REMEDIAL INVESTIGATION

AT THE

LOCKPORT CITY LANDFILL

LOCKPORT (C), NIAGARA (C), NEW YORK

NYSDEC SITE No. 9-32-010

CITY OF LOCKPORT, NEW YORK

REPORT

APRIL 1992

PREPARED BY

URS Consultants, Inc.
282 Delaware Avenue
Buffalo, New York 14202

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AT THE
LOCKPORT CITY LANDFILL

LOCKPORT (C), NIAGARA (C), NEW YORK
NYSDEC SITE NO. 9-32-010
CITY OF LOCKPORT, NEW YORK

APRIL 1992
FINAL

Prepared For:

CITY OF LOCKPORT, NEW YORK
LOCKPORT MUNICIPAL BUILDING
ONE LOCKS PLAZA
LOCKPORT, NEW YORK 14094

PREPARED BY:

URS CONSULTANTS, INC.
282 DELAWARE AVENUE
BUFFALO, NEW YORK 14202

SUMMARY
TABLE OF CONTENTS
LOCKPORT CITY LANDFILL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

PART 1: REMEDIAL INVESTIGATION

PART II: FEASIBILITY STUDY

PART III: APPENDICES

PART I: REMEDIAL INVESTIGATION

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

LIST OF TABLES

LIST OF TABLES (Cont'd)

LIST OF TABLES (Cont'd)

LIST OF FIGURES

LIST OF PLATES

(Bound Separately)

LIST OF APPENDICES

(BOUND SEPARATELY)

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1.0 INTRODUCTION

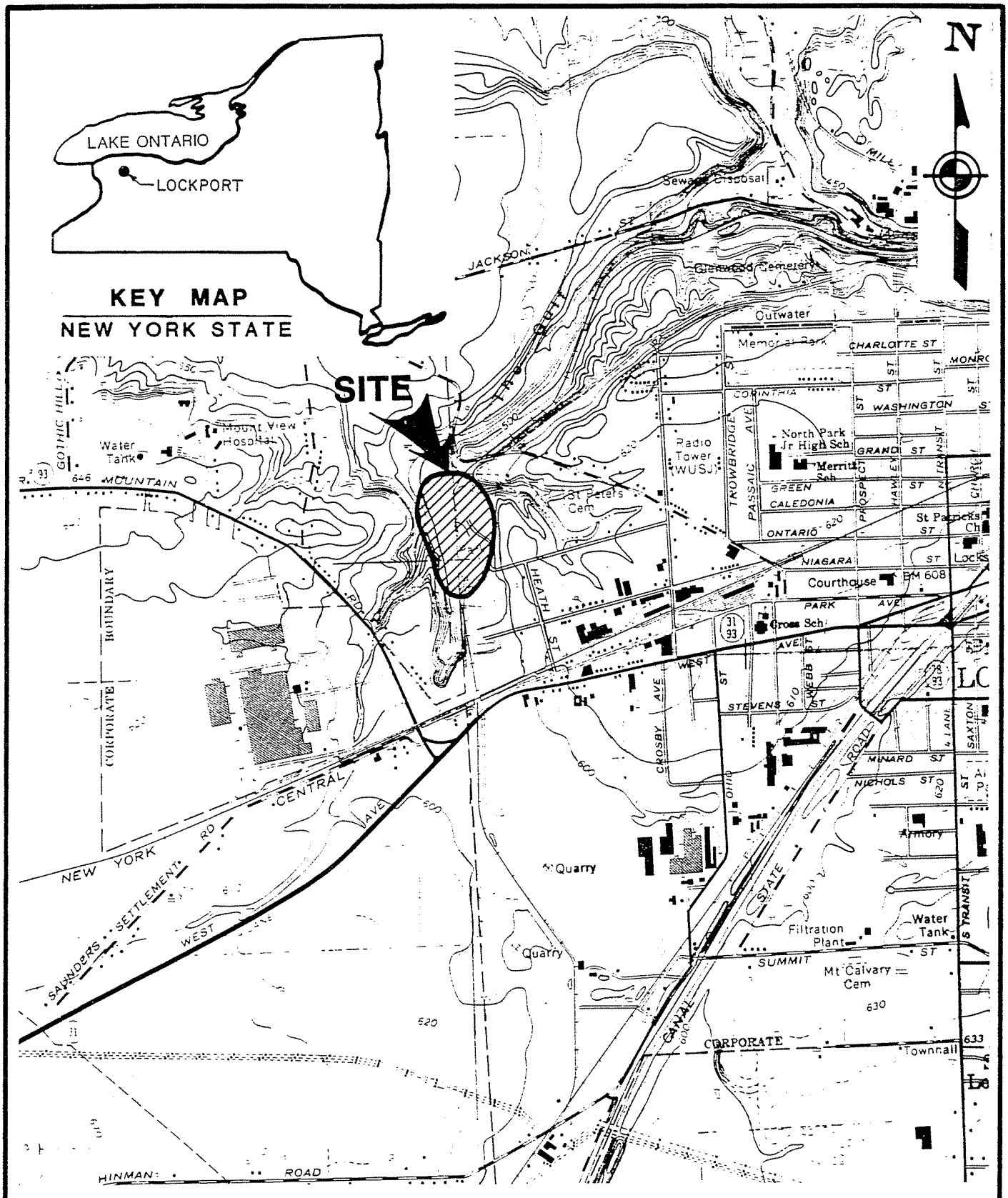
1.1 Purpose of Report

The purpose of this Remedial Investigation Report is to present, summarize, and provide interpretation and conclusions on data gathered during the Remedial Investigation (RI) activities at the Lockport City Landfill, City of Lockport, Niagara County, New York. The report contains results from field activities for the first-phase (May 1989 through 1990), and second-phase (February 1991 through July 1991) RI. The following activities have been completed and are discussed herein: literature reviews, a door-to-door community water well survey, topographic mapping, site entry air monitoring, soil gas survey, geophysical surveys, stream survey, subsurface soil and waste investigations, installation of monitoring wells, exploratory borings through the fill material, two rounds of stream water and groundwater sampling, chemical analysis of samples, hydraulic conductivity tests, geotechnical analysis of selected soils, stream velocity profiles, habitat-based assessment, nature and extent of contamination, groundwater flow, contaminant transport, fugitive dust models, and health risk assessment.

1.2 Site Background

1.2.1 Site Description

The approximately 30-acre Lockport City Landfill is located partially in the City of Lockport and partially in the Town of Lockport, Niagara County, New York. The site location is shown in Figure 1-1, and the site plan in Plate 1. The site is bounded by The Gulf, a creek running along the north and west boundary, by Sutliff Rotary Park and Railroad Street on the east, and by the City Highway Garage on the south. The property is owned by the City of Lockport.



USGS LOCKPORT QUADRANGLE
7.5 MINUTE SERIES
(1965)

SCALE 0 1000 2000 FT.

A-3201

URS CONSULTANTS, INC.	SITE LOCATION MAP LOCKPORT CITY LANDFILL	FIGURE 1-1

The site lies on a re-entrant (angular indentation) of the Niagara escarpment. The site topography is variable. The eastern and southern sections of the site are relatively flat. A steep slope, however, borders this area on the west and to a lesser degree on the north. At the base of this abrupt slope (the escarpment), which is approximately 60 feet high, lie a ravine and The Gulf. The Gulf flows north along the base of the landfill, discharging into Eighteen Mile Creek approximately one mile north of the site. The Gulf is classified by the New York State Department of Environmental Conservation (NYSDEC) as a Class D water body. A 3-acre unclassified wetland is located north of The Gulf at the toe of the landfill. A small pond is located south of the landfill. A 36-inch concrete pipe, which was installed to drain a spring near Oakhurst Street, lies within the fill. The outfall pipe is located near The Gulf in the southwestern portion of the site. It is one of three seeps identified in the Phase I and II reports (RECRA Research, 1983, 1985). An 18-inch storm sewer located in The Gulf runs adjacent to the landfill.

The landfill is composed of two fill areas. These areas are separated by the Somerset Railroad tracks which run in a north-south direction. The main portion of the landfill is located west of the tracks. A smaller fill area, located east of the tracks, served as a borrow point for cover material for the western portion of the landfill. The eastern area was later filled with refuse, and was covered and graded.

The area east of the tracks is sparsely vegetated, with small trees and scrub brush. The western portion of the landfill is heavily vegetated with trees and brush. Large piles of tree limbs are scattered on the surface. The sideslopes are heavily vegetated. Numerous empty drums and other refuse items protrude from this area.

1.2.2 Site History

The Lockport City Landfill was operated by the City of Lockport as a municipal and industrial waste landfill from the early 1950s until 1976. It has been reported that unknown quantities of a variety of wastes were disposed of at the landfill including sewage sludge, wood starch contaminated with peroxide paste; keto and oxylite waste; steel barrels, plastics, glass, cardboard, and waste paper (Recra 1983, 1985). The method of disposal at the facility reportedly consisted of trenching into the overburden, depositing and then burning the wastes, and finally covering the wastes with excavated materials each day. A small northwest-southeast trending ravine identified from aerial photographs and geophysical survey, and confirmed by borings, had been filled with wastes by 1968.

1.2.3 Previous Investigation

The Lockport City Landfill has been the subject of a number of investigations, beginning in 1981, at which time the landfill was inactive. Both the Niagara County Department of Health (NCDOH) and the New York State Department of Environmental Conservation (NYSDEC) performed investigations at the site.

The following is a summary of findings from each of these investigations:

3/3/81 - NCDOH: A site inspection uncovered numerous violations of Part 360.8 of the Environmental Conservation Code. Among these violations were on orange-colored leachate entering The Gulf through the 36-inch outfall pipe and from the face of the landfill. Large amounts of garbage, refuse, and debris had been placed without cover and too close to surface waters, causing leachate and runoff to

enter the stream. No final cover, including vegetative cover, had been applied to it.

4/14/81 - NCDOH: Three water samples were collected during this investigation. These samples were collected at the 36-inch outfall pipe, and upstream and downstream of the outfall pipe in The Gulf.

10/26/81 - NCDOH: Site visit by Mike Hopkins of NCDOH, who estimated that over 200 drums with plastic liners had been deposited along the creek bed. The water from The Gulf had white particulate matter floating on the surface, and a sewage odor.

12/14/81 - NYSDEC: A site inspection by John Tygert, Robert Wozniak, and Thomas Christoffel of NYSDEC Region 9. Three water samples and three sediment samples were obtained from The Gulf. Sediment samples showed high concentrations of iron (110,000 ppb), chromium (150 ppb), copper (40 ppb), lead (640 ppb), and zinc (1,500 ppb). There were also detectable concentrations of halogenated organics in all three samples.

One water sample taken from a leachate outbreak at the midway point of the landfill showed concentrations of arsenic (52 ppb), iron (10 ppm), and lead (0.2 ppm) in excess of the effluent standards for Class D waters.

11/28/83 - NYSDEC: Phase I investigation. A Phase I summary report was prepared for NYSDEC by RECRA Research, Inc. A preliminary Hazard Ranking System score of 23.9 was obtained.

8/85 - NYSDEC: Phase II investigation. A Phase II investigation was carried out for NYSDEC by RECRA Research, Inc. Field work was performed from May 3, 1984, through July 3, 1984. A final Hazard Ranking System score of 23.2 was obtained. Field work involved

placement of 6 monitoring wells, a geophysical survey, and a soil, surface water, and groundwater sampling program. The analytical data from these previous investigations have been compiled in Appendix A.

1.2.4 Possible Responsible Parties

It has been suggested that the Lockport Landfill received wastes from every industrial facility operating in the Lockport area during the landfill's operation (RECRA, Phase I Report, 1983). Landfill personnel recall five major industrial users: Harrison Radiator, Niagara Mohawk, New York State Electric and Gas, Van de Mark Chemicals, and Diamond Alkali (RECRA, 1983). NYSDEC identified the following additional potentially responsible parties: AKZO Chemicals, Inc., Superior Pipe Cleaning Company, and the City of Lockport. A list of industrial users supplied by the Niagara County Environmental Management Council in May 1988 may be found in Appendix B.

1.3 Report Organization

This RI Report has been organized in a format consistent with Chapter 3 of USEPA's Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA (USEPA Draft, March 1988). Appendices are bound separately. The following summarizes each section of the report:

- Section 2.0: Description of the Remedial Investigation field activities.

- Section 3.0: Description of site features, climate, demography, water usage, hydrology, regional and site-specific hydrogeology, community well survey and ecology.

- Section 4.0: Nature and extent of contamination.
- Section 5.0: Fate and transport of contaminants.
- Section 6.0: Applicable or relevant and appropriate requirements (ARARs).
- Section 7.0: Health risk assessment.
- Section 8.0: Summary and conclusions.

2.0 REMEDIAL INVESTIGATION FIELD ACTIVITIES

In carrying out field activities at the Lockport City Landfill, all applicable project plans were followed except where deviations from these documents are noted. Applicable documents included the Work Plans (URS, 1989), Field Sampling Plan (FSP - URS, 1989), Quality Assurance Project Plan (QAPP - URS, 1989), and Site-Specific Health and Safety Plan (HASP - URS, 1989). The field work for the remedial investigation was accomplished using a phased approach. The first-phase field work was performed from October 1989 through March 1990. The second phase was performed from February, 1991 through July, 1991.

2.1 Surveying and Mapping

A topographic map of the Lockport City Landfill was prepared for use during the site investigation, data analysis phase, and subsequent evaluations of remedial alternatives. The map was drawn to a scale of 1 inch equals 100 feet, at a contour interval of 2 feet. Mapping was performed using aerial photography with ground survey. Field surveys were conducted to create a grid system for locational control during site investigation activities (particularly during surface geophysical studies and air/soil screening), and to establish the exact locations and elevations of all groundwater monitors and other field data points. Vertical control was set using the National Geodetic Vertical Datum of 1929, and horizontal control was referenced to a project coordinate system. The project coordinate system at the Lockport City Landfill was derived arbitrarily to give horizontal control over the entire site. Actual horizontal closure was 1:124,000 unadjusted, and primary vertical control was 0.03 (allowable closure error was 0.081). Surveying of the grid and data points was performed by O.M. Popli, P.E., under the supervision of a URS-licensed surveyor.

2.2 Community Well Surveys/Existing Monitoring Well Survey

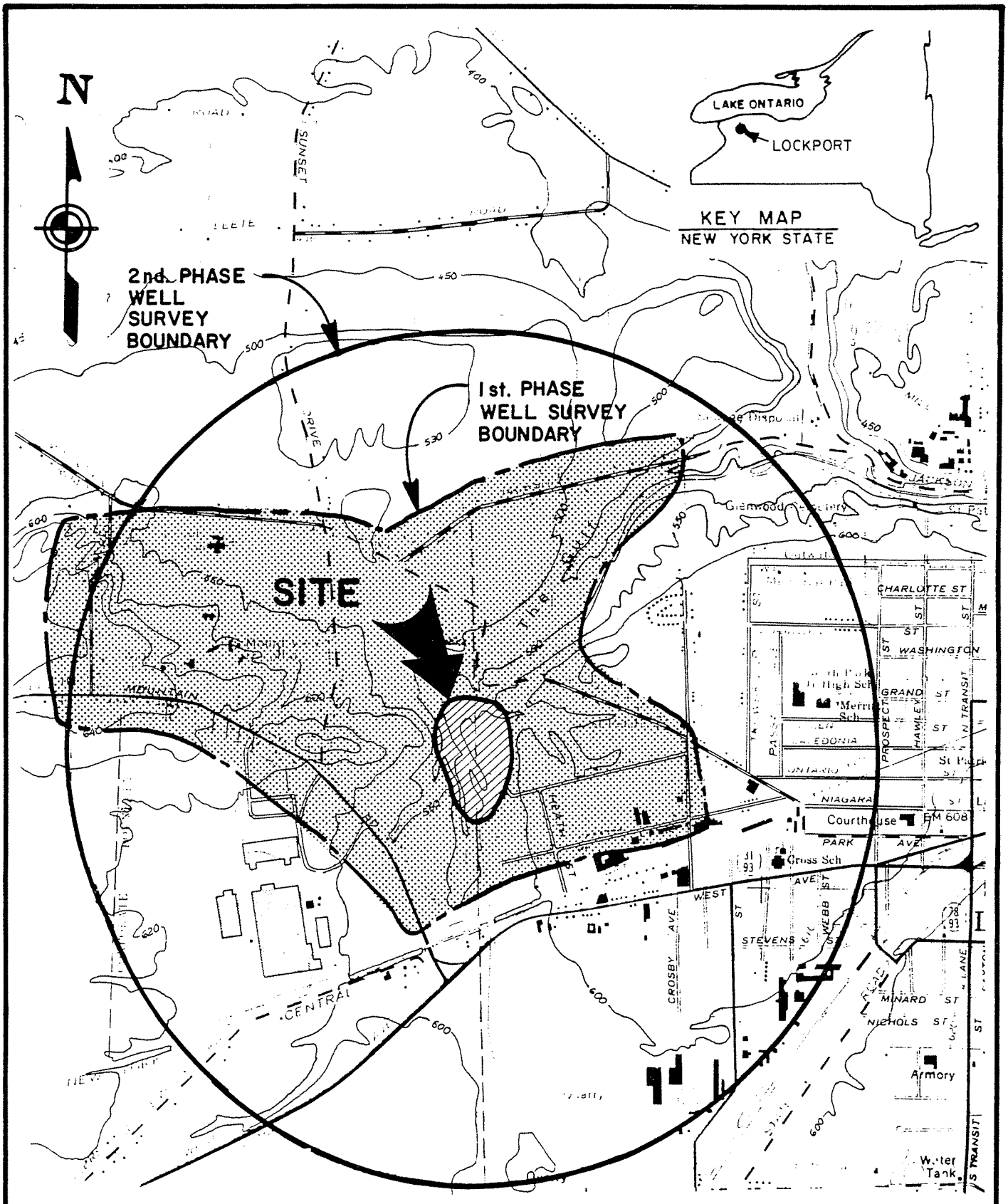
Two community well surveys were performed for the areas surrounding the Lockport City Landfill site. The first survey was completed during Phase I field work and consisted of a door-to-door survey conducted at 43 households adjacent to the site. As requested by NYSDEC, a second survey was performed during the second phase of the RI. This survey was a mailing to all households within a 1.0-mile radius of the site boundary as well as to other addresses on certain streets that extend beyond the 1-mile radius for a total of 557 households. The extent of the surveys are shown on Figure 2-1. Both surveys were completed to determine the well types, depth to groundwater, and groundwater usage in the areas surrounding the site. The information from these surveys may be found in Appendix C. Findings are discussed in Section 3.4.

2.3 Radiological Surface Survey

In order to characterize radiological conditions at the site a radiological surface survey was performed during the drilling of monitoring wells and boreholes. The instrument used was a Ludlum Survey Meter (scintillation detector) equipped with a pancake G-M probe capable of measuring alpha, beta, or gamma radiation ranging from 0.0 to 5.0 millirems per hour (mr/hr). Split-spoon samples and rock cores were monitored at each borehole. No radiation above the background level of 0.02 mr/hr (measured off site) was found.

2.4 Air/Soil Survey

Prior to intrusive activities at the Lockport City Landfill, air and soil gas screening was performed to determine the level of personal protection necessary for these activities and to aid in determining the extent of subsurface contaminants.



URS CONSULTANTS, INC.	COMMUNITY WELL SURVEY BOUNDARY LOCKPORT CITY LANDFILL	FIG. 2-1

A-3229

The air/soil gas monitoring points were located on a grid system at 20- to 50-foot intervals across the site. The air and soil gas screening was performed using both HNu photoionization organic vapor detector and OVA flame ionization vapor detector. The soil gas was sampled to a depth of 18 inches using a soil probe.

The survey was begun on October 15, 1989, and completed on December 15, 1989. A total of 476 air and soil gas monitoring points were screened. The survey was used to place wells and borings as well as to assess health and safety requirements. Appendix D contains the Air and Soil Screening Report (URS, January 1990) which summarizes the survey results.

2.5 Surface Geophysical Survey

In conducting the surface geophysical survey, two geophysical techniques were used: magnetometry and terrain conductivity. The purpose of the geophysical survey was to: (1) help determine the extent of fill at the site; (2) determine the locations of buried metallic objects (such as drums); and (3) obtain information on general subsurface conditions to aid in placement of boreholes.

The geophysical survey was performed by Hager-Richter Geoscience, Inc., of Salem, New Hampshire. Field operations were supervised by URS personnel.

The magnetometer survey was conducted using an EG&G Model 6856 Proton Precession Portable Magnetometer with a gradiometer option. Magnetic data were collected at 1,180 stations. Magnetic stations were occupied on a 20-foot grid in open areas of the site. In the northern and western portions of the site that were covered by dense vegetation, magnetic stations were occupied at 20-foot intervals along lines stacked 100 feet apart.

The terrain conductivity survey was conducted using a Geonics EM31 terrain conductivity meter. The EM31 is an induction-type unit that measures terrain conductivity without ground electrodes. The quadrature - phase component of terrain conductivity was recorded at the site. A total of 408 stations were occupied. Data were collected at 10-foot intervals along lines 20 feet apart in the area east of the railroad tracks. Background terrain conductivity data were measured off site in both the orchard to the east and in the park adjacent to the site.

Results of the geophysical study are discussed in Section 3.8. The complete geophysical report is included as Appendix E.

2.6 Subsurface Drilling Program/Monitoring Well Installation

Soil borings and monitoring wells were constructed at the site during the Phase I and II Field Investigations to directly evaluate subsurface conditions. Conditions evaluated included: stratigraphy, physical soil properties, aquifer parameters, and groundwater flow and quality. Forty-two (42) borings were made at 37 locations; stainless-steel monitoring wells were installed at 15 of these locations; PVC piezometers were installed at 8 of these locations (Plate 2). A total of 3 shallow well points were installed on the north end of the site, south of The Gulf. Borings were advanced in accordance with the procedures specified in the FSP (URS, 1989), with the exception of the rock coring method. Rock coring was done utilizing an Hx core barrel (4-1/4-inch OD), with the monitoring wells set in the resulting corehole. The work plan called for use of an Nx-size corehole (3-1/2-inch OD), followed by reaming of the hole with a roller bit to obtain a 5-inch diameter hole. As a cost saving measure, and after NYSDEC approval, the Hx corehole was utilized for monitoring well installation without reaming.

Borings that were to be utilized as groundwater monitoring wells were advanced using 6-1/4-inch hollow-stem augers until refusal. At

monitoring well locations MW-1I, MW-2I, MW-5I, MW-6D, MW-8I, MW-8D, MW-10I, MW-10D, MW-11D, MW-12I and MW-12D, a 6-inch ID permanent steel casing was grouted into the borehole. The purpose of the steel casing was twofold: (1) to prevent loss of circulating water used for rock coring, and (2) to prevent downward (or upward) migration of contamination. The grout around the casing was allowed to set a minimum of two days before rock coring commenced. An alternate method for sealing the overburden was used at MW-1D and MW-9I. At these locations 4-1/2-inch ID flush-joint casing with a carbide cutting head was advanced until seated in rock. The annular space between the auger and casing was sealed with bentonite powder. This method was utilized at MW-1D due to the shallow bedrock surface. At MW-9I, the auger hole would have collapsed if the casing were removed.

Borings that were not utilized as monitoring wells were advanced using 4-1/4-inch hollow-stem augers.

Continuous split-spoon samples were taken to the maximum depth of overburden at each deep location. At well cluster locations, the overburden was not sampled during the installation of the intermediate-depth wells. Continuous Nx corings of each rock hole were also obtained. Soil samples from split spoons were examined and classified by the supervising geologist in accordance with the procedures found in the FSP. Rock cores were identified for rock type, relative hardness, brokenness, and core recovery.

Monitoring wells were constructed of 2-inch 304 stainless-steel riser and 2-inch 304 20-slot stainless steel screen, except for MW-11D which was redrilled using a 2-inch 304 30-slot stainless steel screen. Well materials were emplaced by tremie tube or poured in annular space. Piezometers were constructed of schedule 40 PVC with 20-slot screens.

Monitoring wells were developed after installation by pumping, bailing, and/or surging. The wells were considered developed when the groundwater indicator parameters, such as pH, specific conductance, and temperature, had stabilized and, if possible, turbidity readings of less than 50 NTUs were achieved.

Two monitoring wells that were proposed were not installed. Background shallow monitoring wells MW-6S and MW-8S were not set since shallow groundwater was not encountered in the overburden.

The borehole for monitoring well MW-1D was advanced below the depth at which the well was eventually screened. In order to place the well screen at the proper depth, the borehole was backfilled with silica sand from 116 to 95 feet below ground surface (BGS) and a three foot bentonite slurry seal was tremied on top of the silica sand from 95 to 92 feet (BGS). The remaining well was installed above the bentonite slurry seal using the procedures given in the FSP.

Background monitoring wells MW-1D and MW-6D were installed with deviations from written well specifications which may affect the usefulness of these wells. The groundwater from MW-1D exhibited anomalously high pH values, possibly as a result of grout contamination during well construction or damage during surge blocking. Monitoring well MW-6D contains a stainless-steel bailer that was lost in the well during development. Several attempts were made to retrieve the bailer, which resulted in the retrieval devices also becoming lodged in the well. The items lost in the well are below the water level, which makes sampling of this well still possible.

Monitoring well MW-10D required replacement when it was discovered that the bentonite slurry seal had migrated downward into the screened portion of the well. To rectify the situation, the stainless-steel well materials were salvaged form the borehole and the borehole thoroughly

flushed with clean water to remove all the remaining well materials (sand and bentonite). The borehole was then advanced an additional five feet to increase the screened portion of the well. The salvaged stainless-steel material was then used (following decontamination) to reconstruct the well. During well development using a stainless-steel bailer, this well exhibited high specific conductance (>20,000 μmho), a strong sulfur odor, and PID headspace readings (from containerized groundwater samples) ranging from 50-150 ppm.

Monitoring wells MW-11D, MW-12I and MW-12D were developed using a surge block in an attempt to hasten the recovery time of the wells. This method involved the addition of water from an approved source to the well to increase the height of the water column, followed by surging and bailing. This method is more aggressive in removing fines from the sand pack, thus improving the yield of the well. Although some improvement in recharge was noted following surge blocking, wells MW-12I and MW-12D continued to have low yield.

Well MW-11D yield was increased from less than 2 gallons per day to greater than 30, and water elevation was increased from 487.14 feet (amsl) to 596.77 (amsl). Since these values varied from other wells completed in the same formation, and the production and water elevations were more indicative of the overburden wells, MW-11D was redrilled. The replacement well was constructed utilizing the riser and casing from the damaged well, and using a new 2-inch 304 30-slotted stainless steel screen with a washed pea gravel pack. This well was then developed as per the FSP (URS, 1989).

Eight (8) exploratory borings were advanced through the fill material to determine the extent of a buried depression that was identified during the Phase I investigation. Two of these borings were completed as piezometers (B-21 and B-23) to monitor the groundwater flow in the fill unit. Borings B-26 and B-27 were relocated from their proposed locations in order to delineate the horizontal extent of a waste

material encountered at boring B-25. A localized pocket of suspected methane gas was encountered at a depth of 16 feet at boring B-21. Sustained LEL (Lower Explosive Limit) levels of 100% were present at this location for a two-hour period. Drilling operations were suspended during this period, and were resumed when acceptable LEL levels were attained.

In an attempt to determine if the wetland north of the site is acting as a localized recharge point for the bedrock aquifers, paired well points (shallow and deep) were proposed in the wetland north of the site to determine vertical hydraulic gradients. Due to the shallow depth of the bedrock in this area (less than 3 feet), installation of the well points was not feasible. It was possible to install three shallow well points (WP-4, WP-5 and WP-6) on the northern end of the site, just south of The Gulf. Well construction diagrams for the well points are included in Appendix G.

The data produced during drilling operations are included in Appendix F (soil boring logs) and Appendix G (monitoring well installation reports). Appendix H contains the well development reports. Appendix I includes well locations and elevations.

2.7 Hydrogeological Testing

Hydrogeological testing of the water-bearing and/or rock formation consisted of pressure-testing of rock holes, slug-testing of all monitoring wells, and physical testing of soil.

Pressure-testing of all rock holes involved forcing water under pressure into the formation to determine rock permeability. Pressure tests were conducted at 5-foot intervals from bottom to top of each test hole. A discussion of pressure test results is presented in Section 3.9.3.

Slug-testing for determining hydraulic conductivity was performed by raising the water level with a stainless-steel slug and electronically monitoring the return of the water level to equilibrium. A discussion of slug test results is presented in Section 3.9.3.

Tests for physical properties of soils included triaxial permeability (4 Shelby tubes), combined sieve and hydrometer analysis (10 soil samples), Atterberg limits (10 soil samples), and moisture content (20 samples). Geotechnical testing of all soil samples was performed according to ASTM methods. Results and methods of analysis are discussed in Section 3.5.2. Laboratory reports may be found in Appendix J.

2.8 Stream Hydrology Studies

Stream hydrology was investigated to aid in the assessment of the effect of the Lockport City Landfill on The Gulf. As part of this study, three stream-stage gauges were installed. Each stream-stage gauge was monitored daily during the field investigation. The stream gauge consists of a graduated scale, placed vertically in the stream bed so that a portion of the scale is immersed in water at all times. The stream gauge was surveyed for vertical and horizontal control.

Cross-section and stream velocity profiles were determined at each staff gauge location.

From the data obtained at each stream gauge location, stream discharge was calculated. Section 3.7.2 contains the discussion of results.

2.9 Macrobenthic Survey

After review and consultation with NYSDEC, the information supplied by the Habitat-based assessment (Section 2.1.11), was deemed sufficient to

proceed with the RI/FS. As a cost saving effort, therefore, the macrobenthic survey was deleted from the study.

2.10 Environmental Sampling

The purpose of the environmental sampling program is to produce a data base adequate to both characterize the site and assess its current impact upon public health and the environment.

Chemical laboratory analyses were performed by NYSDEC Contract Laboratory Program (CLP) laboratories following CLP protocols. All quality assurance/quality control (QA/QC) procedures specified in the Quality Assurance Project Plan (QAPP) were followed (URS, 1989). All data were subjected to a quality review by URS before acceptance. All environmental sampling and testing are summarized on Table 2-1 with analytical schedules given on Table 2-2.

(a) Surficial Soils: Five (5) surficial soil samples were collected during the RI field program. These samples were collected with a hand auger from a depth of 0-12 inches. Plate 2 shows the locations where samples were collected. The prefix "SPS" denotes these samples.

(b) Surface Water/Sediments: Eleven (11) surface water and 11 sediment samples were collected from The Gulf and background locations. The locations where these samples were taken are shown on Plate 2. The prefix "SW" denotes surface water, while "SS" denotes sediment. A sediment grab sample was taken during the second-phase RI field program from the marsh area at the northwest of the site and was identified as WSS-1.

(c) Soil Borings: Sixteen (16) soil samples were collected from boreholes either as composites or discrete samples. Discrete samples were collected from all monitoring well locations (MW-series borings). The

TABLE 2-1
Summary of Environmental Sampling and Testing

SAMPLE ID	MATRIX	TYPE	DATE SAMPLED	LOCATION	ANALYTICAL SCHEDULE
LCL-MW-1S	Groundwater	Grab	3/22/90	Overburden	A & B
LCL-MW-1S	Groundwater	Grab	4/2/91	"	A & B
LCL-MW-1I	Groundwater	Grab	3/22/90	Rochester Formation	A & B
LCL-MW-1I	Groundwater	Grab	4/2/91	"	A & B
LCL-MW-1D	Groundwater	Grab	3/23/90	Irondequoit Formation	A & B
LCL-MW-1D	Groundwater	Grab	6/29/91	"	A & B
LCL-MW-2S	Groundwater	Grab	3/19/90	Overburden	A & B
LCL-MW-2S	Groundwater	Grab	3/28/91	"	A & B
LCL-MW-2I	Groundwater	Grab	3/19/90	Rockway Formation	A & B
LCL-MW-2I	Groundwater	Grab	3/28/91	"	A & B
LCL-MW-3	Groundwater	Grab	3/19/90	Overburden	A & B
LCL-MW-3	Groundwater	Grab	4/1/91	"	A & B
LCL-MW-4S	Groundwater	Grab	3/20/90	Overburden	A & B
LCL-MW-4S	Groundwater	Grab	4/1/91	"	A & B
LCL-MW-5S	Groundwater	Grab	3/20/90	Overburden	A & B
LCL-MW-5S	Groundwater	Grab	4/2/91	"	A & B
LCL-MW-5I	Groundwater	Grab	3/20/90	Grimsby Formation	A & B
LCL-MW-5I	Groundwater	Grab	4/2/91	"	A & B
LCL-MW-6I	Groundwater	Grab	3/21/90	Rochester Formation	A & B
LCL-MW-6I	Groundwater	Grab	4/3/91	"	A & B
LCL-MW-6D	Groundwater	Grab	3/21/90	Irondequoit Formation	A & B
LCL-MW-6D	Groundwater	Grab	4/3/91	"	A & B
LCL-MW-7S	Groundwater	Grab	3/22/90	Overburden	A & B
LCL-MW-7S	Groundwater	Grab	4/2/91	"	A & oil & grease
LCL-MW-8I	Groundwater	Grab	3/21/90	Rochester Formation	A & B
LCL-MW-8I	Groundwater	Grab	4/3/91	"	A & B
LCL-MW-8D	Groundwater	Grab	3/21/90	Irondequoit Formation	A & B
LCL-MW-8D	Groundwater	Grab	4/3/91	"	A & B
LCL-MW-9S	Groundwater	Grab	3/20/90	Overburden	A & B
LCL-MW-9S	Groundwater	Grab	4/1/91	"	A & B
LCL-MW-9I	Groundwater	Grab	3/20/90	Rockway Formation	A & B
LCL-MW-9I	Groundwater	Grab	4/1/91	"	A & B
LCL-MW-10I	Groundwater	Grab	4/3/91	Rochester Formation	A & B
LCL-MW-10D	Groundwater	Grab	4/3/91	Irondequoit Formation	A & B
LCL-MW-11D	Groundwater	Grab	6/29/91	Irondequoit Formation	A & B
LCL-MW-12I	Groundwater	Grab	4/30/91	Rochester Formation	A & B
LCL-MW-12D	Groundwater	Grab	4/30/91	Irondequoit Formation	A & B
LCL-SW-1	Surface Water	Grab	12/1/89	Upstream of Landfill	A & B
LCL-SW-2	Surface Water	Grab	12/1/89	Adjacent to Landfill	A & B
LCL-SW-3	Surface Water	Grab	12/1/89	Adjacent to Landfill	A & B
LCL-SW-4	Surface Water	Grab	12/1/89	Upstream of Landfill	A & B
LCL-SW-4	Surface Water	Grab	4/8/91	Upstream of Landfill	A & B
LCL-SW-5	Surface Water	Grab	12/4/89	Adjacent to Landfill	A & B
LCL-SW-6	Surface Water	Grab	2/15/90	Offsite	A & B
LCL-SW-7	Surface Water	Grab	2/15/90	Offsite	A & B
LCL-SW-8	Surface Water	Grab	12/4/89	Downstream of Landfill	A & B
LCL-SW-9	Surface Water	Grab	4/8/91	Downstream of Landfill	A & B
LCL-SW-10	Surface Water	Grab	4/8/91	Downstream of Landfill	A & B
LCL-L-1	Water	Grab	12/4/89	Groundwater Seep	A & B
LCL-LL-1	Water	Grab	3/19/91	Groundwater Seep	A & B
LCL-L-2	Water	Grab	12/4/89	Groundwater Seep	A & B
LCL-LL-2	Water	Grab	3/19/91	Groundwater Seep	A & B

TABLE 2-1 (Continued)

SAMPLE ID	MATRIX	TYPE	DATE SAMPLED	LOCATION	ANALYTICAL SCHEDULE
LCL-SS-1	Stream Sediment	Grab	12/1/89	Upstream of Landfill	A & C
LCL-SS-2	Stream Sediment	Grab	12/1/89	Adjacent to Landfill	A & C
LCL-SS-3	Stream Sediment	Grab	12/1/89	Adjacent to Landfill	A & C
LCL-SS-4	Stream Sediment	Grab	12/1/89	Upstream of Landfill	A & C
LCS-SS-4	Stream Sediment	Grab	4/8/91	Upstream of Landfill	A & C
LCL-SS-5	Stream Sediment	Grab	12/4/89	Adjacent to Landfill	A & C
LCL-SS-6	Stream Sediment	Grab	2/15/90	Offsite	A & C
LCL-SS-7	Stream Sediment	Grab	2/15/90	Offsite	A & C
LCL-SS-8	Stream Sediment	Grab	12/4/89	Downstream of Landfill	A & C
LCL-SS-9	Stream Sediment	Grab	4/8/91	Downstream of Landfill	A & C
LCL-SS-10	Stream Sediment	Grab	4/8/91	Downstream of Landfill	A & C
LCL-WSS-1	Stream Sediment		3/19/91	Adjacent to Landfill	A & C
LCL-SPS-1	Surface Soil	Grab	12/8/89	On Landfill	A & C
LCL-SPS-2	Surface Soil	Grab	12/8/89	On Landfill	A & C
LCL-SPS-2-DL	Surface Soil	Grab	12/8/89	On Landfill	A & C
LCL-SPS-3	Surface Soil	Grab	12/8/89	On Landfill	A & C
LCL-SPS-4	Surface Soil	Grab	12/11/89	On Landfill	A & C
LCL-SPS-5	Surface Soil	Grab	12/12/89	On Landfill	A & C
LCL-MW-1 0-3'	Soil Boring	Discrete	12/7/89	On Landfill	A & C
LCL-MW-2I 0-2'	Soil Boring	Discrete	1/29/90	On Landfill	A & C
LCL-MW-5I 10-12'	Soil Boring	Discrete	1/2/90	Below Sanitary Sewer	A & C
LCL-MW-5I 2-4'	Soil Boring	Discrete	1/12/90	On Landfill	A & C
LCL-MW-6D 2-4'	Soil Boring	Discrete	1/17/90	On Landfill	A & C
LCL-MW-7S 2-4'	Soil Boring	Discrete	1/15/90	On Landfill	A & C
LCL-MW-8I 2-4'	Soil Boring	Discrete	1/19/90	On Landfill	A & C
LCL-MW-9S 4-6'	Soil Boring	Discrete	1/11/90	On Landfill	A & C
LCL-SB-1	Soil Boring	Composite	1/30/90	On Landfill	A, C & D
LCL-SB-5	Soil Boring	Composite	2/2/90	On Landfill	A, C & D
LCL-SB-9	Soil Boring	Composite	2/7/90	On Landfill	A, C & D
LCL-SB-13	Soil Boring	Composite	2/9/90	On Landfill	A, C & D
LCL-SB-14	Soil Boring	Composite	2/9/90	On Landfill	A, C & D
LCL-SB-18	Soil Boring	Composite	2/13/90	On Landfill	A, C & D
LCL-SB-19	Soil Boring	Composite	2/13/90	On Landfill	A, C & D
LCL-SB-25 MS/MSD	Waste	Composite	4/5/91	On Landfill	A & D
LCL-WS-1	Waste Sample	Grab	2/21/90	On Landfill	A, C & D
LCL-WS-2	Waste Sample	Grab	2/21/90	On Landfill	A, C & D
LCL-WS-3	Waste Sample	Grab	2/21/90	On Landfill	A, C & D
LCL-MH-1	Sewer Water	Grab	3/26/91	Storm/Sanitary Sewer	A
LCL-MH-2	Sewer Water	Grab	3/26/91	Storm/Sanitary Sewer	A

TABLE 2-2
ANALYTICAL SCHEDULES

Schedule A (Aqueous and Solid):	TCL Volatiles TCL Semivolatiles TCL Pesticides/PCBs TCL Metals (23) Aluminum Cobalt Potassium Antimony Copper Selenium Arsenic Iron Silver Barium Lead Sodium Beryllium Magnesium Thallium Cadmium Manganese Vanadium Calcium Mercury Zinc Chromium Nickel Total Cyanide Total Phenols
Schedule B (Aqueous) :	Bicarbonate BOD COD Chloride Hardness Ammonia-Nitrogen TKN Alkalinity Acidity NO3-Nitrogen Phosphate Oil & Grease TOC TSS TDS Sulfate Sulfide
Schedule C (Solids):	Ammonia-Nitrogen Nitrate-Nitrogen TKN Moisture pH TOC
Schedule D (Solid/Waste):	EP Toxicity Metals and Organics Ignitability Corrosivity Reactivity % Chlorine Heat of Combustion Ash Weight % Sulfur

prefix (MW-SB" denotes these samples. Composite samples were collected from each borehole (B-series borings) located on the landfill. The prefix "SB" denotes these samples.

(d) Waste Samples: Three (3) waste samples were collected from waste areas on the landfill. The prefix "WS" denotes a waste sample.

(e) Groundwater: Thirty-seven (37) groundwater samples were collected from 21 wells during the RI field program. Sixteen (16) groundwater wells were sampled during first phase field work and 21 water wells were sampled during second-phase field work. Samples were obtained from 6 monitoring wells installed previously by Recra Research during the Phase II investigation. The seventh well (MW-3) installed by Recra was not sampled because of anomalous water level readings. The remaining 15 wells (10 from the first-phase field work and 5 from the second phase) were installed by URS. As of this writing, sample results from 1D and 11D have not been received.

(f) Leachate Samples: Two (2) leachate samples were collected from seeps found at the landfill. The prefix "L" denotes these samples.

Leachate sample L-1 was collected at a spring located on the top of the landfill. Leachate L-2 was collected from the 36-inch outfall pipe located at the base of the landfill. These locations were resampled during the Phase II RI field program and are labeled LL-1 and LL-2. Plate 2 shows the location of these leachate samples. A third leachate outbreak reported in the Recra Phase I and Phase II investigations could not be located.

(g) Sewer Sampling: An accidental penetration of the sanitary sewer which runs near the perimeter of the site in The Gulf during the first-phase field investigation revealed a high concentration of PCBs. In order to assess the impact of the sanitary sewer on the Gulf, 2 sewer

samples were obtained, one upgradient of the landfill and one downgradient. These samples were labeled MH-1 and MH-2. Their locations are shown on Plate 2.

2.11 Habitat-Based Assessment (HBA)

A Phase I HBA was completed at the Lockport City Landfill. The HBA consisted of delineating the major vegetative communities in and around the landfill by utilizing air photos. A covertype map was produced showing the community boundaries. The data were field-checked on February 20 and 21, 1990. In addition, wildlife-type associations were established with each major vegetative community.

Results of the HBA are presented in Section 3.5.

2.12 Statement of Compliance with Contract Documents

Methods of construction of soil borings, development and installation of monitoring wells, soil/air screening, and performance of other field activities are presented in the FSP (URS, 1989). Unless otherwise noted above, all field work was conducted in a manner consistent with the FSP.

3.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

3.1 Surface Features

The Lockport City Landfill is partially located on a re-entrant (angular indentation) of the Niagara Escarpment. The Niagara Escarpment divides the Ontario Plain on the north from the Huron Plain on the south. Drainage of the Ontario Plain is northward into Lake Ontario. Drainage of the Huron Plain is southward into Tonawanda Creek which flows westward into the Niagara River. The relief at the Lockport City Landfill ranges from about 570 feet above mean sea level (amsl) to 460 feet amsl. The Gulf, a creek which borders the site on the west, enters the site at an elevation of 502 feet amsl directly south of the site, and leaves it on the north at elevation 464 feet amsl.

Cultural features at the site include the Somerset Railroad tracks which run north and south through the length of the site, and a 36-inch combination sewer/stormwater interceptor line which crosses to the landfill side of The Gulf at the landfill's midway point, and follows The Gulf towards Niagara Street.

3.2 Climate

Lockport, New York, has the varied and changeable weather conditions typical of continental areas at this latitude. Seasonal swings in temperature are tempered by Lake Erie to the southwest and Lake Ontario to the north. Data for the years 1951 - 1980 have been compiled by the National Oceanic and Atmospheric Administration (NOAA, 1985). Yearly mean temperature for that period is 47.7°F with extremes rarely exceeding 95°F or falling below -10°F. Precipitation for the year 1989 was 36.84 inches, slightly above the 30-year average of 35.70 inches. 1989 however, saw an unusually wet May and June (7.82 inches greater than 30 year average). Prevailing winds, recorded at the Buffalo weather station approximately 15

miles to the south, came from the southwest. Monthly velocities averaged 10-14 mph for the last 30 years. Snowfall in the region can be locally heavy.

3.3 Demography and Land Use

The estimated population of the postal district that includes both the City and Township of Lockport was 44,355 for the year 1986 (CACI Source book, 1987). The site is situated in an area that is primarily industrial or commercial, although some 50 residences and two city parks lie within a one-mile radius of the site.

Density of population and associated commercial enterprises increases rapidly to the east, with the center of the City of Lockport lying within 3 miles of the site. Agricultural land and a developing residential area lie to the north. General Motor Corporation's Harrison Radiator Division, Lockport Industrial Park, Mountain View Hospital, and the Niagara County Jail lie beyond a line of residences to the west. The area south of the site is dominated by warehouses, small businesses, and the Allegheny Ludlum Steel Corp. special materials division. Rotary Park is separated from the landfill by the Somerset Railroad line that flanks the site to the east. The closest building is the Lockport City Garage, approximately 500 feet southeast. Due to the ongoing investigation, which necessitated the placement of background monitoring wells in Rotary Park, the park was not opened for the 1990 and 1991 season.

3.4 Water Usage

Two community well surveys were conducted during the RI. The first was a door-to-door canvassing of 139 homes adjacent to the site. Face-to-face surveys were conducted at 43 of these homes. The second survey consisted of a questionnaire mailed to all households within a 1-mile radius. Of the total of 557 homes contacted, there were 351 responses.

Of the 351 respondents only 39 had wells, and of these only 15 were being used. [Nineteen are not used or are abandoned, five are unknown]. Most of households with wells are located on West Jackson Street, Niagara Street, and Upper Mountain Roads. The RECRA Research Phase I (1983) and Phase II (1984) reports stated that 27 homes, mostly on Jackson and Niagara Streets, used groundwater for potable water. In 1983, the Town of Lockport constructed water lines which eliminated the need of groundwater on West Jackson Street for potable purposes. The results of the survey, however, show that residences continue to use groundwater for domestic purpose, as well as for watering livestock and lawns. The closest potable water well to the site lies approximately 600 feet north on Niagara Street. The shallow well at this household is reportedly capped, while the deep well is still operable. Results of the community well survey data may be found in Appendix C and the extent of the survey is illustrated on Figure 2-1.

3.5 Soils

3.5.1 Description

Soils found in and around the Lockport City Landfill were formed in glacial material that was deposited during the Wisconsin glaciation. During this time, the advancing ice sheet moved slowly southward and picked up rocks and soil material. This material was later dumped as the ice sheets retreated to form hills, ridges, and plains. This dumped material is called glacial till.

The United States Department of Agriculture Soil Conservation Service has mapped four different soil groups at the site (USDA, 1972). They are as follows:

Farmington Silt Loam, 0-8% Slope,
Hilton-Cayuga Silt Loam, 3-8% Slope,
Rockland, Steep,
Made Land

The Farmington series consists of shallow, well drained, medium-textured soils. These soils were formed in thin glacial till deposits over a calcareous bedrock. Locally, the landscape is controlled by the Lockport and Rochester formations. USDA has classified these soils, using the Unified Soil Classification System, as ML (Inorganic Silts) or CL (Inorganic Clays).

The permeability of the Farmington ranges from 4.45×10^{-4} cm/sec - 4.45×10^{-3} cm/sec. This soil group may be found on the north edge of the landfill, west of the railroad tracks, east of The Gulf, and south of Niagara Street. The 1937 soil survey of Niagara County indicates that most of the area around the landfill was classified as Farmington (USDA, 1937).

The Hilton-Cayuga series consists of deep, moderately well drained soils. These soils were formed in calcareous glacial till containing sandstone and limestone fragments. USDA has classified these soils, using the Unified Soil Classification System, as ML or CL. The permeability of these soils ranges from 1.4×10^{-4} cm/sec - 1.4×10^{-3} cm/sec. This soil group may be found in Rotary Park, near monitoring well location MW-8.

The steep phase Rockland series is found along the escarpment where rock outcrops exist and the soil cover is thin. This land type is affected by rockiness more than by any other soil characteristic. Permeability is normally high because of cracks and fractures in the underlying bedrock.

Made land consists of areas that have been modified by cut-and-fill operations. Most of the landfill has been mapped by the USDA Soil Conservation Service as this type.

3.5.2 Geotechnical Sampling and Analysis

Select soil samples were obtained for classification and permeability testing. Sample locations and analyses performed are outlined in Table 3-1. All sampling was done in accordance with the URS Work Plan (1989). The laboratory analysis was performed by R&R International, Inc., of Columbus, Ohio. The results of these analyses are presented in Appendix I.

The data indicate that the soil underlying the landfill is of very low permeability (3.37×10^{-6} cm/sec to 7.78×10^{-6} cm/sec). Three of the four samples were taken from exploratory boreholes beneath the fill material. The fourth sample was taken just downgradient of the fill at monitoring well location MW-9.

Grain size and Atterberg data for the background soil samples from MW-6 and MW-8 classify the soil as CL (Inorganic Clays), using the Unified Soil Classification System. Classification data for soil samples from MW-5 and MW-7, obtained from the northern part of the landfill, put subsoils in this area into SC (Clayey Sands). Three soil samples (B-5, B-13, and B-15) were collected from the natural material that underlies the fill area. Classification data identified all three samples as CL (Inorganic Clays).

TABLE 3-1
SOIL SAMPLES FOR GEOTECHNICAL ANALYSIS

		Geotechnical Analysis			
Sample Location	Depth (ft.)	Grain Size (1)	Moisture Content (2)	Atterberg Limits (3)	Permeability (4)
MW1I	2-4	X	X	X	
MW2I	2-4	X	X	X	
MW5I	6-8		X		
MW5I	17.5-19.5	X	X	X	
MW6I	10-12	X	X	X	
MW6I	6-8		X		
MW7S	8-10	X	X	X	
MW8D	14-16		X		
MW8D	16-17.5	X	X	X	
MW9S	0-2		X		
MW9I	8-10	X	X	X	
MW9I	6-8				X
B-1	10-12				X
B-2	12-14		X		
B-5	30-R	X	X	X	
B-6	20-22				X
B-9	16-R		X		
B-10	8-8.7		X		
B-11	6-8		X		
B-13	16-18	X	X	X	
B-15	22-24	X	X	X	
B-16	12-14		X		
B-17	8-10		X		
B-18	12-14				X

(1) ASTM D422-63 (1972), (1) 1140-54 (1971)
(2) ASTM D 2216-80
(3) ASTM D 423, 424
(4) COE/EM 1110-2-1906/11-30-70

3.6 Ecology

3.6.1 Covertypes

Lands surrounding the landfill support a diversity of plant communities, which range from wet-meadow and open-water wetlands to mature maple-beech forest. The landfill itself supports younger communities of more invasive species which have colonized the area since the termination of landfilling activities. The ecological variation on and around the landfill is not only topographic in origin but is also caused by human activities. Covertypes may be divided into the following 5 categories (Plate 3):

1) Mature deciduous forest. Such forests surrounding the landfill probably represent what existed in the landfill prior to the start of work there. Mesic maple-beech forest is common. Other areas include Green Ash, American Hornbeam, and Black Cherry dominants. The canopy is continuous, allowing only sparse undergrowth, except near recently disturbed areas, where greater sunlight has been able to penetrate.

2) Open water and wet-meadow wetlands. The wet-meadow wetland (Covertype 2A), approximately 4 acres, is found in the north of the site. A stream channel network, with several standing dead trees, exists throughout. Grasses dominate, with a small amount of Phragmites. The open-water wetland (Covertype 2B) is a shallow impoundment to the south of the site, approximately 1 acre in size. This area has very low flow, with duckweed and submergent vegetation evident, but no appearance of cattails or other cover or feed for waterfowl. A few standing dead trees may be seen in the middle of the lake, with many nest holes in them. Garbage is strewn upon the shore. Aerial photographs indicate that both these wetlands have been formed, or at least changed to their present state, within the past 25 years.

3) Lowland riparian forest. This community is found along The Gulf on both disturbed and undisturbed lands. The undisturbed community Parcel 3A, 1 acre) is dominated by a canopy of mature Black Willow with very sparse undergrowth. The forest on disturbed lands (Covertype 3B, 2 acres) is crowded with younger growth, principally Ashleaf Maple, Hawthorn, Eastern Cottonwood and Black Willow. Undergrowth includes wild grape and raspberry as well as submergent vegetation in a stagnant old channel of The Gulf. Lower-growing willow species occur on some of the sunlit banks of this area.

4) Successional Shrub Savanna (approximately 13 acres). This heterogenous community covers the area of the landfill from the toe of the river valley slope east to the top of the slope, and partway to the railroad tracks. It is bounded by Railroad Street and Rotary Park in the east, by the tracks in the north, and by barren land (where municipal dumping has continued until recently) in the south.

The communities in this area have characteristics of limestone woodlands and successional shrublands, but include a wide variety of invasive plants that do best under mesic conditions. Mature plants, which do not form a continuous canopy, include Eastern Cottonwood, Black Locust, and Ailanthus. Only where Staghorn Sumac dominates (usually on the steeper slopes) is there continuous cover. In between the larger trees are areas of sumac and younger trees of the above-named species, in addition to Green Ash, Ashleaf Maple, Bitternut Hickory, Black Walnut, and others. Grasses, goldenrod, teasel, and wild roses are also present. Several small, dead specimens of American Elm stand in the southern portion.

This is the area of greatest disturbance and clearing. The northern boundary, along with that of Covertype 3B, clearly delineates the northern boundary of landfill activity.

5) Successional Old Field. (Approximately 2 acres) Several herbaceous species, including goldenrod, aster, and teasel, grow here. Seedlings of Ailanthus and Green Ash are sprouting on the eastern and southern borders.

Table 3-2 lists species observed in each area, in approximate order of frequency of occurrence.

3.6.2 Special Resources

According to NYSDEC personnel (personal communication, December 1989), no significant habitats occur in the vicinity of the landfill. No known sightings of threatened or endangered species have occurred on the site.

Five classified wetlands occur downstream of the site. One is approximately one-half mile from the site, upstream of The Gulf's entrance into Eighteen Mile Creek. The other four lie along Eighteen Mile Creek, approximately 10 miles north of the site. All areas are either class I or II wetlands.

Both The Gulf and Eighteen Mile Creek are Class D waters.

3.6.3 Wildlife

As stated previously, no threatened or endangered species are known to have been sighted on the landfill. [See Table 3-3 for animal species listed as "threatened", "endangered", or of "special concern"].

Animals sighted on or near the landfill during the remedial investigation include white tailed deer, wild turkey, great blue heron, racoon, rabbit, rat, field mouse, crow, downy woodpecker, and hawk (unidentified species).

