REMEDIAL DESIGN WORK PLAN

Stauffer Management Company
Niagara Falls Site

APRIL 1993

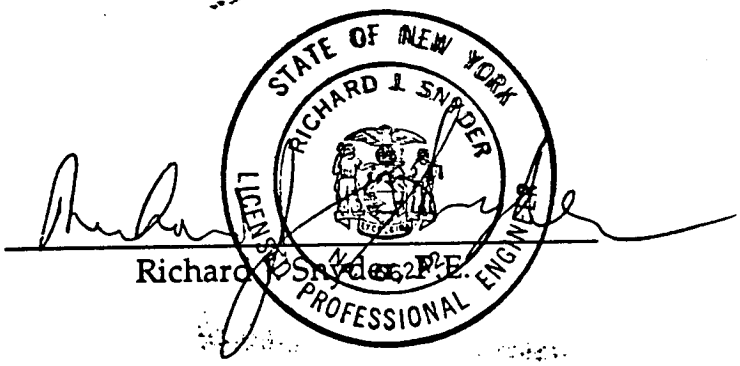
REF. NO. 4980 (1)

CONESTOGA-ROVERS & ASSOCIATES

Revised March 17, 1993

CERTIFICATION

I, Richard J. Snyder, a Professional Engineer in the State of New York certify, based on my review of the document entitled "Remedial Design Work Plan, Stauffer Management Company, Niagara Falls Site" dated January 1993 and revised March 17, 1993, that the referenced Work Plan is appropriate to complete the Remedial Design for the Site and is in accordance with sound engineering principles.



Richard J. Snyder, P.E.

3-17-93

Date

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1.0 INTRODUCTION

This report entitled "Remedial Design Work Plan, Stauffer Management Company, Niagara Falls Site" (RD Work Plan) was prepared by Conestoga-Rovers & Associates (CRA) for Stauffer Management Company (Stauffer) to detail the various activities to be performed under the remedial program for the Stauffer Niagara Falls Site. The preferred remedial alternative is identified in the Record of Decision for the Stauffer Plant Site (Site Number 932053) prepared by the New York State Department of Environmental Conservation (NYSDEC), dated July 1992, and includes:

- In situ vacuum extraction of contaminated soils;
- Bedrock groundwater extraction with on-Site treatment;
- Surface water drainage controls over the Plant Site; and
- DNAPL extraction from bedrock with on-Site or off-Site treatment.

The purpose of the RD Work Plan is to provide a framework for implementation of the remedial design and remedial action.

1.1 SITE BACKGROUND

1.1.1 Location

The former Stauffer Chemical Company Niagara Falls Plant (Site) is located in the Town of Lewiston, New York, immediately north

of the Forebay for the Robert Moses Power Plant and east of the Niagara River. The Site location is presented on Figure 1.1.

The former Stauffer plant site occupies an area of approximately 20 acres. A schematic Site plan is presented on Figure 1.2. The former plant area is fenced and access is provided through a locked gate along the western boundary. The plant was dismantled in 1980, however, foundations, roadways, and rail lines remain. The Site is bounded to the north by the Riverdale Cemetery; to the south by the Forebay for the Robert Moses Power Plant; to the west by the Robert Moses Expressway and the Niagara Gorge; and, to the east by property owned by the New York Power Authority (NYPA).

Stauffer used two areas east of the plant for the disposal of inert materials. These landfills, presented on Figure 1.2, are located on land owned by the NYPA.

The land use within a one-mile radius of the Site is shown on Figure 1.3. Residential areas within this zone consist primarily of single-family dwellings located in three discrete areas north of the Site and one area southwest of the Site. It is estimated that a total of 400 single-family dwellings are within a one-mile radius of the Site.

The Niagara University is located south of the Site on the south side of the NYPA Forebay. This University has a student population of approximately 3,200 students of which 1,200 live on campus in student residences.

The NYPA owns and maintains a large portion of the property within a one-mile radius of the Site including the storage reservoir to the east, the Forebay and transformer station to the south and the generating station to the west along the Niagara River. Similar facilities exist on the Canadian side west of the Niagara River. The remaining area within the one-mile radius is park land and highway right-of-ways.

The total estimated population residing within the one-mile radius of the Site is 3,000.

1.1.2 Site History

Between 1900 and 1930, portions of the Site were owned and used by the Titanium Alloy Manufacturing Company, the American Magnesium Corporation and the Niagara Smelting Company. From 1930 to 1980, the property was the site of a chemical manufacturing plant owned and operated by the Stauffer Chemical Company. Between 1930 and 1976, the plant produced carbon tetrachloride and various metal chlorides. The primary organic chemical feedstock was carbon disulfide which was reacted with chlorine to produce carbon tetrachloride and sulfur chlorides. A pesticide intermediate, parachlorothiophenol, was produced from chlorobenzene and sulfur chlorides. In addition, bulk methylene chloride and tetrachloroethylene were brought into the plant and repackaged. The plant discontinued operations in 1976 and was dismantled in 1980. The Site is currently owned by a wholly owned subsidiary of Stauffer Management

Company (Stauffer). Stauffer was formed as a result of the divestiture of Stauffer Chemical Company in 1987.

1.1.3 Previous Studies

Since 1980, the New York Power Authority (NYPA) has conducted two investigations of the Site and the immediate area to investigate proposed expansion plans for the Robert Moses Power Plant. These studies included the investigation of the presence of Site-related compounds in the soils and groundwater near the proposed expansion areas. The results of these investigations were presented in two reports entitled "Application for Amendment to License, Federal Energy Regulatory Commission, Appendices 13 and 14 November 1984" (Bechtel 1984) and "Niagara Power Project Expansion, Report of the Chemical Contamination Field Investigation Conducted in 1985-1986, August 1986" (Bechtel 1986). The investigations indicated that "some soil and groundwater contamination had occurred and that some volatile organic compounds (VOC) contaminants were migrating in the groundwater system" (Bechtel 1986, p. 1-1 to 1-2).

In May 1988, under the direction of Stauffer, CRA prepared a Site Investigation Work Plan to address identified data base deficiencies to more fully define subsurface conditions at the Site. This plan included drilling and sampling overburden boreholes; installing additional overburden and bedrock monitoring wells; sampling all newly installed and existing monitoring wells; and sampling surface seeps.

In December 1988, an Order on Consent was executed between NYSDEC and Stauffer for development and implementation of a Remedial Investigation and Feasibility Study. The Work Plan and associated Addendum dated August 23, 1988, which was approved in September 1988, was incorporated into the Consent Order.

The field activities were conducted in accordance with the Work Plan during the period from August 1989 to April 1990. The results of the investigation were presented in a report entitled "Site Investigation Report, Stauffer Management Company, Niagara Falls Site" and submitted to the NYSDEC in May 1990. Comments were received from the NYSDEC in a letter dated September 19, 1990. Included in these comments were requests for additional data collection to address specific concerns of the NYSDEC. The additional work requested included:

- installation of three overburden wells northwest of the Site;
- monitoring the three new wells for groundwater and soil gas;
- investigating 12 wells for the presence of DNAPL and sampling the DNAPL if present;
- additional subsurface soil sampling at the former landfill areas; and
- in situ hydraulic conductivity testing of three bedrock monitoring wells.

The Supplemental Data Collection Plan was prepared and submitted to the NYSDEC in November 1990. The additional field work was conducted in accordance with this plan during February and March 1991. The report entitled "Final Site Investigation Report, Stauffer Management Company, Niagara Falls Site" (Final Site Investigation Report) and dated

April 1991, incorporates the additional information obtained during the supplemental data collection with previous data, to further define Site conditions. A Risk Assessment (Endangerment Assessment) is included in Section 7.0 of the Final Site Investigation Report.

The report entitled, "Supplemental Site Investigation Report, Stauffer Management Company, Niagara Falls Site" and dated August 1991 presents the data for the soil gas monitoring northwest of the Site.

A Feasibility Study was conducted to define remedial objectives for the Site and to evaluate potential remedial alternatives. The results of this study are presented in the document entitled "Feasibility Study, Stauffer Management Company, Niagara Falls Site", dated September 1991.

1.2 NATURE AND EXTENT OF CONTAMINATION

During the current and previous investigations at the Site, samples were collected from subsurface soils, groundwater monitoring wells, surface water locations, and seep areas along the Forebay and the Niagara Gorge. Based upon the data collected, it was concluded that the major chemicals of concern at the Site were the Site-Specific Parameter List (SSPL) compounds listed in Table 1.1.

All analytical data collected for the Site is presented in the Final Site Investigation Report and the two Bechtel reports (Bechtel 1984 and

Bechtel 1986). A summary of the nature and extent of chemicals in the different media at the Site is presented in Sections 1.2.1 to 1.2.5.

1.2.1 Overburden Site Soils

During the Stauffer Site Investigation a total of 29 overburden soil borings were drilled within the fenced Site boundary. Selected soil samples were submitted for laboratory analyses. Four of these samples, were analyzed for the Target Compound List (TCL) and Target Analyte List (TAL) parameters and thirty-one (31) samples were analyzed for the SSPL volatile organic compounds. The analytical results are presented in Appendix E of the Final Site Investigation Report.

The analytical results for the overburden soil samples including the results from the NYPA investigation are presented on Plan 1.

The analytical results indicate that the highest concentrations were reported for the samples collected from boreholes located in the northwestern area of the Site (BH5, BH6, BH8, BH9, CL-2A and CL-3). The major chemicals identified in the samples from these boreholes are carbon tetrachloride and chloroform. Calculations indicate that approximately 76 percent of the chemical mass in the Site soils are contained in this area.

Soil samples collected from borehole T-4, located in the southwestern corner of the Site, were reported by Bechtel (1984) to contain

tetrachloroethene at a maximum concentration of 230 ppm. Calculations indicate that approximately 8 percent of the chemical mass in the Site soils are in the vicinity of borehole T-4.

1.2.2 Former Landfills

During the Stauffer site investigation, a total of ten (10) overburden soil borings were drilled at the locations of the two former landfills (see Figure 1.4) and a total of 20 soil samples were collected and submitted for analyses. Two samples from these boreholes were analyzed for TCL and TAL parameters. The remaining eighteen (18) samples were analyzed for the SSPL. The analytical results are presented in Appendix E of the Final Site Investigation Report.

The data for this area indicates that the highest parameter concentrations were reported in samples obtained from boreholes BH30 (10 feet to 12 feet in depth) and BH31 (4 feet to 6 feet in depth). The majority of the parameters detected in these samples were the SSPL volatile organic compounds; however, acetone, 1,2-dichloroethene, xylenes and ethylbenzene were also detected in one or both of the samples.

The VOC data for the borings at the former landfills including previous data collected in this area for the NYPA (Bechtel 1984) are presented on Figure 1.4. Figure 1.4 illustrates that VOC concentrations at the former landfills are generally low (<1 ppm) except at isolated locations such as at BH30 (tetrachloroethene 130 ppm, xylene 19 ppm, methylene chloride

10 ppm and trichloroethene 4 ppm), BH31 (carbon disulfide 34 ppm, acetone 18 ppm, carbon tetrachloride 3 ppm and chloroform 2 ppm) and D2-8 (methylene chloride 340 ppm) (sampled by Bechtel 1984).

It is estimated that approximately 14 percent of the total chemical mass in the soils at the Site is in the former landfills (7 percent in each landfill).

1.2.3 Groundwater

Groundwater samples were collected from monitoring wells and analyzed for chemical constituents during the Bechtel investigations (Bechtel 1984 and Bechtel 1986). For the Stauffer Site Investigation, additional monitoring wells were installed both on Site (six bedrock wells and one overburden well) and northwest of the Site (three overburden wells). Groundwater samples were collected from forty-one (41) observation wells for chemical analyses. Samples collected from eight (8) of the wells were analyzed for TCL and TAL parameters and thirty-three (33) wells were sampled and analyzed for the SSPL. All groundwater analytical results, including the results from the Bechtel investigations are presented in Appendix F of the Final Site Investigation Report. The well locations are presented on Plan 2.

The analytical results for the groundwater samples indicate the presence of volatile organic chemicals in the groundwater beneath the Site and west of the Site. The highest concentrations (carbon

disulfide 570 mg/L, carbon tetrachloride 650 mg/L and chloroform 98 mg/L) were reported in the Rochester waterbearing unit beneath the northwestern corner of the Site at well OW3-89. The southwestward groundwater gradients within the upper hydrogeologic units and the downward gradients between the different hydrogeologic units have resulted in chemicals migrating into the deeper hydrogeologic units (Rochester, Irondequoit/Reynales) west of the Site.

The general areal distribution of volatile organic compounds in the groundwater is also presented on Plan 2. The vertical distribution of chemicals in the groundwater is illustrated on cross Sections A-A' to C-C' presented on Figures 1.5 to 1.7.

1.2.4 Surface Water and Seeps

Seep samples were collected from the Forebay and the Niagara Gorge and surface water samples were collected at the locations presented on Figure 1.8. Descriptions of the seep and surface water sampling locations are presented in Section 2.6 of the Final Site Investigation Report. All samples collected were analyzed for the SSPL; and the analytical results are presented in Tables 5.19 and 5.20 in the Final Site Investigation Report.

Parameter concentrations in both the Forebay and gorge seep samples are significantly lower than the concentrations detected in the groundwater. Low concentrations of trichloroethene (27 µg/L) were reported in the Forebay seep sample from F4 and low levels of chloroform (5 µg/L)

were reported present in the sample from F5 (see Figure 1.8 for locations). Both of these sampling locations are located immediately south of the western part of the Site.

