1 LS | $50,000 |
| Asphalt Pavement | $10,000 | 1 LS | $10,000 |
| Materials Testing | $50,000 | 1 LS | $50,000 |
| Chain Link Fence and Gates | $24 | 3,600 LF | $86,400 |
| Mobilization/Demobilization | $75,000 | 1 LS | $75,000 |
| Warning Signs | $50 | 50 EACH | $2,500 |
| SUBTOTAL | | | $3,949,311 |
| Contingencies (15%) | $592,397 | 1 | $592,397 |
| Engineering (10%) | $394,931 | 1 | $394,931 |
| Contractor (15%) | $592,397 | 1 | $592,397 |
| TOTAL DIRECT CAPITAL COSTS | | | $5,530,000 |

Notes to cost tables:

Landfill Cap

(1) All buried waste within 100 feet of the unnamed stream and Crows Nest Road will be excavated and used to regrade the landfill.
(2) A one acre-ft. stormwater retention basin will be constructed near the intersection of Crows Nest Road and the unnamed stream.
(3) It is assumed that 20% of the waste excavated for the 100-ft setback is buried below the water table. This estimate is conservative since test pits 1, 5 and 6 (located within 100 ft. of the unnamed stream) did not reveal waste below the water table. It is assumed that 20% of the wet waste is water. Therefore 4% of the excavated mass is assumed to be leachate.
(4) When pumping the standing water in the trench, it is assumed that water will seep into the trench at a rate such that twice the volume of standing water will need to be pumped in order to dewater the trench. The excavated trench is assumed to have 1.5 ft. of standing water.
(5) Leachate generated through dewatering and pumping will be trucked and treated at the Ithaca WWTP. The leachate is conservatively estimated to be 2% solids, for treatment cost purposes.
(6) Excavated trenchs will be backfilled with common fill.
(7) Excavated waste used for regrading will be covered with 12 inches of common fill prior to capping.
(8) A blower will pull landfill gas off the stack to prevent condensate build-up in the manifold piping system.
(9) A cost for the excavation and disposal of hazardous waste during the 100 ft setback excavation is not included, since hot spots were not found in these areas during the RI. Hazardous waste discovered during such excavation would require off-site disposal at approximately $300/CY.

Hot Spot Excavation and Removal

(1) Extent of Hot Spots will need to be delineated by further testing before final excavation volume can be determined
(2) Contaminated media contained within the hot spots are considered to require disposal at a RCRA approved landfill.
(3) It is assumed that clean fill will need to be purchased and can not be readily obtained from the site.
(4) Hot Spot volume is defined by initial sample results from the Remedial Investigation. The estimated areal extent of the hot spots are approximated in the Feasibility Study.

Soil Vapor Extraction

(1) Extent of Hot Spots will need to be delineated by further testing before final excavation volume can be determined. The Capital and O&M costs Soil Vapor Extraction were estimated for Hot Spot 5.
(2) Duration of SVE treatment is estimated to be approximately one year.
(3) Vapor Phase destruction will occur by use of a Catalytic Oxidation unit.

Biopiles

(1) Extent of Hot Spots will need to be delineated by further testing before final excavation volume can be determined. The Capital and O&M costs Soil Vapor Extraction were estimated for Hot Spots 3, 4 & 5.
(2) Mixing ratio for contaminated soil with filler soil was estimated at a 2:1ratio.

