U.S. Army Corps of Engineers
Kansas City District

Final Focused Feasibility Study Report

Syncon Resins Superfund Site
Operable Unit 2
Kearny, New Jersey

USACE CONTRACT NO. W912DQ-08-D-0008
TASK ORDER NO. 017

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Focused Feasibility Study

Contents

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Tables

Figures

Appendix

Acronyms

AAWQC	adjusted ambient water quality criteria
ACM	asbestos containing material
ACO	administrative consent order
amsl	above mean sea level
ARARs	applicable or relevant and appropriate requirements
AST	above-ground storage tank
Berger	Louis Berger Group, Inc.
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene and xylene
CDM	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CFM	cubic feet per minute
COC	contaminants of concern
COPC	contaminant of potential concern
COPR	chromium ore processing residue
CPT	cone penetration
CWTS	contaminant water treatment system
cy	cubic yards
DNAPL	dense non-aqueous phase liquid
DRO	diesel range organics
Ebasco	Ebasco Services, Inc.
EDD	Electronic Data Deliverable
EO	Executive Order
EPA	United States Environmental Protection Agency
EPH	Extractable Petroleum Hydrocarbon
FS	Feasibility Study
FFS	Focused Feasibility Study
GRAs	general response actions
GRO	gasoline range organics
GWQS	Groundwater Quality Standards
HCC 42	Hudson County Chromate Site 42
HHRA	Human Health Risk Assessment
HI	hazard index
HQ	hazard quotient
IGWSRS	Impact to Groundwater Soil Remediation Standard
IRM	interim remedial measure
ISCO	in situ chemical oxidation
ISTD	in situ thermal desorption
LDRs	land disposal restrictions
LNAPL	light non-aqueous phase liquid
LTTD	low temperature thermal desorption
mg/kg	milligram per kilogram
mg/L	milligram per liter
Monsanto	Monsanto Company

NCP	National Contingency Plan
NEPA	National Environmental Policy Act
N.J.A.C	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NJGS	New Jersey Geological Survey
NJSRS	New Jersey Soil Remediation Standards
NPL	National Priorities List
NRDCSRS	Non-Residential Direct Contact Soil Remediation Standard
O&M	operation and maintenance
ORO	oil range organics
OSHA	Occupational Safety and Health Administration
OU	operable unit
PCB	polychlorinated biphenyl
PDI	pre-design investigation
PDIR	Pre-Design Investigation Report
PID	photoionization detector
PMK	PMK Group, Inc.
ppm	parts per million
PPRTVs	Provisional Peer Reviewed Toxicity values
PRG	Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
RAOs	Remedial action objectives
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RME	reasonable maximum exposure
ROD	record of decision
RSL	Regional Screening Levels
SIR	Site Investigation Report
Site	Syncon Resins Superfund Site
S.U.	standard units
SVE	soil vapor extraction
SVOC	semivolatile organic compound
TAL	Target Analyte List
TBC	To Be Considered
TCL	Target Compound List
TCLP	toxicity characteristic leaching procedure
TMV	toxicity, mobility, or volume
TPH	total petroleum hydrocarbon
TSCA	Toxic Substance Control Act
TV	television
USACE	United States Army Corps of Engineers
USC	United States Code
UST	underground storage tank
USGS	United States Geological Survey
VOC	volatile organic compound
µg/kg	microgram per kilogram
µg/L	microgram per liter

Section 1
Introduction

Under the United States Army Corps of Engineers (USACE), Kansas City District, Contract No. W912DQ-08-D-0008, Task Order No. 017, CDM Federal Programs Corporation (CDM) has been tasked to provide engineering services for Operable Unit 2 (OU2) at the Syncon Resin Site (Site) located in Kearny, Hudson County, New Jersey. Specifically, CDM was tasked to complete a focused feasibility study (FFS) for OU2 of the Site.

A remedy was selected for the Site for Operable Unit 1 (OU1) on September 29, 1986 which included the removal and disposal of the contents of storage tanks and vessels, lagoon liquids and sediments, and grossly contaminated surface soils; decontamination of buildings and tanks structures; installation of a permeable cover material over the Site to eliminate exposure to contaminated subsurface soils and to allow for natural flushing of underlying soil and groundwater contaminants; and construction of a collection and treatment system for remediating contaminated groundwater from the shallow aquifer, with discharge to the Passaic River. In addition, the selected remedy included a final provision to conduct supplemental studies to evaluate methods to enhance the effectiveness of the flushing and/or treatment of contaminated soils.

The second OU2 was issued on September 27, 2000 to conduct supplemental studies required as part of the remedy. The major components of OU2 were: excavation and drainage of approximately 30,000 cubic yards (CY) of contaminated soil from an area of about 2.5 acres removal and disposal of buried debris and other obstructions from the excavated areas; installation of a drainage layer at the bottom of the excavations, treatment/disposal of drained free product from the excavated materials; addition of soil amendments to the excavated soil before backfilling; possible restoration of natural hydraulic conditions, and discontinuation of the contaminated water treatment system (CWTS) operation, and establishment of institutional controls to ensure continued commercial/industrial use of the property.

The OU2 remedy was not implemented as a result of new information that surfaced during the PDI conducted by NJDEP in 2006. Specifically, based on the 2006 report, soil contamination encountered in the southwest areas of the Site is primarily located in the upper 5 feet of soil, which is mostly unsaturated. The observation of free product in the southwest area is limited to only relatively small areas. The primary contaminants of concern, including PCBs, TPH, PAHs, and pesticides, have absorbed into the soil matrix and therefore, excavation is considered the most efficient method of removing the contamination. Draining would have very limited potential to remove free product and contaminant mass of the excavated soil, particularly the upper 5 feet of unsaturated soil where the contaminants are primarily located. An amendment to the existing OU2 remedy is considered necessary.

The preparation of a Focused Feasibility Study (FFS) will enable the United States Environmental Protection Agency (EPA) to focus effort on evaluating site-wide soil contamination. At the completion of soil remediation activities, an optimization study of the groundwater extraction system will be conducted. This approach is based on the assumption that any soil remedy may potentially change the groundwater flow (and source load) condition(s) at the Site, and thus impact the effectiveness of the OU1 remedy that already exists on site.

1.1 Purpose and Organization of the Report

The purpose of this FFS is to identify remedial action objectives (RAOs) for OU2, identify and evaluate a range of remedial technologies, and develop and screen a range of remedial alternatives for this Site, to enable EPA to select a feasible and cost-effective remedial alternative that will protect public health and the environment from potential risks at the Site. The FFS will be used as the basis for a ROD amendment for OU2. This FFS will focus on soil remediation.

This FFS has been prepared in accordance with the Guidance for Conducting Remedial Investigations and Feasibility Studies under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (EPA 1988).

This FFS is comprised of five sections as described below.

- **Section 1 - Introduction** provides a summary of site background information including the site description, site history, site investigations and remedial activities, field sampling activities, physical characteristics, nature and extent of contamination, and a summary of a human health risk assessment (HHRA) conducted by EPA for OU2.

- **Section 2 - Development of Remedial Action Objectives and Screening of Technologies** develops a list of RAOs by considering the characteristics of contaminants, the risk assessment, and compliance with site-specific applicable or relevant and appropriate requirements (ARARs); documents the quantities of contaminated media; identifies general response actions (GRAs); and identifies and screens remedial technologies and process options.

- **Section 3 - Development of Remedial Action Alternatives** presents the remedial alternatives developed by combining the feasible technologies and process options.

- **Section 4 – Detailed Analysis of Remedial Action Alternatives** provides preliminary design assumptions for the alternatives that were retained. This information is used to develop the cost estimate for each alternative. This section also evaluates and compares the remedial alternatives in detail using the following nine EPA evaluation criteria: overall protection of human health and the environment; compliance with the ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; cost; state acceptance; and community acceptance.

- **Section 5 – References** presents the list of reports, documents, and publications used to prepare the FFS.

1.2 Site Description

The Site is located at 77 Jacobus Avenue, Kearny, Hudson County, New Jersey. The Site occupies approximately 15 acres in a heavily industrialized area, and is bordered to the west by the Passaic River, to the south by Spectraserv, Inc., to the east by Jacobus Avenue, and to the north by Clean Earth, Inc. (formerly S&W Waste, Inc.). A site location map is presented on Figure 1-1. Various chemical plants, hazardous waste transporters, manufacturing companies, petroleum facilities, and storage terminals are situated within the immediate area.

The Site is currently inactive and secured with a locked chain-link fence. Former manufacturing and warehousing facilities are located mostly on the southern portion of the Site. The Site consists of an active groundwater treatment building close to the northwestern corner, former manufacturing and warehousing facilities on the southern portion of the Site, and undeveloped land mostly covered by gravel.

1.3 Site History

Available historical plat maps of the area indicate that the narrow peninsula on which the Site is located was drained in late 1800s, and development began by the early 1900s. Based on the 1931 aerial photograph of the area, the peninsula was already heavily developed by industrial operations.

The origin of the Syncon Resins Site is obscure. The earliest evidence documenting the existence of the Site consists of 1951 aerial photographs of the area. In May 1977, the owners of Syncon Resins filed for bankruptcy under Chapter 11 of the Bankruptcy Act. In November 1981, the New Jersey Department of Environmental Protection (NJDEP) investigated the Site and ordered its owners to control and contain the hazards at the Site. In 1982, the company ceased all operations. In September 1983, the Site was added to the National Priorities List (NPL).

Past site operations that ceased in 1982 included manufacturing resins and varnish-related products reclaimed from off-specification resins, wastes, and solvents, which involved the use of as many as 144 former above-ground storage tanks (ASTs), 6 former underground storage tanks (USTs), approximately 13,000 55-gallon drums containing off-specification materials, and 2 former lagoons used as unlined leaching ponds for the industrial discharge (lagoon #1 was located in the immediate vicinity and east of Building #11, while lagoon #2 was located south of Building #11).

1.4 Summary of Historical Investigations and Remedial Actions

As a result of the widespread contamination present in both soil and groundwater revealed during a limited site investigation performed by NJDEP and EPA in 1982, the Site has been the subject of numerous environmental investigations and remediation work. A brief description of the historical investigation/remediation progress and chronology is presented below.

- November 1981 – An administrative consent order (ACO) was entered between NJDEP and the former site owner for remediation to control and contain the hazards at the Site.

- 1982 - All site operations ceased.

- 1982 – A limited site investigation was conducted by NJDEP and EPA, which identified widespread soil and groundwater contamination.

- September 1, 1983 - Site placed on the NPL.

- February to August 1984 – O.H. Materials Corporation (OHM), on behalf of NJDEP, removed 12,824 55-gallon drums for appropriate off-site disposal as a part of the Interim Remedial Measure (IRM). The drums contained three main classes of materials: polychlorinated biphenyl (PCB) containing, non-PCB containing, and peroxides.

- May 1985 to April 1986 – A remedial investigation/feasibility study (RI/FS) was conducted by EBASCO Services, Inc. (EBASCO) on behalf of NJDEP. RI activities consisted of topographic mapping, permeability testing, tidal study, and sampling of various environmental media at the Site, including soil, groundwater, lagoon sediment and surface liquid, air, and building materials. A variety of contaminants that included volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), PCBs, pesticides, and metals in soil and/or groundwater were identified at the Site. The RI results were documented in a Site Investigation Report (SIR) dated August 1986. Based on the RI results, a total of six remedial alternatives were identified and evaluated during the FS.

- September 29, 1986 – A ROD was signed for OU-1. The interim remedy included the following components:

  - Remove the contents of storage tanks and vessels for disposal in accordance with applicable requirements;

  - Decontaminate buildings and tanks structures as necessary;

  - Remove lagoon liquids and sediments for disposal in accordance with applicable requirements;

  - Remove grossly contaminated surface soils for disposal in accordance with applicable requirements;

  - Install an appropriate cover over the site to allow natural flushing of underlying soil and groundwater contaminants;

    - Collect and treat contaminated waters from the shallow aquifer, with discharge to the Passaic River; and

    - Conduct supplemental studies to evaluate methods to enhance the effectiveness of flushing and/or treatment and destruction of the contaminated soils.

