NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
50 Wolf Road, Albany, New York 12233

Michael D. Zagata
Commissioner

RECEIVED
SEP 14 1995

September 12, 1995

Ms. Carol Graff
Eder Associates, Inc.
413 Riverview Executive Park
Trenton, NJ 08611

SEP 21 1995

Dear Ms. Graff:

RE: FAIRCHILD REPUBLIC OLD RECHARGE BASIN (#152004) REMEDIAL INVESTIGATION REPORT, FEASIBILITY STUDY, AND HEALTH RISK ASSESSMENT

The New York State Department of Environmental Conservation (NYSDEC) has received and reviewed the Remedial Investigation/Feasibility Study (RI/FS) dated August 1995. The Department does not agree with all of the conclusions contained in the RI/FS, however, the Department does hereby approve the RI/FS. A synopsis of the Department's reservations follow:

> The NYSDEC does not agree with the overall implication of the report that all contamination is due to off-site sources and Fairchild cannot be a source of any contamination. The report also implies that several specific sites are responsible for the local contamination found around the Old Recharge Basin (ORB). This has not been demonstrated conclusively. For example, the contaminants found at the Fire Department are not the same contaminants that were found at high levels in the MW-6 cluster and therefore the Fire Department is not a likely source of the contamination found in the MW-6 cluster.
>
> The NYSDEC does not agree that since little groundwater contamination is currently found in the immediate vicinity of the ORB (except in MW-6 cluster), that Fairchild was never a source of groundwater contamination. Contamination may have migrated downgradient.
>
> The NYSDEC does not agree that the SPDES sampling done in the 1980s is indicative of the entire discharge history of Fairchild into the ORB. These comments are discussed at length in previous correspondence.

The Health Risk Assessment, previously reviewed and commented on (letter to C. Graff from NYSDEC dated July 20, 1995), is also hereby approved by the Department. The Department again does not agree with all of the conclusions in the assessment. Those reservations are expressed in the attached letter (to S. Dewes from J. Crua dated July 14, 1995).

A copy of this letter with its attachments is to be placed in the front of each of these reports as a condition of approval. Please send a final copy of each document to Mr. Joseph Crua of NYSDOH, Sy Robbins of the Suffolk County Department of Health Services, Rosalie Rusinko of the Division of Environmental Enforcement in Tarrytown, NY, and two copies of each document to myself by September 20, 1995.

We anticipate holding a public meeting to discuss the Proposed Remedial Action Plan during the first week of November. This will necessitate Eder place these documents in the information repositories by October 11, 1995.

If you have any questions, please call me at (518) 457-3395.

Sincerely,

Sally W Dewes

Sally W.W. Dewes, P.E.
Environmental Engineer 2
Bureau of Eastern Remedial Action
Div. of Hazardous Waste Remediation

c: M. O'Toole
S. Ervolina/S. McCormick
J. Crua, NYSDOH
S. Robbins, SCDHS
R. Rusinko, DEE

FAIR52

STATE OF NEW YORK
DEPARTMENT OF HEALTH

Office of Public Health II University Place Albany, New York 12203-3399

Barbara A. DeBuono, M.D., M.P.H.
Commissioner

Karen Schimke
Executive Deputy Commissioner

July 14, 1995

RECEIVED
JUL 20 1995

Ms. Sally Dewes
Division of Hazardous Waste Remediation
NYS Department of Environmental Conservation
50 Wolf Road
Albany, New York 12233

RE: Health Risk Assessment Revisions
Fairchild Old Recharge Basin
Site# 152004
Farmingdale, Suffolk County

Dear Ms. Dewes:

I have reviewed the "Revisions to the Old Recharge Basin Baseline Risk Assessment" for the above referenced site. Based on that review I have the following comments:

1. As stated previously in my February 7, 1995 letter to you regarding the Baseline Risk Assessment, the risk values presented in the Revised Baseline Risk Assessment are based on the assumption that the potential for exposure to contaminants present on-site will remain limited. That is, the site will remain fenced, posted with warning signs, and the water in the basin will stay at the current depth of 20 to 40 feet which significantly reduces the possibility of contact with contaminated sediments. Any change in the status of the above mentioned barriers which would allow access to areas of confirmed contamination would significantly increase carcinogenic and non-carcinogenic risks.

2. Page 2 - <u>Selection of Chemicals of Concern:</u>

The New York State Department of Environmental Conservation (NYSDEC) soil/sediments Clean-up Criteria are based primarily on the protection of groundwater and <u>not</u> public health. Please remove this reference from the document.

3. Page 3 - <u>Exposure Assessment:</u>

The allegations made by the consultant that "These exposure scenarios are not an estimate of reasonable maximum exposures expected under the current and future land use" is false and should be removed from the document. While visiting the site on July 1, 1993, New York State Department of Health (NYSDOH) and NYSDEC staff observed a raft constructed of 55 gallon drums, planks and ropes. The raft is presumably used by youths to float around the recharge basin. In addition, during a public meeting on February 28, 1994 for the nearby Kenmark Textiles site (ID #152032), one citizen informed NYSDOH staff that children did occasionally trespass onto the Fairchild Old

Recharge Basin site. Based on this information, exposure to site related contaminants could occur by the five pathways listed in the Exposure Assessment section of this document.

4. Page 8 - Summary:

The health risk values calculated for the exposure scenarios referenced in this document do not represent a significant health concern because of the existing on-site barriers which prevent easy access to areas of known contamination. This information should be included in the summary.

5. Page 9 - Uncertainties:

For reasons stated earlier, the exposure scenarios evaluated in this document are relevant to site conditions. Therefore, the allegation made by the consultant in the first sentence of this section, that the exposure scenarios evaluated are "highly improbable" should be removed.

If the statements made by the consultant cited in this letter are not removed from the document as requested, I recommend that you attach a copy of this letter to said document when it is sent to public repository. Also, at your request the NYSDOH can provide you with a photograph of the raft observed in the recharge basin in July 1, 1993, for inclusion into the public repository.

Should you have questions, please call me at (518) 458-6305.

Sincerely,

Joseph P. Crua
Environmental Health Specialist II
Bureau of Environmental Exposure Investigation

sg/95195PR00057

cc: Dr. A. Carlson
Mr. Bates/Mr. VanValkenburg
Mr. Robbins - SCDHS
Ms. McCormick - DEC
Mr. Shah - DEC, Region 1

FAIRCHILD INDUSTRIES, INC.
CHANTILLY, VIRGINIA

OLD RECHARGE BASIN
FEASIBILITY STUDY

SEP 21 1995

PROJECT #961-4.1

SEPTEMBER 1995

Office Location:
EDER ASSOCIATES
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Locust Valley, New York 11560

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Offices in New York, Wisconsin, Michigan, Georgia, Florida and New Jersey

FEASIBILITY STUDY REPORT
OLD RECHARGE BASIN
FAIRCHILD INDUSTRIES, INC.
CHANTILLY, VIRGINIA

Eder Associates is submitting this Feasibility Study report to Fairchild Industries, Inc. for its Old Recharge Basin, East Farmingdale site. The report was prepared in accordance with Eder Associates' strict quality assurance/quality control procedures to ensure that the Feasibility Study meets the highest standards in terms of the methods used and the information presented. If you have any questions or comments concerning the Feasibility Study, please contact one of the individuals listed below.

Respectfully submitted,

EDER ASSOCIATES

Carol S. Graff
Project Manager

Gary A. Rozmus
Senior Vice President

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- continued -

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FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 Purpose and Organization of Report

Fairchild Industries, Inc. (Fairchild) retained EDER ASSOCIATES (EDER) to prepare this Feasibility Study (FS) for its East Farmingdale site in accord with New York Department of Environmental Conservation's (NYSDEC's) March 1992 Order on Consent, which required that Fairchild conduct a Remedial Investigation (RI) and FS for the Old Recharge Basin (ORB) site.

This draft FS includes summaries of the ORB RI, Supplemental Remedial Investigation, and Baseline Risk Assessment results; the remedial action objectives; the screening of general technologies; and the development and screening of alternatives based on effectiveness, implementability, and cost. This FS evaluates alternatives to remediate surface soil around the ORB and basin sediments; groundwater remediation will be addressed in the Fairchild Main Plant RI/FS that is being prepared under a separate Consent Order.

The FS report format corresponds to USEPA's "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, October 1988" and is organized into five sections; Introduction (1.0), Identification and Screening of Technologies (2.0), Development and Screening of Remedial Alternatives (3.0), Detailed Analysis of Remedial Alternatives (4.0), and Comparative Analysis of Remedial Alternatives (5.0). The content of these sections is described below.

Introduction

The FS introduction includes background information from the ORB Final Remedial Investigation Report (EDER, November 1994) and the Baseline Risk Assessment (EDER, December 1994). These documents contain site descriptions and history; the nature and extent of contamination at the ORB in surface soil, sediment, surface water, and groundwater; the fate and transport of contaminants in these media; and the baseline risk assessment.

Identification and Screening of Technologies

The identification and screening of technologies begins by identifying remedial action objectives (RAOs) for the ORB site which are established in Section 2.0 of this FS. General response actions that may achieve the RAOs for the site are also identified. General response actions may include technologies such as treatment, recovery, excavation, containment, disposal, and institutional actions, alone or in combination. Technologies that fall within the general response action categories are identified and screened in two steps in Section 2.0. The technology screening focuses on specific process options within each technology type. At least one representative process option from each technology is retained for further consideration in this FS, if practicable.

Development and Screening of Remedial Alternatives

In Section 3.0, the remaining technologies and process options are assembled into alternatives that define a range of remedial possibilities. A no action alternative, as required by the National Oil and Hazardous Substances Contingency Plan (NCP), is also included. Alternatives addressing contaminated surface soil and sediment are developed and screened in Section 3.0 based on general effectiveness, implementability and cost.

Detailed Analysis of Remedial Alternatives

The alternatives carried through to Section 4.0 are then analyzed in detail, based on the criteria contained in the NCP. The purpose of this detailed evaluation is to provide the decision-maker with the information needed to select an appropriate, cost-effective alternative consistent with site conditions and risks.

Comparative Analysis of Remedial Alternative

In Section 5.0, the remedial alternatives are compared to each other based on the CERCLA evaluation criteria.

1.2 Site Background

Site Description

The Fairchild site is located in Western Suffolk County on the west side of Route 110, south of Conklin Street (Route 24) in East Farmingdale, New York. Figure 1 is a location map of the site. The water-filled portion of the site, referred to as the Old Recharge Basin (ORB), encompasses approximately 10.5 acres and is situated on an approximate 13.2 acre parcel of land surrounded by a chain link fence with a locked gate. Figure 2 is a site map of the ORB. The ORB currently consists of two ponds (referred to as the North Pond and the South Pond) separated by a land bridge. The bottom of the ORB is at a maximum depth of 65 feet below grade. The ORB is hydraulically connected to groundwater and contains about 30 feet of surface water (approximately 32 million gallons). The ORB is a New York State Inactive Hazardous Waste Site (number 152004) and is surrounded by commercial property with the exception of several residences on the west side. Several NYSDEC-listed inactive hazardous waste sites are located hydraulically upgradient (north-northwest) of the ORB.

Ownership of the ORB has changed several times since it was originally developed as a sand mine in the 1930's. Republic Aviation Corporation, a Fairchild predecessor, purchased five acres of the site from New York State in approximately 1940. Republic was permitted to discharge drainage water from the plant to the ORB and to extract water from the Basin for cooling purposes. Fairchild shared ownership of the ORB with the New York State Department of Transportation (NYSDOT) and Picone Brothers (Picone), all of whom reportedly discharged to the Basin. Fairchild's discharge pipe was on the eastern bank of the North Pond; NYSDOT's discharge pipe was located on the northeastern bank of the North Pond; and Picone's discharge pipe was located on the western bank of the southernmost extension of the South Pond.

Other facilities, including Picone and Eaton AIL Division (now occupied by Telephonics Corporation) allegedly discharged wastewater of unknown composition to the ORB for an unknown time period. Fairchild was issued a permit to discharge to the Basin by the New York Department of Health on January 13, 1941 and had a State Pollution Discharge Elimination System (SPDES) permit from 1949 to 1983. At one time, a portion of the ORB was owned by Kenmark Textiles, who operated a facility adjacent to Fairchild. The Kenmark site is now a NYSDEC-listed inactive hazardous waste site (No. 152032) and a suspected groundwater contamination source upgradient of the ORB. The East Farmingdale Fire Department at the corner of Carmans Road and the Target Rock site (NYSDEC site No. 152119) have also been identified as suspected groundwater contamination sources upgradient of the ORB.

In September 1981, the Suffolk County Department of Health Services (SCDHS) ordered that all wastewater discharges to the ORB be eliminated because of flooding. At this time, Fairchild diverted its treated industrial wastewater to the sanitary sewer system but continued to discharge non-contact cooling water and stormwater runoff to the Basin. All Fairchild discharges were diverted to a new recharge basin in 1983 when the outfall pipe to the ORB was sealed. Between 1983 and 1987, the only evident discharges to the ORB were stormwater runoff from Eaton AIL Division located south of the plant on the east side of Route 110, from the northwest end of Republic Airport, and from the northwest corner parking area at the former Fairchild plant east of Route 110. Since April 1987, the only point discharge to the ORB has been stormwater from Route 110 where runoff leaks through a manhole into a sewer pipe leading to the Basin.

Previous Studies

The SCDHS required a comprehensive study of the Basin in response to a 1981 SPDES violation. On August 11, 1982, Fairchild entered into a Consent Agreement with SCDHS to study the ORB and investigations followed between 1982 and 1989.

Five environmental investigations of the ORB, conducted prior to the RI, provided a comprehensive and detailed analysis of the physical, chemical, and hydrogeologic condition of the Basin. The first two studies were conducted by York Wastewater Consultants (YWC) and the remaining three by Geraghty & Miller (G&M). These investigations addressed groundwater, surface water, soil and sediment. Volatile organic compounds (VOCs) were detected at upgradient and downgradient wells at comparable concentrations, indicating that there was no significant impact to on-site groundwater quality.

Samples of bottom sediment were collected from the ORB during the 1985 G&M investigation for analysis to determine the leachability of metals in the sediment. The results indicated that trace amounts of metals leach from the bottom sediments at concentrations below regulatory standards, and demonstrated that the sediment was not a continuing source of metals in groundwater. Further investigations of the sediment and underlying native soil were conducted by G&M in 1989. VOCs, semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and metals were detected in the ORB sediment. Pesticides were also detected in sediment samples from two of eight borings in the South Pond. The concentrations of VOCs and pesticides detected in the sediment samples were an order of magnitude higher than the native soil concentrations.

G&M collected surface water samples from the ORB in January 1989. VOCs and metals were detected in the surface water samples; PCBs and pesticides were not.

1.3 Nature and Extent of Contamination

The five environmental investigations conducted prior to the RI established a database on the physical and chemical characteristics of groundwater, surface water, surrounding surface soil, and sediments at the ORB site. The RI and the Supplemental RI were conducted by EDER to further characterize the nature and extent of contamination in the area of the ORB. The supplemental RI work was implemented in response to NYSDEC's June 1993 request for additional data. The RI results are summarized below. Table 1 summarizes the ORB surface soil, sediment, and surface water analytical data and lists the frequency of detection and average/maximum concentrations of each contaminant detected in the samples. Table 2 includes the applicable NYSDEC standards, cleanup objectives, and criteria for each contaminant detected at concentrations above these levels.

Groundwater

The RI results indicate that the ORB is not a continuing source of the VOCs, SVOCs, chromium, lead, pesticides and PCBs found in the groundwater samples from the monitoring wells installed at the ORB site. These contaminants are not associated with Fairchild's discharges to the Basin and may be due to off-site source(s) located hydraulically upgradient or sidegradient of the Basin.

Two rounds of groundwater samples were collected during the RI from 26 monitoring wells in the vicinity of the ORB. Figure 3 shows the monitoring well locations. The groundwater samples contained the following VOCs at concentrations above the 5 µg/l NYSDEC groundwater quality standard for the individual compounds: 1,1,1-trichloroethane (1,1,1-TCA); 1,1-dichloroethene (1,1-DCE); 1,1-dichloroethane (1,1-DCA); 1,2-dichloroethene (1,2-DCE); trichloroethylene (TCE); and tetrachloroethylene (PCE). 1,1,1-TCA was present at the highest concentration (660 µg/l); the 1,1-DCE concentration (70 µg/l) was the next highest. The remaining VOCs were present at less than 50 µg/l. The highest VOC concentrations were found in groundwater samples collected from monitoring wells located sidegradient of the ORB.

Trace levels of SVOCs were reported at estimated concentrations below the method quantification limit. The estimated pentachlorophenol concentration in one sample (2 µg/l) and the estimated concentrations of benzo(a)pyrene (0.3 to 0.6 µg/l) at two locations were slightly above the NYSDEC groundwater standard. All other SVOC results were below the respective standards.

The groundwater samples collected during the RI were analyzed for total and dissolved metals. The iron, manganese and sodium concentrations in groundwater samples collected from the ORB monitoring wells were above the NYSDEC groundwater standards (300 µg/l, 300 µg/l, and 20,000 µg/l, respectively); however the detected concentrations are consistent with background groundwater quality. The total zinc, chromium, lead, and arsenic concentrations were above the NYSDEC groundwater standards of 300 µg/l, 50 µg/l, 25 µg/l, and 25 µg/l, respectively, but the dissolved concentrations were below the standards.

The concentrations of pesticides (Dieldrin, 4-4'-DDD, alpha-chlordane, and gamma-chlordane) detected in the monitoring wells were very low (maximum detected 1.2 µg/l chlordane) but were above the stringent NYSDEC standards (less than or equal to 0.1 µg/l). The concentrations of PCB Arochlor-1254 (maximum 1.7 µg/l) in monitoring wells located west and downgradient the ORB were above the NYSDEC standard (0.1 µg/l).

Contaminant concentrations in the sidegradient wells and downgradient wells located along the west side of the ORB were generally greater than concentrations in the other downgradient wells, indicating an off-site source of groundwater contamination. The nature and extent of groundwater contamination and groundwater remediation will be addressed under the Fairchild Main Plant Site RI/FS.

Surface Water

Surface water quality was evaluated during the RI at the sampling locations shown on Figure 4. Surface water samples were collected at three locations in the North Pond, and at three locations in the South Pond. Iron and manganese were the only two parameters in the samples at concentrations above the NYSDEC surface water quality standards (300 μg/l for both). The total iron concentrations ranged from 335 μg/l to 912 μg/l and manganese concentrations ranged from 290 μg/l to 1948 μg/l.

The surface water analytical data indicate that the ORB sediments are not a continuing source of contamination. The VOC concentrations in these surface water samples were below the NYSDEC standards, suggesting that the Basin sediments are stable.

Surface Soil

Surface soil samples were collected during the RI and the supplemental RI at the request of NYSDEC and SCDHS. Samples of soil from 0 to 6 inches below grade were collected at the locations shown on Figure 5.

During the RI, surface soil samples were collected at three on-site locations. Polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) were found at concentrations above ambient levels, but these compounds are commonly found in recharge basins that receive runoff from industrial areas. The concentrations of some PAHs, arsenic, beryllium, cadmium, chromium, copper, iron, lead, mercury, nickel and zinc in the surface soil samples exceeded the NYSDEC recommended soil cleanup objectives (January 1994). The concentrations of copper, lead, mercury, silver and zinc exceeded ambient levels (The Soil Chemistry of Hazardous Materials, Dragun, J. Ph.D., 1988).

Surface soil collected at one location (ORB-1) during the RI contained 4,000 µg/kg of Arochlor-1254. The NYSDEC soil cleanup objective for PCBs is 1000 µg/kg, and additional sampling was requested to determine the extent of Arochlor-1254 in surface soil. Four additional surface soil samples were collected 15 feet north, south, east and west of ORB-1 and one additional sample was collected further west of the Basin at the locations shown on Figure 5. Arochlor-1254 was only found in soil sample ORB-4 at 160 µg/kg, below the NYSDEC soil cleanup objective. The supplemental sampling data indicates that the PCBs found at ORB-1 are limited in extent. The volume of surface soil containing PCBs above the NYSDEC 1,000 µg/kg cleanup objective is estimated at 35 cubic yards.

Basin Sediments

During G&M's investigation, samples of ORB sediments and underlying soils were collected from 16 soil borings. Eight borings were drilled in the South Pond and eight borings were drilled in the North Pond at the locations shown on Figure 6. The average thickness of the sediment layer at the bottom of the ORB is approximately six to seven feet. VOCs, SVOCs, PCBs, and total metals were detected in the ORB sediment samples. The analytical data with average and maximum detected concentrations are summarized in Table 1. VOCs were detected in six of the eight samples collected in the South Pond and in five of the eight samples from the North Pond. The VOCs detected included PCE, TCA, 1,2-DCE, and TCE. The SVOC concentrations were higher in the sediment samples from North Pond than the South Pond, consistent with the VOC results.

PCBs were also detected at higher concentrations in the sediment samples from the North Pond. The highest PCB concentrations were found near the Fairchild and NYSDOT discharge pipes to the Basin. Total PCB (Arochlor 1248 and Arochlor 1254) concentrations exceeding the NYSDEC sediment criteria (0.008 μg/kg, assuming sediment has an organic carbon content of one percent) were found in 14 of the 16 borings, and the average concentrations were approximately 25 mg/kg in the South Pond and 40 mg/kg in the North Pond. The PCB concentrations in the sediment were generally an order of magnitude higher than native soil samples. The volume of sediment containing PCBs is estimated at 110,000 cubic yards, as shown in Appendix A.

Pesticides were detected in two of the eight borings in the South Pond but were not detected in the North Pond. In general, the concentrations of these contaminants in the sediments are an order of magnitude higher than in the underlying soils. A leaching potential analysis indicated that trace amounts of metals leach from the bottom basin sediments at concentrations below regulatory levels.

The groundwater analytical data indicate that the ORB sediments are not an on-going source of contamination. Although some sediment samples collected in the North and South Ponds contained VOCs and PCBs at concentrations above the NYSDEC generic sediment aquatic life criteria, it is unlikely that the sediments represent a significant threat to aquatic life. Based on the site-specific Fish and Wildlife Impact Analysis conducted by a project team consisting of EDER staff and Orland Blanchard, Ph.D., there are no evident ecological resources in or around the ORB that have been adversely impacted by site-related contaminants, and there are no pathways by which contaminants could migrate to off-site significant resources. The Fish and Wildlife Impact Analysis Report is contained in Appendix L of the RI report (EDER, November 1994).

1.4 Contaminant Fate and Transport

The fate and transport of the contaminants in the surface soil, sediments, and surface water at the ORB are discussed below. The fate and transport of contaminants in groundwater will be addressed in the Fairchild Main Plant Site RI/FS.

A chemical's persistence, or tendency to degrade and transform, depends on its physical and chemical properties. The rate at which contaminants migrate into air, soil, groundwater, or surface water depends on several factors including contaminant concentrations, solubility, volatility, and the tendency to adsorb (accumulate on the surface of a solid) onto soil particles and atmospheric particulates. In addition, migration is affected by the physical and environmental characteristics of a site such as geology, soil composition, groundwater flow rate, weather, terrain, and vegetative coverage.

Vapor pressure, water solubility, and octanol/water partition coefficient (K_{ow}) are used to estimate partitioning characteristics. The vapor pressure of a liquid or solid is the pressure at which its corresponding gas phase is in equilibrium with the liquid or solid. In general, chemicals with relatively low vapor pressures are less likely to migrate into the air (volatilize) than those with higher vapor pressures. A chemical's water solubility can be used to indicate how efficiently the chemical may be transported by surface runoff and groundwater flow. Water solubility can also affect a chemical's tendency to oxidize, reduce, photolyze, and hydrolyze. An insoluble chemical can form a neat phase at depth which could provide a continuing source of contamination. The K_{ow} can be used to predict the extent to which a chemical may adsorb onto a soil particle, and its tendency to be stored in animal fat cells and move through the food chain. In general, the higher the K_{ow}, the more readily that chemical will sorb onto soil particles or bioaccumulate.

The tendency for a contaminant to volatilize from the aqueous to the gaseous phase depends on its Henry's law constant (K_H). Compounds with a low K_H (less than approximately 10^{-3}

atm-m^3/mole) tend to accumulate in the aqueous phase while those with a high K_H tend to concentrate in the gaseous phase.

Surface Soil

Upper glacial deposits at the ORB site are approximately 100 feet thick and consist mainly of sand and gravel. These deposits are highly permeable (hydraulic conductivity is approximately 150 to 250 feet/day). Precipitation rapidly infiltrates (travels downward) through permeable surface soil, dissolving and carrying water soluble contaminants deeper into the subsoil and eventually to the groundwater.

Contaminants detected in the surface soils include PAHs, PCBs, and metals. PAHs and PCBs typically have low water solubilities, low vapor pressures and high K_{ow}. They are persistent in the environment, adsorb readily onto soil particles and tend to bioaccumulate. Leaching of PAHs and PCBs from soils to groundwater is not expected to be significant (EPA/540/1-86/013). PCBs are not expected to readily degrade without an outside influence to catalyze (promote) dechlorination. Soil particles with adsorbed PAHs and PCBs can become airborne under dry, windy conditions, especially in areas with little or no vegetation to stabilize soil. This situation is unlikely around the ORB because of sufficient vegetation. PCBs adsorbed to soil particles may also migrate when particles are introduced to the groundwater flow. Such colloidal transport generally does not result in PCB migration over significant distances from a source area.

The metals present in the soil are persistent in the environment because they are elemental. Metals do not readily volatilize, tend to adsorb onto soil particles, and may accumulate in mammalian tissue. The oxidation state of a metal can change its tendency to be mobile in the environment.

Migration of metals adsorbed onto soil particles can occur when the particles become airborne under dry, windy weather conditions, especially in areas with little or no vegetation to stabilize the soil. The area of concern at the ORB is generally vegetated. Migration pathways for metals include colloidal transport by water, vertical migration of metals in soil to groundwater, and subsequent transport by groundwater.

Basin Sediments

Contaminants detected in the ORB sediments include VOCs, SVOCs, PCBs, metals, and pesticides. The principal means of contaminant transport from the ORB sediment to the surface water are desorption of contaminants to dissolved forms in the water column, resuspension of particulates, and diffusive exchange between the sediment and the water column. Chemicals that are highly volatile and less sorbed to solids are more commonly found in the dissolved phase of the water column. These chemicals have a greater tendency to bioaccumulate in aquatic life. Conversely, chemicals that are highly sorbed to solids can remain in the sediments for a significant length of time.

The distribution of a chemical between the particulate and dissolved phases depends on the partition coefficient and the solids concentration. A high partition coefficient indicates that the majority of the concentration will be in the particulate form and a low partition coefficient indicates a greater dissolved concentration.

The PCBs, heavy metals, and pesticides in the basin sediments have a relatively high partition coefficients and are expected to remain in the sediment. PAHs have a lower partition coefficient which results in desorption from the sediment to the water column. PAHs are more likely to be found is the dissolved phase when compared to PCBs and metals. VOCs have the lowest partition coefficients relative to the other compounds found in sediments. This indicates that VOC will largely be present in the dissolved phase resulting in the potential for volatilization to the atmosphere. The compounds found in the sediment generally were not found in the Basin water, indicating that there has been little contaminant transfer to the dissolved phase and that the ORB sediments are stable.

Surface Water

Metals were detected in the surface water of the ORB during the RI sampling. The metals have a potential to adsorb to suspended particles, settle and adsorb to sediment particles, or bioaccumulate in aquatic life. The Fish and Wildlife Impact Analysis demonstrated that there is little aquatic life in the Basin, which is typical of stormwater recharge basins, so the sediment does not pose a significant threat.

1.5 Preliminary Baseline Exposure Assessment Summary

EDER conducted a baseline human health risk assessment of the ORB based on analytical data collected during 1988, 1992, and 1993 sampling events, and in accord with USEPA risk assessment guidance.

The baseline human health risk assessment was conducted in four stages. First, the data was evaluated to identify contaminants of concern. Second, an exposure assessment was performed to determine pathways, potential receptors, and intake rates of the contaminants at the ORB site. Third, a toxicity assessment was conducted to develop a quantitative relationship between the extent of exposure and the potential risk of adverse effects to human health. Fourth, a quantitative expression of the anticipated risk was developed for the site.

