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Phase I/Phase II Feasibility Study
Rose Valley Landfill Site
Town of Russia, New York

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Introduction

1.1 Purpose of the Feasibility Study

Ecology and Environment Engineering, P.C. (E & E), under contract (Work Assignment No. D003493-15) to the New York State Department of Environmental Conservation (NYSDEC) has prepared this feasibility study (FS) for the Rose Valley Landfill site (NYSDEC Site No. 6-22-017) in Russia, New York (see Figure 1-1). This FS was prepared in order to determine what areas of the site may require cleanup and to evaluate alternative approaches to meeting cleanup objectives. This FS was conducted in substantial accordance with the United States Environmental Protection Agency's (EPA's) *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 540/G-89/004) and NYSDEC's Technical and Administrative Guidance Memorandum (TAGM) 4030, *Selection of Remedial Actions at Inactive Hazardous Waste Sites.*

The development of remedial action objectives (RAOs) is presented in Section 2. The identification of appropriate technologies and development of alternatives are in Section 3, and the analysis of remedial alternatives is presented in Section 4.

1.2 Site Description

The Rose Valley Landfill is a privately owned, unlined dump that was open from 1963 to 1985. It is located in a rural part of Herkimer County and, until 1986, was part of a 91-acre parcel.

The main entrance to the site is located on Rose Valley Road, approximately 2 miles northeast of the village of Poland, Russia Township, Herkimer County, New York. The site is bounded to the east by Military Road, to the west by Bromley Road, and to the southwest by Rose Valley Road. An unnamed tributary to Hurricane Brook (NYSDEC Class C) separates the site from Military Road. The tributary also is deemed a Class C stream by NYSDEC.

The landfill is located on the side of a hill that has approximately 120 feet of relief. A steep, 60-foot-high sand embankment extends above the landfill to the west. The sand embankment is bordered on the east and west by 10- to 20-foot-high embankments of trash with a thin, partial cover. The upper portion of the landfill, located below the sand embankment, is vegetated with brush and covered with a clay cap. The central and lower portion of the landfill is partially covered with a sand cap and is vegetated with brush and small trees. In 1991, it was reported that several deep rills and mounded ledges formed within the cap and that debris protruded in numerous locations. Also in 1991, an odor was detected over some portions of the sandy cap. Several leachate seeps flow into a wetland area at the toe of the landfill. The wetland extends eastward to the toe of the landfill and Military Road.

The site is characterized by high relief, with sharp drops in elevation from southwest to northeast and a moderate, even south to southwest slope. The gradient across the western portion of the property is less severe, sloping in the opposite direction. Two piles of scrap metal, including empty 55-gallon drums, are located west of the landfill. A former septage pit is located southeast of the scrap metal piles. According to NYSDEC site inspection records, a second septage pit is located west of the landfill; however, its exact location is unknown. A pile of 55-gallon drums, a pile of empty plastic drums, and the foundations of a former equipment storage shed and office are located near the main site entrance. The shed and office are believed to have once housed a smelting operation. In this area, signs of a fire are evident, with charred wood and debris present on and adjacent to the foundations. An underground fuel tank is located between the two foundations. The tank contained a liquid that has a diesel fuel odor.

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The area surrounding the site is sparsely populated, with few known permanent residents immediately downgradient of the landfill. A private well immediately adjacent to the landfill entrance on Rose Valley Road has been contaminated with site-related contaminants. A granulated activated-carbon/ultra-violet filter is being maintained under the state Superfund program. During the RI, the New York State Department of Health (NYSDOH), Herkimer District Office, resampled other adjacent domestic wells.

1.3 Site History

Landfill operations began at Rose Valley in 1963, under the ownership of Clarence and Wilma Sneath. The site served as the municipal landfill for the villages of Poland and Cold Brook. The property was sold to John and Elizabeth Scardina in 1964 and to Gerald Crouch in 1972.

According to a site assessment written by Engineering Science (1991), operations were expanded under Mr. Crouch's ownership to include recycling, the use of two septage pits, and an increase in the rate of landfill tipping. Business was expanded to include the towns of Corsochie, Newport, Herkimer, and Manheim. The types of wastes that were accepted included residential, commercial, industrial, and scavenger. NYSDEC reports indicate that in 1978 the landfill received saturated soils from a 286-gallon pesticide spill.

Mr. Crouch was cited for several NYSDEC permit violations during his operation of the landfill. The most notable violation, which occurred in 1979, alleged the acceptance and open burning of hazardous wastes. The wastes included trichloroethylene and other flammable industrial chemicals.

In 1982, Mr. Crouch entered into a consent order with NYSDEC. The consent order required a hydrogeologic study of the site and an engineering plan to upgrade the landfill to comply with 6 New York Code of Rules and Regulations (NYCRR) Part 360 (Amended Consent Order 1982). The hydrogeologic study was performed by Dunn Geoscience, Inc. (Dunn). Dunn installed monitoring wells B-1 and B-3 to depths of 91.5 and 50.7 feet, respectively. Mr. Crouch retained Stetson-Dale, Inc., an engineering consulting firm, to prepare the plans for upgrading the landfill to comply with Part 360 regulations. One additional permanent monitoring well (B-4) and one temporary well (B-2) were installed to better define the groundwater flow direction. NYSDEC did not accept the engineering plan, citing inadequate liner provisions.

In 1983, Mr. Crouch entered into a consent order to close the landfill. The consent order provided for closure by 1985, in accordance with Part 360 regulations. Stetson-Dale, Inc., completed a landfill closure plan in 1984, which was accepted by NYSDEC. The plan was not implemented, and Mr. Crouch was assessed a civil penalty for failing to operate the landfill in accordance with the Part 360 regulations and for failing to meet the requirements of his consent order.

In 1988, the NUS Corporation, Superfund Division, performed a preliminary assessment of the Rose Valley site under contract to the EPA. The preliminary assessment was performed solely by examining existing files and reports. Following the investigation, the site was classified by NUS as "medium priority." The ranking was attributed to uncontrolled leachate seeps discharging to surface water bodies at the base of the landfill.

1.4 Previous Site Investigations

Environmental samples were collected from the Rose Valley site on several occasions during the 1980s. NYSDEC collected two well samples in 1981 from an upgradient residential well and a well downgradient of the landfill. The upgradient residential well was resampled as part of the 1991 NYSDEC contamination assessment. The samples were analyzed for total metals and selected water quality parameters. The concentrations of several parameters detected in the downgradient well (iron, manganese, sulfate, and total organic carbon [TOC]) exceeded background concentrations detected in the upgradient residential well.

Leachate, surface water, and groundwater samples were collected by NYSDEC and Stetson-Dale in 1984 during separate sampling events. One leachate sample exceeded the 1984 groundwater standards for chloride, arsenic, iron, and manganese. Stetson-Dale collected groundwater samples from the four monitoring wells installed by Dunn. State standards for phenols and iron were exceeded in all four wells. Manganese, arsenic, lead, barium, aluminum, and sulfate groundwater standards were exceeded in at least one of the wells.

In 1988, the EPA Field Investigation Team contractor, NUS Corp., completed a Preliminary Assessment for the site. This comprised a literature search and summary of available information.

In 1989, NYSDOH collected leachate, sediment, soil, and domestic water well samples in the vicinity of the Rose Valley site. Leachate and sediment samples were collected from a drainage basin adjacent to the eastern toe of the landfill. NYSDEC surface water standards were exceeded for chlorobenzene, vinyl chloride, 1,2-dichloroethane, delta-BHC (a pesticide), and iron. Several other compounds were detected below standards.

Three sediment samples also were collected by NYSDEC from the drainage basin. Phenanthrene, fluoranthene, pyrene, and dieldrin (a pesticide) were detected at low concentrations; the PCB Aroclor 1254 was detected in trace concentrations in all three samples. Two surface soil samples were collected near the base of the drum/metal pile in the center of the property, and the pesticides Beta-BHC and 1,1'-DDT were detected in low concentrations.

In 1991, NYSDEC contractor Engineering-Science, Inc., completed its final site contamination assessment report for the Rose Valley Landfill site. This report documented contamination in the groundwater, sediments, leachate, and surface water at the site.

In August 1995, EPA contractors completed a site inspection report that concluded that no further action by EPA was necessary.

In 1998, the Rose Valley Landfill site was referred to the state Superfund program for action.

In May 1999, E & E submitted a Remedial Investigation/ Feasibility Study (RI/FS) work plan to NYSDEC, and RI field investigations were conducted in June through October and December 1999, and January 2000. Results of this RI are presented in the *Remedial Investigation Report for the Rose Valley Landfill Site, Town of Russia, New York* (E & E 2000).

2

Development of Remedial Action Objectives and Definition of Contaminated Media of Concern

2.1 Introduction

This FS addresses contamination in surface water, sediment, surface soils, subsurface soils, and groundwater at the Rose Valley Landfill site. Chemicals analyzed for at this site include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (pest/PCBs), and metals.

A fish and wildlife impact analysis (FWIA), steps I and IIA and IIB, was performed at this site to evaluate possible negative effects that the site may be exerting on biota of the surrounding area. Based on information provided by state and local regulatory guidances, terrestrial wildlife, plants, and invertebrates could be impacted by sediments, surface water, and groundwater contamination at the site. These potential impacts were identified by screening contaminant data against available benchmarks. Due to the detection of several contaminants above screening criteria and the presence of bioaccumulative contaminants, E & E recommends further investigation and analysis of surface water at the site and performance of a toxic effect analysis (FWIA Step II Part C) to determine exposures in the wetland and other surface water.

The RAOs for this site are to reduce exposure to contamination either by restricting access to contaminants or by reducing contaminant concentrations to acceptable levels.

To define the area or volume of each medium that must be addressed to meet the RAOs, chemical-specific cleanup goals were developed for each medium at this site. These cleanup goals were developed based on an evaluation of standards and other criteria and guidance (SCGs). The evaluation determined the levels at which the contaminants can be present but are not deemed a risk to human health and the environment.

Standards refer to promulgated and legally enforceable rules or regulations. *Criteria* and *guidance* refer to policy documents that are non-promulgated and are therefore not legally enforceable.

The SCGs presented in this report are in accordance with Section 121(d)(2) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). They are also consistent with EPA guidance values set forth in the CERCLA Oil and Hazardous Substances National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations [CFR] 300); the two-part document entitled, *CERCLA Compliance with Other Laws Manual* (Office of Solid Waste and Emergency Response [OSWER] Directives 9234.1-01 [Draft], August 8, 1988, and 9234.1-02, August 1989); and the document entitled, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA-540/G-89/004).

There are three types of SCGs:

- **Chemical-specific SCGs**. Usually health- or risk-based numerical values or methodologies that establish an acceptable amount or concentration of a chemical in the ambient environment;
- **Action-specific SCGs**. Usually technology- or activity-based requirements for remedial actions; and
- **Location-specific SCGs**. Restrictions placed on the concentration of hazardous substances or the conduct of activity solely because the activities occur in special locations.

Only chemical-specific SCGs address cleanup goals. Action-specific and location-specific SCGs, if applicable, will be discussed in the detailed analysis of alternatives in relation to specific remedial alternatives.

Cleanup goals are established by evaluating the available SCGs for each contaminant. In general, this process selects standards as preliminary screening values. If no standards exist for a given contaminant, the most appropriate criterion or guidance value is selected as a preliminary screening value. Where appropriate, the preliminary screening values then are compared to site-specific background values to ensure that no preliminary screening value is set below background concentrations. If the site-specific background concentration is higher than the SCG-based preliminary screening value, then the background concentration is selected as the preliminary screening value. These preliminary screening values then are compared to site data to identify which contaminants may require cleanup. These contaminants are then considered with regard to other factors influencing the need for cleanup, including comparison to regional background levels and an evaluation of contamination. The cleanup goals set by this process then are compared again to site data in order to identify areas that must be addressed in the FS.

This process is completed for each medium. Because the nature of the SCGs is different for each medium, the details of this process are medium-specific. These details are presented in each medium-specific section below. Each section describes and presents figures showing the extent of contamination exceeding the cleanup goals, and these areas and volumes form the basis for the remedial technology selection and alternative development sections in this FS.

2.2 Soils

2.2.1 Surface Soils

Two surface soil samples (SS-01 and SS-02) and one duplicate soil sample of SS-01 (SS-03-SD) were collected at the Rose Valley site on July 22, 1999, by the E & E and JCL (a subcontractor) field team. The samples were collected from depths of 0 to 2 inches below ground surface (BGS) in areas downgradient of the north slope fill area. The purpose of these samples was to determine whether contaminants of concern are present in the north slope fill area. The sample locations receive surface water runoff from the fill area, and the sample results therefore would likely indicate if hazardous materials are present in the fill area.

The samples were analyzed for VOCs, SVOCs, pesticides, PCBs, metals, and cyanide. The positive results of this analysis are presented in Tables 5-2 and 5-3 of the RI report for the Rose Valley Landfill site.

2.2.2 Subsurface Soil Investigation

Standard split-spoon sampling of soils (sampling every 5 feet) was conducted at every hydropunch and groundwater monitoring well borehole. Following geologic logging of the findings, soils were selected for laboratory analysis from selected boreholes, based either on the presence of observable staining or organic vapor readings other than methane. Very few of the split-spoon samples collected were submitted for analysis. Most organic vapor readings were due to methane, and very little soil staining was observed.

Hydropunch Samples

Seven hydropunch samples (HP-05, HP-07A, HP-07B, HP-08, HP-09, HP-10, and HP-11) were collected between July 23 and 29, 1999. Samples HP-07A and HP-07B were collected from the same location, HP-07A at a depth of 6.3 feet, and HP-07B at a depth between 45 and 47 feet. For the rest of the hydropunch samples, the depth varied between about 5 feet for HP-05 and HP-09, and almost 50 feet for HP-10. All the samples except HP-07B were analyzed for VOCs. Sample HP-07B was analyzed for SVOCs, pesticides/PCBs, and metals.

Geoprobe Samples

Seven geoprobe samples (GP-01, GP-02, GP-03, GP-04, GP-05, GP-09, and GP-13-SD [duplicate sample of GP-02]) were collected on July 21, 1999. All the samples were analyzed for VOCs. Sample GP-09 was the only one analyzed for metals.

