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FEASIBILITY STUDY

PHASES I, II and III
PLANT NO. 2
VAN DER HORST CORPORATION SITE
SITE NO. 9-05-022
OLEAN, CATTARAUGUS COUNTY

VOLUME I OF II

JULY 1992

SUBMITTED TO:

DIVISION OF HAZARDOUS WASTE REMEDIATION
NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
ALBANY, NEW YORK 12233

SUBMITTED BY:

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ERM-Northeast

FEASIBILITY STUDY
VAN DER HORST CORPORATION PLANT NO. 2 SITE

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ERM-Northeast

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EXECUTIVE SUMMARY

ERM-Northeast (ERM) has completed a Feasibility Study (FS) for the New York State Department of Environmental Conservation (NYSDEC) at the Van Der Horst Corporation Plant No. 2 facility in Olean, New York. The Feasibility Study was conducted in general accordance with: 1) " United States Environmental Protection Agency (USEPA) Guidance for Conducting Remedial Investigation/ Feasibility Studies Under CERCLA", October 1988; and 2) the May 15, 1990 NYSDEC-TAGM entitled, "Selection of Remedial Actions at Inactive Hazardous Waste Sites".

The Phase I FS involved the identification of broadly defined general response actions, where a response is deemed necessary to protect public health or the environment based on the Remedial Investigation (RI) risk assessment. Technologies for each general response action were identified and preliminarily screened solely on the basis of their effectiveness and technical feasibility. The technologies that were retained through this initial screening process were then used to develop media-specific remedial alternatives for the Plant No. 2 site.

The second phase screening involved evaluating these media-specific remedial alternatives primarily on the basis of effectiveness and implementability. Those alternatives passing this second phase of screening were assembled into six (6) comprehensive remedial alternatives for the contaminated media at the site. Some of the data from the Van Der Horst Plant No. 1 bench-scale laboratory Treatability Study were applicable to the Van Der Horst Plant No. 2 site, and were considered to better identify those alternatives that would be effective in treating the actual soil and ground water at the Plant No. 2 site. Based on the results of this Treatability Study, one of the six comprehensive alternatives was found to be ineffective in addressing the inorganic contaminants in the soil (i.e., the alternative involving soil washing). The remaining five (5) comprehensive alternatives then underwent a detailed evaluation during the Phase III FS.

During the Phase III FS, the potential remedial alternatives were subjected to a detailed quantitative evaluation which considered: 1) Overall protection of human health and the environment; 2) Compliance with New York State Standards, Criteria and Guidance (SCGs); 3) Long-term effectiveness and performance; 4) Reduction of toxicity, mobility, and volume; 5) Short-term effectiveness; 6) Implementability; and 7) Cost. Alternatives were then compared to select an environmentally sound and cost-effective remedial action for the Van Der Horst Plant No. 2 site. State and Community acceptance of the results of the Phase III FS, and the potential for combining some aspects of the remedial technologies at the two separated plants (i.e., Nos. 1 and

2), will be evaluated prior to the NYSDEC's Record of Decision (ROD).

The remedial costs associated with each alternative were estimated based on vendor information, conventional cost estimating guides, generic unit costs and prior experience. The total present worth costs for each alternative were estimated using a 5 percent discount per year for the time period associated with implementation of the specific alternative, not to exceed 30 years.

The Phase III FS included an evaluation and comparison of the five comprehensive alternatives using both the NYSDEC-TAGM scoring tables and a Cost-Effectiveness analysis. The final decision on the remedial action to be implemented at the site shall be determined by NYSDEC. As directed by NYSDEC, the report was prepared to group together different technologies as remedial alternatives and to evaluate the potential remedial alternatives for the site. The Proposed Remedial Action Plan (PRAP), which will be prepared by NYSDEC, shall present in detail the recommended remedial action for the site.

1.0 INTRODUCTION

1.1 Feasibility Study Overview

This report summarizes the findings of ERM-Northeast's (ERM) Phase I (Development of Alternatives), Phase II (Preliminary Screening of Alternatives) and Phase III (Detailed Analysis of Alternatives) Feasibility Study (FS) for the New York State Department of Environmental Conservation (NYSDEC) at the Van Der Horst Plant No. 2 former electro-plating facility in Olean, New York. During the Phase I and II FS, ERM was assisted by our subcontractor, YEC, Inc. of Valley Cottage, New York, who prepared a report for our use entitled "Identification of Potential Remedial Action Alternatives for Van Der Horst Plant No. 2 Site RI/FS". ERM provided oversight during the preparation of the YEC report and utilized it in preparation of this ERM report for NYSDEC.

The following two guidance documents were used as the basis for the FS: 1) " United States Environmental Protection Agency (USEPA) Guidance for Conducting Remedial Investigation/Feasibility Studies Under CERCLA", October 1988; and 2) the May 15, 1990 NYSDEC Technical and Administrative Guidance Memorandum (TAGM) entitled, "Selection of Remedial Actions at Inactive Hazardous Waste Sites". These two documents were in general agreement;

however, the NYSDEC TAGM stated that cost should not be considered as an evaluation criteria in the Screening of Technologies (Phase I FS) or the Preliminary Screening of Alternatives (Phase II FS). In preparation of this FS report, ERM followed the NYSDEC-TAGM relative to this issue.

This report identifies general response actions, evaluates remedial technologies, and formulates and evaluates potential remedial action alternatives. Finally, this report presents a conceptual design of the recommended remedial action (Task VII of the RI/FS Scope-of-Work).

The Phase I FS involved the identification of broadly defined general response actions, where a response is deemed necessary to protect public health or the environment based on the Remedial Investigation (RI) risk assessment. Technologies for each general response action were identified and preliminarily screened on the basis of their effectiveness and technical feasibility. The technologies that were retained through this initial screening process were used to develop media-specific remedial alternatives for the site.

The Phase II FS involved evaluating these media-specific remedial alternatives on the basis of effectiveness and implementability. Those alternatives passing the second phase of screening were assembled into comprehensive remedial alternatives addressing contaminated media at the site. It is these comprehensive alternatives that underwent a detailed evaluation during the Phase III FS.

During the Phase III FS, the potential remedial alternatives were subjected to a detailed quantitative evaluation which considered: 1) Overall protection of human health and the environment; 2) Compliance with New York State Standards, Criteria and Guidance (SCGs); 3) Long-term effectiveness and performance; 4) Reduction of toxicity, mobility, and volume; 5) Short-term effectiveness; 6) Implementability; and 7) Cost. Alternatives were then compared to identify an environmentally sound and cost-effective remedial action for the Van Der Horst Plant No. 2 site. State and Community acceptance of the results of the Phase III FS will be evaluated prior to the NYSDEC's Record of Decision (ROD).

1.2 Purpose of Feasibility Study

The purpose of this feasibility study is to evaluate and identify remedial action alternatives which cost-effectively limit the risks to human health and the environment resulting from contamination at the Van Der Horst Plant No. 2 Site. Additionally, since the RI and FS were conducted concurrently, the Phase I and II

FS were used to identify data needs early on in the RI/FS process so that appropriate information would be collected during the RI.

1.3 Report Organization

The information contained in this report is in general accordance with the NYSDEC and USEPA requirements and the format is in general accordance with "USEPA Guidance for Conducting RI/FS Under CERCLA" (Table 6-5 EPA/540/G-89/004, October, 1988). The organization of this report is as follows:

- Section 1.0 - Introduction
- Section 2.0 - Identification and Screening of Technologies
- Section 3.0 - Development and Screening of Alternatives
- Section 4.0 - Treatability Studies
- Section 5.0 - Detailed Analysis of Alternatives
- Section 6.0 - Conceptual Design of Recommended Remedial Action
- Section 7.0 - Limitations and Use of Report
- Section 8.0 - References

2.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

2.1 Introduction

This section discusses the identification and screening of remedial technologies considered for the Van Der Horst Plant No. 2 Site. Initially, this section summarizes the findings of the RI as it applies to the FS program. This summary is followed by a discussion of the remedial action objectives and general response actions for each of the various media (i.e., soil, sediment, ground water, surface water and structures/vats). Finally, feasible technologies/process options are identified and screened to provide a basis for the subsequent development of the remedial alternatives (Section 3.0).

2.2 Summary of Contaminated Media

A complete discussion of the RI including sampling locations and procedures, contaminant levels, physical conditions of the study area, indicator chemicals, potential sources of contamination and extent of contamination is found in the final RI report. The purpose of this section is to summarize the contaminated media in the study area that appear (based upon the findings of the baseline risk assessment and the RI) to: 1) be the result of past site disposal activities; and 2) require a remedial response for protection of human health or the environment. These contaminated media are summarized below:

- Surface soil at the site containing elevated lead, chromium and arsenic concentrations.

- Subsurface soil containing elevated lead, chromium and arsenic concentrations. These analytes were detected in the same general area (see Figure 5-9) which appears to be a source of ground water contamination and should be addressed prior to ground water remediation efforts.

- Ground water containing elevated levels of chromium, lead, arsenic, beryllium and benzene.

- Two Mile Creek sediment along the northern boundary of the site containing elevated levels of chromium. These sediments and the associated surface water may be impacting benthic and aquatic life.

- Asbestos material and surface contamination of structures within the plant. The asbestos and surface contamination on the structures and vats within the plant both need to be removed prior to demolition.

- Sediments within the on-site storm sewer that contain elevated levels of chromium. These sediments may also be impacting Two Mile Creek sediments and surface water quality.

2.3 Remedial Action Objectives

General remedial goals were guided by 40 CFR 300.68 (Code of Federal Regulation 1987), which specifies that the objective of every remedial action is to "mitigate and minimize damage to and provide adequate protection of public health, welfare or the environment". The following site-specific remedial goals were developed for the Van Der Horst Corporation Plant No. 2 site. These goals include the NYSDEC site-specific soil cleanup levels for chromium, arsenic and lead as well as the NYSDEC standards for chromium in ground water and sediment. The ground water and sediment areas identified by the NYSDEC chromium standards (i.e., cleanup levels) generally include the areas of elevated concentrations for the other contaminants of concern (see Table 5-10 of the RI).

Soil

- Limit migration of on-site fugitive dust or ingestion of soil containing chromium, arsenic and lead that would result in an excess cancer risk of greater than 10^{-4} to 10^{-7}. The NYSDEC site-specific soil cleanup levels for chromium, arsenic and lead are 50 parts per million (ppm), 35 ppm, and 500 ppm, respectively.
- Limit releases of organics and inorganics to ground water that would exceed NYSDEC drinking water criteria or result in a potential future excess cancer risk of greater than 10^{-4} to 10^{-7}.

Ground Water

- Limit migration of ground water containing organics and inorganics that would exceed NYSDEC drinking water criteria or result in an excess cancer risk of 10^{-4} to 10^{-7}. The NYSDEC ground water standard for chromium is 50 parts per billion (ppb).

Sediment

- Limit releases of chromium from sediments on surface water and benthic and aquatic life. The NYSDEC sediment standard for chromium is 26 ppm.

Structures/Vats

- Limit direct contact with or migration of contaminants on the surfaces of the plant building or within vats and pits inside the plant building.
- Decontaminate, demolish and remove the plant buildings, as necessary, to: 1) provide access to contaminated soil below the plant; 2) remove residual contamination and asbestos associated with the plant building; and 3) enhance implementation of remedial measures.

2.4 General Response Actions

General response actions describe those actions that satisfy the remedial action objectives. Based on information gathered during the RI, general response actions, or classes of actions, are identified for each medium of concern. The response actions are considered applicable if they generally address the site problems identified in the previous section.

Table 2-1 summarizes the possible general response actions for each medium of concern. These response actions are presented in the form of conceptual alternatives. General response actions considered include the "no action" alternative, which will serve as a baseline against which other remedial measures can be compared. The "no action" alternative is mandated for inclusion by the

TABLE 2-1

SUMMARY OF GENERAL RESPONSE ACTIONS

Medium	Contamination Concern	General Response Actions
Soil.	Surface, Subsurface, and Air Contamination.	No Action. Institutional Action. Containment. Partial Removal. Complete Removal. On-Site or Off-Site Disposal. On-Site or Off-Site Treatment. In-Situ Treatment.
Ground Water.	Horizontal Movement of Contaminated Ground Water Off-Site.	No Action. Institutional Action. Containment. Ground Water Recovery. On-Site or Off Site Treatment. On-Site or Off-Site Disposal. In-Situ Treatment.
Sediment.	Surface and Subsurface Contamination.	No Action. Institutional Action. Containment. Partial Removal. Complete Removal. On-Site or Off-Site Disposal. On-Site or Off-Site Treatment. In-Situ Treatment.
Structures/Vats.	Surface, Subsurface, and Air Contamination.	No Action. Institutional Action. Containment. Partial or Complete Removal. Off-Site Disposal. On-Site Treatment.

Superfund Amendments and Reauthorization Act (SARA). Additionally, potential remedial technologies are identified for each general response action.

2.4.1 General Response Actions for Soil

General response actions for soil, presumably contaminated by the improper disposal of waste, address the pathways of leaching and air transport. Institutional actions such as deed restrictions and fencing are possible responses to contamination in the soil. Containment would reduce leaching from percolation and limit the transport of contaminants by air. Excavation, treatment, and disposal of soil would immobilize or separate soil contaminants and would remove the source of contamination.

2.4.2 General Response Actions for Ground Water

General response actions appropriate for ground water contamination are: 1) monitoring; 2) containment; and 3) ground water recovery, treatment, and disposal. These actions would limit contaminated plume migration, remove the contaminants from the ground water, and provide data on ground water quality.

2.4.3 General Response Actions for Sediments

Remedial actions for contaminated sediments generally involve sediment removal and subsequent treatment and disposal. Sewer lines are cleaned of sediments by various methods of pipe cleaning, while the process of removing bottom sediments from a water body is commonly known as dredging. After the collected contaminated sediments are dewatered, they can then be treated either independently or with the contaminated soil. Thus, for purposes of remedial action, the contaminated soil on the site and the sediment can be considered as a single medium. The contaminated water generated during dewatering may also contain hazardous constituents which may be treated together with the ground water.

The general response actions for sediment include: 1) drainage control measures; and 2) sediment removal, disposal, and/or treatment. Drainage control measures would limit further contamination of creek sediments. Removal, disposal or treatment would remove or immobilize contaminated sediments.

2.4.4 General Response Actions for Surface Waters

Current cadmium levels in the surface waters exceed the NYSDEC ambient water quality standards for Class C streams. It appears that this situation is the result of migration from the sediments. Thus, solving the sediment problem would appear to address the surface water conditions. Consequently, surface water general response actions have been covered under the general response actions for sediments.

2.4.5 General Response Actions for Structures/Vats

General response actions identified for structures/vats are containment, partial or complete removal, off-site disposal, and on-site treatment. These actions would limit direct contact with receptors, reduce leaching, remove the source of contamination, and decontaminate structure surfaces prior to disposal.

2.5 Identification of Applicable Remedial Technologies

Table 2-2 lists the general response actions and potentially applicable remedial technologies for each medium of concern. These applicable remedial technologies include the wide range of technologies available within each of the general remedial response

TABLE 2-2

SUMMARY OF APPLICABLE REMEDIAL TECHNOLOGIES

General Response Action	Applicable Remedial Technology	Process Options
<u>Soil/Sediment</u>		
No Action/ Institutional Actions.	Access Restrictions	Fencing. Deed Restrictions.
Containment.	Surface Capping.	Clay & Asphalt Capping. Clay Cap. Synthetic Membrane. Multilayer. Asphalt. Concrete.
	Vertical Barriers.	Slurry Wall. Sheet Piling. Grout Curtain. Vibrating Beam.
	Horizontal Barriers.	Grouting. Bottom Sealing.
	Surface Controls.	Grading. Diversion/ Collection. Soil Stabilization.
	Sediment Control Barriers.	Coffer Dams. Silt Curtains. Channel Diversion.
	Dust Control	Revegitation. Capping. Watering.
Partial or Complete Removal.	Excavation and Removal.	Solids Excavation.
	Sediment Dredging.	Mechanical Dredging. Hydraulic Dredging. Pneumatic Dredging.

TABLE 2-2 (CONTINUED)

SUMMARY OF APPLICABLE REMEDIAL TECHNOLOGIES

General Response Action	Applicable Remedial Technology	Process Options
Partial or Complete Removal. (continued)	Storm Sewer Cleaning.	Mechanical Scouring. Hydraulic Scouring. Bucket Machines. Suction Devices.
On-Site or Off-Site Disposal.	On-Site Secure Landfill.	Solids Excavation and Disposal.
	Off-Site Secure Landfill.	Solids Excavation and Disposal.
On-Site or Off-Site Treatment.	Pretreatment.	Dewatering Centrifuge. Gravity Thickener. Filtration. Solids Separation Screens and Sieves. Spiral Classifier. Cyclone and Hydroclone. Settling Basin.
	Thermal Treatment.	Liquid Injection. Rotary Kiln. Multiple Hearth. Fluidized Bed. Pyrolysis.
	Chemical Treatment.	Immobilization Soil Washing. Detoxification.
	Physical Treatment.	Solidification/ Stabilization. Encapsulation. Volatilization.

TABLE 2-2 (CONTINUED)

SUMMARY OF APPLICABLE REMEDIAL TECHNOLOGIES

General Response Action	Applicable Remedial Technology	Process Options
In-Situ Treatment.	In-Situ Treatment.	Bioreclamation. Heating. Soil Flushing. Vitrification.
Ground Water		
No Action/ Institutional Actions.	No Action. Access Restrictions. Alternate Water Supply.	Deed Restrictions. City Water Supply. New Community Well.
	Monitoring.	Ground Water. Monitoring.
Containment.	Surface Capping.	Clay & Soil Cap. RCRA Composite Cap. Concrete. Bituminous Concrete/Asphalt. Spray Asphalt.
	Vertical Barriers.	Slurry Wall. Sheet Piling. Grout Curtain. Vibrating Beam.
Containment	Horizontal Barriers	Grouting. Bottom Sealing.

TABLE 2-2 (CONTINUED)

SUMMARY OF APPLICABLE REMEDIAL TECHNOLOGIES

General Response Action	Applicable Remedial Technology	Process Options
Ground Water Recovery.	Pumping. Plume Removal.	Extraction Wells. Extraction/Injection Wells.
	Subsurface Drains.	Interceptor Trenches.
On-Site or Off-Site Treatment (for ground water, process water, seepage and decontamination water).	Biological.	Activated Sludge. Rotating Biological Discs. Fixed Film Bioreactor. Aerobic/Anaerobic Fluidized Bed. Sequencing Batch Reactor. Aerated Lagoon.
	Physical/Chemical	Activated Carbon. Precipitation/Flocculation/Sedimentation. Ion Exchange. Resin Sorption. Filtration. Reverse Osmosis. Neutralization. Gravity Separation Air Stripping. Steam Stripping. Chemical Oxidation. Chemical Reduction. Sulfide Precipitation.
	Physical/Chemical/ Biological.	Powdered Activated Carbon Treatment (PACT).
	Thermal Destruction.	Liquid Injection. Rotary Kiln. Multiple Hearth. Fluidized Beds. Pyrolysis.

TABLE 2-2 (CONTINUED)

SUMMARY OF APPLICABLE REMEDIAL TECHNOLOGIES

General Response Action	Applicable Remedial Technology	Process Options
On-Site or Off-Site Treatment (for ground water, process water, seepage and decontamination water). (continued)	Off-Site Treatment.	POTW. RCRA Facility.
Ground Water Disposal.	Off-Site Disposal.	POTW. Surface Water Discharge.
	On-Site Disposal.	Reinjection Deep Well Injection.
In-Situ Treatment.	In-Situ Treatment.	Biorelamation. Chemical. Physical. Permeable Treatment Bed.
<u>Structures/Vats</u>		
No Action/Institutional Action.	Access Restrictions.	Fencing. Deed Restrictions. Closure.
Containment.	Encapsulation/ Enclosure.	Plaster. Epoxy Resins. Concrete Casts. Painting and Coating.
Partial or Complete Removal.	Demolition and Removal. Dismantling and Removal.	Demolition. Dismantling.

TABLE 2-2 (CONTINUED)

SUMMARY OF APPLICABLE REMEDIAL TECHNOLOGIES

General Response Action	Applicable Remedial Technology	Process Options
On-Site Treatment.	Solids Processing/ Treatment.	Grit Blasting. Hydroblasting/ Water Washing. Scarification. Solvent Washing. Steam Cleaning. Vapor-Phase Solvent Extraction. Photochemical Degradation.
On-Site or Off-Site Disposal.	On-Site Disposal.	On-Site Landfill.
	Off-Site Disposal.	Incineration. Landfill.

actions identified above. For the purposes of this discussion, these technologies have been divided into three groups: 1) Soil/Sediment; 2) Ground Water; and 3) Structures/Vats.

2.5.1 Soil/Sediment Remedial Technologies

Contaminated soil/sediment remedial technologies can be used to contain, remove, or treat the soil/sediment in the study area. The following soil/sediment remedial technologies were initially considered for the site.

No Action

The "no action" alternative was considered for comparison purposes.

Institutional Actions

Institutional actions involve access restrictions. This alternative would include deed restrictions and fencing off areas of contaminated soil/sediment.

Surface Capping

Capping techniques utilize materials such as synthetic membranes, asphalt, concrete, clay, and soil. In general, capping is performed when extensive subsurface contamination at a site precludes excavation and removal of wastes because of potential hazards and/or excessive costs. Clay and soil, concrete, bituminous concrete/asphalt, clay, and composite cap represent commonly used single and multi-layered cap designs.

Vertical and Horizontal Barriers

Subsurface barriers are installed below ground to contain, capture, or redirect ground water flow in the vicinity of a site. The most commonly used subsurface barriers are slurry walls, grouting, sheet piling, vibrating beams, grout curtains, and bottom sealing. These barriers can be used both to redirect the ground water flow upgradient of the site, and to prevent ground water from leaving the site on the downgradient side.

Surface Controls

Diversion/collection, grading, and soil erosion control limit the infiltration and erosion by establishing continuous surface grades, diversion ditches, and collection ditches to limit the ponding of surface water.

Sediment Control Barriers

Sediment control barriers, such as cofferdams and curtain barriers, are used in some contaminated sediment situations. These technologies provide hydraulic isolation of sediments so that dewatering followed by dry excavation may be implemented, or so that hydraulic dredging may be conducted in a contained environment.

Dust Control

Dust control plays an important role in soil remediation, although the technology is very simple and easy to implement. Typical dust control measures include revegetation, capping and watering.

Excavation and Removal

Excavation and removal of soils and wastes is used extensively in the remediation of hazardous waste sites. This technology includes excavating, loading and hauling off site of soil and waste material. Generally, the excavated areas are backfilled with clean fill and graded. This technology usually involves the use of conventional heavy construction equipment with special procedures for containment of contamination during excavation and transport.

Sediment Dredging

The process of removing bottom sediments from a water body is commonly known as dredging. Potential dredging methods include mechanical dredging, hydraulic dredging and pneumatic dredging. These technologies are typically used in conjunction with a sediment control technology to limit sediment transport during dredging.

Storm Sewer Cleaning

Cleaning of sewers, or other pipelines, helps to remove sediment or debris which has built up in the line. When the cleaning is taking place, care should be taken to limit transport of deposits into downstream lines. Collected deposits should be removed, treated and disposed of. The most common methods of sewer cleaning are briefly described in the paragraphs below.

Mechanical scouring techniques include the use of power rodding machines ("snakes"), which pull or push scrapers, augers or brushes through the pipelines. "Pigs", bullet shaped plastic balls lined with scouring strips, are hydraulically propelled at high velocity through sewer mains to scrape the interior pipe surface.

Hydraulic scouring is achieved by running high pressure hoses into sewer lines through manholes and flushing out sections of the sewer. This technique is often used after mechanical scouring devices have cleared the line of solid debris or loosened sediments that coat the inner surface of the pipe.

A bucket machine can be used to dredge grit or contaminated soil from a sewer line. Power winches are set up over adjacent manholes with cable connections to both ends of a collection bucket. The bucket is then pulled through the sewer until loaded with debris. The same technique can be used to pull "sewer balls" or "porcupine scrapers" through obstructed pipes.

Suction devices such as pumps or vacuum trucks may be used to clean sewer lines. Manholes and fire hydrants provide easy access for the set-up and operation of such equipment.

On-Site Disposal

On-site disposal of contaminated soils and sediments involves the construction of a new landfill which will generally comply with NYSDEC Part 360 regulations. On-site landfill requirements include a composite cap and lining system and long-term monitoring.

Off-Site Disposal

Off-site disposal of contaminated soil/waste involves the hauling of excavated soil/waste to a commercial sanitary or secure landfill for disposal.

Pretreatment

On-site or off-site treatment of contaminated soils may require pretreatment such as dewatering and solids separation. Dewatering processes include centrifugation, gravity thickening and filtration. The water generated during dewatering generally contains hazardous constituents, which would require additional treatment and could be treated together with ground water. Solid separation methods include screens and sieves, spiral classifiers, cyclones and hydroclone and settling basins.

Thermal Treatment

Thermal Treatment can be used to destroy organic contaminants in liquid, gaseous and solid waste streams. The most common incineration technologies include liquid injection, rotary kiln, multiple hearth, fluidized bed and pyrolysis.

Chemical Treatment

Generally, organic and inorganic contaminants can be immobilized, chemically extracted, or detoxified using chemical treatment.

Soil washing extracts contaminants from soil matrices using an extracting solution. The washing fluid may be composed of water, organic solvents, chelating agents, surfactants, acids or bases, depending on the contaminant to be removed. The waste types that can be removed include heavy metals (e.g., lead, zinc), halogenated solvents (e.g., TCE, trichloroethane), aromatics (e.g., benzene, toluene, phenol), gasoline, fuel oils and PCBs.

Chemical detoxification techniques include neutralization, hydrolysis, oxidation/reduction, enzymatic degradation, and installation of permeable treatment beds. Operation involves the use of chemicals to destroy, degrade, or reduce the toxicity of contaminants.

Immobilization and Physical Treatment

A number of methods are currently being developed which involve physical manipulation of the soil in order to immobilize or detoxify waste constituents. These technologies include immobilization, solidification/stabilization, encapsulation, and volatilization.

Immobilization methods, which include precipitation, chelation, and polymerization, are designed to bind contaminants and render them less mobile, limit leaching of the contaminants from the soil matrix, and limit contaminant movement from the areas of contamination.

Solidification/stabilization involves mixing the wastes directly with a solidifying agent (e.g. portland cement). Solidification produces a monolithic block with high structural integrity. The contaminants do not necessarily interact chemically with the solidification agent, but are mechanically fixed within the solidified matrix. Stabilization methods usually involve the addition of chemicals in order to limit the solubility or mobility of waste constituents. This technology is well suited for solidifying soils containing heavy metals, organics (generally no more than 20% by volume), and solidified plastic. However, some constituents and soil characteristics may interfere with the use of cement-based methods, such as fine particles, silt, clay, and lignite. The advantages of cement-based methods include their low cost and the use of readily available mixing equipment.

Encapsulation methods physically microencapsulate wastes by sealing them in an organic binder or resin. These methods can be used for both organic and inorganic waste constituents. The major advantage of encapsulation is that the waste material is essentially isolated from leaching solutions. The major disadvantage is that the processes are energy-intensive and relatively costly.

Volatilization can be accomplished through thermal treatment or mechanical aeration. The direct heat rotary dryer is a proven thermal treatment unit and has been used for many years by the asphalt industry. This unit is best suited for use with free flowing granular solids.

In-Situ Treatment

In-situ treatment, a substitutive alternative to waste excavation and removal, entails in-place treatment of the soil through the use of chemical or biological agents or physical manipulations which degrade, remove, or immobilize contaminants. In-situ treatment processes include bioreclamation, in-situ heating, soil flushing, and vitrification.

Bioreclamation is a technique for treating zones of contamination by microbial degradation. The technology involves enhancing the natural biodegradation process by injecting nutrients, oxygen, and cultured bacterial strains or by introduction of genetically engineered microbes. Bioreclamation can provide substantial reduction in organic contaminant levels in soils, without the cost of soil excavation. The technique is well suited for soil contaminated by petroleum by-products. A number of site-specific factors, such as site geology, soil characteristics, and aquifer characteristics, are critical in evaluating the implementability of this technology.

In-situ heating is a method to destroy or remove organic contaminants in the subsurface through thermal decomposition, vaporization, and distillation. Methods of in-situ heating are steam injection and radio frequency heating.

In-situ soil flushing is a process applied to in-place soils using a ground water extraction/reinjection system. In-situ soil flushing consists of injecting a solvent or surfactant solution to enhance the contaminant solubility, resulting in an increased recovery of contaminants in the leachate or ground water. The system includes extraction wells, reinjection wells and a wastewater treatment system.

In-situ vitrification involves electric melting of contaminated soil, converting it into durable glass. The advantages of vitrification processes are: (1) the limited amount of oxidation products and air emissions; and (2) the reduced leachability of inorganic materials, such as heavy metals.

2.5.2 Ground Water Remedial Technologies

Ground water remedial technologies can be applied to contain, collect, divert, or remove the ground water in the study area, in an effort to prevent further migration of contaminants from the site and manage the migration that has already occurred.

No Action

A no action response is typically retained as a baseline against which to judge alternatives. The no action alternative is used to assess other alternatives' effectiveness in reducing impacts, meeting objectives, and cost.

Institutional Actions

Institutional actions include deed restrictions, replacing water supplies from affected wells with city water supply, extension of new community well and ground water monitoring.

Surface Capping

Surface capping has been previously discussed under Soil/ Sediment Remedial Technologies, Section 2.5.1.

Vertical/Horizontal Barriers

Vertical and horizontal barriers are discussed under Soil/Sediment Remedial Technologies, Section 2.5.1.

Ground Water Recovery

Extraction wells, interceptor trenches or extraction/injection well systems and ground water pumping techniques, involve the active manipulation and management of ground water in order to: (1) contain or remove a plume; or (2) adjust ground water levels to limit the formation of a plume. Pumping methods are most effective at sites where underlying aquifers have high intergranular hydraulic conductivities and contaminants move readily in water. When used in conjunction with a barrier wall and a cap, hydrologic isolation of a site can essentially be achieved. Plume removal implies a complete purging of the affected ground water system. Removal techniques are often suitable when contaminant sources have been removed and aquifer restoration is desired.

Interceptor trenches include any type of buried conduit used to collect and convey contaminated ground water. They function like a line of horizontal extraction wells and can be used to contain or remove a plume, or to lower the ground water table to limit contact of water with waste material. One of the drawbacks of interceptor trenches is that they are generally limited to shallow depths.

Biological Ground Water Treatment

The function of biological treatment is to remove organic matter/chemicals from the waste stream through microbial degradation. Biological treatment processes which may be applicable to the treatment of aqueous wastes from hazardous waste sites include activated sludge, rotating biological discs, fixed film bioreactors, aerobic/anaerobic fluidized beds, batch reactors and aerated lagoons.

Physical/Chemical Treatment

Physical and chemical treatment processes are utilized to treat both inorganic and organic hazardous wastes which are either nonbiodegredable or resistant to biodegradation. Several physical/chemical treatment processes are summarized in the following paragraphs.

Activated carbon is well suited for removal of mixed organics from aqueous wastes. The process has been successfully demonstrated on volatile organics, organic nitrogen compounds, and chelated heavy metals.

Precipitation/flocculation/sedimentation is applicable for the removal of soluble metallic ions and certain anions.

Process performance is affected by chemical interactions, temperature, pH, solubility variances and mixing effects. Organic compounds may also interfere with precipitation by forming organo-metallic complexes.

Ion exchange is a well-established technology for removal of heavy metals and hazardous anions from dilute solutions. This process involves the substitution of innocuous cations and anions, such as hydrogen and hydroxide, for more toxic cations and anions, such as cadmium and cyanides.

Resin sorption involves the use of sorptive resins for removal of organics. In this process, the contaminant is transferred from a dissolved state in an aqueous solution to the surface of a resin.

Filtration is frequently installed ahead of other treatment units to reduce the suspended solids load, the potential for biological growth, and clogging. Filtration could also be used as part of a polishing unit to remove residual floc from the effluent of a precipitation, flocculation, and sedimentation process.

Reverse osmosis involves using high pressure to force water through a synthetic membrane,leaving the contaminants behind the membrane. To avoid membrane plugging, it is important to remove suspended solids and oils with pretreatment. The application of membrane processes must be carefully evaluated on a pilot-scale basis, because of the potential for the chemical to react with the membrane.

Neutralization consists of adding acid or base to a waste in order to adjust the pH. The selection of neutralizing agents should take into account the type, buffer capacity, and concentration of the waste.

Gravity separation is used to treat two-phased aqueous wastes, solid/liquid or liquid/liquid. Oil separation, centrifugation, and dissolved air flotation have been used for this purpose. Immiscible oily liquids, suspended solids, and hydrophobic chemicals can be treated with this technology. However, dissolved contaminants will not be removed by this process.

Air stripping is typically applied to ground water or wastewater contaminated with low levels of volatile organics. It is often followed by another process such as biological treatment or carbon adsorption and treatment of the discharge is frequently required.

Steam stripping is effective in the removal of high concentrations of organics dissolved in water. Those organic compound such as volatile organics, phenols, ketones, and phthalates ranging from 1 to 20 percent can be removed by using steam stripping.

Chemical oxidation can be used for detoxification of arsenic cyanide and for treatment of dilute waste streams containing oxidizable organics. Aldehyde, benzene, mercaptans, phenols, benzidine, unsaturated acids, and certain pesticides have been treated by this method. Common commercially available oxidants include potassium permanganate, hydrogen peroxide, calcium or sodium hypochlorite, ozone, and chlorine gas. Chemical oxidation of VOCs can be achieved with a UV-peroxidation system using ultra-violet light and or hydrogen peroxide.

Chemical reduction is well demonstrated for the treatment of lead, mercury, chromium (VI), PCBs, and unsaturated hydrocarbons. Narrow pH ranges need to be maintained to achieve optimum reaction rates. Common commercially available reducing agents include ferrous ions, sulfur dioxide, and sodium bisulfite. The reduced heavy metals would be treated in the precipitation/ flocculation /sedimentation treatment stage.

Sulfide precipitation involves the use of hydrogen sulfide or soluble sulfide salts to precipitate heavy metals. Since most metal sulfides are even less soluble than metal hydroxides at alkaline pH levels, heavy metal removal can be more readily accomplished through the use of sulfide rather than hydroxide as a chemical precipitant prior to sedimentation.

Powdered Activated Carbon Treatment (PACT)

The Powdered Activated Carbon Treatment (PACT) process is one of the most popular physical/chemical/biological treatment methods. PACT has been shown to upgrade effluent quality in conventional activated sludge plants. Pilot studies are necessary to evaluate process feasibility on specific wastes. Settled sludge from PACT may contain elevated levels of organics or heavy metals.

Thermal Destruction

Thermal destruction has been previously discussed under Soil Remedial Technologies in Section 2.5.1 Thermal Treatment.

Off-Site Treatment and Disposal

Off-site treatment involves transferring the liquid wastes at the site to either a Publicly Owned Treatment Works (POTW) or a RCRA-TSD facility for treatment and disposal.

Discharge to the POTW involves the discharge of water to the nearby City of Olean Wastewater Treatment Plant for final treatment and disposal with or without pretreatment.

On-Site Disposal

Deep well injection is a method frequently used for disposal of highly-contaminated or very toxic wastes not easily treated or disposed of by other methods. Deep well injection is limited by on-site geological conditions. There must be a substantial and extensive impervious caprock strata, overlying a porous strata which is not used as a water supply or for other withdrawal purposes.

Reinjection to ground water involves the injection of treated ground water into the aquifer from which it was withdrawn. This approach can be used to help direct the flow of contaminated ground water toward the extraction wells or recovery trenches.

Surface Water Discharge involves the discharge of treated ground water to a nearby surface water body (Two Mile Creek).

In-Situ Treatment

In-situ treatment entails the injection of chemical or biological agents or in-place physical treatment which degrade or immobilize contaminants. The most promising technology is bioreclamation.

Bioreclamation is a technique for treating zones of contamination by microbial degradation. The basic concept involves altering environmental conditions to enhance microbial catabolism of organic contaminants, resulting in the breakdown and detoxification of those contaminants. The bioreclamation method that has received the most attention, and is the most feasible for in-situ treatment, is aerobic bioreclamation which has been discussed previously.

2.5.3 Structures/Vats Remedial Technologies

Abandoned building control technologies are used to enclose, remove, dispose, or treat the building on the site. These technologies are summarized below.

No Action

A no action response is used as a baseline against which to evaluate other alternatives.

Institutional Actions

Institutional actions include access restrictions such as closure, fencing and deed restrictions.

Containment

Contaminants or contaminated structures can be physically separated from building occupants and the ambient environment by a barrier. An encapsulating or enclosing physical barrier may take different forms; among these are plaster, epoxy resins, paints and concrete casts and walls. Acting as a shield, a barrier keeps contaminants inside and away from clean areas, thereby alleviating the hazard.

Partial or Complete Removal

Demolition is the total destruction of a building, structure, or piece of equipment. Specific demolition techniques include burndown, controlled blasting, wrecking with balls or backhoe-mounted rams, rock splitting, sawing, drilling, and crushing. The potentially contaminated debris from demolition may require handling as a hazardous waste.

Dismantling refers to the physical removal of selected structures (such as contaminated pipes, tanks, vats and other process equipment) from buildings or other areas. Dismantling can be the sole activity of decontamination efforts (e.g., removal of contaminated structures from an otherwise clean building), or it can be used in the initial stage of a more complex building decontamination effort (e.g., removal of structures prior to flaming, demolition, or other cleanup techniques).

On-Site Decontamination

There are several technologies that are applicable for the treatment of contaminated buildings. These include gritblasting, hydroblasting/water washing, scarification, solvent washing, steam cleaning, vapor-phase solvent extraction, and photochemical degradation.

Gritblasting is a surface removal technique in which an abrasive material is used for uniform removal of contaminated surface layers from a building or structure. The mixture of contaminated surface debris and spent abrasive material can be thermally decontaminated (e.g., by kiln incineration) before disposal.

Hydroblasting/water washing involves a high pressure (3,500 to 350,000 kPa) water jet used to remove contaminated debris from surfaces. The debris and water are then collected and thermally, physically, or chemically decontaminated. At present, hydroblasting is applicable to explosives, heavy metals, and radioactive contaminants. This method can be used on contaminated concrete, brick, metal, and other materials. It is not applicable to wooden or fiberboard materials.

