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McMahon & Mann
Consulting Engineers, P.C.

FEASIBILITY STUDY
CHEM-TROL SITE
HAMBURG, NEW YORK

Prepared for: SCA Services, Inc.
260 New Toronto Street
Etobicoke, Ontario Canada

By: McMahon & Mann Consulting Engineers, P.C.
2495 Main Street
Buffalo, New York 14214

March, 95
File: 94-022

McMahon & Mann
Consulting Engineers, P.C.
2495 Main Street • Suite 511 • Buffalo, New York 14214

Donald R. McMahon, P.E.
Michael J. Mann, P.E.
Thomas R. Heins, P.E.

March 30, 1995
File : 94-022

Mr. John Muller, P. Eng.
WMI Waste Management of Canada, Inc
260 New Toronto Street
Etobicoke, Ontario M8V 2E8
CANADA

Re: Chem-Trol Site Feasibility Study
Hamburg, New York

Gentlemen:

As requested, McMahon & Mann Consulting Engineers, P.C. has prepared the attached feasibility study report for the Chem-Trol site. This report contains modifications requested by New York State Department of Environmental Conservation in their March 17, 1995 letter.

Please call if you have any questions regarding this information.

Sincerely,
McMAHON & MANN CONSULTING ENGINEERS, P.C.

Thomas R. Heins, P.E.

Michael J. Mann, P.E.

Enclosures

Telephone: (716) 834-8932 • Fax: (716) 834-8934

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EXECUTIVE SUMMARY

The Chem-Trol site is about 17.5 acres in size and is located on Lake Avenue in the Town of Hamburg, New York. The South Branch of Smokes Creek passes through the western portion of the site and a tributary to the creek flows through the northern part of the site.

The Chem-Trol site was operated as a waste treatment and transfer facility between 1970 and 1972 when operations were moved to another location. Activities at the site resulted in soils contamination. As such soils were removed from the site in 1977 and a cover was placed over the area.

More recently, a remedial investigation was completed to assess the effect of the site on groundwater, surface water, surface water sediments, floodplain sediments adjacent to the creek and site soils. Testing done on samples collected during these studies indicated the presence of soil and on-site tributary sediments containing chemicals related to the past site activities.

Groundwater below the site contained chemicals that appear to have leached from the soils. Additionally, a non-aqueous phase liquid (NAPL) was observed in one of the wells at the site. Experience has shown that it is difficult to remove NAPL from the ground and that it serves as a persistent source of chemicals to the groundwater.

Potential human health risks were identified based upon the test data for the following conditions:

- Leaching of substances from site soils to groundwater,
- Direct contact with PCBs in surface water sediments in the on-site tributary,
- Direct contact and leaching to groundwater of PAHs in one floodplain sample and pesticides in another, and
- Ingestion of groundwater.

Compounds detected in the floodplain samples at concentrations above the remedial action objectives generally include PAH's in one sample, pesticides in the NYSDEC split of a second sample and several metals. These substances are likely to be attributable to the fill placed in this area during rerouting of the South Branch of Smokes Creek or analytical testing anomalies (in the case of the pesticides in the NYSDEC split sample). It is not believed that the compounds detected in these two samples are indicative of widespread impact throughout the floodplain area since similar concentrations of these substances were not detected in the other floodplain sediment samples. The chemicals detected in the floodplain sediments were dissimilar to the soils in the source areas. The most prevalent compounds detected in the site soils were VOCs while the floodplain sediments contained primarily PAHs. This is further indication that the chemicals in the floodplain sediment samples are attributable to the fill.

Presently there is not sufficient data to indicate a need for remediating the floodplain sediments. Rather, additional sampling aimed at confirming the presence and limits of affected materials is included in each remedial alternative discussed below. Pending the results of this analysis, the floodplain sediments may be left in place or addressed along with the other affected sediments and site soils.

The following alternatives were evaluated in detail to address the identified risks. [Please refer to the text of the report for a discussion of the alternatives screened out prior to the detailed analysis.]

ALTERNATIVE 1

This alternative is included as a basis of comparison for the other alternatives as required by New York State Department of Environmental Conservation and the Comprehensive Environmental Response, Compensation and Liability Act. This alternative does not include any active remedial work at the site. Periodic monitoring of surface water sediments, floodplain sediments and groundwater would be implemented as part of the alternative to assess changes in site conditions.

ALTERNATIVE 2

This alternative includes "hot spot" soils and on-site tributary sediment removal, deed restrictions, a fence to prevent contact with materials at the site, and monitoring to evaluate if migration of the substances in the groundwater and surface sediments is occurring from their present location. This alternative would remove the most affected and accessible material from the site and eliminate contact with the remaining affected media. The enhanced groundwater monitoring includes studies to determine the extent of affected groundwater downgradient of the site.

ALTERNATIVE 5

In this alternative, in addition to the remedial technologies listed in Alternative 2, a groundwater capture/ ex-situ treatment system would be installed. This is considered a traditional approach to remediating sites similar to Chem-Trol.

Experience with groundwater extraction at similar sites has indicated a lack of effectiveness in attaining complete site restoration. A recent study by the National Research Council in 1994 stated that groundwater pumping and treatment systems have not met the cleanup goals at any of the 42 sites contaminated with dense non-aqueous phase liquid. Groundwater pump and treat systems often act primarily as hydraulic containment systems limiting the mobility of the affected groundwater.

This alternative includes a trench drain as the means of extracting groundwater. Two methods of trench drain construction were considered, open cut trenching and directional drilling. The trench drain could be supplemented with extraction wells if it is found necessary to collect water from deeper in the bedrock.

The extracted groundwater would be treated on-site prior to discharge either to the South Branch of Smokes Creek or to the Erie County Sewer District No. 3 publicly owned treatment works (POTW).

ALTERNATIVE 6

Alternative 6 includes the components of Alternative 5 as well as upgrading the existing cap over the site soils to a minimum thickness of 1.5 feet of soil and 0.5 feet of topsoil.

ALTERNATIVE 7

This alternative includes the components of Alternative 6 along with soil vapor extraction to remove VOCs from the site soils.

A comparative analysis of the alternatives was completed utilizing New York State Department of Environmental Conservation/ United States Environmental Protection Agency evaluation criteria. This analysis indicates that Alternative 7 provides the best balance of the evaluation criteria. Alternative 1 is unacceptable because it is not protective of human health and the environment. Alternatives 2, 5, and 6 rank below Alternative 7 in short term effectiveness, long term effectiveness and reduction in toxicity, mobility and volume through treatment. Alternatives 2, 5, 6, and 7 have a similar degree of implementability . The costs for the alternatives ranged from $1,045,386 for Alternative 1 to $9,504,267 for Alternative 7.

GLOSSARY

GLOSSARY

Definitions of Significant Elements and Terms of the Remedial Program

NOTE: The first eight definitions represent major elements of the remedial process. They are presented in the order in which they occur, rather than in alphabetical order, to provide a context to aid in their definition.

Site placed on Registry of Inactive Hazardous Waste Sites - Each inactive site known or suspected of containing hazardous waste must be included in the Registry. Therefore, all sites which state or county environmental or public health agencies identify as known or suspected to have received hazardous waste should be listed in the Registry as they are identified. Whenever possible, the NYSDEC carries out an initial evaluation at the site before listing.

Phase I Site Investigation - Preliminary characterization of hazardous substances present at a site; estimates pathways by which pollutants might be migrating away from the original site of disposal; identifies population or resources which might be affected by pollutants from a site; observes how the disposal area was used or operated; and gathers information regarding who might be responsible for wastes at a site. Involves a search of records from all agencies known to be involved with a site, interviews with site owners, employees and local residents to gather pertinent information about a site. Information gathered is summarized in a Phase I report.

After a Phase I investigation, NYSDEC may choose to initiate an emergency response; to nominate the site for the National Priorities List; or, where additional information is needed to determine site significance, to conduct further (Phase II) investigation.

Phase II Site Investigation - Ordered by NYSDEC when additional information is still needed after completion of Phase I to properly classify the site. A Phase II investigation is not sufficiently detailed to determine the full extent of the contamination, to evaluate remedial alternatives or to prepare a conceptual design for construction. Information gathered is summarized in a Phase II report and is used to arrive at a final hazard ranking score and to classify the site.

Remedial Investigation (RI) - A process to determine the nature and extent of contamination by collecting data and analyzing the site. It includes sampling and monitoring, as necessary, and includes the gathering of sufficient information to determine the necessity for, and proposed extent of, remedial program for the site.

Feasibility Study (FS) - A process for developing, evaluating and selecting remedial actions, using data gathered during the RI to: define the objects of the remedial program

for the site and broadly develop remedial action alternatives and perform a detailed analysis of a limited number of alternatives which remain after the initial screening stage.

Remedial Design (RD) - Once a remedial action has been selected, technical drawings and specifications for remedial construction at a site are developed, as is specified in the final RI/FS report. Design documents are used to bid and construct the chosen remedial actions. Remedial design is prepared by consulting engineers with experience in inactive hazardous waste disposal site remedial actions.

Construction - NYSDEC selects contractors and supervises construction work to carry out the designed remedial alternative. Construction may be as straight forward as excavation of contaminated soil with disposal at a permitted hazardous waste facility. On the other hand, it may involve drum sampling and identification, complete encapsulation, leachate collection, storage and treatment, groundwater management, or other technologies. Construction costs may vary from several thousand dollars to many millions of dollars, depending on the size of the site, the soil, groundwater and other conditions, and the nature of the wastes.

Monitoring/Maintenance- Denotes post-closure activities to insure continued effectiveness of the remedial actions. Typical monitoring/maintenance activities include quarterly inspection by an engineering technician; measurement of level of water in monitoring wells; or collection of groundwater and surface water samples and analysis for factors showing the condition of water, presence of toxic substances, or other indicators of possible pollution from the site. Monitoring/maintenance may be required indefinitely at many sites.

Consent Order - A legal and enforceable negotiated agreement between the NYSDEC and responsible parties where responsible parties agree to undertake investigation and cleanup or pay for the costs of investigation and cleanup work at a site and a schedule for implementation.

Contract - A legal document signed by a contractor and the NYSDEC to carry out specific site remediation activities.

Contractor - A person or firm hired to furnish materials or perform services, especially in construction projects.

Delisting - Removal of a site from the State Registry based on study which shows the site does not contain hazardous wastes.

Potentially Responsible Party (PRP) Lead Site - An inactive hazardous waste site at which those legally liable for the site have accepted responsibility for investigating problems at the site, and for developing and implementing the site's remedial program. PRPs include: those who own the site during the time wastes were placed, current owners, past and

present operators of the site and those who generated the wastes placed at the site. Remedial programs developed and implemented by PRPs generally result from an enforcement action taken by the State and the costs of remedial program are generally borne by the PRP.

Ranking System - The United States Environmental Protection Agency uses a hazard ranking system (HRS) to assign numerical scores to each inactive hazardous waste site. The scores represent the relative risk or danger from the site.

Responsible Parties - Individuals, companies (e.g. site owners, operators, transporters or generators of hazardous waste) responsible for or contributing to the contamination problems at a hazardous waste site. PRP is a potentially responsible party.

Site Classification - The NYSDEC assigns sites to classifications established by state law, as follows:

- Classification 1 - A site causing or presenting an imminent danger of causing irreversible or irreparable damage to the public health or environment -- immediate action required.

- Classification 2 - A site posing a significant threat to the public health or environment -- action required.

- Classification 2a - A temporary classification for a site known or suspected to contain hazardous waste. Most likely the site will require a Phase I and Phase II investigation to obtain more information. Based on the results, the site then would be reclassified or removed from the state Registry if found not to contain hazardous wastes.

- Classification 3 - A site which has hazardous waste confirmed, but not a significant threat to the public health or environment -- action may be deferred.

- Classification 4 - A site which has been properly closed -- requires continued management.

- Classification 5 - A site which has been properly closed, with no evidence of present or potential adverse impact -- no further action required.

State-Lead Site - An inactive hazardous waste site at which the NYSDEC has responsibility for investigating problems at the site and for developing and implementing the site's remedial program. The NYSDEC uses money available from the State Superfund and the Environmental Quality Bond Act of 1986 to pay for these activities. The NYSDEC has direct control and responsibility for the remedial program.

Common Acronyms

ARAR - Applicable or relevant and appropriate requirement.

ATSDR - Agency for Toxic Substances and Disease Registry: A branch of the Centers for Disease Control that is responsible for preparing health assessments at sites.

CAA - Clean Air Act

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act of 1980, also known as Superfund: Amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA).

CLP - Contract Laboratory Program

CWA - Clean Water Act

DNAPL - Dense non-aqueous phase liquids

DQO - Data quality objectives: Statements that specify the data needed to support decisions regarding remedial response activities.

HSP - Health and safety plan

HOC - Hydrophobic Organic Compounds

IRIS - Integrated Risk Information System

LNAPL - Light non-aqueous phase liquids

MCL - Maximum contaminant level: Established under the Safe Drinking Water Act.

MCLG - Maximum contaminant level goal: Established under the Safe Drinking Water Act.

NAAQS - National Ambient Air Quality Standards

NCP - National Oil and Hazardous Substances Contingency Plan

NEPA - National Environmental Policy Act

NIOSH - National Institute for Occupational Safety and Health

NPDES - National Pollutant Discharge Elimination System

NPL - National Priorities List: A list of sites identified for remediation under CERCLA.

O&M - Operation and maintenance

OSHA - Occupational Safety and Health Administration

OSWER - Office of Solid Waste and Emergency Response

PAH - Polynuclear aromatic hydrocarbons

QC - Quality control

RCRA - Resource Conservation and Recovery Act

ROD - Record of Decision: Documents selection of cost-effective Superfund-financed remedy.

RPM - Remedial Project Manager: The project manager for the lead Federal agency.

SARA - Superfund Amendments and Reauthorization Act of 1986. (See CERCLA).

SDWA - Safe Drinking Water Act

SITE - Superfund innovative technology evaluation

SPHEM - Superfund public health evaluation manual

SVE - Soil Vapor Extraction

SVOC - Semi-Volatile Organic Compound

SWDA - Solid Waste Disposal Act

TBC - To be considered

TCL - Target compound list

TSCA - Toxic Substances Control Act

VOC - Volatile Organic Compound

1. INTRODUCTION

McMahon & Mann Consulting Engineers, P.C. was retained by SCA Services, Inc. to complete a feasibility study (FS) for the Chem-Trol site (NYSDEC ID Number 9-15-015) in Hamburg, New York.

The site location is shown on Figure 1. The FS is being submitted pursuant to the requirements of an administrative order on consent (index no. B9-0226-88-07) dated October 13, 1992. The FS was done in accordance with a New York State Department of Environmental Conservation (NYSDEC) approved work plan (GZA, 1992).

1.1 PURPOSE

The purpose of the feasibility study is to develop and evaluate remedial alternatives for existing or potential environmental contamination at the Chem-Trol site based upon conditions observed during the remedial investigation (RI-GZA, 1994).

The following guidance documents were used as the basis for the feasibility study:

- "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA", United States Environmental Protection Agency (EPA), October, 1988;
- "Selection of Remedial Actions at Inactive Hazardous Waste Sites", NYSDEC Technical and Administrative Guidance Memorandum (TAGM) No. 4030, May, 1990;
- "Determination of Soil Cleanup Objectives and Cleanup Levels", NYSDEC TAGM No. 4046, January 24, 1994; and
- "New York Rules for Inactive Hazardous Waste Disposal Sites", 6 NYCRR Part 375.

The site restoration process consists of the following steps.

Work Planning- A scoping process used to identify appropriate studies to assess site conditions. This work was completed and is reported in the approved work plan (GZA, 1992).

Remedial Investigations- Field studies to define the nature and extent of affected media at the site. This work is complete and is presented in the following documents:

- Chem-Trol Remedial Investigation/Feasibility Study Field Investigation Data Report, GZA GeoEnvironmental of New York, June 1993.
- Chem-Trol Site Preliminary Remedial Investigation, GZA GeoEnvironmental of New York, March 1994.
- Chem-Trol Site Remedial Investigation Report, GZA GeoEnvironmental of New York, November 1994.

Feasibility Studies- Data collected during the remedial investigation is analyzed to consider appropriate methods to remediate the site in accordance with applicable laws and regulations. This work is reported herein.

Remedial Design- Plans and specification for the chosen remedial alternative are prepared.

Remedial Action- The chosen remedial alternative is implemented.

Copies of the reports listed above are made available for review by NYSDEC.

1.2 ORGANIZATION OF REPORT

This feasibility study report is organized following NYSDEC and United States Environmental Protection Agency (EPA) guidance (NYSDEC, 1989 and USEPA, 1988). This report contains the following sections.

1. INTRODUCTION: presents the purpose of the study and the role of community involvement.

2. SITE CHARACTERISTICS: contains a summary of the history, physical conditions, nature and extent of contamination and potential risks at the site as known through the remedial investigation (GZA, 1994).

3. IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES: considers methods that may be appropriate for mitigating the potential site risks, eliminating those that are not likely to be effective or implementable.

4. DEVELOPMENT AND SCREENING OF ALTERNATIVES: combines the remedial technologies addressing the different media at the site into remedial alternatives that each address the entire site.

5. DETAILED ANALYSIS OF ALTERNATIVES: presents an evaluation of each alternative using criteria developed by NYSDEC.

1.3 COORDINATION WITH THE PUBLIC

This work is being done under an agreement between SCA Services, Inc. and the NYSDEC in accordance with an approved work plan (GZA, 1992) and 6 NYCRR Part 375. NYSDEC requires that citizens who are interested in a site be given an opportunity to participate in the remedial program. As such, a citizen participation plan was prepared for this work (GZA, 1993) describing the manner by which public involvement would be sought.

2. SITE CHARACTERISTICS

This section contains a summary of the site conditions, a description of the surficial and subsurface conditions, and the nature and extent of affected media. This discussion is based upon information in the remedial investigation (GZA, 1994).

2.1 SITE HISTORY

The following is a brief summary of the site history. Please refer to the RI for further discussion.

Based upon available correspondence and reports, Chem-Trol purchased the site in October 1969 and began operations in the Spring of 1970. The Chem-Trol facility occupied the portion of the site approximately bounded by Lake Avenue to the south, the property line to the east, the on-site tributary of the South Branch of Smokes Creek to the north and the South Branch of Smokes Creek (original location, see Figure 2) to the west.

A 1972 aerial photograph indicates that the former active area contained four surface impoundments. The 1972 aerial photograph also depicts the South Branch of Smokes Creek being rerouted from a former alignment closer to the former active area to its current flow path (see Figure 2).

Newspaper articles (Buffalo Evening News, July 29, 1972 and Courier Express, July 30, 1972) and other correspondence indicate a fire occurred at the site on July 29, 1972. Subsequent inspection reports prepared by Erie County Department of Health (ECDOH) state that water used in the control of the fire was temporarily contained in the bed of the former South Branch of Smokes Creek.

Following the fire, operations at the Chem-Trol site were halted. Closure operations at the site apparently continued for a period of several years. These operations reportedly included: the transfer of waste materials to a NYSDEC approved facility; dismantling and removal of equipment; and drainage and treating the on-site lagoons with ferro-lime to neutralize the contents and then backfilling the lagoons with slag.

In 1977 Chem-Trol completed an interim remedial measure (IRM) at the site. As part of the IRM, 2,562 cubic feet of soil was reportedly removed from the site and a 2 foot thick cover was placed over the operational area and seeded. An October 3, 1977 letter from the Erie County Department of Health to Chem-Trol states that the site had been inspected and was found to be covered, graded and seeded.

2.2 SITE DESCRIPTION

2.2.1 Surface Water

Two surface water bodies are located on the Chem-Trol site, including the South Branch of Smokes Creek and the unnamed on-site tributary to the South Branch of Smokes Creek (see Figure 2). The South Branch of Smokes Creek originates near the Village of Orchard Park, approximately 4 miles southeast of the site (see Figure 1). NYSDEC has classified the South Branch of Smokes Creek as a Class C surface water indicating a best usage as "suitable for fishing and all other uses except as a source of drinking water." The on-site tributary to the South Branch of Smokes Creek flows generally flows from east to west through the northern portion of the site (see Figure 2). The on-site tributary collects surface runoff from the railroad track area, the Electro Abrasives property (located north of the site) and the northern portion of the site.

2.2.2 Subsurface Conditions

The majority of the natural soils in the vicinity of the site were deposited by glacial processes during Pleistocene time about 10,000 to 15,000 years ago. Typically, soils to the north of the site are part of the Lake Erie plain. These soils were generally deposited by glacial lakes and they consist of interbedded clay, silt and fine sand. Areas south of the site are part of the Allegheny plateau consisting of non-sorted till deposits of dense silt, clay, sand and gravel. It is reported that groundwater wells in these deposits typically yield less than 10 gpm (LaSala, 1968).

The bedrock unit in the vicinity of the Chem-Trol site is the Ludlowville Formation of the Hamilton Group. This rock consists primarily of shale with occasional limestone and sandstone seams. Literature on geologic conditions indicates that the Ludlowville formation is 65 to 130 feet thick (LaSala, 1968).

Groundwater within the shale generally occurs along the thin vertical and horizontal openings, (joints and bedding planes) rather than through the rock mass. Water yields from wells within the bedrock have been reported to range from nearly zero to about 40 gallons per minute (gpm) where limestone is present (LaSala, 1968). In general, bedrock well water yields range from about 10 to 15 gpm.

The subsurface conditions at the site were investigated through test borings, test pits and hand auger probes. Test borings at the monitoring well locations are presented on Figure 3. Hand auger probes were made across the site on a grid pattern and their locations are shown on Figure 4. The hand auger probe locations are identified by their northing and easting/westing distances off of a site-specific baseline. Test pit locations are shown on Figure 5.

The subsurface materials at the Chem-Trol site consists of topsoil overlying miscellaneous fill or glacial deposits followed by bedrock. A conceptual cross-section is presented on Figure 6.

Three types of fill were encountered at the site. These fill materials include a slag-like material, a white-gray chalky material and soil fill.

A soil fill consisting of dark brown silty clay containing lesser amounts of sand and gravel, metal, and wood was encountered at various boring and auger probes located over much of the area investigated. At several locations, the thickness of this material was greater than 5 feet, particularly in the southern portion of the site (south and west of the 4800 Lake Avenue building) and along the western and northern slopes of the formerly active portion of the site. This is believed to be the fill cover placed over the site following closure of the lagoons.

Four to six feet of soil fill (generally clays and silts) were also found to be immediately overlying bedrock at test boring locations within the low lying area to the east of the South Branch of Smokes Creek (i.e., MW-8R, MW-9R, MW-10R and MW-14R on Figure 3). It is believed that this material was placed during the re-routing of the South Branch of Smokes Creek.

Glacial till deposits were encountered below the fill in each of the test borings except those made in the low lying area east of the South Branch of Smokes Creek. The thickness of the glacial deposits, where encountered, varied between 9.5 and 16.2 feet thick. The deposits consisted primarily of silt and clay with varying amounts of sand and gravel. In general, the sand and gravel content of the till tends to increase with depth. Near the bedrock contact, the soils contained a greater sand and gravel fraction with lesser amounts of silt and clay. The thickness of the coarser till material ranged from 0.5 feet to 4.7 feet.

As stated previously, the bedrock underlying the Chem-Trol site is part of the Ludlowville Formation. Rock core samples from the site are generally described as gray, medium to hard, slightly to moderately weathered shale with very thin to thin bedding (i.e. breaks along bedding planes spaced from less than 2 inches to about 2 feet). The Ludlowville Formation is reportedly 130 feet thick in the vicinity of the Chem-Trol site and consists of the Wanakah and Ledyard Members (Kloc, 1983). A geophysical survey done across the site suggested that the upper 25 to 30 feet of the shale was more weathered (GZA, 1991).

Based on test boring data, the bedrock surface slopes downward to the west toward the South Branch of Smokes Creek. Bedrock elevations observed at the site range from about El. 630 feet NGVD at MW-7R to about El. 609 feet NGVD at MW-13R west of the South Branch of Smokes Creek and about El. 624 feet NGVD at MW-6R near the on-site tributary.

Monitoring well MW-9RD was drilled to a depth of 68 feet below the ground surface (El. 549 feet NGVD), providing deeper rock information. Weathered shale was observed from about 6 feet to 28 feet below the ground surface (about El. 611 to El. 589 feet NGVD). From about 28 feet to 38 feet, the shale is more competent, as indicated by the higher rock quality designation (RQD) values that range from 90 to over 92 percent. Fractures within this depth are typically high angle and are filled with calcite through secondary mineralization. Below this zone, the shale had lower RQDs (25% to 60%) and exhibit fresh to moderately weathered fractures.

As noted above, MW-9RD encountered approximately 22 feet of weathered shale overlying competent shale. The geophysical survey mentioned above suggested about 26 feet of weathered shale existed in the area of MW-9RD. Thus the information obtained

from MW-9RD confirms the subsurface conditions indicated by the geophysical data (i.e., 25 to 30 feet of weathered shale overlying competent shale).

2.2.3 Groundwater Conditions

Groundwater flow at and in the area surrounding the Chem-Trol site is controlled by the topography and the soil and rock conditions. These materials include surficial soils such as topsoil and/or miscellaneous fill; glacial till soils; the weathered shale; and the more competent shale below. Refer to the conceptual cross-section in Figure 6.

Based on subsurface explorations, it appears that groundwater flow generally occurs within the lower, more granular glacial till soils, the weathered shale and the competent shale. It is our opinion that the shallow/local groundwater flow at the site is generally the result of recharge within the South Branch of Smokes Creek watershed to the southeast of the site. It is believed that the creek is the discharge point for groundwater in the watershed to the east and west of the creek based on the topography of the area. The subsurface data indicates that the groundwater flow at the site discharges to the South Branch of Smokes Creek.

Recharge to the groundwater system occurs as vertical infiltration through the surficial soils and glacial till. As the recharging infiltration reaches the lower glacial till, it flows along the top of rock to vertical fractures where it enters the more permeable weathered shale.

It is believed that the groundwater flow direction in the weathered shale is primarily horizontal due to its higher hydraulic conductivity relative to the overlying till and the underlying competent shale. Flow is towards the South Branch of Smokes Creek. Flow in the weathered shale is believed to be the primary flow path across the site due to its relatively high permeability. Based on the hydraulic gradients observed at the site and the hydraulic conductivity of the weathered shale, it is estimated that more than 80 percent of the water that passes across the site originates as upgradient flow in the weathered shale (GZA, 1994).

The relatively low hydraulic conductivity of the underlying more competent shale limits the amount of water that can pass through it. The head in the competent shale was

measured at well MW-9RD to be El. 614.3 feet NGVD and the head in the weathered shale at MW-9R was El. 610.9 feet NGVD on June 16, 1994 (refer to Figure 3 for well locations). These groundwater elevations indicate that the groundwater flow was upward from the more competent deeper shale into the shallower weathered shale in the vicinity of well cluster MW-9. This is consistent with conditions that would be expected at a groundwater discharge location.

2.2.4 Land Use

The Chem-Trol site is located within the Town of Hamburg, New York, in Southern Erie County. The Chem-Trol property is located within an urban setting in Hamburg. Zoning maps of Erie County show that there are various industrial zones around the site including heavy and general industrial zones to the north and general and light industrial zones to the east. According to the Erie County DEP Planning Division, the Chem-Trol site does not lie within an agricultural district.

2.2.5 Groundwater Use

The residences in the communities surrounding the site are serviced by public water supplied by Erie County Water Authority pumped from the Niagara River. Based upon conversations with representatives of the Town of Hamburg, Erie County Health Department, and Erie County Water Authority, groundwater is not used as a source of drinking water within three miles of the site. One well used for irrigation was reported to be located about 1 mile northwest of the site.

2.2.6 Ecological Resources

Habitat diversity at the Chem-Trol site is enhanced by the South Branch of Smokes Creek and the on-site tributary as well as the low lying area in the western portion of the site. Wildlife is represented by bird and small mammal species. However, a review of significant fish and wildlife habitat maps provided by the ECDEP do not indicate major fish or wildlife populations in the area. The NYSDEC has also stated that the site is not affected by any known significant habitat or threatened or endangered species.

A review of New York State Protected Waters maps provided by Erie County Department of Environment and Planning (ECDEP) indicates that there are no NYS protected waters

in the area of the Chem-Trol site. However, navigable waters maps of the U.S. Army Corps of Engineers indicate that the South Branch of Smokes Creek is a federally designated navigable waterway.

New York State Protected Plant Habitat maps provided by the ECDEP indicate that the Chem-Trol site lies within a calcareous bedrock region where a calciphilic species of plant life may occur on steep slopes and rock outcrops. The NYSDEC information indicated that Harbinger-of-Spring was found about 2 miles from the site. However, the existence of these species at the Chem-Trol site has not been identified. The data suggests that, while no known habitats are present on-site, some endangered plants have been identified near the site. Prior to remedial work on the site, a detailed review of species on the site may be warranted depending on the type of work proposed.

Flood maps developed by the Federal Insurance Administration (FIA) indicates that portions of the Chem-Trol site east and west of Smokes Creek lie within the 100 and 500 year floodplain.

A review of National Wetlands Inventory (NWI) maps provided by the U.S. Department of the Interior, Fish and Wildlife Service indicates that Smokes Creek is designated as a federal wetlands and that the federal regulatory agency with jurisdiction over wetlands may define and describe the area in a different manner.

2.2.7 Meteorology

The climate in the vicinity of the site and Erie County is typified by moderately warm summers and cold, snowy winters. The county is bound to the west by Lake Erie, which impacts the weather conditions at the site. Information supplied by the Town of Hamburg indicates the average temperature in January is 23.5°F and in July 70.7°F. The average annual rainfall is reported at 37.5 inches. The annual average snowfall is 100 inches.

2.3 NATURE AND EXTENT OF CONTAMINATION

The following sections describe the types of compounds present in the site soils, surface water, surface water sediments, floodplain sediments and groundwater at the site.

Impacted or affected media were identified in the RI by comparing test results for the samples to NYSDEC criteria (e.g., NYSDEC, 1994 and 6 NYCRR Part 704).

2.3.1 Site Soils

Soil testing reported in the RI included 25 samples submitted for laboratory analytical testing; 86 samples screened in the field for selected VOCs; and 77 samples screened in the field for PCBs. Sample locations are shown on Figure 4. The analytical testing indicated the presence of a variety of volatile organic compounds (VOCs) and to a lesser extent semi-volatile organic compounds (SVOCs), pesticides, and metals. These compounds are believed to be residuals left behind after the 1977 removal action.

The extent of soils containing these compounds is shown on Figure 4 . The affected soils cover an area of about 2 acres. The western part of the 2 acre area corresponds approximately to the portion of the site where two of the former surface impoundments were located. The eastern part of the 2 acre area corresponds to the approximate location of a former drum staging pad. The depth of affected soils varied from 5 feet to greater than 8 feet.

Compounds detected in samples from the affected site soils include:

- methylene chloride (0.002 mg/kg to 8.9 mg/kg),
- 1,1,1 trichloroethane (0.004 mg/kg to 8.8 mg/kg),
- trichloroethene (0.002 mg/kg to 8.7 mg/kg),
- phenol (0.051 mg/kg),
- benzo(a)pyrene (0.23 mg/kg to 3.0 mg/kg) and
- PCBs (0.85 mg/kg to 13.9 mg/kg).

The distribution of VOCs was sporadic across the area of affected soils with no discernible pattern. This distribution is consistent with the site history that indicates that more highly contaminated soils were removed and the remaining material was graded across the area.

One "hot spot" was identified within the area of affected soils at sample location SSI-2 (4 to 5 feet) collected from one of the former surface impoundments. The suite of compounds detected at this location was dissimilar to the other sample locations. Sample SSI-2 contained:

- VOCs- 40 mg/kg
- SVOCs- 461 mg/kg
- Pesticides- 50 mg/kg
- PCBs- 1,820 mg/kg,

Specific compounds detected include 120 mg/kg phenol, and 150 mg/kg 1,2,4 trichlorobenzene among other compounds. Other samples collected in the same area did not contain similar concentrations of these substances. A sample was collected for PCB field screening within 10 feet of location SSI-2. This sample only contained 2 mg/kg PCBs. Additionally, a sample collected within 50 feet of SSI-2 that was tested by the analytical laboratory contained 2.4 mg/kg PCBs, 0.180 mg/kg of 1,2,4 trichlorobenzene and phenol was not detected. Therefore, it appears that the conditions observed at SSI-2 have a limited extent and this area will be treated as an isolated "hot spot".

2.3.2 Surface Water Sediments

Nine surface water sediment samples were collected in 1990 and 12 samples were collected in 1993 as part of the RI. These sample locations are primarily spaced along the South Branch of Smokes Creek and the on-site tributary. One sample, SWS-12, was collected from a seep observed along the western slope of the site. Sample locations are shown on Figure 5. Sample locations SWS-1, SWS-3, SWS-4 and SWS-5 are upgradient or upstream of the site and representative of background conditions.

The RI sampling identified an area of affected sediments along the on-site tributary to the South Branch of Smokes Creek. This area extends from sample location SWS-8 to SWS-6 as shown on Figure 5. Samples from this area primarily contained PCBs and low concentrations of VOCs and SVOCs. Compounds detected include PCB (0.94 mg/kg to 2.8 mg/kg), acetone (0.011 mg/kg to 0.53 mg/kg), bis (2-ethylhexyl), phthalate (0.1 mg/kg to 0.88 mg/kg), and benzo(a)pyrene (0.07 mg/kg to 1.1 mg/kg).

Samples of the South Branch of Smokes Creek sediment did not indicate impact by the site.

Analytical test results for SWS-12 indicated impact by metals, primarily iron and lead.

2.3.3 Surface Water

Surface water samples were collected from eight locations in 1990 including SW-1, SW-2 and SW-9 from the South Branch of Smokes Creek and SW-4, SW-5, SW-6, SW-7 and SW-8 from the on-site tributary (see Figure 5). Location SW-3 could not be sampled since standing water was not present at the time of collection. Of these, location SW-1, SW-4 and SW-5 are considered to be upstream locations. These same locations were sampled again in 1993 during the RI. In addition, during the RI, samples were collected from locations SW-10 and SW-11, located on the on-site tributary. This testing indicated that the surface water had not been impacted by the site.

A sample was also collected from a groundwater seep along the western slope at location SW-12 (see Figure 5). This testing indicated impact by metals, primarily iron, lead, and manganese.

2.3.4 Floodplain Sediments

Floodplain sediment samples were collected from two locations (FPS-1 and FPS-2) in 1990 and from four locations during the RI (FPS-3 through FPS-6) in 1993. Samples collected during the RI, were intended to represent environmental conditions within the former creek bed where water was stored after the 1971 fire at the site. The location of these samples are shown on Figure 5 along with the other two sample locations.

Samples of the floodplain sediments generally contained low levels of SVOCs, polynuclear aromatic hydrocarbons (PAHs), pesticides, PCBs, and metals below NYSDEC recommended cleanup objectives (NYSDEC, 1994). Sample FPS-6 (see Figure 5 for location) generally contained higher concentrations of these compounds. For example, sample FPS-6 contained 2.9 mg/kg of benzo (a) pyrene, a PAH, while the range detected in the other 5 samples varied from not detected to 0.22J [J denotes concentration estimated by the laboratory] mg/kg. A similar pattern was observed for the other PAHs and SVOCs detected. The origin of the compounds detected in FPS-6 is unknown but may be attributable to the fill placed at this location during filling of the former creek bed or reconstruction of the bridge over Lake Avenue.

The pesticides delta-BHC, heptachlor epoxide, and endrin were detected in the NYSDEC split of sample FPS-5. These compounds were not detected in the sample analyzed by

Recra Environmental, Inc. for the RI work. It is noted that the test results provided by NYSDEC were not validated in accordance with the procedures stated in the project work plan (GZA, 1992). As such, the usefulness of this data in making a decision regarding the need to consider remedial work is uncertain.

It is not believed that the compounds detected in samples FPS-5 and FPS-6 are indicative of widespread impact throughout the floodplain area since similar concentrations of these substances were not detected in the other floodplain sediment samples. The chemicals detected in the floodplain sediments were dissimilar to the site soils. The most prevalent compounds detected in the site soils were VOCs while the floodplain sediments contained primarily PAHs. This is further indication that the chemicals in the floodplain sediment samples are attributable to the fill.

2.3.5 Groundwater

Monitoring well locations are shown on Figure 3. Eleven monitoring wells were installed in the overburden (designated with an "S") and 12 monitoring wells were installed in the bedrock (designated "R"). One deeper monitoring well designated MW-9RD was installed to a depth of 68 feet into the competent shale.

Samples from the monitoring wells indicate that the groundwater in the overburden and upper weathered bedrock (i.e., the upper 25 to 30 feet of rock) have been impacted primarily by VOCs. The approximate horizontal extent of the affected area is shown on Figure 7.

The RI data indicate that the vertical extent of impact is limited to the upper 25 to 30 feet of weathered shale bedrock. Compounds detected in groundwater samples include those listed on the following page:

Compound	Range of Detection (ppm)	Specific Gravity at 20°C	Solubility in Water at 20°C (ppm)
1,1,1 trichloroethane (1,1,1 TCA)	ND to 2.80	1.34	480 to 4,400
1,1 dichloroethene (1,1 DCE)	ND to 0.27	1.22	400
1,1 dichloroethane (1,1 DCA)	ND to 0.86	1.17	5,000
chloroethane (CE)	ND to 0.20	0.89	5,740
trichloroethene (TCE)	ND to 1.50	1.46	1,000
1,2 dichloroethene (1,2 DCE)	ND to 0.026	1.26	600
vinyl chloride (VC)	ND to 0.003	0.91	1,100
chloroform	ND to 0.26	1.48	8,200
methylene chloride	ND to 0.026	1.33	13,200 to 20,000
chlorotoluene	ND to 130	1.06	Not available

ND - Not detected

Observations made during the RI indicate the presence of dense non-aqueous phase liquid (DNAPL) in MW-3S. NAPL was observed in this monitoring well during sampling done in 1993. The DNAPL was analyzed for volatile organic compounds and found to contain 960 mg/l chlorotoluene.