The data were screened for use in the risk assessment. The result of the database screening was a chemical-specific and medium-specific set of data, or sample population which includes all chemicals that: 1) have not been eliminated based on the sample quantitation limits; 2) have not been eliminated based on the "R" qualifier (indicating that the data is unusable); and 3) were detected in at least one sample in that medium. Due to the small sample population over an area of almost three acres, the surface soil samples were compared with the NYSDEC cleanup criteria, and surface soil was not included as an exposure medium in the risk assessment.

The following exposure scenarios were identified and evaluated in the risk assessment:

- An adult accidentally falls into the ORB and is exposed to the surface water and sediments once in a lifetime.

- A teenage trespasser is exposed to the ORB surface water and sediments one hour per day, two days per week during the summer months.

Each scenario is described by four complete exposure pathways which represent a reasonable maximum exposure case. The exposure routes are incidental ingestion and dermal contact.

The toxicity assessment delineates the toxic effects of chemicals of potential concern that are classified as either chemicals that elicit carcinogenic effects or chemicals that elicit non-carcinogenic effects. For chemicals that elicit carcinogenic effects, a slope factor assigned by USEPA was used to calculate the estimated cancer risk. The estimated cancer risk was compared USEPA's benchmark risk value range of one excess human cancer case in ten thousand to one in one million ($1x10^{-4}$ to $1x10^{-6}$). For chemicals that elicit non-carcinogenic effects, the reference dose was used to calculate the estimated hazard indices. The hazard indices were compared to USEPA's benchmark value of 1. A hazard index less than 1 indicates that the concern for potential non-cancer effects may not exist.

The risk characterization integrates the toxicity assessments into a measurable expression of risk for each exposure scenario. The slope factors for carcinogenic chemicals and reference doses for non-carcinogenic chemicals were combined with the calculated intakes to generate the associated risks and non-carcinogenic hazard indices.

The cancer risks for each scenario are below the benchmark of 1×10^{-6}. The non-cancer hazards for both scenarios are below the benchmark of 1.

Based on the assessment of the two scenarios and USEPA's commonly used risk benchmarks, the bottom sediment and surface water in the ORB do not pose an unacceptable risk to human health.

1.6 Well Inventory

G&M inventoried all public supply wells within a three-mile radius of the site and all private wells within a one-mile radius of the site. The inventory was made to identify public supply wells that could be affected by groundwater quality impacts from the site, to identify groundwater withdrawals that could alter local flow in the vicinity of the ORB, and to identify wells that could be used for monitoring purposes. These data were obtained from SCDHS and NYSDEC files and are summarized in the G&M Work Plan for the Remedial Investigation/Feasibility Study of the Old Recharge Basin. The closest hydraulically downgradient active supply well is approximately two miles southeast of the site. The public supply well inventory will be included in the Main Plant FS.

2.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

2.1 Introduction

Section 2.0 presents the remedial action objectives, identifies general response actions, and screens potentially applicable technology types and process options to remediate the ORB sediments and surrounding surface soil at the site. The remedial action objectives are presented in Section 2.2 and specify the contaminants of concern, potential exposure pathways, and remediation goals. General response actions that satisfy the remedial action objectives are developed in Section 2.3. Remedial technologies that may be applicable to the general response action are identified in Section 2.4.

Process options for each remedial technology type and site characteristics are eliminated in step one (Section 2.4.1). Potentially applicable technologies and process options are evaluated and screened in step two (Section 2.4.2) based on effectiveness, implementability and cost, with the primary focus on probable effectiveness. The second screening evaluation (Section 2.4.2) considers the potential human health and environmental impacts, the prior success and reliability of the process options at similar sites, and their applicability to the Fairchild ORB site. The objective of the second screening evaluation is to identify at least one process option (if practicable) within each remedial technology type to be incorporated in the remedial alternatives developed in Section 3.0.

2.2 Remedial Action Objectives

The NCP requires that remedial actions at Superfund sites protect human health and the environment, comply with ARARs, and be cost-effective. The generic remedial action objectives (RAOs) summarized below were developed within this framework based on the results of the RI, Supplemental RI, and risk evaluation. Table 2 summarizes the contaminants detected in samples of ORB surface soil, sediment, and surface water, and the associated NYSDEC cleanup objectives, criteria and standards which can be used as preliminary remediation goals. Site-specific risk based remediation levels for each exposure route have not been developed because the baseline risk assessment and Fish and Wildlife Impact Analysis indicate that the ORB does not pose human health or environmental impacts.

- To protect human health by eliminating inadvertent contact with surface soil around the ORB and surface water and sediment in the ORB, ingestion/inhalation of contaminants from surface soil, and ingestion of surface water. The RAO to prevent ingestion and inhalation of groundwater will be addressed in the Main Plant FS. The ORB is fenced and a person would have to purposefully scale or break through the fence to enter the property. Accidental entrance is not possible. Contact with the surface soil or water is possible by entering the fenced property walking around the rim of the Basin, touching the soil and/or falling into the water. Contacting the sediment which is 28 to 40 feet below the water surface is possible only if one purposely swims to the Basin bottom and touches the sediment.

- To minimize potential environmental impacts with contaminants in surface soil and sediments at the ORB. Environmental impacts associated with contaminants in ORB surface soil and sediments are unlikely. The contaminants in surface water, sediment, and soils are PCBs, SVOCs and some metals. The PCBs are of limited extent and are not readily soluble in percolating rainfall. Leaching tests conducted on the metals in soil and sediment indicate that the metals are stable and do not leach. There are no impacts to the environment from surface soil or sediments at the ORB.

- To attain all applicable standards, criteria, and guidance for surface soil, sediment, and surface water (summarized in Table 2) to the extent technically and economically feasible. Concentrations of some metals, PAHs, and PCBs are above NYSDEC cleanup objectives and criteria but are stable. It is not feasible to attain all standards, criteria and guidance in a cost-effective manner and there are no offsetting human health or environmental benefits. The RAO to restore the aquifer to the groundwater quality standards will be addressed in the Main Plant FS.

Groundwater contamination, RAOs, and remediation will be addressed in the Fairchild Main Plant Site RI/FS and is not included in this discussion of remedial alternatives.

2.3 General Response Actions

General response actions applicable to achieve the RAOs established for the ORB site are summarized in Table 3, which also presents remedial technologies and process options that are available to achieve the general response actions.

2.4 Identification and Screening of Technology Types and Process Options

2.4.1 Identification and Screening of Technologies and Process Options

All process options associated with the remedial technologies presented in Table 3 that appeared to be technically implementable and applicable to the ORB site conditions were evaluated. A preliminary screening was conducted (see Table 4) to reduce the number of technologies and process options evaluated in this section by eliminating those that would not be appropriate or implementable at the site. Technologies and process options that were determined to be inappropriate for the physical characteristics and contaminant conditions at the ORB site are not described or evaluated in this section. The rationale for eliminating these technically infeasible technologies and process options is indicated in Table 4. Only those technologies and process options that are designated potentially applicable ("PA") in Table 4 are described and evaluated below.

2.4.2 Screening of Potentially Applicable Technologies and Process Options

The technologies and process options which survived the initial screening in Section 2.4.1 are further screened in the following subsections. The technologies and process options that are potentially applicable to remediate the surface soils and sediments at the ORB are identified and discussed in this section.

In each subsection, the technology types are subdivided by process option. Each process option is described and evaluated based on effectiveness, implementability and cost. The process options within each technology type are compared and evaluated at the end of each technology type section. Appropriate process options to remediate surface soil and sediments at the ORB site are retained in Section 2.0 and developed into the alternatives which are described and screened in Section 3.0.

Technology Type: Long-Term Monitoring

Monitoring results can be used to track contaminant concentrations and the effectiveness of remedial options. Long-term surface water and groundwater monitoring at the ORB are described below.

Long-Term Monitoring Process Option: Surface Water Monitoring

Description

Surface water samples would be collected from the ORB and analyzed for target parameters to be determined during the remedial design phase. The surface water monitoring results would be used to verify that the Basin sediments remain stable and that contaminants do not leach from the sediment. NYSDEC would approve a long-term surface water monitoring program prior to implementation.

Effectiveness - Monitoring is an effective means to determine changes in contaminant concentrations and the effectiveness of remedial action.

Implementability - Surface water monitoring could be readily implemented.

Cost Considerations - The principal costs associated with long-term monitoring would be annual sampling and analytical costs. Annual monitoring costs would depend on the sampling frequency and parameters, both to be determined during design.

Long-Term Monitoring Process Option: Groundwater Monitoring

Description

Monitoring results can be used to identify changes in groundwater VOC concentrations. The extent of groundwater contamination at and downgradient of the ORB was determined during the RI, with monitoring wells installed to track VOC concentrations and indicate groundwater flow conditions. Installation of additional monitoring wells under the alternatives presented in this FS would be evaluated during the remedial design phase.

Effectiveness

Monitoring is an effective means to determine changes in groundwater flow and contaminant concentrations, and to track the effectiveness of remedial actions.

Implementability

Groundwater monitoring can be performed using the monitoring wells in place at and around the site. Additional monitoring wells may be installed if necessary.

Cost Considerations

The principal costs associated with this technology would be annual sampling and analytical costs. Annual monitoring costs would depend on the number of wells and the sampling frequency, both to be determined during design.

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Evaluation of Long-Term Monitoring Option

Long-term surface water and groundwater monitoring will be retained for further evaluation in developing alternatives to track contaminant levels and evaluate effectiveness.

Technology Type: Access Restrictions (Institutional Controls)

The NCP requires the development of alternatives that involve little or no treatment, but protect human health and the environment primarily by preventing or controlling exposure to hazardous substances through engineering controls supplemented as necessary with institutional controls.

Access Restrictions (Institutional Controls) Process Option: Fencing

Description

The ORB is located on a 13.2 acre parcel of land surrounded by a chain link fence with a locked gate. The fence will be maintained around the ORB perimeter to reduce the potential for accidental contact with the sediments or contact with the surface soil.

Effectiveness - Fencing around the basin perimeter would reduce the potential for contact with contaminated materials on a temporary or long-term basis.

Implementability - The fencing around the ORB could easily be modified or repaired to effectively maintain restricted access to the site.

Cost Considerations - Fencing would cost approximately $10/ft.

Access Restrictions (Institutional Controls) Process Option: Deed Restrictions

Description

Property deeds could be amended to restrict future residential land development at the ORB site.

Effectiveness - Restrictions on residential land development at the ORB site would reduce the potential for contact with contaminants in surface soil, surface water and sediment.

Implementability - Deed restrictions could be established in accordance with relevant legal requirements.

Cost Considerations - Deed restrictions could be implemented at minimal cost.

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Evaluation of Access Restrictions (Institutional Controls)

Fencing and deed restrictions will be retained for further evaluation in developing remedial alternatives for the ORB site.

Technology-Type: Capping

Caps would eliminate direct contact with and reduce the potential for contaminant migration from surface soil surrounding the ORB or with sediment and surface water in the Basin. Caps would reduce infiltration of water through contaminated materials and the potential for resultant contaminant leaching to underlying groundwater.

Natural soil or synthetic liner caps can be constructed over most sites using generally available construction equipment. Two basic system designs are employed: single layered or multi-layered caps.

Capping Process Option: Single-Layer or Multi-Layer Cap

Description

Most single layer caps are constructed using clay, concrete or bituminous asphalt. Natural soil caps generally are not used because freeze/thaw cycles and drying cause them to shrink and crack. The cap thickness depends on material permeability, anticipated settlement and local weather conditions. Special surface treatments may be periodically applied to asphalt and concrete caps to increase their effective life.

Multi-layered caps are designed using a three-layered system (a vegetative layer underlain by a drainage layer over a low permeability layer). The caps divert infiltrating liquids from the upper vegetative layer through the drainage layer and away from underlying contaminated materials.

The low permeability layer could be constructed from natural soils, a synthetic liner, or a combination of synthetic and soil materials. A synthetic liner overlying low permeability natural soil could be expected to prevent liquid penetration for at least 20 years, and the soil layer would continue to provide protection if the synthetic liner does not perform properly. Standard design practices specify soil liner permeabilities less than or equal to 10^{-7} centimeters/second (cm/sec).

Flexible synthetic membranes are generally more expensive than natural soil layers and often require special field installation methods and sealing techniques to ensure liner integrity. The chemical resistance of a synthetic liner can be critical if organic and/or corrosive vapors would be released. The thickness and flexibility of a synthetic liner are factors in material selection.

The drainage layer is placed directly above the low permeability layer. Current designs generally specify a drainage layer material with permeability greater than or equal to 10^{-3} cm/sec to reduce the possibility that infiltrating rainwater will reach the low permeability layer. Drainage layer thickness would be determined based on the volume of precipitation that may enter the drainage layer and the amount of settling that may occur.

The vegetative layer is placed above the drainage layer, with a filter fabric layer placed between the layers to prevent piping. In general, topsoil is used to establish the vegetative layer which usually exceeds two feet in thickness, depending on the frost depth, the root penetration depth, and the anticipated soil loss rate. A vegetative cover is required to stabilize the surface of a site that has been graded and capped. Revegetation decreases erosion and contributes to stable surface development.

Effectiveness - Caps would prevent direct contact with surface soil and sediment at the ORB, and reduce the potential for vertical contaminant migration to underlying groundwater. The effectiveness of caps would be determined by their long-term ability to divert water away from underlying contaminants and reduce infiltration. Multi-layer caps are a more permanent remedy than single-layer caps and are more effective in reducing infiltration.

Implementability - Single layer caps are generally used as temporary measures, and can be constructed in relatively short periods of time. Multi-layer caps are generally used when long-term protection against contaminant migration to groundwater is required. The clay required to construct a cap would be obtained from an appropriate off-site clay deposit. Frequent inspection and maintenance (i.e. - surface treatments) would be required to maintain the integrity of a cap. It would not be practical to cap the small area of contaminated surface soil around the ORB considering the small volume of contaminated soil and the long-term O&M that would be required. It would be difficult to install a cap in the ORB given the depth to the sediments and the volume of water in the Basin. The Basin cannot be dewatered because it is hydraulically connected to groundwater. The sediment in the ORB could be covered with clean fill such as sand which would eliminate the potential for direct contact with the material but would not reduce the potential for contaminant leaching.

Cost Considerations - The cost to install and maintain a single layer or multi-layer cap would depend on the size of the cap and material of construction. Multi-layer caps require more maintenance (seeding, mowing, etc.) than single layer caps and the annual maintenance costs are higher than the costs to maintain a single-layer cap.

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Evaluation of Capping Process Options

Both single layer and multi-layer capping could not be technically implemented at the ORB site. Capping the contaminated surface soil area near ORB-1 is not a feasible option because caps constructed over such small areas are difficult to control and maintain, and would not be cost effective. It would be difficult to install a cap in the ORB given the depth to the sediment and the volume of water in the Basin. Single-layer and multi-layer capping are not retained as representative process options for further evaluation in developing alternatives for the ORB surface soil or sediments.

The ORB sediment could be covered with clean fill such as sand to eliminate the potential for direct contact with the sediment.

Technology-Type: Excavation

Excavation Process Option: Soil Excavation

Description

Contaminated surface soil could be excavated from the area surrounding sampling point ORB-1 using a small backhoe. The selection of excavation equipment depends on site characteristics, the ability to minimize environmental releases and protect worker safety during excavation activities, and equipment availability.

Conventional excavation equipment could not be used to remove sediment from the bottom of the ORB because the water cannot be pumped out. Dredging is a more appropriate option to remove the sediment, as discussed in the next technology section.

Effectiveness - Excavation is effective and applicable over a wide range of site conditions. A variety of excavation and hauling equipment is available.

Implementability - Contaminated surface soils could be readily excavated using available equipment operated by local contractors.

Cost Considerations - Excavation using conventional equipment would cost approximately $12/cy.

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Evaluation of Excavation Option

Excavation is applicable to conditions at the ORB site, and is a reliable and effective process option. Contaminated surface soil at the site can be excavated using conventional equipment. This option is retained for further evaluation in this FS.

Technology Type: Dredging

Dredging Process Option: Mechanical Dredging

Description

Mechanical dredging involves the use of conventional excavation equipment such as backhoes, clamshells, draglines, bulldozers, and scrapers. Draglines and clamshells are often selected for mechanical dredging and are usually vessel-mounted, but can also be track-mounted and land based. Mechanical dredging maximizes the solids content of the sediments removed.

Effectiveness - Mechanical dredging could effectively remove bottom sediment from the ORB. A variety of dredging equipment is available.

Implementability - Contaminated sediments could be dredged from the ORB using available equipment operated by local contractors. Mechanical dredging is generally not used in recharge basins because it causes significant resuspension of particulates, it has characteristic low production rates, and is primarily applicable to sediment removal from shallow bodies of water.

Cost Considerations - Dredging using conventional equipment would cost approximately \$20/cy depending on the volume of sediment to be removed. This cost does not include dredge mobilization and demobilization costs.

Dredging Process Option: Hydraulic Dredging

Description - Hydraulic dredging equipment uses centrifugal pumps to suction sediment. Hydraulic dredges remove and transport sediment in liquid slurry form (10-20% solids by weight) and are commonly barge-mounted. The dredge suction intake is moved and held at the specified dredging depth using a boom.

Effectiveness - Hydraulic dredging would effectively remove sediments from the bottom of the ORB.

Implementability - Hydraulic dredges can be operated by local contractors and would not cause significant resuspension of sediments during removal. The low solids concentration and high flow rate associated with hydraulic dredging would result in a large quantity of materials requiring transport, treatment, and disposal. Large areas of land are required to settle the dredged materials.

Cost Considerations - The cost of hydraulic dredging depends on the equipment used and the subsequent handling of the dredged sediments.

Dredging Process Option: Pneumatic Dredging

Description - Pneumatic dredging is very similar to hydraulic dredging except that the pump operates on compressed air and hydrostatic pressure to draw sediments to the collection head and through the transport piping. Pneumatic dredges can operate at any depth and yield denser slurries than hydraulic dredges, with lower turbidity and resuspension of solids.

Effectiveness - Pneumatic dredging would effectively remove bottom sediment from the ORB. Production rates are low and equipment is not readily available.

Implementability - Pneumatic dredges can be used at the ORB site. Pneumatic systems are not widely used in the United States and the required equipment is not readily available. This could interfere with scheduling of remedial activities and extend the time required for cleanup procedures. Low production rates are associated with pneumatic systems and would also extend the time required to remove the sediments.

Cost Consideration - The costs to remove the bottom sediment using a pneumatic system would be greater than the other dredging options. The additional time required to obtain equipment and to pump sediment would increase the removal costs.

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Evaluation of Dredging Process Options

Dredging the sediments by mechanical, hydraulic, or pneumatic means will be retained for further evaluation in developing alternatives for the ORB sediment, although some difficulty would be associated with any method. Mechanical dredging results in significant resuspension of sediments. Hydraulic dredging requires large areas for sediment dewatering. Pneumatic dredging is not widely available and would involve a longer timeframe and greater costs than other removal options.

Technology-Type: Dewatering

Dewatering Process Option: Sediment Dewatering

Description

Dewatering sediments is a physical unit operation used to increase the solids content of slurries in order to facilitate handling and prepare the solids for final treatment and disposal. Sediment would have to be removed from the ORB before they could be dewatered. The equipment commonly used in dewatering operations includes gravity thickeners, centrifuges, filters, presses, and dewatering lagoons. These operations separate the solid sediment phase from the liquid phase (filtrate). After the sediments are dewatered, the filtrate would be analyzed to characterize the liquid for disposal. The filtrate would then be discharged to the sanitary or storm sewer system, or hauled to a licensed wastewater disposal facility.

Effectiveness - The sediments could be effectively dewatered once they are removed from the ORB. Dewatering processes such as filter presses would not remove all of the free liquid from the sediment, but would increase the solids content to approximately 50 percent. Mechanical dewatering methods are more effective than settling methods such as lagoons, which would require large land areas to handle the ORB sediment. The dewatered solids would require further treatment to increase the solids content. The water removed from the sediments may require treatment before it is discharged or disposed of.

Implementability - Sediment dewatering could be implemented using readily available equipment once sediment is removed from the ORB. It would be easier to bring dewatering equipment on-site to dewater the large volume of sediment than to construct dewatering lagoons. Dewatering using a manufactured system can also be performed more quickly than using settling lagoons. The dewatering method would be designed to maximize the final solids concentration of the slurry; however, dewatering methods are not capable of producing sludges with solids concentrations high enough to meet final disposal requirements and subsequent treatment would be required. The resulting wastewater associated with dewatering operations typically contains high suspended solids concentrations and may require treatment prior to discharge or disposal.

Cost Consideration - Sediment dewatering costs would depend on the solids content of the sediment once it is removed from the ORB and on the subsequent treatment of the solids and wastewater required.

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Evaluation of Dewatering Process Options

Sediment dewatering using mechanical means to increase the solids content of the sediment as required for final treatment and/or disposal of the material will be retained. Sediment dewatering using settling lagoons will not be retained for further evaluation because it would be less effective and more time consuming than the available mechanical methods such as filter presses, and would require large open areas which are not available at the ORB site.

Technology-Type: Solidification/Stabilization

Solidification/Stabilization Process Option: Solidification

Description

Solidification processes improve material handling characteristics and reduce the solubility and/or toxicity of hazardous constituents. Solidification is designed to convert material into an easily handled solid and reduce the potential for contaminant leaching. The desired results are obtained primarily through the production of a solid, impermeable matrix with high structural integrity. Reagents such as quicklime may be added to hydrate free liquids present in the material by chemical sorption. Lime and fly ash can be used to form a low-strength cement. The finely divided, non-crystalline silica in fly ash combines with the calcium in lime to produce a concrete matrix which effectively entraps the contaminants. Portland cement or other proprietary materials can be used to produce a stronger concrete composite.

Most materials slurred in water can be mixed directly with Portland cement causing the suspended solids to become physically incorporated into a rigid matrix. Most Portland cements are combinations of aluminum, calcium and silica that form less soluble compounds when mixed with water to promote cement setting. Some binders may also be used to modify the chemical environment and maintain the pH and redox potential to reduce contaminant solubility.

Contaminants do not necessarily interact chemically with solidification reagents, but are mechanically bound within the solidified matrix. The leachability of hazardous constituents in the material may not be reduced, and in some cases, constituents may leach from the binder. The solidification process was originally developed in response to restrictions on landfilling materials that contain free liquid.

Solidification may be accomplished in-situ, eliminating the need to remove materials, or ex-situ in a mixing unit such as a pugmill. Predetermined amounts of solidifying agents and water would be mixed directly with the materials in-situ or ex-situ. A more detailed description of an in-situ process that could be used to treat the ORB sediments in place is presented in the following section ("Saturated Zone Stabilization"). The equipment operator usually determines when mixing is complete based on experience. In-situ mixing equipment utilizes several augers to drill into contaminated soils and sludges, concurrently injecting calculated amounts of solidifying agents.

Effectiveness - Solidification would effectively eliminate free liquids from sediment removed from the ORB and could immobilize contaminants present in the surface soil and sediment. A design phase treatability test would be required to verify the effectiveness of solidification and to select an appropriate reagent mixture. The solidification reagent mixture can be formulated for a wide range of compounds. Solidification reagents that contain organophilic clays can be used to physically bind and reduce the mobility of organic contaminants. Changes in pH or material composition can reduce the effectiveness of the reagents and different reagents are often required to bind metals and organics. Portland cement mixtures typically have high pH, with conditions favorable to converting multivalent cations to relatively insoluble hydroxides or carbonates.

Ex-situ solidification would be more effective than the in-situ process because the mixing operation can be easily controlled to ensure a consistent blend of the material and solidification reagents.

Implementability - Solidification processes are widely used and commercially available from numerous vendors. Readily available mixing equipment can generally be used to implement solidification processes. Solidification may be performed on-site or at an off-site facility prior to disposal. In-situ solidification could not be used to treat the surface soil because the area is so small and shallow. The implementability of an in-situ process that could be used to treat the ORB sediments is discussed in the following section.

Cost Considerations - Solidification process costs are generally on the order of approximately $50/cy, including commercial ex-situ or in-situ mixing costs.

Solidification/Stabilization Process Option: Saturated Zone Stabilization

Description

Saturated zone stabilization chemically immobilizes hazardous constituents by combining specially formulated reagents with materials in the saturated zone so that contaminants are chemically maintained in their most immobile or least toxic form. The goal of stabilization is to reduce the solubility or chemical reactivity of contaminants by adding a specific reagent mix.

Saturated zone stabilization is implemented in-situ by mixing sediments with specific types of binders which chemically react with and immobilize hazardous constituents in the material. Stabilization reagent options include oxidation/reduction agents, complexing agents or various chemical adsorbents such as ion exchange resins, activated carbon and organophilic clays. The most commonly used commercial binders are inorganics such as cement kiln dust, fly ash, and other materials that chemically react with water. These binders are typically used alone for solidification and in combination with more specific binders (i.e. - silicates, polybutadiene resin, epoxy) for stabilization.

Barge mounted in-situ mixing equipment would be used to perform saturated zone stabilization of the sediments at the bottom of the ORB. In-situ mixing equipment uses several augers to drill into contaminated materials, concurrently injecting calculated amounts of stabilization reagents into the material. The equipment operator usually determines when mixing is complete based on experience.

Effectiveness - The saturated zone stabilization process would immobilize PCBs, metals and other inorganic contaminants similar to those detected in sediments in the ORB. This would be confirmed by a design phase treatability test. The process effectiveness would depend on the contaminant composition of the material, the types of stabilization additives utilized, and the performance of in-situ mixing. Silicates used with lime, cement or other setting agents may effectively stabilize the metals detected in the sediments. Proprietary additives may be employed to react with or tie-up compounds (such as organics) that may interfere with the stabilization process, thereby increasing process effectiveness and yielding a better product. Some contaminants may leach from the stabilized product. Some vendors indicate that their stabilization processes use specially formulated additives to chemically immobilize organics in addition to heavy metals and inorganics. Reagent tests would be required during design to determine the most effective additive mixture to chemically stabilize the contaminants present in the basin sediments.

Implementability - Stabilization processes have been widely used and are commercially available. Specialized mixing equipment is used to implement in-situ saturated zone stabilization processes. It would be difficult to ensure that the ORB sediments are uniformly stabilized using an in-situ process.

Cost Considerations - Saturated zone stabilization process costs generally range from approximately $100 to $200/cy, including commercial in-situ mixing costs.

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Evaluation of Solidification/Stabilization Process Options

The main difference between solidification and stabilization processes stems from the types of binders added. Solidification reagents are primarily used to eliminate free liquid and improve material handling, whereas stabilization reagents are used to immobilize specific contaminants or classes of contaminants in the product. Ex-situ solidification could effectively remove free liquids from sediments removed from the ORB and reduce the leachability of contaminants from surface soil and sediment. This process will be retained for further evaluation in this FS. In-situ solidification of surface soil is not practical considering the small volume of material, and this process will not receive further evaluation. Saturated zone stabilization will be retained for further evaluation in this FS as an option to treat the sediment at the bottom of the ORB. This stabilization process may effectively eliminate direct contact with the sediment and reduce the potential for contaminants to leach from the sediment.

Technology-Type: Thermal Treatment

Thermal Treatment Process Option: Low Temperature Thermal Desorption

Description

Low temperature thermal desorption (LTTD) is a physical transfer process that uses air, heat, and/or mechanical agitation to volatilize contaminants into a gas stream, where the contaminants are then subjected to further treatment. This technology is most effective on the more volatile organic compounds, and it is limited in its ability to volatilize metals (with the exception of mercury). LTTD is a relatively new technology, based upon a simple mass transfer concept. The equipment used in LTTD includes material handling equipment, an aeration unit, gas stream handling equipment, and appropriate monitoring systems.

The basic principle of LTTD operation is to provide a driving force to aid in the volatilization of contaminants from a soil or sludge matrix into a gas stream, with subsequent treatment of the gas stream. Unlike incineration, LTTD does not rely on combustion or an open flame to oxidize or chemically destroy the contaminants. An LTTD unit can be operated at ambient temperature, or the unit itself and/or the inlet gas stream can be heated by electricity or a fossil fuel.

LTTD systems normally operate at temperatures below 500°C. Operating temperatures are generally determined based on contaminant removal objectives. Most LTTD units incorporate mechanical agitation during treatment to facilitate the effectiveness of heat transfer and overall process efficiency. The inlet gas stream (the "carrier gas") is used to purge the unit of VOCs and possibly SVOCs as they are released from the waste depending on the operating temperature. When air is used, it is usually sent to a treatment train that often includes an afterburner for subsequent treatment. Nitrogen carrier gas can be used to provide a non-oxidizing atmosphere. Nitrogen gas can be filtered, recovered, and recycled back to the process.