Scarification is capable of removing up to 2.5 cm of surface layer from concrete or similar materials. The scarifier tool (scabbler) consists of pneumatically-operated piston heads that strike the surface, causing concrete to chip off. Scarification is potentially applicable to most contaminants except highly toxic residues (e.g., asbestos, dioxins) or highly sensitive explosives. This method is applicable to concrete (not concrete block) and cement.

Solvent washing involves an organic solvent circulated across the surface of a building to solubilize contaminants. Spent solvent is either thermally or chemically treated to remove contaminants, and recycled if no degradation of the solvent occurs during treatment. The hot solvent soaking process has been shown to be effective in decontamination of PCB-contaminated transformers. It has not yet achieved widespread use, although it is beginning to be used in the decommissioning of nuclear facilities.

Steam cleaning physically extracts contaminants from building materials and equipment surfaces. The steam is applied by hand-held wands or automated systems, and the condensate is collected for treatment.

Vapor-phase solvent extraction involves an organic solvent with a relatively low boiling point (such as acetone) heated to vaporization and allowed to circulate in a building. The vapors permeate into porous building materials, where they condense, solubilize contaminants, and diffuse outward. The contaminant-laden liquid solvent is collected in a sump and treated to allow recycling of the solvent.

Photochemical degradation uses intense ultraviolet (UV) light which is applied to a contaminated surface for some period of time. This process is not effective on contaminants imbedded in dense particulate matter (such as deep soil or thick carpet) because UV light cannot penetrate through these surfaces.

On-Site or Off-Site Disposal

Potential on-site or off-site disposal of demolished/ dismantled building materials includes landfilling and incineration. In certain cases, it may be cost-effective to decontaminate the building materials prior to final disposal. These disposal technologies, off-site RCRA landfilling and incineration, were previously discussed under Soil Remedial Technologies, Section 2.5.1.

2.6 Screening of Technologies

An initial screening of potentially applicable remedial technologies for the Van Der Horst Corporation Plant No. 2 site was completed based on <u>technical implementability</u> (i.e., cost criteria were not considered in this evaluation). The results of this screening are presented on Table 2-3. Technical implementability, as per USEPA/540/G-89/004, involves an evaluation of each technology based on the following:

- Site conditions and characteristics;
- Physical and chemical characteristics of contaminants to evaluate the compatibility of various technologies; and
- Performance, reliability, and operating problems.

This initial screening process eliminated those remedial technologies which are unproven, or not expected to achieve an acceptable level of performance. Remedial technologies which could be extremely difficult to implement were also discarded. The technologies with the greatest potential for applicability to the site characteristics and constituents of concern have been retained and are evaluated further in the subsequent sections of this report.

TABLE 2-3
PROCESS OPTIONS PRELIMINARY SCREENING

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
SOIL SEDIMENT				
No action	None	Not Applicable	No action	Required for consideration by NCP
Institution Actions	Access Restrictions	Deed Restrictions	Deeds for property in the area of influence would include deed restrictions	Potentially applicable
		Fencing	Fence off areas of contaminated soil	Potentially applicable

TABLE 2-3 (CONTINUED) SOIL/SEDIMENT

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
Containment	Capping	Clay & Soil	Compacted clay covered with soil over areas of contamination	Potentially applicable
		Concrete	Installation of a concrete slab over contaminated area	Potentially applicable
		Bituminous Concrete/ Asphalt	Installation of asphalt pavement over contaminated area	Potentially applicable
		Composite Liner	Clay & geomembrane covered with soil over contaminated area	Potentially applicable

TABLE 2-3 (CONTINUED) SOIL SEDIMENT

General Response Actions	Remedial Technology	Process Options	Description	Screening Comment
Containment (continued)	Vertical Barriers	Slurry Wall	Trench around contaminated area is filled with soil or cement/benton-ite slurry	Not feasible due to lack of shallow confining layer.
		Sheet Piling	Ground water barrier made of wood, precast concrete or steel	Not feasible due to lack of shallow confining layer.
		Grout Curtain	Pressure injection of group in a regular pattern of drilled holes	Not feasible due to lack of shallow confining layer.
		Vibrating Beam	Vibrating force to advance beams followed by injection of grout as beams are removed	Not feasible due to lack of shallow confining layer.

TABLE 2-3 (CONTINUED) SOIL/SEDIMENT

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
Containment (continued)	Horizontal Barriers	Grouting	Injection of grout into a rock or soil mass	Not feasible due to lack of shallow confining layer.
		Bottom Sealing	Horizontal barrier beneath the site	Not feasible due to lack of shallow confining layer.
	Surface Controls	Diversion/ Collection	Surface water diversion and collection to limit infiltration	Potentially applicable
		Grading	Changing topography of site to reduce migration of contaminants	Potentially applicable
		Soil Stabilization	Revegetation or compaction to reduce erosion	Potentially applicable

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TABLE 2-3 (CONTINUED) SOIL/SEDIMENT

General Response Action	Remedial Technology	Process Options	Description	Screening Comments
Containment (continued)	Sediment Control Barriers	Cofferdams	Small barriers to limit movement of suspended solids during treatment	Potentially applicable
		Curtain Barriers	Silt curtains used to limit migration of suspended solids	Potentially applicable
	Dust Controls	Revegetation	Reseeding of contaminated surface soils susceptible to erosion	Potentially applicable
		Capping	See under "Capping" above	
		Watering	Loose contaminated soils are watered during other remedial actions	Potentially applicable

TABLE 2-3 (CONTINUED) SOIL/SEDIMENT

General Response Action	Remedial Technology	Process Options	Description	Screening Comments
Partial or Complete Removal	Excavation	Solids Removal	Excavate contaminated soils with a mechanical device	Potentially applicable
	Sediment Removal/ Dredging	Mechanical Dredging	Excavate contaminated sediment with a mechanical device	Potentially applicable
		Hydraulic Dredging	Excavate contaminated sediment in the form of a slurry	Potentially applicable
		Pneumatic Dredging	Excavate contaminated sediment using a pump and compressed air	Potentially applicable
	Storm Sewer Cleaning	Mechanical Scouring	Clean storm sewers by use of power rodding machines and scrapers	Potentially applicable

TABLE 2-3 (CONTINUED) SOIL/SEDIMENT

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
Partial or Complete Removal (continued)	Storm Sewer Cleaning	Hydraulic Scouring	Clean Storm Sewers by use of high pressure water	Not feasible. Generates excess amount of waste water
		Bucket Machine	Clean Storm Sewers with power winches attached to a collection bucket	Potentially applicable
		Suction Devices	Clean Storm Sewers with vacuum trucks or pumps	Not feasible. Lines too small for human entrance
Treatment	In-Situ Treatment	Bioreclamation	Treating zones of contamination by microbial degradation	Not feasible for heavy metals. Dif-ficult to implement
		Heating	Destroy or removes contaminants through thermal decomposition, vaporization and distillation	Not applicable for heavy metals. Dif-ficult to imp lement

TABLE 2-3 (CONTINUED) SOIL/SEDIMENT

General Response Action	Remedial Technology	Process Options	Description	Screening Comments
Treatment (continued)	In-Situ Treatment (continued)	Soil Flushing	Injecting a solvent to enhance the solubility of contaminants	Potentially applicable
		Vitrification	Electric melting of soil	Potentially applicable
	Pretreatment - Dewatering	Centrifuge	Rotating auger that separates coarse material from centrate	Potentially applicable
		Gravity Thickener	Circular tank used to concentrate slurries	Potentially applicable
		Filtration	Solids are separated from aqueous by mechanical filtering process	Not applicable filters may get clogged easily.

TABLE 2-3 (CONTINUED) SOIL/SEDIMENT

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
Treatment (continued)	Pretreatment - Solid Separation	Screens and Sieves	Mechanical Filters used to segregate soils	Potentially applicable
		Spiral Classifier	Rotating screens used to wash adhering clay and silt from sand & gravel	Potentially applicable
		Cyclone and Hydroclone	Separated solids that are heavier than water by centrifugal force	Potentially applicable
		Settling Basin	Allows solids to settle out by gravity	Potentially applicable
	Aqueous Waste Treatment for By-Products of Solids Treatment	See "Ground Water Treatment" Options		

TABLE 2-3 (CONTINUED) SOIL/SEDIMENT

General **Response** Actions	Remedial **Technology**	Process **Options**	Description	Screening **Comments**
Treatment (continued)	Thermal Treatment	Liquid Injection	Refractory lined combustion chamber(s) incinerate pumpable waste	Not feasible for inorganics, also difficult to implement
		Rotary Kiln	Incinerates all forms of wastes	Not feasible for inorganics, also difficult to implement
		Multiple Hearth	Series of solid flat hearths incinerate all forms of waste, partic-ularly sludges	Not feasible for inorganics, also difficult to implement
		Fluidized Bed	Waste injected into an agitated bed of sand where combustion occur	Not feasible for inorganics, also difficult to implement

TABLE 2-3 (CONTINUED) SOIL/SEDIMENT

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
Treatment (continued)	Thermal Treatment (continued)	Pyrolysis	Thermal conversion of waste into solid, liquid and gas components	Not feasible for inorganics, also difficult to implement
	Chemical Treatment	Immobilization	Render contaminants insoluble and limit leaching of the contaminants	Potentially applicable
		Soil Washing	Extracts contaminants from soil using solvents	Potentially applicable
		Detoxification	Destroy, degrade or otherwise reduce the toxicity of contaminants	Potentially applicable

TABLE 2-3 (CONTINUED) SOIL/SEDIMENT

General Response Action	Remedial Technology	Process Options	Descriptions	Screening Comments
Treatment (continued)	Physical Treatment	Solidification /Stabilization	Contaminants are mechanically located within a solidified matrix	Potentially applicable
		Encapsulation	Sealing the wastes in an organic binder or resin	Potentially applicable
		Volatilization	Thermal treatment or mechanical aeration	Not applicable for heavy metals
Disposal	On-Site Land Disposal	On-Site Landfill	Construction of a landfill	Not applicable for on-site conditions
	Off-Site Land Disposal	Landfilling	Dispose of waste in an off-site facility	Potentially applicable

TABLE 2-3 (CONTINUED) GROUND WATER

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
GROUND WATER				
No Action	None	Not Applicable	No Action	Required for consideration by NCP
Institutional Actions	Access Restrictions	Deed Restrictions	Supply well usage in the area of influence would include deed restrictions	Potentially applicable
	Alternate Water Supply	City Water Supply	Extension of existing municipal water system to serve residents in area of influence	Not Applicable Municipal water already used by majority of residents
		New Community Well	New supply well to serve residents in area of influence	Not Applicable Municipal water system appears to be adequate
	Monitoring	Ground Water Monitoring	Monitoring of existing wells	Potentially applicable

TABLE 2-3 (CONTINUED) GROUND WATER

General Response Actions	Remedial Technology	Process Options	Description	Screening Comment
Ground Water (continued)	Extraction	Extraction Wells	System of well(s) to extract contaminated ground water	Potentially applicable
	Plume Removal	Extraction/ Injection Wells	Inject uncontaminated water to increase flow to extraction well(s)	Potentially applicable
	Subsurface Drains	Interceptor Trenches	Perforated pipe in trenches to collect contaminated ground water	Difficult to implement due to on-site geologic conditions
On-Site/Off-Site Treatment	Biological	Aerobic Treatment	Degradation of organics in the presence of oxygen	Not feasible for on-site organics
		Anaerobic Treatment	Degradation of organics in the absence of oxygen	Potentially applicable for benzene ethylbenzene, xylene and TCE

TABLE 2-3 (CONTINUED) GROUND WATER

General Response **Actions**	**Remedial** Technology	**Process** Options	**Description**	**Screening** Comments
On-Site/Off-Treatment (continued)	Physical/ Chemical	Activated Carbon	Adsorption of contaminants onto activated carbon	Potentially applicable for benzene, ethylbenzene, xylene and TCE
		Precipitation/ Flocculation/ Sedimentation	Removal of soluble metallic ions	Potentially applicable
		Ion Exchange	Toxic ions are exchanged with harmless ions held by ion exchange material	Potentially applicable
		Resin Sorption	Contaminant is transferred from dissolved state to the surface of the resin	Potentially applicable

TABLE 2-3 (CONTINUED) GROUNDWATER

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
On-Site/Off Treatment (continued)	Physical/ Chemical	Filtration	Suspended solids are removed by passing through a bed of filter media	Potentially applicable
		Reverse Osmosis	Use of high pressure to force water through the membrane leaving contaminants behind	Potentially applicable
		Neutralization	Adding acid or base in order to adjust the pH	Potentially applicable
		Gravity Separation	Separate two-phased aqueous waste	Not feasible for soluble organics

TABLE 2-3 (CONTINUED) GROUND WATER

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
On-Site/Off-Site Treatment (continued)	Physical/ Chemical	Air Stripping	Mixing air with water in a packed column to promote transfer of VOCs to air	Potentially applicable
		Steam Stripping	Mixing steam with volatile organic contaminated water to promote transfer of VOCs to air	Potentially applicable
		Chemical Oxidation (UV-Peroxidation)	Addition of an oxidizing agent	Not applicable for treatment of inorganics
		Chemical Reduction	Addition of a reducing agent	Potentially feasible for Cr(VI) reduction
		Sulfide Precipitation	Hydrogen sulfide or sodium sulfide used to precipitate heavy metals	Potentially applicable

TABLE 2-3 (CONTINUED) GROUND WATER

General Response Action	Remedial Technology	Process Options	Description	Screening Comments
On-Site/Off-Site Treatment (continued)	Physical/ Chemical/ Biological	Powdered Activated Carbon Treatment (PACT)	Addition of carbon to the aeration basin	Potentially applicable for benzene, toluene, ethylbenzene and PCE
	Thermal Destruction	Liquid Injection	Refractory lined combustion chamber(s) incinerate pumpable waste	Not applicable for low levels of toxic organic pollutants and/or inorganics in liquid wastes
		Rotary Kiln	Incinerates all forms of wastes	Not applicable for low levels of toxic organic pollutants and/or inorganics in liquid wastes
		Multiple Hearth	Series of solid flat hearths incinerate all forms of waste, particularly sludges	Not applicable for low levels of toxic organic pollutants and/or inorganics in liquid wastes

TABLE 2-3 (CONTINUED) GROUND WATER

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
On-Site/Off Treatment (continued)	Thermal Destruction (continued)	Fluidized Bed	Waste injected into an agitated bed of sand where combustion occurs	Not applicable for low levels of toxic organic pollutants and/or inorganics in liquid wastes
		Pyrolysis	Thermal conversion of waste into solid, liquid and gas components	Not applicable for low levels of toxic organic pollutants and/or inorganics in liquid wastes
	Off-Site Treatment and Disposal	POTW	Extracted ground water discharge to Olean Waste Water Treatment Plant	Potentially applicable

TABLE 2-3 (CONTINUED) GROUND WATER

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
	Off-Site Treatment (continued)	RCRA Facility	Extracted ground water transported to RCRA facility for treatment	Potentially applicable
On-Site/Off-Treatment (continued)	In-Situ Treatment	Bioreclamation	Treating zones of contamination by microbial degradation	Applicable for organics
		Chemical	Immobilization soil flushing and detoxification used to decontaminate soil	Potentially applicable
		Physical	Heating, vitrification and ground freezing to demobilize contaminants	Potentially applicable

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TABLE 2-3 (CONTINUED) GROUND WATER, STRUCTURES/VATS

General Response Actions	Remedial Technology	Process Options	Description	Screening comments
On-Site/Off-Site Treatment (continued)	In-Situ Treatment (continued)	Permeable Treatment Beds	Downgradient trenches filled with activated carbon or lime to treat contaminants	Not feasible due to lack of shallow confining layer.
Ground Water Disposal	Off-Site Disposal	POTW	Extracted water discharged to Olean Waste Water Treatment Plant	Potentially applicable
		Surface Water	Discharge to Olean Creek following pretreatment	Potentially applicable
	On-Site Disposal	Deep Well Injection	Extracted water discharged to deep well system	Not applicable due to high permeability of subsurface materials
		Reinjection to Ground Water	Discharge to ground water following treatment	Potentially applicable

TABLE 2-3 (CONTINUED) STRUCTURE/VATS

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
STRUCTURES/VATS				
No Action	None	Not applicable	No Action	Required for consideration by NCP
Institutional Actions	Access Restrictions	Deed Restrictions	Deeds for property in the area of influence would include deed restrictions	Potentially applicable
		Fencing	Fence off areas of contaminated soil	Potentially applicable
		Closure	Board-up on-site structures	Potentially applicable
Containment	Encapsulation/ Enclosure	Containment	Protective coating acting as a shield from contaminated surfaces	Potentially applicable

TABLE 2-3 (CONTINUED) STRUCTURES/VATS

General Response **Actions**	**Remedial** Technology	**Process** Options	**Description**	**Screening** Comments
Partial or Complete Removal	Demolition and Removal	Demolish Structures	Includes burn down, controlled blasting, drilling, crushing and sawing	Potentially applicable
	Dismantling and Removal	Physical Removal	Removal of contaminated structures	Potentially applicable

TABLE 2-3 (CONTINUED) STRUCTURES/VATS

General **Response** Action	Remedial **Technology**	Process **Options**	Description	Screening **Comments**
Treatment	On-Site Treatment	Grit Blasting	Abrasive material is used for uniform removal of contaminated surface layers	Potentially applicable to specific surfaces
		Hydroblasting/ Water Washing	A high pressure water jet is used to remove contaminated debris	Potentially applicable to specific surfaces
		Scarification	Pneumatically operated piston heads strike the surface, causing concrete to chip off	Potentially applicable to concrete floor
		Solvent Washing	Organic solvent is used to solubilize contaminants	Not applicable Technology under development

TABLE 2-3 (CONTINUED) STRUCTURES/VATS

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
Treatment (continued)	On-Site Treatment	Steam Cleaning	Use high pressure steam to clean up residual contaminants	Potentially applicable
		Vapor-Phase Solvent Extraction	Organic solvent is heated to vaporize and allowed to circulate in a building	Not applicable Difficult to implement
		Photochemical Degradation	Intense ultra violet light is applied to a contaminated surface	Not applicable Difficult to implement
Disposal	On-Site Land Disposal	On-Site Landfill	Construction of a landfill	Not applicable due to siting concerns

TABLE 2-3 (CONTINUED) STRUCTURES/VATS

General Response Actions	Remedial Technology	Process Options	Description	Screening Comments
Disposal (continued)	Off-Site Disposal	Landfilling	Dispose of waste in an off-site facility	Potentially applicable
		Incineration	See "Thermal Treatment for Soil/Sediment" above	Not applicable see "Thermal Treatment for Soil/Sediment"

2.7 Evaluation of Process Options

The technology processes considered to be implementable were evaluated in greater detail. The results of the second level of screening are summarized in this section. These remedial technologies or process options were evaluated on the basis of effectiveness and implementability. A relative cost comparison was also completed; however, cost was not used as the sole criteria to screen-out any of the technologies. Table 2-4 summarizes the results of the screening process and Table 2-5 summarizes the technologies that were subsequently retained for further consideration. A discussion of each of the evaluation categories is presented below.

Effectiveness

Effectiveness refers to the degree to which a technology achieves the remedial action objectives. As this evaluation pertains to technologies rather than overall remedial alternatives, a technology need not achieve the remedial objective in its entirety to be considered effective. Effective technologies may be combined with other complementary technologies, if required, to form effective alternatives which address the remedial objectives. This evaluation therefore is based upon the effectiveness of each technology at its intended function.

Implementability

Implementability encompasses both the technical and administrative feasibility of implementing a technological process. As discussed in Section 2.6, technical implementability is used to initially screen process options and to eliminate those that are clearly ineffective or unworkable at a site. Therefore, this subsequent, more detailed evaluation of process options places greater emphasis on the institutional aspects of implementability, such as the ability to obtain necessary permits for off-site actions, the availability of treatment, storage and disposal services (including capacity), and the availability of necessary equipment and skilled workers to implement the technology.

Cost

Relative capital and O & M costs were estimated during this stage of the screening process. The cost estimates were made on the basis of published unit costs and vender estimates, and each process option is evaluated as to whether costs are high, medium or low relative to other process options of the same technology type.

TABLE 2-4 EVALUATION OF PROCESS OPTIONS

Process Options	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
SOIL/SEDIMENT				
No Action.	Does not achieve remedial action objectives.	Not acceptable to local government/ public.	None.	Yes. Required as a baseline to evaluate other alternatives.
Fencing.	Effective in limiting contact with contaminated soil. Does not achieve remedial action objectives.	Readily implementable.	Negligible.	No. Fails effectiveness criteria.
Deed Restrictions.	Effective in restricting the land use. Does not achieve remedial action objectives.	Depends on legal requirements and authorities.	Negligible.	No. Fails effectiveness criteria.
Clay & Soil Capping.	Effective in limiting contact with contaminated soil. Susceptible to cracking. No contaminant reduction.	Implementable. Restriction on future land use.	Low capital, moderate O & M.	No. Fails effectiveness criteria.
Concrete Capping.	Effective in limiting contact with contaminated soil. Susceptible to weathering and cracking. No contaminant reduction.	Implementable. Restrictions on future land use.	Moderate capital, moderate O & M.	No. Fails effectiveness criteria.
Bituminous Concrete/ Asphalt clay Capping.	Effective in limiting contact with contaminated soil. Susceptible to weathering and cracking. No contaminant reduction.	Easily implemented with plant building in place. Restrictions on future land use.	Low capital, moderate O & M.	No. Fails effectiveness criteria.

TABLE 2-4 (CONTINUED) SOIL/SEDIMENT

Process Options	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
Composite Capping.	**Effective in limiting** contact with contaminated soil. Least susceptible to cracking. No contaminant reduction.	**Implementable. Restrictions** on future land use, Difficult to construct if plant building remains in place.	**Moderate capital, low** O & M.	**Yes, if combined with other** option(s).
Diversion/Collection.	Effective in limiting infiltration of surface water in contaminated area. Supplements other options (i.e. capping options).	Implementable.	Low capital, low O & M.	Yes.
Grading.	Effective in limiting infiltration of surface water in contaminated areas. Supplements other options (i.e. excavation/ capping).	Implementable.	Low capital, low O & M.	Yes.
Soil Erosion Control.	Effective in reducing erosion of contaminated soil. Supplements other options.	Implementable.	Low capital, low O & M.	Yes.
Cofferdams.	Effective in limiting movement of suspended solids during treatment. Supplements other options.	Implementable.	Moderate capital.	Yes.
Curtain Barriers.	Effective in limiting movement of suspended solids during dredging. Supplements other options.	Readily implementable.	Moderate capital.	Yes.

TABLE 2-4 (CONTINUED) SOIL/SEDIMENT

Process Options	Effectiveness	Implementability	Cost	Retain Action/ Screen Comment
Revegetation/ Restoration.	Effective in reducing erosion of contaminated soil. Supplements other options(i.e. excavation, capping).	Readily implementable.	Low capital, Low O & M.	Yes.
Watering.	Effective in reducing fugitive dust during implementation of other remedial options. Supplements other options (i.e., excavation).	Readily implementable.	Negligible.	Yes.
Solids Excavation.	Effective in removing contaminated soils.	Implementable with proper health and safety measures.	Moderate capital.	Yes.
Mechanical Dredging.	Effective in removing contaminated sediments. Used with sediment control. Should be done during low flow conditions.	Implementable with proper health and safety measures and sediment controls.	Moderate capital.	Yes.
Hydraulic Dredging.	Effective in removing contaminated sediments. Does not require channel rerouting.	Implementable. Requires disposal/treatment option.	Moderate capital.	Yes.
Pneumatic Dredging.	Effective in removing contaminated sediments. Does not require channel rerouting.	Not a common technology in the U.S. Requires disposal/ treatment option.	High capital.	No. Fails implementability criteria.
Mechanical/Hydraulic Scouring	Effective in removing contaminated sediment from storm sewer	Implementable. Requires cooperation of local officials.	Moderate capital.	Yes.
Off-Site Landfill.	Effective in removing contaminants from the site.	Implementable. Requires transport and handling.	High capital, no O & M.	Yes

TABLE 2-4 (CONTINUED) SOIL/SEDIMENT

Process Options	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
Centrifugation.	Effective for separation of soils.	Implementable.	Moderate capital, low O & M.	Yes.
Gravity Thickening.	Effective with other options for concentration of slurries.	Implementable.	Moderate capital low O & M.	Yes.
Screens & Sieves.	Effective for segregation of soils. Supplements other options.	Implementable.	Moderate capital, high O & M.	Yes.
Spiral Classifier.	Effective for separation of coarse soils from fines.	Implementable.	High capital, moderate O & M.	Yes.
Cyclone and Hydroclone.	Effective for separation of solids heavier than water.	Implementable.	High capital, low O & M.	Yes.
Settling Basin.	Effective for separation of suspended solids from liquids.	Implementable. Takes longer than other solids separation processes.	Moderate capital, low O & M.	Yes.
Immobilization.	Effective for limiting solubility of contaminants.	Difficult to Implement. Insufficient field test information.	Moderate capital, no O & M.	No. Fails implementability criteria.
Soil Washing.	Effective in extraction of contaminants from soil.	Implementable. May require site-specific treatability study.	Moderate capital, moderate O & M.	Yes.
Detoxification.	Effective in reducing the toxicity of contaminants	Implementable. May introduce other pollutants.	Moderate capital, no O & M.	No. Fails implementability criteria.

TABLE 2-4 (CONTINUED) GROUNDWATER

Process Options	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
Solidification/ Stabilization.	**Effective for limiting** leaching of wastes. No contaminant reduction.	**Implementable. May require** site-specific treatability study.	**Moderate capital, no** O & M.	Yes.
Encapsulation.	May not be compatible with on-site organic contamination. No long term data available.	Implementable.	High capital, no O & M.	No. Fails effectiveness criteria.
In-Situ Soil Flushing.	Difficult to predict effectiveness. Hasn't been adequately demonstrated.	Implementable.	Moderate capital, moderate O & M.	No. Fails effectiveness criteria.
Vitrification.	Difficult to predict effectiveness. Hasn't been adequately demonstrated.	Difficult to Implement. Insufficient field test information.	Very high capital, no O & M.	No. Fails effectiveness and implementability criteria.
<u>GROUNDWATER</u>				
No Action.	Does not achieve remedial action objectives.	Not acceptable to local government/public.	None.	Yes.
Deed Restrictions.	Effective in restricting the land use. Does not achieve remedial action objectives.	Depends on legal requirements and authorities.	Negligible.	No. Fails effectiveness criteria.
Extension of City Water Supply.	Effective in limiting use of contaminated ground water. No contaminant reduction.	Municipal water system already in place in area of influence.	Negligible.	No. Fails effectiveness criteria.
Groundwater Monitoring.	Useful for documenting conditions. No contaminant reduction.	Alone, not acceptable to local government/ public.	Low capital, low O & M.	Yes.

TABLE 2-4 (CONTINUED) GROUNDWATER

Process Option	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
Capping.*	**See** above **under** "Soil/Sediment".			
Extraction Wells.	Useful if used in conjunction with other options.	Implementable. May pull in contaminants from off-site sources.	Moderate capital, moderate O & M.	Yes.
Extraction/Injection Wells.	Probably will not increase extraction process due to lack of confining layers.	Potentially implementable in overburden.	Moderate capital moderate O & M.	No. Fails effectiveness criteria.
Anaerobic Treatment	Potentially effective to treat some VOCs, however, ineffective on other contaminants.	Difficult to implement at site due to the low organic waste concentration.	Moderate capital, high O & M.	No. Fails effectiveness and implementability criteria.
Activated Carbon.	Proven technology for treating VOCs and Cr(VI).	Readily implementable.	Moderate capital, high O & M.	Yes.
Precipitation/ Flocculation/ Sedimentation.	Effective and reliable. Requires sludge disposal.	Readily implementable.	Low capital, moderate O & M.	Yes.
Ion Exchange	Effective for removal of metals/organics from groundwater.	Readily implementable.	Moderate capital, moderate O & M.	Yes.
Resin Sorption	Effective for removal of metals/organics from groundwater.	Readily implementable.	Moderate capital, moderate O & M.	Yes.
Filtration.	Effective for removing suspended solids. Can be used as pretreatment to other options.	Readily implementable.	Moderate capital, moderate O & M.	Yes.

Note: Capping is addressed under Soil/Sediment.

TABLE 2-4 (CONTINUED) GROUNDWATER

Process Option	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
Reverse Osmosis.	Limited effectiveness for removal of charged ions (EQ): Cr(VI), some organics and metals. Unproven technology for high volume treatment applications.	Difficult to implement. May require extensive pretreatment.	Moderate capital, high O & M.	No. Fails implementability and effectiveness criteria.
Neutralization.	Effective for pH adjustment. Used as pretreatment options.	Readily implementable.	Low capital, low O & M.	Yes.
Air Stripping.	Proven effective technology for treating PCE & TCE. Results in VOC air emissions.	Readily implementable.	Moderate capital, moderate O & M.	Yes
Steam Stripping.	Effective for concentrated waste.	Difficult to contain contaminated water generated during cleaning process.	Very high O & M cost.	No. Fails implementability criteria.
Chemical Reduction.	Effective for reduction of Cr(VI) to Cr(III) by using reducing agents.	Readily implementable.	Moderate capital, moderate O & M.	Yes.
Sulfide Precipitation.	Effective for precipitation of heavy metals.	Readily implementable.	Moderate capital, moderate O & M.	Yes.
Powdered Activated Carbon Treatment (PACT).	Not effective for low level organics and/or inorganics.	Readily implementable.	High capital, high O & M.	No. Fails effectiveness criteria.
Disposal/Treatment at RCRA Facility.	Effective.	No nearby treatment facilities.	Very high capital.	No. Fails implementability criteria.
In-Situ Treatment Bioreclamation.	May be effective for organics, but not effective for inorganics. Unproven technology.	Difficult to implement due to low levels of organics.	Moderate capital.	No. Fails effectiveness and implementability criteria.

TABLE 2-4 (CONTINUED) GROUNDWATER

Process Option	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
In-Situ Chemical Treatment.	Not a proven technology.	Implementable.	Moderate capital, moderate O & M.	No. Fails effectiveness criteria.
In-Situ Physical Treatment.	Effective for organics and immobilizing contaminants. Does not lower contamination levels.	Difficult to implement.	High capital, high O & M.	No. Fails effectiveness and implementability criteria.
Discharge to POTW.	Effective and reliable method.	Implementable. Discharge permits required.	Low capital, low O & M.	Yes.
Discharge to Surface Water.	Effective and reliable method. requires extensive pretreatment.	Implementable. Discharge permits required.	Low capital, low O & M.	Yes.
Deep Well Injection.	Effective. Does not eliminate contaminants.	Implementable. May impact downgradient municipal well.	Moderate capital, moderate O & M.	Yes.
Reinjection to Groundwater.	Potentially effective. Requires pretreatment.	Implementable. May impact municipal supply wells.	Moderate capital, moderate O & M.	Yes.

TABLE 2-4 (CONTINUED) STRUCTURES/VATS

Process Option	Effectiveness	Implementability	Cost	Retain Action/ Screen Comment
STRUCTURES/VATS				
No Action.	Does not achieve remedial action objectives.	Not acceptable to local public/government.	None.	Yes.
Closure.	Effective for limiting vandalism and access to structures. Does not achieve remedial objectives.	Implementable.	Low capital, low O & M.	No. Fails effectiveness criteria.
Fencing.	Effective in limiting contact with wastes. No contaminant reduction. Does not achieve remedial objectives.	Currently in place. Fencing could be upgraded to limit vandalism and trespassing.	Negligible.	No. Fails effectiveness criteria.
Deed Restrictions.	Effectiveness depends on continued future implementation. Does not achieve remedial objectives.	Depends on legal requirement and authorities.	Negligible.	No. Fails effectiveness criteria.
Containment (Encapsulation/ Enclosure).	Effective in limiting direct contact with contaminants. No contaminant reduction.	Implementable.	Low capital, moderate O & M.	No. Fails effectiveness criteria.
Demolition and Removal (Complete Removal).	Effective for breaking down structures and improving handling of debris.	Implementable if buildings are adequately decontaminated prior to demolition.	High capital.	Yes.

TABLE 2-4 (CONTINUED) STRUCTURES/VATS

Process Option	Effectiveness	Implementability	Cost	Retain Action/ Screen Comments
Dismantling and Removal.	Effective for removal of structures.	Implementable if buildings are adequately decontaminated prior to dismantling.	High capital.	Yes.
Grit Blasting.	Effective for removing contaminants from specific surfaces.	Implementable.	Moderate capital.	Yes.
Scarification.	Only effective for removing residual contaminants from masonry surfaces.	Implementable.	Moderate capital.	Yes.
Steam Cleaning.	Effective for removing residual contaminants on structures.	Implementable. Requires containment of water generated during cleaning.	Low capital.	Yes.
On-Site RCRA Facility.	Effective storage of waste. Achieves remedial objectives.	Difficult to implement. Public/local government concerns.	Very high capital, moderate O & M.	No. Fails implementability criteria.
Off-Site Landfill Disposal.	Effective for limiting contamination at site.	Implementable. Requires demolition, transportation and handling.	High capital.	Yes.

TABLE 2-5 SUMMARY OF APPLICABLE TECHNOLOGIES

Type of Media	Applicable Technologies
Soil/Sediment.	No Action. Composite Capping. Diversion/Collection. Grading. Soil Erosion Control. Cofferdams. Curtain Barriers. Revegetation/Restoration. Watering. Solid Excavation. Mechanical/Hydraulic Dredging. Mechanical/Hydraulic Scouring Off-Site Landfill. Centrifugation. Gravity Thickening. Screens and Sieves. Settling Basin. Spiral Classifier. Cyclone and Hydroclone. Soil Washing. Solidification/Stabilization.
Groundwater.	No Action. Groundwater Monitoring. Extraction Wells. Carbon Adsorption. Conventional Precipitation. Ion Exchange using Resin Sorption. Filtration. Neutralization. Air Stripping. Chemical Reduction. Sulfide Precipitation. Discharge to POTW. Discharge to Surface Water. Reinjection to Groundwater. Deep Well Injection.
Structures/Vats	No Action. Demolition/Dismantling and Removal. Steam Cleaning. Off-Site Landfill Disposal. Scarification. Grit Blasting

3.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES

Screening of potentially applicable technologies/process options was discussed in Section 2.0. The most feasible technologies/process options were then combined into remedial alternatives and subsequently screened for each of the three media previously identified (i.e., soil/sediment, ground water and structures/vats). In general, the alternatives discussed herein for each of the media include the no action/limited action alternative, and other alternatives which exceed, achieve, or do not achieve appropriate levels of remediation, as defined by the remedial action objectives.

Finally, this section presents the comprehensive remedial alternatives which, based on the screening process, appear to be the most feasible for the site. These alternatives are evaluated in more detail in Section 5.0, the Phase III FS (Task VI-Detailed Analysis of Alternatives).

3.1 Development of Alternatives

3.1.1 Summary of Alternatives for Contaminated Soil/Sediment Remediation

Alternatives for contaminated soil/sediment remediation are summarized below. Alternatives 1 through 6 address on-site soils and the sediment within Two Mile Creek. Alternative 7 addresses the residual contaminated sediment present in the on-site storm sewer line system.

- Alternative 1: No Action/Limited Action
- Alternative 2: Capping and Grading of Contaminated Soils; Removal of Sediments
- Alternative 3: Excavation and Off-Site Landfill Disposal
- Alternative 4: Soil Washing
- Alternative 5: On-Site Solidification/Stabilization
- Alternative 6: On-Site Solidification/Stabilization and Capping
- Alternative 7: On-Site Sewer Line Cleaning using Hydraulic Scouring Techniques

Each of these alternatives is summarized in the following paragraphs.

Alternative 1: No Action/Limited Action

The no action/limited action alternative would limit access to contaminated areas identified during the RI/FS. This alternative would include site fencing, monitoring and deed restrictions. The no action/limited action alternative is presented here as a baseline against which to evaluate other alternatives.

Alternative 2: Capping of Contaminated Soils; Removal of Sediments

The capping alternative includes a composite cap over the site and improvement of site drainage (e.g., grading, diversion/collection, soil erosion control, revegetation, etc.). For this alternative to be effective the plant building must be removed to allow complete closure of the site. If feasible (i.e., the quantity of the contaminated soil is not excessive) contaminated soil/sediment from off-site may be consolidated on site or in one area of the site, and then capped. Capping would reduce the movement of contamination via air, surface water and ground water (i.e., by reducing infiltration). Surface capping at the Van Der Horst Plant No. 2 site would also limit direct contact with the contaminated soils by persons or animals entering the site area.

Capping would also enhance other technologies (e.g., ground water collection) by mitigating the impacts of infiltration or isolating the source of contamination. However, with regard to public health and the environment, removal of the sources of contamination is generally preferable to capping or any other form of containment. Nevertheless, capping offers a less expensive option.

Sediment would be removed by constructing a cofferdam or silt curtain around the contaminated area of the creek and dredging the sediments. Dredged sediments would be dewatered and disposed of at an off-site disposal facility or on-site.

Alternative 3: Excavation and Off-Site Landfill Disposal

Excavation and off-site disposal is a proven technology for remediation of waste sites where waste quantities are not excessive and the excavated material can be accepted at an off-site landfill. Watering and other dust control measures would be implemented during excavation. Soil excavation can be accomplished by a wide variety of conventional equipment ranging in size from a 22 cubic yard dragline down to the 1/4 cubic yard backhoe. These basic types of excavation machinery fall into the following general categories:

- Backhoes;
- Cranes and attachments (draglines and clamshells); and
- Dozers and loaders.

Excavation, dredging and transport equipment would have to be decontaminated before leaving the site, and other contaminant containment procedures would be used as well.

Sediment would be removed by constructing a cofferdam or silt curtain around the contaminated area of the creek and dredging the sediments. Dredged sediments can be dewatered and taken off-site with the contaminated soil.

Alternative 4: Soil Washing

Under this alternative, contaminated soil would be excavated and washed on-site with a liquid medium for removal of contaminants. Sediment would be removed by constructing a cofferdam or slit curtain around the contaminated area of the creek and dredging the sediments. Dredged sediments would be dewatered and washed on-site together with the contaminated soil. Decontaminated soil/sediment would be backfilled while the washing solution would be reclaimed or treated for removal of the contaminants via the following treatment/disposal technologies:

- o Chromium Reduction;
- o Neutralization;
- o Precipitation/Flocculation;
- o Sedimentation;
- o Filtration;
- o Granular Activated Carbon Adsorption;
- o pH Adjustment;
- o Belt Filter Press (for sludge dewatering); and
- o Off-Site Disposal of Dewatered Sludge.