TABLE 3-2

TREE AND UNDERGROWTH SPECIES IN FORESTED AREAS OF LOCKPORT CITY LANDFILL AS NOTED IN FIELD CHECK, JANUARY 1990

Covertype 1:	Green Ash	Fraxinus pennsylvanica
	American Hornbeam	Ostrya virginiana
	American Beech	Fagus grandifolia
	Hawthorn	Crataegus spp.
	Sugar Maple	Acer saccharum
	Black Cherry	Prunus serotina
	Ashleaf Maple	Acer negundo
	American Basswood	Tilia americana
	White Oak	Quercus alba
	Red Oak	Quercus rubra
	Pin Cherry	Prunus pennsylvanica
	Witch Hazel	Hamemelis virginiana
	Ironwood	Caprinus caroliniana
Covertype 3A:	Black Willow	Salix nigra
	Ashleaf Maple	Acer negundo
	American Hornbeam	Ostya virginiana
	Sugar Maple	Acer saccharum
	Hawthorn	Crataegus spp.
Covertype 3B:	Ashleaf Maple	Acer negundo
	Hawthorn	Crataegus spp.
	Willow (lower types)	Salix spp.
	Sugar Maple	Acer saccharum
	Black Willow	Salix nigra
	Eastern Cottonwood	Populus deltoides
	Bladdernut	Staphylea trifolia

Table 3-2 (Cont'd)

Covertype 4:	Staghorn Sumac	Rhus typhina
	Ashleaf Maple	Acer negundo
	Black Locust	Rominia psuedoacacia
	Eastern Cottonwood	Populus deltoides
	Tree of Heaven	Ailanthus altissima
	Weeping Willow	Salix babylonica
	Pin Cherry	Prunus pennsylvanicum
	Black Walnut	Juglaus nigra
	Bitternut Hickory	Carya cordiformis
	Green Ash	Fraxinus pennsylvanica
Covertype 5:	Goldenrod	Solidago spp.
	Aster	Aster novae-angliae
	Teasel	Dipsacus fullonum
	Thistle	Cirsium spp.
	Tree of Heaven	Ailanthus altissima
	Green Ash	Fraxinus pennsylvanica

TABLE 3-3
WILDLIFE LISTED UNDER THE NEW YORK STATE
ENVIRONMENTAL CONSERVATION LAW AS:

ENDANGERED SPECIES

Mullusk	
**Chittenango Ovate Amber Snail	Succinea chittenangoensis
Insect	
Karner Blue Butterfly	Lycaeides melissa
Fish	
*Shortnose Sturgeon	Acipenser brevirostrum
*Longjaw Cisco	Coregonus alpenae
Round Whitefish	Prosopium cylindraceum
Pugnose Shiner	Notropis anogenus
Eastern Sand Darter	Ammocrypta pellucida
Bluebreast Darter	Etheostoma camurum
Gilt Darter	Percina evides
*Blue Pike	Stizostedion vitreum glaucum
Spoonhead Sculpin	Cottus ricei
Deepwater Sculpin	Myoxocephalus thompsoni
Amphibian	
Tiger Salamander	Ambystoma tigrinum
Reptiles	
Bog Turtle	Clemmys muhlenbergi
*Leatherback Sea Turtle	Dermochelys coriacea
*Hawksbill Sea Turtle	Eretmochelys imbricata
*Atlantic Ridley Sea Turtle	Lepidochelys kempii
Massasauga Rattlesnake	Sistrurus catenatus
Birds	
Golden Eagle	Aquila chrysaetos
*Bald Eagle	Haliaeetus leucocephalus
*Peregrine Falcon	Falco peregrinus
*Eskimo Curlew	Numenius borealis
Least Tern	Sterna albifrons
Roseate Tern	Sterna dougallii
Loggerhead Shrike	Lanius ludovicianus
Mammals	
*Indiana Bat	Myotis sodalis
*Sperm Whale	Physeter catadon
*Sei Whale	Balaenoptera borealis
*Blue Whale	Balaenoptera musculus
*Finback Whale	Balaenoptera physalus
*Humpback Whale	Megaptera novaeangliae
*Right Whale	Balaena glacialis
*Gray Wolf	Canis lupus
*Cougar	Felis concolor

TABLE 3-3 (Cont'd)

THREATENED SPECIES

Fish	
Lake Sturgeon	Acipenser fulvescens
Mooneye	Hiodon tergisus
Lake Chubsucker	Erimyzon sucetta
Mud Sunfish	Acantharchus pomotis
Longear Sunfish	Lepomis magalotis
Amphibian	
Cricket Frog	Acris crepitans
Reptiles	
Mud Turtle	Kinosternon subrubrum
Blanding's Turtle	Emydoidea blandingi
**Loggerhead Sea Turtle	Caretta caretta
**Green Sea Turtle	Chelonia mydas
Timber Rattlesnake	Crotalus horridus
Birds	
Osprey	Pandion haliaetus
Red-shouldered Hawk	Buteo lineatus
Northern Harrier	Cirus cyaneus
Spruce Grouse	Dendragapus canadensis
Piping Plover	Charadrius melodus
Common Tern	Sterna hirundo
Mammal	
Eastern Woodrat	Neotoma floridana

SPECIAL CONCERN SPECIES

Fish	
Silver Chub	Hybopsis storeriana
Gravel Chub	Hybopsis x-punctata
Blackchin Shiner	Notropis heterodon
Black Redhorse	Moxostoma duquesnei
Longhead Darter	Percina macrocephala
Amphibians	
Southern Leopard Frog	Rana sphenocephala
Hellbender	Cryptobranchus alleganiensis
Jefferson Salamander	Ambystoma jeffersonianum
Blue-spotted Salamander	Ambystoma laterale
Spotted Salamander	Ambystoma macultum

TABLE 3-3 (Cont'd)

SPECIAL CONCERN SPECIES

Reptiles	
Spotted Turtle	Clemmys guttata
Wood Turtle	Clemmys insculpta
Diamondback Terrapin	Malaclemys terrapin
Worm Snake	Carphophis amoenus
Eastern Hognose Snake	Heterodon platyrhinos
Birds	
Common Loon	Gavia immer
Least Bittern	Ixobrychus exilis
Cooper's Hawk	Accipiter cooperii
Black Rail	Laterallus jamaicensis
Upland Sandpiper	Bartramia longicauda
Black Tern	Chlidonias niger
Common Barn-Owl	Tyto alba
Short-eared Owl	Asio flammeus
Common Nighthawk	Chordeiles minor
Common Raven	Corvus corax
Sedge Wren	Cistothorus platensis
Eastern Bluebird	Sialia sialis
Henslow's Sparrow	Ammodramus henslowii
Grasshopper Sparrow	Ammodramus savannarum
Vesper Sparrow	Pooecetes gramineus
Mammals	
Small-footed Bat	Myotis leibii
New England Cottontail	Sulvilagus transitionalis
Harbor Porpoise	Phocoena phoceona

* Indicates that the species is currently listed as "endangered" by the U.S. Department of the Interior.

** Indicates that the species is currently listed as "threatened" by the U.S. Department of the Interior.

The value of the landfill site as habitat lies in its variety of plant communities and their difference from the forest surrounding them. The sparse and lower growth, and the different species of plants, provide shelter and food for animals that would not inhabit the mature, well developed forest nearby. However, the size of the landfill limits the number of individuals that it may provide for. The 20 to 30 acres of the entire landfill site is not enough to support more than a few members of most species.

3.7 Surface Water Hydrology

The dominant drainage feature in the vicinity of the site is The Gulf which begins near the Frontier Stone Quarry, west of Hinman Road. The Gulf flows to the north, passing adjacent to the landfill, and joining Eighteen Mile Creek approximately one mile northeast of the site. Eighteen Mile Creek flows northward into Lake Ontario. A narrow portion of the landfill property lies on both sides of The Gulf stream and includes a wetland area that lies within the 100-year floodplain (FEMA, 1975).

3.7.1 Site Drainage

Surface water on the site generally flows westward to The Gulf. The slope of the site ranges from 0% to 30%. Site terrain steepens near The Gulf. Most surface water is derived from precipitation and snow melt. A portion of this precipitation infiltrates into the landfill to form leachate. A small portion of surface water results from these leachate seeps.

A water balance analysis was completed in order to quantify runoff, infiltration, and evapotranspiration. The water balance analysis is based upon the methods developed by Thornthwaite and Mather (1955) and Fenn et al. (1977). Precipitation figures were taken from historical 30-year

means for the Lockport area. Surface runoff was determined as referenced in the Federal Emergency Management Agency (FEMA) Flood Insurance Study for the City of Lockport, New York (1975). Using the above-mentioned reference, evapotranspiration and infiltration were calculated. Table 3-4 summarizes the results of the water balance analysis.

3.7.2 The Gulf Hydrology

As part of this study three stream staff gauges were installed at points along The Gulf (Plate 2). Stream profiles and velocity measurements were made at each location. The stream profiles are shown in Figures 3-1 and 3-2.

Stream gauge 3, located on the east tributary of The Gulf, showed a relatively low stream flow (1.11 cfs). Flow in this tributary of The Gulf is restricted due to the damming of the creek approximately 1,000 feet to the south. Stream gauge 2 is located on the west tributary of The Gulf. The discharge from this tributary amounts to 97 percent of the total flow of The Gulf (35.59 cfs). Most of this flow results from three outfalls at the Harrison Radiator plant. Harrison's outfall 001 (process and stormwater) has a permitted daily maximum discharge of 7.87 million gallons per day (12.12. cfs). Outfalls 002 and 003 have a combined permitted daily maximum discharge of 6-9 million gallons per day (13.93 cfs). The third stream gauge, stream gauge 1, is located near the Niagara Street culvert. The calculated discharge at this point was 30.47 cfs.

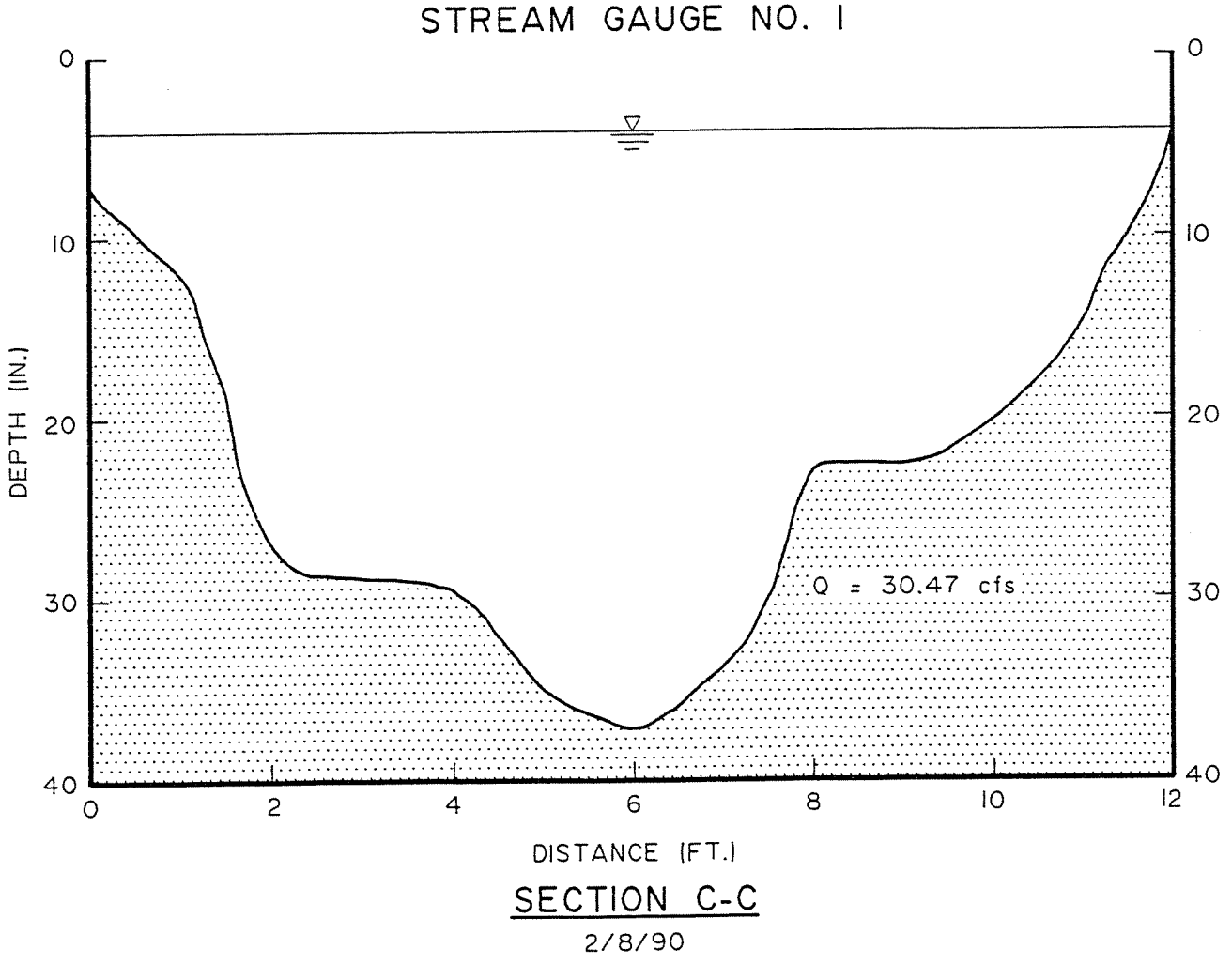
The combined flow from the two tributaries (stream gauges 2 & 3) is 36.70 cfs. Discharge at stream gauge 1 to the Niagara Street culvert totals 30.47 cfs. This leaves 6.23 cfs of discharge unaccounted for. It is believed that the 4-acre wetland at the north end of the site is temporarily storing water or acts as a discharge zone. The 6.23 cfs discharge is equivalent to 12.35 acre-feet per day. Observations made of the wetland during this investigation indicated no more than 3-6 inches of standing water.

TABLE 3-4

WATER BALANCE SUMMARY

Annual Precipitation:	35.70 inches
Surface Runoff:	5.35 inches (15.00 percent)
Evapotranspiration:	22.18 inches (62.13 percent)
Infiltration:	8.16 inches (22.87 percent)

1"=100' 7/8/91



SECTION C-C

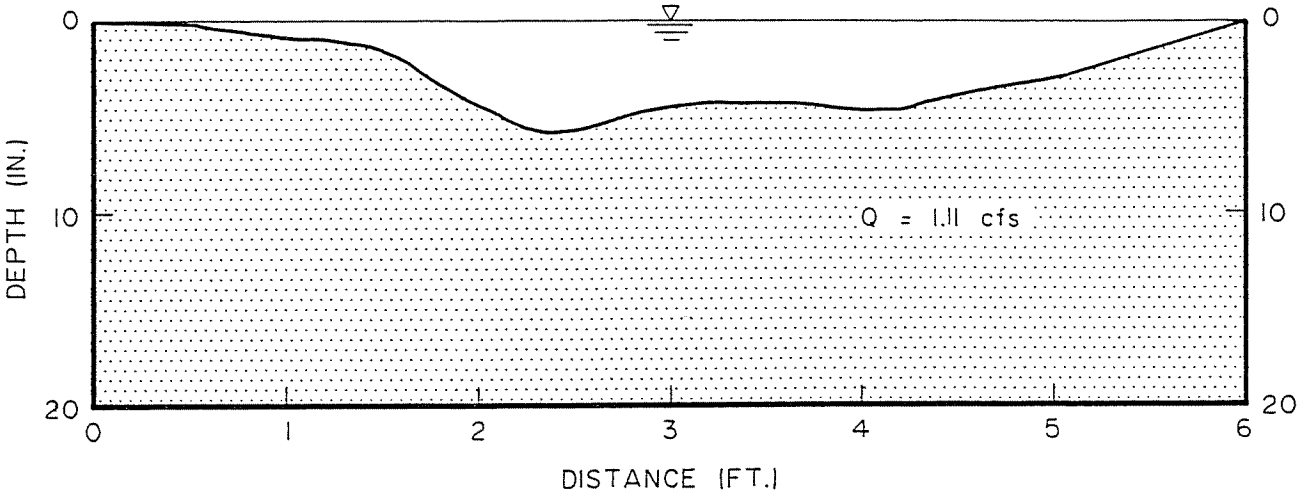
2/8/90

AC-3215

URS CONSULTANTS, INC.	STREAM DATA	FIGURE 3-1

1"=100' 7/8/91

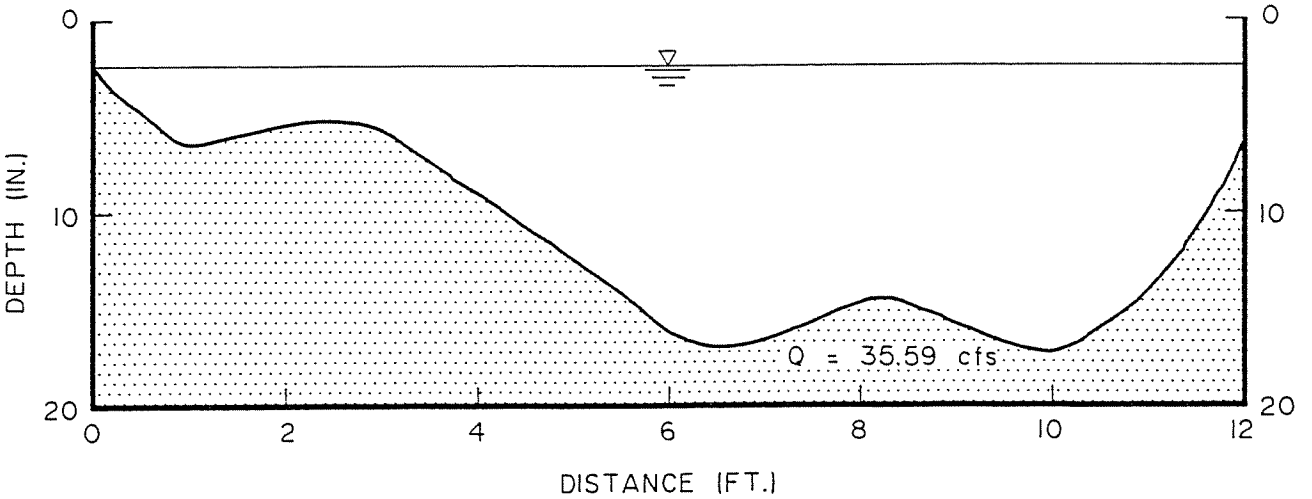
STREAM GAUGE NO. 3



SECTION A-A

2/8/90

STREAM GAUGE NO. 2



SECTION B-B

2/8/90

AC-3214

URS CONSULTANTS, INC.

STREAM DATA

FIGURE 3-2

3.7.3 Historical Drainage

From historical aerial photographs and USGS Topographic Maps of the site, it is evident that a series of three ravines at one time provided surface drainage at the site. Two of these gullies are not presently evident at the site due to subsequent fill operations. These gullies have been filled in with either structural fill (clean material upon which the railroad and city garage were built) or fill associated with the landfill operation. The subsurface geophysical and drilling programs have confirmed the presence of these features. The approximate limits of the ravines are shown in Figure 3-3.

3.8 Geophysical Survey Results

The geophysical survey utilized two geophysical techniques: terrain conductivity and magnetometry. The complete geophysical report may be found in Appendix E.

Four anomalies were detected in the terrain conductivity survey conducted on the graded fill area east of the railroad tracks. Due to the presence of a soil gas anomaly close to one of the magnetic anomalies (1218E, 18375N), an exploratory borehole (B-15/P-5) was placed here. There was no indication of buried metallic objects during borehole advancement. This conductivity anomaly might be attributable to the presence of concrete debris encountered in the shallow subsurface or to the high water table in this area. The terrain conductivity survey also provided a fill boundary line for the eastern extent of the fill. This delineation is represented by the 30 umhos/meter contour line, which approaches the background values of 20 and 25 umhos/meter recorded in Rotary Park (east of the fill area).

The total magnetic field contour map for the site is complex. Numerous magnetic anomalies exist over the entire site. The magnetic

N

E 12500

N 20400

E 12800

N 17000

HEATH STREET

OAKHURST STREET

RUIN

PILES

RAILROAD STREET

NIAGARA STREET

PILE

CITY OF LOCKPORT
TOWN OF LOCKPORT

PILES

WATER EL. 503.3

GENERAL OUTLINE OF PRE-EXISTING VALLEYS
(USGS QUADRANGLE - LOCKPORT, 1950)

THE GULF

E 11100

N 20400

E 11100

N 17000

WATER

HARRISON RADIATOR
WASTE WATER
TREATMENT PLANT

SCALE
0 100 200 FEET

NOTE
ALL PROPERTY LINES SHOWN ARE TAKEN FROM CITY AND TOWN OF LOCKPORT TAX MAPS AND ARE APPROXIMATE IN THEIR LOCATION PHYSICAL FEATURES (AND CONTOURS WHEN SHOWN) ARE TAKEN FROM PHOTOGRAMMETRIC MAPPING PLOTTED BY LOCKWOOD SUPPORT SERVICES, ROCHESTER, N.Y., USING APRIL 1988 AERIAL PHOTOGRAPHY.

APPROXIMATE LOCATION OF HISTORICAL SITE DRAINAGE

URS CONSULTANTS, INC.

FIGURE 3-3

survey did reveal a markedly linear anomaly for location 11800E, 18440. According to the geophysical report by Hager-Richter Geoscience, Inc., this type of anomaly might indicate the presence of trenches filled with metallic objects. This assumption, coupled with the presence of a soil gas "hot spot" in this area, and historical aerial photography depicting an open trench in the same area, led to making a close concentration of boreholes here (B-14, B-16, B-17, B-18 and B-19). Industrial-type wastes were encountered (and sampled for chemical analysis) at boreholes B-14, B-18 and B-19. Dunn Geoscience performed a seismic refraction survey for the Phase II investigation in 1984, detecting what may be a buried valley in the central portion of the landfill. Two soil borings completed during the first-phase field activities (B-5 and B-15) confirmed the existence of the depression/gully, and second-phase borings (B-20 through B-25) further defined the gully.

3.9 Geology and Hydrogeology

Information presented in this section was obtained from a review of available geologic reports, geologic maps, and data gathered during the field investigation. The field investigation included a surface geophysical survey; a soil boring/rock coring program that characterized soil, fill, and bedrock at 40 boring locations; installation of 15 monitoring wells, 3 well points and 8 piezometers (the latter in the fill); and hydraulic testing of water-bearing formations. In addition, 6 groundwater monitoring wells previously installed during the Phase II investigation (RECRA 1985), were utilized for both physical and chemical site characterization.

3.9.1 Regional Geology

The unconsolidated sediments encountered at the Lockport City Landfill are the result of combined forces of fluvial influences (The Gulf) and glacial deposition (Wisconsin glaciation). The present-day Gulf

served as an outlet from Glacial Lake Tonawanda, which formed as the Wisconsin ice sheet retreated (Muller, 1977). During the advance of the Wisconsin ice sheet, lodgement till consisting of silty and sandy clays were deposited over the area.

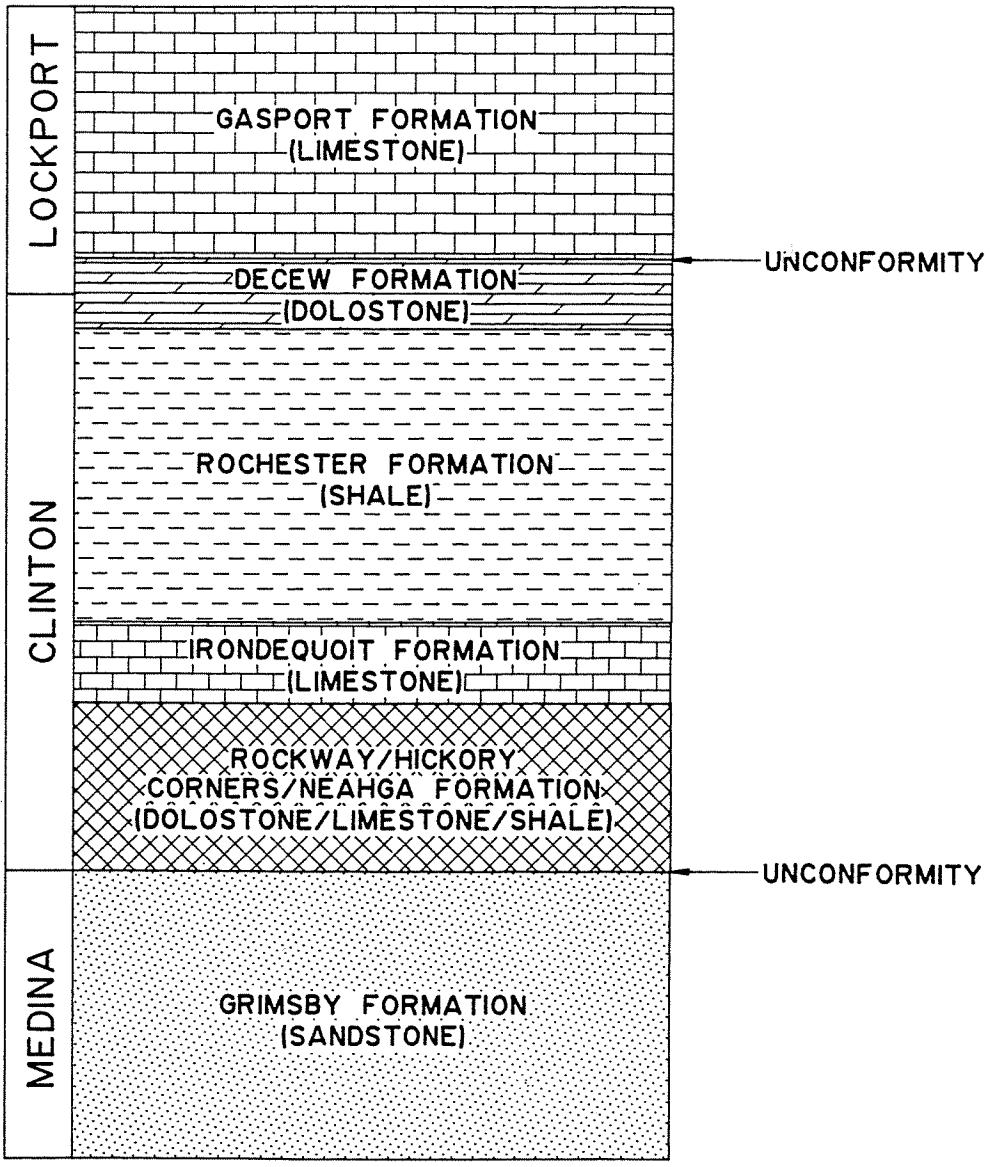
The Middle Silurian Lockport and Clinton Group underlies the Lockport area. The bedrock's southward dip has been calculated at about 30 feet per mile (Yager, 1987). In the Lockport area, the Lockport Dolomite ranges from 0-100 feet in thickness and consists of 5 members that have been differentiated on the basis of lithologic characteristics and fossil evidence (Zenger 1965). The Lockport Dolomite is underlain by the 60-foot thick Rochester Shale of the Clinton Group. The Rochester shale is underlain by a 140-foot thick sequence of limestone, dolomite, shale, and sandstone of Middle and Early Silurian age, much of which is exposed at or near this site. A stratigraphic illustration appears in Figure 3-4. Physical descriptions of the rock units are supplied in Table 3-5 and unit thickness are given in Tables 3-6 and 3-7.

3.9.2 Site Stratigraphy

The Lockport City Landfill is a terraced site that is situated on a re-entrant of the Niagara Escarpment. The stratigraphic units encountered at the site, from top to bottom (youngest to oldest), are:

- Fill from landfill and railroad grade construction;
- Glacial till, which on this site is composed of clayey silt with some sand and gravels, and no apparent soil structure;
- Bedrock, which consists of the following Middle to Early Silurian period formations, from youngest to oldest: Gasport Formation (limestone), Decew Formation (dolostone), Rochester Formation (shale), Irondequoit Formation (limestone), Rockway Formation (dolostone), Hickory Corners Formation (limestone),

1"=100' 7/8/91



AC-3256/a

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STRATIGRAPHIC COLUMN OF ROCK UNITS

FIGURE 3-4

TABLE 3-5

LITHOLOGICAL UNITS

Group	Formation	Description
Lockport	Gasport	Pink to light gray, coarse grained dolomitic limestone, crinoidal remnants present.
Lockport	DeCew	Medium gray crystalline dolostone. Shale partings at base. Gradation to Rochester shale.
Clinton	Rochester	Gray to dark gray aphanitic shale. Fossiliferous and calcareous (bioherms).
Clinton	Irondequoit	Fine to medium grained limestone, light gray to gray in color. Fossiliferous, some pink calcite crystals.
Clinton	Rockway	Aphanitic dolostone, gray-blue to dark green in color. Numerous shale partings.
Clinton	Merritton	Thin-bedded argillaceous limestone, gray in color.
Clinton	Hickory Corners	Dark gray cherty limestone, medium grained.
Clinton	Neahga	Soft green-olivine green shale. Flaky.
Medina	Grimsby	Pale green, fine grained mottled red sandstone with inclusions of sandy red shales.

TABLE 3-6

FILL THICKNESS - EXPLORATORY BOREHOLES THROUGH FILL

Well/Boring No.	Ground Elevation	Fill Thickness (ft)
B-1	503.0	4.4
B-2	514.6	10.3
B-3	538.3	No Fill
B-4	540.3	8.0
B-5	533.7	30.2
B-6	558.4	17.5
B-7	557.3	6.0
B-8	559.6	6.0
B-9	558.7	12.0
B-10	558.6	4.0
B-11	561.2	No Fill
B-12	556.4	14.8
B-13	528.0	16.1
B-14	553.9	14.0
B-15	576.0	16.3
B-16	553.3	12.0
B-17	554.3	6.0
B-18	553.1	10.5
B-19	554.5	24.0
B-20	545.8	12.0
B-21/P-7	547.9	40.5
B-22	566.5	22.0
B-23/P-8	563.8	32.0
B-24	562.5	16.0
B-25	563.4	12.0

TABLE 3-6 (Continued)

B-26	572.6	18.0
B-27	567.4	10.0
MW-1D	584.6	No Fill
MW-2I	507.0	2.0
MW-3S	490.2	No Fill
MW-4S	474.3	No Fill
MW-5I	476.7	2.0
MW-6D	578.8	No Fill
MW-7S	501.6	No Fill
MW-8D	574.3	No Fill
MW-9I	484.1	6.0
MW-10D	577.3	No Fill
MW-11D	612.5	No Fill
MW-12D	578.3	19.0*

* Possible cover or construction fill.

TABLE 3 - 7
STRATIGRAPHIC UNIT THICKNESS
(in feet)

BORING	FILL	CLAYEY SILT (Glacial Till)	GASPORT FORMATION	DECEW FORMATION	ROCHESTER FORMATION	IRONDEQUOIT FORMATION	ROCKWAY, HICKORY CORNERS, NEAGHA, FORMATIONS	GRIMSBY FORMATION
MW-1D	0 NOT PRESENT	4.5	3.0	9.5	60.5	26	>6 BOTTOM OF BORING	
MW-2I	2	6.6	0 NOT PRESENT	0 NOT PRESENT	0 NOT PRESENT	10.2	16.3	>1.0 BOTTOM OF BORING
MW-3S	0 NOT PRESENT	13	0 NOT PRESENT	0 NOT PRESENT	0 NOT PRESENT	0 NOT PRESENT	>1.5 BOTTOM OF BORING	
MW-4S	0 NOT PRESENT	6.0	0 NOT PRESENT	0 NOT PRESENT	0 NOT PRESENT	0 NOT PRESENT	>4 BOTTOM OF BORING	
MW-5I	0 NOT PRESENT	5.5	0 NOT PRESENT	0 NOT PRESENT	0 NOT PRESENT	0 NOT PRESENT	NOT PRESENT	>30.5 BOTTOM OF BORING
MW-6D	0 NOT PRESENT	18	0 NOT PRESENT	0 NOT PRESENT	53.8	>14.8 BOTTOM OF BORING		
MW-7S	0 NOT PRESENT	9.3	0 NOT PRESENT	0 NOT PRESENT	0 NOT PRESENT	0 NOT PRESENT	> 5 BOTTOM OF BORING	
MW-8D	0 NOT PRESENT	18.6	0 NOT PRESENT	0 NOT PRESENT	40.9	17.5	21.2	>14.8 BOTTOM OF BORING
MW-9I	6.0	3.5	0 NOT PRESENT	0 NOT PRESENT	0 NOT PRESENT	0 NOT PRESENT	7.5	>0.5 BOTTOM OF BORING
MW-10D	0 NOT PRESENT	9.5	0 NOT PRESENT	0 NOT PRESENT	61.2	>17.5 BOTTOM OF BORING		
MW-11D	0 NOT PRESENT	20.5	3.0	12	7.8	19	>5.2 BOTTOM OF BORING	
MW-12D	19*	12.5	0 NOT PRESENT	0 NOT PRESENT	47.3	>14 BOTTOM OF BORING		

* - Possible cover or construction fill.

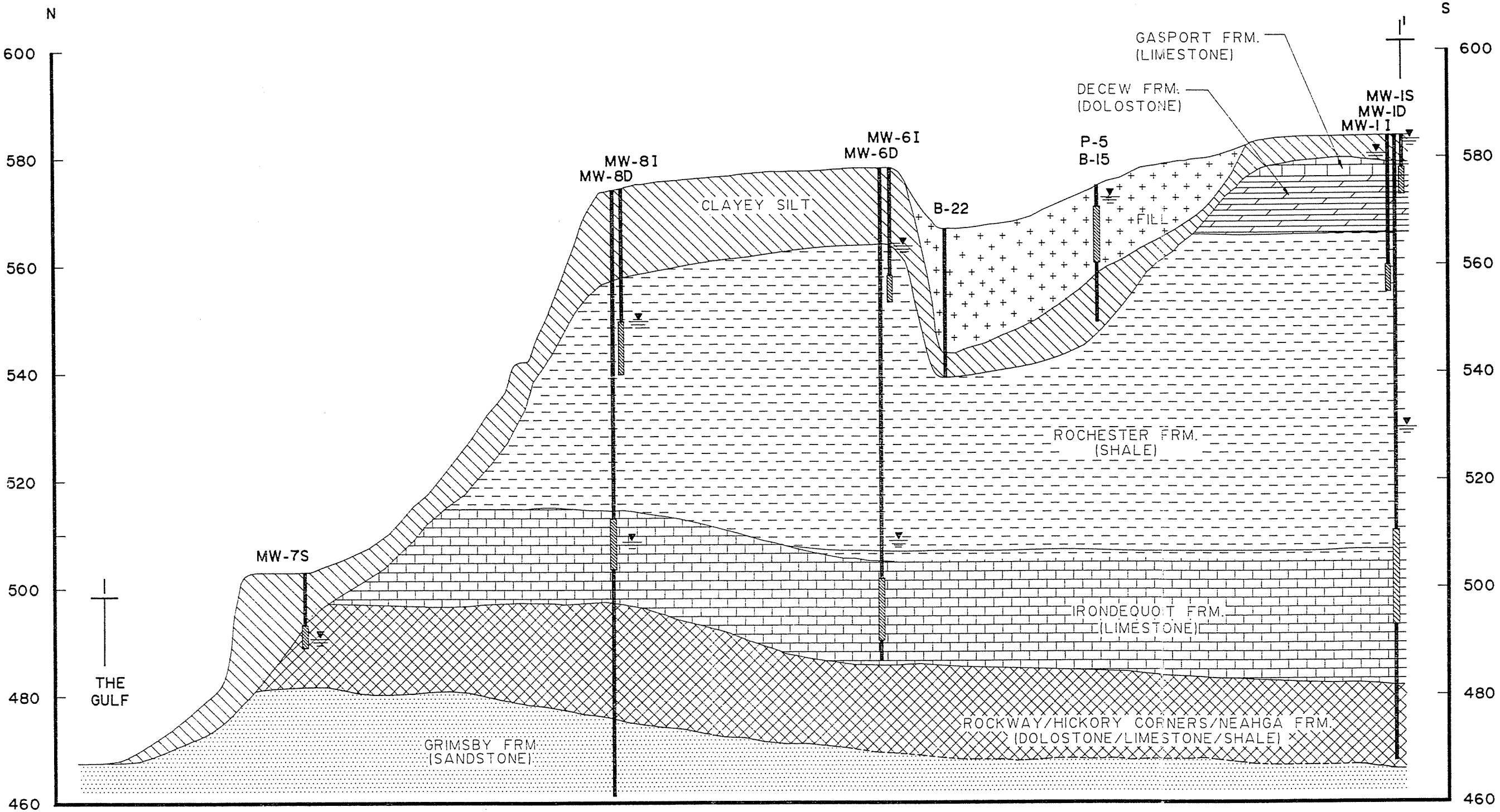
Neahga Formation (shale) and the Grimsby Formation (sandstone).

Cross-sections for these units across the site have been developed and are presented in Figures 3-5 thru 3-14. The cross-sections labeled 1-1', 2-2', 3-3', and 4-4' represent the north-south stratigraphy (numbered from east to west) and cross-sections 5-5' thru 10-10' represent east-west stratigraphy (numbered from north to south). The locations of the cross-sections are given in Plate 4.

Fill is composed of municipal trash, brick fragments, wood, charcoal, coal, and concrete in a matrix of native clayey silt, sand, and gravels and is consistent with the material which would have been deposited during reported landfill operations. These operations were reported to have been placement of trash into dug or existing trenches, burying and covering with local borrow material. The fill ranges from 0 to 40.5 feet thick and has shallow (less then 2 feet) to no cover material. The fill is divided into an east and west area by the Somerset Railroad, which was in place prior to landfill operations. Generally, the fill is thickest on the flat, terraced area, thinning out on the slopes and towards The Gulf. No fill was encountered to the east of Railroad Street or in Sutcliff Rotary Park. To the west and north, the fill thins, and does not cross The Gulf. It is not present in the northeast section of the landfill area. In the southern section of the site the fill grades into cover material.

Soil boring MW-12D passes through 19 feet of material that resembles clean fill (borrow materials) which was used both as cover material, and as subgrade in construction of the railroad and City Garage. It is not possible to determine whether the orgin of this cover material is from landfill operations or is construction fill from the City Garage. Boring MW-12D has been used to delineate the southern extent of the land fill operations.

1"=100' 7/23/91



SCALE: HORIZ. 1"=200'-0"
VERT. 1"=20'-0"

LEGEND

MW-8D — BORING AND MONITORING WELL NUMBER

▽ — GROUNDWATER ELEVATION 4/8/91

— SCREENED INTERVAL OF MONITORING WELL

NOTE:
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.

CC-1853

CROSS SECTION I-I'

URS CONSULTANTS, INC.

FIGURE 3-5

1"=100' 7/26/91

NW

2

SE

2'

580
560
540
520
500
480
460
440

MW-8I
MW-8D

MW-10I
MW-10D

CLAYEY SILT

RAILROAD (STRUCTURAL FILL)

ROCHESTER FRM. (SHALE)

B-2

B-1

FILL

IRONDEQUOIT FRM. (LIMESTONE)

CLAYEY SILT

MW-5S
MW-5I

ROCKWAY/HICKORY CORNERS/NEAHGA FRM. (DOLOSTONE/LIMESTONE/SHALE)

GRIMSBY FRM. (SANDSTONE)

SCALE: HORIZ. 1"=100'-0"
VERT. 1"=20'-0"

LEGEND

MW-8D — BORING AND MONITORING WELL NUMBER

▽ — GROUNDWATER ELEVATION 4/8/91

— SCREENED INTERVAL OF MONITORING WELL

NOTE:
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.

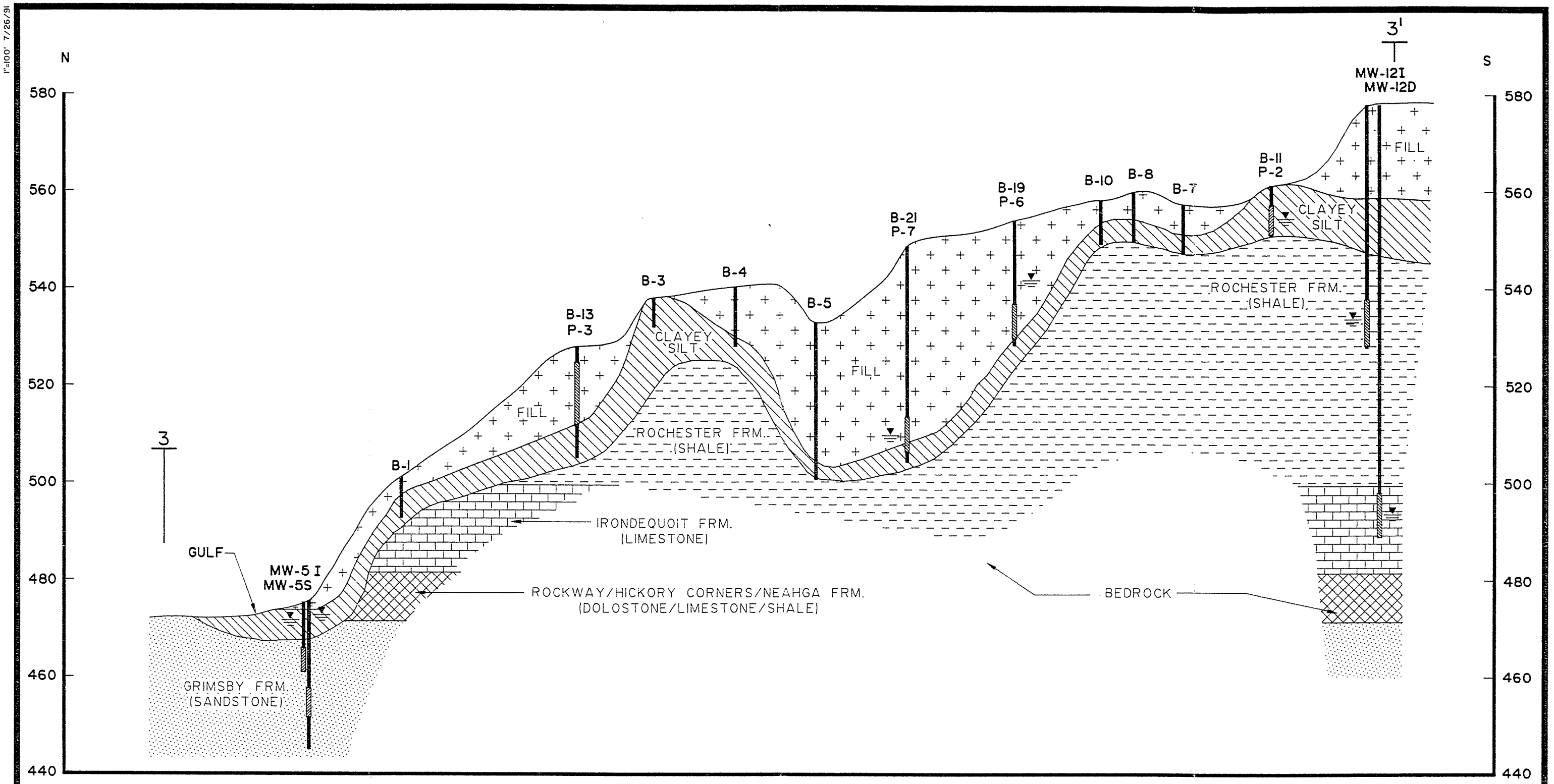
CC-1854

CROSS SECTION 2-2'

URS CONSULTANTS, INC.

FIGURE 3-6

1"=100' 7/25/91



SCALE: HORIZ. 1"=200'-0"
VERT. 1"=20'-0"

LEGEND

MW-8D — BORING AND MONITORING WELL NUMBER

— GROUNDWATER ELEVATION 4/8/91

— SCREENED INTERVAL OF MONITORING WELL

NOTE:
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.

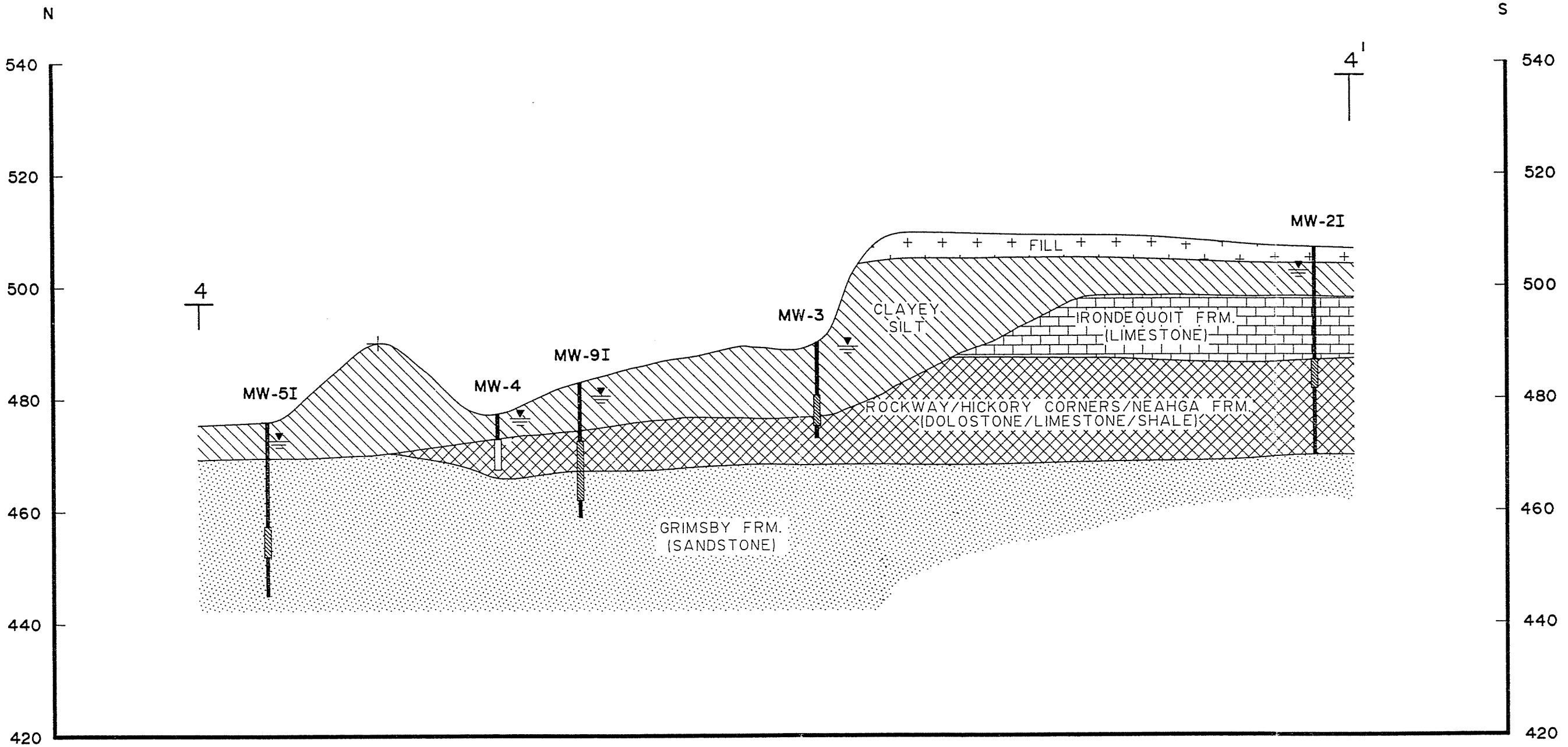
CC-1855

CROSS SECTION 3-3'

URS CONSULTANTS, INC.

FIGURE 3-7

1"=100' 7/25/91



SCALE: HORIZ. 1"=200'-0"
VERT. 1"=20'-0"

LEGEND

MW-2 — BORING AND MONITORING WELL NUMBER

▼ — GROUNDWATER ELEVATION 4/8/91

— SCREENED INTERVAL OF MONITORING WELL

NOTE:
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.

CC-1866

CROSS SECTION 4-4'

URS CONSULTANTS, INC.

FIGURE 3-8

1"=100' 7/26/91

E

5

595
575
555
535
515
495
475
455

MW-8I
MW-8D

CLAYEY SILT

RAILROAD (STRUCTURAL FILL)

BEDROCK OUT CROP

ROCHESTER FRM.
(SHALE)

B-13
P-3

FILL

IRONDEQUOIT FRM.
(LIMESTONE)

ROCKWAY/HICKORY CORNERS/NEAHGA FRM.
(DOLOSTONE/LIMESTONE/SHALE)

GRIMSBY FRM
(SANDSTONE)

THE GULF

MW-9I
MW-9S

CLAYEY SILT

5'

W

595
575
555
535
515
495
475
455

SCALE: HORIZ. 1"=75'-0"
VERT. 1"=20'-0"

LEGEND

MW-8D — BORING AND MONITORING WELL NUMBER

▽ — GROUNDWATER ELEVATION 4/8/91

SCREENED INTERVAL OF MONITORING WELL

NOTE:
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.

CC-2174

CROSS SECTION 5-5'

URS CONSULTANTS, INC.

FIGURE 3-9

1"=100' 7/23/91

E

W

6

6'

MW-10I
MW-10D

MW-6I
MW-6D

MW-3S

CLAYEY SILT

FILL

RAILROAD (STRUCTURAL FILL)

B-20

B-5

CLAYEY SILT

FILL

ROCHESTER FRM.
(SHALE)

IRONDEQUOIT FRM.
(LIMESTONE)

ROCKWAY/HICKORY CORNERS/NEAHGA FRM.
(DOLOSTONE/LIMESTONE/SHALE)

THE GULF

600
580
560
540
520
500
480
460

SCALE: HORIZ. 1"=100'-0"
VERT. 1"=20'-0"

LEGEND

MW-6D — BORING AND MONITORING WELL NUMBER

— GROUNDWATER ELEVATION 4/8/91

— SCREENED INTERVAL OF MONITORING WELL

NOTE:
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.

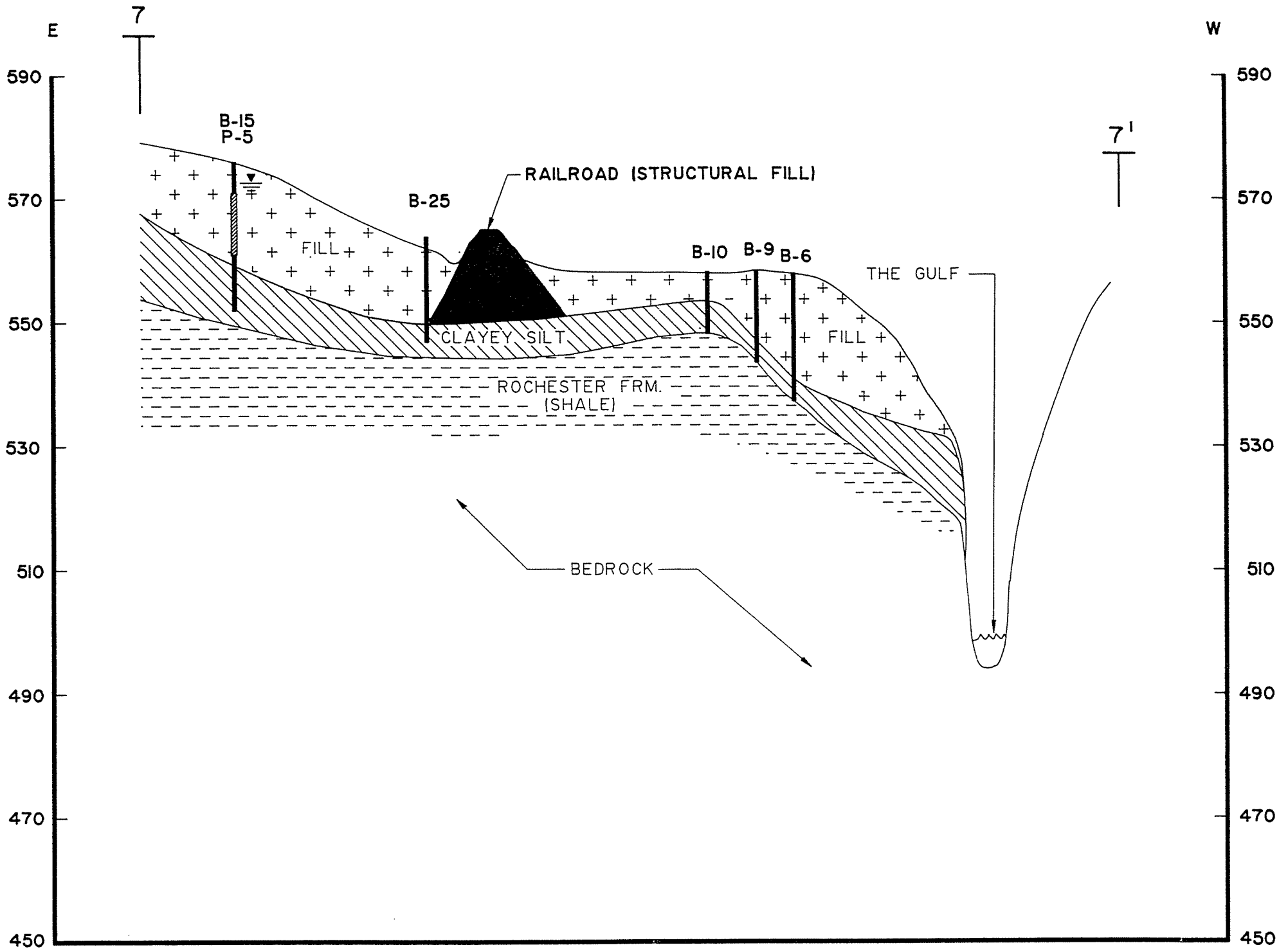
CC-2173

CROSS SECTION 6-6'

URS CONSULTANTS, INC.

FIGURE 3-10

1"=100' 7/26/91



SCALE: HORIZ. 1"=100'-0"
VERT. 1"=20'-0"

LEGEND

MW-11D — BORING AND MONITORING WELL NUMBER

▼ — GROUNDWATER ELEVATION 4/8/91

SCREENED INTERVAL OF MONITORING WELL

NOTE:
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.

CROSS SECTION 7-7'

URS CONSULTANTS, INC.

FIGURE 3-11

CC-2190

1"=100' 7/26/91

NE 8

SW

8'

B-15
P-5

B-26

B-27

DITCH

RAILROAD (STRUCTURAL FILL)

D-3A

B-7

MW-2S
MW-2I

THE GULF

FILL

CLAYEY SILT

FILL

ROCHESTER FRM.
(SHALE)

IRONDEQUOIT FRM.
(LIMESTONE)

ROCKWAY/HICKORY CORNERS/NEAHGA FRM.
(DOLOSTONE/LIMESTONE/SHALE)

GRIMSBY FRM.
(SANDSTONE)

580
560
540
520
500
480
460
440

SCALE: HORIZ. 1"=50'-0"
VERT. 1"=20'-0"

LEGEND

MW-2S — BORING AND MONITORING WELL NUMBER

— GROUNDWATER ELEVATION 4/8/91

— SCREENED INTERVAL OF MONITORING WELL

NOTE:
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.

CC-2171

CROSS SECTION 8-8'

URS CONSULTANTS, INC.

FIGURE 3-12

1"=100' 7/26/91

E

9

W

620
600
580
560
540
520
500
480
460

MW-IID

GASPORT FRM.
(LIMESTONE)

DECEW FRM.
(DOLOSTONE)

CLAYEY SILT

MW-IS
MW-ID
MW-II

RAILROAD STREET

MW-I2D
MW-I2 I

RAILROAD (STRUCTURAL FILL)

FILL

B-II
P-2

CLAYEY
SILT

ROCHESTER FRM.
(SHALE)

9'

FILL

MW-2I
MW-2S

THE GULF

IRONDEQUOIT FRM.
(LIMESTONE)

ROCKWAY/HICKORY CORNERS/NEAHGA FRM.
(DOLOSTONE/LIMESTONE/SHALE)

GRIMSBY FRM.
(SANDSTONE)

SCALE: HORIZ. 1"=200'-0"
VERT. 1"=20'-0"

LEGEND

MW-8D — BORING AND MONITORING WELL NUMBER

— GROUNDWATER ELEVATION 4/8/91

— SCREENED INTERVAL OF MONITORING WELL

NOTE:
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.

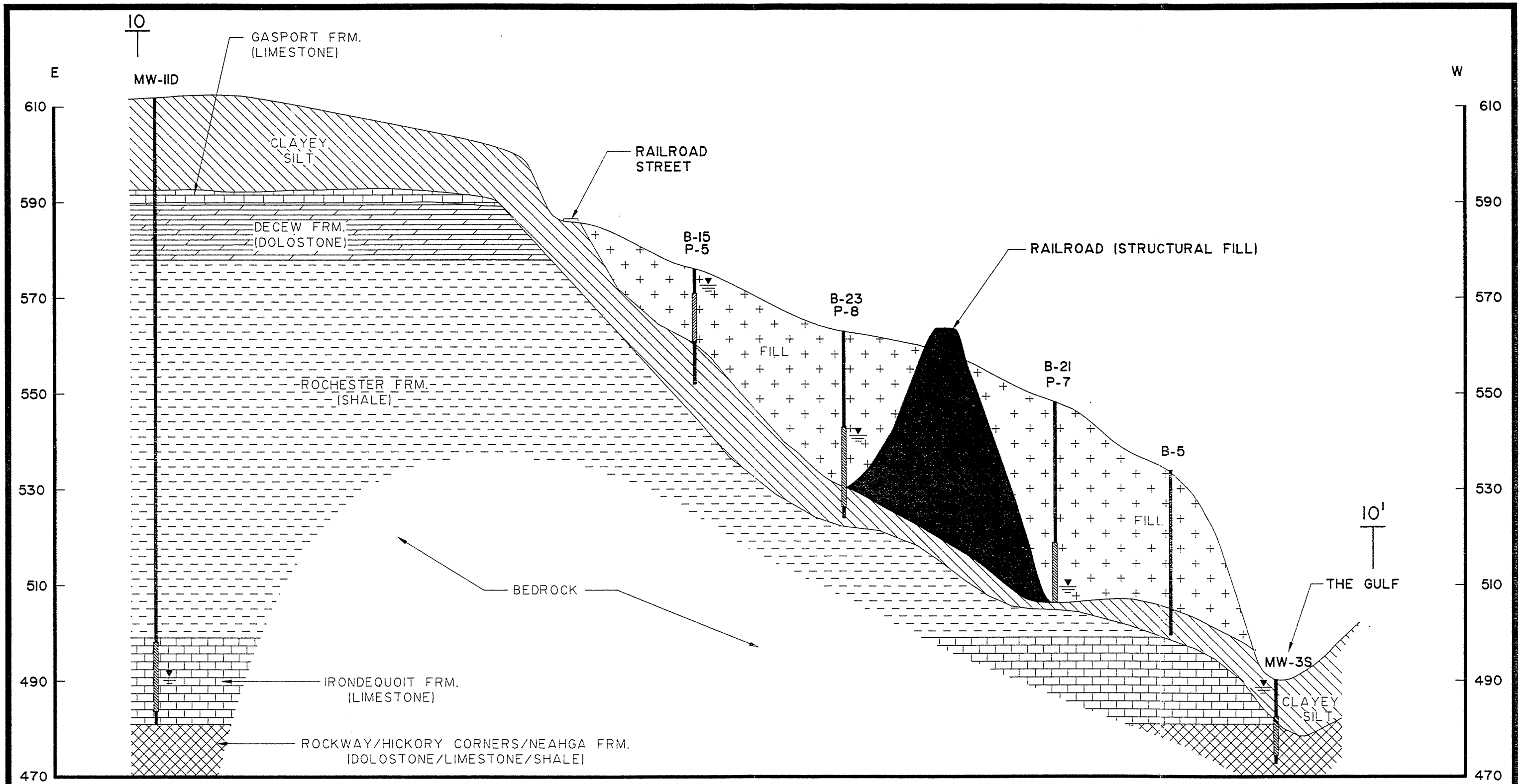
CC-2172

CROSS SECTION 9-9'

URS
CONSULTANTS, INC.