Table 2-10 of the RI report for the Rose Valley Landfill site (E & E 2000) includes the analytical results of the subsurface soil samples.

2.2.3 Selection of Soil Cleanup Goals

Standards

There are no standards promulgated for soils.

Criteria and Guidance Values

The main criteria and guidance values identified for soils at the Rose Valley Landfill site include the NYSDEC TAGM 4046 (January 1994; Appendix A); EPA, Region III, risk-based concentrations (RBCs; April 1999); EPA soil screening levels (SSLs; July 1996); and EPA's *Revised Soil Lead Guidance* (OSWER Directive 9355.4-12, July 1994), which recommends a screening level of 400 parts per million (ppm) for lead in soil for residential land use. Criteria and guidance values for the contaminants detected at this site are presented in Table 2-1.

The TAGM 4046 value for cadmium was updated from the 1994 value of 1 mg/kg (or site background, if available) to 10 mg/kg (or site background, if available). This update has not been published in a revised TAGM; it is included in accordance with directions from NYSDEC staff.

Table 2-1 Cleanup Goal Screening Process for Soils—Rose Valley Landfill Site (mg/kg)

	TBCs						
	Federal			State			
Contaminants	Soil Lead Guidance[a]	EPA Region III RBCs[b]	EPA Soil Screening Levels[c]	NYSDEC TAGM 4046[d]	Preliminary Screening Value	Maximum Concentration	Cleanup Goal
TCL Volatiles							
Methylene Chloride	—	85	85	0.1	0.1	0.004	—
Acetone	—	7,800	7,800	0.2	0.2	0.064	—
Carbon Disulfide	—	7,800	7,800	2.7	2.7	0.008	—
2 - Butanone	—	7,800	—	0.3	0.3	0.013	—
Benzene	—	22	22	0.06	0.06	0.006	—
Tetrachloroethene	—	12	12	1.4	1.4	0.001	—
Toluene	—	16,000	16,000	16,000	16,000	0.067	—
Chlorobenzene	—	1,600	1,600	1.7	1.7	0.210	—
Ethylbenzene	—	7,800	7,800	5.5	5.5	0.035	—
Xylenes (total)	—	160,000	160,000	1.2	1.2	0.230	—
TCL Semivolatiles							
Benzo(b) fluoranthene	—	0.87	0.90	1.1	0.87	0.068	—
Benzo(k) fluoranthene	—	8.7	9.0	1.1	1.1	0.051	—
bis(2-Ethylhexyl) phthalate	—	50	46	50	46	0.073	—
Chrysene	—	87	88	0.40	0.40	0.052	—
Fluoranthene	—	3,100	3,100	50	50	0.078	—
Phenanthrene	—	—	—	50	50	0.049	—
Pyrene	—	2,300	2,300	50	50	0.073	—
TCL Pesticide/PCB							
Dieldrin	—	0.04	0.04	0.044	0.04	0.001	—
4,4'-DDE	—	1.9	2	2.1	1.9	0.003	—
Endrin	—	23	23	0.10	0.10	0.001	—
4,4'-DDT	—	1.9	2.0	2.1	1.9	0.003	—
Aroclor 1260	—	0.32	1.0	1.0	0.32	0.037	—
TCL Metals							
Aluminum	—	78,000	—	—	78,000	3,990	—
Antimony	—	31	31	—	31	5.5	—
Arsenic	—	0.43	0.4	7.5	0.4	4.7	0.4
Barium	—	5,500	5,500	300	300	185	—
Beryllium	—	160	0.1	0.16	0.1	0.26	0.1
Cadmium	—	39	78	10.0	10.0	4.9	—
Calcium	—	—	—	—	—	49,400	—
Chromium	—	120,000[e]	78,000 [e]	10	10	10.9	10
Cobalt	—	4,700	—	30	30	1.1	—
Copper	—	3,100	—	25	25	297	25
Iron	—	23,000	—	2,000	2,000	29,800	2,000
Lead	400	—	400	—	400	215	—
Magnesium	—	—	—	—	—	1,960	—
Manganese	—	1,600	—	—	1,600	469	—
Mercury	—	—	—	0.10	0.10	0.079	—
Nickel	—	1,600	1,600	13	13	13.6	13
Potassium	—	—	—	—	—	360	—
Selenium	—	390	390	2	2	12.6	2
Sodium	—	—	—	—	—	56.5	—

Table 2-1 Cleanup Goal Screening Process for Soils—Rose Valley Landfill Site (mg/kg)

	TBCs						
	Federal			State			
Contaminants	Soil Lead Guidance[a]	EPA Region III RBCs[b]	EPA Soil Screening Levels[c]	NYSDEC TAGM 4046[d]	Preliminary Screening Value	Maximum Concentration	Cleanup Goal
Vanadium	—	550	550	150	150	9.1	—
Zinc	—	23,000	23,000	20	20	383	20
Cyanide	—	1,600	1,600	—	1,600	0.82	—

[a] EPA Office of Solid Waste and Emergency Response, July 1994, OSWER Directive 9355.4-12, Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities.

[b] EPA Region III Risk-Based Concentration Tables, April 1999.

[c] EPA Office of Solid Waste and Emergency Response, July 1996, SSLs. Table A-1: Generic SSLs; screening levels based on human health criteria only.

[d] NYSDEC Technical and Administrative Guidance Memorandum 4046, January 1994. Appendix A.

[e] Value is of chromium III.

Key:

— = No screening value available/applicable.
EPA = United States Environmental Protection Agency.
mg/kg = Milligrams per kilogram.
NYSDEC = New York State Department of Environmental Conservation.
RBCs = Risk-based concentrations.
SSLs = Soil Screening Guidance Levels.
TAGM = Technical and Administrative Guidance Memorandum.
TBCs = To be considereds.

Selection Process

The cleanup goal screening process for surface soil is presented in Table 2-1. The following logical basis was used to select the preliminary cleanup values presented in this table:

- The lowest of the EPA Region III RBCs, EPA SSLs, or NYSDEC TAGM 4046, where they existed, was selected as the preliminary cleanup value, except for lead. For lead, the EPA *Revised Soil Lead Guidance* value was used. Because lead is a common contaminant at many waste sites, this metal has received increased attention, resulting in this commonly accepted value for site cleanups; thus, this value is used instead of the TAGM 4046 value (site background), which is lower;

- The preliminary cleanup values then were compared to the maximum observed concentration for each compound in order to determine which compounds may require cleanup; and

- Finally, the contaminants identified for cleanup were reviewed to determine whether they are site-related and whether cleanup actually is warranted.

Based on this process, it was found that no organic compounds were present above the cleanup goals in the surface and subsurface soil samples. The only exceedances of the cleanup goals are eight metals (arsenic, beryllium, chromium, copper, iron, nickel, selenium, and zinc), as summarized in Table 2-2.

Table 2-2 Contaminants Detected in Soil Above Cleanup Goals (mg/kg)

Contaminant	Cleanup Goal	Number of Exceedances	Concentration Range
Metals			
Arsenic	0.4	2/2 - Surface Soils	1.6 - 4.7
		1/2 - Subsurface Soils	1.1
Beryllium	0.1	2/2 - Surface Soils	0.15 - 0.26
		2/2 - Subsurface Soils	0.16 - 0.25
Chromium	10	1/2 - Surface Soils	10.9
Copper	25	1/2 - Surface Soils	96.9 - 297
Iron	2,000	2/2 - Surface Soils	7,740 - 29,800
		2/2 - Subsurface Soils	5,700 - 6,330
Nickel	13	1/2 - Surface Soils	13.6
Selenium	2	2/2 - Surface Soils	2.6 - 12.6
		2/2 - Subsurface Soils	2.2 - 2.3
Zinc	20	2/2 - Surface Soils	52.1 - 383
		1/2 - Subsurface Soils	21.6

Key:

mg/kg = Milligrams per kilogram.

Figure 2-1 identifies these contaminants and their associated concentrations above cleanup goals.

Two of the above-mentioned metals, chromium and nickel, exceeded the cleanup goals only in soil sample SS-01. The sample concentrations of these two metals were just slightly higher than the cleanup goals (see Table 2-1). Thus, these two metals are not considered for remediation. The concentrations of arsenic and iron exceeded the cleanup goals in most samples; however, these are likely to be naturally occurring. Iron is found widely in soils and is an essential nutrient. Arsenic, while above risk-based criteria (though below TAGM 4046 values), is found at uniformly low levels (less than 5 mg/kg), which is typical of many soils. Thus, these two metals are not considered for remediation.

Additional soil sampling is planned, including background samples. Because no background samples were collected in the RI, the TAGM 4046 guidance values for most metals were set at the generic values provided; these values were typically well below the risk-based values available in other guidance values, such as the two EPA TBCs. The background values, when available, are expected to provide additional justification demonstrating that metals concentrations are not high enough to be of concern.

Other metals detected above cleanup goals in surface soils were copper and zinc. Although these are most likely above background concentrations, they exceed cleanup goals by virtue of exceeding TAGM 4046 default values. In contrast, they are well below the risk-based EPA guidance values and are not expected to pose a risk to human health or the environment.

Beryllium and selenium exceed cleanup goals in every sample analyzed for metals. Selenium, like copper and zinc in the surface samples, is probably above background concentrations but exceeds cleanup goals by virtue of exceeding TAGM 4046 default value. Selenium, however, is well below the risk-based EPA guidance values and is not expected to pose a risk to human health or the environment. One of the EPA risk-based levels is below all of the detected beryllium concentrations. However, this criterion (the EPA SSL) is set at 0.1 mg/kg, while detected beryllium concentrations range from only 0.15 to 0.26. Thus, this metal is not considered for remediation.

Based on this analysis of sampling completed to date, no remedial actions need to be considered for the soil at this site.

2.3 Groundwater

Groundwater data was collected through two main efforts: geoprobe and hydropunch installation; and groundwater monitoring well installation. Ten geoprobe borings (GP-01 to GP-10) were installed on the east side of the site, and seven (GP-21 to GP-27) were installed in the wetland area downgradient of the lower landfill. Twelve hydropunch boreholes (HP-01 to HP-12) were installed on site in locations based on the findings from the soil gas survey. Twelve monitoring wells (MW-06 to MW-17) were installed on site. Analytical data collected from these sites indicates that at least three distinct areas of groundwater contamination exist on site: the house plume area, the HP11 plume area, and the wetland plume area.

2.3.1 Selection of Groundwater Cleanup Goals

Standards

Standards identified for groundwater at the Rose Valley Landfill site are the NYSDEC Class GA maximum contaminant levels (MCL) (June 1998) taken from the NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) (1.1.1) Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, indicating that the best potential use of this groundwater is as a drinking water source.

Guidance

The NYSDEC Class GA water guidance values were also taken from TOGS 1.1.1. The guidance values were used for compounds for which NYSDEC Class GA Standards have not been established.

Background

One monitoring well, MW-06, was installed offsite on Cooper Road, north of Military Road, to obtain data on background concentrations; however, the data were not used in the determination of groundwater clean-up goals. Rather, water quality data from this well are used in evaluating individual cleanup goal exceedances to determine whether they are of concern. No VOCs, SVOCs, pesticides, or PCBs were detected in this well. The inorganics aluminum, barium, calcium, chromium, magnesium, manganese, potassium, sodium, vanadium, and zinc were detected below NYSDEC Class GA Groundwater Standards. Iron was the only constituent detected above standards.

The cleanup goal screening process for groundwater is presented in Table 2-3. The following method was used to select the preliminary cleanup values presented in the table:

- The NYSDEC Class GA standard, if it existed, was selected as the preliminary cleanup value;
- If a groundwater standard did not exist for a constituent, the NYSDEC Class GA guidance value were used;
- The preliminary cleanup values were then compared to the maximum observed concentrations of each compound to determine which compounds may require cleanup; and
- Finally, the contaminants identified for cleanup were reviewed to determine whether they are site related and whether cleanup actually is warranted.

The groundwater contaminant exceedances are summarized in Table 2-4.

Table 2-3 Cleanup Goal Screening Process for Groundwater—Rose Valley Landfill Site (µg/L)

Compound	NYSDEC Class GA Groundwater Standard	NYSDEC Class GA Groundwater Guidance	Maximum Concentration	Cleanup Goal
TCL Volatiles				
Acetone	—	50	33	—
1,1-Dichloroethene	5	0.7	13	5
1,1-Dichloroethane	5	—	14	5
1,2-Dichloroethene (total)	5 [a]	—	29	5
Chloroform	7	—	1 J	—
2-Butanone	—	50	29	—
1,1,1-Trichloroethane	5	C	81	5
cis-1,2-Dichloroethane	5	—	19	5
Trichloroethene	5	—	460 D	5
Benzene	1	—	7 J	1
Tetrachloroethene	5	0.7	2 J	—
Toluene	5	—	1 J	—
Chlorobenzene	5	—	43	5
Ethylbenzene	5	—	9 J	5
Xylene (total)	5 [a]	—	120	5
TCL Semivolatiles				
1, 4-Dichlorobenzene	3	—	5 J	3
Diethylphthalate	—	50	36 J	—
Di-n-butylphthalate	50	—	1 J	—
Butylbenzylphthalate	—	50	2 J	—
bis(2-Ethylhexyl)phthalate	5	—	2 J	—
TCL Pest/PCBs				
Pesticides/PCBs	—	—	—	—
Inorganics				
Aluminum	—	—	344,000 J	—
Antimony	3	—	65	3
Arsenic	25	—	182	25
Barium	1,000	—	1210	1,000
Beryllium	—	3	20.2	3
Cadmium	5	—	54.6	5
Calcium	—	—	470,000	—
Chromium	50	—	459	50
Cobalt	—	—	184	—
Copper	200	—	1010	200
Iron	300	—	253,000	300
Lead	25	—	370 J	25
Magnesium	—	35,000	334,000	35,000

Table 2-3 Cleanup Goal Screening Process for Groundwater—Rose Valley Landfill Site (µg/L)

Compound	NYSDEC Class GA Groundwater Standard	NYSDEC Class GA Groundwater Guidance	Maximum Concentration	Cleanup Goal
Manganese	300	—	17,800	300
Mercury	0.7	—	12 J	0.7
Nickel	100	—	544	100
Potassium	—	—	123,000	—
Selenium	10	—	272 J	10
Silver	50	—	4.1 J	—
Sodium	20,000	—	257,000	20,000
Thallium	—	0.5	—	—
Vanadium	—	—	594	—
Zinc	—	2,000	2,130	2,000
Cyanide	200	—	6.0 J	—

Source: NYSDEC, June 1998, Ambient Water Quality Standard and Guidance Values, Class GA Groundwater.