- May 1990 to December 1993. Remedial construction commenced in May 1990. Construction activities included the removal of contaminated materials contained in storage tanks, lagoon liquids and sediments, and surface soils; the decontamination of buildings and tanks; installation of a gravel cover over the Site to allow natural flushing of underlying soil; construction of a cement-bentonite slurry wall; and the construction of a CWTS. Hazardous materials removed off-site included approximately 2100 CY of contaminated soil and approximately 970 CY of lagoon sediment. These areas had high concentrations of contaminants, and contaminated soil and sediment were removed off-site to reduce exposure. The gravel layer was provided to cover the entire site. Following the completion of these activities, approximately one hundred above-ground storage tanks located in open areas on the Site were recycled and disposed of off-site. Remedial construction activities were completed in 1993. The OU1 remedy of the natural flushing with groundwater collection and treatment is currently in operation at the Site.

- 1994 – Sampling of soil and groundwater at the Site was conducted by NJDEP as a follow-up to the observation of significant and consistent reduction in the levels of contaminants in the extracted groundwater of the CWTS. The widespread soil and groundwater contamination at the Site were reaffirmed, and the results were documented in an NJDEP memorandum dated March 15, 1996.

- 1997 – A site investigation was conducted by Handex, on behalf of NJDEP. The investigation included collection of product samples from MW-11 and MW-19 for chemical and fingerprint analysis, advancement of cone penetration (CPT) borings utilizing a fuel florescence detector to estimate the possible extent of free product at the Site.

- September 27, 2000 – A ROD was signed for OU2.

    - The following RAOs were established in the 2000 ROD:

        - Prevent exposure to contaminants in soil at levels exceeding State soil cleanup criteria;

        - Improve the effectiveness and efficiency of the existing OU-1 remedy that is currently in place by excavating and draining contaminated soils and by removing debris that is impeding ground water flow. To the extent possible, the draining of the contaminated soils would allow the free and residual product to be removed from the soils, since it is acting as a source of ground water contamination. It is NJDEP's and EPA's policy to remove or treat continuing sources of contamination (i.e., free or residual product) when technically feasible or practicable;

  - Potential restoration of the natural ground water flow at the Site (the slurry wall will be modified to allow ground water to flow from the Site into the river), when it is determined that levels of contaminants in the ground water are below applicable criteria; and

  - Provide for restricted (industrial) reuse of the Site.

- The selected remedy in the 2000 ROD included the following components:

  - Excavation and drainage of approximately 30,000 CY of contaminated soil from an area of about 2.5 acres;

  - Removal and disposal of buried debris and other obstructions from the excavated areas;

  - Installation of a drainage layer at the bottom of the excavation;

  - Treatment and disposal of drained free product from the excavated material;

  - Addition of soil amendments to the excavated soil before backfilling;

  - Possible restoration of natural hydraulic conditions, and discontinuation of the contaminated operation; and

  - Establishment of institutional controls to ensure continued commercial/industrial use of the property.

- July to October 2006 – A Pre- Design Investigation (PDI) was conducted by the Louis Berger Group, Inc. (Berger) and its joint venture partner, the PMK Group, Inc. (PMK), on behalf of NJDEP. The PDI consisted of geophysical investigations and soil/groundwater sampling, and was intended to further delineate the source(s) and extent of contamination in soil/groundwater to facilitate an effective and efficient evaluation of the remedy selected in the 2000 ROD for OU2. The results of the investigation and the comparison with the 2000 ROD for the OU2 were presented in a Draft PDI Report (PDIR) dated February 14, 2007 that was submitted to NJDEP.

- Some of the data presented in this report raised questions as to the effectiveness of the planned OU2 remedy. The concerns identified in the report are briefly summarized below.

  - Soil contamination encountered in the southwest area of the Site is primarily located in the top five feet of soil which is mostly unsaturated. The extent of free product observed was much less significant than previously estimated;

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draining would thus have very limited potential to remove free product and contaminant mass of the excavated soil.

- Physical barriers, such as tank and building foundations, remain onsite. Wood and crushed empty drums were also found in test pit TP10 (TP10A through TP10D), and other debris such as bricks and concrete may exist at the Site. As a result, the selected remedy for OU2 would likely not improve natural flushing of contaminants and reduce the required operation time of the CWTS.

- The primary contaminants identified at the Site, such as PCBs, polycyclic aromatic hydrocarbons (PAHs), pesticides, metals and free product, are generally not amenable to bioremediation. As a result, the addition of soil amendments would likely not be effective in removing the contaminants, at least in relatively short periods of time. The residual contaminant sources in the soil matrix would continue to impact groundwater.

- Establishment of institutional controls is considered insufficient based on the Site contamination characteristics. Based on the elevated PCB concentrations and the future land use of the Site (High Occupancy), Toxic Substances Control Act (TSCA) regulations require either capping the areas (engineering control) or removing the soil (active remediation) where PCBs are between 1 milligram per kilogram (mg/kg) and 10 mg/kg, and removing soil (active remediation) with PCBs greater than 10 mg/kg.

- May 2006 – A building assessment was performed by Berger, on behalf of NJDEP, with respect to the structural and hazardous materials evaluation of the existing 12 abandoned buildings at the Site. The structural integrity of these buildings was found to be compromised, which makes it unsafe to perform any vibratory or excavation activities within or adjacent to them, and building demolition was therefore recommended as part of the remedial activities at the Site. In addition, asbestos containing material (ACM) and lead-based paint were suspected to be present in these buildings, but the assessment was limited due to the compromised structural integrity. A more detailed survey with appropriate protective measures was recommended to further investigate the distribution of ACM prior to any building demolition activities.

The RAOs established for OU2 in the 2000 ROD were as follows:

- Prevent exposure to contaminants in soil at levels exceeding State soil cleanup criteria;

- Improve the effectiveness and efficiency of the existing OU1 remedy that is currently in place by excavating and draining contaminated soils and by removing debris that is impeding groundwater flow. To the extent possible, the draining of the contaminated soils would allow the free and residual product to be removed from the soils, since it is acting as a source of groundwater contamination. It is NJDEP's and EPA's policy to remove or treat continuing sources of contamination (i.e., free or residual product) when technically feasible or practicable;

- Potential restoration of the natural groundwater flow at the Site (the slurry wall will be modified to allow groundwater to flow from the Site into the river), when it is determined that levels of contaminants in the groundwater are below applicable criteria; and

- Provide for restricted (industrial) reuse of the Site.

1.5 Study Area Investigation

1.5.1 2008 Data Gap Evaluation

CDM, on behalf of USACE and EPA, performed a data gap evaluation in 2008, which consisted of review of the existing background documents, and compiling and evaluating available data collected during the historical investigations and remedial actions. The findings were summarized in a Data Gap Evaluation Memorandum dated May 2008. The Data Gap Evaluation Memorandum recommended performing investigative activities to fill the identified data gaps for each of the areas of concern at the Site, and to provide supplemental Site characterization information to support the FFS. The detailed description of the proposed sample locations, analytical parameters and rationale were presented in the Data Gap Evaluation Memorandum. In addition, collection of background soil samples was also deemed necessary due to the nature of the soil (i.e., fill up to 10 feet) which may account for the PAHs and/or metal contamination found at the Site.

1.5.2 July 2008 Data Gap Field Investigation

A data gap field investigation program was implemented by CDM in July 2008. As part of the investigation, a total of 62 soil borings were installed on the Site, and an additional 6 soil borings were installed on the Spectraserv Inc. property to determine the impact, if any, of contaminant migration from the Site. Soil samples were collected in accordance with the EPA-approved Quality Assurance Project Plan (QAPP), dated June 2008 and the Field Change Request submitted in July 2008. The soil sample locations were biased toward areas with identified data gaps, in an attempt to take advantage of the large amount of data available from past historical investigations.

Five of the onsite soil borings, all located west of the slurry wall (i.e., SB-03, SB-06, SB-09 through SB-11), were actually converted to test pits due to refusal encountered during initial drilling at these locations. With the exception of these five borings, the soil borings were advanced via direct push to approximately 2 feet into the top of the clay layer underlying the Site. Up to three soil samples (i.e., surface sample, immediately above the groundwater table, and at the top of the clay) were collected from each boring and analyzed for full Target Compound List (TCL) VOCs, TCL SVOCs, TCL pesticide/PCBs, and Target Analyte List (TAL) metals.

Waste characterization samples were also collected from a few of these soil borings based on field observations (e.g., visual/olfactory evidence of contamination, elevated PID readings, etc.) for Resource Conservation Recovery Act (RCRA) characteristics analysis, in order to better estimate the potential waste treatment and disposal cost to support the FFS. Soil samples collected from select borings with the Northeastern Area (SB-29, SB-30, SB-31, SB-36, SB-37, and SB-38) and the Southwestern Area (SB-46 through SB-53, and SB-62) were also analyzed for total petroleum hydrocarbon diesel range organic (TPH-DRO), TPH gasoline range organic (TPH-GRO) and TPH oil range organic (TPH-ORO) analysis. The results of the data gap field investigation sampling program completed in July 2008 were summarized in a Data Investigation Summary Report, which was submitted to USACE in December 2008. In addition, the Electronic Data Deliverable (EDD) file and electronic site base map was submitted to EPA in November 2008 for risk assessment evaluation by EPA.

The results of the July 2008 data gap field investigation were presented in a Data Investigation Summary dated December 2008. They will be discussed in detail in Section 1.7, along with the historical data collected previously (i.e., during the 1997 Handex CPT investigation and the 2006 Berger/PMK investigation).

1.5.3 Existing Monitoring Well Survey

The PDIR (Berger/PMK 2007) and the SIR (EBASCO 1986) prepared for the Site provided significantly different well location, elevation, and construction information. To determine the total depth and screen interval in the monitoring wells at the Site, Advanced Geological Services, a geophysical subcontractor, was retained by CDM to inspect each well with a downhole television (TV) camera. The downhole TV logging was performed on September 18 and 19, 2008, and the results were included in the Data Investigation Summary Report dated December 2008.

In general, the results of the borehole TV logging agreed with the data provided in the SIR. In the case of monitoring well MW-6, vegetation roots have clogged the well, which explains why the PDIR lists the total depth as only 6.52 feet. The TV inspection found the root mass at this depth but could not penetrate it to confirm the well depth of 12 feet reported in the boring log provided in the SIR. Root penetration was also observed in two other monitoring wells, MW-4 and MW-20R. Product was observed in monitoring wells MW-14R2 and MW-19, and these wells were not inspected with the borehole TV camera. Monitoring wells MW-11 and MW-12 were installed as a shallow and deep well pair. In the PDIR, MW-11 was reported as the shallow well and MW-12 as the deep well. In the SIR, MW-11 was reported as the deep well and MW-12 as the shallow well. The borehole TV inspection confirmed that MW-11 is the shallow well and MW-12 is the deep well.

No groundwater sampling was conducted as part of the 2008 investigation for the existing monitoring wells; however, well redevelopment and possibly well rehabilitation will be required prior to future groundwater sampling based on the well survey results.

1.5.4 Background Soil and Groundwater Screening

As part of the recommended investigation activities in the May 2008 Data Gap Evaluation Memorandum, a background sampling program was implemented in May 2009. Soil and groundwater samples were collected in accordance with the EPA-approved QAPP Addendum for Background Sampling.

A total of 10 background soil borings were installed in the vicinity of the Site. The boring locations were selected to meet all of the following criteria:

- Located on property close to the Site which is representative of regional background
- Located on Right-of-Way of city property
- Not in a traffic congested area

Two soil samples were collected from each of the background soil borings, including one surface soil sample from 0.5 – 2.5 feet below ground surface (bgs) and one subsurface soil sample from 4 – 6 feet bgs. The background soil borings were advanced to 10 to 15 feet bgs based on the depth to groundwater, and one grab groundwater screening sample was collected from each boring to characterize the regional groundwater in the vicinity of the Site. The soil and groundwater samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides, TCL PCBs, and TAL metals including mercury and cyanide. The Electronic Data Deliverable (EDD) file for this sampling was submitted to EPA on March 24, 2009 and the updated base map was submitted on February 23, 2009.