## Capital Costs

## Soil Vapor Extraction System

## Urbana Landfill Feasibility Study
## Steuben County, New York

Screening of Remedial Action Alternatives
Cost Estimating Worksheet
(+50% to -30% level)

| DIRECT CAPITAL COSTS:<br>equipment or process | unit cost ($) | quantity | | cost ($) |
|---|---|---|---|---|
| Mobilization | $10,000.00 | 1 | LS | $10,000 |
| Gas Ex-Trench | $200.00 | 800 | LF | $160,000 |
| On-Site Trucking | $1,670.00 | 5 | DAY | $8,350 |
| Fittings and Valves | $8,000.00 | 1 | LS | $8,000 |
| Skid Equipment Installation | $5,000.00 | 1 | LS | $5,000 |
| Groundcover Installation | $3.00 | 2,500 | SF | $7,500 |
| Surveying | $112.00 | 40 | HR | $4,480 |
| As-Builts | $2,500.00 | 1 | LS | $2,500 |
| Prefab Blower Building | $75,000.00 | 1 | LS | $75,000 |
| Electrical Allowance | $31,000.00 | 1 | LS | $31,000 |
| Catalytic Oxidation Unit (w/ Scrubber) | $107,000.00 | 1 | LS | $107,000 |
| SUBTOTAL | | | | $418,830 |
| Contingencies (15%) | $62,824.50 | 1 | | $62,825 |
| Engineering (10%) | $41,883.00 | 1 | | $41,883 |
| Contractor Overhead (15%) | $62,824.50 | 1 | | $62,825 |
| **TOTAL DIRECT CAPITAL COSTS** | | | | **$590,000** |

## Operations and Maintenance Costs

## Institutional Controls
## 30 Year Time Period

## Urbana Landfill Feasibility Study
## Steuben County, New York

Screening of Remedial Action Alternatives
Cost Estimating Worksheet
(+50% to -30% level)

| DIRECT ANNUAL/PERIODIC COSTS: | unit cost ($) | quantity | cost ($) |
|---|---|---|---|
| Annual Fence Maintenance | $1,000.00 | 1 | $1,000 |
| **Annual Total** | | | **$1,000** |

## Operations and Maintenance Costs

## Landfill Cap
## 30 Year Time Period

## Urbana Landfill Feasibility Study
## Steuben County, New York

Screening of Remedial Action Alternatives
Cost Estimating Worksheet
(+50% to -30% level)

| DIRECT ANNUAL/PERIODIC COSTS: | unit cost ($) | quantity | cost ($) |
|---|---|---|---|
| Site Inspections (12/year) | $5,250.00 | 1 | $5,250 |
| Annual Fence Maintenance | $1,000.00 | 1 | $1,000 |
| Blower Electrical Costs | $8,000.00 | 1 | $8,000 |
| Blower Replacement Costs * | $4,900.00 | 1 | $4,900 |
| **Annual Total** | | | **$19,150** |

Note:
* The blower is to be replaced every 5 years at a cost of $30,000. Using an interest rate of 6%, the annual equivalent cost is $4,900.

## Operations and Maintenance Costs

## Quarterly Groundwater Monitoring
## 30 Year Time Period

## Urbana Landfill Feasibility Study
## Steuben County, New York

Screening of Remedial Action Alternatives
Cost Estimating Worksheet
(+50% to -30% level)

| DIRECT CAPITAL COSTS:<br>Description | unit cost ($) | quantity | cost ($) |
|---|---|---|---|
| Metals | $190 | 38 | $7,220 |
| VOAS | $175 | 38 | $6,650 |
| Field/trip blanks | $175 | 5 | $875 |
| Validation | $50 | 81 | $4,050 |
| Labor | $25 | 120 | $3,000 |
| Expendables | $1,000 | 1 | $1,000 |
| ODCs | $1,000 | 1 | $1,000 |
| Report | $2,600 | 1 | $2,600 |
| Quarterly Subtotal | | | $26,395 |
| **Annual Total** | | | **$105,580** |