A number of remediation contractors have designed, and in some cases patented, portable remediation systems that utilize LTTD technology. These systems are sophisticated and remove desorbed compounds from the gas stream by condensation. The LTTD gas treatment system generates organic liquid and sludge residues which require proper management and off-site disposal. These residues may be burned as alternate fuels, incinerated as hazardous wastes or treated by other appropriate methods depending on applicable regulations.

The physical properties of the material, such as moisture content, heating value, and soil composition, may significantly affect treatment performance. High moisture content usually causes the material to exhibit a low heating value, thus, the overall process requires more energy.

Effectiveness - The LTTD process may remove VOCs and some low boiling point SVOCs from ORB surface soil and sediment. Inorganics would not be removed. A treatability test would need to be conducted to demonstrate the feasibility of using LTTD and to determine costs and full scale operating parameters.

The volatilized organics would be transferred to the carrier gas, which would then be treated to condense the organics into liquid and sludge residues that require further treatment. The residues would be characterized to determine the appropriate type of treatment required to satisfy applicable regulations. An air emission control system would ensure that emissions from the LTTD system are in compliance with particulate and hazardous air pollutant standards.

Implementability - Transportable systems that utilize LTTD technology are currently in full scale commercial service. A treatability test would be required to evaluate the technical feasibility of using LTTD to treat materials from the ORB site. The process residues would require subsequent storage, transportation, and disposal.

Cost Considerations - LTTD treatment costs are on the order of approximately $200 to $350/cy. This estimate does not include the costs to dispose of the treated material or the costs to treat and dispose of the LTTD residual sludge and condensate, which would depend on the treatment required to comply with applicable regulations.

Thermal Treatment Process Option: Incineration

Description

Incineration is the destruction of organic contaminants by combustion or thermal oxidation. Incineration is an established technique that could be used to destroy organics and PCBs in the sediment and surface soil at the ORB site. A number of incineration processes meet the

RCRA incineration standards set forth in 40 CFR 264.343. Incineration in a rotary kiln will be discussed in this FS.

The generation of toxic air pollutants and disposal of ash residue from incinerators are regulated. An incineration facility must submit to a full scale evaluation to demonstrate its ability to meet the performance criteria for various materials. This evaluation includes a trial burn, which is monitored by the regulatory agencies. The lead time prior to start-up associated with the trial burn is generally on the order of about a year.

Most large incinerators are equipped with control systems to limit particulate matter and acid gas emissions. Acid gas emission control systems remove halogen acids such as hydrogen chloride, a product of chlorinated organic compound incineration. The need for particulate control systems depends primarily on the ash content of the feed. Incineration flue gases are cleaned prior to discharge by passage through one or more unit processes according to the pollutants present and stack gas quality requirements. Downstream treatment may remove acids by scrubbing. Baghouses, electrostatic precipitators or ionizing wet scrubbers may be used to remove particulates.

Costs may vary widely depending upon contaminant characteristics, incinerator design, and operational considerations such as air emissions control and energy input. Efficient oxidation depends on temperature, time and availability of oxygen. Combustion temperature affects the reaction rate and the time needed to achieve the desired destruction efficiency. Residence time is determined by the incinerator size, combustion gas flow rate, turbulence and the processing rate. Adequate contact of the contaminated material and oxygen is achieved by turbulence and supplying excess air (i.e. - adding more air than needed for combustion) to the system.

Rotary kiln incinerators handle a wide variety of solid and semi-solid materials. The basic type of rotary kiln is a long inclined tube that is slowly rotated. Contaminated materials are fed into the kiln and pass through the combustion zone as the kiln rotates. The tumbling action causes turbulence to improve combustion. Rotary kilns are often equipped with afterburners to improve combustion and flue gas scrubbers to control air emissions. Rotary kilns are widely used and have high capital and operating and maintenance (O&M) costs.

A rotary kiln is fired by burner(s) to maintain a predetermined internal operating temperature that is generally greater than 800°C. The rate and type of material being fed into the kiln, as well as the kiln's rotation speed, determine the residence time which typically ranges from 30 to 60 minutes. Specific operating parameters to effectively destroy organics would be determined during remedial design.

A secondary combustion chamber or afterburner incinerates volatiles which evaporate in the rotary kiln and oxidizes these compounds to hydrochloric acid, water and carbon dioxide. The incinerator's air pollution control system would cool and remove acid and submicron size particulates from the gases exiting the secondary combustion chamber and neutralize the effluent blowdown wastewater generated by the system.

Several vendors supply transportable rotary kiln incineration units for on-site use. Rotary kiln incineration is a proven reliable process to destroy organics. PCBs may be destroyed but incomplete combustion results in the formation of polychlorinated dibenzodioxins, polychlorinated dibenzofurans, chlorinated benzenes, and other chlorinated substances.

Effectiveness - Rotary kiln incinerators are widely used to destroy organics and PCBs which are present in the surface soil and sediments at the ORB site. The process would not remove inorganics from the feed. Residues from rotary kiln incineration generally comply with USEPA leaching standards for organics, but not metals. The residual ash would be subjected to TCLP to determine appropriate disposal options. The material may require several passes through the incinerator to meet desired organics removal in compliance with applicable regulations. The rotary kiln incinerator would be equipped with an air emission control system to produce emissions that comply with air standards.

Implementability - The trial burns required before full scale incineration operations can begin typically take about one year. Rotary kiln incineration is commercially available on transportable units for on-site treatment and is a proven process to destroy the organics and PCBs found in surface soil and sediments at the ORB site. Off-site incineration is also readily available.

Cost Considerations - Rotary kiln incineration costs are on the order of approximately $500/cy to $700/cy for a vendor-supplied transportable system. Costs for an off-site rotary kiln would depend on the distance of the incinerator from the site. An additional cost would be associated with disposal of the incinerator ash. The higher the volume of material to be treated on-site, the lower the unit cost for incineration. Operating costs would depend on the supplemental fuel required to achieve the required operating temperatures.

Thermal Treatment Process Option: In-Situ Vitrification

In-situ vitrification (ISV) converts contaminated soils and sludges to a chemically inert stable glass and crystalline product. This process is being evaluated under the USEPA Superfund Innovative Technologies Evaluation (SITE) program. ISV has been selected for use at approximately 15 Superfund, private, DOD and Department of Energy (DOE) sites. The ISV technology uses electrical heating to melt soil or sludge. Melt temperatures between 1600° and 2000°C destroy organic contaminants by pyrolysis and inorganic contaminants are immobilized within the vitrified mass.

Airborne organic and inorganic combustion by-products are collected in a negative pressure hood which draws the contaminant-air mixture into an off-gas treatment system to remove particulates and other pollutants. Workers are not exposed to hazardous subsoils because excavation is not required.

Most of the field-scale vitrification tests have been performed at the DOE Hanford Reservation on both uncontaminated and radioactively contaminated soils. Non-radioactive materials that have been vitrified include soils contaminated with cyanides, PCBs, heavy metals and organics. No large-scale commercial testing has been conducted due to ISV equipment problems which occurred in 1991. The equipment was modified in 1993 and additional technology testing is underway.

The ISV process converts hazardous organic materials into gaseous or vapor form. A great deal of energy must be supplied to the ISV system to generate the temperatures required to melt the soils and sludges. The process must be monitored to ensure that off-gas treatment equipment is performing properly. Hazardous materials may evolve from the process and must be treated by the off-gas treatment system to prevent an uncontrolled release. The ISV process residual is a glass and crystalline waste form. Results of tests performed on wastes vitrified to date indicate that organic contaminants are destroyed by pyrolysis or are volatilized and treated. Concentrations of inorganics remaining in the vitrified mass should pass EP-Toxicity and TCLP leachability tests. ISV typically reduces soil volumes by 25 to 45%, and greater volume reductions are possible when high water content wastes are vitrified.

The ISV process is limited by the presence of groundwater in a highly permeable waste matrix, the presence of excessive amounts of buried metal, and the pressure requirements of the off-gas treatment system. ISV may also be limited by soil composition and soil properties. The by-products generated by the ISV off-gas treatment system are scrub solution, filters, and activated carbon.

<u>Effectiveness</u> - ISV effectively treats organic contaminants including PCBs through a combination of pyrolysis and volatilization. The process may also immobilize organic

substances and metals that have not been destroyed by the heating to pass the EP-Tox and TCLP tests. High energy levels must be provided to melt contaminated materials and the long cooling times are required before sampling. Off-gas treatment is required to comply with applicable emissions regulations. ISV could not be applied at the ORB because there is less than a one-foot thickness of surface soil containing contaminants at concentrations above the NYSDEC soil cleanup objectives, and the water in the Basin (which cannot be removed due to the hydraulic connection to groundwater) would interfere with the technology.

Implementability - ISV is a developing technology that has not been used in many full-scale commercial applications. Samples of vitrified material could not be tested until the melt cools (approximately one year after processing). The water in the Basin would interfere with the ISV process. Using ISV to treat the surface soil would not be implementable.

Cost Considerations - ISV costs are on the order of approximately $600/cy, which includes the energy requirements. This estimate does not include expenses for treatability testing (which range from approximately $40,000 to $60,000), or mobilization and demobilization (which total approximately $300,000).

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Evaluation of Thermal Treatment Process Options

Low-temperature thermal desorption may remove volatile organics from materials at the ORB site, but would not ensure the removal of PCBs or metals, which are of greater concern at the site. The LTTD process also generates residues which require additional treatment prior to disposal. LTTD will not be retained for further evaluation. Rotary kiln incineration is an established process that destroys organics and PCBs in contaminated soils and sediments. Transportable rotary kiln units are available, making on-site treatment possible, and off-site treatment is readily available. Rotary kiln incineration will be included in developing remedial alternatives in this FS.

The uncertainty of ISV's effectiveness is a disadvantage compared to other well-proven thermal treatment options, such as incineration. Although ISV may effectively treat organics and inorganics in the wastes at the ORB site, comparable effectiveness could be achieved by incineration, used in combination with solidification if high concentrations of metals leach from the incinerator ash. ISV would not be technically implementable at the ORB and will not be retained for further evaluation in this FS.

Technology-Type: Biological Treatment

Biological Treatment Process Option: In-Situ Bioreclamation/Biodegradation

Description

Bioreclamation treats contamination by microbial degradation. The process alters environmental conditions to enhance microbial degradation of organic contaminants, resulting in the breakdown and detoxification of those contaminants. The technology has developed rapidly over recent years, and laboratory, pilot, and field studies have demonstrated that contaminated soils and sediments may be reclaimed using in-situ biological treatment.

The most developed in-situ bioreclamation technique relies on aerobic microbial processes and optimizes environmental conditions by delivering an oxygen source and nutrients to the subsurface soils through injection wells or an infiltration system to enhance microbial activity. The feasibility of bioreclamation as an in-situ treatment technique depends on biodegradability of the organic contaminants present, environmental factors which affect microbial activity (i.e. - pH, temperature, nutrient levels, soil hydraulic conductivity, toxins and predators) and site hydrogeology. The relative aerobic biodegradability of compounds can be estimated using laboratory data associated with oxygen requirements for decomposition, chemical oxygen demand, and the ultimate oxygen demand.

In some cases, the concentrations of inorganic and/or organic contaminants may be high enough to be toxic to the microbial populations. This determination must be made on a case-by-case basis. Conversely, the process may be rendered ineffective if contaminant concentrations are so low that the assimilative processes of the microorganisms are not stimulated. In this case, microbes will not adapt to the particular substrate and the substrate will not be degraded. It is possible that, although a contaminant may be present in acceptable concentrations, the microorganisms will break down another "preferred" carbon source. In-situ systems must provide adequate contact between treatment agents and contaminated soil. In addition, the system must prevent leaching of the treatment solutions and/or contaminants where necessary.

Research has confirmed that, under anaerobic conditions, microorganisms may break down organic compounds. Methane-utilizing microorganisms (methanotrophs) are the selected microbial population when methane and air are introduced into soil samples. The more heavily chlorinated compounds are degraded more slowly than less chlorinated compounds, and sometimes no biological degradation occurs. PCBs may be totally degraded or mineralized to carbon dioxide, water, and hydrogen chloride by indigenous microorganisms, conventional chemical mutants, or recombinant microorganisms.

<u>Effectiveness</u> - In-situ bioreclamation may degrade organic compounds and PCBs present in surface soil and sediments at the ORB site. Biodegradation would not effectively break down inorganics. A pilot test would be required to determine the feasibility of biologically treating surface soil and sediments at the ORB site.

<u>Implementability</u> - Microorganisms are very sensitive to slight changes in their environment, and small fluctuations in pH or temperature may interfere with biodegradation processes or

reduce biodegradation rates. Biodegradation time frames depend on oxygen availability and contaminant levels. It would be difficult to control biodegradation processes and establish uniform conditions in the ORB. There is little full scale experience with in-situ anaerobic biodegradation.

Cost Considerations - In-situ bioreclamation costs would depend on site geology and hydrology, the extent of contamination, the types and concentrations of contaminants and the volume of material requiring treatment. These costs could only be estimated upon completion of a pilot test.

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Evaluation of a Biological Treatment Process Option

Bioreclamation is not well-demonstrated and generally requires substantially increased remediation times compared with other treatment options presented in this section. In-situ bioreclamation will not be retained for further consideration to remediate the surface soil and sediments at the ORB site.

Technology-Type: Physical Treatment

Physical Treatment Process Option: Soil Washing/Solvent Extraction

Description

Soil washing/solvent extraction processes elutriate organic and/or inorganic constituents from soil and sediment for disposal, recovery or treatment. These processes may be performed in-situ or ex-situ. In general, in-situ applications flood a site with an appropriate flushing solution by direct injection and the elutriate is collected in well points or subsurface drains to prevent uncontrolled contaminant migration through uncontaminated soil.

Flushing solutions include water, acidic aqueous solutions, basic solutions, and surfactants. Water may extract constituents that are soluble or mobile in water. Acidic solutions may recover metals and organic constituents. Basic solutions may recover metals, including zinc and lead, complexing and chelating agents, and surfactants. Bench scale testing would be required to develop a flushing solution appropriate to extract contaminants from materials at the ORB site. The contaminated flushing solution would be recovered, treated on-site and either recycled for additional soil flushing or discharged appropriately.

The in-situ or ex-situ application of chemical flushing solutions requires detailed knowledge of reactions that may adversely affect the soil system. It is as important to understand the chemical reaction(s) between the solvent and solute, as it is to understand reactions between the solvent and the soil. Flushing solutions may have toxic or other environmental impacts on soil and groundwater systems. Flushing may alter the soil system, affecting its physical, chemical, and biological properties. It may not be possible to recover all of the flushing solution, and it may be necessary to restore the soil properties so other treatment processes can be implemented. When clean water is the flushing solution applied, the potential for adverse impacts to soil is greatly reduced. Most of the adverse effects are associated with chemicals added to the flushing solutions.

The soil washing/solvent extraction treatment efficiency will vary depending on contact time, the solvent composition and the hydraulic conductivity of the material being treated. This technology is particularly applicable to highly permeable soils.

USEPA has developed a mobile soils washing system to extract a broad range of hazardous materials from contaminated soil using water and chemical additives, such as acids, alkalis, detergents, and organic solvents to enhance soil decontamination. The system capabilities include treating excavated contaminated soil, returning treated soil to the site, and separating the extracted hazardous substances from the washing fluid for further processing and/or disposal.

Effectiveness - In-situ or ex-situ soil washing/solvent extraction processes may remove organics and metals from surface soils and sediments at the ORB site. The flushing solution used and the solubility of the contaminants in the solution would determine the treatment effectiveness. The elutriate containing contaminants may be collected and treated prior to being recycled for additional flushing or discharged at an allowable location. Ex-situ process treatment conditions can be controlled more accurately than in-situ processes and would be more applicable at the ORB, considering the small volume of surface soil that contains PCBs and the significant volume of water in the Basin. The variability of contaminant types and concentrations makes formulation of suitable washing fluids difficult. Simultaneous removal of solvents and metals is also difficult. The time required to achieve desired contaminant level reductions by soil washing/solvent extraction would be evaluated during design, when pilot tests would be conducted and flushing solutions would be formulated.

Implementability - In-situ soil washing/solvent extraction is difficult to control and monitor, and flushing may increase contaminant mobility. The in-situ process would not be used at the ORB given the small volume of contaminated surface soil and the water in the Basin. Flushing solutions may contain potentially hazardous constituents and may introduce contaminants to the materials being treated. Selection of the flushing solution should consider its effect on contaminants, soil properties and any adverse environmental impacts. Large volumes of soil washing/solvent extraction solution would require subsequent treatment in a wastewater treatment system.

Cost Considerations - The estimated costs for ex-situ soil washing/solvent extraction typically range from $100 to $200/cy. A significant portion of the costs is associated with treating the recovered elutriate.

Physical Treatment Process Option: In-Situ Soil Vapor Extraction

Description

Soil vapor extraction (SVE) is an in-situ vadose (unsaturated) zone remediation process that removes volatile organics which are compounds present in low concentration at the ORB site. Vapor extraction wells perforated in the vadose zone are used to remove VOCs from unsaturated soil. The applicability of SVE is affected by the volatility of organic contaminants at ambient temperatures, the depth to groundwater, and the permeability of the soil to permit significant air flow.

SVE systems induce a negative pressure gradient which propagates laterally, volatilizing adsorbed organics. The gases migrate through the soil to the well, the area of lowest pressure, where they are extracted and pulled through separation tanks and an air emission control apparatus before being discharged to the atmosphere. Various air emission control technologies include activated carbon adsorption, thermal oxidizers, catalytic oxidizers, or dispersion stacks.

The process has been applied to volatile compounds such as chlorinated organic solvents and can remove volatile contaminants from the vadose zone. USEPA (1989) indicates that in-situ SVE is a viable option to remediate VOC contaminated soils. VOC recovery rates follow an exponential pattern and remediation times can be estimated based on knowledge of site and contaminant characteristics.

Effectiveness - In-situ SVE may effectively remove VOCs from the vadose zone at the site, but would not effectively treat non-volatile materials. SVE could not be used to treat the ORB sediments because they are located in the saturated zone where soil vapors are not present. In-situ SVE is generally used at sites where subsurface permeabilities exceed 10^{-8} cm/sec. SVE would have little effect on organics with a Henry's Law constant less than 10^{-3}

atm-m^3/mol such as PCBs because they are not likely to volatilize under the vacuum pressure originating at the wells. Air emissions produced by SVE may require treatment in an emissions control system prior to being discharged to the atmosphere.

Implementability - SVE would not be a practical method to treat contaminated surface soil at the ORB given the limited area of concern. SVE could not be technically implemented to remove contaminants from the saturated sediment due to the water in the Basin and the hydraulic connection to groundwater.

Cost Considerations - In-situ SVE costs generally range from $50 to $150/cy and depend on the system design required to address VOC contamination in the unsaturated zone. System costs would be determined based on pilot test results.

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Evaluation of Physical Treatment Process Options

In-situ SVE has been proven effective at other sites to remove VOCs from unsaturated soils. SVE is not a technically feasible option of remediate surface soil and sediment at the ORB. In-situ SVE will not be retained for further evaluation in this FS.

Soil washing/solvent extraction is a difficult process to control and monitor. Flushing solutions may introduce contaminants to the soil being treated. Collection and treatment of the flushing solution can be difficult, and accounts for a significant portion of the costs associated with soil washing/solvent extraction. Soil washing/solvent extraction will not be retained for further evaluation in this FS.

Technology Type: Landfill Disposal

Landfill Disposal Process Option: On-Site Landfill

Description

Treated and/or untreated surface soils and sediments excavated at the ORB site may be disposed of in a landfill constructed according to the regulations set forth by the NYSDEC and other applicable or relevant and appropriate state regulations. A landfill designed to dispose of the ORB sediment (approximately 110,000 cy) would be very large, and there would not be enough area at the site to accommodate the landfill. This would require that the landfill be constructed on a portion of the Main Plant Site, which would interfere with future development of the Main Plant.

The landfill would be designed, constructed and maintained in accordance with State and federal requirements. The State's minimum design criteria for solid waste landfills are set forth in Part 360 of the New York Code of Rules and Regulations.

Constructing a part 360 non-hazardous waste landfill requires a double composite liner system, and two leachate collection and recovery systems and a final cover. The entire landfill site would be graded and covered by vegetation.

A variety of synthetic and natural materials may be used as liners. The liner materials would be compatible with the material being disposed of and would be able to withstand physical forces such as hydrostatic pressure, adverse climatic changes, and other stresses that may be applied during installation, etc. The liners would be placed on a stable foundation designed to prevent failure due to settlement, compression, uplifting, or warping that may be caused by unexpected changes in pressure. The liner system would be monitored and inspected for uniformity, damage and imperfections during installation.

The leachate collection and removal systems would maintain a leachate depth less than one foot above the liner and would be designed to withstand clogging, chemical attack, and forces exerted by wastes, equipment, or soil cover. Sumps or basins would be installed at low points of the base to collect leachate that would discharge from the collection network. A riser pipe would extend from the sump to the ground surface and allow leachate to be removed.

NYSDEC solid waste regulations prohibit materials with free liquid from being landfilled. The paint filter test measures the percentage of free liquid present in a sample. If materials contain free liquid, treatment would be required to eliminate the free liquid and pass the paint filter test prior to being disposed of in a landfill.

<u>Effectiveness</u> - A landfill would be constructed in accordance with applicable or relevant and appropriate NYSDEC regulations. Materials disposed of in the landfill would first be treated to remove free liquid, if necessary. The landfill cover would reduce the potential for infiltration and leachate generation and would eliminate the potential for direct contact with contaminants. The landfill liner and leachate collection and removal system would minimize the potential for contaminant migration from the landfill.

<u>Implementability</u> - The materials and manpower required to construct a landfill at the ORB site are readily available. The landfill location would be evaluated and selected during the design phase. A landfill designed to dispose of the ORB sediment (approximately 110,000 cy) would be very large, and there would not be enough area at the site to accommodate the landfill. This would require that the landfill be constructed on a portion of the Main Plant Site, which would interfere with future development of the Main Plant. A landfill would require long-term inspections and maintenance.

<u>Cost Considerations</u> - The cost to construct and dispose of materials in a landfill constructed in accord with NYSDEC Part 360 regulations are estimated at $200/cy. The actual costs

would depend on the volume of material to be landfilled and the effort required to obtain the necessary approvals.

Landfill Disposal Process Option: Off-Site Landfill

Description

Contaminated surface soils and/or sediments may be removed from the ORB for disposal at an off-site non-hazardous waste landfill in compliance with NYSDEC regulations. The materials would be disposed of at an appropriate off-site facility that operates in accordance with NYSDEC regulations.

A detailed contaminant analysis would be required before an off-site treatment/disposal facility would accept materials from the site. Requirements vary considerably depending on facility permits, state regulations, physical state of the materials, and the final disposal option selected. On-site pre-treatment such as dewatering to remove free liquids may be required to meet the requirements of the transporter or the off-site treatment or disposal facility. Waste transportation is regulated by the Department of Transportation, USEPA, and State and local ordinances and codes.

Effectiveness - Disposal of contaminated sediments and surface soil removed from the ORB site in an off-site non-hazardous waste landfill would be an effective option. Waste materials would be tested and characterized prior to disposal to ensure that they meet the specific landfill requirements. The off-site landfill would be properly licensed and would operate in compliance with its permit and applicable regulations. The off-site facility would be selected based on applicable NYSDEC regulations. Off-site transportation and disposal would comply with applicable federal, State and local regulations. If any of the materials contain free liquid, treatment such as dewatering would be required to remove free liquid prior to disposing of the material in the landfill.

Implementability - Off-site landfilling could be readily implemented. Transportation of waste materials from the site to an appropriate disposal facility would comply with federal, State and local regulations. Operation and maintenance of the landfill is the responsibility of the off-site facility owner/operator.

Cost Considerations - Off-site landfill disposal costs vary based on the landfill type, the type of treatment required (if any), and the distance traveled to the landfill.

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Evaluation of Landfill Disposal Option

The off-site landfilling option is readily implementable and will be retained for further evaluation in this FS. On-site landfilling will not be evaluated further because the construction and long-term maintenance of an on-site landfill for the disposal of ORB surface soil and sediments would not be practical or cost-effective. In addition, a landfill could not be constructed at the ORB site due to space limitations, so a portion of the Main Plant Site would have to be used, limiting future development of the site and surrounding areas.

2.5 Summary of Technology Screening

Based on the screening presented in this section, the following options will be combined to develop remedial alternatives which are described and subjected to a screening evaluation in Section 3.0.

- Long-Term Surface Water and Groundwater Monitoring
- Fencing
- Deed Restrictions
- Cover ORB Bottom Sediment

- Soil Excavation
- Sediment Dredging
- Sediment Dewatering
- Solidification
- Saturated Zone Stabilization
- Incineration
- Off-Site Landfill Disposal

3.0 DEVELOPMENT AND SCREENING OF REMEDIAL ALTERNATIVES

3.1 Introduction

This section combines the general response actions, remedial technology types, and applicable process options identified in Section 2.0 to form potential source control remedial alternatives to address the generic RAOs for the ORB site presented in Section 2.0. The RI identified surface soil adjacent to the ORB and basin bottom sediments as areas of concern. The chemicals of concern are primarily PCBs, SVOCs and several metals.

This FS develops a range of alternatives pursuant to the NCP (Part 300.430):

- Source control alternatives which employ treatment to reduce the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element. This includes alternatives that remove or destroy hazardous substances, pollutants, or contaminants to the maximum extent feasible, thereby eliminating or controlling the need for long-term management;

- Source control alternatives which treat the principal threats posed by the site, but vary in the degree of treatment employed and the quantities and characteristics of the treatment residuals and untreated material that must be managed; and

- Source control alternatives that involve little or no treatment, but protect human health and the environment primarily by preventing or controlling exposure to hazardous substances, pollutants, or contaminants through engineering controls and, as necessary, institutional controls to protect human health and the environment and to assure continued effectiveness of the response action.

The remedial alternatives developed for source control are described and evaluated separately in Section 3.2. As required by the NCP, each alternative is described and then screened based on effectiveness, implementability, and cost. The three screening criteria are briefly described below:

- Effectiveness - Each alternative is evaluated in terms of its effectiveness in protecting the public and the environment from risks associated with the areas of concern. This criterion focuses on the degree to which an alternative reduces contaminant toxicity, mobility, or volume through treatment; controls residual risks; affords long-term protection; complies with ARARs; and achieves the RAOs in a reasonable timeframe.

- Implementability - Each alternative is evaluated in terms of the ability to obtain the equipment, construct and reliably operate the alternative while meeting any technology- or site-specific restrictions until the remedial action is complete.

- Cost - The capital and present worth operating and maintenance costs associated with each alternative are estimated to allow cost comparisons among similar alternatives. The cost estimates presented in Section 3.0 are ranges based on information from vendors, costing guides, and other sources. A seven percent discount rate (before taxes and after inflation) is used to determine present worth in accordance with OSWER Directive No. 9355.3-20 (June 25, 1993). The planned remedial lifetime assumed for costing purposes does not exceed 30 years in accordance with USEPA's RI/FS guidance document (October 1988). Preliminary cost estimate calculations for the remedial alternatives are presented in Appendix B.

Section 3.1.1 presents the applicable or relevant and appropriate requirements (ARARs) that may apply to remedial alternatives for the ORB site. Section 3.2 describes and evaluates the source control remedial alternatives.

3.1.1 ARARs

ARARs are remedial action standards at Superfund sites defined by public health statues and environmental regulations. The alternatives and RAOs presented in this FS were developed within the framework of the ARARs.

ARARs are more specifically defined as follows: "Applicable requirements" means those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, limitations or variances promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a CERCLA site. "Applicability" implies that the circumstances at the CERCLA site satisfy all of the jurisdictional prerequisites of a requirement.

"Relevant and appropriate requirements" means those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations similar enough to those encountered at the CERCLA site so that their use is well suited to the particular site. For example, while RCRA regulations are not applicable to closing undisturbed hazardous wastes in place, the RCRA regulations on closure by capping may be deemed relevant and appropriate. A requirement that is relevant and appropriate must be complied with to the same degree as if it were applicable. Only part of a requirement may be considered relevant and appropriate with the rest dismissed if it is irrelevant or inappropriate to site specific conditions. Non-promulgated advisories or guidance documents issued by federal or state governments are not ARARs, but are "to be considered" when developing and evaluating alternatives.