2.4 FATE AND TRANSPORT OF SITE CHEMICALS

The following section discusses fate and transport of site related compounds based upon the testing done during the RI (GZA, 1994). The historical source of chemicals at the site is believed to be the two western former surface impoundments. Refer to Figure 2 for the locations of the former surface impoundments and Figure 4 for the extent of affected site soils.

The following migration pathways were considered:

- Leaching of chemicals through soils followed by groundwater transport;
- Volatilization of compounds from the soils; and
- Erosion of soils and sediment transport to surface waters.

These migration pathways have resulted in the observed presence of chemicals in the various media described in Section 2.3.

2.4.1 Leaching and Groundwater Transport

As discussed in Section 2.3, DNAPL was observed in MW-3S during the 1993 sampling. It is believed that the DNAPL migrated downward to its present location through the soil from the nearby former surface impoundment. Factors affecting DNAPL mobility include its surface tension, relative density, and the soil porosity (or fracture width in rock). Generally, DNAPL will migrate downward, provided sufficient weight of DNAPL is available to overcome capillary forces. If DNAPL encounters media that it cannot penetrate, it will tend to pool and flow along the surface of media. If there is not sufficient weight of DNAPL to overcome capillary forces then the DNAPL becomes trapped in the soil matrix.

The information collected to date does not indicate significant migration of DNAPL from the vicinity of MW-3S since DNAPL was not observed at the other monitoring well locations. The constituents of the DNAPL at MW-3S will slowly dissolve into the groundwater serving as a continual source of contamination.

Water samples collected from overburden wells contained a variety of VOCs as well as SVOCs. The majority of the VOCs detected were halogenated aliphatic compounds. These compounds have a moderate solubility and moderate sorption characteristics indicating that they may have leached from soils or may be attributable to dissolution of the DNAPL. SVOCs have a low solubility and tend to sorb to soils indicating that they are not readily leached from soil to groundwater. Thus, they are only expected to be present near source areas. This was observed at the Chem-Trol site where SVOCs were primarily detected in MW-3S, located in close proximity to one of the former surface impoundments. Based upon the hydrogeologic model discussed in Section 2.2.3, it is

believed that the majority of the overburden groundwater discharges to the bedrock groundwater zone.

Groundwater samples collected from wells screened in the bedrock generally contained VOCs. The majority of the impacted bedrock wells are located to the west of the potential source areas (see Figure 7). This is consistent with the conceptual hydrogeologic model presented in Section 2.2.3 that states that flow in the weathered shale is primarily horizontal to the west toward the South Branch of Smokes Creek.

VOCs were detected in the bedrock to the west of the South Branch of Smokes Creek at MW-13R indicating flow beneath the creek. This does not appear to be consistent with the conceptual hydrogeologic model that indicates groundwater flow from the west toward the South Branch of Smokes Creek. The presence of compounds to the west of the creek is believed to be attributable to the jointing pattern in the rock (see Figure 8). As the groundwater approaches the creek some fractures create flow paths beneath the creek prior to discharging to it. Therefore, it is predicted that the compounds detected at MW-13R would tend to flow along the creek alignment.

2.4.2 Volatilization

VOCs in the soils and groundwater may volatilize and migrate to the vadose (unsaturated) zone. In the absence of an overlying confining media, the VOCs would tend to vent to the atmosphere. A survey in the air at the site did not indicate the presence of VOCs. As such, the degree of volatilization at the site was less than could be quantified. This is consistent with the relatively low concentrations of VOCs in the site soils.

2.4.3 Erosion

Erosion and sediment transport are believed to have been significant transport mechanisms prior to placement of the existing site cover. Erosion results in the entrainment of soil particles within surface water flow during precipitation events. These particles are then deposited in low lying areas where slower flows exist. Therefore, substances that tend to adsorb onto soil particles, such as PCBs, can be transported by this mechanism. Erosion is believed to have resulted in the PCBs detected in the on-site tributary (see Section 2.3.2). Currently, transport by this mechanism is limited due to the site cover.

2.5 BASELINE RISK ASSESSMENT

A qualitative human health risk assessment was completed as part of the RI (GZA, 1994) to assess potential risks associated with exposure to site soils, surface water sediments, surface water, floodplain sediments, and groundwater. This assessment indicated potential human health risks for the following conditions:

- Leaching of substances from site soils to groundwater,
- Direct contact with PCBs in surface water sediments,
- Direct contact and leaching to groundwater of PAHs in floodplain sediment sample FPS-6 and pesticides in the NYSDEC split of FPS-5, and
- Ingestion of groundwater.

A qualitative environmental risk assessment also identified potential risks related to direct contact with PCBs in surface water sediments.

2.6 SUMMARY OF ENVIRONMENTAL CONDITIONS

Based upon the data collected during the RI as discussed above, the following media need to be addressed at the Chem-Trol site:

Site Soils- including the identified "hot spot" area and other site soils containing primarily residual concentrations of VOCs;

Surface Water Sediments- including sediments in the on-site tributary between SWS-8 and SWS-6 and those at the seep location (SWS-12);

Floodplain Sediments- including those at FPS-5 and FPS-6; and

Groundwater-including addressing the known affected groundwater beneath the site and verification of the downgradient extent of the affected area.

3. IDENTIFICATION AND SCREENING OF REMEDIAL ACTION TECHNOLOGIES

3.1 INTRODUCTION

The purpose of this identification and screening process is to identify a range of suitable remedial action technologies and remedial options that can be assembled into remedial alternatives capable of addressing the existing conditions at the Chem-Trol site. EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA 1988a) and *NYSDEC Guidance for Selection of Remedial Actions at Inactive Hazardous Waste Sites* (NYSDEC 1990) has established a structured process for identifying and screening relevant technologies for remediation of contaminated sites. These guidance documents were followed in this feasibility study. The goal of the remedy-selection process is to select remedial actions that protect human health and the environment, that maintain protection over time, and that minimize untreated waste. The FS process is designed so that appropriate remedial actions are developed and evaluated, and that pertinent information required to select a recommended remediation approach is presented.

The National Contingency Plan (NCP) specifies six criteria for developing remedial alternatives. These criteria were used to develop the preliminary alternatives for remedial action at the Chem-Trol site as required by NYSDEC (NYSDEC, 1989) and include:

- using treatment to address principal risks as defined by the risk assessment;
- using engineering controls for waste that poses a relatively low long-term risk or when treatment is impractical;
- combining methods, such as treatment with engineering controls, to protect human health and the environment;
- supplementing engineering controls with institutional controls, as is appropriate, for short- and long-term management to prevent or to limit exposure;
- using innovative technology; and

- returning usable groundwaters to their beneficial uses or preventing further degradation.

Selecting a response action proceeds in a series of steps designed to reduce the universe of potential alternatives to a group of viable alternatives from which a final remedy may be selected. The selection of remedial action alternatives for the site involves:

- identifying preliminary remedial action objectives specific to the contaminated environmental media;

- identifying general response actions (e.g., removal, treatment, and disposal) required to attain the remedial action objectives and to cover the scope of possible remediation activities for the affected sites;

- identifying remedial technologies (e.g., water treatment processes) and remedial options (e.g. carbon adsorption, air stripping) that can be applied for each of the general response actions and performing an initial screening to reduce the number of remedial options for detailed evaluation; and

- evaluating viable remedial options on criteria of effectiveness, implementability and cost to define a set of options from which to develop alternatives that address the site as a whole.

Section 3.2 describes remedial action objectives for each medium of interest, identifies contaminant-specific applicable or relevant and appropriate requirements (ARARs), other applicable ARARs, likely exposure routes, and likely receptors. Allowable exposures or target cleanup levels are developed based on the ARARs and on the findings of the risk assessment.

Section 3.3 identifies general response actions that satisfy remedial action objectives for the medium of interest at the site, and presents a preliminary identification of the areas to which these actions may need to be applied.

Section 3.4 identifies and screens remedial action technology types under each general response action for soils and sediments and for buildings and structures, respectively.

Technology types are screened on the basis of site-specific technical feasibility at the Chem-Trol site. Under each technology type, remedial options are identified and screened.

In Section 3.5, remedial options identified in the previous section for each medium of concern are evaluated and screened by criteria of effectiveness, implementability, and relative cost, with greatest emphasis on effectiveness.

3.2 REMEDIAL ACTION OBJECTIVES

Remedial action objectives are site-specific requirements that define the extent of cleanup required to achieve overall cleanup objectives. They are based on the nature and extent of contamination, threatened resources, and the potential for human and environmental exposure.

Several elements comprise a remedial action objective. These are (1) the contaminant-specific numerical cleanup limits (i.e., remediation goals or target cleanup levels) for all affected environmental media, (2) the spatial area of attainment, and (3) the restoration time-frame. This section addresses remediation goals. Spatial area of attainment and restoration time frame are discussed in subsequent sections of the feasibility study report.

EPA and NYSDEC specify two "threshold criteria" for deriving target cleanup levels for contaminated environmental media at waste sites:

- The remediation objectives must afford overall protection of human health and the environment.

- Concentrations of contaminants in the environment must comply with State standards, criteria, and guidance (SCGs) and Federal applicable relevant and appropriate requirements (ARARs).

A remedial alternative must satisfy these "threshold criteria" to be eligible for selection.

SCGs/ARARs include requirements that are generally applicable, and officially promulgated, that are either directly applicable, or that are not directly applicable but are

relevant and appropriate. To-Be-Considered criteria (TBCs) are non promulgated advisories or guidance issued by federal or state governments that are not legally binding and do not have the status of potential SCGs/ARARs. However, in many circumstances TBCs can be considered along with SCGs/ARARs in determining the necessary level of cleanup for protection of health or the environment.

As discussed above, a requirement under federal and state environmental laws may be either "applicable" or "relevant and appropriate" but not both. Therefore, identifying SCGs/ARARs is a two-step process: first, to determine if the regulation is applicable; then, if not, to determine if the regulation is both relevant and appropriate. These terms are defined in the 1990 NCP (Section 300.5) as follows.

> *Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at an inactive hazardous waste site. Only those state statutes that are more stringent than federal requirements apply.*
>
> *Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site, address problems or situations sufficiently similar to those encountered at the site that their use is suited to the particular site. Only those Federal statutes more stringent than state requirements are relevant and appropriate.*

Site-specific factors used to identify SCGs/ARARs include the characteristics of the remedial action, hazardous substances present, and physical circumstances of the site. These factors are compared to the requirement under evaluation to determine if it is directly applicable or if it is relevant and appropriate. In some cases, only part of a requirement may be found to be relevant and appropriate.

SCGs/ARARs are not a uniformly derived set of similar standards and do not consider the effects of combined exposures to mixtures of chemicals. SCGs/ARARs cannot always be met as remediation goals for technological reasons, as well as cost factors, but where that is true, a waiver could be invoked to excuse the deficiency. A waiver is appropriate in the following circumstances (6 NYCRR Part 375):

- The proposed action is only part of a complete program that will conform to such standard or criterion [or guidance] upon completion; or
- Conformity to such a standard or criterion will result in a greater risk to the public health or to the environment than the alternatives; or
- Conformity with such a standard or criterion is technically impractical from an engineering perspective; or
- The program will attain a level of performance that is equivalent to that required by the standard or criterion through the use of another method or approach.

Although alternatives for site remediation must comply with SCGs/ARARs, due to site-specific factors (e.g., multiple chemicals and multiple exposure pathways), a cleanup level set at the level of a single chemical-specific requirement may not adequately protect human health or the environment. Remediation objectives are developed through the risk assessment process if:

- an ARAR is not protective (based on results of the risk assessment);
- an ARAR does not exist for the specific chemical or pathways of concern; or
- multiple contaminants result in an unacceptable cumulative risk.

Health advisory levels should be identified or developed to ensure that a remedy is protective.

EPA guidance (EPA 1988) requires that remedial alternatives be developed that protect human health and the environment by eliminating, reducing, and/or controlling risks posed by the site. The first step in the development process is to identify remedial action objectives specifying contaminants and media of concern, potential exposure pathways, and preliminary remediation goals. The goals are based on acceptable risk-based exposure

levels that protect human health and the environment, and are developed by considering SCGs/ARARs and the following factors [1990 NCP Section 300.430(e)(2)(i)(A)]:

- For non carcinogenic toxicants, acceptable exposure levels are those concentrations to which the most susceptible human population may be exposed over a lifetime without adverse effects.

- For known or suspected carcinogens, acceptable exposure levels are those concentrations that represent an upper-bound excess lifetime cancer risk to an individual of between 10^{-6} and 10^{-4} as determined by the dose-response relationship. This range is intended to provide case-by-case flexibility, although the 10^{-6} risk level is the point of departure for determining goals for alternatives when SCGs/ARARs are unavailable or not sufficiently protective.

- Other factors related to technical limitations, uncertainty, and other pertinent information are also considered.

- In the case of multiple contaminants, where the attainment of SCGs/ARARs will result in a cumulative risk in excess of 10^{-4} (the extreme of the acceptable range), acceptable exposure limits based on exposure to new carcinogenic toxicants or cancer risk (described above) must be considered.

- Water quality criteria established under Sections 303 or 304 of the Clean Water Act and 6 NYCRR parts 700-704 shall be attained where relevant and appropriate.

- An alternative concentration limit (ACL) may be established in accordance with CERCLA Section 121(d)(2)(B)(ii).

- Environmental evaluations shall be performed to assess threats to the environment, especially sensitive habitats and critical habitats of species protected under the Endangered Species Act.

Remedial actions may have to comply with several different types of requirements. The classification of SCGs/ARARs described below was developed to provide guidance on how to identify and comply with SCGs/ARARs (EPA 1988).

Chemical-specific requirements are usually health or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the environment.

Location-specific requirements are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations.

Action-specific requirements are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes.

3.2.1 Preliminary Identification of SCGs/ARARs

CERCLA and New York State regulations requires the selection of remedial actions at waste sites that protect human health and the environment and that are cost-effective and technologically and administratively feasible. Section 121 of CERCLA an 6 NYCRR Part 375 specifies that response actions must be undertaken in compliance with SCGs/ARARs established in federal and state environmental laws.

3.2.1.1 Chemical-Specific SCGs/ARARs

Chemical-specific SCGs/ARARs are health or risk-based numerical limits. These values are federal or state requirements establishing acceptable amounts or concentrations of contaminants found in or discharged to the ambient environment (EPA 1988). NYSDEC specifies that if a contaminant has more than one SCG/ARAR, compliance with the most stringent is required. Appendix A-1 contains a listing of the chemical-specific SCGs/ARARs for the Chem-Trol site.

The primary chemical specific SCGs/ARARs include:

- Safe Drinking Water Act - 40 CFR 141,
- New York State Water Quality Regulations - 6 NYCRR Parts 700-705, and
- Clean Water Act - FR 79318.

3.2.1.2 Location-Specific SCGs/ARARs

Location-specific SCGs/ARARs are restrictions on activities or on concentrations of contaminants that may occur at a given location. It is necessary to evaluate the jurisdictional and legislative requirements of each regulation to determine the applicability of location-specific SCGs/ARARs for a given site. Appendix A-2 includes a comprehensive listing of location-specific requirements.

The primary location specific SCGs/ARARs include:

- Floodplain Management/Wetland Protection - 40 CFR 6.302(b), and
- Streams and Navigable Waters - 6 NYCRR Part 608.

United States Army Corps of Engineers Guidance on Activities in Wetlands within Superfund Boundaries will also be considered in planning implementation of the remedial plan.

3.2.1.3 Action-Specific SCGs/ARARs

Action-specific requirements are technology-or activity-based limitations on actions that may be taken at a waste site regarding management of toxic or hazardous materials. These SCGs/ARARs are triggered by the selection of a particular remedial action and may invoke performance standards or technologies as limits on levels of contaminants in effluents or residues.

Appendix A-3 presents a comprehensive overview of potentially applicable action-specific requirements. Note that many of the requirements listed include chemical-specific guidelines. This listing is refined as the FS progresses and the alternatives for site remediation are refined.

Action specific SCGs/ARARs vary greatly with the technology being implemented but several that are common to most remedial plans considered for Chem-Trol include:

- Air Quality Standards,
- USEPA Pretreatment Standards,

- New York State Waste Transporter Regulations, and
- New York State Hazardous Waste Regulations

3.2.2 Derivation of Preliminary Remediation Goals

NYSDEC regulations (6 NYCRR Part 375) state that the goal of remedial activities is to restore the site to pre-release conditions. The requirement that a remedial alternative will meet chemical-specific SCGs/ARARs does not ensure that the proposed alternative is protective and, thereby, potentially acceptable. This can be determined only by:

(1) evaluating the combined carcinogenic risk associated with the SCG/ARAR limits for all chemicals at a given site (assuming additivity of effect in the absence of data on synergism or antagonism);

(2) establishing that SCGs/ARARs do not exceed EPA toxicity benchmarks for non carcinogenic effects (i.e., reference doses or reference concentrations), and are sufficiently protective when multiple chemicals are present;

(3) determining whether environmental effects (in addition to human health considerations) are adequately addressed by the SCGs/ARARs; and

(4) evaluating whether the SCGs/ARARs adequately cover all significant pathways of human exposure identified in the risk assessment.

The establishment of remediation goals or target cleanup levels typically begins during project scoping or concurrently with preliminary RI activities. Preliminary remediation goals were listed in the RI/FS workplan (GZA, 1992). As the RI/FS progresses, the results of risk assessment and the subsequent identification of additional SCGs/ARARs modify the preliminary remediation goals. Ultimately, final remediation goals are derived that ensure that remedial alternatives comply with SCGs/ARARs and protect human health and the environment. The final remediation goals are documented in the ROD.

Based on the available EPA guidance, an outline may be developed of the general approach to derive remediation goals (USEPA, 1988):

- identify subject contaminants of concern;
- list available SCGs/ARARs;
- identify potential exposure pathways and receptors at risk
- develop exposure scenarios and characterize environmental concentrations /activities at the points of exposure using available monitoring data and/or the results of environmental fate modeling;
- if SCGs/ARARs are available for all subject chemicals and environmental media, evaluate the overall protectiveness to human health of exposure to the chemicals at SCG/ARAR levels and take into consideration combined exposure across chemicals and multiple pathways;
- if the SCG/ARAR levels are found to be protective, adopt these as remediation goals (cleanup levels); and
- if SCGs/ARARs are not available for all subject chemicals, or are not found to be protective of human health, derive cleanup levels based upon the results of risk assessment.

The exposure pathways that form the basis for risk characterization in the risk assessment (GZA, 1994) were used in deriving target cleanup levels. Chemical-specific remediation goals for contaminants must afford overall protection of human health and the environment. Overall protection as defined by NYSDEC must take into consideration combined exposure across all contaminants and pathways of concern for receptor groups at primary risk of exposure.

3.2.3 Remedial Action Objectives for the Chem-Trol Site

The RI concluded that several media at the site had been affected by the presence of chemicals. These include overburden and bedrock groundwater, site soils, surface water sediments and flood plain sediments. Preliminary remedial action objectives (RAOs) were presented in the RI. The following discussion is a further development of the

preliminary RAOs. Final acceptable concentrations will be reassessed after implementation of the selected remedy.

3.2.3.1 Soils

The NYSDEC recommended method for establishing soil cleanup objectives at inactive waste sites is discussed in their Technical and Administrative Guidance Memorandum No. 4046. The basis used in determining the soil clean-up objectives include:

(a) Human health based levels that correspond to excess lifetime cancer risks of one in a million for Class A[1] and B[2] carcinogens, or one in 100,000 for Class C[3] carcinogens. These levels are contained in USEPA's Health Effects Assessment Summary Tables (HEASTs) which are compiled and updated quarterly by the NYSDEC's Division of Hazardous Substances Regulation;

(b) Human health based levels for systemic toxicants, calculated from Reference Doses (RfDs). RfDs are an estimate of the daily exposure an individual (including sensitive individuals) can experience without appreciable risks of health effects during a lifetime. An average scenario of exposure in which children ages one to six (who exhibit the greatest tendency to ingest soil) is assumed. An intake rate of 0.2 gram/day for a five year exposure period for a 16-kg child is assumed. These levels are contained in USEPA's Health Effects Assessment Summary Tables (HEASTs) which are compiled and updateded quarterly by the NYSDEC's Division of Hazardous Substances Regulation;

(c) Environmental concentrations which are protective of groundwater/drinking water quality; based on promulgated or proposed New York State Standards;

(d) Background values for contaminants; and

(e) Detection limits.

[1] *Class A are proved human carcinogens*

[2] *Class B are probable human carcinogens*

[3] *Class C are possible human carcinogens*

Routes of Exposure

Exposure to chemical substances within the site soils may occur through leaching to groundwater. Direct contact with site soils is not likely since the site is covered with soil.

Concentrations of some substances within site soils indicates that the potential exists for these substances to leach to groundwater. Although exposure to groundwater is discussed separately below, RAOs for site soils are defined based on the potential leaching of these substances to protect groundwater.

Contaminants of Concern

Contaminants of Concern (COCs) for site soils are those compounds which indicate a potential of leaching to the groundwater at a concentration in excess of values specified in NYSDEC TAGM 4046. These compounds are listed in Table 1.

Chemical Specific Cleanup Objectives

Selection of chemical specific cleanup objectives for site soils was performed in a manner similar to that set forth in TAGM 4046 (NYSDEC, 1994). The procedure for selecting a cleanup objective for organic compounds included comparing the groundwater protection based values with the method detection limit (MDL). If the groundwater protection value was lower than the MDL, the MDL was selected. A similar procedure is used for selection of cleanup objectives for metals, however, comparison of health based and background levels was first completed and the lower selected. The selected value was then compared with MDLs. Chemical specific cleanup objectives for site soils are summarized on Table 1.

Remedial Action Objective

The remedial action objective for soils at the Chem-Trol site is to control the potential for leaching of contaminants from soils containing chemical substances at concentrations in excess of those specified on Table 1 and continue to prevent human contact with those soils.

3.2.3.2 Floodplain Sediments

Routes of Exposure

Potential exposure to chemical substances detected within the floodplain sediments in samples collected from a depth of 0.5 to 2.0 feet is similar to that for site soils. However, the potential for direct contact may be greater since this area was not covered by the 2 foot thick cap. Test borings in this area (i.e. MW-8, MW-9 and MW-10) indicate at least 0.5 feet of topsoil is present overlying the floodplain sediments.

Contaminants of Concern

COCs for floodplain sediments are those compounds which have an associated human health risk for direct contact, or those which exhibit a potential of leaching to the groundwater. Selection of COCs proceeded in a manner similar to that for site soils. A list of the contaminants of concern for floodplain sediments is included on Table 2.

Chemical Specific Cleanup Objectives

Determination of chemical specific cleanup objectives for floodplain sediments was performed in a similar manner to that identified for site soils. Chemical specific cleanup goals for floodplain sediments are included on Table 2.

Remedial Action Objective

The remedial action objective for floodplain sediments at the Chem-Trol site is to continue to limit the potential for contact with or leaching of contaminants from soils containing chemical substances at concentrations in excess of those specified on Table 2.

3.2.3.3 Surface Water Sediments

Routes of Exposure

Exposure to chemical substances within the surface water sediments may occur by direct contact. In addition, surface water sediments are accessible to fish and wildlife.

Therefore, SCGs/ARARs associated with these receptors were considered in defining the RAOs.

Contaminants of Concern

PCB concentrations within the surface water sediment samples from the on site tributary to the south branch of Smokes Creek exceeded SCGs/ARARs. As such, PCBs were selected as the COCs for surface water sediments since no other compounds were detected at concentrations exceeding SCGs/ARARs.

Chemical Specific Cleanup Objectives

Selection of chemical specific cleanup objectives for PCBs in surface water sediments proceeded in a manner similar to that for site soils. These values are summarized on Table 3.

Remedial Action Objective

The remedial action objective for surface water sediments at the Chem-Trol site is to reduce the potential for human or wildlife contact with those sediments containing concentrations of PCBs in excess of those values listed on Table 3.

3.2.3.4 Groundwater

Routes of Exposure

The potential for off-site exposure to chemical substances within the groundwater is considered relatively low. This is because lateral migration is believed to be limited to the site, and adjacent residences are serviced by a public water supply. The location of groundwater wells in the area was investigated as reported in the RI. The nearest groundwater well is reportedly located approximately 1 mile northwest of the site. As such, exposure through ingestion of groundwater is not known to occur. Exposure may occur at outbreaks on the ground surface (i.e., at SW-12) or if future activities at the site include excavation within the saturated zone.

Contaminants of Concern

COCs for groundwater include those chemicals with concentrations exceeding New York State SCGs/ARARs. These include primarily VOCs, some metals and sulfate. COCs for overburden groundwater are included on Table 4.

Chemical Specific Cleanup Objectives

Chemical specific cleanup objectives for groundwater were developed in a manner similar to that used for site soils. Generally, the most stringent SCG/ARAR was used unless this was below the CRQL. Cleanup objectives for individual COCs are included on Table 4.

Remedial Action Objective

The remedial action objective for groundwater is to limit the potential for exposure or migration of overburden groundwater containing substances at concentrations exceeding those listed on Table 4.

3.3 GENERAL RESPONSE ACTIONS

General response actions are broad classes of remedial measures that will satisfy the remedial action objectives. General response actions are media specific and include treatment, containment, removal, Limited Action, etc.

The following sections present general response actions for surface water sediments, floodplain sediments, site soils and groundwater. Additionally, areas and volumes of media associated with the general response actions are presented.

3.3.1 Surface Water Sediment

The following general response actions were considered for the surface water sediments in the on-site tributary to the South Branch of Smokes Creek:

- No action,
- Limited Action,
- Containment, and
- Removal.

The volume of sediments in this area was estimated based upon the data collected during the remedial investigation. Affected sediments appear to extend from sample locations SWS-6 to SWS-8, a length of about 700 feet. The width of the on-site tributary varies from several feet up to about 15 feet. Therefore, the area of sediments is estimated to be about one quarter of an acre. Assuming a sediment depth of 1 foot, the volume of affected sediments is estimated to be 400 cubic yards. This is believed to be a conservative estimate of the sediment depth since bedrock is exposed in the bottom of the on-site tributary in several locations indicating a thin layer of sediment over the rock.

3.3.2 Floodplain Sediments

The following general response actions were considered for the floodplain sediments:

- No action,
- Limited Action,
- Containment,
- Removal, and
- In-situ treatment.

The purpose of the floodplain sediment samples was to evaluate the presence of compounds that are believed to be attributable to water stored in the former bed of the South Branch of Smokes Creek after the 1971 fire at the site (see Section 2.1). Analysis of these samples did not indicate the presence of site related substances at concentrations above the remedial action objectives. The majority of the compounds detected in the site soils were VOCs while the floodplain sediments contained PAHs that may be associated with the fill placed in the area.

Compounds detected at concentrations above the remedial action objectives generally include PAH's in FPS-6, pesticides in the NYSDEC split of FPS-5 and several metals. As discussed in section 2.3.4, these substances are likely to be attributable to the fill placed in this area during the rerouting of the South Branch of Smokes Creek or analytical testing

anomalies (in the case of the pesticides in the NYSDEC split sample). It is not believed that the compounds detected in these two samples are indicative of widespread impact throughout the floodplain area since similar concentrations of these substances were not detected in the other floodplain sediment samples.

The general response actions that may be applied to the floodplain sediments such as containment (i.e., capping), removal, and in-situ treatment would involve extensive earthwork and clearing of the area. Based upon observations made during the remedial investigations the floodplain is likely to be considered a wetland. Additionally, since the floodplain sediment sample locations were covered by 0.5 feet of soil, remedial work would cause increased exposure to site workers and the public to the materials. As such, in accordance with 6 NYCRR Part 375 (see Section 3.2), remedial work should only be done after careful consideration is given to the benefits in reducing potential risks and the harm that would be done to human health and the environment through implementing the remedy.

Presently there is not sufficient data to indicate a need for remediating the floodplain sediments. Rather, additional sampling aimed at confirming the presence and limits of the PAH's detected in FPS-6 and the pesticides that may be present at FPS-4 is included in each remedial alternative. Pending the results of this analysis, the floodplain sediments may be left in place or addressed along with the other affected sediments and site soils.

3.3.3 Site Soils

The following general response actions were considered for the site soils:

- No action,
- Limited Action,
- Containment, and
- In-situ treatment.

The RI test data indicates that the area of affected soils is approximately 2 acres. The aerial extent of this area is shown in Figure 4. These soils are believed to be residuals left behind after the removal action was completed around 1977. The affected soils were observed to extend from a depth of about 1 to 2 feet to a depth of 3 to 8 feet.

The RI test data indicate that a localized hot spot exists in the vicinity of sample SSI-2. The volume of this material is estimated to be 280 cubic yards. Since this area contained a wide variety of chemicals (VOCs, SVOCs, PCBs, and pesticides) at relatively high concentrations and appears to have a small volume, the general response actions for the material are limited. It is not felt that institutional controls, containment or in-situ treatment are appropriate response actions for this material. Rather due to the limited volume of soil involved and the diverse types of compounds present the appropriate general response action for this material is removal with offsite treatment and offsite disposal.

3.3.4 Groundwater

The following general response actions were considered for the site groundwater:

- No action,
- Limited Action,
- Containment,
- Collection/Treatment/Discharge, and
- In-situ treatment.

The aerial extent of groundwater that is to be remediated is beneath the former active portion of the site and extends from MW-12 to the south up to MW-8 to the north and from MW-1R to the east and MW-14R to the west (see Figure 7). Water from the lower soil zone and the upper 25 to 30 feet of the bedrock is affected.

The volume of groundwater that would be treated may vary for each general response action and the specific technology type under consideration. For example, pumping rates for collection/treatment/discharge type systems would be different than pumping rates associated with containment actions.

3.4 IDENTIFICATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

Remedial technologies and process options were identified for the general response actions and media listed in Section 3.3. This preliminary review establishes an overall set

of remedial technologies and process options and eliminates those which cannot be realistically applied to each media at the site. Technologies that are not applicable to the chemicals of concern or are not implementable were eliminated from further consideration.

3.4.1 Surface Water Sediments

Remedial technologies and process options for surface water sediments are summarized in Table 5 and discussed below.

No Action

Under the no-action general response, no remedial work would be implemented for the surface water sediments. This general response will be retained throughout the feasibility study since it represents the current site conditions and practices of environmental monitoring to observe environmental conditions. This general response serves as a baseline for the remedial alternative evaluation process.

Limited Action

Limited action such as deed restrictions, fencing and monitoring, as described in Table 5, can be readily implemented for the surface water sediments at the Chem-Trol site. These technologies are aimed at reducing exposure to contaminants and do not reduce the volume, mobility or toxicity of the media. These technology types will be considered in alternative development.

Containment

Containment of the surface water sediments could be achieved by capping the area with soil, synthetic liners or by replacing the existing on-site tributary with a culvert. These processes would prevent contact with the sediments and reduce their mobility by limiting erosion. The use of synthetic liners to cover the sediments was screened out because this process is aimed at reducing infiltration while the purpose of containing the sediments would be to reduce access. This is more effectively achieved using a soil cover that could resist the potential for erosion or by replacing the tributary with a culvert system.

Removal

Removal of the sediments in the on-site tributary could be done by temporarily diverting the current flow and excavating the soil using conventional methods. The sediments may then be disposed of or treated off site at a NYSDEC approved facility. Alternatively, the soils may be stored on-site.

3.4.2 Site Soils

Remedial technologies and process options for site soils are summarized in Table 6 and are discussed below.

No Action

Under the no-action general response, no remedial work would be implemented for the site soils. This general response will be retained throughout the feasibility study since it represents the current site conditions and practices of environmental monitoring to observe environmental conditions. This general response serves as a baseline for the remedial alternative evaluation process.

Limited Action

Limited action such as deed restrictions, and fencing as described in Table 6 can be readily implemented for the site soils at the Chem-Trol site. Similar to the surface water sediments, these technologies are aimed at reducing exposure to contaminants and do not reduce the volume, mobility or toxicity of the media. These technology types will be considered in alternative development.

Containment

Containment of the site soils could be achieved by capping the area with soil, or synthetic liners. The cover could either be designed to prevent direct contact or both limit infiltration and direct contact. The reduction in infiltration would limit mobility of the chemicals. It is noted that a soil cover was placed at the site in 1977.

"Hot Spot" Removal

Removal of the site soils could be done by excavation using conventional methods. The site soils may then be disposed of or treated off site at a NYSDEC approved facility.

In-Situ Treatment

Treatment of the site soils in-place using processes such as stabilization, vapor extraction, biodegredation, bioventing, soil flushing, and steam stripping was considered. These treatment methods could reduce the toxicity, mobility and volume of the substances in the site soils. Stabilization was excluded from further consideration due to its ineffectiveness in treating some of the types of compounds (i.e., volatile organic compounds) present in the site soils.

3.4.3 Groundwater

Remedial technologies and process options for groundwater are summarized in Table 7 and are discussed below.

No Action

Under the no-action general response, no remedial work would be implemented for groundwater at the site. This general response will be retained throughout the feasibility study since it represents the current site conditions and practices of environmental monitoring to observe environmental conditions. This general response serves as a baseline for the remedial alternative evaluation process.

Limited Action

Limited action such as deed restrictions, and fencing as described in Table 7, can be readily implemented for the groundwater at the Chem-Trol site. Similar to the other media at the site, these technologies are aimed at reducing exposure to contaminants and do not reduce the volume, mobility or toxicity of the media. These technology types will be considered in alternative development.

Containment

Methods of groundwater containment include vertical barriers, horizontal subsurface barriers and encapsulation. Slurry walls were eliminated since this process option is not typically used in rock. Horizontal subsurface barriers were also eliminated from further consideration. These processes are used to form a low permeability zone below an affected area. At the Chem- Trol site a low permeability material already exists below the affected groundwater, and this technology is not necessary.

Collection

Groundwater collection could be implemented at the site through the use of extraction wells or subsurface drains created by excavation or hydrofracturing the weathered rock. Discharge of the collected water to the local POTW may be possible pending their approval. These processes were retained for further consideration in the feasibility study.

Process options that were eliminated from further consideration include 2-phase extraction, and discharge of extracted groundwater to the South Branch of Smokes Creek. Two-phase extraction was eliminated since it would not be feasible to achieve the required vacuum in the weathered shale.

Ex-Situ Treatment

The extracted groundwater could be treated by a variety of biological, physical and chemical treatment methods as listed in Table 7. These treatment methods will be considered further during the feasibility study.

Discharge

The treated groundwater could either be discharged to the South Branch of Smokes Creek or to the POTW. These discharge options were retained for further consideration in the feasibility study.

In-Situ Treatment

In-situ treatment technologies that may be applicable to the groundwater include bioremediation, air sparging and chemical treatment. These methods typically involve a system to deliver the treatment medium (e.g., microbes, air, nutrients, etc.) to the subsurface and a collection system to control the movement of groundwater.

Bioremediation involves introducing water containing oxygen, nutrients and microbes into the subsurface. The microorganisms metabolize compounds either in the groundwater or adhered to the soil transforming them into other compounds. Difficulties have been experienced when applying this technology to complex mixtures of compounds such as those present at Chem-Trol.

Air sparging is a method where air is injected below the water table to strip VOCs from the groundwater. The air then bubbles up to the surface and is collected in a SVES.

Chemical treatment is the in-situ chemical transformation of compounds into less hazardous products.

3.5 PRELIMINARY EVALUATION OF PROCESS OPTIONS

This evaluation is done to reduce the number of potentially applicable remedial process options using the criteria of effectiveness, implementability, and costs. This step eliminates options that are not appropriate for the Chem-Trol site to focus the feasibility study on those that are effective and implementable. Cost is used in evaluating technology types of the same general response category relative to each other.

Effectiveness Evaluation Criteria

The identified remedial technologies were screened further such that those that were not likely to protect human health and the environment and satisfy the remedial action objectives were not considered further. This was done by assessing a technology's ability to reduce the toxicity, mobility, and volume of the substances at the site. Other factors considered in this evaluation were:

- potential impacts to human health and the environment during implementation,
- how proven and reliable a technology is with respect to site conditions, and
- operation and maintenance (O&M) requirements.

The long-term management requirements for residuals at the site reduces the likely effectiveness of a technology and was therefore included in this evaluation.

Implementability Evaluation Criteria

Implementability includes both technical and administrative feasibility of implementing a technology process. Since technical implementability was used as the primary criteria during the initial screening, this evaluation focuses on institutional aspects such as the ability to obtain permits for offsite actions, the availability of equipment to do the work, and the capacity of treatment, storage and disposal facilities.

Costs Evaluation Criteria

Costs play a limited role in the screening of process options. Costs are used in the comparison of process options under the same technology type. At this stage costs are based on engineering judgment, and each process is assigned a relative cost of low, moderate, or high.

3.5.1 Evaluation of Surface Water Sediment Process Options

Surface water sediment process options were evaluated as summarized in Table 8. The following sections discuss our evaluation of the process options for each general response action.

No Action

This response action is retained throughout the FS evaluation to comply with NYSDEC and CERCLA requirements.

Limited Action

The remedial options under this response action include security fencing, deed restrictions, and environmental monitoring. An inspection program would be necessary for a security fencing system. Restriction on future property use could be incorporated for the surface water sediments in the on-site tributary, as appropriate, should the land be sold in the future. Sediment monitoring could be implemented to observe that substances do not migrate offsite where they could impact human health and the environment. These processes address contact but do not reduce the toxicity, mobility or volume of compounds. The costs of these options are considered low. These limited actions will be considered in the detailed analysis.