[a]Standard for each isomer.

Key:

D	=	Dilution result reported, original analysis exceeded calibration.
J	=	Estimated value.
µg/L	=	Micrograms per liter.
NYSDEC	=	New York State Department of Environmental Conservation.
PCB	=	Polychlorinated biphenyl.
Pest	=	Pesticide.
TCL	=	Target Compound List.
—	=	No standard/guidance value available/applicable.

2.3.2 Groundwater Plumes

Figures 2-2 and 2-3 indicate the locations where contaminants exceed Class GA groundwater standards. Based on the cleanup goal screening process, it was concluded that three separate areas of groundwater contamination exist on site: a plume located on the east side of Rose Valley Road, which has contaminated a drinking water supply well (designated the "House Plume"); a second area of contamination, containing the highest concentration of TCE found on site (designated the "HP-11 Plume"); and the "Wetland Plume," found in the wetlands on the far east side of the site.

The House Plume is characterized principally by two VOCs: 1,1-dichloroethane (DCA) and 1,1,1-trichloroethane (TCA) and are the only two VOCs exceeding cleanup goals. The plume appears to originate in the area of MW-08; however, contaminant sources have not been positively identified. The groundwater pattern flow appears to be to moving the plume northwestward, although the western boundary of the plume has not been delineated.

Table 2-4 Contaminants Detected in Groundwater Above Cleanup Goals— Rose Valley Landfill Site, (µg/L)

Contaminant	Cleanup Goal	Number of Exceedances	Concentration Range
TCL Volatiles			
1,1-Dichloroethane	5	10/38	6-14
1,2-Dichloroethene (total)	5	3/38	16-29
1,1,1-Trichloroethane	5	6/38	8-81
cis-1,2-Dichloroethane	5	1/38	19
Trichloroethene	5	1/38	460 D
Benzene	1	4/38	2-7
Chlorobenzene	5	3/38	19-43
Ethylbenzene	5	1/38	9
Xylene (total)	5	2/38	6-120
TCL Semivolatiles			
1, 4-Dichlorobenzene	3	1/20	5
Inorganics			
Antimony	3	3/24	5.1-65
Arsenic	25	3/24	35.3-182
Barium	1,000	1/24	1,210
Beryllium	3	2/24	8-20.2
Cadmium	5	4/24	5.3-54.6
Chromium	50	3/24	60.1-459
Copper	200	2/24	222-1,010
Iron	300	24/24	699-253,000
Lead	25	3/24	36.1-370
Magnesium	35,000	5/24	43,200-334,000
Manganese	300	21/24	327-17,800
Mercury	0.7	2/24	0.76-1.2
Nickel	100	2/24	128-544
Selenium	10	10/24	17.8-272
Sodium	20,000	7/24	40,000-257,000
Zinc	2000	1/24	2,130

Key:

D = Dilution result reported; original analysis exceeded calibration.
TCL = Target compound list.
µg/L = Micrograms per liter.

Cyanide and benzene, toluene, ethylbenzene, and xylenes (BTEX) were not detected in groundwater samples from this plume area. Due to elevated turbidity readings, hydropunch samples were not analyzed for inorganics. However, iron was detected above cleanup standards in all six samples collected from monitoring wells located in the House Plume area. Iron was also found above cleanup standards in MW-06, the background sample, indicating a regionally high iron concentration. Manganese was detected above cleanup standards in five of six House Plume monitoring well samples. Although not exceeding standards in MW-06, manganese is a typical background metal found in groundwater throughout New York State and is likely naturally occurring. Cadmium, chromium, lead, and selenium were detected above standards in only one (MW-11) of six monitoring well samples collected in the House Plume area.

It is important to note that these groundwater samples were unfiltered. In an unfiltered groundwater sample, turbidity prevents accurate quantification of the concentrations of analytes. The analytes sorb to suspended particles in the turbid sample and are measured and reported as the detected concentration. Therefore, in turbid groundwater samples, the analyte concentration reported may reflect the chemical concentration of the sediment or particulate matter present in the groundwater, which is not representative of actual groundwater quality. Thus, strict application of groundwater standards for metals to unfiltered samples may not be appropriate. As a rough guide to evaluating the degree to which adsorbed inorganics are impacting metals analysis, it is instructive to review the aluminum concentrations, since aluminum compounds are generally very insoluble, and usually represent suspended material. The only sample collected from the House Plume that had significant metals contamination (MW-11) also had a much higher aluminum concentration (37,200 mg/kg) than samples collected from other wells in this area, demonstrating that the metals detect in this well were likely due to suspended material and thus do not pose a concern.

Through evaluation of stratigraphy and groundwater elevations performed during the RI (E & E 2000), the HP-11 Plume was determined to be characterized by a perched water-bearing zone (contaminated by trichloroethene [TCE]) of limited extent, coupled with a true water column aquifer below it that exhibited significantly lower concentrations of solvent (primarily 1,2-dichloroethene [DCE] and DCA) in wells surrounding the presumed source at HP-11. Aromatic hydrocarbons, including BTEX, were not detected in any of the HP-11 plume groundwater samples. It is apparent that the high levels of TCE detected at HP-11 represent a limited perched area of contaminated groundwater that is not connected to the general overburden aquifer in this area, and thus does not pose a significant migration threat. HP-11 was not analyzed for inorganic parameters.

Selenium levels appear to be elevated in wells in the vicinity of the plateau above the sand bank. However, the concentrations in these wells are fairly uniform, suggesting that these levels are a localized, naturally occurring phenomenon. In addition, the concentrations detected (28.3 to 55.5 mg/L) are close to the Class GA standard of 10 mg/L and thus are not considered a concern.

The Wetlands groundwater Plume area contains several small areas of VOC contaminant concentration. MW-03, MW-04, and GP-21 contain DCE and DCA. SVOC analysis of groundwater samples indicated low levels of dichlorobenzene in one well located on the southwest side of the wetland area (MW-B4). Neither PCBs nor pesticides were detected in site groundwater. MW-03, MW-04, and GP-21 define the extent of wetland solvent plume.

Numerous metals were detected at concentrations exceeding New York State Class GA Groundwater Standards. Barium and zinc were detected in one Wetland Plume sample, GP-25, at concentrations only slightly above cleanup standards and are not considered to require remediation. Iron was detected above cleanup standards in all the samples analyzed, including the background sample, indicating a regionally high iron concentration. It also exceeded standards in samples collected from background well MW-06. Antimony, beryllium, cadmium, chromium, copper, lead, mercury, and nickel were each detected above cleanup standards in only two of eight Wetland Plume samples, GP-25 and GP-26. However, both samples also had very elevated aluminum levels, suggesting that these levels were due to turbidity in the samples. Although the concentration of manganese was below standards in the background sample, the detection of this common, naturally occurring metal above cleanup standards in all eight Wetland Plume area samples is not considered an indication of contamination.

Sodium and magnesium are relatively soluble metals, and their presence in five wells is likely not due to turbidity. These cations are found throughout samples collected from the Wetland Plume area. Although they exceed their screening criteria, these metals are relatively nontoxic, as reflected in their high Class GA standards. These standards are exceed by less than an order of magnitude, suggesting that they do not pose a threat to human health and the environment.

2.4 Surface Water/Leachate

Surface water/leachate samples were collected from 13 locations throughout the site by the E & E and Lu Engineering field team members on September 27 through 29, 1999. All surface water samples were analyzed for Target compound list (TCL) VOCs, TCL SVOCs, TCL pesticide/PCBs, hardness, Target Analyte List

(TAL) metals, and cyanide. The positive analytical results are summarized in Tables 5-11 and 5-12 of the Rose Valley Landfill RI report (E & E 2000).

VOCs were detected below standards in two of 11 samples. SVOC analysis indicated the presence of several phthalates, which are attributed to sampling and analysis procedures.

Pesticides and PCBs were not detected in any of the surface water samples.

Nine metals were detected in concentrations exceeding regulatory criteria. These elevated concentrations are possibly attributable to leachate from fill areas; however, since the samples were not filtered, they contained high levels of suspended solids, a condition that often results in elevated metals concentrations. For these reasons, metals contamination of surface water is not addressed in this FS. Cyanide was detected in 10 samples, two of which exceeded water quality criteria.

Five samples collected in the wetland area (RV-SW-3, SW-6, SW-8, SW-10, and SW-13) were also analyzed for leachate indicator parameters: ammonia, BOD_5, chemical oxygen demand (COD), chloride, nitrate nitrogen, sulfate, total alkalinity, total dissolved solids (TDS), total Kjeldahl nitrogen (TKN), total organic carbon (TOC), and total phenolics. These parameters are useful for determining which portions of the plume have been impacted by landfill leachate; however, they themselves do not describe areas of contamination that may be hazardous to human health and the environment (at least at the moderate levels observed in this study), and no screening criteria are set for these parameters.

2.4.1 Selection of Surface Water Cleanup Goals

Standards

The only standards identified for surface water at the Rose Valley Landfill site are the NYSDEC Class C surface water standards.

Criteria and Guidance Values

The only guidance values identified for the Rose Valley Landfill site are the NYSDEC Class C surface water guidance values.

Background

No background samples were collected. Sample location 1, which was to be the background sample, was dry during the sampling event.

Selection Process

The cleanup goal screening process for surface water is presented in Table 2-5. The following method was used to select the preliminary cleanup values presented in the table:

Table 2-5 Cleanup Goal Screening Process for Surface Water—Rose Valley Landfill Site (µg/L)

Compound	NYSDEC Class C Ambient Water Standards	NYSDEC Class C Ambient Water Guidance	Maximum Concentration	Cleanup Goal
TCL Volatiles				
1,1-Dichloroethane	—	—	4 J	—
1,1,1-Trichloroethane	—	—	3 J	—
cis-1,3-Dichloropropene	—	—	3 J	—
Toluene	—	100	7 J	—
TCL Semivolatiles				
Di-n-butylphthalate	—	—	1 J	—
bis(2-Ethylhexyl) phthalate	0.6	—	16 J	0.6
Di-n-octylphthalate	—	—	4 J	—
TCL Pest/PCB				
Pesticides/PCBs	—		ND	—
Total Hardness as $CaCO_3$				
Total Hardness	—		1,080	—
Inorganics				
Aluminum	100	—	26,500 J	100
Antimony	—	—	29.7 J	—
Arsenic	150	—	92.6	—
Barium	—	—	2,090	—
Beryllium	1,100	—	2.2 J	—
Cadmium	—	—	ND J	—
	11.3[a]	—	13.4 J	11.3
	8.39[a]	—	2.6 J	—
	9.55[a]	—	19.6 J	9.55
	6.4[a]	—	5.0 J	—
	—	—	ND J	—
	5.24[a]	—	1.5 J	—
	—	—	ND J	—
	5.46[a]	—	2.3 J	—
	8.14[a]	—	4.9 J	—
	13.42[a]	—	23.6	13.42
Calcium	—	—	510,000	—
Chromium	184.04[a]	—	3.7 J	—
	428.02[a]	—	16.2	—

Table 2-5 Cleanup Goal Screening Process for Surface Water—Rose Valley Landfill Site (µg/L)

Compound	NYSDEC Class C Ambient Water Standards	NYSDEC Class C Ambient Water Guidance	Maximum Concentration	Cleanup Goal
	179[a]	—	12.5	—
	—	—	ND	—
	313[a]	—	14.7	—
	364[a]	—	40.2	—
	236.5[a]	—	3.7 J	—
	157[a]	—	1.3 J	—
	193[a]	—	ND	—
	181[a]	—	1.9 J	—
	202[a]	—	0.98 J	—
	307.7[a]	—	7.1 J	—
	517.14[a]	—	7.2 J	—
Cobalt	5	—	2.3 J	—
Copper	—	—	ND J	—
	52[a]	—	11.7 J	—
	24.26[a]	—	8.9 J	—
	46.95[a]	—	68.1	46.95
	—	—	ND	—
	—	—	ND	—
	68.38[a]	—	22.2	—
Iron	300	—	712,000 J	300
Lead	—	—	ND J	—
	12.5[a]	—	3.1 J	—
	35.38[a]	—	60.3 J	35.38
	24.26[a]	—	33.6 J	24.26
	28.9[a]	—	177 J	28.9
	17.12[a]	—	9.8 J	—
	—	—	ND J	—
	13.1[a]	—	3.5 J	—
	—	—	ND J	—
	23.33[a]	—	14.4 J	—
	43.76[a]	—	85.1 J	43.76
Magnesium	—	—	35,900	—
Manganese	—	—	60,000 J	—
Nickel	—	—	ND	—
	128[a]	—	8.4 J	—
	232[a]	—	15.3 J	—
	268[a]	—	5.5 J	—
	—	—	ND	—
	—	—	ND	—
	225[a]	—	7.0 J	—

Table 2-5 Cleanup Goal Screening Process for Surface Water—Rose Valley Landfill Site (µg/L)

Compound	NYSDEC Class C Ambient Water Standards	NYSDEC Class C Ambient Water Guidance	Maximum Concentration	Cleanup Goal
Potassium	—	—	123,000	—
Selenium	4.6	—	284 J	4.6
Silver	0.1[b]	—	14.1	14.1
Sodium	—	—	153,000	—
Thallium	8	—	51	8
Vanadium	14[c]	—	94.3	14
Zinc	212[a]	—	19.3 J	—
	514[a]	—	79.0 J	—
	207[a]	—	26.3 J	—
	259[a]	—	9.2 J	—
	371[a]	—	105 J	—
	428[a]	—	463 J	428
	275[a]	—	30.2 J	—
	181[a]	—	7.6 J	—
	221[a]	—	18.1 J	—
	—	—	192 J	—
Cyanide	5.2	—	28.0	5.2

NYSDEC, June 1998, Ambient Water Quality Standards and Guidance Values, Class C Fresh Surface Water (protection for fish propagation).

[a] Standard is calculated using sample hardness; therefore, it is sample-specific. The standard was calculated for detected compounds only.

[b] Standard applies to the ionic form.

[c] Standard applies to the acid-soluble form.