1.5.5 Background Data Statistical Analysis

The results of the background sampling program, as well as the Site data, were used by Lockheed Martin to develop a statistical evaluation for EPA. The statistical evaluation was performed using ProUCL 4.00.04 (EPA 2007) and Scout 2008 (EPA 2008) software, for the following contaminants of potential concern (COPCs):

- benzene
- benzo(a)anthracene
- benzo(a)pyrene
- benzo(b)fluoranthene
- benzo(k)fluoranthene
- dibenz(a,h)anthracene
- indeno (1,2,3-cd)pyrene
- naphthalene
- 4,4'-D,D,D
- 4,4'-D,D,T
- aldrin
- beryllium
- dieldrin
- heptachlor

- arsenic
- cadmium
- lead
- manganese
- TPH(total)
- zinc

These COPCs were selected by evaluating the chemicals in the August 1986 Task 3 – Risk Assessment Report, and the recent data collected from 2006 and 2008, eliminating known site-related contaminants, and including COPCs that exceeded the NJDEP Non-Residential Direct Contact Soil Remediation Standard (NRDCSRS).

TPH (total) was not analyzed in the background samples, and therefore was excluded from the statistical evaluation.

The results of the statistical evaluation are presented in a report titled "Statistical Analysis of Background and Site Data, Syncon Resins Superfund Site, New Jersey" prepared by Lockheed Martin in August 2009. The comparison of the background data and the Site data for both surface soil and subsurface soil indicates that: (1) in surface soil, the Site results for arsenic, cadmium, naphthalene, dieldrin, and 4,4'-DDD exceed background and (2) in subsurface soil, the Site results for cadmium, benzene, 4,4'-DDT, dieldrin, and 4,4'-DDD exceed background.

1.5.6 Regional Groundwater Flow and Water Quality Assessment

A technical memorandum was prepared by CDM in July 2009 to assess regional groundwater flow and water quality in unconsolidated deposits in the vicinity of the Site, using publicly available information from NJDEP. The groundwater quality discussion in the memorandum is presented below, and the geology, hydrogeology, groundwater flow conceptual model are discussed in Section 1.6.

Groundwater quality was assessed by reviewing the groundwater sample data from nearby environmental remediation sites (see Figure 1-5). The latest available data that covers the period from the early 1990s to 2008 were identified and used to assess regional groundwater quality. Three themes emerge from the groundwater sample results, as summarized below.

- The main metals identified in groundwater and related to fill are arsenic, chromium (total and hexavalent), and lead. Groundwater contamination in the upper zone is from metals whose source is probably the fill material emplaced on Kearny Point. The most significant example of this is groundwater contamination with chromium due to the history of chromite ore processing on the point and the use of chromium ore processing residue (COPR) as fill.

- Groundwater contamination in the upper zone is related to petroleum storage and use. The main contaminants related to petroleum storage are benzene and methyl tert-butyl ether.

- Most groundwater sampling has been conducted in the upper zone. Sample results from the lower zone are limited but indicate that it has not been impacted by site-related contamination.

1.6 Physical Characteristics of the Study Area

1.6.1 Topography

The Site covers about 15 acres, abuts the Passaic River on the west, and is located on the upper northwest side of a low lying, narrow peninsula known as Kearny Point (EBASCO 1986). Soil borings completed at the Site by CDM, and past investigations, show that fill was placed to level most of the Site to allow construction of various buildings and equipment so that manufacturing operations could be conducted. The topography at the Site is highest in the northeast corner of the Site where the ground elevation is about 8 feet above mean sea level (amsl). A four to five foot high berm is also present in the area and surrounds a former tank farm. The site-wide topography is about 7 feet amsl on average. Much of the southeast and southwest areas of the Site are covered by buildings, pavement, or concrete pads. The topography drops off over a distance of 60 to 175 feet to the west of the slurry wall, as the Site intersects the current Passaic River shoreline. The slurry wall is located on the west side of the Site.

1.6.2 Drainage and Surface Water

The Site is located within the Newark Bay drainage basin. There are no significant surface water bodies on the Site. Surface drainage at the Site is to the south and to the west toward the Passaic River which borders the Site on the west. According to the PDI completed by Berger/PMK for NJDEP there are no wetlands at the Site (Berger/PMK 2007). According to their review of NJDEP county-wide wetland files, the closest wetlands are about half a mile north and northeast of the Site.

The Site is located on a narrow peninsula bordered to the east by the Hackensack River and to the west by the Passaic River. The confluence of the two rivers, about 1.5 miles south of the Site, forms the upper reaches of Newark Bay. Both rivers are tidal with a mean spring tide of about 6 feet (Kimball 1998). Over a 60 day period in April and May 2009 tidal fluctuations ranging from about 3.7 feet (tidal high daily and tidal low daily recorded on April 18, 2009 was 1.48 feet amsl and -2.2 feet amsl, respectively) to about 7.3 feet (tidal high daily and tidal low daily recorded on May 26, 2009 was 4.08 amsl and -3.26 feet amsl, respectively) were observed at the United States Geological Survey (USGS) tidal data collection station on the Passaic River at the Passaic Valley Sewage Commission facility in Newark (USGS 2009). The peninsula containing the Site, the Hackensack River and Passaic Rivers and Newark Bay are all located within the Hudson River-New York Bight estuarine system (Kimball 1998).

1.6.3 Climate

New Jersey is located on the east coast of the United States about half way between the equator and the North Pole. This geographic location results in highly variable daily weather influenced by wet, dry, hot, and cold airstreams that are part of the "prevailing westerlies" that flow from west to east over North America. The Site is located in the Central climate zone as defined by the New Jersey State Climatologist (New Jersey State Climatologist 2009a). This zone stretches from the counties in the northeast, adjacent to New York City to the southwest to the bend in the Delaware River at Trenton. This area is characterized by extensive development, many urban areas, and heavy traffic. Because urban areas tend to retain heat they are warmer than surrounding areas and are referred to as heat islands. The Central zone is the transition between the cooler Northern climate zone to the northwest and the warmer Pine Barrens and Coastal zones to the southeast (New Jersey State Climatologist 2009a).

The mean annual precipitation in northern New Jersey for the period 2001-2008 was 51.75 inches. In 2008 monthly precipitation ranged from a low of 1.92 inches in January to 7.13 inches in September. Over the long term, from 1895 to 2008, precipitation is distributed fairly evenly over the year with a mean low of 3.06 inches in February to a mean high of 4.67 inches in July (New Jersey State Climatologist 2009b). Precipitation occurs about 120 days per year with the driest period in the fall. The mean annual temperature in northern New Jersey for the period 2001-2008 was 52.6 degrees Fahrenheit (F). In 2008 monthly mean temperatures ranged from a low of 32.9 degrees F in February to 76.1 degrees F in July (New Jersey State Climatologist 2009b). Snow is likely to fall in the area from October through April.

1.6.4 Soils

The United States Department of Agriculture (USDA) Web Soil Survey does not have data for Hudson County. However, the survey includes information for Essex County which lies to the west of the Site on the other side of the Passaic River (USDA 2009). On the bank of the river opposite the Site two soil types are present: Bigapple loamy sand and Urban land, Bigapple substratum. The Bigapple loamy sand is well drained, composed mainly of sand and gravel, characterized by slopes of 0 to 3 percent, and its parent material is described as "sandy material derived from dredge". The Urban land, Bigapple substratum is used to describe areas that are covered by pavement, concrete, buildings, and other structures which are underlain by Bigapple loamy sand soil. Due to the proximity of the Site to this area it is probable that the Site is underlain by Bigapple loamy sand soil.

1.6.5 Geologic and Hydrogeologic Characteristics

1.6.5.1 Regional Geology

The Site is located in the Piedmont Physiographic province in New Jersey. This province trends northeast to southwest and covers about one-fifth of the state. The province is typically a low rolling plain divided by higher ridges. The ridges are underlain by igneous rocks the most prominent of which is the Palisades along the Hudson River. The province slopes from the Highlands, on the west, toward the southeast, to the Coastal Plain. At the Site, the elevation is close to sea level. In general, the province is underlain by sedimentary rocks of Triassic and Jurassic age (240 million to 140 million years old) and Jurassic-age igneous rocks (Dalton 2003).

According to the surficial geologic map and associated cross sections published in 2004 by the New Jersey Geological Survey (NJGS), the Site is underlain by Quaternary age salt-marsh and estuarine deposits composed of brown, dark brown, gray, and black silt, sand, peat, and minor pebble gravel. Figure 1-2 shows the surficial geologic map of the Site and vicinity. Geologic cross sections C-C′ and K-K′ (see Figure 1-2 for the cross section locations) indicate that the deposits are on the order of 20 feet thick at the Site. The NJGS (2002) glacial geology map shows that the surficial deposits are, in turn, underlain by Quaternary Age, Late Wisconsinan glacial lake bottom deposits composed of gray, brown, yellowish brown, reddish brown silt, clay, and fine sand (Figure 1-3). The NJGS glacial sediment thickness map indicates these deposits are about 100 feet thick at the Site. Borings in the vicinity of the Site, discussed below, show that the glacial lake deposit is about 80 feet thick. Directly overlying the bedrock, in some places is the Quaternary age Rahway Till composed of reddish brown, reddish yellow, yellowish brown, brown clayey silt to sandy silt with some to many pebbles and cobbles, and few boulders. This deposit is generally less than 40 feet thick.

Finally, the Site and vicinity are underlain by the Triassic age mudstone facies of the Passaic Formation (NJGS 2007).

1.6.5.2 Site-Specific Geology

The Site is underlain by a series of geologic deposits, illustrated in 3-dimesional cross section in Figure 1-4, and described in the following order, from shallow to deep.

- Fill and estuarine deposits: At the Site this unit is generally 4 to 12 feet thick and is called the "upper zone". In the northern part of the Site this layer is 4 to 7 feet thick and is composed of fine to coarse grained gray or brown-gray sand with little gravel and trace amounts of silt and clay (EBASCO 1986). In the middle and southern portions of the Site a second sand layer overlies the first layer; it is 1 to 4 feet thick, and is composed of fine to medium grained reddish brown sand (EBASCO 1986). EBASCO (1986) observed fill up to 10 feet thick at well MW-1 consisting of sandy soil, bricks, chunks of wood, and broken concrete. Fill was observed in 57 borings completed at the Site in 2008 and 2009 by CDM. The thickness ranged from 0.5 foot to 6.5 feet thick and averaged 2 feet thick. The fill observed by CDM consisted of the same material observed by EBASCO.

- Salt-marsh deposit: Brown, dark brown, gray, black peat, silt and clay. This layer is characterized by a "meadow mat" at the top which was formed before the overlying coarse-grained estuarine sediments or fill were deposited. The meadow mat is organic-rich and contains abundant roots. These deposits are about 10 feet thick. This layer acts as an aquitard that separates the upper and lower zones.

- Estuarine deposit: Silt, sand, and pebbly gravel, about 10 feet thick. This layer is called the "lower zone".

- Late Wisconsinan age glacial lake bottom deposits consisting of gray, brown, yellowish brown, reddish brown silt, clay, and fine sand. At the Site this unit directly overlies the bedrock and is about 80 feet thick.

- Triassic-age Passaic Formation bedrock.

An example of the complete unconsolidated lithologic sequence typical of the Site and nearby facilities is provided by the log from boring 42-B-130 located at Hudson County Chromate Site 42 (HCC 42) (Eckenfelder 1997). This site is located to the east of Syncon Resins on the other side of Jacobus Avenue. The units observed in the boring included:

Depth (feet bgs)	Description	Stratigraphy
0 – 9	Fine to coarse sand, trace silt	Fill (upper zone)
9 – 20	Organic rich silty clay	Salt marsh, estuarine deposit
20 – 28	Fine to medium sand, little silt	Estuarine deposit (lower zone)
28 – 108	Varved (thinly layered) clay	Late Wisconsinan age glacial lake bottom deposit
108	Auger refusal, bedrock	Passaic Formation

1.6.5.3 Hydrogeology

The water level records from the Site and nearby environmental remediation sites were reviewed to assess the hydrogeology and groundwater flow direction. These observations span the period from 1996 to 2008.