The results for the samples collected from the Niagara Gorge indicate that chemicals on the SSPL were detected in the samples collected from G1 and G2. The G1 sampling location is the outfall for seepage collected in the NYPA north drainage tunnel. The sample for G2 was obtained from discharge from beneath the old service road. Trace levels of carbon disulfide and carbon tetrachloride were detected in the gorge seep samples from locations G6 and G7, respectively.

The surface water sampling results indicate that elevated levels of carbon tetrachloride (up to 4,400 µg/L) and chloroform (up to 340 µg/L) were present in the samples collected from locations S3 and S4, and tetrachloroethene (51 µg/L) was reported present in the sample from S2. S2 is located in the drainage ditch along the southern boundary of the Site.

S3 is located in an open concrete basin outside of the fenced area, immediately west of the Site. At the time of sampling, there appeared to be a source of subsurface flow into this area. This location appears to be part of the on-Site sewer system that is monitored in accordance with the SPDES Permit for surface water discharge from the Site. This sewer system drains the Site in a westerly direction to a weir sump. Enclosed within a small fenced area, the weir sump connects to a manhole, immediately west of the Site. This manhole is monitored on an ongoing basis by the Stauffer Management Company and discharges to a second manhole (sample location

S4) approximately 100 feet to the west. Water flows westerly via the sewer system and discharges into the Niagara Gorge.

1.2.5 Dense Non-Aqueous Phase Liquid (DNAPL)

Material identified as DNAPL was found in monitoring wells OW3-89 and OW7-89 during the Supplemental Data Collection Program. Samples of this material were submitted for analyses of TCL organic parameters and the results are presented in Appendix L of the Final Site Investigation Report.

The DNAPL sample collected from well OW3-89 contained carbon disulfide (53,000 mg/kg) carbon tetrachloride (460,000 mg/kg), chloroform (8,000J mg/kg)[1], and hexachloroethane (10,000 mg/kg). These compounds were all detected at elevated levels in the groundwater sample previously collected from this well. At the time of sampling, it was determined that approximately one to two inches of DNAPL was present at the bottom of this well.

Laboratory analyses indicated that the sample submitted for VOC analyses from well OW7-89 consisted mainly of water and hence was analyzed as such with parameter concentrations reported in µg/L. The analysis of this sample indicated the presence of carbon tetrachloride (41,000 ppb) and chloroform (4,500 ppb). These parameters were also detected

1 J qualifier associated with an analytical result indicates that compound was detected at a level below the quantitation limit and therefore the quantitation is suspect.

in the previous groundwater sample collected from this well; however, higher concentrations were reported during the initial sampling. It was concluded that the quantity of DNAPL at this location is very small and the major constituents of the DNAPL are carbon tetrachloride and chloroform.

1.3 GOALS OF REMEDIAL ACTION

1.3.1 Remedial Action Objectives

The overall goal of Site remediation is to ensure the protection of human health and the environment. The remedial objectives of this program are to:

1. eliminate or minimize the discharge of hazardous constituents in the groundwater to the Forebay/Niagara River;
2. reduce concentrations of hazardous constituents within soil and groundwater with time to acceptable State and Federal levels consistent with the anticipated use of the property;
3. minimize the potential human contact with waste constituents in soils, surface water and seeps;
4. minimize the potential exposure of workers and nearby residents to chemicals via air pathways;
5. minimize the need for future remediation and operation and maintenance activities; and
6. eliminate or minimize risks or impacts to natural resources.

Remedial action objectives have been developed to be protective of human health and the environment for all exposure pathways and to comply with applicable Standards, Criteria and Guidelines (SCGs). The requirement for groundwater remediation is driven by SCGs which include requirements of the 1987 Niagara River Toxics Management Plan (NRTMP) and the International Joint Commission (IJC), Great Lakes Water Quality Agreement of 1978, amended 1987. NYSDEC remediation goals are to attain New York State groundwater standards throughout the contaminated plume. However, data from various groundwater remediation programs has documented the difficulty of achieving restrictive groundwater standards at and near contaminant sources. Consequently, control over the flow of groundwater, i.e. to maintain an inward gradient to the extent practicable, is a remedial goal.

SCGs are categorized as chemical-specific, location-specific and action-specific. Chemical-specific SCGs for the Site potentially apply to soils, surface water, groundwater and air. Currently, there are no standards for soils. However, the NYSDEC technology section has reviewed pertinent data on soils and has concluded that a Site cleanup level of less than 10 ppm for total volatiles may be sufficient for the protection of human health and natural environment at this Site. Site-specific parameter maximum contaminant levels (MCLs) have been established for groundwater and surface water (Table 1.2). SCGs for air are provided in Table 1.3.

Location-specific SCGs at this Site apply to streams or rivers and to national wild, scenic or recreational rivers. The potential New York State SCG is, Use and Protection of Waters (6 NYCRR Part 608). The

corresponding federal SCGs include Fish and Wildlife Coordination Act (40 CFR 6.302) and Wild and Scenic Rivers Act [40 CFR 6.302(e)].

Action-specific SCGs which might regulate various remedial alternatives are noted in Table 1.4.

1.4 REMEDIAL PROJECT PHASES

The remedial project will be implemented in four separate phases. The four phases are:

- Design Data Collection;
- Remedial Design;
- Implementation and Construction; and
- Operation, Maintenance, Monitoring and Reporting.

Each of these phases are briefly described in the following sections. This RD Work Plan provides details on design issues, i.e. the Design Data Collection and the Remedial Design phases of the remedial project. The Implementation and Construction and the Operation, Maintenance, Monitoring and Reporting phases of the remedial project are addressed in the RD Work Plan but specifics of these phases will be provided in the Remedial Design documents.

1.4.1 Design Data Collection

In order to implement the Remedial Design, several design data collection activities will be conducted to better define current Site conditions and develop the design parameters. Once the additional data has been obtained, the remedial components and systems can be evaluated against Site conditions in order to design a remedy that will operate effectively on the given Site conditions to achieve appropriate remediation goals. The design data collection activities that will be performed include:

- Aquifer Pumping Tests;
- Soil Vapor Extraction (SVE) Pilot Study;
- Additional Monitoring Well Installation and Sampling;
- Existing Sewer Investigation; and
- Well Gas Sampling.

These activities are further described in Section 2.0.

1.4.2 Remedial Design

The Remedial Design phase consists of the actual design of the selected remedial action for the Site. Remedial Design generally involves the preparation of all plans and specifications, operations and maintenance manuals and other associated project plans necessary for constructing and implementing the remedial action for the Site. A schedule for implementing the remedial action is also prepared.

The Remedial Design phase will consist of the detailed design of the following Remedial Action items:

- In Situ Soil Vapor Extraction;
- Bedrock groundwater extraction with on-Site treatment;
- Surface water drainage controls over the Site; and
- DNAPL extraction from the bedrock with on-Site or off-Site treatment.

The Remedial Design phase is further discussed in Section 3.0.

1.4.3 Implementation and Construction

Upon approval of all aspects of the Remedial Design for the Site, the remedial processes for each operable unit will be constructed and implemented. This phase involves constructing all items of the remedy in accordance with the plans and specifications prepared during the Remedial Design. The remedial systems that will be constructed and implemented for each operable unit at the Site are briefly described in the following sections:

1.4.3.1 Groundwater Operable Unit

Chemical presence in the groundwater at the Site is limited to the Lockport and Rochester bedrock formations. The chemical

presence in these formations will be addressed by the installation and operation of groundwater extraction wells installed to the base of the Rochester Formation. Extracted groundwater will be conveyed to an on-Site treatment system.

The on-Site treatment system will treat the extracted groundwater via an air stripping process possibly supplemented by carbon adsorption treatment.

The groundwater extraction and treatment systems are further discussed in Section 3.0.

1.4.3.2 Soil Operable Unit

The investigation conducted at the Site delineated four areas of VOC contamination as shown on Plan 1. These areas are designated Area A, B, C and T-4.

The VOCs observed within these areas will be addressed by the installation and operation of an in situ soil vapor extraction (SVE) system. The SVE system consists of soil gas extraction wells and an on-Site air treatment system.

The SVE system is further discussed in Section 3.0.

1.4.3.3 Surface Drainage Operable Unit

The Surface Drainage Operable Unit at the Site involves the control and discharge of all surface waters at the Site. The remedial action will involve the implementation of various controls to contain/divert surface drainage to an appropriate discharge point at the Site. The controls to be implemented include:

- removal or blockage of the existing site storm sewer system;
- general grading of the Site;
- removal of the existing tile drains entering the drainage ditch along the southern perimeter of the Site; and
- placement of six inches of topsoil over graded areas and revegetating.

The surface water drainage controls that are to be designed and implemented at the Site are further discussed in Section 3.0.

1.4.3.4 DNAPL

DNAPL is present at the Site in collectable quantities at monitoring well OW3-89. The DNAPL presence will be addressed by the design and implementation of a collection program to collect as much DNAPL from the bedrock unit as technically feasible. DNAPL collected from OW3-89 will be treated either on Site or off Site.

The DNAPL collection and treatment program is further discussed in Section 3.0.

1.4.4 Operation, Maintenance, Monitoring and Reporting

The final phase of the remedial project is the operation, maintenance, monitoring and reporting phase. This phase involves operating the remedial systems until the remedial objectives have been attained. The operation of the remedial systems involves regular maintenance of each system to ensure that they are operating efficiently and within design specifications, regular monitoring to assess the effectiveness and track the progress of the remedial systems in attaining the remedial objectives and regular reporting to the NYSDEC.

The operation, maintenance, monitoring and reporting of the remedial action is further discussed in Section 4.0.

2.0 DESIGN DATA COLLECTION

The design data collection activities that will be performed at the Site include:

- Aquifer Pumping Tests;
- SVE Pilot Study;
- Additional Monitoring well installation and sampling; and
- Existing Storm Sewer Investigation.

The design data collection activities are discussed in detail in the following subsections. All design data collection activities will be conducted in accordance with the Health and Safety Plan, Sampling Plan and Quality Assurance Project Plan (QAPP) presented in Appendices A, B and C, respectively. The QAPP and Sampling Plan are discussed further in Section 5.0.

2.1 AQUIFER PUMPING TEST

An aquifer pumping test will be conducted in a test extraction well constructed through the Lockport and Rochester formation waterbearing zones. The test extraction well will be located such that it can be utilized as an extraction well in the final groundwater extraction system. The purpose of conducting the aquifer pumping test is to provide sufficient data for the detailed design of the groundwater extraction and treatment system. Specifically, the aquifer pumping test will provide data for the following:

i) calculation of aquifer characteristics to refine extraction well spacing and yields;

ii) determination of zones of capture;

iii) determination of pumping rates required to obtain an inward gradient over the capture zone; and

iv) analysis of representative samples of the extracted groundwater for use in the treatment system design.

A detailed description of the aquifer pumping test to be performed including extraction well installation and sampling protocols is provided in the work plan found in Appendix D.

2.2 SOIL VAPOR EXTRACTION (SVE) PILOT STUDY

There are four areas that require remediation of VOC contaminated subsurface soils as shown on Plan 1. The four identified areas (Areas A, B, C and T-4) will be remediated using an in situ soil vapor extraction system.

The SVE is a process of applying a vacuum to the soil to extract volatile compounds from the soil. The soil gas which contains contaminant mass is subsequently treated to remove the contaminants prior to discharge to the atmosphere. This technology is effective in reducing the mass and mobility of volatile contaminants which may be present in the soil. Henry's Constant for the SSPL compounds is of sufficient magnitude for SVE

to be an effective remedial technology for the VOCs present in the soils at the Site.

The data generated through the pilot study will be used to evaluate:

i) Site-specific airflow rates;
ii) soil air permeability;
iii) air flow distribution profiles;
iv) extraction well radius of influence;
v) equilibrium soil vapor concentrations;
vi) contaminant removal rates; and
vii) ability to attain clean up goals.

The data will then be used to gauge the effectiveness of SVE technology and to complete the final design of the full-scale system.

The pilot study will involve the installation of one extraction well and four vapor/pressure monitoring probe cluster wells in each of the four areas to be remediated. The tests will be conducted using mobile equipment. The SVE pilot tests will be conducted and monitored for a period of two to four weeks.

Details of the SVE pilot study are described in the SVE pilot study work plan provided in Appendix E.

2.3 ADDITIONAL MONITORING WELL INSTALLATION AND SAMPLING

An additional shallow bedrock monitoring well will be installed in the area of existing overburden well OW9-91. This well, designated OW11, will be installed and monitored prior to the completion of the Remedial Design to determine if Site-related chemicals are present in the upper bedrock aquifer at this location and evaluate the need to expand the groundwater extraction system to capture chemical presence in this area.

Monitoring well OW11 will be installed to monitor the upper 15 feet of the Lockport formation. Well installation will be performed using the protocols described in Appendix F and the Health and Safety Plan presented in Appendix A.

Two rounds of groundwater sampling will be conducted at OW11 concurrently with the existing quarterly monitoring program for wells OW8-91, OW9-91 and OW10-91. Samples collected from OW11 will be analyzed for the SSPL in accordance with the protocols specified for the quarterly monitoring program and the QA/QC protocols specified in Appendix C. The need for additional sampling of this well will be determined upon review of the analytical data from the two rounds of sampling.

2.4 EXISTING SEWER INVESTIGATION

The remedial action to address the Surface Drainage Operable Unit will include the removal or blockage of the storm sewer system at the Site. In order to design the appropriate remedial action for the storm sewer system, a determination must be made of the condition of the existing system. As part of the design data collection activities, the condition of the existing sewer system will be investigated. In addition, the condition and status of the sanitary sewer leaving the Site will be evaluated to determine if there are environmental concerns associated with this sewer. The sewer investigation work plan is presented in Appendix G.