Key:

— =	Standard/guidance not applicable/not available/not calculated.
$CaCO_3$ =	Calcium carbonate.
J =	Reported value was from a reading less than Contract-Required Detection Limit but greater than or equal to the Instrument Detection Limit (same as B qualifier on Form 1 of the laboratory data pack for metals analyses). Therefore, the reported value is estimated.
NYSDEC =	New York State Department of Environmental Conservation.
PCB =	Polychlorinated biphenyl.
Pest =	Pesticide.
TCL =	Target compound list
VOC =	Volatile organic compound.
µg/L =	Micrograms per liter.
C =	Standard/guidance not applicable or not available/not calculated.

- As the sole available standards, the NYSDEC Class C surface water standards were selected as the preliminary cleanup values, if available;
- If a surface water standard did not exist for a constituent, the NYSDEC Class C guidance value was used;

- These values were compared to the maximum observed concentrations for each compound to determine which compounds may require cleanup; and
- Finally, the contaminants identified for cleanup were reviewed to determine whether they are site related and whether cleanup actually is warranted.

Based on this process, it was concluded that one SVOC (bis[2-ethylhexyl]phthalate) and 10 metals (aluminum, cadmium, copper, iron, lead, selenium, silver, thallium, vanadium, and zinc) were present above cleanup goals (see Table 2-6). Not all samples were analyzed for all analytes, as reflected in the denominator of "Number of Exceedances." Iron was detected in all surface water samples above cleanup standards; however, background groundwater sample analysis indicated that the region has naturally high iron levels. Copper, thallium, and zinc were each detected above cleanup standards in only one sample. Cadmium was detected in two samples at concentrations slightly above surface water standards. Lead and vanadium were found to exceed cleanup goals in three samples, silver exceedances were detected in four samples, and selenium was detected above cleanup standards in five samples. Figure 2-4 indicates the locations of contaminant exceedances in surface water.

With respect to the observed surface water contamination, the source of this contamination is probably the discharge of contaminated groundwater from the landfill. Therefore, surface water will not be directly addressed in this FS as a contaminated medium of concern; rather, surface water is addressed through the development of remedial alternatives for groundwater.

2.5 Sediments

Thirteen sediment samples (SD-1, SD-2, SD-3, SD-4, SD-5, SD-6, SD-7, SD-8, SD-9, SD-10, SD-11, SD-13, and SD-14) and two duplicate sediment samples (SD-9/D and SD-10/D) were collected at the Rose Valley Landfill site between September 27 and 29, 1999.

All sediment samples and their duplicates have been analyzed for VOCs, SVOCs, pesticides, PCBs, metals, cyanide, and TOC. Analytical results for sediments are shown in Table 5-14 of the RI report for the Rose Valley Landfill site (E & E 2000).

2.5.1 Selection of Sediment Cleanup Goals

Standards

There are no promulgated standards for sediments.

Table 2-6 Contaminants Detected in Surface Water Above Cleanup Goals—Rose Valley Landfill Site (µg/L)

Compound	NYSDEC Class C Ambient Water Standards[a]	Number of Exceedances	Concentration Range
TCL Semivolatiles			
bis(2-Ethylhexyl) phthalate	0.6	3/11	3 - 16
Inorganics			
Aluminum	100	9/11	583 - 26,500
Cadmium	11.3[b]	1/11	13.4
	9.55[b]	1/11	19.6
	13.42[b]	1/11	23.6
Copper	46.95[b]	1/11	68.1
Iron	300	11/11	393 - 712,000
Lead	35.38[b]	1/11	60.3
	24.26[b]	1/11	33.6
	28.9[b]	1/11	177
	43.76[b]	1/11	85.1
Selenium	4.6	8/11	12.3 - 284
Silver	0.1 [c]	6/11	1 - 14.1
Thallium	8	2/11	46.4 - 51
Vanadium	14 [d]	4/11	25.7 - 94.3
Zinc	428[b]	1/11	463
Cyanide	5.2	4/11	6 -28

[a] NYSDEC, June 1998, Ambient Water Quality Standards and Guidance Values, Class C Fresh Surface Water (protection for fish propagation).

[b] Standard is calculated using sample hardness; therefore, it is sample-specific. The standard was calculated for detected compounds only

[c] Standard applies to the ionic form.

[d] Standard applies to the acid-soluble form.

Key:

NYSDEC	=	New York State Department of Environmental Conservation.
TCL	=	Target Compound List
µg/L	=	Micrograms per liter.

Criteria and Guidance Values

The main criteria and guidance values identified for sediments are presented in the NYSDEC *Technical Guidance for Screening Contaminated Sediments*, January 1999; the EPA OSWER, *ECO Update* Ecotox thresholds, January 1996; the effects range-low (ER-L) values from Long and Morgan (1991) used by the National

Oceanic and Atmospheric Administration; and the Ontario Ministry of Environment Proposed Sediment Quality Criteria, lowest effect level (LEL), 1993.

Selection Process

The cleanup goal screening process for sediment is presented in Table 2-7. The following method was used to select the preliminary cleanup values presented in this table:

- The lowest of the Ecotox threshold, the Long and Morgan ER-L, the NYSDEC sediment screening level (for organics) or LEL (for metals), or the Ontario Ministry of Environment LEL, when available, was selected as the preliminary cleanup value;
- The preliminary cleanup values were then compared to the maximum observed concentrations for each compound to determine which compounds may require cleanup; and
- Finally, the contaminants identified for cleanup were reviewed to determine whether they are site related and whether cleanup actually is warranted.

Figure 2-5 identifies these contaminants and their associated concentrations above cleanup goals. A diverse set of contaminants exceeded the identified criteria. Furthermore, there is no clear distribution pattern among the samples regarding cleanup goal exceedances.

Based on the above process, it was found that in the sediment samples 14 PAHs and 10 metals (antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver, and zinc) were present above cleanup goals (see Table 2-8).

All the organic compounds exceeding their cleanup goals (14 PAHs) were detected in a single sediment sample, SD-11. This sample is in a seasonally dry location, southwest of the swamp, and is distinct and separate from the main wetland downgradient of the landfill. Duplicate sample SD-9/D was the only other sediment sample in which an organic compound (benzo(a)pyrene) exceeded its cleanup goal.

The metal exceedences vary from only one for lead (SD-07), with a concentration close to its cleanup goal, to 14 exceedances out of 15 samples for cadmium.

Table 2-7 Cleanup Goal Screening Process For Sediments—Rose Valley Landfill Site (mg/kg)

	TBCs									
	Federal Guidance		State Guidance[a]							
			Benthic Aquatic Life							
Contaminants	Ecotox Threshold[b]	Long & Morgan (ER-L)[c]	Acute	Chronic	Wildlife Bioaccumulation	Human Health Bioaccumulation	Ontario Ministry of Environment (LEL)[d]	Preliminary Screening Value	Maximum Concentration	Cleanup Goal
TCL Volatiles										
Acetone	—	—	—	—	—	—	—	—	0.081	—
2-Butanone	—	—	—	—	—	—	—	—	0.018	—
Chloroethane	—	—	—	—	—	—	—	—	0.004	—
Chloromethane	—	—	—	—	—	—	—	—	0.012	—
1,1 Dichloroethane	—	—	—	—	—	—	—	—	0.004	—
1,2 Dichloroethane (total)	—	—	—	—	—	0.0063	—	0.0063	0.002	—
Toluene	0.67	—	2.1173	0.4415	—	—	—	0.4415	0.006	—
1,1,1 Trichloroethane	0.17	—	—	—	—	0.0054	—	0.0054	0.003	—
TCL Semivolatiles										
Bis(2-ethylhexyl)phthalate	—	—	—	1.797	—	—	---	1.797	0.95	—
Dibenzofuran	2	—	—	—	—	—	—	2	0.072	—
Diethylphthalate	0.63	—	—	—	—	—	—	0.63	0.19	—
Di-n-butylphthalate	11	—	—	—	—	—	—	11	0.44	—
Polycyclic Aromatic Hydrocarbons										
Acenaphthene	0.016	0.16	—	1.261	—	—	—	0.016	0.051	0.016
Acenaphthylene	—	—	—	—	—	—	—	—	0.32	—
Anthracene	—	0.085	8.884	0.964	—	—	0.22	0.085	0.39	0.085
Benzo(a)anthracene	—	0.23	0.847	0.108	—	0.0117	0.32	0.0117	1.3	0.0117
Benzo(a)pyrene	0.43	0.4	—	—	—	0.0117	0.37	0.0117	1.3	0.0117
Benzo(b)fluoranthene	—	—	—	—	—	0.0117	—	0.0117	1.5	0.0117
Benzo(g,h,i)perylene	—	—	—	—	—	—	0.17	0.17	0.3	0.17
Benzo(k)fluoranthene	—	—	—	—	—	0.0117	0.24	0.0117	1.4	0.0117
Carbazole	—	—	—	—	—	—	—	—	0.24	—
Chrysene	—	0.4	—	—	—	0.0117	0.34	0.0117	1.8	0.0017
Dibenzo(a,h)anthracene	—	0.06	—	—	—	—	0.06	0.06	0.21	0.06
Fluoranthene	0.6	0.6	—	9.190	—	—	0.75	0.6	4.2	0.6
Fluorene	0.54	0.035	0.658	0.072	—	—	0.19	0.035	0.24	0.035
Indeno(1,2,3-cd)pyrene	—	—	—	—	—	0.0117	0.2	0.0117	0.58	0.0117
Phenanthrene	0.24	0.225	—	1.081	—	—	0.56	0.225	2.6	0.225
Pyrene	0.66	0.35	79.063	8.658	—	—	0.49	0.35	3.2	0.35
Total Solids %										
Total Solids	—	—	—	—	—	—	—	—	84.7	—
Metals										
Aluminum	—	—	—	—	—	—	—	—	13,500	

Table 2-7 Cleanup Goal Screening Process For Sediments—Rose Valley Landfill Site (mg/kg)

	TBCs									
	Federal Guidance		State Guidance[a]							
			Benthic Aquatic Life							
Contaminants	Ecotox Threshold[b]	Long & Morgan (ER-L)[c]	Acute	Chronic	Wildlife Bioaccumulation	Human Health Bioaccumulation	Ontario Ministry of Environment (LEL)[d]	Preliminary Screening Value	Maximum Concentration	Cleanup Goal
Antimony	—	2	—	—	—	—	—	2	11.9	2
Arsenic	8.2	33	—	—	—	—	6	6	23.6	6
Barium	—	—	—	—	—	—	—	—	343	—
Beryllium	—	—	—	—	—	—	—	—	1.4	—
Cadmium	1.2	5	—	—	—	—	0.6	0.6	6	0.6
Calcium	—	—	—	—	—	—	—	—	215,000	—
Chromium	81	80	—	—	—	—	26	26	14	—
Cobalt	—	—	—	—	—	—	—	—	5.4	—
Copper	34	70	—	—	—	—	16	16	29.5	16
Iron	—	—	—	—	—	—	20,000	20,000	219,000	20,000
Lead	47	35	—	—	—	—	31	31	45.3	31
Magnesium	—	—	—	—	—	—	—	—	3,050	—
Manganese	—	—	—	—	—	—	460	460	9,610	460
Mercury	0.15	0.15	—	—	—	—	0.2	0.15	0.28	0.15
Nickel	21	30	—	—	—	—	16	16	10.6	—
Potassium	—	—	—	—	—	—	—	—	1,990	—
Selenium	—	—	—	—	—	—	—	—	98.2	—
Silver	—	1	—	—	—	—	—	1	2.8	1
Thallium	—	—	—	—	—	—	—	—	9.6	—
Vanadium	—	—	—	—	—	—	—	—	33.4	—
Zinc	150	120	—	—	—	—	120	120	211	120
Cyanide	—	—	—	—	—	—	—	—	2.1	—

[a] NYSDEC Technical Guidance for Screening Contaminated Sediments, January 1999, using the most stringent criteria (lowest TOC value).

[b] USEPA Office of Solid Waste and Emergency Response, January 1996, *ECO Update Ecotox Thresholds*

[c] Long and Morgan, Effects Range - Low (ER-L), 1991

[d] Ontario Ministry of Environment Proposed Sediment Quality Criteria, Lowest Effect Level (LEL), 1993 (Persaud and Jaagumagi).

Key:

— = No screening value available/applicable.
% = Percent.
mg/kg = Milligrams per kilogram.
NYSDEC = New York State Department of Environmental Conservation.
TOC = Total Organic Carbon.
USEPA = United States Environmental Protection Agency.

Table 2-8 Contaminants Detected in Sediment Above Cleanup Goals (mg/kg)

Contaminant	Cleanup Goal	Number of Exceedances	Concentration Range
Polycyclic Aromatic Hydrocarbons			
Acenaphthene	0.016	1/13	0.051
Anthracene	0.085	1/13	0.39
Benzo(a)anthracene	0.0117	1/13	1.3
Benzo(a)pyrene	0.0117	2/13	0.07 - 1.3
Benzo(b)fluoranthene	0.0117	1/13	1.5
Benzo(g,h,i)perylene	0.17	1/13	0.3
Benzo(k)fluoranthene	0.0117	1/13	1.4
Chrysene	0.0117	1/13	1.8
Dibenz(a,h)anthracene	0.06	1/13	0.21
Fluoranthene	0.6	1/13	4.2
Fluorene	0.035	1/13	0.24
Indeno(1,2,3-cd)pyrene	0.0117	1/13	0.58
Phenanthrene	0.225	1/13	2.6
Pyrene	0.35	1/13	3.2
Metals			
Antimony	2	3/13	4.8 - 11.9
Arsenic	6	7/13	6.3 - 23.6
Cadmium	0.6	11/13	0.74 - 6.0
Copper	16	3/13	16.3 - 29.5
Iron	20,000	9/13	22,200 - 219,000
Lead	31	1/13	45.3
Manganese	460	11/13	634 - 9,610
Mercury	0.15	2/13	0.18 - 0.28
Silver	1	5/13	1.1 - 2.8
Zinc	120	1/13	211

Key:

mg/kg = Milligrams per kilogram.