## Operations and Maintenance Costs

## Soil Vapor Extraction System
## 1 Year Time Period

## Urbana Landfill Feasibility Study
## Steuben County, New York

Screening of Remedial Action Alternatives
Cost Estimating Worksheet
(+50% to -30% level)

| DIRECT ANNUAL/PERIODIC COSTS:: equipment or process | unit cost ($) | quantity | cost ($) |
|---|---|---|---|
| Blower Electrical Cost | $16,000.00 | 1 LS | $16,000 |
| Catalytic/Oxidation Unit | $13,000.00 | 1 LS | $13,000 |
| Maintenance (5% of Capital Costs) | $37,000.00 | 1 LS | $37,000 |
| Monitoring | $30,000.00 | 1 LS | $30,000 |
| Labor | $20,000.00 | 1 LS | $20,000 |
| **ANNUAL TOTAL** | | | **$116,000** |

## Capital Costs

## Hot-Spot Excavation and Off-site Disposal of Excavated Material

## Urbana Landfill Feasibility Study
## Steuben County, New York

Screening of Remedial Action Alternatives
Cost Estimating Worksheet
(+50% to -30% level)

| DIRECT CAPITAL COSTS: equipment or process | unit cost ($) | quantity | | cost ($) |
|---|---|---|---|---|
| Mobilization and Demobilization | $10,000 | 1 | ls | $10,000 |
| Subcontractor Excavator and Operator | $1,500 | 30 | days | $45,000 |
| Subcontractor Dumptruck | $450 | 30 | days | $13,500 |
| Subcontractor - 2 Field Technicians | $900 | 30 | days | $27,000 |
| Decontamination Costs | $400 | 30 | days | $12,000 |
| CDM Excavation Oversight | $75 | 300 | hrs. | $22,500 |
| Hot-spot's 1, 3, 4 & 5 Disposal | $350 | 4,500 | tons | $1,575,000 |
| Backfill Material | $25 | 10,000 | cy | $250,000 |
| Health and Safety Equipment and Testing during Excavation | $20,000 | 1 | ls | $20,000 |
| Soil Borings | $10 | 750 | ft | $7,500 |
| Split-spoon samples | $7 | 150 | ea. | $1,050 |
| Soil Sampling - (BNAs, Pest., Metals) | $480 | 50 | ea. | $24,000 |
| Soil Sampling - (VOCs) | $150 | 100 | ea. | $15,000 |
| Miscellaneous | | | | |
| Asphalt Pavement | $5,000 | 1 | ls | $5,000 |
| Staging Area Pad | $20,000 | 1 | ls | $20,000 |
| Miscellaneous Work | $30,000 | 1 | ls | $30,000 |
| SUBTOTAL | | | | $2,077,550 |
| Contingencies (25%) | $519,388 | 1 | | $519,388 |
| Engineering (10%) | $207,755 | 1 | | $207,755 |
| Contractor Overhead/Design Development (30%) | $623,265 | 1 | | $623,265 |
| **TOTAL DIRECT CAPITAL COSTS** | | | | **$3,430,000** |

## Capital Costs

## Biopile Remediation of Hot Spot 1

## Urbana Landfill Feasibility Study
## Steuben County, New York

Screening of Remedial Action Alternatives
Cost Estimating Worksheet
(+50% to -30% level)

| DIRECT CAPITAL COSTS:<br>equipment or process | unit cost ($) | quantity | | cost ($) |
|---|---|---|---|---|
| Mobilization & Demobilization | $10,000 | 1 | LS | $10,000 |
| Engineering/Pilot Testing | $20,000 | 1 | LS | $20,000 |
| Excavation of Contaminated Soils | $18 | 1,000 | CY | $18,000 |
| Screen, Crush & Condition Soils | $268 | 1,000 | CY | $268,000 |
| Soil Amendments | $56,000 | 1 | LS | $56,000 |
| Assembly of Biopile | $123,000 | 1 | LS | $123,000 |
| Stormwater Collection System | $9,700 | 1 | LS | $9,700 |
| Placement of Remediated Soil in Landfill | $30 | 1,500 | TONS | $45,000 |
| Health & Safety Monitoring | $5,000 | 1 | LS | $5,000 |
| SUBTOTAL | | | | $554,700 |
| Contingencies (25%) | $138,675 | 1 | | $138,675 |
| Engineering (10%) | $55,470 | 1 | | $55,470 |
| Contractor Overhead/Design Development (30%) | $166,410 | 1 | | $166,410 |
| TOTAL DIRECT CAPITAL COSTS | | | | $920,000 |