A schematic flow diagram of a typical soil washing treatment train is presented in Figure 3-1. Additionally, soil segregation methods (e.g., centrifugation, gravity thickening, screens and sieves, spiral classifier, cyclone, hydroclone, and settling basins) may be used to separate the soils into various particle sizes prior to the washing process. The treated effluent would be discharged to the POTW, surface water or ground water. Prior to implementation of this alternative, treatability studies would be needed to evaluate the soil washing medium and the appropriate wash solution treatment process.

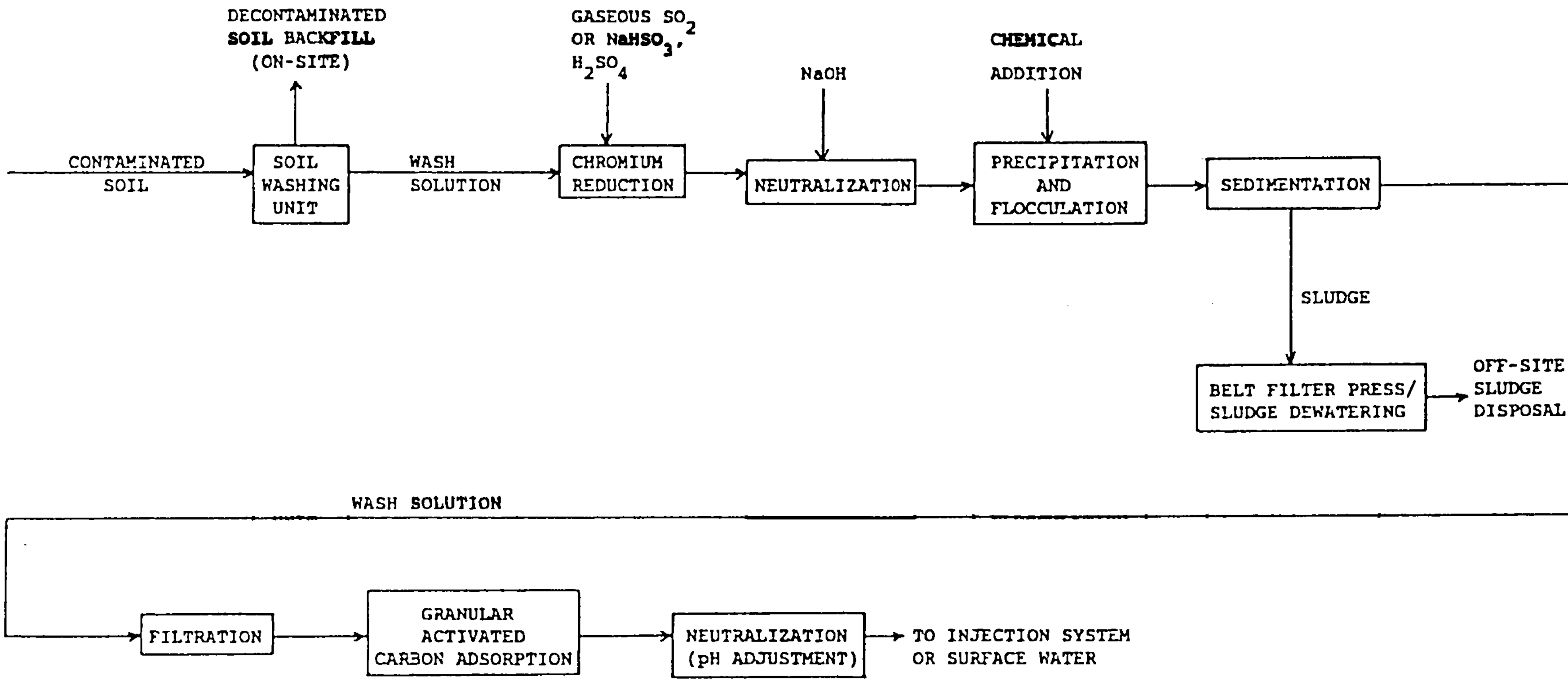


Figure 3-1 : TYPICAL SOIL WASHING TREATMENT PROCESS TRAIN

Source: YEC, INC.

Alternative 5: On-Site Solidification/Stabilization

Under this alternative, contaminated soil/sediment would be excavated/dredged and solidified/stabilized on-site. There are various types of solidification/stabilization processes such as cement solidification, silicate-based processes, sorbent materials processes, and thermoplastic techniques. The objectives of the solidification treatment process are to:

- Improve the handling and physical characteristics of the waste;
- Decrease the surface area across which transfer or loss of pollutants can occur;
- Limit the solubility of metal contaminants in the waste; and
- Make the soil less hazardous.

The success of this technology would depend primarily upon two factors: (1) the site-specific waste characteristics; and (2) the chemicals/binding reagents to be applied to the soil.

Alternative 6: On-Site Solidification/Stabilization and Capping

Under this alternative , contaminated soil/sediment would be excavated/dredged and solidified/stabilized on-site then capped. Basically this alternative is the same as Alternative 5 with the addition of a composite cap over the backfilled solidified soil/waste.

Alternative 7: On-Site Storm Sewer Line Cleaning using Hydraulic Scouring Techniques

This alternative uses a high pressure water wash to dislodge contaminated sediment and debris. The sediments are then vacuumed from the catch basin and the end of the line using vacuum trucks. This material would then be taken to an off-site landfill or to the site to be treated and disposed of with the other soil/sediments.

3.1.2 Summary of Alternatives for Ground Water Migration Control

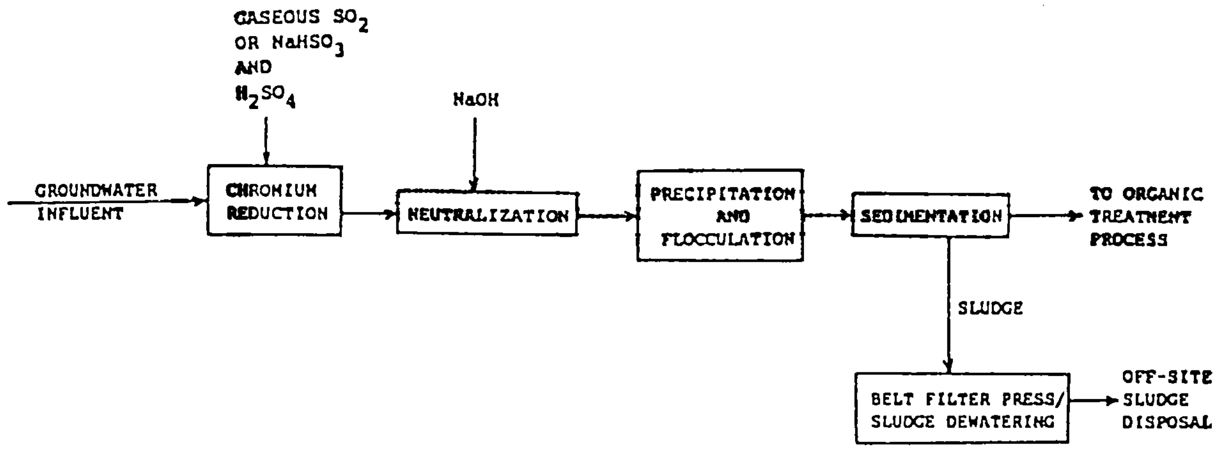
The following four (4) alternatives have been identified for control of ground water contaminant migration:

- Alternative 1: No Action/Limited Action
- Alternative 2: Ground Water Extraction, Treatment, and Discharge to Surface Water
- Alternative 3: Ground Water Extraction, Pretreatment, if necessary, and Discharge to POTW
- Alternative 4: Ground Water Extraction, Treatment, and Reinjection

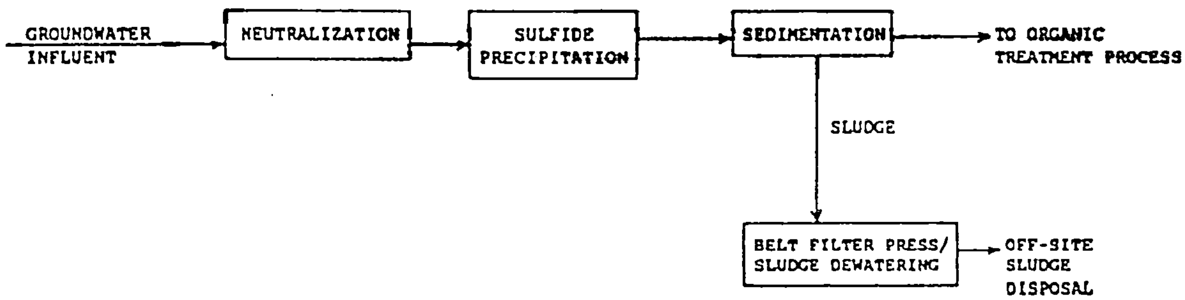
Alternatives 2, 3 and 4 potentially involve on-site treatment of contaminated ground water. Therefore, potential treatment options are discussed independently.

Since both inorganic (e.g., arsenic, chromium, beryllium and lead) and organic (e.g., benzene) contaminants are of concern, the following two groups of treatment options were evaluated:

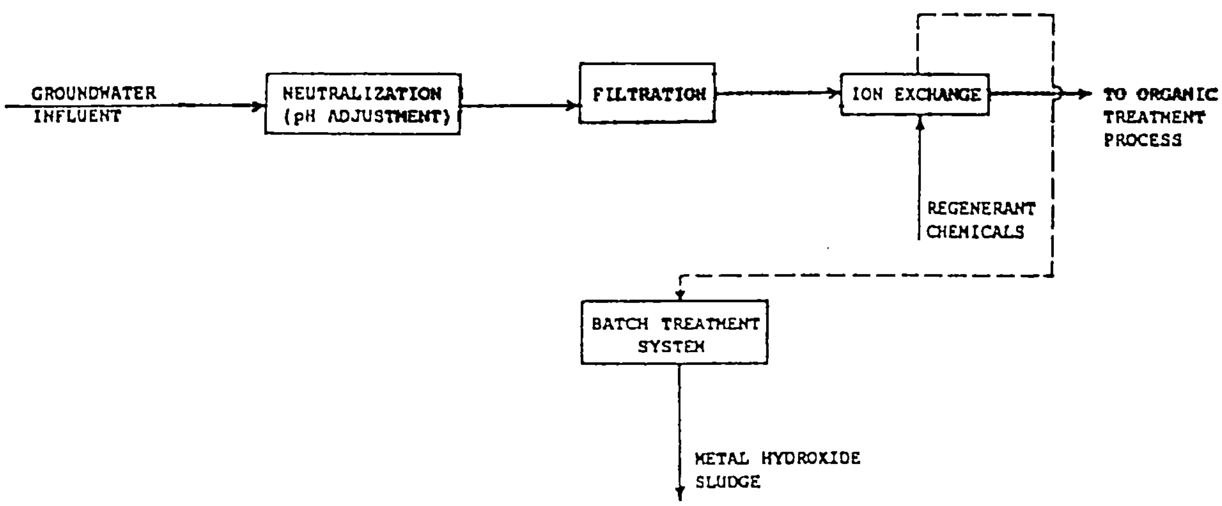
1. Metal Treatment Options (Figure 3-2):
   a. Conventional Chemical Precipitation,
   b. Sulfide Precipitation;
   c. Ion Exchange; and
   d. Activated Carbon Adsorption



A. METAL TREATMENT OPTION 1



B. METAL TREATMENT OPTION 2



C. METAL TREATMENT OPTION 3

Source: YEC, INC.

Figure 3-2 : METAL TREATMENT OPTIONS

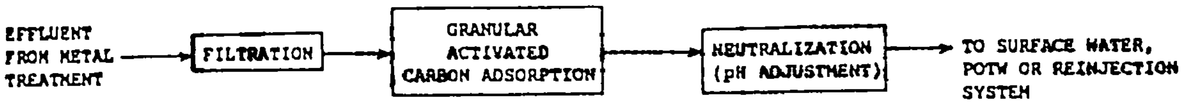
2. Organic Chemical Treatment Options (Figure 3-3):
    a. Activated Carbon Adsorption;
    b. Air Stripping and Off-Gas Treatment by Carbon Adsorption; and
    c. Air Stripping followed by Carbon Adsorption.

Alternative 1: No Action/Limited Action

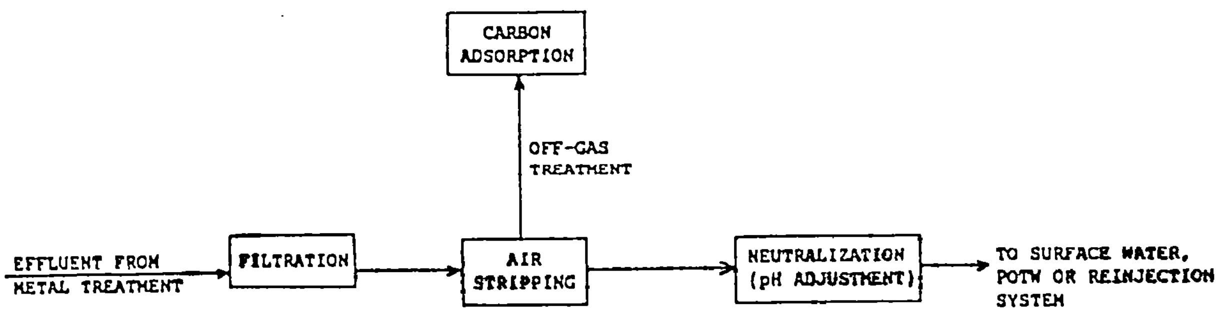
This alternative includes monitoring and land use restrictions. The monitoring wells and downgradient supply wells would be sampled and tested for contaminants periodically. No treatment or disposal actions would be taken relative to ground water remediation. Restrictions on the use of supply wells within the area of influence would be implemented by local government.

Alternative 2: Ground Water Extraction, Treatment and Discharge to Surface Water

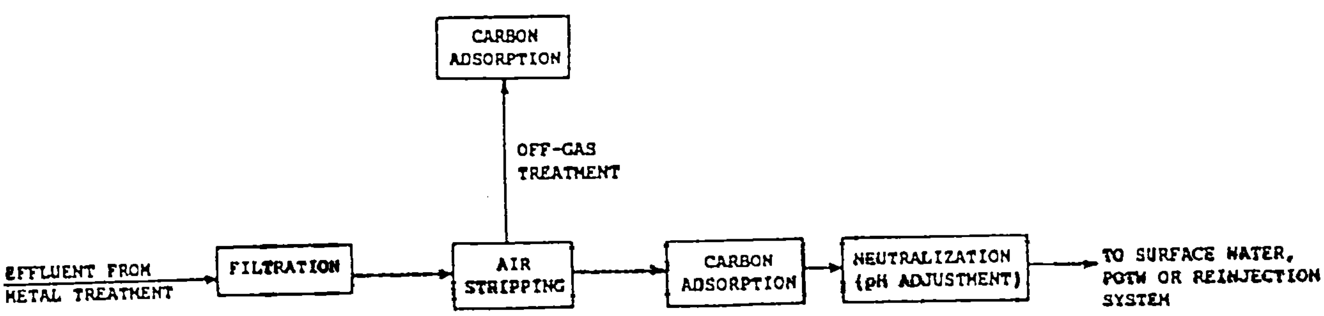
This alternative would involve extraction of ground water through a pumping system in the vicinity of the site, followed by on-site treatment to remove metal and organic contamination. The objective of the treatment system would be



A. ORGANIC TREATMENT OPTION 1



B. ORGANIC TREATMENT OPTION 2



C. ORGANIC TREATMENT OPTION 3

Figure 3-3 : ORGANIC TREATMENT OPTIONS

Source: YEC, INC.

to meet Class C stream standards, for eventual discharge to Two Mile Creek.

Ground water pumping and treatment is feasible, given the nature of the aquifer and the level and type of metal and organic contamination. Surface water discharge may also be practical, so long as the volume of water does not produce localized flooding problems. A State Pollutants Discharge Elimination System (SPDES) permit would be required under this alternative.

Alternative 3: Ground Water Extraction, Pretreatment, and Discharge to City of Olean Wastewater Treatment Plant

This alternative is basically the same as Alternative 2, with the exception that ground water (pretreated, if necessary) would be discharged to a Publicly Owned Treatment Works (POTW). The nearest POTW is operated by the City of Olean and is serviced by an activated sludge treatment plant.

The POTW consists of a main pumping station (which includes mechanical screens, influent pumps and aerated grit chambers), primary clarifiers, aeration tanks, secondary clarifiers, and a chlorine contact tank. The treated wastewater is discharged to the Allegheny River.

This plant has a design capacity of 7 MGD and is currently operating at 4.5 MGD with an additional 1 MGD of capacity reserved for use by surrounding communities. Table 3-1 lists the current limits of contaminants that are allowed in discharges to the City of Olean sanitary sewer system. Based on ground water samples collected during the RI the ground water at the site presently meets these limits except for arsenic. However, based on conversations with POTW personnel, an on-site pretreatment system may be needed to reduce chromium loadings to the POTW due to its discharge limitations. Based on the Plant 2 anticipated ground water extraction rate (i.e., 75 gallons per minute), POTW capacity modifications do not appear to necessary.

Alternative 4: Ground Water Extraction, Treatment and Reinjection

This alternative includes extraction, treatment and reinjection of the treated ground water. A ground water treatment system would probably have to treat the extracted ground water down to NYSDEC Class GA water quality standards. The reinjection system would require more engineering and equipment than disposal to the POTW.

TABLE 3-1

LIMITS OF TOXIC SUBSTANCES IN SEWAGE DISCHARGE*

Contaminant	24 Hour Composite
Chromium, Hexavalent	5.5 mg/l
Copper (Total)	2.1.mg/l
Cadmium (Total)	1.0 mg/l
Cyanide (D)	0.2 mg/l
Zinc (Total)	20.0 mg/l
Nickel (Total)	0.9 mg/l
Arsenic (D)	0.02 mg/l
Lead (Total)	18.0 mg/l
Mercury (D)	0.7 mg/l
Silver (D)	10.2 mg/l
Trichlorethylene	1.0 mg/l

(D) - Dissolved- amenable to chlorination

*From City of Olean Sewer Use Ordinance.

3.1.3 Summary of Alternatives for Structures/Vats Remediation

Remedial alternatives for contaminated structures/vats are summarized below:

- Alternative 1: No Action/Limited Action
- Alternative 2: Demolition/Dismantling and Off-Site Landfill Disposal
- Alternative 3: Decontamination of Structure Surfaces

Alternative 1: No Action/Limited Action

This alternative would include restricting access to contaminated structures by boarding-up the on-site structures and upgrading fencing around the site. The no action/limited action alternative is presented here as a baseline against which to judge other alternatives. This alternative may be unacceptable in terms of environmental impact, public health, and/or regulatory restriction concerns.

Alternative 2: Demolition/Dismantling and Off-Site Landfill Disposal

The objective of this alternative is to remove or decontaminate the source of the contaminated structures/vats and to demolish the plant. The disposal of the materials would be at an off-site construction and demolition (C&D) landfill. This alternative consists of: 1) decontaminating the structure using various methods (e.g., steam cleaning, scarification, grit blasting); 2) demolition/dismantling of structures, which can be done using a variety of methods previously discussed; and 3) transporting the debris to a landfill. Some of the materials may require additional decontamination prior to landfilling in a C&D landfill.

Alternative 3: Decontamination of Surfaces

Steam cleaning, grit blasting and scarification can be used to remove the contaminants from the structural surfaces. As previously discussed this alternative involves the use of technologies which would be selected for use based upon the specific contaminant and surface characteristics.

3.2 Screening of Remedial Alternatives (Phase II FS)

In this section, remedial alternatives discussed in Section 3.1 for soil/sediment, ground water and structures/vats are screened on the basis of effectiveness and implementability. The objective of the screening is to narrow the list of potential alternatives that will be evaluated in detail during the Phase III FS. Pursuant to the May, 1990 NYSDEC TAGM, cost was not used as an evaluation criteria. The evaluation forms for effectiveness and implementability from the above mentioned TAGM are included in Appendix A. A summary of the scoring results are presented in Tables 3-2 and 3-3.

3.2.1 Evaluation of Soil Remediation Alternatives

Alternative 1: No Action/Limited Action

The no action/limited action alternative has been retained only to provide a baseline condition against which other alternatives can be compared. As the title states, this alternative involves no remedial action, except fencing the site and land use restrictions. This alternative would leave the site in its present condition and does not meet remedial objectives.

TABLE 3-2 PRELIMINARY SCREENING OF SOIL REMEDIATION ALTERNATIVES

Alternatives	Short Term/Long Term Effectiveness									Implementability				Total Score
	1	2	3	4	5	6	7	8	Sum	1	2	3	Sum	
1. No Action	4	0	1	0	0	0	0	0	**5**	9	2	3	**14**	**19**
2. Capping and Grading.	3	3	2	0	0	3	0	1	**12**	8	0	3	**11**	**23**
3. Excavation & Off-Site Landfill Disposal.	3	3	2	0	0	3	5	4	**20**	10	1	3	**14**	**34**
4. On-Site Soil Washing.	3	3	2	3	3	0	5	3	**22**	6	1	2	**9**	**31**
5. On-Site Stabilization/ Solidification.	3	3	2	3	3	0	5	3	**22**	7	1	3	**11**	**33**
6. On-Site Stabilization/ Solidification and Capping	3	3	2	3	3	0	5	2	**21**	8	0	2	**10**	**31**
7. Storm Sewer Cleaning.	4	3	2	3	3	0	4	4	**23**	10	2	3	**15**	**38**

TABLE 3-3 PRELIMINARY SCREENING OF GROUNDWATER REMEDIATION ALTERNATIVES

Alternatives	Short Term/Long Term Effectiveness									Implementability				Total Score
	1	2	3	4	5	6	7	8	Sum	1	2	3	Sum	
1. No Action	4	0	1	0	0	0	0	0	**5**	9	2	3	**14**	**19**
2. GW Extraction, Treatment, & Discharge to Surface Water.	4	4	1	3	3	0	4	2	**21**	8	0	3	**11**	**32**
3. GW Extraction, Pretraetment, & Discharge to POTW.	4	4	1	3	3	0	4	2	**21**	8	0	3	**11**	**32**
4. GW Extraction, Treatment, & Reinjection.	4	4	1	3	3	0	3	1	**19**	6	0	3	**9**	**28**

Effectiveness

No action/limited action is not considered effective, because environmental and public health risks (due to the contamination at the site) would not be alleviated by this alternative. The magnitude of risks would remain the same and any reduction in risk would be due to natural attenuation. The contaminated soils/sediments would continue to be subjected to surface water percolation and run-off as well as lateral and vertical seepage, which could cause additional ground water and surface water contamination. Additionally, chromium could potentially migrate via fugitive dust.

Implementability

There would be no significant technical difficulty associated with the implementation of this alternative. Land use restrictions associated with this alternative would require minor coordination activities between NYSDEC and the local government.

Alternative 2: Capping of Contaminated Soils; Removal of Sediments

This alternative involves capping the site, or a portion of it, with a composite cap and grading the surrounding area. Capping of the soils would limit fugitive dust migration. It would also limit surface water infiltration thereby controlling contaminated ground water migration. Contaminated sediments from Two Mile Creek would be dredged, dewatered and disposed of in an off-site landfill or consolidated with the on-site soils prior to capping.

Effectiveness

A properly installed and maintained cap would be effective in limiting exposure and fugitive dust migration, since the contaminated soil would be physically isolated. This alternative would satisfy the remedial action objectives and would alleviate the short-term risks to human health once the cap is in place. However, potential for long-term risks would still exist, since the source of contamination would remain beneath the cap. Deed restrictions would be needed to maintain long-term effectiveness.

Dredging and subsequent management of contaminated sediments is a viable alternative for handling contaminated sediments. The remedial action objectives for sediment would be satisfied under this alternative.

Implementability

Capping technology is reliable and well demonstrated. The materials, equipment, and labor to grade and cap the site are readily available. The composite cap presents a fairly durable, weather resistant surface; however, it is susceptible to cracking and settling if not properly maintained. The capping option is particularly attractive if the plant building is removed. If present, the configuration of the plant building makes the installation of the cap very difficult.

Capping the site would require restricting its future use. The site would need to be securely fenced to prevent damage to the cap. Capping and fencing the site would preclude using the site as a residential area.

Mechanical dredging could resuspend contaminated sediment, thereby increasing the potential for downstream contaminant migration. This potential problem can be controlled by dredging during periods of low flow, and through the use of turbidity controls (e.g., silt curtains).

Alternative 3: Excavation and Off-Site Landfill Disposal

This alternative includes excavation of contaminated soil, dredging of contaminated sediments, and disposal of both soil and sediments in an off-site landfill. Excavation of the contaminated soils/sediments would require a field mobilization program which may include construction of the following:

- o A haul road to provide stabilized access to the site;
- o A decontamination pad for decontaminating excavation equipment; and
- o A staging area for dewatering and temporary storage of excavated soils.

Remedial action for the contaminated sediments under this alternative would be the same as described for soil/sediment Alternative 2.

Effectiveness

This alternative relies on established technologies for removal and disposal of contaminated soil. Additionally, remedial action objectives for the soil/sediment would be met. The possibility of human health risks from on-site inhalation would be limited, although the potential for future contaminant migration from the off-site landfill would still potentially exist. In addition, the potential for ground water or surface water contamination from the soil would be reduced.

The effectiveness evaluation for remediation of the contaminated sediment was previously discussed under soil/sediment Alternative 2.

Implementability

Under this alternative, it will be necessary to identify a landfill to accept the contaminated soil and sediments. Treatment may be required at the site, prior to landfilling, to meet landfill acceptance criteria and RCRA requirements.

Alternative 4: Soil Washing

This alternative involves excavation followed by soil washing. As previously discussed, inorganic contaminants can be washed from contaminated soils/sediments by means of an extraction process termed "soil washing". This process extracts contaminants from the soil/sediment matrix using a liquid medium as the washing solution. This washing solution is then treated for removal of the contaminants and discharged to the POTW, surface water or ground water. Solutions with the greatest potential for use in soil washing fall into the following classes:

- o Acids-bases;
- o Complexing and chelating agents; and
- o Certain reducing/oxidizing agents.

Water alone can be used to leach water-soluble or water-mobile organics and inorganics. However, for most inorganics, including lead, chromium, barium, arsenic and copper, adjusting the pH with dilute solutions of acids or bases will enhance inorganic solubilization and removal.

Desirable soil washing fluid characteristics are listed below:

- o Favorable separation coefficient for extraction;
- o Low volatility;
- o Low toxicity;
- o Safety and ease of handling;
- o Recoverability; and
- o Treatability of washing fluid.

Effectiveness

Soil washing is an extracting process with a number of variations that range from experimental to full scale. Acids, bases, and chelating and/or solvent solutions have been used to extract the metals from soil. The extracting solutions are treated to recover or concentrate the metals. Although the treated soil could theoretically be backfilled if delisted, concentrated metal sludge must be disposed of as a hazardous waste.

The effectiveness of this technology at the Van Der Horst site would be related to the soil type, extracting agent, and other factors. A pilot study is needed to evaluate the chemicals required and the efficiency of the soil washing system.

Implementability

Soil washing systems have experienced some problems related to soil/liquid separation. These problems were encountered subsequent to the washing phase, due to the high percentage of silt or clay in the soil material. In general, if the contaminated soil contains more than 50% clay material, soil washing is not an effective remedial technology. However, if the contaminated soil contains more than 50% sand and gravel materials, soil washing may provide a cost-effective solution.

Review of the characteristics of the unconsolidated strata (0 to 60 ft.) at the Van Der Horst site indicates the soil is primarily gravel and sand with occasional cobbles. Thus, soil washing appears to be a feasible remedial alternative for this site.

Alternative 5: On-Site Solidification/Stabilization

Under this alternative, contaminated soil would be excavated and contaminated sediment would be dredged. The contaminated soil and sediment would be solidified/stabilized on-site. The treated media would then be backfilled on-site or disposed of off-site in a landfill. The method of excavation or dredging would be the same as described for Alternative 3.

A cement-based or thermoplastic solidification process appears feasible for the Van Der Horst site, since this technique has proven effectiveness in treating soils contaminated with heavy metals and low-level organics. However, bench-scale and pilot-scale studies are needed to evaluate the optimum solidification/stabilization process.

Factors to be considered include leachability, volume increase, and strength of the solidified material.

Solidification of the contaminated soil and sediment is expected to result in an increase in volume of approximately 40%. The actual increase in volume would be evaluated by bench- and pilot-scale studies. Although solidification of the contaminated soil and sediment would reduce the potential for direct contact with heavy metals, it appears the treated soil may still be defined as a RCRA-listed hazardous waste due to its contact with a hazardous waste (e.g., chromic acid).

Effectiveness

Excavation/dredging and landfilling are both established technologies. Solidification/stabilization techniques have been effective in immobilizing organic and inorganic contaminants in a solid monolith, thereby limiting their release to the environment and the possibility of direct contact with potential receptors. Thus, under this remedial alternative the remedial action objectives for the soil and sediment appear to be satisfied.

The major issue regarding solidification is its long term performance. Studies may be conducted during the bench-scale and pilot-plant testing to evaluate long-term leaching potential of the solidified material.

Implementability

During implementation of this alternative, the solidified material would be placed in lined dump trucks or trailers and transported to the closest available hazardous waste landfill. Thus, prior to implementing an on-site solidification/stabilization technology, a preliminary bench-scale study will be needed to evaluate the suitability of this technology relative to off-site transport.

Alternative 6: On-Site Solidification/Stabilization and Capping

Remedial action under this alternative would include the same methods as described for soil/sediment Alternatives 2 and 5. In this case the contaminated soil would be excavated, dredged, treated (solidified/stabilized), backfilled and capped on-site.

Effectiveness

Excavation/dredging and landfilling beneath a composite capping system are all established technologies.

Solidification/Stabilization technologies have been effective in immobilizing organic and inorganic contaminants in a solid monolith, thereby limiting their release to the environment and the possibility of direct contact with potential receptors. Thus, under this remedial alternative, the remedial action objectives for the soil and sediment appear to be satisfied.

As previously stated, the major issue regarding solidification/stabilization is its long term performance. Studies may be conducted during bench-sale and pilot-plant testing to evaluate long term leaching potential of the solidified/stabilized material.

Implementability

This alternative would be technically implementable, as discussed for soil/sediment Alternatives 2 and 5. During implementation of this alternative, a preliminary bench-scale study will be needed to evaluate the suitability of this technology. Note that this alternative offers no significant advantages over Alternative 5, based on implementability and effectiveness (see Table 3-2).

Alternative 7: On-site Storm Sewer line Cleaning

This alternative would involve the use of mechanical and hydraulic sewer cleaning methods to remove sediment from the on-site storm sewer line lines between Van Der Horst Plant 2 and Two Mile Creek. The sediment will then be dewatered. The resulting liquids will be discharged to the local sanitary sewer system and the dewatered sediment will be treated and/or disposed of by one of the alternatives applicable to soil/sediment.

Effectiveness

This alternative satisfies the remedial action objectives for the on-site storm sewer line because it removes any past deposits of contamination and limits the potential future sources of contamination in the on-site storm sewer line. However, the effectiveness of the treatment of the sediment is dependent upon the selected soil treatment technology, since the sediment is being treated with the contaminated soil.

Implementability

This alternative would be readily implementable. The hydraulic and mechanical cleaning techniques are available and have been utilized extensively in the past. The equipment and techniques for collecting the sediment and dewatering it are also tried and available methods.

3.2.2 Evaluation of Ground Water Migration Control Alternatives

Four (4) ground water alternatives are discussed in this section. These alternatives, except for the no action/limited action alternative, involve pumping, treatment and disposal of contaminated water.

The preliminary screening of treatment technologies was discussed in Sections 2.6 and 2.7. Based on this preliminary technology screening, five metal treatment options and three organic chemical treatment options were selected. Section 3.2.2.1 discusses the screening of these treatment options and the incorporation of the selected options into the alternatives. Screening of the ground water alternatives is then addressed in Section 3.2.2.2.

3.2.2.1 Treatment Option Screening

The objective of ground water treatment is to reduce the concentrations of both inorganic and organic contaminants in the ground water to appropriate clean-up standards. These clean-up standards are established by a health risk assessment and compared with SCGs. These treatment processes can be implemented by installing or mobilizing the equipment at the site or by transporting the water to an off-site facility.

Metal Treatment Option 1: Conventional Chemical Precipitation

Chemical precipitation (i.e., precipitation/ flocculation/sedimentation) is the most common technique for the removal of heavy metals from wastewaters. The chemicals most frequently used for precipitation of metals are lime, caustic soda, and sodium carbonate. Although most heavy metals are precipitated readily without pH adjustment, hexavalent chromium is highly soluble and does not precipitate out of solution at any pH. Consequently, treatment for chromium usually consists of a two-stage process. First, the hexavalent chromium is reduced to the trivalent form (i.e, chemical reduction). Second, the trivalent chromium is precipitated out of solution and the water is neutralized prior to discharge.

Reducing agents most commonly employed are gaseous sulfur dioxide or a solution of sodium bisulfite. Since the reduction proceeds rapidly at low pH, an acid (for example, sulfuric acid or hydrochloric acid) is usually added to keep the wastewater pH between 2 and 3. The reduced chromium waste stream is then treated in the neutralization/precipitation stage for removal of heavy metals.

Metal Treatment Option 2: Sulfide Precipitation

Since most metals form stable sulfides, removals can be attained by sulfide precipitation. Sulfide precipitation yields lower residual metal concentrations than hydroxide precipitation, and metal sulfides usually settle faster and can be dewatered more readily than hydroxide sludges.

Sulfide precipitation processes currently used for wastewater treatment fall into two broad categories: 1) the soluble sulfide process (SSP); and 2) the insoluble sulfide process (ISP). In the SSP, the sulfide is added in the form of a water-soluble reagent, such as sodium sulfide. In the ISP process, developed by Permutt Co., a fresh prepared slurry (made by reacting ferrous sulfate and NaHS) serves as the source of sulfide ions. Sulfide and ferrous ions reduce hexavalent chromium to the trivalent state, thereby eliminating the need to treat the chromium wastes separately.

Metal Treatment Option 3: Ion Exchange

Ion exchange is a stoichiometric and reversible chemical reaction, wherein an ion from solution is exchanged for a similarly charged ion attached to an immobile solid particle. Although there are numerous inorganic materials possessing ion exchange capability, the synthetic organic sorptive resins are the predominant type used today because their characteristics can be tailored to specific applications.

Wastewater pretreatment requirements consist of pH adjustment to ensure that pH is within the operating range of the resin, and filtration to remove suspended solids that would foul the resin bed. A major drawback of ion exchange is that the resin must be regenerated after it has exhausted its exchange capacity. This problem complicates the operation of the system considerably. Hence, this treatment option is <u>not</u> retained for further evaluation.

Organic Chemical Treatment Option 1 and Metal Treatment Option 4: Activated Carbon Adsorption

Benzene and chromium have been found to be readily adsorbed onto activated carbon, due to their high affinity towards activated carbon. Most applications involve the use of adsorption units which contain granular activated carbon (GAC) and operate in a downflow series mode. This method has been found to be cost-effective and produces the lowest effluent concentrations relative to other carbon absorber configurations (e.g., downflow in parallel, moving bed, upflow-expanded).

Activated carbon can be implemented into more complex treatment systems. The process is well suited to mobile treatment systems as well as to on-site construction. Space requirements are small, start-up and shut-down are rapid, and there are numerous contractors who are experienced in operating mobile units.

Organic Chemical Treatment Option 2: Air Stripping

Air stripping is a mass transfer process in which volatile contaminants in water are transferred to gas. Air stripping is used to remove volatile organics from aqueous waste streams. Generally, components with Henry's Law constants of greater than 0.003 can be removed by air stripping.

An important factor in the consideration of whether to utilize the air stripping technology for the removal of volatile contaminants, is the air pollution implications of air stripping. The gas stream generated during air stripping treatment may require collection and subsequent treatment or incineration. Hence, this option alone is not retained for further evaluation.

Organic Chemical Treatment Option 3: Air Stripping followed by Carbon Adsorption

Stripping of contamination by means of air has high removal efficiencies with chlorinated hydrocarbons. However, it is difficult to achieve the stringent NYS drinking water standards by air stripping alone. Air stripping followed by carbon adsorption (as a polishing unit) is considered as a viable option. However, the potential of generating air pollution problem plus the need for regenerating exhausted carbon are two major drawbacks. Hence, this option is not retained for further evaluation.

3.2.2.2 Screening of Ground Water Migration Control Alternatives

Alternative 1: No Action/Limited Action Alternative

Under this alternative, no remedial actions would be taken to contain or treat the ground water. However, periodic monitoring of the concentrations of contaminants in monitoring wells and downgradient supply wells, if present, would be implemented.

Effectiveness

This alternative would not be effective in meeting the remedial action objectives. It would help in keeping track of the extent and migration patterns of contamination with the passage of time. Initial contamination found in the aquifer may remain as residual contamination after the implementation of this alternative. Any reduction in the level of contamination would be due to natural processes.

Implementability

No technical difficulties would be associated with implementation of this alternative. However, the no action/limited action alternative may be strongly opposed by the public due to concern over environmental conditions at the site.

Alternative 2: Ground Water Extraction, Treatment and Discharge to Surface Water

This alternative would include extraction of ground water, pretreatment, and discharge of the treated ground water to Two Mile Creek, and would require a SPDES permit. The treatment system would be designed to attain or nearly attain Class C stream standards. It is anticipated such a permit would likely be granted.

Effectiveness

Although the exact hydrogeological behavior of contaminants cannot be predicted, this alternative appears to satisfy ground water remedial objectives for the site.

Implementability

No significant barriers to implementation are expected for this alternative. However, under this alternative ground water would require substantially more treatment than Alternative 3. As noted above, a SPDES permit would be required. The remedial scheme would require land area to locate the treatment units and land use restrictions would be necessary at the location of the treatment units for the duration of remediation.