Containment

Containment methods including soil cover and replacing the existing on-site tributary with a culvert system are considered effective and implementable methods of achieving the remedial action objectives for surface water sediments. These process options both prevent direct contact with the sediments and limit mobility by reducing the potential for erosion and subsequent deposition at downstream locations. These options would require a maintenance program to assess if they are performing as designed. Costs for these options are considered moderate. Containment of the on-site tributary sediments is retained for further consideration in the detailed analysis.

Removal

The surface water sediments could be excavated from their present location for subsequent disposal. Two options for disposing of the sediments were considered, on-site disposal in a landfill cell and off site disposal. On-site disposal was eliminated from further consideration since it would require construction of a landfill cell. It is believed that the implementability of such an option is questionable due to technical considerations and community acceptance. Costs for the removal option are considered high relative to the others considered. Removal of the on-site tributary sediments is retained for further consideration in the detailed analysis.

3.5.2 Site soils

Site soils process options were evaluated as summarized on Table 9. The following sections discuss our evaluation of the process options for each general response action.

No Action

This response action is retained throughout the FS evaluation to comply with NYSDEC and CERCLA requirements.

Limited Action

The remedial options under this response action include security fencing, and deed restrictions. As with the surface water sediments, an inspection program would be necessary for a security fencing system. Restriction on future property use could be incorporated for the site soils as appropriate should the land be sold in the future. The costs of these options are considered low. Limited action for the site soils will be considered in the detailed analysis.

Containment

Containment methods including soil cover, low permeability soil, and a synthetic cap would meet the remedial action objectives for site soils. These process options prevent direct contact with the soils and reduce infiltration. The fact that the low permeability soil and synthetic caps would reduce infiltration would tend to limit the mobility of the compounds in the soil. As such, low permeability capping could be used in conjunction with a remedial plan that was aimed at holding the compounds in place. A soil cap that limits contact with the soils while allowing some infiltration would be more appropriate in cases where the remedial plan used treatment methods that were designed to remove the compounds from the soil for subsequent collection or treatment. These options would require a maintenance program to assess if they are performing as designed. Costs for these options are considered high. Containment of the site soils will be considered in the detailed analysis.

"Hot Spot" Removal

The site soils in the "Hot Spot" area could be excavated from their present location for subsequent treatment/disposal offsite. This would result in a reduction of the volume of affected soils at the site. Costs for the removal option were considered high relative to the others considered. "Hot Spot" removal will be considered in the detailed analysis.

Treatment

In-situ treatment methods such as vapor extraction, biodegredation, bioventing, soil flushing and steam stripping were considered for treatment of the site soils.

Vapor extraction would reduce the volume of VOCs in the soil at the site. Vapor extraction has the added affect of introducing oxygen rich air into the subsurface thus acting in a manner similar to a bioventing system, increasing the rate of biological degradation. Therefore, for the purposes of the feasibility study, these process options will be considered together. Vapor extraction is readily implementable at moderate capital costs and is retained for further consideration.

Biological treatment has proven effective at treating petroleum contaminated soils but its use in treating mixtures of a variety of chlorinated VOCs and SVOCs has been limited to bench and pilot scale studies. There is also a lack of certainty of the success in implementing bioremediation in Northern climates. As such, bench and pilot scale treatability studies would be necessary to evaluate the effectiveness and implementability of in-situ biological treatment at the Chem -Trol site and this treatment method will not be considered further.

Soil flushing is currently being developed as a remedial method to treat soils contaminated with mixtures of VOCs and SVOCs as are present at the Chem-Trol site. However, as in the case of bioremediation it also has not been used to treat actual sites. This technology will not be considered further in the feasibility study.

Steam stripping is effective at removing VOCs from soil but not SVOCs. This technology will not be considered further due to its lack of ability to treat SVOCs since vapor

extraction could treat the VOCs at the Chem-Trol site with fewer implementation problems.

3.5.3 Groundwater

Remedial technologies and process options for groundwater are summarized in Table 10 and are discussed below.

No Action

This response action is retained throughout the FS evaluation to comply with NYSDEC and CERCLA requirements.

Limited Action

The remedial options under this response action include security fencing, and deed restrictions. As with the surface water sediments, an inspection program would be necessary for a security fencing system. Restriction on future property use including the drilling of wells could be implemented including restrictions on drilling groundwater wells in downgradient areas. The costs of these options are considered low.

Collection

Groundwater collection would reduce the mobility of compounds at the site by manipulating groundwater flow patterns. This general response action is considered readily implementable at moderate costs. As such, collection is retained for further consideration in combination with other methods aimed at treating the affected groundwater as discussed below.

Ex-Situ Treatment/ Discharge

This response action includes the groundwater collection methods listed above and couples them with ex-situ treatment. This remedial approach is widely used to treat sites similar to Chem-Trol. However, because of the low solubility of the compounds and other factors such as adsorption, this response action removes compounds from the ground very slowly, resulting in very long times to reach remedial action objectives.

A variety of treatment process option are effective at removing compounds from the pumped groundwater such that the water may be discharged to a surface water body such as the South Branch of Smokes Creek or the POTW (see Table 10). These methods include biological treatment (anaerobic and aerobic) and physical treatment (precipitation, stripping, carbon adsorption, reverse osmosis and ion exchange). The ex-situ treatment method used at the Chem-Trol site would likely include several unit operations in a treatment train. The selection of the treatment method will be made during remedial design.

Costs for this response action are considered high. This response action is retained since it represents the currently accepted practice for groundwater remediation.

In-Situ Treatment

In-situ treatment technologies include intrinsic bioremediation, bioremediation, air sparging, chemical transformation and reactive barriers.

As discussed above under "Site Soils", bioremediation (both intrinsic and enhanced) has proven effective at treating petroleum compounds and its use in treating chlorinated VOCs is currently being studied. This technology will not be retained due a lack of implementation at sites containing mixtures of VOCs in cold climates.

Air sparging would reduce the volume of compounds at the site soils by transferring them into the vadose zone for collection by a vapor extraction system. However this process option may not be effective in rock since the air movement is not widely understood. Small variations in permeability control air pathways and large portions of the targeted remediation zone may be bypassed by the air. As such, air sparging will not be considered further.

Chemical transformation has not been implemented at sites where there exists a mixture of unknown compounds. Therefore this process will not be considered further.

Reactive barriers are effective at removing a wide variety of compounds. However, it would not be practical to construct a reactive barrier wall in the bedrock or over an area

as large as is present at the site. As such, this technology was deleted from further consideration.

Containment

Methods of groundwater containment include vertical barriers, and encapsulation. Vertical grout curtains are effective, implementable means of reducing the amount of seepage at the site. These methods will be considered in feasibility studies.

The long-term effectiveness and implementability of encapsulation for immobilization of the VOCs at the site is unknown due to the potential for compounds to continue to leach and this technology was eliminated from further consideration.

4. DEVELOPMENT OF REMEDIAL ALTERNATIVES

The technically feasible remedial technologies retained after the preliminary screening and evaluation in Section 3 are combined in this section to form site wide remedial alternatives. Remedial alternatives were developed that protect human health and the environment through a range of appropriate management options. Appropriate options involve eliminating hazardous substances at the site, reducing the concentrations of these substances to acceptable levels, and preventing exposure to the substances or combinations of these methods.

The remedial technologies and process options retained after the initial screening discussed in Section 3.5 are listed in Table 11. In some instances more than one process option was retained after the initial screening. In these cases the process option that was felt to be more suitable for the site conditions was included in the detailed analysis of remedial alternatives. The rationale for selecting one process option over another is listed on Table 11.

The remaining process options were combined into remedial alternatives. Process option combinations were chosen such that a range of "source control" and "migration management" components were assembled. Source control refers to remedial processes that involve removal, treatment, or containment of the affected site soils and sediments that may serve as continued sources. Migration management relates to means of controlling substances that have moved away from source areas.

The source control and migration management components were assembled into an overall matrix where each axis contains system components which can be combined into 16 comprehensive site wide alternatives as shown on Table 12. Six of the 16 combinations were not considered to be reasonable and were therefore deleted from further consideration. These combinations are those that include "no action" for source control with the migration management components and those that include "no action" for migration management with the source control components. These alternatives would not comprehensively address site conditions.

4.1 PRELIMINARY SCREENING OF ALTERNATIVES

The remaining ten alternatives were screened using the criteria of effectiveness, implementability and costs as defined in Section 3. This evaluation is summarized on Tables 13 through 15. The following paragraphs discuss the rationale for eliminating certain alternatives based upon effectiveness, implementability, and costs.

Alternatives 2, 3 and 4 combine the migration management components of access restrictions and groundwater monitoring with increasingly agressive methods of source control (see Table 13). Alternatives 3 and 4 were judged to be ineffective. Alternatives 3 and 4 include upgrading the existing soil cover (Alternatives 3 and 4) and soil vapor extraction (Aternative 4). These componants of source control are only felt to be reasonable when combined with some active means of migration management. As such, Alternatives 3 and 4 will not be considered further during the detailed analysis. Alternative 2 includes removal of the on-site tributary sediments and "hot spot " soils along with access restrictions and monitoring. This alternative is believed to represent the minimal action necessary to be protective of human health and the environment and will be considered in the detailed analysis of alternatives.

Alternatives 8, 9 and 10 include groundwater pumping wells as the means of extracting groundwater. The volume of groundwater and well spacing that would need to be pumped to control flow at the site was estimated using a capture zone method presented in "Application of Capture-Zone Type Curves for Aquifer Cleanup" (Javandel, 1984). This estimate was made using the average hydraulic parameters presented in the RI (GZA, 1994). These calculations indicated a system consisting of four extraction wells pumping at 15 gallons per minute would be required. These wells would be spaced about 125 feet apart between MW-10R and MW-12R.

Such a pumping well system is not felt to be an effective means of capturing contaminated groundwater in fractured rock. In addition, aquifer heterogeneities and anisotropies would allow contaminants to potentially bypass even an elaborate groundwater recovery well system. It is our opinion that a closer well spacing may be necessary to prevent flow past the system through fractures that are not intersected by the wells. As a minimum, extensive testing (i.e., pumping tests, tracer tests, etc.) would be necessary to demonstrate

the effectiveness of such a system. It is believed that a continuous trench drain, included in Alternatives 5, 6, and 7, would be a more effective means of extracting groundwater.

The implementability of a system of pumping wells was also considered to be low due to the need to maintain pumps in each well. It is our experience that pumping well systems require a higher level of maintenance than gravity type systems (i.e., a trench drain) limiting their implementability.

Based upon the effectiveness and implementability considerations discussed above Alternatives 8, 9, and 10 were deleted from further consideration during the detailed analysis of alternatives.

4.2 ALTERNATIVE 1

Alternative 1	Groundwater Monitoring Sediment Monitoring Floodplain Monitoring

This alternative is included as a basis of comparison for the other alternatives as required by NYSDEC and CERCLA. This alternative does not include any active remedial work at the site. Periodic monitoring of surface water sediments and groundwater would be implemented as part of the alternative to assess changes in site conditions.

4.3 ALTERNATIVE 2

Alternative 2	Sediment Monitoring Enhanced Groundwater Monitoring Floodplain Monitoring "Hot Spot" Excavation/Treatment/Offsite Disposal On-site Tributary Sediment Excavation/Treatment/Offsite Disposal Access Restrictions Site Fence

This alternative includes "hot spot" soils and on-site tributary sediment removal, deed restrictions, a fence to prevent contact with materials at the site, and monitoring to evaluate if migration of the substances in the groundwater and surface sediments is occurring from their present location. This alternative would remove the most affected and accessible material from the site and eliminate contact with the remaining affected media. The enhanced groundwater monitoring includes studies to determine the extent of affected groundwater downgradient of the site.

It is noted that this alternative and each of those discussed below include removal and offsite disposal of the on-site tributary sediments. Another means of addressing the on-site tributary sediments is to cover them in place. Sediments in the on-site tributary could be covered with an erosion resistant cap consisting of a drainage filter fabric overlain by 1 foot of clean soil to limit direct contact.

As such, a sediment cover could perform adequatly to limit contact with the on-site tributary sediments. Covering the on-site tributary sediments may be considered during design of the choosen remedy.

4.4 ALTERNATIVE 5

Alternative 5	Sediment Monitoring Enhanced Groundwater Monitoring Floodplain Monitoring "Hot Spot" Excavation/Treatment/Offsite Disposal Access Restrictions On-site Tributary Sediment Excavation/Treatment/Offsite Disposal Groundwater Extraction and Treatment

In this alternative, in addition to the remedial technologies listed in Alternative 2, a groundwater pumping/ ex-situ treatment system would be installed. This is considered a traditional approach to remediating sites similar to Chem-Trol.

Experience with groundwater extraction at similar sites has indicated a lack of effectiveness in attaining complete site restoration. A recent study by the National Research Council (NRC, 1994) stated that groundwater pump and treatment systems have

not met the cleanup goals at any of the 42 sites contaminated with dense non-aqueous phase liquid. Groundwater pump and treat systems often act primarily as hydraulic containment systems limiting the mobility of the affected groundwater.

This alternative includes a trench drain as the means of extracting groundwater. Two methods of trench drain construction were considered, open cut trenching and directional drilling. These two construction methods and their impact on the remediation strategy are discussed in Section 5. The trench drain could be supplemented with extraction wells if it is found necessary to collect water from deeper in the bedrock.

The extracted groundwater would be treated on-site prior to discharge either to the South Branch of Smokes Creek or to the Erie County Sewer District No. 3 publicly owned treatment works (POTW).

4.5 ALTERNATIVE 6

Alternative 6	Sediment Monitoring
	Enhanced Groundwater Monitoring
	Floodplain Monitoring
	"Hot Spot" Excavation/Treatment/Disposal Offsite
	Access Restrictions
	On-Site Tributary Sediment Excavation/Treatment/Offsite Disposal
	Site Soils Cover
	Groundwater Extraction and Treatment

Alternative 6 includes the components of Alternative 5 but considers upgrading the existing cap over the site soils.

4.6 ALTERNATIVE 7

Alternative 7	Sediment Monitoring Groundwater Monitoring Floodplain Monitoring "Hot Spot" Excavation/Treatment/Offsite Disposal Limited Action Site Soils Cover On-site Tributary Sediment Excavation/Treatment/Offsite Disposal Soil Vapor Extraction Groundwater Extraction and Treatment

This alternative includes the components of Alternative 6 along with soil vapor extraction to remove VOCs from the site soils.

5. DETAILED ANALYSIS OF ALTERNATIVES

5.1 INTRODUCTION

A detailed analysis of the alternatives identified in Section 4 is presented below. This analysis provides the basis for selecting a preferred alternative. The detailed analysis consists of defining the components of each alternative with respect to affected site media, technologies to be implemented and performance requirements, and an assessment of the alternatives against prescribed evaluation criteria.

The identification of remedial alternatives is based solely on the existing data. No pilot plant or design related evaluations or studies have been conducted. Conclusions about sizes/ capacities, and estimated costs are subject to the limitations implied by the level of evaluation conducted. Differing conditions may become evident with further investigation. If such conditions become evident it may be necessary to reevaluate the feasibility of the remedial alternatives.

NYSDEC and EPA have identified nine evaluation criteria to use in assessing remedial alternatives. These criteria are divided into threshold criteria that must be achieved by the remedy, balancing criteria that are used to weigh one alternative against another, and modifying criteria to incorporate public comments. These evaluation criteria are listed and explained below.

Threshold Criteria

Overall protection of human health and the environment addresses whether an alternative provides adequate protection of human health and the environment, and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls. It also examines whether the alternative poses any unacceptable short-term or cross media impacts. The overall protection criterion is based on the results of several other evaluation criteria, especially long term effectiveness, permanence, and achieving SCGs/ARARs.

Compliance with standards criteria and guidance (SCGs) and applicable or relevant and appropriate requirements (ARARs) or other environmental laws is required by 6 NYCRR

Part 375 and CERCLA. A selected remedy generally must meet all SCGs/ARARs or provide grounds for invoking a waiver allowed under CERCLA. Compliance is addressed in relation to chemical specific, action specific and location specific SCGs/ARARs

Primary Balancing Criteria

Long-term effectiveness and permanence addresses the likelihood that alternative implementation will protect human health and the environment over the long term after remediation goals have been met.. It also addresses the adequacy and reliability of controls to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

Short-term effectiveness and environmental impacts addresses the effects of an alternative during the construction and implementation phase until remedial action objectives are met, including the speed with which the remedy achieves protectiveness and the potential to create adverse impacts on human health and the environment during construction and implementation. Also included under this criterion are the impacts to human and natural environment that may be of a longer duration.

Reduction of toxicity, mobility, or volume through treatment addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. This evaluation addresses the anticipated performance of the technologies that may be employed in achieving these treatment goals. It includes the amount of waste treated or destroyed; the reduction in toxicity, mobility or volume; the irreversibility of the treatment process; and the type and quantity of residuals resulting from the treatment process.

Implementability addresses the technical and administrative feasibility of implementing an alternative, and the availability of services and materials required during its implementation. This evaluation includes such items as the ability to construct and operate the technology; the reliability of the technology; the ease of undertaking additional remedial actions; the ability to obtain services, capacities, equipment, and personnel; the ability to monitor the performance and effectiveness of technologies; and the ability to obtain necessary approvals and coordinate with regulatory agencies and authorities.

The cost criterion addresses the costs associated with implementing a remedial action alternative, including capital costs, operating and maintenance costs, and total present worth costs. The cost estimates developed and presented are considered order-of-magnitude estimates (minus 30% to plus 50%). The costs presented in this report are subject to the following inherent limitations:

- The preliminary costs estimates presented in the report represent our best professional judgment in this matter but are not an absolute worst case remedial cost estimate. Actual quantities and unit costs will vary from those presented here depending on true labor and material costs, actual site conditions, competitive market conditions, implementation schedule, and other variables which cannot be accurately estimated until the time of implementation. The costs presented here include only those items identified and should not be construed to include other costs not listed.

Modifying Criteria

State or support agency acceptance will be assessed in the ROD following a review of the comments received on the draft FS.

Community acceptance will be assessed in the ROD following a review of the public comments received on the draft FS.

5.2 ALTERNATIVE 1 - NO ACTION

This alternative includes:

Component
Groundwater Monitoring
Sediment Monitoring
Floodplain Monitoring

This alternative is included in the feasibility study as a basis for comparison of other alternatives. This alternative represents the natural tendency of site conditions to improve with time. A monitoring system is included to observe this improvement.

Sediment Monitoring

Sediment monitoring would be implemented to assess the conditions in and around the affected portions of the on-site tributary. As discussed in Section 2, sediments in this area contain concentrations of PCBs up to 2.8 PPM, which is in excess of NYSDEC recommended soil cleanup criteria (TAGM 4046, NYSDEC, 1994) of 1.0 PPM for protection of human health and NYSDEC sediment cleanup criteria of 0.08 PPM for protection of the environment. Sediment monitoring locations have been established upstream, downstream and within this area (see Figure 9).

It is anticipated that the PCB concentrations would diminish slowly with time. Adsorption to organic material in sediments is the likely fate of more heavily chlorinated PCBs. Once bound to the sediments the PCBs may persist for years with slow desorption decreasing the concentrations in the sediments.

Groundwater Monitoring

Groundwater monitoring would be undertaken to observe conditions present in the lower soil and weathered bedrock zones. Groundwater beneath the site and in the area to the west (see Figure 7) contained primarily VOCs in excess of NYSDEC ambient groundwater standards. Similar to the sediments, monitoring would be conducted upgradient, downgradient and within the affected area. Existing monitoring wells would be used.

As with the sediments, it is expected that the concentrations of VOCs, SVOCs and metals in the groundwater would decrease with time due to natural attenuation. Factors that would tend to result in decreasing concentrations include natural biodegredation, dilution of the groundwater with infiltrating water, sorption of the substances to the soil, and chemical transformations.

Since the contaminant sources at the site would not be treated under this alternative it is anticipated that they may serve as a continued source of substances to the groundwater. The magnitude of the effect of this process on the concentrations in groundwater is uncertain.

Floodplain Soils Monitoring

Floodplain soils monitoring would be done to further assess the presence of hazardous substances in this area. As discussed in Section 2, one sample from this area (FPS-6) contained PAHs in excess of NYSDEC recommended cleanup objectives and a second sample (FPS-5) contained pesticides in a portion of the sample tested by NYSDEC's laboratory but not in the portion tested by SCA's laboratory. This monitoring will consist of collecting two samples in the vicinity of FPS-6 for PAH analysis and two samples in the vicinity of FPS-5 for pesticide analysis.

5.2.1 Overall Protection of Human Health and the Environment

The no action alternative is not considered protective of human health and the environment. Although it is believed that concentrations at the site will decrease with time, potential risks associated with the site are left unchanged in the short term.

5.2.2 Compliance with SCGs/ARARs

The "no action" alternative could be implemented in compliance with location and action specific SCGs/ARARs, including those associated with environmental monitoring (i.e. OSHA -Safety and Health Standards), and construction in potential wetland areas.

The "no action" alternative would not comply with the chemical specific SCGs/ARARs for ambient groundwater quality (6 NYCRR Part 704).

5.2.3 Long Term Effectiveness and Permanence

Groundwater and surface sediment monitoring would be adequate to assess the future conditions at the site and identify any future exposure pathways associated with the site. These types of action are used routinely to evaluate sites similar to Chem-Trol.

The long-term risks posed by the site are likely to be similar to those present today. Concentrations of substances in the site soils, surface water sediments, and groundwater would preclude future development of the site.

5.2.4 Reduction in Toxicity, Mobility and Volume Through Treatment

The only treatment that would affect toxicity, mobility and volume of substances at the site, are the natural processes discussed above.

5.2.5 Short-term Effectiveness

Short-term effects during implementation of monitoring activities related to the protection of the community, workers, and the environment, could be mitigated through the use of standard health and safety and construction practices that have been used at the site during past environmental monitoring work.

5.2.6 Implementability

The no action alternative is readily implementable and would not preclude other actions. New monitoring wells would be constructed and sampled using protocols previously implemented successfully at the site. The reliability of this monitoring data would be continually assessed using standard validation techniques. It is anticipated that approvals and coordination with public agencies, in addition to NYSDEC and NYSDOH would be minimal and would not hinder implementation.

5.2.7 Costs

The estimated costs associated with Alternative 1 are summarized below:

Capital Cost	$ 14,400
Annual Operation and Maintenance Cost	$ 63,120
30 Year Present Worth	$ 1,268,026

Refer to Appendix B for a breakdown of these costs.

5.3 ALTERNATIVE 2 - LIMITED ACTION

Alternative 2 includes:

Component	See Detailed Discussion Under Alternative:
Sediment Monitoring	1
Enhanced Groundwater Monitoring	
Floodplain Monitoring	1
"Hot Spot" Excavation/Treatment/Offsite Disposal	
On-Site Tributary Sediment Excavation/Treatment/Offsite Disposal	
Access Restrictions	
Site Fence	

Enhanced groundwater monitoring would include additional studies to assess the extent of affected groundwater downgradient of the site in addition to the monitoring discussed under Alternative 1. The "Hot Spot" identified during the RI at sample location SSI-2 would be excavated and taken offsite for treatment and disposal (see Figure 9). The institutional controls are intended to prevent contact with affected media. Access restrictions, including fencing to limit site access and deed restrictions, would be implemented to prevent direct contact with affected site soils, surface water sediment and groundwater.

Enhanced Groundwater Monitoring

As discussed in Section 2.4.1, VOCs were detected in groundwater samples collected at MW-13R west of the South Branch of Smokes Creek. It is our opinion that this observation is indicative of groundwater flow beneath the creek along the creek alignment (see Figure 8). Therefore we do not believe that affected groundwater is migrating further to the west.

The enhanced groundwater monitoring program includes studies to confirm the assumptions made in the conceptual model. These studies include installing two new monitoring wells, one to the west of the site along the South Alfred Road right-of-way and the other along the creek downgradient of the site (see Figure 10 for proposed locations).

Samples from these two monitoring wells and existing well MW-13R would be analyzed for volatile organic compounds using New York State Analytical Services Protocol (NYSASP). Depending upon the results of this analysis the need for further action will be evaluated.

"Hot Spot" Excavation/Treatment/Offsite Disposal

Prior to excavation of the material at SSI-2, additional testing would be done to further define the extent of this material. The presumed extent of this area is shown on Figure 9. Based upon the RI test results, it is expected that the volume of soil to be removed is about 280 cubic yards.

Excavation work would be done in accordance with an appropriate health and safety plan. It is anticipated that suitable engineering controls and personnel protective equipment are available to adequately protect workers and the surrounding community during excavation and handling of the soils.

"Hot Spot" removal would require construction of a staging area for temporary storage of materials. Excavated material would be placed in the staging area, while the analytical testing needed for characterization is completed. It is anticipated that the staging area

would be a bermed area lined with a low permeability synthetic material. The excavated material would also be covered with synthetic to prevent runoff.

Disposal options for this material were discussed with representatives of a waste disposal company. They indicated that analytical testing is needed to determine the appropriate disposal method for this material. Testing would be done at a rate of one analysis per 200 cubic yards of soil. Analytical testing to be completed for characterization of the material would include:

- Toxicity Characteristic Leaching Procedure (TCLP) metals SVOCs, pesticides, herbicides and VOCs, and
- Total SVOCs, pesticides, herbicides, PCBs and VOCs.

Depending upon the results of the testing the material may be landfilled or incinerated. For the purposes of cost estimating it is presumed that the material would be incinerated.

On-Site Tributary Sediment Excavation/Treatment/Offsite Disposal

The on-site tributary sediment would be removed by excavating the affected materials, and staging them on-site for analytical characterization similar to that described above. It is presumed that the material could be then transported to an offsite facility for disposal. The excavation along the on-site tributary would be backfilled and graded using materials similar to those that were excavated. The area would then be revegetated with plants indigenous to the area.

Limited Action/Site Fence

Access restrictions would be used to prevent contact with the site soils, surface water sediments, floodplain sediments and groundwater. A perimeter site fence would be used to prevent unintentional access to the site. Deed restrictions regarding excavation, land use and groundwater wells would be implemented.

The following discussions present the detailed analysis of this alternative primarily focusing on the components unique to this alternative. For further information on the other components refer to the discussions referenced above.

5.3.1 Overall Protection of Human Health and the Environment

This alternative mitigates the known site risks primarily through implementation of institutional controls and removal of the "hot spot" soils and the on-site tributary sediments. Removal of "hot spot" soils and sediments from the site would permanently reduce risks by reducing the volume of affected media. Similar to Alternative 1, natural processes would tend to reduce the concentration of substances in the groundwater at the site. The monitoring program would be used to assess the effectiveness of the institutional controls on limiting direct contact, and the long term effect of natural processes.

5.3.2 Compliance with SCGs/ARARs

Alternative 2 could be implemented in compliance with action specific and location specific SCGs/ARARs. This would require special consideration of dredge requirements, and floodplain management/wetland protection. Other action specific SCGs/ARARs are those pertaining to worker health and safety. It would also be necessary to comply with SCGs/ARARs for hazardous material identification, packaging, transportation, manifesting and storage. Location specific SCGs/ARARs related to fence construction near the South Branch of Smokes Creek and within potential wetlands could be complied with.

Chemical specific groundwater SCGs/ARARs for ambient water quality (i.e. 6 NYCRR Part 704) would not be met.

5.3.3 Long Term Effectiveness and Permanence

Excavation, treatment and offsite disposal of the "hot spot" soils and on-site tributary sediments would result in a permanent reduction in risks posed by the material. Residual risks at the site associated with the these materials would be minimal since the material would be removed.

Institutional controls would generally be effective as long as the owners of the site maintain them appropriately. The effectiveness of fencing this site for preventing access is uncertain since the site is traversed by two streams. As such, the fence would have to abut the streams allowing access to the site at these locations.

Deed restrictions would require legal attention during transactions regarding the property. The overall reliability of this alternative is considered good as long as SCA maintains ownership of the property.

This alternative mitigates current potential risks posed by site soils, surface water sediment, and groundwater at the site. A potential future risk may be experienced if the institutional controls are not kept in place.

5.3.4 Reduction of Toxicity, Mobility and Volume Through Treatment

Sediments removing would reduce the volume of affected material at the site. Disposal of the on-site tributary sediments would take place off-site. The material would be placed in a permitted landfill, limiting the mobility of any residuals in the sediments.

Alternative 2 also includes the excavation and off-site treatment of the identified "hot spot" in the vicinity of SSI-2. This sample contained the highest concentrations of SVOCs, PAHs, pesticides and PCBs observed in the site soils. Removing this material from the site eliminates the material containing the majority of volume of these substances. Based upon the RI test results it is estimated that this would eliminate over 90 percent of the PCBs and pesticides from the site.

Alternative 2 does not include treatment to reduce the toxicity, mobility or volume of substances in the groundwater at the site. Treatment of these materials would be through natural processes that would work at much slower rates than active remedial measures.

5.3.5 Short term Effectiveness

Factors considered related to the short-term effectiveness of Alternative 2 include environmental impacts and the protection of site workers and the community during excavation of the "hot spot" and the on-site tributary sediments. Additionally some environmental impacts may occur during fence construction.

It is anticipated that engineering controls (i.e. dust suppression, erosion control, and air monitoring) and personnel protective equipment could be used to adequately protect the community and remediation workers during construction work at the site. Offsite disposal would result in about 60 to 80 truck trips to and from the site. This is not anticipated to

pose a problem since the site is serviced by Lake Avenue, a road approved for use by tandem trucks. The effect of this truck traffic is expected to be small and of short duration (i.e., several days).

Excavation of the "hot spot" and, to a lesser degree, constructing the fence would cause environmental impacts during construction. These impacts could be mitigated through the use of controls such as silt fences and dust suppression.

Excavation of the sediments would result in short-term and permanent environmental impact in the vicinity of the on-site tributary. These impacts could be controlled by restoring the area to a condition similar to that which is currently present.

It is anticipated that Alternative 2 could be designed and implemented over the course of one construction season.

5.3.6 Implementability

Alternative 2 is comprised of technologies and construction practices that are currently available and routinely implemented at similar sites. It is anticipated that these technologies could be constructed and operated in a reliable manner with a monitorable effectiveness.

Sediment and soil removal, treatment, and disposal is an implementable technology. Similar removal actions have taken place (i.e. Black and Bergholtz Creeks Remediation, Niagara Falls, NY) and permitted facilities currently have the capacity to receive the materials.

Implementation would require approval and coordination with other agencies. United States Army Corps of Engineers (USACOE) approval may be necessary for the work done in the vicinity of the South Branch of Smokes Creek and its floodplain. Sediment removal would require coordination with other agencies such as the USACOE and NYSDEC Division of Fish and Wildlife.

5.3.7 Costs

The estimated costs associated with Alternative 2 are summarized below:

Capital Cost	$ 1,347,719
Annual Operation and Maintenance Cost	$ 69,600
30 Year Present Worth	$ 2,730,044

Refer to Appendix B for a breakdown of these costs.

5.4 ALTERNATIVE 5

Alternative 5 includes:

Component	See Detailed Discussion Under Alternative:
Sediment Monitoring	1
Enhanced Groundwater Monitoring	2
Floodplain Sediment Monitoring	1
"Hot Spot" Excavation	2
Deed Restrictions	2
On-Site Tributary Sediment Excavation/Treatment/ Disposal	2
Groundwater Extraction and Treatment	

The monitoring program, "hot spot" removal, sediment removal, and access restrictions are discussed under Alternatives 1 and 2. Refer to previous discussions of these systems components. The details of the groundwater pumping and treatment system are discussed below.

Groundwater Extraction and Treatment

Groundwater would be collected by a subsurface drain installed in the weathered bedrock. The drain would consist of a continuous slotted pipe surrounded by stone. The proposed length of the drain is 600 feet, and three manholes would be placed along the alignment to provide access. The proposed location of the drain is shown on Figure 11.

The drain would be located near the South Branch of Smokes Creek (see Figure 11). This location was selected because it is downgradient of most of the affected groundwater at the site, but still within the affected area. Therefore, a drain at this location would intercept upgradient flow towards it and tend to draw affected groundwater back.

The drain would be positioned within the weathered shale. This would allow the drain to intercept fractures in the shallow bedrock and therefore remove substances effectively from this zone. The drain system would be supplemented with relief wells to collect water from deeper in the bedrock. The drain would flow toward a pumping station. A conceptual detail of the drain system is shown on Figure 12.

Relief wells are often used to relieve uplift pressures beneath dams where the permeable stratum is too deep to be penetrated by a drain. The concept is to provide groundwater at depth and higher hydrostatic heads a means to flow to the drain (Cedergren, 1989). At the Chem-Trol site the hydrostatic head in the weathered shale is near the top of rock. The drain and relief wells would be used to lower the head near the top of weathered shale to below the top of rock. The drain would lower the head at the top of the relief wells such that a gradient is maintained from the bottom of the wells to the top causing flow up the well (see Figure 12). The drain system would be operated at a flow rate designed to collect the full volume of water that passes beneath the site (see discussion of flow rates below).

As discussed in Section 4, installation of the trench drain may be accomplished by a "cut and cover" technique or by directional drilling. The final decision on which method would be appropriate for the site would be made during remedial design.

The "cut and cover" method involves excavating a trench to the required depth into the rock for drain placement. It is presently expected that a trench would be excavated 5 to 10

feet into the rock. The directional drilling technique would include drilling a hole from the ground surface along the alignment using drilling mud to stabilize the hole and pulling a pipe into the hole.

The following sections discuss considerations related to the two construction methods.

"Cut and Cover" Trench drain Construction

Preliminary assessment of the rock unit for excavation has been made based upon data in the RI (GZA, 1994) and a site visit. The rock is described as slightly to moderately weathered shale to down to depths of approximately 20 feet from the bedrock surface. The material has thin bedding and evidence of vertical jointing.

The quality of the rock unit was assessed using the Rock Mass Rating (RMR) System (Bieniawski, 1988). This classification system uses the uniaxial compressive strength of the rock material, rock quality designation (RQD), spacing of discontinuities, condition of discontinuities, groundwater conditions, and orientation of discontinuities to assess the ability to excavate a rock formation. The weathered rock at the site was described as fair, with a RMR of about 40 indicating that the rock is not diggable and excavation by ripping is likely to be very difficult (Franklin, 1989). It is likely that it would be necessary to loosen the rock by blasting prior to excavation. Before the excavation method can be determined further design study is necessary including test borings and or test pits along the proposed drain alignment. The additional design information would include:

- Borings and or test pits along the drain alignment to determine the depth to the more competent shale;
- A field test to determine the depth of rock excavatability; and
- Piezometers to measure the hydraulic head and vertical gradients along the drain alignment.

After the trench is excavated it would need to be dewatered prior to drain pipe installation. Since the dewatering system discharge would need to be treated this could represent a significant portion of the cost of the "cut and cover" installation method. Dewatering costs represent a significant unknown in estimating construction costs of

this method. Sequencing the construction so that the groundwater treatment system is in place prior to construction could reduce the dewatering costs.

It is presumed that the rock spoil could be used to backfill the upper portion of the excavation and that offsite disposal of this material would not be necessary. If this is not the case then disposal of the spoil may represent a significant cost depending upon the chemical characteristics of the material.

In summary, the advantages and disadvantages of the "cut and cover" excavation method include:

Advantages

- This excavation method is a proven technology,
- Local contractors are readily available to do the work, and
- The trench would provide an effective cutoff intercepting flow in fractures extending from the top of rock to the pipe elevation.

Disadvantages

- Ease of excavation is uncertain,
- Excavation would create ground disturbance in a potential wetland area,
- Dewatering costs could be significant and are highly uncertain, and
- Excavation spoil may require special handling and disposal depending upon its chemical characteristics.

The cost estimates for the drain system and the detail in Figure 12 presume that this excavation method is used.

Horizontal Directional Drilling

Horizontal directional drilling is a technique often used to install pipelines beneath river beds. It is considered an attractive alternative since it creates less ground disturbance than the "cut and cover" method, would result in less excavation spoil and does not require dewatering.

Directional drilling has certain space requirements that become significant when considering a site the size of Chem-Trol. On the drilling side of the alignment a 40 foot

wide by 70 foot long working area is required for drilling equipment. In order to reach the desired depth the pipe must be angled on the entry and exit sides of the alignment. The entry and exit side angles are generally limited by the radius to which the collection pipe may be pulled and the maneuverability of the drilling equipment. At the Chem-Trol site approximately 100 feet may be needed to reach the required depth. Additionally, the collection pipe is usually assembled on the exit side of the alignment prior to pulling it back through. Therefore about 600 feet beyond the exit side of the drain would be required to assemble the pipe at Chem-Trol. Space requirements could be reduced if the pipe is assembled in sections as it is pulled back through the bored hole.

The area of the Chem-Trol site where the drain is proposed for construction does not have enough space to accommodate the items listed above. On the south side of the drain there is less than 50 feet to the embankment of Lake Avenue and on the north side there less than 100 feet to the on-site tributary. The area north of the on-site tributary is separated by a steep slope and is wooded.

Advantages and disadvantages to the use of horizontal directional drilling are listed below.

Advantages

- Decreased ground disturbance
- Limited volume of spoil
- Dewatering is not required

Disadvantages

- Space limitations required at the entry and exit sides of the boring may necessitate obtaining temporary easements on adjacent property, clearing wooded areas of the site, or using non conventional drilling methods
- The use of drilling mud would require "development" of the drain to assure that it is functioning as intended
- Some groundwater may bypass the drain in fractures above the drain elevation
- Horizontal directional drilling requires the use of a specialty contractor

The pumping rate for the groundwater collection drain was assessed using a software package entitled BEAVERSOFT (1987), developed by Jacob Bear and Arnold Verruijt. The program models plane, steady state flow with infiltration and leakage using the finite element method. These calculations are intended to give an initial approximation of the rate of groundwater extraction for this alternative so that it may be compared to other alternatives. Further work may be necessary to design the system for implementation.