The major components of the groundwater flow system are represented conceptually in plan view in Figure 1-5. The figure illustrates the basic characteristics of the groundwater flow system. The water levels may fluctuate over time but the basic flow system characteristics will not change. The basic flow characteristics in the upper zone are summarized below.

- Groundwater is encountered in the upper zone at depths ranging from 1 to 4 feet bgs.

- In the upper zone groundwater flow is generally toward surface water or toward the storm sewer running north/south along Central Avenue (Figure 1-5).

- At sites close to the Passaic River or Hackensack River, groundwater flow in the upper zone is toward the river.

- At the Site the slurry wall impedes the normal westward groundwater flow in the upper zone toward the Passaic River. This causes groundwater to mound in the middle of the Site. The September 2006 upper zone potentiometric surface shown on Figure 1-6 illustrates this mounding effect. (The site investigation conducted by EBASCO in 1986, prior to the installation of the slurry wall in 1991, indicated that the groundwater flow of the upper zone shallow aquifer was to the southwest into the Passaic River.) The groundwater divide created by this mound extends to the north into the Clean Earth site. To the west of the mound on the Site, flow is toward the drainage trench just to the east of the slurry wall. On the Clean Earth site, groundwater flow to the west of the divide is westerly (i.e., toward the Passaic River). To the east of the mound on both the Site and Clean Earth, flow is to the east toward the sewer drain along Central Avenue.

The basic flow characteristics in the lower zone are summarized below.

- Data from the chromate sites indicate that groundwater flow in the lower unit is generally to the south toward Newark Bay (Figure 1-5).

- Data from the EBASCO (1986) study indicate that groundwater in the lower zone is under confined conditions. Observations from September 2006, listed on Table 1-1, show that the lower zone is confined. The water level elevation in well MW-12 (completed in the lower zone) was 1.13 feet, which is above the top of the clay confining unit that separates the upper and lower zones. This observation is consistent with groundwater discharge from the lower zone to the nearby Passaic River and Upper Newark Bay.

Stratigraphic, water level elevation, and water quality data are a strong indication that the meadow mat and silt and clay salt marsh units act as an aquitard which hydraulically separates the upper and lower zones. Water level elevation data from wells installed at site HCC 42 (Figure 1-5) show a vertical downward gradient from the shallow unit zone to the underlying lower zone. Water level elevations in November 1996 in the upper zone wells ranged from 6.39 to 6.74 feet amsl. Water level elevations in the lower zone wells ranged from 2.04 to 2.41 feet amsl (Brown and Caldwell 2000). A similar vertical downward gradient was observed at the Site in September 2006 at the MW-11 and MW-12 well pair (Table 1-1). The water level elevation in upper zone well MW-11 was 5.42 feet while it was 1.13 feet in lower zone well MW-12. Groundwater sampling results at monitoring well cluster 168W-101S and 168W-101D at site HCC 168 also indicate that the silt and clay unit acts as an aquitard. Chromium concentrations in groundwater samples from these wells also illustrate how the salt marsh unit acts as an aquitard. In September 1995 and April 1996, total chromium concentrations (filtered) were 7,580 micrograms per liter (µg/L) and 5,460 µg/L, respectively, in groundwater samples from shallow monitoring well 168W-101S. During the same sampling events, hexavalent chromium concentrations (filtered) were 7,400 µg/L and 5,500 µg/L, respectively (Brown and Caldwell 2001). In contrast, the chromium concentrations in deep well 168W-101D in September 1995 and April 1996 were significantly lower with total chromium concentrations (filtered) at 5.5 µg/L and 11.1 µg/L, respectively, in groundwater samples collected from deep monitoring well 168W-101D. During the same events, the hexavalent chromium concentration (filtered) was 10 U (not detected, detection limit 10 µg/L) in both groundwater samples from deep monitoring well 168W-101D (Brown and Caldwell 2001).

Conceptual Flow Model

Based on the geology, hydrogeology, and groundwater flow observations discussed above, the regional groundwater flow conceptual model consists of the following elements, in order from shallow to deepest.

- Upper zone. The upper zone is composed of fill and sand deposits. It is a water table aquifer with groundwater flow toward the nearest surface water body or artificial drainage such as a storm sewer. In the upper zone the flow consists of three elements:
  - Flow to the west toward the Passaic River with a groundwater flow divide trending roughly north/south through the Syncon Resins facility.
  - Flow from the west and the east toward the storm sewer drain in the middle of Kearny Point. This flow regime is bordered on the east and west by groundwater flow divides.
  - Flow to the east toward the Hackensack River with a groundwater flow divide trending roughly north/south between site HCC 176 and the Marino Realty/Matco Transportation Property.
- Aquitard. The aquitard is composed of silt and clay.
- Lower zone. The lower zone consists of silt, sand, and gravel. It is a confined aquifer with groundwater flow toward the south. In the lower zone groundwater flows generally southward toward Newark Bay (Figure 1-5).
- A thick clay unit separates the lower zones from the underlying bedrock.

A recent tidal study performed by NJDEP for the Site reportedly indicated that the Passaic River, located west of the Site, influenced the groundwater elevation only west of the slurry wall. Groundwater west of the slurry wall fluctuated by approximately three feet between high and low tide (Berger/PMK 2007). The work conducted by EBASCO (1986), before the slurry wall was installed showed that wells screened in the lower zone near the Passaic River were affected by tidal fluctuations. The water levels in two wells, MW-1 and MW-8, located about 100 feet from the river, varied by as much as 3.5 feet over a tidal cycle. Other wells located between 100 and 200 feet from the river were not impacted by the tidal fluctuations.

1.7 Nature and Extent of Contamination

Numerous VOCs, SVOCs, TPH, PCBs, pesticides, and metals were identified at the Site during the historical investigations and the study area investigation. Free product was also reportedly present within the Southwestern Area.

With the exception of TPH, soil delineation criteria used to evaluate the nature and extent of contamination at the Site were compiled from the following two sources:

- NJDEP Non-Residential Direct Contact Soil Remediation Standard (NRDCSRS)
- NJDEP Impact to Groundwater Soil Remediation Standard (IGWSRS)

For TPH, a new guidance was recently developed by NJDEP based on the method "*Analysis of Extractable Petroleum Hydrocarbon Compounds (EPH) in Aqueous and Soil/Sediment/Sludge Matrices*" (NJDEP EPH 10/08 Revision 2) and is being certified by NJDEP for general use. An 8,000 mg/kg delineation criterion, as agreed upon by EPA, USACE, NJDEP and CDM, was selected for the FFS based on a Category 1 residual product/free product limit (Category 1 consists of discharges of only No. 2 fuel oil and/or diesel fuel):

Groundwater at the Site is classified as Class IIA groundwater. Therefore, groundwater delineation criteria used to evaluate the nature and extent of contamination at the Site were compiled from the NJDEP Groundwater Quality Standards (GWQS) for Class IIA groundwater.

1.7.1 Summary of Soil Contamination

The historical soil data considered in this section consist of data collected during the investigations listed below.

- CPT sampling event conducted by Handex in 1997
- PDI conducted by Berger/PMK in 2006
- Data gap field investigation conducted by CDM in 2008

The sample locations from these four investigations are depicted on Figures 1-7 and 1-8. The rest of the historical soil data were excluded from consideration for the purposes of this study due to: (1) the age of the data and (2) the significant change in Site conditions as a result of the remedial actions undertaken between November 1989 and December 1993. The Site has been divided into five distinct areas for the convenience of discussion (i.e., Northeastern Area, Northwestern Area, Southeastern Area, Southwestern Area, and Area West of Slurry Wall).

Soil sampling results revealed widespread contamination at the Site. Figures 1-7 and 1-8 show a variety of VOCs, SVOCs, TPH, PCBs, pesticides, and metals identified in soil that exceeded the delineation criteria. Specifically, contaminants that were detected exceeding the delineation criteria include:

- VOCs – benzene, toluene, ethylbenzene and xylenes (BTEX), 1,2-dibromo-3-chloropropane, and 1,2-dichloropropane
- SVOCs – benzo(a)anthracene, benzo(a)pyrene, benzo(a)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and naphthalene

- PCBs
- Pesticides – Aldrin, diedrin, 4,4'-DDD, 4,4'-DDT, and heptachlor
- TPH
- Metals – arsenic, cadmium, lead, and manganese

VOCs (BTEX) appear to be localized within the Southwestern Area, and coincides with the estimated extent of product based on the 1997 CPT investigation. For instance, the soil sampling results indicate that benzene was not detected frequently or at high concentrations at the Site; the highest concentration of benzene was detected at 1.1 mg/kg at a boring (SB-47) in the Southwestern Area.

With the exception of a few soil sample locations within the Southeastern Area (e.g., SB-42), PCBs also appear to be primarily located within the Southwestern Area, with the highest PCB concentrations in the vicinity of former Lagoon #1 (SW-10 through SW-12 and SB-48). PCB concentrations apparently declined with depth, as evidenced by SW-10 where PCBs were detected at 5,300 mg/kg, 3,400 mg/kg, and 5.7 mg/kg for the depth intervals 0 – 2 feet bgs, 5 – 6 feet bgs, and 6 – 6.5 feet bgs, respectively. A similar trend can also be observed at SB-48, where PCBs were detected at 1,700 mg/kg, 0.9 mg/kg, and 0.57 mg/kg for the depth intervals 4.5 – 6.5 feet bgs, 8.5 – 10.5 feet bgs, and 11.5 – 13.5 feet bgs, respectively.

Elevated TPH concentrations were detected in soil samples collected from the Northeastern Area (NE01, NE04, NE07 and NE11), Southwestern Area (SB-46, SB-47, and SB-49 through SB-51), and to a lesser extent Southeastern Area (SE01). Similar to BTEX contamination, the spatial distribution of TPH appears to be consistent with the estimated extent of product based on the 1997 CPT investigation. Vertically, TPHs extended below the groundwater table in the Northeastern Area and Southwestern Area, which was encountered at approximately 5 to 6 feet bgs during boring installation (however, depth to groundwater was measured at approximately 2 to 3 feet bgs in nearby onsite monitoring wells). For instance, TPH was detected at 8,636 mg/kg and 13,170 mg/kg in the soil samples collected from the 9.5 – 10.5 feet bgs interval of SB-49 and 5.6 – 8.6 feet bgs interval of SB-50, respectively.

Pesticides exceeded the delineation criteria only at isolated locations, specifically, NE21 within the Northeastern Area, SB-48 in the Southwestern Area, and SB-08 through SB-11 in the West of Slurry Wall. In addition, the isolated and limited exceedances occurred only in the shallowest sample depth intervals of these sample locations, indicating that the pesticides resulted from surface release.

Metal and SVOC exceedances of respective delineation criteria were identified across the Site. One of the metal contaminants, arsenic, was detected throughout the Site, but the highest concentrations (up to 265 mg/kg) of arsenic appear to be clustered in three areas of the Site: West of Slurry Wall, Northwestern Area, and Northeastern Area.