Antimony concentrations in three locations (SD-05, SD-10 and its duplicate SD-10/D, and SD-14) range from 4.8 to 11.9 mg/kg; the cleanup goal is 2 mg/kg. Arsenic exceedances, ranging from 6.3 mg/kg to 23.6 mg/kg, were found at seven locations (SD-03, SD-04, SD-05, SD-07, SD-08, SD-10 and its duplicate SD-10/D, and SD-14). Except for SD-06, cadmium exceeded its cleanup goal at all the sampling locations. Two metals, iron (SD-03, SD-04, SD-05, SD-07, SD-08, SD-09, SD-10 and its duplicate SD-10/D, SD-13, and SD-14) and manganese (SD-01, SD-03, SD-04, SD-05, SD-06, SD-07, SD-08, SD-09, SD-10 and its duplicate SD-10/D, SD-13, and SD-14) exceeded their cleanup goals at more than 10 locations and in a very wide range of concentrations (22,200 to 219,000 mg/kg for iron, and 634 to 9,610 mg/kg for manganese).

For copper, two out of three exceedances (SD-01, SD-08, and SD-09) were very close to the cleanup goal, 16 mg/kg. For silver, three out of six exceedances (SD-05, SD-07, SD-08, SD-10 and its duplicate SD-10/D, and SD-14), were very close to the cleanup goal, 1 mg/kg, and the remaining exceedances ranged from 2.2 to 2.8 mg/kg. The mercury exceedances occurred at only two sampling locations (SD-01 and SD-03) at concentrations of 0.18 and 0.28 mg/kg, compared to 0.15 mg/kg. The lead (SD-07) and zinc (SD-08) exceedances were each detected in only one sample.

Although some of the metals exceeded their screening criteria on only slightly criterion, these levels prompt the need to evaluate potential impacts on environmental receptors at this site. The criteria are presented for generic exposure scenarios, including scenarios that may not necessarily reflect the conditions in the streams and wetlands at the Rose Valley site. Therefore, a site-specific ecological risk assessment is proposed to determine whether these exceedances warrant a remedial effort. Until such a determination has been made, no remedial approaches will be considered for site sediments.

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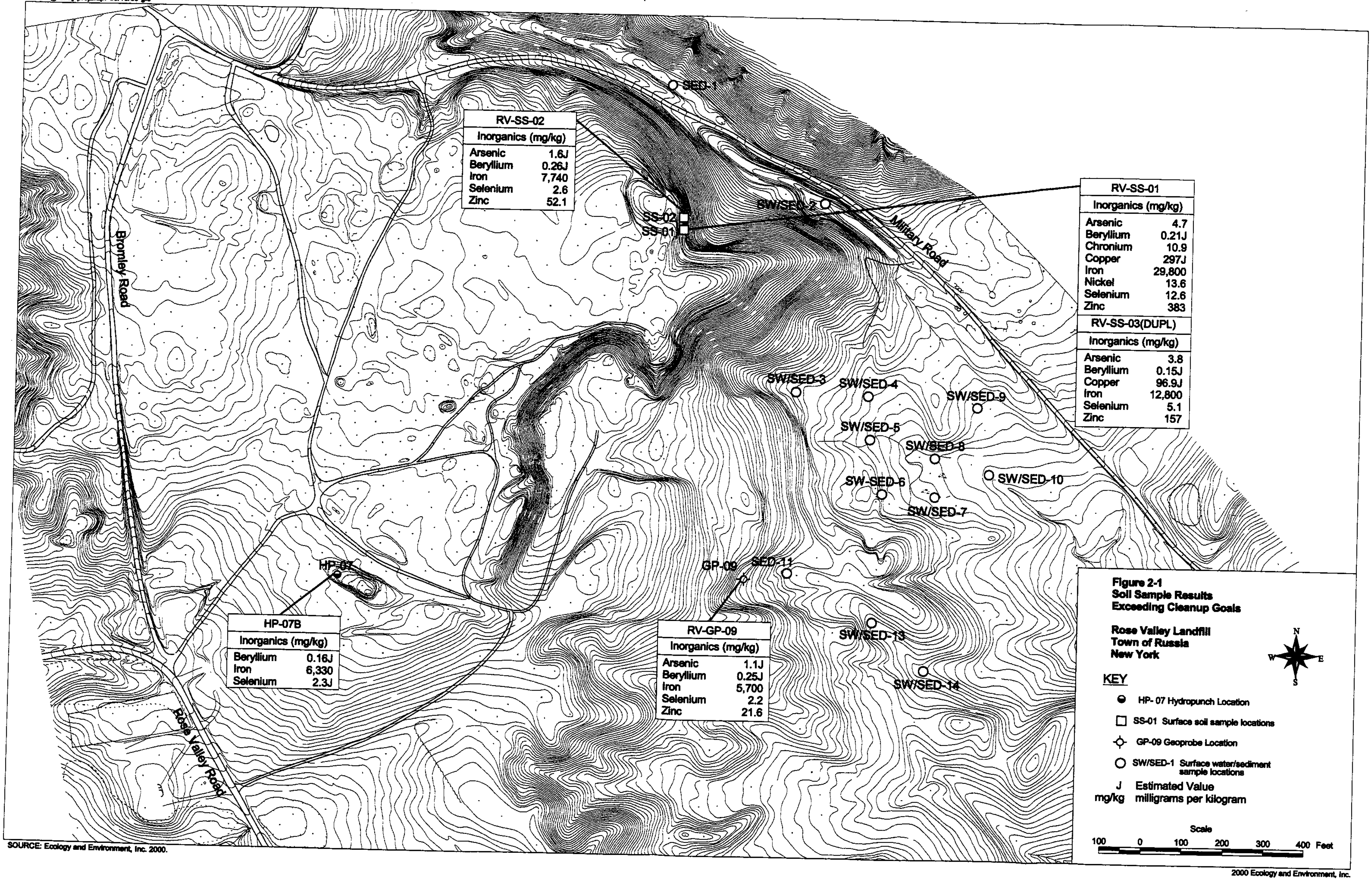

RV-SS-02	
Inorganics (mg/kg)	
Arsenic	1.6J
Beryllium	0.26J
Iron	7,740
Selenium	2.6
Zinc	52.1

RV-SS-01	
Inorganics (mg/kg)	
Arsenic	4.7
Beryllium	0.21J
Chronium	10.9
Copper	297J
Iron	29,800
Nickel	13.6
Selenium	12.6
Zinc	383
RV-SS-03(DUPL)	
Inorganics (mg/kg)	
Arsenic	3.8
Beryllium	0.15J
Copper	96.9J
Iron	12,800
Selenium	5.1
Zinc	157

HP-07B	
Inorganics (mg/kg)	
Beryllium	0.16J
Iron	6,330
Selenium	2.3J

RV-GP-09	
Inorganics (mg/kg)	
Arsenic	1.1J
Beryllium	0.25J
Iron	5,700
Selenium	2.2
Zinc	21.6

Figure 2-1
Soil Sample Results
Exceeding Cleanup Goals

Rose Valley Landfill
Town of Russia
New York

KEY

- ● HP- 07 Hydropunch Location
- ☐ SS-01 Surface soil sample locations
- ⌖ GP-09 Geoprobe Location
- ○ SW/SED-1 Surface water/sediment sample locations

J Estimated Value
mg/kg milligrams per kilogram

SOURCE: Ecology and Environment, Inc. 2000.

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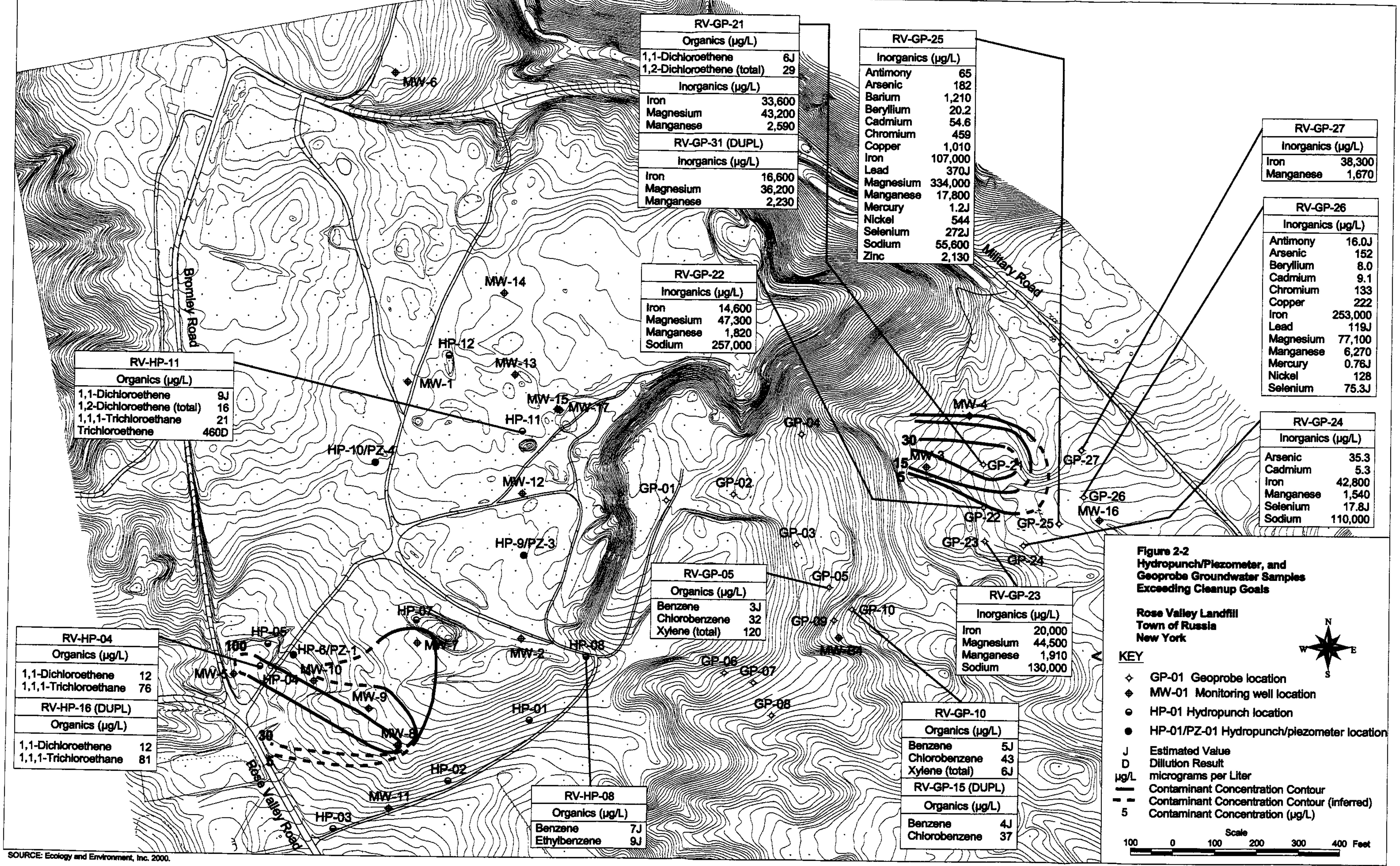

Figure 2-2
Hydropunch/Piezometer, and Geoprobe Groundwater Samples Exceeding Cleanup Goals

Rose Valley Landfill
Town of Russia
New York

KEY

◇	GP-01 Geoprobe location
◈	MW-01 Monitoring well location
⊖	HP-01 Hydropunch location
●	HP-01/PZ-01 Hydropunch/piezometer location
J	Estimated Value
D	Dilution Result
µg/L	micrograms per Liter
—	Contaminant Concentration Contour
- -	Contaminant Concentration Contour (inferred)
5	Contaminant Concentration (µg/L)

Scale
100 0 100 200 300 400 Feet

RV-GP-21	
Organics (µg/L)	
1,1-Dichloroethene	6J
1,2-Dichloroethene (total)	29
Inorganics (µg/L)	
Iron	33,600
Magnesium	43,200
Manganese	2,590
RV-GP-31 (DUPL)	
Inorganics (µg/L)	
Iron	16,600
Magnesium	36,200
Manganese	2,230

RV-GP-25	
Inorganics (µg/L)	
Antimony	65
Arsenic	182
Barium	1,210
Beryllium	20.2
Cadmium	54.6
Chromium	459
Copper	1,010
Iron	107,000
Lead	370J
Magnesium	334,000
Manganese	17,800
Mercury	1.2J
Nickel	544
Selenium	272J
Sodium	55,600
Zinc	2,130

RV-GP-27	
Inorganics (µg/L)	
Iron	38,300
Manganese	1,670

RV-GP-26	
Inorganics (µg/L)	
Antimony	16.0J
Arsenic	152
Beryllium	8.0
Cadmium	9.1
Chromium	133
Copper	222
Iron	253,000
Lead	119J
Magnesium	77,100
Manganese	6,270
Mercury	0.76J
Nickel	128
Selenium	75.3J

RV-GP-24	
Inorganics (µg/L)	
Arsenic	35.3
Cadmium	5.3
Iron	42,800
Manganese	1,540
Selenium	17.8J
Sodium	110,000

RV-GP-22	
Inorganics (µg/L)	
Iron	14,600
Magnesium	47,300
Manganese	1,820
Sodium	257,000

RV-HP-11	
Organics (µg/L)	
1,1-Dichloroethene	9J
1,2-Dichloroethene (total)	16
1,1,1-Trichloroethane	21
Trichloroethene	460D

RV-GP-05	
Organics (µg/L)	
Benzene	3J
Chlorobenzene	32
Xylene (total)	120

RV-GP-23	
Inorganics (µg/L)	
Iron	20,000
Magnesium	44,500
Manganese	1,910
Sodium	130,000

RV-HP-04	
Organics (µg/L)	
1,1-Dichloroethene	12
1,1,1-Trichloroethane	76
RV-HP-16 (DUPL)	
Organics (µg/L)	
1,1-Dichloroethene	12
1,1,1-Trichloroethane	81

RV-HP-08	
Organics (µg/L)	
Benzene	7J
Ethylbenzene	9J

RV-GP-10	
Organics (µg/L)	
Benzene	5J
Chlorobenzene	43
Xylene (total)	6J
RV-GP-15 (DUPL)	
Organics (µg/L)	
Benzene	4J
Chlorobenzene	37

SOURCE: Ecology and Environment, Inc. 2000.