2.5 WELL GAS SAMPLING

Soil vapor and groundwater monitoring in the overburden is currently being conducted on a quarterly basis at observation wells OW8-91, OW9-91 and OW10-91 (located northwest of the Site) shown on Figure 2.1.

Gas samples are collected from each well headspace and analyzed for the SSPL compounds according to EPA Method TO-14. Groundwater samples are collected from each well and analyzed for Target Compound List (TCL) volatile organic compounds (VOCs).

The program will continue until the end of 1993, at which point the data collected and reported to the NYSDEC will be evaluated to determine if additional monitoring is required.

3.0 REMEDIAL DESIGN ACTIVITIES

3.1 DESIGN ELEMENTS

As previously discussed in Section 1.4, there are several components or systems that must be designed, constructed and/or implemented to complete the remedial action for the Site. The design aspects of each of these components are discussed in the following sections.

3.1.1 SVE System

A SVE system will be installed at each of the four areas exhibiting elevated VOCs (Areas A, B, C and T-4). The system will consist of a network of vapor extraction wells arranged in a regular grid pattern over each of the four areas.

A SVE Pilot Study as described in Section 2.2 and Appendix E will be conducted prior to the actual design of the full scale system. Data obtained from the pilot study would be used to determine the effectiveness of SVE as a treatment technology for Site soils, to develop specifications for the number of wells required and to determine if the extracted soil gas will require treatment prior to discharge to the atmosphere.

Based on existing Site conditions, such as soil chemical concentrations and hydrogeology, it is estimated that the vapor extraction wells would be spaced approximately 40 feet apart which would require

approximately 150 wells within the four areas. The results of the pilot study will be used to design the actual well spacing. Each extraction well would be installed to the depth of the bedrock or top of the water table, whichever is encountered first.

The design elements for the SVE system consist of the following:

i) vapor extraction wells;
ii) discharge piping;
iii) vacuum system; and
iv) air treatment system (if required).

3.1.2 Groundwater Extraction System

A series of bedrock groundwater extraction wells will be installed at the Site to provide hydraulic containment of chemicals present in the groundwater beneath the Site. The extraction wells will be installed to the west and along the southern portion of the Site. The actual number of wells required and their location will be determined based upon the results of the Aquifer Pumping Test described in Section 2.1. Each well will be installed to the bottom of the Rochester formation.

The design elements associated with the extraction wells are:

i) extraction well construction;

ii) pumps and associated equipment; and

iii) discharge piping.

3.1.3 Groundwater Treatment System

An on-Site groundwater treatment system will be installed at the Site to treat extracted bedrock groundwater. Based on the presence of VOCs in the groundwater at the Site and the magnitude of Henry's Constant for these VOCs, the most appropriate treatment technology is air stripping. Other treatment technologies such as UV oxidation and liquid phase carbon adsorption will also be considered. The treatment facility will consist of a decanting unit for separating any collected DNAPL from the aqueous phase liquids, an air stripping unit and, if required based upon the results of atmospheric dispersion modelling, activated carbon treatment.

The detailed design of the treatment system will be based upon flow data and influent concentrations observed during the Aquifer Pumping Test described in Section 2.1.

The design elements associated with the treatment system are:

i) process piping and tanks;

ii) pumps;

iii) air stripping unit; and

iv) activated carbon system (if required).

3.1.4 Groundwater Discharge System

Treated groundwater will be discharged to a surface water body via a new outfall. Discharge to the outfall would be regulated by a SPDES permit or the Site Order on Consent to which this RD Work Plan is appended.

The design elements associated with the groundwater discharge system are:

i) discharge piping; and
ii) outfall structure.

3.1.5 Surface Water Drainage Controls

The surface water drainage controls that will be implemented at the Site include:

i) removal of the existing tile drains entering the drainage ditch along the southern perimeter of the Site;
ii) removal and/or blockage of the existing storm sewer system;

iii) grading of the entire Site with the exception of the existing building foundations to promote surface water runoff towards the south and east;

iv) placing six inches of topsoil over graded areas and revegetating; and

v) provision of sheet runoff to the south of the plant or discharge of water from the southern drainage ditch via the outfall discussed.in Section 3.1.4.

Remediation of the existing storm sewer system will be based upon the results of the storm sewer investigation discussed in Section 2.4.

3.1.6 DNAPL Collection and Treatment

DNAPL will be collected from existing monitoring well OW3-89 located in the northwest corner of the Site. Collected DNAPL will be pumped from the well on a regular basis (monthly or as required) using a dedicated low rate pump system. Extracted DNAPL will be collected in appropriate steel containers and either treated on Site, possibly in the groundwater treatment system, or transported off Site for treatment. Depending on the quantity of DNAPL available, containers may be temporarily staged on Site as per RCRA (Part 373) regulations prior to transport.

3.2 DESIGN PLANS AND SPECIFICATIONS

Design plans and specifications will be created to construct and implement the remedial systems for the Site. Design plans and specifications will be required for the following systems:

i) SVE system;
ii) Groundwater extraction system;
iii) Groundwater treatment system;
iv) Groundwater discharge system;
v) Surface water drainage controls; and
vi) DNAPL collection and treatment.

The design plans and specifications will detail all electrical, mechanical and structural needs of each system. The items that will be included in the design plans and specifications are further discussed in Section 3.5.

3.3 OPERATIONS AND MAINTENANCE MANUALS

Operations and Maintenance manuals will be developed for the following remedial systems:

i) SVE system;
ii) Groundwater extraction system;
iii) Groundwater treatment system; and

iv) DNAPL collection and treatment.

The Operations and Maintenance manuals will generally contain the following information:

i) description of normal operation and maintenance (O & M);
ii) description of potential operating problems;
iii) description of routine monitoring and laboratory testing;
iv) description of a contingency plan to prevent undue hazard should systems fail;
v) corrective action plan;
vi) safety plan;
vii) description of equipment; and
viii) records and reporting mechanisms required.

3.4 PERMITTING/LAND ACCESS/EASEMENTS

In order to implement and operate the remedial systems at the Site, several permits, land access agreements and easements will be obtained. The permits, land access agreements and easements that are required will be incorporated into the Remedial Design and are discussed in the following sections.

3.4.1 Permits

3.4.1.1 Air Emissions Permit

An air emission permit will be required to operate the SVE and possibly the groundwater treatment system. An application will be submitted to the NYSDEC Division of Air Resources as part of the design activities for the SVE and possibly the groundwater treatment systems.

3.4.1.2 SPDES Permit

A modification to the existing Site SPDES permit may be required to discharge treated groundwater to a surface water body should the surface drainage plan for the Site involve the discharge of storm water to an outfall. In that case, an application for a permit modification will be submitted to the NYSDEC as part of the groundwater treatment system and discharge system design. If discharge of storm water via sheet runoff is selected as part of the surface drainage plan for the Site, a SPDES permit may not be required and the groundwater discharge can be regulated under the Site Order on Consent to which this RD Work Plan is appended.

3.4.1.3 Building Permits

Building permits may be required to construct the groundwater treatment system, soil gas treatment system (if required) and

other construction activities. Any required building permits will be obtained from the Town of Lewiston.

3.4.1.4 DNAPL Handling Permits

A permit for the off-Site treatment of DNAPL is not required, however, the following must be performed/obtained:

i) characterization of DNAPL constituents;

ii) approval from the on-Site treatment vendor or off-Site facility to treat the DNAPL based on the characterization; and

iii) approval from the NYSDEC/EPA that the on-Site treatment or off-Site facility can treat DNAPL from the Site.

3.4.2 Land Access

3.4.2.1 NYPA Landfills

A land access agreement will be required to obtain access to the NYPA Landfills to the east of the Site (Areas B and C). Access to the two areas will be required to conduct the SVE Pilot Study and to construct and operate the full-scale SVE system. The access agreement will be obtained prior to conducting the SVE Pilot Study.

3.4.2.2 Access for Monitoring Wells

Access will be required from the Town of Lewiston to install monitoring well OW11 as part of the design data collection activities. In addition, access will be required to install any additional off-Site monitoring wells for monitoring the performance of the groundwater extraction system. The need for any additional monitoring wells will be determined during the design of the groundwater extraction system. Should additional monitoring be required, the appropriate land owner will be approached to obtain access permission (NYPA, Town of Lewiston or Riverdale Cemetary Association).

3.4.2.3 Access to Sample Off-Site Wells

Access will be required from the Town of Lewiston to sample monitoring well OW11 as part of the design data collection activities. In addition, access may be required to sample existing or potential off-Site monitoring well installations to monitor the performance of the groundwater extraction system. The need to sample existing or potential off-Site monitoring wells will be determined during the design of the monitoring program for the groundwater extraction system. Should off-Site monitoring wells require sampling, the appropriate land owner will be approached to obtain access permission (NYPA, Town of Lewiston or Riverdale Cemetary Association).

3.4.3 Easements

Easements will be required to construct a new outfall from the Site and to construct potential off-Site forcemains to transfer extracted groundwater to the on-Site groundwater treatment system. The easement for the new outfall will be obtained from the NYPA. The need for off-Site forcemain easements will be determined during the design of the groundwater extraction system. Should off-Site forcemains be required, the appropriate land owner will be approached to obtain the necessary easement.

3.5 DESIGN SUBMITTALS

In order to ensure NYSDEC concurrence during the remedial design process, details of the design will be submitted to the NYSDEC for review and approval at designated intervals, as discussed in the following sections. The design submittals will be prepared in accordance with the schedule presented in Section 8.0.

3.5.1 Preliminary Design Submittal

The Preliminary Design will be submitted for NYSDEC review and approval when the design effort is approximately 50 percent complete. At this stage, existing conditions of the Site will be field verified. The Preliminary Design shall reflect a level of effort such that the technical requirements of the project have been addressed and outlined so that they

may be reviewed to determine if the Final Design will provide an operable and usable Remedial Action. Supporting data and documentation will be provided with the design documents defining the functional aspects of the program. The scope of the technical specifications will be outlined in a manner reflecting the final specifications. The Preliminary Design will include design calculations reflecting the same percentage of completion as the designs they support.

The Preliminary Design submittal will include, as a minimum, the following:

i) Design Criteria;

ii) Project Delivery Strategy;

iii) Preliminary Plans and Specifications, including:

   a) Outline of the contract drawings and specifications,

   b) Description of the conceptual aspects of the design,

   c) Preliminary construction drawings; and

iv) Identified Permit and Regulatory Requirements.

3.5.2 Pre-Final and Final Design Submittals

The Pre-final/Final Design documents will be submitted to the NYSDEC in two parts. The first submission shall be at 95 percent completion of design (i.e. pre-final). The Pre-final Design submittal will be prepared subsequent to NYSDEC review of the 50 percent design submittal. Following NYSDEC review of the Pre-final submission, any required

revisions will be incorporated and the 100 percent Final documents complete with reproducible drawings and specifications will be submitted to NYSDEC for review and approval.

The Pre-final Design Submittal will be submitted at 95 percent completion of design and will include, as a minimum, the following:

i) Design Plans and Specifications;
ii) Draft Operation and Maintenance Plan (O & M Plan);
iii) Draft Construction Quality Assurance Project Plan (CQAPP);
iv) Draft Field Monitoring Plan;
v) Draft Construction Cost Estimate;
vi) Draft Construction Implementation Plan;
vii) Draft Construction Schedule;
viii) Draft Health and Safety Plan; and
xi) Sampling Analysis and Monitoring Plan for air, soil, groundwater and groundwater treatment system influent and effluent sample collection to be performed during construction and performance monitoring of the Remedial Action.

The Final Design Submittal will be submitted at 100 percent completion of design and will include, as a minimum, the following:

i) Final Design Plans and Specifications;
ii) Draft Operation and Maintenance Plan;

iii) Final Construction Quality Assurance Project Plan;

iv) Final Field Monitoring Plan;

v) Final Construction Implementation Plan;

vi) Final Construction Schedule; and

vii) Final Health and Safety Plan.

The NYSDEC approved Final Design Submittal shall be deemed the Remedial Design Report (RD Report). A RD Report will be submitted for each of the operable units at the Site. Components of the Final Design Submittal are further overviewed below.

A) Design Plans and Specifications

Clear and comprehensive biddable quality design plans and specifications will be prepared which will include:

i) Discussion of the design strategy and the design basis;

ii) Discussion of the technical factors of importance;

iii) Description of assumptions made and detailed justification of these assumptions;

iv) Discussion of the possible sources of error and references to possible operation and maintenance problems;

v) Detailed drawings of the proposed design;

vi) Tables listing equipment and specifications;

vii) Tables giving material balances; and

viii) Appendices including:

a) sample calculations (one example presented and explained clearly for significant or unique design calculations); and

b) derivation or equations essential to understanding the report.

B) Draft Operation and Maintenance Plan

A draft Operation and Maintenance Plan will be prepared which covers both implementation and long-term maintenance of the Remedial Action. The plan will be composed of the following elements:

i) Description of normal Operation and Maintenance (O & M);

ii) Description of potential operating problems;

iii) Description of routine monitoring and laboratory testing;

iv) Description of alternate O & M to prevent undue hazard should systems fail;

v) Corrective Action Plan;

vi) Safety Plan;

vii) Description of equipment;

viii) Records and reporting mechanisms required; and

ix) Shutdown and/or emergency notifications.