FIGURE 3-13

1"=100' 7/24/91



SCALE: HORIZ. 1"=150'-0"
VERT. 1"=20'-0"

LEGEND

MW-IID — BORING AND MONITORING WELL NUMBER

▼ — GROUNDWATER ELEVATION 4/8/91

SCREENED INTERVAL OF MONITORING WELL

NOTE:
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.

CROSS SECTION 10-10'

URS CONSULTANTS, INC.

FIGURE 3-14

CC-2189

Two reported subsurface features associated with the fill have been investigated during the RI. The first feature is a "buried valley" which was uncovered during the seismic geophysical investigation performed during the Phase II investigation of Recra Research Inc. (1985). This valley has been confirmed from a USGS 1950 Lockport Quadrangle Map and by soil borings B-5, B-20 thru B-26, and B-15. From these borings this valley appears to be a localized feature which trends southeast to northwest in a continuous line from boring B-15 to B-5, with a depth of 16 to 40.5 feet below grade. This feature extends under the Somerset Railroad line that bisects the site. This valley was a drainage feature, (gully, or ravine) with a side channel which drained into the Gulf (see Section 3.7.3). It was initially filled along the Somerset Railroad with structural fill and subsequently landfilled on either side of the railroad right of way. The Somerset Railroad was present prior to landfill operations. Cross-section 10-10' is located laterally through the valley. The valley is shown in plan view on Figure 3-3.

The second feature reported (RECRA, 1985) to be on site was a series of waste trenches in which waste was reportedly dumped, burned, and covered. These trenches were reported to be up to 80 feet thick. Evidence supporting this operation was not found during the RI field program. The thickest fill concentrations were found to be associated with the buried valley and side gully.

Glacial till, composed primarily of clayey silts, silts, clays, sand, and gravel is the natural surface material present in all borings except B-9 and B-14, where fill lies on a thin layer of till and weathered bedrock. It ranges from less than 2 feet to more than 20 feet thick across the landfill and at offsite borings. The unit thickens from south to north, and ranges from less than 2 to 8 feet thick under the landfill. This material has also been excavated to provide cover material for landfill operations.

The youngest bedrock at the site is the Gasport Formation. This formation is composed of non-dolomitic and dolomitic limestones which contain significant porosity in the form of fractures and vugs (solution cavities). The Gasport was encountered off site in only two borings, MW-11D and MW-1D, located southwest of the site. The lower 3 feet of the formation were revealed in MW-11D, and the lower 5 feet of the formation were seen at MW-1D. The Gasport has been removed by erosion along the face of the escarpment west and northwest of MW-1D as shown in cross-sections 1-1', 9-9' and 10-10' (Figures 3-5, 3-13 and 3-14). The Decew Formation is a thin-bedded dolostone with shaley partings. It was encountered at borings MW-11D and MW-1D. Twelve (12) feet of dolostone was found below the Gasport at MW-11D, and 5 feet at MW-1D. The Decew, like the Gasport, has been eroded along the face of The Gulf escarpment.

The Rochester Formation is a calcareous shale with argillaceous limestone interbeds. It lies below the Decew and above the Irondequoit Formation. The Rochester Formation was found to have a thickness from 0 to 78 feet in the study area. This formation is thickest southeast of the landfill (MW-11D), thins to the northwest, and is absent in borings MW-2I, MW-3S, MW-4S, MW-5I, MW-7S, and MW-9I along The Gulf and northern area of the site. The Rochester outcrops at the base of the Somerset Railroad, near the middle of the western portion of the landfill. This outcrop is shown on cross-section 5-5'. The top of the Rochester Formation at the site contains numerous fractures with occasional clay seams (MW-10D and MW-12D), and becomes more competent with depth. Core run recoveries range from 80 percent at the top of the unit to 100 percent in the middle of the unit.

The Irondequoit Formation lies below the Rochester and above the Rockway Formation. It is a crinoidal limestone with a few shale seams and is the coarsest-grained rock immediately underlying the area. The Irondequoit Formation is a competent limestone with few open fractures. Those fractures present in the formation were associated with shale

partings which were concentrated in the upper part of the rock unit. Iron staining was usually present at the fractures. Rock core recoveries ranged from 90 to 100 percent. The Irondequoit Formation varies locally in thickness from 0 to 26 feet. The greatest thickness was encountered southeast of the landfill at boring MW-1D. The formation thins to the northwest and is absent at The Gulf in borings MW-3S, MW-4S, MW-5I, MW-7S and MW-9I. The Irondequoit is present at boring MW-2I, which is located near the southwestern section of the site near The Gulf. Also, the Irondequoit Formation appears to outcrop on a small island located in The Gulf at the extreme southwestern edge of the study area. The bottom elevation of the Irondequoit Formation varies between 481.11 to 499 feet (amsl). The top of the Irondequoit formation shows a variable strike and dip . The strike ranges from N12°E to N50°E with east to southeasterly dips of 0.86° (80 feet per mile) to 1.18° (108 feet per mile) depending upon the borings used to establish strike and dip. The literature (Yager, 1987) reports a regional dip of 0.32° (30 feet per mile) to the south. Anomalies in strike and dip of the Irondequoit formation measured east and west of MW-1D and MW-6D, suggest a possible 5 to 7 foot downward displacement of the Irondequoit in the vicinity of D-3 and MW-12D.

The Rockway Formation is a fine-grained dolostone having numerous shale partings, and thin to massive bedding. It underlies the Irondequoit Formation and is in turn underlain regionally by the Merritton Formation, which was not encountered at the site. The Hickory Corners Formation is a medium-grained cherty limestone, which locally underlies the Rockway. The Neagha Formation is a green-olivine green shale which underlies the Hickory Corners and unconformably overlies the Grimsby Formation. The Rockway, Hickory Corners, and Neagha Formations have a combined thickness of 0 to 21.2 feet and are eroded to the northwest as shown in cross-sections 2-2', 3-3', and 4-4' (Figures 3-6, 3-7, and 3-8). They are absent in boring MW-5I. The Grimsby Formation comprises mottled, fine-grained red sandstones with shaly lenses or inclusions. This formation is the deepest and oldest unit encountered at the site. Over most of the

site it is overlain by younger units, except in the northwest, where it immediately underlies the overburden (clayey silts/fill). It is reported to be between 50 and 70 feet thick (Tesmer, 1981).

All formations examined at the site contained both horizontal bedding plane and northeast/northwest trending vertical fractures. The largest fractures typically were encountered within the top 10-25 feet of the uppermost bedrock unit.

3.9.3 Hydraulic Conductivity

The hydraulic conductivity of each of the hydrogeologic units underlying the site area was estimated by conducting pressure tests and/or variable-head slug tests. Results of these analyses are summarized in Tables 3-8 and 3-9.

The ranges of measured hydraulic conductivities were generally similar within the individual units. There was also reasonable agreement between pressure and slug test results. Owing to differences in the strata immediately underlying the surface, the widest range of conductivities occurred in the water table aquifer.

Specific properties of each unit are described below:

(a) Fill Material - Hydraulic conductivities for fill units have a wide range, depending on the type of fill material and the grain size of any admixed natural material. The only measured value (7.41×10^{-3} cm/s) was recorded at location MW-2S where the disturbed material was a silty clay.

(b) Glacial Till (Clayey silt with trace of sand and gravel) - Glacial tills have a wide range of hydraulic conductivities. The only

TABLE 3-8

LOCKPORT LANDFILL RI/FS
PERMEABILITY VALUES GENERATED FROM PACKER TEST DATA FOR BEDROCK WELLS

WELL NUMBER	INTERVAL TESTED	BOREHOLE RADIUS (feet)	INTERVAL LENGTH (feet)	ELEVATION HEAD (feet)	PRESSURE HEAD (psi)	TEST DURATION (min)	TOTAL FLOW (gal)	k (ft/min)	k (cm/sec)
MW-1D	92-87	0.333	5.0	102.4	44.0	5.0	0.0	0.0E+00	0.0E+00
MW-1D	87-82	0.333	5.0	102.4	42.0	5.0	21.0	2.4E-04	1.2E-04
MW-1D	82-77	0.333	5.0	102.3	40.0	5.0	6.0	7.1E-05	3.6E-05
MW-1D	77-72	0.333	5.0	81.5	38.0	5.0	3.6	4.9E-05	2.5E-05
MW-1I	26.3-21.3	0.333	5.0	30.3	20.0	5.0	4.8	1.4E-04	7.3E-05
MW-1I	21.3-16.3	0.333	5.0	29.3	15.0	5.0	14.0	5.0E-04	2.6E-04
MW-1I	16.3-11.3	0.333	5.0	29.3	15.0	3.0	0.0	0.0E+00	0.0E+00
MW-2I	28.1-23.1	0.250	5.0	39.3	20.0	5.0	20.0	6.0E-04	3.0E-04
MW-2I	23.1-18.1	0.250	5.0	39.3	17.0	5.0	20.0	6.5E-04	3.3E-04
MW-2I	18.1-13.1	0.250	5.0	30.1	14.0	5.0	22.0	9.0E-04	4.6E-04
MW-5I	25.5-20.5	0.416	5.0	28.5	18.0	4.0	8.5	3.2E-04	1.6E-04
MW-5I	20.5-15.5	0.416	5.0	28.5	10.0	5.0	10.0	4.1E-04	2.1E-04
MW-6D	84-79	0.333	5.0	90.0	45.0	5.0	0.0	0.0E+00	0.0E+00
MW-6D	79-74	0.333	5.0	90.0	45.0	5.0	0.0	0.0E+00	0.0E+00
MW-6D	77-72	0.333	5.0	86.0	15.0	5.0	47.0	9.0E-04	4.6E-04
MW-6D	26-21	0.333	5.0	29.7	13.0	5.0	5.0	1.9E-04	9.8E-05
MW-8I	31.7-26.7	0.333	5.0	35.2	28.0	5.0	2.0	4.6E-05	2.3E-05
MW-8I	26.7-21.7	0.333	5.0	35.2	16.0	5.0	13.0	4.1E-04	2.1E-04
MW-8D	79-74	0.333	5.0	86.0	50.0	5.0	0.5	5.7E-06	2.9E-06
MW-8D	74-69	0.333	5.0	86.0	20.0	5.0	31.0	5.4E-04	2.7E-04
MW-8D	69-64	0.333	5.0	76.0	46.0	5.0	11.0	1.4E-04	7.1E-05
MW-8D	64-59	0.333	5.0	76.0	50.0	5.0	1.0	1.2E-05	6.1E-06
MW-12D	80.7-75.7	0.250	5.0	21.14	38.0	5.0	28.8	6.7E-04	3.4E-04
MW-12D	85.7-80.7	0.250	5.0	16.14	40.0	5.0	11.7	2.7E-04	1.4E-04
MW-12D	90.7-85.7	0.250	5.0	11.14	43.0	5.0	16.5	3.8E-04	1.9E-04

TABLE 3-9
LOCKPORT RI/FS
SUMMARY OF HYDRAULIC CONDUCTIVITY TESTS (SLUG TESTS)

WELL NUMBER	SCREENED INTERVAL (ft.)	STRATIGRAPHIC UNIT	SCREEN LENGTH (ft.)	HYDRAULIC CONDUCTIVITY (cm/sec)		
				SLUG IN	SLUG OUT	AVERAGE
MW-1S	6.2 - 11.0	WATER TABLE	5	1.14E-04	3.97E-05	7.69E-05
MW-1I	17.0 - 27.0	ROCHESTER SHALE	10	3.65E-04	3.02E-04	3.34E-04
MW-1D	77.0 - 87.0	IRONDEQUOIT	10	NA	1.08E-05	1.08E-05
MW-2S	7.5 - 12.5	WATER TABLE	5	6.99E-03	7.82E-03	7.41E-03
MW-2I	20.0 - 25.0	ROCKWAY	5	1.42E-03	1.10E-03	1.26E-03
MW-3S	12.0 - 17.0	WATER TABLE	5	7.65E-04	6.18E-04	6.91E-04
MW-4S	5.0 - 10.0	WATER TABLE	5	3.20E-04	2.58E-04	2.89E-04
MW-5S	9.1 - 14.1	WATER TABLE	5	4.93E-04	5.77E-04	5.35E-04
MW-5I	18.8 - 23.8	GRIMSBY	5	9.26E-04	9.51E-04	9.38E-04
MW-6I	20.0 - 25.0	ROCHESTER SHALE	5	5.28E-04	7.04E-04	6.16E-04
MW-7S	8.0 - 13.0	WATER TABLE	5	3.91E-04	1.86E-04	2.89E-04
MW-8I	21.0 - 31.0	ROCHESTER SHALE	10	NA	1.63E-04	1.63E-04
MW-8D	64.0 - 74.0	IRONDEQUOIT	10	6.25E-05	4.17E-05	5.21E-05
MW-9S	4.0 - 9.0	WATER TABLE	5	9.60E-03	1.32E-02	1.14E-02
MW-9I	12.5 - 17.5	ROCKWAY	5	3.77E-03	2.78E-03	3.28E-03
MW-10I	24.0 - 34.0	ROCHESTER SHALE	10	1.50E-04	1.57E-04	1.53E-04
MW-10D	74.5 - 84.5	IRONDEQUOIT	10	1.43E-04	1.40E-04	1.41E-04

field-measured value, 1.14 x 10^{-2} cm/s, was recorded at location MW-9S where the sand and gravel content was unusually high, and probably represents the upper limit for till. Triaxial permeability tests on three undisturbed samples averaged 4.22 x 10^{-6} cm/s for this unit.

(c) Rochester Shale - Hydraulic conductivity measurements from the Rochester Shale ranged from 2.5 x 10^{-5} to 6.16 x 10^{-4} cm/s. Shale conductivities are typically less than 10^{-7} cm/s (Freeze and Cherry, 1979), but fractures and bioherms in the unit may enhance porosity and groundwater flow.

(d) Irondequoit Limestone - Hydraulic conductivity values from this unit ranged from 6.1 x 10^{-6} to 4.6 x 10^{-4} cm/s. These values are typical for limestone.

(e) Rockway Dolostone - Hydraulic conductivities of 3.0 x 10^{-4} to 3.28 x 10^{-3} cm/s, measured for this unit, fall toward the upper end of the range typical for dolostone. This is probably attributable to solution features and/or coarse-grained facies within the unit.

(f) Grimsby Sandstone - Measurements of hydraulic conductivity in the Grimsby Sandstone ranged from 1.6 x 10^{-4} to 9.8 x 10^{-4} cm/s. These are typical of sandstone values.

The conductivity values are generally dependent upon fractures. This is most likely attributable to the unloading of overburden, and relief from the late Wisconsin ice sheet retreat.

Sedimentary rocks have a wide range of porosities. Representative ranges are: limestone and dolomite, 0-20%; shale, 0-10%; and sandstone, 5-30% (Freeze and Cherry, 1979). Unconsolidated silt porosities are reported at 35-50%, and those of glacial till, 10-20% (Fetter, 1980).

3.9.4 Groundwater Flow Pattern

Monitoring wells, well points, and piezometers were installed in the 5 stratigraphic units (Overburden, Rochester Formation, Irondequoit Formation, Rockway Formation, and Grimsby Formation) that underlie the study area. Data from multiple monitors completed in three of the units were used to determine groundwater flow patterns. These units are:

- o the water table aquifer that flows through both fill and clayey silt (till units) and is locally perched and unconfined;

- o the Rochester Formation (shale) which is present only on the east and southern areas of the site but is absent along The Gulf. Monitoring wells were installed so as to monitor unconfined groundwater in fractures of the Upper Rochester.

- o The Irondequoit Formation (limestone) which is locally confined in the southern and eastern portions of the site, but is absent to the north and west near The Gulf.

- o Wells were completed in the Rockway Formation (MW-2I and MW-9I), and one in the Grimsby Formation (MW-5I). In these formations the horizontal flow was not determined. Groundwater conditions in the water table aquifer and Rochester and Irondequoit Formatiions are described below.

Water Table Aquifer: Flow patterns in the water table aquifer were interpreted from shallow wells MW-1S, MW-2S, MW-3S, MW-4S, MW-5S, MW-7S, MW-9S, piezometers P-1, P-2, P-4, P-6 and well points WP-4, WP-5, and WP-6, as indicated in Plate 5. Shallow wells proposed at locations MW-6 and MW-8 were not installed since water was not encountered in the overburden.

The water table surface contours indicated that groundwater enters the site primarily from the east and discharges west and northwest into The Gulf. Horizontal gradients are noticeably steeper within the southern half of the site. The water table flows at a gentler gradient to the northwest of the site reflecting the less steeply sloping terrain.

The vertical hydraulic gradient between the water table and underlying bedrock was compared at monitoring well pairs MW-1, MW-2, MW-5, and MW-9. A downward gradient of -0.34 to -0.60 was observed between wells MW-1S and MW-1I which monitor the overburden and the Rochester Formation. The vertical gradient between the overburden and the Rockway was monitored by well pairs MW-2 and MW-9, and between the overburden and the Grimsby at MW-5. At monitoring location MW-2, which is situated along the more deeply incised southern portion of the site and is adjacent to The Gulf, a consistent downward gradient (-0.03 to -0.05) was observed indicating a potential for water to recharge (infiltrate) from the surface. Proceeding downstream toward the swamp bordering the site on the north, vertical gradients change from predominantly downward at monitoring location MW-9 (0.06 to -0.06), to upward at monitoring location MW-5 (-0.19 to 0.25). Change in the direction of the vertical gradient at these locations may be related to downstream changes in longitudal gradient of The Gulf, proximily to the swamp, and seasonal fluctuation in precipitation.

Rochester Shale Aquifer: The piezometric surface for the Rochester shale (Plate 6) is interpreted from data obtained at MW-1I, MW-6I, MW-8I, MW-10 and MW-12I. These data indicate that groundwater in this unit flows in a general west to northwest direction beneath the landfill. A groundwater divide is also inferred from the data east of the site, in the vicinity of Railroad Street. Groundwater on either side of the divide ultimately discharges to The Gulf west and north of the Town park. Vertical hydraulic gradients between the Rochester Formation and the Irondequoit Formation were compared at 5 well clusters, (MW-1, MW-6, MW-8,

MW-10, and MW-12). In all clusters, a downward vertical gradient of between -0.83 to -1.10 with an average of -0.94 was observed indicating a potential for water to infiltrate downward in the uplying areas east of the site. A potential for downward infiltration was also observed between piezometers P-2 installed in the fill/overburden and MW-12I in the underlying Rochester Shale (Figure 3-13). The position of the water table surface within the screen interval of MW-12I further confirms the existence of unsaturated conditions between the Rochester and overburden materials substantiating localized perching of groundwater within the site. Gradient data for the well clusters are given in Table 3-10.

Irondequoit Limestone Aquifer: Plate 7 illustrates the piezometric surface for this aquifer as interpreted from data obtained from monitoring wells MW-6D, MW-8D, MW-10D, MW-11D and MW-12D. Hydraulic conductivity in the Irondequoit Limestone was the lowest of the bedrock units tested (Table 3-9). In these uplying areas east and south of the site, groundwater flow is to the southeast in the direction of rock dip with a very shallow horizontal gradient in the town park area.

Tables 3-10 and 3-11 provide a detailed summary of the groundwater elevations recorded for all the wells on site, as well as stream elevations for the Gulf.

TABLE 3 - 10
VERTICAL HYDRAULIC GRADIENTS

UNIT	WELL NO.	HEAD DIFFERENCE (ft)							SCREEN INTERVAL SEPARATION	GRADIENT (ft/ft)							
		JAN-30-90	FEB-9-90	FEB-25-91	MAR-29-91	APR-8-91	APR-25-91	MAY-28-91	(ft)	JAN-30-90	FEB-9-90	FEB-25-91	MAR-29-91	APR-8-91	APR-25-91	MAY-28-91	MEAN
CLAYEY SILT	1S	NA	NA	-2.40	-2.04	-2.72	-2.44	-3.64	6.07	NA	NA	-0.41	-0.34	-0.45	-0.40	-0.60	-0.44
ROCHESTER FRM	1I																
CLAYEY SILT	2S	-0.44	-0.34	-0.32	-0.28	-0.29	-0.30	-0.46	8.84	-0.05	-0.04	-0.04	-0.03	-0.03	-0.03	-0.05	-0.04
ROCKWAY FRM	2I																
CLAYEY SILT	5S	-0.18	-1.16	-0.16	1.62	1.54	1.62	1.49	6.22	-0.03	-0.19	-0.03	0.18	0.25	0.18	0.24	0.09
GRIMSBY	5I																
CLAYEY SILT	9S	0.48	0.47	-0.36	-0.27	-0.39	-0.27	-0.46	7.3	0.07	0.06	-0.05	-0.04	-0.05	-0.04	-0.06	-0.02
ROCKWAY FRM	9I																
ROCHESTER FRM	1I	NA	NA	-51.89	-51.94	-51.26	-52.09	-42.52	60.5	NA	NA	-0.86	-0.86	-0.85	-0.86	-0.70	-0.83
ROCHESTER and IRONDEQUOIT FRMs	1D																
ROCHESTER FRM	6I	NA	NA	-55.66	-57.87	-56.32	-58.11	-54.66	53.13	NA	NA	-1.05	-1.09	-1.06	-1.09	-1.03	-1.06
IRONDEQUOIT FRM	6D																
ROCHESTER FRM	8I	NA	NA	-41.74	-41.38	-41.68	41.31	-42.52	43.1	NA	NA	-0.97	-0.96	-0.97	-0.96	-0.99	-0.97
IRONDEQUOIT FRM	8D																
ROCHESTER FRM	10I	NA	NA	NA	-48.3	-48.2	-48.3	-48.1	50.6	NA	NA	NA	-0.95	-0.95	-0.95	-0.95	-0.95
IRONDEQUOIT FRM	10D																
ROCHESTER FRM	12I	NA	NA	NA	-40.71	-40.26	-41.48	-37.59	43.1	NA	NA	NA	-0.94	-0.93	-0.96	-0.87	-0.93
IRONDEQUOIT FRM	12D																

NOTES:

A NEGATIVE SIGN (-) DENOTES A DOWNWARD FLOW TENDENCY

NA - Not Available

TABLE 3 - 11
LOCKPORT CITY LANDFILL GROUNDWATER AND STREAM ELEVATIONS

MONITOR LOCATION	MW-1S	MW-1I	MW-1D	MW-2S	MW-2I	MW-3S	MW-4S	MW-5S	MW-5I	MW-6I	MW-6D
HORIZON	WT	RS	RS & IL	WT	RK	WT	WT	WT	MS	RS	IL
RISER ELEVATION	586.72	587.26	586.73	509.23	508.29	491.78	480.49	477.32	479.34	580.15	581.05
GROUND ELEVATION	584.6	584.6	586.83	507.4	507	490.2	478.6	476	476.7	579	578.8
SCREEN LENGTH	5	10	10	5	5	5	5	5	5	5	10
12/13/89	582.96			504.4		488.18	477.13	471.96		559.84	
12/19/89	583.66			NT		488.4	477.09	471.82		558.69	
12/27/89	581.74			503.23		488.08	476.99	471.62		558.21	
12/29/89	581.82			502.83		487.58	475.69	471.42		557.65	
1/2/90	583.41		568.71	503.45		488.3	477.19	471.84		560.45	
1/5/90	584.29		569.01	503.65		488.58	477.53	472.38		562.08	
1/9/90	583.85		567.24	503.51		488.44	477.23	472.22		562.39	
1/16/90	583.98		503.13	503.63		488.52	477.36	472.22		562.79	
1/17/90	NT		519.05	503.67		488.66	477.63	472.4		563.23	
1/18/90	584.3		523.69	503.85		489.1	478.15	473.02		563.93	
1/19/90	584.04		527.43	503.75		488.64	477.61	473		564.29	
1/22/90	583.82		534.75	503.63		486.18	477.41	472.52	472.64	563.71	
1/23/90	583.76		533.03	503.59		488.44	477.37	472.52	472.56	563.41	
1/24/90	583.98		537.13	503.63		488.52	477.43	472.4	472.62	563.45	
1/25/90	583.9		538.77	503.49		488.56	477.45	472.38	472.64	563.61	
1/26/90	583.84		539.43	503.69		488.54	477.45	472.38	472.58	563.57	
1/29/90	583.7		523.99	503.89		488.36	477.29	472.24	472.36	563.15	
1/30/90	583.64		508.83	503.45	503.01	488.44	477.29	472.22	472.4	562.97	
1/31/90	583.56		515.35	503.43	502.97	488.4	477.31	472.32	472.38	562.75	
2/1/90	583.62		510.73	NT	NT	487.96	477.19	472.3	472.26	562.55	
2/6/90	583.82		526.33	NT	NT	488.5	477.4	472.22	472.4	563.39	
2/7/90	583.9		528.93	503.59	503.13	489.06	477.39	NT	472.4	563.37	
2/8/90	584.26		530.55	503.75	503.29	489.13	477.58	NT	473.22	563.85	
2/9/90	584.46		532.01	503.85	503.51	489.48	477.06	472.82	473.98	564.57	
2/12/90	584		522.74	503.78	503.09	489.18	477.64	472.74	471.66	564.91	
2/13/90	584		516.11	503.69	503.27	489.2	477.64	472.52	471.68	565.01	
2/14/90	584		512.26	503.61	503.17	489.14	477.65	472.44	472.64	NT	
2/15/90	584.02		513.13	503.7	503.39	489.22	477.71	472.52	472.72	NT	
2/16/90	584.38		516.85	503.87	503.49	489.42	477.89	472.8	473	564.93	
2/19/90	584.14		526.13	503.77	503.43	489.28	477.71	472.58	472.8	565.37	
2/20/90	584.22		528.19	503.73	503.31	489.18	477.63	472.48	472.64	565.21	
2/21/90	584.38		530.35	503.73	503.31	489.18	477.61	472.48	472.62	565.03	508.99
2/22/90	584.32		531.79	504.11	503.83	489.68	478.29	473.3	473.44	565.19	509.11
2/23/90	584.3	582.38	517.03	503.91	503.67	489.48	477.99	472.91	473.16	566.19	509.69
2/27/90	584.1	581.37	516.41	503.74	503.37	489.24	477.69	472.48	472.68	565.63	508.69
2/28/90	583.99	581.23	519.88	502.71	503.29	489.17	477.64	471.49	472.61	565.21	509.47
3/1/90	583.94	581.15	522.1	503.71	503.27	489.14	477.58	471.45	472.54	565.01	508.33
3/2/90	584.16	581.6	526.71	503.81	503.33	489.22	477.61	472.36	472.54	564.83	NT
3/5/90	584.16	581.58	517.72	503.68	503.25	489.12	477.49	472.28	472.38	564.39	NT
3/6/90	583.84	580.96	517.07	503.63	503.19	489.14	477.47	472.28	472.4	564.25	508.35
3/7/90	583.7	580.84	514.29	503.63	503.09	489.18	477.16	472.26	472.38	564.07	508.75
3/8/90	583.71	580.79	515.93	503.61	503.19	489.08	477.45	472.24	472.36	563.99	508.45
3/9/90	583.7	580.88	507.63	503.63	503.19	489.16	477.46	472.24	472.36	563.98	510.01
3/12/90	584.4	582.32	515.89	504.59	502.99	489.52	478.13	472.99	473.22	566.01	509.07

WT = Water Table
IL = Irondequoit Limestone
RS = Rochester Shale
MS = Medina Sandstone
RK = Rockway Dolostone
NT = Not Taken

TABLE 3 - 11 (continued)
LOCKPORT CITY LANDFILL GROUNDWATER AND STREAM ELEVATIONS

MONITOR LOCATION	MW-7S	MW-8I	MW-8D	MW-9S	MW-9I	MW-10I	MW-10D	MW-11D	MW-12I	MW-12D
HORIZON	WT	RS	IL	WT	RK	RS	IL	IL	RS	IL
RISER ELEVATION	503.82	576.96	577.3	488.01	486.53	580.25	579.76	614.9	580.79	580.76
GROUND ELEVATION	501.6	574.4	574.3	484.4	484.1	577.4	577.3	612.5	578.1	578.3
SCREEN LENGTH	5	5	10	5	5	10	10	10	10	10
12/13/89										
12/19/89										
12/27/89										
12/29/89										
1/2/90										
1/5/90										
1/9/90										
1/16/90				481.41	480.85					
1/17/90				481.37	480.87					
1/18/90	491.8			481.55	481.15					
1/19/90	491.66			481.43	481.01					
1/22/90	491.2			481.37	480.93					
1/23/90	491.12			481.35	480.91					
1/24/90	491.1			481.39	480.93					
1/25/90	491.14			481.39	480.99					
1/26/90	491.08			481.39	480.97					
1/29/90	491.06			481.37	480.95					
1/30/90	490.98			481.37	480.89					
1/31/90	490.94			481.35	480.89					
2/1/90	491.02			481.39	480.89					
2/6/90	490.96			481.35	480.76					
2/7/90	490.88			481.36	481.79					
2/8/90	491.11			481.46	480.93					
2/9/90	491.42			481.6	481.13					
2/12/90	491.25			481.51	481.01					
2/13/90	491.22			481.51	481.08					
2/14/90	491.04	551.56	508.62	481.41	480.93					
2/15/90	491.24	NT	NT	481.07	481.11					
2/16/90	491.38	551.72	509.66	481.59	481.19					
2/19/90	491.28	551.78	509.4	NT	NT					
2/20/90	491.12	551.44	508.92	481.51	481.03					
2/21/90	491.1	551.6	508.98	481.51	481.05					
2/22/90	491.12	551.66	509.16	481.61	480.63					
2/23/90	491.14	551.72	509.5	481.51	481.19					
2/27/90	491.18	551.84	509.5	481.59	481.11					
2/28/90	490.11	551.5	509.08	481.55	NT					
3/1/90	490.14	551.51	508.01	481.55	NT					
3/2/90	488.5	551.56	509.16	481.55	481.11					
3/5/90	490.91	551.06	507.31	481.51	481.21					
3/6/90	490.9	550.72	507.98	481.5	480.99					
3/7/90	490.9	550.58	508.01	481.53	481.03					
3/8/90	490.9	550.68	508.24	481.61	481.03					
3/9/90	490.84	550.78	508.36	481.51	481.01					
3/12/90	491.97	550.48	508.96	481.69	481.31					

WT = Water Table
MS = Medina Sandstone
IL = Irondequoit Limestone
RK = Rockway Dolostone
RS = Rochester Shale
NT = Not Taken

TABLE 3 - 11 (continued)
LOCKPORT CITY LANDFILL GROUNDWATER AND STREAM ELEVATIONS

MONITOR LOCATION	MW-1S	MW-1I	MW-1D	MW-2S	MW-2I	MW-3S	MW-4S	MW-5S	MW-5I	MW-6I	MW-6D
HORIZON	WT	RS	RS & IL	WT	RK	WT	WT	WT	MS	RS	IL
RISER ELEVATION	586.72	587.26	586.73	509.23	508.29	491.78	480.49	477.32	479.34	580.15	581.05
GROUND ELEVATION	584.6	584.6	586.83	507.4	507	490.2	478.6	476	476.7	579	578.8
SCREEN LENGTH	5	10	10	5	5	5	5	5	5	5	10
3/13/90	584.32	582.14	518.65	NT	NT	NT	NT	NT	NT	566.68	509.31
2/21/91	NT	582.04	529.83	503.79	503.51	489.40	477.69	472.56	472.78	566.07	508.73
2/25/91	584.04	581.64	529.75	503.63	503.31	489.26	477.55	472.26	472.42	565.13	509.47
2/27/91	583.95	581.48	529.89	503.63	506.25	489.25	477.49	472.25	471.66	564.79	509.15
3/1/91	584.07	581.45	530.00	503.71	503.31	489.34	477.57	472.28	473.98	564.62	509.08
3/5/91	584.32	579.29	530.27	503.86	503.56	489.50	477.77	472.61	478.904	566.23	509.23
3/7/91	NT	NT	NT	NT	NT	NT	NT	NT	479.150	567.71	509.65
3/8/91	584.31	582.30	530.23	503.93	503.77	489.48	477.77	NT	446.34	567.45	509.45
3/11/91	584.24	582.03	530.01	NT	NT	NT	NT	NT	NT	566.61	509.67
3/12/91	584.20	581.90	530.03	503.87	503.71	489.44	477.69	472.43	NT	566.37	509.71
3/14/91	584.14	581.78	530.18	NT	NT	NT	NT	NT	NT	566.03	509.63
3/15/91	584.09	582.30	530.03	503.93	503.43	489.39	477.63	472.37	NT	565.82	509.17
3/18/91	584.15	581.66	530.33	503.99	503.49	489.44	477.79	472.43	NT	565.70	509.70
3/19/91	584.17	581.81	530.26	503.78	503.52	489.50	478.21	472.57	NT	566.00	509.48
3/20/91	584.12	581.72	530.09	503.47	503.47	489.40	477.71	472.52	NT	565.44	509.22
3/21/91	584.12	581.70	530.17	503.62	503.46	489.38	477.68	472.47	NT	565.96	509.50
3/22/91	584.08	581.60	530.09	503.73	503.44	489.36	477.66	472.38	NT	565.75	509.23
3/25/91	584.24	582.05	530.21	503.85	503.57	489.46	477.75	472.56	NT	566.66	509.25
3/26/91	584.25	581.98	530.11	503.88	503.60	489.45	477.74	472.52	NT	566.64	508.39
3/28/91	584.36	582.50	530.40	504.02	503.87	489.66	477.99	472.88	NT	568.19	509.97
3/29/91	584.27	582.23	530.29	503.95	503.76	489.48	477.84	472.64	474.26	567.73	509.86
4/1/91	584.16	581.83	530.12	NT	NT	489.40	477.73	472.50	474.20	566.57	509.96
4/2/91	584.09	581.66	529.94	NT	NT	489.39	477.79	472.47	474.14	566.67	509.55
4/3/91	NT	NT	NT	NT	NT	NT	NT	NT	NT	566.57	509.41
4/4/91	584.10	581.56	529.93	503.83	503.53	489.36	477.74	472.42	474.11	566.45	509.71
4/5/91	584.11	581.52	529.86	503.78	503.50	489.33	477.70	472.35	474.03	566.26	509.63
4/8/91	583.96	581.24	529.98	503.76	503.47	489.28	477.63	472.32	473.86	565.65	509.33
4/9/91	583.93	581.15	530.05	503.75	503.44	489.26	477.67	472.32	473.84	565.51	509.28
4/10/91	583.98	581.22	530.06	503.78	503.47	489.29	477.62	472.31	473.84	565.45	509.05
4/11/91	583.85	581.04	529.77	NT	NT	NT	NT	NT	NT	NT	NT
4/12/91	583.74	580.95	529.52	503.73	503.38	489.23	477.57	472.26	473.79	565.11	508.45
4/15/91	584.15	581.32	529.89	NT	NT	489.44	477.81	471.93	474.46	565.08	509.12
4/17/91	583.94	581.12	529.73	NT	NT	489.24	477.63	472.32	473.85	565.52	508.68
4/25/91	584.19	581.75	529.66	503.99	503.69	489.38	476.86	472.58	474.20	567.79	509.68
4/26/91	584.17	581.48	529.68	NT	NT	NT	477.79	471.54	474.23	567.39	509.83
4/29/91											
5/9/91										564.19	568.43
5/10/91											
5/13/91											
5/14/91	583.49		529.45		580.50					563.23	508.37
5/15/91										563.15	504.13
5/21/91	583.53	580.66	529.03	NT	NT	NT	476.85	472.03	473.74	NT	508.31
5/22/91											
5/23/91	583.26	580.45	552.48	NT	NT	489.24	477.28	472.14	473.84	NT	509.85
5/28/91	583.72	580.08	528.59	503.73	503.27	482.02	477.37	471.95	473.44	562.71	508.05
5/29/91	583.48	580.79	528.70							563.33	508.86

WT = Water Table IL = Irondequoit Limestone RS = Rochester Shale
MS = Medina Sandstone RK = Rockway Dolostone NT = Not Taken

TABLE 3 - 11 (continued)
LOCKPORT CITY LANDFILL GROUNDWATER AND STREAM ELEVATIONS

MONITOR LOCATION	MW-7S	MW-8I	MW-8D	MW-9S	MW-9I	MW-10I	MW-10D	MW-11D	MW-12I	MW-12D
HORIZON	WT	RS	IL	WT	RK	RS	IL	IL	RS	IL
RISER ELEVATION	503.82	576.96	577.3	488.01	486.53	580.25	579.76	614.9	580.79	580.76
GROUND ELEVATION	501.6	574.4	574.3	484.4	484.1	577.4	577.3	612.5	578.1	578.3
SCREEN LENGTH	5	5	10	5	5	10	10	10	10	10
3/13/90	NT	551.01	509.18	NT	NT					
2/21/91	491.60	550.72	508.62	481.49	481.17					
2/25/91	491.04	550.76	509.02	481.47	481.11					
2/27/91	490.98	550.70	508.88	481.46	481.08					
3/1/91	491.04	550.80	508.85	481.55	481.13		513.46			
3/5/91	491.04	550.88	509.08	481.61	481.26	557.41	512.89			
3/7/91	492.00	550.98	509.57	NT	NT	558.03	512.89			
3/8/91	491.56	550.96	509.49	NT	481.29	557.97	505.32			
3/11/91	NT	550.94	509.51	NT	NT	557.77	509.61			
3/12/91	491.25	550.96	509.48	481.61	481.28	557.82	509.75			
3/14/91	491.15	550.89	509.38	NT	NT	557.55	509.86			508.38
3/15/91	491.12	550.78	509.07	481.59	481.20	557.26	509.68			NT
3/18/91	491.22	550.97	509.36	481.63	481.25	557.67	NT			509.56
3/19/91	491.37	550.88	509.25	481.63	481.28	557.55	NT		554.37	509.52
3/20/91	491.37	550.78	509.05	481.60	481.23	557.28	NT		552.46	509.20
3/21/91	491.29	550.95	509.28	481.60	481.22	557.59	NT		534.43	509.01
3/22/91	491.22	550.78	509.02	481.59	481.21	556.54	509.84		535.11	495.84
3/25/91	491.52	550.82	509.10	481.63	481.26	557.39	509.42		539.13	501.09
3/26/91	491.49	550.93	509.13	481.65	481.31	557.62	509.14		539.47	508.10
3/28/91	492.24	551.14	509.82	481.69	481.43	558.29	509.95		532.43	491.54
3/29/91	491.89	551.12	509.74	481.66	481.39	558.10	509.80		531.11	490.40
4/1/91	489.40	551.11	509.77	481.64	481.28	557.51	509.88		534.09	493.54
4/2/91	491.39	550.90	509.41	481.62	481.23	557.51	510.46		534.13	490.74
4/3/91	NT	564.86	509.27	NT	NT	557.41	509.31		534.35	491.66
4/4/91	491.47	551.03	509.50	481.62	481.26	557.67	509.36	592.95	531.49	490.78
4/5/91	491.39	550.92	509.38	481.64	481.23	557.64	509.54	491.70	532.01	491.36
4/8/91	491.15	550.77	509.09	481.60	481.21	557.48	509.28	491.18	534.58	494.32
4/9/91	491.17	550.74	509.02	481.59	481.18	557.43	509.26	489.94	532.33	492.82
4/10/91	491.12	550.64	508.80	481.54	481.15	557.27	509.03	486.97	531.73	490.60
4/11/91	NT	550.49	518.42	NT	NT	556.87	508.56	486.80	531.74	491.16
4/12/91	491.14	550.52	508.30	481.57	481.15	556.84	508.43	487.14	532.33	490.41
4/15/91	491.17	548.88	508.80	481.65	481.24	557.45	509.16	487.30	533.44	491.59
4/17/91	491.12	548.62	508.44	481.59	481.16	557.21	508.68	487.14	532.55	490.92
4/25/91	491.74	550.90	509.59	481.67	481.40	557.95	509.65	597.02	530.44	488.96
4/26/91	491.54	550.95	509.68	481.67	481.37	557.91	509.83	596.77	531.17	490.45
4/29/91									533.85	492.74
5/9/91		550.46	508.21			556.8	508.41		533.11	492.01
5/10/91									533.53	492.64
5/13/91									534.85	492.22
5/14/91		550.47	508.10			556.57	508.42		535.33	494.82
5/15/91		55.04	507.90			556.35	508.63		535.69	495.34
5/21/91	491.13	550.43	507.78	486.58	481.13	556.78	508.34	524.21	537.72	498.99
5/22/91	490.93	550.11	508.05	481.67	481.26	556.62	508.31	484.63	538.35	500.26
5/23/91								491.57		
5/28/91	490.70	550.32	507.80	481.51	481.05	556.17	508.06	476.18	540.55	502.96
5/29/91		550.40	507.93			556.81	508.37		539.34	500.84

WT = Water Table IL = Irondequoit Limestone RS = Rochester Shale
MS = Medina Sandstone RK = Rockway Dolostone NT = Not Taken

TABLE 3 - 11 (continued)
LOCKPORT LANDFILL GROUNDWATER AND STREAM ELEVATIONS

MONITOR LOCATION	SG-1	SG-2	SG-3	P-1	P-2	P-3	P-4	P-5
HORIZON	STREAM	STREAM	STREAM	WT	WT	WT	WT	WT
RISER ELEVATION	NA	NA	NA	561.36	563.85	530.16	556.82	578.15
ELEVATION	469.4	493.71	495.52	558.6	561.2	528	553.9	576
SCREEN LENGTH				5	5	5	5	5
1/17/90	467.98	491.79	492.98					
1/18/90	469.07	492.54	493.15					
1/19/90	467.82	491.50	493.02					
1/22/90	467.48	491.50	492.90					
1/23/90	467.50	491.36	492.85					
1/24/90	467.69	491.54	492.87					
1/25/90	467.50	491.23	492.87					
1/26/90	467.56	491.59	492.87					
1/29/90	467.17	490.96	492.83					
1/30/90	467.59	491.34	492.83					
1/31/90	467.50	491.34	492.83					
2/1/90	467.63	491.38	492.84					
2/6/90	467.59	491.34	492.85					
2/7/90	467.58	491.34	492.85					
2/8/90	467.78	491.59	492.90					
2/9/90	468.39	491.96	493.04					
2/12/90	467.46	491.46	492.87	545.44			542.13	
2/13/90	467.61	491.42	492.85	545.58	554.51		543.17	572.35
2/14/90	467.73	491.54	492.85	NT	553.25		NT	NT
2/15/90	467.61	491.45	492.87	545.54	553.41		543.10	572.37
2/16/90	NT	492.04	493.02	545.58	554.65		543.14	572.95
2/19/90	467.69	491.50	492.96	545.54	555.49		543.14	573.01
2/20/90	467.59	491.13	492.90	545.46	555.33		543.10	572.43
2/21/90	467.46	491.34	492.87	545.56	555.13		543.12	572.43
2/22/90	NT	492.63	493.35	545.66	554.89		543.17	572.73
2/23/90	NT	492.09	493.31	545.36	554.76		543.02	573.75
2/27/90	467.42	491.31	492.94	545.56	554.55		543.12	572.95
2/28/90	467.36	491.04	492.94	545.51	554.20		543.08	572.48
3/1/90	467.23	491.13	492.90	545.54	554.14		543.10	572.44
3/2/90	467.23	491.13	493.15	545.56	554.06		542.12	572.43
3/5/90	467.15	491.09	493.02	545.43	553.75		543.09	571.97
3/6/90	467.32	491.21	492.85	545.38	553.71		543.06	571.77
3/7/90	467.28	491.21	492.85	545.36	553.61		543.04	571.63
3/8/90	467.11	490.96	492.85	545.44	553.53		543.06	571.63
3/9/90	467.07	491.34	492.82	545.45	553.43		543.07	571.73
3/12/90	NT	491.92	493.10	545.45	553.34		543.08	573.77

WT - Water Table
STREAM - Surface water elevations in Gulf.
NT - Not Taken

TABLE 3 - 11 (continued)
LOCKPORT LANDFILL GROUNDWATER AND STREAM ELEVATIONS

MONITOR LOCATION	P-6	P-7	P-8	D-3A	WP-4	WP-5	WP-6
HORIZON	WT	WT	WT	WT	WT	WT	WT
RISER ELEVATION	557.56	551.66	567.64	559.66	475.3	472.89	472.68
ELEVATION	554.5	547.9	563.8	558.6	473.4	470.8	471.9
SCREEN LENGTH	5	5	5	9.2	5	5	5
1/17/90							
1/18/90							
1/19/90							
1/22/90							
1/23/90							
1/24/90							
1/25/90							
1/26/90							
1/29/90							
1/30/90							
1/31/90							
2/1/90							
2/6/90							
2/7/90							
2/8/90							
2/9/90							
2/12/90							
2/13/90	NT						
2/14/90	NT						
2/15/90	542.62						
2/16/90	542.64						
2/19/90	542.58						
2/20/90	542.56						
2/21/90	542.62						
2/22/90	542.61						
2/23/90	542.48						
2/27/90	542.58						
2/28/90	542.66						
3/1/90	542.67						
3/2/90	542.68						
3/5/90	541.61						
3/6/90	542.58						
3/7/90	542.56						
3/8/90	542.56						
3/9/90	542.56						
3/12/90	542.58						

WT - Water Table
STREAM - Surface water elevations in Gulf.
NT - Not Taken

TABLE 3 - 11 (continued)
LOCKPORT LANDFILL GROUNDWATER AND STREAM ELEVATIONS

MONITOR LOCATION	SG-1	SG-2	SG-3	P-1	P-2	P-3	P-4	P-5
HORIZON	STREAM	STREAM	STREAM	WT	WT	WT	WT	WT
RISER ELEVATION	NA	NA	NA	561.36	563.85	530.16	556.82	578.15
ELEVATION	469.4	493.71	495.52	558.6	561.2	528	553.9	576
SCREEN LENGTH				5	5	5	5	5
3/13/90	467.86	NT	NT	NT	NT		NT	NT
2/21/91	NT	NT	NT	545.32	556.77		542.90	NT
2/25/91	447.81	463.15	464.51	545.39	555.77		542.87	572.75
2/27/91	454.06	486.90	490.95	545.37	555.42		542.97	572.48
3/1/91	454.81	488.15	491.01	545.49	555.20		543.06	572.30
3/5/91	449.06	485.15	489.76	545.46	556.64		543.04	573.46
3/7/91	NT	NT	NT	545.46	557.44		543.04	NT
3/8/91	449.31	485.15	489.51	545.49	557.02		543.01	574.60
3/12/91	453.56	487.15	490.76	545.60	556.05		543.05	573.60
3/14/91	454.56	NT	NT	545.39	555.73		543.07	573.35
3/15/91	453.44	487.78	491.01	545.52	555.55		543.05	573.15
3/18/91	451.56	487.78	491.01	545.58	555.15		543.10	NT
3/19/91	451.19	486.90	490.51	545.52	556.72		543.10	573.33
3/20/91	452.19	468.15	491.01	545.47	556.45		543.07	573.22
3/21/91	453.56	487.40	491.01	545.52	556.23		543.09	573.37
3/22/91	455.06	488.03	491.14	545.40	556.03		543.08	573.08
3/25/91	451.19	486.90	490.14	545.47	556.70		543.08	573.62
3/26/91	452.94	486.03	490.76	545.56	556.42		543.10	573.77
3/28/91	447.06	482.15	488.01	545.56	556.42		543.10	573.77
3/29/91	452.56	487.15	488.76	545.52	557.12		543.09	575.19
4/1/91	451.81	485.28	490.39	545.57	NT		543.10	573.75
4/2/91	452.31	486.65	490.51	545.54	555.84		543.09	573.78
4/4/91	453.56	488.15	490.76	545.59	559.06		543.13	NT
4/5/91	455.06	487.15	490.76	545.50	555.43		543.06	573.59
4/8/91	454.69	486.90	490.89	545.47	555.21		543.06	573.21
4/9/91	454.06	489.40	491.14	545.44	554.91		543.06	573.03
4/10/91	453.06	487.15	491.01	545.40	554.76		543.06	572.89
4/12/91	453.94	488.03	491.26	545.39	554.55		543.02	572.57
4/15/91	447.06	482.65	463.31	545.48	554.28		543.07	572.82
4/17/91	454.06	487.40	491.14	545.40	554.15		543.02	572.85
4/25/91	453.56	487.15	489.76	545.47	556.56		542.99	574.62
4/26/91	453.06	486.40	490.39	545.48	556.29		543.00	574.42
5/9/91	454.56			545.37	553.42		543.02	571.55
5/14/91				545.36	553.85		542.97	571.30
5/21/91				545.36	553.50		542.93	571.88
5/28/91	467.94		495.26	545.34	553.19		543.63	571.63
5/29/91				545.32	552.50		542.81	572.36

WT - Water Table
STREAM - Surface water elevations in Gulf.
NT - Not Taken

TABLE 3 - 11 (continued)
LOCKPORT LANDFILL GROUNDWATER AND STREAM ELEVATIONS

MONITOR LOCATION	P-6	P-7	P-8	D-3A	WP-4	WP-5	WP-6
HORIZON	WT	WT	WT	WT	WT	WT	WT
RISER ELEVATION	557.56	551.66	567.64	559.66	475.3	472.89	472.68
ELEVATION	554.5	547.9	563.8	558.6	473.4	470.8	471.9
SCREEN LENGTH	5	5	5	9.2	5	5	5
3/13/90	NT						
2/21/91	542.14						
2/25/91	542.37						
2/27/91	542.28						
3/1/91	542.44						
3/5/91	542.46						
3/7/91	542.54						
3/8/91	542.53						
3/12/91	542.62			547.16			
3/14/91	542.64			547.16			
3/15/91	542.64			547.15		470.52	469.70
3/18/91	542.68			547.20		470.68	470.36
3/19/91	542.66			547.21		470.73	470.36
3/20/91	542.65			547.21		NT	470.04
3/21/91	542.66			547.20		470.67	469.91
3/22/91	542.68			547.20		470.59	469.79
3/25/91	NT			547.24		470.69	470.14
3/26/91	542.71			547.26		470.66	470.26
3/28/91	542.71			547.26		470.81	470.66
3/29/91	575.19			547.27		470.76	470.29
4/1/91	542.80			547.31		470.66	470.33
4/2/91	542.76			NT		470.64	470.02
4/4/91	542.82	510.46		547.28		470.58	469.78
4/5/91	542.72	510.30	540.62	547.23	470.11	470.56	469.75
4/8/91	542.67	510.30	540.48	547.23	469.96	470.47	469.64
4/9/91	542.70	510.30	540.46	547.22	469.95	470.48	469.62
4/10/91	542.68	510.28	540.39	547.20	470.06	470.47	469.72
4/12/91	542.62	510.19	540.14	547.14	469.90	470.39	469.53
4/15/91	542.61	NT	540.32	547.16	470.59	470.65	470.31
4/17/91	542.58	510.23	540.12	547.13	470.31	470.57	469.88
4/25/91	542.62	510.21	540.61	547.24	470.70	470.69	470.09
4/26/91	542.63	510.24	540.66	546.13	470.38	470.61	468.94
5/9/91	542.23	510.18	538.80	546.73			
5/14/91	542.39	510.21	539.94	546.88			
5/21/91	542.26	510.22	539.81	545.75			
5/28/91	542.18	510.18	539.04	546.64	469.29	470.01	472.68
5/29/91	541.91	510.85	539.41	554.31			

WT - Water Table
STREAM - Surface water elevations in Gulf.
NT - Not Taken

4.0 NATURE AND EXTENT OF CONTAMINATION

This section reviews the potential sources, nature, and extent of contamination associated with the Lockport City Landfill site. The following discussions utilize the information obtained and analytical results from Phase I and Phase II Remedial Investigations, as described in Section 2.0.

The data from previous studies, as described in Section 1.2.3 and presented in Appendix A, are not included in the discussions and analyses presented in this section. However, the previous studies were compared to, and found to be consistent with, the current data and conclusions.

The following is a summary of the chemical constituents found in the surface and subsurface soils and fill, stream sediments, surface water, and groundwater, and is based upon data found in Appendix M.

4.1 Soils and Fill

4.1.1 Subsurface Soils

A total of four (4) subsurface soil samples were obtained from depths of 0-3 and 2-4 feet. Three of these samples were from locations outside of the landfill (MW-1, MW-6, and MW-8) and one sample was taken on the landfill (MW-7). No volatile organic compounds were detected in any of the offsite subsurface soils. A total of eighteen (18) semivolatile organic compounds (SVOCs) were detected in the offsite soil boring MW-1. The two remaining offsite subsurface samples had no SVOCs detected. Of the eighteen SVOCs present in MW-1, sixteen were polycyclic aromatic hydrocarbons (PAHs), thirteen were below the quantitation limits and two (phthalates) were associated with blank contamination. The highest total SVOC concentration for the offsite subsurface soil samples was 9.983 ppm in MW-1.

The SVOC with the highest concentration not associated with method blank cross-contamination was pyrene at 1.0 ppm. Two pesticide compounds, endosulfan II (0.0047 ppm) and gamma-chlordane (.032 ppm) were detected, again only in subsurface soil sample MW-1, and both analytes were below quantitation limit.

No polychlorinated biphenyls (PCBs) were detected in the offsite subsurface soil samples. Sample MW-1 generally had the highest concentrations as well as the most numerous (18) number of detections for metals. All detections were within the ranges reported for soils in the eastern United States by the USGS (1984), except calcium (211,000 ppm) in sample MW-8. Table 4-1 summarizes the TCL analytes present in the subsurface soil samples. Table 4-2 provides the comparison of metal concentrations with those of the eastern United States.

Only one subsurface soil sample was taken with the limits of the site (MW-7). No VOCs, pesticides or PCBs were detected. One SVOC (fluoranthene at .026 ppm) was found, below quantitation limits. Fourteen (14) metals were detected in the onsite subsurface soil sample, all of which were within the ranges reported for soils in the eastern United States and were generally lower than those found offsite.

4.1.2 Onsite Surficial Soil

Five (5) onsite surface soil samples were taken from the landfill. These samples, which were given an SPS designation, were shallow grab samples taken from a depth of 0 to 6 inches. These samples were obtained from borrow materials used to cover the landfill. The TCL compound found in these soils are present on Table 4-1.

Two VOCs (2-butanone and total xylenes) were detected each below sample quantitation limits (.001 ppm). Twenty-six (26) SVOCs were detected, of which PAHs were the most common organic compound representing

TABLE 4 - 1

TARGET COMPOUND LIST ANALYTES PRESENT IN SOILS AND FILL

maximum number of detections possible (#)			OFFSITE SUBSURFACE SOILS		ONSITE SUBSURFACE SOILS		ONSITE SURFACE FILL		ONSITE SURFACE SOILS		ONSITE SUBSURFACE FILL		BELOW SANITARY SEWER SOIL	
			# OF DETECTIONS (3)	MAXIMUM CONCENTRATION	# OF DETECTIONS (1)	MAXIMUM CONCENTRATION	# OF DETECTIONS (3)	MAXIMUM CONCENTRATION	# OF DETECTIONS (5)	MAXIMUM CONCENTRATION	# OF DETECTIONS (11)	MAXIMUM CONCENTRATION	# OF DETECTIONS (1)	MAXIMUM CONCENTRATION
PARAMETERS	TYPES	UNITS												
ACETONE	VOC	ppb	0		0		0		0		0		0	
CARBON DISULFIDE	VOC	ppb	0		0		1	6 J	0		0		0	
CHLOROFORM	VOC	ppb	0		0		3	1 J	0		0		0	
2-BUTANONE	VOC	ppb	0		0		0		R/1	1 J	0		0	
TOLUENE	VOC	ppb	0		0		0		0		1	2100 J	0	
ETHYLBENZENE	VOC	ppb	0		0		1	13	0		3	1500	0	
TOTAL XYLENES	VOC	ppb	0		0		1	140	1	1 J	3	210000	0	
TOTAL VOLATILES		ppb	0		0		3	160	1	2	4	227100	0	

R - Rejected parameter (See Appendix O)

J - Indicates result is less than the sample quantitation limit but greater than zero.