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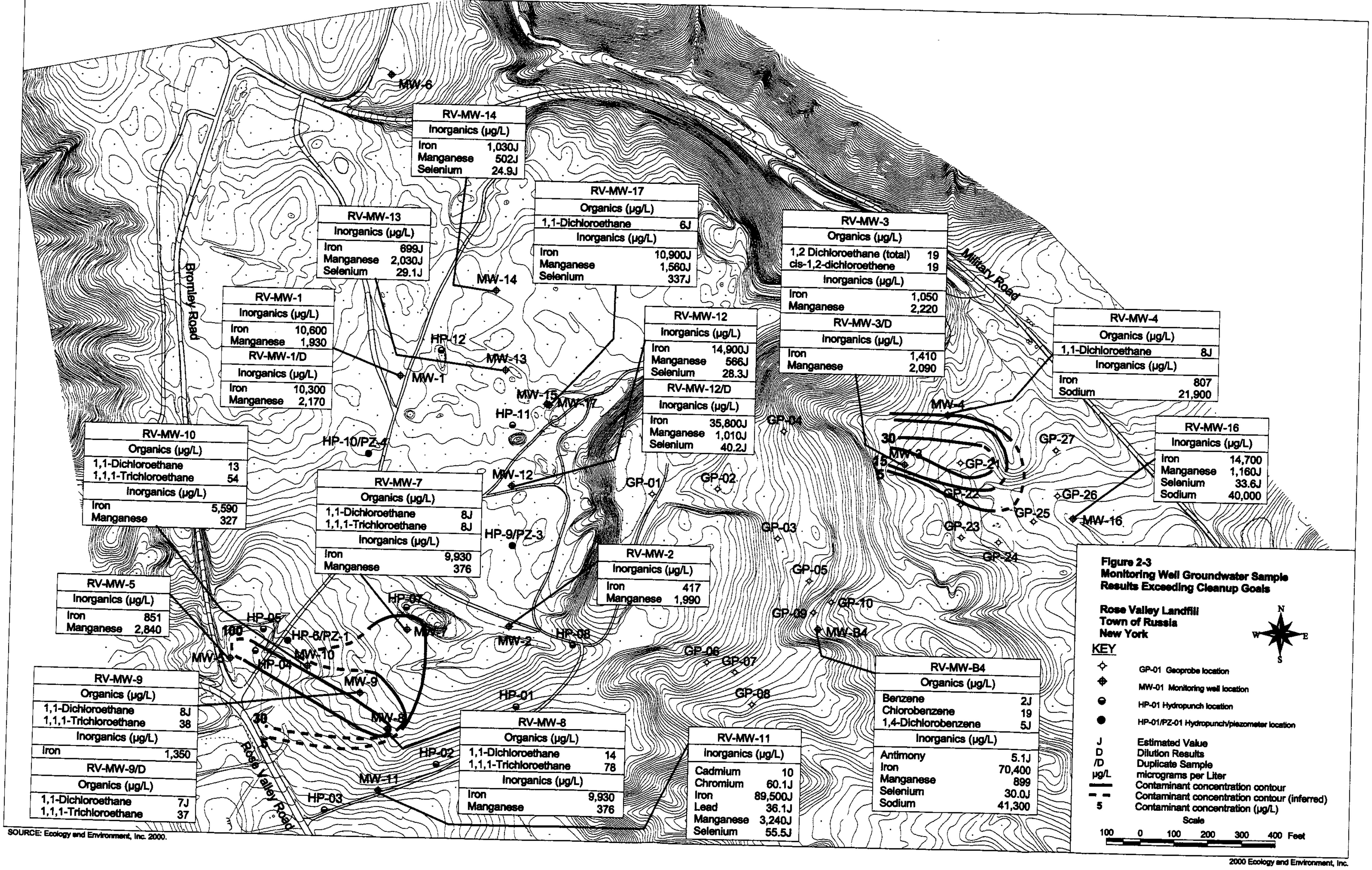

RV-MW-14	
Inorganics (µg/L)	
Iron	1,030J
Manganese	502J
Selenium	24.9J

RV-MW-13	
Inorganics (µg/L)	
Iron	699J
Manganese	2,030J
Selenium	29.1J

RV-MW-17	
Organics (µg/L)	
1,1-Dichloroethane	6J
Inorganics (µg/L)	
Iron	10,900J
Manganese	1,560J
Selenium	337J

RV-MW-3	
Organics (µg/L)	
1,2 Dichloroethane (total)	19
cis-1,2-dichloroethene	19
Inorganics (µg/L)	
Iron	1,050
Manganese	2,220
RV-MW-3/D	
Inorganics (µg/L)	
Iron	1,410
Manganese	2,090

RV-MW-4	
Organics (µg/L)	
1,1-Dichloroethane	8J
Inorganics (µg/L)	
Iron	807
Sodium	21,900

RV-MW-1	
Inorganics (µg/L)	
Iron	10,600
Manganese	1,930
RV-MW-1/D	
Inorganics (µg/L)	
Iron	10,300
Manganese	2,170

RV-MW-12	
Inorganics (µg/L)	
Iron	14,900J
Manganese	566J
Selenium	28.3J
RV-MW-12/D	
Inorganics (µg/L)	
Iron	35,800J
Manganese	1,010J
Selenium	40.2J

RV-MW-16	
Inorganics (µg/L)	
Iron	14,700
Manganese	1,160J
Selenium	33.6J
Sodium	40,000

RV-MW-10	
Organics (µg/L)	
1,1-Dichloroethane	13
1,1,1-Trichloroethane	54
Inorganics (µg/L)	
Iron	5,590
Manganese	327

RV-MW-7	
Organics (µg/L)	
1,1-Dichloroethane	8J
1,1,1-Trichloroethane	8J
Inorganics (µg/L)	
Iron	9,930
Manganese	376

RV-MW-2	
Inorganics (µg/L)	
Iron	417
Manganese	1,990

RV-MW-5	
Inorganics (µg/L)	
Iron	851
Manganese	2,840

RV-MW-9	
Organics (µg/L)	
1,1-Dichloroethane	8J
1,1,1-Trichloroethane	38
Inorganics (µg/L)	
Iron	1,350
RV-MW-9/D	
Organics (µg/L)	
1,1-Dichloroethane	7J
1,1,1-Trichloroethane	37

RV-MW-8	
Organics (µg/L)	
1,1-Dichloroethane	14
1,1,1-Trichloroethane	78
Inorganics (µg/L)	
Iron	9,930
Manganese	376

RV-MW-11	
Inorganics (µg/L)	
Cadmium	10
Chromium	60.1J
Iron	89,500J
Lead	36.1J
Manganese	3,240J
Selenium	55.5J

RV-MW-B4	
Organics (µg/L)	
Benzene	2J
Chlorobenzene	19
1,4-Dichlorobenzene	5J
Inorganics (µg/L)	
Antimony	5.1J
Iron	70,400
Manganese	899
Selenium	30.0J
Sodium	41,300

Figure 2-3
Monitoring Well Groundwater Sample Results Exceeding Cleanup Goals

Rose Valley Landfill
Town of Russia
New York

KEY

✧	GP-01 Geoprobe location
⊕	MW-01 Monitoring well location
◒	HP-01 Hydropunch location
●	HP-01/PZ-01 Hydropunch/piezometer location
J	Estimated Value
D	Dilution Results
/D	Duplicate Sample
µg/L	micrograms per Liter
━	Contaminant concentration contour
╍	Contaminant concentration contour (inferred)
5	Contaminant concentration (µg/L)

Scale
100 0 100 200 300 400 Feet

SOURCE: Ecology and Environment, Inc. 2000.

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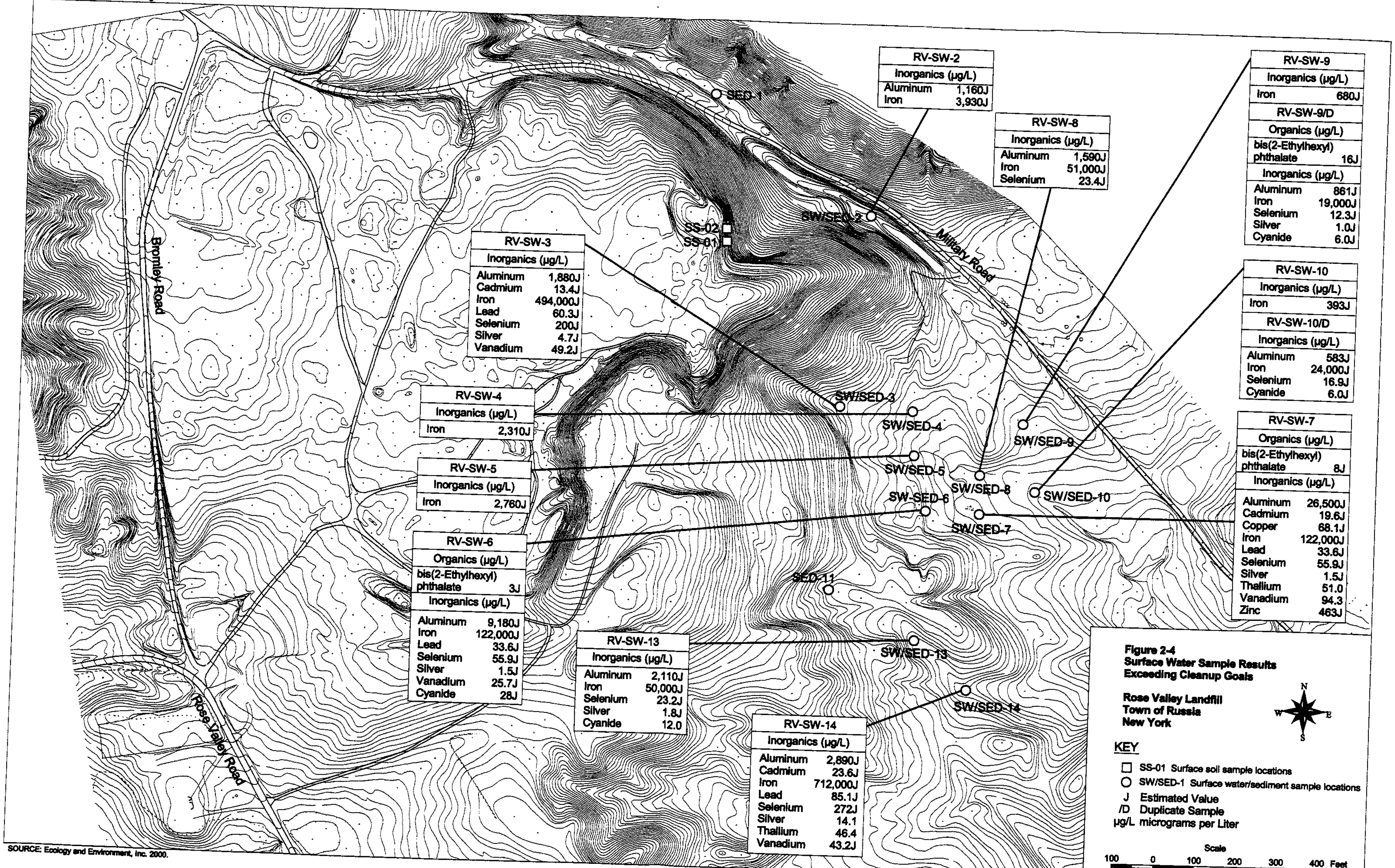

RV-SW-2	
Inorganics (µg/L)	
Aluminum	1,160J
Iron	3,930J

RV-SW-8	
Inorganics (µg/L)	
Aluminum	1,590J
Iron	51,000J
Selenium	23.4J

RV-SW-9	
Inorganics (µg/L)	
Iron	680J
RV-SW-9/D	
Organics (µg/L)	
bis(2-Ethylhexyl) phthalate	16J
Inorganics (µg/L)	
Aluminum	861J
Iron	19,000J
Selenium	12.3J
Silver	1.0J
Cyanide	6.0J

RV-SW-3	
Inorganics (µg/L)	
Aluminum	1,880J
Cadmium	13.4J
Iron	494,000J
Lead	60.3J
Selenium	200J
Silver	4.7J
Vanadium	49.2J

RV-SW-10	
Inorganics (µg/L)	
Iron	393J
RV-SW-10/D	
Inorganics (µg/L)	
Aluminum	583J
Iron	24,000J
Selenium	16.9J
Cyanide	6.0J

RV-SW-4	
Inorganics (µg/L)	
Iron	2,310J

RV-SW-7	
Organics (µg/L)	
bis(2-Ethylhexyl) phthalate	8J
Inorganics (µg/L)	
Aluminum	26,500J
Cadmium	19.6J
Copper	68.1J
Iron	122,000J
Lead	33.6J
Selenium	55.9J
Silver	1.5J
Thallium	51.0
Vanadium	94.3
Zinc	463J

RV-SW-5	
Inorganics (µg/L)	
Iron	2,760J

RV-SW-6	
Organics (µg/L)	
bis(2-Ethylhexyl) phthalate	3J
Inorganics (µg/L)	
Aluminum	9,180J
Iron	122,000J
Lead	33.6J
Selenium	55.9J
Silver	1.5J
Vanadium	25.7J
Cyanide	28J

RV-SW-13	
Inorganics (µg/L)	
Aluminum	2,110J
Iron	50,000J
Selenium	23.2J
Silver	1.8J
Cyanide	12.0

RV-SW-14	
Inorganics (µg/L)	
Aluminum	2,890J
Cadmium	23.6J
Iron	712,000J
Lead	85.1J
Selenium	272J
Silver	14.1
Thallium	46.4
Vanadium	43.2J

Figure 2-4
Surface Water Sample Results
Exceeding Cleanup Goals

Rose Valley Landfill
Town of Russia
New York

KEY

☐	SS-01 Surface soil sample locations
○	SW/SED-1 Surface water/sediment sample locations
J	Estimated Value
/D	Duplicate Sample
µg/L	micrograms per Liter

SOURCE: Ecology and Environment, Inc. 2000.