C) Construction Quality Assurance Project Plan

A Construction Quality Assurance Program Plan (CQAPP) will be prepared to ensure, with a reasonable degree of certainty, that a completed Remedial Action meets or exceeds all design criteria, plans and

specifications. At a minimum, the CQAPP will include the elements that are summarized below.

i) Responsibility and Authority;

ii) Construction Quality Assurance Personnel Qualifications;

iii) Inspection Activities;

iv) Sampling Requirements; and

v) Documentation.

D) Field Monitoring Plan

The Field Monitoring Plan will be prepared as part of the CQAPP and will include those activities identified in Items C)iii. and C)iv., above.

E) Construction Implementation Plan

The objectives and framework for the development of a construction implementation program will be identified and documented. These will include the following: review of shop drawings to confirm consistency with the RD Work Plan; submission of engineering drawings depicting all constructed facilities; construction oversight; inspection activities; and procedures for development and approval of modifications to the implementation of the Remedial Design (change orders). Also, a discussion of the pre-bid conference, pre-construction conference, substantial completion inspection and final inspection will be included.

F) Construction Schedule

A project construction schedule will be developed and submitted to NYSDEC for construction and implementation of the Remedial Actions which identifies timing for initiation and completion of all critical path tasks.

G) Construction Health and Safety Plan

A Construction Health and Safety Plan will be developed to address the activities to be performed at the Site to implement the Remedial Actions.

3.6 DESIGN PROCESS

The remedial design process for the potential components of the remedial action is overviewed in this section.

3.6.1 SVE System Design

The design of the SVE system includes location and construction of vapor extraction wells, selection of vacuum blower(s) and vacuum manifold(s), and selection of the VOC off-gas treatment system, if required.

The design of individual vapor extraction wells requires selecting a well construction that produces the appropriate radius of influence, minimizes well losses and short circuiting to the atmosphere, and minimizes well interference effects that lead to "zones of stagnation", that is, areas where airflow is very small leading to unacceptably long cleanup times. It is appropriate to define the radius of influence in terms of cleanup time; owing to the three-dimensional flow fields and curved path lines associated with vapor extraction wells, the term "hemisphere of influence" is a better description of the cleanup volume associated with each well. An SVE well's hemisphere of influence will depend upon its flowrate, screened interval, soil air permeability and anisotrophy, VOC type and distribution, required cleanup levels, and the interaction of VOCs with the soil. Flowrate at the Site, and therefore the wells' hemispheres of influence, will also be limited to an optimal value owing to the effects of diffusion.

An SVE well's hemisphere of influence can be determined utilizing the permeability and vertical anisotrophy derived from pneumatic well tests combined with analytical expressions that account for path lines and interaction of the target VOCs with site soils and water content. An analytical model will be used to evaluate the position, screened interval, and interaction of an array of vapor extraction (or injection) wells. Coupled with the VOC data generated during the design data collection activities, this evaluation will be used to plan the location of and select the suitable construction for the vapor extraction wells comprising the SVE well field. Construction of suitably located injection wells also might be indicated based on model results.

The sum of the well airflows predicted by the modelling will be used to size the vacuum (and pressure) manifold(s) connecting the wells together and also the vacuum blower(s). Pressure losses through this manifold will be accounted for by standard engineering methods and included in the selection of the blower specifications. The predicted vacuum also will be used to select the vacuum blower type. For example, regenerative blowers are limited to relatively small vacuums and could not be used if the necessary vacuum were as high as one-quarter atmosphere.

The well array resulting from this design process should be regarded as tentative and subject to refinement due to variability in Site permeability and anisotrophy. This refinement is best accomplished by installing a subset of the wells on a coarse grid, performing pneumatic tests on the wells as they are installed, and changing the locations of additional wells spacings based on the more complete permeability and anisotrophy data obtained from the pump tests.

The final component of the SVE system is to determine if a VOC off-gas treatment system is required. The determination as to whether an off-gas treatment system is needed, will require an evaluation of the amount, concentration, and type of VOCs to be captured, and will also be affected by VOC emission requirements. Catalytic incineration, activated carbon, and solvent-stripping are three possible technologies; a combination of technologies might prove to be most cost effective.

The design of the SVE system will necessarily include the design of a monitoring system for both the equipment and to track site

cleanup. This design will be influenced by Site characteristics such as soil types and VOC distribution. In general, permanent soil gas monitoring wells or probes provide the most cost effective monitoring system. Monitoring requirements will also include developing criteria for determining when remediation is complete so that the system can be shut down.

Lastly, operation and maintenance, to be included in the SVE system design, will depend on the choice of SVE equipment, well construction, and monitoring system.

3.6.2 Groundwater Extraction, Treatment and Discharge System

The groundwater extraction, treatment and discharge system will be designed based on the results of the extraction well aquifer test (Appendix D) and existing groundwater conditions.

The drawdown values observed during aquifer testing will be used to determine the hydraulic parameters of the aquifer and the degree of interconnection between the Lower Lockport WBZ, the Rochester/Lockport WBZ and the Rochester WBZ. The drawdown and recovery data will be reduced and analyzed by the methods of Theis (1935) and/or Cooper and Jacobs (1946) (see Appendix D), as appropriate. In addition, the analytical solution of Hantush and Jacob (1955) (see Appendix D) will be used to evaluate the data in order to determine the degree of hydraulic interconnection between the aforementioned water bearing zones.

The drawdown experienced by the observation wells will provide an estimate of the capture zone associated with the pumping rate.

Data from the constant-rate pumping test will be used to calculate aquifer hydraulic parameters (transmissivity, storativity) at the test extraction well (TEW2) location and to evaluate the extent of the capture zone. The drawdown and recovery data will be plotted on a distance-drawdown curve to provide an estimate of the extent of the capture zone.

The data obtained from wells screened in the Rochester and Lockport Water Bearing Zones will be utilized to determine if there is any vertical leakage from the Rochester to the Lockport WB2 or if there are any boundary effects.

The capture zone observed during the aquifer pumping test and the calculated aquifer parameters will be used to determine the number of extraction wells necessary and the appropriate spacing of each to obtain the required hydraulic containment for the Site.

The groundwater extraction system will consist of a network of extraction wells designed to capture and contain contaminated groundwater under the Site. The extraction system design process will include defining the number of extraction wells, the location of the extraction wells and the pumping rate for each well. The design may be altered as extraction wells are installed and pump tested to optimize the number and location of the required extraction wells.

The groundwater treatment system will be designed to treat extracted groundwater to meet appropriate standards in accordance with the SPDES permit. An air stripping groundwater treatment unit will be designed based on standard air stripping theory which takes into account the air stripper dimensions, packing type, groundwater flow rate, airflow rate and the chemical properties of the compounds to be treated in the groundwater. Other treatment technologies or combinations of treatment technologies including UV oxidation and liquid phase carbon adsorption will be considered.

The treated groundwater will be discharged to surface water via the construction of a new outfall.

4.0 MONITORING AND MAINTENANCE

4.1 PERFORMANCE STANDARDS

The following sections discuss the development of performance standards for the remedial systems, methods to determine the effectiveness of the remedial systems and the remedial system evaluations to be performed.

4.1.1 Development

4.1.1.1 Groundwater Extraction System

The purpose of the groundwater extraction system is to provide hydraulic containment of hazardous constituents in the bedrock groundwater at the Site, prevent the discharge of those constituents to the Niagara River and reduce the concentrations of hazardous constituents within the groundwater to acceptable State and Federal levels (if possible) consistent with the anticipated use of the property. The groundwater extraction system will be designed such that the goals are achieved to the extent practicable. The groundwater standards and criteria for Site-specific parameters are presented in Table 1.2.

4.1.1.2 Groundwater Discharge

Discharge from the on-Site groundwater treatment system will be in accordance with the SPDES criteria outlined in the modified SPDES Permit or in the Order on Consent. Discharge limits for the treated effluent will be based upon best available technology and/or professional judgement and chemical concentrations considered reasonably achievable by the approved treatment technology selected. Surface water standards and criteria for Site-specific parameters are presented in Table 1.2.

4.1.1.3 Air Emission Criteria

Discharge of soil gas from the SVE system and possibly air emissions from the groundwater treatment system will be in accordance with the air permit obtained for the operation of each system. Air emission limits for the SVE system and groundwater treatment system will be as stated in the air permit to be issued by NYSDEC. The current guideline values for Site-specific parameters are presented in Table 1.3.

4.1.1.4 Soil Treatment Levels

There are currently no standards for the remediation of soil. However, the NYSDEC technology section has reviewed pertinent data on soils and has concluded that a cleanup level of less than 10 ppm total

VOCs may be acceptable for the Site. The SVE system will be designed to achieve these cleanup levels over the shortest time period.

4.1.2 Operation Effectiveness

4.1.2.1 Groundwater Level Monitoring

The effectiveness of the bedrock groundwater extraction system will be established by implementing a groundwater level monitoring program. The purpose of the monitoring program will be to demonstrate that an inward gradient across the Site is being created and maintained by the operation of the groundwater extraction system. The groundwater monitoring program is further discussed in Section 4.2.

4.1.2.2 Sampling of Treatment System Discharge

The effectiveness of the groundwater treatment system will be determined by sampling of the effluent. Sampling of the effluent will be conducted in accordance with the criteria specified in the modified SPDES Permit or included in the Order on Consent.

4.1.2.3 Sampling of Air Emissions

Air discharges from the SVE system and groundwater extraction system will be monitored in accordance with the air permit to be issued by NYSDEC to ensure that emission limits are not exceeded. The sampling of air emissions from the SVE system will be conducted in accordance with the air permit.

4.1.2.4 Soil and Subsurface Gas Sampling

The effectiveness of the SVE system will be determined by collecting and analyzing soil and subsurface gas samples in accordance with the monitoring program discussed in Section 4.2. The analytical results of the samples will be compared to background samples collected prior to SVE system startup and the soil cleanup criteria to monitor the performance of the SVE system.

4.1.3 System Review and Re-Evaluation

The performance of the groundwater extraction and treatment systems and the SVE system will be comprehensively reviewed and re-evaluated every five years. The review and re-evaluation process will involve determining the effectiveness of the remedial systems in achieving the remedial objectives for the Site and specifying and implementing any

improvements to the system deemed necessary to improve the effectiveness of the remedial systems.

4.1.3.1 Petition to Shut Down Remedial Systems

When the remedial objectives for the Site have been achieved to the extent possible, a petition to shut down one or all of the remedial systems may be submitted to the NYSDEC in accordance with the Order on Consent.

The remediation of the groundwater at the Site will be deemed achieved if all reasonable efforts have been made to restore the groundwater quality at the Site to the levels set forth in 6 NYCRR Parts 700-705 consistent with the anticipated use of the property. It is recognized that such restoration in the bedrock aquifer may be technically infeasible. Therefore, termination of the groundwater remedial program prior to achieving State groundwater quality standards will be considered by NYSDEC if the following can be demonstrated:

- any future off-Site migration of residual groundwater chemical presence does not pose an unacceptable risk to human health and environment;
- the residual groundwater chemical presence is compatible with the anticipated future use of the Site; and
- a "zero-slope" has been reached with regard to groundwater quality improvement (i.e. continued pumping and treatment will not result in

any noticeable decrease in the concentration of chemicals in the groundwater).

Remediation of the soils at the Site will be deemed achieved if all reasonable efforts have been made to achieve the soil cleanup levels presented in Section 4.1.1.4. Termination of the SVE system prior to achieving these cleanup levels will be considered by NYSDEC if the following can be demonstrated:

- the residual chemical presence in the soil does not pose an unacceptable risk to human health and environment;
- the residual chemical presence in the soil is compatible with the anticipated future use of the Site; and
- a "zero-slope" has been reached with regard to soil quality improvement (i.e. further operation of the SVE system will not result in any noticeable decrease in the concentration of chemicals in the soil).

The criteria outlined above for termination of groundwater and soil remediation may be modified and refined based on the performance and evaluation of the respective remedial systems.

4.2 SYSTEM OPERATIONS MONITORING

The operation of the groundwater extraction and treatment system and the SVE system will be monitored to ensure that the systems are operating within design specifications and to obtain data that will

be used to determine if modifications to the systems are required to make them operate more efficiently.

Operations monitoring of the groundwater extraction and treatment system and the SVE system will include but not be limited to:

- routine monitoring and laboratory testing;
- recording operational problems;
- minor modifications to system operation; and
- reporting.

4.3 SYSTEM INSPECTION AND MAINTENANCE

A system maintenance program will be developed for each remedial system and presented in the Operation and Maintenance Plan (O&M Plan). The O&M Plan will be submitted to NYSDEC with the Remedial Design for approval. The remedial systems requiring such a program are discussed below.

4.3.1 Extraction Wells

During full-scale operation of the groundwater extraction system, all extraction wells will be visually inspected on a regular basis. Any components of the extraction wells that are damaged will be replaced or

repaired. General inspection and maintenance activities that will be performed include:

- inspection of extraction wells, piping and pumps;
- correction of operational problems; and
- repair or replacement of damaged parts.

4.3.2 SVE System Maintenance

A regular inspection and maintenance program will be developed and implemented during operation of the SVE system. Components of the SVE system that are damaged will be either repaired or replaced. General inspection and maintenance activities that will be performed include:

- inspection of extraction wells, vacuum piping and vacuum blower;
- correction of operational problems; and
- repair or replacement of damaged parts.