Free product was identified in the subsurface within a portion of the Southwestern Area (e.g., MW-14R2, MW-19, TP08), and may affect the selection of the remedial alternative for soil given that the targeted soil impact is not limited to the unsaturated soil. Waste characterization analysis performed on the free product samples from MW-19 and TP08, and composite soil samples from the 0 – 5 feet bgs interval of SW33 through SW36, indicated exceedance of RCRA ignitability standard (i.e., flash point less than 140°F) for these samples. The toxicity characteristic leaching procedure (TCLP) benzene result, 28.4 milligrams per liter (mg/L), of the free product sample collected from TP08 far exceeded the regulatory level of 0.5 mg/L. In addition, PCBs were detected at 85 mg/kg in the free product sample collected from MW-19, and exceeded the TSCA limit of 50 mg/kg. As such, any alternative for the Southwestern Area that involves off-site disposal after excavation may involve a combination of disposal methods: (1) disposal of recovered free product (e.g., via draining) as TSCA/RCRA hazardous waste, (2) disposal of all soil within the general area including SW10 through SW12 that exhibited PCBs above the TSCA limit of 50 mg/kg as TSCA chemical waste, (3) disposal of grossly contaminated soil as RCRA hazardous waste if the soil is beyond the area exhibiting PCBs above the TSCA limit of 50 mg/kg, and (4) disposal of the rest of the material as non-hazardous waste.

1.7.2 Summary of Groundwater Contamination

Groundwater contamination was identified at the inception of the site investigations. As indicated in the 1986 ROD, a limited site investigation performed by NJDEP and EPA in 1982 revealed the presence of 6 contaminants in the lower zone aquifer and 24 contaminants in the upper zone aquifer, at concentrations exceeding the then applicable adjusted ambient water quality criteria. Thirteen of the contaminants were detected at extremely high concentrations at the time. In order to mitigate the risk posed by the contaminated groundwater, the selected remedy in the 1986 ROD included installation of a CWTS and a groundwater containment system for the shallow aquifer that consists of a cut-off wall and a concrete retaining wall partially around the Site and adjacent to the river. The contaminant levels in the groundwater showed a dramatic decline since the CWTS had been in operation since April 1992, which likely was attributed to the slow migration of contamination in the soil and groundwater at the Site as indicated by a study performed by NJDEP in 1994. The same study confirmed significant mass of contaminants (such as BTEX) remaining in the soil and groundwater at the Site. To address this, the 2000 ROD selected a remedy that combined source removal activities and possible restoration of natural hydraulic conditions. However, the remedy was not executed, due to the obstacles to implementation of the OU2 remedy identified in the PDI conducted by Berger/PMK in 2006.

The most recent site-wide groundwater sampling event was conducted in 2006 as part of the PDI. Four monitoring wells were not sampled either because the well was dry (i.e., MW-6 and MW-20R) or free product was present (i.e., MW-14R2 and MW-19). As previously noted, the product in these two wells was re-affirmed during the monitoring well survey performed by CDM in 2008. As illustrated on Figure 1-9, analytical results for the groundwater samples from the site-wide monitoring wells indicated the following contaminants exceeded the current NJDEP GWQS.

- VOCs: BTEX with the highest concentrations in MW-11 (benzene, toluene and xylenes were detected at 250 μg/L, 61,000 D μg/L and 4,400 μg/L, respectively).
- SVOCs: 2,4-Dimethylphenol in MW-11.
- Metals: Arsenic, iron, manganese, and/or sodium in essentially all of the monitoring wells that were sampled; however, the latter three are believed to reflect site background levels. Thallium was detected in only one well, MW-11.

MW-12, located in the immediate vicinity of MW-11 that exhibited the highest BTEX concentrations at the Site, is a deep well and screened below the clay layer. Toluene was detected at 0.5 μg/L in the groundwater sample collected from this well during the 2006 Berger/PMK investigation, while the rest of the BTEX contaminants were non-detect, indicating that the groundwater contamination identified in MW-11 (above the clay layer) did not migrate downward and impact the groundwater underneath the clay layer at the time of the investigation.

1.7.3 Summary of Building Contamination

A total of 13 buildings are currently present at the Site, including 12 abandoned buildings (namely, Buildings #1, #1A, #6A, #7, #7A, #8 through #12, Red Building, and Shed) located mostly on the southeastern portion, and one steel structure located close to the northwestern corner that houses the CWTS. Historical aerial photographs indicate there was another building located north of Building #11 and within the western-central portion of the Site. This building likely was used as a main production center prior to being demolished sometime between 1971 and 1977. However, the building foundation was left in place. In addition, another former building was located close to the northeastern corner of the Site (referred to as "Oil Building" in the 2001 NJDEP Close-Out Report). The demolition of the Oil Building was completed in August 1990.

The building locations are depicted on Figures 1-7 and 1-8. Historical use of the buildings was investigated and the results were documented in the 1986 SIR prepared by EBASCO and the 1986 ROD. The EBASCO site investigation noted extensive distribution of chemical and resin-like contamination on the floor and the interior and exterior walls of seven of the buildings.

Remedial actions were undertaken at the Site between November 1989 and December 1993, to execute the remedy selected in the 1986 ROD. Work completed related to decontamination of buildings included the removal of chemical solids from the Oil Building prior to demolition; staging of waste from Buildings #10 and #11; vacuuming the Red Building and Buildings #7, #10, and #11; scraping of small areas in the Red Building and Building #11; and removal of ACM in Buildings 7, #7A, #9, and #11.

Based on the Building Assessment report prepared by Berger in May 2006, the structural integrity of the buildings (excluding the building housing the CWTS) was found to be compromised and not suitable for any vibratory or excavation activities within or adjacent to the buildings. Additionally, ACM and lead-based paint appeared to be still present in these buildings.

No soil borings were installed inside the buildings during the July 2008 data gap field investigation program, based on safety concerns over the compromised structural integrity. Rather, a number of soil borings (e.g., SB-54 through SB-60) were installed in the immediate vicinity of these buildings within the Southeastern Area to investigate soil conditions. The purpose was to: (1) determine whether there is any soil impact resulting from the former operations inside the buildings and (2) delineate the extent of product since the estimated extent of product (based on the 1997 CPT investigation) appears to extend underneath some of the buildings (e.g., Building #9). The results did not suggest any evidence of product. Moreover, with the exception of low levels of benzene and PCBs (benzene was detected at 0.0069 mg/kg in the soil sample from the 11 – 14 feet bgs interval of SB-57, and PCBs were detected at 0.23 mg/kg and 0.93 mg/kg in the soil samples from the 1.9 – 3.4 feet bgs interval of SB-55 and 0.8 – 2.2 feet bgs interval of SB-58, respectively. All were below the applicable NJDEP NRDCSRS). Metals and SVOCs were also detected, but at concentrations comparable with background.

This FFS report focuses on remedial alternatives for soil remediation. Building demolition activities are anticipated to be coordinated in the remedial design phase of the project.

1.8 Human Health Risk Assessment

A baseline HHRA was completed by EPA for OU2 to determine the cancer risks and non-cancer hazards associated with current and future exposure to contaminated soils at the Site.

The data used in the risk assessment included the 2006 data provided in the 2007 Berger Draft PDIR and the 2008 CDM Data Investigation Summary Report. The HHRA did not evaluate the entire datasets from 2006 and 2008, but rather focused on select COPCs from the 1986 ROD, contaminants that exceed the New Jersey Non-Residential Soil Remediation Standards, and site contaminants suspected to be present above background conditions.

The following human receptor groups and exposure routes were evaluated in the HHRA.

- Current/Future Land-Use Scenario
  - Trespasser: Ingestion, dermal contact, inhalation of fugitive dust/volatile
- Future Land-Use Scenario

- Site Worker: Ingestion, dermal contact, inhalation of fugitive dust/volatiles
- Construction/Utility Worker: Ingestion, dermal contact, inhalation of fugitive dust/volatiles

Quantitative estimates of the magnitude, frequency, and duration of exposure for each of these receptors were made using the reasonable maximum exposure (RME). RME assumptions, representing the highest exposure reasonably expected to occur at the Site.

In the toxicity assessment, current toxicological human health data (i.e., reference doses and concentrations, and slope factors) were obtained for each of the COPCs from EPA's Integrated Risk Information System, EPA's Provisional Peer Reviewed Toxicity values (PPRTVs) developed by the Office of Research and Development/ National Center for Environmental Assessment/Superfund Health Risk Technical Support, and the California Environmental Protection Agency (Cal EPA) toxicity values (Tier 3).

Risk characterization combines the exposure and toxicity information to provide a quantitative assessment of site risks. Exposures are evaluated based on the potential risk to develop cancer and the potential for non-cancer health hazards.

The potential for non-cancer effects was evaluated by comparing an exposure level over a specified time period with a reference dose (RfD) derived for a similar exposure period. The ratio of exposure to toxicity is referred to as a hazard quotient (HQ). An HQ ≤ 1.0 indicates that the receptor's dose of a single contaminant is less than the RfD, and that toxic non-cancer effects from that chemical are unlikely. The hazard index (HI) is the sum of the HQs for all the COPCs that affect the same target organ or act through the same mechanism of action within a medium or across all media to which an individual may reasonably be exposed. An HI ≤ 1.0 indicates that, based on the sum of all HQs from different contaminants and exposure routes, adverse toxic non-cancer effects from all contaminants are unlikely. An HQ > 1.0 indicates that a Site-related exposure may present a hazard to human health.

Cancer risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. The upper-bound excess lifetime cancer risk is estimated by multiplying the lifetime exposure by the cancer slope factor. Excess lifetime cancer risks are probabilities that usually are expressed in scientific notation. An excess lifetime cancer risk of 1×10^{-6} indicates that an individual experiencing the RME has a 1 in 1,000,000 excess chance of developing cancer as a result of Site-related exposure. The National Contingency Plan (NCP), the regulation that implements the Superfund law, defines the acceptable risk range for Site-related exposure as one in a million (1×10^{-6}) to one in ten thousand (1×10^{-4}).

Risk estimates for potential receptors are summarized in Table 1-2. For cancer risks, site workers (8×10^{-4}) and construction/utility workers (6×10^{-4}) under the future land-use scenario had cancer risks above the NCP's acceptable risk range of 1×10^{-6} to 1×10^{-4}. Current and future trespassers had cancer risk at the upper end of NCP's acceptable range. Aroclor 1248 contributes almost all of the risk. For non-cancer health hazards, all receptors had non-cancer hazards above EPA's threshold of 1. Aroclor 1242, 1248, and 1254 contribute all hazards and cause adverse effects on the immune system.

Due to the presence of contaminants in groundwater and the shallow water table, the potential exists for construction/utility workers to be exposed via incidental ingestion and dermal pathways. A quantitative risk above acceptable risk levels from exposure to mixed soils has been demonstrated. Any additional risk from exposure to contaminated groundwater further supports the need to take an action at the Site. Areas of pure product (MW-14R2, MW-19, TP-08, SB-49) and/or high levels of PCBs (former lagoon #1) should be considered hot spots and may need to be treated as Principal Threat Wastes, which will be discussed in detail in Section 2.

Because of the presence of VOCs in the groundwater and the shallow water table, vapor intrusion was qualitatively evaluated as a potential exposure route. The chemical concentrations in the water were compared to the corresponding values in Table 2c of the November 2002 "OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils". The values in this table represent a cancer risk of one in a million or an HQ of 1. The non-cancer HQs from the table were adjusted to 0.1 to account for the potential cumulative effect of multiple chemicals to a target organ or system. BTEX chemicals and chlorobenzene were flagged as COPCs for vapor intrusion, mainly in areas of the Site with known product (MW-11 and MW-19). Since shallow groundwater flows in a westerly direction toward the Passaic River on the western portion of the Site and toward the storm sewer along Central Avenue on the eastern portion of the Site, the potential for VOCs in groundwater to migrate onto neighboring properties is unlikely. On the other hand, regional groundwater flow is generally toward Newark Bay in a southerly direction. Regional groundwater sample results are limited, but indicate the regional groundwater has not been impacted by site-related contamination. As a result, the vapor intrusion pathway is only a concern for future onsite buildings.

Because the Site may be redeveloped in the future, any new construction would need to consider the potential for vapor intrusion. If development is pursued, two options may be considered prior to construction. One option would be to include a vapor mitigation system in the building design. Indoor air sampling and monitoring after construction would need to be conducted to verify that the system is working as intended. The second option would be to complete construction and then perform sub-slab air tests at regular intervals until COPC concentrations in groundwater have been reduced below levels of concern to determine that the migration of vapors is not occurring. If vapors are detected above levels of concern, an appropriate mitigation system should be installed to remove the vapors.