## Operations and Maintenance Costs

## Biopile Remediation of Hot Spot 1
## 1 Year Time Period

## Urbana Landfill Feasibility Study
## Steuben County, New York

Screening of Remedial Action Alternatives
Cost Estimating Worksheet
(+50% to -30% level)

| DIRECT ANNUAL/PERIODIC COSTS:: equipment or process | unit cost ($) | quantity | cost ($) |
|---|---|---|---|
| Operation and Monitoring of Biopile | $33,000.00 | 1 LS | $33,000 |
| **ANNUAL TOTAL** | | | **$33,000** |

Note:
The O&M cost for the biopile system includes soil moisture/temperature probes, gas probes, soil microbe respiration tests, and biopile soil sampling.

# Appendix B

Technical Memorandum

Date: July 21, 1997

To: File

From: Mark Maimone, P.E., CDM

Subject: Feasibility of Using a French Drain Upgradient of the Urbana Landfill to Lower the Water Table beneath the Landfill.

## 1. Groundwater Diversion Using a French Drain

At the request of the NYSDEC, an additional alternative for control of VOC contamination of the groundwater was examined for feasibility and applicability to the Urbana Landfill site. The alternative consists of the installation of approximately 400 feet of slotted piping in a trench, backfilled with gravel to improve drainage. The drain would be installed south of MW-101, and would be designed to decrease the water table in the overburden material south of the drain to isolate VOC contamination in Hot Spot 5. The system is conceived as a passive system in which the permeability of the trench material and the slotted pipe is high enough to draw down the water table to the pipe invert elevation. The groundwater that enters the drain would be collected and allowed to drain away from the landfill, with discharge of clean ground water into the unnamed stream that runs along the western side of the landfill.

The drain would have to be located a sufficient distance upgradient of the landfill to avoid capturing contaminated groundwater from the landfill. This makes it necessary to have the drain placed just south of MW-101. In this area, the water table is at about 1580 feet above mean sea level (msl). Bedrock begins at about 1585 feet above msl. Thus, the drain would have to be installed into the bedrock to reach groundwater. For the purposes of this feasibility screening, it is assumed that the drain is installed about at least 5 feet below the water table, which would require trenching into bedrock of 5 to 10 feet at a minimum.

Prior to developing the alternative further, an analysis of the potential effectiveness of the drain in achieving its objective was performed as part of the initial screening of alternatives. This consisted of the development of a groundwater flow model of the site which includes the bedrock, overburden, and landfill cap. The model was then used to assess the expected drawdown of the water table in the area of Hot Spot 5.

## 2. Groundwater model structure

A rectangular grid, 1200 feet by 1200 feet was developed with a node spacing of 25 feet. The grid is a stylized representation of the landfill cross section from north to south, and is designed to assess the drawdown of the water table as a function of distance from the drain beneath the landfill cap. Figure 1 shows the model cross section, with model layers including the cap material, the overburden material, and the bedrock fracture zone. The following hydraulic properties, taken from estimates made during the Remedial Investigation, were assigned to each unit.

| Unit | Horizontal Hydraulic Conductivity (Ft/day) | Vertical Hydraulic Conductivity (Ft/day) |
|---|---|---|
| Bedrock | 0.35 | 0.05 |
| Overburden | 1.0 | 0.1 |
| Cap Material | 0.001 | 0.00001 |

A recharge rate of 22 inches was applied to the uncapped portion of the model, with no recharge assigned to the area beneath the landfill cap.

Head were fixed upgradient of the landfill at 1588 feet above mean sea level (msl). Heads were fixed downgradient at levels close to those found near Crows Nest Road, at 1480 feet msl. The sides of the model were no flow boundaries, and the analysis was performed for a cross section through the center of the model.