The program was used to calculate the flow from the drain necessary to meet two design criteria:

1. The upgradient capture width should exceed the width of affected groundwater flowing beneath the site, and
2. A gradient from the South Branch of Smokes Creek toward the drain should be maintained.

The first criteria is intended to address continued migration from the site. The second criteria is aimed at drawing affected groundwater back toward the site for treatment to the extent practical.

These preliminary calculations indicate that a flow rate of 50 to 100 gallons per minute would meet the design criteria depending upon the location of the drain relative to the creek. This flow results in a predicted head in the vicinity of the drain that is about 2 feet below the elevation of the South Branch of Smokes Creek.

The extracted groundwater would be treated either at the site or the publicly owned treatment works (POTW) at Erie County Sewer District No. 3.

The ex-situ treatment system would be comprised of a combination of the unit processes listed in Table 11. Preliminary analysis indicates an on-site treatment system, consisting of an air stripper followed by carbon adsorption, could treat the extracted groundwater for discharge to the South Branch of Smokes Creek. It is presumed that the "total organic substances" treatment requirement for discharge to the creek would be 0.1 mg/l as listed in 6 NYCRR Part 702.16.

Pretreatment of metals may also be necessary to prevent fouling of the system. The vapor discharge from the air stripper would be treated by catalytic oxidation prior to discharge to the atmosphere.

Erie County Sewer District No. 3 has indicated that they may be able to accept the extracted water for treatment. The pretreatment requirement for discharge to their system for "total toxic organics" is 2.13 mg/l. This discharge option may be considered during design of the system.

The groundwater extraction and treatment system would be operated until no further improvement in water quality is observed in the groundwater monitoring. An assessment of the potential risks posed by the groundwater would then be completed, taking into account the water usage and chemical characteristics. If these risks are found to be within acceptable ranges then groundwater would be monitored for a period of time to determine if the levels of substances begin to increase. If no significant increase is noted then the treatment would be discontinued. If unacceptable potential risks are identified then alternative approaches to the remedial plan will be considered.

5.4.1 Overall Protection of Human Health and the Environment

This alternative achieves overall protection of human health and the environment. The "hot spot" soils and on-site tributary sediments would be removed from the site. Affected groundwater would be extracted for treatment. Additionally, monitoring and deed restrictions would act as secondary means of assuring that risks are mitigated and that the systems are operating as intended.

5.4.2 Compliance With SCGs/ARARs

Action specific SCGs/ARARs for this alternative include those associated with OSHA health and safety requirements, SPDES requirements related to discharge to the South Branch of Smokes Creek (if appropriate), pretreatment requirements for discharge to a POTW (if appropriate), hazardous materials handling, air quality emission standards, and wetlands regulations. It is anticipated that this alternative could be implemented in accordance with each of these SCGs/ARARs.

Location specific SCGs/ARARs related to wetlands and surface waters would also have to be considered during design. It is anticipated that these SCGs/ARARs would be met by this alternative.

Chemical specific SCGs/ARARs for groundwater and surface water include New York State ambient water quality standards It is unlikely that the groundwater at the site would be remediated to these levels in the next several years. However, the pumping system would contain the majority of the affected groundwater, preventing further contravention of SCGs/ARARs.

5.4.3 Long-term Effectiveness and Permanence

Upon successful implementation of Alternative 5, the residual site risk would be limited. Subsurface drains may be subject to clogging by biological activity or sediment infiltration. These processes would be considered in the design of the system. As such, operation and maintenance is required to assure long-term effectiveness.

The technologies included in this alternative are routinely implemented at sites similar to Chem-Trol. The alternative includes monitoring and operation and maintenance. Therefore, control of the remedy is believed to be adequate and reliable.

5.4.4 Reduction of Toxicity, Mobility and Volume Through Treatment

This alternative includes active measures to reduce the mobility and volume of affected media. As discussed above the volume of substances in the site soils would be substantially reduced through the "hot spot" removal. The volume of the affected sediments in the on-site tributary would be limited by the removal of this material.

The mobility and volume of substances in the groundwater would be reduced by the groundwater extraction system. The mobility would be reduced since the potential for offsite migration would be lessened by the groundwater extraction system. Volume of substances present in the ground would be reduced by the ex-situ treatment of the groundwater. Residuals of the on-site treatment would include the air discharge from the air stripper and the spent carbon. These residuals would be managed appropriately by limiting discharge from the air stripper to permitted levels and through carbon

regeneration. There would not be site related residuals if the water were treated at the POTW.

5.4.5 Short-term Effectiveness

Construction activities at the site, related to drain construction and removing the surface water sediments and "hot spot" soils, would result in short-term effects. These effects would result from dust emissions from the site, erosion and increased truck traffic.

Protection of the community and site workers would be achieved through the use of engineering controls and personnel protective equipment. Environmental impacts would be mitigated by limiting construction activities to the affected areas of the site and restoring the site to its present condition where practical.

It is anticipated that implementation of this alternative could be completed in one construction season.

5.4.6 Implementability

The components of Alternative 5 are readily constructable using conventional construction techniques. The construction methods included in this alternative have been used many times in the past and quality control methods have been developed to measure that the constructed work meets the design requirements. For example, drain installation by directional drilling techniques would require measuring the location of the pipe horizontally and vertically. This is done using instrumentation placed at the drill bit to measure inclination and azimuth. This data is used to calculate the location of the hole along its alignment.

This alternative would require the approval of Erie County Sewer District No. 3, if it was decided to discharge the extracted groundwater there. If this approval was not possible, then on-site discharge would be necessary. Similar to Alternative 2, coordination with the USACOE would be necessary for work in the vicinity of wetlands and surface waters.

5.4.7 Costs

The estimated costs associated with Alternative 5 are summarized below:

Capital Cost	$ 3,133,229
Annual Operation and Maintenance Cost	$ 317,040
30 Year Present Worth	$ 9,429,960

A breakdown of the costs for Alternative 5 is presented in Appendix B.

5.5 ALTERNATIVE 6

Alternative 6 includes:

Component	See Detailed Discussion Under Alternative:
Sediment Monitoring	1
Enhanced Groundwater Monitoring	2
Floodplain Sediment Monitoring	1
"Hot Spot" Excavation/treatment/Offsite Disposal	2
Deed Restrictions	2
On-Site Tributary Sediment Excavation/Treatment/ Offsite Disposal	2
Site Soils Cover	
Groundwater Extraction and Treatment	5

The monitoring program, "hot spot" removal, on-site tributary sediment removal and deed restrictions are discussed under Alternative 2. The groundwater extraction and treatment systems are discussed under Alternative 5. Refer to previous discussions of these systems components. The details of the soil cover are discussed below.

The seep area at SWS-12 will also be covered with a soil cover similar to that discussed below. Prior to placing the cover, the source of the seep will be controlled so that the

cover material is not eroded. The seepage may be controlled by diverting it to the groundwater collection system or by limiting the source.

Site Soils Cover

The intention of the site soils cover is to supplement the existing cap so that a uniform thickness is maintained and to prevent direct contact with the site soils while allowing processes that tend to promote natural treatment to proceed. These processes include dissolving of substances in the soil into infiltrating water and vaporization. These processes are further discussed below.

The rate of dissolution into infiltrating water is dependent upon the permeability of the surrounding soils which primarily controls the amount of infiltration. The natural soils at the site have a low permeability, on the order of $1x10^{-6}$ cm/sec (GZA, 1994). It was estimated in the RI that about 5 to 8 inches of infiltration occurs annually. The effect of this infiltration is to slowly remove chemicals from the soil as they partition into the water and migrate down to the groundwater table. Since this alternative includes a groundwater extraction and treatment system to collect the infiltrating water, it is felt that the cover should have a permeability equal to or greater than the natural soils. This will allow the infiltration that is presently occurring to continue and act as a treatment process for the soils.

A second natural process that tends to treat the soils is vaporization. Movement of vapor away from the affected material is controlled by molecular diffusion. The diffusion rate depends on the diffusion coefficient (which is a function of the compound and the media) and the concentration gradient. Use of a low permeability cover would tend to decrease the diffusion coefficient of a particular compound, resulting in less vaporization. Similarly, a low permeability cap would tend to hold vapor within the vadose zone and decrease the concentration gradient, limiting volatilization. Therefore, the cap should have as high a permeability as possible to promote volatilization.

In consideration of the issues discussed above, a cap consisting of 1.5 feet of soil with a permeability greater than $1x10^{-6}$ cm/sec and 0.5 feet of topsoil would be used to limit direct contact. The former active portion of the site is reportedly covered with approximately 2 feet of soil. Observations at the site indicate that this material is present across part of the area of affected site soils. However, erosion may have removed the soil

in some areas. Therefore the first step in capping would be to evaluate the thickness and permeability of the existing soil. Material would then be added such that the cover material properties stated above are maintained.

5.5.1 Overall Protection of Human Health and the Environment

This alternative achieves overall protection of human health and the environment through active treatment of each of the affected media. "Hot spot" soils and on-site tributary sediments would be removed from the site. The site soils would be covered to prevent direct contact. Affected groundwater would be extracted for treatment. Additionally, monitoring and deed restrictions would act as secondary means of assuring that risks are mitigated and that the systems are operating as intended.

5.5.2 Compliance With SCGs/ARARs

Action specific SCGs/ARARs for this alternative include those associated with OSHA health and safety requirements, SPDES requirements related to discharge to the South Branch of Smokes Creek (if appropriate), pretreatment requirements for discharge to a POTW (if appropriate), hazardous materials handling, air quality emission standards, and wetlands regulations. It is anticipated that this alternative could be implemented in accordance with each of these SCGs/ARARs.

Location specific SCGs/ARARs related to wetlands and surface waters would also have to be considered during design. It is anticipated that these SCGs/ARARs would be met by this alternative.

Chemical specific SCGs/ARARs for groundwater and surface water include New York State ambient water quality standards It is unlikely that the groundwater at the site would be remediated to these levels in the next several years. However, the pumping system would contain the majority of the affected groundwater, preventing further contravention of SCGs/ARARs.

5.5.3 Long-term Effectiveness and Permanence

Upon successful implementation of Alternative 6, the residual site risk would be limited. Alternative 6 mitigates risks primarily through limiting the potential for contact (i.e. with site soils, and groundwater). The site soils cap would require routine inspections to assure that it is functioning as designed.

The technologies included in this alternative are routinely implemented at sites similar to Chem-Trol. The alternative includes monitoring and operation and maintenance. Therefore, control of the remedy is believed to be adequate and reliable.

5.5.4 Reduction of Toxicity, Mobility and Volume Through Treatment

This alternative includes active measures to reduce the mobility and volume of affected media.

As discussed above the volume of substances at the site would be substantially reduced through the "hot spot" and on-site tributary sediments removal.

The mobility of the site soils through erosion, would be limited by the cover material. This reduction in mobility is reversible if the cover material were to be breached, highlighting the importance of careful maintenance of the system.

Similar to Alternative 5, the mobility and volume of substances in the groundwater would be reduced by the groundwater extraction system. However, as noted previously, pump and treat systems are not likely to attain complete site restoration.

5.5.5 Short-term Effectiveness

Construction activities at the site, related to drain construction and removing the surface water sediments and site soils, would result in short-term effects. These effects would result from dust emissions from the site, erosion and increased truck traffic.

Protection of the community and site workers would be achieved through the use of engineering controls and personnel protective equipment. Environmental impacts would

be mitigated by limiting construction activities to the affected areas of the site and restoring the site to its present condition where practical.

The amount of increased traffic would depend primarily on the volume of material needed to cover the site soils. Since the site is presently covered, it is believed that the quantity of soil necessary to upgrade the thickness over the site soils would be small (i.e. several thousand cubic yards) and would not impair traffic conditions near the site. However, it will be necessary to take the surrounding community into consideration when scheduling remedial work (i.e. limiting truck traffic to daylight hours).

It is anticipated that implementation of this alternative could be completed in one construction season.

5.5.6 Implementability

The components of Alternative 6 are readily constructable using conventional construction techniques. The construction methods included in this alternative have been used many times in the past and quality control methods have been developed to measure that the constructed work meets the design requirements.

Similar to Alternative 5 this alternative would require the approval of Erie County Sewer District No. 3, if it was decided to discharge the extracted groundwater there. If this approval was not possible, then on-site discharge would be necessary. Similar to Alternative 2, coordination with the USACOE would be necessary for work in the vicinity of wetlands and surface waters.

5.5.7 Costs

The estimated costs associated with Alternative 6 are summarized below:

Capital Cost	$ 3,270,929
Annual Operation and Maintenance Cost	$ 335,040
30 Year Present Worth	$ 9,837,880

A breakdown of the costs for Alternative 6 is presented in Appendix B.

5.6 ALTERNATIVE 7

The components of Alternative 7 are summarized in the following table.

Component	Components discussed in alternative
Sediment Monitoring	1
Enhanced Groundwater Monitoring	2
Floodplain Monitoring	1
"Hot Spot" Excavation/Treatment/Offsite Disposal	2
Access Restrictions	2
Soil Cover	6
On-site Tributary Sediment Excavation/Treatment/ Offsite Disposal	2
Soil Vapor Extraction	
Groundwater Extraction and Treatment System	5

This alternative includes the components of Alternative 6 along with soil vapor extraction. The components of Alternative 7 are shown in plan on Figure 14 and in cross section on Figure 15. Please refer to previous discussions regarding the other components of the alternative. The soil vapor extraction system is discussed below.

Soil Vapor Extraction

This alternative represents an active approach to the remediation of residual VOCs in the site soils. Rather than relying on natural processes to treat the soil, a vapor extraction system would be used to remove VOCs. The vapor extraction system promotes the volatilization of compounds from the soil. SVE promotes mass transfer by volatilization by increasing the concentration gradient and removing compounds as they volatilize.

The soils targeted for treatment by soil vapor extraction (SVE) are at a depth of 2 feet to about 8 feet below ground surface. It is anticipated that the SVE system would consist of a series of horizontal, perforated pipes placed in trenches. The pipes would be placed in the slag fill where it is possible since this material is more porous than the natural soils and

would promote vapor movement. A schematic layout of the piping for the SVE system is presented on Figure 14. The actual layout of the piping system would be determined during design based upon pilot studies.

Air would be drawn from the pipes using a vacuum blower extraction system. Typically, the extraction system includes sampling ports, flow measurement devices (pitot tubes), a condensate tank to remove water vapor from the air, particulate filters, air makeup valves to control flow quantities and the blowers.

If necessary, an air treatment system may be added. The need for a treatment would depend upon:

1. The concentration of substances in the soil gas.
2. The flow rate necessary to achieve the desired treatment.
3. The air loading emission limits established for the project.

These factors would be considered in designing the system. Treatment processes for SVE systems often consist of carbon adsorption for low concentrations and catalytic oxidation for high concentrations.

The goal of operating the SVE system would be to reduce the concentration of VOCs in the soils to below the remedial action objectives (i.e., TAGM #4046, NYSDEC, 1994). Monitoring would be done during operation of the system to assess the progress of the remedial effort. When the monitoring indicates that the remedial action objectives may have been attained samples of the soil would then be collected for testing. Depending upon the results of this testing the need for further action will be evaluated.

5.6.1 Overall Protection of Human Health and the Environment

Alternative 7 provides protection of human health and the environment through active measures to mitigate risks identified for the site. Affected surface water sediments, site soils and groundwater would each be addressed.

5.6.2 Compliance With SCGs/ARARs

Compliance with chemical specific, action specific and location specific SCGs/ARARs for the SVE system components of this alternative are discussed below.

To-be-considered criteria for soil listed in NYSDEC TAGM 4046, Recommended Practice for Establishing Soil Clean-up Objectives, (NYSDEC, 1994) would form the basis for evaluating the effectiveness of the SVE system. It is anticipated that the SVE system could result in a reduction of the concentration of volatile organic compounds in the soil to concentrations less than those stated in the NYSDEC TAGM.

As with the other alternatives, this work would involve some construction in wetlands and adjacent to navigable waters. It is anticipated that the work could be done in accordance with applicable regulations.

5.6.3 Long-term Effectiveness and Permanence

The SVE system would result in a permanent reduction of the mass of substances in the soil. Reduction of the concentration of VOCs to below the criteria in NYSDEC TAGM #4046 would eliminate the potential risk for these substances.

SVE systems are considered a demonstrated technology for treating soils affected with VOCs (National Research Council, 1994). Controls placed on the system would adequately and reliably assure that it operates as intended.

5.6.4 Reduction In Toxicity, Mobility and Volume Through Treatment

The SVE would reduce the volume of the VOCs in the site soils. It is expected that the amount of VOCs in the soil could be reduced to the TAGM 4046 criteria. Residuals from the SVE would consist of air discharge or spent carbon (if used as an air treatment media).

5.6.5 Short-term Effectiveness

Similar to the other components of this alternative it is expected that the community and site workers could be adequately protected by conventional engineering controls and

personnel protective equipment during installation of the SVE system. Environmental impacts of these actions would be limited.

It is anticipated that the components of this alternative could be constructed during one construction season.

5.6.6 Implementability

The SVE system is comprised of readily available components that are routinely used. The construction of the SVE would not preclude the implementation of other remedial actions at the site. In fact, the SVE system may be useful when considering future development at the site as a vapor relief mechanism. Implementation of the SVE would require coordination with the NYSDEC Division of Air regarding discharge of the vapor.

5.6.7 Costs

The estimated costs associated with Alternative 7 are summarized below:

Capital Cost	$ 3,512,579
Annual Operation and Maintenance Cost	$ 378,240
30 Year Present Worth	$ 10,474,676

Refer to Appendix B for a breakdown of costs.

5.7 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section presents a comparative analysis of the alternatives developed for the Chem-Trol site relative to NYSDEC/EPA evaluation criteria. The comparative analysis of alternatives is presented in Table 16 and discussed below. The relative degree of compliance with the NYSDEC/EPA evaluation criteria was evaluated and is presented on Table 17.

5.7.1 Overall Protection of Human Health And The Environment

Each alternative, except Alternative 1, provides overall protection of human health and the environment to varying degrees. Alternative 7 provides the greatest degree of protection to human health and the environment. Removal of the "hot spot" soils and on-site tributary sediments, soil vapor extraction and the soil cover would mitigate potential risks posed by the site soils. Groundwater would be addressed through a groundwater collection and treatment system. Short term risks to workers and the community during implementation could be mitigated using safety procedures and personnel protective equipment. Short term risks to the environment caused by working in wetlands and the on-site tributary could be addressed during detailed design.

Alternatives 5 and 6 include "hot spot" removal, and groundwater pumping and treatment. Alternative 6 includes upgrading the cover over the site soils, while alternative 5 includes leaving the existing cap as is. These alternatives provide the next best level of protection compared to alternative 7, but are less aggressive in nature. The site soils would be covered as part of Alternative 6 to reduce the potential for direct contact but they would not be treated. The on-site tributary sediment excavation is expected to result in short-term environmental impact.

Alternative 2 provides protection through "hot spot" and on-site tributary sediment removal and institutional controls such as site fencing. Since groundwater would not be addressed, this alternative is ranked below Alternatives 5, 6, and 7.

Alternative 1 does not provide any increased level of protection but involves a low degree of risk to site workers and the environment.

5.7.2 Compliance With SCGs/ARARs

It is anticipated that each alternative could be implemented in accordance with action specific and location specific SCGs/ARARs. Chemical specific SCGs/ARARs for ambient groundwater quality would not be met by any of the alternatives. Work on other sites containing DNAPL indicates that these standards have not been achieved even after many years of groundwater extraction. Alternative 7 provides the greatest degree of compliance

with these SCGs/ARARs, since it includes measures to treat the on-site soils (i.e., the source area) as well as the components of the other alternatives.

5.7.3 Long-Term Effectiveness and Permanence

Long-term effectiveness is based upon the degree to which potential human health risks due to exposure to affected media is reduced from the existing risk and the reliability of controls.

Alternative 7 mitigates risks related to soils, groundwater and sediments. The soils treatment would result in a permanent reduction of risks related with these materials. Residual risks related to sediments and groundwater are believed to be small and would be reliably controlled through routine maintenance.

Alternative 6 would mitigate risks to a lesser degree than Alternative 7 since soils would not be treated. However, residual risks would still be small since the site soils would be covered and groundwater flow would be controlled. This alternative relies more heavily on maintenance to assure that these systems are adequately protective.

Alternative 5 mitigates risks attributable to soils through removal of the identified "hot spot" and on-site tributary sediments. Groundwater would be controlled in the same manner as in Alternatives 6 and 7. Residual risks related to soils would be greater for this alternative since soils would not be covered or treated. Residual risks related to sediments would be minimal since this material would be removed from the site. This alternative relies more heavily on maintenance to control risks since less active measures are included to treat the site soils.

Alternative 2 would result in a permanent reduction in risk related to the "hot spot" soils and the on-site tributary sediments since these materials would be removed. However, site soils and groundwater would not be addressed except through access restrictions. As such residual risks would be greater for Alternative 2 than for the alternatives discussed above.

Alternative 1 does not include measures to decrease risks from their current levels. As such, Alternative 1 has a low long-term effectiveness.

5.7.4 Short-Term Effectiveness

Short-term effectiveness is a measure of risks posed to the community and site workers during implementation of the alternative, the duration that these short-term risks will exist and the short-term environmental impacts. More complex alternatives generally result in a decrease in short-term effectiveness due to increased material handling and site disturbance.

Alternative 1, no action, has the highest degree of short-term effectiveness, since it involves the least amount of site work and material handling. Alternative 1 could be implemented over the course of several months.

Alternative 2 involves removal of the "hot spot" soils and tributary sediments and constructing a perimeter fence. Removal will necessitate exposure of construction workers to the materials. Exposure to the community could also occur through dust emissions. Engineering controls would be necessary to reduce the impact on the South Branch of Smokes Creek. Environmental impacts are also expected but could be addressed by using engineering controls to prevent erosion of soils into the South Branch of Smokes Creek. It is expected that the site workers and the community could be adequately protected through implementation of standard safety procedures and the use of personnel protective equipment. Alternative 2 is ranked low in terms of short term effectiveness.

Alternative 5, 6, and 7 include groundwater pumping and treatment in addition to the components of Alternative 2. This additional site work would involve increased potential to impact the community and remediation workers due primarily to completing work over a larger area. Similar to Alternative 2, it is believed that these risks could be reduced using standard engineering controls (i.e. personnel protective equipment, dust suppression, air monitoring, etc.) and this alternative has a low degree of short-term effectiveness.

5.7.5 Reduction in Toxicity , Mobility and Volume Through Treatment

Alternative 1 does not include reduction of toxicity, mobility or volume of materials and is rated low in this respect.

Alternative 2 includes offsite disposal of the "hot spot" soils and on-site tributary sediments but does not address reducing the toxicity, mobility and volume of the remaining site soils and groundwater. It is noted that since the material in the on-site tributary is not restricted from land disposal it would likely be placed in a secure landfill cell that prevents migration of the material. This alternative has a medium rating for the reduction of toxicity, mobility and volume through treatment.

Alternative 5 includes groundwater treatment in addition to the components of Alternative 2 This represents a moderate increase in reduction of toxicity, mobility and volume over that included in Alternative 2.

Alternative 6 further reduces toxicity, mobility and volume through the use of a soil cover over the site soils.

Alternative 7 includes a SVE system to treat VOCs in the soils in addition to the components of Alternative 6. The SVE system results in an increase in the reduction of toxicity, mobility and volume over Alternative 6.

5.7.6 Implementability

Each of the alternatives identified include remedial technologies that are readily implementable. Vendors for each component of the alternatives have been contacted as discussed in the detailed analysis to help assure that the technologies presented are appropriate and available for use at the site.

The degree of implementability is therefore related to the complexity of the alternative. Alternative 1 is the least complex and has a high degree of implementability. Alternatives 2, 5, 6 and 7 have a medium degree of relative complexity and implementability.

5.7.7 Costs

The cost comparison includes capital costs, yearly operation and maintenance costs and the 30 year present worth costs of the alternatives as tabulated below.

Alternative	Direct Capital Costs	Indirect Capital Costs	Annual Operating Costs	Present Worth Value
1		$14,400	$63,120	$1,268,026
2	$998,310	$349,409	$69,600	$2,730,044
5	$2,320,910	$812,319	$317,040	$9,429,960
6	$2,422,910	$848,019	$335,040	$9,837,880
7	$2,601,910	$910,669	$378,240	$10,474,676

6. PREFERRED ALTERNATIVE

This section summarizes site conditions and presents the components of the alternative that we feel address potential risks.

6.1 SUMMARY OF SITE CONDITIONS

The Remedial Investigation was completed to assess the effect of the site on groundwater, surface water, surface water sediments, floodplain sediments east of the South Branch of Smokes Creek and site soils. These studies indicated potential human health risks for the following conditions:

- Leaching of substances from site soils to groundwater,
- Direct contact with PCBs in surface water sediments in the on-site tributary,
- Direct contact and leaching to groundwater of PAHs in one floodplain sample and pesticides in another, and
- Ingestion of groundwater.

6.2 SUMMARY OF PREFERRED ALTERNATIVE

A variety of remedial alternatives were considered as discussed in Sections 4 and 5 and based upon the comparative analysis, it is appropriate to implement Alternative 7. This alternative is comprised of the following components:

Sediment Monitoring
Enhanced Groundwater Monitoring
Floodplain Monitoring
"Hot Spot" Soils Excavation/Treatment/Offsite Disposal
Deed Restrictions
Site Soils Cover
On-site Tributary Sediment Excavation/Treatment/Offsite Disposal
Soil Vapor Extraction
Groundwater Extraction and Treatment

Figures 10 and 14 present a schematic layout of the various components of this alternative. Further information regarding these components is presented below.

This alternative will address applicable chemical specific, location specific and action specific SCGs/ARARs for the Chem-Trol site. Table 18 presents a summary of how the components of the preferred alternative satisfy the requirements of the SCGs/ARARs. Table 19 presents a summary of parameters detected at the site, the chemical specific remedial action objective, maximum detected concentrations and the component of the preferred remedial alternative that address these parameters.

Sediment Monitoring

Sediment monitoring would be implemented to assess the conditions in and around the affected portions of the on-site tributary. Since affected on -site tributary sediments will be removed as part of this alternative (see discussions below), monitoring will be done to verify that sediments do not become affected in the future. Sediment monitoring locations have been established upstream, downstream and within this area (see Figure 9).

Enhanced Groundwater Monitoring

The enhanced groundwater monitoring program includes studies to confirm the assumption made in the conceptual model that groundwater containing substances at concentrations exceeding the remedial action objectives listed in Table 19 have not migrated past the vicinity of the South Branch of Smokes Creek. These studies include installing three new monitoring wells; one to the west of the site along the South Alfred Road right-of-way, another along the creek downgradient of the site, and a third well upgradient to the east of the site (see Figure 10 for proposed locations).

Samples from these three monitoring wells and existing well MW-13R would be analyzed for volatile organic compounds using New York State Analytical Services Protocol (NYSASP). Depending upon the results of this analysis the need for further action will be evaluated.

Floodplain Soils Monitoring

Floodplain soils monitoring would be done to further assess the presence of hazardous substances in this area. As discussed in Section 2, one sample from this area (FPS-6) contained PAHs in excess of NYSDEC recommended cleanup objectives and the remedial action objectives listed in Table 2 and a second sample (FPS-5) contained pesticides in a portion of the sample tested by NYSDEC's laboratory but not in the portion tested by SCA's laboratory. This monitoring will consist of collecting two samples in the vicinity of FPS-6 for PAH analysis and two samples in the vicinity of FPS-5 for pesticide analysis.

It is noted that soils from this area will also be evaluated during "design phase studies". This work will include:

- Test borings along the proposed trench drain alignment to assess the rock and groundwater conditions,
- Test pits along the trench drain alignment to assess excavatability, and
- Analytical testing of the soil along the trench drain alignment to evaluate the presence of substances that may be encountered during construction

Additionally, these soils will be exposed during the construction of the proposed trench drain. Therefore, it is our opinion that we will have sufficient information to reevaluate the need to address the floodplain sediment soils at several points as the project continues.

"Hot Spot" Excavation/Treatment/Offsite Disposal

Prior to excavation of the material at SSI-2, additional testing will be done to further define the extent of this material. The remedial action objectives listed in Table 19 for PCBs, pesticides, and SVOCs would be used in evaluation of the additional test data to define the extent of affected soils.

"Hot Spot" removal will require construction of a staging area for temporary storage of materials. Excavated material will be placed in the staging area, while analytical testing needed for characterization is completed. It is anticipated that the staging area will be a bermed area lined with a low permeability synthetic liner. The excavated material would also be covered with a synthetic liner to prevent runoff.

Analytical testing is needed to determine the appropriate disposal method for this material. Testing would be done at a rate of one analysis per 200 cubic yards of soil. Analytical testing to be completed for characterization of the material would include:

- Toxicity Characteristic Leaching Procedure (TCLP) metals SVOCs, pesticides, herbicides and VOCs, and
- Total SVOCs, pesticides, herbicides, PCBs and VOCs.

These test results will be compared to values contained in 6 NYCRR Part 371.1-371.4 "Identification and Listing of Hazardous Waste" and land disposal restrictions. Depending upon the results of the testing the material may be landfilled or incinerated.

Deed Restrictions

Deed restrictions regarding excavation, land use and groundwater wells would be implemented. Deed restrictions prohibiting these activities would be implemented for the portion of the site south of the on-site tributary of the South Branch of Smokes Creek.

Site Soils Cover

The intention of the site soils cover is to supplement the existing cap so that a uniform thickness is maintained and to prevent direct contact with the site soils while allowing processes that tend to promote natural treatment to proceed. The cap would extend over the identified area of affected soils shown on Figure 14.

The seep area at SWS-12 will also be capped with a soil cover. Prior to placing the cover, the source of the seep will be controlled so that the cover material is not eroded. The seepage may be controlled by diverting it to the groundwater collection system or by limiting the source.

A cap would consist of 2.0 feet of material to limit direct contact. Of this material, 1.5 feet would have a permeability greater than $1x10^{-6}$ cm/sec and 0.5 feet would consist of topsoil to allow vegetative cover. The former active portion of the site is reportedly already covered with approximately 2 feet of soil. Observations at the site indicate that this material is present across part of the area. Erosion may have removed some of the soil in

certain areas. Therefore, the first step in capping would be to evaluate the thickness and permeability of the existing soil. Material would then be added such that the cover material properties stated above are maintained.

On-Site Tributary Sediment Excavation/Treatment/Offsite Disposal

The on-site tributary sediment would be removed by excavating the affected materials, and staging them on-site for analytical characterization similar to that described above for the "Hot Spot" soils. The location of the soils to be removed is shown on Figure 14. This area encompasses sample locations SWS-6, SWS-8, and SWS-10. These sample locations contained PCBs in excess of the sediment clean-up objective of 0.19 mg/kg.

It is noted that sample location SWS-7 is located between SWS-6 and SWS-10 and did not contain PCBs in excess of the clean-up objective. Additional sampling may be completed in the area between SWS-6 and SWS-10 the confirm the limits of PCBs in this area.

It is presumed that the material could be then transported to an offsite facility for disposal. The excavation along the on-site tributary would be backfilled and graded using materials similar to those that were excavated. The area would then be revegetated with plants indigenous to the area.

Groundwater Extraction and Treatment

Samples from the monitoring wells installed as part of the remedial investigations indicate that the groundwater in the overburden and upper weathered bedrock (i.e., the upper 25 to 30 feet of rock) have been impacted primarily by VOCs at concentrations in excess of the groundwater remedial action objectives listed in Table 19. The approximate horizontal extent of the affected area is shown on Figure 7.

Groundwater would be collected by a subsurface drain installed in the weathered bedrock. The drain would consist of a continuous slotted pipe surrounded by stone. The proposed length of the drain is 600 feet, and three manholes would be placed along the alignment to provide access. The proposed location of the drain is shown on Figure 14.

The drain would be located near the South Branch of Smokes Creek (see Figure 14). This location was selected because it is downgradient of most of the affected groundwater at the site, but still within the affected area. Therefore, a drain at this location would intercept upgradient flow towards it and tend to draw affected groundwater back.

The drain would be positioned within the weathered shale to intercept fractures in the shallow bedrock and therefore remove substances effectively from this zone. The drain system would be supplemented with passive relief wells to collect water from deeper in the bedrock. The drain would flow toward a pumping station.

Relief wells are often used to relieve uplift pressures beneath dams where the permeable stratum is too deep to be penetrated by a drain. The concept is to provide groundwater at depth and higher hydrostatic heads a means to flow to the drain (Cedergren, 1989). At the Chem-Trol site the hydrostatic head in the weathered shale is near the top of rock. The drain and relief wells would be used to lower the head near the top of weathered shale to below the top of rock. The drain would lower the head at the top of the relief wells such that a gradient is maintained from the bottom of the wells to the top causing flow up the well (see Figure 12). The drain system would be operated at a flow rate designed to collect the volume of water that passes beneath the site.

Preliminary calculations indicate that a flow rate of 50 to 100 gallons per minute would meet the design criteria depending upon the location of the drain relative to the creek. This flow results in a predicted head in the vicinity of the drain that is about 2 feet below the elevation of the South Branch of Smokes Creek.

The extracted groundwater would be treated either at the site or the publicly owned treatment works (POTW) at Erie County Sewer District No. 3.

On site treatment would be comprised of a combination of the unit processes listed in Table 11. Preliminary analysis indicates an on-site treatment system, consisting of an air stripper followed by carbon adsorption, could treat the extracted groundwater for surface discharge. Pretreatment of metals may also be necessary to prevent fouling of the system. The vapor discharge from the air stripper could be treated (e.g., catalytic oxidation, carbon adsorption) prior to discharge to the atmosphere if necessary.

It is presumed that the "total organic substances" treatment requirement for discharge to the South Branch of Smokes Creek would be 0.1 mg/l as listed in 6 NYCRR Part 702.16. Preliminary specific compound effluent concentrations are presented in 6 NYCRR Part 703.

Erie County Sewer District No. 3 has indicated that they may be able to accept the extracted water for treatment. The pretreatment requirement for discharge to their system for "total toxic organics" is 2.13 mg/l. This discharge option will be considered during design of the system.

The groundwater extraction and treatment system would be operated until no further improvement in water quality is observed in the groundwater monitoring. An assessment of the potential risks posed by the groundwater would then be completed, taking into account the lack of domestic groundwater consumption in the area and anticipated chemical characteristics of the groundwater should treatment cease. If these risks are found to be within acceptable ranges then groundwater would be monitored to note whether the concentrations remain at levels. If no significant increase in risk is noted then the treatment would be discontinued. If unacceptable potential risks are identified then alternative approaches to the remedial plan will be considered.

Soil Vapor Extraction

A soil vapor extraction (SVE) system will be used to actively remove VOCs from the affected site soils. Vapor extraction promotes the volatilization of compounds from the soil. SVE promotes mass transfer by volatilization by increasing the concentration gradient and removing compounds as they volatilize.

The soils targeted for treatment by SVE are at a depth of 2 feet to about 8 feet below ground surface in the area shown on Figure 14. VOCs detected in samples from the affected site soils include:

- methylene chloride (0.002 mg/kg to 8.9 mg/kg),
- 1,1,1 trichloroethane (0.004 mg/kg to 8.8 mg/kg),
- trichloroethene (0.002 mg/kg to 8.7 mg/kg),

It is anticipated that the SVE system would consist of a series of horizontal, perforated pipes placed in trenches. The pipes would be placed in the slag fill because this material is more porous than the natural soils. This would promote vapor movement. A schematic layout of the piping for the SVE system is presented on Figure 14. The actual layout of the piping system would be determined during design based upon pilot studies.

Air would be drawn from the pipes using a vacuum blower extraction system. Typically, the extraction system includes sampling ports, flow measurement devices (pitot tubes), a condensate tank to remove water vapor from the air, particulate filters, air makeup valves to control flow quantities and the blowers.

If necessary, an air treatment system may be added. The need for a treatment would depend upon:

1. The concentration of substances in the soil gas.
2. The flow rate necessary to achieve the desired treatment.
3. The air loading emission limits established for the project.

These factors would be considered in designing the system. Treatment processes for SVE systems often consist of carbon adsorption for low concentrations and catalytic oxidation for high concentrations.

The goal of operating the SVE system would be to reduce the concentration of VOCs in the soils to below the remedial action objectives (i.e., TAGM #4046, NYSDEC, 1994). Monitoring would be done during operation of the system to assess the progress of the remedial effort. When the monitoring indicates that the remedial action objectives may have been attained samples of the soil would then be collected for testing. Depending upon the results of this testing the need for further action will be evaluated.