4.3.3 Groundwater Treatment System Maintenance

A regular inspection and maintenance program will be developed and implemented during operation of the groundwater treatment system. General inspection and maintenance activities that will be performed include:

- replacement of carbon beds (if an activated carbon system is used);
- inspection of piping, tanks, pumps, etc.;
- correction of operational problems; and
- repair or replacement of damaged parts.

4.3.4 Surface Grading Maintenance

Following completion of Site grading activities, a regular inspection and maintenance program will be implemented to ensure that the vegetative soil cap is maintained and that surface water drainage is in accordance with design specifications. General inspection and maintenance activities that will be performed include:

- repair damaged sections of the soil cap;
- fill low lying areas that may develop to prevent surface water ponding;
- remove debris from drainage ditches and swales; and
- implement measures to prevent erosion as required.

5.0 SAMPLING AND ANALYTICAL PROTOCOLS

The sampling and analytical protocols that will be used during the remedial design phase (design data collection) and the remedial action phase (operation and monitoring) are discussed in the following sections. Deviations from these protocols will be implemented, if necessary, with prior approval from the NYSDEC.

5.1 DESIGN DATA COLLECTION

The sampling and analytical protocols to be used during design data collection activities are described in the Sampling Plan provided in Appendix B and the Quality Assurance Project Plan (QAPP) presented in Appendix C. A brief discussion of the sampling activities to be performed is presented in the following sections.

5.1.1 Groundwater Sampling

Groundwater samples will be collected during the Aquifer Pumping Test and the Additional Monitoring Well Sampling discussed in Sections 2.1 and 2.3, respectively. Samples of the extracted groundwater from the Aquifer Pumping Test will be collected five times during the 48-hour pumping test. The collected samples will be analyzed for the SSPL, TAL metals and the general chemistry parameters presented in Table B.2 of Appendix B. Two rounds of groundwater samples will be collected from

additional monitoring well OW11. These samples will be collected at the same time as the current quarterly sampling of the wells northwest of the Site. The collected samples will be analyzed for the SSPL. The need for additional sampling of OW11 will be determined upon review of the analytical data from the two rounds of sampling.

5.1.2 Subsurface Soil Sampling

Subsurface soil samples will be collected during the SVE Pilot Study discussed in Section 2.2. Samples will be collected from five locations within each of Areas A,B, C and T-4 prior to the SVE pilot test and from two locations upon completion of the SVE Pilot test. Collected samples will be analyzed for the SSPL. Samples will be collected prior to the SVE Pilot Study from 18 boreholes to further delineate the extent of the soil remediation areas and to further quantify the chemical mass in these areas. Details of the subsurface soil sampling are presented in Appendix E.

5.1.3 Soil Gas Sampling

Soil gas samples will be collected during the SVE Pilot Study discussed in Section 2.2. Samples will be collected for both field analysis and laboratory analysis. Samples for field analysis will be collected and analyzed for total VOCs using a flame ionization detector (OVA). Samples for laboratory analysis will be collected using SUMMA® canisters and analyzed for the SSPL.

5.1.4 Sewer Sampling

Sediment samples may be collected during the Existing Sewer Investigation discussed in Section 2.4. Samples will be collected from all sanitary manholes containing significant quantities of sediment and analyzed for the SSPL. In addition, a water sample will be collected from the first downstream manhole off Site and analyzed for SSPL compounds.

5.2 OPERATION AND MONITORING

The sampling and analytical protocols to be used during operation and monitoring of the remedial systems will be developed during the remedial design process as described in Section 3.5. Sampling protocols will be described in the Field Monitoring Plan and analytical protocols will be described in the Construction Quality Assurance Project Plan. A brief discussion of the sampling activities that will be performed during operation and monitoring of the remedial systems follows.

5.2.1 Groundwater Sampling

Groundwater sampling will be conducted to monitor operation of the groundwater extraction system. The purpose of the sampling will be to monitor the effectiveness of the extraction system and the systems progress in achieving the remedial objectives. The results of the groundwater

sampling will also be used to determine the point when operation of the groundwater extraction system at the Site can be terminated.

Groundwater sampling will also continue at the four overburden wells northwest of the Site.

5.2.2 Soil Sampling

Soil sampling will be conducted to monitor the operation of the SVE system. The purpose of the sampling will be to monitor the effectiveness of the SVE system and its progress in achieving the established cleanup levels. The results of the soil samples will also be used to determine the point at which operation of the SVE system can be terminated.

5.2.3 Air Sampling

Air sampling will be conducted to monitor the vented gas from the SVE system and the groundwater treatment system. The purpose of the sampling will be to monitor the ambient air to ensure that ambient air criteria are not exceeded during operation of the SVE system and groundwater treatment.

Air sampling would also continue at the four overburden monitoring wells northwest of the Site.

5.2.4 Surface Water Sampling

Surface water sampling will be conducted to monitor the effluent from the groundwater treatment system. The purpose of the sampling will be to monitor the treatment system effluent to ensure that the limits specified in the SPDES permit or the Order on Consent are not exceeded.

6.0 WASTE HANDLING

The following sections present the waste handling procedures that will be implemented during the design data collection phase of the remedial design, construction/implementation of the remedial systems and operation of the remedial systems.

6.1 DESIGN DATA COLLECTION PHASE

6.1.1 Soils

Soils generated by the installation of wells and boreholes will be placed back into the borehole to the extent possible. Excess soils will be placed in 55-gallon drums, characterized and disposed of off Site at an appropriate disposal facility.

6.1.2 Groundwater

6.1.2.1 Well Development and Purge Waters

Well development and purge waters will be contained in 55-gallon drums or hazmat tankers, characterized and treated either on Site or at an appropriate off-Site treatment facility.

6.1.2.2 Aquifer Pumping Test Waters

Waters generated during the aquifer pumping test will be treated on Site. Extracted groundwater will be treated by two in-line carbon treatment units. Upstream of the carbon treatment units, provisions will be made for the collection of NAPL during the test. All NAPL collected will be contained in 55-gallon drums, characterized and treated at an appropriate off-Site treatment facility. The treated groundwater will be discharged to the existing Site outfall. Samples of the treated groundwater will be collected and analyzed for the Site-specific parameters. These samples will be collected shortly after the beginning of the test, after 12 hours, 24 hours, 36 hours and near the end of the test.

An evaluation has been performed to determine if in-line carbon units will remove chemistry from the extracted aquifer pump test water to a satisfactory level. Influent chemistry from the pump test waters has been estimated using a batch flushing model as described for alternative 11a in the document entitled "Description and Evaluation of Supplemental Remedial Alternatives", dated February 1992.

The technology evaluation indicates that the Site-specific parameters are easily removed from groundwater using carbon adsorption technology. The influent chemistry and a maximum flow rate of 16 gpm (see Appendix D) was used to determine carbon usage for the aquifer pumping test. The carbon usage during the test was estimated to be approximately 280 lbs. Carbon adsorption technology vendors have indicated that based on the chemistry present, flow rate and carbon usage that two carbon canisters in

series will adequately remove contaminants from the aquifer pump test waters.

6.2 CONSTRUCTION/IMPLEMENTATION

6.2.1 Soils

Soils generated during construction of the remedial systems will be placed in 55-gallon drums or rolloffs dependent on the quantity generated. The containerized soils will be analyzed for corrosivity, reactivity, ignitability and toxicity (TCLP testing) to determine any hazardous properties and will also be analyzed SSPL VOCs. Soils deemed non-hazardous will be backfilled on Site at a location acceptable to NYSDEC provided that the concentration of SSPL compounds are below the cleanup levels. If VOC concentrations are greater than the Site soil cleanup levels, then the soil will be shipped to an off-Site disposal facility. Soils that are deemed hazardous will be transported off Site and disposed at an appropriate disposal facility.

6.2.2 Groundwater

Groundwater generated during the construction and implementation of the remedial systems will be temporarily stored on Site in 55-gallon drums or hazmat tankers (depending on quantity generated) and then treated at the on-Site groundwater treatment facility.

6.2.3 Concrete Rubble

Concrete rubble generated during the construction and implementation of the remedial systems will either be pulverized and used as grading material or will be disposed of off Site in a sanitary landfill.

6.2.4 Equipment Cleaning and Decontamination Waters

Equipment cleaning and decontamination waters generated during construction and implementation of the remedial systems will be handled in accordance with the protocols discussed in Section 6.2.2.

6.3 OPERATION

6.3.1 DNAPL

DNAPL generated by pumping OW3-89 and the decant tank at the groundwater treatment facility will be collected and placed in appropriate secure containers. The collected DNAPL will be characterized to obtain approval for on-Site or off-Site treatment. Following approval of the NYSDEC and either the on-Site treatment vendor or the off-Site treatment facility the DNAPL will be either treated on Site or transported off Site via hazmat transport regulations and treated at the off-Site facility.

Characterization of the DNAPL will be performed as required for off-Site transportation and treatment.

6.3.2 Spent Carbon

Spent carbon generated by the groundwater treatment system or the air filters of the SVE system or air stripper will be either disposed of off Site at an appropriate landfill or will be sent off Site for regeneration. The determination as to which handling method will be used will be made based on economics and the amount of spent carbon generated.

7.0 CONTINGENCY PLAN

The Contingency Plan is presented in Appendix H. The Contingency Plan describes procedures to be followed for emergency situations at the Site. The plan is intended to provide a safe and immediate response to an emergency situation. A list of appropriate regulatory and emergency agencies to be notified during an emergency is provided in the plan. The Contingency Plan will be implemented during all remedial design and action activities. If performance of any subsequent phase of work required by the remedial design and remedial action necessitates alteration of the Contingency Plan, proposed amendments to the Contingency Plan will be submitted to the NYSDEC for review and approval.

8.0 PROJECT SCHEDULE

Figure 8.1 presents the proposed schedule for the Remedial Design and Remedial Action program for three operable units - groundwater, soil, and surface water drainage. It is intended that all three operable units be addressed under a single construction schedule. Unanticipated events may necessitate modification of the schedule as the project develops. However, Stauffer intends that delays in the schedule for one operable unit will not impact the schedule for the other operable units. Thus, for example, the groundwater program may proceed on schedule even though the SVE schedule may be lengthened. The proposed schedule may also be shortened as appropriate if activities are completed ahead of schedule.

The initiation of several activities shown in the schedule depends on prompt NYSDEC review and approval of reports and plans. Therefore, the actual schedule of several activities may require revisions, depending on the actual time required for the NYSDEC to review and approve the reports and plans, as well as the time required for any revisions that may be required by the NYSDEC.

Activities to be conducted on property owned by others, such as the NYPA and the Town of Lewiston, will require that access to the property be obtained prior to performing the work. If this cannot be accomplished in a timely manner, NYSDEC will be notified and assistance requested as necessary. However, the schedule may require modification to reflect the actual time necessary for obtaining access. Specific activities which may require access include the installation and/or sampling of monitoring wells, the installation and operation of extraction well(s), installation of an outfall to the Forebay or the Niagara Gorge for treated groundwater, conducting the SVE Pilot Study plus the installation and operation of the final SVE system for soil remediation, and grading the site to address surface water drainage.

A detailed schedule for the construction, implementation and operation of the remedial systems will be included with the 95 percent design submittal. The construction, implementation and operation activities schedule will address major construction milestones, inspection activities, sampling to be performed prior to system startup and operation activities. Routine sampling for operations and maintenance purposes to be performed during system operation will be scheduled according to the Operations and Maintenance Plan. A proposed construction, implementation and operation schedule is presented on Figure 8.1. It is noted that the actual schedule for these activities is dependent upon several factors which are unknown at this time and therefore, the schedule will be subject to change and revision as additional information is obtained during the design phase. The revised schedule will be included with the 95 percent design submittal as described above.

9.0 CITIZEN PARTICIPATION

Appendix I contains the Citizen Participation Plan which has been developed by the NYSDEC for implementation throughout the RD/RA process. The plan will be implemented by Stauffer. This plan has been designed to involve the public in the RD/RA process. Significant documents generated during the implementation of the RD/RA for the site will be made available at the public repositories identified in the Citizen Participation Plan.

- identify NYSDEC contact person (also NYSDOL and NYSDOH, if appropriate).

At the completion of Remedial Design construction activities, the contact list should be used to:

- briefly describe the Site and the remedial program;
- explain how the remedial program has mitigated problems at the Site;
- provide a brief description of the long-term operational, monitoring and maintenance requirements at the Site;
- identify who is responsible for operations, monitoring and maintenance; and
- identify NYSDEC contact person (also NYSDOL and NYSDOH, if appropriate).

During the development and implementation of an operations, monitoring and maintenance program, a Site-specific Citizen Participation Plan will be implemented. The Citizen Participation Plan has been developed by the NYSDEC and is presented in Appendix I. This Plan has been designed to involve the public in the development of the long-term monitoring, operation and maintenance program and to keep them informed throughout the program's implementation.