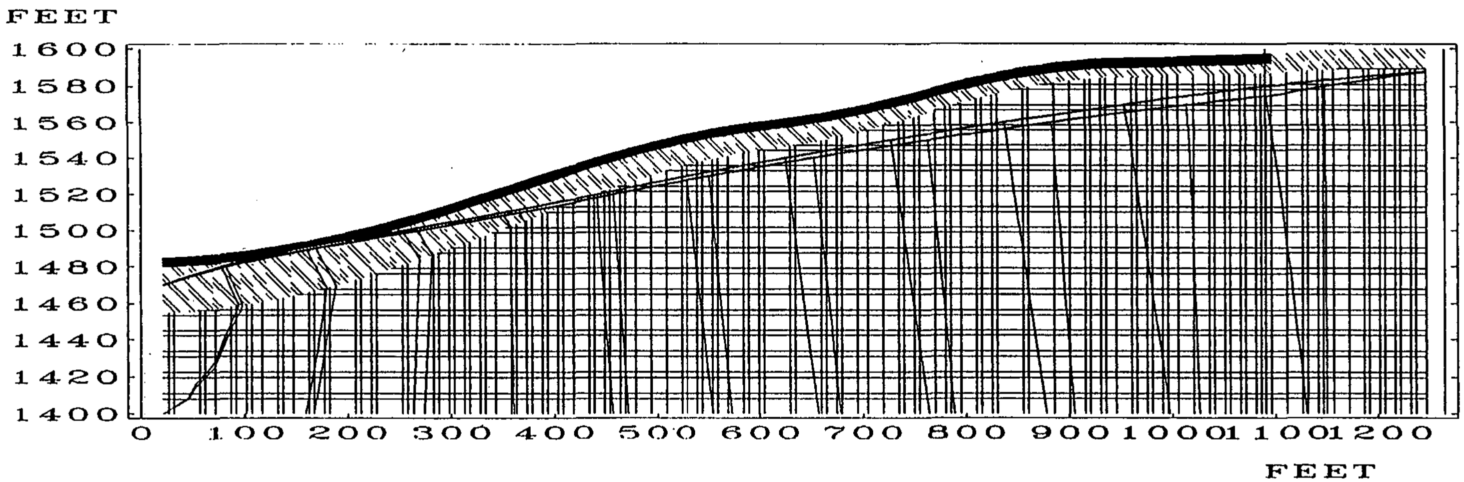
3. Results

Figure 2 shows a close up of the results of the model run, in cross-section. Two model runs were made. The first run was with no French Drain, and the results are shown as the upper water table line. For the second run, heads were fixed at the proposed invert elevation of the drain at the edge of the landfill. Heads were drawn down in the model by 5 feet at the drain, as shown by the lower water table line in Figure 2. The model run shows that the drawdown extends beneath the cap several hundred feet beneath the landfill. At the drain the simulated drawdown is 5 feet, at a distance of 300 feet, the drawdown is about 3 feet, and at 600 feet, the drawdown would be expected to be less than 1 foot.

4. Conclusion

Installing a French Drain into bedrock would result in high costs for excavation and installation. The resulting drawdowns in fractured bedrock would be difficult to predict, however, using a groundwater model using equivalent porous medium assumptions for the bedrock, drawdowns, even under ideal conditions of no resistance to flow in the trench, would not be expected to be significant near the targeted hot spot. Hot Spot 5, which would be about 300 feet or more downgradient of the proposed drain, would only experience a drawdown of about 1 to 3 feet at best. The hot spot, which is estimated to be within the first five feet below the ground surface, would not be significantly affected by this drawdown. Since the water table is already below the hot spot in this area the impacts from this hot spot on groundwater quality would not be improved by this approach. Data from MW-103 indicate that the water table near the hot spot may be located in the bedrock, below the contaminated zone, and further drawdown of the water table would not make any difference.