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TABLE 1
Chem-Trol Feasibility Studies
Site Soils Remedial Action Objectives

Parameter	NYSDEC TAGM #4046		USEPA Superfund PCB Cleanup	Method detection Limit (MDL)	Cleanup objective
	Soil Cleanup Objective to Protect GW Quality	USEPA Health Based Criteria for Direct Contact			
VOCs (mg/kg)					
Methylene Chloride	0.10	93.0		0.005	0.100
Chloroform	0.30	114.0		0.005	0.300
Tetrachloroethene	1.40	14.0		0.005	1.400
1,1,1-Trichloroethane	0.76	7,000		0.005	0.760
Trichloroethene	0.70	64.0		0.005	0.700
Total Xylenes	1.20	200,000		0.005	1.200
SVOCs (mg/kg)	500 (total)				500 (total)
Phenol	0.03	50,000		0.330	0.330
2-Methylphenol	0.10			0.330	0.330
4-Methylphenol	0.90	4,000		0.330	0.900
Hexachlorobenzene	1.40	0.410		0.330	0.410
PAHs (mg/kg)					
Benzo (a)Anthracene	3.0	0.224		0.330	3.0
Chrysene	0.40			0.330	0.40
Benzo (b)Fluoranthene	1.10			0.330	1.1
Benzo (k)Fluoranthene	1.10			0.330	1.1
Benzo (a)Pyrene	11.0	0.061		0.330	11.0
Dibenzo (a,h)Anthracene	165,000	0.014		0.330	165,000
Pesticides(mg/kg)	10.0 (total)				10 (total)
delta-BHC	0.30			0.008	0.300
gamma-BHC	0.06	5.4		0.008	0.060
PCBs (mg/kg)	10.0 (total)	1.0 (total)	10.0 (total)		10 (total)
Aroclor-1242				0.160	
Aroclor-1248				0.160	
Aroclor-1254				0.160	
Aroclor-1260				0.160	
Metals (mg/kg)					
Aluminum	16,653			20	16,653
Arsenic	8			1	8
Beryllium		0.16		0.5	0.5
Cadmium	0.77			0.5	0.77
Calcium	72,865			500	72,865
Chromium	26			1	26
Copper	55			2.5	55
Iron	31,337			10	31,337
Magnesium	7,938			500	7,938
Manganese	902			1.5	902
Silver	0.12			1	1
Sodium	381			500	500

Notes:

1. Referance NYSDEC TAGM # 4046: Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, January 24,1994.

2.Referance MDL: Analytical Services Protocol (ASP) 91 for New York State Department of Environmental Conservation. "Low Soil/ Sediment" MDLs are shown, actual detection limits are highly matrix dependant and the values shown may not always be achievable.

TABLE 2
Chem-Trol Feasibility Studies
Floodplain Sediment Remedial Action Objectives

Parameter	NYSDEC TAGM #4046		USEPA Superfund PCB Cleanup	Method detection Limit (MDL)	Cleanup objective
	Soil Cleanup Objective to Protect GW Quality	USEPA Health Based Criteria for Direct Contact			
SVOCs (mg/kg)	500 (total)				500 (total)
Phenol	0.03	50,000		0.33	0.33
2,4-Dinitrophenol	0.20	200		1.60	1.60
Hexachlorobenzene	1.40	0.41		0.33	1.40
PAHs (mg/kg)					
Benzo (a)Anthracene	3.0	0.224		0.33	3.0
Chrysene	0.40			0.33	0.40
Benzo (b)Fluoranthene	1.10			0.33	1.10
Benzo (k)Fluoranthene	1.10			0.33	1.10
Benzo (a)Pyrene	11.0	0.061		0.33	11.0
Dibenzo (a,h)Anthracene	165,000	0.014		0.33	165,000
Pesticides(mg/kg)	10.0 (total)				10.0 (total)
delta-BHC	0.30			0.008	0.30
Heptaclor Epoxide	0.02	0.077		0.008	0.02
Endrin	0.10	20.0		0.008	0.10
PCBs (mg/kg)	10.0 (total)	1.0 (total)	10.0 (total)		10.0 (total)
Aroclor-1248				0.08	
Aroclor-1254				0.16	
Aroclor-1260				0.16	
Metals (mg/kg)					
Beryllium		0.16		0.5	0.5
Cadmium	0.77			0.5	0.77
Chromium	26			1	26
Copper	55			2.5	55
Sodium	381			500	500

Notes:
1. Referance NYSDEC TAGM # 4046: Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, January 24,1994.
2.Referance MDL: Analytical Services Protocol (ASP) 91 for New York State Department of Environmental Conservation. "Low Soil/ Sediment" MDLs are shown, actual detection limits are highly matrix dependant and the values shown may not always be achievable.

TABLE 3
Chem-Trol Feasibility Studies
On-Site Tributary Sediments Remedial Action Objectives

Parameter	NYSDEC TAGM #4046		USEPA Superfund PCB Cleanup	Environmental Based Criteria			Method detection Limit (MDL)	Cleanup objective
	Soil Cleanup Objective to Protect GW Quality	USEPA Health Based Criteria for Direct Contact		Aquatic Toxicity	Human Health Residue	Wildlife Residue		
PCBs (mg/kg)								
Aroclor-1242							0.08	
Aroclor-1248							0.08	
Aroclor-1254							0.16	
Aroclor-1260							0.16	
Total PCBs	10.0	1.0	0.19	2.76	0.00008	0.195		0.19

Notes:

1. Reference NYSDEC TAGM # 4046: Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, January 24,1994.

2. Reference MDL: Analytical Services Protocol (ASP) 91 for New York State Department of Environmental Conservation. "Low Soil/ Sediment" MDLs are shown, actual detection limits are highly matrix dependent and the values shown may not always be achievable.

Table 4
Chem-Trol Feasibility Studies
Groundwater Remedial Action Objectives

Parameter	NYS Class GA Standard	USEPA MCL	USEPA MCLG	USEPA Health Advisories			MDL	Remedial Action Objective
				Child one-day	Child long-term	Adult lifetime		
VOCs (ug/l)								
Chloroethane	5						10	10
Methylene Chloride	5	5	0	10,000			5	5
Acetone	50				10	200	10	10
1,1-Dichloroethane	5						5	5
1,1,Dichloroethene	5	7	7	2,000	1,000	7	5	5
Total 1,2 Dichlorethenes	5	70	70	20,000	2,000	100	5	5
Chloroform	7	100		4,000	100		5	7
1,1,1-Trichloroethane	5	200	200	100,000	40,000	200	5	5
Trichloroethene	5	5	0				5	5
Benzene	0.7	5	0	200			5	5
Toluene	5	1000	1000	20,000	2,000	1,000	5	5
Vinyl Chloride	2	2		3,000	10		10	10
Chlorotoluene	5			2,000	2,000	100		5
SVOCs (ug/l)								
4-Chloro-3-methylphenol	5						10	10
METALS (ug/l) see note 2								
Aluminum	100						200	5,460
Iron	500						100	7,180
Magnesium	35,000						5,000	37,900
Manganese	500		200				15	500
Sodium	20,000						5,000	54,000
Inorganics (ug/l)								
Sulfate	250,000							250,000

Notes:

1. Reference MDL: Analytical Services Protocol (ASP) 91 for New York State Department of Environmental Conservation. "Low Soil/ Sediment" MDLs are shown, actual detection limits are highly matrix dependent and the values shown may not always be achievable.

2. Cleanup objectives for metals are based upon maximum upgradient concentrations measured in monitoring wells MW-7R and MW-11R.

TABLE 5

CHEM-TROL FEASIBILITY STUDY

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

Surface Water Sediment

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
No Action	None	Not Applicable	No Action	Required for consideration by NCP
Limited Action	Access Restriction	Deed Restriction	Deeds for affected areas include excavation restrictions	Potentially applicable
		Fencing	Place a fence around the site to control access	Potentially applicable
	Monitoring	Sediment Monitoring	Sampling and analysis of sediment samples	Potentially applicable
Containment	Capping	Soil	Cover affected area with an erosion resistant soil to prevent contact	Potentially applicable
		Synthetic	Cover affected area with a low permeability plastic liner	Not applicable since the cover in intended to prevent direct contact
		Culvert	Replace the on-site tributary with a culvert	Potentially applicable
Removal	Excavation	Treatment/Disposal Offsite	Remove sediments and dispose of them in an appropriate facility	Potentially applicable
		On-site disposal	Remove sediments and dispose of them on-site	Potentially applicable

Legend

Technologies that are screened out

TABLE 6
CHEM-TROL FEASIBILITY STUDY
INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

Site Soils

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
No Action	None	Not Applicable	No Action	Required for consideration by NCP
Limited Action	Access Restriction	Deed Restriction	Deeds for affected areas include excavation restrictions	Potentially applicable
		Fencing	Place a fence around the site to control access	Potentially applicable
Containment	Capping	Soil	Cover affected area with soil to prevent contact	Potentially applicable
		Low permeability soil	Cover affected area with low permeability soil	Potentially applicable
		Synthetic	Cover affected area with a low permeability plastic liner	Potentially applicable
Removal	Excavation	Treatment/Disposal offsite	Remove soils and handle them in an appropriate off-site facility	Potentially applicable
Treatment	In-situ treatment	Stabilization	Soil mixed with pozzolanic/cement that solidifies to reduce mobility	Not applicable to VOCs present in site soils
		Vapor Extraction	VOCs stripped from soil and recovered in vapor form	Potentially applicable
		Biodegradation	Soils seeded with microorganisms and nutrients to allow degradation	Potentially applicable
		Bioventing	Air is pumped through the soil to promote biodegradation	Potentially applicable
		Soil Flushing	Aqueous solutions are introduced into the soil to recover compounds	Potentially applicable
		Steam Stripping	Steam is pumped through the soil and recovered	Potentially applicable

Legend

Technologies that are screened out

TABLE 7
CHEM-TROL FEASIBILITY STUDY
INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

Groundwater

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
No Action	None	Not Applicable	No Action	Required for consideration by NCP
Limited Action	Access Restriction	Deed Restriction	Deeds for affected areas would include restrictions on wells	Potentially applicable
	Monitoring	Groundwater Monitoring	On-going monitoring of wells	Potentially applicable
Collection	Extraction	Extraction Wells	Series of wells to remove affected groundwater	Potentially applicable
		2-Phase Extraction	Use of a high vacuum to remove both groundwater and soil vapor simultaneously	Not feasible to achieve high vacuum in the weathered shale, not applicable
		Extraction/Injection Wells	Inject clean water to increase flow toward extraction wells	Potentially applicable
	Subsurface Drains	Interceptor Trenches	Perforated pipe in a trench backfilled with porous material to collect groundwater	Potentially applicable
		Fracturing	Low permeability media is fractured to increase flow	Potentially applicable to weathered rock

Legend

Technologies that are screened out

TABLE 7
CHEM-TROL FEASIBILITY STUDY
INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

Groundwater

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Ex-Situ Treatment	Biological Treatment	Aerobic	Degradation of organics using microorganisms in an aerobic environment	Potentially applicable
		Anaerobic	Degradation of organics using microorganisms in an anaerobic environment	Potentially applicable
	Physical/Chemical Treatment	Precipitation	Alteration of chemical equilibrium to reduce solubility of compounds	Potentially applicable as pretreatment to remove inorganics prior to other treatment
		Stripping	Mixing air through water in a packed column to promote transfer of VOCs to air	Potentially applicable
		Carbon adsorption	Adsorption of compounds onto activated carbon	Potentially applicable
		Reverse Osmosis	Use of high pressure to force water through a membrane leaving contaminants behind	Potentially applicable
		Ion Exchange	Water is passed through a resin bed where ions are exchanged between water and resin	Potentially applicable

Legend

Technologies that are screened out

TABLE 7
CHEM-TROL FEASIBILITY STUDY
INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

Groundwater

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Discharge	On-site Discharge	South Branch of Smokes Creek	Extracted groundwater discharged to South Branch of Smokes Creek	Only applicable if groundwater is treated as required
	Offsite Discharge	POTW	Extracted groundwater is discharged to the local POTW for treatment	Potentially applicable
In-situ Treatment	Biological treatment	Intrinsic Bioremediation	Allows natural biodegradation to occur with careful monitoring	Potentially applicable
		Bioremediation	Pump material through the affected area to stimulate growth of organisms	Potentially applicable
	Physical treatment	Air sparging	Injects air below the water table to strip contaminants	Potentially applicable
	Chemical treatment	Chemical transformation	Chemically transforms compounds into less hazardous products	Potentially applicable
		Reactive barriers	Treats groundwater as it passes through a zone containing chemicals, organisms or carbon	Potentially applicable
		Reactive Media	Treats groundwater using a zero valence catalyst as it flows to a collection point	Potentially applicable

Legend

Technologies that are screened out

TABLE 7
CHEM-TROL FEASIBILITY STUDY
INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

Groundwater

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Containment	Vertical barriers	Slurry wall	Trench around area is backfilled with a low permeability soil/bentonite mixture	Not applicable to weathered bedrock
		Grout curtain	Pressure injection of grout into a regular pattern of drilled holes	Potentially applicable
	Horizontal barriers	Grout injection	Pressure injection of grout at a specified depth through drilled holes	Not applicable
		Block displacement	Fractures in the rock are opened by injecting water at high pressure	Not applicable
	Encapsulation	Chemical grout admixes	Entraps compounds in a matrix of solid material where they are chemically inert	Potentially applicable

Legend

Technologies that are screened out

TABLE 8
CHEM-TROL FEASIBILITY STUDY
EVALUATION OF PROCESS OPTIONS

Surface Water Sediment

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Costs
No Action	None	Not Applicable	Would not reduce risk	Readily implementable, may not be acceptable to public	Negligible
Limited Action	Access Restriction	Deed Restriction	Limits contact but depends on continued future implementation	Readily implementable for the site	Low
		Fencing	Limits contact	Readily implementable	Low capital and O&M
	Monitoring	Sediment Monitoring	Useful in documenting conditions, does not reduce risk	Readily implementable	Low capital, moderate O&M
Containment	Capping	Soil	Reduces mobility of sediments and prevents direct contact	Readily implementable	Moderate capital, low O&M
		Culvert	Reduces mobility of sediments and prevents direct contact	Readily implementable	Moderate capital, low O&M
Removal	Excavation	Treatment/Disposal Offsite	Reduces mobility and volume of sediments	Readily implementable	High capital, low O&M
		On-site disposal	Reduces mobility of sediments and prevents direct contact	Difficult implementation, requires construction of a landfill cell	High capital, moderate O& M

Legend

Technologies that are screened out

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TABLE 9
CHEM-TROL FEASIBILITY STUDY
EVALUATION OF PROCESS OPTIONS

Site Soils

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Costs
No Action	None	Not Applicable	Would not reduce risk	Readily implementable, may not be acceptable to public	Negligible
Limited Action	Access Restriction	Deed Restriction	Limits contact but depends on continued future implementation	Readily implementable for the site	Low
		Fencing	Limits contact	Readily implementable	Low capitol an
Containment	Capping	Soil	Prevents direct contact with site soils	Readily implementable	Moderate capit O&M
		Low permeability soil	Prevents direct contact and infiltration into site soils	Readily implementable	High capitol a moderate O&
		Synthetic	Prevents direct contact and infiltration into site soils	Readily implementable	High capitol a moderate O&
Removal	Excavation	Treatment/Disposal offsite	Reduces volume of affected site soils	Readily implementable	High capitol a O&M
Treatment	In-situ treatment	Vapor Extraction	Reduces volume of substances in site soils	Readily implementable	Moderate capit O&M
		Biodegradation	Reduces volume of substances in site soils, some by products may be more toxic than original compounds	Requires treatability studies to assess effectiveness	Moderate capit O&M
		Bioventing	Reduces volume of substances in site soils, some by products may be more toxic than original compounds	Readily implementable	Moderate capit O&M
		Soil Flushing	Depends on ability to capture compounds flushed from soil	Requires treatability studies to assess effectiveness	Moderate capit O&M
		Steam Stripping	Not effective for range of contaminants	Readily implementable	Moderate capit O&M

Legend

Technologies that are screened out

TABLE 10
CHEM-TROL FEASIBILITY STUDY
EVALUATION OF PROCESS OPTIONS

Groundwater

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
No Action	None	Not Applicable	Does not achieve remedial objectives	Not acceptable to public and/or local government	minimal
Limited Action	Access Restriction	Deed Restriction	Effectiveness depends on continued implementation	Implementable on-site	low
	Monitoring	Groundwater Monitoring	Useful on documenting conditions. Does not reduce risks by itself.	Readily implementable.	low capital and O&M
Collection	Extraction	Extraction Wells	Effective at reducing contamination, may require long periods of time.	Readily implementable	Moderate and O&M costs
		Injection Wells	Effective at introducing water into permeable groundwater systems	Readily implementable	Moderate capital and O&M
	Subsurface Drains	Trench	Effective means of collecting groundwater from shallow depths	Readily implementable	High capital, moderate O&M
		Fracturing	May be useful for increasing the effectiveness of an extraction system	Readily implementable	High capital, moderate O&M

Legend

Technologies that are screened out

TABLE 10
CHEM-TROL FEASIBILITY STUDY
EVALUATION OF PROCESS OPTIONS

Groundwater

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
Ex-Situ Treatment	Biological Treatment	Aerobic	Reduces levels of organics, sludge needs to be treated	Readily implementable	High capital and O&M
		Anaerobic	Reduces levels of organics, sludge and gas may need to be treated	Readily implementable	High capital and O&M
	Physical/Chemical Treatment	Precipitation	Effectively treats metals, requires sludge disposal	Readily implementable	High capital and O&M
		Stripping	Effectively treats VOCs, offgas needs to be treated	Readily implementable	High capital and O&M
		Carbon adsorption	Effective treatment for trace concentrations of organics	Readily implementable, testing needed to estimate carbon use	Moderate capital, high O&M
		Reverse Osmosis	Effectively removes ions and organics at high concentrations	Readily implementable	High capital and O&M
		Ion Exchange	Removes ions from solution	Readily implementable	High capital and O&M
Discharge	Offsite Discharge	POTW	Effective discharge method, treats water at the POTW	Depends on type of POTW, permits required	Moderate capital and O&M
	On-site Discharge	South Branch of Smokes Creek	Effective if water is treated prior to discharge	Depends upon effluent requirements	High capital, moderate O&M

Legend

Technologies that are screened out

TABLE 10
CHEM-TROL FEASIBILITY STUDY
EVALUATION OF PROCESS OPTIONS

Groundwater

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
In-situ Treatment	Biological treatment	Intrinsic Bioremediation	Effective but time to achieve RAOs is uncertain	Readily implementable	Low capital, moderate O&M
		Bioremediation	Effective in treating petroleum, no field studies for chlorinated solvents	Readily implementable	High capital and O&M
	Physical treatment	Air sparging	Effective at removing VOCs from soil, use in rock unknown	Field testing would be necessary to evaluate	High capital and O&M
	Chemical treatment	Chemical transformation	Not effective for unknown mixtures	Field testing would be necessary to evaluate	High capital and O&M
		Reactive barriers	Effective at removing a broad range of compounds	Not implementable in bedrock	High capital and O&M
		Reactive Media	Effective at removing chlorinated hydrocarbons from groundwater	Implementable as a componant of a collection system	High capital and O&M
Containment	Vertical barriers	Grout curtain	Effectively lowers the permeability of rock, decreasing mobility	Readily implementable	High capital, low O&M
	Encapsulation	Chemical grout admixes	Long-term effectiveness is unknown	Field testing would be necessary to evaluate	High capital, moderate O&M

Legend

Technologies that are screened out

TABLE 11

CHEM-TROL FEASIBILITY STUDY

SUMMARY OF PROCESS OPTION SELECTION

Media	Remedial Technology	Process Option	Process Option Screening Comment
On-Site Tributary Sediment	Access Restriction	Deed Restriction Fencing	
	Monitoring	Sediment Monitoring	
	Capping	Soil Culvert	Not included, may be considered in lieu of excavation during design Not included, may be considered in lieu of excavation during design
	Excavation	Treatment/Disposal Offsite	
Soils	Access Restriction	Deed Restriction Fencing	
	Capping	Soil Low permeability soil Synthetic	(Refer to Section 5.5 for discussion related to selecting this process option) Not included, soil cover is felt to be more suitable for site conditions Not included, soil cover is felt to be more suitable for site conditions
	In-situ treatment	Vapor Extraction Bioventing	Included as a result of vapor extraction
"Hot Spot" Removal	Excavation	Treatment/Disposal offsite	Removal is considered more appropriate than institutional controls, containment or in-situ treatment due to the small volume and relatively high compound concentrations in the "hot spot" soils.
Groundwater	Access Restriction	Deed Restriction	
	Monitoring	Groundwater Monitoring	
	Extraction	Extraction Wells Injection Wells	Not included, on-site injection is not presently part of remedial plan
	Subsurface Drains	Trench Fracturing	Not included, trench drain and extraction wells are felt to be more suitable
	In-Situ Treatment	Reactive Media	Not included, may be considered in conjunction with the trench drain during remedial design
	Discharge	POTW South Branch of Smokes Creek	
	Biological Treatment Physical/Chemical Tmt.	Aerobic Anaerobic Precipitation Stripping Carbon adsorption Reverse Osmosis Ion Exchange	The treatment train implemented at the site may consist of any of these process options. For the purpose of alternative evaluation it is assumed that the treatment system consists of air stripping followed by carbon adsorption. The off gas from the air stripper would be treated by catalytic oxidation.
	Vertical barriers	Grout curtain	Not included, may be considered as a means of reducing groundwater extraction volumes in the future.

TABLE 12
CHEM-TROL FEASIBILITY STUDY
SUMMARY OF ALTERNATIVE DEVELOPMENT

Migration Management Components	Source Control Components			
	No Action	Access Restrictions, Floodplain Sediment Monitoring, "Hot Spot" Removal and On-site Tributary Sediment Removal	Access Restrictions, Floodplain Sediment Monitoring, "Hot Spot" Removal, On-site Tributary Sediment Removal, and Upgrade Existing Soil Cover	Access Restrictions, Floodplain Sediment Monitoring, "Hot Spot" Removal, On-site Tributary Sediment Removal, Upgrade Existing Soil Cover and SVE
No Action	Alternative 1	Eliminated due to a lack of addressing ground-water	Eliminated due to a lack of addressing ground-water	Eliminated due to a lack of addressing ground-water
Access Restrictions and Enhanced Groundwater Monitoring	Eliminated due to a lack of addressing source areas	Alternative 2	Alternative 3	Alternative 4
Access Restrictions, Enhanced Groundwater Monitoring, and Trench Drain	Eliminated due to a lack of addressing source areas	Alternative 5	Alternative 6	Alternative 7
Access Restrictions, Enhanced Groundwater Monitoring, and Pumping Wells	Eliminated due to a lack of addressing source areas	Alternative 8	Alternative 9	Alternative 10

TABLE 13
CHEM-TROL FEASIBILITY STUDY
PRELIMINARY SCREENING OF ALTERNATIVES

Effectiveness

Migration Management Componants	Source Control Componants			
	No Action	Access Restrictions, Floodplain Sediment Monitoring, "Hot Spot" Removal, and On-site Tributary Sediment Removal	Access Restrictions, Floodplain Sediment Monitoring, "Hot Spot" Removal, On-site Tributary Sediment Removal, and Upgrade Existing Soil Cover	Access Restrictions, Floodplain Sediment Monitoring, "Hot Spot" Removal, On-site Tributary Sediment Removal, Upgrade Existing Soil Cover and SVE
No Action	Alternative 1 • Ineffective	N/A	N/A	N/A
Access Restrictions and Enhanced Groundwater Monitoring	N/A	Alternative 2 • Effective	Alternative 3 • Ineffective	Alternative 4 • Ineffective
Access Restrictions, Enhanced Groundwater Monitoring, and Trench Drain	N/A	Alternative 5 • Effective	Alternative 6 • Effective	Alternative 7 • Effective
Access Restrictions, Enhanced Groundwater Monitoring, and Pumping Wells	N/A	Alterative 8 • Less effective than Alternative 5	Alternative 9 • Less effective than Alternative 6	Alternative 10 • Less effective than Alternative 7

TABLE 14
CHEM-TROL FEASIBILITY STUDY
PRELIMINARY SCREENING OF ALTERNATIVES

Implementability

Migration Management Componants	Source Control Componants			
	No Action	Access Restrictions, Floodplain Sediment Monitoring, "Hot Spot" Removal, and On-site Tributary Sediment Removal	Access Restrictions, Floodplain Sediment Monitoring, "Hot Spot" Removal, On-site Tributary Sediment Removal, and Upgrade Existing Soil Cover	Access Restrictions, Floodplain Sediment Monitoring, "Hot Spot" Removal, On-site Tributary Sediment Removal, Upgrade Existing Soil Cover and SVE
No Action	Alternative 1 • Implementable	N/A	N/A	N/A
Access Restrictions and Enhanced Groundwater Monitoring	N/A	Alternative 2 • Implementable	Alternative 3 • Implementable	Alternative 4 • Implementable
Access Restrictions, Enhanced Groundwater Monitoring, and Trench Drain	N/A	Alternative 5 • Implementable	Alternative 6 • Implementable	Alternative 7 • Implementable
Access Restrictions, Enhanced Groundwater Monitoring, and Pumping Wells	N/A	Alterative 8 • Less implementable than Alternative 5	Alternative 9 • Less implementable than Alternative 6	Alternative 10 • Less implementable than Alternative 7

TABLE 15
CHEM-TROL FEASIBILITY STUDY
PRELIMINARY SCREENING OF ALTERNATIVES

Costs

Migration Management Components	Source Control Components			
	No Action	Access Restrictions, Floodplain Sediment Monitoring, "Hot Spot" Removal, and On-site Tributary Sediment Removal	Access Restrictions, Floodplain Sediment Monitoring, "Hot Spot" Removal, On-site Tributary Sediment Removal, and Upgrade Existing Soil Cover	Access Restrictions, Floodplain Sediment Monitoring, "Hot Spot" Removal, On-site Tributary Sediment Removal, Upgrade Existing Soil Cover and SVE
No Action	Alternative 1 • Low Cost	N/A	N/A	N/A
Access Restrictions and Enhanced Groundwater Monitoring	N/A	Alternative 2 • Moderate Cost	Alternative 3 • Moderate Cost	Alternative 4 • Moderate Cost
Access Restrictions, Enhanced Groundwater Monitoring, and Trench Drain	N/A	Alternative 5 • Moderate to High Cost	Alternative 6 • Moderate to High Cost	Alternative 7 • High Cost
Access Restrictions, Enhanced Groundwater Monitoring, and Pumping Wells	N/A	Alternative 8 • High Cost	Alternative 9 • High Cost	Alternative 10 • High Cost

TABLE 16

CHEM-TROL SITE FEASIBILITY STUDY
COMPARATIVE ANALYSIS

CRITERIA	Alternative 1 No Action	Alternative 2 "Hot Spot" Removal, Tributary Sediment Removal, Monitoring, Site Fence and Deed Restrictions	Alternative 5 "Hot Spot" Removal, Tributary Sediment Removal, Monitoring and Deed Restrictions: Groundwater treatment	Alternative 6 "Hot Spot" Removal, Tributary Sediment Removal, Monitoring, Deed Restrictions, and Upgrade Existing Soil Cover: Groundwater Treatment	Alternative 7 "Hot Spot" Removal, Tributary Sediment Removal, Monitoring, Deed Restrictions, Upgrade Existing Soil Cover and Soil Vapor Extraction: Groundwater Treatment
Threshold Criteria					
Overall Protection • **Human Health** **Sediments** **Site Soils** **Groundwater** • **Environment**	Not protective of human health and the environment	Protective of human health and the environment	Protective of human health and the environment	Protective of human health and the environment	Protective of human health and the environment
Compliance with SCGs/ARARs					
• **Chemical Specific**	Not in compliance	Not in compliance	Compliance with groundwater ARAR/SCG at the site is unlikely, prevents further contravention	Complies with soils criteria to a higher degree than Alt 5	Complies to a higher degree than other alternatives due to SVE
• **Action Specific**	In compliance	In compliance	In compliance	In compliance	In compliance
• **Location Specific**	In compliance	In compliance	In compliance	In compliance	In compliance

TABLE 16 (Continued)

	Alternative 1	Alternative 2	Alternative 5	Alternative 6	Alternative 7
Balancing Criteria					
Short Term Effectiveness • **Community Protection** • **Worker Protection** • **Environmental Impacts**	The community, workers and the environment will be protected during implementation using engineering controls as needed.	The community, workers and the environment will be protected during implementation using engineering controls as needed.	The community, workers and the environment will be protected during implementation using engineering controls as needed.	The community, workers and the environment will be protected during implementation using engineering controls as needed.	The community, workers and the environment will be protected during implementation using engineering controls as needed.
• **Time Until Action is Complete**	6 months	1 year	1 year	1 year	1 year
Long Term Effectiveness • **Residual Risk**	Long term risks are similar to those present today.	Risks are mitigated as long as institutional controls are in place. Removal action permanently reduces risk.	Removal action permanently reduces risk. Groundwater movement controlled by extraction system.	Removal action permanently reduces risk. Groundwater movement controlled by extraction system. Cover limits soils contact	Removal action permanently reduces risk Groundwater movement controlled by extraction system. SVE treats soils.
• **Adequacy of Controls**	None	Adequate as long as SCA owns site.	O&M required	O&M required	O&M required
• **Need for 5-year Review**	Yes	Yes	Yes	Yes	Yes
Reduction of TMV Through Treatment • **Treatment process**	None	"Hot spot" offsite treatment.	(see Alt. 2 for "hot spot" treatment) Ex-situ groundwater treatment.	(see Alt. 2 for "hot spot" treatment and Alt. 3 for groundwater)	(see Alt. 2 for "hot spot" treatment an Alt. 3 for groundwater) Soil Vapor Extraction
• **Amount destroyed or treated**		Over 90 percent of PCBs and pesticides at site.	Treated to discharge standards.		Treat VOCs in soils to RAOs.
• **Residuals**		None	Spent carbon		Condensate and air discharge

TABLE 16 (Continued)

	Alternative 1	Alternative 2	Alternative 5	Alternative 6	Alternative 7
Implementability					
• **Ability to Construct**	Readily implementable	Readily implementable	Readily implementable	Readily implementable	Readily implementable
• **Monitorability**	Adequate	Adequate	Adequate	Adequate	Adequate
• **Coordination with Agencies**	Minimal required	Required for creek work	Required for creek work and discharge	Required for creek work and discharge	Required for creek work and discharge
• **Availability of Equipment and Services**	None	None	None	None	None
Costs					
• **Capital Costs**	$14,400	$1,347,719	$3,133,229	$3,270,929	$3,512,579
• **Annual Operation and Maintenance**	$63,120	$69,600	$317,040	$335,040	$378,240
• **30 Year Present Worth (6% discount rate, 3% inflation)**	$1,268,026	$2,730,044	$9,429,960	$9,837,880	$10,474,676

TABLE 17

CHEM-TROL SITE FEASIBILITY STUDY
ALTERNATIVE RELATIVE RANKING

CRITERIA	Alternative 1 No Action	Alternative 2 "Hot Spot" Removal, Tributary Sediment Removal, Monitoring, Site Fence and Deed Restrictions	Alternative 5 "Hot Spot" Removal, Tributary Sediment Removal, Monitoring and Deed Restrictions: Groundwater treatment	Alternative 6 "Hot Spot" Removal, Tributary Sediment Removal, Monitoring, Deed Restrictions, and Upgrade Existing Soil Cover: Groundwater Treatment	Alternative 7 "Hot Spot" Removal, Tributary Sediment Removal, Monitoring, Deed Restrictions, Upgrade Existing Soil Cover and Soil Vapor Extraction: Groundwater Treatment
Threshold Criteria					
Overall Protection of Human Health and Environment	Low	Medium	Medium	Medium	High
Compliance with SCGs/ARARs	Low	Medium	Medium	Medium	High
Balancing Criteria					
Short Term Effectiveness	High	Low	Low	Medium	Medium
Long Term Effectiveness	Low	Medium	Medium	Medium	High
Reduction of TMV Through Treatment	Low	Medium	Medium	Medium	High
Implementability	High	Medium	Medium	Medium	Medium
Costs (30 Year Present Worth, 6% discount rate, 3% inflation)	$1,268,026	$2,730,044	$9,429,960	$9,837,880	$10,474,676
Overall Evaluation					
Rating	Low	Medium	Medium	Medium	High

Table 18
Summary SCGs/ARAR Compliance
Chem-Trol Site

Standard, Criteria and Guidance/ Applicable, Relevant and Appropriate Requirement	Components of the Preferred Alternative								
	Sediment Monitoring	Enhanced Groundwater Monitoring	Floodplain Monitoring	"Hot Spot" Excavation/ Treatment/ Offsite Disposal	Deed Restrictions	Soil Cover	On-Site Tributary Sediment Excavation/ Treatment/ Offsite Disposal	Soil Vapor Extraction	Ground-water Extraction and Treatment System
Chemical Specific SCGs/ARARs									
Groundwater and Surface Water, 6 NYCRR part 700-704		Monitoring to assess compliance							Treatment of groundwater exceeding standards
Groundwater, Soil, Surface Water and Sediment, NYSDEC Draft Cleanup Policy and Guidelines, October 1991.	Monitoring to assess compliance		Monitoring to assess compliance		Aides in preventing direct contact with materials exceeding guidance values	Provides barrier to direct contact with materials exceeding guidance values	Removal of material containing concentrations exceeding guidance values		
NYSDEC Technical and Administrative Guidance Memorandum (TAGM) HWR-94-4046, January 24, 1994.			Monitoring to assess compliance	Removal of material containing concentrations exceeding guidance values	Aides in preventing direct contact with materials exceeding guidance values	Provides barrier to direct contact with materials exceeding guidance values	Removal of material containing concentrations exceeding guidance values	Treatment of material exceeding guidance values	
Location Specific SCGs/ARARs									
Dredge or Fill Requirements (404), 40 CFR Parts 230 & 231 (1992) 33 CFR 320-330 (1992)							Excavation and fill placement work to be done in compliance		

Table 18
Summary SCGs/ARAR Compliance
Chem-Trol Site

Standard, Criteria and Guidance/ Applicable, Relevant and Appropriate Requirement	Components of the Preferred Alternative								
	Sediment Monitoring	**Enhanced Groundwater Monitoring**	**Floodplain Monitoring**	**"Hot Spot" Excavation/ Treatment/ Offsite Disposal**	**Deed Restrictions**	**Soil Cover**	**On-Site Tributary Sediment Excavation/ Treatment/ Offsite Disposal**	**Soil Vapor Extraction**	**Ground-water Extraction and Treatment System**
Guidance On Activities In Wetlands Within Superfund Site Boundaries, USACOE RGL 85-07 July 5, 1985							Will be used as guidance on completing the work		Will be used as guidance on completing the work
Wetland/ Floodplain Protection, ECL Art. 24 (incl. tit. 7 & 9), 6NYCRR Parts 662, 663, 664, 617, 621 & 624 Executive Order No. 11988, Executive Order No. 11990, 40 CFR 6.302(b) Appendix A (1992).							Construction work to be completed in compliance		Construction work to be completed in compliance
Action Specific SCGs/ARARs									
OSHA Standards, 29 CFR Part 1910, 1926 and 1904 (1992)	Field work to be done in compliance	Field work to be done in compliance	Field work to be done in compliance	Construction work to be done in compliance		Construction work to be done in compliance	Construction work to be done in compliance	Construction work to be done in compliance	Construction work to be done in compliance
National and Stste Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Part 61 (1992) and 6NYCRR Part 201 and 212								Will be used to assess allowable discharge to the atmosphere from system	

Table 18
Summary SCGs/ARAR Compliance
Chem-Trol Site

Standard, Criteria and Guidance/ Applicable, Relevant and Appropriate Requirement	Components of the Preferred Alternative								
	Sediment Monitoring	Enhanced Groundwater Monitoring	Floodplain Monitoring	"Hot Spot" Excavation/ Treatment/ Offsite Disposal	Deed Restrictions	Soil Cover	On-Site Tributary Sediment Excavation/ Treatment/ Offsite Disposal	Soil Vapor Extraction	Ground-water Extraction and Treatment System
National Pollutant Discharge Elimination System (NPDES), 40 CFR Parts 122-125 (1992) and Implementation of SPDES Program in New York, N.Y.COMP. CODES R. & REGS tit. 6, 750-758 (BNA)									Will be used in designing treatment system if surface water discharge is implemented
EPA Pretreatment Standards, 40 CFR 403									Will be used in designing pretreatment if sewer discharge is implemented
New York Identification and Listing of Hazardous Wastes Regulations, N.Y.COMP. CODES R. & REGS tit. 6, 371.1-371.4 (BNA), Appendix 23				Will be used in assessing the proper disposal of removed material			Will be used in assessing the proper disposal of removed material		
Rules and Regulations for Erie County Sewer Districts									Will be used in designing groundwater extraction system if sewer discharge is implemented

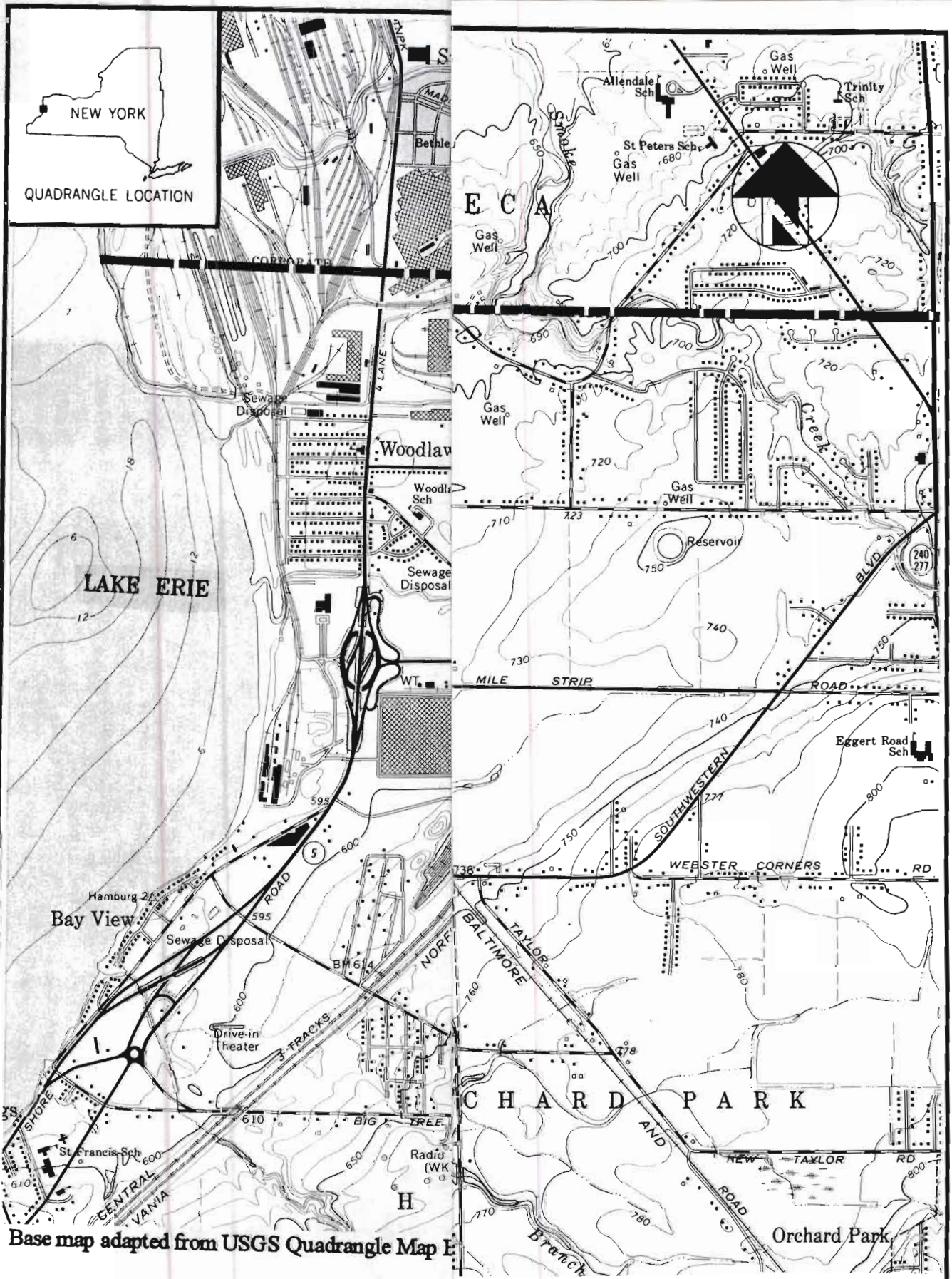
TABLE 19
Chem-Trol Feasibility Studies
Summary of Site Conditions and Remedial Technologies