B - Analyte detected in associated method blank.

TABLE 4 – 1 (CONT.)

TARGET COMPOUND LIST ANALYTES PRESENT IN SOILS AND FILL

maximum number of detections possible (#)			OFFSITE SUBSURFACE SOILS # OF DETECTIONS (3)	OFFSITE SUBSURFACE SOILS MAXIMUM CONCENTRATION	ONSITE SUBSURFACE SOILS # OF DETECTIONS (1)	ONSITE SUBSURFACE SOILS MAXIMUM CONCENTRATION	ONSITE SURFACE FILL # OF DETECTIONS (3)	ONSITE SURFACE FILL MAXIMUM CONCENTRATION	ONSITE SURFACE SOILS # OF DETECTIONS (5)	ONSITE SURFACE SOILS MAXIMUM CONCENTRATION	ONSITE SUBSURFACE FILL # OF DETECTIONS (11)	ONSITE SUBSURFACE FILL MAXIMUM CONCENTRATION	BELOW SANITARY SEWER SOIL # OF DETECTIONS (1)	BELOW SANITARY SEWER SOIL MAXIMUM CONCENTRATION
PARAMETERS	TYPES	UNITS												
PHENOL	SEMI	ppb	0		0		0				1	170 J	0	
4-METHPHENOL	SEMI	ppb	1	87 J	0		0				0		0	
BENZOIC ACID	SEMI	ppb	1	410 J	0		1	290 J	4	510 J	7	1900 J	0	
NAPHTHALENE	SEMI	ppb	1	280 J	0		1	3400	2	160 J	8	70000	0	
2-METHYLNAPTHALENE	SEMI	ppb	1	230 J	0		1	1200 J	2	180 J	7	40000	0	
DIMETHYLPHTHALATE	SEMI	ppb	0		0		0		1	1400	0		0	
ACENAPHTHYLENE	SEMI	ppb	1	27 J	0		0		3	430 J	4	240 J	0	
ACENAPTHENE	SEMI	ppb	1	75 J	0		1	2200 J	2	420 J	8	2700 J	1	1200 J
DIBENZOFURAN	SEMI	ppb	1	48 J	0		1	1600 J	2	230 J	5	4000 J	1	570 J
DIETHYPHTHALATE	SEMI	ppb	0		0		0	63 J	1	33 J	4	460 J	0	
FLUORENE	SEMI	ppb	1	130 J	0		1	1500 J	3	510 J	8	5200 J	1	1500 J
N-NITROSODIPHENYLAMINE	SEMI	ppb	0		0		0		0		2	850	0	
PENTACHLOROPHENOL	SEMI	ppb	0		0		0		1	320 J	1	25000 J	1	1300 J
PHENANTHRENE	SEMI	ppb	1	380 J	0		2	2300	5	6000	11	19000	1	18000
ANTHRACENE	SEMI	ppb	1	140 J	0		1	91 J	5	890 J	8	3900	1	5600
DI-N-BUTYLPHTHALATE	SEMI	ppb	R		R		0		R/2	6000	R\4	500 J	0	
FLUORANTHENE	SEMI	ppb	1	890	1	26 J	2	15000	5	8700	11	16000	1	34000
PYRENE	SEMI	ppb	1	1000	0		2	26000	5	10000	11	12000	1	33000
BUTYLBENZYLPHTHALATE	SEMI	ppb	1	66 J	0		0		1	130 J	3	3900	0	
BENZO(A)ANTHRACENE	SEMI	ppb	1	300 J	0		2	1100	5	5000	11	5000 J	1	19000
CHRYSENE	SEMI	ppb	1	340 J	0		2	14000	5	4800	11	4800	1	16000
BIS(2-ETHYLHEXYL)PHTHALA	SEMI	ppb	1	4300 B	0		3	50000 B	R/4	4000	R/6	78000 B	R	
DI-N-OCTYLPHTHALATE	SEMI	ppb	1	770 B	0		0		3	260	6	2000 J	1	
BENZO(B)FLUORANTHENE	SEMI	ppb	1	510	0		2	10000	5	5900	10	2200	1	18000
BENZO(K)FLUORANTHENE	SEMI	ppb	0		0		2	8100	4	3200	1	1700	1	11000
BENZ(A)PYRENE	SEMI	ppb	0		0		2	11000	5	4100	10	4100	1	14000
INDENO(1,2,3-CD)PYRENE	SEMI	ppb	0		0		1	8700	2	2100	9	2400 J	1	8700
DIBENZ(A,H)ANTHRACENE	SEMI	ppb	0		0		0		2	1200	2	140 J	1	2300
BENZO(G,H,I)PERYLENE	SEMI	ppb	0		0		0		2	3300	8	2400 J	1	7300
TOTAL SEMIVOLATILES		ppb	1	9983	1	26	3	186700	5	60870	11	220200	1	191470

R – Rejected parameter (See Appendix O)

J – Indicates result is less than the sample quantitation limit but greater than zero.

B – Analyte detected in associated method blank.

TABLE 4 - 1 (CONT.)

TARGET COMPOUND LIST ANALYTES PRESENT IN SOILS AND FILL

maximum number of detections possible (#)			OFFSITE SUBSURFACE SOILS		ONSITE SUBSURFACE SOILS		ONSITE SURFACE FILL		ONSITE SURFACE SOILS		ONSITE SUBSURFACE FILL		BELOW SANITARY SEWER SOIL	
			# OF DETECTIONS (3)	MAXIMUM CONCENTRATION	# OF DETECTIONS (1)	MAXIMUM CONCENTRATION	# OF DETECTIONS (3)	MAXIMUM CONCENTRATION	# OF DETECTIONS (5)	MAXIMUM CONCENTRATION	# OF DETECTIONS (11)	MAXIMUM CONCENTRATION	# OF DETECTIONS (1)	MAXIMUM CONCENTRATION
PARAMETERS	TYPES	UNITS												
ALDRIN	PEST	ppb	0		0		0		2	67	0		0	
4,4'-DDE	PEST	ppb	0		0		0		0		1	57	0	
ENDRIN	PEST	ppb	0		0		0		0		1	120	0	
ENDOSULFAN II	PEST	ppb	1	4.7 J	0		0		0		1	7.7 J	0	
4,4'-DDD	PEST	ppb	0		0		0		0			150	0	
4,4-DDT	PEST	ppb	0		0		0		0			450	0	
GAMMA-CHLORDANE	PEST	ppb	1	32 J	0		1	230 J	1	7.9 J		26 J	0	
TOTAL PESTICIDES		ppb	1	36.7	0		1	230	3	67	2	784.7	0	
AROCLOR-1242	PCB	ppb	0		0		0		0		1	8700	0	
AROCLOR-1248	PCB	ppb	0		0		2	1200	1	9300	7	32000	1	10000
AROCLOR-1254	PCB	ppb	0		0		2	450 J	4	1900	5	11000	1	3100
TOTAL PCB		ppb	0		0		2	1650	5	9300	10	43000	1	13100

R - Rejected parameter (See Appendix O)

J - Indicates result is less than the sample quantitation limit but greater than zero.

B - Analyte detected in associated method blank.

TABLE 4 – 1 (CONT.)

TARGET COMPOUND LIST ANALYTES PRESENT IN SOILS AND FILL

maximum number of detections possible (#)			OFFSITE SUBSURFACE SOILS		ONSITE SUBSURFACE SOILS		ONSITE SURFACE FILL		ONSITE SURFACE SOILS		ONSITE SUBSURFACE FILL		BELOW SANITARY SEWER SOIL	
			# OF DETECTIONS (3)	MAXIMUM CONCENTRATION	# OF DETECTIONS (1)	MAXIMUM CONCENTRATION	# OF DETECTIONS (3)	MAXIMUM CONCENTRATION	# OF DETECTIONS (5)	MAXIMUM CONCENTRATION	# OF DETECTIONS (11)	MAXIMUM CONCENTRATION	# OF DETECTIONS (1)	MAXIMUM CONCENTRATION
PARAMETERS	TYPES	UNITS												
ALUMINUM	METALS	ppm	3	1300	1	8810	3	23400	5	15100	11	28700	1	3700
ANTIMONY	METALS	ppm	0		0		0		2	14	1	8.8	0	
ARSENIC	METALS	ppm	3	15.6	1	12	3	24.8	5	19.8	11	20.1	1	11.7
BARIUM	METALS	ppm	3	103	1	56.4	3	779	5	122	11	323	1	33
BERYLLIUM	METALS	ppm	2	1.7	0		0		3	1.4	4	1.4	0	
CADMIUM	METALS	ppm	0		0		3	16.4	3	5.4	9	9.7	0	
CALCIUM	METALS	ppm	3	211000	1	163000	3	92200	5	155000	11	144000	1	159000
CHROMIUM	METALS	ppm	3	8.5	0		3	1480	5	403	11	295	0	
COBALT	METALS	ppm	1	8.6	1	15.4	2	223	5	18.6	9	94.5	0	
COPPER	METALS	ppm	2	31.6	1	257	3	1540	5	637	11	2870	1	23
IRON	METALS	ppm	3	26400	1	21200	3	67300	5	23500	11	68600	1	11300
LEAD	METALS	ppm	3	65.3	1	21.3	3	4810	5	1520	11	3020	1	57.3
MAGNESIUM	METALS	ppm	3	21200	1	2570	3	12700	5	24400	11	46900	1	31300
MANGANESE	METALS	ppm	3	1450	1	2060	3	2660	5	1280	11	1540	1	939
MERCURY	METALS	ppm	3	1.2	0		2	0.66	5	2.4	11	1.5	1	0.23
NICKEL	METALS	ppm	2	23.9	1	16.1	3	61.9	5	159	11	189	1	4
POTASSIUM	METALS	ppm	3	3310	1	1600	3	5900	5	3080	11	3960	1	1240
SELENIUM	METALS	ppm	0		0		0		0		0		0	
SILVER	METALS	ppm	0		0		2	7.4	3	4	3	8.9	0	
SODIUM	METALS	ppm	1	219	0		2	2260	5	370	8	3940	1	222
THALLIUM	METALS	ppm	0		0		0		0		0		0	
VANADIUM	METALS	ppm	3	22.5	1	20.6	3	30.5	5	28.3	11	41.4	1	6.4
ZINC	METALS	ppm	3	115	1	67.2	3	9570	5	6070	11	6260	1	39.7
CYANIDE	MISC.	ppm	0		0		0		1	5.6	2	15.5	0	
PHENOLS	MISC.	ppm	0		0		0		0		1	15.6	0	

R – Rejected parameter (See Appendix O)

J – Indicates result is less than the sample quantitation limit but greater than zero.

B – Analyte detected in associated method blank.

TABLE 4-2
MAXIMUM VALUES OF INORGANIC COMPOUNDS DETECTED IN SOILS, FILL AND SEDIMENTS
(in ppm)

COMPOUND	SOIL	FILL	STREAM SEDIMENTS	EASTERN UNITED STATES OBSERVED RANGE (ppm)*
Aluminum	15,100	28,700	29,000	7,000 - 100,000
Antimony	14	8.8	17.3	Not Listed
Arsenic	19.8	24.8	45	<0.1 - 73
Barium	122	779	398	10 - 1,500
Beryllium	1.7	1.9	1.2	<1.0 - 7
Cadmium	5.4	16.4	14.7	Not Listed
Calcium	211,000	159,000	147,000	100 - 28,000
Chromium	403	1,480	604	1.0 - 1,000
Cobalt	18.6	223	11.9	<0.3 - 70
Copper	637	2,870	1,540	<1.0 - 700
Iron	31,100	68,600	47,100	100 - 100,000
Lead	1,990	4,810	4,330	<10 - 300
Magnesium	24,400	46,900	49,200	50 - 50,000
Manganese	2,060	2,660	1,030	<2 - 7,000
Mercury	2.4	1.5	1.1	0.01 - 3.4
Nickel	159	163	102	<5 - 700
Potassium	3,310	5,900	5,670	50 - 37,000
Selenium	ND	ND	2.2	0.1 - 3.9
Silver	4	8.9	ND	0.1 - 73
Sodium	370	3,940	1,320	500 - 50,000
Thallium	ND	ND	1.1	2.2 - 23
Vanadium	28.3	36.8	57.4	<7 - 300
Zinc	6,070	9,570	4,940	<5 - 2,900

* H.T. Shacklette and J.G. Boerngen "Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States", U.S. Geological Survey, Professional Paper 1270, p. 6, 1984.

sixteen of the twenty-six SVOCs detected. Pyrene was detected at the highest concentration (10 ppm), and the highest total SVOC concentration was 60.87 ppm in SPS-2DL (dilution).

Two pesticide compounds were detected including aldrin, found in two surface samples at a maximum concentration of .067 ppm, and gamma-chlordane found in one sample at .0079 ppm. The highest total pesticides concentration was 0.067 ppm in SPS-3.

PCBs were present in all five onsite surface soil samples. Aroclor-1254 was detected in four samples while aroclor-1248 reported the highest concentration (9.3 ppm) in sample (SPS-2). The highest total concentration of PCBs in the onsite surface soil samples was 9.3 ppm in SPS-2.

Twenty-one metals were detected in the onsite surface soil samples.

Metals were more prevalent in onsite surface soils, at generally higher concentrations, than those reported in the offsite and onsite subsurface soil samples. Except for zinc (6,070 ppm) and lead (1,520 ppm), all other metals fell within the range identified for typical soils in the eastern United States (USGS, 1984). Cyanide was also detected at 5.6 ppm in one sample (SPS-2).

In general, a greater number and concentration of analytes were detected in the onsite surface soils than in the subsurface soils, but fewer than were detected in the fill samples. No discernable pattern or trend was observed among the onsite surface soil samples.

4.1.3 Onsite Surficial Waste

Three (3) onsite surficial waste samples (designated WS) were obtained from fill/cover material, at a depth of 0 to 6 inches on the

landfill. These samples were subjected to chemical analysis for TCL analytes. Four VOCs were detected in one surface fill sample. Chloroform was the only analyte detected in more than one sample. It was present in all samples at .001 ppm but was below the quantitation limit. Total xylenes had the highest concentration of any VOCs in the surface fill samples at 0.140 ppm. The highest total concentration of VOCs was 0.016 ppm in WS-3 (reanalyzed). Eighteen (18) SVOCs were detected in the onsite surface soil samples. Nine SVOCs were detected in only one sample, eight SVOCs were detected in two, and only one SVOC (bis(2-ethylhexyl)phthalate) was detected in all three. Thirteen of the eighteen SVOCs are PAHs. Pyrene had the highest concentration of any compound (26.0 ppm) without blank contamination. The highest total concentration of SVOCs for the surface fill is 186.7 ppm in WS-3 (reanalyzed). One pesticide, (gamma-chlordane at 0.230 ppm) two aroclors of PCBs (1248 and 1254) were detected at a total maximum PCB concentration of 1.65 ppm in WS-3.

Nineteen (19) metals were detected in the onsite surface waste samples. Fifteen metals were detected in all three samples, and four metals were found in two samples. The concentrations of calcium, chromium, cobalt, copper, lead and zinc were higher than the observed range reported for soils in the eastern United States (USGS 1984). The number and concentration of metals are generally greater than those found in the surface and subsurface soils but similar to those found in the subsurface fill. RCRA toxicity parameters were performed on all samples. No RCRA parameters were detected above regulatory limits. No discernable trend was observed in the shallow surface samples.

4.1.4 Onsite Subsurface Fill

Eleven (11) subsurface fill samples were obtained from soil borings at discrete sample intervals (0-2, 2-4, and 4-6 feet in MW-2I, MW-5I, and MW-9S) and from borehole composites (SB designation). Three VOCs (toluene, ethylbenzene and total xylenes) were detected in the subsurface fill samples. Two VOCs were detected in three samples and one (toluene) was found in one sample. The highest concentrations and largest number of VOCs found in the subsurface fill samples were in SB-25. Total xylenes appeared in the highest concentration (210 ppm) while the highest total concentration of VOCs was 227.1 ppm in SP-25.

Twenty-seven (27) SVOCs were detected in the subsurface fill samples. Bis(2-ethylhexyl)phthalate was detected in all eleven subsurface fill samples and at the highest concentration of any SVOC (78 ppm); however, blank contamination is also associated with this compound. Naphthalene was detected in 8 samples and had the highest concentration (70 ppm) of any analyte not associated with blank contamination. Phenanthrene, fluoranthene, pyrene, benzo(a)anthracene and chrysene were the most widely distributed SVOCs present in eleven subsurface samples. SVOC concentration and distribution were similar in all subsurface samples with SB-25 having the highest concentration and largest number of detections. The highest total SVOC concentration was 220.2 ppm in SB-25.

Six pesticides were detected in the subsurface fill sample. No pesticides were detected in more than one sample, and subsurface fill sample SB-25 had the greatest number of detections and highest concentration of pesticides (4,4'-DDT at 0.450 ppm). The highest total concentration of pesticides detected was 0.78 ppm in SB-25. Three aroclor's of PCBs were encountered in the subsurface fill samples. Aroclor-1248 was detected in seven samples and has the highest concentration at 32 ppm, and the highest total PCBs detected in any sample was 43 ppm in SB-1.

Twenty-one metals were detected in the subsurface fill samples. Fifteen metals were detected in all eleven samples. Most metals were with the ranges reported for soil in the eastern United States (USGS 1984), except calcium (144,000 ppm), cobalt (94.5 ppm), copper (2,870 ppm), lead (3,020 ppm) and zinc (6,260 ppm). Cyanide was found in two subsurface fill samples at a maximum concentration of 15.5 ppm and phenols were detected in one sample at 15.6 ppm.

Complete RCRA characterization - corrosivity, ignitability, reactivity and toxicity (EP Tox metals) - was performed on eight of the subsurface fill composite. No sample showed any RCRA parameter above regulatory limits. One sample, SB-25, was subjected to TCLP toxicity analysis with no parameters detected above regulatory limits.

The analyses illustrated no trend among the subsurface fill samples. However, the number of analytes detected, and their concentrations, are generally greater for the subsurface fill samples than for any other soil or fill samples analyzed except for sanitary sewer sample SB-5I#.

4.1.5 Sanitary Sewer Soil/Fill

One soil/fill sample (MW-5I#) was obtained from below the sanitary sewer line which runs adjacent to the northerly limit of the landfill at a depth of 10-12 feet. No VOCs were detected in this sample. Sixteen SVOCs were detected with a total concentration of 191.5 ppm. Fifteen of the sixteen compounds are PAHs, with fluoranthene reported at the highest concentration for an individual SVOC at 34.0 ppm. No pesticides were reported in this sample. Two PCB aroclors (1248 and 1254) were detected in the sample with a total PCB concentration of 13.1 ppm. Fifteen metals were detected, and, with the exception of calcium, all concentrations were within the ranges given for soils in the eastern United States.

Concentrations of SVOCs were generally higher than those encountered in the fill except for SB-25. PCB concentrations were similar to those in subsurface fill, as were the metals concentrations. No cyanides or phenols were detected.

4.2 Stream Sediments

Stream sediment samples were collected from the Gulf at locations which were upstream, downstream, and adjacent to the landfill. Two stream sediment samples were also obtained from an offsite swale which joins The Gulf at the northeast corner of the site. One sample (WSS-1) was taken from the marsh area located in The Gulf at the northwest end of the site. All stream sediment samples were grab samples taken from the stream bottom at the same locations as the surface water sample. Stream sediment samples are identified by the prefix SS. Analytical results are summarized in Table 4-3.

4.2.1 Upstream Sediments

Three upstream sediment samples (SS-1, SS-4, and SS-4a) were collected and analyzed for TCL analytes. A total of six VOCs were detected in the upstream sediments. Chlorobenzene was the most prevalent, being detected in two of the three samples, while 2-butanone, with a concentration of .006 ppm had the highest concentration. All VOCs detected were less than the quantitation limit for that analyte. The highest total concentration of VOCs for the upstream sediments is .014 ppm in SS-1.

Twenty-six SVOCs were detected in the upstream sediments. Fifteen of the SVOCs were detected in all three upstream samples, four SVOCs were detected in at least two samples and seven SVOCs were detected in only one sample. PAHs were the most common SVOCs present comprising sixteen of the twenty-seven SVOCs detected. Pyrene had the highest concentration in all

TABLE 4-3
TARGET COMPOUND LIST ANALYTES PRESENT IN STREAM SEDIMENTS

maximum number of detections possible (#)			UPSTREAM GULF SEDIMENTS		ADJACENT GULF SEDIMENTS		DOWNSTREAM GULF SEDIMENTS		OFFSITE SWALE SEDIMENTS	
			# OF DETECTIONS (3)	MAXIMUM CONCENTRATION	# OF DETECTIONS (4)	MAXIMUM CONCENTRATION	# OF DETECTIONS (3)	MAXIMUM CONCENTRATION	# OF DETECTIONS (2)	MAXIMUM CONCENTRATION
PARAMETERS	TYPES	UNITS								
ACETONE	VOC	ppb	R		R		R		R/1	250 B
2-BUTANONE	VOC	ppb	1	6 J	R		R		2	1 J
TRICHLOROETHENE	VOC	ppb	1	4 J	1	19	0		0	
BENZENE	VOC	ppb	1	2 J	0		0		0	
TETRACHLOROETHENE	VOC	ppb	1	3 J	1	7 J	0		0	
TOLUENE	VOC	ppb	R		R		1	2 J	0	
CHLOROBENZENE	VOC	ppb	2	2 J	0		0		0	
TOTAL XYLENES	VOC	ppb	1	1 J	0		0		0	
TOTAL VOLATILES		ppb	2	14	1	26	1	2	2	251
PHENOL	SEMI	ppb	1	490 J	1	100 J	0		0	
1,4-DICHLOROBENZENE	SEMI	ppb	1	97 J	0		0		0	
1,2-DICHLOROBENZENE	SEMI	ppb	1	160 J	0		0		0	
4-METHYLPHENOL	SEMI	ppb	1	320 J	0		0		0	
BENZOIC ACID	SEMI	ppb	1	580 J	R/2	910 J	0		1	97 J
NAPHTHALENE	SEMI	ppb	3	630 J	1	1700 J	2	74 J	1	49 J
2-METHYLNAPTHALENE	SEMI	ppb	3	440 J	2	790 J	0		1	52 J
ACENAPHTHYLENE	SEMI	ppb	2	1700	1	39 J	1	1600	2	410 J
ACENAPTHENE	SEMI	ppb	3	1400 J	2	2100	2	290 J	2	130 J
4-NITROPHENOL	SEMI	ppb	0		0		0		1	100 J
DIBENZOFURAN	SEMI	ppb	3	1200 J	2	2000	2	190 J	2	160 J
DIETHYPHTHALATE	SEMI	ppb	R		R/1	53 J	0		R	
FLUORENE	SEMI	ppb	3	1600 J	1	2600	2	1000	2	520
N-NITROSODIPHENYLAMINE	SEMI	ppb	1	130 J	0		0		0	
PHENANTHRENE	SEMI	ppb	3	14000	4	19000	3	6900	2	2800
ANTHRACENE	SEMI	ppb	3	2400	3	3100	2	1400	2	900
DI-N-BUTYLPHTHALATE	SEMI	ppb	R		R		R		R/1	70 J
FLUORANTHENE	SEMI	ppb	3	13000	4	15000	3	11000	2	5100
PYRENE	SEMI	ppb	3	15000	4	14000	3	5100	2	2500
BUTYLBENZYLPHTHALATE	SEMI	ppb	2	1200	1	40 J	1	25 J	R/1	180 J
BENZO(A)ANTHRACENE	SEMI	ppb	3	5600	2	8300	3	4400	2	1900
CHRYSENE	SEMI	ppb	3	7200	2	7000	3	4400	2	1800
BIS(2-ETHYLHEXYL)PHTHALATE	SEMI	ppb	R		R		R/1	93000 B	R/I	3100 B
DI-N-OCTYLPHTHALATE	SEMI	ppb	2	950 J	2	43 J	0		R/1	250 J
BENZO(B)FLUORANTHENE	SEMI	ppb	3	15000	3	5600	3	3800	2	3100
BENZO(K)FLUORANTHENE	SEMI	ppb	2	2200	2	5800	3	3900	2	1800
BENZ(A)PYRENE	SEMI	ppb	3	7700	2	5500	2	3700	2	1600
INDENO(1,2,3-CD)PYRENE	SEMI	ppb	3	5200	2	2600	3	980	2	390 J
DIBENZ(A,H)ANTHRACENE	SEMI	ppb	1	920 J	2	660 J	1	190 J	0	
BENZO(G,H,I)PERYLENE	SEMI	ppb	3	5000	2	1800 J	2	910	2	310 J
TOTAL SEMIVOLATILES		ppb	3	80520	3	97550	3	98220	3	27221

R - Rejected parameter (See Appendix O).

J - Indicates Result is less than quantitation limit but greater than zero.

TABLE 4-3
TARGET COMPOUND LIST ANALYTES PRESENT IN STREAM SEDIMENTS

maximum number of detections possible (#)			UPSTREAM GULF SEDIMENTS		ADJACENT GULF SEDIMENTS		DOWNSTREAM GULF SEDIMENTS		OFFSITE SWALE SEDIMENTS	
			# OF DETECTIONS (3)	MAXIMUM CONCENTRATION	# OF DETECTIONS (4)	MAXIMUM CONCENTRATION	# OF DETECTIONS (3)	MAXIMUM CONCENTRATION	# OF DETECTIONS (2)	MAXIMUM CONCENTRATION
PARAMETERS	TYPES	UNITS								
BETA-BHC	PEST	ppb	0		1	110	0		0	
ENDOSULFAN I	PEST	ppb	0		1	53	0		0	
DIELDRIN	PEST	ppb	0		1	8.5 J	2	580	2	47
4,4'-DDD	PEST	ppb	1	240 J	0		0		0	
GAMMA-CHLORDANE	PEST	ppb	2	330 J	0		1	130 J	1	9 J
TOTAL PESTICIDES		ppb	2	570	2	118.5	2	720	2	47
AROCLOR-1248	PCB	ppb	0		1	2400	0		0	
AROCLOR-1260	PCB	ppb	1	2900	0		0		0	
TOTAL PCB		ppb	1	2900	1	2400	0	0	0	0
ALUMINUM	METALS	ppm	3	16000	4	29000	3	7410	2	9130
ANTIMONY	METALS	ppm	0		1	17.3	0		0	
ARSENIC	METALS	ppm	3	45	4	31.2	3	13.9	2	5.6
BARIUM	METALS	ppm	3	398	4	118	3	49.3	2	84.3
BERYLLIUM	METALS	ppm	1	0.53	2	1.2	2	0.55	0	
CADMIUM	METALS	ppm	2	14.7	2	3.8	2	1.3	0	
CALCIUM	METALS	ppm	3	147000	4	141000	3	122000	2	112000
CHROMIUM	METALS	ppm	3	218	2	277	3	43.5	2	17.9
COBALT	METALS	ppm	3	10.5	3	11.9	3	5.9	2	8.1
COPPER	METALS	ppm	3	1540	4	754	3	125	2	35.9
IRON	METALS	ppm	3	44700	4	47100	3	15500	2	16100
LEAD	METALS	ppm	1	4330	4	2390	3	277	2	88.1
MAGNESIUM	METALS	ppm	3	24100	4	16400	3	26100	2	49200
MANGANESE	METALS	ppm	3	709	4	1030	3	871	2	631
MERCURY	METALS	ppm	2	1.1	4	0.51	1	0.14	1	0.18
NICKEL	METALS	ppm	3	102	4	77.8	3	29.7	1	12.6
POTASSIUM	METALS	ppm	3	2630	4	5670	3	1530	2	1660
SELENIUM	METALS	ppm	0		1	2.2	0		0	
SILVER	METALS	ppm	0		0		0		0	
SODIUM	METALS	ppm	3	1320	4	1080	3	386	0	
THALLIUM	METALS	ppm	0		1	1.1	2	0.57	0	
VANADIUM	METALS	ppm	3	26.7	3	57.4	2	12.9	3	14.6
ZINC	METALS	ppm	3	4270	4	4940	3	666	2	212
CYANIDE	MISC.	ppm	1	3.4	1	8.7	0		0	
PHENOLS	MISC.	ppm	1	1.0	1	2.91	1	1.08	0	

R - Rejected parameter (See Appendix O).

J - Indicates Result is less than quantitation limit but greater than zero.

R - Rejected parameter (See Appendix O).

J - Indicates Result is less than quantitation limit but greater than zero.

three samples, with a maximum result of 15 ppm. Sample SS-1 collected upstream in the east branch of the Gulf had the greatest number of SVOCs detected, while SS-4a collected from the west branch generally had the highest concentrations of SVOCs at 80.5 ppm.

Two pesticides were present, 4,4'-DDD at .24 ppm (detected only at SS-1) and gamma-chlordane at .32 ppm (detected in SS-1 and SS-4). Both pesticide compounds were reported below the quantitation limit. The total maximum concentration of pesticide's is .57 ppm. PCB arclor-1260 was detected in upstream sample SS-1 at a concentration of 2.9 ppm. No PCBs were detected in the remaining two samples.

Nineteen metals were detected with fifteen metals present in all three samples. The metals were generally within the range reported for on and offsite surface and subsurface soils/fill samples. The metals concentrations are generally higher for the upstream samples than those reported for the offsite, adjacent, and downstream samples. Cyanide was detected at 3.4 ppm in SS-1, while phenols were reported at 1.0 ppm in SS-4.

The upstream samples were found to contain more organic compounds , at generally higher concentrations, than stream sediments collected adjacent to, or downstream in The Gulf. The types of organic compounds and metals reported are similar to the chemical suites described previously in the onsite and offsite soil and fill.

4.2.2 Adjacent Stream Sediments

Four stream sediments (SS-2, SS-3, SS-5 and WWS-1) were obtained from four locations in The Gulf adjacent to the landfill. Two VOCs, trichloroethene (.019 ppm) and tetrachloroethene (.007 ppm), were detected in an adjacent stream sediment SS-5 located in the marsh at the northwest end of the landfill.

Twenty-three (23) SVOCs were reported with only three SVOCs (phenanthrene, fluoranthene and pyrene) reported in all four samples. Seventeen SVOCs were present in stream sediments taken near the marsh area. PAHs were the most prevalent SVOCs with phenanthrene (19 ppm) reporting the highest concentration. The highest total concentration of SVOCs was 97.5 ppm in SS-5.

Three pesticides were detected including beta-BHC at .110 ppm, endosulfan I at .053 ppm and dieldrin at 0.008 ppm. All pesticide compounds were from samples near the marsh at the northwest end of the site. PCB, aroclor-1248 was also found at 2.4 ppm in sample SS-5 from the marsh area.

Twenty-two metals were detected with fourteen metals detected in all four samples. The highest concentrations and number of detections for metals occurred in the sediment samples from the marsh area. Metal concentrations are generally lower than the upstream samples, but higher than the downstream samples. Cyanide at 8.7 ppm and phenols at 2.91 ppm were detected only in sample WSS-1 which was taken in the marsh.

Generally, all TCL parameters in the adjacent stream sediments are similar in nature and concentrations to those encountered in the upstream sediments. The major pattern observed is the increase in the number and concentration of parameters detected in the marsh area.

4.2.3 Offsite Swale Sediments

Two samples (SS-6 and SS-7) were collected from an offsite swale (ditch) located to the east of the site. This swale flows in a northwesterly direction and joins The Gulf downstream of the site. Two VOCs were detected in the offsite swale sediments, 2-butanone (.001 ppm) and acetone (.250 ppm); however, acetone is associated with method blank contamination. Twenty-three (23) SVOCs were detected with fifteen found

in both samples. PAHs are the most common SVOCs with the highest concentrations (fluoranthene at 5.1 ppm) not associated with blank contamination. The highest total SVOCs concentration for the offsite swale sediments is 27.2 ppm in SS-6. Two pesticide compounds were detected in the offsite swale sediments. Dieldrin was detected in both samples with a maximum concentration of .047 ppm, and gamma-chlordane was detected in one sample at .009 ppm. No PCBs were detected in either sample. Sixteen metals were detected in these samples. Fourteen metals were present in both samples. No cyanide or phenols were detected.

Parameters reported are similar to those found in the upstream, adjacent and downstream sediments, as well as those encountered in surface and subsurface soils. Analyte concentrations were generally greater in the downstream sediment sample (SS-7) than the upstream swale sample (SS-6). The concentrations of TCL parameters reported in the offsite swale samples, usually exhibited lower concentrations than those found in The Gulf sediments.

4.2.4 Downstream Sediments

Three downstream sediments (SS-8, SS-9, and SS-10) were obtained from locations downstream of the landfill and the offsite swale. One VOC was detected below the quantitation limit (toluene at .02 ppm). Nineteen SVOCs were detected with fourteen SVOCs detected at least twice. PAHs were the most prevalent compounds, with fluoranthene (11 ppm) registering the highest concentration of any SVOCs not associated with blank contamination. The highest total concentration of SVOCs for the downstream sediments occurred in SS-10 at 98.2 ppm with bis(2-ethylhexyl) phthalate (also encountered in the method blank) reporting 93.0 ppm.

Two pesticides, dieldrin and gamma-chlordane, were encountered in the downstream samples at a maximum total concentration of .720 ppm. No PCBs were encountered in the downstream samples. Twenty metals were found

at least once in downstream samples. Fifteen metals were found in all three samples. The metals encountered are at concentrations similar to those encountered in the other stream sediments. Phenols were encountered in sample SS-9 at 1.08 ppm.

The organic parameters generally decrease in concentration moving downstream within the downstream Gulf sediment samples from SS-8 through SS-10. The metals did not illustrate a similar pattern.

The downstream sediments identified similar types of chemical parameters to the upstream, adjacent, and offsite stream sediments. The concentrations were, however, generally less than those reported further upstream in the Gulf.

4.3 Surface Waters

Surface water grab samples were taken at seeps (groundwater outbreaks) from the landfill, in The Gulf upstream, adjacent to, and downstream of the landfill, and in an offsite drainage swale northeast and upslope of the landfill. The seep samples were labeled with a prefix L for the first round sampling and LL for the second round sampling. The analytes detected in these samples are presented in Table 4-4. The stream sediments were labeled SW and correspond with stream sediment sampling locations. Only one sample at each stream location was obtained and the results are presented on Table 4-5.

4.3.1 Landfill Seeps

Seven VOCs were detected at least once in the two seeps that were sampled (L-1 and L-2). Of the seven detections, only 1,2-dichloroethene was detected at both sample locations (LL-1 and LL-2), but it was not present during the first round sampling event. Benzene was the only VOC

TABLE 4-4
TARGET COMPOUND ANALYTES PRESENT IN LANDFILL SEEPS

			TOP OF SLOPE		BOTTOM OF SLOPE	
maximum number of detections possible (#)			# OF DETECTIONS (2)	MAXIMUM CONCENTRATION	# OF DETECTIONS (2)	MAXIMUM CONCENTRATION
PARAMETERS	TYPES	UNITS				
VINYL CHLORIDE	VOC	ppb			1	47
1,2-DICHLOROETHENE (TOTAL)	VOC	ppb	1	5	1	140
1,1,1-TRICHLOROETHANE	VOC	ppb	1	0.7 J		
TRICHLOROETHENE	VOC	ppb	1	8		
BENZENE	VOC	ppb			2	2 J
CHLOROBENZENE	VOC	ppb			1	1 J
ETHYLBENZENE	VOC	ppb			1	7
TOTAL VOLATILES		ppb	2	13	2	196
BENZOIC ACID	SEMI	ppb			1	4 J
2-METHYLNAPHTHALENE	SEMI	ppb			1	0.5 J
ACENAPHTHENE	SEMI	ppb			1	2 J
DIETHYPHTHALATE	SEMI	ppb			1	1 J
FLUORENE	SEMI	ppb			1	1 J
PHENANTHRENE	SEMI	ppb			1	1 J
DI-N-BUTYLPHTHALATE	SEMI	ppb			1	0.5 J
FLUORANTHENE	SEMI	ppb	1	0.5 J		
PYRENE	SEMI	ppb	1	0.4 J		
TOTAL SEMIVOLATILES		ppb	1	0.9	1	10
ALUMINUM	METALS	ppb	2	600	1	506
ANTIMONY	METALS	ppb			1	29.1 B
ARSENIC	METALS	ppb	1	1.3 B	1	1.9 B
BARIUM	METALS	ppb	2	205	2	857
CADMIUM	METALS	ppb			1	2.2 B
CALCIUM	METALS	ppb	2	156000	2	129000
CHROMIUM	METALS	ppb			1	10.4
COPPER	METALS	ppb	1	32.7	1	26.1
IRON	METALS	ppb	2	15600	2	41500
LEAD	METALS	ppb	2	5.2	1	21.5
MAGNESIUM	METALS	ppb	2	33200	2	46000
MANGANESE	METALS	ppb	2	1640	2	303
MERCURY	METALS	ppb	1	1.4	1	0.39
POTASSIUM	METALS	ppb	2	10100	2	80000
SELENIUM	METALS	ppb	1	1.2 B		
SILVER	METALS	ppb	1	13.6		
SODIUM	METALS	ppb	2	363000	2	99200
VANADIUM	METALS	ppb			2	14.9 B
ZINC	METALS	ppb	2	38.4	1	10 B
CYANIDE	MISC.	ppm			1	40.2
PHENOLS	MISC.	ppm			2	92

J – Indicates Result is less than quantitation limit but greater than zero.
B – Indicates result is less than quantitation limit but greater than instrument detection limit.

TABLE 4-5
TARGET COMPOUND LIST ANALYTES PRESENT IN SURFACE WATERS

maximum number of detections possible (#)			UPSTREAM GULF WATERS		ADJACENT GULF WATERS		DOWNSTREAM GULF WATERS		OFFSITE SWALE WATERS	
			# OF DETECTIONS (3)	MAXIMUM CONCENTRATION	# OF DETECTIONS (3)	MAXIMUM CONCENTRATION	# OF DETECTIONS (3)	MAXIMUM CONCENTRATION	# OF DETECTIONS (2)	MAXIMUM CONCENTRATION
PARAMETERS	TYPES	UNITS								
ACETONE	VOC	ppb	2	18000 B	R/1	18000 B	3	26000 B	2	12
CHLOROFORM	VOC	ppb	0		R/1	9	0		0	
TRICHLOROETHENE	VOC	ppb	1	6	2	3 J	0		0	
BENZENE	VOC	ppb	1	0.5 J	1	1 J	1	10 J	0	
TETRACHLOROETHENE	VOC	ppb	1	2 J	0		0		0	
TOLUENE	VOC	ppb	0		2	63 J	3	98 J	1	0.9 J
TOTAL XYLENES	VOC	ppb	1	98 J	0		0		0	
TOTAL VOLATILES		ppb	3	18098	3	18063	3	26098	2	12.9
PHENOL	SEMI	ppb	0		0		1	5 J	0	
2-NITROPHENOL	SEMI	ppb	1	2 J	0		0		0	
BENZOIC ACID	SEMI	ppb	2	38 J	1	6 J	3	12 J	0	
DIBENZOFURAN	SEMI	ppb	0		0		1	0.4 J	0	
DIETHYPHTHALATE	SEMI	ppb	2	1 J	1	1 J	1	2 J	0	
FLUORENE	SEMI	ppb	0		0		1	0.9 J	0	
4-NITROANILINE	SEMI	ppb	0		0		1	0.9 J	0	
N-NITROSODIPHENYLAMINE	SEMI	ppb	0		0		1	2 J	0	
HEXACHLOROBENZENE	SEMI	ppb	0		0		1	2 J	0	
PHENANTHRENE	SEMI	ppb	0		0		1	2 J	0	
ANTHRACENE	SEMI	ppb	0		0		1	2 J	0	
FLUORANTHENE	SEMI	ppb	0		0		1	4 J	0	
PYRENE	SEMI	ppb	0		0		1	3 J	0	
BUTYLBENZYLPHTHALATE	SEMI	ppb	0		0		1	3 J	0	
BENZO(A)ANTHRACENE	SEMI	ppb	0		0		1	3 J	0	
CHRYSENE	SEMI	ppb	0		0		1	3 J	0	
BIS(2-ETHYLHEXYL)PHTHALATE	SEMI	ppb	R		R		R		R/1	1 J
BENZO(K)FLUORANTHENE	SEMI	ppb	0		0		1	2 J	0	
INDENO(1,2,3-CD)PYRENE	SEMI	ppb	0		0		1	2 J	0	
DIBENZ(A,H)ANTHRACENE	SEMI	ppb	0		0		1	2 J	0	
BENZO(G,H,I)PERYLENE	SEMI	ppb	0		0		1	2 J	0	
TOTAL SEMIVOLATILES		ppb	3	40	2	6	3	48.2	1	1
DIELDRIN	PEST	ppb	0		0		0		1	0.022 J
TOTAL PCB	PCB	ppb	0		0		0		0	

R - Rejected parameter (See Appendix O).

J - Indicates the result is less than quantitation limit but greater than zero.

B - Analyte detected in associated method blank.

TABLE 4-5
TARGET COMPOUND LIST ANALYTES PRESENT IN SURFACE WATERS

maximum number of detections possible (#)			UPSTREAM GULF WATERS # OF DETECTIONS (3)	UPSTREAM GULF WATERS MAXIMUM CONCENTRATION	ADJACENT GULF WATERS # OF DETECTIONS (3)	ADJACENT GULF WATERS MAXIMUM CONCENTRATION	DOWNSTREAM GULF WATERS # OF DETECTIONS (3)	DOWNSTREAM GULF WATERS MAXIMUM CONCENTRATION	OFFSITE SWALE WATERS # OF DETECTIONS (2)	OFFSITE SWALE WATERS MAXIMUM CONCENTRATION
PARAMETERS	TYPES	UNITS								
ALUMINUM	METALS	ppb	3	506	2	8520	3	735	2	698
ANTIMONY	METALS	ppb	1	29.1	0		1	27.9	0	
ARSENIC	METALS	ppb	2	4.3	2	5.7	0		2	5.4
BARIUM	METALS	ppb	1	44.3	2	67.1	2	30.7	2	82.8
BERYLLIUM	METALS	ppb	1	3.4	0		0		0	
CADMIUM	METALS	ppb	1	9.4	0		0		0	
CALCIUM	METALS	ppb	3	148000	3	145000	3	138000	2	90000
CHROMIUM	METALS	ppb	2	23.7	1	20.7	3	0.9	0	
COPPER	METALS	ppb	2	47.6	3		1	53.8	2	109
IRON	METALS	ppb	2	155	3	78.5	3	378	2	890
LEAD	METALS	ppb	3	52.3	3	184	3	155	1	5.5
MAGNESIUM	METALS	ppb	3	21800	3	38600	3	17100	2	31800
MANGANESE	METALS	ppb	3	74.1	3	75.5	3	248	1	35.9
MERCURY	METALS	ppb	2	0.6	3	1.4	1	0.39	0	
NICKEL	METALS	ppb	1	30.6	1	19	1	19.2	0	
POTASSIUM	METALS	ppb	2	101000	3	103000	3	98000	2	2900
SILVER	METALS	ppb	2	136	3	20.8	2	102000	1	36.1
SODIUM	METALS	ppb	3	117000	3	231000	3	125000	2	50000
THALLIUM	METALS	ppb	0		0		0		1	2.4
VANADIUM	METALS	ppb	1	12.4	1	17.4	0		0	
ZINC	METALS	ppb	3	399	3	585	3	517	2	39.2
CYANIDE	MISC.	ppm	2	92	1	271	2	45.7	0	
PHENOLS	MISC.	ppm	2	100	0		2	64	0	
CHEMICAL OXYGEN DEMAND	MISC.	ppm	3	88.1	3	11.7	3	88.6	2	21.1
TOTAL DISSOLVED SOLIDS	MISC.	ppm	3	1254	3	1291	3	1182	2	629
TOTAL SUSPENDED SOLIDS	MISC.	ppm	1	7	3	13	2	7	1	4
AMMONIA, AS N	MISC.	ppm	3	5.5	2	5.9	3	3.8	2	5.9
NITRATE-NITROGEN	MISC.	ppm	3	667.7	3	614.4	3	645.4	2	2.07
TOTAL KJELDAHL NITROGEN, AS N	MISC.	ppm	2	25	1	25.2	3	24.6	0	
pH UNITS	MISC.	ppm	3	7.85	3	7.6	3	8.04	2	7.9
TOTAL ORGANIC COMPOUNDS	MISC.	ppm	3	20.3	3	5.14	3	14.7	2	47.7
ALKALINITY	MISC.	ppm	3	298.5	3	300.5	3	159	2	273
BICARBONATE	MISC.	ppm	3	298.5	3	300.5	3	159	2	273
BOD	MISC.	ppm	3	135	3	70.9	3	63.6	2	25.6
CHLORIDE	MISC.	ppm	3	434.2	3	450.7	3	376.7	2	129
HARDNESS	MISC.	ppm	3	406.5	3	445.7	3		2	
SULFATE	MISC.	ppm	3	147.5	3	145	3	177.5	2	155
SP.CONDUCTANCE	MISC.	ppm	3	1804	3	2222	3	1848	2	570

R - Rejected parameter (See Appendix O).

J - Indicates the result is less than quantitation limit but greater than zero.

B - Analyte detected in associated method blank.

detected during both phases of the sampling, and it is only present at the downslope location (LL-2). The highest concentrations of VOCs (vinyl chloride, .047 ppm; 1,2-dichloroethene, .140 ppm; and benzene, .002 ppm and ethylbenzene at .007 ppm) were obtained at downslope location LL-2 during the second round of sampling. Of the seven VOCs detected in all seeps, only ethylbenzene was common to both the seep and subsurface soil or fill samples from the landfill.

Nine SVOCs were detected at least once in seep samples. Semi-volatile compounds were not detected during the first round sampling, and the two compounds detected at seep L-1 were different than those detected at L-2. Although benzoic acid had the highest reported value (.004 ppm) all SVOCs were detected below the quantitation limit. The second round sample obtained at L-2 had the largest number of SVOCs detected and the highest concentrations (.010 ppm). Pesticides and PCBs were not detected in the seep samples. Twenty-one metals were reported for the seeps samples. Seven metals were present at both locations and during both sampling events. No obvious trend is apparent in any of the parameters reports for the seeps.

4.3.2 Upstream Surface Waters

Three upstream water samples (SW-1, SW-4, and SW-4a) were collected from The Gulf at the same locations from which upstream sediment samples were obtained. Six VOCs were detected, but only acetone was detected in more than one sample. Acetone, which was present in the highest concentration (18 ppm), was also found in the method blank, making its presence suspect. The upstream surface water with the greatest number of VOCs detected was SW-1, although sample SW-4 reported the highest total concentration of 18.01 ppm (total xylenes at .098 ppm).

Three SVOCs were detected in the upstream surface water sample at least once. Benzoic acid had the largest concentration at 0.038 ppm in

Acetone data rejected for MW-3S, 6D, 8D, 9I + 9S

1/27/98

sample SW-4. No PCBs or pesticides were detected in any upstream Gulf waters. Twenty metals were detected in the upstream waters. Fourteen metals were present in two or more upstream samples. Cyanide and phenol were detected in both upstream samples located in the west branch of The Gulf. The miscellaneous water quality parameters showed no discernable pattern and were within the ranges exhibited by the other surface water samples. Organic parameters (VOCs and SVOCs) in the upstream waters are similar in type and concentrations to those taken adjacent to the site. The number of SVOCs detected in downstream sample SW-9 is much greater than those found in the other surface water samples.

4.3.3 Offsite Swale Surface Waters

Two samples (SW-6 and SW-7) were taken in the waters running in a offsite swale (ditch) located northeast of the landfill. Two VOCs were detected at least once in the offsite samples, acetone at a maximum of .012 ppm, and toluene at .0009 ppm. One SVOC, bis(2-ethylhexyl)phthalate was found at .001 ppm in one sample. One pesticide compound (dieldrin at .00002 ppm) was detected at one location in the offsite waters.

Fourteen metals were detected in the swale samples. The metal concentrations are generally lower than those concentrations found in The Gulf surface waters, although the water quality parameters (COD, TSS, BOD) are within the range exhibited by The Gulf stream waters. The organics detected were fewer in number and lower in concentration than those of other surface waters.

4.3.4 Surface Waters Adjacent to the Landfill

Three surface water samples (SW-2, SW-3, and SW-5) were taken from The Gulf locations adjacent to the landfill. Five VOCs were detected at least once in these samples. Acetone registered the highest VOC concentration at 18 ppm, but is also associated with the method blanks.

Two SVOCs, benzoic acid (.006 ppm) and diethyphthalate (.001 ppm), were detected in the adjacent water samples adjacent to the landfill. The SVOCs were also present in the upstream samples. Seventeen metals present in the stream waters adjacent to the landfill were slightly higher than in the upstream samples or downstream samples. Water quality parameters were similar to those upstream.

4.3.5 Downstream Surface Waters

Three surface water samples (SW-8, SW-9, and SW-10) were collected from The Gulf downstream of the landfill and offsite swale. Three VOCs were detected in one or more samples. Acetone was detected in all three samples and registered the highest concentration (26 ppm), but the validity of this value is questionable due to associated method blank contamination. Generally, the VOCs and their concentrations are similar to the surface waters collected upstream and adjacent to the landfill. The waters from the offsite swale when compared to the downstream water had fewer VOCs detected and, for those present, were reported at lower concentrations. Nineteen SVOCs were detected in the downstream waters. Of these nineteen detections all are attributed to one sample SW-9 taken downstream of SW-8 (which is closer to the landfill). Only one SVOC (benzoic acid) was detected in all three downstream samples. This analyte was also present in samples both upstream of, and adjacent to the landfill. No pesticides or PCBs were detected in any of the downstream waters.

Sixteen metals were detected, with ten present in all three samples. The concentrations and types of metals found are similar to those recorded upstream and adjacent to the landfill. Cyanide and phenols were present in two downstream samples but at lower concentrations than were recorded upstream of the landfill. Water quality parameters were within the ranges recorded for the other surface water samples.

4.4 Sanitary Sewer Effluent

Two samples (MW-1 and MW-2) were obtained from the sanitary sewer which runs adjacent to the landfill in The Gulf. Sample MH-1 was taken upgradient of the site. The analytes detected are given in Table 4-6. Three VOCs were detected including, 1,2-dichloroethene and trichloroethene (TCE) which were present in both samples. TCE had the highest VOC concentration at .035 ppm.

Six SVOCs were detected in the sewer samples. Four SVOCs were present in both the upgradient and downgradient samples. Bis(2-ethylhexyl)phthalate recorded the highest concentration of .045 ppm but was also found in the method blank thereby making the value questionable. Highest SVOC concentrations were reported in the upstream sewer sample (.054 ppm). No pesticides or PCBs were detected in the samples. Thirteen metals were detected in both up and downgradient samples, as was total phenols.

No obvious trend was observed between up and downgradient samples. The analytes present are similar to those found in the other surface water samples.

4.5 Groundwater

Thirty-four groundwater samples were taken from nineteen groundwater wells. Fifteen wells which were installed during previous investigations or during the first phase of the RI were sampled twice. Wells MW-12I, MW-12D, and MW-10D were sampled only once. All wells were given the prefix MW and a suffix of S for shallow, I for intermediate, and D for deep.

TABLE 4-6
TARGET COMPOUND ANALYTES PRESENT IN SANITARY SEWER

maximum number of detections possible (#)			UPSTREAM SEWER		DOWNSTREAM SEWER	
			# OF DETECTIONS (1)	CONCENTRATION	# OF DETECTIONS (1)	CONCENTRATION
PARAMETERS	TYPES	UNITS				
ACETONE	VOC	ppb	1	14		
1,2-DICHLOROETHENE (TOTAL)	VOC	ppb	1	25	1	19
TRICHLOROETHENE	VOC	ppb	1	12	1	35
TOTAL VOLATILES	VOC	ppb	1	51	1	54
1,4-DICHLOROBENZENE	SEMI	ppb			1	0.4 J
BENZOIC ACID	SEMI	ppb	1	3 J	1	2 J
DIETHYPHTHALATE	SEMI	ppb	1	1 J	1	1 J
DI-N-BUTYLPHTHALATE	SEMI	ppb	1	2 J		
BUTYLBENZYLPHTHALATE	SEMI	ppb	1	3 J	1	2 J
BIS(2-ETHYLHEXYL)PHTHALATE	SEMI	ppb	1	45 B	1	26 B
TOTAL SEMIVOLATILES	SEMI	ppb	1	54	1	31.4
ALUMINUM	METALS	ppb	1	210	1	221
ARSENIC	METALS	ppb	1	1.3 B	1	1.1
BARIUM	METALS	ppb	1	43.4 B	1	46.7
CALCIUM	METALS	ppb	1	56100	1	64000
COPPER	METALS	ppb	1	29.5	1	30.2
IRON	METALS	ppb	1	487	1	700
LEAD	METALS	ppb	1	9.9	1	10
MAGNESIUM	METALS	ppb	1	14600	1	17600
MANGANESE	METALS	ppb	1	57.6	1	80.8
POTASSIUM	METALS	ppb	1	12100	1	7750
SELENIUM	METALS	ppb	1	1.4 B	1	1.0 B
SODIUM	METALS	ppb	1	97500	1	133000
ZINC	METALS	ppb	1	93	1	83.1
PHENOLS	MISC.	ppm	1	0.078	1	0.028

J - Indicates Result is less than quantitation limit but greater than zero.

B - Indicates result is less than quantitation limit but greater than instrument detection limit.

The designation S has been assigned to all the monitoring wells screened in the first water bearing zone. This zone is in the unconsolidated (overburden) material and represents the water table (unconfined) aquifer. These wells were subdivided for evaluation into upgradient (MW-1S) and downgradient (MW-7S, MW-2S, MW-3S, MW-4S, MW-5S and MW-9S) wells based on their hydrologic position relative to the landfill.

The designation I was assigned to those monitors which were completed in the second water bearing zone. These intermediate wells are screened in three different bedrock units which lie directly below overburden and include from southeast to northwest, the Rochester, Rockway and Grimsby Formations.

Five of the eight intermediate wells monitoring fractures in the Rochester formation at elevations above the landfill (MW-1I, MW-6I, MW-8I, MW-10I and MW-12I) were considered upgradient of the site. Of the three monitoring wells downgradient of the landfill (MW-2I, MW-5I, and MW-9I) MW-5I installed in the Grimsby was presented separately to assess upward gradient effects on water quality at that location.

The deep wells are all completed in the Irondequoit formation which is conformitively overlain by the Rochester shale. All of the deep wells, with the exception of MW-12D, are located east of the site above the landfill. The hydraulic position of the uplying wells (MW-1D, MW-6D, MW-8D, MW-10D and MW-11D) cannot, however, be identified with certainty based on the current hydrogeologic data. Well MW-12D is installed below the western fill area and is considered downgradient of the site.

The analytical results for all wells have been summarized in Table 4-7. Complete listing of analytical results for individual wells can be found in Appendix M.

TABLE 4 – 7
GROUNDWATER MONITORING WELLS
NUMBER OF DETECTIONS AND MAXIMUM CONCENTRATIONS
LOCKPORT CITY LANDFILL

			WATER TABLE SHALLOW WELLS UPGRADIENT MW-1S		WATER TABLE SHALLOW WELLS DOWNGRADIENT MW-2S, MW-3S, MS-4S, MW-5S, MW-7S, MW-9S		SECOND WATER-BEARING ZONE INTERMEDIATE WELLS UPGRADIENT MW-1I, MW-6I, MW-8I, MW-10I, MW-12I (ROCHESTER FRM)		SECOND WATER-BEARING ZONE INTERMEDIATE WELLS DOWNGRADIENT MW-2I, MW-9I (ROCKWAY FRM)		SECOND WATER-BEARING ZONE INTERMEDIATE WELLS DOWNGRADIENT MW-5I (GRIMSBY FRM)		DEEP WATER-BEARING ZONE IRONDEQUOIT WELLS UPGRADIENT MW-6D, MW-8D, MW-10D MW-11D, MW-12D	
maximum number of detections possible (#)			# OF DETECTIONS (2)	MAXIMUM CONCENTRATION	# OF DETECTIONS (12)	MAXIMUM CONCENTRATION	# OF DETECTIONS (8)	MAXIMUM CONCENTRATION	# OF DETECTIONS (4)	MAXIMUM CONCENTRATION	# OF DETECTIONS (2)	MAXIMUM CONCENTRATION	# OF DETECTIONS (9)	MAXIMUM CONCENTRATION
PARAMETERS	TYPES	UNITS												
VINYL CHLORIDE	VOC	ppb	0		1	4 J	0		2	12	0		2	81
METHYLENE CHLORIDE	VOC	ppb	0		0		1	2 J	0		0		R/2	15 J
ACETONE	VOC	ppb	0		R\2	16	2	16 B	R/1	5 J	0		R/1	340 B
1,2-DICHLOROETHENE	VOC	ppb	0		3	9	0		3	21	0		2	790
CHLOROFORM	VOC	ppb	0		0		1	4 J	0		0		0	
TRICHLOROETHENE	VOC	ppb	0		0		0		0		0		2	130
BENZENE	VOC	ppb	0		R\2	3 J	1	3 J	0		0		0	
TOLUENE	VOC	ppb	0		0		1	8	0		0		0	
CHLOROBENZENE	VOC	ppb	0		2	2 J	0		0		0		0	
ETHYLBENZENE	VOC	ppb	0		1	1 J	0		0		0		0	
TOTAL XYLENES	VOC	ppb	0		2	6	1	4 J	1	3 J	0		0	
TOTAL VOLATILES		ppb	0		6	32	2	35	3	37	0		3	1016

R\1 – Rejected parameter \ number of detections

B – Method Blank Contamination

Shading – Detection not verified in two rounds of sampling or rejected bue to blank contamination.