NYSDEC has prepared a comprehensive list of promulgated State ARARs which may apply to Superfund clean-ups, titled "Index to New York State Standards, Criteria and Guidelines" (equivalent to ARARs). This list is presented in Appendix C and was reviewed along with more recent revisions and additions to the regulations to determine the State ARARs that would be potentially applicable or relevant and appropriate to each alternative developed in this FS. NYSDEC's ARARs list includes State policies and guidance to be considered when developing and evaluating remedies. The list also includes State permit, license, and plan approval ARARs which often specify technical standards and design or construction requirements. The State ARARs that may have the greatest impact on the remedial actions are described in this section.

On-site remedial actions at Superfund sites are exempt from permitting requirements (40 CFR 300.400(e)), but the actions must comply with the substantive requirements of a permit. State and federal approvals must be obtained prior to implementation.

USEPA classifies ARARs into three types: chemical-specific, action-specific, and location-specific. Chemical-specific ARARs are usually health-based or risk-based chemical concentration limits in environmental media; action-specific ARARs set performance, design, or similar controls on remedial alternatives; and location-specific ARARs set limits on activities based on the site location.

The following ARARs are of particular significance regarding potential source control actions at the ORB site:

- New York State Solid Waste and Hazardous Waste Management Statutes and Regulations

- The Toxic Substance Control Act

- RCRA Corrective Action Regulations

A detailed discussion of these ARARs follows. Other more specific requirements may apply, depending on the alternative selected.

New York Solid Waste and Hazardous Waste Management Regulations

State regulations governing the identification, storage, handling, treatment, and disposal of solid wastes, hazardous wastes, and non-hazardous contaminated soil are set forth in Title 6, Chapter IV of the New York State Administrative Code. The State regulations are more restrictive than their federal counterparts. For example, New York State identifies wastes containing more than 50 parts per million (ppm) PCBs as listed hazardous waste, whereas USEPA does not regulate PCB wastes as hazardous under RCRA. The contaminated surface soil and sediment at the ORB are not hazardous wastes. The PCB concentrations in these materials are below the 50 ppm regulatory threshold value, and the concentrations of other constituents that leach from the materials are well below the toxicity characteristic values set forth at 6 NYCRR Part 371. Therefore, the surface soil and sediment remedial activities would not be subject to hazardous waste regulations. The requirements that apply to land disposal are of particular importance. Materials containing free liquid, as determined by the paint filter test (USEPA Method 9095) are prohibited from land disposal in non-hazardous waste landfills and hazardous waste landfills (Subpart 373-2). Waste materials to be disposed of in a landfill would be analyzed by the paint filter test and treated, if necessary to remove free liquids.

The NYSDEC Technical Assistance Guidance Memorandum (TAGM) on Determination of Soil Cleanup Objectives and Cleanup Levels, January 1994, should be considered when establishing remedial objectives for contaminated surface soil at the ORB. For example, the cleanup objective for PCBs in soil is one ppm. Samples of the ORB surface soil contained PCB and metals at concentrations above the NYSDEC soil cleanup objectives. NYSDEC has also published Technical Guidance for Screening Contaminated Sediments, November 1993, which contains contaminant criteria levels for sediments and provides methodologies that should be used to determine when remediation is appropriate. For example, the NYSDEC criteria for PCB sediment in freshwater bodies are as follows:

- Human Health Bioaccumulation - 0.0008 μg PCBs/g organic carbon
- Benthic Aquatic Life-Acute Toxicity - 2760.8 μg PCBs/g organic carbon
- Benthic Aquatic Life-Chronic Toxicity - 19.3 μg PCBs/g organic carbon
- Wildlife Bioaccumulation - 1.4 μg PCBs/g organic carbon

Sediment is considered "contaminated" when the criteria are exceeded. Where the sediment is in a deposition zone and resuspension of the contaminants is unlikely, remediation of the contaminants may not be necessary.

The sediment criteria are based on the interstitial water concentrations in the sediment, which are assumed to be available for uptake by organisms in the sediment. The criteria depend on the organic carbon content of the sediment, which is used as an indicator of how much of a contaminant is available for uptake. The criterion based on human health would not be applicable to the ORB because the site-specific baseline risk assessment determined that exposure to contaminants in the Basin does not pose unacceptable health risks. The other criteria are based on aquatic life and wildlife exposure to contaminants in the sediment. The Fish and Wildlife Impact Analysis indicated that conditions at the ORB do not pose a significant threat to ecological resources, aquatic organisms, or wildlife. The site-specific studies indicate that the ORB does not pose a risk to human health or ecological resources (including aquatic organisms and wildlife); therefore application of the NYSDEC sediment criteria would not be appropriate.

Additional regulations and guidelines would have to be considered when contaminated sediments are in navigable waters or in waters of the State. Included in these are New York State dredging requirements, the Interim Guidance on Freshwater Navigation Dredging, the Army Corps of Engineers regulations, and the NYSDEC Water Quality Standards and Guidance Values. These regulations and guidelines may apply to the ORB because it is considered a water of the State.

Toxic Substance Control Act (TSCA)

USEPA regulates waste containing over 50 ppm PCBs under the Toxic Substance Control Act (TSCA) at 40 CFR Part 761. The TSCA regulations would not apply at the ORB because PCB concentrations in surface soil and sediment are below 50 ppm. TSCA allows three disposal methods for regulated PCB wastes: incineration, placement in a chemical waste landfill, and burning in a high efficiency boiler. In certain circumstances, liquids and sludges containing up to 10,000 ppm PCBs can be chemically dechlorinated.

RCRA Corrective Action Regulations

HSWA introduced corrective action requirements for solid waste management units (SWMUs). Regulations prescribing actions to be taken in the event of a release from SWMUs are contained in 40 CFR 264 Subpart F and in the National Contingency Plan (NCP). A SWMU is any discernible unit at which solid wastes have been placed at any time, regardless of whether the unit was intended for the management of solid or hazardous waste. Any area at a facility where solid wastes have been routinely and systematically released is a SWMU, including process sewers, sumps, and ditches used to convey solid wastes (40 CFR 264.501).

Corrective action remedies are required to meet the following standards under 40 CFR 264.525(a): 1) they must protect human health and the environment, considering all current and reasonably expected use of the property; 2) media cleanup standards identified by USEPA or the authorized state agency must be attained; 3) the source of the release must be controlled or eliminated to the extent practicable; and 4) the corrective action must comply with other RCRA regulations except in certain conditions.

In July 1990, USEPA proposed a new regulatory framework to determine the need for and scope of corrective action associated with releases from SWMUs at RCRA facilities (55 FR 30798). The proposed rule prescribes the scope of the release investigation, the corrective measures study, and the design and implementation of corrective measures. The proposed rule also states that source control should be the primary objective of RCRA corrective action. Portions of the proposed RCRA corrective action rule have been adopted as interim policy in some USEPA regions and by many states that are authorized to implement RCRA corrective action rules. USEPA expects to promulgate the final RCRA corrective action rule in September 1995.

The proposed RCRA corrective action rule includes action levels for soil established with direct contact as the exposure scenario. In situations where a site specific risk assessment has not been performed, USEPA has determined that the general cleanup goal should be equal to or less than the 1×10^{-4} to 1×10^{-6} incremental lifetime cancer risk for carcinogens. For non-carcinogens, cleanup levels should be such that adverse effects would not be expected to occur.

3.2 Development and Screening of Source Control Alternatives

The nature and extent of contamination at the areas of concern at the ORB site (surface soil adjacent to the ORB and basin bottom sediments) are described in Section 1.0. The generic RAOs are described in Section 2.2. The baseline risk assessment indicates that exposure to contaminants at the ORB would not pose unacceptable risks to human health. The RI results indicate that the ORB is not a continuing source of downgradient groundwater contamination.

Contaminant concentrations above the NYSDEC soil cleanup objectives and sediment criteria were detected in samples of the ORB surface soil and sediment. The FS evaluates alternatives to meet the NYSDEC standards, criteria and guidance although there are no human health risks or groundwater impacts attributable to the ORB. The following source control alternatives are described in this section based on effectiveness, implementability, and cost along with the No Action alternative.

1: No Action
2: Limited Action/Site Use Restrictions (Institutional Controls)
3: Cover Bottom Sediment with Clean Fill (Sediment Only)
4: Remove Contaminated Surface Soil/Sediment and Dispose of in Off-site Landfill
5: Remove Contaminated Surface Soil/Sediment, Treat on-site, and Dispose of in Off-site Landfill
6: Remove Contaminated Surface Soil/Sediment, Treat off-site, and Dispose of in Off-site Landfill
7: Saturated Zone Stabilization (Sediment Only)

3.2.1 Alternative 1: No Action

The NCP requires that a No Action alternative be considered to provide a baseline against which other source control alternatives can be compared.

Under the No Action alternative, source control measures would not be implemented at the ORB. The No Action alternative would be limited to long-term groundwater monitoring. For the purpose of the FS it is assumed that the following RI monitoring wells will be used for long-term groundwater monitoring: 10S and 10D (upgradient), 6S and 6D (on-site), and 8S and 8I (downgradient). The samples will be collected semi-annually for the first year and annually thereafter and analyzed for Target Compound List VOCs. NYSDEC approval of the monitoring program (monitoring locations, frequency and analytical parameters) would be required. The groundwater monitoring program may be modified after the Main Plant Site remedy is selected in order to establish a single monitoring program for the ORB and Main Plant Sites.

Effectiveness - This alternative would not eliminate the potential for direct contact with surface soils and sediment and surface water in the Basin. The potential for contaminants to leach from sediments to groundwater and/or surface water would remain. Although the No Action alternative would not achieve the generic RAOs, the baseline risk assessment indicates that exposure to contaminants at the ORB would not pose unacceptable risks to human health, and the RI results indicate that the ORB is not a continuing source of downgradient groundwater contamination.

Implementability - The No Action alternative is readily implementable.

Cost - Groundwater monitoring would be the only costs associated with this alternative. There would be no capital costs. The estimated annual O&M costs are $24,700 for the first year and $14,300 thereafter. The estimated total present worth of this alternative is approximately $187,000. The estimated costs are summarized in Table 7 in Appendix B.

3.2.2 Alternative 2: Limited Action/Site Use Restrictions (Institutional Controls)

This alternative would leave the surface soil and sediment at the ORB in place. Direct contact with the surface soil would be limited through administrative (institutional) controls and physical barriers. This alternative would include long-term monitoring of the surface water in the ORB to continue to ensure that the sediments are stable and do not have significant adverse impacts on the water in the Basin. It is assumed that two surface water samples (one from the North Pond and one from the South Pond) would be collected annually and analyzed for VOCs, SVOCs, PCBs, pesticides, and metals. This alternative also includes long-term groundwater monitoring. For the purpose of the FS it is assumed that the following RI monitoring wells will be used for long-term groundwater monitoring: 10S and 10D (upgradient), 6S and 6D (on-site), and 8S and 8I (downgradient). The samples will be collected semi-annually for the first year and annually thereafter and analyzed for Target Compound List VOCs. NYSDEC approval of the monitoring program (monitoring locations, frequency and analytical parameters) would be required. The groundwater monitoring program may be modified after the Main Plant Site remedy is selected in order to establish a single monitoring program for the ORB and Main Plant Sites.

Leaving the surface soil and sediment in place would require administrative controls to limit the use of the site. A deed restriction prohibiting substantial modifications to the site without NYSDEC approval would be placed on future development of the ORB site. A deed restriction would include a scaled site map indicating the impacted area boundaries, the concentrations of contaminants present in the soil and sediment, and a statement indicating that the current operations would continue and NYSDEC would be notified of any planned substantial modifications to the site. The existing fence around the site boundary would restrict unauthorized access and minimize the potential for direct contact with surface soil and sediments. The boundary fence would be inspected regularly for damage and repairs would be made when necessary.

<u>Effectiveness</u> - Administrative controls and physical barriers would minimize the potential for direct contact with surface soils and sediment and surface water in the Basin. The potential for contaminants to leach from sediment to groundwater and/or surface water would remain. Although this alternative would not achieve the generic RAOs because the NYSDEC cleanup objectives would not be met, the baseline risk assessment indicates that exposure to contaminants at the ORB would not pose unacceptable risks to human health, and the RI results indicate that the ORB is not a continuing source of downgradient groundwater contamination. Surface water monitoring in the ORB would continue to ensure that the sediments are stable and do not have significant adverse impacts on the water in the Basin.

Long-term groundwater monitoring would effectively track the distribution and concentrations of VOCs in groundwater in the area of the ORB.

Implementability - This alternative is readily implementable. Deed restrictions could be instituted and fencing could be maintained and modified, if necessary, with minimal difficulty.

Cost - The estimated costs associated with this alternative are summarized in Tables 1 and 8 in Appendix B. The estimated capital cost is $65,000 and the annual O&M cost is approximately $40,300 for the first year and $29,900 thereafter. The estimated total present worth cost of this alternative is approximately $446,000.

3.2.3 Alternative 3: Cover Bottom Sediment with Clean Fill

This alternative would install a layer of clean fill over bottom sediments at the ORB site. This alternative does not apply to the ORB surface soil. The "cap" would prevent the erosive transport of sediments, prevent direct contact with the sediments, and may minimize the potential for contaminant leaching from the sediment to groundwater and/or surface water.

The cap would consist of an inert material such as silt, clay or sand, and/or active materials such as limestone or gypsum which would form a seal at the bottom of the Basin. Cap construction materials would be obtained from an off-site location and hauled to the ORB site. The types, quantities and procurement of materials required to construct the cap would be determined during the design phase.

The fill material would be placed at the bottom of the ORB using a submerged diffuser system. This system is an effective method for controlling the placement of fill material while decreasing the scouring of the bottom sediments. Fill material would be pumped through a pipeline system to the submerged diffuser head. The diffuser head is designed to reduce the velocity and turbulence associated with the discharge of cover materials; however some sediment would be disturbed and resuspended, but metals would not be dissolved. The impact velocity and thickness of the cover can be controlled by varying the height of the discharge above the bottom, using a crane or similar equipment, as well as the discharge velocity. The fill layer would be approximately three feet thick.

This alternative would include long-term monitoring of the surface water in the ORB to continue to ensure that the sediments are stable and do not have significant adverse impacts on the water in the Basin. It is assumed that two surface water samples (one from the North Pond and one from the South Pond) would be collected annually and analyzed for VOCs, SVOCs, PCBs, pesticides, and metals. This alternative also includes long-term groundwater monitoring. For the purpose of the FS it is assumed that the following RI monitoring wells will be used for long-term groundwater monitoring: 10S and 10D (upgradient), 6S and 6D (on-site), and 8S and 8I (downgradient). The samples will be collected semi-annually for the first year and annually thereafter and analyzed for Target Compound List VOCs. NYSDEC approval of the monitoring program (monitoring locations, frequency and analytical parameters) would be required. The groundwater monitoring program may be modified after the Main Plant Site remedy is selected in order to establish a single monitoring program for the ORB and Main Plant Sites.

<u>Effectiveness</u> - The cap would eliminate the potential for direct contact with the sediments and would prevent erosive transport of contaminated sediment. Cap erosion would be limited due to the lack of bottom currents and the low flow velocity of rainwater runoff into the ponds. The cap may minimize the potential for contaminant leaching from the sediment to groundwater and/or surface water. The long-term effectiveness of this alternative is uncertain and new sediments would continue to collect on the cap surface as a result of surface water runoff that enters the Basin.

Although this alternative would not achieve the RAOs because the NYSDEC cleanup objectives would not be met, the baseline risk assessment indicates that exposure to contaminants at the ORB would not pose unacceptable risks to human health, and the RI results indicate that the ORB is not a continuing source of downgradient groundwater contamination. Surface water monitoring in the ORB would continue to ensure that the sediments are stable and do not have significant adverse impacts on the water in the Basin. Long-term groundwater monitoring would effectively track the distribution and concentrations of VOCs in groundwater in the area of the ORB.

This alternative would disturb the sediments at the bottom of the ORB, which are currently in a stable condition and do not impact human health or the environment. Disturbing the sediment in the Basin may result in significant adverse impacts because there is a greater potential for exposure to contaminants in suspended sediment.

Implementability - A sediment cap could be constructed at the ORB site by local contractors using a submerged diffuser system. It is expected that the clean fill material could be obtained from a local source provided that the material specifications determined during the remedial design phase are met.

Installing a uniform cap over the bottom sediment would be difficult due to the steep slopes, shallow depth, and irregular bottom profile of the ORB. Visual inspection of the sediment cap during installation or over the long-term would not be possible due to standing water in the Basin.

Cost - The estimated costs associated with this alternative are summarized in Tables 2 and 8 of Appendix B. The estimated capital cost is $2,958,000 to $3,698,000 and the annual O&M cost is approximately $40,300 for the first year and $29,900 thereafter. The estimated total present worth cost of this alternative is approximately $3,339,000 to $4,079,000.

For purposes of alternative screening, the estimated costs are presented as ranges to reflect variations in fill materials, where sand purchased from a local quarry would have the lowest unit capital cost and clay purchased from an upstate or out of state source would have the highest capital cost.

3.2.4 Alternative 4: Remove Contaminated Soil/Sediment and Dispose of in an Off-Site Landfill

This alternative would consist of removing surface soil and sediment for disposal in an off-site non-hazardous landfill. The off-site landfill would be properly licensed and would operate in compliance with its permit and applicable regulations. The off-site facility would be selected during the remedial design phase based on NYSDEC requirements and the ability and willingness of the facility to accept the material.

Separate descriptions and evaluations of the applicability of this alternative relative to the surface soil and sediment at the ORB site are presented below.

Surface Soil

Surface soil containing contaminants at concentrations above the NYSDEC soil cleanup objectives is found in a small area west of the South Pond. The area measures approximately 30 feet by 30 feet, with a maximum depth of about one foot (approximately 35 cubic yards). The soil would be removed using conventional excavating equipment such as a small backhoe and would be characterized prior to off-site transportation and disposal.

Sediment

Sediment containing contaminants at concentrations above the NYSDEC sediment criteria is found in the North and South Ponds. The volume of sediment in the Basin is estimated to be approximately 110,000 cubic yards (Appendix A) based on site investigations results. It is assumed that the sediment would be removed using mechanical dredging equipment such as draglines or clamshells. Other dredging options would be evaluated during remedial design. The sediments would have to be dewatered to pass the paint filter test prior to disposal. This FS assumes that the sediments would be dewatered using a filter press to minimize the volume of material requiring off-site transportation and disposal. Alternative dewatering processes would be evaluated during remedial design. There may not be sufficient space at the ORB site to accommodate the equipment required to dewater the large volume of sediment that would be removed from the Basin. This would require that the equipment be set up on a portion of the Main Plant Site adjacent to the ORB site, which would interfere with future development of the property and involve a significant amount of material handling and hauling between the ORB and the dewatering area.

Filtration is a physical process in which the suspended solids in a fluid are separated from the liquid by forcing the fluid through a porous medium. The filter press consists of vertical plates that are held rigidly in a frame and are pressed together by a large screw jack or hydraulic cylinder. The material to be filtered (dredged sediments) enters the cavity formed by the frame and perforated metal plates covered with filter fabric are pressed against this frame. The plate operates on a cycle which includes filling, pressing, cake removal, media washing and press closing. As the material flows through the filter medium, solids are entrapped and build up within the cavity until the cavity is full. The slurry is dewatered until no filtrate is produced. The press is opened, the dewatered slurry removed, the plates cleaned, and the cycle is repeated.

Mechanical dewatering system such as filter presses would not remove all of the free liquid from the sediment, but would increase the solids content to approximately 50 percent. The dewatered solids would require further treatment such as the addition of moisture absorbents to eliminate the remaining free liquid.

After the sediment is dewatered, the filtrate (liquid removed by the filter press) would be analyzed to characterize this liquid for subsequent treatment and disposal. The filtrate would be treated on-site to remove suspended solids and reduce contaminant concentrations to acceptable levels, if necessary. The treatment operations may include: coagulation/ sedimentation to coagulate and settle fine sediments; sand filtration to remove suspended solids; and carbon filtration to remove soluble contaminants. The treatment requirements and costs would be evaluated during the remedial design phase.

The filtrate would then be characterized and discharged to the sanitary sewer or storm sewer system, or hauled to a licensed wastewater disposal facility.

Once the free liquids have been eliminated from the sediment, the material would be characterized prior off-site transportation and disposal.

No long-term O&M would be required under this alternative if all contaminated soil/sediment is removed from the ORB site.

Effectiveness - Disposing of ORB surface soil and sediment that does not meet the NYSDEC soil cleanup objectives and sediment criteria at an appropriate off-site landfill would achieve the generic RAOs. The potential for direct contact with the contaminated surface soil and sediment would be eliminated by removing these materials from the ORB site. Removal and off-site land disposal would also eliminate the potential for contaminant migration from these materials to surface water and/or groundwater. The baseline risk assessment indicates that exposure to contaminants at the ORB would not pose unacceptable risks to human health. The RI results indicate that the ORB is not a continuing source of downgradient groundwater contamination. The off-site landfill would be inspected, maintained and monitored by the owner/operator in compliance with its permit to ensure long-term integrity and environmental protection.

The effectiveness of the sediment removal operation would depend on the type and precision of the dredge and operator capabilities. Inaccuracies in dredge cut positioning and depth control, sediment sloughing, and difficulties with obstructions and debris would interfere with the efficiency of dredging. Dredging causes sediments to become resuspended in overlying water, making complete removal difficult. Double pass dredging is often used to ensure complete removal of contaminated sediments, but this generally yields a substantial amount of uncontaminated sediments which must be disposed of.

This alternative would disturb the sediments at the bottom of the ORB, which are currently in a stable condition and do not impact human health or the environment. Disturbing the sediment in the Basin may result in significant adverse impacts because there is a greater potential for exposure to contaminants in suspended sediment.

Filtration is the most effective method for dewatering slurries. The process is generally reliable, provided the slurries have been properly prescreened and conditioned. Filter press performance is dependent on the type of filter, the particle size distribution of the slurry, and the slurry solids content. Pilot test would be conducted during the design phase to determine the system efficiency.

This alternative assumes that the surface soil and sediment would not require treatment in addition to dewatering prior to off-site transportation and disposal.

<u>Implementability</u> - Appropriate off-site land disposal facilities would be selected during remedial design based on the type and volume of materials to be disposed of, NYSDEC requirements, and the willingness of the facilities to accept wastes from a CERCLA site for disposal. It may be difficult to locate a facility that has the capacity to accept the large volume of ORB sediment (estimated at 110,000 cy) for disposal. The environmental status of potential disposal facilities would be checked when selecting off-site landfills.

Local contractors would be retained to excavate the soil and sediment. The excavated materials would be transported from the ORB site to the off-site landfill by a licensed waste hauler in accordance with applicable regulations.

Filter presses generally require a large area and mobile systems are available from several contractors. There may not be sufficient space at the ORB site to accommodate the equipment required to dewater the large volume of sediment that would be removed from the Basin. This would require that the equipment be set up on a portion of the Main Plant Site adjacent to the ORB site, which would interfere with future development of the property and involve a significant amount of material handling and hauling between the ORB and the dewatering area. The required periodic replacement of the filter media on a filter press is both expensive and time consuming. The filtrate and dewatered sludge are likely to require further treatment prior to disposal. The water generated from washing the filter media will require treatment. It may be difficult to obtain the approvals required to discharge the filtrate and washwater to sanitary or storm sewer systems or to an off-site wastewater treatment facility.

This alternative would remove contaminated surface soil and sediment for off-site disposal, so no operation and maintenance would be required at the ORB site.

Cost - The estimated costs associated with this alternative are summarized in Table 3 of Appendix B. The estimated capital cost is $27,753,000 and there are no annual O&M costs. The estimated total present worth cost of this alternative is approximately $27,753,000.

For cost estimating purposes, this FS assumes that surface soil and sediment from the ORB would be disposed of at the American Landfill located in Waynesboro, Ohio.

3.2.5 Alternative 5: Remove Contaminated Soil/Sediment, Treat On-Site, and Dispose of in an Off-Site Landfill

This alternative would consist of removing surface soil and sediment, treating the materials on-site by solidification or incineration, and transporting the treated material for disposal in an off-site non-hazardous waste landfill. The off-site landfill would be properly licensed and would operate in compliance with its permit and applicable regulations. The off-site facility would be selected during the remedial design phase based on NYSDEC requirements and the ability and willingness of the facility to accept the material.

The area of surface soil containing contaminants at concentrations above the NYSDEC soil cleanup objective would be removed using conventional excavating equipment such as a backhoe and would be characterized prior to off-site transportation and disposal. The sediment would be removed from the ORB, as described in Alternative 4. The surface soil and sediment would then be treated on-site by solidification or incineration processes as described below.

No long-term O&M would be required under this alternative if all contaminated soil/sediment is removed from the ORB site.

Solidification

The surface soil and sediment could be solidified to eliminate free liquids and reduce the potential for contaminant leaching.

There is insufficient space at the ORB site to accommodate the equipment required for solidification and the cells that would have to be constructed to cure the solidified sediment and surface soil. This would require that the solidification equipment/curing cells be set up on a portion of the Main Plant Site, which would interfere with future development of the property and involve a significant amount of material handling and hauling between the ORB and the solidification area.

The sediments would be dewatered using a mechanical method such as a filter press to increase the solids content to about 50 percent and improve the material handling characteristics as described in Alternative 4. The dewatered solids would be fed to the rotary mixer by an auger conveyor mechanism. The rotary mixer would rotate slowly to agitate the feed while Portland cement and other solidification additives are added to the mixing chamber. The solidification additive mixture would be formulated based on design phase tests. The fixed solids would be discharged from the rotary mixer and placed in the cells to cure until they are non-flowable. The solidified product characteristics may range from a granular solid to a solid mass. It is assumed that solidification would increase the volume of material by approximately 25 percent. TCLP analysis of the cured solids would be conducted to determine if they contain toxic levels of leachable inorganics, as defined in 40 CFR 261. The cured solids would then be loaded onto trucks and transported to an appropriate off-site non-hazardous waste landfill for disposal.

Pilot tests would be conducted on representative samples of surface soil and sediment from the ORB site during the remedial design to determine the effectiveness of solidification and to evaluate material handling concerns.

Incineration

The surface soil and sediment could be incinerated to destroy PCBs in a transportable rotary kiln incineration system. There is insufficient space at the ORB site to accommodate the incineration equipment. This would require that the incinerator be set up on a portion of the Main Plant Site, which would interfere with future development of the property and involve a significant amount of material handling and hauling between the ORB and the incineration area.

The sediments would be dewatered on-site using a mechanical method such as a filter press to increase the solids content to about 50 percent and improve the material handling characteristics as described in Alternative 4. The dewatered solids would be fed to the rotary kiln by an auger conveyor mechanism. The rotary kiln would rotate slowly to agitate the feed, exposing it to oxygen to improve heat transfer and ensure complete combustion. The rotary kiln and the associated emissions control system would be operated in accord with RCRA incinerator standards. The incinerator ash would be discharged from the rotary kiln, stockpiled, cooled, and wetted to control dust. It is assumed that incineration would decrease the volume of material by approximately 50 percent. TCLP analysis of the residual ash would be conducted to determine if it contains toxic levels of leachable inorganics, as defined in 40 CFR 261. The incinerator ash would then be loaded onto trucks and transported to an appropriate off-site non-hazardous waste landfill for disposal.

Pilot tests would be conducted on representative samples of wastes from the ORB site during the remedial design to determine the effectiveness of rotary kiln incineration and to evaluate material handling concerns.

<u>Effectiveness</u> - On-site treatment and off-site disposal of ORB surface soil and sediment that does not meet the NYSDEC soil cleanup objectives and sediment criteria at an appropriate off-site landfill would achieve the generic RAOs. The potential for direct contact with the contaminated surface soil and sediment would be eliminated by removing these materials from the ORB site. Removal, on-site treatment, and off-site land disposal would also eliminate the potential for contaminant migration from these materials to surface water and/or groundwater. The baseline risk assessment indicates that exposure to contaminants at the ORB would not pose unacceptable risks to human health. The RI results indicate that the ORB is not a continuing source of downgradient groundwater contamination.

The effectiveness of the sediment removal operation would depend on the type and precision of the dredge and operator capabilities. Inaccuracies in dredge cut positioning and depth control, sediment sloughing, and difficulties with obstructions and debris would interfere with the efficiency of dredging. Dredging causes sediments to become resuspended in overlying water, making complete removal difficult. Double pass dredging is often used to ensure complete removal of contaminated sediments, but this generally yields a substantial amount of uncontaminated sediments which must be disposed of.