Section 2
Development of Remedial Action Objectives and Screening of Technologies

Remedial Action Objectives (RAOs) are media-specific goals to protect human health and the environment that serve as guidance for the development of remedial alternatives. The process of identifying the RAOs follows the identification of affected media and contaminant characteristics; evaluation of exposure pathways, contaminant migration pathways and exposure limits; and the evaluation of chemical concentrations that will result in acceptable exposure. The RAOs are based on regulatory requirements that may apply to the various remedial activities being considered for the Site. This section reviews the affected media and contaminant exposure pathways and identifies federal, state, and local regulations that may affect remedial actions.

Preliminary remediation goals (PRGs) were selected based on federal or state promulgated ARARs, risk-based concentrations, background concentrations, and with consideration also given to guidance values. These PRGs were then used as a benchmark in the technology screening, alternative development and screening, and detailed evaluation of alternatives presented in the subsequent sections of this report.

Section 121(d) of the CERCLA as amended, requires that, at a minimum, any remedial action must achieve overall protection of human health and the environment and comply with ARARs. Other criteria that do not meet the definition of an ARAR are known as "to be considered" (TBC) criteria, which may also be used to develop RAOs and are considered in evaluation of remedial alternatives.

The remedial action alternatives developed in subsequent sections of this report are required to attain applicable federal, State of New Jersey or facility siting laws. Technical requirements of ARARs must be met by the remedial action alternatives. However, Section 121(d) (4) of CERCLA allows selection of remedies that will not attain all ARARs provided one of the following conditions is satisfied:

1. The remedial action is an interim measure where the final remedy will attain the ARAR upon completion

2. Compliance with all ARARs will result in greater risk to human health and the environment than other options

3. Compliance is technically impracticable

4. The remedial action will attain the equivalent of the ARAR

5. Compliance with the ARAR will not provide a balance between protecting public health, welfare, and the environment at the site and the availability of funding for response at other facilities (fund balancing)

2.1 Identification of Remedial Action Objectives

RAOs for the Site are identified in this Section. The process of identifying the RAOs follows the identification of COCs, identification of potentially applicable or relevant and appropriate federal and state regulations and other guidance, development of site-specific risk-based cleanup levels. After identifying the RAOs, the PRGs are selected based on the ARARs, guidance values, or risk-based values. Generally, where a chemical-specific ARAR exists, it provides the basis for the corresponding PRG; if more than one applicable chemical-specific ARAR exists, the most stringent applicable requirements are generally applied first. The selected PRGs provide the basis for the evaluation of remedial technologies. A detailed discussion of the PRGs development is included in Section 2.3.

2.1.1 Contaminants of Concern

In September 2009, a meeting was held with EPA, USACE, NJDEP and CDM to evaluate the historical data and the data collected during the 2008 data gap field investigation. COCs were identified based on the following criteria:

- Exceedances of ARARs (i.e., NJDEP Soil Remediation Standards)
- Major risk drivers (i.e., exceedances of EPA Regional Screening Levels [RSLs])
- Exceedances of Site-specific background levels
- CERCLA petroleum exclusion

The following constituents have been selected as the COCs in soil and are the focus of the FFS.

- VOCs – BTEX
- SVOCs – naphthalene
- PCBs
- Pesticides – aldrin, diedrin, 4,4'-DDD, 4,4'-DDT, and heptachlor
- Metals – arsenic and cadmium
- Petroleum free product containing PCBs within the Southwestern Area

The rest of contaminants exceeding the soil delineation criteria, as presented in Section 1.7, are excluded for the following reasons: (1) the contaminant was detected only at levels within the background range, (2) the contaminant has been determined to pose low risk to human health, or (3) the CERCLA petroleum exclusion (i.e., TPH).

2.1.2 Remedial Action Objectives for Soil

As discussed in Section 1.7, widespread VOC, SVOC, TPH, PCB, pesticide, and metal contamination was observed at the Site during the historical investigations and the study area investigation. In addition, free product was also encountered during the investigations within the Southwestern Area.

The following RAOs have been identified for the contaminated soil:

- Reduce or eliminate the direct contact risks associated with contaminated soil to levels protective of a commercial/industrial use
- Improve the effectiveness and efficiency of the existing OU1 remedy that is currently in place;
- Remove or treat continuing sources of contamination (i.e., principal threat waste) when technically feasible or practicable;
- Address potential future exposure through inhalation of vapors that may migrate from contaminated soils; and
- Provide for restricted (industrial) reuse of the Site.

As discussed in Section 1, this FFS focuses only on soil remediation. The groundwater remediation component (i.e., optimization of the existing groundwater treatment system) will be conducted after the completion of the soil remedy, most likely through an optimization study. This approach is based on the assumptions that any soil remedy may potentially change the groundwater flow and contaminant load condition at the Site, and thus impact the effectiveness of the OU1 remedy that already exists.

<u>Definition of Principal Threat Waste</u>

According to the EPA guidance *A Guide to Principal Threat and Low Level Threat Wastes* (November 1991), Principal Threat Waste refers to those source area materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present significant risk to human health or the environment should exposure occur. Where toxicity and mobility of source material combine to pose a potential risk of 10^{-3} or greater, generally treatment alternatives should be evaluated.

<u>Site-Specific Principal Threat Waste</u>

In general, free product related to petroleum hydrocarbon spills or leaks would fall into the CERCLA petroleum exclusion. Therefore, it will typically be excluded from CERCLA response authority and liability unless specifically listed under RCRA or some other statute. However, elevated concentrations of PCBs (e.g., PCBs were detected at 85 mg/kg in a free product sample collected from onsite groundwater monitoring well MW-19 during the 2006 pre-design investigation conducted by

Berger), which are not normally found in crude oil or refined petroleum fractions, were detected in the free product within the Southwestern Area and thus rendered this PCB-containing free product at the Site subject to CERCLA response authority and liability.

PCB-contaminated soils were not specifically targeted in the 2000 ROD. However, according to the EPA Guidance on Remedial Actions for Superfund Sites with PCB Contamination (OSWER Directive No. 9355.4-01), principal threats generally include material contaminated at PCB concentrations exceeding 100 mg/kg for sites in residential areas and concentrations exceeding 500 mg/kg for sites in industrial areas reflecting concentrations one to two orders of magnitude higher than the PRGs.

As such, Principal Threat Waste at the Site has been determined to include free product contaminated with PCBs, grossly contaminated soils with free product contaminated with PCBs, and contaminated soils with PCB concentrations exceeding 500 mg/kg. The grossly contaminated soils herein are defined as soils that contain visibly identifiable free or otherwise readily detectable free or residual PCB-containing product.

2.2 Applicable or Relevant and Appropriate Requirements (ARAR), Guidance, and Other Criteria

As required under Section 121 of CERCLA, remedial actions carried out under Section 104 or secured under Section 106 must be protective of human health and the environment and attain the levels or standards of control for hazardous substances, pollutants, or contaminants specified by the ARARs of federal environmental laws and state environmental and facility siting laws, unless waivers are obtained. According to EPA guidance, remedial actions also must take into account non-promulgated TBC criteria or guidelines if the ARARs do not address a particular situation.

The degree to which these environmental and facility siting requirements must be met varies, depending on the applicability of the requirements. Applicable requirements must be met to the full extent required by law. CERCLA provides that permits are not required when a response action is taken onsite. The NCP defines the term onsite as the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for the implementation of the response action (40 Code of Federal Regulations [CFR] 300.5). Although permits are not required, the substantive requirements of the applicable permits must be met.

A requirement under CERCLA, as amended, may be either "applicable" or "relevant and appropriate" to a site-specific remedial action, but not both. The distinction is critical to understanding the constraints imposed on remedial alternatives by environmental regulations other than CERCLA.

Applicable Requirements

Applicable requirements pertain to those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable. Applicable requirements are defined in the NCP, under 40 CFR 300.5 -- Definitions.

Relevant and Appropriate Requirements

Relevant and appropriate requirements pertain to those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site per se, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate. Relevant and appropriate requirements are defined in the NCP, under 40 CFR 300.5 -- Definitions.

Other Requirements To Be Considered (TBCs)

These requirements pertain to federal and state criteria, advisories, guidelines, or proposed standards that are not generally enforceable but are advisory and that do not have the status of potential ARARs. Guidance documents or advisories "to be considered" in determining the necessary level of remediation for protection of human health or the environment may be used where no specific ARARs exist for a chemical or situation, or where such ARARs are not sufficient to be protective.

Potential ARARs and TBC criteria are divided into three groups:

- Chemical-specific ARARs and TBC criteria
- Location-specific ARARs and TBC criteria
- Action-specific ARARs and TBC criteria

Each of these groups of ARARs and TBCs is described below. Summaries of the potential ARARs and TBCs criteria are provided in Tables 2-1 through 2-3.

2.2.1 Chemical-specific ARARs and TBCs

Chemical-specific ARARs are health- or technology-based numerical values that establish concentration or discharge limits for specific chemicals or classes of chemicals. If more than one requirement applies to a contaminant, compliance with the more stringent applicable ARAR is required. In the absence of ARARs, TBC criteria and guidance values are considered.

2.2.1.1 Federal Standards and Guidelines

ARARs

- TSCA Spill Cleanup Policy (40 CFR Part 761) regulates the cleanup, treatment, and disposal of PCBs.

TBCs

- Guidance on Remedial Actions for Superfund Sites with PCB Contamination (OSWER Directive No. 9355.4-01) provides guidance on selection of PRGs and remedial actions for PCBs at a Superfund site.

- EPA RSL for Chemical Contaminants at Superfund Sites provides risk-based screening levels for residential and industrial screening levels for soil, air, and tap water. The RSLs for industrial soil are considered applicable for the Site.

- EPA guidance *A Guide to Principal Threat and Low Level Threat Wastes*.

2.2.1.2 New Jersey Standards and Guidelines

New Jersey State chemical-specific standards and guidelines exist for various media present at the Site, including soil and groundwater. However, this report focuses only on contaminated soil at the Site. The NJDEP impact to groundwater soil remediation standards for the site contaminants will not be considered, because impact to the groundwater from the site contaminants are currently being addressed under the OU1 remedy.

ARARs

- Cleanup Standards for Contaminated Sites: New Jersey Soil Remediation Standard (NJSRS). (N.J.A.C. 7:26D) – Non-residential direct contact soil remediation standards will be considered in the development of cleanup levels.

2.2.2 Location-Specific ARARs

Location-specific ARARs are those which are applicable or relevant and appropriate due to the location of the Site or area to be remediated. Possible applicable regulations at the Site are relevant to wetlands, historical places, archaeological significance, endangered species, and wildlife habitats.

2.2.2.1 Federal Standards and Guidelines

Wetlands and Floodplains Standards and Regulations

- Statement on Procedures on Floodplain Management and Wetlands Protection (40 CFR 6 Appendix A)

- Policy on Floodplains and Wetland Assessments for CERCLA Actions (OSWER Directive 9280.0-12, 1985)
- Wetlands Executive Order(EO) (EO 11990)
- Floodplain Executive Order (EO 11988)

Wildlife Habitat Protection Standards and Regulations

- Federal Endangered Species Act (16 USC 1531 et seq.; 40 CFR 400)
- Federal Fish and Wildlife Conservation Act (16 USC 2901 et seq.)