J – Indicates the result is less than the sample quantitation limit but greater than zero.

TABLE 4 – 7 (cont.)
GROUNDWATER MONITORING WELLS
NUMBER OF DETECTIONS AND MAXIMUM CONCENTRATIONS
LOCKPORT CITY LANDFILL

maximum number of detections possible (#)			WATER TABLE SHALLOW WELLS UPGRADIENT MW-1S		WATER TABLE SHALLOW WELLS DOWNGRADIENT MW-2S, MW-3S, MS-4S, MW-5S, MW-7S, MW-9S		SECOND WATER-BEARING ZONE INTERMEDIATE WELLS UPGRADIENT MW-1I, MW-6I, MW-8I, MW-10I, MW-12I (ROCHESTER FRM)		SECOND WATER-BEARING ZONE INTERMEDIATE WELLS DOWNGRADIENT MW-2I, MW-9I (ROCKWAY FRM)		SECOND WATER-BEARING ZONE INTERMEDIATE WELLS DOWNGRADIENT MW-5I (GRIMSBY FRM)		DEEP WATER-BEARING ZONE IRONDEQUOIT WELLS UPGRADIENT MW-6D, MW-8D, MW-10D MW-11D, MW-12D	
			# OF DETECTIONS (2)	MAXIMUM CONCENTRATION	# OF DETECTIONS (12)	MAXIMUM CONCENTRATION	# OF DETECTIONS (8)	MAXIMUM CONCENTRATION	# OF DETECTIONS (4)	MAXIMUM CONCENTRATION	# OF DETECTIONS (2)	MAXIMUM CONCENTRATION	# OF DETECTIONS (9)	MAXIMUM CONCENTRATION
PARAMETERS	TYPES	UNITS												
BENZOIC ACID	SEMI	ppb	0		1	2 J	1	1 J	1	1 J			1	4
ACENAPTHENE	SEMI	ppb	0		1	0.4 J								
DIETHYLPHTHALATE	SEMI	ppb	0		R/1	0.5 J	3	5 J			R/1	1 J		
PHENANTHRENE	SEMI	ppb	0		2	3 J								
ANTHRACENE	SEMI	ppb	0		2	0.9 J								
DI-N-BUTYLPHTHALATE	SEMI	ppb	0		R/2	8 J	1	4 J	1	2 J			3	4 J
FLUORANTHENE	SEMI	ppb	0		4	5 J	2	4 J	1	0.3 J				
PYRENE	SEMI	ppb	0		3	3 J	2	2 J						
BUTYLBENZYLPHTHALATE	SEMI	ppb	0		5	1 J	1	4 J	2	1 J	1	0.6 J		
BENZO(A)ANTHRACENE	SEMI	ppb	0		2	2 J								
CHRYSENE	SEMI	ppb	0		2	2 J								
BIS(2-ETHYLHEXYL)PHTHALA	SEMI	ppb	0		R/1	9 J	1	26 B						
DI-N-OCTYLPHTHALATE	SEMI	ppb	0		5	0.9 J	2	4 J					R/3	61 B
BENZO(B)FLUORANTHENE	SEMI	ppb	0		2	1 J	1	4 J						
BENZO(K)FLUORANTHENE	SEMI	ppb	0		1	0.5 J							1	0.3 J
BENZ(A)PYRENE	SEMI	ppb	0		2	1 J								
TOTAL SEMIVOLATILES		ppb	0		8	19.5	3	28	4	2.9	1	1	6	64.3

R/1 – Rejected parameter / number of detections

B – Method blank contamination

Shading – Detection not verified in two rounds of sampling or rejected due to blank contamination.

J – Indicates the result is less than the sample quantitation limit but greater than zero

TABLE 4 – 7 (cont.)
GROUNDWATER MONITORING WELLS
NUMBER OF DETECTIONS AND MAXIMUM CONCENTRATIONS
LOCKPORT CITY LANDFILL

maximum number of detections possible (#)			WATER TABLE SHALLOW WELLS UPGRADIENT MW-1S		WATER TABLE SHALLOW WELLS DOWNGRADIENT MW-2S, MW-3S, MS-4S, MW-5S, MW-7S, MW-9S		SECOND WATER-BEARING ZONE INTERMEDIATE WELLS UPGRADIENT MW-1I, MW-6I, MW-8I, MW-10I, MW-12I (ROCHESTER FRM)		SECOND WATER-BEARING ZONE INTERMEDIATE WELLS DOWNGRADIENT MW-2I, MW-9I (ROCKWAY FRM)		SECOND WATER-BEARING ZONE INTERMEDIATE WELLS DOWNGRADIENT MW-5I (GRIMSBY FRM)		DEEP WATER-BEARING ZONE IRONDEQUOIT WELLS UPGRADIENT MW-6D, MW-8D, MW-10D MW-11D, MW-12D	
			# OF DETECTIONS (2)	MAXIMUM CONCENTRATION	# OF DETECTIONS (12)	MAXIMUM CONCENTRATION	# OF DETECTIONS (8)	MAXIMUM CONCENTRATION	# OF DETECTIONS (4)	MAXIMUM CONCENTRATION	# OF DETECTIONS (2)	MAXIMUM CONCENTRATION	# OF DETECTIONS (9)	MAXIMUM CONCENTRATION
PARAMETERS	TYPES	UNITS												
ALDRIN	PEST	ppb	0		0									
DELTA-BHC	PEST	ppb			1	0.01 J	0		1	0.2 J				
TOTAL PESTICIDES					1	0.01			1	0.2				
AROCLOR - 1248	PCB	ppb			1	1.1 J								
AROCLOR - 1254	PCB	ppb			1	0.14 J								
TOTAL PCBs					2	1.24								

Shading – Detection not verified in two rounds of sampling or rejected due to blank contamination.

J – Indicates the result is less than the sample quantitation limit but greater than zero.

TABLE 4 – 7 (cont.)
GROUNDWATER MONITORING WELLS
NUMBER OF DETECTIONS AND MAXIMUM CONCENTRATIONS
LOCKPORT CITY LANDFILL

			WATER TABLE SHALLOW WELLS UPGRADIENT MW-1S		WATER TABLE SHALLOW WELLS DOWNGRADIENT MW-2S, MW-3S, MS-4S, MW-5S, MW-7S, MW-9S		SECOND WATER-BEARING ZONE INTERMEDIATE WELLS UPGRADIENT MW-1I, MW-6I, MW-8I, MW-10I, MW-12I (ROCHESTER FRM)		SECOND WATER-BEARING ZONE INTERMEDIATE WELLS DOWNGRADIENT MW-2I, MW-9I (ROCKWAY FRM)		SECOND WATER-BEARING ZONE INTERMEDIATE WELLS DOWNGRADIENT MW-5I (GRIMSBY FRM)		DEEP WATER-BEARING ZONE IRONDEQUOIT WELLS UPGRADIENT MW-6D, MW-8D, MW-10D MW-11D, MW-12D	
maximum number of detections possible (#)			# OF DETECTIONS (2)	MAXIMUM CONCENTRATION	# OF DETECTIONS (12)	MAXIMUM CONCENTRATION	# OF DETECTIONS (8)	MAXIMUM CONCENTRATION	# OF DETECTIONS (4)	MAXIMUM CONCENTRATION	# OF DETECTIONS (2)	MAXIMUM CONCENTRATION	# OF DETECTIONS (9)	MAXIMUM CONCENTRATION
PARAMETERS	TYPES	UNITS												
ALUMINUM	METALS	ppm	0		11	80300	8	1160	5	29400	2	419	6	6180
ANTIMONY	METALS	ppm	0		2	36	0		2	28.6	1	27.5	3	43
ARSENIC	METALS	ppm	1	2.6	9	60.5	1	5.8 B	4	53.8	2	9.7	6	15.5
BARIUM	METALS	ppm	2	161	12	567	3	1073	5	107	2	341	8	744 E
BERYLLIUM	METALS	ppm	0		1	1.5	0		0		0		0	
CALCIUM	METALS	ppm	2	115000	12	211000	8	631000	5	631000	2	200000	8	93800000
CHROMIUM	METALS	ppm	1	44.2	7	44	5	1560	2	38	1	14	6	203
COBALT	METALS	ppm	0		4	102	0		1	7.3	0		3	11.6
COPPER	METALS	ppm	1	25.6	6	130	1	61.3	4	76.6	0		4	36
IRON	METALS	ppm	2	44100	12	26300	7	4960	5	25500	2	3520	8	7500
LEAD	METALS	ppm	2	122	9	721	5	7.3	4	194	1	1.5	5	120
MAGNESIUM	METALS	ppm	2	30700	12	99000	7	47700	5	140000	2	65000	8	3900000
MANGANESE	METALS	ppm	2	2990	12	2170	6	104	5	1670	2	1820	8	846 E
MERCURY	METALS	ppm	0		5	0.6	2	0.4	0		0		1	0.2
NICKEL	METALS	ppm	0		6	124	2	758	2	37.1	0		8	108
POTASSIUM	METALS	ppm	2	3080	12	95200	7	33100	5	100000	2	25000	8	559000
SILVER	METALS	ppm	0		2	25.5	0		2	11	1	9.1	1	11 B
SODIUM	METALS	ppm	2	51000	12	225000	7	78300	5	1300000	2	91700	8	33900000
VANADIUM	METALS	ppm	1	3.6	4	13.7	3	4.4	2	18.4	0		3	11.4 B
ZINC	METALS	ppm	2	16600	12	5650	7	3260	5	645	2	113	7	489
CYANIDE	MISC.	ppm											0	
PHENOL	MISC.	ppm			1	0.007			1	0.009			3	0.131

E – Estimated due to interference.
B – Less than quantitation limit but greater than or equal to instrument detection limit.

4.5.1 Water Table Aquifer (Shallow Wells)

The seven wells completed in the water table aquifer have been divided into two groups, upgradient (MW-1S) and downgradient (MW-2S, MW-3S, MW-4S, MW-5S, MW-7S and MW-9S). All wells have been subjected to two rounds of sampling and analysis.

In the upgradient well, no VOCs, SVOCs, pesticides, PCBs, cyanide or phenols were detected. Thirteen metals were present in the upgradient well. All thirteen metals were also found in the downgradient wells. Calcium, chromium, iron, manganese and zinc were reported at higher concentrations in the upgradient well than in the downgradient wells.

In the six shallow downgradient wells, seven VOCs were detected. Of these seven detections, six VOC detections are questionable due to method blank contamination or confirmation by only one round of sampling. 1,2-dichloroethene was detected most frequently with three detections in two wells (MW-3S and MW-9S) and is the only VOC found above sample quantitation limits and not in the method blanks as well as being confirmed by two rounds of sampling. The highest concentration for any VOC encountered in the downgradient samples was acetone (.016 ppm); however, the presence of this analyte in the groundwater is questionable as it is a common laboratory contaminant. The highest total concentration of VOC for these wells is .032 ppm in MW-9S.

Sixteen SVOCs were detected during the first round of sampling. Most of these first round detections were present in two wells MW-2S and MW-9S. All of these detections were at concentrations below the quantitation limit and were all less than .008 ppm. None of the SVOCs detected in the first round samples was confirmed by the second round. Therefore, all the SVOC detections are questionable. If a conservative approach is used, butylbenzylphthalate and di-n-octylphalates were the parameters detected most frequently. Bis(2-ethylhexyl)phthalate recorded

the highest concentration of any SVOC at .009 ppm but was also present in the method blank. The highest total SVOC concentration is .020 ppm in MW-2S.

Two pesticides, delta-BHC (.0001 ppm) and aldrin (.002 ppm) were detected in first-round sampling, but were not confirmed in the second round of sampling. Two questionable detections of PCBs (aroclor-1248 at .0011 ppm and aroclor-1254 at .00014 ppm) were detected in well MW-9S during the first round of sampling but were not found in the second round. PCBs were not detected in any other groundwater sample.

Twenty metals were detected at least once in the downgradient wells. Eight metals were detected in both rounds and in all six of the downgradient water table wells. Thirteen metals that were detected in the upgradient samples were also found in the downgradient samples. Of these thirteen, five metals were recorded at higher concentrations in the upgradient wells. Sodium was recorded at the highest concentration of any metal in the downgradient samples. Cyanide was not detected in any downgradient samples, and phenols were detected in one well but in only one round.

With the exception of 1,2-dichloroethene (at .009 ppm), no other organic compound was confirmed in more than one round of sampling in the shallow groundwater samples. More metals were identified in the downgradient samples, but at generally lower concentration than in the upgradient sample.

4.5.2 Second Water Bearing Zone (Intermediate Wells)

The second water bearing zone present at the site is monitored by wells screened in three different lithologic/stratigraphic units. These units are the Rochester Formation (the first rock unit encountered upgradient of the fill areas), the Rockway Formation (the first rock unit

encountered northwest and downgradient of the fill, adjacent to The Gulf) and the Grimsby Formation (the first rock unit encountered downgradient to the fill and north of the site adjacent to The Gulf). The samples from these intermediate wells were divided into three groups, based upon the lithologic unit in which the wells are screened.

The wells which were assigned to the Rochester Formation upgradient group are MW-1I, MW-6I, MW-8I, MW-10I and MW-12I. These wells were considered upgradient due to their placement with respect to the landfill, although horizontal flow is away from the eastern margin of the site and will most likely discharge to the overburden at the site. MW-2I and MW-9I were assigned to the Rockway Formation downgradient group. Well MW-5I was also analyzed in a separate downgradient group because it is the only well which monitors the Grimsby Formation and demonstrated a fairly consistent upward gradient relative to the shallow monitor. Three of the five upgradient wells were sampled twice. Wells MW-10I and MW-12I were sampled only once during the second phase Remedial Investigation field activities.

In the upgradient intermediate wells, two VOCs, methylene chloride, (.002 ppm) and acetone (.010 ppm), were detected in one well (MW-10I). Both VOCs are common laboratory contaminants, and acetone was found in the method blank. Therefore, the validity of these compounds is questionable. No second round confirmatory data is available for this sample. Well MW-12I, which was also sampled only once, had the most number of VOCs detected at five, and the highest total VOC concentration at .035 ppm. No other VOCs were detected during any round of sampling in the remaining three upgradient intermediate wells.

Eight SVOCs were detected in the upgradient intermediate samples. All detections except for diethylphthalate are suspect because of either method blank contamination or lack of second round confirmation. All of the SVOC detections were encountered in the first round sample obtained from well MW-6I. Diethylphthalate was present in both samples taken from

MW-6I and had a maximum concentration of .005 ppm. No pesticides or PCBs were detected in any samples from this group.

Thirteen metals were present of which seven were detected in the upgradient wells during both sampling events. No cyanide or phenols were detected in any well during either sampling event.

In general, the number of individual analytes detected in the intermediate upgradient wells were greater in number and concentration than those encountered in upgradient shallow well MW-1S. No obvious pattern or distribution of analytes was observed within the upgradient intermediate wells.

The three downgradient intermediate wells were each sampled twice. Four VOCs were detected at least once but only vinyl chloride (.012 ppm) and total 1,2-dichloroethene (.021 ppm) are considered valid detections (second round confirmation and absence of method blank contamination). Vinyl chloride and 1,2-dichloroethene were detected twice in well MW-9I. 1,2-dichloroethene was detected only once at well MW-2I (at .001 ppm). The highest total concentration of VOCs in the downgradient intermediate wells was .037 ppm in MW-9I.

Five SVOCs were present in downgradient wells; however, none of these SVOCs were confirmed in more than one round of sampling. All SVOC detections were below the quantitation limit. The highest total of SVOCs in downgradient wells was .002 ppm in MW-9I. MW-9I had the largest number of SVOC's detected, and the pesticide, aldrin at .0002 ppm, was detected during the first round sampling of well MW-9I. No PCBs were detected in any well. Eighteen metals were detected in the downgradient wells with eight metals found in all wells during both sampling events. No cyanides were present in the downgradient wells and phenols were detected at .009 ppm in well MW-2I.

Of the three downgradient intermediate wells, MW-5I is the only well completed in the Grimsby Formation. In two rounds of sampling at MW-5I, there were no VOCs detected, a maximum total SVOC concentration of .001 ppm, no pesticides or PCBs, generally fewer detections of metals than in the Rockway Formation, and no cyanide or phenols.

The intermediate wells directly west of the landfill, completed in the Rockway, detected more analytes than the intermediate Grimsby well located further north near The Gulf. As a group, however, the intermediate wells tended to report fewer analytes than both the shallow downgradient, or the deeper uplying wells in the Irondequoit formation.

4.5.3 Third Water Bearing Zone (Irondequoit Wells)

The five deep wells (MW-6D, MW-8D, MW-10D, MW-11D, and MW-12D) are completed in the Irondequoit formation at surface elevations above the landfill. Three wells, MW-6D, MW-8D and MW-10D, were sampled twice, and MW-11D and MW-12D were sampled once.

Five VOCs were detected at least once in the Irondequoit wells. Three VOCs, vinyl chloride, 1,2-dichloroethene and trichloroethene, were detected during both rounds of sampling in well number MW-8D. This well had the highest number and concentration of confirmed VOCs of any well in any group. The highest total VOCs concentration was 1.016 ppm in MW-8D.

The only SVOC's to be confirmed in two rounds of sample results are di-n-butylphthalate (MW-6D and MW-8D) and diethylphthate (MW-8D). All concentrations were below the quantitation limit. The highest total SVOCs concentration for the deep water bearing zone was 0.064 ppm in MW-6D. No pesticides or PCBs were detected in the deep wells. Eighteen metals were detected in the Irondequoit wells. Of these, seven were present in all wells during both sampling events. No cyanide was found and total phenols were detected in three wells with the highest concentration of 0.013 ppm.

Monitoring wells screened within the Irondequoit had the highest concentration of VOC's detected at the site. Individual SVOCs and metals identified in the deep wells were similar to those encountered in the other water bearing zones.

4.6 Potential Sources of Chemical Constituents

Several potential sources of contamination may be contributing chemical compounds detected in media samples collected around the Lockport City Landfill. In addition to the fill materials disposed of during landfill operations, other unidentified sources typical of similar urban industrial environments are apparently contributing analytes to the various investigation media.

The fill material associated with the landfill was placed by probable end-dumping into pre-existing drainage features and subsequently graded and covered. This material was found to occur in two areas separated by the Somerset railroad which predated filling operations. Samples of the landfill material and underlying soil indicate that the chemical composition of the two fill areas are similar and composed mainly of SVOCs (PAHs and phalates) with a maximum SVOC concentration of 220 ppm in subsurface samples. PCBs were also encountered in most surface fill samples with a maximum detection of 43 ppm. Metals were detected in both offsite and onsite soils. Metal concentrations were generally higher in onsite soils than in offsite soil.

Offsite sources of contamination were apparent in offsite soil, and upstream surface water and sediment samples. In addition, several compounds not found in the fill material, including: vinyl chloride; 1,2-dichloroethene; chloroform; trichloroethene; and benzene, where detected in perimeter groundwater and seep samples. Many of the analytes found in soil and groundwater samples around the landfill were also found in upstream water and sediment samples, often at higher concentrations.

Other compounds including PCBs were found associated with the sanitary sewer line adjacent to the site, and pesticides were detected in offsite samples.

In summary, with the exception of SVOCs (PAHs and phalates) and low level PCBs, both of which are relatively immobile in soils, no other significant types of contaminants have been associated with the fill. Furthermore, background data suggests offsite sources of contamination exist upstream and possibly upgradient of this site.

5.0 FATE AND TRANSPORT OF CONTAMINATION

In order to assess the fate and transport of contamination in groundwater and air at the Lockport City Landfill a series of environmental models were performed. This section reports the findings of hand calculated environmental models. The models were computed for the following: groundwater flow, solute (chemical) transport in groundwater and wind erosion. The calculations used in these models are found in Appendix N.

5.1 Groundwater Flow Model

To develop a groundwater flow model representative of the existing condition at the Lockport City Landfill site, an analytical 1-Dimensional, steady state approach was used. The model was based on URS field observations and measurements conducted during the Remedial Investigation. The model utilizes the water levels as recorded for wells, well points, piezometers and stream gauges during the second phase of Remedial Investigation from 2/21/91 to 4/26/91.

The main objective of the groundwater flow model was to determine the directions and quantities of flows through various aquifers present on site. Since the utilized water levels were recorded during the Spring season, the calculated flows are considered to be above average and provide a conservative estimate.

5.1.1 Approach

A steady state, 1-Dimensional analytical model was utilized. The site was represented by three cross sections, based on the hydrogeological data provided by the RI. Flow through each of the layers within a cross section was calculated using the appropriate groundwater flow equations.

The resulting 2-dimensional flows were multiplied by lengths tributary to the cross sections in order to obtain a 3-dimensional flows.

5.1.2 Groundwater Model Assumptions

o Hydrogeology

Six hydrogeologic units were identified on sister. They include:

- fill - mostly municipal waste
- overburden soil - clayey silt
- Rochester Shale
- Irondequoit Limestone
- Rockaway Dolostone
- Grimsby Sandstone

The hydrogeologic properties for each of these units are summarized below based on the results of the RI.

o Fill

The fill material encountered on site consists mostly of municipal waste and construction/demolition debris in a matrix of native soils: silt, clay, sand and gravel. The thickness of the fill layer ranges from 0 to 30 feet and decreases along the slope of The Gulf and to the north. Fill in general is considered fairly permeable. The measured values of hydraulic conductivity averaged 7.4E-3 cm/sec. The saturated thicknesses of the fill layer vary from 0 to about 25 feet.

o Overburden Soil

This layer is composed primarily of silts and clay with varying admixtures of sand and gravel. Its thickness ranges from 2 feet to 20 feet, with values of 2-8 feet directly underneath the landfill area. The laboratory measurements of the vertical hydraulic conductivity indicate values of about 8E-6 cm/sec. The saturated thickness ranges from 0 to about 5-10 feet.

o Rochester Shale

The Rochester Shale is approximately 60 feet of calcareous shale with limestone interbeds. It contains numerous fractures at the top and becomes more competent with depth. The unit is not continuous under the landfill area, it outcrops at the face of the cliff. The hydraulic conductivities as measured by slug and packer tests range from 2E-5 cm/sec to 6E-4 cm/sec. The groundwater flow within the Rochester Shale occurs under both confined and unconfined conditions.

o Irondequoit Limestone

This layer consists of approximately 25 feet of crinoidal limestone with some shale seams. The hydraulic conductivities as measured by slug and packer tests range from 6E-6 cm/sec to 5E-4 cm/sec. The layer appears to be well fractured at the interface with the Rochester Shale. The groundwater flow occurs under both confined and unconfined conditions. This unit outcrops at the face of the cliff or pinches out to the north.

o Rockway Dolostone

The Rockway Dolostone is a fine-grained rock with numerous shale partings. Its thickness ranges from 8 feet to 13 feet. The values of hydraulic conductivities as measured by slug and packer tests range

from 3E-4 cm/sec to 3E-3 cm/sec. The layer outcrops at the face of the cliff or pinches out to the north. It is considered to be under confined conditions.

- o Grimsby Sandstone

It is the lowest and oldest unit examined. It is reported to be 50 to 70 feet thick. The hydraulic conductivities as measured by slug and packer tests range from 2E-4 cm/sec to 1E-3 cm/sec. The layer is considered to be continuous under the entire length of the site and extend beyond The Gulf to the north. It is considered to be under confined conditions.

- o Infiltration

An infiltration of 8.16 inches/year was assumed after the RI.

- o The Gulf

The Gulf was assumed to constitute a downstream specified head condition for all three cross sections used. The water level elevations were assumed after the topographic map.

- o Areal Extent

The model was performed only for the area of the landfill, as no off-site information was available. The flows were estimated for the area between The Gulf to the north and well MW-12 to the south. The Gulf also formed a western boundary of the modeled area, with the eastern boundary determined by wells MW-8, MW-6, and MW-1.

o General Flow Regime

The flow patterns were determined based on water levels monitored in wells, well points, and piezometers during the second round of sampling from 2/21/91 to 4/26/91.

The monitoring levels indicate, that the general flow pattern is very similar for all screened layers. In the southern portion of the site the primary direction of flow is from east to west. In the northern part, approximately from the line connecting MW-3 and MW-6 the flow direction changes to from south-east to north-west.

Generally, the flow direction is perpendicular to the edge of the cliff.

The groundwater divide can be observed along the eastern boundary of the site, about 500-700 feet from the Gulf, within the Rochester Shale and Irondequoit Limestone. The water table contour maps indicate that the vertical gradients between the overburden aquifer and the Rochester Shale can vary significantly. Downward gradients prevail in uplying areas east of the site, with varied gradients developing towards the face of the cliff.

Downward gradients are present between the Rochester Shale and the Irondequoit Limestone. The vertical gradients between the Irondequoit and the Rockaway formation are hard to determine, because of the lack of monitored levels in the Rockaway.

5.1.3 Flow Quantities

Based on the hydrogeologic properties of the aquifers and the monitored water levels, the 1-dimension steady state groundwater flow model was constructed. The site was represented by three cross sections.

The hydrogeologic parameters used in the model as well as resulting flows are summarized in Table 5-1.

5.1.4 Summary of Groundwater Model Results

- A 1-D, steady state analytical groundwater model was based on the results of the RI investigation and water levels recorded during the second round 2/21/91 - 4/26/91. The hydrogeology and general flow regime are described in section 5.1.1 through 5.1.3.

- The magnitude of the horizontal flow reaching the site was estimated at about 140 GPM (27,000 Ft^3/D) and the magnitude of horizontal flow leaving the site was estimated at 81 GPM (15,600 Ft^3/D). The magnitude of the recharge through infiltration and leakage into the deeper formations were estimated at 12 GPM (2,300 Ft^3/D) and 78 GPM (15,000 Ft^3/D), respectively.

5.2 Solute Transport

In order to evaluate the potential for the offsite migration of contaminants from the Lockport City Landfill, a contaminant transport analysis was performed. The model was based on the results of the Remedial Investigation and the groundwater flow model discussed previously.

5.2.1 Approach

The model follows a step-by-step approach in attempting to trace the propagation of contaminants from the onsite fill to the private well located about 600 feet north of the landfill.

TABLE 5-1

HydroGeologic Parameters

Section AA - East to West Between Wells MW-1, MW-3

	UNIT	LAYER 1	LAYER 2	LAYER 3
Formation		OVS, Fill	RS	IL
Type		Unconf.	Unconf.	Unconf.
Upstream Boundary	ft	MW-1S 584	MW-1I 581	MW-1D 530
Downstream Boundary	ft	Gulf 505	Lay. Bot 500	Gulf 505
Kh	cm/sec	2.7E-4	1.7E-4	3.8E-5
Length of Flow	ft	460	700	700
Thickness	ft	varies	varies	25
Vertical Flow				
Upper Face	ft/day	+ 1.9E-3	+ 4.6E-3	+ 1.27E-2
Lower Face	ft/day	- 4.6E-3	- 1.27E-2	- 1.24E-2
Horizontal Flow				
Upstream	ft^3/D	952	3,612	0
Downstream	ft^3/D	0	0	140
Tributary Length	ft	700	700	700

Total Horizontal Flows:

Upstream = 952 + 3,612 + 0 = 4,564 FT^3/D

Downstream = 0 + 0 + 140 = 140 FT^3/D

OVS - Overburden Soils

RS - Rochester Shale

IL - Irondequoit Limestone

TABLE 5-1 (Continued)
HydroGeologic Parameters

Section BB - East to West Between Wells MW-6, MW-2

	UNIT	LAYER 1	LAYER 2	LAYER 3
Formation		OVS, Fill	RS	IL
Type		Unconf.	Unconf.	Unconf.
Upstream Boundary	ft	MW-1S 584	MW-1I 581	MW-6D 509.5
Downstream Boundary	ft	Gulf 505	Lay. Bot 500	Gulf 490
Kh	cm/sec	2.7E-4	1.74-4	1.4E-4
Length of Flow	ft	460	650	650
Thickness	ft	varies	varies	20
Vertical Flow				
Upper Face	ft/day	+ 1.9E-3	+ 4.6E-3	+ 1.27E-2
Lower Face	ft/day	- 4.6E-3	- 1.27E-2	- 1.24E-2
Horizontal Flow				
Upstream	ft^3/D	1,496	15,840	132
Downstream	ft^3/D	0	10,120	319
Tributary Length	ft	1,100	1,100	1,100

Total Horizontal Flows:

Upstream = 1,496 + 15,840 + 132 = 17,468 FT^3/D

Downstream = 0 + 10,120 + 319 = 10,439 FT^3/D

OVS - Overburden Soils
RS - Rochester Shale
IL - Irondequoit Limestone

TABLE 5-1 (Continued)

Hydrogeologic Parameters

Section CC - Southeast to Northwest Between Wells MW-8, MW-5

	UNIT	LAYER 1
Formation		Fill, OVS, RK
Type		
Upstream Boundary	ft	assumed 505
Downstream Boundary	ft	MW-5S 472
Kh	cm/sec	9.5E-4
Length of Flow	ft	500
Thickness	ft	varies
Vertical Flow		
Upper Face	ft/day	not used
Lower Face	ft/day	not used
Horizontal Flow		
Upstream	ft^3/day	5,040
Downstream	ft^3/day	5,040
Tributary Length	ft	1,200

Total Horizontal Flows:
Upstream = 5,040 ft^3/day
Downstream = 5,040 ft^3/day

OVS - Overburden Soils
RK - Rockaway Dolostone

- o First, the groundwater contour maps generated based on the water level measurements, are analyzed in order to determine the pathways by which contaminants can reach the private well.

- o Second, the preparation of contaminants along these pathways is traced using the analytical methods of calculations.

The analytical techniques include calculating the contaminated concentration directly underneath the site using a steady state 1-Dimensional mass balance and assessing the extent of transport towards the private well using the time of travel.

5.2.2 Determination of Contaminant Migration Pathways

The results of the groundwater flow model provided a basis for the contaminant transport model. They indicate, that the contamination of the private well can occur only through the Grimsby aquifer. This is due to the fact, that all other aquifers identified on site (overburden, Rochester shale, Irondequoit Limestone and Rockaway Dolostone) discharge either to The Gulf or on the face of the cliff. Grimsby seems to be the only geologic formation that stretches continuously underneath the site and towards the private well.

Since no hydrogeological data is available for the Grimsby aquifer, the worst case scenario was assumed. This corresponds to the vertical flows of downward directions reaching the Grimsby aquifer from the landfill and horizontal flows in Grimsby towards the private well. The well was also assumed to draw water form the Grimsby aquifer.

5.2.3 Calculation of Contaminant Concentrations

The potential migration pathways were determined in the previous section based on the results of the groundwater flow model. The

contaminant concentration along these pathways was described using the analytical techniques and utilizing the aquifer parameters obtained both the RI field investigation.

- Bedrock layers directly underneath the landfill
  As determined earlier, there is a potential for leachate from the Lockport City Landfill to enter the underlying bedrock aquifers. The vertical velocity was assumed to be equal to infiltration rate of 1.9E-3 ft/day. The contaminant concentration within the leachate was conservatively assumed to be equal to that directly in the landfill. The accumulation of the pollutant in the bedrock aquifers was modeled utilizing a 1-Dimensional steady-state mass balance approach, with the contaminated leachate treated as a distributed source over the length of 650 ft.

- Grimsby aquifer directly underneath the landfill
  As mentioned earlier, the direction of vertical flow between upper bedrock layers and Grimsby was assumed as downward, at the rate equal to the infiltration (1.9E-3 ft/day). The contaminant concentration in that vertical flow will cause the accumulation of pollutants within Grimsby underneath the landfill. This was modeled using a 1-Dimensional steady state mass balance approach, with the contaminated flow coming from the upper layers treated as a distributed source.

  The resulting concentrations in the Grimsby aquifer at the downstream end of the landfill was estimated as 3% of the contaminant concentration in the groundwater directly within the waste layer. (Reduction of 2 orders of magnitude).

- Grimsby aquifer form the downgradient end of the landfill to the private well

The direction of the horizontal flow within the Grimsby aquifer was assumed towards the private well located approximately 600 feet to the north of the landfill. Since no data was available as to the velocity of that flow, two typical values of 0.1 ft/day and 1.0 ft/day were used. The contaminant was assumed to spread only due to the effects of convection, (i.e. by being carried with the flow as a front). Based on that, the time needed to reach the private well was estimated at 1.37-13.7 years. Considering that the landfill has been operated for about 40 years, the full concentration of about 3% of that directly in the landfill is reaching the vicinity of the private well.

5.2.4 Summary of Solute Transport Model Results

Based on the results of the contaminant transport model, the following conclusions can be made:

- Contaminated groundwater form the upper layers (overburden, Rochester, Irondequoit and Rockaway) is intercepted by The Gulf; therefore, the residential well which is located on the opposite side of The Gulf is not being contaminated via those layers.

- If downward gradients are assumed between the upper layers and the Grimsby aquifer, the Grimsby is being contaminated with the leachate form the landfill. For the vertical flow magnitude equal to the infiltration and horizontal flow in Grimsby equal to the flow in the upper layers, the contamination of groundwater in Grimsby reaches 3% of that in the landfill.

- If the northward direction of the horizontal flow are assumed in Grimsby, a concentration of 3% of the amount present at the landfill ($C_{landfill}$) may reach the private well area within several years.

- This model is very conservative. The actual contamination migrating off site in the groundwater is probably several orders of magnitude less than the threat predicted by the model.

5.3 Particulate Emissions Model

The concentration of contaminants in airborne particulates was estimated using modeling techniques from Rapid Assessment of Exposure to Particulate Emission from Surface Contamination (Cowherd, 1985). As no vehicular traffic is anticipated on site, only the wind erosion emissions were modeled. The pertinent calculations can be found in Appendix N.

- Estimation of Wind Erosion Emissions: Factors influencing wind erosion of erodible material include the amount of onsite vegetative cover at the site, the amount of nonerodible elements, and climatic factors. In accordance with Cowherd, sites can be characterized by the finite availability ("limited reservoir") of erodible material or by the "unlimited reservoir" of erodible particles. For this assessment, the site is considered a limited reservoir, since most of the site surface is impregnated with nonerodible elements (i.e., vegetation) and the estimated threshold friction velocity is above 75 cm/sec. (It should be noted that the threshold friction velocity is determined from the size distribution mode of particles in surficial soil. Since this information was not available, the mode was estimated based on the particle size distribution of subsurface soil and

a description of the surface morphology.) Chronic exposure concentrations are based on annual modeling of air emissions. The annual rate of wind erosion emissions with a "limited reservoir" is estimated by a predictive emission factor equation developed by Cowherd:

$$(1) \quad E10 = 0.83 \quad \frac{F\ P\ (U^+)\ \ (1-V)}{(PE/50)^2}$$

Where:

E10 = PM10 emission factor, i.e., the average rate of emissions of particles 10um or smaller (respirable particles) per unit area of contaminated surface (mg/m^2-hr)

F = frequency of disturbance per month

U^+ = observed (or probable) fastest mile of wind for the period between disturbances (m/s)

$P(U^+)$ = erosion potential quantity of erodible particles present on the surface prior to the onset of wind erosion (g/m^2)

V = fraction of contaminated surface area covered by continuous cover

PE = Thornwaite's Precipitation Evaporation Index used as a measure of average soil moisture content.

The emission factor for the Lockport site resulting from wind erosion is estimated at 27.6 mg/m^2-hr. The values used for determining this emission factor are summarized in Table 5-2.

TABLE 5-2

VALUES FOR DETERMINING EMISSION FACTOR (E10)

Equation Components	Value	Source[1]
F	10/month	Assumed [2]
U^+	24.1 m/s	Table 4-1[3]
$P(U^+)$	53.6 g/m^2	[4]
V	0.70	Estimated based on current site conditions
PE	110	Figure 4-2
E10	27.6 mg/m^2-hr	Equation 1

Notes:

1. Source of all values is Cowherd (1985) unless otherwise stated.

2. The number of disturbances for the worst case scenario is given by Cowherd as 30/month. For the annual average, the number was assumed as 1/3 of that for the worst case.

3. Values for closest weather station reported, i.e., Buffalo, NY.

4. $P(U^+) = 6.7\ (U^+ - U_t),\ U^+ > U_t$

$$U_t = u_* \frac{1}{0.4} \ln (z/Zo)$$

Where:

u_* = friction velocity (m/s) = 1.25 (Figure 3-4)
z = height above surface (cm) = 700 (Given)
Zo = 4 (Figure 3-6)
u_t = wind speed at height of 700 cm (m/s) = 16.1

The emission rate for the annualized model is estimated from the emission factor by:

R10 = (E10) (A) (Csoil)

Where:

R10 = emission rate of compound (mg/hr)

Csoil = concentration of compound in respirable particles assumed equal to concentration in soil (g/g)

E10 = emission factor (mg/m^2-hr)

A = surface area (m^2

The values used determining the emission rate are summarized in Table 5-3.

For the Lockport site,

R10 = 0.644 Csoil g/s

The air concentration at a receptor point results from dispersion of the emitted soil particles. Cowherd et al (1985) provides a series of previously obtained outputs from the ISCLT model for estimating dispersion. The ISCLT mode was run with average meteorological data for seven climatic regions of the United States and for a 10-m by 10-m and 100-m by 100m area sources. The outputs of these runs are the unscaled dispersion factors that are used to estimate the ambient air concentration by multiplication with a scaling factor (Q_I). Q_I is based on the emission strength (R10) and the climatic region factor (Pr):

$$Q_I = R10/Pr$$

According to Cowherd (1985), Lockport is part of Climatic Region 4, thus Pr = 0.288, and

Q_I = 2.236 Csoil g/s

o Air Dispersion Modeling - The ambient air concentration at a receptor is estimated from presolved ISCLT computer modeling runs. Cowherd et al. (1985) ran the models for the two types

TABLE 5-3

VALUES FOR DETERMINING EMISSION RATE (R10)

Equation Components	Value	Source[1]
E10	27.6 mg/m^2-hr	As determined by calculations
Csoil	Generic	
A	21 Acres (84,000 m^2)	RI Report (1)

Notes:

1. 70% of the total site area of 30 acres was assumed to be covered with the contaminated fill.

of particle emissions, for two different source areas, and for seven different climatic regions. The results of these runs are unscaled ambient air concentrations due to a unit erosion rate (f_I) or a unit mechanical emission rate (f_{II}). For a specific site, the ambient air concentration is estimated by:

Respirable Concentration (X) = (Q_I) (f_I) + (Q_{II}) (f_{II})
For the Lockport site, Q_{II} = 0 (no vehicular traffic assumed) Unscaled ambient air concentration utilized for long-term dispersion modeling of this site assumed a 100m x 100m source and a downwind receptor distance of 100m, south of the site. The respective value of f_r was obtained by extrapolation and was equal to 4,000 ms/m^3. Based on that and the Q_I scaling factor of 2.236 Csoil g/s, the respirable concentrations at the receptor point of any given contaminant are : X = 8.944 Csoil mg/m^3 and are summarized in Table 5-4.

TABLE 5–4

RESPIRABLE CONTAMINATION CONCENTRATIONS

(at the nearest receptor point)

LOCKPORT CITY LANDFILL SITE

PARAMETERS	CONCENTRATION IN SOIL	CONCENTRATION IN SOIL	RESPIRABLE CONCENTRATION AT THE RECEPTOR
	[ug/kg]	[dimensionless]	[μg/m^3]
Carbon Disulfide	5.31E+00	5.31E-09	4.75E-08
Chloroform	1.00E+00	1.00E-09	8.94E-09
2-Butanone	1.00E+00	1.00E-09	8.94E-09
Ethylbenzene	6.59E+00	6.59E-09	5.89E-08
Xylenes (total)	4.15E+01	4.15E-08	3.71E-07
Benzoic Acid	4.65E+02	4.65E-07	4.16E-06
Napthalene	1.12E+03	1.12E-06	1.00E-05
2-Methylnaphthalene	4.89E+02	4.89E-07	4.38E-06
Dimethylphthalate	9.21E+02	9.21E-07	8.24E-06
Acenaphthylene	3.55E+02	3.55E-07	3.18E-06
Acenaphthene	8.21E+02	8.21E-07	7.34E-06
Dibenzofuran	6.13E+02	6.13E-07	5.48E-06
Diethylphthalate	6.30E+01	6.30E-08	5.63E-07
Fluorene	6.22E+02	6.22E-07	5.57E-06
Pentachlorophenol	3.40E+03	3.40E-06	3.04E-05
Phenanthrene	7.44E+03	7.44E-06	6.65E-05
Anthracene	8.18E+02	8.18E-07	7.31E-06
Di-n-butylphthalate	2.06E+03	2.06E-06	1.84E-05
Fluoranthene	5.74E+03	5.74E-06	5.13E-05
Pyrene	8.97E+03	8.97E-06	8.02E-05
Butylbenzylphthalate	2.60E+02	2.60E-07	2.33E-06
Benzo(a)anthracene	4.21E+03	4.21E-06	3.76E-05
Chrysene	4.90E+03	4.90E-06	4.38E-05
Bis(2-ethylhexyl)phthalate	1.45E+04	1.45E-05	1.30E-04
Di-n-octylphthalate	2.60E+02	2.60E-07	2.33E-06
Benzo(b)fluoranthene	4.35E+03	4.35E-06	3.89E-05
Benzo(k)fluoranthene	3.08E+03	3.08E-06	2.76E-05
Benzo(a)pyrene	4.13E+03	4.13E-06	3.69E-05
Indeno(1,2,3-cd)pyrene	2.71E+03	2.71E-06	2.42E-05

TABLE 5–4 (continued)

RESPIRABLE CONTAMINATION CONCENTRATIONS

(at the nearest receptor point)

LOCKPORT CITY LANDFILL SITE

PARAMETERS	CONCENTRATION IN SOIL	CONCENTRATION IN SOIL	RESPIRABLE CONCENTRATION AT THE RECEPTOR
	[ug/kg]	[dimensionless]	[μg/m^3]
Dibenz(a,h)anthracene	8.80E+02	8.80E-07	7.87E-06
Benzo(g,h,i)perylene	1.36E+03	1.36E-06	1.22E-05
Aldrin	4.20E+01	4.20E-08	3.75E-07
gamma-Chlordane	2.30E+02	2.30E-07	2.06E-06
Aroclor-1248	3.53E+03	3.53E-06	3.16E-05
Aroclor-1254	9.78E+02	9.78E-07	8.75E-06
Aluminum	1.61E+07	1.61E-02	1.44E-01
Antimony	1.15E+04	1.15E-05	1.03E-04
Arsenic	2.11E+04	2.11E-05	1.89E-04
Barium	3.63E+05	3.63E-04	3.25E-03
Beryllium	1.19E+03	1.19E-06	1.06E-05
Cadmium	8.48E+03	8.48E-06	7.58E-05
Calcium	1.07E+08	1.07E-01	9.60E-01
Chromium	6.32E+05	6.32E-04	5.66E-03
Cobalt	1.86E+04	1.86E-05	1.66E-04
Copper	8.00E+05	8.00E-04	7.16E-03
Iron	4.28E+07	4.28E-02	3.83E-01
Lead	2.50E+06	2.50E-03	2.24E-02
Magnesium	1.86E+07	1.86E-02	1.66E-01
Manganese	1.53E+06	1.53E-03	1.37E-02
Mercury	1.30E+03	1.30E-06	1.16E-05
Nickel	1.14E+05	1.14E-04	1.02E-03
Potassium	3.68E+06	3.68E-03	3.29E-02
Silver	4.86E+03	4.86E-06	4.34E-05
Sodium	1.37E+06	1.37E-03	1.22E-02
Vanadium	2.85E+04	2.85E-05	2.55E-04
Zinc	4.96E+06	4.96E-03	4.43E-02
Cyanide	2.59E+03	2.59E-06	2.31E-05

6.0 NEW YORK STATE STANDARDS, CRITERIA, AND GUIDANCE (SCGs)

New York State and federal standards, criteria and guidance (SCGs) for consideration during the remediation of the Lockport City Landfill are listed in Table 6-1, including location-specific, action-specific, and chemical-specific requirements. Location-specific SCGs are restrictions on remedial activities that are based on the physical characteristics of the site or its intermediate environment, such as restrictions on wetlands development.

Action-specific SCGs, controls or restrictions on particular remedial activities, will be identified when alternatives for remediation are developed. The New York State Hazardous Waste Management System (6NYCRR 370-375) provides the most pertinent action-specific requirements. Section 121 of SARA exempts onsite CERCLA activities from requiring permits; however, permit requirements are listed as SCGs as the substantive requirements of the permit conditions must be met.

Chemical-specific SCGs are listed in Tables 6-2 through 6-12 for groundwater, surface water (NYS Class D), soil and sediment. In every case, only the most stringent SCG is listed. Stream sediment criteria have been determined by the equilibrium partition method in NYSDEC Division of Fish and Wildlife's "Cleanup Criteria for Aquatic Sediments" (1989) and are presented in Table 6-11. Soil and waste standards are based on the USEPA Toxicity Characteristic Rule (40 CFR 261) and EP Toxicity (former 40 CFR 261) and are presented in Tables 6-10 and 6-11.: one sample was tested for TCLP and ten for EP Tox. The calculated values for surface water criteria have been determined by formulas in NYSDEC Division of Water Technical and Operational Guidance Series (TOGS 1.1.1, September 25, 1989) and are presented in Tables 6-6 and 6-8. Seep samples collected from groundwater surface breakout on the landfill and sewer water samples obtained from a sanitary sewer adjacent to the site were

compared against Class D surface water standards since these waters may enter The Gulf and are not elsewhere classified.

The only compounds listed in Tables 6-2 through 6-12 are those detected at levels exceeding chemical-specific SCG levels or approaching them (within one half the SCG level).

Sources and abbreviations for Tables 6-2 through 6-12:

SOURCES:

A - New York State DEC Water Quality Standards and Guidelines (TOGS 1.1.1 9/25/90)
B - Clean Water Act Guidelines
EP Tox - Former 40 CFR 261 Extraction Procedures for Toxicity
TCLP - 40 CFR 261 Toxicity Characteristic Leaching Procedure

ABBREVIATIONS:

VOC - Volatile Organic Compound
SEMI - Semivolatile Organic Compound
PST - Pesticide
MCP - Metals, Cyanide, Phenols
MISC - Miscellaneous

TABLE 6-1

STANDARDS, CRITERIA AND GUIDANCE FOR LOCKPORT CITY LANDFILL

ITEM	CITATION	DESCRIPTION	TYPE
Federal Groundwater Standards			
Safe Drinking Water Act			
Primary Drinking Water Standards	40 CFR 141	Water standards for public water supplies	Chemical-Specific
Secondary Drinking Water	40 CFR 143	Water standards for public water supplies	Chemical-Specific
Clean Water Act		Water quality standards for drinking water	Chemical-Specific
RCRA	40 CFR 264	Groundwater monitoring requirements	Action-Specific
New York State Groundwater Standards			
NYSDEC Groundwater Quality Standards	TOGS 1.1.1 September 25, 1990	Groundwater standards and guidelines for NYS groundwater	Chemical-Specific
	6NYCRR Parts 701, 703.5 revised 9/1/91	Groundwater standards	Chemical Specific
NYSDOH MCLs, Public Water Supplies	10 NYCRR Subpart 5-1	Water standards for drinking water Maximum Contaminant Levels	Chemical-Specific
NYSDOH Standards, Sources of Water Supplies	10 NYCRR 170	Water standards for water supply sources	Chemical-Specific
Standards for Owners and Operators of Hazardous Waste TSD Facilities	6 NYCRR Parts 360 and 373	Site closure and groundwater monitoring	Action-Specific

Table 6-1 (Cont'd.)

STANDARDS, CRITERIA AND GUIDANCE FOR LOCKPORT CITY LANDFILL

ITEM	CITATION	DESCRIPTION	TYPE
Federal Surface Water Standards			
Clean Water Act	40 CFR 304	Water quality standards for fish consumption and protection of aquatic life	Chemical-Specific
Regulation of Activities Affecting Water of the US	33 CFR 320-329	Corps of Engineers Regulations for wetlands and navigable waters	Action-Specific
Executive Order on Protection of Wetlands	Order #11990 40 CFR 6 Appendix A	Required for consideration during remedial actions that may impact wetlands	Location-Specific
Executive Order on Floodplain Management	Order #11988 40 CFR 6 Appendix A	Required for consideration of remedial actions that impact floodplains	Location-Specific
Fish and Wildlife			
Coordination Act Improvement Act Conservation Act	16 USC 661 16 USC 742 16 USC 2901	Regulates remedial actions that may affect wetlands	Location-Specific
New York State Surface Water Standards			
NYSDEC Surface Water Quality Standards	T.O.G.S. 1.1.1 9/25/90	Surface water standards and guidelines	Chemical-Specific
	6 NYCRR 701	Standards and guidelines for surface water quality	Chemical-Specific
SPDES		Discharge of treatment system effluent	Action-Specific
Health-based standards for surface water		Health Risk Assessment performed during RI	Chemical Specific

Table 6-1 (Cont'd.)

STANDARDS, CRITERIA AND GUIDANCE FOR LOCKPORT CITY LANDFILL

ITEM	CITATION	DESCRIPTION	TYPE
Federal Soil Standards			
Toxicity Characteristic Rule	Toxicity Characteristic Rule 40 CFR 261	Regulations for Classification of Hazardous Waste	Chemical-Specific
RCRA	40 CFR 264	For treatment, storage, disposal of RCRA wastes	Action-Specific
New York Soil Standards			
Method of partition coefficients and toxicity data for subsurface soil		Using NYS Class GA groundwater standards and the partition coefficient method to calculate the equilibrium concentration of a compound in soil	Chemical-Specific
Health-Based Standards for surficial soil		Health Risk Assessment performed during RI	Chemical-Specific
Standards for Owners and Operators of Hazardous Waste TSD Facilities	6 NYCRR Parts 360 and 373	Site closure	Action-Specific
Federal Sediment Standards			
Clean Water Act	40 CFR 230.10 CWA Section 404	Provides protection of wetlands and other aquatic habitats; discusses disposal of dredged material	Location-specific, Action-Specific
Army Corps of Engineers		Evaluates permit applications for above	Action-Specific
USEPA		Evaluates permit applications for above	Action-Specific

Table 6-1 (Cont'd.)

STANDARDS, CRITERIA AND GUIDANCE FOR LOCKPORT CITY LANDFILL

ITEM	CITATION	DESCRIPTION	TYPE
New York State Sediment Standards			
NYSDEC Division of Fish & Wildlife Sediment Criteria	Sediment Criteria guidance document December 1989	Sediment criteria formula may be appropriate for developing cleanup levels	Chemical-Specific
Federal Air Standards			
Clean Air Act			Action-Specific
National Ambient Air Quality Standards	40 CFR 50	Air Standards	Chemical- Specific
National Emissions Standards for Hazardous Air Pollutants	40 CFR 61	For asbestos and wet dust, beryllium, vinyl chloride, benzene, etc. Includes standards for tank storage.	Chemical-Specific, Action-Specific
New York State Air Standards			
Division of Air	6 NYCRR Part 200, 201, 211, 212, 257	Division of air general provisions permits and certificates and air quality standard	Chemical-Specific, Action-Specific
Division of Air	Air Guide 1	Guidelines for control of toxic ambient air contaminants	Action-Specific
Health-based standards for air		Health Risk Assessment performed by RI	Chemical-Specific

Table 6-1 (Cont'd.)

STANDARDS, CRITERIA AND GUIDANCE FOR LOCKPORT CITY LANDFILL

ITEM	CITATION	DESCRIPTION	TYPE
Additional Federal Considerations			
OSHA	29 CFR 1904 1910 1226	Worker safety at hazardous waste sites	Action-Specific
Standards applicable to generators of hazardous waste	40 CFR 262	Waste excavation, removal, treatment and disposal	Action-Specific
Standard applicable to transporters of hazardous waste	40 CFR 263	For transporters of hazardous waste	Action-Specific
Land disposal restrictions	40 CFR 268	Treatment standards for final deposition of hazardous wastes	Action-Specific
Additional New York State Considerations			
Waste Transporter Permits	6 NYCRR Part	For transporters of hazardous waste	Action-Specific
Hazardous Waste Manifest System	6 NYCRR Part 372	For generators, transporters, and facilities	Action-Specific
Hazardous Waste TSD facilities	6 NYCRR Part 373	For treatment, storage, and disposal facilities	Action-Specific

TABLE 6-2
LOCKPORT CITY LANDFILL
GROUNDWATER ANALYTICAL RESULTS AND SCGs
OVERBURDEN MONITORING WELLS

SAMPLE-ID		MW-1S(a)		MW-2S		MW-3		MW-4S		MW-5S		MW-7S		MW-9S		SCG	SOURCE
ROUND		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd		
PARAMETER	TYPE																
VINYL CHLORIDE	VOC														4 J	2	A
1,2-DICHLOROETHENE (TOTAL)	VOC					3 J								7	9	5	A(1)
BENZENE	VOC					1 J								3J		ND	A
TOTAL XYLENES	VOC					6								3 J		5	A
BENZO(A)ANTHRACENE	SEMI			2 J										1 J		0.002	A
CHRYSENE	SEMI			2 J										0.4 J		0.002	A
BENZO(B)FLUORANTHENE	SEMI			1 J										0.6 J		0.002	A
BENZO(K)FLUORANTHENE	SEMI													0.5 J		0.002	A
BENZO(A)PYRENE	SEMI			1 J										0.5 J		ND	A
DELTA-BHC	PST											0.01 J				ND	A
AROCLOR-1248	PCB													1.1		0.1	A
AROCLOR-1254	PCB													0.14 J		0.1	A
ANTIMONY	MCP						27.6 B								36 B	3	A
ARSENIC	MCP		2.6 B	3.6 B		10.5	4 B	60.5	3.7 B	5.4	5.3 B	9.2 B			10.6	25	A
BARIUM	MCP	161 B	145	85.9 B	74.3 B	517	567	396	425	212	253	71.8 B	30 B	46.8 B	58.8 B	1000	A
BERYLLIUM	MCP									1.5 B						3	A
CHROMIUM	MCP	44.20		15.4		8.2 B				13.8		22.9	44	22		50	A
COPPER	MCP	25.60		42				34				69.8	18.2 B	130		200	A
IRON	MCP	44100	19500	18300	26300	12700	18600	13400	18800	18900	22400	11900	1760	3140	3390	300	A
LEAD	MCP	122	19	74.6	28.4		10.2	37	12.2		10.4		1.5 B	721	22	25	A
MAGNESIUM	MCP	23100	30700	39600	46200	74500	76800	56600	55500	66300	71100	99000	97500	75000	77200	35000	A
MANGANESE	MCP	2990	2380	2050	1600	185	180	1540	1550	1670	1880	2170	364	1230	1270	300	A
MERCURY	MCP			0.60		0.30				0.20		0.40			0.20	2	A
SILVER	MCP			25.5					3 B							50	A
SODIUM	MCP	51000	38300	189000	189000	212000	22500	11100	11200	69900	142000	47900	49700	93900	78100	20000	A
ZINC	MCP	16600	1760	5220	5650	2120	2400	4140	1930	5210	4480	96.1	63.4	1950	77.5	300	A

All results reported in μg/L (ppb) unless otherwise specified.

Only detected results are reported.

J - Indicates the result is less than the sample quantitation limit but greater than zero.

B - Less than quantitation limit but greater than or equal to instrument detection limit.

(a) - Includes reanalyzed samples.

- Shading indicates value greater than SCG.