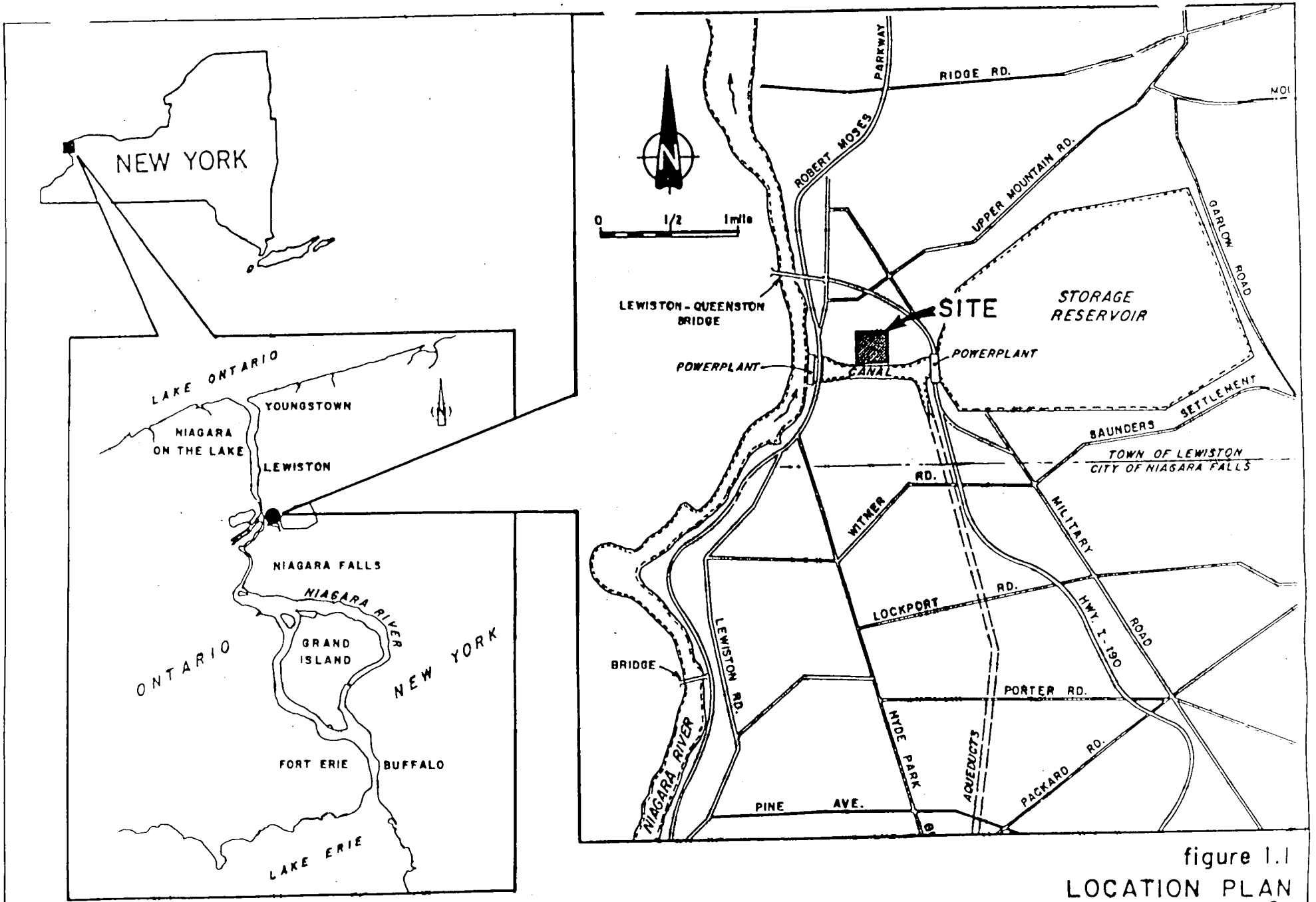

figure 1.1
LOCATION PLAN
Stauffer Management Co.

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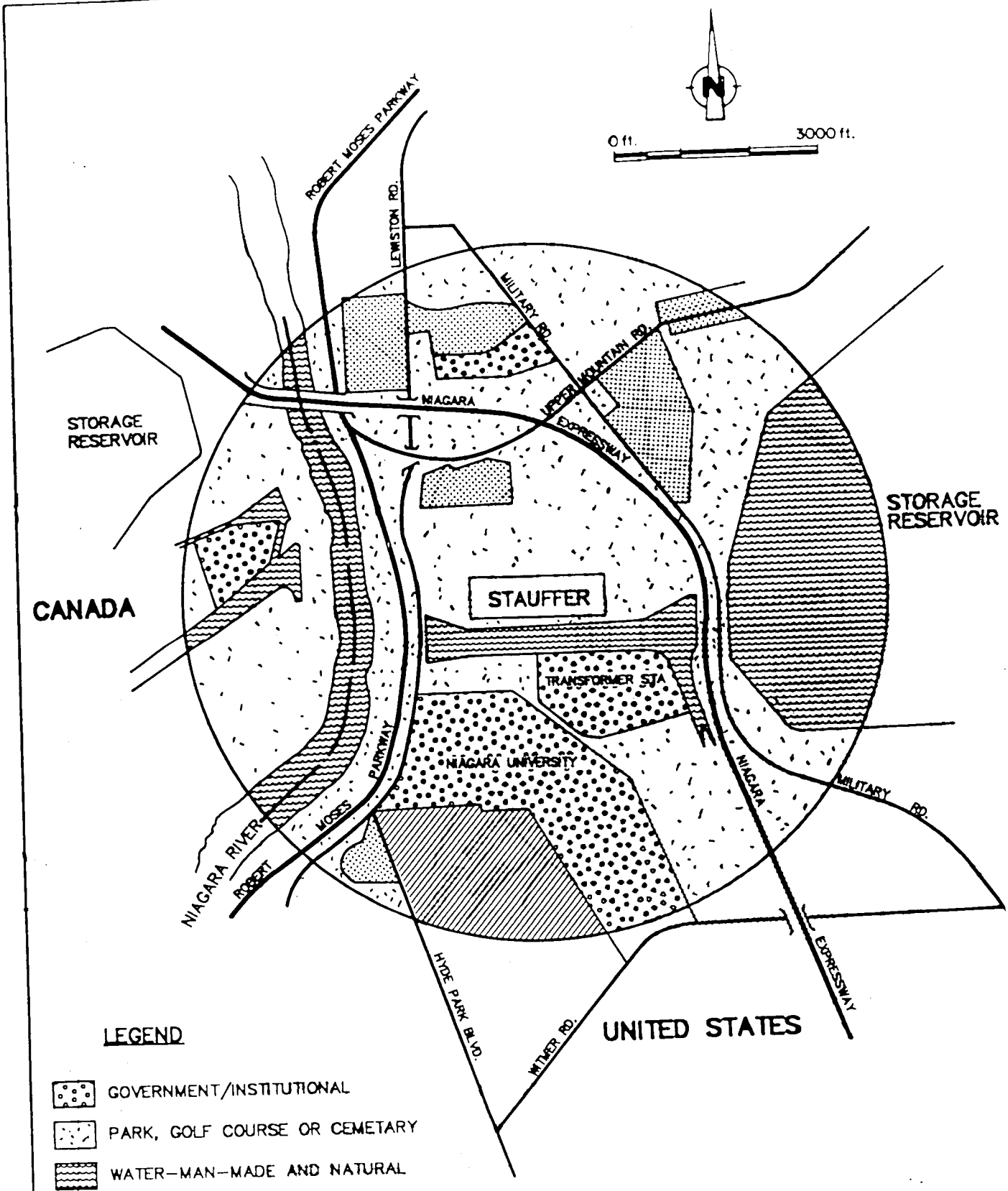

figure 1.3

SITE DEMOGRAPHY–1 MILE RADIUS

Stauffer Management Co.

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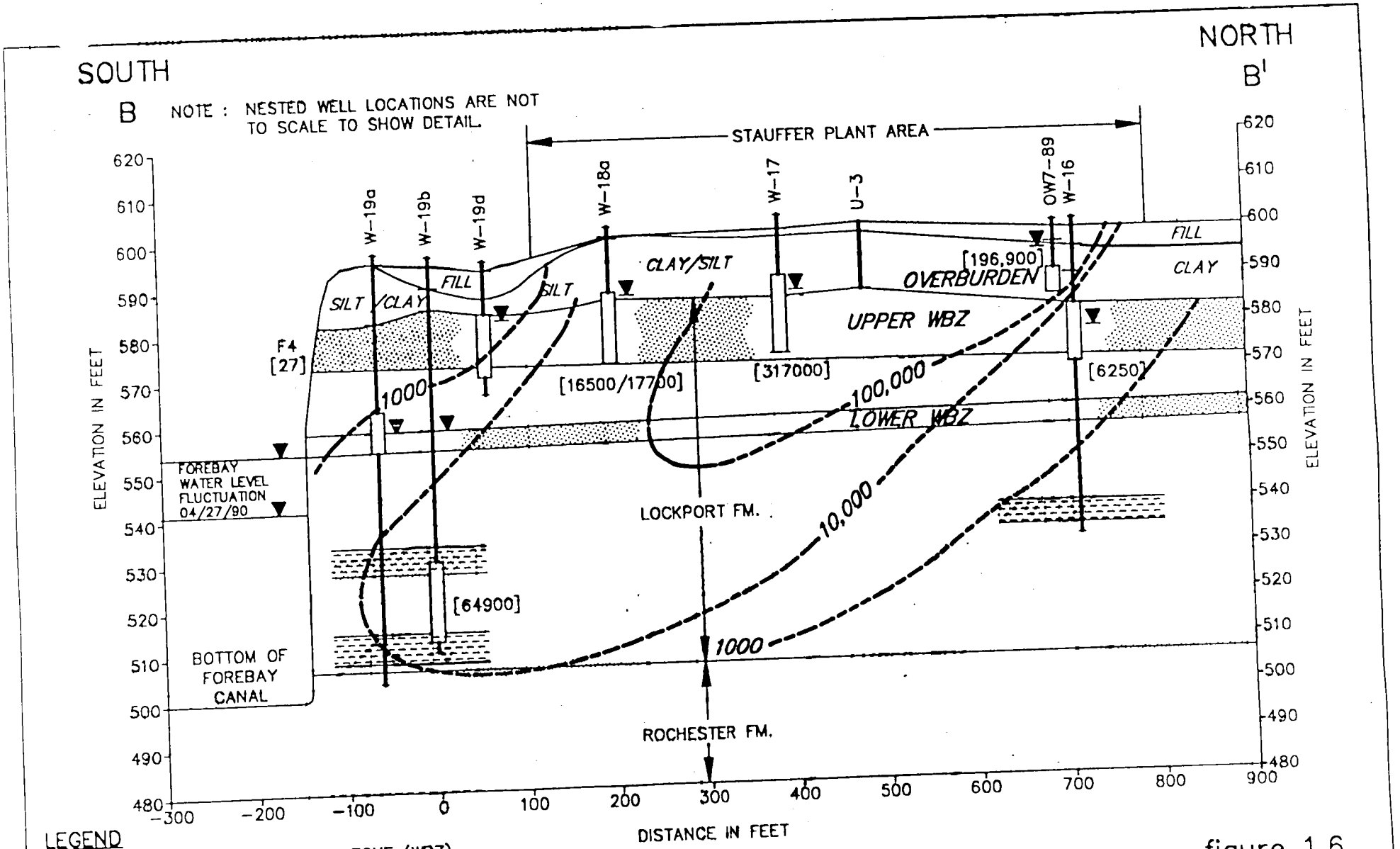
4980(1)–AUG 20/92 REV.0



LEGEND

- WATERBEARING ZONE (WBZ) (CORRELATED ZONE OF OPEN FRACTURE)
- UNCORRELATED OPEN FRACTURE ZONE
- [64900] TOTAL VOLATILE ORGANIC CONCENTRATION (ppb), 1989-1990
- *1000* ESTIMATED TOTAL VOLATILE ORGANIC ISOPLETH (DASHED WHERE INTERPOLATED)

figure 1.6

TOTAL VOLATILE ORGANIC ISOPLETHS SECTION B-B'

Stauffer Management Co.

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1000 (1) AUG 20/92, REV.0 (x-01)

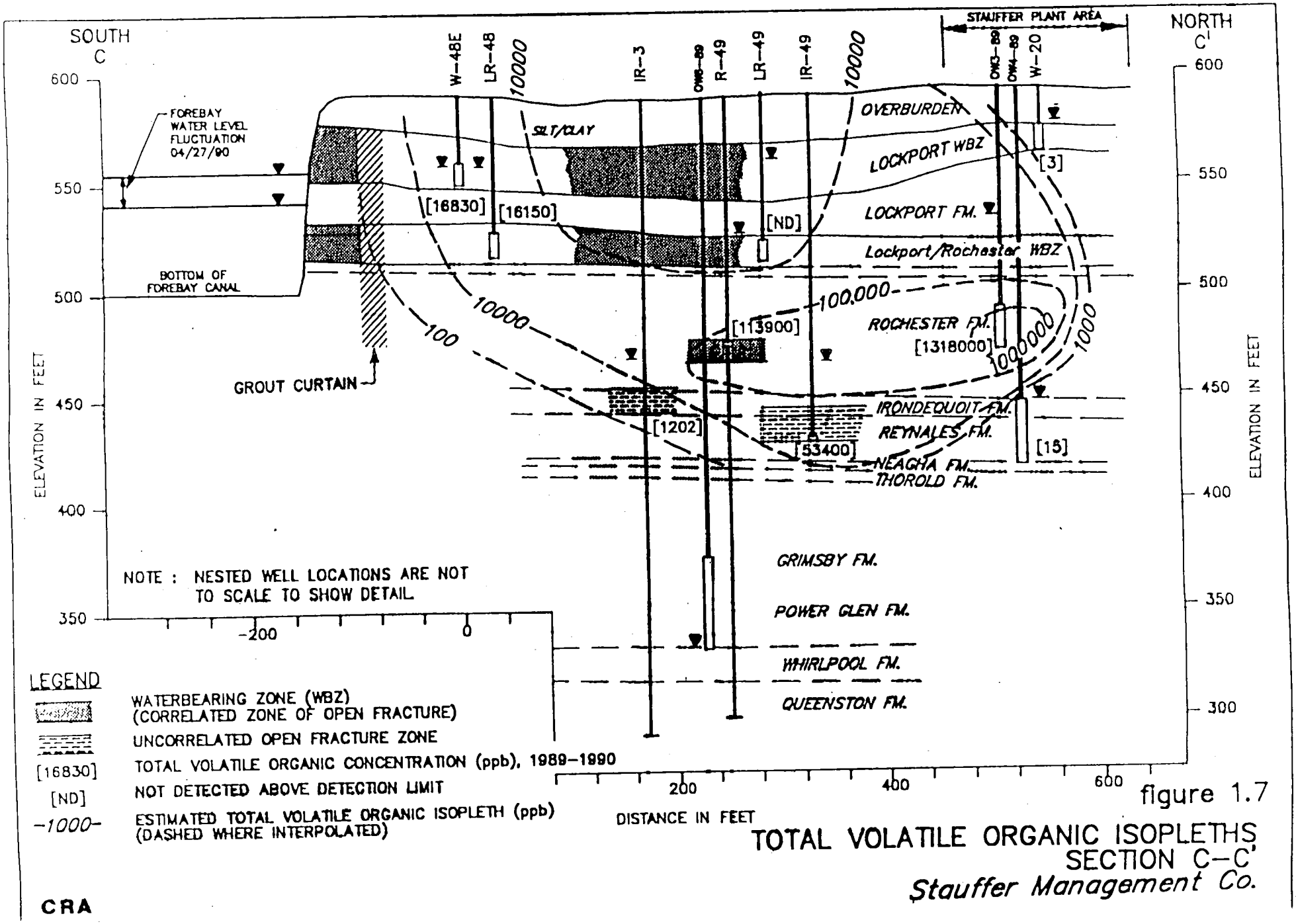


figure 1.7

TOTAL VOLATILE ORGANIC ISOPLETHS
SECTION C-C'
Stauffer Management Co.