Cultural Resources

- National Historic Preservation Act (40 CFR 6.301)

Historic Preservation Standards and Regulations

- National Historic Preservation Act (40 CFR 6.301)

2.2.2.2 New Jersey Standards and Guidelines

Wetlands and Floodplains Standards and Regulations

- New Jersey Flood Hazard Area Control Act - Floodplain Use and Limitations (N.J.A.C. 7:13)
- New Jersey Freshwater Wetland Protection Act - Freshwater Wetlands Protection Act Rules (N.J.S.A. 13:9B-1; N.J.A.C. 7:7A)

Wildlife Habitat Protection Standards and Regulations

- New Jersey Endangered and Non-Game Species Conservation Act (N. J. S. A. 23:2A-1 to -13)
- New Jersey Endangered Plant Species List Act - Endangered Plant Species Program (N.J.S.A. 13.1B-15.151 to -15.158; N.J.A.C. 7:5B)

2.2.3 Action-Specific ARARs

Action-specific ARARs are requirements which set controls and restrictions to particular remedial actions, technologies, or process options. These regulations do not define site cleanup levels but do affect the implementation of specific remedial technologies. For example, although outdoor air has not been historically identified as a contaminated medium of concern, air quality ARARs are listed below, because some potential remedial actions may result in air emissions of toxic or hazardous substances. These action-specific ARARs are considered in the screening and evaluation of various technologies and process options in subsequent sections of this report.

2.2.3.1 Federal Standards and Guidelines

General - Site Remediation

- RCRA: Identification and Listing of Hazardous Waste (40 CFR 261); Standards Applicable to Generators of Hazardous Waste (40 CFR 262); Standards Applicable to Owners and Operators of Treatment, Storage, and Disposal Facilities (40 CFR 264)

Transportation of Hazardous Waste

- Hazardous Materials Transportation Regulations (49 CFR 107, 171, 172, 177, and 179)

- Federal Resource Conservation and Recovery Act - Standards Applicable to Transporters of Hazardous Waste (40 CFR 263).

Disposal of Hazardous Waste

- Federal Resource Conservation and Recovery Act - Land Disposal Restrictions (40 CFR 268).

Disposal of PCB Waste

- TSCA Spill Cleanup Policy (40 CFR Part 761).

Discharge of Groundwater

- Federal Clean Water Act - National Pollutant Discharge Elimination System (40 CFR 100 et seq.); Effluent Guidelines and Standards for the Point Source Category (40 CFR 414); Ambient Water Quality Criteria (40 CFR 131.36).

Off-Gas Management

- Federal Clean Air Act - National Ambient Air Quality Standards (40 CFR 50); National Standards of Performance for New Stationary Sources (40 CFR 60); National Emission Standards for Hazardous Air Pollutants (40 CFR 61).

- Federal Directive - Control of Air Emissions from Superfund Air Strippers (OSWER Directive 9355.0-28)

2.2.3.2 New Jersey Standards and Guidelines

General - Site Remediation

- Technical Requirements for Site Remediation (N.J.A.C. 7:26E)

- New Jersey Soil Erosion and Sediment Control - Soil Erosion and Sediment Control Standards (N.J.A.C. 16.25A)

- Vapor Intrusion Guidance (NJDEP, October 2005)
- Soil Erosion and Sediment Control/Mitigation (N.J.A.C. 7:13-3.3, 3.4)
- Noise Control (N.J.A.C. 7:29)
- Identification and Listing of Hazardous Waste (N.J.A.C. 7:26G-5)

Transportation of Hazardous Waste

- Transportation of Hazardous Materials (N.J.A.C. 16:49)

Discharge

- The New Jersey Pollutant Discharge Elimination System (N.J.A.C. 7:14A)

Disposal of Hazardous Waste

- Land Disposal Restrictions (N.J.A.C. 7:26G-11)

Off-Gas Management

- New Jersey Air Pollution Control Act - Air Permits and Certificates (N.J.A.C. 7:27-22)
- Air Pollution Control, Standards for Hazardous Air Pollutants (N.J.A.C. 7:27)
- Ambient Air Quality Standards (N.J.A.C. 7:27-13)

2.3 Preliminary Remediation Goals

2.3.1 Preliminary Remediation Goals for Soil

The PRGs for soil at the Site have been developed to: (1) reduce or eliminate the direct contact risk associated with contaminated soil to levels protective of a commercial/industrial use and (2) remediate Principal Threat Waste. The direct contact risk can be reduced or eliminated by providing two feet of clean soil cover at areas with surface soil contamination. The surface soil herein is defined as the top two feet of the soils beneath the existing gravel cover or concrete slab, where present. For alternative development purpose, two feet of contaminated surface would be excavated and backfilled with clean soil in order to maintain the current topography for drainage consideration. This approach may be reevaluated during the remedial design phase.

EPA Guidance on Remedial Actions for Superfund Sites with PCB Contamination (OSWER Directive No. 9355.4-01), New Jersey Soil Remediation Standards (NJAC 7:26D), EPA RSL for industrial soil, the HHRA, and site background are used to develop the PRGs for surface soils at the Site. The selection of the PRGs involves a two-step process: (1) the PRGs were selected such that they represent the more stringent criteria between the NJDEP NRDCSRS and the EPA RSL for industrial soil and (2) the PRGs are the higher of the standards/screening levels or the Site-specific background levels.

As discussed earlier, Principal Threat Waste at the Site has been determined to include free product contaminated with PCBs, grossly contaminated soils with free product contaminated with PCBs, and soils contaminated with PCB concentrations exceeding 500 mg/kg.

Table 2-4 summarizes the selected PRGs.

2.3.2 Area and Volume of Soil to be Remediated

Estimates were made of the quantity of contaminated soil present at the Site. These estimates were determined based on the contaminant data collected during the historical site investigations as well as the 2008 CDM data gap field investigation program that exceeded the PRGs.

The approximate areas to be remediated are depicted on Figure 2-1, including areas where surface soil contamination exceeds PRGs and areas where subsurface soil contamination exceeds PRGs related to Principal Threat Waste. Quantity estimates of the area and volume of soils to be remediated are presented in Table A-1 in Appendix A. In summary, the volume of soil that needs to be remediated is approximately 39,000 CY. The volume estimates are based on limited data and are for the purpose of alternative development. Several conservative assumptions were made to arrive at the estimates, as listed below.

- Horizontal limits of soil to be remediated are generally bound by the soil borings exhibiting soil sampling results below PRGs.

- For surface soil remediation, the volume estimate includes the upper most two feet of soil, excluding the gravel layer or concrete slab, if present.

- For subsurface soil remediation, soil to be remediated is determined by the soil sampling results, regardless of where the groundwater table was encountered at the time of sampling (i.e., saturated soil exceeding PRGs will need to be included in the soil to be remediated).

- The depth of soil to be remediated for each of the subsurface areas is defined by the next clean (i.e., below PRGs related to Principal Threat Waste) sample below the deepest contaminated (i.e., above PRGs related to Principal Threat Waste) sample within that area. This assumption will be confirmed during the remedial design phase.

- For individual areas, the vertical extent of soil to be remediated extends from grade to the depth of soil to be remediated as calculated above, and thus includes the existing clean gravel layer, if present. The clean gravel taken from the contaminated areas would be staged onsite for later re-use during the backfilling of subsurface excavations.

Due to the limited number of samples, the volume estimates represent preliminary estimates of volume of soil to be remediated. As a result, the volume to be remediated will be refined once the full extent of contaminated soil has been determined during the remedial design phase.

For waste treatment and disposal purposes, the contaminated soils are divided into the categories described below.

1. TSCA waste (with PCB concentrations above 50 mg/kg) will be disposed of in a TSCA landfill or treated onsite prior to onsite re-use.

2. Hazardous waste, (i.e., soils that fail TCLP) will require onsite treatment prior to onsite re-use, off-site treatment to meet Land Disposal Restriction prior to disposal in a RCRA Subtitle C landfill, or disposal directly in a RCRA Subtitle C landfill.

3. Non-hazardous waste with other contaminants will be soil that passes TCLP but exceeds the PRGs. The soil can be backfilled on site or disposed of in an industrial waste landfill.

2.4 General Response Actions

GRAs are broad categories of actions that might satisfy the RAOs and that characterize the range of remedial responses appropriate to the media of concern at the Site. Following the development of GRAs, one or more remedial technologies and process options were identified for each general response action category. Although an individual response action may be capable of satisfying the RAOs alone, combinations of response actions are usually required to adequately address site contamination. GRAs applicable to soil remediation at this Site are described below.

2.4.1 No Action

The NCP and CERCLA require the evaluation of a No Action alternative as a basis for comparison with other remedial alternatives. Under the No Action alternative, no remedial actions are implemented, the current status of the site remains unchanged, and no action is taken to reduce the potential for exposure to contamination.

2.4.2 Institutional/Engineering Controls

Institutional/Engineering Controls typically are restrictions placed to minimize access or future use of the Site. Examples of Institutional Control include well drilling restrictions or classification exception area [CEA] designation, whereas an example of Engineering Control includes fencing. These limited measures are implemented to provide some protection of human health and the environment from exposure to Site contaminants. They are also used to continue monitoring contaminant migration (e.g., long-term monitoring). Institutional/ Engineering Controls are generally used in conjunction with other remedial technologies; alone they are not effective in preventing contaminant migration or reducing contamination.

2.4.3 Containment

Containment response actions use physical barriers and/or groundwater extraction wells to minimize or eliminate contaminant migration. Containment response actions can be in-situ or ex-situ.

For soil contamination, in-situ containment generally refers to a cover or cap system and/or vertical barrier. These caps can be multi-layered (e.g., RCRA hazardous waste cap) or single layered to prevent direct contact with contaminants. Low-permeability vertical barriers can be installed to isolate the contaminated area from surface water infiltration. Ex-situ containment usually refers to removal of the impacted medium and placement of it in a landfill. The landfill can be located on or off site. Off-site landfilling is discussed in subsequent sections as a disposal response action. Containment response actions minimize direct human contact with contaminated soil, control volatilization or windblown dispersion of contaminants into the air, and reduce infiltration of leachate into the groundwater.

Containment technologies do not involve treatment to reduce the toxicity or volume of the contaminants at the site. These response actions require long-term monitoring to determine whether containment measures are performing successfully. The NCP does not prefer containment response actions since they do not provide permanent remedies.

2.4.4 Removal

Removal response actions refer to methods typically used to excavate and handle soil, sediment, waste, and/or other solid materials. Excavation technologies provide no treatment of wastes, but may be used prior to treatment or disposal to remove wastes from designated areas. Removal technologies would be considered support technologies for treatment and disposal response actions.

2.4.5 Treatment

Treatment of contaminated soil includes both in-situ treatment technologies and ex-situ treatment technologies in conjunction with removal response actions. Treatment response actions reduce the toxicity, mobility, and/or volume of contaminants. The use of treatment technologies to achieve RAOs is favored by CERCLA, unless site conditions limit their application.

2.4.6 Discharge/Disposal

Disposal response actions for soil involve the disposal of excavated soil in an off-site facility permitted for the specific waste type, or backfill onsite if treated to regulatory limits.

Discharge response actions for groundwater involve the discharge of extracted groundwater (e.g., through dewatering at the Site during remedial action) via onsite injection, onsite surface recharge or surface water discharge following treatment to meet regulatory discharge and disposal requirements.

2.5 Identification and Screening of Remedial Technologies and Process Options

Potential remedial technologies and process options associated with each GRA are identified and screened in this section. Representative remedial technologies and process options that have been retained are used to develop remedial action alternatives, either alone or in combination with other technologies.

The technology screening approach is based on the procedures outlined in the *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA 1988). The evaluation process uses three criteria: Effectiveness, Implementability, and Relative Cost. Among these three, the effectiveness criterion outweighs the implementability and relative cost criteria. These criteria are described below.

Effectiveness - This evaluation criterion focuses on the potential effectiveness of process options to handle the estimated areas or volumes of media and to meet the remediation goals identified in the RAOs. It also evaluates the potential impacts to human health and the environment during the construction and implementation phase, and how proven and reliable the process is with respect to Site-specific conditions.

Implementability - This evaluation criterion encompasses both the technical and administrative feasibility of the technology or process option. Technical implementability is used as an initial screening of technology types and process options to eliminate those that are clearly ineffective or unworkable at a site. It includes an evaluation of pretreatment requirements, residuals management, and the relative ease or difficulty to perform the operation and maintenance (O&M) requirements. Process options that are clearly ineffective or unworkable at the site are eliminated by this criterion.