TABLE 6-3
LOCKPORT CITY LANDFILL
GROUNDWATER ANALYTICAL RESULTS AND SCGs
INTERMEDIATE MONITORING WELLS

Rockway, Grimsby, and Rochester Formations

SAMPLE-ID		MW-1I		MW-2I		MW-5I(a)		MW-6I		MW-8I		MW-9I		MW-10I	MW-12I	SCG	
ROUND		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	2nd	2nd	VALUE	Source
PARAMETER	TYPE																
VINYL CHLORIDE	VOC											12	11			2	A
1,2-DICHLOROETHENE (TOTAL)	VOC				1 J							17	21			5	A
BENZENE	VOC														3 J	ND	A
TOTAL XYLENES	VOC											3 J			4	5	A
BENZO(B)FLUORANTHENE	SEMI							4 J								0.002	A
ALDRIN	PST												0.2 J			ND	A
ANTIMONY	MCP	154 B	229		28.6 B		27.5 B									3	A
ARSENIC	MCP			53.8		9.7 B	2 B					16.4	1.2 B		5.8 B	25	A
CHROMIUM	MCP	1560	328			14				13.3	12.7	28			38	50	A
IRON	MCP	4960	1180	428	443	3520	1550	337	183	754	855	25500	1400	97.1 B	13100	300	A (1)
LEAD	MCP		1.7 B		1.8 B		1.5 B	7.3	6.3	6.8	3.8 B	194	82		38.9	25	A
MAGNESIUM	MCP	42400	40400	72100	74500	65000	59700	36200	34900	47700	47500	98400	68000	43300	140000	35000	A
MANGANESE	MCP	104	20.2	438	583	1820	1310		2.5 B	76.8	19	1670	1030	11 B	493	300	A (1)
SODIUM	MCP	78300	76000	142000	144000	91700	74900	4150 B	4350 B	5260	4630 B	868500	83900	41700	1300000	20000	A
ZINC	MCP	101	18.4 B	23.9	36.6	36.3	113	2930	3260	77.4	27.2	268	645	14.2 B	53.7	300	A
SULFIDE	MISC			11.2								13.6		61.6		50	A(2)

All results reported in µg/L (ppb) unless otherwise specified.

Only detected results are reported.

J - Less than the sample quantitation limit but greater than zero.

B - Less than quantitation limit but greater than or equal to instrument detection limit.

Shading indicates contamination level greater than SCG.

NOTES:

(1) Standard for sum of iron and manganese is 500 ppb.

(2) Total sulfides expressed as hydrogen sulfide.

(a) - Includes reanalyzed samples.

TABLE 6-4
LOCKPORT CITY LANDFILL
GROUNDWATER ANALYTICAL RESULTS AND SCGs
DEEP MONITORING WELLS

IRONDEQUOIT FORMATION

SAMPLE-ID		MW-1D		MW-6D		MW-8D		MW-10D	MW-11D	MW-12D	SCG	SOURCE
ROUND		1st	2nd	1st	2nd	1st	2nd	2nd	2nd	2nd	VALUE	
PARAMETER	TYPE											
VINYL CHLORIDE	VOC					23 J	81		NA		2	A
METHYLENE CHLORIDE	VOC			R		R	15 J	12 JB	NA		5	A
ACETONE	VOC			R		R	R	340 B	NA		50	A
1,2-DICHLOROETHENE (TOTAL)	VOC					460	790		NA		5	A
TRICHLOROETHENE	VOC					51	130		NA		5	A
TOLUENE	VOC								NA		5	A
CHLOROBENZENE	VOC								NA		5	A
XYLENES	VOC								NA		5	A
4-METHYLPHENOL	SEMI								NA		1	A
BENZO(A)ANTHRACENE	SEMI	2 J							NA		0.002	A
CHRYSENE	SEMI	1 J							NA		0.002	A
BIS(2-ETHYLHEXYL)PHTHALATE	SEMI			R	61	R		12	NA	R	50	A
BENZO(B)FLUORANTHENE	SEMI	1 J		0.3 J					NA		0.002	A
BENZO(K)FLUORANTHENE	SEMI	2 J							NA		0.002	A
ANTIMONY	MCP						29.2 B	43 B	NA	26.2 B	3	A
CHROMIUM	MCP	203	212	48.5	48	31.7	17.9	19.1	NA		50	A
IRON	MCP	4010	4250	3790	1350	7500	4160	210	NA	812	300	A (1)
LEAD	MCP			22 B	120		9.4 B		NA	1.1 B	25	A
MAGNESIUM	MCP		56300	50000	48500	68900	77600	215000	NA	139000	35000	A
MANGANESE	MCP			40.6	36.4	721	685	168	NA	256	300	A (1)
SODIUM	MCP			86400	83200	178000	177000	2160000	NA	1870000	20000	A
ZINC	MCP	489		272	128	140	80.2		NA	83.1	300	A
SULFIDE (mg/L)	MISC							135	NA		50	A (2)

All results reported in µg/L (ppb) unless otherwise specified.

Only detected results are reported.

J - Less than the sample quantitation limit but greater than zero.

R - Analyte rejected due to blank contamination.

B - Less than quantitation limit but greater than or equal to instrument detection limit.

NA - Not Analyzed

Shading indicates contamination level greater than SCG.

NOTES:

(1) Standard for sum of iron and manganese is 500 ppb.

(2) Total sulfides expressed as hydrogen sulfide.

TABLE 6-5
LOCKPORT CITY LANDFILL
CLASS D SURFACE WATER ANALYTICAL RESULTS AND SCGs

SAMPLE-ID		SW-1	SW-2	SW-3	SW-4	SW-4a	SW-5	SW-8	SW-9	SW-10	SW-6	SW-7	AQUATIC	SOURCE
STREAM		EAST GULF	EAST GULF	GULF	WEST GULF	WEST GULF	GULF	GULF	GULF	GULF	GULF	GULF		
ROUND		1st	1st	1st	1st	2nd	1st	1st	2nd	2nd	2nd	2nd	SCG	
PARAMETER	TYPE													
TRICHLOROETHENE	VOC	6	3 J	2 J									11	A
BENZENE	VOC	0.5 J		1 J					10 J				6	A
TETRACHLOROETHENE	VOC	2 J											1	A
PHENOL	SEMI							5 J					5	A@
DIETHYLPHTHALATE	SEMI	1 J	1 J			0.4			2 J				3	B
BUTYLBENZYLPHTHALATE	SEMI								3 J				3	B
DIELDRIN	PST										0.022		0.001	A
BERYLLIUM	MCP				3.4 B								5.3	B
CADMIUM	MCP				9.4								CALC	A
COPPER	MCP	25.5	78.5	65.6	47.6		50.5	53.8			109	46.5	CALC	A
IRON	MCP	155	154	184		56.1 B	114	65.8 B	376	378	890	169	300	A
LEAD	MCP	6.3	185	6.1	52.3	21.5	79	155	18	18.7	5.5		CALC	A
MERCURY	MCP	0.6	0.4	0.5	0.3		1.4	0.39					0.012	B
SILVER	MCP	136	20.8	19.4	11.6		8.5	8.7			36.1		CALC	A
ZINC	MCP	146	213	188	399	388	585	517	268	274	39.2	28.6	CALC	A
CYANIDE	MCP				92	40.2	271		45.7	28			5.2	B
TOTAL PHENOLS	MCP				100	0.006		64	0.007				5, 1	A@

All results reported in µg/L (ppb) unless otherwise specified.

Only detected results are reported.

-Shading indicates value greater than SCG.

J - Indicates the result is less than the sample quantitation limit but greater than zero.

B - Less than quantitation limit but greater than or equal to instrument detection limit.

@ - Standard is 5.0 for total unchlorinated phenols and 1.0 for total chorinated phenols.

CALC - Calculated standards based on hardness - See Table 6-6 for standards.

TABLE 6-6
LOCKPORT CITY LANDFILL
CALCULATED SURFACE WATER SCGs

SAMPLE-ID		SW-1		SW-2		SW-3		SW-4		SW-4a		SW-5	
STREAM CLASS		Class D		Class D		Class D		Class D		Class D		Class D	
		SCG	CONC.	SCG	CONC.	SCG	CONC.	SCG	CONC.	SCG	CONC.	SCG	CONC.
PARAMETER	TYPE												
Cadmium	MCP	11.09		21.17		20.91		19.08	9.4	12.23		19.08	
Chromium	MCP	3693		5905		5853		5476	23.7	3965	10.4	5476	20.7
Copper	MCP	42.23	25.5	72.46	78.5	71.73	65.6	66.44	47.6	45.82		66.44	50.5
Lead	MCP	265.27	155	547.93	185	540.47	6.1	487.65	52.3	295.96	21.5	487.65	79
Nickel	MCP	3715		5743		5696		5355	30.6B	3968		5355	19B
Silver	MCP	20	136	53	20.8	52	19.4	45	11.6	23		45	8.5
Zinc (*)	MCP	255.48	146	415.15	213	411.35	188	383.99	399	274.90	388	383.99	585
Standards are based upon:													
Hardness (mg/l)	MISC		251.3		445.7		440.9		406.5		274		406.5
Ammonia (as N)	MISC	10.32	0.108	11.94	0.22	11.13		23.62	5.5	4.16	.833	23.00	5.9
Standards are based upon:													
Temp.(Deg. C)	MISC		3.7		0.9		0.3		9.4		18.6		4.5
pH	MISC		7.65		7.55		7.6		6.8		7.85		6.85

All units are in ug/l (ppb) unless noted.

Metals standards apply to acid-soluble forms only.

B - Less than quantitation limit but greater than or equal to detection limit.

TABLE 6-7
LOCKPORT CITY LANDFILL
LEACHATE ANALYTICAL RESULTS AND SCGs

SAMPLE-ID		L-1	LL-1	L-2	LL-2	AQUATIC SCGs	SOURCE
LOCATION		TOP OF SLOPE		BOTTOM OF SLOPE			
ROUND		1st	2nd	1st	2nd		
PARAMETER	TYPE						
TRICHLOROETHENE	VOC		8			11	A
CADMIUM	MCP				2.2 B	CALC	A
CHROMIUM	MCP				10.4	CALC	A
COPPER	MCP	32.7		26.1		CALC	A
IRON	MCP	15600	1380	39100	41500	300	A
LEAD	MCP	1.6 B	5.2		21.5	CALC	A
MERCURY	MCP	1.4		0.039		0.012	B
SILVER	MCP	13.6				CALC	A
ZINC	MCP	38.3	38.4		10 B	CALC	A
CYANIDE	MCP				40.2	5.2	A
TOTAL PHENOLS	MCP				92	5.1	A@

All results reported in µg/L (ppb) unless otherwise specified.

Only detected results are reported.

B - Less than quantitation limit but greater than or equal to instrument detection limit.

@ - Standard is 5.0 for total unchlorinated phenols and 1.0 for total chorinated phenols.

CALC - Calculated standards based on hardness - See Table 6-8 for standards.

- Shading indicates value greater than SCG.

TABLE 6-8
LOCKPORT CITY LANDFILL
CALCULATED SURFACE WATER SCGs FOR LEACHATE SAMPLES

SAMPLE-ID		L-1		LL-1		L-2		LL-2	
STREAM CLASS		Class D		Class D		Class D		Class D	
		SCG	CONC.	SCG	CONC.	SCG	CONC.	SCG	CONC.
PARAMETER	TYPE								
Cadmium	MCP	25.54		16.64		24.83		21.66	2.2 B
Chromium	MCP	6768		4958		6630		6006	10.4
Copper	MCP	84.77	32.7	59.26		82.79	26.1	73.89	
Lead	MCP	676.43	1.6	418.14	5.2	655.35		562.45	21.5
Silver	MCP	71	13.6	37		68		55	
Zinc (*)	MCP	478.01	38.3	346.44	38.4	467.99		422.47	10 B
Standards are based upon:									
Hardness (mg/l)	MISC		526.4		360		513.4		455
Ammonia (as N)	MISC	31.9(b)	1.8	2.11	0.59	31.9 (b)	9.8	24.249	16.5
Standards are based upon:									
Temp.(Deg. C)	MISC		5.2		5.7		8.1		12.2
pH	MISC		5.55		6.88		5.4		6.8

All units are in ug/l (ppb) unless noted.
Only detected results are reported.
Metals standards apply to acid-soluble forms only.

(b) Standard based on pH level of 6.5.
B - Less than quantitation limit but greater than or equal to instrument detection limit.
(*) - Calculated based upon proposed standards.

TABLE 6-9
LOCKPORT CITY LANDFILL
SOIL BORINGS AND WASTE SAMPLES EPTOX RESULTS AND SCGs

SAMPLE-ID		SB-1	SB-5	SB-9	SB-13	SB14	SB-18	SB-19	WS-1	WS-2	WS-3	SCG	SOURCE
ROUND		1st	1st	1st	1st	1st	1st	1st	1st	1st	1st	VALUE	
PARAMETER	TYPE												
CORROSIVITY	MISC	NON	NON	NON	NON	NON	NON	NON	NON	NON	NON		
IGNITABILITY	MISC	NON	NON	NON	NON	NON	NON	NON	NON	NON	NON		
REACTIVITY	MISC	NON	NON	NON	NON	NON	NON	NON	NON	NON	NON		
pH, S.U.	MISC	8.36	8.88	8.08	7.30	7.65	7.82	7.83	7.90	7.54	7.14		
SULFUR (%)	MISC	0.13	0.11	0.15	0.16	0.14	0.16	0.56	0.019	0.010	0.010		
CHLORINE (PPM)	MISC		0.030						137		109		
ASH WEIGHT(%)	MISC	61.30	52.91	54.25	56.03	54.47	63.37	53.51	61.68	70.52	32.41		
HEAT OF COMBUSTION (BTU/lb	MISC									443	3,046		
EP Tox - ARSENIC	MCP					18.5	26.4				22	5000	EPTox
EP Tox - BARIUM	MCP	456	610	625	656	530	985	704	1070	1000	293	100000	EPTox
EP Tox - CADMIUM	MCP	32.9	4.4 B	1.7 B	75.1	27.8	26.1	12.1	38.3	6.9		1000	EPTox
EP Tox - CHROMIUM	MCP		4.3 B	3 B		8.5 B	10.7	3.3 B			14.6	5000	EPTox
EP Tox - LEAD	MCP	86.4		28.6	1990	130	279	231	496	14.1	1190	5000	EPTox
EP Tox - MERCURY	MCP											200	EPTox
EP Tox - SELENIUM	MCP											1000	EPTox
EP Tox - SILVER	MCP											5000	EPTox
EP Tox - Lindane	PEST											400	EPTox
EP Tox - Endrin	PEST											20	EPTox
EP Tox - Methoxychlor	PEST											10000	EPTox
EP Tox - Toxaphene	PEST											500	EPTox
EP Tox - 2,4-D	HERB											10000	EPTox
EP Tox - Silvex	HERB											1000	EPTox
WATER REACTIVITY	WASTE			NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG		
HEXANE SOLUBILITY	WASTE			NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG		
WATER SOLUBILITY	WASTE			NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG		
pH	WASTE			8.08	7.30	7.65	7.82	7.83	7.90	7.54	7.14		
FLAMMABILITY	WASTE			NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG		
RADIOACTIVITY(mR/h)	WASTE												
S/CN RELEASE	WASTE			NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG		
BEILESTEIN TEST	WASTE			NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG		
PEROXIDE TEST(mg/Kg)	WASTE												
REDOX POTENTIAL(mV)	WASTE			-48.4	-24.9	-58.1	-30.7	-33.2	-88.3	-104	90.1		

All results reported in μg/L (ppb) unless otherwise specified.
Only detected results reported.

NA - Not Analyzed
NEG - No reaction
NON - Non-corrosive, non-reactive, non-ignitable
B - Less than quantitation limit but greater than or equal to instrument detection limit.

TABLE 6-10
LOCKPORT CITY LANDFILL
SOIL BORING TCLP RESULTS AND SCGs

PARAMETER	TYPE	SB-25	SCG VALUE
BENZENE	VOC	0.009	0.5
CARBON TETRACHLORIDE	VOC		0.5
CHLOROBENZENE	VOC	.004 J	100
CHLOROFORM	VOC		6
2-BUTANONE	VOC	.003 J	200
TETRACHLOROETHYLENE	VOC		0.7
TRICHLOROETHYLENE	VOC		0.5
VINYL CHLORIDE	VOC		0.2
1,2-DICHLOROETHANE	VOC		0.5
1,1-DICHLOROETHYLENE	VOC		0.7
1,4-DICHLOROBENZENE	SEMI		7.5
HEXACHLOROETHANE	SEMI		3
NITROBENZENE	SEMI		2
HEXACHLOROBUTADIENE	SEMI		0.5
2,4,6-TRICHLOROPHENOL	SEMI		2
2,4,5-TRICHLOROPHENOL	SEMI		400
2,4-DINITROTOLUENE	SEMI		0.13
HEXACHLOROBENZENE	SEMI		0.13
PENTACHLOROPHENOL	SEMI		100
2-METHYLPHENOL	SEMI		200
3-METHYLPHENOL*	SEMI		200
4-METHYLPHENOL*	SEMI		200
PYRIDINE	SEMI		5
CHLORDANE	PEST		0.03
ENDRIN	PEST		0.02
HEPTACHLOR	PEST		0.008
LINDANE	PEST		0.4
METHOXYCHLOR	PEST		10
TOXAPHENE	PEST		0.5
2,4-D	HERB		10
SILVEX	HERB		1
ARSENIC	MCP		5
BARIUM	MCP	0.93	100
CADMIUM	MCP	0.006	1
CHROMIUM	MCP		5
LEAD	MCP	0.77	5
MERCURY	MCP		0.2
SELENIUM	MCP		1
SILVER	MCP		5

* - Cannot be seperated.

All concentrations are presented in mg/L (ppm).

TABLE 6-11
LOCKPORT CITY LANDFILL
STREAM SEDIMENT CLEANUP CRITERIA (1)

Sample ID: SS-1

Total Organic Carbon = 6.37%

Parameter (7)	AWQS/GV (µg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (µg/gOC) (4)	Sample Specific SCG (µg/kg) (5)	Conc. at SS-1 (µg/kg) (6)
TRICHLOROBENZENE	11	2.29	195	2	137	4
BENZENE	6	2.13	135	1	52	2
TETRACHLOROETHENE	1	2.88	759	1	48	
TOLUENE	17000	2.69	490	8,326	530,148	
CHLOROBENZENE	50	2.84	692	35	2,203	2
PHENOL	5	1.46	29	0	9	490
1,2-DICHLOROBENZENE	50	3.38	2,399	120	7,637	
1,4-DICHLOROBENZENE	50	3.39	2,455	123	7,815	97
ACENAPHTHENE	500	4.33	21,380	10,690	680,642	260
4-NITROPHENOL	5	1.91	81	0	26	
DI-N-BUTYLPHTHALATE	3	5.2	158,489	475	30,274	
FLUORANTHENE	3900	5.33	213,796	833,805	53,090,046	7000
BUTYLBENZYLPHTHALATE	3	5.8	630,957	1,893	120,523	1200
BIS(2-ETHYLHEXYL)PHTHALATE	3	8.73	537,031,796	1,611,095	102,581,666	
DI-N-OCTYLPHTHALATE	3	9.2	1,584,893,192	4,754,680	302,739,958	950
BENZO(A)PYRENE	0.0012	6.04	1,096,478	1	84	7700
BETA-BHC	2	3.8	6,310	13	803	
4-4'-DDD	0.001	5.99	977,237	1	62	240
AROCLOR-1248	0.001	5.75	562,341	1	36	
AROCLOR-1260	0.001	7.14	13,803,843	14	879	2900

Shading indicates value greater than SCG value.

(1) Based on "Cleanup Criteria for Aquatic Sediments" 1989. Criteria was calculated for nonpolar organic compounds.
(2) AWQS/GV = Ambient Water Quality Standard/Guidance Value (Class D Stream)
(3) EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
(4) Sediment Criterion = AWQS/GV x Kow x 0.001
(5) Sample Specific SCG = Sediment Criterion x Organic Carbon x 1000
(6) Only detected results are reported.
(7) Criteria were calculated for only detected, nonpolar organic compounds for which AWQS/GVs exist and Kows are known.

TABLE 6-11
LOCKPORT CITY LANDFILL
STREAM SEDIMENT CLEANUP CRITERIA (1)

Sample ID: SS-2

Total Organic Carbon = 0.57%

Parameter (7)	AWQS/GV (μg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (μg/gOC) (4)	Sample Specific SCG (μg/kg) (5)	Conc. at SS-2 (μg/kg) (6)
TRICHLOROBENZENE	11	2.29	195	2	12	
BENZENE	6	2.13	135	1	5	
TETRACHLOROETHENE	1	2.88	759	1	4	
TOLUENE	17000	2.69	490	8,326	47,426	
CHLOROBENZENE	50	2.84	692	35	197	
PHENOL	5	1.46	29	0	1	
1,2-DICHLOROBENZENE	50	3.38	2,399	120	683	
1,4-DICHLOROBENZENE	50	3.39	2,455	123	699	
ACENAPHTHENE	500	4.33	21,380	10,690	60,889	
4-NITROPHENOL	5	1.91	81	0	2	
DI-N-BUTYLPHTHALATE	3	5.2	158,489	475	2,708	
FLUORANTHENE	3900	5.33	213,796	833,805	4,749,355	40
BUTYLBENZYLPHTHALATE	3	5.8	630,957	1,893	10,782	40
BIS(2-ETHYLHEXYL)PHTHALATE	3	8.73	537,031,796	1,611,095	9,176,799	
DI-N-OCTYLPHTHALATE	3	9.2	1,584,893,192	4,754,680	27,082,655	35
BENZO(A)PYRENE	0.0012	6.04	1,096,478	1	7	
BETA-BHC	2	3.8	6,310	13	72	
4-4'-DDD	0.001	5.99	977,237	1	6	
AROCLOR-1248	0.001	5.75	562,341	1	3	
AROCLOR-1260	0.001	7.14	13,803,843	14	79	

Shading indicates value greater than SCG value.

(1) Based on "Cleanup Criteria for Aquatic Sediments" 1989. Criteria was calculated for nonpolar organic compounds.

(2) AWQS/GV = Ambient Water Quality Standard/Guidance Value (Class D Stream)

(3) EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.

(4) Sediment Criterion = AWQS/GV x Kow x 0.001

(5) Sample Specific SCG = Sediment Criterion x Organic Carbon x 1000

(6) Only detected results are reported.

(7) Criteria were calculated for only detected, nonpolar organic compounds for which AWQS/GVs exist and Kows are known.

TABLE 6-11
LOCKPORT CITY LANDFILL
STREAM SEDIMENT CLEANUP CRITERIA (1)

Sample ID: SS-3

Total Organic Carbon = 0.48%

Parameters (7)	AWQS/GV (µg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (µg/gOC) (4)	Sample Specific SCG (µg/kg) (5)	Conc. at SS-3 (µg/kg) (6)
TRICHLOROBENZENE	11	2.29	195	2	10	
BENZENE	6	2.13	135	1	4	
TETRACHLOROETHENE	1	2.88	759	1	4	
TOLUENE	17000	2.69	490	8,326	40,157	
CHLOROBENZENE	50	2.84	692	35	167	
PHENOL	5	1.46	29	0	1	
1,2-DICHLOROBENZENE	50	3.38	2,399	120	578	
1,4-DICHLOROBENZENE	50	3.39	2,455	123	592	
ACENAPHTHENE	500	4.33	21,380	10,690	51,557	
4-NITROPHENOL	5	1.91	81	0	2	
DI-N-BUTYLPHTHALATE	3	5.2	158,489	475	2,293	
FLUORANTHENE	3900	5.33	213,796	833,805	4,021,443	80
BUTYLBENZYLPHTHALATE	3	5.8	630,957	1,893	9,129	
BIS(2-ETHYLHEXYL)PHTHALATE	3	8.73	537,031,796	1,611,095	7,770,313	
DI-N-OCTYLPHTHALATE	3	9.2	1,584,893,192	4,754,680	22,931,820	43
BENZO(A)PYRENE	0.0012	6.04	1,096,478	1	6	
BETA-BHC	2	3.8	6,310	13	61	
4-4'-DDD	0.001	5.99	977,237	1	5	
AROCLOR-1248	0.001	5.75	562,341	1	3	
AROCLOR-1260	0.001	7.14	13,803,843	14	67	

Shading indicates value greater than SCG value.

(1) Based on "Cleanup Criteria for Aquatic Sediments" 1989. Criteria was calculated for nonpolar organic compounds.
(2) AWQS/GV = Ambient Water Quality Standard/Guidance Value (Class D Stream)
(3) EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
(4) Sediment Criterion = AWQS/GV x Kow x 0.001
(5) Sample Specific SCG = Sediment Criterion x Organic Carbon x 1000
(6) Only detected results are reported.
(7) Criteria were calculated for only detected, nonpolar organic compounds for which AWQS/GVs exist and Kows are known.

TABLE 6-11
LOCKPORT CITY LANDFILL
STREAM SEDIMENT CLEANUP CRITERIA (1)

Sample ID: SS-4

Total Organic Carbon = 0.50%

Parameters (7)	AWQS/GV (µg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (µg/gOC) (4)	Sample Specific SCG (µg/kg) (5)	Conc. at SS-4 (µg/kg) (6)
TRICHLOROBENZENE	11	2.29	195	2	11	
BENZENE	6	2.13	135	1	4	
TETRACHLOROETHENE	1	2.88	759	1	4	3
TOLUENE	17000	2.69	490	8,326	41,789	
CHLOROBENZENE	50	2.84	692	35	174	2
PHENOL	5	1.46	29	0	1	
1,2-DICHLOROBENZENE	50	3.38	2,399	120	602	
1,4-DICHLOROBENZENE	50	3.39	2,455	123	616	
ACENAPHTHENE	500	4.33	21,380	10,690	53,652	170
4-NITROPHENOL	5	1.91	81	0	2	
DI-N-BUTYLPHTHALATE	3	5.2	158,489	475	2,386	
FLUORANTHENE	3900	5.33	213,796	833,805	4,184,868	2800
BUTYLBENZYLPHTHALATE	3	5.8	630,957	1,893	9,500	38
BIS(2-ETHYLHEXYL)PHTHALATE	3	8.73	537,031,796	1,611,095	8,086,088	
DI-N-OCTYLPHTHALATE	3	9.2	1,584,893,192	4,754,680	23,863,737	120
BENZO(A)PYRENE	0.0012	6.04	1,096,478	1	7	1300
BETA-BHC	2	3.8	6,310	13	63	
4-4'-DDD	0.001	5.99	977,237	1	5	
AROCLOR-1248	0.001	5.75	562,341	1	3	
AROCLOR-1260	0.001	7.14	13,803,843	14	69	

Shading indicates value greater than SCG value.

(1) Based on "Cleanup Criteria for Aquatic Sediments" 1989. Criteria was calculated for nonpolar organic compounds.
(2) AWQS/GV = Ambient Water Quality Standard/Guidance Value (Class D Stream)
(3) EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
(4) Sediment Criterion = AWQS/GV x Kow x 0.001
(5) Sample Specific SCG = Sediment Criterion x Organic Carbon x 1000
(6) Only detected results are reported.
(7) Criteria were calculated for only detected, nonpolar organic compounds for which AWQS/GVs exist and Kows are known.

TABLE 6-11
LOCKPORT CITY LANDFILL
STREAM SEDIMENT CLEANUP CRITERIA (1)

Sample ID: SS-4a

Total Organic Carbon = 6.50%

Parameter (7)	AWQS/GV (µg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (µg/gOC) (4)	Sample Specific SCG (µg/kg) (5)	Conc. at SS-4a (µg/kg) (6)
TRICHLOROBENZENE	11	2.29	195	2	139	
BENZENE	6	2.13	135	1	53	
TETRACHLOROETHENE	1	2.88	759	1	49	
TOLUENE	17000	2.69	490	8,326	541,206	
CHLOROBENZENE	50	2.84	692	35	2,248	
PHENOL	5	1.46	29	0	9	
1,2-DICHLOROBENZENE	50	3.38	2,399	120	7,796	
1,4-DICHLOROBENZENE	50	3.39	2,455	123	7,978	
ACENAPHTHENE	500	4.33	21,380	10,690	694,838	1400
4-NITROPHENOL	5	1.91	81	0	26	
DI-N-BUTYLPHTHALATE	3	5.2	158,489	475	30,905	
FLUORANTHENE	3900	5.33	213,796	833,805	54,197,339	1300
BUTYLBENZYLPHTHALATE	3	5.8	630,957	1,893	123,037	
BIS(2-ETHYLHEXYL)PHTHALATE	3	8.73	537,031,796	1,611,095	104,721,200	
DI-N-OCTYLPHTHALATE	3	9.2	1,584,893,192	4,754,680	309,054,173	
BENZO(A)PYRENE	0.0012	6.04	1,096,478	1	86	5600
BETA-BHC	2	3.8	6,310	13	820	
4-4'-DDD	0.001	5.99	977,237	1	64	
AROCLOR-1248	0.001	5.75	562,341	1	37	
AROCLOR-1260	0.001	7.14	13,803,843	14	897	

Shading indicates value greater than SCG value.

(1) Based on "Cleanup Criteria for Aquatic Sediments" 1989. Criteria was calculated for nonpolar organic compounds.
(2) AWQS/GV = Ambient Water Quality Standard/Guidance Value (Class D Stream)
(3) EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
(4) Sediment Criterion = AWQS/GV x Kow x 0.001
(5) Sample Specific SCG = Sediment Criterion x Organic Carbon x 1000
(6) Only detected results are reported.
(7) Criteria were calculated for only detected, nonpolar organic compounds for which AWQS/GVs exist and Kows are known.

TABLE 6-11
LOCKPORT CITY LANDFILL
STREAM SEDIMENT CLEANUP CRITERIA (1)

Sample ID: SS-5

Total Organic Carbon = 9.55%

Parameters (7)	AWQS/GV (µg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (µg/gOC) (4)	Sample Specific SCG (µg/kg) (5)	Conc. at SS-5 (µg/kg) (6)
TRICHLOROBENZENE	11	2.29	195	2	205	19
BENZENE	6	2.13	135	1	77	
TETRACHLOROETHENE	1	2.88	759	1	72	7
TOLUENE	17000	2.69	490	8,326	794,931	
CHLOROBENZENE	50	2.84	692	35	3,303	
PHENOL	5	1.46	29	0	14	
1,2-DICHLOROBENZENE	50	3.38	2,399	120	11,451	
1,4-DICHLOROBENZENE	50	3.39	2,455	123	11,718	
ACENAPHTHENE	500	4.33	21,380	10,690	1,020,588	2100
4-NITROPHENOL	5	1.91	81	0	39	
DI-N-BUTYLPHTHALATE	3	5.2	158,489	475	45,394	
FLUORANTHENE	3900	5.33	213,796	833,805	79,605,885	15000
BUTYLBENZYLPHTHALATE	3	5.8	630,957	1,893	180,718	
BIS(2-ETHYLHEXYL)PHTHALA	3	8.73	537,031,796	1,611,095	153,816,110	
DI-N-OCTYLPHTHALTE	3	9.2	1,584,893,192	4,754,680	453,943,523	
BENZO(A)PYRENE	0.0012	6.04	1,096,478	1	126	5500
BETA-BHC	2	3.8	6,310	13	1,205	
4-4'-DDD	0.001	5.99	977,237	1	93	
AROCLOR-1248	0.001	5.75	562,341	1	54	2400
AROCLOR-1260	0.001	7.14	13,803,843	14	1,318	

Shading indicates value greater than SCG value.

(1) Based on "Cleanup Criteria for Aquatic Sediments" 1989. Criteria was calculated for nonpolar organic compounds.
(2) AWQS/GV = Ambient Water Quality Standard/Guidance Value (Class D Stream)
(3) EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
(4) Sediment Criterion = AWQS/GV x Kow x 0.001
(5) Sample Specific SCG = Sediment Criterion x Organic Carbon x 1000
(6) Only detected results are reported.
(7) Criteria were calculated for only detected, nonpolar organic compounds for which AWQS/GVs exist and Kows are known.

TABLE 6-11
LOCKPORT CITY LANDFILL
STREAM SEDIMENT CLEANUP CRITERIA (1)

Sample ID: SS-6

Total Organic Carbon = 1.47%

Parameters (7)	AWQS/GV (µg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (µg/gOC) (4)	Sample Specific SCG (µg/kg) (5)	Conc. at SS-6 (µg/kg) (6)
TRICHLOROBENZENE	11	2.29	195	2	32	
BENZENE	6	2.13	135	1	12	
TETRACHLOROETHENE	1	2.88	759	1	11	
TOLUENE	17000	2.69	490	8,326	122,804	
CHLOROBENZENE	50	2.84	692	35	510	
PHENOL	5	1.46	29	0	2	
1,2-DICHLOROBENZENE	50	3.38	2,399	120	1,769	
1,4-DICHLOROBENZENE	50	3.39	2,455	123	1,810	
ACENAPHTHENE	500	4.33	21,380	10,690	157,664	130
4-NITROPHENOL	5	1.91	81	0	6	100
DI-N-BUTYLPHTHALATE	3	5.2	158,489	475	7,013	70
FLUORANTHENE	3900	5.33	213,796	833,805	12,297,793	5100
BUTYLBENZYLPHTHALATE	3	5.8	630,957	1,893	27,918	180
BIS(2-ETHYLHEXYL)PHTHALATE	3	8.73	537,031,796	1,611,095	23,762,046	3100
DI-N-OCTYLPHTHALATE	3	9.2	1,584,893,192	4,754,680	70,126,769	250
BENZO(A)PYRENE	0.0012	6.04	1,096,478	1	19	1600
BETA-BHC	2	3.8	6,310	13	186	
4-4'-DDD	0.001	5.99	977,237	1	14	
AROCLOR-1248	0.001	5.75	562,341	1	8	
AROCLOR-1260	0.001	7.14	13,803,843	14	204	

Shading indicates value greater than SCG value.

(1) Based on "Cleanup Criteria for Aquatic Sediments" 1989. Criteria was calculated for nonpolar organic compounds.
(2) AWQS/GV = Ambient Water Quality Standard/Guidance Value (Class D Stream)
(3) EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
(4) Sediment Criterion = AWQS/GV x Kow x 0.001
(5) Sample Specific SCG = Sediment Criterion x Organic Carbon x 1000
(6) Only detected results are reported.
(7) Criteria were calculated for only detected, nonpolar organic compounds for which AWQS/GVs exist and Kows are known.

TABLE 6-11
LOCKPORT CITY LANDFILL
STREAM SEDIMENT CLEANUP CRITERIA (1)

Sample ID: SS-7

Total Organic Carbon = 0.11%

Parameters (7)	AWQS/GV (μg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (μg/gOC) (4)	Sample Specific SCG (μg/kg) (5)	Conc. at SS-7 (μg/kg) (6)
TRICHLOROBENZENE	11	2.29	195	2	2	
BENZENE	6	2.13	135	1	1	
TETRACHLOROETHENE	1	2.88	759	1	1	
TOLUENE	17000	2.69	490	8,326	8,884	
CHLOROBENZENE	50	2.84	692	35	37	
PHENOL	5	1.46	29	0	0	
1,2-DICHLOROBENZENE	50	3.38	2,399	120	128	
1,4-DICHLOROBENZENE	50	3.39	2,455	123	131	
ACENAPHTHENE	500	4.33	21,380	10,690	11,406	10
4-NITROPHENOL	5	1.91	81	0	0	
DI-N-BUTYLPHTHALATE	3	5.2	158,489	475	507	
FLUORANTHENE	3900	5.33	213,796	833,805	889,670	340
BUTYLBENZYLPHTHALATE	3	5.8	630,957	1,893	2,020	
BIS(2-ETHYLHEXYL)PHTHALATE	3	8.73	537,031,796	1,611,095	1,719,039	
DI-N-OCTYLPHTHALATE	3	9.2	1,584,893,192	4,754,680	5,073,243	
BENZO(A)PYRENE	0.0012	6.04	1,096,478	1	1	100
BETA-BHC	2	3.8	6,310	13	13	
4-4'-DDD	0.001	5.99	977,237	1	1	
AROCLOR-1248	0.001	5.75	562,341	1	1	
AROCLOR-1260	0.001	7.14	13,803,843	14	15	

Shading indicates value greater than SCG value.

(1) Based on "Cleanup Criteria for Aquatic Sediments" 1989. Criteria was calculated for nonpolar organic compounds.

(2) AWQS/GV = Ambient Water Quality Standard/Guidance Value (Class D Stream)

(3) EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.

(4) Sediment Criterion = AWQS/GV x Kow x 0.001

(5) Sample Specific SCG = Sediment Criterion x Organic Carbon x 1000

(6) Only detected results are reported.

(7) Criteria were calculated for only detected, nonpolar organic compounds for which AWQS/GVs exist and Kows are known.

TABLE 6-11
LOCKPORT CITY LANDFILL
STREAM SEDIMENT CLEANUP CRITERIA (1)

Sample ID: SS-8

Total Organic Carbon = 0.66%

Parameters (7)	AWQS/GV (µg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (µg/gOC) (4)	Sample Specific SCG (µg/kg) (5)	Conc. at SS-8 (µg/kg) (6)
TRICHLOROBENZENE	11	2.29	195	2	14	
BENZENE	6	2.13	135	1	5	
TETRACHLOROETHENE	1	2.88	759	1	5	
TOLUENE	17000	2.69	490	8,326	55,020	2
CHLOROBENZENE	50	2.84	692	35	229	
PHENOL	5	1.46	29	0	1	
1,2-DICHLOROBENZENE	50	3.38	2,399	120	793	
1,4-DICHLOROBENZENE	50	3.39	2,455	123	811	
ACENAPHTHENE	500	4.33	21,380	10,690	70,638	290
4-NITROPHENOL	5	1.91	81	0	3	
DI-N-BUTYLPHTHALATE	3	5.2	158,489	475	3,142	
FLUORANTHENE	3900	5.33	213,796	833,805	5,509,785	11000
BUTYLBENZYLPHTHALATE	3	5.8	630,957	1,893	12,508	
BIS(2-ETHYLHEXYL)PHTHALATE	3	8.73	537,031,796	1,611,095	10,646,118	
DI-N-OCTYLPHTHALATE	3	9.2	1,584,893,192	4,754,680	31,418,923	
BENZO(A)PYRENE	0.0012	6.04	1,096,478	1	9	3700
BETA-BHC	2	3.8	6,310	13	83	
4-4'-DDD	0.001	5.99	977,237	1	6	
AROCLOR-1248	0.001	5.75	562,341	1	4	
AROCLOR-1260	0.001	7.14	13,803,843	14	91	

Shading indicates value greater than SCG value.

(1) Based on "Cleanup Criteria for Aquatic Sediments" 1989. Criteria was calculated for nonpolar organic compounds.
(2) AWQS/GV = Ambient Water Quality Standard/Guidance Value (Class D Stream)
(3) EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
(4) Sediment Criterion = AWQS/GV x Kow x 0.001
(5) Sample Specific SCG = Sediment Criterion x Organic Carbon x 1000
(6) Only detected results are reported.
(7) Criteria were calculated for only detected, nonpolar organic compounds for which AWQS/GVs exist and Kows are known.

TABLE 6-11
LOCKPORT CITY LANDFILL
STREAM SEDIMENT CLEANUP CRITERIA (1)

Sample ID: SS-9

Total Organic Carbon = 3.90%

Parameters (7)	AWQS/GV (µg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (µg/gOC) (4)	Sample Specific SCG (µg/kg) (5)	Conc. at SS-9 (µg/kg) (6)
TRICHLOROBENZENE	11	2.29	195	2	84	
BENZENE	6	2.13	135	1	32	
TETRACHLOROETHENE	1	2.88	759	1	30	
TOLUENE	17000	2.69	490	8,326	324,723	
CHLOROBENZENE	50	2.84	692	35	1,349	
PHENOL	5	1.46	29	0	6	
1,2-DICHLOROBENZENE	50	3.38	2,399	120	4,678	
1,4-DICHLOROBENZENE	50	3.39	2,455	123	4,787	
ACENAPHTHENE	500	4.33	21,380	10,690	416,903	49
4-NITROPHENOL	5	1.91	81	0	16	
DI-N-BUTYLPHTHALATE	3	5.2	158,489	475	18,543	
FLUORANTHENE	3900	5.33	213,796	833,805	32,518,403	2600
BUTYLBENZYLPHTHALATE	3	5.8	630,957	1,893	73,822	25
BIS(2-ETHYLHEXYL)PHTHALATE	3	8.73	537,031,796	1,611,095	62,832,720	
DI-N-OCTYLPHTHALATE	3	9.2	1,584,893,192	4,754,680	185,432,504	
BENZO(A)PYRENE	0.0012	6.04	1,096,478	1	51	980
BETA-BHC	2	3.8	6,310	13	492	
4-4'-DDD	0.001	5.99	977,237	1	38	
AROCLOR-1248	0.001	5.75	562,341	1	22	
AROCLOR-1260	0.001	7.14	13,803,843	14	538	

Shading indicates value greater than SCG value.

(1) Based on "Cleanup Criteria for Aquatic Sediments" 1989. Criteria was calculated for nonpolar organic compounds.
(2) AWQS/GV = Ambient Water Quality Standard/Guidance Value (Class D Stream)
(3) EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
(4) Sediment Criterion = AWQS/GV x Kow x 0.001
(5) Sample Specific SCG = Sediment Criterion x Organic Carbon x 1000
(6) Only detected results are reported.
(7) Criteria were calculated for only detected, nonpolar organic compounds for which AWQS/GVs exist and Kows are known.

TABLE 6-11
LOCKPORT CITY LANDFILL
STREAM SEDIMENT CLEANUP CRITERIA (1)

Sample ID: SS-10

Total Organic Carbon = 4.70%

Parameters (7)	AWQS/GV (μg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (μg/gOC) (4)	Sample Specific SCG (μg/kg) (5)	Conc. at SS-10 (μg/kg) (6)
TRICHLOROBENZENE	11	2.29	195	2	101	
BENZENE	6	2.13	135	1	38	
TETRACHLOROETHENE	1	2.88	759	1	36	
TOLUENE	17000	2.69	490	8,326	391,333	
CHLOROBENZENE	50	2.84	692	35	1,626	
PHENOL	5	1.46	29	0	7	
1,2-DICHLOROBENZENE	50	3.38	2,399	120	5,637	
1,4-DICHLOROBENZENE	50	3.39	2,455	123	5,769	
ACENAPHTHENE	500	4.33	21,380	10,690	502,421	
4-NITROPHENOL	5	1.91	81	0	19	
DI-N-BUTYLPHTHALATE	3	5.2	158,489	475	22,347	
FLUORANTHENE	3900	5.33	213,796	833,805	39,188,845	1300
BUTYLBENZYLPHTHALATE	3	5.8	630,957	1,893	88,965	
BIS(2-ETHYLHEXYL)PHTHALATE	3	8.73	537,031,796	1,611,095	75,721,483	93000
DI-N-OCTYLPHTHALATE	3	9.2	1,584,893,192	4,754,680	223,469,940	
BENZO(A)PYRENE	0.0012	6.04	1,096,478	1	62	
BETA-BHC	2	3.8	6,310	13	593	
4-4'-DDD	0.001	5.99	977,237	1	46	
AROCLOR-1248	0.001	5.75	562,341	1	26	
AROCLOR-1260	0.001	7.14	13,803,843	14	649	

Shading indicates value greater than SCG value.

(1) Based on "Cleanup Criteria for Aquatic Sediments" 1989. Criteria was calculated for nonpolar organic compounds.
(2) AWQS/GV = Ambient Water Quality Standard/Guidance Value (Class D Stream)
(3) EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
(4) Sediment Criterion = AWQS/GV x Kow x 0.001
(5) Sample Specific SCG = Sediment Criterion x Organic Carbon x 1000
(6) Only detected results are reported.
(7) Criteria were calculated for only detected, nonpolar organic compounds for which AWQS/GVs exist and Kows are known.

TABLE 6-11
LOCKPORT CITY LANDFILL
STREAM SEDIMENT CLEANUP CRITERIA (1)

Sample ID: WSS-1

Total Organic Carbon = 6.60%

Parameters (7)	AWQS/GV (µg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (µg/gOC) (4)	Sample specific SCG (µg/kg) (5)	Conc. at WSS-1 (µg/kg) (6)
TRICHLOROBENZENE	11	2.29	195	2	142	
BENZENE	6	2.13	135	1	53	
TETRACHLOROETHENE	1	2.88	759	1	50	
TOLUENE	17000	2.69	490	8,326	549,532	
CHLOROBENZENE	50	2.84	692	35	2,283	
PHENOL	5	1.46	29	0	10	
1,2-DICHLOROBENZENE	50	3.38	2,399	120	7,916	
1,4-DICHLOROBENZENE	50	3.39	2,455	123	8,101	
ACENAPHTHENE	500	4.33	21,380	10,690	705,527	59
4-NITROPHENOL	5	1.91	81	0	27	
DI-N-BUTYLPHTHALATE	3	5.2	158,489	475	31,381	
FLUORANTHENE	3900	5.33	213,796	833,805	55,031,144	2400
BUTYLBENZYLPHTHALATE	3	5.8	630,957	1,893	124,930	
BIS(2-ETHYLHEXYL)PHTHALATE	3	8.73	537,031,796	1,611,095	106,332,296	
DI-N-OCTYLPHTHALATE	3	9.2	1,584,893,192	4,754,680	313,808,852	
BENZO(A)PYRENE	0.0012	6.04	1,096,478	1	87	1200
BETA-BHC	2	3.8	6,310	13	833	110
4-4'-DDD	0.001	5.99	977,237	1	64	
AROCLOR-1248	0.001	5.75	562,341	1	37	
AROCLOR-1260	0.001	7.14	13,803,843	14	911	

Shading indicates value greater than SCG value.

(1) Based on "Cleanup Criteria for Aquatic Sediments" 1989. Criteria was calculated for nonpolar organic compounds.
(2) AWQS/GV = Ambient Water Quality Standard/Guidance Value (Class D Stream)
(3) EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
(4) Sediment Criterion = AWQS/GV x Kow x 0.001
(5) Sample Specific SCG = Sediment Criterion x Organic Carbon x 1000
(6) Only detected results are reported.
(7) Criteria were calculated for only detected, nonpolar organic compounds for which AWQS/GVs exist and Kows are known.

TABLE 6-12
LOCKPORT CITY LANDFILL
SEWER SAMPLE ANALYTICAL RESULTS AND SCGs

SAMPLE-ID		MH-1	MH-2	SCG	
ROUND		2nd	2nd	VALUE	
PARAMETER	TYPE				
TRICHLOROETHENE	VOC	12	35	11	A
DI-N-BUTYLPHTHALATE	SEMI	2 J		3	B
BUTYLBENZYLPHTHALATE	SEMI	3 J	2 J	3	B
BIS(2-ETHYLHEXLY)PHTHALATE	SEMI	45	26	3	B
IRON	MCP	487	700	300	A
CYANIDE	MCP			5.2	A
TOTAL PHENOLS	MCP	0.078	0.028	5, 1	A@

All results reported in μg/L (ppb) unless otherwise specified.

Only detected results are reported.

B - Less than quantitation limit but greater than or equal to instrument detection limit.

@ - Standard is 5.0 for total unchlorinated phenols and 1.0 for total chorinated phenols.

- Shading indicates value greater than SCG.

7.0 HEALTH RISK ASSESSMENT

7.1 Introduction

7.1.1 Objectives and Scope

The public health risk assessment (HRA) presented in this chapter is an analysis of the potential adverse health effects caused by the release of chemicals from the Lockport City Landfill site. Two separate analyses have been performed in order to assess the human health risk. The first is a qualitative health risk assessment. The focus of this assessment on the possible health threats posed by chemical contaminants attributable to the site to which residents/workers near the site may be subjected. This qualitative health risk assessment is performed on the promise that an institutional remedial action will be taken at the site. This institutional action would consist, at a minimum, of a fence surrounding the landfill. Appropriate operation and maintenance of the fence will be taken in order to prevent trespassing onto the site. The second analysis is performed in the absence of remedial measures being taken at the site. This may be classified as a no-action, or "baseline" HRA. This baseline HRA, which will be quantitative, addresses both current and reasonably foreseeable future uses of the Lockport City Landfill site.

The following health risk assessment must be regarded as an integral part of the RI and FS for the Lockport City Landfill site. It utilizes validated data and other information provided during site characterization activities of the RI, and in turn generates an assessment of human health risk which serves as one of the principal criteria for determining whether, and to what degree, remedial action may be required at the site.

The HRA for the Lockport City Landfill site follows the general format and procedures set forth in USEPA's Risk Assessment Guidance for Superfund (RAGS) (EPA/540/1-89-002). Both the quantitative and the

qualitative HRA will include the following five major sections:

1. Selection of Chemicals of Potential Concern
2. Exposure Assessment
3. Toxicity Assessment
4. Risk Characterization
5. Uncertainty Analysis

7.1.2 Site Background

The Lockport City Landfill site is located on the Niagara Escarpment in the Lake Ontario drainage basin. The 30-acre site (currently owned by the City of Lockport) has five notable features:

- A steep slope that falls off from the site to the west and north
- The site is bound by a stream (The Gulf) that flows along the north and west boundaries
- There is a large point source of industrial contamination about 1,000 feet upstream of the landfill
- A functional railroad track that runs in a north-south direction on the landfill
- A 36-inch concrete drain (of uncertain purpose) that runs beneath the filled area and empties into The Gulf.

The area east of the Somerset Railroad tracks is sparsely vegetated with small trees and scrub brush. The main portion of the landfill is heavily vegetated with trees and brush. Large piles of tree limbs are scattered on the surface. The sideslopes are heavily vegetated.

Unknown quantities of both hazardous and non-hazardous wastes have been deposited at this site from the early 1950s to 1976. The method of disposal at the facility consisted of trenching into the overburden, depositing and then burning the wastes, and finally covering the wastes with excavated materials.

A community well survey was conducted during the RI, however, it is unclear to what extent the surrounding community relies upon groundwater as a source of potable water. The nearest residence to the landfill is approximately 600 feet northeast of it. Planned development of the site, whether industrial or residential, is undetermined.

7.2 Nature and Extent of Contamination

The nature and extent of contamination at the Lockport City Landfill were discussed in Chapter 4.0. This section, which is based on Chapter 4.0, includes a summary discussion of each environmental medium evaluated in the health risk assessment.

Groundwater samples were collected from each of the wells at the Lockport City Landfill. Groundwater flow patterns indicate that five of the wells (MW-1, MW-6, MW-8, MW-10 and MW-11) are upgradient or on the opposite side of an upward movement relative to the landfill, therefore, these wells are considered representative of background conditions. Many of the chemicals detected in these upgradient samples were also present at similar concentrations in the downgradient samples.

The nearest resident to the site is located approximately 600 feet northeast of the site (M. George property, 998 Niagara St.). It has been reported that the M. George property currently uses a well that is approximately 500 feet deep. [A shallow well at the same location is capped.] However, based upon predicted groundwater flow at and around the landfill, it is not expected that any residents are using groundwater that

has passed through and thus been effected by the landfill [See Section 3.0 for a discussion of hydrogeology.] This well was not sampled during this investigation, but in June 1989 the NYSDOH collected a groundwater sample from the deep well. The sample was analyzed for priority pollutant pesticides/PCBs, volatiles, semivolatiles, and metals [See Appendix A for analytical data.] The unvalidated analytical results indicated that there were no chemicals detected above the drinking water standards.

Stream sediment and surface water samples were collected from The Gulf (both upgradient and downgradient of the site), in the wetland area in the northeastern sector of the landfill, and from an offsite northwest drainage feature labeled the swale. These samples were collected to determine what impact the Lockport City Landfill may have on nearby surface water. Of the eleven surface water and stream sediment samples collected, five (5) are considered upgradient of the site and therefore indicative of background concentrations. Tables 7-1 and 7-2, respectively, present the chemicals of potential concern for surface water and stream sediments. If an organic or inorganic chemical was detected in at least one sample, and exceeded the upgradient or background concentrations, it was considered a chemical of potential concern.

Concentrations of surface water sample contaminants are relatively low. No pesticides/PCBs were detected. The only volatile organic chemicals (VOC) detected above background were chloroform and toluene. These two chemicals were present at relatively low concentrations in the surface samples and were not present in any stream sediments samples above background levels. The only surface water sample where semivolatile organics were detected at levels above background was sample SW-9. This is a downstream sample collected from the northeastern portion of The Gulf. The majority of chemicals detected in SW-9 were polynuclear aromatic hydrocarbons (PAHs). None of these chemicals were detected in any other surface water samples, or in stream sediments, at levels above background. It therefore does not appear that the chemicals present in

TABLE 7-1

SURFACE WATER CHEMICALS OF POTENTIAL CONCERN

Chloroform
Phenol
Fluorene
N-Nitrosodiphenylamine
Phenanthrene
Fluoranthene
Butylbenzylphthalate
Chrysene
Indeno(1,2,3-cd)pyrene
Benzo(g,h,i)perylene
Toluene
Dibenzofuran
4-Nitroaniline
Hexachlorobenzene
Anthracene
Pyrene
Benzo(a)anthracene
Benzo(k)fluoranthene
Dibenz(a,h)anthracene

TABLE 7-2

STREAM SEDIMENT CHEMICALS OF POTENTIAL CONCERN

Bis(2-ethylhexyl)phthalate	Diethylphthalate
beta-BHC	Endosulfan I
Aroclor 1248	Antimony
Selenium	Thallium

SW-9 are attributable to the Lockport City Landfill. No metals were found to exceed background concentrations.

The nature and extent of contamination of the stream sediments appears to be very similar to the surface water samples. No VOCs were detected at levels above background concentration. Only two (2) semivolatile compounds, phthalate esters, were reported above background. Bis(2-ethylhexyl)phthalate was detected at an elevated concentration in sample SS-10, located downstream of the landfill. This compound was not detected in any other stream sediment samples located upstream from this sample, therefore, the presence of this compound may be anomalous, and therefore it is not considered attributable to the site. Three pesticides and one Aroclor (PCB) were detected in the onsite stream sediment samples. Another Aroclor, similar in chemical composition, was also detected in an upstream sediment sample. Three metals were found to exceed background concentrations by one order of magnitude.

The surficial soil and waste samples were collected based on the results of the soil gas survey, geophysical survey, and discussions with NYSDEC. Only one round of sampling took place and no background samples were collected during the RI. All sampled points showed a similar degree of contamination with a similar range of chemicals. A more quantitative discussion of surficial soil/waste contamination as well as identification of chemicals of potential concern are discussed in Section 7.4.

The analytical data generated during the RI have been audited, and the results validated in accordance with procedures outlined in the site work plans, except where noted in Section 2.0.

7.3 Qualitative Assessment of Environmental Media

7.3.1 Exposure Assessment

The intent of this qualitative exposure assessment is, first, to examine the physical environment and the potentially exposed populations and, second, to identify potential exposure pathways. The exposure assessment includes identification of potential human exposure pathways under both existing and future-use scenarios.

7.3.1.1 Potentially Exposed Population

Under the current land use scenario, the populations most likely to come into direct contact with the surficial soil/waste samples are teenagers ranging in age from 13-18. Although the park adjacent to the site and the landfill itself are officially closed, it was evident during RI activities that trespassing has occurred. It was reported that debris (beer and soda pop cans) were observed at several different locations. Since the landfill is inactive, no landfill workers will come into direct contact with the soil. However, it is expected that workers at the municipal garage located approximately 200 feet southeast of the site may be exposed to the fugitive dust generated from the surficial soil/waste. This is quantitatively discussed in Section 7.4. Under a future land use scenario, the potentially exposed populations would remain the same, i.e., trespassers. However, exposure would be significantly reduced, if not entirely prevented, by the use of a fence surrounding the site. Future land use, whether residential or commercial/industrial, is undetermined at this time.

Neither residents nor garage workers are exposed to groundwater via ingestion or inhalation.

The potential exists under both the current and future land use

scenario for direct exposure to surface water and stream sediments by residents living nearby and also by workers from the municipal garage.

7.3.1.2 Exposure Pathways

An exposure pathway is the mechanism by which an individual or population is exposed to contaminants at or originating from a site. Each pathway includes a source or mechanism of release from a source, an exposure point, and an exposure route (e.g. ingestion). If the exposure point differs from the source, a transport/exposure medium (e.g. air) is also necessary.

At the Lockport City Landfill site exposure pathways have been addressed for the current and future land use scenarios. The current and future risks for each environmental medium discussed in Section 7.2 are qualitatively presented in the following sections.

A. Current Land Use

Potential human exposure pathways under the current (existing) land use scenario are classified as recreational (trespass). Table 7-3 shows the exposure pathways for this population. Media-specific exposure pathways are discussed below.

1. Groundwater - As previously stated, it does not appear that groundwater from the landfill is being used for residential use. Therefore, this is not an exposure medium of concern.

2. Soil/Waste - Persons trespassing on the landfill might be exposed to surficial soil/waste at any point on the site. The landfill is officially closed, however, there is a public park (closed during the RI activities) adjacent to the site, as well as access roads leading to the landfill. Under a no-action scenario, short-term (young adult) exposure

TABLE 7-3

POTENTIAL EXPOSURE PATHWAYS: CURRENT LAND USE
(Recreational or Trespasser)

EXPOSURE MEDIA	EXPOSURE POINT	EXPOSURE ROUTE(S)
Soil/Waste	Persons walking or playing onsite exposed to surficial soil contaminants on a site wide basis.	Ingestion Dermal
Surface Water/ Stream Sediment	Persons walking or playing in the wetland area or The Gulf.	Ingestion Dermal

would have to be evaluated. If trespassing occurred under these conditions, it would be assumed that the young adult age 13-18 would be subject to short-term exposure. Younger children (pica and non-pica) were not evaluated because the likelihood of such children trespassing on site is considered minimal due to the physical characteristics of the site. All exposures would result from direct contact with the soil/waste, and subsequent incidental ingestion or dermal absorption of contaminants. Exposure frequency is assessed based on warm-weather months (i.e., May-October) and is conservatively estimated to be 90 days/year. Exposure duration would be 5 years based upon the range in age of 13-18 years. The fraction ingested would be one (1) and would be significantly less when absorbed through dermal contact. Section 7.4 contains a quantitative presentation of fugitive dust generated from the soil/waste.