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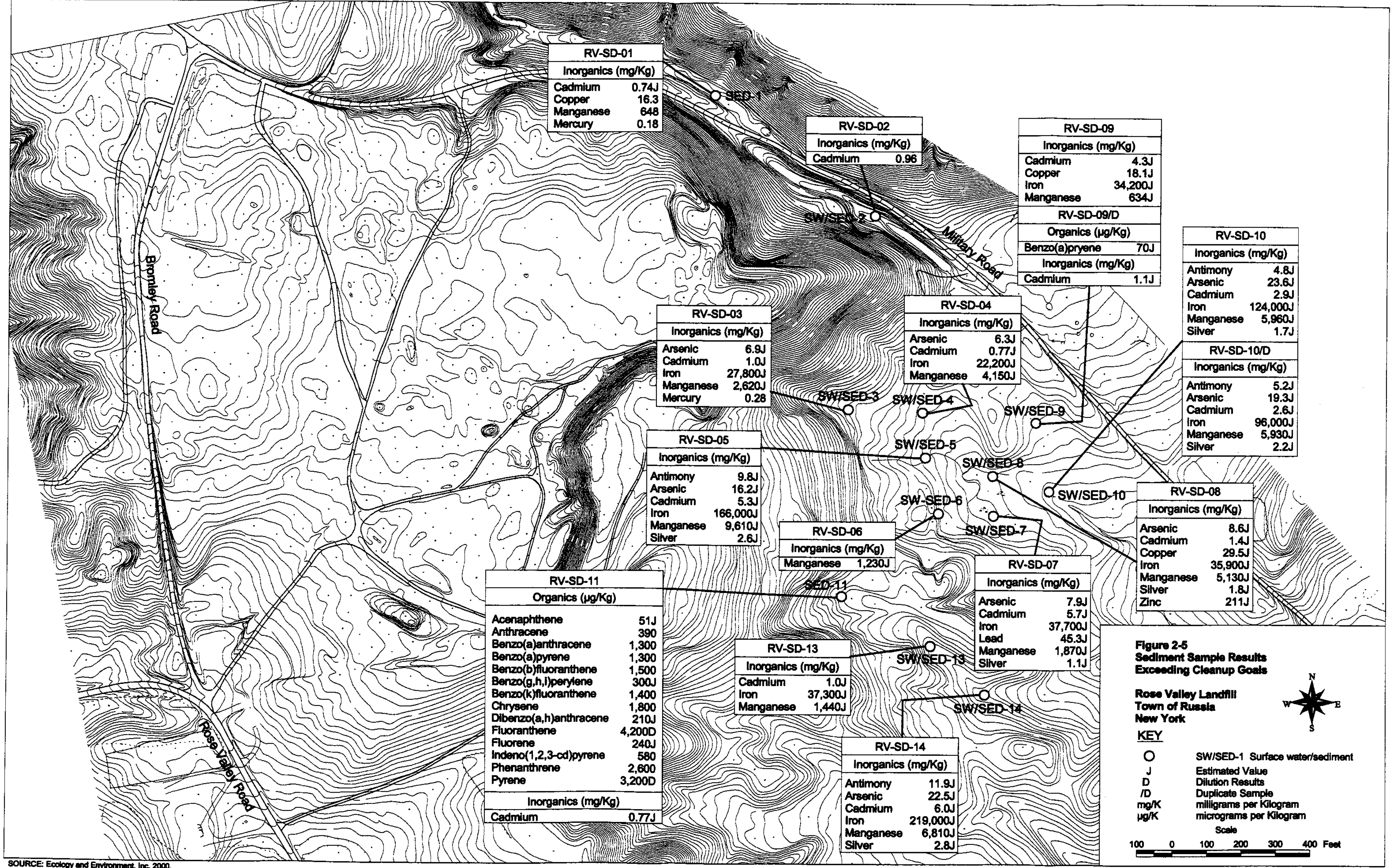

RV-SD-01	
Inorganics (mg/Kg)	
Cadmium	0.74J
Copper	16.3
Manganese	648
Mercury	0.18

RV-SD-02	
Inorganics (mg/Kg)	
Cadmium	0.96

RV-SD-03	
Inorganics (mg/Kg)	
Arsenic	6.9J
Cadmium	1.0J
Iron	27,800J
Manganese	2,620J
Mercury	0.28

RV-SD-04	
Inorganics (mg/Kg)	
Arsenic	6.3J
Cadmium	0.77J
Iron	22,200J
Manganese	4,150J

RV-SD-05	
Inorganics (mg/Kg)	
Antimony	9.8J
Arsenic	16.2J
Cadmium	5.3J
Iron	166,000J
Manganese	9,610J
Silver	2.6J

RV-SD-06	
Inorganics (mg/Kg)	
Manganese	1,230J

RV-SD-07	
Inorganics (mg/Kg)	
Arsenic	7.9J
Cadmium	5.7J
Iron	37,700J
Lead	45.3J
Manganese	1,870J
Silver	1.1J

RV-SD-08	
Inorganics (mg/Kg)	
Arsenic	8.6J
Cadmium	1.4J
Copper	29.5J
Iron	35,900J
Manganese	5,130J
Silver	1.8J
Zinc	211J

RV-SD-09	
Inorganics (mg/Kg)	
Cadmium	4.3J
Copper	18.1J
Iron	34,200J
Manganese	634J
RV-SD-09/D	
Organics (µg/Kg)	
Benzo(a)pryene	70J
Inorganics (mg/Kg)	
Cadmium	1.1J

RV-SD-10	
Inorganics (mg/Kg)	
Antimony	4.8J
Arsenic	23.6J
Cadmium	2.9J
Iron	124,000J
Manganese	5,960J
Silver	1.7J
RV-SD-10/D	
Inorganics (mg/Kg)	
Antimony	5.2J
Arsenic	19.3J
Cadmium	2.6J
Iron	96,000J
Manganese	5,930J
Silver	2.2J

RV-SD-11	
Organics (µg/Kg)	
Acenaphthene	51J
Anthracene	390
Benzo(a)anthracene	1,300
Benzo(a)pyrene	1,300
Benzo(b)fluoranthene	1,500
Benzo(g,h,i)perylene	300J
Benzo(k)fluoranthene	1,400
Chrysene	1,800
Dibenzo(a,h)anthracene	210J
Fluoranthene	4,200D
Fluorene	240J
Indeno(1,2,3-cd)pyrene	580
Phenanthrene	2,600
Pyrene	3,200D
Inorganics (mg/Kg)	
Cadmium	0.77J

RV-SD-13	
Inorganics (mg/Kg)	
Cadmium	1.0J
Iron	37,300J
Manganese	1,440J

RV-SD-14	
Inorganics (mg/Kg)	
Antimony	11.9J
Arsenic	22.5J
Cadmium	6.0J
Iron	219,000J
Manganese	6,810J
Silver	2.8J

Figure 2-5
Sediment Sample Results
Exceeding Cleanup Goals

Rose Valley Landfill
Town of Russia
New York

KEY

○	SW/SED-1 Surface water/sediment
J	Estimated Value
D	Dilution Results
/D	Duplicate Sample
mg/K	milligrams per Kilogram
µg/K	micrograms per Kilogram

Scale
100 0 100 200 300 400 Feet

SOURCE: Ecology and Environment, Inc. 2000.

2000 Ecology and Environment, Inc.

3

Identification of Technologies and Development of Alternatives

3.1 General Response Actions

Based on the information presented in the RI report (E & E 2000) and the RAOs established in Section 2, this section identifies general response actions (GRAs), or classes of responses, to contaminated areas. GRAs describe classes of technologies that can be used to meet the remediation objectives for each medium of concern.

3.1.1 Groundwater

As discussed in Section 2.3.2, the site contains three groundwater plumes contaminated primarily with the VOCs TCA, DCA, DCE, TCE, and BTEX. Metals contamination is not a concern. GRAs appropriate for groundwater contamination include:

- Collection,
- Ex situ treatment,
- In situ treatment, and
- Monitoring.

3.1.2 Sediments

Sediment samples collected during the RI indicated the potential for impacts from metals. However, these impacts are only suggested due to exceedances of generic guidelines. These generic guidelines do not necessarily reflect actual risks that may be posed by the sediments at the site. Therefore, an ecological risk assessment will be performed to further define the risk to environmental receptors. The results of the ecological risk assessment will be used to determine necessary remediation measures for sediments; therefore, the cleanup of sediments will not be addressed in this FS.

3.1.3 Landfill

The landfill itself does not pose a direct-contact threat to human health and the environment. Direct contact is effectively blocked by the sand cap and extensive vegetation present atop the landfilled material. However, landfilled material is apparently directly contributing to the contamination found in the Wetland Plume, and may be contributing to the contamination found in the wetland sediments. Furthermore, evaluation of the expected elevation of the bottom of the fill in relation to the elevation of the top of the groundwater table suggests that generation of additional leachate is governed primarily by infiltration of precipitation; groundwater flowing towards the landfill from upgradient is below the fill except possibly in the extreme lower parts of the landfill (see Figure 3-1). As the source of the contamination, the landfill contaminants must be addressed. The spread of landfill contaminants can be prevented by excavating and moving the landfill contaminants or by reducing infiltration to the landfill using exposure controls. Since excavating and burying the landfill contents would not be cost effective or feasible, the only GRA to prevent migration is infiltration control.

3.2 Identification of Remedial Technologies

This section identifies the potential remedial action technologies that may be applicable to remediation of the media at the Rose Valley Landfill site identified above as requiring attention. Because of extensive experience in addressing landfill contamination and organic solvent groundwater plumes, not all possible remedial technologies are presented in this section. Rather, only the technologies most applicable to the treatment of these contamination issues are presented.

3.2.1 Groundwater Technologies

3.2.1.1 Collection

The process of collecting contaminated groundwater comprises two types of technologies: extraction and collection.

Groundwater extraction systems are used to control, contain, or remove groundwater contaminant plumes. Groundwater extraction can be achieved by using pumping wells. Pumping methods involve the active manipulation and management of groundwater through the use of well systems. The selection of an appropriate well system depends upon a number of factors, including the depth of contamination and the hydrological and geologic characteristics of the aquifer.

Groundwater collection uses trenches and buried conduit to convey and collect contaminated groundwater by gravity flow. Subsurface drains function essentially like extraction wells and therefore can perform many of the same functions as wells.

3.2.1.2 Ex situ Treatment

Based on industry experience with ex-situ treatment at numerous chlorinated solvent contamination sites, three primary technologies have been found to be most effective, both technically and cost-wise, for treating extracted groundwater: carbon adsorption, air stripping, and UV oxidation. These processes are used to remove VOCs from groundwater and are evaluated below.

Carbon adsorption is used to remove dissolved organic compounds from groundwater. This process has been shown to be effective at removing low-solubility organic substances over a broad concentration range. Carbon adsorption can be designed for either column or batch application, but groundwater treatment is typically performed using columns. In column applications, the contaminated water is passed through a bed of activated carbon, and the contaminants are absorbed into the carbon. Once the carbon has been used to its maximum adsorptive capacity, it is removed for disposal, destruction, or most likely, regeneration. During regeneration, adsorbed contaminants are destroyed.

UV oxidization uses ultraviolet light together with an oxidizer, typically hydrogen peroxide or ozone, to chemically oxidize organic contaminants present in water. The oxidizer is added to the contaminated water and the mixture is passed through a unit lighted with UV light bulbs. The combination of the intense UV light and oxidizer oxidizes the contaminants, causing the complex organic molecules to break down into a series of less-complex molecules, resulting in end products of water, carbon dioxide, and hydrogen chloride. This method is effective in treating chlorinated organic compounds, but it does not destroy some VOCs such as TCA. Also the presence of turbidity, metals, and oils and grease adversely affect the performance of UV oxidization.

Air stripping is a mass-transfer process in which VOCs are transferred from water to the air stream by pumping the contaminated groundwater through a packed air-stripping tower. The towers range from approximately 15 to 40 feet high, or may be constructed according to proprietary low-profile designs. The air-stripping tower has a spray nozzle at the top that sprays water down the tower. A fan forces the air upward against the water flow. At the bottom of the tower is a sump that collects the decontaminated water. The organic-laden air stream from the tower is then typically treated using carbon adsorption. Air stripping, using packed towers, is a well-established, effective remedial technology for the removal of VOCs from groundwater. Following transfer to the gas phase, the VOCs can either be further treated in this phase or released to the atmosphere. The need for gas-phase treatment is determined by the requirements of an air discharge permit, which evaluates, on a site-specific basis, the need for off-gas control. Often, off-gas treatment is not required. VOCs released by through air stripping are photodegraded in the atmosphere upon release.

The actual preferred ex situ technology depends upon extraction rates and concentrations, which have not yet been developed for this site. However, air stripping is generally the most preferred of the these groundwater treatment methods because it is less expensive than the other technologies over a wide range of concentration/flow rate conditions.

3.2.1.3 In situ Groundwater Treatment

As with any treatment technology, in situ treatment technologies address contamination through removal, destruction, or immobilization of contaminants. For organic contaminants in groundwater, applicable technologies would either remove or destroy the contaminants. Removal technologies are limited to those that transfer the contaminants to the gas phase, allowing recovery of the gas, and thus cleanup of the groundwater. The technology typically used to affect this type of removal is air sparging. Destruction technologies convert the contaminants into innocuous by-products such as carbon dioxide and chloride ions. Representative technologies include reactive iron walls and anaerobic biodegradation (including natural attenuation). There are also direct-oxidation technologies available for treating chlorinated solvents. For example, use of the strong oxidizer potassium permanganate has been examined as a reagent for the direct oxidation of a variety of solvents. However, permanganate works by attacking a double bond between carbon atoms. It would thus be ineffective on single-bonded organic solvents such as the TCA and DCA seen in the House Plume.

3.2.1.3.1 Air Sparging

Air sparging technology injects air just beneath the contaminant plume. As the air bubbles rise through the plume, they strip out volatile organics. The volatilized contaminants are then transferred to the vadose zone, and are collected by a vapor extraction system installed in this zone. This technology is not appropriate to either of the two plumes addressed in this FS. At the House Plume, groundwater is far below the ground surface; the water table is up to 40 feet below ground surface, and the bottom of the plume is presumably lower. Although it is technically feasible to inject air this far below the surface, generating a vapor plume at such a depth makes it difficult to collect the generated gases. In fact, generating such a vapor plume runs the risk of causing migration of contaminant vapors beyond the current horizontal distribution of the plume. This could potentially cause exposure problems to the residences located adjacent to the House Plume. For this reason, air sparging is not recommended for this plume.