Parameter	Remedial Action Objective	Maximum Detected Concentration	Location	Primary Remedial Component
Groundwater				
VOCs (ug/l)				
Chloroethane	10	200	MW-9S	Groundwater Extraction and Treatment System
Methylene Chloride	5	26	MW-9R	
Acetone	10	93	MW-12S	
1,1-Dichloroethane	5	1,000	MW-9R	
1,1,Dichloroethene	5	270	MW-13R	
Total 1,2 Dichlorethenes	5	52	MW-9R	
Chloroform	7	260	MW-3S	
1,1,1-Trichloroethane	5	2,800	MW-9R	
Trichloroethene	5	1,500	MW-1R	
Toluene	5	120	MW-3S	
Chlorotoluene	5	130,000	MW-3S	
SVOCs (ug/l)				
4-Chloro-3-methylphenol	10	270	MW-3S	
METALS (ug/l)				
Aluminum		9,520	MW-6R	
Iron		16,300	MW-10S	
Magnesium		135,000	MW-6S	
Manganese		2,190	MW-10S	
On-Site Tributary Sediments				
PCBs, Total (mg/kg)	0.19	2.8	SWS-6	

TABLE 19
Chem-Trol Feasibility Studies
Summary of Site Conditions and Remedial Technologies

Parameter	Remedial Action Objective	Maximum Detected Concentration	Location	Primary Remedial Component
Soil				
VOCs (mg/kg)				
Methylene Chloride	0.100	8.9	SSI-1 (5-5.3')	Soil Vapor Extraction System and Soil Cover
Chloroform	0.300	34	SSI-1 (5-5.3')	
Tetrachloroethene	1.400	35	N400, W200 (2.5')	
1,1,1-Trichloroethane	0.760	8.8	N200, W200 (5')	
Trichloroethene	0.700	8.7	SPMW-1 (6-8')	
Total Xylenes	1.200	18	SSI-2 (4-5')	
SVOCs (mg/kg)				
Phenol	0.330	120	SSI-2 (4-5')	"Hot Spot" Excavation/ Treatment/ Offsite and Soil Cover
2-Methylphenol	0.330	14	SSI-2 (4-5')	
4-Methylphenol	0.900	52	SSI-2 (4-5')	
Hexachlorobenzene	0.410	21	SSI-2 (4-5')	
Pesticides(mg/kg)				"Hot Spot" Excavation/ Treatment/ Offsite Disposal
delta-BHC	0.300	46	SSI-2 (4-5')	
gamma-BHC	0.060	2.6	SSI-2 (4-5')	
PCBs, Total (mg/kg)	10	1,800	SSI-2 (4-5')	"Hot Spot" Excavation/ Treatment/ Offsite Disposal

FIGURES



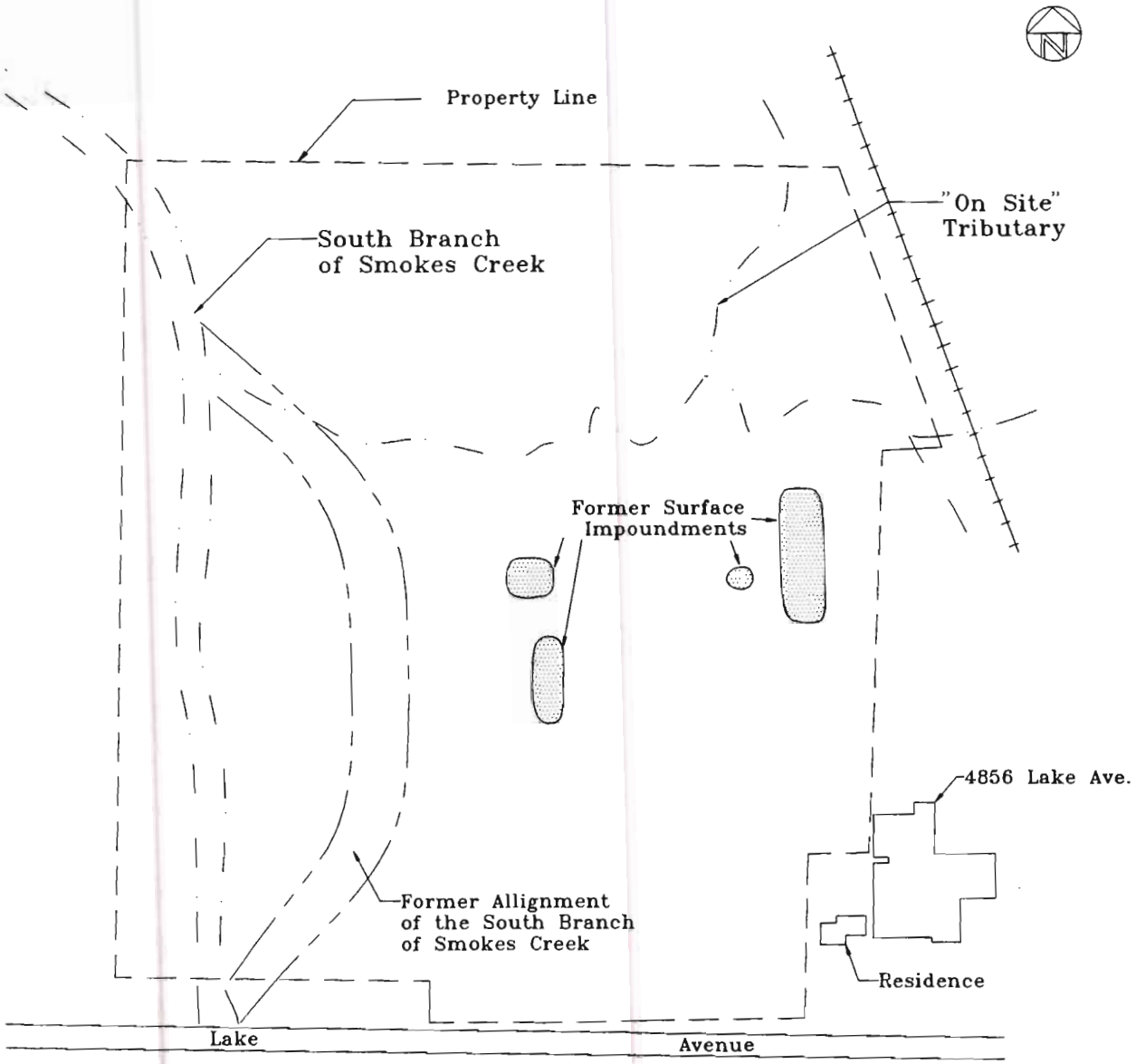
Base map adapted from USGS Quadrangle Map E

McMahon & Mann
Consulting Engineers, P.C.

TION PLAN

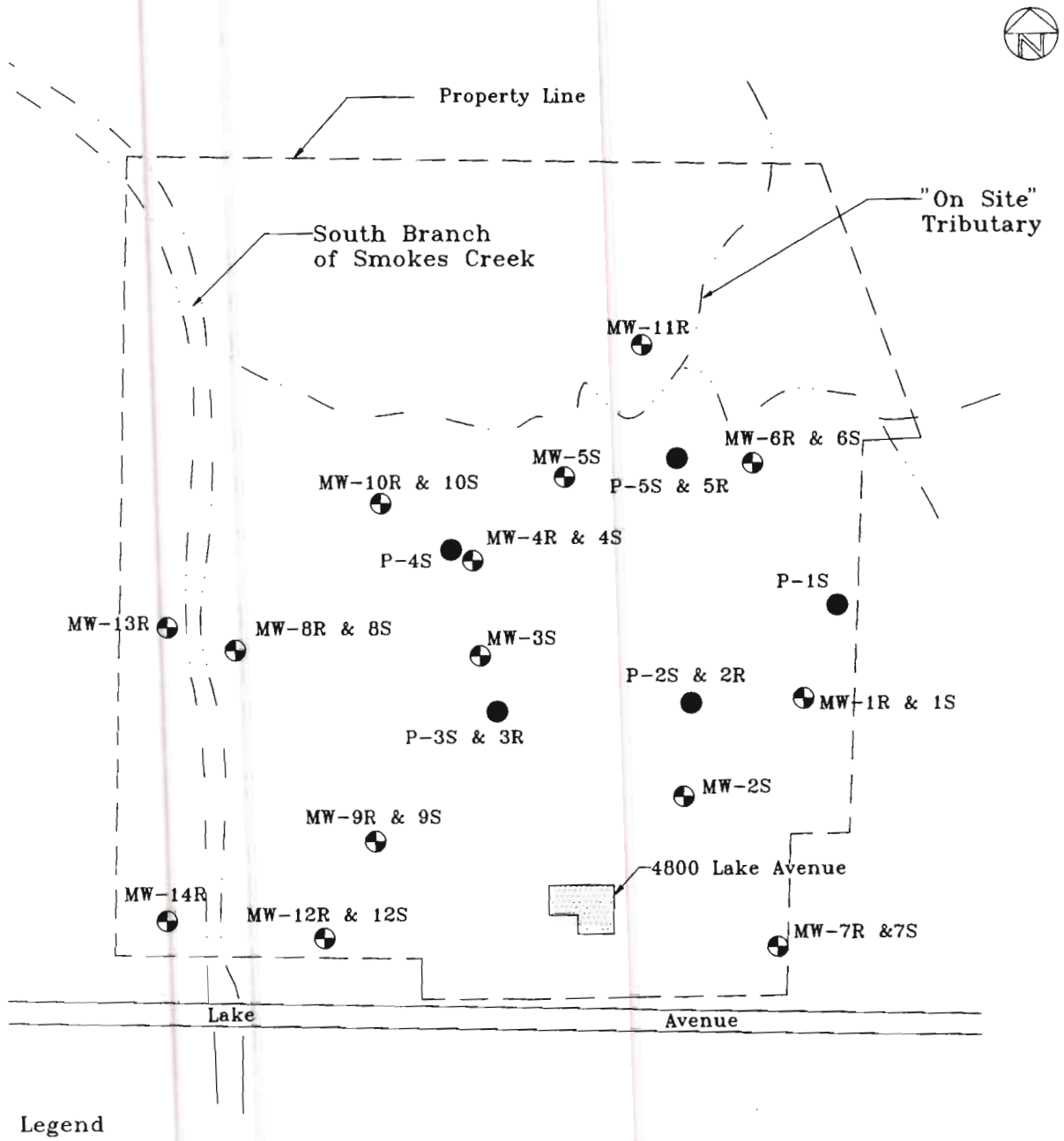
Sca

Figure 1



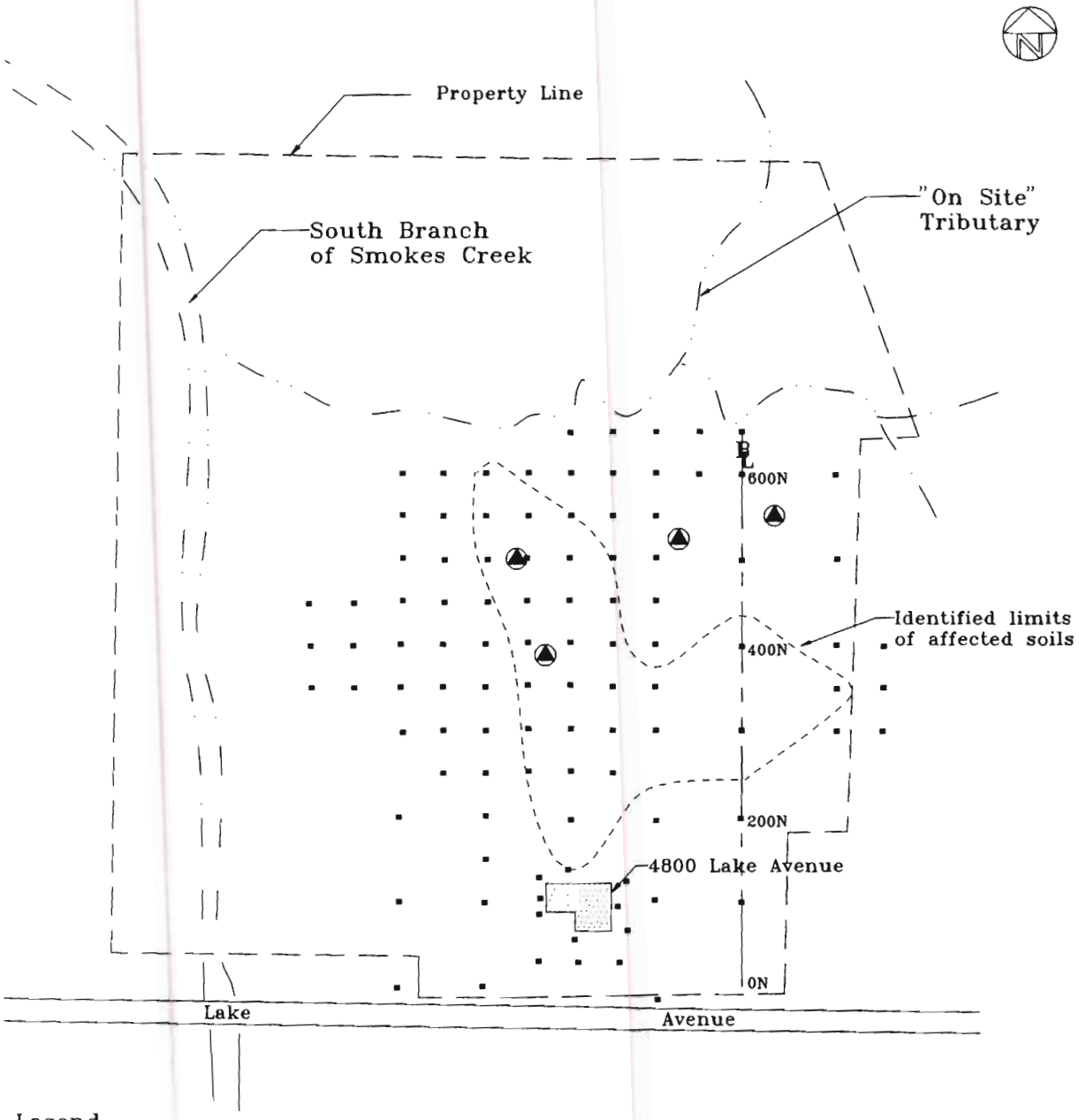
Note: Site features were adapted from a 1972 aerial photograph provided by Erie County Department of Environment and Planning.

McMahon & Mann Consulting Engineers, P.C.	**CHEM-TROL SITE** **HAMBURG, NEW YORK** **FEASIBILITY STUDIES** **SCA Services, Inc.** Scale: 1 inch= 200 feet	**SITE PLAN** **Figure 2**



Note: Base map adapted from "Monitoring Well and Piezometer Location Map" by GZA GeoEnvironmental of New York, dated March 1994.

McMahon & Mann Consulting Engineers, P.C.	**CHEM-TROL SITE** **HAMBURG, NEW YORK** **FEASIBILITY STUDIES** **SCA Services, Inc.** Scale: 1 inch= 200 feet	**MONITORING WELL LOCATIONS** **Figure 3**

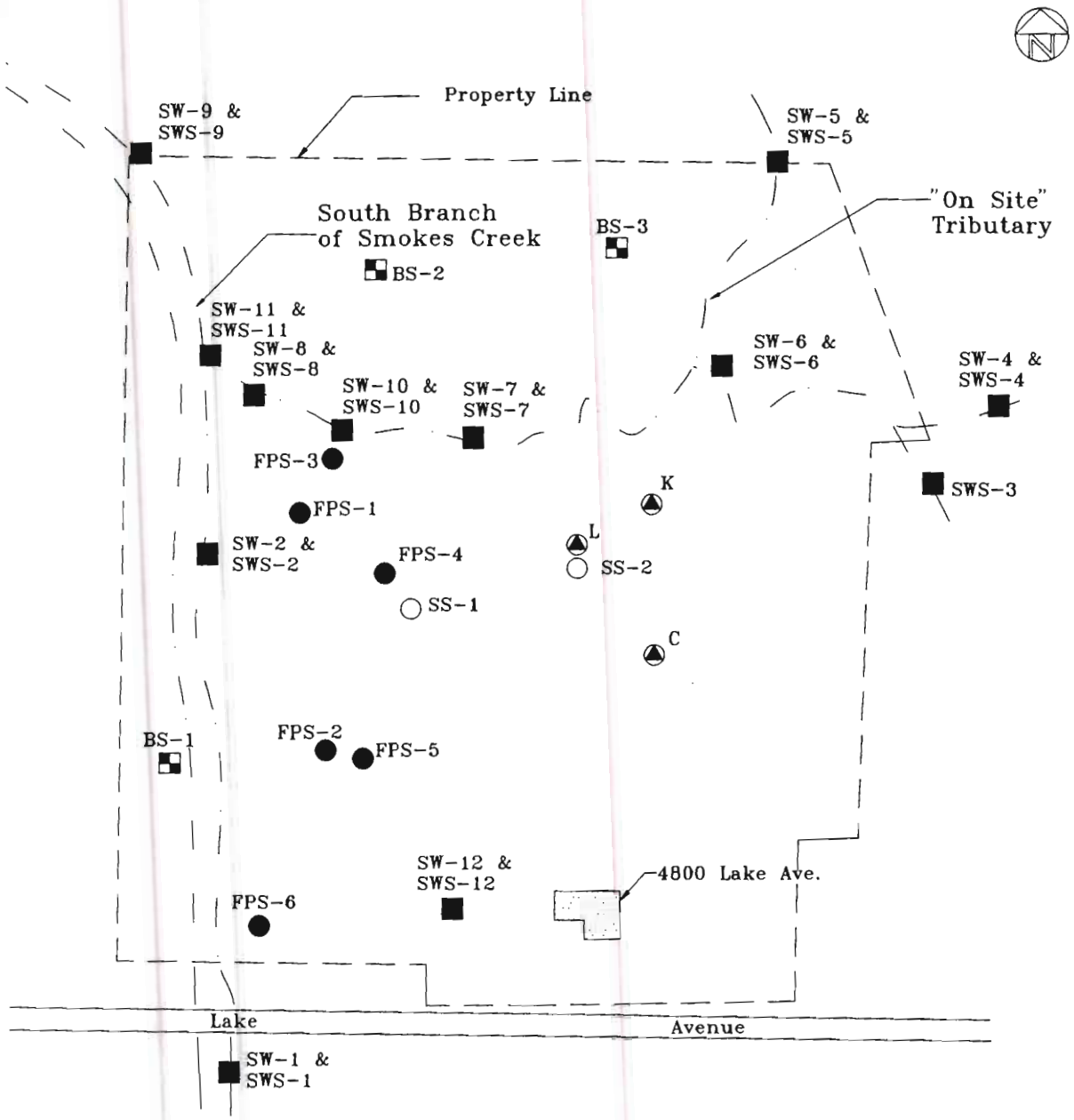


Legend

- Soil Sample Location (1992-93)
- Soil Sample Location (1989)

Note: Extent of affected soils estimated based upon test results presented in "Chem-Trol Site Remedial Investigation", GZA GeoEnvironmental of New York, November 1994.

McMahon & Mann Consulting Engineers, P.C.	**CHEM-TROL SITE** **HAMBURG, NEW YORK** **FEASIBILITY STUDIES** **SCA Services, Inc.** Scale: 1 inch= 200 feet	**EXTENT OF AFFECTED SOILS** **Figure 4**



Legend

- SW-1 & SWS-1, Surface Water and surface water sediment sample locations
- BS-1, Background soil sample location
- FPS-1, Flood plain sediment sample location
- SS-1, Surface or subsurface soil sample location
- C, Test Pit

Note: Base map adapted from "Environmental Sample and Test Pit Locations" by GZA GeoEnvironmental of New York, dated March 1994.

McMahon & Mann Consulting Engineers, P.C.	**CHEM-TROL SITE** **HAMBURG, NEW YORK** **FEASIBILITY STUDIES** **SCA Services, Inc.** **Scale: 1 inch= 200 feet**	**ENVIRONMENTAL SAMPLE LOCATIONS** **Figure 5**

Geometric Mean
Hydraulic Conductivity
(cm/sec)

Glacial Till
(9.5 to 16.2 feet thick)

Lower Glacial Till
(0.5 to 4.7 feet thick)

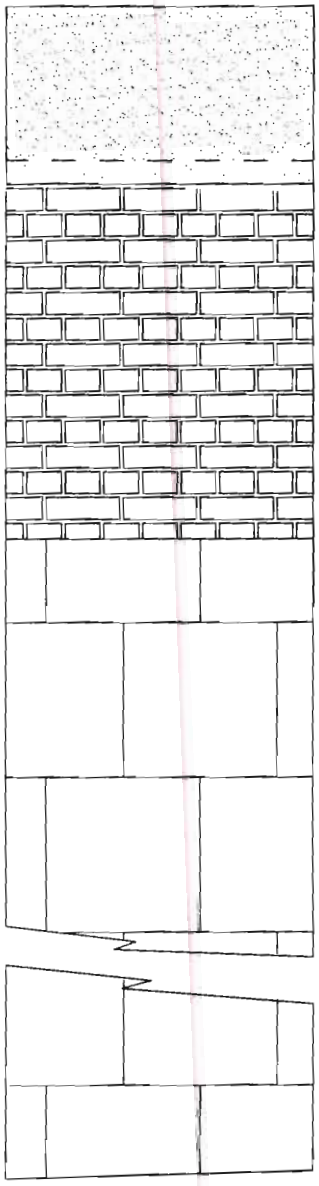
9×10^{-5}

Weathered Shale
(25 to 30 feet thick)

3×10^{-3}

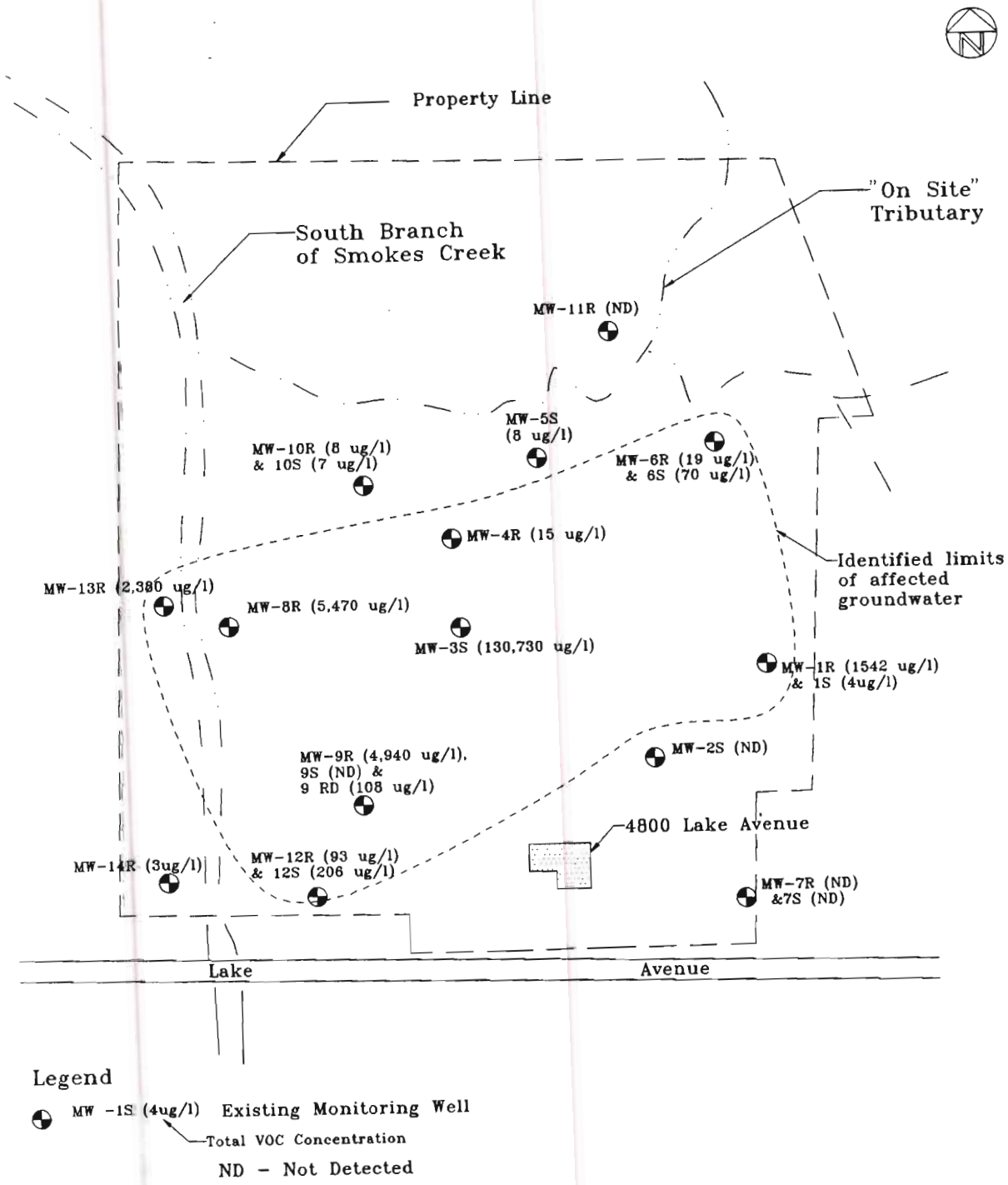
Competent Shale
(65 to 130 feet thick)

3×10^{-5}



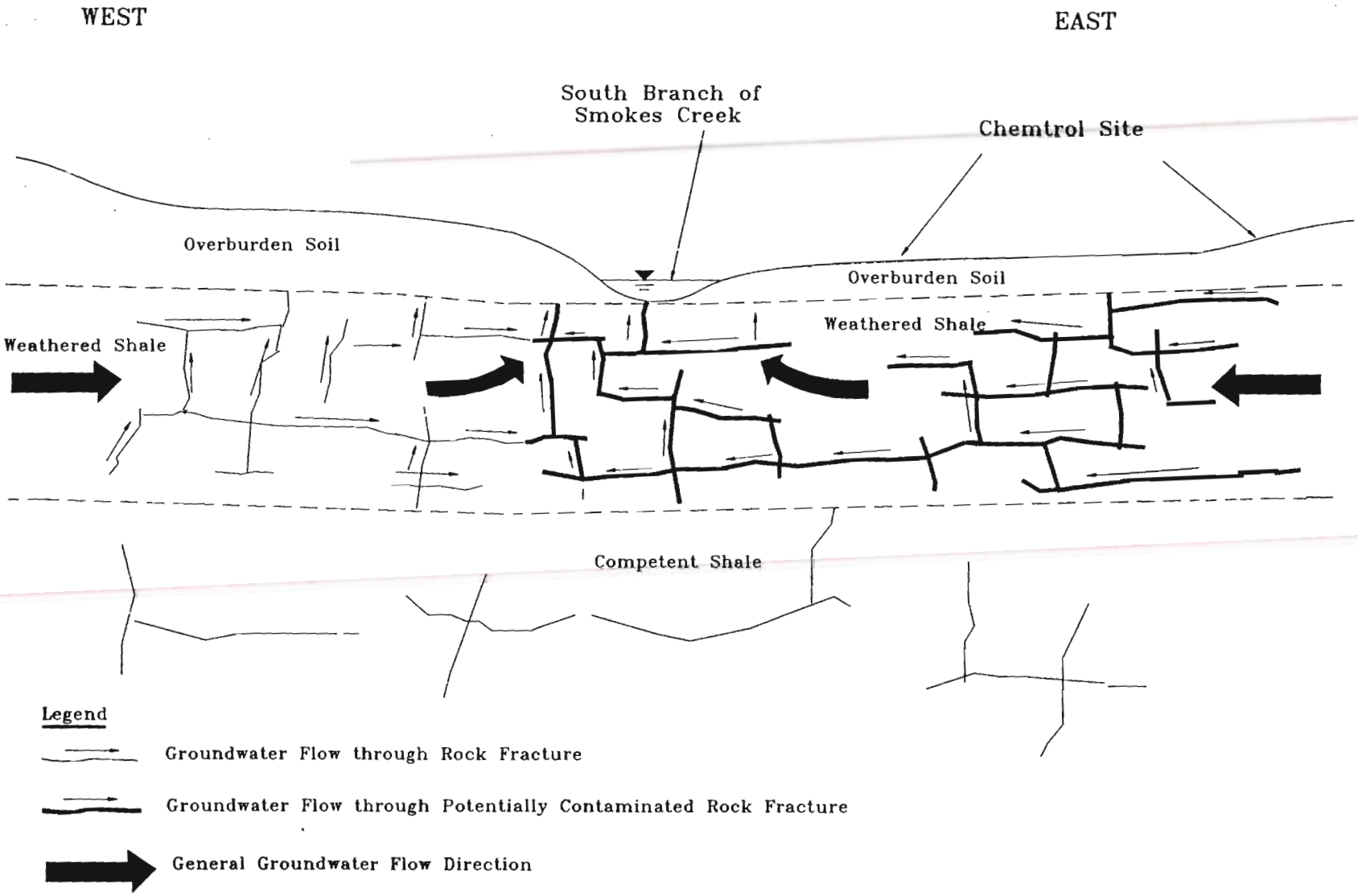
Note: Based on data presented in "Chem-Trol Site Remedial Investigation Report, Hamburg New York" by GZA GeoEnvironmental of New York ,dated November 1994.

McMahon & Mann Consulting Engineers, P.C.	**CHEM-TROL SITE** **HAMBURG, NEW YORK** **FEASIBILITY STUDIES** **SCA Services, Inc.**	**CONCEPTUAL CROSS SECTION** **Figure 6**

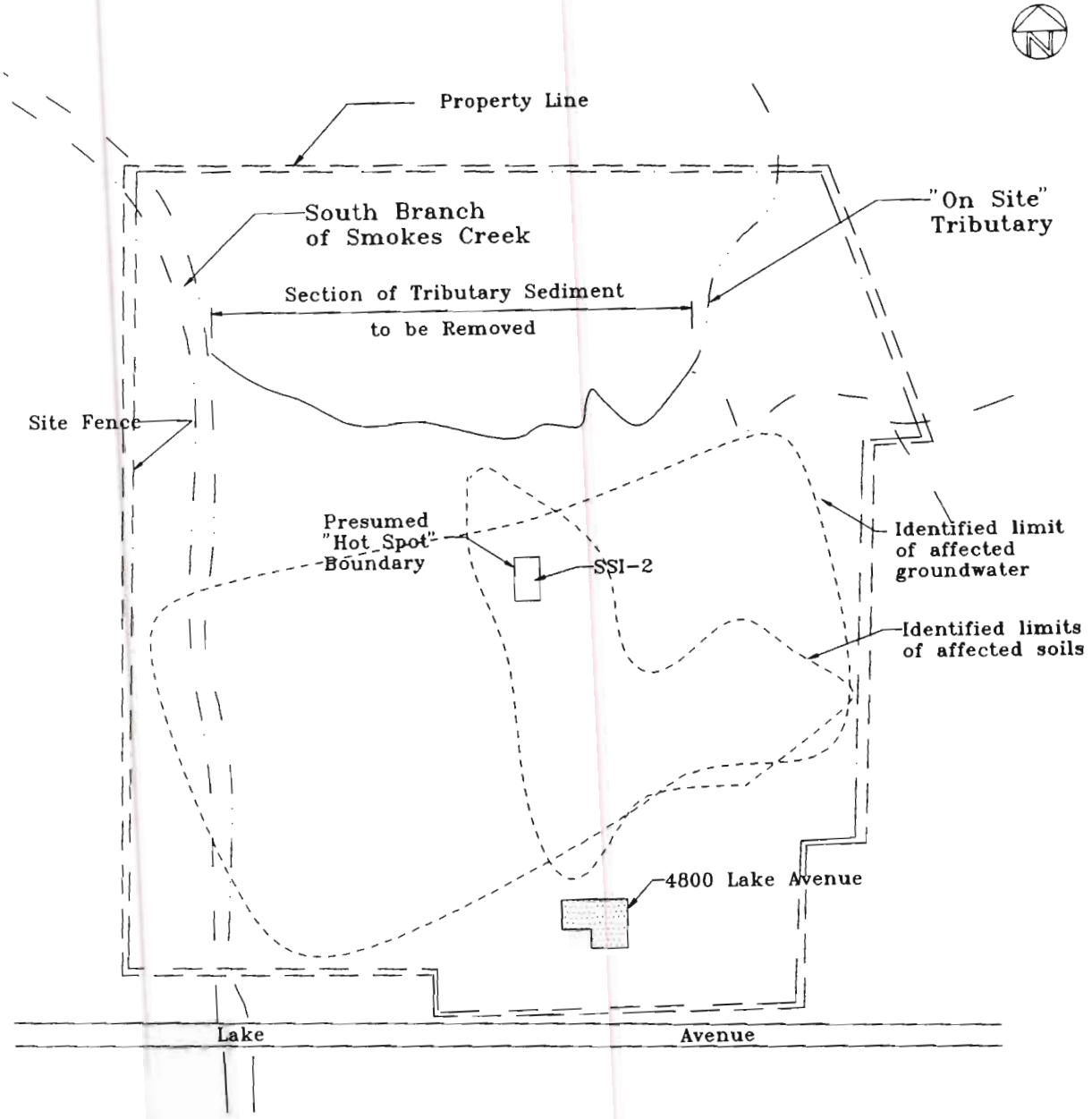


Note: Extent of affected groundwater estimated based upon test results presented in "Chem-Trol Site Remedial Investigation", GZA GeoEnvironmental of New York, November 1994.