Alternative 3: Ground Water Extraction, Pretreatment and Discharge to POTW

This alternative would include extraction of ground water, pretreatment, if necessary to meet the City of Olean Sewer Use Ordinance, followed by discharge to the POTW. Pretreatment may involve using either carbon adsorption alone, conventional precipitation followed by carbon adsorption or sulfide precipitation followed by carbon adsorption.

Effectiveness Evaluation

Although the exact hydrogeological behavior of contaminants cannot be predicted, this alternative appears to satisfy ground water remedial objectives for the site.

Implementability

To implement this alternative, a Sewer Use Ordinance permit may be needed. It is anticipated that this permit can be obtained with limited effort. Additionally the POTW would need to be upgraded to handle the added volume.

Alternative 4: Ground Water Extraction, Treatment and Reinjection

This alternative would include extraction of ground water, pretreatment using either conventional precipitation followed by carbon adsorption or sulfide precipitation followed by carbon adsorption. Treated water would then be discharged into the aquifer using injection wells.

Effectiveness

This alternative is effective and appears to satisfy the ground water remedial objectives.

Implementability

A discharge to ground water permit would be necessary to implement this alternative. The injection system would require substantial engineering design and the injection of ground water would have to be done off-site to limit the effects on the capture zone of the extraction system. This alternative would require treatment to more stringent requirements (Class GA) than ground water Alternative 3. Thus, this alternative is not retained for further evaluation because it provides no benefit over Alternatives 2 and 3 and results in substantially more potential implementation problems and costs.

3.2.3 Evaluation of Structure/Vats Alternatives

Alternative 1: No Action/Limited Action

Under this alternative, no remedial actions would be taken to clean or remove the structures/vats. However, securing the site by locking entrances and boarding windows will take place. This, along with the perimeter fence system, will help deter persons from coming into contact with the structures/vats.

Effectiveness

This alternative would not be effective in meeting the remedial action objectives. It would assist in keeping unwanted persons from contacting any potential contaminated surfaces, but it would not reduce the amount of contamination present.

Implementability

No technical difficulties would be associated with implementation of this alternative. However, the no action/limited action alternative may be strongly opposed by the public.

Alternative 2: Demolition and Off-Site Landfill Disposal

This alternative includes demolition of the structure, removal of the vats and disposal of the materials in an off-site landfill. Prior to the demolition and removal, the grossly contaminated structures/vats would be washed or cleaned using methods applicable to the particular material (e.g., steam cleaning, grit blasting, scarification, etc.) to meet disposal requirements for a sanitary or C&D landfill possible. If enough gross contamination is removed, the possibility of a scrap dealer, instead of a landfill, receiving some of the materials is possible.

Effectiveness

This alternative appears to satisfy the remedial objectives for this site.

Implementability

This alternative uses technologies that are currently available. There should be no difficulty in implementing this alternative

Alternative 3: Decontamination of Surfaces

Under this alternative the structure/vats would be decontaminated using various cleaning techniques. The wastes from the cleaning would be contained either treated on-site with the soil/sediment or taken to an off-site facility.

Effectiveness

This alternative would be effective in meeting the remedial action alternatives if the contamination is just on the surface. However, if contamination is imbedded in the building materials decontamination may not be effective. Also, since contamination was found beneath the building floor, the structure appears to need demolition. Thus, this alternative is not retained for further evaluation, since it restricts implementation of the overall site remediation program.

Implementability

This alternative uses proven technology that is readily available and therefore would be highly implementable if just surface contamination is encountered.

3.3 Summary of Screening

Seven (7) alternatives for soil/sediment, three (3) treatment process options for ground water, and two (2) for structures/vats passed the screening and appear to be the most feasible. These alternatives are summarized in this section.

3.3.1 Soil/Sediment Remediation Alternatives

The seven (7) soil/sediment remediation alternatives that appear to be the most feasible, based on the screening process, are summarized below. Each alternative provides a distinctly different and effective (except Alternative 1) approach to addressing soil/sediment remediation in the study area.

- Alternative 1: No Action/Limited Action
- Alternative 2: Capping and Grading of Contaminated Soils; Removal of Sediment
- Alternative 3: Excavation and Off-Site Landfill Disposal
- Alternative 4: On-Site Soil Washing
- Alternative 5: On-Site Solidification/ Stabilization
- Alternative 6: On-Site Solidification/Stabilization and Capping
- Alternative 7: On-Site Storm Sewer Line Cleaning Using Hydraulic Scouring

3.3.2 Ground Water Migration Control Alternatives

Ground water Alternatives 2 and 4, which involved treatment followed by discharge to surface water and ground water, respectively, did not appear as feasible as Alternative 3 based on the screening process. As previously discussed, they involved treatment to more stringent water quality levels, which was not as implementable as discharging to the POTW. Since discharge to surface water appears more feasible then reinjection, Alternative 2 was retained as a contingency in the event that POTW discharge is not acceptable to the local regulatory agencies. The ground water alternatives and treatment options retained for detailed analysis are summarized below:

- Alternative 1: No Action/Limited Action
- Alternative 2: Ground Water Extraction, Pretreatment, if necessary, using Conventional Precipitation and/or Activated Carbon Adsorption and Discharge to City of Olean Wastewater Treatment Plant or Two Mile Creek
- Alternative 3: Ground Water Extraction, Pretreatment, if necessary, using Sulfide Precipitation and/or Activated Carbon Adsorption and Discharge to City of Olean Wastewater Treatment Plant or Two Mile Creek

3.3.3 Structures/Vats Remediation Alternatives

Structures/Vats Remediation Alternative 2, which involves decontaminating the structure, demolishing/dismantling it and landfilling the debris appears to be the only feasible alternative for structures/vats. Decontamination and demolition are necessary to address the chromium contaminated soil below the plant building. Additionally, the present location of the plant structures makes implementation of the majority of the soil remedial alternatives extremely difficult. Thus, the demolition/decontamination alternative along with the no action/limited action alternative are summarized below:

- Alternative 1: No Action/Limited Action

- Alternative 2: Decontamination and Demolition
  Note that Decontamination will include grit blasting and scarification depending on contaminant type and surface to be cleaned.

3.3.4 Comprehensive Remedial Alternatives

The following range of comprehensive alternatives were developed for the Van Der Horst Plant No. 2 site by combining the alternatives for soil/sediment, ground water and structures/vats. These remedial alternatives will be further evaluated during the Treatability Study (Section 4.0) and the Detailed Analysis of Alternatives (Section 5.0).

Alternative 1: (1) No Action/Limited Action

Alternative 2:
(1) Capping the Site (or a specific area of the site)
(2) Dredging of Sediments and Off-Site Landfill Disposal or Consolidation On-Site
(3) Monitoring of Ground Water
(4) Demolition/Decontamination of Plant Building
(5) On-site Storm Sewer line Cleaning

Alternative 3:

(1) Excavation/Dredging of Soil/Sediment and Off-Site Landfill Disposal

(2) Ground Water Extraction, Pretreatment, if necessary, using Conventional Precipitation and/or Carbon Adsorption and Discharge to POTW or Two Mile Creek

(3) Monitoring of Ground Water

(4) Demolition/Decontamination of Plant Building

(5) On-site Storm Sewer line Cleaning

Alternative 4:

(1) Excavation/Dredging of Soil/Sediment and Soil Washing

(2) Ground Water Extraction, Pretreatment, if necessary, using Sulfide Precipitation and/or Carbon Adsorption and Discharge to POTW or Two Mile Creek

(3) Monitoring of Ground Water

(4) Demolition/Decontamination of Plant Building

(5) On-site Storm Sewer line Cleaning

Alternative 5:

(1) Excavation/Dredging of Soil/Sediment followed by Consolidation and On-Site Solidification/Stabilization

(2) Ground Water Extraction, Pretreatment, if necessary, using Sulfide Precipitation and/or Carbon Adsorption and Discharge to POTW or Two Mile Creek

(3) Monitoring of Ground Water

(4) Demolition/Decontamination of Plant Building

(5) On-site Storm Sewer line Cleaning

Alternative 6:

(1) Capping the Site (or a specific area of the site)

(2) Dredging of Sediments and Off-Site Landfill Disposal or Consolidation On-Site

(3) Ground Water Extraction, Pretreatment, if necessary, using Conventional Precipitation and/or Carbon Adsorption and Discharge to POTW or Two Mile Creek

(3) Monitoring of Ground Water

(4) Demolition/Decontamination of Plant Building

(5) On-site Storm Sewer line Cleaning

4.0 TREATABILITY STUDIES

4.1 Introduction

Site-specific treatability studies were not conducted for Van Der Plant No. 2, due to time and budget constraints. However, because some of the contaminants of concern encountered at Plant No. 2 were the same as those encountered at Van Der Horst Plant No. 1, the Plant No. 1 Treatability Study data were considered for use at Plant No. 2. These Plant No. 1 Treatability Study data were reviewed to: 1) provide guidance for preliminary development of treatment alternatives; and 2) to screen-out selected technologies that did not appear to be applicable due to site conditions.

The information presented in this section is based primarily upon the Van Der Horst Plant No. 2 RI and the applicable data from the February 12, 1991 "Van Der Horst Treatability Study" report for Van Der Horst Plant No. 1. The Treatability Study report was prepared by General Testing Corporation (GTC), Rochester, New York and is included in the January 1992 Van Der Horst Plant No. 1 FS Report. Additionally, the USEPA Risk Reduction Engineering Laboratory (RREL) Treatability Database (Version 4, 1991) and the 1990 CERCLA Site Discharges To POTWs Treatability Manual were considered in evaluating treatment technologies for the Plant No. 2 site.

Although there are similarities between the contaminants encountered at Plant No. 1 and Plant No. 2, differences which may impact applicability of the Plant No. 1 treatability data to Plant No. 2 are summarized below:

1) Soil Conditions - It appears that the contaminated soil at Plant No. 1 is comprised of a greater percentage of fill than the soil at Plant No. 2.

2) Ground Water Conditions - There are higher concentrations of organics in the ground water at Plant No. 2.

3) Chemical Differences - Although chromium is the primary contaminant of concern at both sites, Plant No. 2 has a larger number of analytes in the soil and ground water because of different processes used at this plant, and because of on-site landfilling.

4) Concentration Levels - In general, there are higher contaminant concentrations in the soil and ground water at Plant No. 1 than at Plant No. 2.

4.2 Summary of Van Der Horst Plant No. 1 Treatability Study

The treatment technologies evaluated during the Van Der Horst Plant No. 1 Treatability Study and its findings are summarized as follows:

1) Solidification/Stabilization of contaminated soil was evaluated for several solidification agents. The most effective solidification/stabilization method appears to be a 4:1:1 soil to additive to water weight ratio with a 1:1 mixture of lime and ferrous sulfate. The ferrous sulfate reduces the hexavalent chromium while the lime appears to stabilize the metals. The consistency of this mixture after drying is a crumbly solid.

2) Soil Washing of contaminated soil was evaluated for several different soil washing solutions. This treatment technology was found to be ineffective, due to the overall lack of effectiveness in meeting the proposed cleanup requirements, mainly chromium and lead, and was eliminated from the list of applicable technologies for soil remediation.

3) Carbon Adsorption of chromium contaminated ground water was evaluated. This treatment technology was found to be effective in reducing chromium concentrations below POTW levels.

4) Conventional Precipitation of chromium contaminated ground water was evaluated for several treatment processes. A two-step precipitation process using sodium metabisulfite and lime was found to be the most effective of the technologies evaluated.

4.3 Comparison of Plant No. 1 Findings with Plant No.2 Data

4.3.1 Solidification/Stabilization

The maximum concentration of chromium measured in a soil sample from Plant No. 2 (9,690 ppm) was below the original concentration of the Plant No. 1 chromium contaminated soil sample (11,800 ppm) that underwent treatability testing. Thus, it is anticipated that Solidification/Stabilization of the chromium contaminated soil at Plant No. 2 should produce similar chromium results to those shown on Table 4-1. It is currently unknown whether solidification/stabilization would produce the results shown on Table 4-1 for arsenic, barium, cadmium, mercury, selenium and silver, because the maximum

TABLE 4-1
TCLP DATA FROM PLANT NO. 1 SOLIDIFIED/STABILIZED SOILS
units are in ppm unless otherwise stated

TEST	Plant 2 Maximum Total Metals Concentrations	Plant 1 Total Metals Concentrations	Original TCLP Results for Plant 1 Sample	Lime/Ferrous Sulfate TCLP Results for Plant 1 Sample			TCLP Limits
				2:1	3:1	4:1	
% SOLIDS	NA	78.4	NA	NA	NA	NA	NA
Hex Chromium	NA	943	NA	14	21	10	NA
Arsenic	390	23.2	<0.5	<0.50	<0.50	<0.50	5.0
Barium	35100	3280	3.91	0.8	0.83	1	100.0
Cadmium	21.9	<0.5	<0.1	NA	NA	NA	1.0
Chromium	9690	11800	0.717	1.8	2.1	1.6	5.0
Lead	3230	8960	39.2	<0.10	<0.10	<0.10	5.0
Mercury	2.6	0.363	<0.002	<0.002	<0.002	<0.002	0.2
Selenium	9.2	<0.5	<0.5	NA	NA	NA	1.0
Silver	8.7	<1	<0.1	NA	NA	NA	5.0

(shaded) - PLANT 2 MAXIMUM CONCENTRATION EXCEEDS PLANT 1 TREATABILITY TEST CASE.

NA - NOT ANALYZED

concentrations of these metals in soil samples collected from Plant No. 2 were higher than the original concentrations of the Plant No. 1 soil sample that underwent treatability testing. However, based on the magnitude of the concentrations of these metals in the Plant No. 2 soil, it is anticipated that a solidified/stabilized sample of Plant No. 2 soil containing the maximum concentrations measured to date would be within the TCLP limits for these metals. Additionally, the 1986 USEPA "Handbook for Stabilization/Solidification of Hazardous Wastes" states that cement-based solidification technologies are generally effective for heavy metals.

4.3.2 Ground Water Treatment

The maximum Plant No. 2 hexavalent chromium concentration in ground water (0.073 ppm) was below the original chromium concentration of the Plant No. 1 ground water sample (6.96 ppm) that underwent activated carbon treatability testing. Thus, it is anticipated that this technology would be successful in reducing the hexavalent chromium concentrations in Plant No. 2 ground water, if required prior to POTW discharge. Based on the Plant No. 2 ground water data collected to date, it is anticipated that the analyte concentrations of the extracted Plant No. 2 ground water will be within the POTW sewer discharge limits. However, due to concerns regarding a resulting increase in chromium concentrations in its sludge, the local POTW has indicated that on-site pretreatment of ground water will be required.

Note that based on the USEPA Risk Reduction Engineering Laboratory (RREL) data base (Version 4, 1991), activated carbon is not effective in removing beryllium from wastewater. However, this same data base indicates that activated-sludge technologies (similar to the Olean POTW) have a 50 percent removal efficiency for beryllium.

Table 4-2 presents a comparison of maximum concentrations of various metals in ground water samples collected at Plant No. 2 with the Plant No. 1 Treatability Study data for two-step conventional precipitation. The maximum Plant No. 2 chromium concentration in ground water (1.2 ppm) was below the original concentration of the Plant No. 1 ground water sample (20.8 ppm) that underwent treatability testing. Thus, it is anticipated that the Plant No. 2 ground water can be successfully treated for chromium using the sodium metabisulfite and lime two-step conventional precipitation method. However, the maximum concentrations of arsenic, barium, cadmium, lead, mercury and iron in Plant No. 2 ground water samples exceeded the concentrations in the Plant No. 1

Table 4-2
PLANT 2 GROUND WATER CONCENTRATIONS AND PLANT 1 TREATED GROUND WATER RESULTS

Reducing Agent	Plant 2 Max.	Plant 1	POTW	NYSDEC	$Na_2S_2O_5$	$Na_2S_2O_5$	$FeSO_4$	$FeSO_4$	SO_2	SO_2	Na_2S	Na_2S
Precip. Agent	**Water Conc.**	**Water**	**Limits**	**Class GA**	**Lime**	NaOH	Lime	NaOH	**Lime**	**NaOH**	**Lime**	**NaOH**
Volume	NA	NA	NA	NA	1700 ml	1700 ml	2000 ml	2000 ml	2000 ml	2000 ml	1700 ml	1700 ml
pH	NA	7.5	NA	NA	10.1	10.1	10	10	10.3	10	10.4	10.2
Suspended solids	NA	24.6	NA	NA	89	90.6	27.4	3	131	59.8	2.5	55.5
Hex Cr	0.073	6.96	5.5	0.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
As	0.0652	<0.005	0.02	0.025	----	----	----	----	----	----	----	----
Ba	1.31	0.075	NA	1	<0.10	<0.10	0.2	<0.10	<0.10	<0.10	0.16	<0.10
Cd	0.012	<0.005	1	0.01	----	----	----	----	----	----	----	----
Cr	1.5	20.8	NA	0.5	0.051	7.6	0.052	0.029	0.022	6.5	0.043	12.4
Pb	0.24	<0.50	18	0.025	----	----	----	----	----	----	----	----
Hg	0.0003	<0.0002	0.7	0.002	----	----	----	----	----	----	----	----
Se	NA	<0.005	NA	0.01	----	----	----	----	----	----	----	----
Ag	0.015	0.21	10.2	0.05	<0.010	<0.010	<0.010	<0.010	0.023	0.017	0.02	0.012
Fe	212	1.62	NA	0.3	<0.050	<0.050	1.33	1.39	0.06	0.11	<0.05	0.15

NOTE:
1) EXCEPT WHERE NOTED, UNITS ARE IN mg/L.
2) TREATABILITY STUDY RESULTS ARE FOR TWO STEP PRECIPITATION PROCESS.
3) NA=NOT AVAILABLE
4) ----- = NOT ANALYZED
(shaded) - PLANT 2 MAXIMUM CONCENTRATION EXCEEDS PLANT 1 TREATABILITY TEST CASE.

ground water that underwent treatability testing. Thus, additional treatability testing of Plant No. 2 ground water would be needed to verify that conventional precipitation of Plant No. 2 ground water would reduce the levels of the six aforementioned metals below NYSDEC water quality standards.

4.4 Alternative Summary

The comprehensive alternatives were modified based on a review of the applicable Plant No. 1 Treatability Study data. The primary modifications that were made to the comprehensive alternatives based on Treatability Study data were: 1) the elimination of soil washing as an effective technology for the on-site contaminated soil; and 2) the elimination of sulfide precipitation as an effective technology for the on-site contaminated ground water. The comprehensive alternatives are summarized below and are further evaluated in Section 5.0 of this FS report.

Alternative 1: (1) No Action/Limited Action

Alternative 2:
(1) Capping the Site (or a specific area of the site)
(2) Removal of Sediments and Off-Site Landfill Disposal or Consolidation On-Site
(3) Monitoring of Ground Water
(4) Demolition/Decontamination of Plant Bldg.
(5) On-site Storm Sewer line Cleaning

Alternative 3:
(1) Excavation of Soil/Sediment and Off-Site Landfill Disposal
(2) Ground Water Extraction, Pretreatment, if necessary, using Conventional Precipitation and/or Carbon Adsorption and Discharge to POTW or Two Mile Creek
(3) Monitoring of Ground Water
(4) Demolition/Decontamination of Plant Building
(5) On-site Storm Sewer line Cleaning

Alternative 4: (Formerly Section 3.0 Alternative 5)	(1)	Excavation of Soil/Sediment followed by Consolidation and On-Site Solidification/Stabilization
	(2)	Ground Water Extraction, Pretreatment, if necessary, using Conventional Precipitation and/or Carbon Adsorption and Discharge to POTW or Two Mile Creek
	(3)	Monitoring of Ground Water
	(4)	Demolition/Decontamination of Plant Building
	(5)	On-site Storm Sewer line Cleaning
Alternative 5: (Formerly Section 3.0 Alternative 6)	(1)	Capping the Site (or a specific area of the site)
	(2)	Removal of Sediments and Off-Site Landfill Disposal or Consolidation On-Site
	(3)	Ground Water Extraction, Pretreatment, if necessary, using Conventional Precipitation and/or Carbon Adsorption and Discharge to POTW or Two Mile Creek
	(4)	Monitoring of Ground Water
	(5)	Demolition/Decontamination of Plant Bldg.
	(6)	On-site Storm Sewer line Cleaning

5.0 DETAILED ANALYSIS OF ALTERNATIVES

The five (5) potential comprehensive alternatives developed for the Van Der Horst Plant No. 2 site are outlined in the previous section, and are summarized on Table 5-1. These remedial alternatives undergo a more detailed evaluation in this section.

The detailed evaluation of alternatives (Phase III FS) includes an individual analysis of the alternatives relative to criteria described in USEPA 540/6-89/004, and a comparative analysis of the relative performance of each of the alternatives. Completed evaluation forms for each alternative (adapted from the May 1990 NYSDEC-TAGM for criteria 1 through 6) are included in Appendix C. The comparative analysis identifies the relative advantages and disadvantages of each alternative and includes a measure of remediation and cost-effectiveness. Ultimately, the comparative analysis leads to the selection of the recommended alternative.

5.1 Individual Analysis of Alternatives

The five (5) remedial alternatives represent a range of distinct waste management strategies which, to a varying degree, address human health and environmental concerns associated with the site. Although the selected alternative will be further refined as

TABLE 5-1
SUMMARY OF ALTERNATIVES

MEDIA	Technologies	Alternative 1	2	3	4	5
Ground Water	Monitoring/Institutional Actions	●	●	●	●	●
	Extraction			●	●	●
	Carbon Absorption and Discharge to POTW or Conventional Precipitation and discharge to Surface Water			●	●	●
Soil/Sediment	Capping		●			●
	Excavation/Dredging		●	●	●	●
	Off-Site Disposal			●		
	Solidification/Stabilization and on-site disposal				●	
	Storm Sewer Cleaning/Dredging		●	●	●	●
Structures/Vats	Building Decontamination/Demolition/Dismantling		●	●	●	●

necessary during the design phase, these alternatives reflect the fundamental components of the various alternative hazardous waste management approaches being considered for this site. These alternatives are evaluated with respect to seven (7) of the nine (9) criteria recommended in USEPA 540/G-89/004. The seven (7) criteria are summarized in the following paragraphs. State acceptance and community acceptance, the remaining two (2) criteria, are not dealt with herein but will be addressed in the Record of Decision (ROD), once public comments have been received on the RI/FS report.

1) Overall Protection of Human Health and the Environment - The evaluation of each alternative with respect to the overall protection of human health and the environment provides a summary of how the alternative reduces the risk from potential exposure pathways through treatment, engineering or institutional controls. This criteria also evaluates whether alternatives pose unacceptable short-term or cross-media impacts. Pursuant to NYSDEC's request for this project, the risks associated with each alternative were evaluated qualitatively as opposed to a quantitative evaluation.

2) Compliance with SCGs - The applicable or relevant and appropriate New York State Standards, Criteria and Guidelines (SCGs) are applied to each alternative. The ability of each alternative to meet the SCGs or the need to justify a waiver is noted for each.

3) Long-Term Effectiveness and Permanence - Long-term effectiveness and permanence are evaluated with respect to the magnitude of residual risk and the adequacy and reliability of controls used to manage remaining waste (i.e., untreated waste and treatment residuals) over the long-term. Alternatives that have the highest degree of long-term effectiveness and permanence are those that leave little or no waste remaining at the site, such that long-term maintenance and monitoring are unnecessary and reliance on institutional controls is limited.

4) Reduction of Toxicity, Mobility, or Volume Through Treatment - Evaluation of reduction of toxicity, mobility, or volume through treatment addresses the anticipated performance of the treatment technologies. This evaluation relates to the statutory preference for selecting a remedial action that uses treatment to reduce the toxicity, mobility, or volume of hazardous substances. Aspects of this criteria include: 1) the amount of waste treated or destroyed; 2) the reduction of toxicity, mobility, or volume; 3) the irreversibility of the treatment process; and 4) the type and quantity of residuals resulting from any treatment process.

5) **Short-Term Effectiveness** - Evaluation of alternatives with respect to short-term effectiveness takes into account: 1) protection of workers and the community during the remedial action; 2) environmental impacts from implementing the action; and 3) the time required to achieve the cleanup goals.

6) **Implementability** - Implementability deals with the administrative and technical feasibility of implementing the alternatives as well as the availability of necessary goods and services. This evaluation includes such items as: 1) the ability to obtain services, capacities, and equipment; 2) the ability to construct and operate components of the alternative; 3) the ability to monitor the performance and the effectiveness of the technologies; and 4) the ability to obtain the necessary approvals and permits from other agencies.

7) **Costs** - Costs are divided into capital and operation and maintenance (O&M) costs. Capital costs include those expenditures required to implement a remedial action (i.e., both direct and indirect costs are considered). Direct capital costs include construction costs or expenditures for equipment, labor, and materials required to implement a remedial action. Indirect capital costs include those associated with engineering, permitting (as required), construction management, and other services necessary to carry out a remedial action.

Annual O&M costs include labor, maintenance materials, energy, and purchased services. The O&M costs include costs incurred even after the initial remedial activity is complete. The 1991 present worth costs are estimated using a 5 percent discount per year for the time period associated with implementation of the specific alternative, not to exceed 30 years. Tables summarizing the basis for each cost and the actual cost estimate summaries are included in Appendix D.

The cost estimates presented herein are order-of-magnitude estimates; these costs are based on vendor information, conventional cost estimating guides, generic unit costs and prior experience. The feasibility study cost estimates shown have been prepared for guidance in project evaluation from the information available at the time of the estimate. The real costs of the project at the time of implementation will depend on real labor and material costs, site conditions, competitive market conditions, final project scope, the implementation schedule, and other variable factors both anticipated and unforseen. An uncertainty that would affect the cost is actual volumes of contaminated soil, sediment and ground water. The accuracy of these "study estimate" costs are expected to be in the range of +50 percent to -30 percent based on assumed site conditions and other variables as mentioned above.

Sensitivity analyses were not conducted on the individual costs. This analysis was considered to be of limited value for this site since the primary parameters that have a large degree of uncertainty associated with them (e.g., contaminated soil and water volumes) have a similar impact on the costs of Alternatives 2 through 5. The cost of Alternative 1 is substantially lower than Alternatives 2 through 5. Thus, a sensitivity analyses will not change the relative ranking of the alternatives with respect to cost. However, Section 6.0 includes a sensitivity analysis that was conducted on the selected alternative to estimate the need for contingency or reserve funds.

5.1.1 Common Components Alternatives 1 through 5

Alternatives 1 through 5 have the following two (2) common components: 1) supply well restrictions; and 2) ground water monitoring. Descriptions of these components are presented below and the evaluation of these alternatives is included with the assessment of Alternative 3.

- **Supply well restrictions** - The local government or agencies will be requested to oversee well installation and use in the area that is, or is expected to be, within the affected area. This oversight may include a local regulation requiring a review/permit for all proposed ground water well installation and use plans. This regulation would prohibit installing or using wells in contaminated areas of the aquifer until ground water meets NYSDEC water quality standards.

- **Ground water monitoring** - Ground water monitoring is a method of evaluating the long-term performance of the selected remedial alternative by reviewing the contaminant concentrations within the ground water over time. Ground water monitoring of indicator parameters within the existing monitoring wells would be done periodically, until the parameter levels are below the SCG levels. This periodic monitoring program would continue beyond the cessation of remediation (for a limited time) to verify that contamination has been removed from the local ground water.

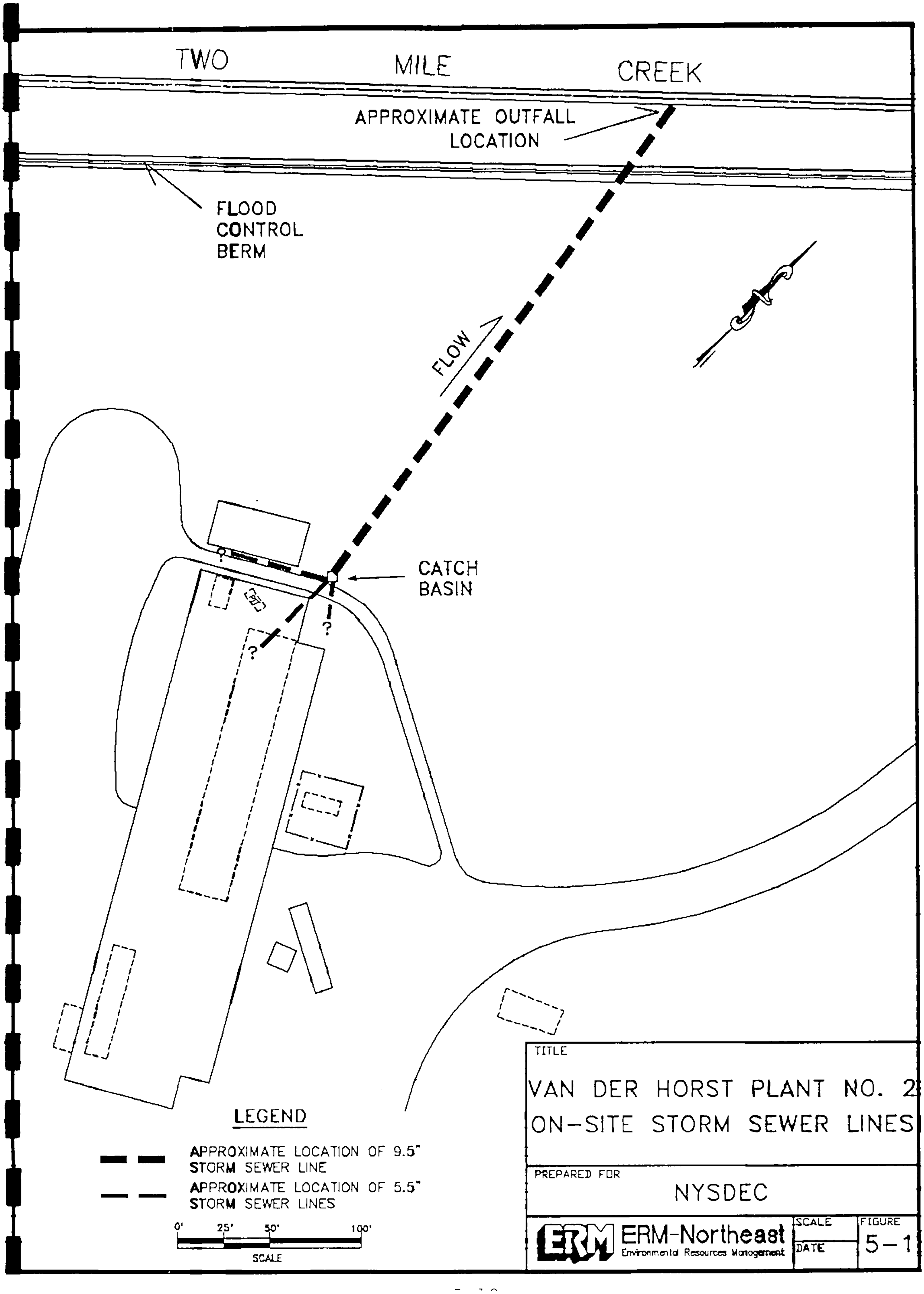
Alternatives 2 through 5

Alternatives 2 through 5 have the following four (4) common components, as well as the two listed above: 1) storm sewer cleaning; 2) dredging of creek sediments; 3)demolition/ decontamination of structures/vats; and 4) excavation. These components are described below.

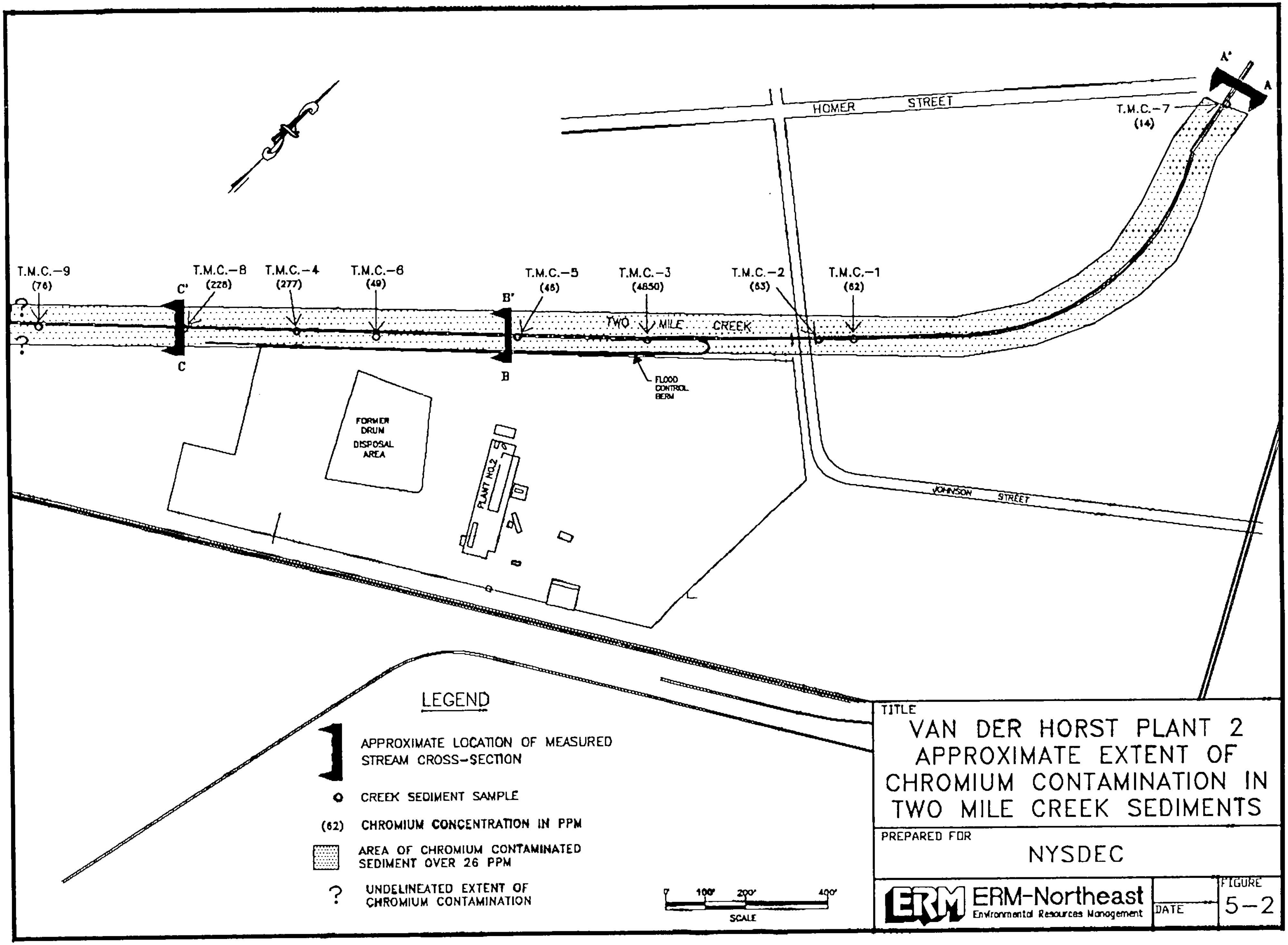
- **Storm Sewer Cleaning** - Storm Sewer cleaning consists of using a high pressure water wash to clean contaminated sediment and debris from the storm sewer system. The sediment/debris will be collected at the manholes and transported in a vacuum truck to a mobil filter press for dewatering, if necessary. The dewatered storm-sewer sediment/debris would then be transported and disposed of along with the sediment dredged from Two Mile Creek. Video taping of the sewer will be preformed immediately following the cleaning of each reach to verify the cleaning process, prior to contractor demobilization.

Description of Sewer Cleaning; Dredging, Demo/Decon

The storm sewer line that presently appears to require cleaning is shown in Figure 5-1. Note that the storm sewer lines associated with the roof and floor drains in and around the plant building will require further sampling prior to remediation to evaluate whether these lines also contain contaminated sediments. It is currently anticipated that the storm sewer cleaning program, at a minimum, will involve the cleaning of 484 linear feet of line between the catch basin and Two Mile Creek and the catchbasin (see Figure 5-1). The estimated volume of sediment that will be removed, based on visual estimates of the depth of sediment in the line and catchbasin, is approximately 0.53 cubic yards.