This alternative would disturb the sediments at the bottom of the ORB, which are currently in a stable condition and do not impact human health or the environment. Disturbing the sediment in the Basin may result in significant adverse impacts because there is a greater potential for exposure to contaminants in suspended sediment.

Filtration is the most effective method to dewater slurries. The process is generally reliable, provided the slurries have been properly prescreened and conditioned. Filter press performance depends on the type of filter, the particle size distribution of the slurry, and the slurry solids content. A pilot test would be conducted during the design phase to determine the system efficiency.

Solidification would physically bind most of the PCBs and metals found in surface soil and sediment at the ORB site. Some compounds may not be effectively immobilized with Portland cement because generally, they are not bound in the matrix and would remain susceptible to leaching. Solidification would significantly increase the volume of material (on the order of approximately 25%) requiring subsequent transportation and disposal. A pilot scale study would be conducted during the remedial design to determine the effectiveness of solidification and materials handling concerns.

PCBs in the surface soil and sediment would be destroyed by incineration, but the inorganics would not be destroyed. Inorganics may be released in the exhaust gas from the incinerator as either particulates or vapor depending on the operational characteristics of the incinerator. Incinerator operation and emissions would be evaluated by trial testing that would be conducted during the remedial design phase. Incineration would reduce the volume of material by approximately 50 percent. Solidification would be required to immobilize the inorganics in the incinerator ash if toxic levels of inorganics leach from the ash. This FS assumes that solidification of the ash would not be required, which would be confirmed during design phase tests.

The off-site landfill would be inspected, maintained and monitored by the owner/operator in compliance with its permit to ensure long-term integrity and environmental protection.

Implementability - Appropriate on-site treatment technologies and off-site land disposal facilities would be selected during remedial design based on the type and volume of materials to be treated and disposed of, NYSDEC requirements, and the willingness of the facilities to accept wastes from a CERCLA site for disposal. It may be difficult to locate a facility that has the capacity to accept the large volume of ORB sediment (estimated at 110,000 cy) for disposal. The environmental status of potential disposal facilities would be checked when selecting off-site landfills.

Local contractors would be retained to excavate the soil and sediment, and to construct the curing cells required for the solidification option. Experienced remediation companies would be contracted to ensure that the selected treatment technology is operated properly. The excavated materials would be transported from the ORB site to the off-site landfill by a licensed waste hauler in accordance with applicable regulations.

Filter presses generally require a large area and mobile systems are available from several contractors. The required periodic replacement of the filter media on a filter press is both expensive and time consuming. The filtrate and dewatered sludge are likely to require further treatment prior to disposal. The water generated from washing the filter media will require treatment. It may be difficult to obtain the approvals required to discharge the filtrate and washwater to sanitary or storm sewer systems, or to an off-site wastewater treatment facility.

Commercially available cement mixing and handling equipment on mobile trailer mounted systems can be used for the solidification processes. Mobile mixing plants give excellent mixing results and reasonably good production rates. Cement solidification can result in large volume increases, depending on the amount of additives required. This FS assumes that solidification would increase the volume of material requiring off-site transportation and disposal by approximately 25 percent.

Transportable rotary kiln incineration systems are available. Rotary kiln incineration is widely used to destroy organics in sludges and solid feeds. Waste processing before introduction into the incinerator may be required to produce a feed with fairly uniform moisture content. Preprocessing requirements and material handling concerns would be evaluated during the remedial design phase. Incineration would reduce the volume of material requiring off-site transportation and disposal by approximately 50 percent. Implementing an incineration remedy would be significantly constrained by the long lead times associated with trial burns. There may be strong public opposition to the on-site incineration option.

There is insufficient space at the ORB site to accommodate the equipment required for this alternative. This would require the use of a portion of the Main Plant Site, which would interfere with future development of the property and involve a significant amount of material handling and hauling from the ORB site to these areas.

This alternative would remove contaminated surface soil and sediment for off-site disposal, so no operation and maintenance would be required at the ORB site.

<u>Cost</u> - The estimated costs associated with this alternative are summarized in Table 4 of Appendix B. The estimated capital cost is \$37,722,000 to \$93,946,000 and there are no annual O&M costs. The estimated total present worth cost of this alternative is approximately

$37,722,000 to $93,946,000. The cost ranges reflect on-site treatment by solidification or incineration.

For cost estimation purposes, this FS assumes that surface soil and sediment from the ORB would be disposed of at the American Landfill located in Waynesboro, Ohio.

3.2.6 Alternative 6: Remove Contaminated Soil/Sediment, Treat Off-Site, and Dispose of in an Off-Site Landfill

This alternative would consist of removing surface soil and sediment, dewatering the sediment on-site, and transporting the dewatered sediment and surface soil to an off-site facility for treatment and disposal in a non-hazardous waste landfill. The off-site landfill would be properly licensed and would operate in compliance with its permit and applicable regulations. The off-site facility would be selected during the remedial design phase based on NYSDEC requirements and the ability and willingness of the facility to accept the material.

The area of surface soil containing contaminants at concentrations above the NYSDEC cleanup objective would be removed using conventional excavation equipment such as a backhoe, and would be characterized prior to off-site transportation, treatment, and disposal. The sediment would be removed from the ORB, as described in Alternative 4. The sediments would be dewatered using a mechanical method such as a filter press to increase the solids content to about 50 percent and improve the material handling characteristics as described in Alternative 4. The dewatered sediment would also be characterized prior to off-site transportation, treatment and disposal. The ORB surface soil and sediment would be treated at the off-site disposal facility by solidification or incineration. This FS assumes that off-site solidification and disposal would occur at the American Landfill in Waynesboro, Ohio and that off-site incineration and disposal would occur at the Chemical Waste Management facility in Model City, New York. The actual facilities would be selected during remedial design.

No long-term O&M would be required under this alternative if all contaminated soil/sediment is removed from the ORB site.

Effectiveness - Treating and disposing of ORB surface soil and sediment that does not meet the NYSDEC soil cleanup objectives and sediment criteria at an appropriate off-site landfill would achieve the generic RAOs. The potential for direct contact with the contaminated surface soil and sediment would be eliminated by removing these materials from the ORB site. Removal and off-site treatment and land disposal would eliminate the potential for contaminant migration from these materials to surface water and/or groundwater. The baseline risk assessment indicates that exposure to contaminants at the ORB would not pose unacceptable risks to human health. The RI results indicate that the ORB is not a continuing source of downgradient groundwater contamination. The off-site treatment facility and landfill would be inspected, maintained and monitored by the owner/operator in compliance with its permit to ensure long-term integrity and environmental protection.

The effectiveness of the sediment removal operation would depend on the type and precision of the dredge and operator capabilities. Inaccuracies in dredge cut positioning and depth control, sediment sloughing, and difficulties with obstructions and debris would interfere with the efficiency of dredging. Dredging causes sediments to become resuspended in overlying water making complete removal difficult. Double pass dredging is often used to ensure complete removal of contaminated sediments, but this generally yields a substantial amount of uncontaminated sediments which must be disposed of.

This alternative would disturb the sediments at the bottom of the ORB, which are currently in a stable condition and do not impact human health or the environment. Disturbing the sediment in the Basin may result in significant adverse impacts because there is a greater potential for exposure to contaminants in suspended sediment.

Filtration is the most effective method to dewater slurries. The process is generally reliable, provided the slurries have been properly prescreened and conditioned. Filter press performance depends on the type of filter, the particle size distribution of the slurry, and the slurry solids content. A pilot test would be conducted during the design phase to determine the system efficiency.

Off-site solidification would physically bind most of the PCBs and metals in the ORB surface soil and sediment before these materials are landfilled. Some compounds may not be effectively immobilized with Portland cement because they are not bound in the matrix and would remain susceptible to leaching.

Off-site incineration would destroy the PCBs in ORB surface soil and sediment prior to off-site disposal, but would not destroy inorganics. Solidification would be required to immobilize the inorganics in the incinerator ash if toxic levels of inorganics leach from the ash. This FS assumes that solidification of the ash would not be required, which would be confirmed during design phase tests.

<u>Implementability</u> - Appropriate off-site treatment and land disposal facilities would be selected during remedial design based on the type and volume of materials to be treated and disposed of, NYSDEC requirements, and the willingness of the facilities to accept wastes from a CERCLA site for disposal. It may be difficult to locate a facility that has the capacity to accept the large volume of ORB sediment (estimated at 110,000 cy) for disposal. The environmental status of potential treatment and disposal facilities would be checked during the remedial design.

Local contractors would be retained to excavate the soil and sediment. The excavated materials would be transported from the ORB site to the off-site treatment and disposal facility by a licensed waste hauler in accordance with applicable regulations.

Filter presses generally require a large area and mobile systems are available from several contractors. There may not be sufficient space at the ORB site to accommodate the equipment required to dewater the large volume of sediment that would be removed from the Basin. This would require that the equipment be set up on a portion of the Main Plant Site adjacent to the ORB site, which would interfere with future development of the property and involve a significant amount of material handling and hauling between the ORB and the dewatering area. The required periodic replacement of the filter media on a filter press is both expensive and time consuming. The filtrate and dewatered sludge are likely to require further treatment prior to disposal. The water generated from washing the filter media will require treatment. It may be difficult to obtain the approvals required to discharge the filtrate and washwater to sanitary or storm sewer systems, or to an off-site wastewater treatment facility.

This alternative would remove contaminated surface soil and sediment for off-site disposal, so no operation and maintenance would be required at the ORB site.

<u>Cost</u> - The estimated costs associated with this alternative are summarized in Table 5 of Appendix B. The estimated capital cost is $35,728,000 to $243,078,000 and there are no annual O&M costs. The estimated total present worth cost of this alternative is approximately $35,728,000 to $243,078,000. The cost ranges reflect off-site treatment by solidification or incineration.

For cost estimation purposes, this FS assumes that off-site solidification and disposal would occur at the American Landfill in Waynesboro, Ohio and that off-site incineration and disposal would occur at the Chemical Waste Management facility in Model City, New York.

3.2.7 Alternative 7: Saturated Zone Stabilization

This alternative would stabilize sediments at the bottom of the ORB through the injection of binder materials into the sediments. This alternative does not apply to the ORB surface soil. Saturated zone stabilization would prevent erosive transport of sediments, prevent direct contact with the sediments, and minimize the potential for contaminant leaching from the sediment to groundwater and/or surface water. Bench scale treatability tests would be performed during the design phase to determine whether the contaminants present in the sediment can be effectively immobilized by saturated zone stabilization.

The stabilization additives would consist of active materials such as clay-cement or quicklime to chemically react with and immobilize hazardous constituents in the sediment. Experienced remediation companies would be contracted to supply the materials and specialized injection/ mixing equipment, and to ensure that the stabilization is properly completed.

Barge mounted in-situ mixing equipment would be used to perform saturated zone stabilization of the sediments at the bottom of the ORB. In-situ mixing equipment uses several augers to drill into contaminated material, concurrently injecting calculated amounts of specially formulated stabilization reagents into the material. The equipment operator usually determines when mixing is complete based on experience. The layer of stabilized material at the bottom of the ORB would be approximately 10 feet thick. The saturated zone stabilization injection and mixing operation may resuspend some sediment, which would not be stabilized with the remainder of the bottom material.

This alternative would include long-term monitoring of the surface water in the ORB to continue to ensure that the sediments are stable and do not have significant adverse impacts on the water in the Basin. It is assumed that two surface water samples (one from the North Pond and one from the South Pond) would be collected annually and analyzed for VOCs, SVOCs, PCBs, pesticides, and metals. This alternative also includes long-term groundwater monitoring. For the purpose of the FS it is assumed that the following RI monitoring wells will be used for long-term groundwater monitoring: 10S and 10D (upgradient), 6S and 6D (on-site), and 8S and 8I (downgradient). The samples will be collected semi-annually for the first year and annually thereafter and analyzed for Target Compound List VOCs. NYSDEC approval of the monitoring program (monitoring locations, frequency and analytical parameters) would be required. The groundwater monitoring program may be modified after the Main Plant Site remedy is selected in order to establish a single monitoring program for the ORB and Main Plant Sites.

Effectiveness - This alternative would achieve the generic RAOs by stabilizing the sediment at the bottom of the ORB that contains contaminants at concentrations above the NYSDEC sediment criteria. Saturated zone stabilization would eliminate the potential for direct contact with the sediments and would prevent the erosive transport of contaminated sediment. Erosion of the stabilized materials would be limited due to the lack of bottom currents and the low flow velocity of rainwater runoff into the ponds. This alternative would also minimize the potential for contaminant leaching from the sediment to groundwater and/or surface water. The long-term effectiveness of this alternative is uncertain and new sediments would continue to collect on the stabilized bottom of the ORB as a result of surface water runoff that enters the Basin. Reagent tests would be required during design to determine the most effective additive mixture to chemically stabilize the contaminants present in the ORB sediment.

The baseline risk assessment indicates that exposure to contaminants at the ORB would not pose unacceptable risks to human health. The RI results indicate that the ORB is not a continuing source of downgradient groundwater contamination. Surface water monitoring in the ORB would continue to ensure that the sediments are stable and do not have significant adverse impacts on the water in the Basin. Long-term groundwater monitoring would effectively track the distribution and concentrations of VOCs in groundwater in the area of the ORB.

This alternative would disturb the sediments at the bottom of the ORB, which are currently in a stable condition and do not impact human health or the environment. Disturbing the sediment in the Basin may result in significant adverse impacts because there is a greater potential for exposure to contaminants in suspended sediment.

Implementability - Stabilization of the sediments could be performed at the ORB site by experienced contractors using specialized barge mounted equipment and materials to inject the stabilizing agents into the sediments.

Achieving a uniform stabilized layer at the bottom of the ORB would be difficult due to the steep slopes, shallow depth, and irregular bottom profile of the Basin. The saturated zone stabilization injection and mixing operation may resuspend some sediment, which would not be stabilized with the remainder of the bottom material. Visual inspection of the stabilized sediments during the remedial action or over the long-term would not be possible due to standing water.

Cost - The estimated costs associated with this alternative are summarized in Tables 6 and 8 of Appendix B. The estimated capital cost is \$31,900,000 and the annual O&M cost is approximately \$40,300 for the first year and \$29,900 thereafter. The estimated total present worth cost of this alternative is approximately \$32,281,000.

3.3 Summary of Remedial Alternative Screening

The following remedial alternatives will be subjected to the Section 4.0 detailed analysis against the NCP evaluation criteria (overall protection of human health and the environment; compliance with ARARs; reduction of toxicity, mobility and volume through treatment; long-term effectiveness and permanence; short-term effectiveness; implementability; and cost), based on the alternatives screening presented in this section.

- Alternative 1: No Action
- Alternative 2: Limited Action/Site Use Restrictions (Institutional Controls)
- Alternative 3: Cover Bottom Sediment with Clean Fill (excludes ORB surface soil)
- Alternative 4: Remove Contaminated Surface Soil for Disposal in an Off-site Landfill (excludes ORB sediments)

As described below, Alternatives 5, 6, and 7 (and Alternative 4 as it relates to the sediment) would not be appropriate or cost-effective considering the ORB site conditions and the associated risks.

The surface soil and sediment at the ORB are not listed or characteristic hazardous wastes as defined by NYSDEC and USEPA. The baseline risk assessment determined that exposure to contaminants at the ORB would not pose an unacceptable risk to human health. The possibility of inadvertent direct contact with the ORB sediments is extremely remote because the sediment is beneath about 30 feet of water. The RI determined that the ORB is not a continuing source of groundwater contamination, which will be addressed in the Main Plant Site FS. The Fish and Wildlife Impact Analysis conducted at the ORB determined that there are no significant ecological resources, such as aquatic organisms and wildlife present at the ORB that could be impacted by contaminants in the surface soil and sediment. The site specific information indicates that the existing conditions do not impact human health, groundwater, or ecological resources. Administrative actions (institutional controls) can be taken to ensure that impacts do not occur in the future.

Some of the samples of surface soil and sediment collected at the ORB contained PCBs and metals at concentrations above the NYSDEC soil cleanup objectives and sediment criteria. These generic objectives and criteria are based on protecting human health, groundwater, aquatic life and wildlife. Although some of the concentrations at the ORB do not meet the levels established by NYSDEC, the site-specific information including the RI, baseline risk assessment, and Fish and Wildlife Impact Analysis results indicates that there are no impacts posed by or associated with the surface soil and sediment at the ORB. Therefore, the cost to remove and dispose of these materials would have no offsetting human health or environmental benefit.

There is an extremely large volume (approximately 110,000 cy) of sediment at the bottom of the ORB, and the alternatives (4, 5 and 6) that include sediment removal would involve substantial implementation problems due to the material handling that would be required. These alternatives would disturb the sediment at the bottom of the ORB, which are currently in a stable condition and do not impact human health or the environment. Disturbing the sediment in the Basin may result in significant adverse impacts because there is a greater potential for exposure to contaminants in suspended sediment. On the other hand, the small volume of surface soil (approximately 35 cy) that does not meet the NYSDEC soil cleanup objectives could be easily removed and disposed of at an off-site non-hazardous waste landfill.

Performing saturated zone stabilization (Alternative 7) to stabilize the sediment would be technically difficult and costly, and would have no offsetting benefit because the RI data indicate that the bottom sediment is already stable. In addition, Alternative 7 would disturb the sediments at the bottom of the ORB, which are currently in a stable condition and do not impact human health or the environment. Disturbing the sediment in the Basin may result in significant adverse impacts. The long-term effectiveness of this alternative is uncertain and new sediments would continue to collect on top of the stabilized sediments. Installing a uniform stabilized layer at the bottom of the ORB would be difficult due to the steep slopes, shallow depth, and irregular bottom profile of the Basin. Visual inspection of the stabilized layer would not be possible due to the standing water in the Basin.

The alternatives (5, 6, and 7) that include treatment of the surface soil and/or sediment to destroy or immobilize contaminants are not appropriate because the contaminants do not impact human health or the environment. Alternatives 4, 5, 6, and 7 are not cost-effective and would not result in any benefit to human health, groundwater, or ecological resources because there are no impacts. These alternatives (except Alternative 4 as it relates to surface soil, which could be readily implemented) will not be carried through the detailed analyses in Section 4.0.

Alternative 3 would be subject to similar effectiveness and implementation issues as described for Alternative 7 above. Covering the ORB bottom sediment with a clean layer of fill is representative of an alternative that would eliminate the potential for direct contact with the sediment. This alternative will be carried through the detailed analysis so that a comprehensive range of remedial options is evaluated as required by the NCP.

4.0 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

4.1 Introduction

The remedial alternatives listed below were carried through the Section 3.0 alternatives screening process.

- Alternative 1 - No Action - Long-Term Groundwater Monitoring
- Alternative 2 - Limited Action/Site Use Restrictions (Institutional Controls)
- Alternative 3 - Cover Bottom Sediment with Clean Fill
- Alternative 4 - Remove Contaminated Surface Soil for Disposal in an Off-Site Landfill (excludes ORB Sediment)

These alternatives present a range of methods to achieve the remedial action objectives and are described and evaluated in detail in this section. Each alternative is assessed in terms of CERCLA compliance. According to SARA 121(b), remedies are to be assessed in terms of their ability to satisfy the following criteria:

- Nature of the Waste - SARA 121(b)(C) relates to the nature of the waste as it may pose a hazard to human health or the environment.
- Potential Health Effects - SARA 121(b)(D) relates to the potential human health effects posed by the site.

- Long-Term Maintenance Costs - SARA 121(b)(E) relates to minimizing the long-term cost to maintain post closure conditions.

- Costs Associated with Remedial Failure - SARA 121(b)(F) relates to the cost associated with a remedial failure.

USEPA incorporated the SARA 121(b) criteria into nine evaluation criteria presented in the NCP (Part 300.430) and as required, each remedial alternative is assessed against these criteria in this section. The NCP criteria are described below.

Two of the criteria relate directly to statutory findings that must be made in the Record of Decision. Each alternative must meet these threshold criteria:

- Overall Protection of Human Health and the Environment - The degree to which unacceptable site risks posed through exposure pathways identified in the risk assessment are eliminated, reduced or controlled by the remedial action.

- Compliance with ARARs - Whether requirements that are applicable or relevant and appropriate to a given alternative are satisfied by the alternative or whether there is sufficient justification for a waiver. ARARs are discussed in Section 3.1.1.

The following five are the balancing criteria which are used to evaluate the trade-offs between the alternatives:

- Long-Term Effectiveness and Permanence - The magnitude of risk remaining after remedial activities are complete. Potential risks relate to untreated waste or treatment residuals and the ability of controls to provide sufficient protection from hazardous residuals.

- Reduction of Toxicity, Mobility or Volume Through Treatment - The ability of an alternative to reduce threats at a site by destroying toxic contaminants, reducing the total mass or volume of toxic contaminants and/or contaminant mobility.

- Short-Term Effectiveness - Health and environmental impacts during implementation including the need to protect the community and workers during the remedial action, environmental impacts during implementation, and the time required to achieve the remedial action objectives.

- Implementability - The technical and administrative feasibility of implementing an alternative including the reliability of the technology, technical difficulties encountered in construction and operation of the technology, and the ease of implementing additional remedial actions that might be necessary in the future.

- Cost - The capital cost, annual operation and maintenance (O&M) cost and present worth of the alternative.

  Capital costs include expenditures for the equipment, labor, materials, transportation and disposal necessary to implement the remedial actions, as well as expenditures for engineering, legal, financial and other necessary services. Annual O&M costs are required to ensure the continued effectiveness of a remedial action and include maintenance, materials, labor, disposal and energy costs, insurance, taxes, licensing, and administrative costs. The present worth analysis discounts all future cost streams to a common year, usually the current year. USEPA recommends using a discount rate of seven percent (OSWER Directive No. 9355.3-20, June 25, 1993) before taxes and after inflation in the analysis of present worth costs for Superfund activities, with a planned remedial lifetime for costing purposes not to exceed 30 years. Preliminary cost estimate calculations are presented in Appendix B.

The last two modifying criteria, State Acceptance and Community Acceptance address state and public concerns regarding the alternatives. The Community Acceptance criteria will be addressed after the RI/FS report and proposed remediation plan have been reviewed by the public.

4.2 Detailed Analysis of Surface Soil and Basin Sediment Remedial Alternatives

This section presents the detailed evaluations of the ORB surface soil and basin sediment remedial alternatives based on the NCP criteria described in Section 4.1. The alternatives and remedial scenarios are evaluated based on preliminary concepts. The actual remedial system specifications and monitoring locations would be determined during the design phase.

4.2.1 Alternative 1: No Action

The no action alternative is carried through the FS evaluation as required by the NCP to provide a baseline for comparison with other remedial alternatives.

Under the No Action alternative, source control measures would not be implemented at the ORB. The No Action alternative would be limited to long-term groundwater monitoring. For the purpose of the FS it is assumed that the following RI monitoring wells will be used for long-term groundwater monitoring: 10S and 10D (upgradient), 6S and 6D (on-site), and 8S and 8I (downgradient). The samples will be collected semi-annually for the first year and annually thereafter and analyzed for Target Compound List VOCs. NYSDEC approval of the monitoring program (monitoring locations, frequency and analytical parameters) would be required. The groundwater monitoring program may be modified after the Main Plant Site remedy is selected in order to establish a single monitoring program for the ORB and Main Plant Sites.

Overall Protection of Human Health and the Environment - This alternative would not eliminate the potential for direct contact with surface soils, sediment and surface water. The potential for contaminants to leach from sediments to groundwater and/or surface water would remain. The baseline risk assessment indicates that exposure to contaminants at the ORB would not pose unacceptable risks to human health.

The ORB is fenced and the possibility of inadvertent direct contact with the sediments is extremely remote because the sediment is beneath approximately 30 feet of water and is stable. The Fish and Wildlife Impact Analysis determined there are no significant ecological resources in or surrounding the ORB that could be impacted by contaminants in the surface soil, sediment, or surface water. The RI determined that the basin sediment is not a continuing source of groundwater contamination. Site-specific information indicates that the ORB does not impact human health or ecological resources and groundwater (i.e., the environment).

Compliance with ARARs - This alternative would not comply with the NYSDEC soil cleanup objectives and sediment criteria. Although some of the contaminant concentrations at the ORB do not meet the levels established by NYSDEC, the site-specific information including the RI, baseline risk assessment, and Fish and Wildlife Impact Analysis results indicate that there are no impacts posed by or associated with the surface soil and sediment at the ORB.

Long-Term Effectiveness and Permanence - Access to the ORB is restricted by the existing fence, and the possibility of inadvertent direct contact with the sediments is extremely remote. These conditions would be maintained over the long-term. A long-term groundwater monitoring program would effectively track contaminant migration in groundwater.

Reduction of Toxicity, Mobility or Volume Through Treatment - This alternative would not reduce the toxicity, mobility, or volume of contaminants in ORB surface water, surface soil, and sediment through treatment.

Short-Term Effectiveness - This alternative would not achieve the RAOs for the site. However, the potential for inadvertent contact is extremely remote and site-specific studies indicate that there are no human health or environmental impacts posed by the ORB, as previously discussed. Worker exposure to contaminants during monitoring activities would be controlled through a site-specific health and safety plan developed prior to implementation. The no action alternative can be implemented immediately upon NYSDEC approval of a long-term groundwater monitoring program.

Implementability - The no action alternative is readily implementable.

Cost - Groundwater monitoring would be the only costs associated with this alternative. There would be no capital costs. The estimated annual O&M costs are $24,700 for the first year and $14,300 thereafter. The estimated total present worth of this alternative is approximately $187,000. The estimated costs are summarized in Table 7 in Appendix B.

4.2.2 Alternative 2: Limited Action/Site Use Restrictions (Institutional Controls)

This alternative would leave the surface soil and sediment at the ORB in place. Direct contact with the surface soil would be limited through administrative (institutional) controls and physical barriers. This alternative would include long-term monitoring of the surface water in the ORB to continue to ensure that the sediments are stable and do not have significant adverse impacts on the water in the Basin. It is assumed that two surface water samples (one from the North Pond and one from the South Pond) would be collected annually and analyzed for VOCs, SVOCs, PCBs, pesticides, and metals. This alternative also includes long-term groundwater monitoring. For the purpose of the FS it is assumed that the following RI monitoring wells will be used for long-term groundwater monitoring: 10S and 10D (upgradient), 6S and 6D (on-site), and 8S and 8I (downgradient). The samples will be collected semi-annually for the first year and annually thereafter and analyzed for Target Compound List VOCs. NYSDEC approval of the monitoring program (monitoring locations, frequency and analytical parameters) would be required. The groundwater monitoring program may be modified after the Main Plant Site remedy is selected in order to establish a single monitoring program for the ORB and Main Plant Sites.

Leaving the surface soil and sediment in place would require administrative (institutional) controls to limit the use of the site. A deed restriction prohibiting substantial modifications to the site without NYSDEC approval would be placed on future development of the ORB site. A deed restriction would include a scaled site map indicating the impacted area boundaries, the concentrations of contaminants present in the soil and sediment, and a statement indicating that the current operations would continue and NYSDEC would be notified of any planned substantial modifications to the site. The ORB is fenced to restrict unauthorized access and minimize the potential for direct contact with surface soil and sediments. The boundary fence would be inspected regularly for damage and repairs would be made when necessary.

<u>Overall Protection of Human Health and the Environment</u> - This alternative would not eliminate the potential for direct contact with surface soils, sediment and surface water. The potential for contaminants to leach from sediments to groundwater and/or surface water would remain. The baseline risk assessment indicates that exposure to contaminants at the ORB would not pose unacceptable risks to human health. The limited action alternative would minimize the potential for inadvertent contact with contaminants. Long-term surface water monitoring would ensure that the basin sediments remain stable and do not impact surface water in the ORB or groundwater. Long-term groundwater monitoring would effectively track the distribution and concentrations of VOCs in groundwater in the area of the ORB.

Site use restrictions and the perimeter fencing would effectively restrict unauthorized access to the ORB and reduce the potential for human health impacts.

The RI determined that the basin sediment is not a continuing source of groundwater contamination. Site-specific information indicates that the ORB does not impact human health or the environment.

Compliance with ARARs - This alternative would not comply with the NYSDEC soil cleanup objectives and sediment criteria. Although some of the contaminant concentrations at the ORB do not meet the levels established by NYSDEC, the site-specific information including the RI, baseline risk assessment, and Fish and Wildlife Impact Analysis results indicate that there are no impacts posed by or associated with the surface soil and sediment at the ORB.