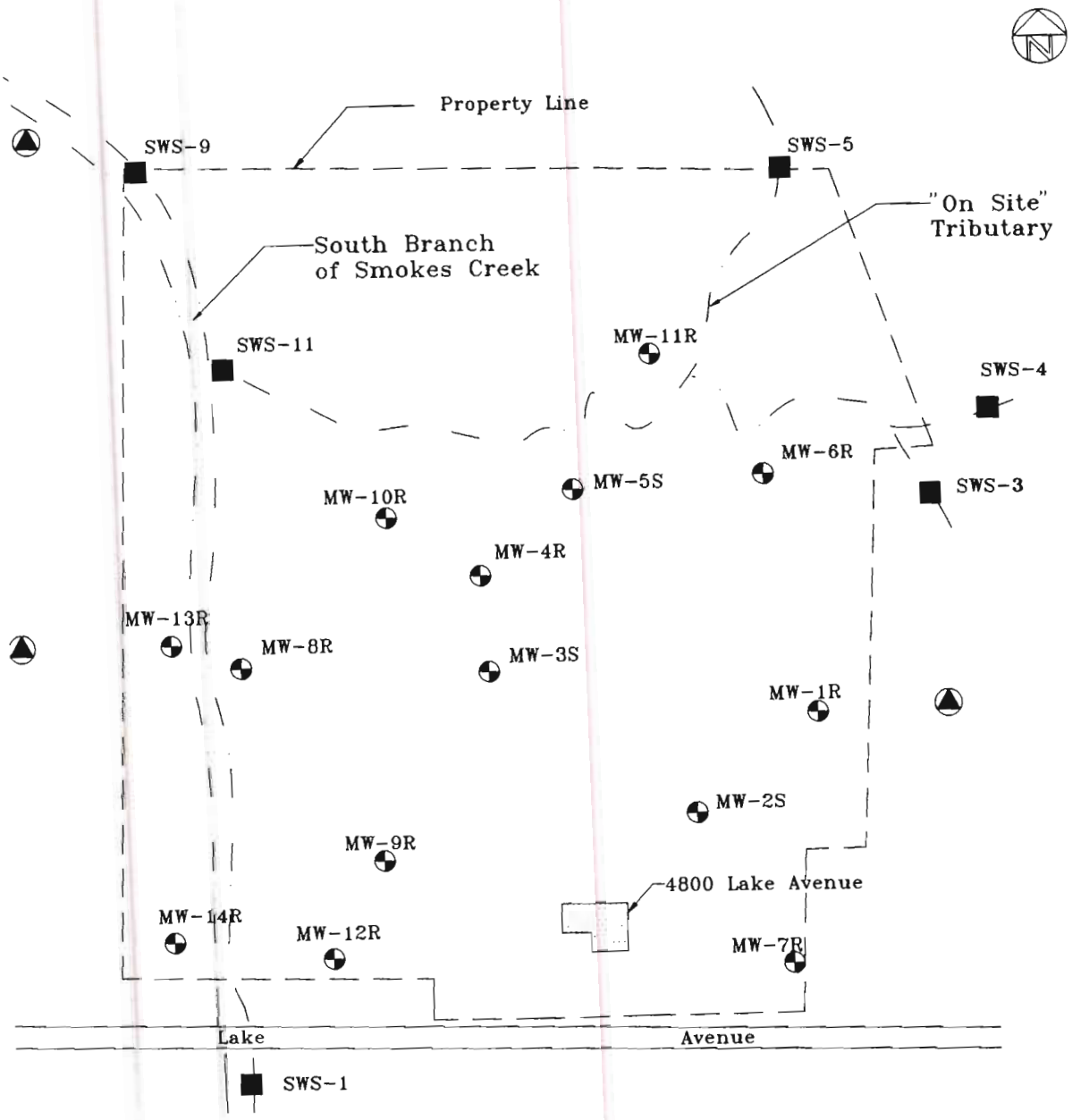
McMahon & Mann Consulting Engineers, P.C.	**CHEM-TROL SITE** **HAMBURG, NEW YORK** **FEASIBILITY STUDIES** **SCA Services, Inc.** Scale: 1 inch= 200 feet	**EXTENT OF AFFECTED GROUNDWATER** **Figure 7**



McMahon & Mann Consulting Engineers, P.C.	**CHEM-TROL SITE** **HAMBURG, NEW YORK**	**CONCEPTUAL GROUNDWATER FLOW** **NEAR THE SOUTH BRANCH OF SMOKES CREEK** **Figure 8**



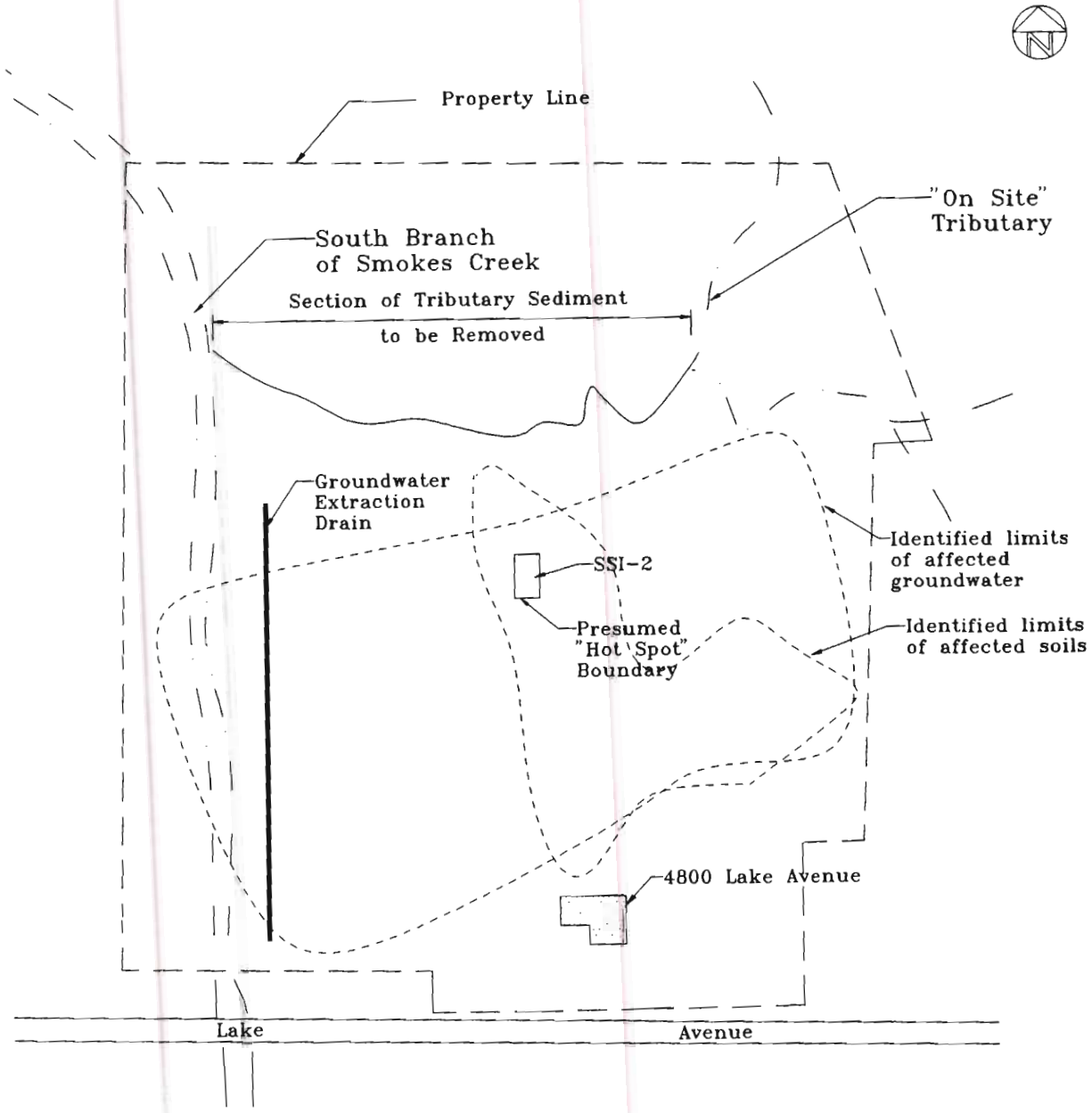
McMahon & Mann Consulting Engineers, P.C.	**CHEM-TROL SITE** **HAMBURG, NEW YORK** **FEASIBILITY STUDIES** **SCA Services, Inc.** Scale: 1 inch= 200 feet	**ALTERNATIVE 2** **Figure 9**



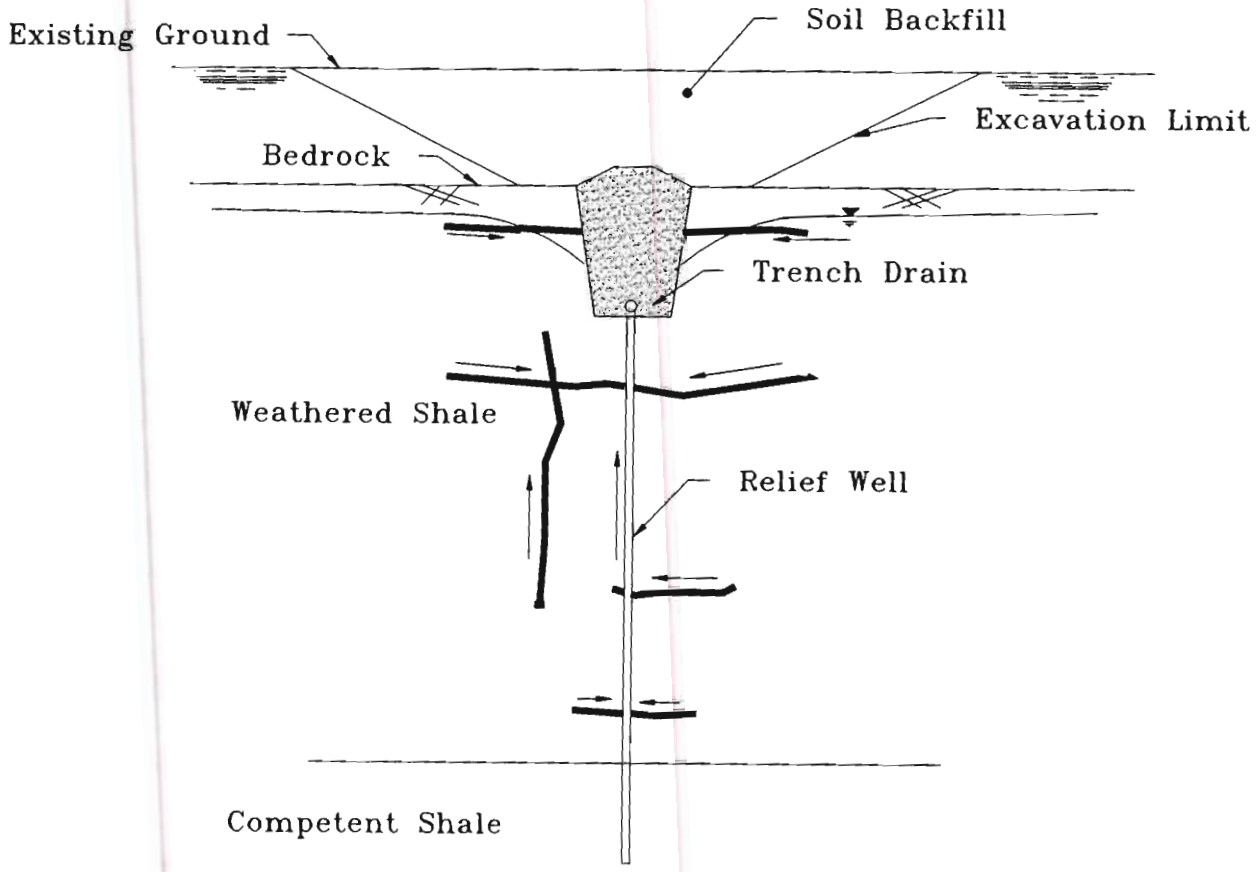
Legend

- Existing Monitoring Well
- Proposed Monitoring Well
- Surface Water Sediment Sample Location

McMahon & Mann Consulting Engineers, P.C.	**CHEM-TROL SITE** **HAMBURG, NEW YORK** **FEASIBILITY STUDIES** **SCA Services, Inc.** Scale: 1 inch= 200 feet	**ENHANCED GROUNDWATER MONITORING PROGRAM** **Figure 10**



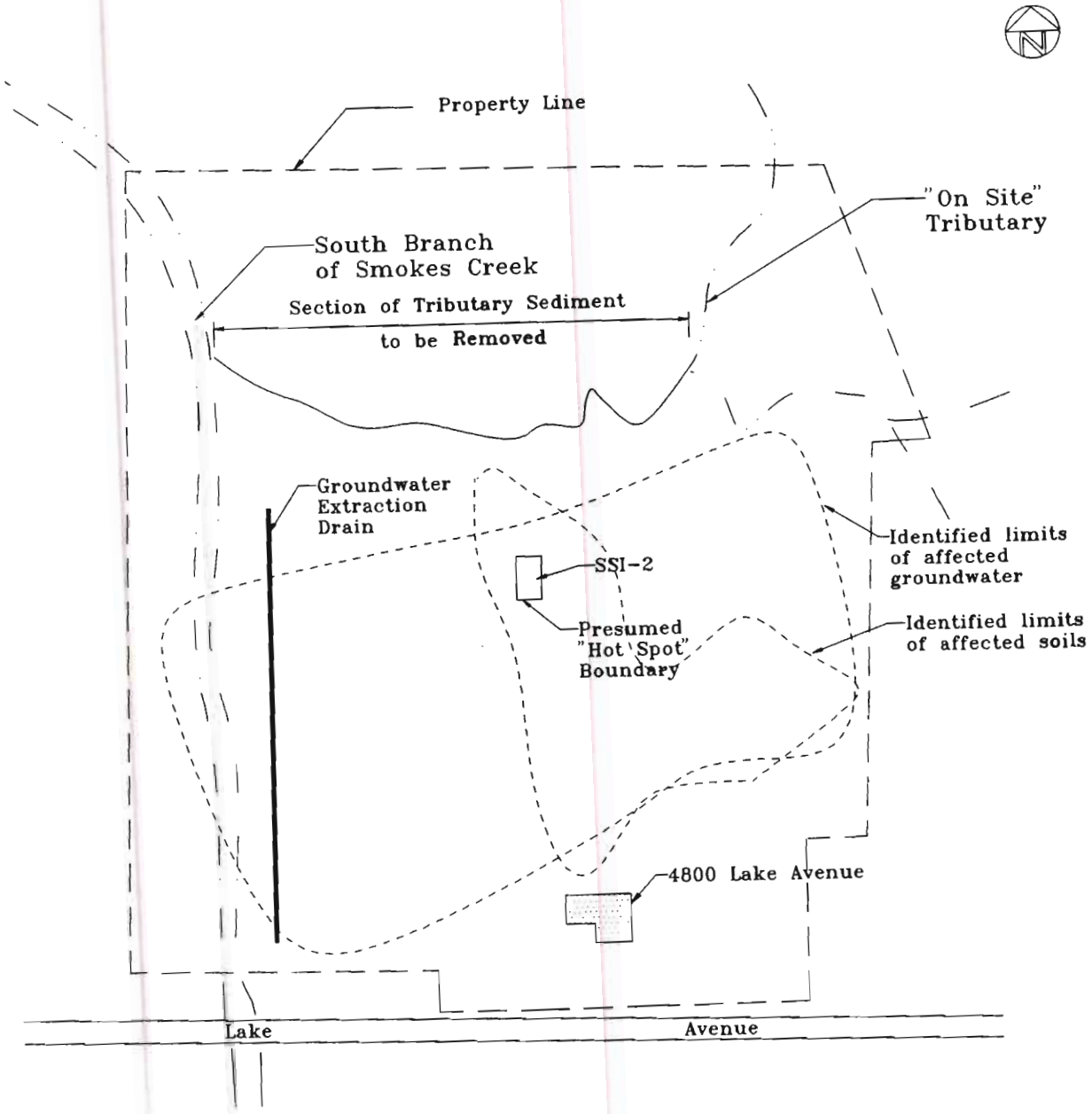
McMahon & Mann Consulting Engineers, P.C.	**CHEM-TROL SITE** **HAMBURG, NEW YORK** **FEASIBILITY STUDIES** **SCA Services, Inc.** Scale: 1 inch= 200 feet	**ALTERNATIVE 5** **Figure 11**



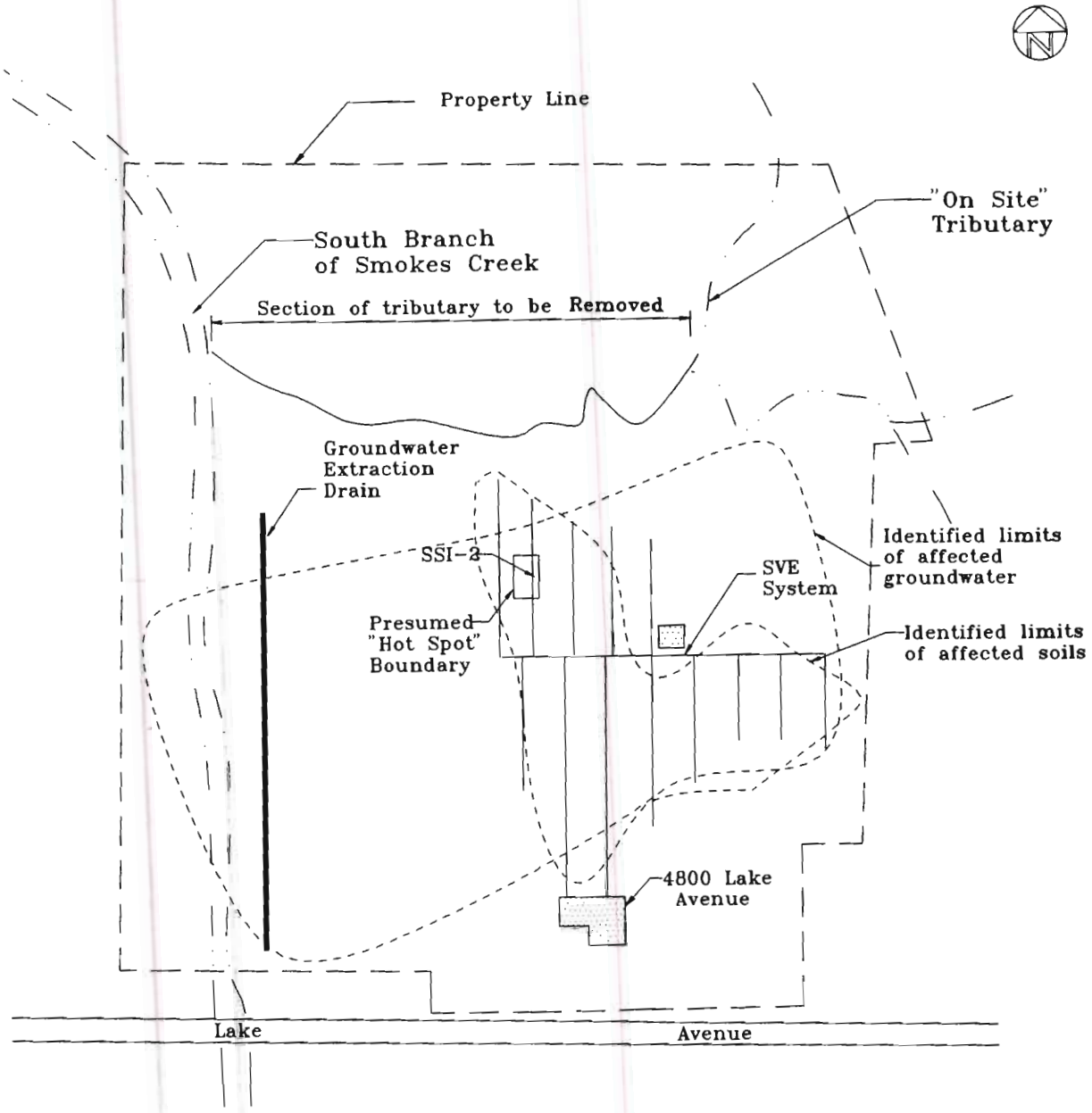
Groundwater Extraction System Detail

1 inch = 10 feet

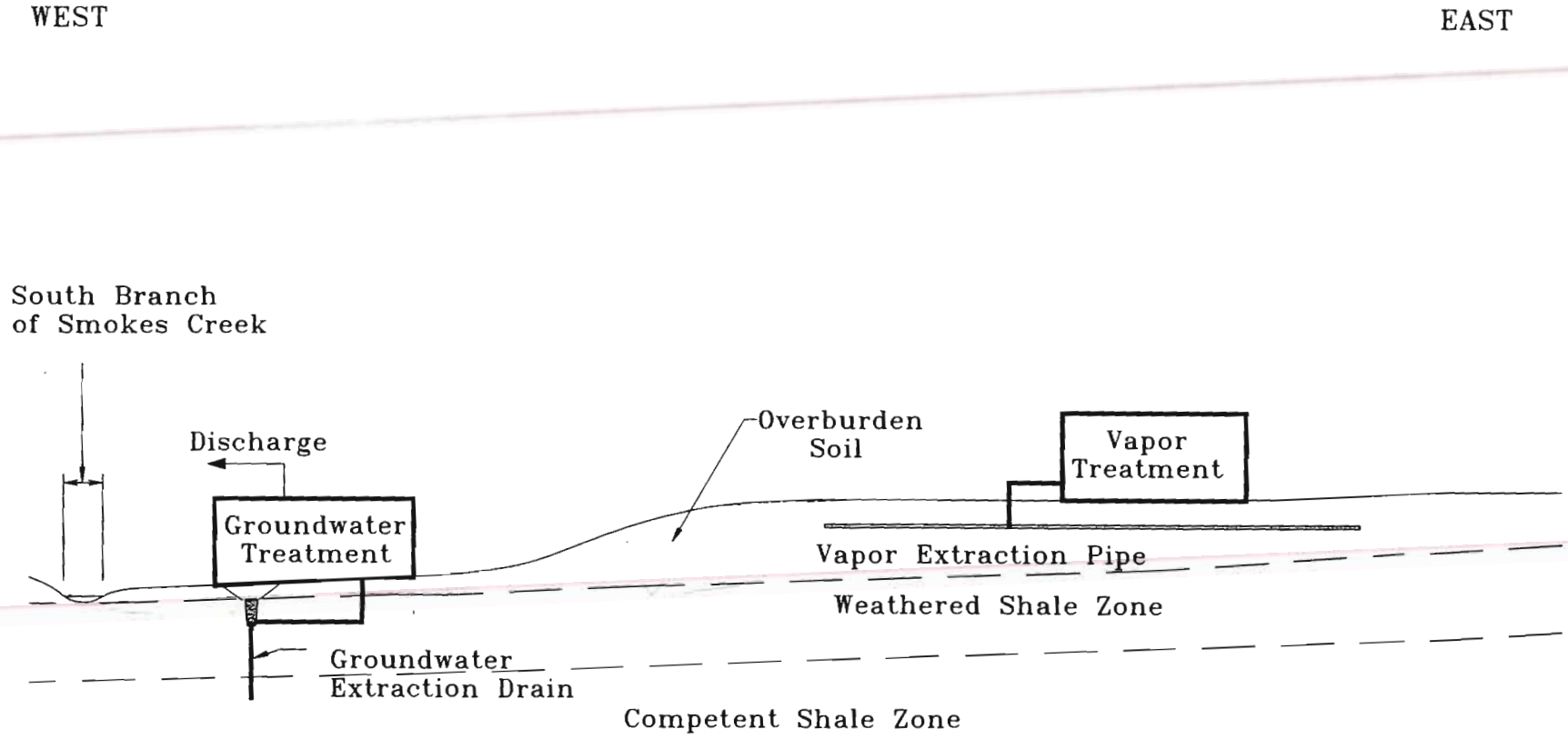
McMahon & Mann Consulting Engineers, P.C.	**CHEM-TROL SITE** **HAMBURG, NEW YORK** **FEASIBILITY STUDIES** **SCA Services, Inc.** Scale: 1 inch= 10 feet	**TRENCH DETAIL** **Figure 12**



McMahon & Mann Consulting Engineers, P.C.	**CHEM-TROL SITE** **HAMBURG, NEW YORK** **FEASIBILITY STUDIES** **SCA Services, Inc.** Scale: 1 inch= 200 feet	**ALTERNATIVE 6** **Figure 13**



McMahon & Mann Consulting Engineers, P.C.	**CHEM-TROL SITE** **HAMBURG, NEW YORK** **FEASIBILITY STUDIES** **SCA Services, Inc.** Scale: 1 inch= 200 feet	**ALTERNATIVE 7** **Figure 14**



McMahon & Mann Consulting Engineers, P.C.	**CHEM-TROL SITE** **HAMBURG, NEW YORK**	**ALTERNATIVE 7** **CONCEPTUAL CROSS SECTION**

Figure 15

Appendix A

- Summary of standards, criteria and guidance/ applicable, relevant and appropriate regulations (SCGs/ARARs)

A1: Chemical Specific SCGs/ARARs
A2: Location Specific SCGs/ARARs
A3: Action Specific SCGs/ARARs

Table A-1
Chemical Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Environmental Media	Citation	Description	Applicable or Relevant and Appropriate	Comments
Groundwater and Surface Water	6 NYCRR part 700-704	Established ambient surface and groundwater standards for conventional parameters.	Relevant and Appropriate	
Groundwater, Soil, Surface Water and Sediment	NYSDEC Draft Cleanup Policy and Guidelines, October 1991.	Established NYSDEC policy regarding cleanup goals and objectives.	TBC	This guidance document provides methodologies for deriving numeric criteria for soil and sediment cleanup levels. Soil levels are based on protection of groundwater, sediment levels are based on aquatic toxicity, human health and wildlife residue.
Drinking Water	Public Health Law Section 225 (NYSDOH, part 5) Maximum Contaminant Levels (MCLs)	Established for the ultimate user via a public water supply system.	TBC	
Soil	NYSDEC Technical and Administrative Guidance Memorandum (TAGM) HWR-94-4046, January 24, 1994.	Established procedure for determining soil cleanup levels.	TBC	Numeric soil cleanup levels for organics are developed by relating to groundwater quality standards through partioning theory.
Groundwater	Safe Drinking Water Act 40 CFR Part 141.11-.16	Established primary maximum contaminant levels (MCLs) for "public water systems" defined as systems with at least 15 connections which service a minimum of 25 persons.	Relevant and Appropriate	
Groundwater	Safe Drinking Water Act 40 CFR 141.50 - .51	Established maximum contaminant level goals (MCLGs) non-enforceable health goals for public water systems. This regulation is relevant and appropriate to groundwater quality in the vicinity of the Chem-Trol site.	Relevant and Appropriate	
Groundwater	Safe Drinking Water Act 40 CFR 141.11 - .16	Established secondary maximum contaminant levels (MCLs), non-enforceable goals regarding taste, odor, color and appearance of drinking water.	Relevant and Appropriate	

Table A-1
Chemical Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Environmental Media	Citation	Description	Applicable or Relevant and Appropriate	Comments
Soil	National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 CFR 300	Established USEPA's policy for the evaluation of public health risks at Superfund sites.	Relevant and Appropriate	The NCP outlines the USEPAs policy for evaluation of public health risks. Numeric values of carcinogenic risk and non-carcinogenic health effects (evaluated by the hazard index) are provided which are considered acceptable
Soil	Superfund Evaluation Public Health Manual	Established policies for determining contaminant concentration goals when ARAR are not available.	TBC	Health based chemical concentrations may be derived from these values where other ARARs are not available or are not sufficiently protective because of multiple contaminants or pathways at the site.
Surface Water	Clean Water Act FR 79318 Nov. 29, 1980	Established Federal Water Quality Criteria (FWQC) for human health protection and aquatic life protection. This regulation is relevant and appropriate to surface water at and near the Chem-Trol site.	Relevant and Appropriate	FWQC may be used by NYSDEC in setting NPDES permit levels.

Table A-2
Location Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation, Standard, Requirement, Criteria or Limitation	Citation	Description	Applicable or Relevant and Appropriate
National Historic Preservation Act	16 USC 470 (1992, as amended) 40 CFR 6.301(b) (1992) 36 CFR 800 (1992)	Requires Federal agencies to take into account the effect of any Federally-assisted undertaking or licensing on any district, site, building, structure or object that is included in or eligible for inclusion in the National Register of Historic Places (NRHP).	TBC
Archeological and Historical Preservation Act	16 USC 469 (1992, as amended) 40CFR 6.301 (c) (1992)	Establishes procedures to provide for preservation of historical and archeological data which might be destroyed through alteration of terrain as a result of a Federal construction project or a Federally licensed activity or program.	TBC
Historic Sites, Buildings, Objects and Antiquities Act	16 USC 461-469 (1992 as amended) 40 CFR 6.301(a) (1992)	Requires Federal agencies to consider the existence and location of landmarks on the National Registry of Natural Landmarks to avoid undesirable impacts on each landmark.	TBC
Fish and Wildlife Coordination Act	16 USC 661-668ee (1992, as amended) 40 CFR 6.302(g) (1992)	Requires consultation when Federal department or agency proposes or authorizes any modification of any stream or other water body, and adequate provision for protection of fish and wildlife resources.	Applicable
Dredge or Fill Requirements (404)	40 CFR Parts 230 & 231 (1992) 33 CFR 320-330 (1992)	Requires permits for discharge of dredged or fill material into waters of the United States, including wetlands. General regulatory policies on permitting.	May be applicable

Table A-2
Location Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation, Standard, Requirement, Criteria or Limitation	Citation	Description	Applicable or Relevant and Appropriate
Floodplain Management/ Wetlands Protection	Executive Order No. 11988	Requires Federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid, to the maximum extent possible, the adverse impacts associated with direct and indirect development of a floodplain.	TBC
	Executive Order No. 11990	Requires Federal agencies to evaluate the potential effects of actions on wetlands and to avoid undertaking, to maximum extent possible, actions negatively impacting wetlands.	TBC
	40 CFR 6.302(b) Appendix A (1992)	Procedures on floodplain management and wetlands protection.	Applicable
Guidance On Activities In Wetlands Within Superfund Site Boundaries	USACOE RGL 85-07 July 5, 1985	States EPA and USACOE policy on wetland activities on superfund sites.	TBC
Wetland Protection	ECL Art. 24 (incl. tit. 7 & 9), 6NYCRR Parts 662, 663, 664, 617, 621 & 624.	Actions within 100 feet of wetland boundaries as defined on State maps.	TBC
Streams and Navigable Waterways	6NYCRR Part 608	Permits/approvals for disturbances of protected streams, construction of dams or docks, or excavation or placement of fill in navigable water	Applicable to the South Branch of Smokes Creek

Table A-3
Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
OSHA-General Industry Standards	29 CFR Part 1910 (1992)	Specifies the 8 hr. time weighted average concentration for various organic compounds. Training requirements for workers at hazardous waste operations are specified in 29 CFR 1910.120.	TBC	Proper respiratory equipment will be worn if it is impossible to maintain the work atmosphere below the concentration. Workers performing activities must have completed specific training requirements under 40 CFR 300.150. Has been amended to add new requirements for workers in confined spaces. 58 FR4462 (Jan. 14, 1993). The effective date is April 15, 1993.
OSHA-Safety and Health Standards	29 CFR Part 1926 (1992)	Specifies the type of safety equipment and procedures to be followed during site remediation.	TBC	All appropriate safety equipment will be onsite, and safety procedures would be followed during onsite activities under 40 CFR 300.150.
OSHA-Recordkeeping, Reporting, and Related Regulations	29 CFR Part 1904 (1992)	Outlines the recordkeeping and reporting requirements for an employer under OSHA.	TBC	These requirements apply to all site contractors and subcontractors and must be followed during all site work under 40 CFR 300.150.
National Emissions Standards for Hazardous Air Pollutants (NESHAP)	40 CFR Part 61 (1992)	Designates hazardous air pollutants and sets emission standards.	Applicable	No new source may be operated, modified, or constructed unless these regulations are met.
Air Quality Standards	40 CFR 50 (1992) 40 CFR 52 (1992)	Establishes National Primary and Secondary Ambient Air Quality Standards. State implementation Plans (SIPs)	Applicable	May be applicable or relevant and appropriate if excavation equipment exhaust and fugitive dust contribute significantly to air quality ranking for region.

Table A-3
Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
National Pollutant Discharge Elimination System (NPDES)	40 CFR Parts 122-125 (1992)	Requires permits for the discharge of pollutants from any point source into waters of the United States. The Act defines a point source as any discernible conveyance from which pollutants are or may be discharged. Effluent limitations must protect beneficial uses of water.	Applicable	Remedial actions which would discharge a pollutant into surface waters would enter into the NPDES regulatory framework. A permit is not required for onsite CERCLA response actions, but the substantive requirements would apply. Offsite discharges would require a permit In response to a 1992 case, deadlines have been specified for the issuance of NPDES permits in areas having a population of 100,000 or more. 57 FR 60444 (Dec. 18, 1992). NY operates the PDES program in the state.
Water Quality Standards Regulation	40 CFR Part 131 (1992)	Provides Chemical-specific numeric criteria for toxic pollutants in waters of certain use classifications for states that have not fully complied with the requirements of the Clean Water Act.	Applicable	

Table A-3
Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
Hazardous Materials Transportation Regulations	49 CFR Part 171 (1992)	Definitions of hazardous materials, wastes, substances, reportable quantities, etc.	Applicable	Must be used to determine applicability of specific hazardous materials or waste transportation requirements, regardless of destination.
	49 CFR Part 172 (1992)	Provides information and requirements addressing shipping paper descriptions, marking and labeling of packages, placarding of vehicles and requirements for emergency response information.	Applicable	Parts 172 and 173 were amended by final rule to give regulatory relief for materials being shipped at elevated temperatures. 58 FR 3343 (Jan 8, 1993).
	49 CFR Part 172, Subpart G	Emergency response information for use in the mitigation of accidents involving hazardous materials and wastes.	Applicable	Must include at a minimum: (1) the basic description and technical name of the hazardous material; (2) immediate hazards to health; (3) risks of fire or explosion; (4) immediate precautions to be taken in the event of an accident or incident; (5) immediate methods for handling fires; (6) initial methods for handling spills or leaks in the absence of fire; and (7) preliminary first aid measures.
	49 CFR Part 173 (1992)	Shippers-General requirements for shipments and packaging	Applicable	
Safety requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances and Hazardous Wastes	DOE Order 5480.3	Specifies requirements for the labeling and packaging of these substances in addition to 49 CFR.	TBC	
Environmental Protection, Safety and Health Protection Standards	DOE Order 5480.4	Specifies other applicable regulations, standards, requirements and guidance.	TBC	

Table A-3
Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
Executive Orders Protection & Enhancement of Environmental Quality	Executive Order No. 11514 (Mar. 5, 1970)	Requires monitoring, developing procedures to allow public information, share information with other states and agencies, and comply with CEQ regulations.	TBC	Purpose is to require federal agencies to follow mandate of NEPA. Not promulgated.
The Administration of the CAA and CWA with respect to Federal Contracts, Grants or Loans	Executive Order 10.11738 (Sept. 10, 1973)	Prohibits federal agencies from entering into contracts with firms which have been convicted of an offense of the CAA or CWA.	TBC	EPA keeps a list of firms with convictions. Limited exemptions are available. Not promulgated.
Federal Compliance with Pollution Control Standards	Executive Order No.12088 (Oct. 13, 1978)	Requires federal agencies to comply with federal pollution prevention laws.	TBC	Also establishes conflict resolution procedures to resolve differences between agencies. Not promulgated.
Superfund Implementation	Executive Order No.12580 (Jan. 23, 1987)	Implements National Contingency Plan and delegates presidential authority to various agencies.	TBC	Secretary of Energy is named as one of the federal trustees for natural resources. Not promulgated.
EPA Pretreatment Standards	40 CFR 403	Establishes responsibilities of Federal, State, and local government to implement National pretreatment standards to control pollutants that pass through to a POTW.	May be Appliable	Applies if discharge is made to the POTW.
Determining Applicable Emission Standards	N.Y.COMP. CODES R & REGS. tit. 6, 212.4 (BNA)	Establishes emission standards where air contaminants from two or more devices or contrivances are emitted to the outdoor atmosphere through a single emission point.	Applicable	A process emission source, subject to the Federal new source performance standards in 40 CFR Part 60, the national emission standards for hazardous air pollutants in 40 CFR Part 61, or to PCB disposal criteria in 40 CFR Part 761, satisfies the requirements of this Part if the source owner can demonstrate that the source is in compliance with the respective Federal regulation.

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Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
Emissions from Motor Vehicles Propelled by Gasoline Engine	N.Y. COMP CODES R & REGS. tit. 6, Subpart 217-1 (BNA)	Gasoline powered motor vehicle(s) subject to an exhaust emission test will not be operated in such a manner that it emits carbon monoxide (CO) or hydrocarbons (HC) in the exhaust in excess of the standards below or that has a combined CO and carbon dioxide emission less than 6.0 percent when measured using the test procedure specified in the DMVs "Emissions Inspection Procedure" document. Vehicle Model Year / CO Limit / HC Limit Light / Heavy / % / (PPM) 1974+ / 1969+ / 7.0 / 800 1970-73 / 6.0 / 700 1974-78 / 4.5 / 600 1975-78 / 1979+ / 3.0 / 300 1979-80 / 2.5 / 300 1981+ / 1.2 / 220	Applicable	May be applicable to excavation equipment used in remediation activities.

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Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
Vehicles Propelled by Diesel Engines	N.Y. COMP. CODES R &REGS. tit. 6,Subpart 217-3 (BNA)	Vehicle(s) propelled by diesel engines shall not be operated in such a manner that exhaust emission of a shade of blue, black or grey equal to or greater than Number 1 on the Ringelmann chart or equivalent standard acceptable to the commission is produced for a continuous period of more than 5 seconds when the vehicle is in motion. Do not allow a bus or truck to idle for more than 5 consecutive minutes when the vehicle is not in motion, except as otherwise permitted by section 218.3.	Applicable	May be applicable to excavation equipment used in remediation activities.
Opacity of Emissions Limited	N.Y.COMP CODES R & REGS. tit 6, 212.5 (BNA)	Establishes limitations for opacity of emissions. Commissioner may accept for an emission source an equivalent opacity standard exceeding the opacity standard of subdivision (a) if the source owner can demonstrate through acceptable tests for such source compliance with all applicable emission requirements other than the opacity standard and that the source and any associated emission control equipment is being operated and maintained in a manner acceptable to the Commissioner	Applicable	An equivalent opacity standard will only be granted where reasonably available control technology (RACT) has been used. In any event, the source owner or operator will not cause or allow emissions to exceed the equivalent opacity.

Table A-3
Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
Open Fires	N.Y. COMP CODES R & REGS. tit 6, 215.2 (BNA)	Unless permitted by Section 215.3, no person shall burn, cause, sufferm allow or permit the burning in an open fire: • garbage; • refuse at a refuse disposal area; • rubbish for salvage; • rubbish generated by industrial or commercial activities for onsite disposal; • rubbish generated by land clearing or demolition for the erection of any structure.	Applicable	May be applicable to remediation activities.
Restricted Burning	N.Y. COMP CODES R & REGS. tit 6, 215.3 (BNA)	Restricted burning. Burning in an open fire, provided it is not contrary to other law, will be permitted.	Applicable	Permitted permit holder operates within constraints of a valid permit.
Application for Specific Permits	N.Y.COMP. CODES R. &REGS. tit 6, 621.4 (BNA)	Application for specific permits. Includes additional information to be furnished, in order for the application to be determined complete, and schedule of fees.	Applicable	Applicable to permits sought under the Environmental Conservation Law (ECL) article 19 and 6 N.Y.COMP. CODES R. & REGS. Parts 201, 203 and 215-Air Pollution Control.
Application for Permit Renewals or Modifications	N.Y.COMP. CODES R & REGS.tit. 6, 621.13 (BNA)	Applications to renew or modify permits must be submitted to the regional permit administrator. Such application shall provide information supporting the action sought, shall include a statement of necessity or reasons for modification.	Applicable	Applications for renewals must be submitted no less than 30 calendar days with the exception for Standard Pollutant Discharge Elimination System (SPDES), hazardous waste manufacturing facility (HWMF), air pollution control (APC), or solid waste manufacturing facility (SWMF) permits which must be submitted no less than 180 calendar days prior to permit expiration.