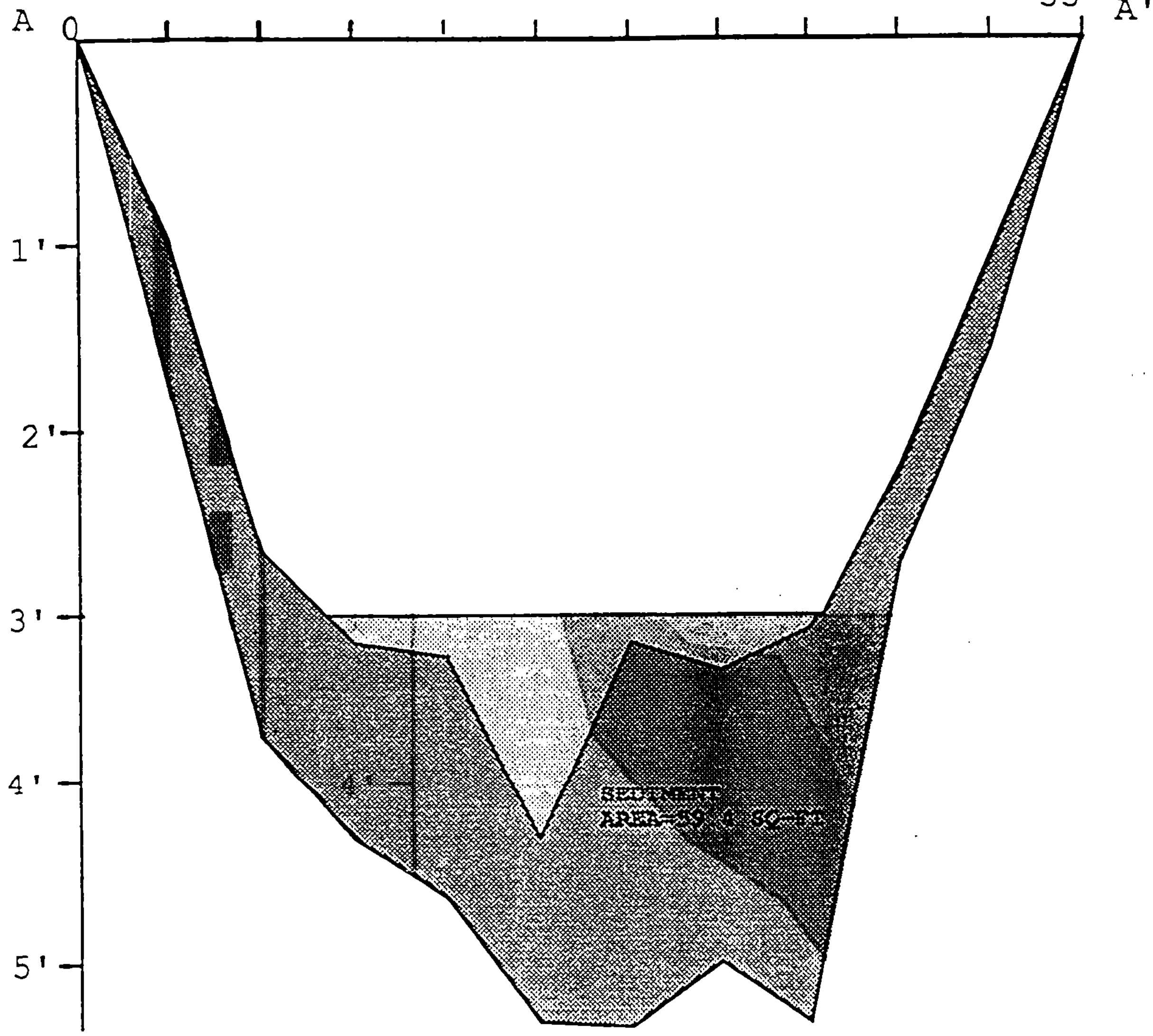

TWO MILE CREEK
APPROXIMATE OUTFALL LOCATION
FLOOD CONTROL BERM
FLOW
CATCH BASIN
?
?
LEGEND
APPROXIMATE LOCATION OF 9.5" STORM SEWER LINE
APPROXIMATE LOCATION OF 5.5" STORM SEWER LINES
0' 25' 50' 100'
SCALE
TITLE
VAN DER HORST PLANT NO. 2
ON-SITE STORM SEWER LINES
PREPARED FOR
NYSDEC
ERM-Northeast
Environmental Resources Management
SCALE
DATE
FIGURE
5-1

- **Dredging** - An approximate 2,611 foot section of Two Mile Creek (Figure 5-2) with an average cross-sectional area of approximately 39 square feet (Figures 5-3 through 5-5) would be dredged (total volume approximately equal to 4,000 cubic yards). Since the western extent of the chromium contaminated sediments (i.e., concentrations greater than 26 ppm total chromium) was not identified, this volume estimate may increase based on the pre-design investigation. The dredging would occur during mid to late summer low-flow conditions and would consist of installing a series of temporary dams to section-off of the creek and limit the transport of potentially contaminated sediment during dredging. Two Mile Creek would be allowed to back-up in the section being dredged. The sediment would be removed using a backhoe and dewatered in a mobile filter press. The liquid from the filter press would be treated in conjunction with the selected ground water treatment alternative, and the remaining solids would be treated in conjunction with the contaminated soil/sediment at the site.



TITLE
VAN DER HORST PLANT 2 APPROXIMATE EXTENT OF CHROMIUM CONTAMINATION IN TWO MILE CREEK SEDIMENTS

FIGURE 5-3
TWO-MILE CREEK
CHANNEL CROSS-SECTION A-A'



DISTANCE	CHANNEL DEPTH	WATER DEPTH	SEDIMENT DEPTH
0'	0"	-	0"
5'	13"	-	9"
10'	33"	-	12"
11'	35"	0"	--
15'	39"	4"	13"
20'	40"	5"	16"
25'	52"	17"	11"
30'	39"	4"	25"
35'	41"	6"	19"
40'	38"	0"	26"
45'	28"	-	6"
50'	14"	-	6"
55'	0"	-	0"

NOTES:

1) HORIZONTAL SCALE: 1" = 10'
2) VERTICAL SCALE: 1" = 1'
3) DEPTHS OF SEDIMENT ARE APPROXIMATE AND WERE ESTIMATED BY PROBING AT WIDELY SPACED INTERVALS. THE DATA SHOULD BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.

LEGEND:

APPROXIMATE SEDIMENT AREA ON 1/31/92

APPROXIMATE WATER AREA ON 1/31/92

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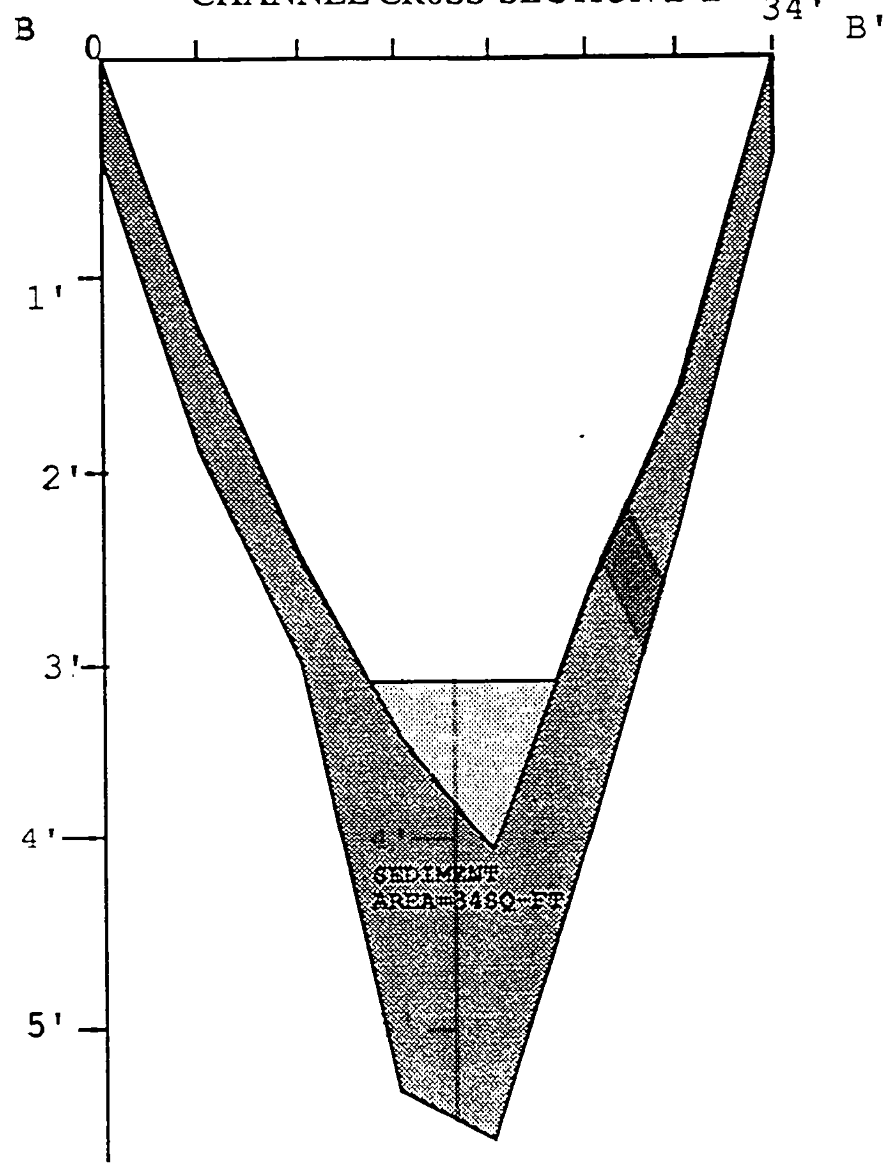
FIGURE 5-4
TWO-MILE CREEK
CHANNEL CROSS-SECTION B-B'



DISTANCE	CHANNEL DEPTH	WATER DEPTH	SEDIMENT DEPTH
0'	0"	-	6"
4'	17"	-	7"
9'	31"	-	6"
12'	39"	0"	--
14'	42"	3"	22"
19'	49"	10"	18"
23'	39"	0"	--
24'	33"	-	15"
29'	20"	-	9"
34'	0"	-	6"

NOTES:

1) HORIZONTAL SCALE: 1" = 10'
2) VERTICAL SCALE: 1" = 1'
3) DEPTHS OF SEDIMENT ARE APPROXIMATE AND WERE ESTIMATED BY PROBING AT WIDELY SPACED INTERVALS. THE DATA SHOULD BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.

LEGEND:

APPROXIMATE SEDIMENT AREA ON 1/31/92

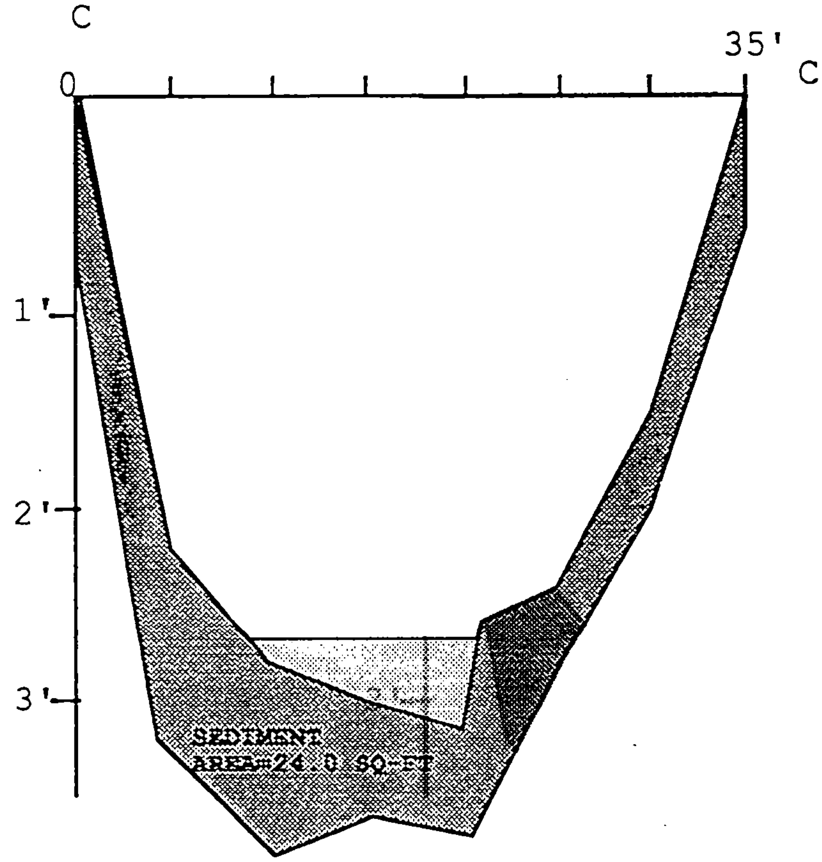
APPROXIMATE WATER AREA ON 1/31/92

ERM ERM-Northeast
Environmental Resources Management

148621

FIGURE 5-5

TWO-MILE CREEK
CHANNEL CROSS-SECTION C-C'



DISTANCE	CHANNEL DEPTH	WATER DEPTH	SEDIMENT DEPTH
0'	0"	-	10"
5'	28"	-	12"
9'	32"	0"	--
10'	35"	3"	12"
15'	37"	5"	7"
20'	39"	7"	7"
21'	32"	0"	--
25'	30"	-	5"
30'	19"	-	6"
35'	0"	-	7"

NOTES:

1) HORIZONTAL SCALE: 1" = 10'
2) VERTICAL SCALE: 1" = 1'
3) DEPTHS OF SEDIMENT ARE APPROXIMATE AND WERE ESTIMATED BY PROBING AT WIDELY SPACED INTERVALS. THE DATA SHOULD BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.

LEGEND:

- APPROXIMATE SEDIMENT AREA ON 1/31/92
- APPROXIMATE WATER AREA ON 1/31/92

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- **Demolition/Decontamination** - Decontamination <u>and</u> demolition are necessary for implementation of Alternatives 2 through 5 due to the chromium contaminated soil identified below the Plant No. 2 building that needs to be either capped, removed or treated. Initially, the asbestos containing materials (ACM) within the plant will be removed. Interior and exterior surfaces of the plant building will then be decontaminated using scarification and grit blasting. These methods were selected to limit the generation of liquid wastes. Wastes from the cleaning process will be collected, containerized and treated in conjunction with the selected on-site soil/sediment alternative. If the collected wastes are not compatible with the selected technologies or schedule of implementation, they will be taken to an off-site disposal facility. Once decontaminated, the building structure would be demolished/dismantled by a demolition contractor and the debris would be either sold to a scrap dealer or pulverized/crushed and taken to an off-site C&D landfill.

- **Excavation** - In Alternatives 2-5 excavation or grading is used to varying degrees. However, there are associated activities that would take place as part of the excavation process that would be completed regardless of the extent of the excavations. These operations include decontamination, dust control and restoration/ revegetation.

Decontamination would be done at the designated decontamination area. This area would include a decontamination pad to be used for decontaminating equipment. The pad would be bermed and sloped to a sump to collect the water used to decontaminate the equipment. This water would then be treated and discharged along with the water from the storm sewer and creek sediment dewatering process.

On-site dust control would take place during construction and excavation operations. This technology would involve wetting down the soil to limit dust emissions. The quantity of water would be limited and would not cause leachate production and contaminant migration vertically into the soil or laterally off-site.

Following excavation, treatment (if required), and backfilling, the disturbed areas will be graded to limit surface flow on the land surface during storm events. The graded areas will then be seeded with perennial grass seed to limit erosion and fugitive dust emissions from the site. This procedure will also improve aesthetic conditions, given that the site is adjacent to residential housing.

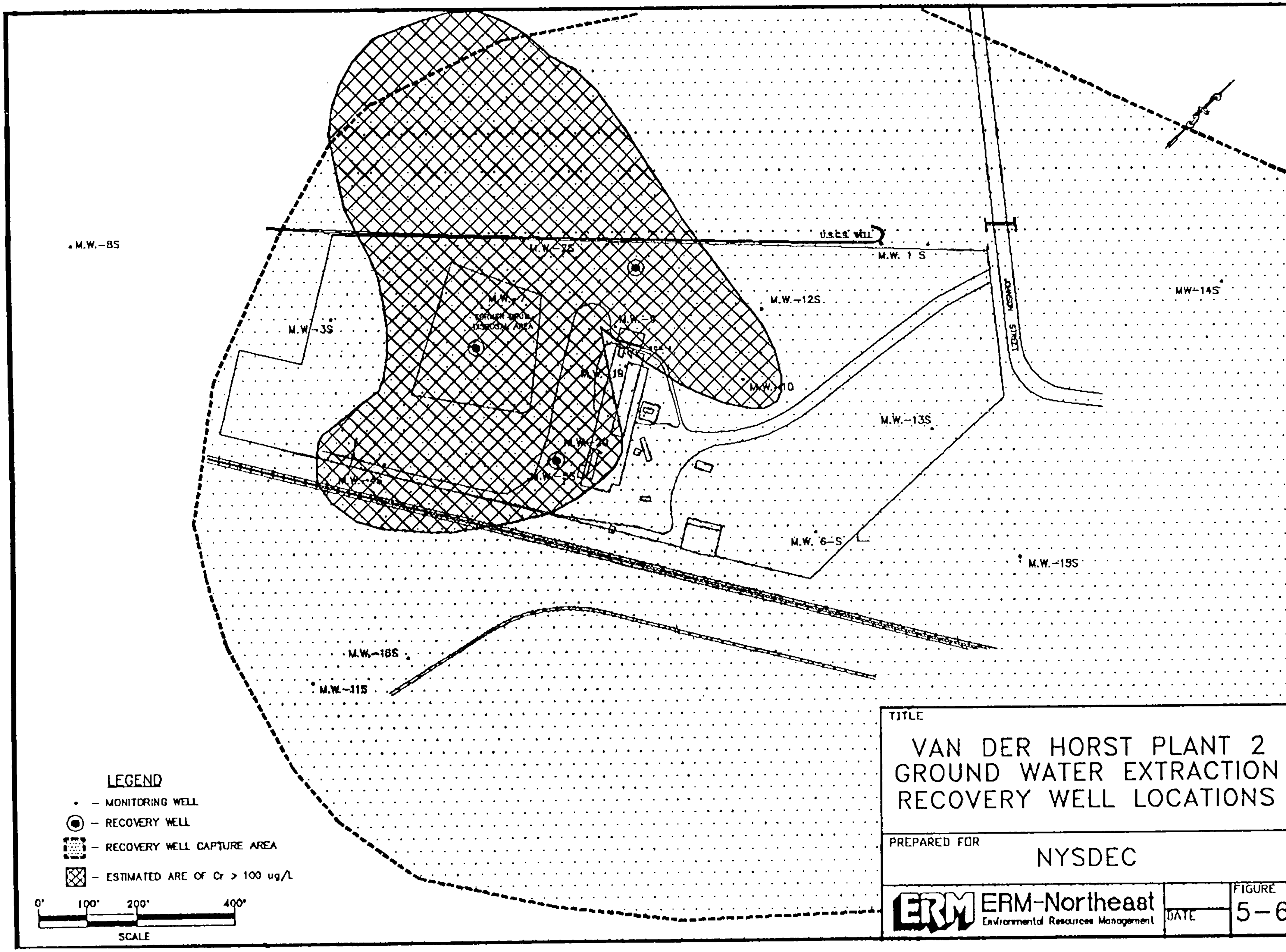
Alternatives 3 through 5

In addition to the six previously mentioned technologies, Alternatives 3 through 5 have the following three (3) components in common: 1) ground water extraction; 2) ground water treatment; and 3) discharge to either the POTW or to Two Mile Creek. These components are described below:

- **Ground Water Extraction** - Ground water extraction is completed by strategically installing a series of wells in the study area to capture the contaminant plume. The wells are then continuously pumped, using submersible pumps, until the contaminant plume has been contained and then removed. The monitoring of ground water quality in the on-site monitoring well network as well as the water quality of the extracted ground water is used to assess the progress of the remediation. Remediation at this site will be considered complete when ground water concentrations of the analytes of concern are below SCGs for ground water set by NYSDEC.

Figure 5-6 shows the proposed locations of the three extraction wells. Based on the ground water model, this extraction well array will capture the ground water identified by the shallow monitoring well network with chromium concentrations greater than 100 ppb. As discussed in the RI report, although the cleanup level for chromium in ground water is 50 ppb (based on SCGs), the area of chromium contamination has been delineated by the 100 ppb chromium concentration contour line to distinguish the on-site plume from off-site background chromium levels exceeding 50 ppb. Although chromium is the primary indicator chemical, this capture area also includes the areas of elevated lead, arsenic, beryllium and benzene that can be potentially attributed to the site.

The combined 3-well pumping rate will be approximately 75 gallons per minute (gpm). The total annual estimated volume of ground water that will be extracted is 39.4 million gallons which is approximately 1.4 plume volumes based on an estimate of the lateral and vertical extent of the chromium contaminated plume. The period of pumping to meet NYSDEC water quality standards is unknown, and would depend upon source area remediation; however, the performance of the extraction



M.W.-8S
M.W.-3S
U.S.G.S. WELL
M.W. 1 S
M.W.-12S
MW-14S
M.W.-10
M.W.-13S
M.W. 6-S
M.W.-15S
M.W.-18S
M.W.-11S
LEGEND
– MONITORING WELL
– RECOVERY WELL
– RECOVERY WELL CAPTURE AREA
– ESTIMATED ARE OF Cr > 100 ug/L
0' 100' 200' 400'
SCALE
TITLE
VAN DER HORST PLANT 2
GROUND WATER EXTRACTION
RECOVERY WELL LOCATIONS
PREPARED FOR
NYSDEC
ERM-Northeast
Environmental Resources Management
DATE
FIGURE
5-6

system will be reviewed yearly using the monitoring well sampling results and evaluated every 5 years.

- **Ground water treatment** - Ground water treatment for this site involves two alternatives: 1) carbon adsorption pretreatment followed by discharge to the POTW; or 2) on-site conventional precipitation followed by discharge to Two Mile Creek.

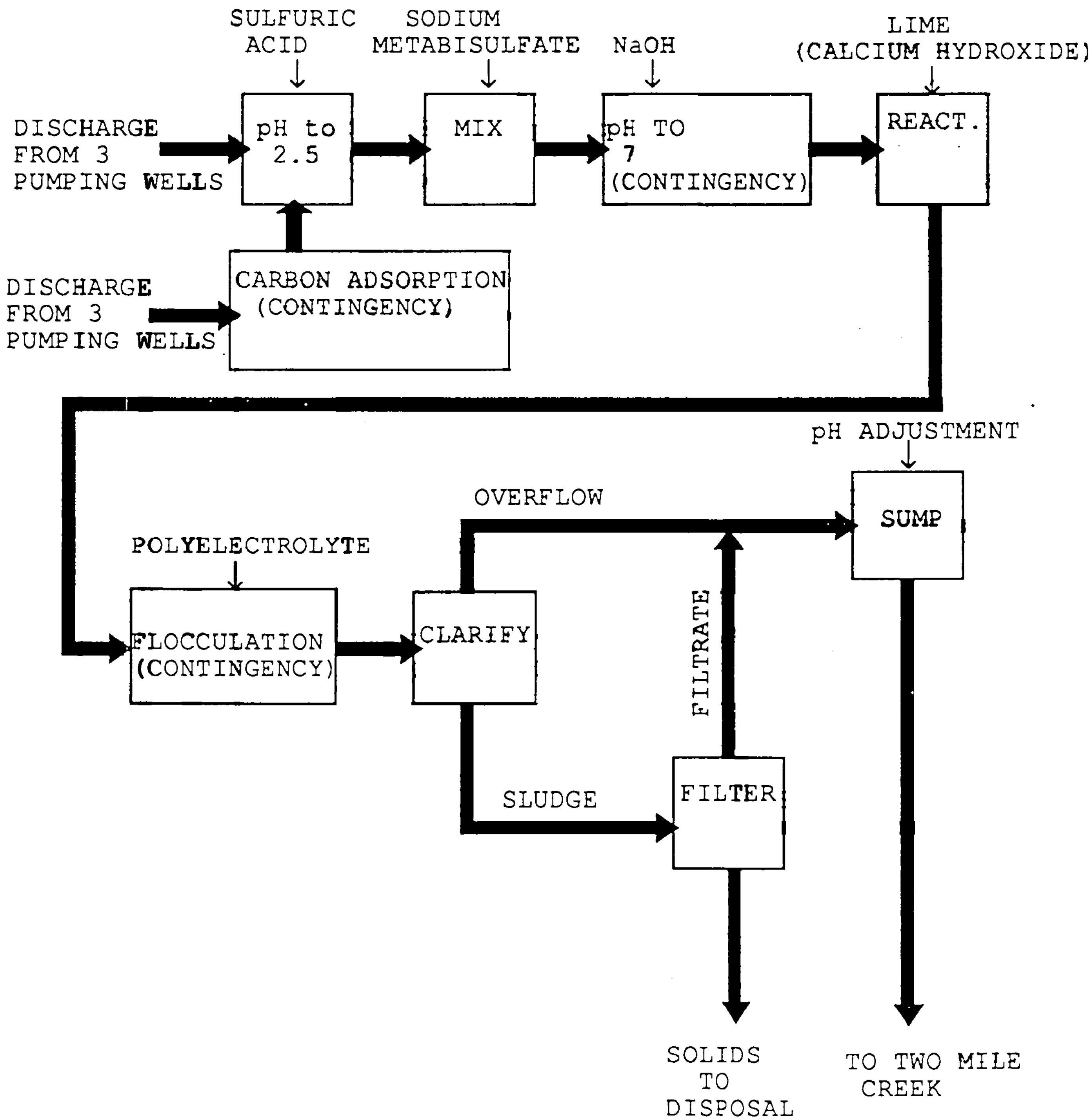
Based on the chromium concentrations measured in the ground water samples collected from on-site shallow monitoring wells, it appears that the ground water will require treatment prior to discharge to the POTW. As previously mentioned, this pretreatment is not necessary to meet POTW influent limits but rather to alleviate POTW concerns that additional long-term chromium loadings to the POTW may cause an increase in chromium concentrations in the POTW sludge. This pretreatment would involve passing the water from this well through a portable carbon filtration unit.

Once the ground water reaches the plant it will undergo treatment including mechanical screens, influent pumps and aerated grit chambers, primary clarifiers, aeration tanks, secondary clarifiers, and a chlorine contact tank. The treated wastewater would then be discharged to the Allegheny River. A discharge permit and approval from the city will be necessary. If selected, this alternative will require further study to evaluate potential POTW upgrading requirements (currently anticipated to be <u>unnecessary</u> for 75 gallons per minute) and possible modeling of the wastewater treatment train using the USEPA Fate and Treatability Estimator (FATE) Model.

Under the conventional precipitation alternative, a wastewater treatment facility would need to be constructed on the site. If selected, this proposed treatment facility would likely be designed for the combined flow from Plant Nos. 1 and 2. The plant design is schematically presented on Figure 5-7 and incorporates the findings of the Treatability Study. The treated water would be discharged to Two Mile Creek (which was previously modified to accommodate a several MGD discharge by Felmont Oil).

FIGURE 5-7

ON-SITE GROUND WATER TREATMENT FLOW DIAGRAM



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5.1.2 Alternative 1 - No Action/Limited Action

Description

The no-action/limited alternative provides a baseline for comparing other alternatives. Actions under this alternative would include maintaining the present fencing at the site, land use restrictions, supply well installation and usage restrictions, and periodic monitoring of the level of contaminants in monitoring wells and downgradient supply wells, if present.

Assessment

Because no remedial actions would be implemented to correct or contain the contamination with the no-action/limited action alternative, long-term human health and environmental risks for the site would essentially be the same as those identified in the baseline risk assessment. However, the risk associated with future ingestion of ground water would be reduced as a result of the supply well restrictions.

Alternative 1 provides no control of exposure via fugitive dust emissions, only a slight reduction in future risk to human health posed by ground water, and no decrease in impact on benthic life. It also allows for the possible continued migration of the contaminant plume and further degradation of the ground water. Since no action is being taken to reduce or contain the contamination, it would not meet SCGs for a number of analytes including chromium, lead, arsenic, beryllium and benzene.

This alternative includes no controls for exposure and no long-term management measures. All current and potential future risks would remain under this alternative. This alternative provides no reduction in toxicity, mobility or volume of the contaminated soil or ground water through treatment. There would be no additional risks posed to the community, the workers, or the environment as a result of this alternative being implemented. The only implementation concern is that of the addition of land and supply well use restrictions to the deeds of the affected properties. The present worth cost and capital cost of the individual technologies/process options as well as the comprehensive alternatives are included on Tables 5-2 and 5-3, respectively. The basis and cost estimate forms are included in Appendix D.

TABLE 5-2

Technology Cost Estimate Summary for Van der Horst #2

Technology	Direct Costs	Indirect Costs	Capital Costs	Annual O&M	Imp Time	Comp Time	PW Cap. x $1,000	PW O&M x $1,000	Total PW x $1,000
Sediment Removal	$69,643	$32,732	$102,375	$0	1993	2	$93	$0	$93
Storm Sewer Cleaning	$12,100	$9,922	$22,022	$0	1993	2	$20	$0	$20
Surface Soil Removal	$1,570,671	$471,201	$2,041,872	$0	1993	2	$1,852	$0	$1,852
Sub. Surf. Soil Rem.									
Minimum Volume	$3,629,551	$1,088,865	$4,718,416	$0	1994	3	$4,076	$0	$4,076
Maximum Volume	$23,591,580	$8,257,053	$31,848,633	$0	1994	3	$27,512	$0	$27,512
GW Extraction	$43,722	$28,419	$72,141	$78,498	1995	34	$59	$993	$1,052
Building Decon.	$279,000	$94,860	$373,860	$0	1993	2	$339	$0	$339
Asbestos Rem.	$40,640	$17,069	$57,709	$0	1993	2	$52	$0	$52
Building Demo.	$575,440	$264,702	$840,142	$0	1993	2	$762	$0	$762
Capping									
Minimum Volume	$2,125,092	$743,782	$2,868,874	$0	1994	34	$2,478	$0	$2,478
Maximum Volume	$6,874,890	$3,093,701	$9,968,591	$0	1994	34	$8,611	$0	$8,611
Soil Soid./Stab.									
Minimum Volume	$2,607,082	$1,433,895	$4,040,977	$0	1994	3	$3,491	$0	$3,491
Maximim Volume	$8,835,749	$5,743,237	$14,578,986	$0	1994	3	$12,594	$0	$12,594
Off-site Landfill(Total)									
Minimum Volume	$6,327,468	$2,214,614	$8,542,082	$0	1993	2	$7,748	$0	$7,748
Maximum Volume	$21,444,633	$8,577,853	$30,022,486	$0	1993	2	$27,231	$0	$27,231
Site Rest.	$188,586	$60,348	$248,934	$1,812	1995	34	$205	$23	$228
Act. Carbon to POTW	$48,000	$23,520	$71,520	$338,759	1995	9	$59	$1,207	$1,265
G.W. to POTW	$0	$0	$0	$47,432	2000	34	$0	$431	$431
Conv. Prec. to Surf. Wat.	$244,841	$134,663	$379,504	$376,415	1995	34	$312	$4,761	$5,073
Semi-Annual Monitoring	$0	$0	$0	$34,860	1995	34	$0	$441	$441

Note: Imp Time - Year when implementation of technology could be initiated, based on a 1993 project start-up.
Comp Time - Time to complete technology in years.
PW - Present Worth
Minimum Volume - Excavation to 4 feet below ground surface.
Maximum Volume - Excavation to 15 feet below ground surface.

Specific costs

TABLE 5-3
SUMMARY OF ALTERNATIVE COSTS

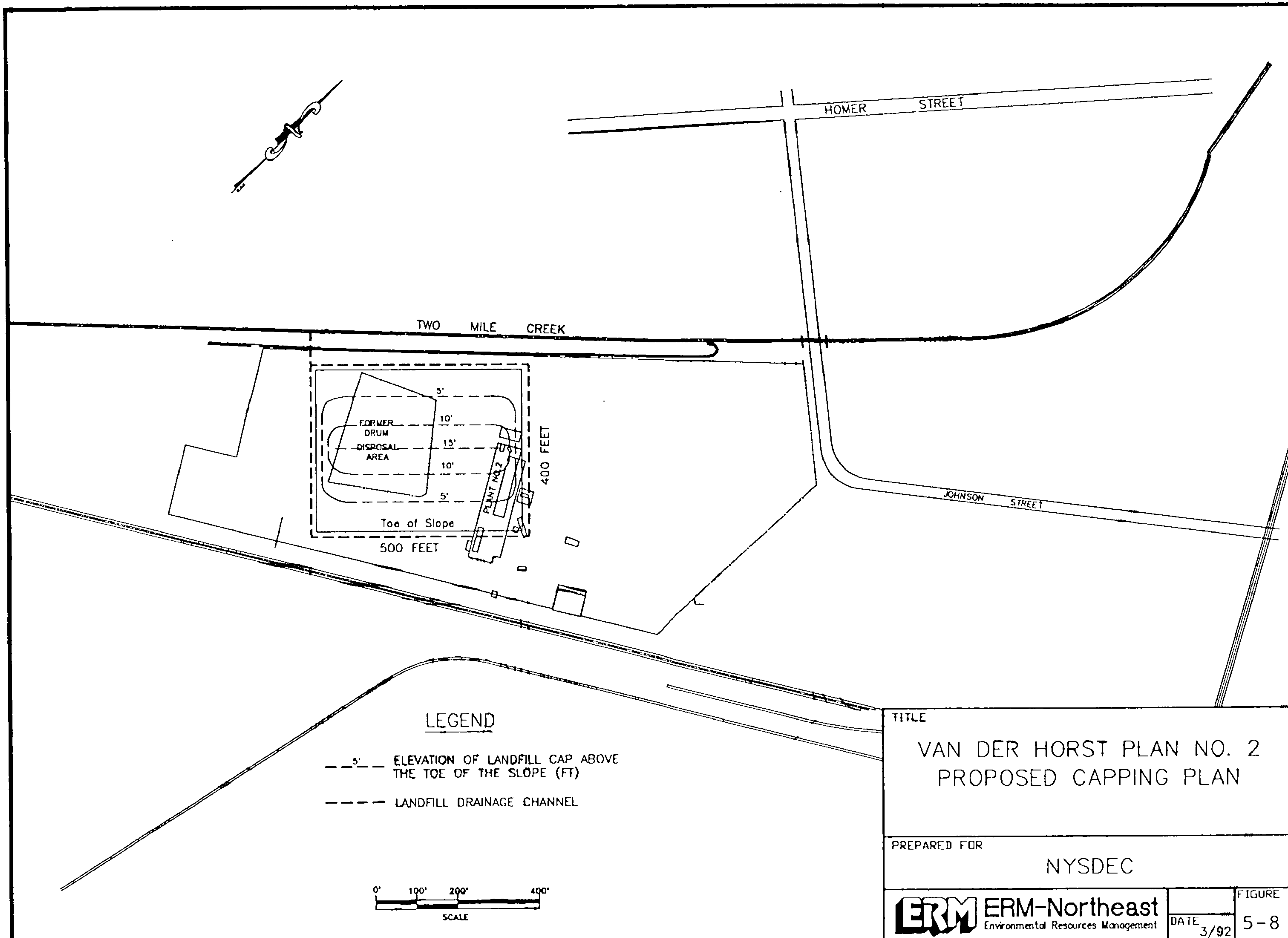
ALTERNATIVE	CAPITAL COSTS		O&M COSTS		TOTAL COSTS	
	4' Exacvation	15' Exacvation	4' Exacvation	15' Exacvation	4' Excavation	15' Excavation
1	$0	$0	$441,000	$441,000	$441,000	$441,000
2	$3,949,000	$10,082,000	$464,000	$464,000	$4,413,000	$10,546,000
3	$17,597,000	$60,517,000	$3,094,000	$3,094,000	$20,691,000	$63,611,000
4	$11,008,000	$43,547,000	$3,094,000	$3,094,000	$14,102,000	$46,641,000
5	$4,068,000	$10,201,000	$3,094,000	$3,094,000	$7,162,000	$13,295,000

Note:
All costs are present worth using a 1991 base year and a maximum 30 year operation period.

5.1.3 Alternative 2 - Containment

Description

The primary components of Alternative 2 are: 1) building decontamination/demolition; 2) excavation and off-site disposal of heavily contaminated soil (i.e., greater than 1,000 ppm total chromium) below the former chromium vat in the southwest corner of the plant building, if present; 3) removal and off-site landfilling of storm sewer sediment and Two Mile Creek sediment; 4) regrading and capping the site with a composite cap including on-site consolidation of chromium lead and arsenic contaminated soil outside the proposed cap limits; and 5) monitoring of ground water wells and downgradient supply wells, if they exist. The composite cap would be constructed on the site as shown on Figure 5-8. This area is approximately 200,000 square feet, and would initially be covered with a geotextile to provide a protective barrier between the site soil and a 60-mil Hypalon geomembrane. The geomembrane would be covered with a 2-foot layer of suitable soil which would be covered with a 6-inch layer of topsoil. The permeability of the completed cap will be approximately 1×10^{-12} cm/sec. This cap will be sloped to a drainage system that would collect and transport surface water away from the cap toward Two Mile Creek and would limit run-on.



TITLE

VAN DER HORST PLAN NO. 2
PROPOSED CAPPING PLAN

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FIGURE 5-8

The composite cap will reduce the leaching of chromium and other analytes of concern to the ground water. The monitoring wells would be used to evaluate the natural attenuation of the contaminants. Also included in this alternative are deed restrictions that will not allow on-site excavation and installation and use of supply wells within the affected area.

Assessment

Alternative 2 is protective of the human health in that exposure to contamination is controlled. Exposure to contaminated soil/sediment and fugitive dust is reduced and further release of contaminants to the ground water and surface water is limited. This alternative, however, allows for the continued migration of the existing contaminated ground water.

Alternative 2 would reduce the risks associated with the contaminated soil/sediment. The capping should reduce fugitive dust emissions and since the sewer lines would be cleaned and the sediment removed from Two Mile Creek, the contaminant levels in the creek should return to background. Ground water exposure in this alternative would only be limited by restrictions placed on supply well usage and installation.

In order to remain effective over the long-term, careful maintenance of the cap and restricting water well usage is required. Erosion or heaving damage to the cap should be repaired to limit leachate production. Damage to the cap could potentially allow ground water contamination and fugitive dust emissions. Long term monitoring, maintenance, and control would be required under this alternative because contaminated soil would remain on-site and because the ground water may remain contaminated above NYSDEC water quality levels. The institutional controls (i.e., well restrictions) are expected to be effective over the short term but may not be effective over the long term due to the degree of difficulty in enforcing any possible regulation or restriction with new residents or industries not familiar with the local conditions. A review would be conducted every five (5) years to provide adequate protection of human health and the environment in accordance with CERCLA 121(c) as this alternative would leave hazardous substances on-site. Since the highly chromium contaminated soil (if present) and the sediment is being removed from the creek and storm sewer and being disposed of in a landfill, cleanup of this soil/sediment would be permanent and effective over the long term.

This alternative provides reduction in toxicity, mobility or volume of the highly contaminated soil (if present below the chromium vat area) through treatment because the highly contaminated soil would undergo solidification/stabilization prior to off-site landfilling. Additionally, the contaminated sediment would be removed from the creek and storm sewer, thereby reducing the volume and the mobility of contaminants in the creek.

The potential for particulate emissions during construction would be limited through the use of dust control technologies (i.e., watering). The cap limits further fugitive dust emissions and the storm sewer cleaning and dredging limits further impact to benthic life. Once the heavily contaminated soil/sediment is removed, this cap could be constructed within a one-year period. The only implementation concerns are the addition of: 1) land use restrictions; and 2) water supply well restrictions. The other materials and equipment to be used under this alternative are readily available and easy to procure.