Long-Term Effectiveness and Permanence - Access to the ORB is restricted by the existing fence, and the possibility of inadvertent direct contact with the sediments is extremely remote. These conditions would be maintained over the long-term. Long-term surface water and groundwater monitoring would track the effectiveness and permanence of the alternative. The fence would be inspected over the long-term and repaired as necessary, to ensure effectiveness and permanence. Deed restrictions would be established for the ORB to restrict development of the site and prevent exposure to contaminants under future use conditions.

Reduction of Toxicity, Mobility or Volume Through Treatment - This alternative would not reduce the toxicity, mobility, or volume of contaminants in ORB surface water, surface soil, and sediment through treatment.

Short-Term Effectiveness - This alternative would not achieve the RAOs for the site. However, the potential for inadvertent contact is extremely remote and site-specific studies indicate that there are no human health or environmental impacts posed by the ORB, as previously discussed. Worker exposure to contaminants during monitoring activities would be controlled through a site-specific health and safety plan developed prior to implementation. This alternative could be implemented in approximately six months pending NYSDEC approval and establishment of deed restrictions.

Implementability - This alternative is readily implementable. Deed restrictions would be instituted and fencing would be maintained and modified, if necessary, with minimal difficulty.

Cost - The estimated costs associated with this alternative are summarized in Tables 1 and 8 in Appendix B. The estimated capital cost is $65,000 and the annual O&M cost is approximately $40,300 for the first year and $29,900 thereafter. The present worth of the annual O&M cost is $381,000, based on a 30 year remedial timeframe in accordance with USEPA RI/FS guidance. The estimated total present worth cost of this alternative is approximately $446,000.

4.2.3 Alternative 3: Cover Bottom Sediment with Clean Fill

This alternative would install a layer of clean fill over bottom sediments at the ORB site. This alternative does not apply to the ORB surface soil. The "cap" would prevent the erosive transport of sediments, prevent direct contact with the sediments, and may minimize the potential for contaminant leaching from the sediment to groundwater and/or surface water.

The cap would consist of an inert material such as silt, clay or sand, and/or active materials such as limestone or gypsum which would form a seal at the bottom of the Basin. Cap construction materials would be obtained from an off-site location and hauled to the ORB site. The types, quantities and procurement of materials required to construct the cap would be determined during the design phase.

The fill material would be placed at the bottom of the ORB using a submerged diffuser system. This system is an effective method for controlling the placement of fill material while decreasing the scouring of the bottom sediments. Fill material would be pumped through a pipeline system to the submerged diffuser head. The diffuser head is designed to reduce the velocity and turbulence associated with the discharge of cover materials; however some sediment would be disturbed and resuspended. The impact velocity and thickness of the cover can be controlled by varying the height of the discharge above the bottom, using a crane or similar equipment, as well as the discharge velocity. The fill layer would be approximately three feet thick.

This alternative would include long-term monitoring of the surface water in the ORB to continue to ensure that the sediments are stable and do not have significant adverse impacts on the water in the Basin. It is assumed that two surface water samples (one from the North Pond and one from the South Pond) would be collected annually and analyzed for VOCs, SVOCs, PCBs, pesticides, and metals. This alternative also includes long-term groundwater monitoring. For the purpose of the FS it is assumed that the following RI monitoring wells will be used for long-term groundwater monitoring: 10S and 10D (upgradient), 6S and 6D (on-site), and 8S and 8I (downgradient). The samples will be collected semi-annually for the first year and annually thereafter and analyzed for Target Compound List VOCs. NYSDEC approval of the monitoring program (monitoring locations, frequency and analytical parameters) would be required. The groundwater monitoring program may be modified after the Main Plant Site remedy is selected in order to establish a single monitoring program for the ORB and Main Plant Sites.

<u>Overall Protection of Human Health and the Environment</u> - A cap would eliminate the potential for direct contact with sediments to protect human health, however, the possibility of inadvertent contact before capping is extremely remote because the ORB is fenced and the sediments are approximately 30 feet below the water. The baseline risk assessment indicates that exposure to contaminants at the ORB would not pose unacceptable risks to human health.

The cap would prevent erosive transport of the contaminated sediment to the surface water and may minimize the potential for contaminant leaching from the sediment to groundwater and/or surface water. The RI indicates the ORB sediment is not a continuing source of groundwater contamination. Site-specific information indicates that the ORB does not impact human health or the environment.

Compliance with ARARs - This alternative would not comply with the NYSDEC sediment criteria because the contaminants would remain in the sediment at the bottom of the Basin beneath the clean fill. The surface soil would not be removed under this alternative so the NYSDEC soil cleanup objectives would not be met. Although some of the contaminant concentrations at the ORB do not meet the levels established by NYSDEC, the site-specific information including the RI, baseline risk assessment, and Fish and Wildlife Impact Analysis results indicate that there are no impacts posed by or associated with the surface soil and sediment at the ORB.

Long-Term Effectiveness and Permanence - The long-term effectiveness of this alternative is uncertain. This alternative would disturb the sediments at the bottom of the ORB, which are in a stable condition and do not impact human health or the environment. Disturbing the sediment may result in significant adverse impacts because there is a greater potential for exposure to contaminants in suspended sediment. New sediments would continue to collect on the cap surface as a result of surface water runoff that enters the Basin. The integrity of the cap would degrade over time, although erosion would be limited due to the lack of bottom currents and the low flow velocity of rainwater runoff into the ponds. Surface water samples would be collected annually to monitor contaminant concentrations in the basin and the stability of the sediments. Long-term groundwater monitoring would effectively track the distribution and concentrations of VOCs in groundwater in the area of the ORB. Long-term surface water and groundwater monitoring would indicate the effectiveness and permanence of the cap.

Reduction of Toxicity, Mobility or Volume Through Treatment - This alternative would not reduce the toxicity, mobility, or volume of contaminants in ORB sediment or surface water through treatment.

Short-Term Effectiveness - This alternative would eliminate the potential for direct contact with the sediment but would not achieve the RAOs because the NYSDEC sediment criteria would not be met. This alternative would disturb the sediments at the bottom of the ORB, which are in a stable condition and do not impact human health or the environment. Disturbing the sediment may result in significant adverse impact because there is a greater potential for exposure to contaminants in suspended sediment. The potential for inadvertent contact (even without a cap) with contaminated sediment is extremely remote and site-specific studies indicate that there are no human health or environmental impacts posed by the ORB, as previously discussed.

Worker exposure to contaminants during cap installation and surface water and groundwater monitoring activities would be controlled through a site-specific health and safety plan. This alternative could be implemented in approximately 12 to 18 months.

Implementability - A sediment cap could be constructed at the ORB site by local contractors using a submerged diffuser system. It is expected that the clean fill material could be obtained from a local source provided that the material specifications determined during the remedial design phase are met.

Installing a uniform cap over the bottom sediment would be difficult due to the steep slopes, shallow depth, and irregular bottom profile of the ORB. Visual inspection of the sediment cap during installation or over the long-term would not be possible due to standing water in the Basin.

Cost - The estimated costs associated with this alternative are summarized in Tables 2 and 8 of Appendix B. The estimated capital cost is $2,958,000 to $3,698,000 and the annual O&M cost is approximately $40,300 for the first year and $29,900 thereafter. The present worth of the annual O&M cost is $381,000 based on a 30 year remedial timeframe in accordance with USEPA RI/FS guidance. The estimated total present worth cost of this alternative is approximately $3,339,000 to $4,079,000.

For purposes of alternative screening, the estimated costs are presented as ranges to reflect variations in fill materials, where sand purchased from a local quarry would have the lowest unit capital cost and clay purchased from an upstate or out of state source would have the highest capital cost.

4.2.4 Alternative 4: Remove Contaminated Surface Soil and Dispose of in an Off-Site Landfill

This alternative would consist of removing surface soil for disposal in an off-site non-hazardous landfill. The off-site landfill would be properly licensed and would operate in compliance with its permit and applicable regulations. The off-site facility would be selected during the remedial design phase based on NYSDEC requirements and the ability and willingness of the facility to accept the material.

Surface soil containing contaminants at concentrations above the NYSDEC soil cleanup objectives is found in a small area west of the South Pond. The area measures approximately 30 feet by 30 feet, with a maximum depth of about one foot (approximately 35 cubic yards). The soil would be removed using conventional excavating equipment such as a small backhoe and would be characterized prior to off-site transportation and disposal.

This scenario differs from the Alternative 4 evaluated in Section 3.2.4 in that contaminated sediments would remain in the ORB. Therefore, this alternative would include long-term monitoring since only surface soil would be removed. It is assumed that two surface water samples (one from the North Pond and one from the South Pond) would be collected annually and analyzed for VOCs, SVOCs, PCBs, pesticides, and metals. For the purpose of the FS it is assumed that the following RI monitoring wells will be used for long-term groundwater monitoring: 10S and 10D (upgradient), 6S and 6D (on-site), and 8S and 8I (downgradient). The samples will be collected semi-annually for the first year and annually thereafter and analyzed for Target Compound List VOCs. NYSDEC approval of the monitoring program (monitoring locations, frequency and analytical parameters) would be required. The groundwater monitoring program may be modified after the Main Plant Site remedy is selected in order to establish a single monitoring program for the ORB and Main Plant Sites.

Overall Protection of Human Health and the Environment - This alternative would eliminate the potential for direct contact with surface soil. Removal of the basin sediment was screened out as discussed in Section 3.3. The potential for contaminant migration from surface soil to ORB surface water or sediments and groundwater would be eliminated by surface soil removal and off-site disposal.

The baseline risk assessment indicates that exposure to contaminants at the ORB would not pose unacceptable risks to human health. Site-specific information indicates that the ORB does not impact human health or the environment.

Compliance with ARARs - This alternative would comply with ARARs by removing surface soil that contains contaminants at concentrations above the NYSDEC soil cleanup objectives. The sediment at the bottom of the Basin would not be removed, so the NYSDEC sediment criteria would not be met. Although some of the contaminant concentrations at the ORB do not meet the levels established by NYSDEC, the site-specific information including the RI, baseline risk assessment, and Fish and Wildlife Impact Analysis results indicate that there are no impacts posed by or associated with the surface soil and sediment at the ORB.

Long-Term Effectiveness and Permanence - Removal of contaminated surface soils surrounding the ORB would eliminate risk associated with these areas and would achieve generic RAOs. Off-site disposal of the ORB surface soil would eliminate on-site contact with this material and the potential for contaminant migration from the soil to surface water and/or groundwater. Long-term surface water and groundwater monitoring would track the effectiveness and permanence of the cap. Long-term groundwater monitoring would effectively track the distribution and concentrations of VOCs in groundwater in the area of the ORB. The off-site landfill would be inspected, maintained, and monitored by the owner/operator in compliance with its permit to ensure long-term integrity and environmental protection.

Reduction of Toxicity, Mobility, or Volume Through Treatment - Removal and off-site disposal of the contaminated surface soil would eliminate the toxicity, mobility and volume of contaminants at the site. This alternative assumes that the surface soil would not be treated prior to disposal.

Short-Term Effectiveness - This alternative would eliminate the potential for direct contact with contaminants in surface soil and contaminant migration to surface water and groundwater. The NYSDEC soil cleanup objectives would be met on-site.

Worker exposure to contaminants during soil removal and monitoring would be controlled through a site-specific health and safety plan. This alternative could be implemented in approximately six months.

Implementability - Appropriate off-site land disposal facilities would be selected during remedial design based on the type and volume of materials to be disposed of, NYSDEC requirements, and the willingness of the facilities to accept wastes from a CERCLA site for disposal. Local contractors would be retained to excavate the soil. The excavated materials would be transported from the ORB site to the off-site landfill by a licensed waste hauler in accordance with applicable regulations.

Cost - The estimated costs associated with this alternative (surface soil only) are summarized in Tables 3 and 9 of Appendix B. The estimated capital cost is \$7,000 and the annual O&M cost is \$33,800 for the first year and \$23,400 thereafter. The present worth of the annual O&M cost is \$300,000, based on a 30 year remedial timeframe in accordance with USEPA RI/FS guidance. The estimated total present worth cost of this alternative is approximately \$307,000.

5.0 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

This section compares the various remedial alternatives in accord with the NCP criteria. Alternatives 1, 2, 3 (sediment only) and 4 (surface soil only) were carried through the detailed analysis in Section 4.0, and are discussed in this comparative analysis. The first two NCP criteria, overall protection of human health and the environment and compliance with ARARs, are eligibility threshold requirements. The alternatives evaluated in this FS protect human health and the environment, and are eligible for selection. The five primary balancing criteria are long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; and cost. The remedial alternative selected for the ORB site should provide the best balance of trade-offs among the alternatives in terms of these five balancing criteria. The final two criteria, state acceptance and community acceptance, will be evaluated following comment on the RI/FS report. The recommended remedial alternative for the ORB site is described in Section 5.2.

5.1 Comparative Analysis

Overall Protection of Human Health and the Environment

All of the alternatives evaluated in the FS would protect human health and the environment. The surface soil and sediment at the ORB are not listed or characteristic hazardous wastes as defined by NYSDEC and USEPA. The ORB is fenced and the possibility of inadvertent direct contact with the sediments (beneath approximately 30 feet of water) is extremely remote. The baseline risk assessment indicates that exposure to contaminants at the ORB would not pose unacceptable risks to human health. The Fish and Wildlife Impact Analysis determined that there are no significant ecological resources in or surrounding the ORB that could be impacted by contaminants in the surface soil, sediment or surface water. The RI determined that the ORB is not a continuing source of groundwater contamination. The Main Plant FS will address groundwater remedial alternatives. Site-specific information indicates that the ORB does not impact human health or the environment.

The sediment would remain in place in the Basin under all of the remedial alternatives carried through the detailed analysis. Alternative 3 would install a layer of clean fill above the sediment to eliminate the potential for direct contact and possibly to minimize the potential for contaminant leaching from the sediment. The surface soil containing contaminants at concentrations above the NYSDEC soil cleanup objectives would be removed and disposed of at an off-site facility under Alternative 4 to eliminate the potential for direct contact and contaminant migration from the soil. Alternative 2 includes deed restrictions to restrict future development of the site and to prevent exposure to contaminants under future use conditions. Alternatives 2, 3 and 4 (surface soil only, as discussed in Section 4.2.4) would include long-term surface water and groundwater monitoring to ensure that contaminants remain stable and do not impact surface water or groundwater in the future.

Compliance with ARARs

Some of the contaminant concentrations in the ORB sediment and surface soil do not meet the NYSDEC soil cleanup objectives and sediment criteria. Alternative 4 would remove the surface soil containing contaminants at concentrations above the NYSDEC objectives for disposal at an off-site facility. Alternatives 1, 2, and 3 would leave the sediment and surface soil in place at the ORB, so the NYSDEC criteria/objectives would not be met. Site-specific information including the RI, baseline risk assessment, and Fish and Wildlife Impact Analysis results indicate that there are no impacts posed by or associated with the surface soil and sediment at the ORB. Contaminant concentrations in the ORB surface soil, sediment and surface water would be reduced by natural attenuation processes (biodegradation, etc.) under Alternatives 1, 2, 3, and 4.

Long-Term Effectiveness and Permanence

Access to the ORB is restricted by the existing fence, and the possibility of inadvertent direct contact with the sediments (beneath approximately 30 feet of water) is extremely remote. Long-term groundwater monitoring would be conducted under all of the alternatives pursuant to the Main Plant FS/Record of Decision. Alternatives 2, 3 and 4 (surface soil only) would include surface water and groundwater monitoring to verify that contaminants in the sediment remain stable and do not impact surface water or groundwater in the future. Alternatives 2 and 3 would also include long-term fence inspection and repairs as necessary to ensure effectiveness and permanence. Deed restrictions would be established under Alternative 2 to restrict development of the ORB and prevent exposure to contaminants under future use conditions. The long-term effectiveness and permanence of a sediment cap (Alternative 3) is uncertain. Disturbing the stable sediment while installing a clean fill cap may cause adverse impacts because there is a greater potential for exposure to contaminants in suspended sediment. Removal and off-site disposal of surface soil (Alternative 4) would permanently eliminate on-site contact and the potential for contaminant migration from the soil.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 1, 2, 3 and 4 would not include treatment and would not reduce the toxicity, mobility, or volume of contaminants through treatment. Alternative 4 would remove contaminated surface soil from the site to eliminate the toxicity, mobility, and volume of contaminants on site.

Short-Term Effectiveness

Worker exposure to contaminants during implementation of all alternatives would be controlled through a site-specific health and safety plan. The potential for inadvertent contact with contaminated surface soil, sediment and surface water is extremely remote under existing conditions and site-specific studies indicate that there are no human health or environmental impacts posed by the ORB. Alternatives 1, 2 and 3 would not achieve the generic RAO to meet the NYSDEC soil cleanup objectives and sediment criteria. Installation of a cap (Alternative 3) would disturb the bottom sediment, which is currently stable, and the suspended sediments would increase the potential for exposure to contaminants. Surface soil that contains contaminant concentrations above the NYSDEC soil cleanup objectives could be removed and hauled to an off-site disposal facility (Alternative 4) within a short period of time.

Implementability

Alternatives 1, 2 and 4 would be readily implementable. Deed restrictions (Alternative 2) would be instituted in consultation with NYSDEC. Fencing would be maintained and repaired as necessary, and surface water monitoring would be conducted (in addition to groundwater monitoring pursuant to the Main Plant FS/Record of Decision) with minimal difficulty under Alternatives 2, 3, and 4. An appropriate off-site land disposal facility for the small volume of surface soil (Alternative 4) would be selected during remedial design. Local contractors would be retained to excavate the soil. Installing a uniform cap over the bottom sediment (Alternative 3) would be problematic due to the steep slopes, shallow depth, and irregular bottom profile of the ORB, and visual inspection of the cap would not be possible.

Cost

The estimated costs for the alternatives are summarized below.

Alternative 1

•	Capital	$ 0
•	Annual O&M	$ 24,700 (year 1)
		$ 14,300 (years 2+)
•	Total Present Worth	$187,000

Alternative 2

•	Capital	$ 65,000
•	Annual O&M	$ 40,300 (year 1)
		$ 29,900 (years 2+)
•	Total Present Worth	$446,000

Alternative 3

•	Capital	$2,958,000 to $3,698,000
•	Annual O&M	$40,300 (year 1)
		$29,900 (years 2+)
•	Total Present Worth	$3,339,000 to $4,079,000

Alternative 4 (Surface Soil Only)

•	Capital	$ 7,000
•	Annual O&M	$ 33,800 (year 1)
		$ 23,400 (years 2+)
•	Total Present Worth	$307,000

5.2 Recommended Remedial Alternative

Alternative 2 (Limited Action/Site Use Restrictions) is the recommended remedial alternative for the ORB site based on the alternative screening, detailed analysis, and comparative analysis presented in this FS. This alternative would maintain the fence around the site (with regular inspections and repairs as necessary) to restrict unauthorized access and reduce the potential for inadvertent contact with contaminants. Deed restrictions would also be instituted to limit future site development to appropriate uses (i.e. - non-residential) to prevent future exposure to contaminants. Alternative 2 would be protective of human health and the environment given the site-specific studies that indicate that there are no risks associated with existing site conditions. This alternative would also be cost-effective because funds would be used for long-term surface water and groundwater monitoring and fence maintenance to ensure that there are no significant future impacts. Remediation of materials that do not pose a significant threat to human health or the environment would not be appropriate.

Alternatives (3 and 4) that would remove contaminated surface soil or cap bottom sediment are not recommended because they would have no offsetting human health or environmental benefit considering existing site conditions. Although the small volume of ORB surface soil that contains contaminants at concentrations above the generic NYSDEC soil cleanup objectives could be easily removed at a relatively low cost, a removal action cannot be justified because site-specific studies indicate that there are no impacts posed by or associated with the surface soil.

FAIRCHILD INDUSTRIES, INC.
OLD RECHARGE BASIN
EAST FARMINGDALE, NEW YORK

TABLE 1

SUMMARY OF ANALYTICAL RESULTS FOR ORB SEDIMENT, SURFACE WATER AND SOIL SAMPLES

Parameters	Sediment				Surface Water				Soil			
	No. of Samples	No. of Detects	Avg. Conc. (μg/kg)	Max. Conc. (μg/kg)	No. of Samples	No. of Detects	Avg. Conc. (ug/l)	Max. Conc. (ug/l)	No. of Samples	No. of Detects	Avg. Conc. (mg/kg)	Max. Conc. (mg/kg)
VOCs												
Methylene Chloride	35	2	28	43	27	14	0.25	0.6	5	4	5.8	7
Acetone	35	10	886	4600	45	1	30	30	5	5	8.6	13
1,2-Dichloroethane (total)	35	4	1588	5000	59	16	31	54	5	0	--	--
Chloroform	35	0	--	--	59	5	1.04	2	5	0	--	--
Toluene	35	5	343	860	59	10	0.6	3	5	0	--	--
Chlorobenzene	35	2	170	180	27	2	0.14	0.17	5	0	--	--
Ethylbenzene	35	1	12	12	59	4	0.56	2	5	0	--	--
Xylene (total)	35	8	224	430	32	1	2	2	NA	NA	NA	NA
2-Butanone	35	8	395	1100	13	0	--	--	5	0	--	--
Vinyl Chloride	35	2	655	1100	27	2	0.1	0.1	5	0	--	--
Tetrachloroethene	35	4	3	6	59	41	16.3	66	5	0	--	--

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Table 1 Continued . . .

Parameters	Sediment				Surface Water				Soil			
	No. of Samples	No. of Detects	Avg. Conc. (μg/kg)	Max. Conc. (μg/kg)	No. of Samples	No. of Detects	Avg. Conc. (ug/l)	Max. Conc. (ug/l)	No. of Samples	No. of Detects	Avg. Conc. (mg/kg)	Max. Conc. (mg/kg)
Benzene	NA	NA	NA	NA	59	10	0.31	2	5	0	--	--
Trichloroethene	35	3	921	1800	59	39	5.7	22	5	1	2	2
1,1,1-Trichloroethane	35	3	8	13	27	20	1.2	2.9	5	0	--	--
Carbondisulfide	NA	NA	NA	NA	45	0	--	--	5	1	0.7	0.7
Dichlorodifluoromethane	NA	NA	NA	NA	14	8	0.05	0.17	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA	27	4	0.19	0.28	5	0	--	--
Bromomethane	NA	NA	NA	NA	27	3	0.16	0.2	5	0	--	--
Trichlorofluoromethane	NA	NA	NA	NA	14	2	0.24	0.4	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	27	10	0.32	1	5	0	--	--
1,1-Dichloroethane	NA	NA	NA	NA	27	10	0.24	0.4	5	0	--	--
1,2-Dichloropropane	NA	NA	NA	NA	14	2	0.07	0.07	5	0	--	--
cis-1,2-Dichloroethene	NA	NA	NA	NA	27	24	0.6	1.5	5	0	--	--
Carbon tetrachloride	NA	NA	NA	NA	27	5	0.28	0.38	5	0	--	--
Bromodichloromethane	NA	NA	NA	NA	27	1	5.06	5.06	5	0	--	--
trans-1,3-Dichloropropene	NA	NA	NA	NA	27	1	0.12	0.12	5	0	--	--
1,3-Dichloropropane	NA	NA	NA	NA	14	1	0.4	0.4	NA	NA	NA	NA

MW3547

Table 1 Continued . . .

Parameters	Sediment				Surface Water				Soil			
	No. of Samples	No. of Detects	Avg. Conc. (μg/kg)	Max. Conc. (μg/kg)	No. of Samples	No. of Detects	Avg. Conc. (ug/l)	Max. Conc. (ug/l)	No. of Samples	No. of Detects	Avg. Conc. (mg/kg)	Max. Conc. (mg/kg)
Dibromochloromethane	NA	NA	NA	NA	27	9	2.3	7.76	5	0	--	--
ortho-Xylene	NA	NA	NA	NA	27	1	0.12	0.12	5	0	--	--
Bromoform	NA	NA	NA	NA	27	3	0.3	0.63	5	0	--	--
2-Chlorotoluene	NA	NA	NA	NA	14	1	0.06	0.06	NA	NA	NA	NA
4-Chlorotoluene	NA	NA	NA	NA	14	0	--	--	NA	NA	NA	NA
1,3,5-Trimethylbenzene	NA	NA	NA	NA	14	4	0.07	0.08	NA	NA	NA	NA
1,2,4-Trimethylbenzene	NA	NA	NA	NA	14	1	0.06	0.06	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	14	2	0.21	0.21	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	14	1	0.20	0.20	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	14	2	0.34	0.36	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	NA	NA	NA	NA	14	8	1.9	3.75	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	14	3	0.97	1.0	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	14	3	0.73	1.1	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	14	2	0.85	0.9	NA	NA	NA	NA
1,2,3-Trichlorobenzene	NA	NA	NA	NA	14	2	1.9	2.2	NA	NA	NA	NA

Table 1 Continued . . .

Parameters	Sediment				Surface Water				Soil			
	No. of Samples	No. of Detects	Avg. Conc. (μg/kg)	Max. Conc. (μg/kg)	No. of Samples	No. of Detects	Avg. Conc. (ug/l)	Max. Conc. (ug/l)	No. of Samples	No. of Detects	Avg. Conc. (mg/kg)	Max. Conc. (mg/kg)
SVOCs												
N-Nitrosodiphenylamine	35	1	86	86	57	1	4	4	4	0	--	--
1,2-Dichlorobenzene	35	7	155	590	27	0	--	--	4	0	--	--
Diethylphthalate	35	1	22	22	57	29	0.74	4	4	2	13	17
Di-n-butylphalate	35	9	268	1800	57	23	0.73	9	4	4	83.5	129
Hexachlorobenzene	35	1	43	43	57	1	2	2	4	0	--	--
2-Chlorophenol	35	0	--	--	27	3	0.3	0.3	4	0	--	--
Benzo (g,h,i) perylene	35	1	210	210	27	0	--	--	4	2	423.5	549
Benzo (a) pyrene	35	21	1204	4600	57	1	3	3	4	2	1930	2315
Indeno (1,2,3-cd) pyrene	35	3	363	500	57	1	3	3	4	2	870.5	1073
4-methylphenol	35	1	43	43	44	1	7	7	NA	NA	NA	NA
Acenaphthene	35	6	341	750	27	0	--	--	4	3	282	502
bis (2-ethylhexyl) phthalate	35	1	15,000	15,000	57	27	1.1	4	4	4	465.8	989
Dibenzofuran	35	10	181	410	27	0	--	--	4	3	177	352
2,4-Dimethylphenol	35	5	8101	27,000	27	0	--	--	4	1	26	26
Benzoic acid	35	5	128	250	NA	NA	NA	NA	NA	NA	NA	NA

Table 1 Continued . . .

Parameters	Sediment				Surface Water				Soil			
	No. of Samples	No. of Detects	Avg. Conc. (µg/kg)	Max. Conc. (µg/kg)	No. of Samples	No. of Detects	Avg. Conc. (ug/l)	Max. Conc. (ug/l)	No. of Samples	No. of Detects	Avg. Conc. (mg/kg)	Max. Conc. (mg/kg)
Benzo (b) fluoranthene	35	23	2590	12,000	27	0	--	--	4	2	1957	2298
Benzo (k) fluoranthene	35	11	633	2400	57	1	3	3	4	2	1588	1946
1,2,4-trichlorobenzene	35	1	170	170	27	0	--	--	4	0	--	--
Naphthalene	35	10	185	510	27	2	0.5	0.9	4	3	136.7	343
Benzo (a) anthracene	35	8	2594	6200	27	0	--	--	4	3	3093.7	4666
Chrysene	35	20	1834	900	57	1	2	2	4	4	2264.8	4579
4-chloro-3-methylphenol	35	1	44	44	27	0	--	--	4	0	--	--
2-Methylnaphthalene	35	12	465	1900	27	0	--	--	4	3	63	121
Phenanthrene	35	11	4885	10,000	57	2	1.6	3	4	4	2758	5675
Anthracene	35	13	647	1700	57	1	2	2	4	3	706	1148
Di-n-octyl phthalate	35	2	153	280	57	11	12.9	59	4	1	8	8
Fluoranthene	35	13	954	2400	57	1	6	6	4	4	4955.5	9532
Pyrene	35	30	3602	14,000	57	3	1.7	5	4	4	3694	8201
Dimethyl phthalate	35	2	47	56	27	0	--	--	4	0	--	--
Acenaphthylene	35	11	175	560	27	0	--	--	4	3	59.3	56
Fluorene	35	6	443	880	27	0	--	--	4	3	335	593

Table 1 Continued . . .