3. Stream Sediments - Persons walking or playing in the wetland or The Gulf may be exposed to chemicals of potential concern via ingestion or dermal contact. Exposure, which is expected to occur during the warm weather months of May-October, would not be expected to exceed 30 days/year based upon The Gulf's accessibility and its "dirty" appearance. The exposure duration would conservatively be estimated to be 30 years (based upon an adult) in accordance with USEPA "Standard Default Exposure Factors," May 1991. The fraction of sediment ingested would be one (1) and would be significantly less if dermal contact were the exposure pathway. It should also be noted that the skin surface area exposed to the stream sediments via dermal contact is expected to be minimized due to the unattractive appearance of the water body.

4. Surface Water - As discussed in Section 7.2, surface water should have no adverse impact upon surrounding populations, since the only chemicals of potential concern were not detected in more than one surface water sample. Surface water is not an exposure medium of concern.

B. Future Land Use

Table 7-4 presents the residential and recreational (trespass) exposure pathways for the Lockport City Landfill site under a future-use scenario. The discussion presented below is predicated upon the assumption that the site will be surrounded by a fence prohibiting entry to the contaminated area.

1. Groundwater - The area around the landfill is currently used for commercial/industrial purposes. It is not expected that the landfill will ever be zoned for residential use. It is even less likely, knowing the frequency and extent of contamination of the onsite subsurface samples, that a residential area would be developed on the landfill with the residential potable water supply obtained from groundwater below the landfill. The potential for this scenario to occur is remote and therefore will not be addressed.

2. Soil/Waste - A fence surrounding the landfill would result in greatly reducing, if not entirely eliminating, any exposure to soil/waste on site. The potential does exist for vandalism. It is estimated that this may occur up to 10 days/year during the months of May-October. A conservative estimate of exposure duration would be 30 years, consistent with USEPA guidelines. The fraction ingested would be one (1) and would be significantly less when absorbed through dermal contact.

3. Stream Sediment - The exposure frequency and duration remain the same as in the current (existing) land use scenario. All variables (i.e. frequency, duration, absorption, etc.) remain unchanged. This is based on the "no-action" scenario, that is, the stream sediments will remain accessible to persons, since it is not expected that a fence will surround The Gulf.

4. Surface Water - This is not a medium of concern.

TABLE 7–4

POTENTIAL EXPOSURE PATHWAYS: FUTURE LAND USE (Residential or Trespasser)

EXPOSURE MEDIA	EXPOSURE POINT	EXPOSURE ROUTE
Groundwater	Nearby residents using groundwater from wells as potable source.	Ingestion
Soil/Water	Persons trespassing onsite exposed to surficial soil contaminants on a site wide basis.	Ingestion Dermal
Surface Water/ Stream Sediment	Persons walking or playing in the wetland area or The Gulf.	Ingestion Dermal

7.3.2 Toxicity Assessment

The chemicals of potential concern identified from media collected at the Lockport City Landfill site may be categorized by their relative health risks. Risks are divided into carcinogenic and noncarcinogenic effects, with noncarcinogenic chemicals further subdivided into chronic and subchronic categories. Toxicity constants have been defined by USEPA to be used in evaluating these risks.

Toxicity data (with the exception of data for PAHs) for the health risk assessment were collected from the following hierarchy of sources as mandated by USEPA. First, Integrated Risk Information System (IRIS) was consulted through an on-line computer linkage. Second, when information was not available on IRIS the Health Effects Assessment Summary Tables (HEAST) for the Annual FY 1991 were consulted. Third, a list of compounds for which information was still missing was sent to USEPA Environmental Criteria and Assessment Office (ECAO). Tables 7-5 and 7-6 identify from which of these documents relavent factors were taken, and the date of verification by USEPA.

For evaluating carcinogenic risk from exposure to contaminants, a slope factor (SF) has been established. The SF is a plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. SFs are developed for oral intake and inhalation routes of exposure.

For evaluating noncarcinogenic effects from exposure to contaminants, the toxicity constants used are the reference dose (RfD), which pertains to ingestion or dermal contact, and reference concentration (RfC) which pertains to inhalation. Specific values are developed for chronic and subchronic RfDs and RfCs.

Chronic RfDs are derived from the No-Observed-Adverse-Effect-Level

TABLE 7-5

TOXICITY VALUES: POTENTIAL CARCINOGENIC EFFECTS

CHEMICAL	SLOPE FACTORS (mg/kg/day)^-1		WEIGHT-OF-EVIDENCE		TUMOR SITE		REFERENCE/SOURCE		DATE RECORDED INHAL/ORAL
	INHALATION	ORAL	INHALATION	ORAL	INHALATION	ORAL	INHALATION	ORAL	
Aldrin (a)	1.70E+01	1.70E+01	B2	B2	Liver	Liver	HEAST	HEAST	FY91
Arsenic (a)	5.00E+01 (b)	ND	A	A	Respiratory	Skin	HEAST	HEAST	FY91
Benzo(a)anthracene (c)	6.10E+00	1.15E+01	B2	B2	Respiratory	Stomach	SPHEM	SPHEM	1986
Benzo(a)pyrene	6.10E+00	1.15E+01	B2	B2	Respiratory	Stomach	SPHEM	SPHEM	1986
Benzo(b)fluoranthene (c)	6.10E+00	1.15E+01	B2	B2	Respiratory	Stomach	SPHEM	SPHEM	1986
Benzo(k)fluoranthene (c)	6.10E+00	1.15E+01	B2	B2	Respiratory	Stomach	SPHEM	SPHEM	1986
Beryllium (a)	8.40E+00	4.30E+00	B2	B2	Lung	Total Tumors	IRIS	IRIS	1-91
Bis(2-ethylhexyl)phthalate (a)	ND	1.40E-02	B2	B2	NA	Liver	IRIS	IRIS	5-90
Butylbenzylphthalate (a)	ND	ND	NA	C	NA	NA	HEAST	IRIS	FY91/2-89
Cadmium (a)	6.10E+00	ND	B1	ND	Respiratory	NA	IRIS	HEAST	3-91/FY91
Chlordane (a,d)	1.30E+00	1.30E+00	B2	B2	Liver	Liver	IRIS	IRIS	1-91
Chloroform (a)	8.10E-02	6.10E-03	B2	B2	Liver	Kidney	HEAST	HEAST	FY91
Chrysene (a,c)	6.10E+00	1.15E+01	B2	B2	Respiratory	Stomach	SPHEM	SPHEM	1986
Dibenz(a,h)anthracene	6.10E+00	1.15E+01	B2	B2	NA	NA	SPHEM	SPHEM	FY91
Hexachlorobenzene	1.60E+00	1.60E+00	B2	B2	Liver	Liver	HEAST	HEAST	FY91
Indeno(1,2,3-cd)pyrene (c)	6.10E+00	1.15E+01	B2	B2	Respiratory	Stomach	SPHEM	SPHEM	1986
Lead (a)	ND	ND	B2	B2	NA	NA	IRIS	IRIS	2-89
Nickel (a)	8.40E-01	ND	A	ND	Respiratory	NA	HEAST	HEAST	FY91
Pentachlorophenol (a)	ND	1.20E-01	B2	B2	NA	Liver,adrenal,CS	HEAST	HEAST	FY91
Polychlorinated Biphenyls	ND	7.70E+00	B2	B2	NA	Liver	HEAST	HEAST	FY91

Notes:

(a) - Refer to Table 7-6 for noncarcinogenic effects.

(b) - An absorption factor of 30% is used to calculate unit risk from the slope factor.

(c) - Toxicity values for benzo(a)pyrene were used for all carcinogenic PAHs when data were otherwise unavailable.

(d) - Slope factors are obtained for chlordane.

(e) - Calculated from the Unit Risk for Inhalation Exposure (mg/m^3)^-1

ND - Not determined.

NA - Not applicable.

CS - Circulatory system.

BW - Body weight.

IRIS - Integrated Risk Information System. Date indicates last update by US EPA. Access to IRIS was March, April 1991.

HEAST - Health Effects Assessment Summary Tables. Date indicates fiscal year for which table was published.

SPHEM - Superfund Public Health Evaluation Manual, USEPA 1986.

TABLE 7-6

TOXICITY VALUES: POTENTIAL NONCARCINOGENIC EFFECTS

CHEMICAL	TOXICITY VALUES (mg/kg/day)				CRITICAL EFFECT				REF/SOURCE				DATE RECORDED
	SUBCHRONIC		CHRONIC		SUBCHRONIC		CHRONIC		SUBCHRONIC		CHRONIC		
	INHALATION Rfc	ORAL Rfd	INHALATION Rfc	ORAL Rfd	INHALATION Rfc	ORAL Rfd	INHALATION Rfc	ORAL Rfd	INHALATION Rfc	ORAL Rfd	INHALATION Rfc	ORAL Rfd	Inhal/Oral
Acenaphthene	ND	6.00E-01	ND	6.00E-02	NA	Hepatotoxicity	NA	Hepatotoxicity	HEAST	HEAST	HEAST	HEAST	FY91
Acenaphthylene	Data inadequate for quantitative risk assessment. (HEAST)												
Aldrin (c)	ND	3.00E-05	ND	3.00E-05	NA	Liver lesions	NA	Liver lesions	HEAST	HEAST	HEAST	HEAST	FY91
Aluminum	Data inadequate for quantitative risk assessment. (HEAST)												
Anthracene	ND	3.00E+00	ND	3.00E-01	NA	No effects	NA	No effects	HEAST	HEAST	HEAST	HEAST	FY91
Antimony	ND	4.00E-04	ND	4.00E-04	Cancer	Blood	Cancer	Blood	HEAST	HEAST	HEAST	HEAST	FY91
Arsenic (c)	ND	1.00E-03	ND	1.00E-03	NA	Skin	NA	Skin	HEAST	HEAST	HEAST	HEAST	FY91
Barium	1.00E-03	5.00E-02	1.00E-04	5.00E-02	Fetal Toxicity	Increased BP	Fetal Toxicity	Increased BP	HEAST	HEAST	HEAST	HEAST	FY91
beta-BHC	No Data Available												
Benzo(g,h,i)perylene (b)	ND	4.00E-02	ND	4.00E-03	NA	Decreased BW	NA	Decreased BW	HEAST	HEAST	HEAST	HEAST	FY91
Benzoic Acid	ND	4.00E+00	ND	4.00E+00	NA	Malaise	NA	Malaise	HEAST	HEAST	HEAST	IRIS	FY91/1-91
Beryllium	ND	5.00E-03	ND	5.00E-03	NA	None observed	NA	None observed	HEAST	HEAST	HEAST	IRIS	FY91/9-90
Bis(2-ethylhexyl)phthalate (c)	ND	2.00E-02	ND	2.00E-02	NA	Liver	NA	Liver	HEAST	HEAST	HEAST	IRIS	FY91/9-89
2-Butanone (MEK)	9.00E-01	5.00E-01	9.00E-02	5.00E-02	CNS	Fetotoxicity	CNS	Fetotoxicity	HEAST	HEAST	HEAST	IRIS	FY91/6-90
Butylbenzylphthalate (c)	ND	2.00E+00	ND	2.00E-01	NA	BW,Testes,Liver,Kidney	NA	BW,Testes,Liver,Kidney	HEAST	HEAST	HEAST	IRIS	FY91/9-89
Cadmium (c)	ND	ND	ND	5.00E-04 (f)	Cancer	NA	Cancer	Kidney	HEAST	HEAST	HEAST	IRIS	FY91/10-89
Calcium	No Data Available												
Carbon Disulfide (d)	2.86E-03(a)	1.00E-01	2.86E-03(a)	1.00E-01	Fetal Toxicity	Fetal toxicity	Fetal Toxicity	Fetal toxicity	HEAST	HEAST	HEAST	IRIS	FY91/9-90
Chlordane (c)	ND	6.00E-05	ND	6.00E-05	NA	Liver	NA	Liver	HEAST	HEAST	HEAST	IRIS	FY91/7-89
Chloroform (c)	ND	1.00E-02	ND	1.00E-02	NA	Liver lesions	NA	Liver lesions	HEAST	HEAST	HEAST	HEAST	FY91
Chromium (II) (c)	5.71E-06(a)	1.00E+01	5.71E-07(a)	1.00E+00	Nasal mucosa	Liver	Nasal mucosa	Liver	HEAST	HEAST	HEAST	IRIS	FY91
Chrysene (c)	Data inadequate for quantitative risk assessment. (HEAST)												
Cobalt (d)			1.00E-06	1.00E-05	ND	ND	Respiratory	Heart,Blood					
Copper	ND	Inadequate data	ND	Inadequate data	NA	GI irritation	NA	GI irritation	HEAST	HEAST	HEAST	HEAST	FY91
Cyanide	ND	2.00E-02	ND	2.00E-02	NA	Wt.loss,thyroid	NA	Wt.loss,thyroid	HEAST	HEAST	HEAST	HEAST	FY91
Dibenzofuran	Data inadequate for quantitative risk assessment (HEAST)												
Di-n-butylphthalate	ND	1.00E+00	ND	1.00E-01	NA	Mortality	NA	Mortality	HEAST	HEAST	HEAST	HEAST	FY91
Diethylphthalate	ND	8.00E+00	ND	8.00E-01	NA	Body weight	NA	Body weight	HEAST	HEAST	HEAST	IRIS	FY91/9-87
Dimethylphthalate	ND	1.00E+00	ND	1.00E+00	NA	Body growth, kidney	NA	Body growth, kidney	HEAST	HEAST	HEAST	HEAST	FY91
Di-n-octylphthalate	ND	2.00E-02	ND	2.00E-02	NA	Kidney,Liver	NA	Kidney,Liver	HEAST	HEAST	HEAST	HEAST	FY91
Ethylbenzene	2.86E-01(a)	1.00E+00	2.86E-01(a)	1.00E-01	Developmental	Kidney,Liver	Developmental	Kidney,Liver	HEAST	HEAST	HEAST	IRIS	FY91
Fluoranthene	ND	4.00E-01	ND	4.00E-02	NA	Kidney,liver,blood	NA	Kidney,liver,blood	HEAST	HEAST	HEAST	HEAST	FY91
Endosulfan I	ND	2.00E-04	ND	5.00E-05	NA	Kidney lesions	NA	Kidney lesions	HEAST	HEAST	HEAST	IRIS	FY91

TABLE 7-6 (continued)

TOXICITY VALUES: POTENTIAL NONCARCINOGENIC EFFECTS

CHEMICAL	TOXICITY VALUES (mg/kg/day)				CRITICAL EFFECT				REF/SOURCE				DATE RECORDED
	SUBCHRONIC		CHRONIC		SUBCHRONIC		CHRONIC		SUBCHRONIC		CHRONIC		
	INHALATION Rfc	ORAL Rfd	INHALATION Rfc	ORAL Rfd	INHALATION Rfc	ORAL Rfd	INHALATION Rfc	ORAL Rfd	INHALATION Rfc	ORAL Rfd	INHALATION Rfc	ORAL Rfd	Inhal/Oral
Fluorene	ND	4.00E-01	ND	4.00E-02	NA	Blood	NA	Blood	HEAST	HEAST	HEAST	HEAST	FY91
Hexachlorobenzene	ND	8.00E-04	ND	8.00E-04	NA	Liver, Blood	NA	Liver, Blood	HEAST	HEAST	HEAST	IRIS	FY91
Iron	ND	ND	ND	4.30E-01	NA	NA	NA	NA	HEAST	HEAST	HEAST	(d)	FY91
Lead (c)	ND	ND	ND	ND	NA	NA	CNS	CNS	HEAST	HEAST	HEAST	IRIS	FY91/2-91
Magnesium	No Data Available												
Manganese	1.14E-04 (a)	1.00E-01	1.14E-04 (a)	1.00E-01	Respiratory, CNS	No effect	Respiratory, CNS	No effect	HEAST	HEAST	IRIS	IRIS	FY91/12-90
Mercury	8.57E-05 (a)	3.00E-04	8.57E-05 (a)	3.00E-04	Neurotoxicity	Kidney	Neurotoxicity	Kidney	HEAST	HEAST	HEAST	HEAST	FY91
2-Methylnaphthalene (b)	ND	4.00E-02	ND	4.00E-03	NA	Decreased BW	NA	Decreased BW	HEAST	HEAST	HEAST	HEAST	FY91
Naphthalene	ND	4.00E-02	ND	4.00E-03	NA	Decreased BW	NA	Decreased BW	HEAST	HEAST	HEAST	HEAST	FY91
Nickel (c)	ND	2.00E-02	ND	2.00E-02	Cancer	Reduced body, organ wt.	Cancer	Reduced body, organ wt.	HEAST	HEAST	HEAST	HEAST	FY91
4-Nitroaniline	Data inadequate for quantitative risk assesment.(HEAST)												
N-Nitrosodiphenylamine	Data inadequate for quantitative risk assesment.(HEAST)												
Pentachlorophenol (c)	ND	3.00E-02	ND	3.00E-02	NA	Fetal Toxicity	NA	Liver,Kidney	HEAST	HEAST	HEAST	HEAST	FY91
Phenanthrene	Data inadequate for quantitative risk assessment. (HEAST)												
Potassium	No Data Available												
Pyrene	ND	3.00E-01	ND	3.00E-02	NA	Kidney	NA	Kidney	HEAST	HEAST	HEAST	HEAST	FY91
Silver	ND	3.00E-03	ND	3.00E-03	NA	Argyria	NA	Argyria	HEAST	HEAST	HEAST	HEAST	FY91
Sodium (d)	ND	ND	ND	ND	NA	NA	NA	NA					
Selenium	No Data Available												
Thallium	No Data Available												
Toluene	5.71E-01	2.00E+00	5.71E-01	2.00E-01	CNS	Eyes,nose,liver,kidney	CNS	Eyes,nose,liver,kidney	HEAST	HEAST	HEAST	IRIS	FY91
Phenol	ND	6.00E-01	ND	6.00E-01	NA	Decreased fetal BW	NA	Decreased fetal BW	HEAST	HEAST	HEAST	IRIS	FY91
Vanadium	ND	7.00E-03	ND	7.00E-03	NA	None observed	NA	None observed	HEAST	HEAST	HEAST	HEAST	FY91
Xylenes, Total	8.57E-02(a)	4.00E+00	8.57E-02(a)	2.00E+00	CNS,Nose,Throat	None	CNS,Nose,Throat	BW & hyperactivity	HEAST	HEAST	IRIS	IRIS	FY91/9-87
Zinc	ND	2.00E-01	ND	2.00E-01	NA	Anemia	NA	Anemia	HEAST	HEAST	HEAST	HEAST	FY91

(a) - Converted from inhalation Rfc (mg/m^3).
(b) - Toxicity values based on Oral Rfd for naphthalene (HEAST FY91).
(c) - Refer to Table 7-5 for carcinogenic effects.
(d) - Data from US EPA internal memo, Pei-Fung Hurst, Superfund Health Risk Technology Support Center, Environmental Criteria and Assesment Office, April, 1991.
(f) - RFD is based on water.
IRIS - Integrated Risk Information System. Date indicates when last updated by US EPA. Access to IRIS was March, April 1991.
HEAST - Health Effects Assessment Summary Tables. Date indicates fiscal year for which table was published.

ND - Not Determined
NA - Not Applicable
BP - Blood Pressure
BW - Body Weight
CNS - Central Nervous System.
GI - Gastrointestinal

(NOAEL) for the critical toxic effect and modified by application of uncertainty factors reflecting the type of study on which the values are based. RfDs are used to estimate risk from oral or dermal routes of exposure.

Chronic RfCs are derived in a similar fashion but are based upon studies of inhalation exposure. For this reason, calculation of RfCs is more complex, and therefore RfCs are available for fewer chemicals.

Since toxicity information is limited for many chemicals used in the HRA, uncertainty factors are published for non-carcinogenic chemicals. These uncertainty factors generally range between 10 and 1,000. A high uncertainty factor indicates low strength of evidence for the toxicity value and further indicates that the toxicity value might change if additional data become available. A low uncertainty factor indicates that there is a high degree of confidence in the value and that a change is less likely should more data become available.

7.3.2.1 Health Effects

A. Carcinogenic Chemicals

Table 7-5 summarizes information for the potentially carcinogenic chemical compounds which were detected in one or more of the surficial soil/waste, surface water or stream sediment samples at the Lockport City Landfill site. For each of these compounds, the following information is provided:

1. Weight of evidence for carcinogenicity expresses the degree of confidence relating to exposure to a given chemical and the likelihood that the chemical causes cancer in humans. This weight of evidence is based upon the following USEPA classification system:

Group A--Human Carcinogen

This category indicates that there is sufficient evidence from epidemiological studies to support a causal association between an agent and cancer in humans.

Group B--Probable Human Carcinogen

This category generally indicates that there is at least limited evidence from epidemiological studies of carcinogenicity to humans (Group B1) or that, in the absence of positive data on humans, there is sufficient evidence of carcinogenicity in animals (Group B2).

Group C--Possible Human Carcinogen

This category indicates that there is limited evidence of carcinogenicity in animals in the absence of positive human data.

Group D--Not Classified

This category indicates that there were no data to evaluate or that the evidence for carcinogenicity in humans and in animals was inadequate.

Group E--No Evidence of Carcinogenicity to Humans

This category indicates that there is no evidence of carcinogenicity in at least two adequate animal tests in different species or in both epidemiological and animal studies.

2. Slope factor, or cancer potency factor, represents a plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. This slope factor allows the calculation of

incremental lifetime cancer risk associated with exposure to the chemical at a known or estimated dosage. Table 7-5 provides separate slope factors, where applicable and available, for oral and inhalation routes of exposure.

3. References, including source(s) and date(s), are provided to indicate the basis for identified slope factors.

4. Tumor site, i.e., type of cancer upon which the slope factor and weight of evidence are based.

B. Noncarcinogenic Chemicals

Unlike carcinogens, noncarcinogenic compounds are thought to have threshold dosage levels below which adverse effects are not expected. Table 7-6 summarizes toxicity information for the noncarcinogenic chemicals which were detected in the surface water, stream sediments, and surficial soil/waste at the Lockport City Landfill site. [Note that some chemicals (e.g., arsenic) have both carcinogenic and noncarcinogenic effects, and are therefore listed in both Table 7-5 and Table 7-6.] For each of the Table 7-6 chemicals the following information is provided separately for oral and inhalation routes of exposure where appropriate:

1. Toxicity Value, expressed in mg/kg-day for noncarcinogenic chemicals, generally identifies the threshold dosage level below which adverse health effects are not expected. The most common and preferred criterion for expressing potency is the reference dose (RfD), which is an estimate of the average daily exposure level below which significant, adverse noncarcinogenic health effects are not expected.

2. Source(s) of dose-response data.

3. Date(s) of source information.

4. Critical Effect expresses the end point of adverse response (e.g., liver damage) associated with the exposure to noncarcinogenic chemicals.

7.3.2.2 Toxicity Profiles

For each chemical a toxicity profile has been prepared that summarizes physical and chemical as well as toxicological information. Various sources were consulted for this information, and citations are given where appropriate. These profiles are presented in Appendix P.

7.3.3 Risk Assessment

7.3.3.1 Overview

This section describes the final step of the health risk assessment process, risk characterization. In this step, the toxicity and exposure assessments are summarized and integrated into qualitative expressions of risk.

Noncarcinogenic risk evaluation is based on a threshold response theory. The process involves a comparison of an exposure level (or dose) to the estimated threshold response level. The term used to make this comparison is the "Hazard Index": which is defined as:

$$\text{Hazard Index} = \frac{\text{Exposure Level (Intake or Absorbed Dose) (mg/kg/day)}}{\text{Toxicity Value (mg/kg/day)}}$$

According to USEPA, a concern for potential noncarcinogenic health effects exists when the Hazard Index exceeds unity (1.0).

Carcinogenic risk is expressed as the incremental lifetime cancer risk that could be experienced by an individual or population exposed to

carcinogenic contaminants at the Lockport City Landfill site. This incremental lifetime cancer risk corresponds to the upper 95th percentile confidence limit of the probability of developing cancer over a 70-year lifetime from exposure to hazardous substances at the Lockport City Landfill site. It is calculated by the following equation:

$$\text{Cancer Risk} = \underline{\text{Exposure Level (mg/kg/day) x Slope Factor (mg/kg/day)}^{-1}}$$

Incremental lifetime cancer risk is dimensionless. A risk of 1.0 E-06 for example, indicates that an individual would incur an additional risk of 0.000001 (or 1 in one million) due to his/her exposure to contaminants at a given site. Alternately, out of a population of one million persons so exposed, this risk would indicate that one person, on average, would contact cancer due to such exposure.

Through its National Oil and Hazardous Substances Pollution Contingency Plan (NCP), USEPA has established acceptable exposure levels for known or suspected carcinogens that are to be used to establish remedial action objectives. The acceptable exposure levels are concentration levels that represent an excess upper-bound lifetime cancer risk of 1.0E-06 to 1.0E-04. The risk associated with each environmental medium identified in the previous sections is discussed in this section.

7.3.3.2 Pathway Risk - Results and Discussion

A. Current/Future Land Use

1. Surface Water - As stated in Section 7.2, the surface water results for semivolatile chemicals appears to be anomalous. Therefore, the only chemicals of potential concern are chloroform and toluene. Dermal contact and incidental ingestion are the two potential exposure pathways. Both of these compounds are classified by USEPA as noncarcinogens. Chronic toxicity values are available for these

chemicals. [As discussed earlier the likelihood of children 1-6 years old accessing The Gulf are very remote, therefore, a subchronic evaluation was not performed.] The exposure intake variables are the same for both current and future land use scenarios. The total chronic Hazard Index for this medium, taking into consideration dermal contact and ingestion, is considerably less than unity. Surface water does not appear to be a human health risk to the surrounding population.

2. Stream Sediment - The risk associated with stream sediments via incidental ingestion and dermal contact is minimal. Five organic chemicals and three inorganic chemicals are of potential concern (Section 7.2.). Of these chemicals, three (beta-BHC, selenium, thallium) had no toxicity values reported in any of the USEPA sources. A chronic Hazard Index was calculated for endosulfan I, antimony and bis(2-ethylhexyl) phthalate (also a carcinogen) (subchronic was not evaluated). Exposure intake variables are the same for both current and future land use scenarios. The total chronic Hazard Index was calculated to be approximately two orders of magnitude less than unity for this medium.

The carcinogenic risk was evaluated in accordance with USEPA RAGS guidelines. The total cancer risk associated with both dermal and ingestion pathways for bis(2-ethylhexyl)phthalate and Aroclor 1248 is within the USEPA upper-bound lifetime cancer risk of 1.0E-06 to 1.0E-04.

Based upon this evaluation, stream sediments do not pose a human health threat, chronic or cancerous, to the population surrounding the landfill.

3. Surficial Soil/Waste - Although currently the surface of the Lockport City Landfill is accessible, the future land use scenario requires that a fence surround the site. This will reduce if not entirely eliminate any chronic hazard or cancer risk which may exist at the landfill. [It should be noted that without this institutional action, an

estimate of the total (dermal and ingestion) cancer risk at the site would exceed acceptable limits established by USEPA with a value of 4.0E-04. The total chronic Hazard Index for both dermal and ingestion exposures is less than 1.0.]

7.3.4 Uncertainty Analysis

The estimates of carcinogenic risk and noncarcinogenic health effects (chronic/subchronic) in this HRA are based upon numerous assumptions, and, therefore involve a considerable degree of uncertainty. Some of this uncertainty is inherent in the risk assessment process itself, and the current limits of scientific knowledge regarding human health risk factors. For example, the necessary extrapolation of animal study data to humans introduces a large uncertainty factor into the process, as does extrapolation from the high doses used in these studies to the low doses associated with most hazardous waste sites such as the Lockport City Landfill site. Likewise, estimating human exposure and human intake is largely judgmental, and involves extrapolation of human behavioral patterns (often unknown even at present) into the relatively distant (up to 70 years) future.

Due to these types of uncertainties, which are discussed in greater detail below, the results of the HRA for the Lockport City Landfill site should not be taken as a characterization of absolute risk, or as a fully probabilistic estimate of this risk. Rather, they are intended to identify the types and relative levels of risk associated with various potential exposure routes at the Lockport City Landfill site, so that remedial efforts may focus upon those aspects of the site which are of greatest concern from a human health standpoint.

The discussion of uncertainty is broken down into three categories as follows:

- o Uncertainty concerning exposure
- o Uncertainty concerning toxicity
- o Uncertainty concerning risk characterization

Each of these categories is discussed below.

A. Uncertainty Concerning Exposure

1. Values for Intake Variables - The exposure frequency utilized to evaluate exposure to onsite soil, waste, surface water, and stream sediment (via ingestion or dermal contact) under the trespass scenario is an estimate based largely on professional judgement, and consequently introduces uncertainty. Actual exposure frequency would more accurately be determined by evaluating data on behavioral patterns of nearby residents or nearby employees. However, these data are unavailable. Therefore, exposure frequency values recommended by USEPA for evaluating onsite trespass and residential use were utilized in the exposure assessment. These values may be considered to be conservative values that would not underestimate exposure to surface water, stream sediment, or onsite soil contamination.

2. Exposure Pathways - The potential exists for exposure to surface water and stream sediments from The Gulf which may be contaminated by the landfill. Exposure at this point would result from dermal contact with chemicals in The Gulf during recreational activities or from incidental ingestion of chemicals in the water. As stated in the previous sections, however, recreational activities (e.g. fishing) are not likely to occur (no aquatic life was noted during RI activities or site walkovers) and the "dirty" appearance of The Gulf would most likely deter any type of recreational activity. [It should also be noted that NYSDEC has classified The Gulf as Class D surface water.] Some uncertainty is associated with the groundwater pathway as well. It is highly unlikely that groundwater used by residents is the same groundwater that flows

through the site. This decision is based upon geological and hydrogeological information and analytical data. However, there is a certain degree of uncertainty associated with this pathway.

B. Uncertainty Concerning Toxicity Information

1. Surrogate Values - Dose-response information is not available for some chemicals found on site at the Lockport City Landfill. For PAHs, surrogate values have been used to quantify risk as discussed below.

a. Carcinogenic PAHs - All carcinogenic PAHs were assumed to have the same slope factor as benzo(a)pyrene. This slope factor was taken from the HEAST Tables (FY 1991).

b. Non-carcinogenic PAHs - All noncarcinogenic PAHs were assumed to have the same reference dose value as naphthalene. This reference dose value was taken from the HEAST Tables (FY 1991).

These surrogate values may be considered conservative and may oversimplify the toxic properties and interactions of PAHs.

2. Compounds With No Values - There are many chemicals for which dose-response data are undetermined or inadequate, and for which no surrogate value is available. The risk associated with these chemicals cannot be quantified.

C. Uncertainty Concerning Risk Characterization

1. Combination of Pathways - In order to determine media-specific risk, the risks from individual exposure pathways were combined. This method essentially involves the addition of risks associated with pathways which are not mutually exclusive (e.g. dermal and ingestion). From a probability standpoint, it essentially involves compounding (by

multiplication) the probability of exposure via each pathway. The net probability of an individual being exposed through all non-exclusive pathways is considered to be very low. Alternately stated, this combination of pathways tends to produce a very conservative risk estimate.

2. Summation of Hazard Indices - In order to determine pathway specific values for a chronic Hazard Index, the index values for individual chemical compounds were first calculated individually, and then totalled. The resulting total Hazard Index value for each medium is conservative, since different chemicals typically affect different human organs, and therefore produce different noncarcinogenic effects. Addition of their individual index values does not account for these different effects, and typically produces a conservatively high total Hazard Index.

7.4 Quantitative Assessment of Soil/Waste as Fugitive Dust

7.4.1 Selection of Chemicals of Potential Concern

Data presented in Chapter 4.0 were used to compute averages (arithmetic mean) and to identify maximum concentrations of contaminants in surficial soil/waste samples from onsite sources. These values were utilized in accordance with other criteria discussed below to select contaminants (chemicals of potential concern) for inclusion in this quantitative risk assessment. These average and maximum concentrations were subsequently employed to determine exposure point concentrations for use in the exposure assessment.

A list of organic and inorganic chemicals detected in surficial soil/waste samples at the Lockport City Landfill is presented in Table 7-7. Also included in this table are sample quantitation limit ranges, sample frequency and onsite concentrations (maximum and average concentrations).

TABLE 7-7
ONSITE SURFACE SOIL/WASTE CONTAMINATION LEVELS
LOCKPORT CITY LANDFILL SITE

PARAMETER	TYPE	SQL RANGE	SAMPLE FREQUENCY		ONSITE CONCENTRATION	
			# DETECTS	#SAMPLES	AVERAGE	MAXIMUM
Carbon Disulfide	VOC	7-12	1	8	6.000	6.000
Chloroform	VOC	7-12	3	8	1.000	1.000
2-Butanone	VOC	15-23	1	8	1.000	1.000
Ethylbenzene	VOC	7-12	1	8	10.000	10.000
Xylenes (total)	VOC	7-12	2	8	54.250	107.500
Benzoic Acid	SEMI	2000-15000	5	8	230.400	465.000
Naphthalene	SEMI	400-550	3	8	1005.000	2700.000
2-Methylnaphthalene	SEMI	400-550	3	8	428.333	955.000
Dimethylphthalate	SEMI	400-3100	1	8	1350.000	1350.000
Acenaphthylene	SEMI	460-3100	3	8	223.333	355.000
Acenaphthene	SEMI	400-550	3	8	801.667	1800.000
Dibenzofuran	SEMI	400-550	3	8	563.333	1280.000
Diethylphthalate	SEMI	400-3100	2	8	48.000	63.000
Fluorene	SEMI	460-550	4	8	507.000	1225.000
Pentachlorophenol	SEMI	2000-15000	1	8	320.000	320.000
Phenanthrene	SEMI	510	7	8	3877.143	17500.000
Anthracene	SEMI	510-3100	6	8	308.500	825.000
Di-n-butylphthalate	SEMI	97-680	1	8	4850.000	4850.000
Fluoranthene	SEMI	510	7	8	3515.000	11050.000
Pyrene	SEMI	510	7	8	4998.571	19500.000
Butylbenzylphthalate	SEMI	400-3100	1	8	130.000	130.000
Benzo(a)anthracene	SEMI	510	7	8	2441.429	8500.000
Chrysene	SEMI	510	7	8	2717.143	10750.000
Bis(2-ethylhexyl)phthalate	SEMI	320	7	8	6569.286	38000.000
Di-n-octylphthalate	SEMI	480-3100	3	8	135.333	260.000
Benzo(b)fluoranthene	SEMI	510	7	8	2615.714	8100.000
Benzo(k)fluoranthene	SEMI	510-550	6	8	1865.000	7050.000
Benzo(a)pyrene	SEMI	510	7	8	2322.857	8850.000
Indeno(1,2,3-cd)pyrene	SEMI	400-550	3	8	3150.000	6150.000

Notes:
All concentrations are presented in ppb.
Average concentrations were calculated using one-half the sample quantitation limit (SQL) for samples where an analyte was not detected.

TABLE 7-7 (continued)
ONSITE SURFACE SOIL/WASTE CONTAMINATION LEVELS
LOCKPORT CITY LANDFILL SITE

PARAMETER	TYPE	SQL RANGE	SAMPLE FREQUENCY		ONSITE CONCENTRATION	
			# DETECTS	#SAMPLES	AVERAGE	MAXIMUM
Dibenz(a,h)anthracene	SEMI	400–3100	2	8	7.000E+02	1.200E+03
Benzo(g,h,i)perylene	SEMI	400–3100	2	8	1.758E+03	2.550E+03
Aldrin	PEST	9.8–130	2	8	4.350E+01	6.700E+01
gamma–Chlordane	PEST	110–1300	2	8	1.190E+02	2.300E+02
Aroclor–1248	PCB	98–130	3	8	3.537E+03	9.300E+03
Aroclor–1254	PCB	250–2500	6	8	4.617E+02	1.900E+03
Aluminum	MCP	—	8	8	1.258E+07	2.340E+07
Antimony	MCP	8100–25800000	2	8	1.365E+04	1.400E+04
Arsenic	MCP	—	8	8	1.798E+04	2.480E+04
Barium	MCP	—	8	8	2.007E+05	7.790E+05
Beryllium	MCP	740–2800	3	8	1.157E+03	1.400E+03
Cadmium	MCP	1200–1700	6	8	6.600E+03	1.640E+04
Calcium	MCP	—	8	8	7.965E+07	1.550E+08
Chromium	MCP	—	8	8	2.939E+05	1.480E+06
Cobalt	MCP	9600	7	8	4.187E+04	2.230E+05
Copper	MCP	—	8	8	5.092E+05	1.540E+06
Iron	MCP	—	8	8	3.158E+07	6.730E+07
Lead	MCP	—	8	8	1.424E+06	4.810E+06
Magnesium	MCP	—	8	8	1.390E+07	2.440E+07
Manganese	MCP	—	8	8	1.043E+06	2.660E+06
Mercury	MCP	280	7	8	9.043E+02	2.400E+03
Nickel	MCP	—	8	8	7.581E+04	1.630E+05
Potassium	MCP	—	8	8	2.815E+06	5.900E+06
Silver	MCP	1700–3400	5	8	4.640E+03	7.400E+03
Sodium	MCP	761000	7	8	8.670E+05	2.260E+06
Vanadium	MCP	—	8	8	2.366E+04	3.050E+04
Zinc	MCP	—	8	8	2.698E+06	9.570E+06
Cyanide	MCP	1200–2800	1	8	5.600E+03	5.600E+03

Notes:
All concentrations are presented in ppb.
Average concentrations were calculated using one–half the sample quantitation limit (SQL) for samples where an analyte was not detected.

There was no background surficial soil/waste sample collected for this investigation. Therefore, any chemical which was detected in at least one sample during the RI has been considered a chemical of potential concern. Table 7-8 presents the surficial soil/waste chemicals of potential concern (CPCs).

7.4.2 Exposure Assessment

The objective of this exposure assessment is to estimate the type and magnitude of potential human exposures to chemical compounds present in the surficial soil/waste at the Lockport City Landfill site. Ultimately, this objective is achieved by estimating an exposure dose for each pathway and each onsite chemical. As discussed in the previous sections, the only exposure pathway of concern with regard to the surficial soil/waste is the inhalation of airborne chemicals from the generation of fugitive dust which would then be transported offsite. The exposure variables (i.e. exposure frequency, exposure duration, etc.) used to calculate intake concentrations are the same for both current and future-use scenarios. The process includes an estimation of chemical concentrations at the point of potential human exposure, and the application of assumptions and exposure parameters to estimate an exposure dose for the selected pathway of concern.

7.4.2.1 Exposure Concentrations

In order to quantify health effects from the inhalation of fugitive dust, it is necessary to establish the concentration of each chemical of potential concern at the point(s) where it comes into contact with a human receptor. The exposure concentrations in this study, were derived from a combination of both monitoring and modeling data. The method for determining the exposure concentration utilized for the surficial soil/waste is summarized below. [A more detailed description of exposure point concentration determination is included in Section 5.0 and Appendix N.]

TABLE 7-8

SURFICIAL SOIL/WASTE CHEMICALS OF POTENTIAL CONCERN

Carbon Disulfide
Chloroform
2-Butanone
Ethylbenzene
Xylenes (total)
Benzoic Acid
Naphthalene
2-Methylnaphthalene
Dimethylphthalate
Acenaphthylene
Acenaphthene
Dibenzofuran
Diethylphthalate
Fluorene
Pentachlorophenol
Phenanthrene
Anthracene
Di-n-butylphthalate
Fluoranthene
Pyrene
Butylbenzylphthalate
Benzo(a)anthracene
Chrysene
Bis(2-ethylhexyl)phthalate
Di-n-octylphthalate
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Ideno(1,2,3-cd)pyrene
Dibenz(a,h)anthracene
Benzo(g,h,i)perylene
Aldrin
gamma-Chlordane
Aroclor-1248
Aroclor-1254
Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Magnesium
Manganese
Mercury
Nickel
Potassium
Silver
Sodium
Vanadium
Zinc
Cyanide

a. Soil/Waste - Respirable exposure concentrations at the nearest worker/resident were analytically modeled and utilized to evaluate risk under the current/future land use scenario (Table 7-9). An estimate of wind erosion emissions was determined to have the most effect on the workers at the Lockport Municipal Garage since these are the closest human receptors to the site. In general, because of the uncertainty associated with estimating exposure concentrations, the exposure concentration in soil/waste is the upper confidence limit (i.e. the 95 percent upper confidence limit) on the arithmetic average for all surficial soil/waste samples. For chemicals where the upper confidence limit on the arithmetic average was higher than the maximum concentration (because one-half the sample quantitation limit was used for non-detected values) the maximum concentration was used as the exposure concentration and input into the transport model for eventual calculation of respirable contaminant concentrations. Table 7-10 presents representative concentrations as well as the values used for surficial soil/waste samples. (A more detailed description of the fugitive dust model and the determination of respirable concentrations for surficial/waste is presented in Appendix N).

7.4.2.2 Estimate of Chemical Intakes

The exposure dose, or intake, is defined as the mass of a substance given to an organism and in contact with an exchange boundary (e.g., lungs) per unit body weight per unit time. Units for exposure intake are typically milligrams per kilogram-day (mg/kg-day). Exposure dose is calculated by dividing the total amount of chemical exposure (mg) by body weight (kg) and exposure time (days). The total amount of chemical exposure is based upon chemical concentration in the environmental medium of concern, relative absorption factor of the chemical, and a number of intake variables expressing the frequency, duration, and magnitude of exposure. These intake variables are selected conservatively, so that, in combination, they produce an estimate of the reasonable maximum exposurefor the inhalation exposure pathway. The following discussion

TABLE 7-9

RESPIRABLE CONCENTRATIONS AT THE NEAREST RECEPTOR POINT LOCKPORT CITY LANDFILL SITE

PARAMETERS	CONCENTRATION IN SOIL	CONCENTRATION IN SOIL	RESPIRABLE CONCENTRATION AT THE RECEPTOR
	[ug/kg]	[dimensionless]	[μg/m^3]
Carbon Disulfide	5.31E+00	5.31E-09	4.75E-08
Chloroform	1.00E+00	1.00E-09	8.94E-09
2-Butanone	1.00E+00	1.00E-09	8.94E-09
Ethylbenzene	6.59E+00	6.59E-09	5.89E-08
Xylenes (total)	4.15E+01	4.15E-08	3.71E-07
Benzoic Acid	4.65E+02	4.65E-07	4.16E-06
Naphthalene	1.12E+03	1.12E-06	1.00E-05
2-Methylnaphthalene	4.89E+02	4.89E-07	4.38E-06
Dimethylphthalate	9.21E+02	9.21E-07	8.24E-06
Acenaphthylene	3.55E+02	3.55E-07	3.18E-06
Acenaphthene	8.21E+02	8.21E-07	7.34E-06
Dibenzofuran	6.13E+02	6.13E-07	5.48E-06
Diethylphthalate	6.30E+01	6.30E-08	5.63E-07
Fluorene	6.22E+02	6.22E-07	5.57E-06
Pentachlorophenol	3.40E+03	3.40E-06	3.04E-05
Phenanthrene	7.44E+03	7.44E-06	6.65E-05
Anthracene	8.18E+02	8.18E-07	7.31E-06
Di-n-butylphthalate	2.06E+03	2.06E-06	1.84E-05
Fluoranthene	5.74E+03	5.74E-06	5.13E-05
Pyrene	8.97E+03	8.97E-06	8.02E-05
Butylbenzylphthalate	2.60E+02	2.60E-07	2.33E-06
Benzo(a)anthracene	4.21E+03	4.21E-06	3.76E-05
Chrysene	4.90E+03	4.90E-06	4.38E-05
Bis(2-ethylhexyl)phthalate	1.45E+04	1.45E-05	1.30E-04
Di-n-octylphthalate	2.60E+02	2.60E-07	2.33E-06
Benzo(b)fluoranthene	4.35E+03	4.35E-06	3.89E-05
Benzo(k)fluoranthene	3.08E+03	3.08E-06	2.76E-05
Benzo(a)pyrene	4.13E+03	4.13E-06	3.69E-05
Indeno(1,2,3-cd)pyrene	2.71E+03	2.71E-06	2.42E-05

TABLE 7-9 (continued)

RESPIRABLE CONCENTRATIONS AT THE NEAREST RECEPTOR POINT
LOCKPORT CITY LANDFILL SITE

PARAMETERS	CONCENTRATION IN SOIL	CONCENTRATION IN SOIL	RESPIRABLE CONCENTRATION AT THE RECEPTOR
	[ug/kg]	[dimensionless]	[μg/m^3]
Dibenz(a,h)anthracene	8.80E+02	8.80E-07	7.87E-06
Benzo(g,h,i)perylene	1.36E+03	1.36E-06	1.22E-05
Aldrin	4.20E+01	4.20E-08	3.75E-07
gamma-Chlordane	2.30E+02	2.30E-07	2.06E-06
Aroclor-1248	3.53E+03	3.53E-06	3.16E-05
Aroclor-1254	9.78E+02	9.78E-07	8.75E-06
Aluminum	1.61E+07	1.61E-02	1.44E-01
Antimony	1.15E+04	1.15E-05	1.03E-04
Arsenic	2.11E+04	2.11E-05	1.89E-04
Barium	3.63E+05	3.63E-04	3.25E-03
Beryllium	1.19E+03	1.19E-06	1.06E-05
Cadmium	8.48E+03	8.48E-06	7.58E-05
Calcium	1.07E+08	1.07E-01	9.60E-01
Chromium	6.32E+05	6.32E-04	5.66E-03
Cobalt	1.86E+04	1.86E-05	1.66E-04
Copper	8.00E+05	8.00E-04	7.16E-03
Iron	4.28E+07	4.28E-02	3.83E-01
Lead	2.50E+06	2.50E-03	2.24E-02
Magnesium	1.86E+07	1.86E-02	1.66E-01
Manganese	1.53E+06	1.53E-03	1.37E-02
Mercury	1.30E+03	1.30E-06	1.16E-05
Nickel	1.14E+05	1.14E-04	1.02E-03
Potassium	3.68E+06	3.68E-03	3.29E-02
Silver	4.86E+03	4.86E-06	4.34E-05
Sodium	1.37E+06	1.37E-03	1.22E-02
Vanadium	2.85E+04	2.85E-05	2.55E-04
Zinc	4.96E+06	4.96E-03	4.43E-02
Cyanide	2.59E+03	2.59E-06	2.31E-05

TABLE 7 - 10
REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL AND WASTE
Lockport City Landfill Site

SAMPLE ID	SPS-1	SPS-2	SPS-3	SPS-4	SPS-5	WS-1	WS-2	WS-3
PARAMETERS								
Carbon Disulfide	4.00E+00	6.00E+00	5.00E+00	4.50E+00	3.50E+00	4.50E+00	4.00E+00	6.00E+00
Chloroform	4.00E+00	6.00E+00	5.00E+00	4.50E+00	3.50E+00	1.00E+00	1.00E+00	1.00E+00
2-Butanone	8.00E+00	1.15E+01	1.00E+01	1.00E+00	7.50E+00	8.50E+00	8.00E+00	9.00E+00
Ethylbenzene	4.00E+00	6.00E+00	5.00E+00	4.50E+00	3.50E+00	4.50E+00	4.00E+00	1.00E+01
Xylenes (total)	4.00E+00	6.00E+00	5.00E+00	1.00E+00	3.50E+00	4.50E+00	4.00E+00	1.08E+02
Benzoic Acid	1.00E+03	4.65E+02	2.50E+02	7.70E+01	7.00E+01	2.90E+02	1.25E+03	7.50E+03
Naphthalene	2.00E+02	1.55E+02	1.60E+02	2.75E+02	2.30E+02	2.55E+02	2.60E+02	2.70E+03
2-Methylnaphthalene	2.00E+02	1.80E+02	1.50E+02	2.75E+02	2.30E+02	2.55E+02	2.60E+02	9.55E+02
Dimethylphthalate	2.00E+02	1.35E+03	2.40E+02	2.75E+02	2.30E+02	2.55E+02	2.60E+02	1.55E+03
Acenaphthylene	1.20E+02	1.95E+02	3.55E+02	2.75E+02	2.30E+02	2.55E+02	2.60E+02	1.55E+03
Acenaphthene	2.00E+02	4.15E+02	1.90E+02	2.75E+02	2.30E+02	2.55E+02	2.60E+02	1.80E+03
Dibenzofuran	2.00E+02	2.35E+02	1.75E+02	2.75E+02	2.30E+02	2.55E+02	2.60E+02	1.28E+03
Diethylphthalate	2.00E+02	3.30E+01	2.40E+02	2.75E+02	2.30E+02	2.55E+02	6.30E+01	1.55E+03
Fluorene	4.30E+01	4.70E+02	2.90E+02	2.75E+02	2.30E+02	2.55E+02	2.60E+02	1.23E+03
Pentachlorophenol	1.00E+03	1.25E+03	1.15E+03	3.20E+02	1.15E+03	1.25E+03	1.25E+03	7.50E+03
Phenanthrene	3.50E+02	5.40E+03	3.05E+03	3.70E+02	1.60E+02	2.55E+02	3.10E+02	1.75E+04
Anthracene	9.70E+01	8.25E+02	7.25E+02	7.70E+01	3.60E+01	2.55E+02	9.10E+01	1.55E+03
Di-n-butylphthalate	4.85E+01	4.85E+03	3.40E+02	1.60E+02	2.30E+02	2.55E+02	2.60E+02	1.55E+03
Fluoranthene	8.00E+02	6.30E+03	4.65E+03	8.50E+02	4.00E+02	2.55E+02	5.55E+02	1.11E+04
Pyrene	4.20E+02	8.60E+03	5.00E+03	7.30E+02	3.50E+02	2.55E+02	3.90E+02	1.95E+04
Butylbenzylphthalate	2.00E+02	2.60E+02	1.30E+02	2.75E+02	2.30E+02	2.55E+02	2.60E+02	1.55E+03
Benzo(a)anthracene	3.10E+02	4.60E+03	2.95E+03	3.00E+02	1.80E+02	2.55E+02	2.50E+02	8.50E+03
Chrysene	3.10E+02	4.45E+03	2.75E+03	3.20E+02	1.90E+02	2.55E+02	2.50E+02	1.08E+04
Bis(2-ethylhexyl)phthalate	6.80E+02	3.95E+03	1.80E+03	1.60E+02	1.40E+03	6.60E+01	8.90E+01	3.80E+04
Di-n-octylphthalate	5.80E+01	2.60E+02	2.40E+02	2.75E+02	8.80E+01	2.55E+02	2.60E+02	1.55E+03
Benzo(b)fluoranthene	3.20E+02	5.25E+03	3.65E+03	3.90E+02	2.60E+02	2.55E+02	3.40E+02	8.10E+03
Benzo(k)fluoranthene	3.00E+02	7.90E+02	2.70E+03	2.75E+02	2.20E+02	2.55E+02	1.30E+02	7.05E+03
Benzo(a)pyrene	2.80E+02	3.90E+03	2.55E+03	2.80E+02	1.80E+02	2.55E+02	2.20E+02	8.85E+03
Indeno(1,2,3-cd)pyrene	2.00E+02	1.90E+03	1.40E+03	2.75E+02	2.30E+02	2.55E+02	2.60E+02	6.15E+03

All concentrations are reported in ppb.

One-half the sample quantitation limit (SQL) was used for non-detects.

TABLE 7 - 10 (continued)
REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL AND WASTE
Lockport City Landfill Site

SAMPLE ID	SPS-1	SPS-2	SPS-3	SPS-4	SPS-5	WS-1	WS-2	WS-3
PARAMETERS								
Dibenz(a,h)anthracene	2.00E+02	1.20E+03	2.00E+02	2.75E+02	2.30E+02	2.55E+02	2.60E+02	1.55E+03
Benzo(g,h,i)perylene	2.00E+02	2.55E+03	9.65E+02	2.75E+02	2.30E+02	2.55E+02	2.60E+02	1.55E+03
Aldrin	4.90E+00	6.50E+01	6.70E+01	2.00E+01	5.50E+00	6.00E+00	6.50E+00	1.90E+01
gamma-Chlordane	7.90E+00	6.50E+02	6.00E+01	6.50E+01	5.50E+01	6.00E+01	6.50E+01	2.30E+02
Aroclor-1248	4.90E+01	9.30E+03	6.00E+01	6.50E+01	5.50E+01	6.00E+01	1.10E+02	1.20E+03
Aroclor-1254	3.60E+01	1.25E+03	1.90E+03	1.70E+02	1.60E+02	1.25E+02	5.40E+01	4.50E+02
Aluminum	6.55E+06	1.51E+07	9.87E+06	1.02E+07	1.28E+07	1.43E+07	8.39E+06	2.34E+07
Antimony	4.05E+03	1.40E+04	4.65E+03	1.33E+04	4.75E+03	7.15E+03	8.65E+03	1.29E+04
Arsenic	1.11E+04	1.82E+04	1.77E+04	1.39E+04	1.98E+04	2.33E+04	2.48E+04	1.50E+04
Barium	2.82E+04	1.22E+05	1.08E+05	8.45E+04	8.97E+04	7.79E+05	2.54E+05	1.40E+05
Beryllium	3.70E+02	9.70E+02	1.10E+03	5.00E+02	1.40E+03	8.00E+02	9.50E+02	1.40E+03
Cadmium	6.00E+02	4.50E+03	5.40E+03	8.50E+02	2.40E+03	1.64E+04	6.10E+03	4.80E+03
Calcium	1.55E+08	6.94E+07	8.37E+07	1.09E+08	2.18E+07	4.86E+07	9.62E+07	5.35E+07
Chromium	6.60E+03	4.03E+05	3.50E+05	3.14E+04	2.94E+04	3.63E+04	1.42E+04	1.48E+06
Cobalt	3.20E+03	9.00E+03	1.86E+04	6.50E+03	1.66E+04	1.62E+04	2.23E+05	4.80E+03
Copper	1.28E+04	6.26E+05	6.37E+05	1.24E+05	1.24E+05	8.00E+05	2.10E+05	1.54E+06
Iron	1.49E+07	2.35E+07	2.10E+07	2.14E+07	3.11E+07	6.73E+07	4.33E+07	3.01E+07
Lead	7.80E+04	1.99E+06	1.52E+06	2.74E+05	3.86E+05	2.16E+06	1.70E+05	4.81E+06
Magnesium	2.35E+07	1.64E+07	2.44E+07	1.21E+07	7.44E+06	6.93E+06	7.71E+06	1.27E+07
Manganese	6.52E+05	6.47E+05	1.09E+06	5.85E+05	1.28E+06	1.09E+06	2.66E+06	3.42E+05
Mercury	1.20E+03	7.60E+02	2.40E+03	6.90E+02	4.30E+02	1.90E+02	6.60E+02	1.40E+02
Nickel	1.53E+04	8.27E+04	1.59E+05	3.82E+04	5.87E+04	6.19E+04	2.77E+04	1.63E+05
Potassium	2.12E+06	3.08E+06	2.05E+06	2.02E+06	2.47E+06	2.43E+06	2.45E+06	5.90E+06
Silver	8.50E+02	3.60E+03	2.90E+03	1.20E+03	4.00E+03	5.30E+03	1.70E+03	7.40E+03
Sodium	3.28E+05	3.70E+05	3.62E+05	3.39E+05	3.50E+05	2.26E+06	3.81E+05	2.06E+06
Vanadium	8.80E+03	2.83E+04	2.74E+04	2.47E+04	2.74E+04	2.55E+04	1.67E+04	3.05E+04
Zinc	8.90E+04	6.07E+06	2.06E+06	5.62E+05	6.84E+05	2.05E+06	4.97E+05	9.57E+06
Cyanide	6.00E+02	5.60E+03	7.00E+02	8.50E+02	7.00E+02	8.00E+02	9.50E+02	1.40E+03

All concentrations are reported in ppb.

One-half the sample quantitation limit (SQL) was used for non-detects.