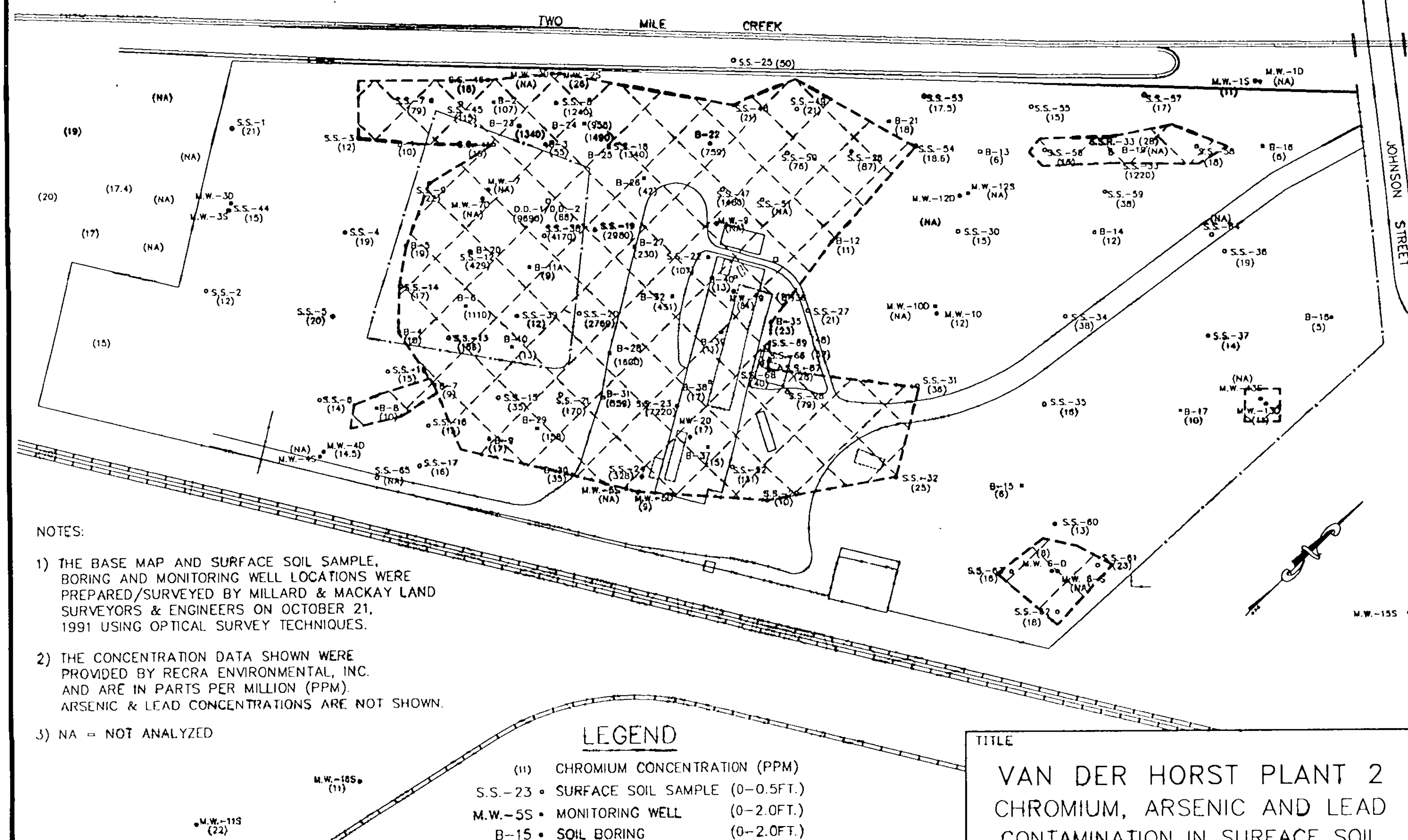
The present worth cost of Alternative 2 is presented on Table 5-2. The annual O&M cost are mainly for cap maintenance and monitoring well sampling and analysis.

5.1.4 Alternative 3 - Soil/Sediment Disposal with Ground Water Treatment

Description

The primary components of this alternative include: 1) building decontamination/demolition; 2) sediment dredging and storm sewer cleaning; 3) excavation of the on-site soil that exceeds cleanup levels for chromium, arsenic and lead and disposing of it in an off-site landfill; 4) ground water extraction, treatment, and discharge to the POTW or Two Mile Creek; 5) regrading and restoration of the site; and 6) ground water monitoring. The estimated contaminated soil volume ranges from approximately 37,000 (0 to 4 feet) to 136,000 cubic yards (0 to 15 feet) of material, based on sampling done during the RI. Figure 5-9 shows the area of surface soil above the cleanup levels for chromium, arsenic and lead.

The additional volume of contaminated subsurface soil that potentially lies below the surface area shown on Figure 5-9 was not delineated by the RI; however, based on the RI data, it appears to extend to a depth of at least 4 feet below ground surface. Additionally, the surface areas of arsenic and lead over cleanup levels are not believed to extend below a depth of 2 feet, based on the small isolated nature of these deposits. Thus, for volume estimation, two volume estimates were considered. The first, considered the "minimum" volume,



NOTES:

1) THE BASE MAP AND SURFACE SOIL SAMPLE, BORING AND MONITORING WELL LOCATIONS WERE PREPARED/SURVEYED BY MILLARD & MACKAY LAND SURVEYORS & ENGINEERS ON OCTOBER 21, 1991 USING OPTICAL SURVEY TECHNIQUES.

2) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY RECRA ENVIRONMENTAL, INC. AND ARE IN PARTS PER MILLION (PPM). ARSENIC & LEAD CONCENTRATIONS ARE NOT SHOWN.

3) NA = NOT ANALYZED

4) THE LIMITS OF THE SHADED AREA ON THIS FIGURE EXTEND TO FIRST CHROMIUM, ARSENIC OR LEAD CONCENTRATION BELOW ITS CORRESPONDING CLEANUP LEVEL. THE AREA ENCOMPASSED BY THE SHADING IS A CONSERVATIVE APPROXIMATION OF THE EXTENT OF CONTAMINATION AND IS BASED UPON WIDELY SPACED DATA POINTS.

LEGEND

(11) CHROMIUM CONCENTRATION (PPM)

S.S.-23 ∘ SURFACE SOIL SAMPLE (0-0.5FT.)

M.W.-5S • MONITORING WELL (0-2.0FT.)

B-15 • SOIL BORING (0-2.0FT.)

APPROXIMATE AREA OF SURFACE SOIL EXCEEDING CLEANUP LEVELS.

0' 100' 200' 400'

SCALE

TITLE

VAN DER HORST PLANT 2
CHROMIUM, ARSENIC AND LEAD CONTAMINATION IN SURFACE SOIL

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Environmental Resources Management

DATE 7/92

FIGURE 5-9

includes the volume of soil from ground surface to a depth of 2 feet below the surface area of chromium, lead and arsenic contaminated soil plus the volume soil from 2 to 4 feet below the surface area of chromium contaminated soil. The second, considered the "maximum" volume, includes the volume of soil from ground surface to a depth of 2 feet below the surface area of chromium, lead and arsenic contaminated soil plus the volume soil from 2 to 15 feet below the surface area of chromium contaminated soil. A maximum depth of 15 feet was selected because the average on-site ground water table is approximately 15 feet below ground surface. An additional volume of 4,000 cubic yards from the creek dredging and sewer cleaning would also require disposal.

Note that the soil delineated by the 50 ppm chromium contour line would include almost all of the soil with elevated concentrations for the other analytes of concern (e.g., lead and arsenic). However, three areas of elevated lead (cleanup level=500 ppm) and/or arsenic (cleanup level=35 ppm) concentrations in surface soil east of the site were included in the total volume to be remediated.

The material would be excavated using backhoes, front-end loaders, and other excavation equipment. The material, after excavation, would be loaded into dump trucks for transportation to a non-hazardous sanitary landfill. The majority of the excavated soil/sediment would be within TCLP limits, based on TCLP testing done to date. Following excavation, the area would be backfilled with clean fill, regraded to improve drainage, and revegetated.

Note that there may be a pocket of highly chromium contaminated soil (i.e., chromium concentrations above 1,000 ppm) below the ground water table in the former chromium vat area. Although this area of soil has not been delineated, data suggest that it is relatively small (approximately 1 or 2 cubic yards). Should this condition extend several feet below the ground water table, then alternate methods including sheet piling, dewatering and other excavation methods may be required. Post-excavation soil sampling of the excavations' side walls and floor would also be needed to determine the lateral and vertical extent of the excavation.

Assessment

Protection of human health and the environment in Alternative 3 is accomplished by removing the contaminants and the suspected source(s) of the ground water contamination from the environment. Exposure to contaminated fugitive dust and ground water is reduced. Also, further spread of the contaminants and further environmental degradation are reduced because the source(s) of the contamination are expected to be removed. This alternative would meet SCGs and also would reduce the carcinogenic risk to an acceptable level.

Since soil/sediment excavation, ground water extraction and sewer cleaning are expected to remove contamination from the contaminated media at the site, this alternative would be considered permanent and effective over the long term. The ground water extraction and soil/sediment excavation would reduce the long-term health risk by limiting the contaminants left in the environment. A five (5) year review would be necessary under this alternative to evaluate ground water conditions.

This alternative provides reduction in toxicity, mobility or volume of the contaminated soil/sediment through treatment at the landfill prior to disposal. The ground water would also undergo various treatment processes that would both reduce its toxicity and its mobility. The treatment of the wastewater removes the contaminants from the discharge effluent which makes the process irreversible.

The potential for particulate emissions during excavation would be limited through the use of dust control technologies (i.e., watering). The transportation of the soil/sediment between excavation points and the disposal/treatment facilities, and conveyance of the ground water via the sewer system to the treatment facility would cause additional risks to the community, the workers, or the environment as a result of this alternative being implemented. The excavation and removal of soil/sediment would be completed over an approximate 1-year period.

The techniques used in implementing Alternative 3 are established, and the materials (i.e., piping, pumps, fill, and stone) and equipment are readily available. However, identifying a secure landfill to receive the material may be costly, due to the strain on landfill space.

Capital and O&M costs for this alternative are included on Table 5-3. The major capital costs are those associated with landfilling the soil/sediment (i.e., transportation and disposal costs). O&M costs would include monitoring the site and operating the ground water treatment system for a 30-year period.

5.1.5 Alternative 4 - Solidification/Stabilization with Ground Water Treatment

Description

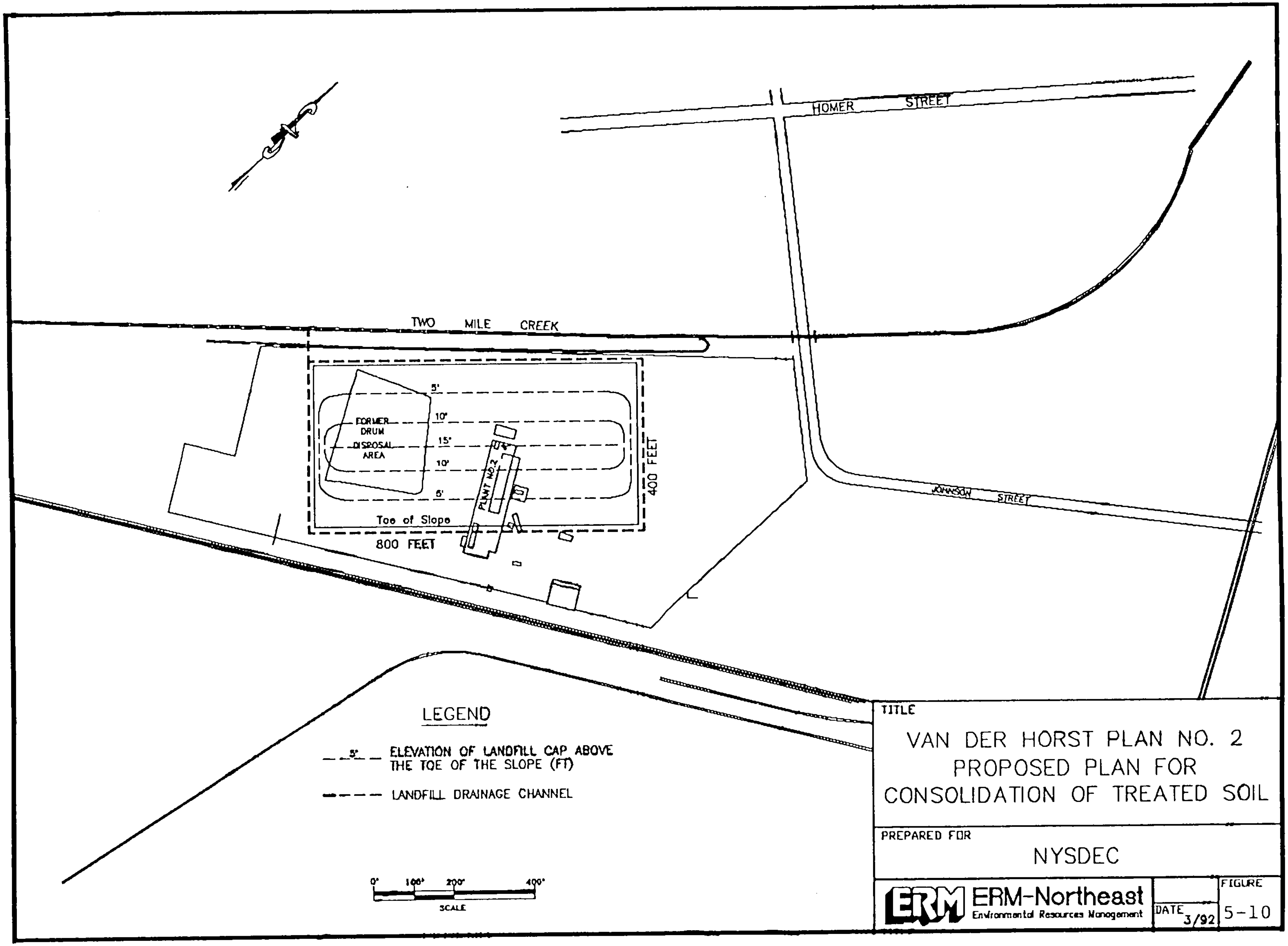
The primary components of Alternative 4 are: 1) building decontamination/demolition; 2) sediment dredging from Two Mile Creek and storm sewer cleaning; 3) excavation, regrading and restoration; 4) solidification/ stabilization and backfilling of treated soil/sediment; 5) ground water extraction, treatment, and discharge to the POTW or Two Mile Creek; and 6) ground water monitoring.

Once the soil with chromium, lead and arsenic concentrations above the cleanup levels is excavated, and the sediment dredged, it will then be solidified/stabilized on-site. The Plant No. 1 Treatability Study indicated that a mixture of lime and ferrous sulfate provides the most favorable results with respect to reducing the leaching potential of the soil. The properties of this treated mixture include a 25% volume increase over the original soil/sediment, and the leachability of the material is reduced to a level below the TCLP limit for chromium. Since the TCLP limits for inorganics are based on drinking water standards, it appears that the treated chromium contaminated soil would not be a source to ground water and could be back-filled on-site. The final topography of the site following soil/sediment treatment and closure would be similar to the lay-out presented on Figure 5-10. The height of on-site cap will be a function of the volume increase resulting from the treatment process (i.e., approximately 25%) and a one foot thick topsoil layer to support vegetation.

Assessment

Protection of human health and the environment in Alternative 4 is similar to Alternative 3. Exposure to fugitive dust emissions and ground water is reduced in this alternative. Further spread of the contaminants and further environmental degradation are reduced because the source(s) of the contamination are expected to be immobilized. Additionally, this alternative would meet SCGs. This alternative would also appear to reduce the carcinogenic risk to an acceptable level.

This alternative would be considered permanent and effective over the long term. A five (5) year review would be necessary under this alternative to evaluate the progress of the ground water remediation.



TITLE
VAN DER HORST PLAN NO. 2
PROPOSED PLAN FOR
CONSOLIDATION OF TREATED SOIL

PREPARED FOR
NYSDEC

ERM-Northeast
Environmental Resources Management

DATE 3/92

FIGURE 5-10

This alternative provides on-site reduction in mobility of the contaminated soil/sediment through solidification/ stabilization of the soil. The potential for particulate emissions during excavation would be limited through the use of dust control technologies (e.g., watering). The solidification/stabilization process may cause a slight exposure risk to the community, the workers, or the environment as a result of this alternative being implemented.

The present worth cost of Alternative 4 is estimated on Table 5-3. The annual O&M cost are mainly for monitoring and operation of the treatment facility. The major capital costs are those associated with treating the soil/sediment.

5.1.6 Alternative 5 - Containment with Ground Water Treatment

Description

The primary components of Alternative 5 are: 1) building decontamination/demolition; 2) excavation and off-site disposal of heavily contaminated soil (i.e., greater than 1,000 ppm total chromium) below the former chromium vat in the southwest corner of the plant building, if present; 3) removal and off-site landfilling of storm sewer and Two Mile Creek sediment; 4) regrading and capping the site with a composite cap including on-site consolidation of chromium, lead and arsenic contaminated soil outside the proposed cap limits; 5) ground water extraction, treatment, and discharge to the POTW or Two Mile Creek; and 6) ground water monitoring. Alternative 5 is the same as Alternative 2 with the addition of ground water treatment. The highly contaminated soil/sediment would be excavated/dredged and taken to an off-site landfill. The composite cap would reduce the leaching of chromium to the ground water and the existing ground water plume would be extracted and treated. The monitoring wells would be used to evaluate the natural attenuation of the contaminants of concern. Also included in this alternative are deed restrictions that will not allow any excavation on the site and installation and use of supply wells within the affected area.

Assessment

Alternative 5 is protective of the human health in that exposure to contamination is controlled. Exposure to contaminated soil/sediment and fugitive dust is reduced and further release of contaminants to the ground water and surface water is limited.

Alternative 5 would reduce the risks associated with the contaminated soil/sediment. The capping would reduce fugitive dust emissions and since the sewer lines would be cleaned and the sediment removed from Two Mile Creek, the contaminant levels in the creek should return to background.

In order to remain effective over the long-term, careful maintenance of the cap is required. Erosion or heaving damage should be repaired to limit leachate production. Damage to the cap could potentially allow ground water contamination and fugitive dust emissions. Long term monitoring, maintenance, and control would be required under this alternative because contaminated soil would remain on-site. A review would be conducted every five (5) years to provide adequate protection of human health and the environment in accordance with CERCLA 121(c) as this alternative would leave hazardous substances on-site. Since the highly contaminated soil/sediment is being removed from below the former chromium vat, the creek and storm sewer, and being disposed-of in a landfill, cleanup of the soil/sediment would be permanent and effective over the long term.

This alternative provides limited reduction in toxicity, mobility or volume of the contaminated soil or ground water through treatment because the heavily contaminated soil taken off-site would undergo treatment prior to landfilling and because the ground water would be treated. Additionally, the contaminated sediment would be removed from the creek and storm sewer, thereby reducing the volume and the mobility of contaminants in the creek.

The potential for particulate emissions during construction would be limited through the use of dust control technologies (i.e., watering). The cap limits further fugitive dust emissions and the dredging limits further impact to benthic life. Once the contaminated soil is consolidated below the proposed capping area, this cap could be constructed within a one-year period. The other materials and equipment to be used under this alternative are readily available and easy to procure.

The present worth cost of Alternative 5 is presented on Table 5-3. The annual O&M cost are mainly for cap maintenance, operation of the treatment system and monitoring well sampling and analysis.

5.2 Comparative Analysis

A comparative analysis of the alternatives discussed in the previous section was completed in general accordance with USEPA 540/6-89/004 and the May 1990 NYSDEC-TAGM for the Selection of Remedial Actions at Inactive Hazardous Waste Sites. The completed evaluation forms for each alternative are included in Appendix C and a summary of the scores for each alternative is included on Table 5-4. Initially, Section 5.2.1 compares the two potential ground water treatment technologies: 1) carbon absorption of hexavalent chromium followed by discharge to the POTW; and 2) on-site conventional precipitation. Section 5.2.2 presents the comparison of the five comprehensive alternatives with inclusion of the ground water treatment technology selected in Section 5.2.1, where applicable.

5.2.1 Ground Water Treatment Evaluation

Initially, the two ground water treatment process options, previously described in Section 5.1.1, were compared using the NYSDEC-TAGM evaluation tables. Based upon our comparative analyses, the recommended option for ground water treatment is activated carbon treatment followed by discharge to the POTW. The main difference in scoring between the conventional precipitation option and the activated carbon option was the score for cost. The higher cost to operate the on-site conventional treatment plant resulted in the selection of the POTW option. In the other six categories these two options scored similarly.

TABLE 5-4
SUMMARY OF ALTERNATIVE SCORES

	Compliance w/SCGs	Implementability	Long-Term Effectiveness	Prot. of Human Health and the Env.	Reduction of Toxicity Mobility or Volume	Short-Term Effectiveness	Cost	Total
	(10)	(15)	(15)	(20)	(15)	(10)	(15)	(100)
No Action	0	11	0	2	0	10	15	38
Conv. Precip to Olean Cr.	10	12	13	20	15	9	1	80
Activated Carbon to POTW	10	12	13	20	15	9	11	90
ALTERNATIVE 1	0	11	0	2	0	10	15	38
ALTERNATIVE 2	2.5	12	6	11	15	8	12	66.5
ALTERNATIVE 3	10	13	13	20	15	7	1	79
ALTERNATIVE 4	10	11	13	20	15	7	5	81
ALTERNATIVE 5	7.5	11	6	20	15	7	10	76.5

The costs of the ground water treatment options were scored on a linear type scale. The no action/limited action option was included to provide a baseline cost. The least expensive option (i.e., no action/limited action) was given a score of 15 and the most expensive option (i.e., on-site conventional treatment) was given a score of 1. The points for the remaining option (i.e., POTW discharge) was then interpolated linearly between the least and most expensive option.

5.2.2 Comprehensive Alternative Evaluation

The ground water treatment option (i.e., activated carbon pretreatment followed by POTW discharge) was included in Alternatives 3 through 5. All five alternatives were then scored and compared using the NYSDEC-TAGM evaluation tables. Based upon the NYSDEC-TAGM scoring tables, Alternative 4 scored the highest. However, Alternative 3 scored within two points of Alternative 4. The slightly lower score for Alternative 3 can be attributed to its relatively higher cost.

The costs of the comprehensive alternatives were scored on a linear type scale using the costs for the 4 foot deep soil contamination scenario (see Section 5.1.4 for details). The 4 foot scenario was used because it appears that this scenario is more likely than the 15 foot scenario, based on soils data collected during the RI which indicate a shallow fill depth (i.e., typically less than 8 feet). The least expensive option (no action/limited action) was given a score of 15 and the most expensive option (Alternative 3) was given a score of 1. The points for the remaining alternatives were interpolated linearly between the least and most expensive alternatives.

Alternative 3 would have scored higher than the other alternatives if cost was not a factor, due to the ease of implementability and its protection of human health and the environment. It was felt that Alternatives 1, 2 and 5 would not meet all SCGs and; thus, would not be as effective over the long term and would not be as protective of human health and the environment. As previously mentioned, the completed NYSDEC-TAGM evaluation forms for each alternative are included in Appendix C. A qualitative comparison of the alternatives with respect to each of the evaluation criteria is discussed below.

Compliance with SCGs

Alternatives 3 and 4 are expected to meet their respective SCGs through either removal or treatment technologies or a combination of both. Alternative 1 will not meet any SCGs and Alternative 2 will only meet location specific SCGs since it addresses the storm sewer and Two Mile Creek. Alternative 5 will not meet all non-promulgated SCGs because it leaves contaminated subsurface soil in contact with ground water.

Implementability

Alternatives 1 through 5 scored similarly with respect to implementability. Minor differences in the scores between these alternatives were mainly due to the uncertainties regarding the depth of the excavation under the building, how well the solidification/stabilization technology will work on the highly contaminated soil and the effectiveness of the capping technology.

Long-term Effectiveness and Permanence

Alternatives 3 and 4 provide the highest degrees of long term effectiveness at the site, compared to the other alternatives, because they use technologies which solidify or stabilize the contaminants, which reduces the hazards. While some wastes would be left on the site after the implementation of Alternative 4, the wastes would have a reduced mobility due to the treatment technology.

Alternatives 1, 2 and 5 were not felt to be as effective over the long term mainly due to the untreated waste that would remain at the site. Under Alternative 1 (no action) the contaminated materials would be left in place and a more extensive ground water monitoring program would be required compared to the other alternatives. Under Alternative 2 and 5 there would be some untreated soil left in place and a cap would be added to reduce infiltration; however, more extensive ground water monitoring would be required to evaluate the impact of the remaining potential sources.

Protection of Human Health and the Environment

All of the alternatives except Alternative 1 and 2 appear to provide adequate protection of human health and the environment. Risk through direct contact and ground water ingestion are reduced to acceptable levels through Alternatives 3 through 5. These alternatives prevent further migration of the contaminated ground water by extracting and treating the plume to acceptable levels.

Alternative 2 provides some measure of protection through capping the site and allowing the ground water to attenuate naturally.

Reduction of Toxicity, Mobility, or Volume Through Treatment

All of the alternatives, with the exception of Alternative 1, score high in this category due to the fact that they use a permanent method to treat at least some of the soil and ground water at the site. Alternative 3 involves removal of the soil and ground water treatment. Alternative 4 uses a solidification/stabilization technology to reduce the mobility of the contaminants and ground water treatment. Results from the treatability study suggest that the residues from the solidification process as well as the ground water treatment may be classified as non-hazardous wastes (i.e., they pass TCLP); thus, no hazardous wastes are left at the site in these alternatives.

Under Alternatives 2 and 5, there is a contingency measure to remove the highly chromium contaminated soil/sediment (i.e., greater than 1,000 ppm total chromium), if present, and take it to a secure landfill for treatment and disposal. The remaining soil, although containing varying concentrations of chromium, arsenic and lead, appears to be non-hazardous (i.e., it passes TCLP). Thus, these two alternatives score highly since no hazardous wastes are left on-site.

Short-Term Effectiveness

Alternative 1 scored highest in terms of short-term effectiveness. This result was due mainly to the short period of time to implement the no action/limited action remedy and the absence of soil disturbance, thereby limiting the risk to the local community and environment.

Alternative 2 scored the next highest in this category. The difference between Alternative 2 and Alternative 1 is that soil is moved in Alternative 2 and the resulting potential dust emissions could impact the local community and the environment. However, dust emissions could be controlled with techniques such as watering.

Alternatives 3 through 5 all scored similarly. The difference between their scores and the score for Alternative 2 is the time to implement the remedy. In the case of Alternative 2, the implementation time is less than 2 years; however, in the remaining alternatives the time to implement the remedy is greater than 2 years due to ground water extraction and treatment.

Cost

Alternative 3 was the most expensive alternative due to the costs associated with off-site disposal and transportation. Alternative 5 was less expensive than Alternatives 3 and 4 because Alternative 5 did not include soil treatment. Alternative 2 was less expensive than Alternatives 3 through 5 because Alternative 2 does not include a ground water extraction and treatment system.

5.3 Cost-Effectiveness Evaluation

In accordance with the Work Plan for this RI/FS, a cost-effectiveness analysis was completed to identify a cost-effective and environmentally sound remedial alternative. This analysis was completed as a further check on the results of the NYSDEC-TAGM evaluation forms. A Cost-Effectiveness (CE) Rating was computed for each alternative. The CE Rating was calculated as the product of the Cost Rating and Effectiveness Rating, as described below.

The cost rating for an alternative reflects both the capital investments and O&M costs. The alternative with the highest capital cost was given a score of 1; the alternative with the lowest capital cost was given a score of 5. Other alternatives were scaled to lie between these extremes. A similar method was used with respect to O&M costs, with the most costly alternative given an O&M score of 1 and the least costly given an O&M score of 5. The Cost Rating is the sum of the two (2) scores.

The effectiveness measure of the alternative required the evaluation of the following criteria: 1) level of achievable remediation; 2) time to achieve remediation; 3) feasibility; 4) implementability; 5) ability to minimize on-site impacts during action; 6) ability to minimize off-site impacts because of action; 7) remoteness of activities; 8) useability of surface water and ground water; 9) compatibility with remedial actions selected for remainder of study area; and 10) compatibility with overall site restoration plan. Each of the alternatives was rated 1 through 5 with respect to each of these criteria. A score of one (1) represented low effectiveness while a score of five (5) represented high effectiveness. The Effectiveness Rating for an alternative was the sum of the individual scores. The scores for each of the alternatives for the above mentioned criteria can be found in Table 5-5.

TABLE 5-5
COST-EFFECTIVENESS SUMMARY

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
COST RATING					
1) Capital Cost	5	4	1	2	3
2) O & M Cost	5	5	4	4	4
TOTAL	10	9	5	6	7
EFFECTIVENESS RATING					
1) Level of Achievable remediation	1	2	5	5	3
2) Time to Achieve Remediation	1	2	5	4	3
3) Feasibility	1	2	4	4	3
4) Implementability	5	4	3	2	3
5) Ability to Minimize On-Site Impacts	1	2	5	4	2
6) Ability to Minimize Off-Site Impacts	1	2	3	4	3
7) Remoteness of Activities	5	3	4	4	3
8) Useability of Surface and Ground Water	1	1	5	5	3
9) Compatibility with Other Remedial Actions	5	3	4	4	3
10) Compatibility with Overall Site Plan	5	4	4	4	4
TOTAL	26	25	42	40	30
OVERALL CE RATING (Total CR x Total ER)	260	225	210	240	210

Alternative 4 was found to be the most cost-effective alternative (excluding Alternative 1 which does not meet remedial objectives) based on this method of analysis. This result compares favorably with the results of the NYSDEC-TAGM evaluation forms.

The final decision on the remedial action to be implemented at the site shall be determined by NYSDEC. As directed by NYSDEC, this report was prepared to group together different technologies as remedial alternatives and to evaluate the potential remedial alternatives for the site. The Proposed Remedial Action Plan (PRAP), which will be prepared by NYSDEC, shall present in detail the recommended remedial action for the site.

6.0 LIMITATIONS AND USE OF REPORT

This report was prepared in accordance with generally accepted practices of other consultants undertaking similar studies at the same time and in the same geographical area, and we observed that degree of care and skill generally exercised by other consultants under similar circumstances and conditions. The analyses and conclusions submitted in this report are based in part upon data and information provided by others, and are contingent upon their validity.

This report was prepared exclusively for the NYSDEC for specific application to the Van Der Horst Plant No. 2 site in accordance with generally accepted engineering practice. No other warranty, expressed or implied, is made.

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FEASIBILITY STUDY

PHASES I, II and III
PLANT NO. 2
VAN DER HORST CORPORATION SITE
SITE NO. 9-05-022
OLEAN, CATTARAUGUS COUNTY

VOLUME II OF II

JULY 1992

SUBMITTED TO:

DIVISION OF HAZARDOUS WASTE REMEDIATION
NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
ALBANY, NEW YORK 12233

SUBMITTED BY:

ERM-NORTHEAST, INC.
5500 MAIN STREET
WILLIAMSVILLE, NEW YORK 14221

ERM-Northeast

LIST OF APPENDICES

APPENDIX A
Screening Evaluation Forms

Soil Sediment Remediation
No Action/Limited Action

Table 4.1

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___ 0 No _X_ 4
	o Can the Short-term risk be easily controlled?	Yes ___ 1 No ___ 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___ 0 No ___ 2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes _X_ 0 No ___ 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___ 3 No _X_ 0
Subtotal (maximum = 4)		0
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr _X_ 1 ≥2yr ___ 0
	o Required duration of themitigative effort to control short-term risk.	<2yr ___ 1 >2yr _X_ 0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	___ 3 ___ 1 _X_ 0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes ___ 3 No _X_ 0
Subtotal (maximum = 3)		0

Table 4.1 (con'd)

Soil/Sediment Remediation
No Action/Limited Action

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr ___ 3 20-25yr ___ 2 15-20yr ___ 1 <15yr _X_ 0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None ___ 3 <25% ___ 2 25-50% ___ 1 ≥50% _X_ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes _X_ 0 No ___ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		0
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr ___ 1 >5yr _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___ 1 Somewhat to not confident _X_ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ___ 2 Moderate ___ 1 Extensive _X_ 0
Subtotal (maximum = 4)		0
TOTAL (maximum = 25)		5

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Soil/Sediment Remediation
No Action/Limited Action

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screenign	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	___2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specifiec process efficiencies or performance goals.	___2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		9
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	X 2
	ii) Required coordination is normal.	___1
	iii) Extensive Coordination is required.	___0
Subtotal (maximum = 2)		2
3. Availability of Services and Materials	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		14

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Capping of Cont'd Soils/Removal of Sediments

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes X 0 No __ 4
	o Can the Short-term risk be easily controlled?	Yes X 1 No __ 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes __ 0 No X 2
Subtotal (maximum = 4)		3
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes X 0 No __ 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes X 3 No __ 0
Subtotal (maximum = 4)		3
3. Time to implement the remedy.	o What is the required time to implement the remedy?	<2yr X 1 ≥2yr __ 0
	o Required duration of the mitigative effort to control short-term risk.	<2yr X 1 >2yr __ 0
Subtotal (maximum = 2)		2
4. On-site or off-site treatment or land disposal	o On-site treatment*	__ 3
	o Off-site treatment*	__ 1
	o On-site or off-site land disposal	X 0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes __ 3 No X 0
Subtotal (maximum = 3)		0

Table 4.1 (Cont'd)

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Capping of Cont'd Soils/Removal of Sediments

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr X 3 20-25yr ___2 15-20yr ___1 <15yr ___0
Subtotal (Maximum = 3)		3
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None ___ 3 <25% ___ 2 25-50% ___ 1 ≥50% X 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes X 0 No ___ 2
	iii) Is the treated residual toxic?	Yes X 0 No ___ 1
	iv) Is the treated residual mobile?	Yes X 0 No ___ 1
Subtotal (maximum = 5)		0
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr ___ 1 >5yr X 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes X 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident X 1 Somewhat to not confident ___0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ___2 Moderate ___1 Extensive X0
Subtotal (maximum = 4)		1
TOTAL (maximum = 25)		12

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.2

Capping of Cont'd Soils/Removal of Sediments

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor		Basis for Evaluation During Preliminary Screenign	Score
1. Technical Feasibility			
a. Ability to construct technology.	i)	Not difficult to construct.	___3
	ii)	Somewhat difficult to construct. No uncertainities in construction.	X 2
	iii)	Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i)	Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii)	Somewhat reliable in meeting the specifiec process efficiencies or performance goals.	___2
c. Schedule of delays due to technical problems.	i)	Unlikely	X 2
	ii)	Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i)	No future remedial actions may be anticipated.	___2
	ii)	Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)			8
2. Administrative Feasibility			
a. Coordination with other agencies.	i)	Minimal coordination is required	__ 2
	ii)	Required coordination is normal.	__ 1
	iii)	Extensive Coordination is required.	X 0
Subtotal (maximum = 2)			0
3. Availability of Services and Materials	i)	Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
a. Availability of prospective technologies.	ii)	Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i)	Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)			3
TOTAL (MAXIMUM = 15)			11

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Excavation and Off-Site Landfill Disposal

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes_X_0 No ___4
	o Can the Short-term risk be easily controlled?	Yes X 1 No __0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes __0 No X 2
Subtotal (maximum = 4)		3
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes_X_0 No ___4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes_X 3 No ___0
Subtotal (maximum = 4)		3
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr_X1 ≥2yr__0
	o Required duration of the mitigative effort to control short-term risk.	<2yr_X1 >2yr__0
Subtotal (maximum = 2)		2
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	___3 ___1 _X_0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes___3 No _X_0
Subtotal (maximum = 3)		0

Table 4.1 (con'd)

Excavation and Off-Site Landfill Disposal

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr _X_ 3 20-25yr ___ 2 15-20yr ___ 1 <15yr ___ 0
Subtotal (Maximum = 3)		3
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None _X_ 3 <25% ___ 2 25-50% ___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr _X_ 1 >5yr ___ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes ___ 0 No _X_ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___ 1 Somewhat to not confident __ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum _X_ 2 Moderate _1 Extensive _0
Subtotal (maximum = 4)		4
TOTAL (maximum = 25)		20

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.2

Excavation and Off-Site Landfill Disposal

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screenign	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	__2
	iii) Very difficult to construct and/or significant uncertainities in construction.	__1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specifiec process efficiencies or performance goals.	__2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	__1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	__1
Subtotal (maximum = 10)		10
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__2
	ii) Required coordination is normal.	X 1
	iii) Extensive Coordination is required.	__0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No __0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		14

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

On-Site
Soil Washing

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes _X_ 0 No ___ 4
	o Can the Short-term risk be easily controlled?	Yes _X_ 1 No ___ 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___ 0 No _X_ 2
Subtotal (maximum = 4)		3
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes _X_ 0 No ___ 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes _X_ 3 No ___ 0
Subtotal (maximum = 4)		3
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr _X_ 1 ≥2yr ___ 0
	o Required duration of the mitigative effort to control short-term risk.	<2yr _X_ 1 >2yr ___ 0
Subtotal (maximum = 2)		2
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	_X_ 3 ___ 1 ___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/treatment or solidification/chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes _X_ 3 No ___ 0
Subtotal (maximum = 3)		3

Table 4.1 (con'd)

On Site
Soil Washing

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr ___0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None__X_3 <25%____2 25-50%___1 ≥50% ___0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes _____0 No _X__2
	iii) Is the treated residual toxic?	Yes ____0 No ____1
	iv) Is the treated residual mobile?	Yes ____0 No ____1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr_X__1 >5yr____ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes _X__ 0 No ____ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident X 1 Somewhat to not confident __0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum __2 Moderate _X1 Extensive__0
Subtotal (maximum = 4)		3
TOTAL (maximum = 25)		22

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.2

On-Site
Soil Washing

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screenign		Score
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct.		___3
	ii) Somewhat difficult to construct. No uncertainities in construction.		X 2
	iii) Very difficult to construct and/or significant uncertainities in construction.		___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.		___3
	ii) Somewhat reliable in meeting the specifiec process efficiencies or performance goals.		X 2
c. Schedule of delays due to technical problems.	i) Unlikely		___2
	ii) Somewhat likely		X 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.		___2
	ii) Some future remedial actions may be necessary.		X 1
Subtotal (maximum = 10)			6
2. Administrative Feasibility			
a. Coordination with other agencies.	i) Minimal coordination is required		___2
	ii) Required coordination is normal.		X 1
	iii) Extensive Coordination is required.		___0
Subtotal (maximum = 2)			1
3. Availability of Services and Materials			
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes ___ No X	1 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X No ___	1 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X No ___	1 0
Subtotal (maximum = 3)			2
TOTAL (MAXIMUM = 15)			9