Parameters	Sediment				Surface Water				Soil			
	No. of Samples	No. of Detects	Avg. Conc. (μg/kg)	Max. Conc. (μg/kg)	No. of Samples	No. of Detects	Avg. Conc. (ug/l)	Max. Conc. (ug/l)	No. of Samples	No. of Detects	Avg. Conc. (mg/kg)	Max. Conc. (mg/kg)
Butylbenzylphthalate	35	1	12	12	57	9	1.3	6	4	4	52	139
Carbazole	NA	NA	NA	NA	27	0	--	--	4	3	1039	1656
Pesticides												
Alpha Chlordane	35	3	1.7	4.3	27	0	--	--	5	0	--	--
Gamma Chlordane	35	3	2.1	5.4	27	0	--	--	5	0	--	--
Gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA	NA	5	2	30.8	60
Aldrin	NA	NA	NA	NA	NA	NA	NA	NA	5	1	97	97
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA	NA	5	4	745	1100
4,4'-DDD	NA	NA	NA	NA	NA	NA	NA	NA	5	1	210	210
Endosulfan	NA	NA	NA	NA	NA	NA	NA	NA	5	1	17	17
4,4'-DDT	NA	NA	NA	NA	NA	NA	NA	NA	5	3	270	300
Endrin Ketone	NA	NA	NA	NA	NA	NA	NA	NA	5	1	420	420
PCBs												
Arochlor 1248	35	16	25	88	27	0	--	--	9	0	--	--
Arochlor 1254	35	27	9.7	51	27	0	--	--	9	4	237.5	620

Table 1 Continued . . .

Parameters	Sediment				Surface Water				Soil			
	No. of Samples	No. of Detects	Avg. Conc. (μg/kg)	Max. Conc. (μg/kg)	No. of Samples	No. of Detects	Avg. Conc. (ug/l)	Max. Conc. (ug/l)	No. of Samples	No. of Detects	Avg. Conc. (mg/kg)	Max. Conc. (mg/kg)
Metals (total)												
Aluminum	35	35	13,890	35,900	57	41	119	238	4	4	10,965	36,502
Antimony	35	4	13.4	15.6	57	1	33.8	33.8	4	0	--	--
Arsenic	35	26	9.2	34.4	57	0	--	--	4	4	4.4	9
Barium	35	28	41.2	461	57	55	47.5	90.9	4	4	38.3	108
Berylium	35	19	2.0	6.4	57	0	--	--	4	2	4.93	9.4
Cadmium	35	30	51	267	57	0	--	--	4	3	2.9	7.3
Calcium	35	35	9929	103,000	57	57	23,805	27,998	4	4	1211.8	2305
Chromium	35	35	2706	11,400	57	27	5.8	12.5	4	4	294.2	907
Cobalt	35	28	16	108	57	2	7.15	11.1	4	3	6.2	14.8
Copper	35	30	304	1130	57	6	8.9	16.2	4	4	42.2	121
Iron	35	35	18,004	49,700	57	29	472	2955	4	4	11,818	34,850
Lead	35	34	186	864	57	6	1.7	3.8	4	4	102.4	289
Magnesium	35	35	2756	9940	57	57	4239	4686	4	4	1659	4813
Manganese	35	35	434	1730	57	47	375	2840	4	4	151.8	346
Mercury	35	21	1.5	6.4	57	2	0.4	0.53	4	1	0.28	0.28

Table 1 Continued . . .

Parameters	Sediment				Surface Water				Soil			
	No. of Samples	No. of Detects	Avg. Conc. (µg/kg)	Max. Conc. (µg/kg)	No. of Samples	No. of Detects	Avg. Conc. (ug/l)	Max. Conc. (ug/l)	No. of Samples	No. of Detects	Avg. Conc. (mg/kg)	Max. Conc. (mg/kg)
Nickel	35	27	28	90.2	57	0	--	--	4	4	12.3	24.7
Potassium	35	32	523	1430	57	0	4314	46,152	4	3	739	1926
Selenium	35	14	0.7	1.9	57	2	1.9	2.1	4	2	0.41	0.61
Silver	35	30	42.7	360	57	0	--	--	4	3	3.8	9.7
Sodium	35	8	614	1210	57	57	13,715	21,991	4	4	48	120
Thallium	35	0	--	--	57	1	2.1	2.1	4	2	0.23	0.26
Vanadium	35	33	36.2	142	57	0	--	--	4	4	21.3	49.8
Zinc	35	35	1229	7470	57	45	12.3	33.9	4	4	140	341
Cyanide	35	25	22	116	57	3	12	13.2	NA	NA	NA	NA

NOTES:

1. Table only presents data for parameters that were detected in ORB sediment, surface water or soil samples.
2. NA = Not Analyzed
3. Data were compiled from "Work Plan for the Remedial Investigation/Feasibility Study of the Old Recharge Basin Fairchild Republic Company" (Geraghty & Miller, Inc.) and "Old Recharge Basin Final Remedial Investigation Report" (EDER ASSOCIATES, December 1994).
4. Table 2 summarizes the NYSDEC sediment criteria, surface water standards, and soil cleanup objectives for those parameters whose maximum detected concentrations were above these levels.

FAIRCHILD INDUSTRIES, INC.
OLD RECHARGE BASIN
EAST FARMINGDALE, NEW YORK

TABLE 2

SUMMARY OF PRELIMINARY REMEDIATION GOALS BASED ON NYSDEC CRITERIA, OBJECTIVES, AND STANDARDS

	Sediment	Surface Water	Soil
Parameter	NYSDEC Sediment Criteria (μg/kg)	NYSDEC Standard (μg/l)	NYSDEC Cleanup Objective (mg/kg)
VOCs			
1,2-Dichloroethane (total)	0.7	0.8	0.3
Vinyl Chloride	0.07	0.3(G)	0.2
Tetrachloroethene	0.8	0.7(G)	1.4
Trichloroethene	2.0	3(G)	0.7
1,1-Dichloroethene	0.02	0.07(G)	0.4
Carbon Tetrachloride	0.6	0.04(G)	0.6
1,2-Dibromo-3-Chloropropane	--	0.2(G)	--
Hexachlorobutadiene	0.3	0.5	--
SVOCs			
Hexachlorobenzene	0.15	0.02(G)	0.41
Benzo (a) pyrene	1.3	0.002G	0.061 or MDL
bis (2-ethylhexyl) phthalate	199.5	0.6	50
Benzo (k) fluoranthene	--	0.002(G)	1.1
Benzo (a) anthracene	--	0.002(G)	0.22 or MDL
Chrysene	--	0.002(G)	0.4
Phenanthrene	120	50(G)	50
Fluoranthene	1,020	50(G)	50
Pyrene	--	50(G)	50
Carbazole	--	--	8.3
Pesticides			
Gamma-BHC (Lindane)	--	--	5.4
Aldrin	0.1	0.002(G)	0.041
4,4'-DDE	0.01	0.001	2.1

Table 2 Continued . . .

Parameter	Sediment NYSDEC Sediment Criteria (μg/kg)	Surface Water NYSDEC Standard (μg/l)	Soil NYSDEC Cleanup Objective (mg/kg)
4,4'-DDD	0.01	0.001	2.9
Endosulfan	0.03	0.009	0.9
4,4'-DDT	0.01	0.001	2.1
PCBs			
Arochlor 1248	0.0008	0.001	1 (surface) 10 (subsurface)
Arochlor 1254	0.0008	0.001	1 (surface) 10 (subsurface)
Metals			
Antimony	--	3(G)	--
Berylium	--	3(G)	0.16
Iron	2%-4%	300	--
Lead	31,000-110,000	50	200-500
Manganese	460,000-110,000	300	--

NOTES:

(G) Guidance Values

1. Table only includes parameters where maximum detected concentrations were above the NYSDEC criteria, objective, or standard.
2. NYSDEC sediment criteria (November 1993) are the most stringent of the criteria based on human health bioaccumulation, benthic aquatic life acute or chronic toxicity, or wildlife accumulation. A sediment organic carbon content of 1% was assumed where the criteria were based on organic carbon content.
3. NYSDEC surface water standards are the most stringent of the standards for the various classes of surface water, NYSDEC DoW TOGS 1.1.1, October 22, 1993.
4. NYSDEC soil cleanup objectives TAGM, January 24, 1994.

FAIRCHILD INDUSTRIES, INC.
OLD RECHARGE BASIN
EAST FARMINGDALE, NEW YORK

TABLE 3

UNIVERSE OF TECHNOLOGY TYPES AND PROCESS OPTIONS

Environmental Media	General Response Actions	Remedial Technologies	Process Options
Contaminated Surface Soil and Basin Sediment	No Action	No Action	Not Applicable
	Long-Term Monitoring	Long-Term Monitoring	Groundwater Monitoring Surface Water Monitoring
	Institutional Actions	Access Restrictions (Institutional Controls)	Fencing Deed Restrictions
	Containment	Capping	Single-Layer Cap Multi-Layer Cap
	Removal	Excavation	Soil Excavation
		Dredging	Mechanical Dredging Hydraulic Dredging Pneumatic Dredging
		Dewatering	Pumping Sediment Dewatering
		Solidification/Stabilization	Solidification Saturated Zone Stabilization

Table 3 Continued . . .

Environmental Media	General Response Actions	Remedial Technologies	Process Options
Contaminated Surface Soils and Basin Sediment	Treatment	Thermal Treatment	Low Temperature Thermal Desorption Incineration In-Situ Vitrification
		Biological Treatment	In-Situ Bioreclamation/Biodegradation
		Physical Treatment	Soil Washing/Solvent Extraction In-Situ Soil Vapor Extraction
	Disposal	Landfill Disposal	On-Site Landfill Off-Site Landfill

FAIRCHILD INDUSTRIES, INC.
OLD RECHARGE BASIN
EAST FARMINGDALE, NEW YORK

TABLE 4

TECHNICAL IMPLEMENTABILITY SCREENING OF PROCESS OPTIONS

General Response Actions	Remedial Technologies	Process Options	Description	Screening Comments
No Action	No Action	Not Applicable	No further action	Required for Consideration by NCP.
Long-Term Monitoring	Long-Term Monitoring	Groundwater Monitoring	Collect groundwater samples from monitoring wells for contaminant analyses.	PA
		Surface Water Monitoring	Collect surface water samples for contaminant analyses.	PA
Institutional Actions	Access Restrictions (Institutional Controls)	Fencing	Fence around areas of contamination to restrict access.	PA
		Deed Restrictions	Property deeds would restrict development at the site.	PA
Containment	Capping	Single-Layer Cap	A single-layer cap constructed over contaminated areas.	PA
		Multi-Layer Cap	A multi-layer cap constructed over contaminated areas.	PA
Removal	Excavation	Soil Excavation	Removal of waste materials using conventional equipment.	PA
	Dredging	Mechanical Dredging	Sediment removal using equipment such as draglines and clamshells.	PA
		Hydraulic Dredging	Sediment removal using suction.	PA
		Pneumatic Dredging	Sediment removal using pneumatic pressure.	PA
	Dewatering	Pumping	Standing water removed using pumps and piping.	Not applicable - ORB is hydraulically connected to groundwater and cannot be dewatered.
		Sediment Dewatering	Increase solids content of sediment using mechanical methods.	PA
Treatment	Solidification/Stabilization	Solidification	Solidify wastes in the saturated zone by injecting and mixing with additives to remove free liquids.	PA
		Saturated Zone Stabilization	Stabilize wastes in the saturated zone by injecting and mixing with binders to immobilize contaminants	PA
	Thermal Treatment	Low Temperature Thermal Desorption	Remove organics from solids by heating.	PA
		Incineration	Destroy organics by incineration.	PA
		In-Situ Vitrification	Extreme temperatures pyrolyze organics, inorganics are immobilized in the solid product.	PA
	Biological Treatment	In-Situ Bioreclamation/ Biodegradation	Microorganisms metabolize contaminants and detoxify them.	PA
	Physical Treatment	Soil Washing/Solvent Extraction	Soil is flushed with water or chemicals to solubilize contaminants for recovery/removal.	PA
		In-Situ Soil Vapor Extraction	Vacuum applied to volatilize and recover VOCs from soils.	PA
Disposal	Landfill Disposal	On-Site Landfill	Waste disposed of in a landfill constructed on-site.	PA
		Off-Site Landfill	Waste transported to an off-site landfill for disposal.	PA

NOTE:
PA - Potentially Applicable.

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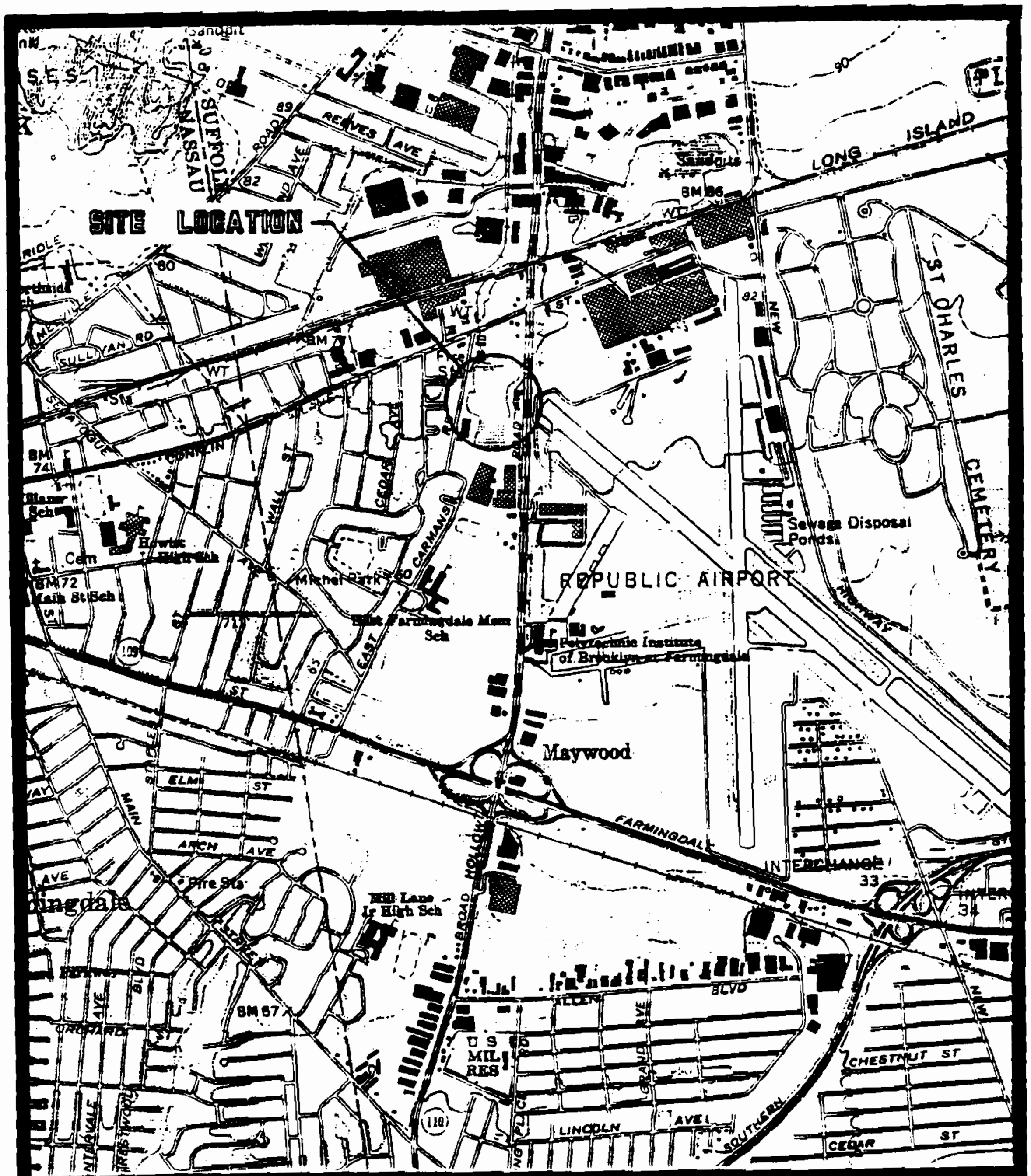
FIGURE 1

FAIRCHILD INDUSTRIES INC.

EAST FARMINGDALE, NEW YORK

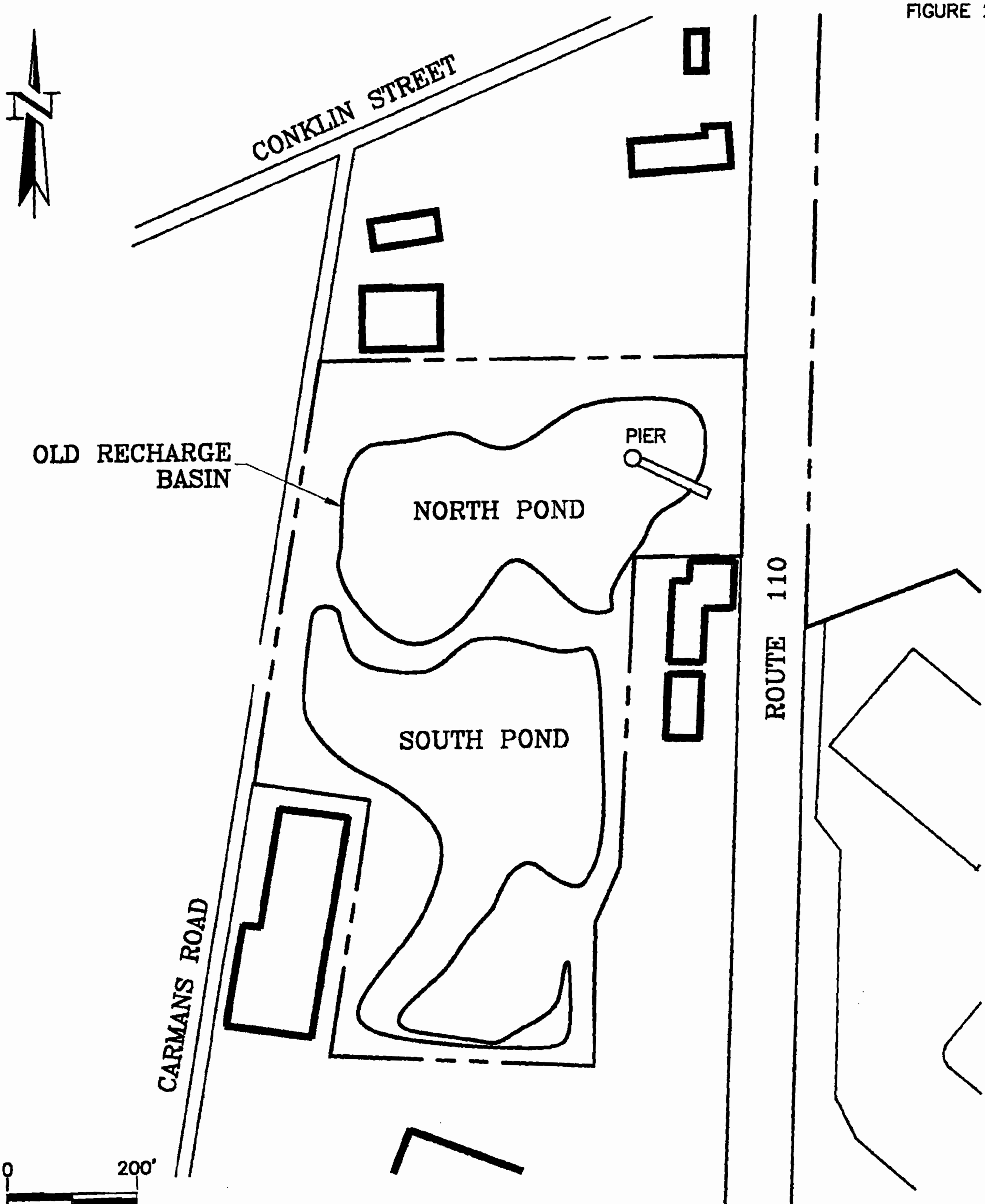


SCALE 1"=2000'