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Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
NEW YORK New York Ambient Air Quality Standard • Air Quality Classification System	N.Y.COMP. CODES R. & REGS.tit 6, Part 256 (BNA)	Air Quality Classification System. Describes the four general levels of social and economic development and pollution potentials that exist in the State of N.Y. The land uses associated with the classification levels assigned to the geographical areas of the state are detailed below: Level I-Predominantly used for timber, agricultural crops, dairy farming, or recreation. Habitation and Industry sparse. Level II-Predominantly single and two family residences, small farms, and limited commercial services and industrial development. Level III-Densely populated, primarily commercial office buildings, department stores and light industries in small and medium metropolitan complexes, or suburban areas of limited commercial and industrial development near large metropolitan complexes. Level IV-Densely populated, primarily commercial office buildings, department stores and industries in large metropolitan complexes, or areas of heavy industry.	Applicable	Air quality standards for the Chem-Trol site will be set by Part 257 and the appropriate level assigned to the site.

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Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
New York Ambient Air Quality Standards • General Application	N.Y.COMP. CODES R. & REGS.tit. 6, 257-1.3 (BNA)	Emissions in a classified area shall be controlled to the extent required by the Commissioner to be compatible with standards established in other areas. Ambient air concentrations shall be determined in accordance with the procedures and techniques as specified in the standard or in accordance with other methods or techniques acceptable to the Commissioner. The Commissioner may publish acceptable methods from time to time.	Applicable	
• Compliance	N.Y.COMP CODES R. & REGS tit 6, 257-1.4 (BNA)	Prohibits the emission of contaminants from an emission source which alone or in combination with emissions from other sources cause contravention of air quality standards. Prohibits the emissions of odorous, toxic or deleterious substance in concentrations or of such duration that will affect human health or well-being, or unreasonably interfere with the enjoyment of property or unreasonably and adversely affect plant or animal life.	Applicable	Applies to remediation activities that include a controlled air emission source. May be applicable or relevant and appropriate if excavation equipment exhaust and fugitive dust contribute significantly to air quality ranking for region.

Table A-3
Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
Air Quality Standards - Particulates	N.Y.COMP. CODES R. & REGS. tit 6, Subpart 257-3 (BNA)	Sets forth measurement techniques, sampling frequencies, 24-hr., annual, 30-day, 60-day and 90-day standards for suspended particulates, and 12-month standard for settleable particulates (dustfall).	Applicable	

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Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
Air Quality Standards - Particulates	N.Y.COMP. CODES R. & REGS. tit 6, 257-3.3 (BNA)	Establishes the following standards for suspended particulates: • For any 24-hr. period the average concentration shall not exceed 250 ug/m3 more than once a year. • During any 12 consecutive months, the geometric mean of the 24-hr. average concentrations shall not exceed: • Level I - 45ug/m3 • Level II - 55ug/m3 • Level III - 65ug/m3 • Level IV - 75ug/m3 • During any 30 consecutive days, the arithmetic mean of the 24-hr. average concentrations at any location shall not exceed: Level I - 80ug/m3 Level II - 100ug/m3 Level III - 115ug/m3 Level IV - 135ug/m3 • During any 60 consecutive days, the arithmetic mean of the 24 hr. average concentrations at any location shall not exceed: Level I - 70ug/m3 Level II - 85ug/m3 Level III - 95 ug/m3 Level IV - 115 ug/m3		

Table A-3
Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
Air Quality Standards - Particulates	N.Y.COMP. CODES R & REGS tit 6, 257-3.3 (BNA)	• During any 90 consecutive days, the arithmetic mean of the 24-hr, average concentrations at any location shall not exceed: Level I - 65ug/m3 Level II - 80ug/m3 Level III - 90ug/m3 Level IV - 105ug/m3 Standards described for 30,60 and 90 consecutive days are intended for enforcement purpose. Monitoring will be performed only as required.		
Standard for Settleable Particulates	N.Y.COMP. CODES R. & REGS. tit 6, 257-3.4 (BNA)	Settleable particulates (dustfall) standards. • During any 12 consecutive months, 50% of the values of the 30-day average concentrations shall not exceed: Level I - 0.30mg/cm2/mo Level II - 0.30mg/cm/mo Level III - 0.40mg/cm2/mo Level IV - 0.60mg/cm2/mo • During any 12 consecutive months, 84 percent of the values of the 30 day average concentrates shall not exceed: Level I - 0.45mg/cm2/mo Level II - 0.45mg/cm2/mo Level III - 0.60mg/cm2/mo Level IV - 0.90mg/cm2/mo	Applicable	

Table A-3
Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
Air Quality Standard - Carbon Monoxide Standard	N.Y.COMP. CODES R. & REGS. tit 6, 257-4.3 (BNA)	Establishes the following carbon monoxide standards: • For an 8-hr. period, the average concentration of carbon monoxide shall not exceed 9 ppm more than once in any 12 consecutive months; • For a 1 hr. period, the average concentration of carbon monoxide shall not exceed 35 ppm more than once in any 12 consecutive months.	Applicable	Applicable to all levels identified in 256.
Air Quality Standard - Photochemical Oxidants	N.Y.COMP. CODES R. & REGS. tit 6, Subpart 257-5 (BNA)	Establishes the following photochemical oxidants standards: • In any 1-hr. period, the average concentration of photochemical oxidant shall not exceed 0.08 ppm more than once in any 12 consecutive months.	Applicable	Applicable to all levels identified in Part 256. An equivalent method for measurement may be approved by the Commissioner.
Air Quality Standard - Hydrocarbons (Non-Methane)	N.Y.COMP. CODES R. & REGS. tit 6, Subpart 257-6 (BNA)	Establishes the following hydrocarbons (Non-Methane) standard: • During the 3-hr. period from 6 to 9 a.m., the average non-methane hydrocarbon concentration must not exceed 0.24 ppm more than once in any 12 consecutive months.	Applicable	Applicable to all levels identified in Part 256. Other methods of measurement may be approved by the Commissioner.

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Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
Air Quality Standard - Nitrogen Dioxide	N.Y.COMP CODES R. & REGS tit. 6, Subpart 257-7 (BNA)	Establishes the following nitrogen dioxide standards: • During any 12 consecutive months, the annual average of the 24-hr. concentrations shall not exceed 0.05 ppm (100ug/m3).	Applicable	Applicable to all levels identified in Part 256. Concentration may be determined by method specified or an equivalent method approved by the Commissioner.
Air Quality Standard - Flouride	N.Y.COMP. CODES R. & REGS tit. 6, Subpart 257-8 (BNA)	• Establishes the following fluoride standards: • Total fluorides, ppm, dry weight basis (as F), in and on forage for consumption by grazing ruminants. Average concentration shall be less than the following for all levels: • -For growing season (not to • exceed 6 consecutive • months) - 40 ppm • -For any 60 day period - 60 • ppm • -For any 30 day period - 80 • ppm. • Gaseous fluorides in air (ppm of air) as F-all levels (25 degrees Centigrade, 760mm Hg) • -12-hr. averages to be less than 4.5 ppb (3.7ug/m3) • -24-hr. averages to be less than 3.5 ppb (2.85 ug/m3) • 1 week average to be less than 2.0 ppb (1.65 ug/m3) • 1 month averages to be less than 1.0 ppb (0.8ug/m3)	Applicable	Applicable to all levels identified in Part 256.

Table A-3
Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
Air Quality Standards - Beryllium	N.Y.COMP CODES R. & REGS.tit 6, Subpart 257-9 (BNA)	Required that during any month, the average concentration of beryllium shall not exceed 0.01 ug/m3 .	Applicable	Identifies measurement methodology.
Air Quality Standards - Hydrogen Sulfide	N.Y.COMP. CODES R. & REGS tit. 6, Subpart 257-10 (BNA)	Establishes the standard that in any 1-hr. period, the average concentration of hydrogen sulfide shall not exceed 0.01 ppm (14ug/m3)	Applicable	Applicable to all levels identified in Part 256. Identifies measurement methodology.
New York Waste Transport Permit Regulations	N.Y.COMP. CODES R. & REGS tit. 6, 364.1(BNA)	The collection, transport and delivery of regulated waste, originating or terminating at a location with New York, will be governed in accordance with Part 364.	Applicable	Applicable if site's wastes fall into regulated catagories.
Permit Requirements	N.Y.COMP. CODES R. & REGS tit. 6, 364.2(BNA)	• Without a valid permit regulate waste will not be: • collected or removed from its point of origin, generation or occurrence; • transported; • delivered to any TSD facility or otherwise disposed or relinquished; • landspread septage; or • landspread sewage sludge.	Applicable	Although a permit is not required, the substantive provisions of the regulation must be met if site's wastes fall into regulated catagories.

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Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
Permitting Standards	N.Y.COMP. CODES R & REGS tit 6, 364.4(BNA)	A decision to issue or deny a permit for ter transport of a regulated waste is based on: • Status of receiving facility: • Receiving facility must be authorized to accept such waste, must operate under an active department issued order on consent, provide proof of authorization to operate if facility is outside the jurisdiction of New York, or if facility is not required by the state to be licensed, permitted or certified to operate. • Compliance status of receiving facility. • Compliance history and reliability of applicant. Waste transporter permit may be denied, revoked, suspended or modified based on the unsuitability of the applicant (under provisions of Environmental Conservation Law 27-0913). Waste transporter permits may be denied, revoked, suspended or modified if the receiving facility has been determined to have violated any law, rule or regulation or permit condition related to the operation of its TSD facility.	Applicable	Applicable to waste transporters of regulated waste from the Chem-Trol site associated with remedial actions.

Table A-3
Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
Vehicle/Operation Requirements	N.Y.COMP CODES R & REGS tit. 6, 364.6(BNA)	Governs conditions under which regulated wastes may be transported.	Applicable	Applicable to transport of regulated waste from the Chem-Trol site during remedial activities.
New York Rules on Hazardous Waste Program Fees Fees related to Clean-up, Remediation or Corrective Action	N.Y.COMP CODES R. & REGS. tit. 6, 483.4 (BNA)	Generator fees shall not be patable for waste resulting from services which are provided: • under contract with the department, EPA or a court order related to the clean-up or remediation of a hazardous material or hazardous waste spill, discharge or surficial clean-up, pursuant to ECL or a removal action pursuant to CERCLA; • under contract for or with approval of department for clean-up and removal of petroleum spill or discharge; • under the order of a court, the Department of Health, EPA or CERCLA related to an inactive hazardous waste disposal site; • voluntarily and without expectation of monetary compensation in accordance with subdivision 1 of ECL 27-1321; or • under permit or order requiring corrective action pursuant to title 9 of ECL article 27 or RCRA.	Applicable	Applicable to the clean-up, remediation or corrective action associated with the Chem-Trol site if hazardous waste is generated during remediation. DOE's position is that as a federal agency they are exempt from user fees.

Table A-3
Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
Waste Transporter Program Fees	N.Y.COMP CODES R & REGS tit. 6, Part 484 (BNA)	Fee schedules.	Applicable	Applicable if wastes to be transported are included in the regulation.
New York Identification and Listing of Hazardous Wastes Regulations	N.Y.COMP. CODES R. & REGS tit. 6, 371.1-371.4 (BNA) Appendix 23	Lists regulated hazardous waste. Each hazardous waste is assigned an EPA Hazardous Waste Number which must be used in complying with the notification requirements of 3010 of RCRA or certain recordkeeping and reporting requirements under of this Title. Lists hazardous constituents.	Applicable	Applicable if site's wastes are listed or characteristic hazardous wastes.
New York Hazardous Waste Manifest System Regulations	N.Y.COMP. CODES R. & REGS tit. 6, 372.1-372.2 (BNA)	General standards and specific manifest requirements for generators of hazardous waste.	Applicable	Applicable if Chem-Trol site meets the criteria of a generator of hazardous materials as defined in N.Y.COMP. CODES R. & REGS. tit. 6, 372.1 (d).

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Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
New York Water Classifications and Quality Standards	N.Y.COMP. CODES R. & REGS tit. 6, Part 701 (BNA) N.Y.COMP CODES R. & REGS tit. 6, Part 702 (BNA) N.Y.COMP. CODES R. & REGS tit. 6, Part 703 (BNA)	Lists classifications of surface waters and groundwaters. Sets forth procedures for deriving standards and guidance values for implementing the control of toxic and deleterious substances. Surface water and groundwater quality standards and groundwater effluent standards.	Applicable	Do not violate or exceed the established MCL or specific levels established for principal organic contaminants. Substances belonging to the principal organic contaminant classes and for which there is no specific MCL, the standard or guidance value shall be 5 u/L or a less stringent value as determined by the Commissioner of the N.Y. State Department of Health. Substances that do not have an applicable health (water source) standard in Section 703.5 and that the Department determines may pose a threat to human health if discharged into the waters of the state shall be determined by the requirements of Section 702.15. Does not incorporate federal standards.
Implementation of SPDES Program in New York	N.Y.COMP. CODES R. & REGS tit. 6, 750-758 (BNA)	Regulates permitted releases into waters of the state.	Applicable	
New York Water Pollution Control Regulations - Use and Protection of Waters	N.Y.COMP. CODES R. & REGS tit. 6, 608.4 (BNA)	Regulates excavation or fill in any of the navigable waters of the state or in adjacent marches, estuaries, tidal marshes and wetlands.	Applicable	Applicable if the remedial activities for the Chem-Trol site require excavation from or placing fill in any of the navigable waters of the state or in marshes, estuaries, tidal marshes, and wetlands.
NEW YORK FRESHWATER WETLANDS ACT	N.Y. ENVTL. CONSERV. LAW art. 24 (BNA)	Regulates the use and development of wetlands.	Applicable	May be applicable if the remedial alternative involves draining or dredging.

Table A-3
Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
NEW YORK ENVIRONMENTAL CONSERVATION LAW - Water Pollution Control	N.Y. ENVTL. CONSERV. LAW art. 17 (BNA)	Do not discard organic or inorganic matter into waters during remedial activities without first obtaining an SPDES permit.	Applicable	
Permit for Outlet Point Source and for Disposal System Required	N,Y, ENVTL. CONSERV. LAW 17-0701 (BNA)	Regulates point sources for the discharge of sewage, industrial waste or other wastes or effluents into the waters of the state of New York.	Applicable	17-0105.2, "Waters" or "waters of the state" shall be construed to include lakes, bays, sounds, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Atlantic Ocean within the territorial limits of the State of N.Y. and all other bodies of surface or underground water, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters which do not combine or affect a junction with natural surface or underground waters), which are wholly or partially within or border in the state or within its jurisdiction.
NEW YORK ENVIRONMENTAL CONSERVATION LAW	N.Y. ENVTL. CONSERV. LAW art. 37 (BNA)	Governs the storage or release to the environment of substances hazardous or acutely hazardous substances to public health, safety or the environment.	Applicable	
Criteria for identifying the Characteristics of Hazardous Waste and for Listing Hazardous Waste	N.Y.COMP. CODES R. & REGS tit. 6, 371.1-371.4(BNA)	Classification of Hazardous Waste.	Applicable	Applies to transportation and all other hazardous waste management practices in the State of N.Y. Applicable if hazardous waste is generated during remediation.

Table A-3
Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
New York State Hazardous Waste Manifest System Regulations	N.Y.COMP. CODES R. & REGS tit. 6 372.1	Establishes standards for generators and transporters of hazardous waste on the manifest system and recordkeeping requirements.	Applicable	All Chem-Trol site waste shipments must be properly manifested, in accordance with applicable N.Y. State and federal requirements. Applicable if hazardous waste is generated during remediation.
	N.Y.COMP. CODES R. & REGS tit. 6, 372.1 (BNA) (cont)	Regulates hazardous waste transportation manifesting and manifest recordkeeping requirements. Also includes spill response and reporting requirements.	Applicable	Applicable to transporters if hazardous waste is transported during remediation.
Shipments by Rail or Water	N.Y.COMP CODES R. & REGS tit. 6, 372.7 (BNA)	Outline shipping documentation requirements for bulk rail and water shipments.	Applicable	Applicable if either of these modes is selected for Chem-Trol site waste shipments, if generated wastes are hazardous.
	Appendix 30	Instructions for the Uniform Hazardous Waste Manifest.	Applicable	Supplements EPA manifest requirements, if generated wastes are hazardous.
New York State Solid Waste Management Facilities Rules	N.Y.COMP CODES R. & REGS tit. 6, Part 360 (BNA)	Regulate Solid waste management facilities, other than hazardous waste management facilities subject to Part 373 or 374 of this Title (6), and facilities managing radioactive (NARM) waste, and low-level radioactive waste subject to Parts 380, 382 and 383 of this Title (6), located wholly within the State of N.Y.	TBC	

Table A-3
Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
New York Hazardous Waste Management System Regulations - General	N.Y.COMP. CODES R. & REGS tit. 6, Part 370 (BNA)	Provides definitions of terms and general standards applicable to Parts 370 through 374 and 376 of this Title (6).	TBC	Definitions for solid and hazardous waste given in section 371.1: "Solid waste" is any discarded material not excluded under 371.1(e)(1); 371.1(e)(1)(iv) states that radioactive materials which are source, special nuclear, or by-product material as defined by the Atomic Eneregy Act of 1954, are not solid wastes. 371.1(d) states that a "hazardous waste" is a solid waste that is not excluded under paragraph (e)(2), and exhibits any of the characteristics of hazardous waste identified in section 371.3: ignitability, corrosivity, reactivity or toxicity; a solid waste that is listed in and not excluded from secion 371.4 solely because it exhibits one or more of the characteristics of hazardous waste identified in section 371.3.
New York Rules for Inactive Hazardous Waste Disposal Sites - Hazardous Waste Disposal Site Remedial Program	N.Y.COMP. CODES R & REGS. tit. 6 Part 375 (BNA)	Applies to development and implementation of programs under the authority of, ECL art. 27, tit. 13.	Applicable	Incorporates the National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. Part 300, by reference. Effective 5/30/92.

Table A-3
Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
Anbient Water Quality Standards and Guidance Values (9/90)	NYSDEC Division of Water Technical and Operational Guidance Series (TOGS)1.1.1	Provides standards/guidance values for ambient concentrations of toxic and nonconventional pollutants in surface and groundwater used by NYSDEC in SPDES permitting.	TBC	Consider if remedial action requires obtaining an SPDES Permit.
Underground Injection/Recirculation - Groundwater Remediation Sites (5/87)	NYSDEC TOGS 2.2.3	Provides guidance to SPDES permitting where groundwater remediation is proposed.	TBC	To Be Considered if remedial action requires obtaining an SPDES Permit.
Primary and Principal Aquifer Determinations (5/87)	NYSDEC TOGS 2.1.3	Provides guidance on determining water supply aquifers in upstate New York.	TBC	

Table A-3
Action Specific SCGs/ARARs For Remedial Activities
Chem-Trol Site

Regulation,Standard,Requirement ,Criteria or Limitation	Citation	Description of Requirement	Applicable or Relevant and Appropriate	Comment
New York Environmental Quality Review Regulations	N.Y. COMP. CODES R & REGS. tit. 6, Part 617 (BNA)	Implements provisions of State Environmental Quality Review Act (SEQR).	TBC	617.16 Actions involving a federal agency. When draft and final EIS has been prepared under NEPA, an agency shall have no obligation to prepare an additional EIS under this part. Where a finding of no significant impact (FNSI) or other written threshold determination that the action will not require a Federal impact statement has been made under NEPA, that determination does not automatically constitute compliance with SEQR. In the case of an action involving a Federal agency for which either a Federal FNSI or a Federal draft and final EIS has been prepared, except where otherwise required by law, a final decision by a Federal agency shall not be controlling on any State or local agency decision on the action.
Rules and Regulations for Erie County Sewer Districts		Contains rules and regulations for use of and discharge to Erie County sewer systems.	TBC	

Appendix B

Preliminary Itemized Estimate of Costs

- Itemized estimated costs

  Alternative 1
  Alternative 2
  Alternative 5
  Alternative 6
  Alternative 7

- Summary of the basis for cost components

CHEM-TROL SITE
Alternative 1
Estimated Costs

Description	Quantity		Unit Price	Capital Cost	Annual Cost
A. DIRECT CAPITAL COSTS					
B. INDIRECT CAPITAL COSTS					
Engineering (Work Planning)				$12,000	
Contingency (20%)				$2,400	
C. ANNUAL OPERATING COSTS					
Site Inspections	4	/yr	$1,000		$4,000
Groundwater Sample Collection	13	ea	$300		$3,900
Sediment Sample Collection	6	ea	$200		$1,200
Sample Analysis	19	ea	$1,500		$28,500
Quality Control	1	ls	$5,000		$5,000
Reporting	1	ls	$10,000		$10,000
Contingency (20 % of Annual O & M)					$10,520
Subtotal					$63,120
TOTAL CAPITAL COSTS				$14,400	
TOTAL ANNUAL COSTS					$63,120
TOTAL PRESENT WORTH COSTS 30 YEAR LIFE (6% discount rate, 3% inflation) $1,268,026					

Cost estimate intended for the purpose of comparing remedial alternatives, actual construction costs will vary.

CHEM-TROL SITE
Alternative 2
Estimated Costs

Description	Quantity		Unit Price	Capital Cost	Annual Cost
A. DIRECT CAPITAL COSTS					
Monitoring					
Monitoring Well Construction	3	ea	$2,300	$6,900	
Groundwater Studies	1	ls	$12,500	$12,500	
Floodplain Sampling	4	ea	$1,500	$6,000	
Floodplain Evaluation and Report	1	ls	$10,000	$10,000	
Institutional Controls					
Site Fence	3760	lf	$15	$56,400	
Legal Fees	1	ls	$50,000	$50,000	
"Hot Spot" Removal					
Mob/demob	1	ls	$65,000	$65,000	
Waste Characterization	1	ls	$30,000	$30,000	
Silt Fences	1500	lf	$1.10	$1,650	
Staging Area	1	ls	$5,000	$5,000	
Clean Fill	280	cy	$15	$4,200	
Topsoil	25	cy	$20	$500	
Seeding	0.2	ac	$3,000	$600	
Excavation of "hot spot"	280	cy	$20	$5,600	
Offsite Disposal (Incineration)	280	cy	$1,800	$504,000	
Sediment Removal					
Site Clearing	2	ac	$1,500	$3,000	
Silt Fences	1600	lf	$1.10	$1,760	
Excavate Sediments	450	cy	$20.00	$9,000	
Clean Fill	450	cy	$20	$9,000	
Topsoil	800	cy	$20	$16,000	
Revegetation	2	ac	$6,600	$13,200	
Flow Diversion	800	lf	$10	$8,000	
Transportation and Disposal (Landfill)	450	cy	$400	$180,000	
Subtotal				$998,310	
B. INDIRECT CAPITAL COSTS					
Engineering (15% of total direct capital cost)				$149,747	
Contingency (20% of total direct capital cost)				$199,662	

CHEM-TROL SITE
Alternative 2
Estimated Costs

C. ANNUAL OPERATING COSTS					
Site Inspections	4	/yr	$1,000		$4,000
Groundwater Sample Collection	16	ea	$300		$4,800
Sediment Sample Collection	6	ea	$200		$1,200
Sample Analysis	22	ea	$1,500		$33,000
Quality Control	1	ls	$5,000		$5,000
Reporting	1	ls	$10,000		$10,000
Contingency (20 % of annual O & M)					$11,600
Subtotal					$69,600
TOTAL CAPITAL COSTS				$1,347,719	
TOTAL ANNUAL COSTS					$69,600
TOTAL PRESENT WORTH COSTS 30 YEAR LIFE (6% discount rate, 3% inflation) $2,730,044					

Cost estimate intended for the purpose of comparing remedial alternatives, actual construction costs will vary.

CHEM-TROL SITE
Alternative 5
Estimated Costs

Description	Quantity		Unit Price	Capital Cost	Annual Cost
A. DIRECT CAPITAL COSTS					
Monitoring					
Monitoring Well Construction	3	ea	$2,300	$6,900	
Groundwater Studies	1	ls	$12,500	$12,500	
Floodplain Sampling	4	ea	$1,500	$6,000	
Floodplain Evaluation and Report	1	ls	$10,000	$10,000	
Institutional Controls					
Legal Fees	1	ls	$50,000	$50,000	
"Hot Spot" Removal					
Mob/demob	1	ls	$65,000	$65,000	
Waste Characterization	1	ls	$30,000	$30,000	
Silt Fences	1500	lf	$1.10	$1,650	
Staging Area	1	ls	$5,000	$5,000	
Clean Fill	280	cy	$15	$4,200	
Topsoil	25	cy	$20	$500	
Seeding	0.2	ac	$3,000	$600	
Excavation of "hot spot"	280	cy	$20	$5,600	
Offsite Disposal (Incineration)	280	cy	$1,800	$504,000	
Sediment Removal					
Site Clearing	2	ac	$1,500	$3,000	
Silt Fences	1600	lf	$1.10	$1,760	
Excavate Sediments	450	cy	$20.00	$9,000	
Clean Fill	450	cy	$20	$9,000	
Topsoil	800	cy	$20	$16,000	
Revegetation	2	ac	$6,600	$13,200	
Flow Diversion	800	lf	$10	$8,000	
Transportation and Disposal (Landfill)	450	cy	$400	$180,000	
Groundwater Extraction					
SPDES Permitting	1	ls	$10,000	$10,000	
Treatability Study	2	ea	$15,000	$30,000	
Field Explorations	1	ls	$24,000	$24,000	
Drain construction	550	lf	$1,000	$550,000	
Plumbing	200	lf	$75	$15,000	
Treatment System	1	ls	$750,000	$750,000	
Subtotal				$2,320,910	
B. INDIRECT CAPITAL COSTS					
Engineering (15% of total direct capital cost)				$348,137	
Contingency (20% of total direct capital cost)				$464,182	

CHEM-TROL SITE
Alternative 5
Estimated Costs

C. ANNUAL OPERATING COSTS					
Site Inspections	26	/yr	$1,000		$26,000
Treatment System Operation	1	/yr	$35,000		$35,000
Maintenance	1	/yr	$28,000		$28,000
Groundwater Sample Collection	16	ea	$300		$4,800
Sediment Sample Collection	6	ea	$200		$1,200
Sample Analysis	22	ea	$1,500		$33,000
Quality Control	1	ls	$5,000		$5,000
Reporting	1	ls	$10,000		$10,000
Carbon Usage	1	/yr	$50,000		$50,000
Water Discharge Monitoring	1	ls	$25,000		$25,000
Electric Power	6.60E+05	kw	$0.07		$46,200
Contingency (20 % of annual O&M)					$52,840
Subtotal					$317,040
TOTAL CAPITAL COSTS				$3,133,229	
TOTAL ANNUAL COSTS					$317,040
TOTAL PRESENT WORTH COSTS 30 YEAR LIFE (6% discount rate, 3% inflation) $9,429,960					

Cost estimate intended for the purpose of comparing remedial alternatives, actual construction costs will vary.

CHEM-TROL SITE
Alternative 6
Estimated Costs

Description	Quantity		Unit Price	Capital Cost	Annual Cost
A. DIRECT CAPITAL COSTS					
Monitoring					
Monitoring Well Construction	3	ea	$2,300	$6,900	
Groundwater Studies	1	ls	$12,500	$12,500	
Floodplain Sampling	4	ea	$1,500	$6,000	
Floodplain Evaluation and Report	1	ls	$10,000	$10,000	
Institutional Controls					
Legal Fees	1	ls	$50,000	$50,000	
"Hot Spot" Removal					
Mob/demob	1	ls	$65,000	$65,000	
Waste Characterization	1	ls	$30,000	$30,000	
Silt Fences	1500	lf	$1.10	$1,650	
Staging Area	1	ls	$5,000	$5,000	
Clean Fill	280	cy	$15	$4,200	
Topsoil	25	cy	$20	$500	
Seeding	0.2	ac	$3,000	$600	
Excavation of "hot spot"	280	cy	$20	$5,600	
Offsite Disposal (Incineration)	280	cy	$1,800	$504,000	
Sediment Removal					
Site Clearing	2	ac	$1,500	$3,000	
Silt Fences	1600	lf	$1.10	$1,760	
Excavate Sediments	450	cy	$20	$9,000	
Clean Fill	450	cy	$20	$9,000	
Topsoil	800	cy	$20	$16,000	
Revegetation	2	ac	$6,600	$13,200	
Flow Diversion	800	lf	$10	$8,000	
Transportation and Disposal (Landfill)	450	cy	$400	$180,000	
Groundwater Extraction					
SPDES Permitting	1	ls	$10,000	$10,000	
Treatability Study	2	ea	$15,000	$30,000	
Field Explorations	1	ls	$24,000	$24,000	
Drain construction	550	lf	$1,000	$550,000	
Plumbing	200	lf	$75	$15,000	
Treatment System	1	ls	$750,000	$750,000	
Soil Cover					
Clearing	2	ac	$1,500	$3,000	
Clean Fill	5000	cy	$18	$90,000	
Topsoil	450	cy	$20	$9,000	
Subtotal				$2,422,910	
B. INDIRECT CAPITAL COSTS					
Engineering (15% of total direct capital cost)				$363,437	
Contingency (20% of total direct capital cost)				$484,582	

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CHEM-TROL SITE
Alternative 6
Estimated Costs

C. ANNUAL OPERATING COSTS					
Site Inspections	26	/yr	$1,000		$26,000
Treatment System Operation	1	/yr	$35,000		$35,000
Maintenance	1	/yr	$28,000		$28,000
Groundwater Sample Collection	16	ea	$300		$4,800
Sediment Sample Collection	6	ea	$200		$1,200
Sample Analysis	22	ea	$1,500		$33,000
Quality Control	1	ls	$5,000		$5,000
Reporting	1	ls	$10,000		$10,000
Carbon Usage	1	/yr	$50,000		$50,000
Water Discharge Monitoring	1	ls	$25,000		$25,000
Air Stack Monitoring	1	ls	$15,000		$15,000
Electric Power	6.60E+05	kw	$0.07		$46,200
Contingency (20% of annual O & M)					$55,840
Subtotal					$335,040
TOTAL CAPITAL COSTS				$3,270,929	
TOTAL ANNUAL COSTS					$335,040
TOTAL PRESENT WORTH COSTS 30 YEAR LIFE (6% discount rate, 3% inflation) $9,837,880					

Cost estimate intended for the purpose of comparing remedial alternatives, actual construction costs will vary.

CHEM-TROL SITE
Alternative 7
Estimated Costs

Description	Quantity		Unit Price	Capital Cost	Annual Cost
A. DIRECT CAPITAL COSTS					
Monitoring					
Monitoring Well Construction	3	ea	$2,300	$6,900	
Groundwater Studies	1	ls	$12,500	$12,500	
Floodplain Sampling	4	ea	$1,500	$6,000	
Floodplain Evaluation and Report	1	ls	$10,000	$10,000	
Institutional Controls					
Legal Fees	1	ls	$50,000	$50,000	
"Hot Spot" Removal					
Mob/demob	1	ls	$65,000	$65,000	
Waste Characterization	1	ls	$30,000	$30,000	
Silt Fences	1500	lf	$1.10	$1,650	
Staging Area	1	ls	$5,000	$5,000	
Clean Fill	280	cy	$15	$4,200	
Topsoil	25	cy	$20	$500	
Seeding	0.2	ac	$3,000	$600	
Excavation of "hot spot"	280	cy	$20	$5,600	
Offsite Disposal (Incineration)	280	cy	$1,800	$504,000	
Sediment Removal					
Site Clearing	2	ac	$1,500	$3,000	
Silt Fences	1600	lf	$1	$1,760	
Excavate Sediments	450	cy	$20.00	$9,000	
Clean Fill	450	cy	$20.00	$9,000	
Topsoil	800	cy	$20	$16,000	
Revegetation	2	ac	$6,600	$13,200	
Flow Diversion	800	lf	$10	$8,000	
Transportation and Disposal (Landfill)	450	cy	$400	$180,000	
Groundwater Extraction					
SPDES Permitting	1	ls	$10,000	$10,000	
Treatability Study	2	ea	$15,000	$30,000	
Field Explorations	1	ls	$24,000	$24,000	
Drain construction	550	lf	$1,000	$550,000	
Plumbing	200	lf	$75	$15,000	
Treatment System	1	ls	$750,000	$750,000	
Soil Cover					
Clearing	2	ac	$1,500	$3,000	
Clean Fill	5000	cy	$18	$90,000	
Topsoil	450	cy	$20	$9,000	
Soil Vapor Extraction					
Pilot Study	1	ls	$15,000	$15,000	
Piping	2600	lf	$15	$39,000	
Blower System	1	ls	$25,000	$25,000	
Catylitic Oxidation	1	ls	$100,000	$100,000	
Subtotal				$2,601,910	

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CHEM-TROL SITE
Alternative 7
Estimated Costs

B. INDIRECT CAPITAL COSTS					
Engineering (15% of total direct capital cost)				$390,287	
Contingency (20% of total direct capital cost)				$520,382	
C. ANNUAL OPERATING COSTS					
Site Inspections	26	/yr	$1,000		$26,000
Treatment System Operation	1	/yr	$35,000		$35,000
Maintenance	1	/yr	$28,000		$28,000
Groundwater Sample Collection	16	ea	$300		$4,800
Sediment Sample Collection	6	ea	$200		$1,200
Sample Analysis	22	ea	$1,500		$33,000
Quality Control	1	ls	$5,000		$5,000
Reporting	1	ls	$10,000		$10,000
Carbon Usage	1	/yr	$50,000		$50,000
Water Discharge Monitoring	1	ls	$25,000		$25,000
Air Stack Monitoring	1	ls	$15,000		$15,000
Electric Power	6.60E+05	kw	$0.07		$46,200
SVE Monitoring (5 years)	1	/yr	$12,000		$12,000
SVE Operation (5 years)	1	/yr	$24,000		$24,000
Contingency (20% of annual O&M)					$63,040
Subtotal					$378,240
TOTAL CAPITAL COSTS				$3,512,579	
TOTAL ANNUAL COSTS					$378,240
TOTAL PRESENT WORTH COSTS 30 YEAR LIFE (6% discount rate, 3% inflation)	$10,474,676				

Cost estimate intended for the purpose of comparing remedial alternatives, actual construction costs will vary.

CHEM-TROL SITE
Basis for
Estimated Costs

Description	Items Included in Unit Costs
A. DIRECT CAPITAL COSTS	
Groundwater Monitoring	
Monitoring Well Construction	Mobilization/demobilization, drilling, soil sampling,
	rock coring, monitoring well installation, protective casing,
	logging by a field engineer, and health and safety supplies.
Groundwater Studies	Report presenting results of downgradient extent of
	impacted groundwater study
Floodplain Sampling	Sampling and analysis for SVOCs and pesticides
Floodplain Evaluation and Report	Report presenting test results and recommendation for
	no action or remedial appropriate activity.
Institutional Controls	
Legal Fees	Fees for implementing access restrictions
Fencing	6 foot high security fence
"Hot Spot" Removal	
Silt Fences	Materials and installation
Staging Area	50 x 50 foot polyethylene lined area
Clean Fill	Materials, transportation, and placement
Topsoil	Materials , transportation, and placement
Seeding	Seed, fertilizer, mulch, and erosion control
Excavation of "hot spot"	Labor and health and safety supplies
Offsite Disposal	Transportation and offsite incineration
Sediment Removal	
Site Clearing	Clearing and grubbing, assumes 2 acres per day
Divert Flow	Bypass pumps, and temporary piping
Silt Fences	Materials and installation
Excavate sediments	Labor and health and safety supplies
Topsoil	Materials, transportation, and placement
Clean Fill	Materials, transportation, and placement
Revegetation	Reestablishment of vegetation by providing hydrologic
	conditions for natural wetland growth.
Transportation and Disposal	Transportation and offsite land disposal

CHEM-TROL SITE
Basis for
Estimated Costs

Groundwater Extraction	
SPDES Permitting	Preparation of permit documents
Treatability Study	Sample collection, bench scale treatment studies by
	vendors
Field Explorations	Piezometers, test pits and soils analytical testing along
	trench alignment
Drain construction	Soil and rock excavation, relief well drilling on 25 foot
	centers, drainage pipe, drainage stone, soil backfill,
	manholes, site restoration, and dewatering
Plumbing	Piping and pumps to the treatment plant
Treatment System	Air stripper, carbon adsorption, treatment of
	air stripper offgas, utility hookups, and system startup.
Soil Cover	
Clearing	Clearing and grubbing, assumes 2 acres per day
Clean Fill	Materials, transportation, and placement
Topsoil	Materials , transportation, and placement
Soil Vapor Extraction	
Pilot Study	Tests to establish design parameters
Piping	Trench excavation and PVC piping
Carbon treatment system	Carbon drums and offsite regeneration
Blower System	500 SCFM blower, piping, enclosure, and instrumentation
B. INDIRECT CAPITAL COSTS	
1. Engineering	Design drawings, contact documents
2. Contingency	Unanticipated site conditions, etc.
C. ANNUAL OPERATING COSTS	
Site Inspections	Half day site visit and preparation of observation report
Treatment System Operation	Labor costs for treatment plant operation
Maintenance	system repair, replacement parts
Groundwater Sample Collection	Field time, sampling equipment, health and safety supplies
Sediment Sample Collection	Field time, sampling equipment, health and safety supplies
Sample Analysis	Testing for VOCs, SVOCs and PCBs
Quality Control	MS/MSD, duplicates, equipment blanks, trip blanks
Reporting	Summary of field procedures and test results
Carbon Usage	Transportation and carbon regeneration
Electric Power	Power usage at 100 HP
Water discharge monitoring	Testing of effluent from system daily for solids,
	and weekly for VOCs
Air Stack Monitoring	Monthly testing for VOCs from air stripper emission