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

On-Site Solidification/ Stabilization

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o **Are there significant** short-**term** risks to the **community** that must be addressed? (If answer is no, go to Factor 2.)	Yes _X_ 0 No ___ 4
	o Can the Short-term risk be easily controlled?	Yes _X_ 1 No ___ 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes __ 0 No _X_ 2
Subtotal (maximum = 4)		3
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes _X_ 0 No __ 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes _X_ 3 No ___ 0
Subtotal (maximum = 4)		3
3. Time to implement the remedy.	o **What is the required** time to implement the remedy?	≤2yr _X_ 1 ≥2yr ___ 0
	o Required duration of the mitigative effort to control short-term risk.	<2yr _X_ 1 >2yr ___ 0
Subtotal (maximum = 2)		2
4. **On-site or off-site treatment or land disposal**	o On-site treatment*	_X_ 3
	o **Off-site treatment***	___ 1
	o **On-site** or off-site land disposal	___ 0
Subtotal (maximum = 3)		3
*treatment **is** defined as destruction or separation/ treatment **or** solidification/ chemical **fixation** of inorganic **wastes**		
5. Permanence of the remedial alternative.	o **Will the remedy** be classified as permanent **in** accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes _X_ 3 No ___ 0
Subtotal (maximum = 3)		3

Table 4.1 (con'd)

On-Site Solidification/ Stabilization

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr ___0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None_X_ 3 <25%____ 2 25-50%___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes _X_ 0 No ____ 2
	iii) Is the treated residual toxic?	Yes ____ 0 No _X_ 1
	iv) Is the treated residual mobile?	Yes ____ 0 No _X_ 1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr_X_ 1 >5yr___ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_1 Somewhat to not confident __0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum __2 Moderate _X1 Extensive__0
Subtotal (maximum = 4)		3
TOTAL (maximum = 25)		22

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.2

On-Site Solidification/ Stabilization

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screenign	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	__3
	ii) Somewhat difficult to construct. No uncertainities in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainities in construction.	__1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	__3
	ii) Somewhat reliable in meeting the specifiec process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	__1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	__2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		7
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__2
	ii) Required coordination is normal.	X 1
	iii) Extensive Coordination is required.	__0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No __0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		11

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

On-Site Stabilization/ Solidification and Capping

SHORT-TERM/LONG-TERM EFFECTIVENESS

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes _X_ 0 No ___ 4
	o Can the Short-term risk be easily controlled?	Yes _X_ 1 No ___ 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___ 0 No _X_ 2
Subtotal (maximum = 4)		3
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes _X_ 0 No ___ 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes _X_ 3 No ___ 0
Subtotal (maximum = 4)		3
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr _X_ 1 ≥2yr ___ 0
	o Required duration of the mitigative effort to control short-term risk.	<2yr _X_ 1 >2yr ___ 0
Subtotal (maximum = 2)		2
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	_X_ 3 ___ 1 ___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes _X_ 3 No ___ 0
Subtotal (maximum = 3)		3

Table 4.1 (con'd)

On-Site Stabilization/
Solidification and Capping

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr ___0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None_X_3 <25%___2 25-50%___1 ≥50% ___0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes ___0 No _X_2
	iii) Is the treated residual toxic?	Yes ___0 No ___1
	iv) Is the treated residual mobile?	Yes ___0 No ___1
Subtotal (maximum = 5)		5
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr___ 1 >5yr_X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes _X_ 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_1 Somewhat to not confident __0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum __2 Moderate _X1 Extensive__0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		21

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.2

On-Site Stabilization/ Solidification and Capping

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screenign	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	___3
	ii) Somewhat difficult to construct. No uncertainities in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___3
	ii) Somewhat reliable in meeting the specifiec process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	___1
Subtotal (maximum = 10)		8
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	___2
	ii) Required coordination is normal.	___1
	iii) Extensive Coordination is required.	X 0
Subtotal (maximum = 2)		0
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes ___ 1 No X 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___ 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___ 0
Subtotal (maximum = 3)		2
TOTAL (MAXIMUM = 15)		10

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1
SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Storm Sewer Cleaning

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes___ 0 No _X_ 4
	o Can the Short-term risk be easily controlled?	Yes___ 1 No ___ 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes___ 0 No ___ 2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes_X_ 0 No ___ 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes_X_ 3 No ___ 0
Subtotal (maximum = 4)		3
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr_X_1 ≥2yr___0
	o Required duration of the mitigative effort to control short-term risk.	<2yr_X_1 >2yr___0
Subtotal (maximum = 2)		2
4. On-site or off-site treatment or land disposal	o On-site treatment* - solidification o Off-site treatment* o On-site or off-site land disposal	_X_ 3 ___ 1 ___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes _X_3 No ___0
Subtotal (maximum = 3)		3

Table 4.1 (con'd) Storm Sewer Cleaning

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr ___0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None_____ 3 <25% X___ 2 25-50%___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes X___ 0 No _____ 2
	iii) Is the treated residual toxic?	Yes ____ 0 No X___ 1
	iv) Is the treated residual mobile?	Yes ____ 0 No X___ 1
Subtotal (maximum = 5)		4
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr X___ 1 >5yr____ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes ____ 0 No X___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___1 Somewhat to not confident __0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum X 2 Moderate___1 Extensive__0
Subtotal (maximum = 4)		4
		23

TOTAL (maximum = 25)
IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.2 Storm Sewer Cleaning

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screenign	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	___2
	iii) Very difficult to construct and/or significant uncertainities in construction.	___1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specifiec process efficiencies or performance goals.	___2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	___1
Subtotal (maximum = 10)		10
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	X 2
	ii) Required coordination is normal.	___1
	iii) Extensive Coordination is required.	___0
Subtotal (maximum = 2)		2
3. Availability of Services and Materials	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No ___0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		15

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Ground Water Treatment
No Action

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X_4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes _X_0 No ___4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No _X_0
Subtotal (maximum = 4)		0
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr _X_1 ≥2yr ___0
	o Required duration of the mitigative effort to control short-term risk.	<2yr ___1 >2yr _X_0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	___ 3 ___ 1 _X_ 0
Subtotal (maximum = 3)		0
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes ___3 No _X_0
Subtotal (maximum = 3)		0

Table 4.1 (con'd)

Ground Water Treatment
No Action

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr ___3 20-25yr ___2 15-20yr ___1 <15yr _X_0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None ___3 <25% ___2 25-50% ___1 ≥50% _X_0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes _X_0 No ___2
	iii) Is the treated residual toxic?	Yes _X_0 No ___1
	iv) Is the treated residual mobile?	Yes _X_0 No ___1
Subtotal (maximum = 5)		0
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr ___1 >5yr _X_0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes _X_0 No ___1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___1 Somewhat to not confident ___X0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ___2 Moderate ___1 Extensive _X0
Subtotal (maximum = 4)		0
TOTAL (maximum = 25)		5

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.2

Ground Water Treatment
No Action

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screenign	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	2
	iii) Very difficult to construct and/or significant uncertainities in construction.	1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specifiec process efficiencies or performance goals.	2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		9
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	X 2
	ii) Required coordination is normal.	1
	iii) Extensive Coordination is required.	0
Subtotal (maximum = 2)		2
3. Availability of Services and Materials	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No 0
a. Availability of prospective technologies.	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No 0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No 0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		14

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

Ground Water Extraction, Treatment, Discharge to **Surface Water**

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No X 4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No X 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No X 0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	$\leq$2yr ___1 $\geq$2yr X 0
	o Required duration of the mitigative effort to control short-term risk.	<2yr X 1 >2yr ___0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	X 3 ___ 1 ___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes X 3 No ___0
Subtotal (maximum = 3)		3

Table 4.1 (con'd)

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Ground Water Extraction, Treatment, Discharge to Surface Water

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr X 0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None_____3 <25% X 2 25-50%____1 ≥50% ____0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes ____ 0 No X 2
	iii) Is the treated residual toxic?	Yes ____ 0 No ____ 1
	iv) Is the treated residual mobile?	Yes ____ 0 No ____ 1
Subtotal (maximum = 5)		4
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr____ 1 >5yr X 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes X 0 No ____ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident X 1 Somewhat to not confident __ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ___2 Moderate X 1 Extensive__0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		21

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.2

IMPLEMENTABILITY
(Maximum Score = 15)

Ground Water Extraction Treatment, Discharge to Surface Water

Analysis Factor	Basis for Evaluation During Preliminary Screenign	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	__2
	iii) Very difficult to construct and/or significant uncertainities in construction.	__1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	__3
	ii) Somewhat reliable in meeting the specifiec process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	__2
	ii) Somewhat likely	X 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	__1
Subtotal (maximum = 10)		8
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__2
	ii) Required coordination is normal.	__1
	iii) Extensive Coordination is required.	X 0
Subtotal (maximum = 2)		0
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No __0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		11

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Tabel 4.1

Ground Water Extraction
Pretreatment, Discharge to
POTW

SHORT-TERM/LONG-TERM EFFECTIVENESS
Pretreatment, Discharge to
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___0 No _X 4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X 0
	o Required duration of the mitigative effort to control short-term risk.	<2yr_X 1 >2yr___0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	_X 3 ___ 1 ___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes _X 3 No ___0
Subtotal (maximum = 3)		3

Table 4.1 (con'd)

Ground Water Extraction, Pretreatment, Discharge to POTW

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr___3 20-25yr___2 15-20yr___1 <15yr ___0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None____ 3 <25% X___ 2 25-50%___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes ____ 0 No _X__ 2
	iii) Is the treated residual toxic?	Yes ____ 0 No ____ 1
	iv) Is the treated residual mobile?	Yes ____ 0 No ____ 1
Subtotal (maximum = 5)		4
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr____ 1 >5yr_X__ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes _X__ 0 No ____ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident _X_1 Somewhat to not confident _____0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum___2 Moderate_X1 Extensive_0
Subtotal (maximum = 4)		2
TOTAL (maximum = 25)		21

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.2

IMPLEMENTABILITY
(Maximum Score = 15)

Ground Water Extraction, Pretreatments, Discharge to POTW

Analysis Factor	Basis for Evaluation During Preliminary Screenign	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	X 3
	ii) Somewhat difficult to construct. No uncertainities in construction.	__2
	iii) Very difficult to construct and/or significant uncertainities in construction.	__1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	__3
	ii) Somewhat reliable in meeting the specifiec process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	__2
	ii) Somewhat likely	X 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	__1
Subtotal (maximum = 10)		8
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__2
	ii) Required coordination is normal.	__1
	iii) Extensive Coordination is required.	X 0
Subtotal (maximum = 2)		0
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No __0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		11

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.1

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Ground Water Extraction, Treatment, Reinjection

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes __ 0 No _X_ 4
	o Can the Short-term risk be easily controlled?	Yes ___1 No ___0
	o Does the mitigative effort to control short-term risk impact the community life-style?	Yes ___0 No ___2
Subtotal (maximum = 4)		4
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (If answer is no, go to Factor 3.)	Yes ___0 No _X_4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___3 No ___0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤2yr___1 ≥2yr_X_0
	o Required duration of the mitigative effort to control short-term risk.	<2yr_X_1 >2yr___0
Subtotal (maximum = 2)		1
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal	_X_ 3 ___ 1 ___ 0
Subtotal (maximum = 3)		3
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes		
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). (If answer is yes, go to Factor 7.)	Yes _X_3 No ___0
Subtotal (maximum = 3)		3

Table 4.1 (con'd)

Ground Water Extractions, Treatment, Reinjection

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
6. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr ___ 3 20-25yr ___ 2 15-20yr ___ 1 <15yr ___ 0
Subtotal (Maximum = 3)		0
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None ___ 3 <25% X 2 25-50% ___ 1 ≥50% ___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes X 0 No ___ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No X 1
	iv) Is the treated residual mobile?	Yes X 0 No ___ 1
Subtotal (maximum = 5)		3
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	<5yr ___ 1 >5yr X 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "IV")	Yes X 0 No ___ 1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident X 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ___ 2 Moderate ___ 1 Extensive X 0
Subtotal (maximum = 4)		1
TOTAL (maximum = 25)		19

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.2

Ground Water Extraction, Treatment, Reinjection

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screenign	Score
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct.	__3
	ii) Somewhat difficult to construct. No uncertainities in construction.	__2
	iii) Very difficult to construct and/or significant uncertainities in construction.	X 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	__3
	ii) Somewhat reliable in meeting the specifiec process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	__2
	ii) Somewhat likely	X 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	__1
Subtotal (maximum = 10)		6
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required	__2
	ii) Required coordination is normal.	__1
	iii) Extensive Coordination is required.	X 0
Subtotal (maximum = 2)		0
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __0
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	Yes X 1 No __0
Subtotal (maximum = 3)		3
TOTAL (MAXIMUM = 15)		9

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

APPENDIX B
Detailed Analysis Evaluation Summaries

CONVENTIONAL PRECIPITATION TO OLEAN CREEK

COMPLIANCE WITH SCGs
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as ground water standards.	Yes _X_ 2.5 No ___ 0
2. Compliance with action-specific SCGs.	Meets SCGs such as RCRA minimum technology standards.	Yes _X_ 2.5 No ___ 0
3. Compliance with location-specific SCGs.	Meets location-specific SCGs such as wild and scenic Rivers Act.	Yes _X_ 2.5 No ___ 0
4. Compliance with appropriate criteria, advisories and guidelines.	The alternative meets all relevant and appropriate Federal and State guidelines that are not promulgated.	Yes _X_ 2.5 No ___ 0
TOTAL (Maximum = 10)		10

CONVENTIONAL PRECIPITATION TO OLEAN CREEK

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	__ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	__ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	__ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	__ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	__ 1
Subtotal (maximum = 10)	Minimum Required Score = 7	9
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required.	__ 2
	ii) Required coordination is normal.	__ 1
	iii) Extensive coordination is required.	X 0
Subtotal (maximum = 2)		0
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __ 0

CONVENTIONAL PRECIPITATION TO OLEAN CREEK

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialist may be available without significant delay.	Yes _X_ 1 No ___ 0
Subtotal (maximum = 3)		3
TOTAL (Maximum = 15)		12

CONVENTIONAL PRECIPITATION TO OLEAN CREEK

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c), (If answer is yes, go to Factor 3.)	Yes _X_ 5 No ___ 0
Subtotal (maximum = 5)		5
2. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr.___ 4 20-25yr.___ 3 15-20yr.___ 2 < 15yr.___ 0
Subtotal (maximum = 4)		0
3. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None _X_ 3 ≤ 25% ___ 2 25-50% ___ 1 > 50% ___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 4.)	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
4. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	< 5yr. ___ 1 > 5yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes ___ 0 No _X_ 2
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives evaluated in the Detailed Analysis).	Minimum ___ 2 Moderate _X_ 1 Extensive ___ 0
Subtotal (maximum = 5)		3
TOTAL (Maximum) = 15)		13

CONVENTIONAL PRECIPITATION TO OLEAN CREEK

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Volume of hazardous waste reduced (Reduction in volume or toxicity).	i) Quantity of hazardous waste destroyed or treated.	100% X 10 80-99% ___ 8 60-80% ___ 6 40-60% ___ 4 20-40% ___ 2 < 20% ___ 0
	ii) Are there concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.)	Yes ___ 0 No X 2
	iii) How is the concentrated hazardous waste stream disposed?	On-site land disposal ___ 0 Off-site secure land disposal ___ 1 On-site or off-site destruction or treatment ___ 2
Subtotal (maximum = 12) (If subtotal = 12, go to 3)		12
2. Reduction in mobility of hazardous waste.	i) Method of Reduction	
	- Reduced mobility by containment	___ 1
	- Reduced mobility by alternative treatment technologies.	___ 3
	ii) Quantity of Wastes Immobilized	≤ 100% ___ 2 ≥ 60% ___ 1 < 60% ___ 0
Subtotal (maximum = 5)		0
3. Irreversibility of the destruction or treatment of hazardous waste.	Completely irreversible	X 3
	Irreversible for most of the hazardous waste constituents.	___ 2
	Irreversible for only some of the hazardous waste constituents	___ 1
	Reversible for most of the hazardous waste constituents.	___ 0
Subtotal (maximum = 3)		3
TOTAL (Maximum = 15)		15

CONVENTIONAL PRECIPITATION TO OLEAN CREEK

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Weight
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___ No _X_	0 4
	o Can the risk be easily controlled?	Yes ___ No ___	1 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes ___ No ___	0 2
Subtotal (maximum = 4)			4
2. Environmental impacts	o Are there significant short-term risks to the environment that must be addressed? (If the answer is no, go to Factor 3.)	Yes ___ No _X_	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___ No ___	3 0
Subtotal (maximum = 4)			4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2yr. ___ > 2yr. _X_	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2yr. _X_ > 2yr. ___	1 0
Subtotal (maximum = 2)			1
TOTAL (Maximum = 10)			9

CONVENTIONAL PRECIPITATION TO OLEAN CREEK

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes _X_ 20 No ___ 0
TOTAL (Maximum = 20)		20
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes ___ 3 No ___ 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes ___ 4 No ___ 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes ___ 3 No ___ 0
Subtotal (maximum = 10)		0
3. Magnitude of residual public health risks after the remediation.	i) Health risk ii) Health risk	≤ 1 in 1,000,000 ___5 ≤ 1 in 100,000 ___2
Subtotal (maximum = 5)		0
4. Magnitude of residual environmental risk after the remediation.	i) Less than acceptable	___ 5
	ii) Slightly greater than acceptable	___ 3
	iii) Significant risk still exists	___ 0
Subtotal (maximum = 5)		0
TOTAL (Maximum = 20)		20

ACTIVATED CARBON TREATMENT AND DISCHARGE TO POTW

COMPLIANCE WITH SCGs
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as ground water standards.	Yes _X_ 2.5 No ___ 0
2. Compliance with action-specific SCGs.	Meets SCGs such as RCRA minimum technology standards.	Yes _X_ 2.5 No ___ 0
3. Compliance with location-specific SCGs.	Meets location-specific SCGs such as wild and scenic Rivers Act.	Yes _X_ 2.5 No ___ 0
4. Compliance with appropriate criteria, advisories and guidelines.	The alternative meets all relevant and appropriate Federal and State guidelines that are not promulgated.	Yes _X_ 2.5 No ___ 0
TOTAL (Maximum = 10)		10

ACTIVATED CARBON TREATMENT AND DISCHARGE TO POTW

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	__ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	__ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	__ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	__ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	__ 1
Subtotal (maximum = 10)	Minimum Required Score = 7	9
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required.	__ 2
	ii) Required coordination is normal.	__ 1
	iii) Extensive coordination is required.	X 0
Subtotal (maximum = 2)		0
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __ 0

ACTIVATED CARBON TREATMENT AND DISCHARGE TO POTW

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialist may be available without significant delay.	Yes _X_ 1 No ___ 0
Subtotal (maximum = 3)		3
TOTAL (Maximum = 15)		12

ACTIVATED CARBON TREATMENT AND DISCHARGE TO POTW

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c), (If answer is yes, go to Factor 3.)	Yes _X_ 5 No ___ 0
Subtotal (maximum = 5)		5
2. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr.___ 4 20-25yr.___ 3 15-20yr.___ 2 < 15yr.___ 0
Subtotal (maximum = 4)		0
3. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None _X_ 3 ≤ 25% ___ 2 25-50% ___ 1 > 50% ___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 4.)	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
4. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	< 5yr. ___ 1 > 5yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes ___ 0 No _X_ 2
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives evaluated in the Detailed Analysis).	Minimum ___ 2 Moderate _X_ 1 Extensive ___ 0
Subtotal (maximum = 5)		3
TOTAL (Maximum) = 15)		13

ACTIVATED CARBON TREATMENT AND DISCHARGE TO POTW

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Volume of hazardous waste reduced (Reduction in volume or toxicity).	i) Quantity of hazardous waste destroyed or treated.	100% X 10 80-99% ___ 8 60-80% ___ 6 40-60% ___ 4 20-40% ___ 2 < 20% ___ 0
	ii) Are there concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.)	Yes ___ 0 No _X_ 2
	iii) How is the concentrated hazardous waste stream disposed?	On-site land disposal ___ 0 Off-site secure land disposal ___ 1 On-site or off-site destruction or treatment ___ 2
Subtotal (maximum = 12) (If subtotal = 12, go to 3)		12
2. Reduction in mobility of hazardous waste.	i) Method of Reduction	
	- Reduced mobility by containment	___ 1
	- Reduced mobility by alternative treatment technologies.	___ 3
	ii) Quantity of Wastes Immobilized	≤ 100% ___ 2 ≥ 60% ___ 1 < 60% ___ 0
Subtotal (maximum = 5)		0
3. Irreversibility of the destruction or treatment of hazardous waste.	Completely irreversible	_X_ 3
	Irreversible for most of the hazardous waste constituents.	___ 2
	Irreversible for only some of the hazardous waste constituents	___ 1
	Reversible for most of the hazardous waste constituents.	___ 0
Subtotal (maximum = 3)		3
TOTAL (Maximum = 15)		15

ACTIVATED CARBON TREATMENT AND DISCHARGE TO POTW

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___ 0 No _X_ 4
	o Can the risk be easily controlled?	Yes ___ 1 No ___ 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes ___ 0 No ___ 2
Subtotal (maximum = 4)		4
2. Environmental impacts	o Are there significant short-term risks to the environment that must be addressed? (If the answer is no, go to Factor 3.)	Yes ___ 0 No _X_ 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___ 3 No ___ 0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2yr. ___ 1 > 2yr. _X_ 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2yr. _X_ 1 > 2yr. ___ 0
Subtotal (maximum = 2)		1
TOTAL (Maximum = 10)		9

ACTIVATED CARBON TREATMENT AND DISCHARGE TO POTW

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes _X_ 20 No ___ 0
TOTAL (Maximum = 20)		20
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes ___ 3 No ___ 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes ___ 4 No ___ 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes ___ 3 No ___ 0
Subtotal (maximum = 10)		0
3. Magnitude of residual public health risks after the remediation.	i) Health risk ii) Health risk	≤ 1 in 1,000,000 ___5 ≤ 1 in 100,000 ___2
Subtotal (maximum = 5)		0
4. Magnitude of residual environmental risk after the remediation.	i) Less than acceptable	___ 5
	ii) Slightly greater than acceptable	___ 3
	iii) Significant risk still exists	___ 0
Subtotal (maximum = 5)		0
TOTAL (Maximum = 20)		20

ALTERNATIVE 1

COMPLIANCE WITH SCGs
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as ground water standards.	Yes ___ 2.5 No _X_ 0
2. Compliance with action-specific SCGs.	Meets SCGs such as RCRA minimum technology standards.	Yes ___ 2.5 No _X_ 0
3. Compliance with location-specific SCGs.	Meets location-specific SCGs such as wild and scenic Rivers Act.	Yes ___ 2.5 No _X_ 0
4. Compliance with appropriate criteria, advisories and guidelines.	The alternative meets all relevant and appropriate Federal and State guidelines that are not promulgated.	Yes ___ 2.5 No _X_ 0
TOTAL (Maximum = 10)		0

ALTERNATIVE 1

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	X 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	__ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	__ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	__ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	NA 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	__ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	__ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		6
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required.	X 2
	ii) Required coordination is normal.	__ 1
	iii) Extensive coordination is required.	__ 0
Subtotal (maximum = 2)		2
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No __ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No __ 0

ALTERNATIVE 1

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialist may be available without significant delay.	Yes _X_ 1 No ___ 0
Subtotal (maximum = 3)		3
TOTAL (Maximum = 15)		11

ALTERNATIVE 1

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c), (If answer is yes, go to Factor 3.)	Yes ___ 5 No _X_ 0
Subtotal (maximum = 5)		0
2. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr. ___ 4 20-25yr. ___ 3 15-20yr. ___ 2 < 15yr. _X_ 0
Subtotal (maximum = 4)		0
3. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None ___ 3 ≤ 25% ___ 2 25-50% ___ 1 > 50% _X_ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 4.)	Yes _NA_ 0 No ___ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		0
4. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	< 5yr. ___ 1 > 5yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes _X_ 0 No ___ 2
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___ 1 Somewhat to not confident _X_ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives evaluated in the Detailed Analysis).	Minimum ___ 2 Moderate ___ 1 Extensive _X_ 0
Subtotal (maximum = 5)		0
TOTAL (Maximum) = 15)		0

Alternative 1

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Weight
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)		Yes ___ 20 No _X_ 0
TOTAL (Maximum = 20)			0
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?		Yes ___ 3 No _X_ 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?		Yes ___ 4 No _X_ 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?		Yes ___ 3 No _X_ 0
Subtotal (maximum = 10)			0
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤ 1 in 1,000,000	___5
	ii) Health risk	≤ 1 in 100,000	_X_2
Subtotal (maximum = 5)			2
4. Magnitude of residual environmental risk after the remediation.	i) Less than acceptable		___ 5
	ii) Slightly greater than acceptable		___ 3
	iii) Significant risk still exists		_X_ 0
Subtotal (maximum = 5)			0
TOTAL (Maximum = 20)			2

ALTERNATIVE 1

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Volume of hazardous waste reduced (Reduction in volume or toxicity).	i) Quantity of hazardous waste destroyed or treated.	100% ___ 10 80-99% ___ 8 60-80% ___ 6 40-60% ___ 4 20-40% ___ 2 < 20% X 0
	ii) Are there concentrated hazardous waste produced as a result of (i)? If answer is no, go to Factor 2.)	Yes NA 0 No ___ 2
	iii) How is the concentrated hazardous waste stream disposed?	On-site land disposal ___ 0 Off-site secure land disposal ___ 1 On-site or off-site destruction or treatment ___ 2
Subtotal (maximum = 12) (If subtotal = 12, go to 3)		0
2. Reduction in mobility of hazardous waste.	i) Method of Reduction	
	- Reduced mobility by containment	NA 1
	- Reduced mobility by alternative treatment technologies.	___ 3
	ii) Quantity of Wastes Immobilized	≤ 100% ___ 2 ≥ 60% ___ 1 < 60% X 0
Subtotal (maximum = 5)		0
3. Irreversibility of the destruction or treatment of hazardous waste.	Completely irreversible	___ 3
	Irreversible for most of the hazardous waste constituents.	___ 2
	Irreversible for only some of the hazardous waste constituents	___ 1
	Reversible for most of the hazardous waste constituents.	X 0
Subtotal (maximum = 3)		0
TOTAL (Maximum = 15)		0

ALTERNATIVE 1

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes ___ 0 No _X_ 4
	o Can the risk be easily controlled?	Yes ___ 1 No ___ 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes ___ 0 No ___ 2
Subtotal (maximum = 4)		4
2. Environmental impacts	o Are there significant short-term risks to the environment that must be addressed? (If the answer is no, go to Factor 3.)	Yes ___ 0 No _X_ 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes ___ 3 No ___ 0
Subtotal (maximum = 4)		4
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2yr. _X_ 1 > 2yr. ___ 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2yr. _X_ 1 > 2yr. ___ 0
Subtotal (maximum = 2)		2
TOTAL (Maximum = 10)		10

CAPITAL COST SUMMARY FOR SEDIMENT REMOVAL

Cost Compoent	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. Construction Costs	69,643	Attached Calculation	1993
a. Equipment			
b. Labor			
c. Materials			
Subtotal	69,643		
2. Equipment Costs			
___ Installed			
___ Purchased			
3. Land and Site Development			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
4. Buildings and Service			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
5. Relocation Costs			
Subtotal	0		
6. Disposal Costs			
Subtotal	0		
TOTAL DIRECT COSTS	69,643		1993
INDIRECT CAPITAL COSTS			
1. Engineering and Design	10,446	15% TDC	
2. Contingency Allowance	17,411	25% TDC	
3. Other Indirect Costs			
a. Legal Fees	1,393	2% TDC	
b. Licence/permit Costs	3,482	5% TDC	
c. Start-up & Shake-down			
Subtotal	4,875		
TOTAL INDIRECT COSTS	32,732		
TOTAL CAPITAL COSTS	102,375		1993

ALTERNATIVE 2

COMPLIANCE WITH SCGs
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as ground water standards.	Yes ___ 2.5 No _X_ 0
2. Compliance with action-specific SCGs.	Meets SCGs such as RCRA minimum technology standards.	Yes ___ 2.5 No _X_ 0
3. Compliance with location-specific SCGs.	Meets location-specific SCGs such as wild and scenic Rivers Act.	Yes _X_ 2.5 No ___ 0
4. Compliance with appropriate criteria, advisories and guidelines.	The alternative meets all relevant and appropriate Federal and State guidelines that are not promulgated.	Yes ___ 2.5 No _X_ 0
TOTAL (Maximum = 10)		2.5

ALTERNATIVE 2

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___ 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		7
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required.	X 2
	ii) Required coordination is normal.	___ 1
	iii) Extensive coordination is required.	___ 0
Subtotal (maximum = 2)		2
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___ 0

ALTERNATIVE 2

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialist may be available without significant delay.	Yes _X_ 1 No ___ 0
Subtotal (maximum = 3)		3
TOTAL (Maximum = 15)		12

ALTERNATIVE 2

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight	
1. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c), (If answer is yes, go to Factor 3.)	Yes ___	5
		No _X_	0
Subtotal (maximum = 5)			0
2. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr.___	4
		20-25yr._X_	3
		15-20yr.___	2
		< 15yr.___	0
Subtotal (maximum = 4)			3
3. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None _X_	3
		≤ 25% ___	2
		25-50% ___	1
		> 50% ___	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 4.)	Yes _NA_	0
		No ___	2
	iii) Is the treated residual toxic?	Yes ___	0
		No ___	1
	iv) Is the treated residual mobile?	Yes ___	0
		No ___	1
Subtotal (maximum = 5)			3
4. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	< 5yr. ___	1
		> 5yr. _X_	0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes _X_	0
		No ___	2
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___	1
		Somewhat to not confident _X_	0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives evaluated in the Detailed Analysis).	Minimum ___	2
		Moderate ___	1
		Extensive _X_	0
Subtotal (maximum = 5)			0
TOTAL (Maximum) = 15)			6

Alternative 2

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes ___ 20 No _X_ 0
TOTAL (Maximum = 20)		0
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes _X_ 3 No ___ 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes ___ 4 No _X_ 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes _X_ 3 No ___ 0
Subtotal (maximum = 10)		6
3. Magnitude of residual public health risks after the remediation.	i) Health risk ii) Health risk	≤ 1 in 1,000,000 ___5 ≤ 1 in 100,000 _X_2
Subtotal (maximum = 5)		2
4. Magnitude of residual environmental risk after the remediation.	i) Less than acceptable	___ 5
	ii) Slightly greater than acceptable	_X_ 3
	iii) Significant risk still exists	___ 0
Subtotal (maximum = 5)		3
TOTAL (Maximum = 20)		11

ALTERNATIVE 2

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Volume of hazardous waste reduced (Reduction in volume or toxicity).	i) Quantity of hazardous waste destroyed or treated.	100% X 10 80-99% ___ 8 60-80% ___ 6 40-60% ___ 4 20-40% ___ 2 < 20% ___ 0
	ii) Are there concentrated hazardous waste produced as a result of (i)? (If answer is no, go to Factor 2.)	Yes ___ 0 No X 2
	iii) How is the concentrated hazardous waste stream disposed?	On-site land disposal ___ 0 Off-site secure land disposal ___ 1 On-site or off-site destruction or treatment ___ 2
Subtotal (maximum = 12) (If subtotal = 12, go to 3)		12
2. Reduction in mobility of hazardous waste.	i) Method of Reduction	
	- Reduced mobility by containment	___ 1
	- Reduced mobility by alternative treatment technologies.	___ 3
	ii) Quantity of Wastes Immobilized	≤ 100% ___ 2 ≥ 60% ___ 1 < 60% ___ 0
Subtotal (maximum = 5)		0
3. Irreversibility of the destruction or treatment of hazardous waste.	Completely irreversible	X 3
	Irreversible for most of the hazardous waste constituents.	___ 2
	Irreversible for only some of the hazardous waste constituents	___ 1
	Reversible for most of the hazardous waste constituents.	___ 0
Subtotal (maximum = 3)		3
TOTAL (Maximum = 15)		15

ALTERNATIVE 2

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight	
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes _X_ 0 No ___ 4	
	o Can the risk be easily controlled?	Yes _X_ 1 No ___ 0	
	o Does the mitigative effort to control risk impact the community life-style?	Yes ___ 0 No _X_ 2	
Subtotal (maximum = 4)			3
2. Environmental impacts	o Are there significant short-term risks to the environment that must be addressed? (If the answer is no, go to Factor 3.)	Yes _X_ 0 No ___ 4	
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes _X_ 3 No ___ 0	
Subtotal (maximum = 4)			3
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2yr. _X_ 1 > 2yr. ___ 0	
	o Required duration of the mitigative effort to control short-term risk.	≤ 2yr. _X_ 1 > 2yr. ___ 0	
Subtotal (maximum = 2)			2
TOTAL (Maximum = 10)			8

ALTERNATIVE 3

COMPLIANCE WITH SCGs
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as ground water standards.	Yes _X_ 2.5 No ___ 0
2. Compliance with action-specific SCGs.	Meets SCGs such as RCRA minimum technology standards.	Yes _X_ 2.5 No ___ 0
3. Compliance with location-specific SCGs.	Meets location-specific SCGs such as wild and scenic Rivers Act.	Yes _X_ 2.5 No ___ 0
4. Compliance with appropriate criteria, advisories and guidelines.	The alternative meets all relevant and appropriate Federal and State guidelines that are not promulgated.	Yes _X_ 2.5 No ___ 0
TOTAL (Maximum = 10)		10

ALTERNATIVE 3

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___ 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	X 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___ 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	X 2
	ii) Some future remedial actions may be necessary.	___ 1
Subtotal (maximum = 10)		9
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive coordination is required.	___ 0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___ 0

ALTERNATIVE 3

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialist may be available without significant delay.	Yes _X_ 1 No ___ 0
Subtotal (maximum = 3)		3
TOTAL (Maximum = 15)		13

ALTERNATIVE 3

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c), (If answer is yes, go to Factor 3.)	Yes _X_ 5 No ___ 0
Subtotal (maximum = 5)		5
2. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr.___ 4 20-25yr.___ 3 15-20yr.___ 2 < 15yr.___ 0
Subtotal (maximum = 4)		0
3. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None _X_ 3 ≤ 25% ___ 2 25-50% ___ 1 > 50% ___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 4.)	Yes ___ 0 No _X_ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		5
4. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	< 5yr. ___ 1 > 5yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes ___ 0 No _X_ 2
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives evaluated in the Detailed Analysis).	Minimum ___ 2 Moderate _X_ 1 Extensive ___ 0
Subtotal (maximum = 5)		3
TOTAL (Maximum) = 15)		13

Alternative 3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Weight
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes _X_ No ___	20 0
TOTAL (Maximum = 20)			20
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes ___ No ___	3 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes ___ No ___	4 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes ___ No ___	3 0
Subtotal (maximum = 10)			0
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤ 1 in 1,000,000 ___	5
	ii) Health risk	≤ 1 in 100,000 ___	2
Subtotal (maximum = 5)			0
4. Magnitude of residual environmental risk after the remediation.	i) Less than acceptable	___	5
	ii) Slightly greater than acceptable	___	3
	iii) Significant risk still exists	___	0
Subtotal (maximum = 5)			0
TOTAL (Maximum = 20)			20

ALTERNATIVE 3

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Volume of hazardous waste reduced (Reduction in volume or toxicity).	i) Quantity of hazardous waste destroyed or treated.	100% X 10 80-99% ___ 8 60-80% ___ 6 40-60% ___ 4 20-40% ___ 2 < 20% ___ 0
	ii) Are there concentrated hazardous waste produced as a result of (i)? (If answer is no, go to Factor 2.)	Yes X 0 No ___ 2
	iii) How is the concentrated hazardous waste stream disposed?	On-site land disposal ___ 0 Off-site secure land disposal X 1 On-site or off-site destruction or treatment ___ 2
Subtotal (maximum = 12) (If subtotal = 12, go to 3)		11
2. Reduction in mobility of hazardous waste.	i) Method of Reduction	
	- Reduced mobility by containment	___ 1
	- Reduced mobility by alternative treatment technologies.	X 3
	ii) Quantity of Wastes Immobilized	≤ 100% X 2 ≥ 60% ___ 1 < 60% ___ 0
Subtotal (maximum = 5)		5
3. Irreversibility of the destruction or treatment of hazardous waste.	Completely irreversible	X 3
	Irreversible for most of the hazardous waste constituents.	___ 2
	Irreversible for only some of the hazardous waste constituents	___ 1
	Reversible for most of the hazardous waste constituents.	___ 0
Subtotal (maximum = 3)		3
TOTAL (Maximum = 15)		15

ALTERNATIVE 3

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes _X_ 0 No ___ 4
	o Can the risk be easily controlled?	Yes _X_ 1 No ___ 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes ___ 0 No _X_ 2
Subtotal (maximum = 4)		3
2. Environmental impacts	o Are there significant short-term risks to the environment that must be addressed? (If the answer is no, go to Factor 3.)	Yes _X_ 0 No ___ 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes _X_ 3 No ___ 0
Subtotal (maximum = 4)		3
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2yr. ___ 1 > 2yr. _X_ 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2yr. _X_ 1 > 2yr. ___ 0
Subtotal (maximum = 2)		1
TOTAL (Maximum = 10)		7

ALTERNATIVE 4

COMPLIANCE WITH SCGs
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as ground water standards.	Yes _X_ 2.5 No ___ 0
2. Compliance with action-specific SCGs.	Meets SCGs such as RCRA minimum technology standards.	Yes _X_ 2.5 No ___ 0
3. Compliance with location-specific SCGs.	Meets location-specific SCGs such as Wild and Scenic Rivers Act.	Yes _X_ 2.5 No ___ 0
4. Compliance with appropriate criteria, advisories and guidelines.	The alternative meets all relevant and appropriate Federal and State guidelines that are not promulgated.	Yes _X_ 2.5 No ___ 0
TOTAL (Maximum = 10)		10

ALTERNATIVE 4

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___ 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		7
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive coordination is required.	___ 0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___ 0

ALTERNATIVE 4

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialist may be available without significant delay.	Yes _X_ 1 No ___ 0
Subtotal (maximum = 3)		3
TOTAL (Maximum = 15)		11

ALTERNATIVE 4

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c), (If answer is yes, go to Factor 3.)	Yes _X_ 5 No ___ 0
Subtotal (maximum = 5)		5
2. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr.___ 4 20-25yr.___ 3 15-20yr.___ 2 < 15yr.___ 0
Subtotal (maximum = 4)		0
3. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None _X_ 3 ≤ 25% ___ 2 25-50% ___ 1 > 50% ___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 4.)	Yes _X_ 0 No ___ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No _X_ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No _X_ 1
Subtotal (maximum = 5)		5
4. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	< 5yr. ___ 1 > 5yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes ___ 0 No _X_ 2
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___ 1 Somewhat to not confident ___ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives evaluated in the Detailed Analysis).	Minimum ___ 2 Moderate _X_ 1 Extensive ___ 0
Subtotal (maximum = 5)		3
TOTAL (Maximum) = 15)		13