At the Wetland Plume, the opposite concern makes air sparging inappropriate. Because the plume is hydraulically connected to surface water in the wetland, there is no vadose zone available in which to collect the generated vapors. Although direct venting of the vapors to the atmosphere may not pose a significant threat to human health or the environment, sparging air through the wetland would alter the environment of the wetlands, which includes anaerobic sections. It may also introduce turbidity through fluidization of wetland sediments. For these reasons, this technology is not appropriate for this plume.

3.2.1.3.2 Reactive Iron Walls

Elemental iron has been found to dechlorinate certain solvents given sufficient surface area and contact time. As the chlorinated solvents are reduced to the corresponding alkane or alkene, iron is oxidized to ferrous iron. However, there are drawbacks to implementing this technology for the Rose Valley plumes. This technology is primarily effective on double-bonded solvents such as TCE. It is less effective on single-bonded contaminants such as TCA and DCA, which are prevalent at the House Plume. In addition, the great depth to the groundwater and the bottom of the plume would result in very high installation costs; this technology is better suited to shallower plumes and thus is not appropriate for the House Plume. Double-bonded solvents including TCE and DCE are present in the Wetland Plume and would be amenable to this type of treatment. However, the location of the wetland plume immediately below the wetland would complicate implementation of this technology. To be effective, the groundwater must flow through the wall and maintain a minimum residence time in contact with the iron surfaces. Because of the hydraulic connection between the groundwater and the wetland surface water, it would be difficult to force such contact. The wall may instead act as a conduit for groundwater to flow upward towards the surface because of higher permeability there. Not only would this partially bypass the iron, it would facilitate the removal/destruction processes already occurring (as evidenced by the lower concentrations of contaminants in the wetland surface water). Accelerating the existing removal mechanisms as a primary mechanism of treatment would not justify the high cost of iron purchase and installation. Thus, this technology is not considered further.

3.2.1.3.3 Anaerobic Biodegradation

Chlorinated solvents can be anaerobically biodegraded. Chlorinated solvents act as electron acceptors, generating a negatively charged chloride ion and replacing the chlorine's position on the solvent with a hydrogen. This reaction requires an electron donor. Although metabolically the electrons are provided by hydrogen, the source of the electrons is typically from other organic material present in the aquifer. Without such additional material, anaerobic reductive dechlorination is not possible. Anaerobic biodegradation can be accomplished either through the use of naturally occurring organic matter (natural attenuation) or through the addition of exogenous organic material. Both approaches are considered for these plumes.

Natural Attenuation

There is evidence of natural attenuation in both of the plumes of interest. At the House Plume, TCA has been seen degraded to DCA; in the Wetland Plume, TCE has been reduced to DCE. There may be sufficient organic material present in the House Plume from other material that has been disposed of at the site. At the Wetland Plume, organic material leaching from the landfill, together with the contaminants, would provide the necessary electron donors. Also, wetland sediments are high in organic material and provide an excellent environment for reductive dechlorination.

Implementing natural attenuation is a relatively involved task. To effectively apply natural attenuation at a site (according to the EPA Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater EPA/600/R-98/128), a number of lines of evidence need to be demonstrated. To implement natural attenuation, the plume has to be fully characterized in the vertical and horizontal dimensions to demonstrate lack of receptors. Second, in addition to analysis of contaminants, other parameters that provide clues to the type of biological activity occurring (e.g., oxygen, redox potential, sulfate, ferrous iron, and sulfide concentrations, etc.) need to be measured on a regular basis. Finally, a predictive model of the groundwater flow and attenuation must be completed to indicate degradation prior to exposure to receptors.

Accelerated Anaerobic Degradation Through the Addition of Electron Donors

The natural processes of reductive dechlorination may be accelerated through the addition of exogenous electron donors. Under anaerobic conditions, carbohydrates can be fermented to organic acids. Hydrocarbons have also been shown to be converted to organic acids under anaerobic conditions in aquifers. These organic acids can be further oxidized to release the hydrogen needed to provide the reducing power needed for dechlorination. Exogenous electron donors can be added directly as carbohydrates or organic acids. Alternatively, proprietary material such as HRC (hydrogen release compound) from Regenesis, Inc., may be added to provide a slow-release constant source of electron donors to the aquifer (generic organic material need to be added more frequently additions). Use of such electron donors has been shown to accelerate reductive dechlorination.

3.2.1.4 Long-term Monitoring

Long-term monitoring is not, per se, a remedial technology. While it does not actively clean up a plume, it can be useful to demonstrate that no exposures, or no new exposures, are occurring. Long-term monitoring generally uses an array of monitoring wells that are used to regularly sample the groundwater. These wells are placed such that they would detect migration towards any new receptors, for example a residential well not currently impacted by the plume. Long-term monitoring is distinct from natural attenuation as it does not attempt to demonstrate that the contaminants are being degraded and/or that they will be attenuated prior to reaching any new receptors. However, under long-term monitoring, natural attenuation may be occurring, albeit not fully documented.

3.2.2 General Response Actions for Landfills

Because groundwater is a site concern, a landfill cover that will reduce infiltration is needed to prevent the future spread of contaminants. Two technologies identified as appropriate for this site are a 6 NYCRR Part 360 cap and a poplar tree cap.

3.2.2.1 NYCRR Part 360 Cap

Capping called for by 6 NYCRR Part 360 for solid waste landfills requires a cap that will reduce infiltration into the landfill and prevent contaminant migration. Typically, this type of cap produces a reduction in infiltration of greater than 95%. Part 360 caps generally consist of several layers, which are described in detail below.

The first layer above the compacted trash is a filter layer. The filter layer is designed to prevent the migration of small fines into a coarser grain material, allow water or gases to move freely, and maintain the integrity of the next layer, a gas-venting layer. The gas-venting layer prevents the buildup of gases inside the landfill by venting it to the atmosphere. The soil surrounding the gas vent piping is a minimum of 1 foot thick and the piping extends at least 3 feet above the final elevation of the cover system. The layer above the gas-venting layer is an impermeable clay or geotextile fabric layer constructed to minimize infiltration of precipitation into the landfill. The layer above the impermeable layer is a protective layer, usually at least 2 feet thick, designed to protect the impermeable layer from frost and root penetration and resist erosion. The final layer, a topsoil layer, is at least 6 inches thick and designed to grow vegetation to stabilize and protect the cap. Because of their overall thickness, these caps are installed beyond the edges of the contaminated area to provide anchoring of the various layers.

Poplar Tree Cap

Among their many phytoremediation uses, poplar trees are used as vegetative landfill caps. The poplar trees planted above the landfill act as a hydraulic pumps, removing water from the landfill by absorption. Because the trees use large quantities of water, they are able to prevent migration of landfill contaminants by removing infiltrating water before it percolates into landfill contaminants.

Unlike a standard Part 360 cap, the poplar trees control the amount of landfill infiltration by water uptake rates. Evapotranspiration rates increase with leaf surface area. Through cross breeding, scientists have created hybrid trees with leaf surface areas four times larger than the parent trees. Once these hybrid trees reach maturity, they are able to uptake greater amounts of water. Data from several studies indicate that one fully grown tree uptakes approximately 25 to 300 gallons of water per day.

Because the water demand is site specific and depends upon several factors, the permeability of the cap can fluctuate. Besides leaf size, other factors effecting water uptake rates include climate, season, geographic region, age of tree, and density of trees planted. Additional advantages of poplar trees are that they can be used to degrade organics such as TCE in surface and groundwater, remove metals in soils and surface water, minimize surface soil erosion, and create a usable by-product.

3.4 Development of Alternatives

In this section, the technologies selected to address groundwater and landfill contaminants are combined into alternatives. Because groundwater contamination at the site was found to occur in separate plumes, this section has been divided into three subsections to address each plume separately, and the fourth subsection addresses the landfill alternatives.

3.4.1 House Plume

The TCA House Plume apparently originates in the vicinity of monitoring well MW-08. It has contaminated the well of one home and appears to be moving toward the northwest; however, the groundwater gradient in the area is very slight. The western and southern extents of the plume are not well defined. Collection trenches are not feasible for this area due to the depth to the surface of the water table, slight groundwater gradient, and undefined plume boundaries, so extraction wells are recommended for ex situ groundwater treatment measures. The recommended alternatives for the House Plume include:

- Alternative A1: No Action;
- Alternative A2: Extraction and treatment via air stripping;
- Alternative A3: In situ treatment via HRC;
- Alternative A4: Natural attenuation; and
- Alternative A5: Long-term monitoring.

3.4.2 HP-11 Plume

Since the high levels of TCE detected in the HP11 Plume represent only a limited perched area of contaminated groundwater that is not connected to the general overburden aquifer in this area, this does not pose a significant migration threat. Therefore, the only alternative developed for the HP-11 Plume is:

- Alternative B1: Long-term monitoring.

3.4.3 Wetlands Plume

The wetlands groundwater plume area contains several small areas of VOC contamination, including DCE, DCA, and BTEX. Soil gas conducted topographically upgradient of the wetland area indicated that BTEX is flowing toward the wetlands. SVOC analysis of groundwater showed minor amounts of dichlorobenzene in one well on the southwest side of the wetland area (MW-B4). Neither PCBs nor pesticides were detected in site groundwater.

Unlike the House Plume, the groundwater table in the Wetland Plume area is close to the surface and in direct hydraulic connection with the wetland. Essentially, the plume extends from just below the ground surface to actually above the ground surface. Only small amounts of contaminants are actually present in the surface water due to volatilization and natural biodegradation processes.

At this plume, active in situ groundwater technologies would be rendered ineffective due to the hydraulic connection to the wetland, so only passive in situ and ex situ technologies are considered feasible. For the same reason, groundwater collection via a collection trench is more reasonable than extraction methods. The alternatives developed for the Wetland Plume include:

- Alternative C1: No Action;
- Alternative C2: Collection (via trench) and treatment by air stripping;
- Alternative C3: Natural attenuation; and
- Alternative C4: Long-term monitoring.

3.4.4 Landfill

Remediation measures are necessary to stop contaminant migration due to infiltration. As discussed in Section 3.1.3 only exposure-control technologies were chosen to be feasible; therefore, the two alternatives developed for the landfill include:

- Alternative D1: No Action;
- Alternative D2: NYCRR Part 360 cap; and
- Alternative D3: Poplar tree cap.

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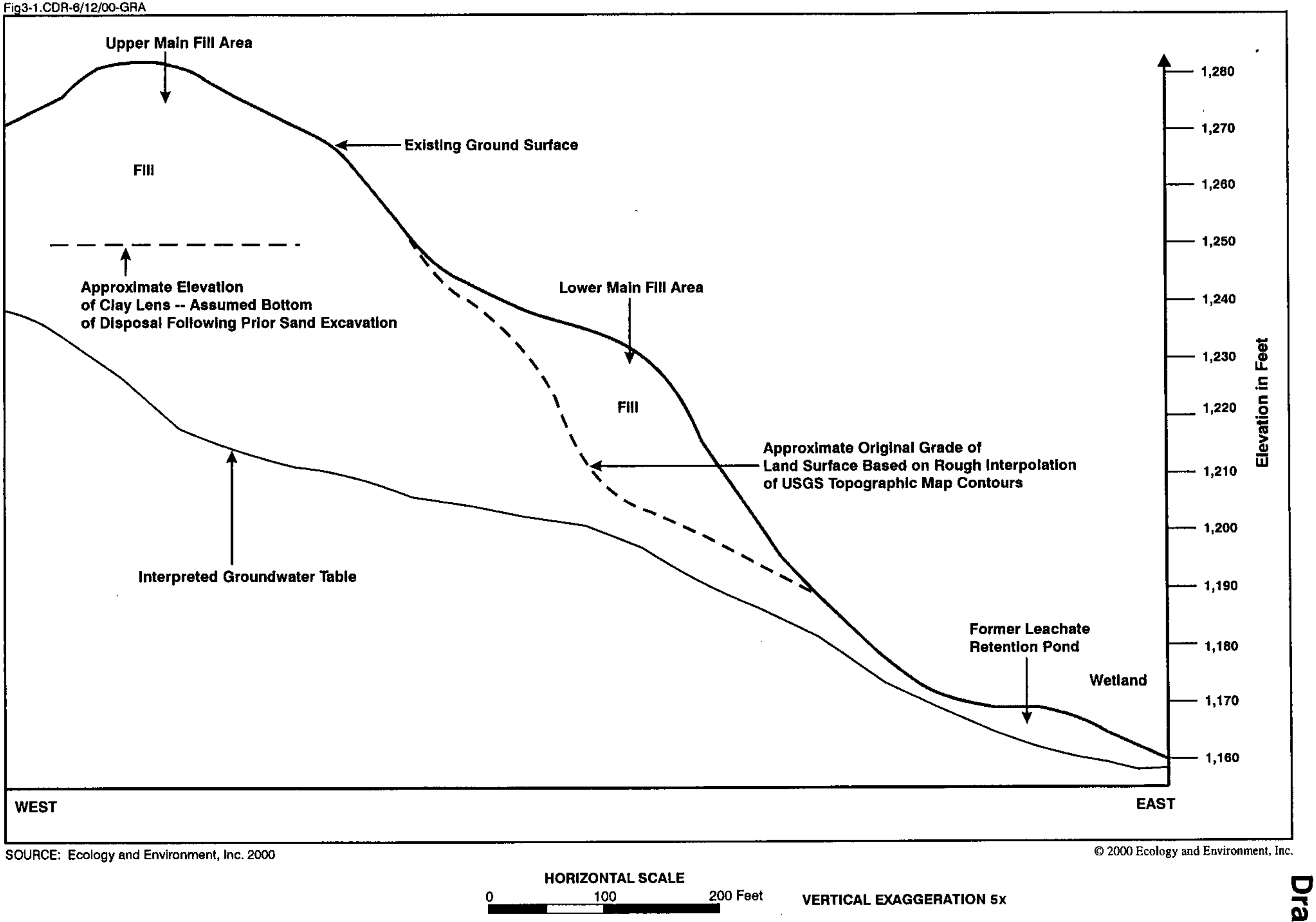
Fig3-1.CDR-6/12/00-GRA



SOURCE: Ecology and Environment, Inc. 2000

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Figure 3-1 APPROXIMATE CROSS SECTION OF ROSE VALLEY LANDFILL SHOWING INTERPRETED LEVEL OF GROUNDWATER TABLE BELOW ASSUMED DEPTH OF FILL