CRA

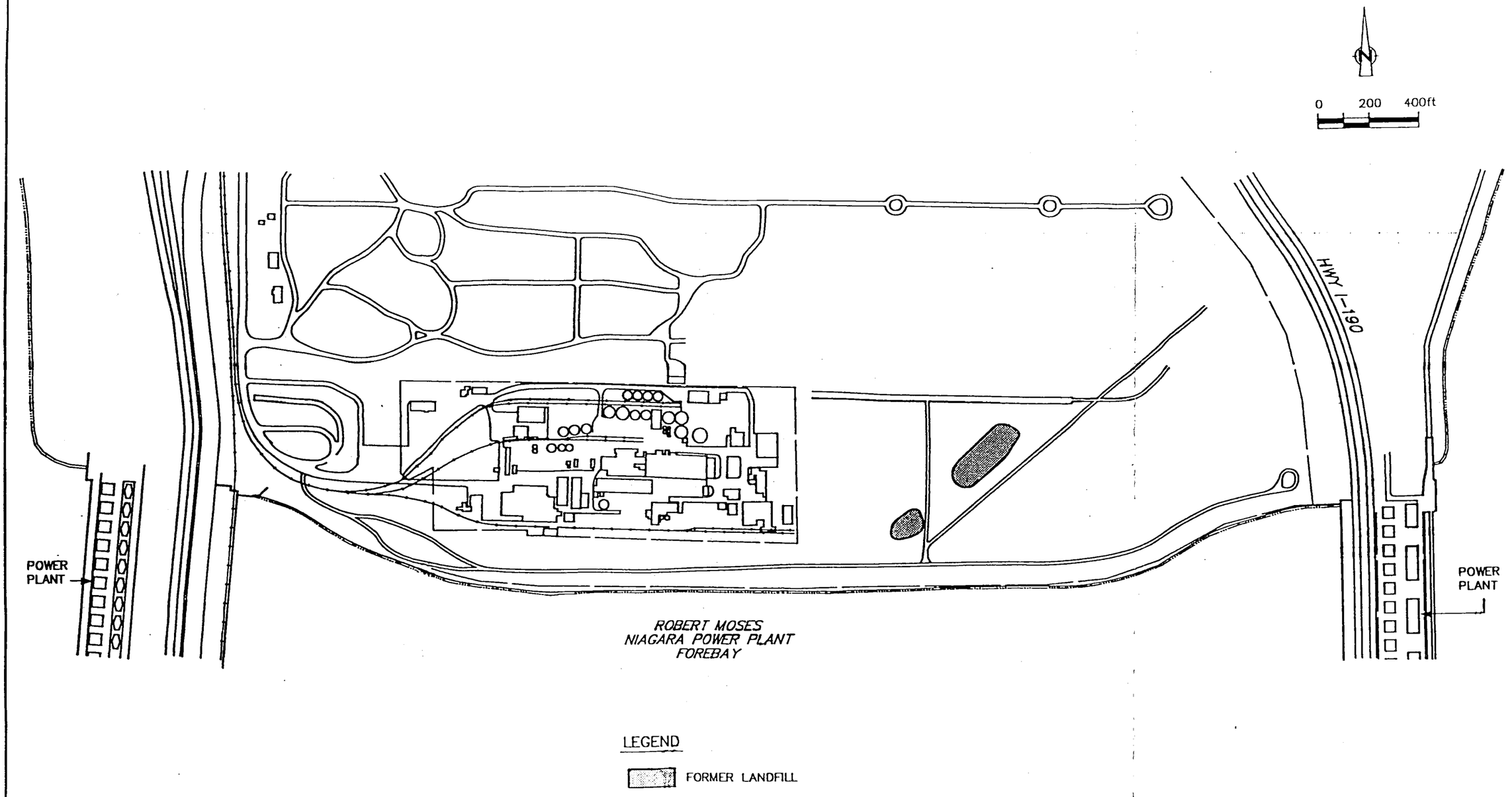


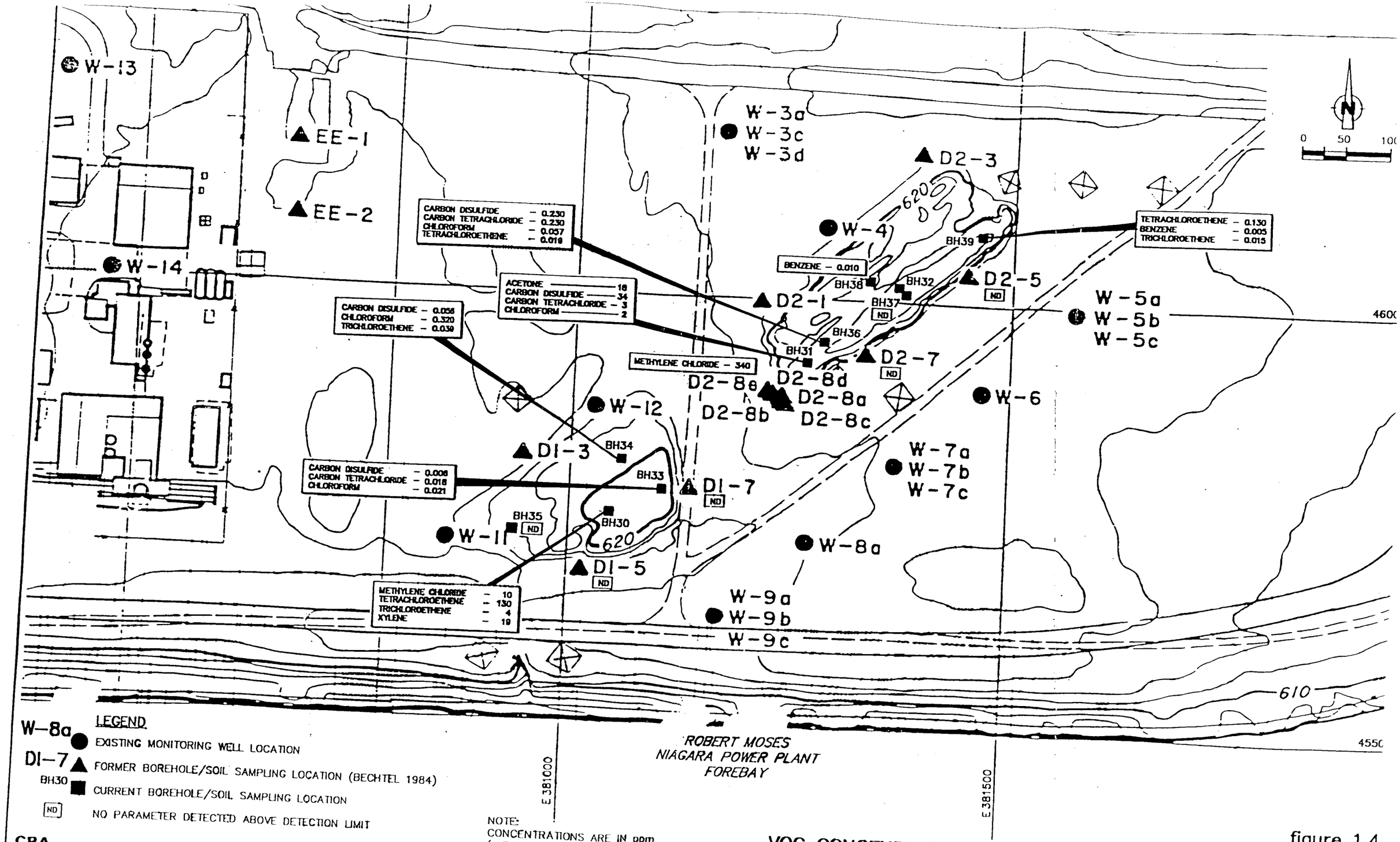
figure 1.2

SITE PLAN

Stauffer Management Co.

CRA

4980(1)-AUG 20/92 REV.0



LEGEND

NOTE:
CONCENTRATIONS ARE IN ppm
(milligram/kilogram of soil)

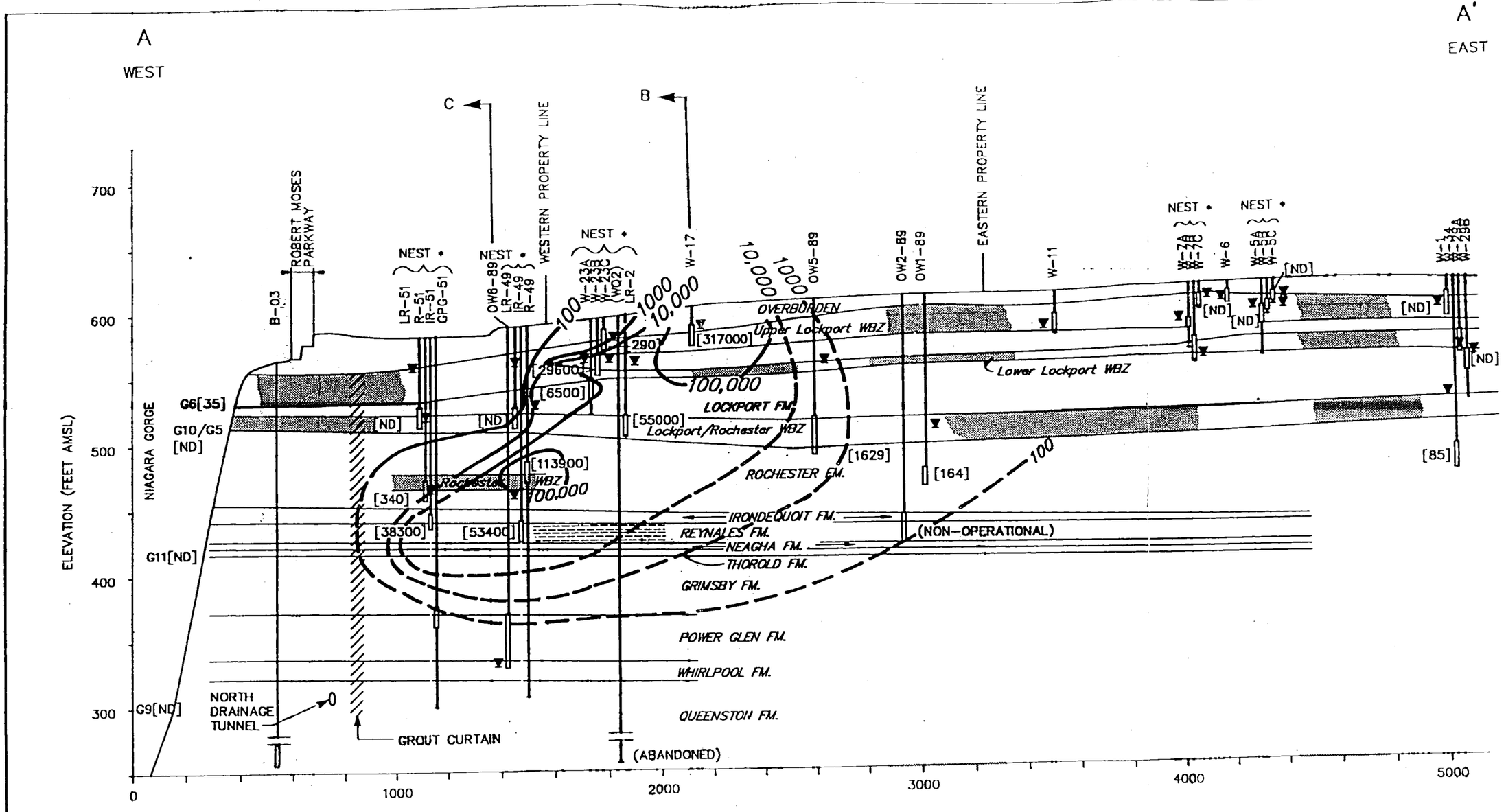
CRA

4980(1)–AUG 20/92 REV.0

figure 1.4

VOC CONCENTRATIONS IN SOIL SAMPLES – FORMER LANDFILLS

Stauffer Management Co.