TABLE 7 - 10 (continued)
REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL AND WASTE
Lockport City Landfill Site

PARAMETERS	AVG	STD DEV	n	SQRT n	(n-1)	t(0.95)	UCL95	max. conc.	value used
Carbon Disulfide	4.69E+00	9.23E-01	8	2.828	7	1.895	5.31E+00	6.00E+00	5.31E+00
Chloroform	3.25E+00	2.00E+00	8	2.828	7	1.895	4.59E+00	1.00E+00	1.00E+00
2-Butanone	7.94E+00	3.09E+00	8	2.828	7	1.895	1.00E+01	1.00E+00	1.00E+00
Ethylbenzene	5.19E+00	2.09E+00	8	2.828	7	1.895	6.59E+00	1.00E+01	6.59E+00
Xylenes (total)	1.69E+01	3.66E+01	8	2.828	7	1.895	4.15E+01	1.08E+02	4.15E+01
Benzoic Acid	1.36E+03	2.52E+03	8	2.828	7	1.895	3.05E+03	4.65E+02	4.65E+02
Naphthalene	5.29E+02	8.78E+02	8	2.828	7	1.895	1.12E+03	2.70E+03	1.12E+03
2-Methylnaphthalene	3.13E+02	2.63E+02	8	2.828	7	1.895	4.89E+02	9.55E+02	4.89E+02
Dimethylphthalate	5.45E+02	5.62E+02	8	2.828	7	1.895	9.21E+02	1.35E+03	9.21E+02
Acenaphthylene	4.05E+02	4.68E+02	8	2.828	7	1.895	7.18E+02	3.55E+02	3.55E+02
Acenaphthene	4.53E+02	5.49E+02	8	2.828	7	1.895	8.21E+02	1.80E+03	8.21E+02
Dibenzofuran	3.64E+02	3.72E+02	8	2.828	7	1.895	6.13E+02	1.28E+03	6.13E+02
Diethylphthalate	3.56E+02	4.91E+02	8	2.828	7	1.895	6.85E+02	6.30E+01	6.30E+01
Fluorene	3.81E+02	3.60E+02	8	2.828	7	1.895	6.22E+02	1.23E+03	6.22E+02
Pentachlorophenol	1.86E+03	2.30E+03	8	2.828	7	1.895	3.40E+03	7.50E+03	3.40E+03
Phenanthrene	3.42E+03	5.99E+03	8	2.828	7	1.895	7.44E+03	1.75E+04	7.44E+03
Anthracene	4.57E+02	5.38E+02	8	2.828	7	1.895	8.18E+02	8.25E+02	8.18E+02
Di-n-butylphthalate	9.62E+02	1.64E+03	8	2.828	7	1.895	2.06E+03	4.85E+03	2.06E+03
Fluoranthene	3.11E+03	3.93E+03	8	2.828	7	1.895	5.74E+03	1.11E+04	5.74E+03
Pyrene	4.41E+03	6.81E+03	8	2.828	7	1.895	8.97E+03	1.95E+04	8.97E+03
Butylbenzylphthalate	3.95E+02	4.69E+02	8	2.828	7	1.895	7.09E+02	2.60E+02	2.60E+02
Benzo(a)anthracene	2.17E+03	3.04E+03	8	2.828	7	1.895	4.21E+03	8.50E+03	4.21E+03
Chrysene	2.41E+03	3.72E+03	8	2.828	7	1.895	4.90E+03	1.08E+04	4.90E+03
Bis(2-ethylhexyl)phthalate	5.77E+03	1.31E+04	8	2.828	7	1.895	1.45E+04	3.80E+04	1.45E+04
Di-n-octylphthalate	3.73E+02	4.83E+02	8	2.828	7	1.895	6.97E+02	2.60E+02	2.60E+02
Benzo(b)fluoranthene	2.32E+03	3.02E+03	8	2.828	7	1.895	4.35E+03	8.10E+03	4.35E+03
Benzo(k)fluoranthene	1.47E+03	2.41E+03	8	2.828	7	1.895	3.08E+03	7.05E+03	3.08E+03
Benzo(a)pyrene	2.06E+03	3.08E+03	8	2.828	7	1.895	4.13E+03	8.85E+03	4.13E+03
Indeno(1,2,3-cd)pyrene	1.33E+03	2.05E+03	8	2.828	7	1.895	2.71E+03	6.15E+03	2.71E+03

All concentrations are reported in ppb.
One-half the sample quantitation limit (SQL) was used for non-detects.

TABLE 7 - 10 (continued)
REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL AND WASTE
Lockport City Landfill Site

PARAMETERS	AVG	STD DEV	n	SQRT n	(n-1)	t(0.95)	UCL95	max. conc.	value used
Dibenz(a,h)anthracene	5.21E+02	5.36E+02	8	2.828	7	1.895	8.80E+02	1.20E+03	8.80E+02
Benzo(g,h,i)perylene	7.86E+02	8.62E+02	8	2.828	7	1.895	1.36E+03	2.55E+03	1.36E+03
Aldrin	2.42E+01	2.65E+01	8	2.828	7	1.895	4.20E+01	6.70E+01	4.20E+01
gamma-Chlordane	1.49E+02	2.13E+02	8	2.828	7	1.895	2.92E+02	2.30E+02	2.30E+02
Aroclor-1248	1.36E+03	3.23E+03	8	2.828	7	1.895	3.53E+03	9.30E+03	3.53E+03
Aroclor-1254	5.18E+02	6.87E+02	8	2.828	7	1.895	9.78E+02	1.90E+03	9.78E+02
Aluminum	1.26E+07	5.26E+06	8	2.828	7	1.895	1.61E+07	2.34E+07	1.61E+07
Antimony	8.68E+03	4.19E+03	8	2.828	7	1.895	1.15E+04	1.40E+04	1.15E+04
Arsenic	1.80E+04	4.65E+03	8	2.828	7	1.895	2.11E+04	2.48E+04	2.11E+04
Barium	2.01E+05	2.42E+05	8	2.828	7	1.895	3.63E+05	7.79E+05	3.63E+05
Beryllium	9.36E+02	3.76E+02	8	2.828	7	1.895	1.19E+03	1.40E+03	1.19E+03
Cadmium	5.13E+03	5.00E+03	8	2.828	7	1.895	8.48E+03	1.64E+04	8.48E+03
Calcium	7.97E+07	4.13E+07	8	2.828	7	1.895	1.07E+08	1.09E+08	1.07E+08
Chromium	2.94E+05	5.05E+05	8	2.828	7	1.895	6.32E+05	1.48E+06	6.32E+05
Cobalt	3.72E+04	7.53E+04	8	2.828	7	1.895	8.77E+04	1.86E+04	1.86E+04
Copper	5.09E+05	5.08E+05	8	2.828	7	1.895	8.50E+05	8.00E+05	8.00E+05
Iron	3.16E+07	1.68E+07	8	2.828	7	1.895	4.28E+07	6.73E+07	4.28E+07
Lead	1.42E+06	1.61E+06	8	2.828	7	1.895	2.50E+06	4.81E+06	2.50E+06
Magnesium	1.39E+07	6.99E+06	8	2.828	7	1.895	1.86E+07	2.44E+07	1.86E+07
Manganese	1.04E+06	7.26E+05	8	2.828	7	1.895	1.53E+06	2.66E+06	1.53E+06
Mercury	8.09E+02	7.27E+02	8	2.828	7	1.895	1.30E+03	2.40E+03	1.30E+03
Nickel	7.58E+04	5.66E+04	8	2.828	7	1.895	1.14E+05	1.63E+05	1.14E+05
Potassium	2.82E+06	1.29E+06	8	2.828	7	1.895	3.68E+06	5.90E+06	3.68E+06
Silver	3.37E+03	2.22E+03	8	2.828	7	1.895	4.86E+03	7.40E+03	4.86E+03
Sodium	8.06E+05	8.37E+05	8	2.828	7	1.895	1.37E+06	2.26E+06	1.37E+06
Vanadium	2.37E+04	7.27E+03	8	2.828	7	1.895	2.85E+04	3.05E+04	2.85E+04
Zinc	2.70E+06	3.37E+06	8	2.828	7	1.895	4.96E+06	9.57E+06	4.96E+06
Cyanide	1.45E+03	1.69E+03	8	2.828	7	1.895	2.59E+03	5.60E+03	2.59E+03

All concentrations are reported in ppb.

One-half the sample quantitation limit (SQL) was used for non-detects.

indicates how exposure dose has been calculated for the current/future land use scenario for the inhalation of fugitive dust at the Lockport City Landfill site. Note that for this exposure pathway an average daily exposure concentration has been calculated for chronic (lifetime) exposure only, since children (subchronic) are not a population of concern via this pathway. Chronic exposure concentrations are used to quantify carcinogenic and noncarcinogenic health effects.

The intake equation for the inhalation exposure pathway is presented below. The numerical values for the variables used in each intake equation and the intakes calculated for this exposure pathway are presented in Tables 7-11 and 7-12. For the purpose of clarity, separate tables were developed for noncarcinogenic (non-cancer-causing) and carcinogenic (cancer-causing) chemicals. The list of chemicals included in each of these two categories and the method used to determine the chemical classification is presented in Section 7.3.3

1. Inhalation of Airborne Chemicals From Fugitive Dust

Equation:

$$\text{Intake (mg/kg-day)} = \frac{CA \times CF \times IR \times ET \times EF \times ED}{BW \times AT}$$

Where:

CA = Respirable Concentration in Fugitive Dust -ug/m^3 (value determined from transport model, Section 5.0)
IR = Inhalation Rate (m^3/hr)
CF = Conversion Factor (10^{-3} mg/ug)
ET = Exposure Time (hours/day)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)

TABLE 7-11

COMMERCIAL / INDUSTRIAL EXPOSURE
INHALATION OF CARCINOGENIC CHEMICALS FROM FUGITIVE DUST

CHEMICAL	RESPIRABLE CHEMICAL CONCENTRATION ($\mu g/m^3$)	INTAKE (mg/kg-day) CURRENT/FUTURE USE ADULT WORKER
Chloroform	8.94E-09	2.08E-13
Pentachlorophenol	3.04E-05	7.08E-10
Butylbenzylphthalate	2.33E-06	5.43E-11
Benzo(a)anthracene	3.76E-05	8.76E-10
Chrysene	4.38E-05	1.02E-09
Bis(2-ethylhexyl)phthalate	1.30E-04	3.03E-09
Benzo(b)fluoranthene	3.89E-05	9.06E-10
Benzo(k)fluoranthene	2.76E-05	6.43E-10
Benzo(a)pyrene	3.69E-05	8.59E-10
Dibenz(a,h)anthracene	7.87E-06	1.83E-10
Aldrin	3.75E-07	8.73E-12
gamma-Clordane	2.06E-06	4.80E-11
Aroclor-1248	3.16E-05	7.36E-10
Aroclor-1254	8.75E-06	2.04E-10
Arsenic	1.89E-04	4.40E-09
Beryllium	1.06E-05	2.47E-10
Cadmium	7.58E-05	1.77E-09
Lead	2.24E-02	5.22E-07
Nickel	1.02E-03	2.38E-08
Indeno(1,2,3-cd)pyrene	2.42E-05	5.64E-10

VARIABLE	CURRENT/FUTURE USE
INHALATION RATE (m^3/hour) :	0.833
CONVERSION FACTOR (mg/ug) :	1.00E-03
EXPOSURE TIME (hours/day) :	8
EXPOSURE FREQUENCY (days/year) :	250
EXPOSURE DURATION (years) :	25
BODY WEIGHT (kg) :	70
AVERAGING TIME (days) :	25550

TABLE 7-12

COMMERCIAL / INDUSTRIAL EXPOSURE
INHALATION OF NONCARCINOGENIC CHEMICALS FROM FUGITIVE DUST

CHEMICAL	RESPIRABLE CHEMICAL CONCENTRATION ($\mu g/m^3$)	INTAKE (mg/kg-day) CURRENT/FUTURE USE ADULT WORKER
Carbon Disulfide	4.75E-08	3.10E-12
Chloroform	8.94E-09	5.83E-13
2-Butanone	8.94E-09	5.83E-13
Ethylbenzene	5.89E-08	3.84E-12
Xylenes (total)	3.71E-07	2.42E-11
Benzoic Acid	4.16E-06	2.71E-10
Naphthalene	1.00E-05	6.52E-10
2-Methylnaphthalene	4.38E-06	2.85E-10
Dimethylphthalate	8.24E-06	5.37E-10
Acenaphthylene	3.18E-06	2.07E-10
Acenaphthene	7.34E-06	4.79E-10
Dibenzofuran	5.48E-06	3.57E-10
Diethylphthalate	5.63E-07	3.67E-11
Fluorene	5.57E-06	3.63E-10
Pentachlorophenol	3.04E-05	1.98E-09
Phenanthrene	6.65E-05	4.34E-09
Anthracene	7.31E-06	4.77E-10
Di-n-butylphthalate	1.84E-05	1.20E-09
Fluoranthene	5.13E-05	3.35E-09
Pyrene	8.02E-05	5.23E-09
Butylbenzylphthalate	2.33E-06	1.52E-10
Bis(2-ethylhexyl)phthalate	1.30E-04	8.48E-09
Di-n-octylphthalate	2.33E-06	1.52E-10

VARIABLE	CURRENT/FUTURE USE
INHALATION RATE (m^3/hour) :	0.833
CONVERSION FACTOR (mg/ug) :	1.00E-03
EXPOSURE TIME (hours/day) :	8
EXPOSURE FREQUENCY (days/year) :	250
EXPOSURE DURATION (years) :	25
BODY WEIGHT (kg) :	70
AVERAGING TIME (days) :	9125

TABLE 7-12 (continued)

COMMERCIAL / INDUSTRIAL EXPOSURE
INHALATION OF NONCARCINOGENIC CHEMICALS FROM FUGITIVE DUST

CHEMICAL	RESPIRABLE CHEMICAL CONCENTRATION ($\mu g/m^3$)	INTAKE (mg/kg-day) CURRENT/FUTURE USE ADULT WORKER
Benzo(g,h,i)perylene	1.22E-05	7.95E-10
Aldrin	3.75E-07	2.45E-11
gamma-Chlordane	2.06E-06	1.34E-10
Aluminum	1.44E-01	9.39E-06
Antimony	1.03E-04	6.70E-09
Arsenic	1.89E-04	1.23E-08
Barium	3.25E-03	2.12E-07
Beryllium	1.06E-05	6.93E-10
Cadmium	7.58E-05	4.95E-09
Calcium	9.60E-01	6.26E-05
Chromium (III)	5.66E-03	3.69E-07
Cobalt	1.66E-04	1.08E-08
Copper	7.16E-03	4.67E-07
Iron	3.83E-01	2.50E-05
Lead	2.24E-02	1.46E-06
Magnesium	1.66E-01	1.08E-05
Manganese	1.37E-02	8.92E-07
Mercury	1.16E-05	7.56E-10
Nickel	1.02E-03	6.63E-08
Potassium	3.29E-02	2.15E-06
Silver	4.34E-05	2.83E-09
Sodium	1.22E-02	7.97E-07
Vanadium	2.55E-04	1.66E-08
Zinc	4.43E-02	2.89E-06
Cyanide	2.31E-05	1.51E-09

VARIABLE	CURRENT/FUTURE USE
INHALATION RATE (m^3/hour) :	0.833
CONVERSION FACTOR (mg/ug) :	1.00E-03
EXPOSURE TIME (hours/day) :	8
EXPOSURE FREQUENCY (days/year) :	250
EXPOSURE DURATION (years) :	25
BODY WEIGHT (kg) :	70
AVERAGING TIME (days) :	9125

BW = Body Weight (kg)

AT = Average time (period over which exposure is averaged - days)

Excluding concentrations, all variable values except exposure frequency and exposure time were derived from Risk Assessment Guidance for Superfund (RAGS) (USEPA, December 1989). Exposure time is based upon a normal 8-hour work day and is derived from the Exposure Factors Handbook (USEPA, July 1989). Values for exposure frequency are based on professional judgement and reflect the concept of reasonable maximum exposure (RME). Numerical values for variables used to calculate intake of carcinogenic and noncarcinogenic chemicals via inhalation of airborne chemicals from fugitive dust originating from the landfill are presented in Tables 7-9 and 7-10, respectively.

7.4.3 Toxicity Assessment

The chemicals of potential concern identified in the surficial soil/waste from the Lockport City Landfill site may be categorized by their relative health risks. Risks are divided into carcinogenic and noncarcinogenic effects. USEPA has defined toxicity constants to be used in evaluating these risks.

Toxicity data (with the exception of PAHs) for this risk assessment was collected following the hierarchy of sources recommended by USEPA. First, Integrated Risk Information System (IRIS) was consulted through an on-line computer linkage. Second, when information was not available on IRIS the Health Effects Assessment Summary Tables (HEAST) for fiscal year 1991 were consulted. Third, a list of compounds for which information was missing was sent to USEPA Environmental Criteria and Assessment Office (ECAO). Toxicity data for PAHs were derived from the HEAST Tables (FY 1991). Although this source is not specified for use by the USEPA, it was utilized because of the number of PAHs detected in onsite media. PAHs are

discussed further in Section 7.3.5. Only those values from IRIS or HEAST are used in this risk assessment. Tables 7-5 and 7-6 identify from which of these sources each coefficient was taken, and the date of verification by USEPA.

For evaluating carcinogenic risk from exposure to contaminants, a slope factor (SF) has been established. The SF is a plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. SFs are developed for oral intake and inhalation routes of exposure.

For evaluating noncarcinogenic effects from exposure to contaminants, the toxicity constants used are the reference dose (RfD) and reference concentration (RfC). Specific values are developed for chronic RfDs and RfCs.

Chronic RfDs are derived from the No-Observed-Adverse-Effect-Level (NOAEL) for the critical toxic effect and modified by application of uncertainty factors reflecting the type of study on which the values are based. RfDs are used to estimate risk from oral or dermal routes of exposure.

Chronic RfCs are derived in a similar fashion but are based upon studies of inhalation exposure. For this reason, calculation of RfCs is more complex, and therefore RfCs are available for fewer chemicals.

Since toxicity information is limited for many chemicals used in the HRA, uncertainty factors are published for noncarcinogenic chemicals. These uncertainty factors generally range between 10 and 1,000. A high uncertainty factor indicates low strength of evidence for the toxicity value and further indicates that the toxicity value might change if additional data become available. A low uncertainty factor indicates that there is a high degree of confidence in the value and that a change is

less likely should more data become available. Uncertainty factors associated with noncarcinogenic chemicals of greatest concern for the baseline HRA are discussed further in Section 7.4.5.

7.4.3.1 Carcinogenic Effects

Table 7-5 summarizes information for the potentially carcinogenic chemicals which were detected in one or more of the environmental media at the Lockport City Landfill. For each of these compounds, the following information is provided:

a. Weight of evidence for carcinogenicity expresses the degree of confidence relating to exposure to a given chemical and the likelihood that the chemical causes cancer in humans. This weight of evidence is based upon the following USEPA classification system:

Group A--Human Carcinogen

This category indicates that there is sufficient evidence from epidemiological studies to support a causal association between an agent and cancer in humans.

Group B--Probable Human Carcinogen

This category generally indicates that there is at least limited evidence from epidemiological studies of carcinogenicity to humans (Group B1) or that, in the absence of positive data on humans, there is sufficient evidence of carcinogenicity in animals (Group B2).

Group C--Possible Human Carcinogen

This category indicates that there is limited evidence of carcinogenicity in animals in the absence of positive human data.

Group D--Not Classified

This category indicates that there were no data to evaluate or that the evidence for carcinogenicity in humans and in animals was inadequate.

Group E--No Evidence of Carcinogenicity to Humans

This category indicates that there is no evidence of carcinogenicity in at least two adequate animal tests in different species or in both epidemiological and animal studies.

b. Slope factor, or cancer potency factor, represents a plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. This slope factor allows the calculation of incremental lifetime cancer risk associated with exposure to the chemical at a known or estimated dosage. Table 7-5 provides separate slope factors, where applicable and available, for oral and inhalation routes of exposure.

c. References, including source(s) and date(s), are provided to indicate the basis for identified slope factors.

d. Tumor site, i.e., type of cancer upon which the slope factor and weight of evidence are based.

7.4.3.2 Noncarcinogenic Effects

Unlike carcinogens, noncarcinogenic compounds are thought to have threshold dosage levels below which adverse effects are not expected. This section provides information concerning these threshold levels.

Table 7-6 summarizes toxicity information for the noncarcinogenic

chemicals which were detected at the Lockport City Landfill site. [Note that some chemicals (e.g., arsenic) have both carcinogenic and noncarcinogenic effects, and are therefore listed in both Table 7-5 and Table 7-6.] For each of the Table 7-6 chemicals the following information is provided separately for oral and inhalation routes of exposure where appropriate:

a. Toxicity Value, expressed in mg/kg-day for noncarcinogenic chemicals, generally identifies the threshold dosage level below which adverse health effects are not expected. The most common and preferred, criterion for expressing potency is the reference dose (RfD), which is an estimate of the average daily exposure level below which significant, adverse noncarcinogenic health effects are not expected.

b. Source(s) of dose-response data.

c. Date(s) of source information.

d. Critical Effect expresses the end point of adverse response (e.g., liver damage) associated with the exposure to noncarcinogenic chemicals. Although noncarcinogenic health effects for all chemicals are initially added, regardless of critical effect, this identification is necessary to indicate the degree of conservatism involved with this assumption and, if necessary, to subsequently revise it.

7.4.3.3 Chemicals for Which No Values Are Available

The following chemicals, although identified as being detected in the Lockport City Landfill site samples, were not used in any of the risk calculations due to the lack of published inhalation toxicity values. These chemicals include 5 carcinogens: butylbenzylphthalate, bis(2-ethylhexyl)phthalate, lead, pentachlorophenol and polychlorinated biphenyls, and 39 noncarcinogens: chloroform, benzoic acid, naphthalene,

2-methylnaphthalene, dimethylphthalate, acenaphthylene, acenaphthene, dibenzofuran, diethylphthalate, fluorene, pentachlorophenol, phenanthrene, anthracene, fluoranthene, di-n-butylphthalate, pyrene, butylbenzylphthalate, bis(2-ethylhexyl)phthalate, di-n-octylphthalate, benzo(g,h,i)perylene, aldrin, gamma-chlordane, aluminum, antimony, arsenic, beryllium, cadmium, calcium, copper, iron, lead, magnesium, nickel, potassium, silver, sodium, vanadium, zinc, and cyanide.

The remaining chemicals for which some toxicity information is available were included in pathway-specific risk calculations only when relevant toxicity information was available for that pathway. Consequently, only chemicals with toxicity values (noncarcinogens) or slope factors (carcinogens) shown in Table 7-5 or 7-6 are shown in subsequent tables for risk calculation. For example, of 48 noncarcinogenic chemicals, only 9 have been assigned chronic RfCs.

In general, more information is available for each listed carcinogen. This is because the level of data required to classify a compound as a human carcinogen is usually sufficient to also calculate a slope factor. Of 2 carcinogens, 14 have inhalation SFs.

7.4.3.4 Toxicity Profiles

For each contaminant a toxicity profile has been prepared that summarizes physical and chemical as well as toxicological information. Various sources were consulted for this information, and citations are given where appropriate. These profiles are presented in Appendix P.

7.4.4 Risk Characterization

7.4.4.1 Method of Analysis

Health risk is a function of both human exposure and chemical

toxicity. Following from this principle, the risk characterization for the Lockport City Landfill site is the process by which the toxicity, or dose-response, assessment (Section 7.3.3) is integrated with the exposure assessment (Section 7.3.2) to estimate present/future potential threats to human health posed by contamination at the site. The health risks are the same for both future and current land use scenarios since none of the intake variables change. The following sections describe, respectively, the carcinogenic and noncarcinogenic (chronic) risks posed by the Lockport City Landfill site under current/future conditions, i.e., in the absence of remedial measures.

7.4.4.2 Carcinogenic Risk

Carcinogenic risk is expressed as the incremental lifetime cancer risk that could be experienced by an individual or population exposed to contaminants at the Lockport City Landfill site under the exposure scenario, and at the exposure doses, that have been postulated for the site. This incremental lifetime cancer risk corresponds to the upper 95th percentile confidence limit of the probability (when based on animal data), or to the maximum likely estimate (when based on human data), of developing cancer over a 70-year lifetime from exposure to hazardous substances present at the Lockport City Landfill site. It is computed by the following equation:

$$\text{Cancer Risk} = \text{Exposure Level (mg/kg-day)} \times \text{Slope Factor } [(\text{mg/kg-day})^{-1}]$$

As indicated by the above equation, incremental lifetime cancer risk is dimensionless. A risk of 1.0 E-06 for example, indicates that an individual would incur an additional risk of 0.000001 (or 1 in one million) due to his/her exposure to contaminants at a given site. Alternately, out of a population of one million persons so exposed, this risk would indicate that one person, on average, would contract cancer due to such exposure. Table 7-13 presents the cancer risk for inhalation of

carcinogenic chemicals for fugitive dust.

7.4.4.3 Noncarcinogenic Risk

Noncarcinogenic risk evaluation is based on a threshold response theory. The process involves a comparison of an exposure level (or dose) to the estimated threshold response level. The term used to make this comparison is the "Hazard Index," which is defined as:

$$\text{Hazard Index} = \frac{\text{Exposure Level (Intake or Absorbed Dose) (mg/kg/day)}}{\text{Toxicity Value (mg/kg/day)}}$$

In the above equation, reference dose (RfD) or reference concentration (RfC) are the most common (and the preferred) toxicity values for determining noncarcinogenic effects.

As previously discussed, different noncarcinogenic chemicals may produce different forms of human response, or end points. Therefore, summing the Hazard Indices of all noncarcinogenic chemicals within a pathway is not theoretically correct. It is, however, conservative, and for this reason has been employed as an initial step in the assessment of potential noncarcinogenic health effects at the Lockport City Landfill site. If the Hazard Index calculated in this manner produces a value less than the acceptable upper limit of one, distinction between end points is not required. If, however, the total Hazard Index exceeds this acceptable limit of one, further evaluation of the Hazard Index based on the health effects may be required.

Noncarcinogenic effects have been evaluated for chronic (lifetime) exposure and assumes a 30-year exposure to Lockport contaminants. Table 7-14 presents the total chronic Hazard Index from the inhalation of noncarcinogenic chemicals from fugitive dust.

TABLE 7-13

INHALATION OF CARCINOGENIC CHEMICALS FROM FUGITIVE DUST
CANCER RISK - CURRENT / FUTURE USE

CHEMICAL	INTAKE (mg/kg-day) ADULT WORKER	SLOPE FACTOR (mg/kg-day)^-1 INHALATION	CANCER RISK (unitless) ADULT WORKER
Chloroform	2.08E-13	8.10E-02	1.69E-14
Pentachlorophenol	7.08E-10	ND	ND
Butylbenzylphthalate	5.43E-11	ND	ND
Benzo(a)anthracene	8.76E-10	6.10E+00	5.34E-09
Chrysene	1.02E-09	6.10E+00	6.22E-09
Bis(2-ethylhexyl)phthalate	3.03E-09	ND	ND
Benzo(b)fluoranthene	9.06E-10	6.10E+00	5.53E-09
Benzo(k)fluoranthene	6.43E-10	6.10E+00	3.92E-09
Benzo(a)pyrene	8.59E-10	6.10E+00	5.24E-09
Dibenz(a,h)anthracene	1.83E-10	6.10E+00	1.12E-09
Aldrin	8.73E-12	1.70E+01	1.48E-10
gamma-Clordane	4.80E-11	1.30E+00	6.24E-11
Aroclor-1248	7.36E-10	ND	ND
Aroclor-1254	2.04E-10	ND	ND
Arsenic	4.40E-09	5.00E+01	2.20E-07
Beryllium	2.47E-10	8.40E+00	2.07E-09
Cadmium	1.77E-09	6.10E+00	1.08E-08
Lead	5.22E-07	ND	ND
Indeno(1,2,3-cd)pyrene	5.64E-10	6.10E+00	3.44E-09
Nickel	2.38E-08	8.40E-01	2.00E-08
TOTAL CANCER RISK :			3E-07

ND - Not Determined
NA - Not Applicable

7.4.4.4 Carcinogenic Risk - Results and Discussion

A. Current/Future Land Use

The total cancer risk associated with inhalation exposure to fugitive dust from the Lockport City Landfill site, under current/future land use conditions, is presented in Table 7-13 for municipal garage workers. The following items of discussion refer to the values presented in this table.

1. Acceptable risk - USEPA has, through its National Oil and Hazardous Substances Pollution Contingency Plan (NCP), established acceptable exposure levels for known or suspected carcinogens that are to be used to establish remedial action objectives. These acceptable exposure levels are concentration levels that represent an excess upper-bound lifetime cancer risk of 1.0E-06 to 1.0E-04.

2. Total cancer risk - As indicated in Table 7-13 the cancer risk for adult workers fall within the acceptable risk range established by the NCP.

3. Inhalation of airborne (fugitive dust) carcinogenic chemicals generated from the landfill - As shown in Table 7-13, arsenic is the major contributor to the cancer risk associated with this pathway with a value of 2.2E-07. This is significant since arsenic is classified as a known human carcinogen (USEPA weight of evidence group A) by USEPA.

TABLE 7-14

INHALATION OF NONCARCINOGENIC CHEMICALS FROM FUGITIVE DUST HAZARD INDICES - CURRENT / FUTURE USE

CHEMICAL	INTAKE (mg/kg-day) ADULT WORKER	TOXICITY VALUES (mg/kg-day) INHALATION	HAZARD QUOTIENT (unitless) ADULT WORKER
Carbon Disulfide	3.10E-12	2.86E-03	1.08E-09
Chloroform	5.83E-13	ND	ND
2-Butanone	5.83E-13	9.00E-02	6.48E-12
Ethylbenzene	3.84E-12	2.86E-01	1.34E-11
Xylenes (total)	2.42E-11	8.57E-02	2.82E-10
Benzoic Acid	2.71E-10	ND	ND
Naphthalene	6.52E-10	ND	ND
2-Methylnaphthalene	2.85E-10	ND	ND
Dimethylphthalate	5.37E-10	ND	ND
Acenaphthylene	2.07E-10	NI	NI
Acenaphthene	4.79E-10	ND	ND
Dibenzofuran	3.57E-10	NI	NI
Diethylphthalate	3.67E-11	ND	ND
Fluorene	3.63E-10	ND	ND
Pentachlorophenol	1.98E-09	ND	ND
Phenanthrene	4.34E-09	NI	NI
Anthracene	4.77E-10	ND	ND
Di-n-butylphthalate	1.20E-09	ND	ND
Fluoranthene	3.35E-09	ND	ND
Pyrene	5.23E-09	ND	ND
Butylbenzylphthalate	1.52E-10	ND	ND
Bis(2-ethylhexyl)phthalate	8.48E-09	ND	ND
Di-n-octylphthalate	1.52E-10	ND	ND

ND - Not Determined
NI - No Information Available

TABLE 7-14 (continued)

INHALATION OF NONCARCINOGENIC CHEMICALS FROM FUGITIVE DUST
HAZARD INDICES - CURRENT / FUTURE USE

CHEMICAL	INTAKE (mg/kg-day) ADULT WORKER	TOXICITY VALUES (mg/kg-day) INHALATION	HAZARD QUOTIENT (unitless) ADULT WORKER
Benzo(g,h,i)perylene	7.95E-10	ND	ND
Aldrin	2.45E-11	ND	ND
gamma-Chlordane	1.34E-10	ND	ND
Aluminum	9.39E-06	NI	NI
Antimony	6.70E-09	ND	ND
Arsenic	1.23E-08	ND	ND
Barium	2.12E-07	1.00E-04	2.12E-03
Beryllium	6.93E-10	ND	ND
Cadmium	4.95E-09	ND	ND
Calcium	6.26E-05	NI	NI
Chromium (III)	3.69E-07	5.71E-07	6.46E-01
Cobalt	1.08E-08	1.00E-06	1.08E-02
Copper	4.67E-07	ND	ND
Iron	2.50E-05	ND	ND
Lead	1.46E-06	ND	ND
Magnesium	1.08E-05	NI	NI
Manganese	8.92E-07	1.14E-04	7.82E-03
Mercury	7.56E-10	8.57E-05	8.82E-06
Nickel	6.63E-08	ND	ND
Potassium	2.15E-06	NI	NI
Silver	2.83E-09	ND	ND
Sodium	7.97E-07	ND	ND
Vanadium	1.66E-08	ND	ND
Zinc	2.89E-06	ND	ND
Cyanide	1.51E-09	ND	ND
TOTAL CHRONIC HAZARD INDEX :			7E-01

ND - Not Determined
NI - No Information Available

7.4.4.5 Chronic Health Effects - Results and Discussions

A. Current/Future Land Use

The total chronic Hazard Index associated with lifetime exposure to Lockport City Landfill site fugitive dust contaminants, under current/future land use conditions, is presented in Tables 7-14. The following discussion addresses the magnitude of the non-cancer risk limit, or Hazard Index; major factors contributing to the Hazard Index; and the primary health effects at the site.

1. Acceptable Hazard Index - The chronic Hazard Index is a measure of whether or not long-term exposure to site contaminants poses a concern for potential noncarcinogenic health effects. According to USEPA, such a potential exists when the Hazard Index exceeds unity (1.0).

2. Total Hazard Index - As shown in Table 7-14, the total chronic Hazard Index is 0.7 for the adult worker.

3. Inhalation From Landfill - The primary chemicals contributing to the Hazard Index are chromium (III) and cobalt, as shown in Table 7-14. In combination, these two chemicals contribute to greater than 98 percent of the Hazard Index.

4. Critical Health Effects - Chromium (III) is the primary contributor to the Chronic Hazard Index. The critical health effects of concern include the nasal passageway. The health effects are based on human data. The inhalation uncertainty factor used for computation of the toxicity value for trivalent chromium is 300. The other major contributory chemical to the inhalation pathway is cobalt, which affects the respiratory system. The toxicity data is based upon actual occupational exposure. The literature did not assign an uncertainty factor for cobalt to the inhalation reference concentration.

7.4.5 Uncertainty Analysis

The estimates of carcinogenic risk and noncarcinogenic health effects (chronic/subchronic) in this baseline HRA are based upon numerous assumptions, and, therefore involve a considerable degree of uncertainty. Some of this uncertainty is inherent in the risk assessment process itself, and the current limits of scientific knowledge regarding human health risk factors. For example, the necessary extrapolation of animal study data to humans introduces a large uncertainty factor into the process, as does extrapolation from the high doses used in these studies to the low doses associated with most hazardous waste sites such as the Lockport City Landfill site. Likewise, estimating human exposure and human intake is largely judgmental, and involves extrapolation of human behavioral patterns (often unknown even at present) into the relatively distant (up to 70 years) future. The exposure assessment for this study is based upon reasonable maximum exposures, meaning that the general population is almost certainly not exposed to site contaminants at the levels used in this analysis, and, therefore would not experience the calculated risks.

Due to these types of uncertainties, which are discussed in greater detail below, the results of the baseline HRA for the Lockport City Landfill site should not be taken as a characterization of absolute risk, or as a fully probabilistic estimate of this risk. Rather, they are intended to identify the types and relative levels of risk associated with the identified potential exposure route at the Lockport City Landfill site, so that remedial efforts can focus upon these aspects of the site which are of greatest concern from a human health standpoint.

The discussion of uncertainty is broken down into three categories as follows:

- Uncertainty concerning exposure

- o Uncertainty concerning toxicity
- o Uncertainty concerning risk characterization

Each of these categories is discussed below.

7.4.5.1 Uncertainty Concerning Exposure

1. Monitoring Data - During the RI, no air monitoring samples were taken within the boundaries of the landfill or at the Lockport Municipal Garage. Because no offsite background samples were collected from the surficial soils, all detected chemicals were utilized in the exposure assessment. This is a conservative approach since many of these chemicals, especially metals, may be naturally occurring in the environment. Consequently, inhalation exposure to soil/waste contaminants from fugitive dust could be either overestimated or underestimated.

2. Exposure Model

a. Fugitive Dust - The contaminants in airborne particulates were estimated using modeling techniques from Rapid Assessment of Exposure to Particulate Emission from Surface Contamination (Cowherd, 1985). Many factors are estimated in order to evaluate wind erosion emission (e.g. weather conditions, vegetative cover, surface disturbance, etc.). Since particle size analysis was not performed on the surficial soil/waste samples, the values from subsurface soil samples were used. Therefore, a degree of uncertainty is associated with this model as well as with the calculated respirable contaminant concentrations.

3. Values for Intake Variables - The exposure frequency utilized to evaluate exposure to onsite soil/waste (via inhalation) is an estimate based largely on professional judgement and consequently introduces uncertainty into the calculation of inhalation of fugitive dust. Actual exposure frequency would more accurately be determined by evaluating data

on behavioral patterns of nearby workers. However, these data are unavailable. The values used to calculate intake concentrations may be considered to be conservative values that would not underestimate exposure to the workers from inhalation of fugitive dust.

7.4.5.2 Uncertainty Concerning Toxicity

1. Surrogate Values - Dose-response information is not available for many chemicals found on site at the Lockport City Landfill. For PAHs, surrogate values have been used to quantify risk as discussed below.

a. Carcinogenic PAHs - All carcinogenic PAHs were assumed to have the same slope factor as benzo(a)pyrene. This slope factor was taken from the HEAST Tables (FY 1991).

b. Non-carcinogenic PAHs - All noncarcinogenic PAHs were assumed to have the same reference dose value as naphthalene. This reference dose value was taken from the HEAST Tables (FY 1991).

Although these surrogate values may be considered conservative and may oversimplify the toxic properties and interactions of PAHs, the quantity of PAHs detected at the site and the potential risk associated with PAHs seems to justify this conservative approach.

2. Compounds With No Values - There are many chemicals for which dose-response data are undetermined or inadequate, and for which no surrogate value is available. The risk associated with these chemicals cannot be quantified.

3. Chromium Toxicity Values - The literature lists toxicity values for only trivalent chromium and hexavalent chromium. The value used for this HRA was chromium (III). This is not the most conservative value since chromium (VI) is considered a carcinogen. The use of chromium

(VI), however, was determined to be unwarranted. There is no history or evidence of any disposal of hexavalent chromium at the landfill. A more realistic value was therefore used to reflect the toxicity of chromium.

7.4.5.3 Uncertainty Concerning Risk Characterization

1. Summation of Hazard Indices/Cancer Risk - In order to determine the total chronic Hazard Index or total cancer risk, the index values (cancer risk) for individual chemical compounds were first calculated individually, and then totalled. The resulting total Hazard Index (cancer risk) value is conservative, since different chemicals typically affect different human organs, and therefore produce different noncarcinogenic (carcinogenic) effects. Addition of their individual index (risk) values does not account for these different effects, and typically produces a conservatively high total Hazard Index or cancer risk.

7.5 Summary of Health Risk Assessment

The public health risk assessment was presented as two separate analyses in this Section. When a qualitative HRA is performed certain steps are followed in order to assess the impact on human health, such as identifying potentially exposed populations and potential exposure pathways (i.e., a source or mechanism of release from a source, on exposure point (human) and an exposure route (ingestion). These same steps are followed when performing a quantitative HRA, but in addition, the magnitude (quantity) of risk is calculated and its acceptability according to USEPA health risk guidelines is determined. The following subsections present the results of both the qualitative and quantitative health risk assessment.

7.5.1 Qualitative Assessment of Environmental Media

It was determined, based upon the RI findings, that a fence would be required to prevent contact with onsite surficial soil/waste. As a result of this remedial action, surficial soil/waste are discussed qualititatively with respect to exposure frequency and duration, etc., rather than quantitatively. However, it should be noted that if no remedial action were taken to protect human health from contact (dermal and ingestion) with the landfill soil/waste, under the current land-use scenario the cancer risk at the site would exceed the USEPA acceptable range of 1.0E-06 to 1.0E-04, with a value of 4.0E-04. The chronic (noncarcinogenic) Hazard Index would be within the USEPA guidelines with a value less than 1.0. Although a fence will be used as a remedial measure, it does not prevent the generation of fugitive dust from the surficial soil/waste as a result of wind erosion. Therefore, a quantitative analysis on fugitive dust was performed. The results of this quantitative assessment are discussed in Section 7.4.

Based upon the hydrogeology of the site (discussed in Section 3.0), and upon the results of previous investigations, it was determined that groundwater were used by the resident nearest to the landfill, it would not have passed through and thus been effected by the landfill. Therefore, this medium was not considered a cause of adverse health effects under the current land use scenario.

Since the area around the landfill is currently used for commercial/industrial purposes, it is not expected that the landfill would be zoned for residential use. Also, based upon the nature and extent of contamination (Chapter 4.0) from onsite subsurface samples, it is unlikely that a residential area would be developed on the landfill and then the residential potable water supply obtained from groundwater below the landfill. The potential for this scenario is remote and therefore has not been addressed.

The Gulf is not expected to require remediation as a result of the RI findings, therefore the exposure frequency, duration, etc., remain the same for both current and future land-use scenarios. The environmental quality of The Gulf with regard to the surface water and stream sediment does not present a health risk to nearby residents/workers. The surface water samples collected do not appear to contain contaminants at appreciable concentrations. Several semivolatile compounds were detected in one downstream sample only. These compounds were not detected in any other surface samples water and were detected in none of the stream sediment samples above background concentrations. Therefore, these chemicals are not considered attributable to Lockport City Landfill.

The stream sediment sample results are similar to the surface water samples. Stream sediments, therefore, do not present an adverse health effect to the surrounding population. One downstream sediment sample contained elevated concentrations of bis(2-ethylhexyl)phthalate. This value appears to be anomalous since this chemical was not detected in any stream sediment samples collected further downstream. Also detected in a stream sediment sample was an Aroclor (PCB). Another Aroclor, similar in chemical composition, was also detected in an upstream "background" sediment sample, and therefore, was not considered a chemical of potential concern.

7.5.2 Quantitative Assessment of Soil/Waste as Fugitive Dust

7.5.2.1 Chemicals of Potential Concern

Each environmental medium was first assessed to determine if there was a possibility of potential human health threat. It was determined that groundwater did not pose a threat and was, therefore, not considered. Onsite contact (ingestion or dermal exposure) to surficial soil/waste was not addressed quantitatively since a fence surrounding the site virtually eliminates human exposure.

The next step in the risk assessment was the selection of chemicals of potential concern, i.e. chemicals to be used to evaluate potential risk. Sample results were utilized to select chemicals of potential concern in the baseline HRA for each environmental medium, i.e., soil/waste, groundwater, surface water, and stream sediments. For surface water and stream sediment, the concentrations of chemicals detected in each medium were compared to background concentrations in background samples. Organic and inorganic compounds were considered chemicals of potential concern if the average onsite concentration exceeded background concentration. Because no background samples were collected for surficial soil/waste samples, all chemicals detected on site in surficial soil/waste were selected as CPCs.

7.5.2.2 Exposure Assessment

In the exposure assessment, surface water and stream sediments were qualitatively discussed as to their potential for adverse human health effects as a result of exposure to the media. Any medium (soil/waste) that will be eliminated (as a result of eventual remediation of the site) was presented qualitatively. A quantitative discussion of the inhalation of contaminants from fugitive dust was presented.

Because exposure variables did not change when assessing current and future land use they were frequently presented together. For example, one of the only exposure variables that may change in the future regarding the inhalation of fugitive dust would be the distance the contaminated particles travel to the point receptor (i.e. worker). However, the exposure model utilized allows for established distances. The value used for this model was an even shorter distance and was determined by extrapolation. Any further calculation without actual monitoring data introduces a greater uncertainty to the model.

Intake values for inhalation exposure were calculated utilizing the

equation presented in the Risk Assessment Guidance for Superfund (RAGS). Variables used in the equations were primarily obtained from RAGS or other commonly used USEPA documents.

7.5.2.3 Toxicity Assessment

Toxicity data were collected, according to the hierarchy prescribed by USEPA, from IRIS and the Health Effects Assessment Summary Tables (HEAST). These data included slope factors, weight-of-evidence category, tumor site for cancer-causing chemicals of potential concern, toxicity values (RfDs or RfCs), and critical effects for non-cancer-causing (toxic) chemicals of potential concern. Toxicity data were not available for a number of chemicals of potential concern from the sources listed above. These chemicals were therefore excluded from the subsequent risk characterization, i.e. calculation of risk.

7.5.2.4 Risk Characterization

Risks were determined by integrating toxicity data with estimates of exposure intake. Cancer risk was computed for the inhalation pathway by multiplying the exposure level (intake) and the slope factor. The non-cancer risk or Hazard Index was computed for the inhalation pathway by dividing the exposure level by the appropriate toxicity value (reference concentration).

Results of the risk characterization are summarized below:

a. Cancer Risk - (Current/Future land use) - The inhalation cancer risk from fugitive dust for adult workers (3E-07) was within the acceptable risk range (1E-06 to 1E-04) established by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The primary contaminant responsible for fugitive dust-related risk was arsenic.

b. Chronic Health Effects (Current/Future land use) - The total inhalation Hazard Index was below one, which is within acceptable range of concern for noncarcinogenic health effects, for the adult workers. Two chemicals, i.e. chromium (III) and cobalt, accounted for greater than 98 percent of the noncarcinogenic risk associated with exposure to the fugitive dust from the landfill.

7.5.2.5 Uncertainty Analysis

Uncertainty is an inherent part of the HRA since numerous assumptions and judgements are utilized and because the current scientific knowledge regarding human health risk factors is limited. Conservative assumptions were generally utilized to estimate these concentrations, so that the likelihood of underestimating risk is small. However, the assumptions cannot be verified, thus greater uncertainty is associated with the modeled exposure concentrations.

The Lockport City baseline HRA was also impacted by the lack of toxicity data available for certain chemicals. [Toxicity values were simply not published.] Therefore, risks associated with these chemicals could not be quantified. However, as with PAHs, surrogate values were used to quantify risk. For PAHs, it was assumed that all carcinogenic PAHs were as potent as benzo(a)pyrene. Although the surrogate value method may be considered simplistic, this approach was utilized because of the number of PAHs detected on site.

Although uncertainty is inherent in the risk analysis, the HRA is based upon the concept of reasonable maximum exposure, meaning that the general population is almost certainly not exposed at levels used in this analysis, and therefore, would experience risks which are smaller than those estimated herein.

7.6 Biota Assessment

According to NYSDEC personnel (personal communication, December 1989), no significant habitats are found in the vicinity of the landfill. No known sightings of threatened or endangered species have occurred on the site.

The Gulf, which is downstream from the site, is classified by NYSDEC as a Class D water, which means it is suitable for fishing. However, NYSDEC states that "other factors may limit the use for that purpose. Due to such natural conditions as intermittency of flow, water conditions not conducive to propagation of game fishery or stream bed conditions, the waters will not support fish propagation." This appears to be the situation with The Gulf. The flow in The Gulf is minimal and the appearance of the water is said to be milky, probably due to the industrial discharge from the upstream facility. It is not believed that fish would be able to live under these conditions. Therefore, ingestion of fish is not a reasonable exposure pathway.

Animals (white-tailed deer, wild turkey, racoon, rabbit, etc.) have been sighted on or near the landfill during the remedial investigation. In order to assess human health risk from the ingestion of animals meat (e.g., rabbit, deer, fish), these organisms should be sampled. The same is true for grains (e.g., wheat, corn), vegetables (e.g., spinach, carrots), and fruits (e.g., melon, strawberries). The Risk Assessment Guidance for Superfund (RAGS) (EPA/540/1-89/002) provides equations for the calculation of intake for the ingestion of contaminated nuts, vegetables and contaminated fish and shellfish. Since there is no actual monitoring data for any of the above-referenced edible items, all values, variables, and assumptions would be based upon professional judgement and have a high degree of uncertainty associated to it. For example, if one of the residents was a hunter and shot a deer for his family's consumption, an assumption would be that the family ate filleted portions

of venison. A list of chemicals of potential concern would have to be determined, but since no actual monitoring data were collected, it would have to be assumed that all target compound chemicals are bioconcentrating in the animal meat. A model would have to be used to calculate the transfer coefficients from the animal meat into the digestive system and eventually absorbed into the blood stream. Once the data were generated from the model, intake doses could be calculated and the risk associated with such a pathway could be determined. However, as stated earlier, a great deal of uncertainty is associated with calculating human health risk without actual monitoring data.

8.0 SUMMARY AND CONCLUSIONS

The purpose of the remedial investigation of the Lockport City Landfill was to collect data and characterize the site in sufficient detail to identify, develop, and evaluate remedial alternatives as part of the Feasibility Study. Sections 1 through 7 of this report present the results of the RI, and the key findings are as follows:

- The 30-acre landfill was operated by the City of Lockport as a municipal and industrial waste landfill from the early 1950s to 1976. An estimated 640,000 cubic yards of fill was reportedly placed in trenches excavated into the overburden, and into two former valleys.

- The landfill site is located along a re-entrant of the Niagara Escarpment referred to as The Gulf. Due to the southerly dip of the bedrock formations, the landfill is underlain by successively younger rock units which span from the Grimsby sandstone on the north to the Rochester shale on the south. Rock altitudes, calculated from rock elevations identified in boreholes, indicate a local dip of between 0.86 to 1.18 degrees toward the east and southeast. Anomalous rock elevations obtained beneath the southern extent of the landfill suggest vertical displacement of the rock units adjacent to The Gulf.

- Surface water from precipitation on the site discharges into The Gulf. A portion of this precipitation infiltrates the landfill surface and emerges as leachate. A small portion of surface water results from a seep which discharges near the top of the landfill. The Gulf flows into a 3-acre wetland directly north of the site and continues north one mile to

Eighteen Mile Creek. The stream flow measurements indicate an amount of discharge unaccounted for that may be stored in, or vertically recharged from, the wetland.

- Three groundwater zones (shallow, intermediate, and deep) were monitored at the site. In uplying areas east of the site, unconfined groundwater in overburden (shallow) and near surface fractures of the Rochester shale (intermediate) were monitored. Deeper, potentially confined groundwater in fractures and bedding plane separations of the Irondequoit formation were also monitored. Observations of static-water levels within screen intervals of some intermediate and deep wells suggest unsaturated conditions and probable stratigraphic perching of water bearing zones within rock units of the escarpment above the level of The Gulf.

  In low-lying areas around the base of slope, groundwater within the overburden (shallow) and underlying rock unit (intermediate) were monitored. Rock units monitored included the Grimsby and Rockway formations.

- Groundwater elevation data from well clusters indicate a consistent downward vertical gradient between monitoring pairs in uplying areas. In low-lying areas adjacent to The Gulf, a progressive downward to upward vertical gradient was observed proceeding from the more steeply dissected valley area south of the landfill, to the open, marshy area directly north of the landfill.

  Horizontal gradients in the shallow monitoring wells indicate that flow in the silty clay overburden and fill is generally west to northwest across the site toward the Gulf into which

it discharges. Hydraulic conductivity values of the fill averaged 7.4×10^{-3} cm/sec and ranged from 1.1×10^{-2} to 4.22×10^{-6} cm/sec. Horizontal gradients in the Rochester shale and Irondequoit limestone east of the site indicate flow toward the east and northeast away from the landfill in the same general direction of bedrock dip. Available information on the direction of groundwater flow within rock units beneath the landfill is limited and ambiguous. In general, flow within surficially fractured rock would be expected to be directed toward The Gulf following the slope of the bedrock surface. However, flow in the direction of rock dip is possible where less permeable rock units are present to intercept and perch surficial flow.

Hydraulic conductivity of the Rochester shale ranged from 6.6×10^{-4} to 2.5×10^{-5} cm/sec, while the conductivity of the Irondequoit limestone provided lower values in the order of 10^{-5} cm/sec.

- Of the three soil samples from offsite monitoring well borings (MW-1, MW-6 and MW-8), one sample (MW-1, 0 to 3 feet) detected low levels of SVOCs including benzoic acid, naphthalene, benzo(a)pyrene and other PAHs. The same compounds were also identified in soil samples from the onsite well locations. Particularly high levels of these compounds were identified in a sample obtained below the sewer line at MW-5. Some onsite soil samples also detected PCBs and elevated levels of arsenic, barium, chromium, lead, and zinc.

- Many of the analytes identified in soil samples from the offsite and onsite monitoring well locations were also identified at somewhat higher concentrations in samples from

the landfill. In addition to numerous PAH compounds, several composite fill and waste samples (SB-5, SB-14, SB-25, and WS-3), also reported low levels of VOCs (chloroform, toluene, ethylbenzene and xylenes). High concentrations of VOCs were particularly evident at sample location SB-25, east of the railroad tracks.

A comparison of analytes found in the fill with surface soil samples from the landfill again showed a correspondence in the type of compounds present. Both groups contained similar concentrations of SVOCs (mostly PAHs with maximum 220 ppm at SB-25), PCBs (maximum 43 ppm at SB-1), and an occasional pesticide. Trace elements detected at elevated levels included barium (SB-19, WS-1, WS-2), chromium (SB-14, SB-18, SB-25, WS-3, SPS-2, SPS-3), and cobalt (SB-25 and WS-2).

- Stream sediment samples collected upstream of the landfill were shown to generally contain a greater number and concentration of organic compounds (particularly PAHs) than those sampled adjacent to the site, indicating that the landfill is not contributing significantly to the compounds found in the stream sediments. The types of organic compounds and metals found are similar to those identified in onsite and offsite soil and fill samples.

- Although the surface water samples failed to detect the number and concentration of PAHs identified in corresponding sediment samples, a number of VOCs, including 1,2-dichloroethene (1,2-DCE), trichloroethene (TCE), benzene and toluene, were detected at low concentrations in both up- and downgradient samples. Several of the VOCs detected in the surface water samples (1,2-DCE, TCE and benzene) were also detected in the

leachate seep (L-2) discharging from the base of the landfill and in water samples from surrounding manholes up- and downgradient of the site. SVOCs in the surface water, seep and sewer samples were limited to benzoic acid and several low concentration phthalates. Metals were similar in type and concentration in up- and downgradient samples, and pesticides and PCBs were not detected.

- A comparison of groundwater quality between up- and downgradient shallow and intermediate monitoring wells indicates that, with the exception of low levels of phthalates, the upgradient wells were essentially free of organic analytes. Little, if any, organics were found in upgradient wells MW-1S, MW-1I, or MW-8I. The same phthalate compounds detected in the upgradient wells (diethylphthalate, di-n-butylphthalate, and bis(2-ethylhexyl)phthalate were also found at low concentrations in the downgradient wells.

In addition to the phthalates, monitoring wells MW-2S and MW-9S reported a number of PAHs below sample quantitation limits. Low concentrations of VOCs, including vinyl chloride, 1,2-DCE, benzene, and xylenes, were also detected in wells MW-3S and Mw-12I and well pair MW-9S and MW-9I (confirmed in both rounds of groundwater analyses). Little organic contamination was evident in wells MW-4S, MW-5S, MW-5I, and MW-7S on the northern area of the site. None of the monitoring wells (including the deep well series) detected any pesticides or PCBs.

Similar types and concentrations of metals were identified in most groundwater samples. Elevated levels of trace elements

included arsenic (MW-2I and MW-4S), barium (MW-3S, MW-4S, Mw-5S, MW-5I), cobalt (MW-7S) and chromium (MW-1I and MW-6D).

- Analysis of the sample results from the deep monitoring wells (excluding MW-11D) indicate that groundwater samples from wells MW-6D, MW-10D and MW-12D were essentially free of organics when compounds associated with blank contamination (bis(2-ethylhexyl)phthalate, methanol and acetone) were deleted.

  The groundwater sample from MW-1D identified a number of VOCs (carbon disulfate, toluene, chlorobenzene, xylenes) and PAHs, all at concentrations below sample quantitation limits. Elevated concentrations of barium and chromium were also identified. In well MW-8D, elevated levels of vinyl chloride, 1,2-DCE and TCE were confirmed in both rounds of groundwater analyses. The organic compounds detected in wells MW-1D and MW-8D were not, however, identified in their corresponding intermediate or shallow well pairs.

- Most of the SVOCs identified in the soil sample collected at well location MW-1 were also detected in the deep groundwater sample (MW-1D) suggesting that the well location may be the source of contamination. The absence of these compounds in shallow and intermediate groundwater samples would further suggest possible contamination of the deep well during well installation. If so, the second round groundwater sample should report lesser quantities of the compounds.

- The principal contaminants identified in fill and waste samples from the landfill included SVOCs (mainly PAHs), PCBs, some pesticides and a few metals. The general absence of

these analytes in perimeter monitoring wells and seeps attests to their relative immobility and confirm that the landfill is not significantly impacting area groundwater quality.

- The presence of elevated levels of VOCs in MW-8D (vinyl chloride, 1,2-DCE, and TCE) and the occurrence of these same compounds in groundwater (MW-9S and MW-9I) and seep (1-2) samples directly west, suggests an intermediate source area. The much higher concentrations detected at MW-8D, implies a probable source location either along the east central margin of the landfill or within the adjacent railroad right-of-way or town park area. These compounds were not identified in landfill soil and waste samples.

- It is apparent from the results of the sediment and surface water samples that the landfill is not contributing significantly to contamination of The Gulf. The occurrence of similar types and concentrations of organics in upstream samples from both east and west branches of The Gulf, suggests several different offsite sources contributing contamination.

- The results of the health risk assessment determined that, given the premise that a fence is constructed around the site to limit access, there will be no adverse health effects to the surrounding public.

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