This alternative is not recommended for further development or inclusion in the Feasibility Study.

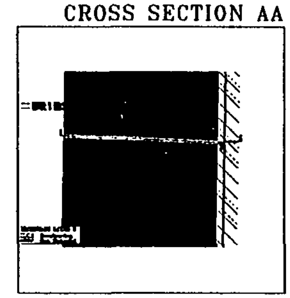



MATERIALS CROSS-SECTION AA

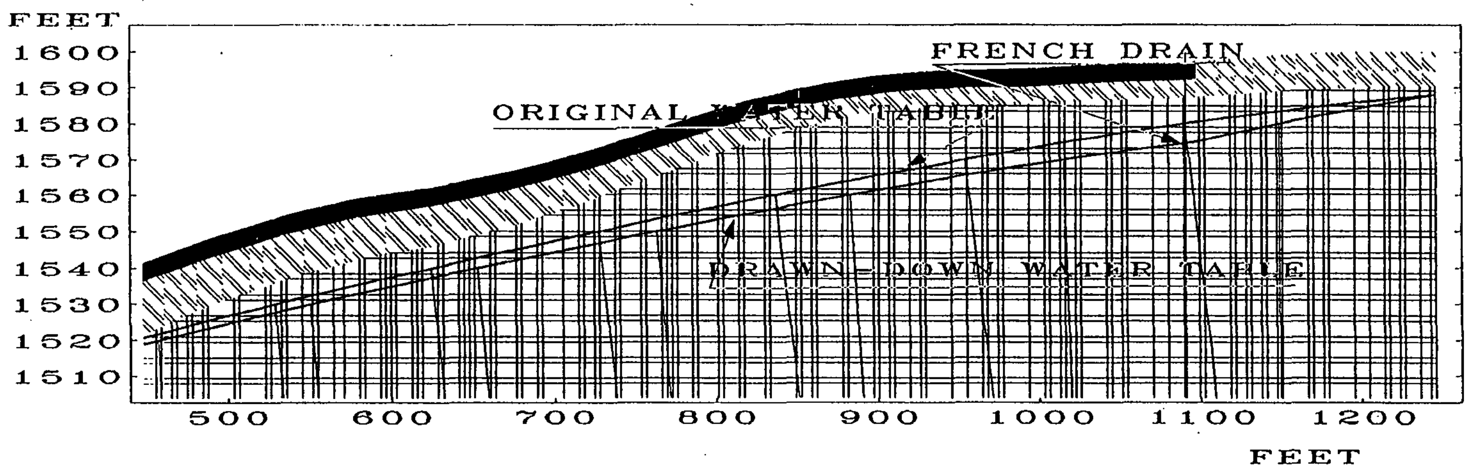
- Cap Material
- Overburden
- Bedrock

— HEAD
— HEAD

CROSS SECTION AA



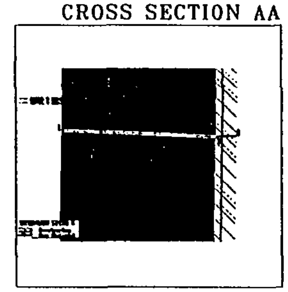
| FIGURE 1 | URBANA LANDFILL<br>3-D GROUNDWATER MODEL<br><br>CROSS-SECTION SHOWING GROUNDWATER LEVEL DRAWDOWN | CDM<br>*environmental engineers, scientists, planners, & management consultants* |
|---|---|---|




MATERIALS CROSS-SECTION AA
- Cap Material
- Overburden
- Bedrock

— HEAD
— HEAD

CROSS SECTION AA



| | | |
|---|---|---|
| FIGURE 2 | URBANA LANDFILL<br>3-D GROUNDWATER MODEL<br><br>CLOSE UP CROSS-SECTION SHOWING DRAIN AND WATER TABLE | CDM<br>*environmental engineers, scientists, planners, & management consultants* |