Alternative 4

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes ___ 20 No _X_ 0
TOTAL (Maximum = 20)		0
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes _X_ 3 No ___ 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes _X_ 4 No ___ 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes _X_ 3 No ___ 0
Subtotal (maximum = 10)		10
3. Magnitude of residual public health risks after the remediation.	i) Health risk ii) Health risk	$\leq$ 1 in 1,000,000 _X_ 5 $\leq$ 1 in 100,000 ___ 2
Subtotal (maximum = 5)		5
4. Magnitude of residual environmental risk after the remediation.	i) Less than acceptable	_X_ 5
	ii) Slightly greater than acceptable	___ 3
	iii) Significant risk still exists	___ 0
Subtotal (maximum = 5)		5
TOTAL (Maximum = 20)		20

ALTERNATIVE 4

REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Volume of hazardous waste reduced (Reduction in volume or toxicity).	i) Quantity of hazardous waste destroyed or treated.	100% X 10 80-99% ___ 8 60-80% ___ 6 40-60% ___ 4 20-40% ___ 2 < 20% ___ 0
	ii) Are there concentrated hazardous waste produced as a result of (i)? (If answer is no, go to Factor 2.)	Yes X 0 No ___ 2
	iii) How is the concentrated hazardous waste stream disposed?	On-site land disposal ___ 0 Off-site secure land disposal X 1 On-site or off-site destruction or treatment ___ 2
Subtotal (maximum = 12) (If subtotal = 12, go to 3)		11
2. Reduction in mobility of hazardous waste.	i) Method of Reduction	
	- Reduced mobility by containment	___ 1
	- Reduced mobility by alternative treatment technologies.	X 3
	ii) Quantity of Wastes Immobilized	≤ 100% X 2 ≥ 60% ___ 1 < 60% ___ 0
Subtotal (maximum = 5)		5
3. Irreversibility of the destruction or treatment of hazardous waste.	Completely irreversible	X 3
	Irreversible for most of the hazardous waste constituents.	___ 2
	Irreversible for only some of the hazardous waste constituents	___ 1
	Reversible for most of the hazardous waste constituents.	___ 0
Subtotal (maximum = 3)		3
TOTAL (Maximum = 15)		15

ALTERNATIVE 4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Weight
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes _X_ No ___	0 4
	o Can the risk be easily controlled?	Yes _X_ No ___	1 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes ___ No _X_	0 2
Subtotal (maximum = 4)			3
2. Environmental impacts	o Are there significant short-term risks to the environment that must be addressed? (If the answer is no, go to Factor 3.)	Yes _X_ No ___	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes _X_ No ___	3 0
Subtotal (maximum = 4)			3
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2yr. ___ > 2yr. _X_	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2yr. _X_ > 2yr. ___	1 0
Subtotal (maximum = 2)			1
TOTAL (Maximum = 10)			7

ALTERNATIVE 5

COMPLIANCE WITH SCGs
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as ground water standards.	Yes _X_ 2.5 No ___ 0
2. Compliance with action-specific SCGs.	Meets SCGs such as RCRA minimum technology standards.	Yes _X_ 2.5 No ___ 0
3. Compliance with location-specific SCGs.	Meets location-specific SCGs such as wild and scenic Rivers Act.	Yes _X_ 2.5 No ___ 0
4. Compliance with appropriate criteria, advisories and guidelines.	The alternative meets all relevant and appropriate Federal and State guidelines that are not promulgated.	Yes ___ 2.5 No _X_ 0
TOTAL (Maximum = 10)		7.5

ALTERNATIVE 5

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Technical Feasibility		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___ 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	X 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___ 1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	X 2
c. Schedule of delays due to technical problems.	i) Unlikely	X 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	X 1
Subtotal (maximum = 10)		7
2. Administrative Feasibility		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	X 1
	iii) Extensive coordination is required.	___ 0
Subtotal (maximum = 2)		1
3. Availability of Services and Materials		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes X 1 No ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes X 1 No ___ 0

ALTERNATIVE 5

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialist may be available without significant delay.	Yes _X_ 1 No ___ 0
Subtotal (maximum = 3)		3
TOTAL (Maximum = 15)		11

ALTERNATIVE 5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c), (If answer is yes, go to Factor 3.)	Yes ___ 5 No _X_ 0
Subtotal (maximum = 5)		0
2. Lifetime of remedial actions.	o Expected lifetime or duration of effectiveness of the remedy.	25-30yr.___ 4 20-25yr._X_ 3 15-20yr.___ 2 < 15yr.___ 0
Subtotal (maximum = 4)		3
3. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None _X_ 3 ≤ 25% ___ 2 25-50% ___ 1 > 50% ___ 0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 4.)	Yes _NA_ 0 No ___ 2
	iii) Is the treated residual toxic?	Yes ___ 0 No ___ 1
	iv) Is the treated residual mobile?	Yes ___ 0 No ___ 1
Subtotal (maximum = 5)		3
4. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	< 5yr. ___ 1 > 5yr. _X_ 0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes _X_ 0 No ___ 2
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ___ 1 Somewhat to not confident _X_ 0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives evaluated in the Detailed Analysis).	Minimum ___ 2 Moderate ___ 1 Extensive _X_ 0
Subtotal (maximum = 5)		0
TOTAL (Maximum) = 15)		6

Alternative 5

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Weight
1. Use of the site after remediation.	Unrestricted use of the land and water. (If answer is yes, go to the end of the Table.)	Yes ___ No _X_	20 0
TOTAL (Maximum = 20)			0
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	Yes _X_ No ___	3 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes _X_ No ___	4 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	Yes _X_ No ___	3 0
Subtotal (maximum = 10)			10
3. Magnitude of residual public health risks after the remediation.	i) Health risk	≤ 1 in 1,000,000 _X_	5
	ii) Health risk	≤ 1 in 100,000 ___	2
Subtotal (maximum = 5)			5
4. Magnitude of residual environmental risk after the remediation.	i) Less than acceptable	_X_	5
	ii) Slightly greater than acceptable	___	3
	iii) Significant risk still exists	___	0
Subtotal (maximum = 5)			5
TOTAL (Maximum = 20)			20

ALTERNATIVE 5

REDUCTION OF TOXICITY, MOBILITY OR VOLUME

(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight
1. Volume of hazardous waste reduced (Reduction in volume or toxicity).	i) Quantity of hazardous waste destroyed or treated.	100% X 10 80-99% ___ 8 60-80% ___ 6 40-60% ___ 4 20-40% ___ 2 < 20% ___ 0
	ii) Are there concentrated hazardous waste produced as a result of (i)? (If answer is no, go to Factor 2.)	Yes X 0 No ___ 2
	iii) How is the concentrated hazardous waste stream disposed?	On-site land disposal ___ 0 Off-site secure land disposal X 1 On-site or off-site destruction or treatment ___ 2
Subtotal (maximum = 12) (If subtotal = 12, go to 3)		11
2. Reduction in mobility of hazardous waste.	i) Method of Reduction	
	- Reduced mobility by containment	___ 1
	- Reduced mobility by alternative treatment technologies.	X 3
	ii) Quantity of Wastes Immobilized	≤ 100% X 2 ≥ 60% ___ 1 < 60% ___ 0
Subtotal (maximum = 5)		5
3. Irreversibility of the destruction or treatment of hazardous waste.	Completely irreversible	X 3
	Irreversible for most of the hazardous waste constituents.	___ 2
	Irreversible for only some of the hazardous waste constituents	___ 1
	Reversible for most of the hazardous waste constituents.	___ 0
Subtotal (maximum = 3)		3
TOTAL (Maximum = 15)		15

ALTERNATIVE 5

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis	Weight	
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? (If answer is no, go to Factor 2.)	Yes _X_ No ___	0 4
	o Can the risk be easily controlled?	Yes _X_ No ___	1 0
	o Does the mitigative effort to control risk impact the community life-style?	Yes ___ No _X_	0 2
Subtotal (maximum = 4)			3
2. Environmental impacts	o Are there significant short-term risks to the environment that must be addressed? (If the answer is no, go to Factor 3.)	Yes _X_ No ___	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	Yes _X_ No ___	3 0
Subtotal (maximum = 4)			3
3. Time to implement the remedy.	o What is the required time to implement the remedy?	≤ 2yr. ___ > 2yr. _X_	1 0
	o Required duration of the mitigative effort to control short-term risk.	≤ 2yr. _X_ > 2yr. ___	1 0
Subtotal (maximum = 2)			1
TOTAL (Maximum = 10)			7

APPENDIX C
Basis and Cost Estimation Summaries

BASIS FOR CAPITAL COST FOR ALTERNATIVE: Sediment Removal

COST ITEM: Direct Capital Costs

COST COMPONENT: Construction Costs

BASIS: Direct capital costs include a temporary dam across Two Mile Creek, removal of the contaminated sediments, transportation of the sediments to VDH #2 for staging and restoration of the Creek.

CALCULATION/SOURCE: Costs were taken from the "Remedial Action at Waste Disposal Sites: Handbook (Revised)", October 1985. Costs were updated to 1991 dollars using ENR Construction Cost Index data.

CAPITAL COST SUMMARY FOR STORM SEWER CLEANING

Cost Compoent	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. Construction Costs	12,100	Quotation	1993
a. Equipment			
b. Labor			
c. Materials			
Subtotal	12,100		
2. Equipment Costs			
___ Installed			
___ Purchased			
3. Land and Site Development			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
4. Buildings and Service			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
5. Relocation Costs			
Subtotal	0		
6. Disposal Costs			
Subtotal	0		
TOTAL DIRECT COSTS	12,100		1993
INDIRECT CAPITAL COSTS			
1. Engineering and Design	1815	15% TDC	
2. Contingency Allowance	3025	25% TDC	
3. Other Indirect Costs			
a. Legal Fees	121	1% TDC	
b. Licence/permit Costs	121	1% TDC	
c. Start-up & Shake-down			
Subtotal	5082		
TOTAL INDIRECT COSTS	9,922		1993
TOTAL CAPITAL COSTS	22,022		1993

BASIS FOR CAPITAL COST FOR ALTERNATIVE: Storm Sewer Cleaning

COST ITEM: Direct Capital Costs

COST COMPONENT: Labor, Eqpt.& Materials

BASIS: Direct costs based on quotations from 4 experienced local storm sewer cleaning contractors to pressure wash lines and vacuum-out sediment and transfer the sediment into 55 gallon drums. Included in the cost are items such as labor, equipment rental, air quality monitoring, safety equipment, video taping of the line and mobilization and demobilization.

CALCULATION/SOURCE: Contractors provided unit cost estimates ($/linear foot) for sewer cleaning based on past experience. These cost estimates ranged from $10/ft. to $32/ft. with an average price of $25/ft. This price includes all associated labor, equipment and material costs including video taping of the lines following cleaning. Total Direct Capital Cost= 484 linear ft.x $25/ft.=$12,100.

CAPITAL COST SUMMARY FOR SURFACE SOIL REMOVAL

Cost Compoent	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. Construction Costs	1,570,671	Published Costs	1993
a. Equipment			
b. Labor			
c. Materials			
Subtotal	1,570,671		
2. Equipment Costs			
___ Installed			
___ Purchased			
3. Land and Site Development			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
4. Buildings and Service			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
5. Relocation Costs			
Subtotal	0		
6. Disposal Costs			
Subtotal	0		
TOTAL DIRECT COSTS	1,570,671		
INDIRECT CAPITAL COSTS			
1. Engineering and Design	157,067	10% TDC	
2. Contingency Allowance	314,134	20% TDC	
3. Other Indirect Costs			
a. Legal Fees			
b. Licence/permit Costs			
c. Start-up & Shake-down			
Subtotal	471,201		
TOTAL INDIRECT COSTS	471,201		
TOTAL CAPITAL COSTS	2,041,872		1993

BASIS FOR CAPITAL COST FOR ALTERNATIVE: Surface Soil Removal

COST ITEM: Direct Capital Cost

COST COMPONENT: Construction Costs

BASIS: Direct capital costs include excavation of the top two (2) feet of soil with chromium concentrations greater than 50 ppm. Costs include items such as mobilization/ demobilization, removing the soil from its current location and stock piling it for treatment on-site, air monitoring for the presence of dust particles and watering to control dust.

CALCULATION/SOURCE: Costs are taken from the "Compendium of Costs of Remedial Technologies at Hazardous Waste Sites", October 1987, page 145, using the average excavation expenditure cost for the USEPA ELI/JRB 1979 surface soil cleanup in Missouri. Costs are updated to 1991 dollars using ENR Construction Cost Indexes.

CAPITAL COST SUMMARY FOR SUBSURFACE SOIL REMOVAL

2 TO 4 FEET OF SUBSURFACE SOIL

Cost Compoent	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. **Construction Costs**	3,629,551	Published Costs	1994
a. Equipment			
b. Labor			
c. Materials			
Subtotal	3,629,551		
2. **Equipment Costs**			
___ Installed			
___ Purchased			
3. **Land and Site Development**			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
4. **Buildings and Service**			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
5. **Relocation Costs**			
Subtotal	0		
6. **Disposal Costs**			
Subtotal	0		
TOTAL DIRECT COSTS	3,629,551		1994
INDIRECT CAPITAL COSTS			
1. **Engineering and Design**	362,955	10% TDC	
2. **Contingency Allowance**	725,910	20% TDC	
3. **Other Indirect Costs**			
a. Legal Fees			
b. Licence/permit Costs			
c. Start-up & Shake-down			
Subtotal	1,088,865		
TOTAL INDIRECT COSTS	1,088,865		
TOTAL CAPITAL COSTS	4,718,416		1994

CAPITAL COST SUMMARY FOR SUBSURFACE SOIL REMOVAL
2 to 15 FEET OF SUBSURFACE SOIL

Cost Compoent	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. Construction Costs	23,591,580	Published Costs	1994
a. Equipment			
b. Labor			
c. Materials			
Subtotal	23,591,580		
2. Equipment Costs			
___ Installed			
___ Purchased			
3. Land and Site Development			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
4. Buildings and Service			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
5. Relocation Costs			
Subtotal	0		
6. Disposal Costs			
Subtotal	0		
TOTAL DIRECT COSTS	23,591,580		1994
INDIRECT CAPITAL COSTS			
1. Engineering and Design	2,359,158	10% TDC	
2. Contingency Allowance	5,897,895	25% TDC	
3. Other Indirect Costs			
a. Legal Fees			
b. Licence/permit Costs			
c. Start-up & Shake-down			
Subtotal	8,257,053		
TOTAL INDIRECT COSTS	8,257,053		
TOTAL CAPITAL COSTS	31,848,633		1994

BASIS FOR CAPITAL COST FOR ALTERNATIVE: Subsurface Soil Removal

COST ITEM: Direct Capital Cost

COST COMPONENT: Construction Costs

BASIS: Direct capital costs include excavation of soil from 2 to 4 feet (minimum case) and from 2 to 15 feet (maximum case) with chromium concentrations greater than 50 ppm. Included are costs such as removing the soil from its current location and stock piling it for on-site treatment or loading it for off-site disposal, air monitoring, watering for dust control equipment and labor. Not included are costs for shoring due to presently unknown extent of contamination beneath the plant.

CALCULATION/SOURCE: Costs are taken from the "Compendium of Costs of Remedial Technologies at Hazardous Waste Sites", October 1987, page 146, excavation/removal costs for soil removal down to 15 feet done by the USEPA ELI/JRB in 1981 in California. Costs are updated to 1991 dollars using ENR Construction Cost Indexes.

CAPITAL COST SUMMARY FOR GROUND WATER EXTRACTION SYSTEM

Cost Component	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. Construction Costs	37,122	Published Cost Factors	1995
a. Equipment			
b. Labor			
c. Materials			
Subtotal	37,122		
2. Equipment Costs		Estimated From Plant Costs	1Phase II 1995
___ Installed			
_X_ Purchased	6,600		
3. Land and Site Development			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	6,600		
4. Buildings and Service			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
5. Relocation Costs			
Subtotal	0		
6. Disposal Costs			
Subtotal	0		
TOTAL DIRECT COSTS	43,722		
INDIRECT CAPITAL COSTS			
1. Engineering and Design	6,558	15% TDC	
2. Contingency Allowance	10,931	25% TDC	
3. Other Indirect Costs			
a. Legal Fees	1,312	3% TDC	
b. Licence/permit Costs	874	2% TDC	
c. Start-up & Shake-down	8,744	20% TDC	
Subtotal	28,419		
TOTAL INDIRECT COSTS	28,419		
TOTAL CAPITAL COSTS	72,141		1995

O&M COST ESTIMATE

TECHNOLOGY: Ground Water Extraction

BASIS: Published Cost Factors

CALCULATION:	Power	$9,519 Annually/Pump X 3 Pumps	$28,557
	Operations	$1.90/hr x 8760 hrs x 3 Pumps=	$49,932
		ANNUAL O&M COST	$78,489

BASIS FOR CAPITAL COST FOR ALTERNATIVE: Ground Water Extraction System

COST ITEM: Direct Capital Costs

COST COMPONENT: Construction and Equipment Costs

BASIS: Direct capital costs include construction and equipment costs for a three well ground water extraction system. Costs include items such as installation of wells, materials to construct wells, pumps, piping, electrical wiring, instruments and labor for field construction of these items.

CALCULATION/SOURCE: Installation and equipment costs were estimated based on similar costs from the Plant 1 Phase II RI pumping test. Piping, labor and setup costs were calculated using factors from Perry's Chemical Engineers' Handbook, 6th Edition. O&M costs were taken from "Remedial Action at Waste Disposal Sites: Handbook (Revised)", October 1985. Costs were updated, if necessary to 1991 dollars using ENR Construction Cost Indexes.

CAPITAL COST SUMMARY FOR BUILDING DECONTAMINATION

Cost Compoent	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. Construction Costs	240,000	Vender Quote	1993
a. Equipment			
b. Labor			
c. Materials			
Subtotal	240,000		
2. Equipment Costs			
___ Installed			
___ Purchased			
3. Land and Site Development			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
4. Buildings and Service			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
5. Relocation Costs			
Subtotal	0		
6. Disposal Costs	39,000	Estimate	1993
Subtotal	39,000		
TOTAL DIRECT COSTS	279,000		1993
INDIRECT CAPITAL COSTS			
1. Engineering and Design	19,530	7% TDC	
2. Contingency Allowance	69,750	25% TDC	
3. Other Indirect Costs			
a. Legal Fees	2,790	1% TDC	
b. Licence/permit Costs	2,790	1% TDC	
c. Start-up & Shake-down			
Subtotal	94,860		
TOTAL INDIRECT COSTS	94,860		
TOTAL CAPITAL COSTS	373,860		1993

BASIS FOR CAPITAL COST FOR ALTERNATIVE: Building Decontamination

COST ITEM: Direct Capital Cost

COST COMPONENT: Construction Costs

BASIS: Direct capital cost includes decontamination of the building and its components to prepare it for demolition/dismantling and disposal. Total cost includes sand blasting surfaces, labor, materials, safety equipment, air monitoring and disposing of waste sand in a secure landfill.

CALCULATION/SOURCE: Decontamination costs were based on a vender quotation and disposal and treatment costs from similar projects.

CAPITAL COST SUMMARY FOR ASBESTOS REMOVAL

Cost Compoent	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. Construction Costs	40,000	Vender Estimate	1993
a. Equipment			
b. Labor			
c. Materials			
Subtotal	40,000		
2. Equipment Costs			
___ Installed			
___ Purchased			
3. Land and Site Development			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
4. Buildings and Service			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
5. Relocation Costs			
Subtotal	0		
6. Disposal Costs	640	Estimate	1993
Subtotal	640		
TOTAL DIRECT COSTS	40,640		1993
INDIRECT CAPITAL COSTS			
1. Engineering and Design	6,096	15% TDC	
2. Contingency Allowance	10,160	25% TDC	
3. Other Indirect Costs			
a. Legal Fees	406	1% TDC	
b. Licence/permit Costs	406	1% TDC	
c. Start-up & Shake-down			
Subtotal	17,069		
TOTAL INDIRECT COSTS	17,069		
TOTAL CAPITAL COSTS	57,709		1993

BASIS FOR CAPITAL COST FOR ALTERNATIVE: Asbestos Removal

COST ITEM: Direct Capital Cost

COST COMPONENT: Construction and Disposal costs

BASIS: Direct capital costs include removal and disposal of asbestos containing material within VDH Plant #2. Asbestos volume is based on preliminary observations and sampling data. Included in the cost are items such as air monitoring, asbestos removal, asbestos disposal, safety equipment and other removal equipment.

CALCULATION/SOURCE: Costs are based on a vender estimate and from waste disposal costs incurred at other similar sites.

CAPITAL COST SUMMARY FOR BUILDING DEMOLITION

Cost Component	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. Construction Costs	575,440	Vender Estimate	1993
a. Equipment			
b. Labor			
c. Materials			
Subtotal	575,440		
2. Equipment Costs			
___ Installed			
___ Purchased			
3. Land and Site Development			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
4. Buildings and Service			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
5. Relocation Costs			
Subtotal	0		
6. Disposal Costs		Included Above	
Subtotal	0		
TOTAL DIRECT COSTS	575,440		1993
INDIRECT CAPITAL COSTS			
1. Engineering and Design	86,316	15% TDC	
2. Contingency Allowance	143,860	25% TDC	
3. Other Indirect Costs			
a. Legal Fees	5,754	1% TDC	
b. Licence/permit Costs	28,772	5% TDC	
c. Start-up & Shake-down			
Subtotal	264,702		
TOTAL INDIRECT COSTS	264,702		
TOTAL CAPITAL COSTS	840,142		

BASIS FOR CAPITAL COST FOR ALTERNATIVE: Building Demolition

COST ITEM: Direct Capital Cost

COST COMPONENT: Construction Costs

BASIS: Direct capital costs include demolition of the VDH Plant #2 building, transportation and disposal costs of the debris. Additional equipment costs were included such as air monitoring, safety and heavy demolition equipment. Material is assumed to be disposed of in a C&D landfill. Asbestos removal and building decontamination are covered under separate technology cost items.

CALCULATION/SOURCE: Costs are based on a vender estimate and from costs incurred in similar projects.

CAPITAL COST SUMMARY FOR SITE CAPPING
(0-2' excavation of contaminated soil outside cap area)

Cost Compoent	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. Construction Costs	2,125,092	Published Costs	1994
a. Equipment			
b. Labor			
c. Materials			
Subtotal	2,125,092		
2. Equipment Costs			
___ Installed			
___ Purchased			
3. Land and Site Development			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
4. Buildings and Service			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
5. Relocation Costs			
Subtotal	0		
6. Disposal Costs			1993
Subtotal	0		
TOTAL DIRECT COSTS	2,125,092		1994
INDIRECT CAPITAL COSTS			
1. Engineering and Design	212,509	10% TDC	
2. Contingency Allowance	425,018	20% TDC	
3. Other Indirect Costs			
a. Legal Fees	42,502	2% TDC	
b. Licence/permit Costs	63,753	3% TDC	
c. Start-up & Shake-down			
Subtotal	106,255		
TOTAL INDIRECT COSTS	743,782		
TOTAL CAPITAL COSTS	2,868,874		1994

CAPITAL COST SUMMARY FOR SITE CAPPING
(0-15' excavation of contaminated soil outside cap area)

Cost Compoent	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. Construction Costs	6,874,890	Published Costs	1994
a. Equipment			
b. Labor			
c. Materials			
Subtotal	6,874,890		
2. Equipment Costs			
___ Installed			
___ Purchased			
3. Land and Site Development			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
4. Buildings and Service			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
5. Relocation Costs			
Subtotal	0		
6. Disposal Costs			1993
Subtotal	0		
TOTAL DIRECT COSTS	6,874,890		1994
INDIRECT CAPITAL COSTS			
1. Engineering and Design	1,031,234	15% TDC	
2. Contingency Allowance	1,718,723	25% TDC	
3. Other Indirect Costs			
a. Legal Fees	137,498	2% TDC	
b. Licence/permit Costs	206,247	3% TDC	
c. Start-up & Shake-down			
Subtotal	343,745		
TOTAL INDIRECT COSTS	3,093,701		
TOTAL CAPITAL COSTS	9,968,591		1994

BASIS FOR CAPITAL COST FOR ALTERNATIVE: Site Capping

COST ITEM: Direct Capital Costs

COST COMPONENT: Construction Costs

BASIS: Direct capital costs include capping a portion of the site (approximately 200,000 sq. ft) with a composite cap. The cost estimate does not include topsoil which is included in the site restoration technology and cap maintenance which is a separate cost item.

CALCULATION/SOURCE: Direct costs were taken from "Remedial Action at Waste Disposal Sites: Handbook (Revised)", October 1985. Costs were updated to current dollars using ENR Construction Cost Indexes.

CAPITAL COST SUMMARY FOR SOLIDIFICATION/STABILIZATION OF CONTAMINATED SOIL/SEDIMENT

2 to 4 FEET OF SUBSURFACE SOIL

Cost Compoent	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. Construction Costs a. Equipment b. Labor c. Materials	2,607,082	Published Costs	1994
Subtotal	2,607,082		
2. Equipment Costs ___ Installed ___ Purchased			
3. Land and Site Development a. Equipment b. Labor c. Materials			
Subtotal	0		
4. Buildings and Service a. Equipment b. Labor c. Materials			
Subtotal	0		
5. Relocation Costs			
Subtotal	0		
6. Disposal Costs			
Subtotal	0		
TOTAL DIRECT COSTS	2,607,082		
INDIRECT CAPITAL COSTS			
1. Engineering and Design	260,708	10% TDC	
2. Contingency Allowance	521,416	20% TDC	
3. Other Indirect Costs			
a. Legal Fees	78,212	3% TDC	
b. Licence/permit Costs	52,142	2% TDC	
c. Start-up & Shake-down	521,416	20% TDC	
Subtotal	1,433,895		
TOTAL INDIRECT COSTS	1,433,895		
TOTAL CAPITAL COSTS	4,040,977		1994

CAPITAL COST SUMMARY FOR SOLIDIFICATION/STABILIZATION OF CONTAMINATED SOIL/SEDIMENT

2 TO 15 FEET OF SUBSURFACE SOIL

Cost Component	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. Construction Costs a. Equipment b. Labor c. Materials	8,835,749	Published Costs	1994
Subtotal	8,835,749		
2. Equipment Costs ___ Installed ___ Purchased			
3. Land and Site Development a. Equipment b. Labor c. Materials			
Subtotal	0		
4. Buildings and Service a. Equipment b. Labor c. Materials			
Subtotal	0		
5. Relocation Costs			
Subtotal	0		
6. Disposal Costs			
Subtotal	0		
TOTAL DIRECT COSTS	8,835,749		
INDIRECT CAPITAL COSTS			
1. Engineering and Design	1,325,362	15% TDC	
2. Contingency Allowance	2,208,937	25% TDC	
3. Other Indirect Costs			
a. Legal Fees	265,072	3% TDC	
b. Licence/permit Costs	176,715	2% TDC	
c. Start-up & Shake-down	1,767,150	20% TDC	
Subtotal	5,743,237		
TOTAL INDIRECT COSTS	5,743,237		
TOTAL CAPITAL COSTS	14,578,986		1994

BASIS FOR CAPITAL COST FOR ALTERNATIVE: Solidification/Stabilization of Contaminated Soil

COST ITEM: Direct Capital Costs

COST COMPONENT: Construction Costs

BASIS: Direct Capital Costs include Solidification/Stabilization of chromium contaminated soil based upon estimated volumes. Included in the costs are items such as labor, equipment rental, construction of on-site facilities for batch mixing, air monitoring and chemical costs.

CALCULATION/SOURCE: Direct costs were taken from "Remedial Action at Waste Disposal Sites: Handbook (Revised)", October 1985. Costs were updated to 1991 dollars using ENR Construction Cost Indexes.

CAPITAL COST SUMMARY FOR CONTAMINATED SOIL TO OFF-SITE LANDFILL

2 TO 4 FEET OF SUBSURFACE SOIL

Cost Compoent	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. Construction Costs			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
2. Equipment Costs			
___ Installed			
___ Purchased			
3. Land and Site Development	2,274,580	Vender Quotes	1993
a. Equipment			
b. Labor			
c. Materials			
Subtotal	2,274,580		
4. Buildings and Service			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
5. Relocation Costs			
Subtotal	0		
6. Disposal Costs	4,052,888	Vender Information	1993
Subtotal	4,052,888		
TOTAL DIRECT COSTS	6,327,468		
INDIRECT CAPITAL COSTS			
1. Engineering and Design	632,747	10% TDC	
2. Contingency Allowance	1,265,494	20% TDC	
3. Other Indirect Costs			
a. Legal Fees	126,549	2% TDC	
b. Licence/permit Costs	189,824	3% TDC	
c. Start-up & Shake-down			
Subtotal	2,214,614		
TOTAL INDIRECT COSTS	2,214,614		
TOTAL CAPITAL COSTS	8,542,082		1993

CAPITAL COST SUMMARY FOR CONTAMINATED SOIL TO OFF-SITE LANDFILL

2 TO 15 FEET OF SUBSURFACE SOIL

Cost Compoent	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. **Construction Costs**			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
2. **Equipment Costs**			
___ Installed			
___ Purchased			
3. **Land** and Site Development	7,708,855	Vender Quotes	1993
a. Equipment			
b. Labor			
c. Materials			
Subtotal	7,708,855		
4. **Buildings and Service**			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
5. **Relocation Costs**			
Subtotal	0		
6. **Disposal Costs**	13,735,778	Vender Information	1993
Subtotal	13,735,778		
TOTAL DIRECT COSTS	21,444,633		
INDIRECT CAPITAL COSTS			
1. **Engineering and Design**	**2,144,463**	10% TDC	
2. **Contingency Allowance**	**5,361,158**	25% TDC	
3. **Other Indirect Costs**			
a. Legal Fees	**428,893**	2% TDC	
b. Licence/permit Costs	**643,339**	3% TDC	
c. Start-up & Shake-down			
Subtotal	8,577,853		
TOTAL INDIRECT COSTS	8,577,853		
TOTAL CAPITAL COSTS	30,022,486		1993

BASIS FOR CAPITAL COST FOR ALTERNATIVE: Off-site Landfilling

COST ITEM: Direct Capital Costs

COST COMPONENT: Land Development and Disposal Costs

BASIS: Direct capital costs were based on disposal facility unit costs for disposal and transportation. Costs include items such as procurement, placement and rough grading of clean fill in the excavated areas, disposal of the contaminated soil, and transportation of soil/fill to and from the site.

CALCULATION/SOURCE: Cost information for treatment, transportation and disposal came from current vender costs. Cost information for backfilling was from quotes provided to ERM for a similar project recently completed.

CAPITAL COST SUMMARY FOR SITE RESTORATION

Cost Compoent	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. Construction Costs			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
2. Equipment Costs			
___ Installed			
___ Purchased			
3. Land and Site Development	188,586	Published Costs	1995
a. Equipment			
b. Labor			
c. Materials			
Subtotal	188,586		
4. Buildings and Service			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
5. Relocation Costs			
Subtotal	0		
6. Disposal Costs			
Subtotal	0		
TOTAL DIRECT COSTS	188,586		1995
INDIRECT CAPITAL COSTS			
1. Engineering and Design	18,859	10% TDC	
2. Contingency Allowance	37,717	20% TDC	
3. Other Indirect Costs			
a. Legal Fees	1,886	1% TDC	
b. Licence/permit Costs	1,886	1% TDC	
c. Start-up & Shake-down			
Subtotal	60,348		
TOTAL INDIRECT COSTS	60,348		
TOTAL CAPITAL COSTS	248,934		1995

O&M COST ESTIMATE

TECHNOLOGY: Site Restoration

BASIS: Published Cost Factors

CALCULATION:	Annual Inspection	\$604/year
	Mowing/Revegetation	\$725/year
	Erosion Control	\$242/year
	Repairs	\$241/year
	ANNUAL O&M COST	\$1,812/year

BASIS FOR CAPITAL COST FOR ALTERNATIVE: Site Restoration

COST ITEM: Direct Capital Costs

COST COMPONENT: Land and Site Development

BASIS: Direct capital costs include an additional 300,658 sq. ft. of topsoil, grass and small trees to restore site grade and surrounding area. Included in the cost are items such as procurement, placement and grading of the topsoil, seeding, tree and shrub placement, labor and equipment costs.

CALCULATION/SOURCE: Costs for both direct costs and O&M were taken from "Remedial Action at Waste Disposal Sites: Handbook (Revised)", October 1985. Costs were updated to current dollars using ENR Construction Cost Indexes.

CAPITAL COST SUMMARY FOR CONVENTIONAL PRECIP. TO OLEAN CREEK

Cost Component	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. Construction Costs	244,841	Published Costs	1995
a. Equipment			
b. Labor			
c. Materials			
Subtotal	244,841		
2. Equipment Costs		Included Above	
___ Installed			
___ Purchased			
3. Land and Site Development			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
4. Buildings and Service			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	0		
5. Relocation Costs			
Subtotal	0		
6. Disposal Costs			
Subtotal	0		
TOTAL DIRECT COSTS	244,841		1995
INDIRECT CAPITAL COSTS			
1. Engineering and Design	36,726	15% TDC	
2. Contingency Allowance	61,210	25% TDC	
3. Other Indirect Costs			
a. Legal Fees	2,448	1% TDC	
b. Licence/permit Costs	9,794	4% TDC	
c. Start-up & Shake-down	24,484	10% TDC	
Subtotal	36,726		
TOTAL INDIRECT COSTS	134,663		
TOTAL CAPITAL COSTS	379,504		1995

O&M COST ESTIMATE

TECHNOLOGY: Conventional Ground Water Treatment with Discharge to Surface Water

BASIS: Vender Estimates, Treatability Study and Published Costs

CALCULATION:	Process O&M	$43,139/year	$43,139
	Sludge Disposal	$4,333/year	$4,333
	Operators	$190,000/year	$190,000
	Chemical Costs	$138,943/year	$138,943
		TOTAL ANNUAL O&M COST	$376,415

BASIS FOR CAPITAL COST FOR ALTERNATIVE: On-site Conventional Treatment with Discharge to Surface Water

COST ITEM: Direct Capital Costs

COST COMPONENT: Construction Costs

BASIS: Direct Capital costs are for an on-site treatment system which includes items such as equipment purchase/rental, pumps, field construction of plant, instrumentation, piping and secondary containment for the facility. The total costs for O&M include, operator costs, disposal of the sludge and treatment chemical costs.

CALCULATION/SOURCE: Direct costs were taken from "Remedial Action at Waste Disposal Sites: Handbook (Revised)", October 1985. Costs were updated to current dollars using ENR Construction Cost Indexes. Chemical usage numbers and sludge volume were based on the treatability study. Chemical costs were taken from "Technologies for Upgrading Existing or Designing New Drinking Water Treatment Facilities", EPA, March 1990.

O&M COST ESTIMATE

TECHNOLOGY: Semi-Annual Monitoring

BASIS: ERM RI Costs

CALCULATION:	Analysis	$1,319/Sample x 10 Samples=	$13,190
	Labor	2 persons x 3days/event x 9 hrs/day x $60/hr=	$3,240
	Equipment	Costs	$1,000
		Cost/Event	$17,430
		ANNUAL O&M COST 2x$17,430=	$34,860

CAPITAL COST SUMMARY FOR ACTIVATED CARBON DISC. TO POTW

Cost Compoent	Cost Estimate	Basis of Estimate	Year Incurred
DIRECT CAPITAL COSTS			
1. Construction Costs		Published Costs	1995
a. Equipment			
b. Labor			
c. Materials			
Subtotal	$0		
2. Equipment Costs	$15,000	Vender Quote	1995
_x_ Installed (leased)			
___ Purchased			
3. Land and Site Development			
a. Equipment			
b. Labor			
c. Materials			
Subtotal	$15,000		
4. Buildings and Service	$33,000	Vendor Information	1995
a. Equipment			
b. Labor			
c. Materials			
Subtotal	$33,000		
5. Relocation Costs			
Subtotal	$0		
6. Disposal Costs			
Subtotal	$0		
TOTAL DIRECT COSTS	$48,000		
INDIRECT CAPITAL COSTS			
1. Engineering and Design	$4,800	10% TDC	
2. Contingency Allowance	$12,000	25% TDC	
3. Other Indirect Costs			
a. Legal Fees	$480	1% TDC	
b. Licence/permit Costs	$1,440	3% TDC	
c. Start-up & Shake-down	$4,800	10% TDC	
Subtotal	$23,520		
TOTAL INDIRECT COSTS	$23,520		
TOTAL CAPITAL COSTS	$71,520		1995

O&M COST ESTIMATE

TECHNOLOGY: Activated Carbon Treatment followed by Discharge to POTW

BASIS: Published Cost Factors and Vender Estimates

CALCULATION:

Carbon and Delivery		
Trans for Disposal		
Lease Cost	\$80,000/year	\$80,000
Carbon Disposal	\$4,000/load x 3 loads	\$12,000
Power & Maintenance	\$9,327/year	\$9,327
Operators	\$190,000/year	\$190,000
POTW Charge	\$47,432/year	\$47,432
	TOTAL ANNUAL O&M COST	\$338,759

BASIS FOR CAPITAL COST FOR ALTERNATIVE: Activated Carbon Treatment of Contaminated Ground Water and Discharge to POTW

COST ITEM: Direct Capital Costs

COST COMPONENT: Construction, Equipment and Buildings Costs

BASIS: Direct Capital costs include leasing a carbon treatment system to treat 75 gpm of contaminated ground water followed by discharge of 75 gpm of ground water to the POTW. Also included are items such as construction of a line to tap into the local sanitary sewer main and initial carbon costs.

CALCULATION/SOURCE: Cost data were mainly taken from vendor information and from the "Remedial Action at Waste Disposal Sites: Handbook (Revised)", October 1985. Costs were updated, if necessary, using ENR Construction Cost Index data.

O&M COST ESTIMATE

TECHNOLOGY: Ground Water to POTW

BASIS: Vender Estimates

CALCULATION:	POTW Charge	75 gal/min x \$0.90/748 gal x 525,600 min/yr	\$47,432
		TOTAL ANNUAL O&M COST	\$47,432