U.S.G.S. 7.5 MINUTE QUADRANGLE
AMITYVILLE, NEW YORK

LOCATION MAP

eder associates
FIGURE 2

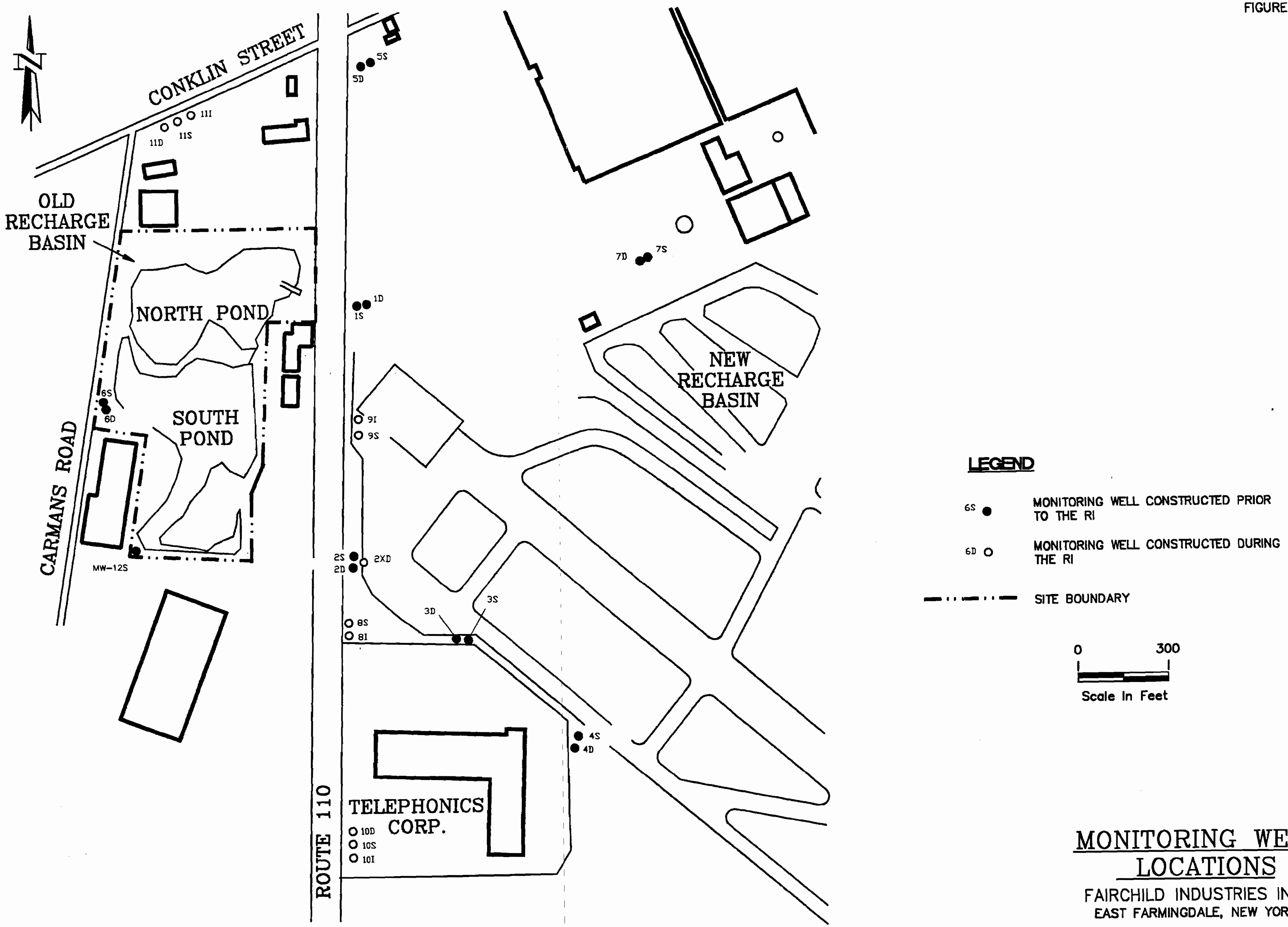


SITE MAP
OLD RECHARGE BASIN
FAIRCHILD INDUSTRIES INC.
EAST FARMINGDALE, NEW YORK

SK961-4E
120394

eder associates

FIGURE 3

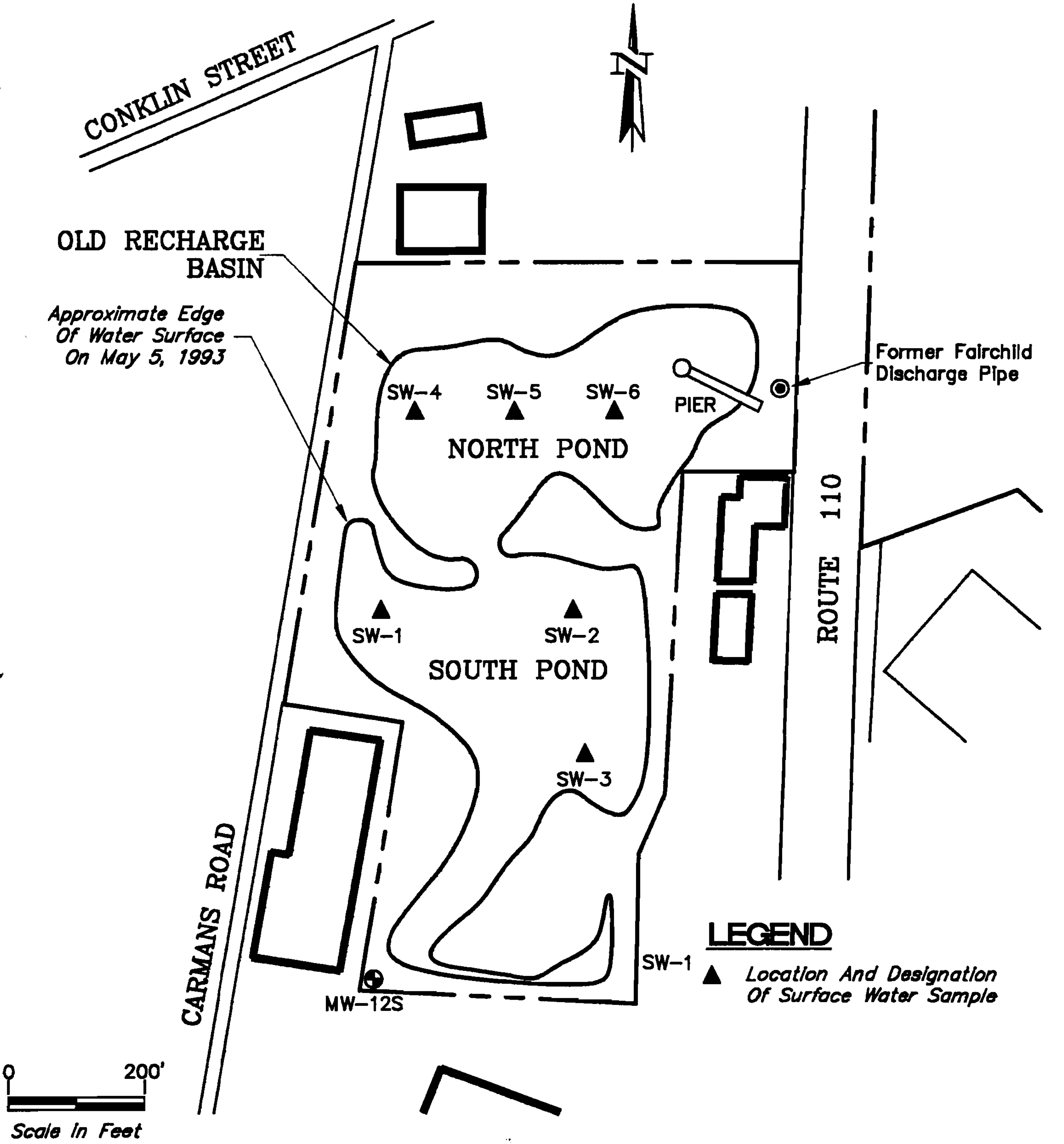


MONITORING WELL LOCATIONS

FAIRCHILD INDUSTRIES INC.
EAST FARMINGDALE, NEW YORK

SK961-48
120594

eder associates
FIGURE 4

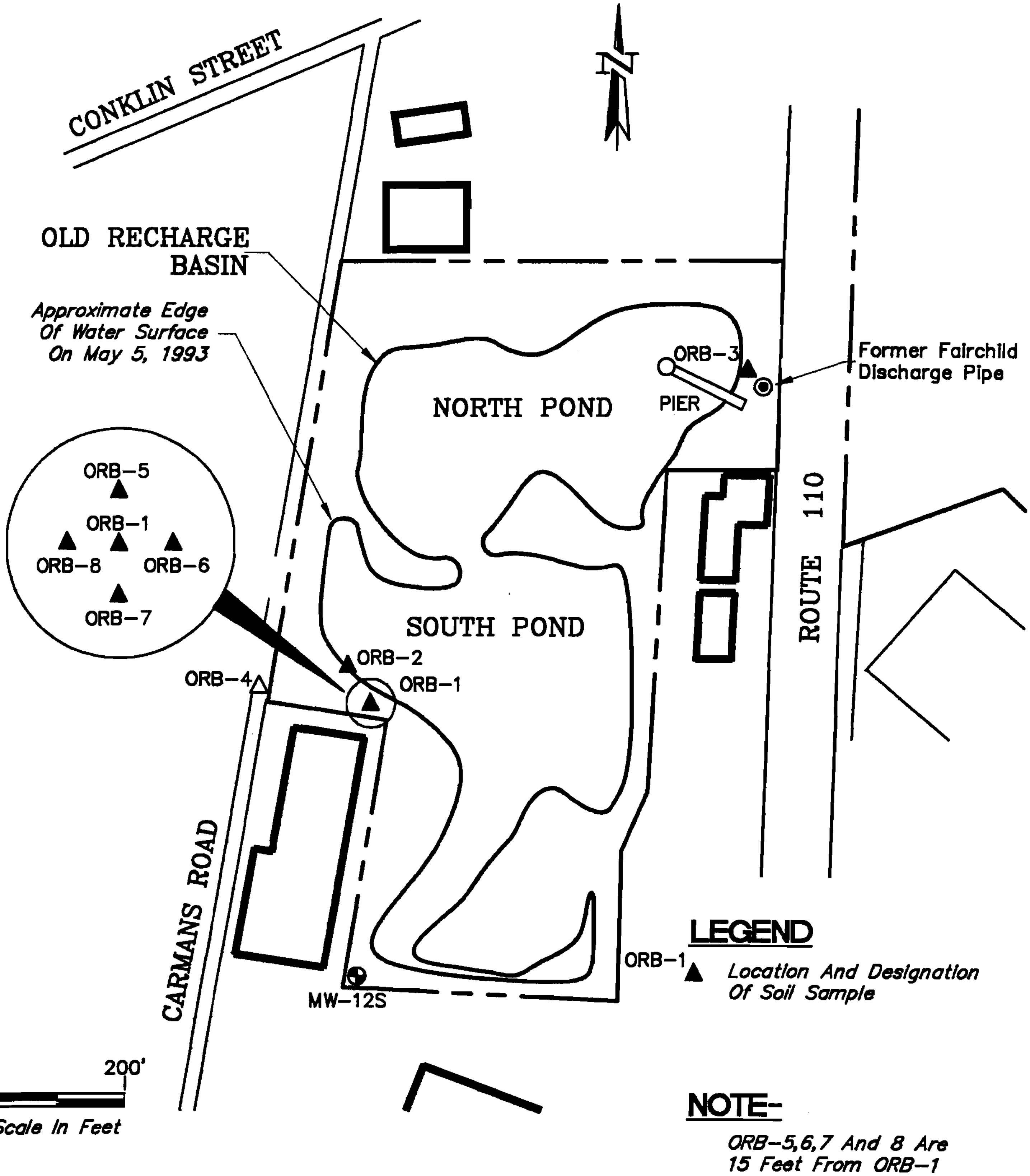


SURFACE WATER SAMPLING LOCATIONS

FAIRCHILD INDUSTRIES INC.
EAST FARMINGDALE, NEW YORK

SK961-4D
120594

eder associates
FIGURE 5

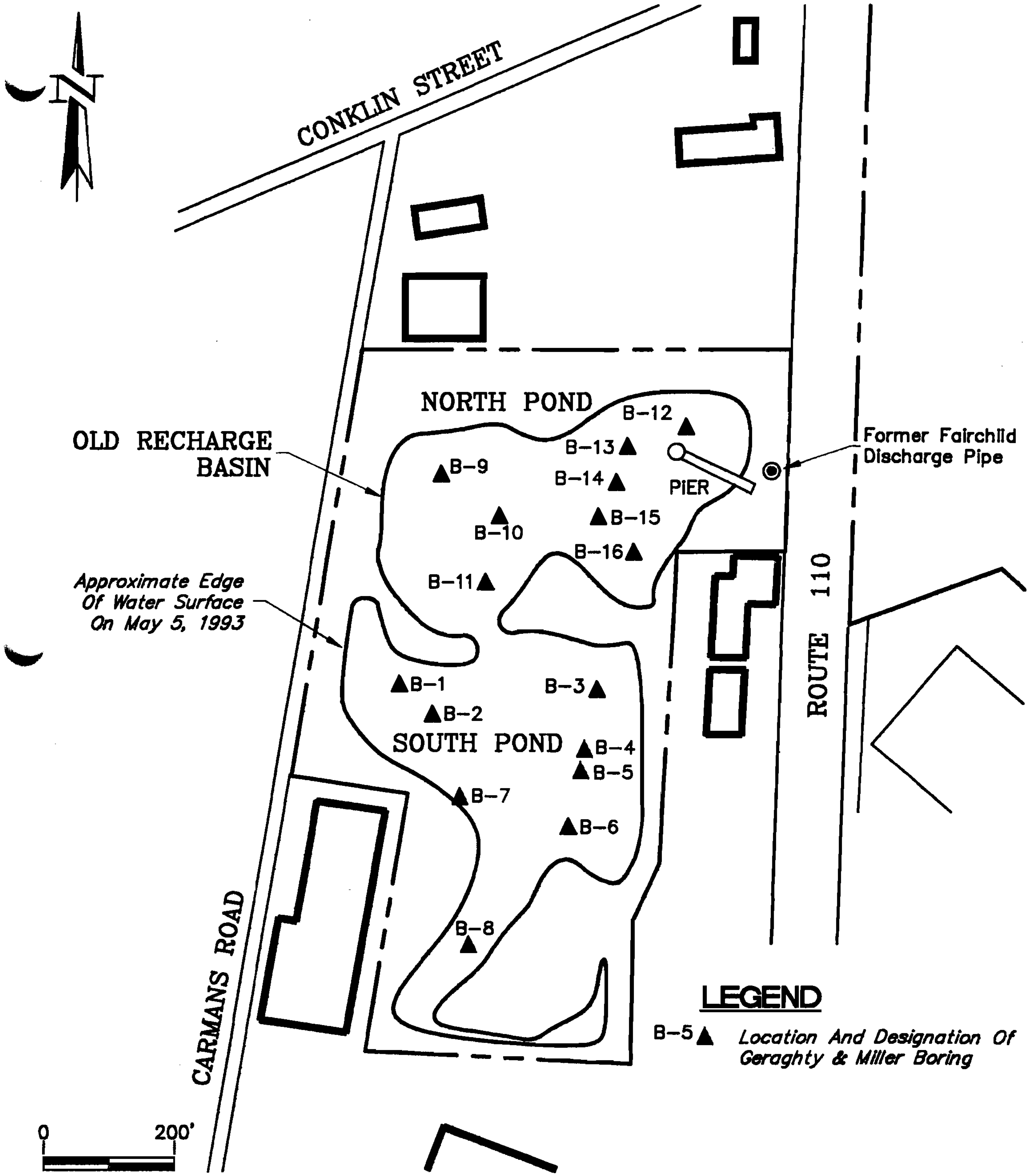


SURFACE SOIL SAMPLING LOCATIONS

FAIRCHILD INDUSTRIES INC.
EAST FARMINGDALE, NEW YORK

SK961-4F
120594

eder associates
FIGURE 6



SEDIMENT SAMPLING LOCATIONS

FAIRCHILD INDUSTRIES INC.
EAST FARMINGDALE, NEW YORK

SK961-4C
120594

APPENDIX A

SEDIMENT VOLUME ESTIMATE CALCULATIONS

ESTIMATED SEDIMENT VOLUME IN ORB

Sixteen borings were drilled in the ORB during the 1988 Geraghty and Miller Investigation.

Estimated Thickness of Sediment in each boring:

B-1: 7.5 ft	B-9: 4 ft
B-2: 7.75 ft	B-10: 4 ft
B-3: 1 ft	B-11: 4 ft
B-4: 6 ft	B-12: 7 ft
B-5: 3.5 ft	B-13: 11 ft
B-6: 2 ft	B-14: 15.5 ft
B-7: 2 ft	B-15: 18 ft
B-8: 2 ft	B-16: 8 ft

Average Sediment Thickness = 6.5 ft

Areal Extent of Basin = 10.5 Acres = 457,380 ft^2

Estimated Volume of Sediment =

$$(457{,}380\ ft^2)\ (6.5\ ft)\ (yd^3/27\ ft^3) = 110{,}000\ yd^3$$

APPENDIX B

PRELIMINARY COST ESTIMATE CALCULATIONS

FAIRCHILD INDUSTRIES, INC.
OLD RECHARGE BASIN
EAST FARMINGDALE, NEW YORK

Table 1
Preliminary Capital Cost Estimate
Alternative 2: Site Use Restrictions

Item	Estimated Cost
Establish Deed Restrictions	$25,000
Modify Fence, if Necessary	$20,000
Subtotal	$45,000
Contingencies (@ 25%)	$11,000
Engineering, Legal, and Administrative Fees (@20%)	$9,000
Total	$65,000

FAIRCHILD INDUSTRIES, INC.
OLD RECHARGE BASIN
EAST FARMINGDALE, NEW YORK

Table 2
Preliminary Capital Cost Estimate
Alternative 3: Cover Bottom Sediment with Clean Fill

Item	Estimated Quantity (cy)	Estimated Unit Cost ($ /cy)	Estimated Cost
Purchase and Transport Clean Fill to Site			
- Sand	51,000	$20	$1,020,000
- Clay	51,000	$30	$1,530,000
Operation of the Submerged Diffuser System	51,000	$20	$1,020,000
Subtotal (Sand)			$2,040,000
Subtotal (Clay)			$2,550,000
Contingencies (@ 25%) (Sand)			$510,000
Contingencies (@ 25%) (Clay)			$638,000
Engineering, Legal, and Admin. Fees (@20%) (Sand)			$408,000
Engineering, Legal, and Admin. Fees (@20%) (Clay)			$510,000
Total (Sand)			$2,958,000
Total (Clay)			$3,698,000

FAIRCHILD INDUSTRIES, INC.
OLD RECHARGE BASIN
EAST FARMINGDALE, NEW YORK

Table 3
Preliminary Capital Cost Estimate
Alternative 4: Excavate and Dispose of in an Off-Site Non-Hazardous Landfill

Item	Estimated Quantity (cy)	Estimated Unit Cost ($ /cy)	Estimated Cost
Dredge Sediment	110,000	$20	$2,200,000
Dewater Sediment (Filter Press)	110,000	$4	$440,000
Excavate Soil	35	$12	$420
Blend in Additives to Eliminate Free Liquids from Dewatered Soil & Sediment Mix	110,000	$20	$2,200,000
Transport and Dispose of Off-Site	110,000	$130	$14,300,000
Subtotal			$19,140,000
Contingencies (@ 25%)			$4,785,000
Engineering, Legal,and Administrativ Fees (@20%)			$3,828,000
Total			$27,753,000

FAIRCHILD INDUSTRIES, INC.
OLD RECHARGE BASIN
EAST FARMINGDALE, NEW YORK

Table 4
Preliminary Capital Cost Estimate
Alternative 5: Excavate, Treat On-Site, and Dispose of in an Off-Site Non-Hazardous Landfill

Item	Estimated Quantity (cy)	Estimated Unit Cost ($ /cy)	Estimated Cost
Dredge Sediment	110,000	$20	$2,200,000
Dewater Sediment (Filter Press)	110,000	$4	$440,000
Excavate Soil	35	$12	$420
Treatment On-Site			
- Solidification	110,000	$50	$5,500,000
- Incineration	110,000	$500	$55,000,000
Transport and Dispose of Off-Site			
- Solidified Material	137,500	$130	$17,875,000
- Incinerated Material	55,000	$130	$7,150,000
Subtotal (with Solidification)			$26,015,000
Subtotal (with Incineration)			$64,790,000
Contingencies (@ 25%) (with Solid.)			$6,504,000
Contingencies (@ 25%) (with Inciner.)			$16,198,000
Engineering, Legal,and Administrative Fees (@20%) (with Solidification)			$5,203,000
Engineering, Legal,and Administrative Fees (@20%) (with Incineration)			$12,958,000
Total (with Solidification)			$37,722,000
Total (with Incineration)			$93,946,000

FAIRCHILD INDUSTRIES, INC.
OLD RECHARGE BASIN
EAST FARMINGDALE, NEW YORK

Table 5
Preliminary Capital Cost Estimate
Alternative 6: Excavate, Treat Off-Site, and Dispose of in an Off-Site Non-Hazardous Landfill

Item	Estimated Quantity (cy)	Estimated Unit Cost ($ /cy)	Estimated Cost
Dredge Sediment	110,000	$20	$2,200,000
Dewater Sediment	110,000	$4	$440,000
Excavate Soil	35	$12	$420
Transport/ Treatment and Dispose of Off-Site			
- Solidification	110,000	$200	$22,000,000
- Incineration	110,000	$1,500	$165,000,000
Subtotal (with Solidification)			$24,640,000
Subtotal (with Incineration)			$167,640,000
Contingencies (@ 25%) (with Solid.)			$6,160,000
Contingencies (@ 25%) (with Inciner.			$41,910,000
Engineering, Legal,and Administrativ Fees (@20%) (with Solidification)			$4,928,000
Engineering, Legal,and Administrativ Fees (@20%) (with Incineration)			$33,528,000
Total (with Solidification)			$35,728,000
Total (with Incineration)			$243,078,000

FAIRCHILD INDUSTRIES, INC.
OLD RECHARGE BASIN
EAST FARMINGDALE, NEW YORK

Table 6
Preliminary Capital Cost Estimate
Alternative 7: Saturated Zone Stabilization

Item	Estimated Quantity (cy)	Estimated Unit Cost ($ /cy)	Estimated Cost
Saturated Zone Stabilization	110,000	$200	$22,000,000
Subtotal			$22,000,000
Contingencies (@ 25%)			$5,500,000
Engineering, Legal,and Administrative Administrative Fees (@20%)			$4,400,000
Total			$31,900,000

FAIRCHILD INDUSTRIES, INC.
OLD RECHARGE BASIN
EAST FARMINGDALE, NEW YORK

Table 7
Preliminary Annual Operation and Maintenance Cost Estimate
Alternative 1

Item	Estimated Cost Year 1	Estimated Cost Years 2+
Groundwater Monitoring		
- Sample Collection	$7,000	$4,000
- Laboratory Analysis	$4,000	$2,000
- Data Evaluation & Report Preparation	$8,000	$5,000
Subtotal	$19,000	$11,000
Contingencies (@20%)	$3,800	$2,200
Engineering, Legal, and Administrative Fees (@10%)	$1,900	$1,100
Total	$24,700	$14,300

Note:
Present Worth of Annual O&M Costs (assumes 30 year timeframe and 7% discount rate) = 0.9346 * [24700 + 14300 * (12.2777)] = $187,000

FAIRCHILD INDUSTRIES, INC.
OLD RECHARGE BASIN
EAST FARMINGDALE, NEW YORK

Table 8
Preliminary Annual Operation and Maintenance Cost Estimate
Alternatives 2,3,7

Item	**Estimated Cost** **Year 1**	**Years 2+**
Surface Water Monitoring		
- Sample Collection	$1,500	$1,500
- Laboratory Analysis	$2,500	$2,500
- Data Evaluation & Report Preparation	$3,000	$3,000
Groundwater Monitoring		
- Sample Collection	$7,000	$4,000
- Laboratory Analysis	$4,000	$2,000
- Data Evaluation & Report Preparation	$8,000	$5,000
Fence Inspection and Repairs	$5,000	$5,000
Subtotal	$31,000	$23,000
Contingencies (@20%)	$6,200	$4,600
Engineering, Legal, and Administrative Fees (@10%)	$3,100	$2,300
Total	$40,300	$29,900

Notes:
Present Worth of Annual O&M Costs (assumes 30 year timeframe and 7% discount rate) = 0.9346 • [40300 + 29900 • (12.2777)] = $381,000

There is no annual O&M associated with alternatives 4,5, and 6, except for alternative 4 (surface soil only). Refer to Table 9 for alternative 4 (surface soil only) O&M costs.

Cost estimate assumes that the perimeter fence is inspected semi-annually by Fairchild personnel and that annual fence repair costs average $500.

FAIRCHILD INDUSTRIES, INC.
OLD RECHARGE BASIN
EAST FARMINGDALE, NEW YORK

Table 9
Preliminary Annual Operation and Maintenance Cost Estimate
Alternative 4 (Surface Soil Only)

Item	**Estimated Cost**	
	Year 1	**Years 2+**
Surface Water Monitoring		
- Sample Collection	$1,500	$1,500
- Laboratory Analysis	$2,500	$2,500
- Data Evaluation & Report Preparation	$3,000	$3,000
Groundwater Monitoring		
- Sample Collection	$7,000	$4,000
- Laboratory Analysis	$4,000	$2,000
- Data Evaluation & Report Preparation	$8,000	$5,000
Subtotal	$26,000	$18,000
Contingencies (@20%)	$5,200	$3,600
Engineering, Legal, and Administrative Fees (@10%)	$2,600	$1,800
Total	$33,800	$23,400

Notes:
Present Worth of Annual O&M Costs (assumes 30 year timeframe and 7% discount rate) = 0.9346 * [33800 + 23400 * (12.2777)] = $300,000

APPENDIX C

INDEX TO NEW YORK STATE STANDARDS, CRITERIA, AND GUIDELINES

INDEX — Revised 12/93

VOLUME I

NEW YORK STATE Standards, Criteria and Guidelines (equivalent to ARAR's)

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

- **Division of Solid Waste**

  - *6 NYCRR Part 360 - Solid Waste Management Facilities (effective October 9, 1993)

- **Division of Hazardous Substances Regulation**

  - Description of Difference - EPA/State Regulations
  - 6 NYCRR Part 364 - Waste Transporter Permits (revised January 12, 1990)
  - 6 NYCRR Part 370 - Hazardous Waste Management System: General (revised January 31, 1992)
    - Part 371 - Identification and Listing of Hazardous Wastes (revised January 31, 1992)
    - Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities (revised January 31, 1992)
  - 6 NYCRR Subpart 373-1 - Hazardous Waste Treatment, Storage and Disposal Facility Permitting Requirements (revised January 31, 1992)
    - 373-2 - Final Status Standards for Owners and Operators of Hazardous Waste Treatment Storage and Disposal Facilities (revised January 31, 1992)
    - 373-3 - Interim Status Standards for Owners and Operators of Hazardous Waste Facilities (revised January 31, 1992)
  - 6 NYCRR Part 374 - Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities (revised January 31, 1992)

  - 6 NYCRR Part 376 - Land Disposal Restrictions (January 31, 1992)

- **Division of Hazardous Waste Remediation**

  - 6 NYCRR Part 375 - Inactive Hazardous Waste Disposal Site Remedial Program (May 1992)

  - Technical and Administrative Guidance Memorandum (TAGM)

    HWR-92-4046 Determination of Soil Cleanup Objectives and Cleanup Levels. (November, 1992)

    ** HWR-92-4030 Selection of Remedial Actions at Inactive Hazardous Waste Sites. (May 1990).

* revised ** newly added

INDEX
VOLUME II
NEW YORK STATE SCGs

Revised 12/93

- **Division of Water**

  - 6 NYCRR Part 700-705 - NYSDEC Water Quality Regulations for Surface Waters and Groundwater

  - 6 NYCRR Part 750-757 - Implementation of NPDES Program in NYS

  - 6 NYCRR Part 702.15(a),(b),(c),(d) and (e) Empowers DEC to Apply and Enforce Guidance where there is no Promulgated Standard

  - Technical and Operations Guidance Series (TOGS)

  • 1.1.1; October, 1993 - Ambient Water Quality Standards and Guidance Values
  1.2.1; April, 1990 - Industrial SPDES Permit Drafting Strategy for Surface Waters
  1.3.1; May, 1990 - Waste Assimilative Capacity Analysis and Allocation for Setting Water Quality Based Effluent Limits
  1.3.1 C; August 1991 - Development of Water Quality Based Effluent Limits for Metals Amendment
  1.3.2; May, 1990 - Toxicity Testing in the SPDES Permit Program
  1.3.4; April 1, 1987 - BPJ Methodologies
  1.3.4.a; November 3, 1988 - BPJ Methodologies/Amendments
  1.3.7; July, 1990 - Analytical Detectability and Quantitation Guidelines for Selected Environmental Parameters
  2.1.2; July, 1990 - Underground Injection/Recirculation (UIR) at Groundwater Remediation Sites
  2.1.3; October, 1990 - Primary and Principal Aquifer Determinations

- **Division of Air**

  - *6 NYCRR Part 200 (200.6) - General Provisions (Revised January 29, 1993)
  - *6 NYCRR Part 201 - Permits and Certificates (Revised March 31, 1993)
  - 6 NYCRR Part 211 (211.1) - General Prohibitions
  - 6 NYCRR Part 212 - General Process Emission Sources
  - 6 NYCRR Part 257 - Air Quality Standards
  - Air Guide 1 - Guidelines for the Control of Toxic Ambient Air Contaminants

- **Division of Spills Management**

  - Spill Technology and Remediation Series (STARS)

    ** Memo #1, August, 1992 - Petroleum-Contaminated Soil Guidance Policy

• revised   ** newly added

INDEX
VOLUME II
NEW YORK STATE SCGs (cont'd)

NEW YORK STATE DEPARTMENT OF HEALTH

- NYSDOH PWS 68 - Blending Policy for Use of Sources of Drinking Water
- NYSDOH PWS 69 - Organic Chemical Action Steps for Drinking Water
- NYSDOH PWS 152 - Procedure for Handling Community Water System Emergencies
- NYSDOH PWS 159 - Responding to Organic Chemical Concerns at Public Water Systems
- NYSDOH PWS 160 - Public Notification of Organic Chemical Incidents Regarding Public Water Supplies
- The 10 ppt criterion for 2,3,7,8 - TCDD is fish flesh
- The Binghamton State Office Building cleanup criteria for PCDDs, PCDFS and PCBs
- Part 5 of the State Sanitary Code, Drinking Water Supplies (effective March 11, 1992)
- Part 170 of title 10 of the NYCRR, Water Supply Sources
- Appendix 5-A of Part 5 of the State Sanitary code (Recommended Standards for Water Works)
- Appendix 5-B of Part 5 of the State Sanitary Code (Rural Water Supply)
- NYSDOH Interim Report on Point-of-Use Activated Carbon Treatment Systems
- Part 16 draft limits on the disposal of radioactive materials into sewer systems
- Criteria for the development of health advisories for sport fish consumption
- Tolerance levels for EDB in food

* revised   ** newly added

INDEX
VOLUME III
NEW YORK STATE SCGs

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (cont'd)

- **Division of Fish and Wildlife**

  - 6 NYCRR Part 608 - Use and Protection of Waters
  - 6 NYCRR Part 662 - Freshwater Wetlands - Interim Permits
    663 - Freshwater Wetlands Permit Requirements
    664 - Freshwater Wetlands Maps and Classifications
    665 - Local Government Implementation of the Freshwater Wetlands Act and Statewide Minimum Land - Use Regulations for Freshwater Wetlands
  - 6 NYCRR Part 182 - Endangered and Threatened Species of Fish and Wildlife
  - ECL Article 24 and Article 71, Title 23 - Freshwater Wetlands Act

- **Division of Regulatory Affairs**

  - 6 NYCRR Part 361 - Siting of Industrial Hazardous Waste Facilities
  - Article 27, Title II of the ECL - Industrial Siting Hazardous Waste Facilities
  - 6 NYCRR Part 621 - Uniform Procedures
  - 6 NYCRR Part 624 - Permit Hearing Procedures

- **Division of Marine Resource, Bureau of Marine Habitat Protection**

  - Chapter 10 of 6 NYCRR Part 661 Tidal Wetlands - Land Use Regulations

- **Division of Mineral Resources**

  - 6 NYCRR Part 420 - General
    421 - Permits
    422 - Mined Land - Use Plan
    423 - Reclamation Bond
    424 - Enforcement
    425 - Civil Penalties
    426 - Hearings
  - Title 27 - NYS Mined Land Reclamation Law

NEW YORK STATE DEPARTMENT OF LABOR

- 12 NYCRR 50 - Lasers
- 12 NYCRR 38 - Ionizing Radiation Protection

NEW YORK STATE DEPARTMENT OF AGRICULTURE AND MARKETS

- 1 NYCRR Part 371 - Notice of Intent

- Part 600 - Department of State, Waterfront Revitalization and Coastal Resources Act
- State Coastal Policies
- State Consistency Process
- Federal Consistency Process
- NYS Coastal Policies
- NYS Coastal Management Program
- Federal Register, June 25, 1979 - Part V - Department of Commerce - Federal Consistency Regulation

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233-3505

Thomas C. Jorling
Commissioner

July 27, 1990

MEMORANDUM

TO: Bureau Directors, Regional Water Engineers, Section Chiefs

SUBJECT: Division of Water Technical and Operational Guidance Series (2.1.2) UNDERGROUND INJECTION/RECIRCULATION (UIR) AT GROUNDWATER REMEDIATION SITES

(Originator: Joseph F. Kelleher)

I. PURPOSE

This document provides guidance on the applicability of SPDES permits and groundwater effluent standards to the use of UIR as a remediation measure.

II. DISCUSSION

At groundwater contamination sites, including inactive hazardous waste sites, an increasingly popular remedial measure involves pumping out contaminated groundwater, treating it, and then recirculating a portion of it to the ground in order to speed the movement of pollutants toward the purge wells. A portion of the treated groundwater (blowdown) is always discharged to either surface waters or to a POTW so that the system operates at a net hydraulic deficit. This helps to prevent pollutants from migrating beyond the target area. The blowdown, if discharged to a surface water body, will normally require either a SPDES permit or consent order. If the blowdown is discharged to a POTW, it must meet all pretreatment and sewer district requirements.

This document addresses only that portion which is injected into the ground. For the injected water we need to know if the UIR system requires a SPDES permit and if the groundwater effluent standards, (contained in 6 NYCRR Section 703.6) or the groundwater quality standards (contained in 703.5 (a) (2)) apply.

III. GUIDANCE

A. SPDES Requirement

1. UIR systems will require a SPDES permit unless they meet the criteria of paragraph 2 of this section.

2. A SPDES permit will not be required if either of the following conditions is met:

a. The area in which purging/injection is taking place is contained, either by a physical barrier (e.g. a slurry wall), or a hydraulic barrier (e.g. a large number of overlapping purge wells), so that contaminated groundwater is prevented from migrating beyond the boundaries of the containment zone. Containment must be complete to the extent measureable and the system must operate at a sufficient hydraulic deficit so as to maintain a hydraulic gradient into the containment area.

b. The site is being remediated pursuant to an order. Any conditions that are necessary to satisfy the substantive technical requirements of the SPDES program can be incorporated into the order which, in effect, serves as a substitute for a permit. To allow this, it is necessary that a full agreement be reached with the responsible party on the appropriate conditions.

B. Applicability of Groundwater Effluent Standards

The injected water will be required to meet the groundwater discharge standards of section 703.6, or quality standards of section 703.5 (a) (2) unless the following conditions are met:

a. The injection is into a "contained" area, as described in paragraph A (2)(a) above, and

b. There is no net increase in the concentration of any chemical pollutant in the discharge prior to injection, and

c. The remedial plan for the site includes groundwater monitoring, both inside and outside the contained area, sufficient to insure that no degredation of groundwater quality will result.

If the aforementioned conditions are met, the groundwater discharge standards and quality standards will not apply. Instead, limits for the injected water will be specified that are representative of BAT/BPJ, but which will still allow the actual wastewater treatment processes to be selected on a site by site basis. The blowdown must also satisfy surface water quality standards (surface discharge) or pretreatment requirements (POTW discharge), as appropriate.

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