LEGEND

- WATERBEARING ZONE (WBZ) (CORRELATED ZONE OF OPEN FRACTURE)
- UNCORRELATED OPEN FRACTURE ZONE
- [113900] TOTAL VOLATILE ORGANIC CONCENTRATION (ppb), 1989--1990
- [ND] NOT DETECTED ABOVE DETECTION LIMIT
- *1000* ESTIMATED TOTAL VOLATILE ORGANIC ISOPLETH (DASHED WHERE INTERPOLATED)

NOTES:

- NESTED WELLS – LOCATIONS ARE NOT TO SCALE TO SHOW DETAIL

figure 1.5

TOTAL VOLATILE ORGANIC ISOPLETHS SECTION A–A'
Stauffer Management Co.

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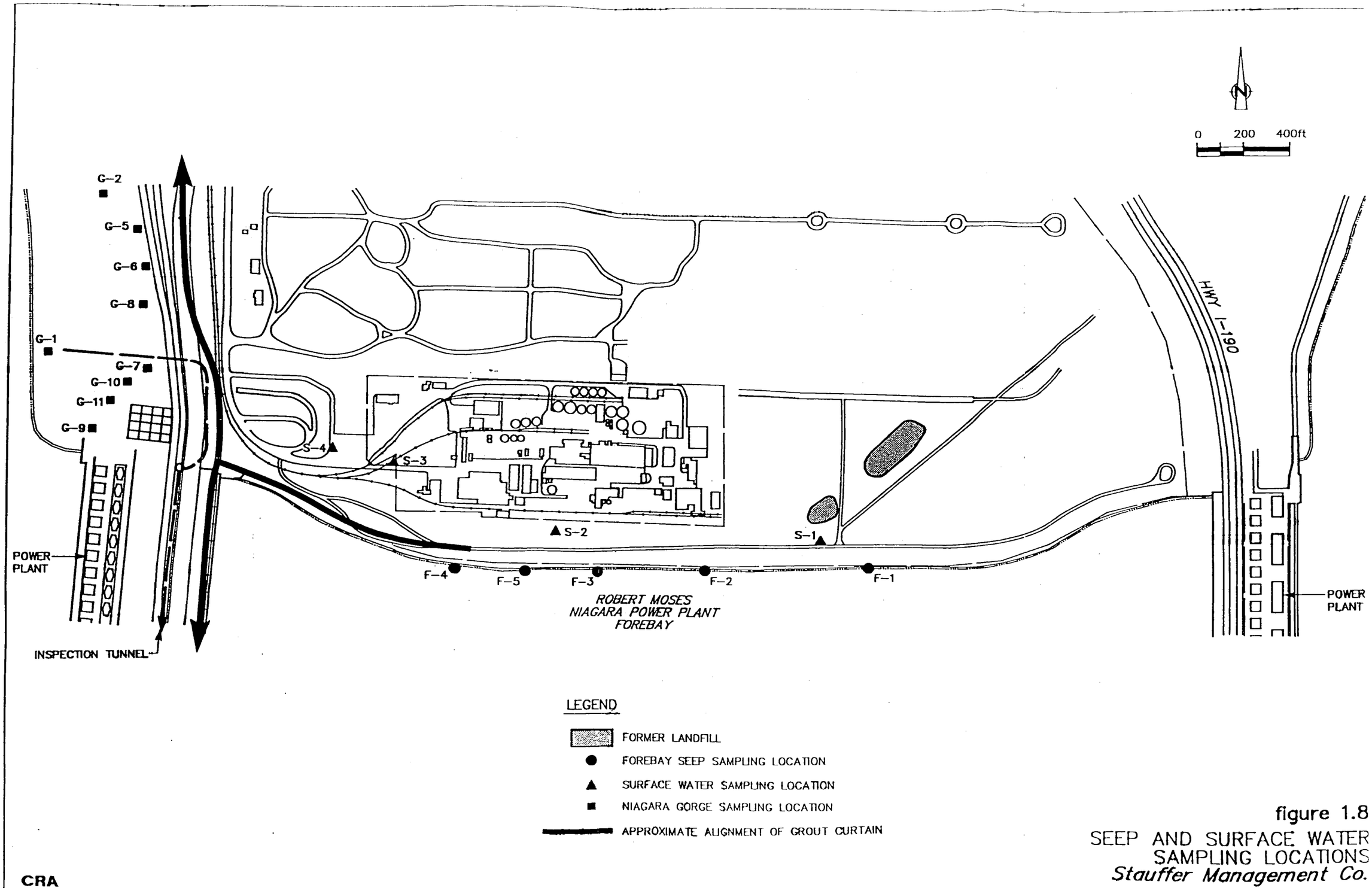
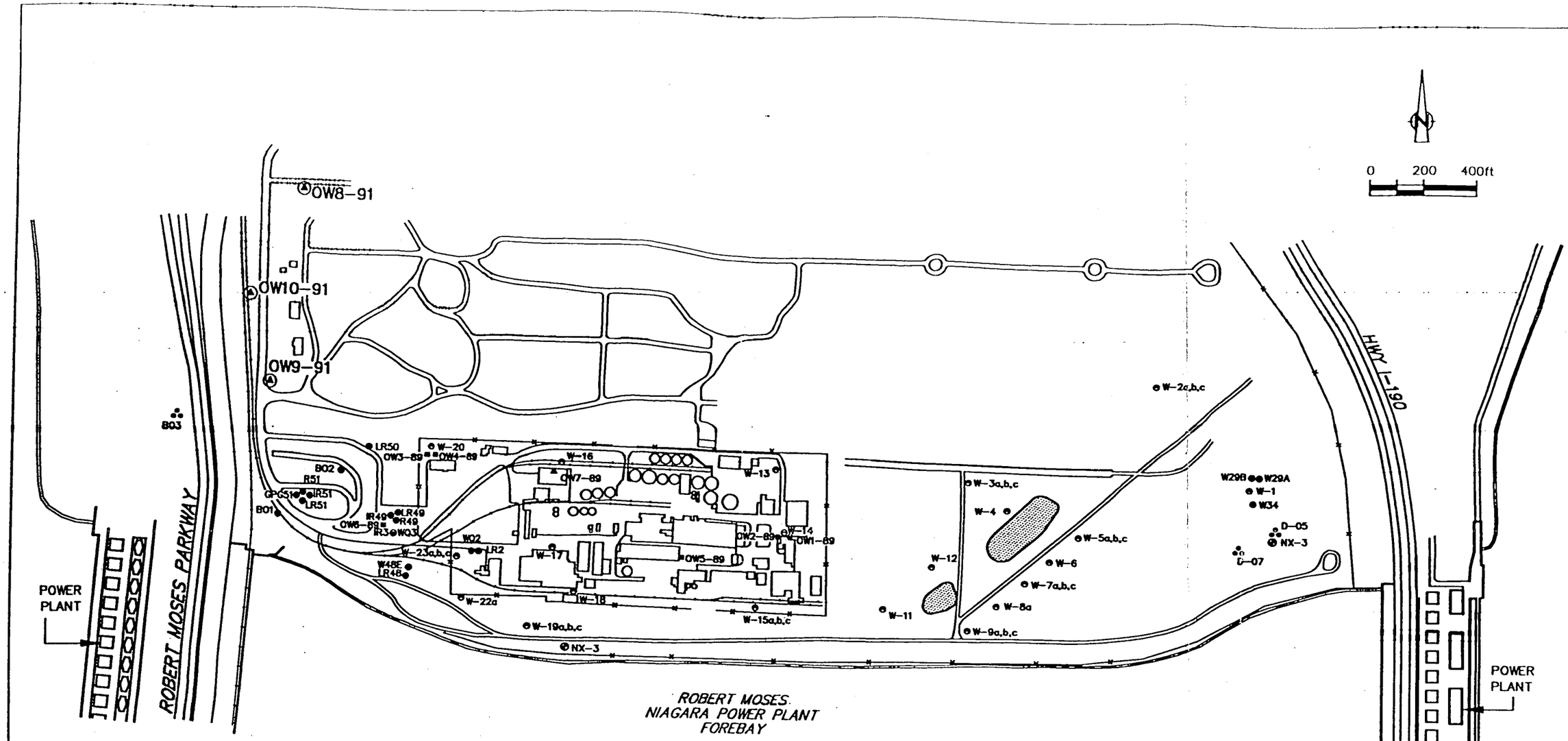


figure 1.8
SEEP AND SURFACE WATER SAMPLING LOCATIONS
Stauffer Management Co.

CRA

4980(1)–AUG 20/92 REV.0



LEGEND

EXISTING WELLS

● LR48	MONITORING WELLS, 1985–1986
⊙ W-22a	MONITORING WELLS, 1983
⁂ B03	PIEZOMETER INSTALLED BY PBQ & D.
▪	BEDROCK MONITORING WELLS, 1989
⊛ NX-3	BORINGS PREVIOUSLY DRILLED (CASED TO ROCK, OPEN HOLE IN LOCKPORT FORMATION)
▲	OVERBURDEN MONITORING WELLS, 1989, 1991
ⓐ OW10-91	OVERBURDEN MONITORING WELLS SAMPLED FOR WELL GAS

FORMER LANDFILL

CRA

4980 (1) DEC 23/92 REV.0 (P-03)

figure 2.1
MONITORING WELL LOCATIONS
WELL GAS SAMPLING PROGRAM
Stauffer Management Co.

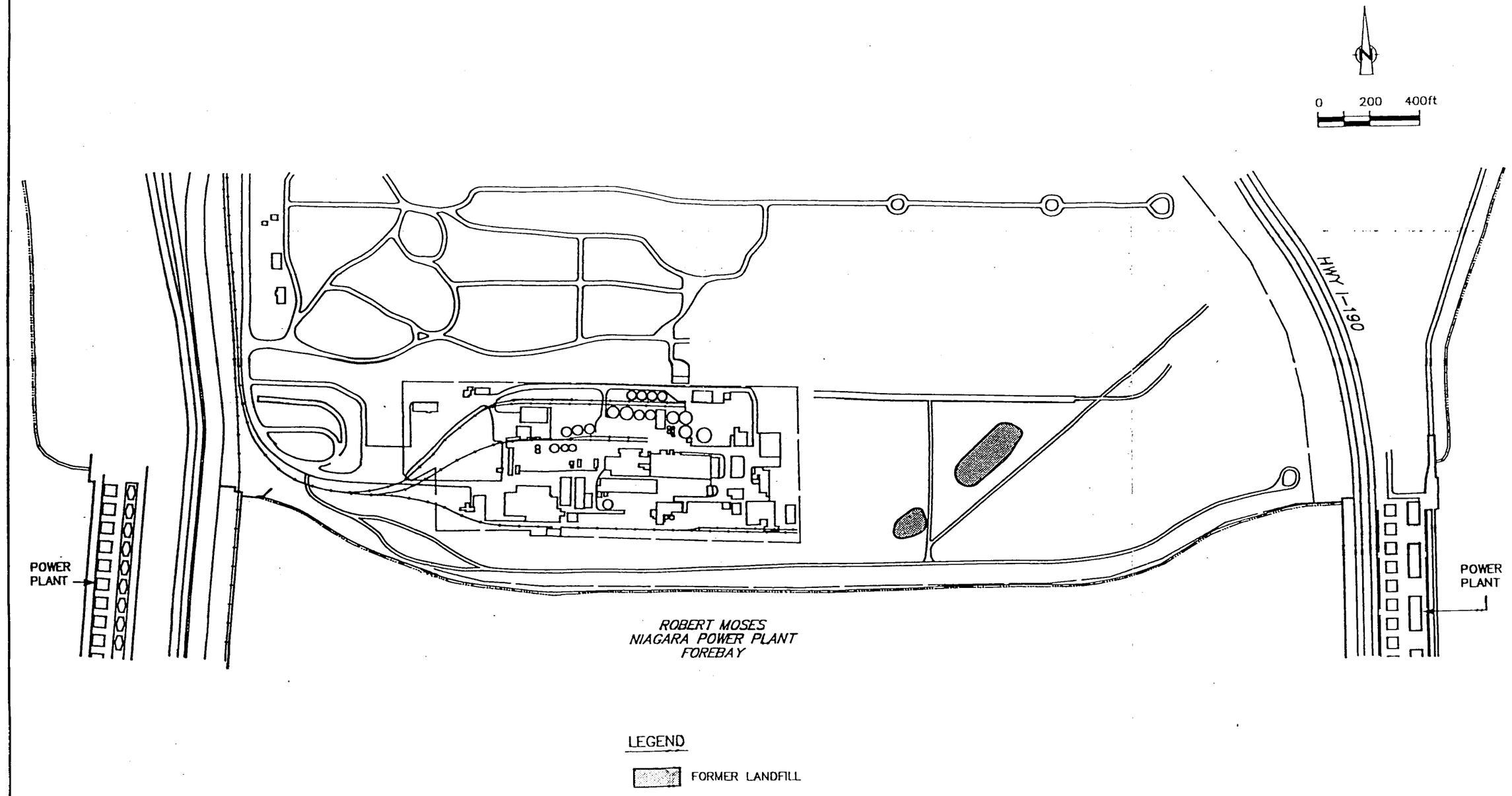


figure 1.2

SITE PLAN

Stauffer Management Co.

CRA

4980(1) AUG 20/92 REV.0