Relative Cost - Cost plays a limited role in the screening process. Both capital costs and O&M costs are considered. The cost analysis is based on engineering judgment and each process is evaluated as to whether costs are low, moderate, or high relative to the other options within the same technology type.

Results of this technology and process option screening are described in Table 2-5 Technology Evaluation for Soil.

2.5.1 No Action

The No Action alternative is not a technology. The NCP requires that a No Action alternative be considered as a basis for comparison.

Effectiveness – The No Action alternative is used as a baseline against which other technologies may be compared. It generally does not provide measures that would comply with ARARs, or otherwise meet RAOs.

Implementability – The No Action alternative is implementable given there is no action required.

Relative Cost – The No Action alternative involves no capital or O&M costs.

Conclusion - The NCP requires that the No Action alternative be retained for further consideration.

2.5.2 Institutional/Engineering Controls

Institutional/Engineering Controls do not reduce the toxicity, mobility, or volume of contamination, but can be implemented to reduce the probability of exposure to contaminants. Institutional/Engineering Controls typically are restrictions placed to minimize access or future use of the site. These limited measures are implemented to provide some protection of human health and the environment from exposure to site contaminants. They are also used to continue monitoring contaminant migration and are generally used in conjunction with other remedial technologies; alone they are not effective in preventing contaminant migration or reducing contamination. Some degree of institutional/engineering control measures will need to be taken at the Site as a component of the remedy to be selected, unless the active treatment can remediate the entire Site below all applicable soil cleanup criteria.

As will be discussed in Section 3, Institutional/Engineering Controls will be a common component of the remedial alternatives that are under consideration in this FFS except the No Action alternative.

2.5.2.1 Fencing

The Site is currently inactive and secured with a locked chain-link fence.

Effectiveness - Fencing can reduce site access but does not reduce the toxicity, volume, or mobility of the contaminated media, which will continue to pose risks to the environment.

Implementability - This process option is easily implemented for the Site, since an existing fence is already in place. Equipment for fence maintenance/repair is readily available.

Relative Cost - This process option has relatively low capital cost and low O&M cost.

Conclusion - Fencing will be retained for further consideration for soil remediation.

2.5.2.2 Deed Notices

Deed notices are regulatory actions that are used to control future use of a property. They typically would: (1) indicate the types and extent of residual contamination onsite in soils and groundwater at the completion of remedial action, (2) limit the property to certain use (commercial/industrial for the Site), and (3) require that future property users refrain from activities that would disturb residual contamination, or take measures to address the residual contamination if it must be disturbed.

Effectiveness - Deed notices may effectively meet RAOs from a human health standpoint through restriction of future site uses or activities which may result in direct contact with contaminated soil. Deed notices would not reduce exposures to biota or potential migration of contaminants from soil.

Implementability - Deed notices limit the use of contaminated property. Deed notices may be difficult to enforce over the long term and may limit future land use options. However, deed notices may be implemented, in addition to remediation activities, as protective measures to prevent exposure to contaminants during remediation.

Relative Cost - The cost to implement deed notices is relatively low.

Conclusion - Deed notices will be retained for further consideration.

2.5.2.3 Long-Term Monitoring

Long-term monitoring includes periodic sampling and analysis of soils. This program would provide an indication of the breakdown and/or movement of the contaminants and the progress of remedial activities.

Effectiveness - Monitoring is a proven and reliable process to track the migration of contaminants. However, PCBs and metals in soils are not prone to migration or attenuation via natural processes. Long-term monitoring is effective in monitoring the migration and degradation of VOCs. Long-term monitoring alone would not be effective in meeting the RAOs, as it will not prevent or minimize exposure of contaminated surface soil to the environment.

Implementability - Long-term monitoring could be easily implemented. All monitoring locations are easily accessible for sample collection.

Relative Cost - Long-term monitoring involves relatively low capital and medium O&M cost.

Conclusion - Long-term monitoring will be retained for further consideration. Although it is an inappropriate control for the COCs by itself, it can be coupled with other remedial technologies and process options that can effectively address the COCs.

2.5.3 Containment

Containment technologies are implemented to reduce contaminant mobility but do not directly impact contaminant toxicity or volume. However, by reducing contaminant mobility, containment will reduce or eliminate potential exposures. Containment technologies are typically accompanied by long-term monitoring to verify that they continue to be effective.

2.5.3.1 Capping

Capping is a process which can be used to isolate contaminated media from direct contact with humans or biota, contact with surface runoff, or infiltration of precipitation. Capping can isolate contaminated media from groundwater. Therefore, it reduces or eliminates the possibility of leaching contaminants into groundwater. There are two basic cap designs: single-layered and multi-layered. Single-layered caps are used most commonly to prevent direct contact risks. Multi-layered caps are mostly used to cover RCRA hazardous wastes that may leach contaminants to groundwater

2.5.3.1.1 Single Layered (Non-RCRA) Cap

The non-RCRA cap is a single layer cap (e.g., clay, soil, gravel, asphalt, or concrete) that is compatible with site contaminants and placed over treated or untreated soil to minimize direct contact with contaminants.

Effectiveness – Installation of a non-RCRA cap would be effective in meeting RAOs by preventing direct contact with, or migration of, contaminated soil. It does not reduce toxicity or volume of contaminated soil. The proper selection of the cap material would ensure long-term effectiveness of the cap. Leaving capped soils onsite would limit the future use of the property.

Implementability – The cap would be installed using conventional earth-moving construction equipment. Issues with flooding could reduce implementability. There is an existing gravel cover onsite.

Relative Cost – A non-RCRA cap involves relatively low capital and O&M costs.

Conclusion - The non-RCRA cap will be retained for further consideration as a component of containment of the Site.

2.5.3.1.2 Multi-Layered (RCRA) Cap

Multi-layered caps are mostly used to cover RCRA hazardous wastes that pose a potential for migration into groundwater. A RCRA cap typically consists of (from top to bottom): a vegetative soil layer, a protective soil layer, a drainage layer, one or more clay/synthetic liners, and a bedding layer. A vapor/gas collection system may be necessary when there is an indication that the underlying contaminated material will generate gases or vapors. The design of multi-layered caps usually conforms to performance standards in 40 CFR 264.310, which addresses RCRA Subtitle C hazardous waste landfill closure requirements. These standards include minimum liquid migration through the waste, low cover maintenance requirements, efficient site drainage, high resistance to damage by settling or subsidence, and permeability lower than or equal to the underlying liner system or natural soils.

Effectiveness – A RCRA cap is considered to be the best-engineered cap currently available to ensure long-term durability and to minimize vertical infiltration of precipitation. It is effective in meeting RAOs by preventing infiltration of precipitation and direct contact with soil, but may affect the effectiveness of the OU1 remedy by minimizing vertical infiltration and subsequent flushing. In addition, leaving capped soils onsite would limit the future use of the property.

Implementability – A RCRA cap is composed of both clay and synthetic liners and is therefore subject to the design and implementation constraints of these materials. A RCRA cap would raise site topography by several feet; the cap thickness could be reduced with a geocomposite clay liner in place of the clay cap. Issues with flooding may reduce implementability. Installation of a RCRA cap on PCB-contaminated soil at the site would require installation and maintenance at several small areas, as excavation and onsite consolidation of PCB-contaminated material would not be possible without construction of an onsite landfill cell.

Relative Cost – A RCRA cap involves relatively high capital and medium O&M costs.

Conclusion - A RCRA hazardous waste cap will not be retained for further consideration, as it is not more advantageous than a non-RCRA cap in terms of preventing direct contact with contaminated soil and may hinder the effectiveness of OU1 remedy by minimizing vertical infiltration and subsequent flushing.

2.5.4 Removal

2.5.4.1 Excavation

Excavation technologies use standard earthwork equipment to excavate contaminated soil for consolidation, treatment, and/or disposal. In general, heavy machinery can be utilized to remove large quantities of soil. A variety of equipment (e.g., backhoes, bulldozers, front end-loaders) can be used for excavation. Manual excavation is useful for removal of small amounts of soil or when heavy machinery cannot be used in certain hard to access areas. Dewatering of excavation areas may be required when excavating below the water table.

Effectiveness – Excavation alone would not achieve the RAOs, but it is effective in removing solid materials. It is a support technology for the treatment or disposal of contaminated soil. It would not reduce the toxicity, mobility, or volume of contamination. It is a common construction technique and does not require long-term maintenance.

Implementability – Excavation of soil is technically and administratively feasible. The process uses commercially available equipment.

Relative Cost – Excavation has relatively low capital and no O&M costs.

Conclusion - Excavation will be retained for further consideration.

2.5.5 Treatment

2.5.5.1 Biological Treatment

This category of remedial technology reduces the toxicity, mobility, and/or volume of contaminants by biodegradation processes. The process options included in this technology category for screening are in-situ biodegradation and land-farming.

2.5.5.1.1 *In-Situ Bioremediation*

In-situ bioremediation takes advantage of the intrinsic biodegradation (i.e., natural breakdown of contaminants by microorganisms in the soil and/or groundwater), through which contaminants are converted to innocuous end products. The microorganisms may be indigenous or the media may be inoculated. In-situ bioremediation can be accomplished either aerobically or anaerobically, although generally it is more rapid under aerobic condition. The rate at which contaminants degrade is influenced by the specific contaminant concentrations, oxygen concentration, moisture, temperature, pH, nutrient supply, rate of bioaugmentation (enhanced bioremediation), and cometabolism.

Effectiveness – In-situ bioremediation is typically used to address petroleum hydrocarbons, chlorinated solvents, and other organic compounds such as PAHs. However, it is not effective in removing PCBs or metals (in-situ biodegradation in some cases is capable of changing the valence state of some inorganics to aid in adsorption, immobilization, precipitation, uptake, accumulation, and concentration in micro- or macro-organisms. Moreover, this process is relatively difficult to predict, and the immobilized inorganics can become mobile again at a later time subject to change of subsurface conditions) and hence need to couple with some other remedial technology to treat these contaminants.

Implementability – In-situ bioremediation is a proven technique for soils contaminated by BTEX and TPH under appropriate site conditions. Vendors are available for this service. However, potential complications may arise during the implementation of in-situ bioremediation, such as preferential colonization of microbes resulting in delivery system clogging. In addition, treatment may take a long time depending upon specific site conditions.

Relative Cost – This process involves medium capital and low to medium O&M costs.

Conclusion – In-situ bioremediation is eliminated from further consideration because of potential complications with implementation, as well as its inability to treat PCBs and metal contamination.

2.5.5.1.2 *Land-Farming*

Land-farming involves placement of excavated contaminated soils, sediments, or sludges onto lined beds (coupled with other methods to control leaching of contaminants) and are periodically turned over or tilled to aerate the waste. Soils are maintained at appropriate conditions to optimize the rate of contaminant degradation, and the controlled conditions normally include moisture, aeration, pH, and nutrients. Contaminated media is usually treated in lifts.

Effectiveness – Land-farming is effective in treating petroleum hydrocarbons but the degradation rate generally deceases as the molecular weight gets higher. Field success has been demonstrated for diesel fuel, No. 2 and No. 6 fuel oils, oily sludge, and certain pesticides. However, it is not effective in removing PCBs or metals, and hence needs to be coupled with some other remedial technology to treat these contaminants.

Implementability – Land-farming is a proven technique for TPH contaminated soil with vendors available for this service. However, compared to some other remedial technologies, land-farming is a relatively slow process, and thus requires a large amount of space for considerable amount of time. The Site is located within the 100-year flood zone, and is thus subject to the applicable New Jersey Flood Hazard Area Control Act - Floodplain Use and Limitations (N.J.A.C. 7:13), which would prohibit construction of any permanent structure (the treatment unit to be constructed during land-farming may be considered a permanent structure). As such, land-farming may not be administratively implementable onsite. However, there are vendors offering land-farming treatment of TPH-contaminated soil at off-site locations. The treated soils, when suitable, are used as fill, landfill caps or road base.

Relative Cost – This process involves relatively medium capital and medium O&M costs.

Conclusion – Land-farming is eliminated from further consideration for onsite treatment because of potential administrative issues in implementation. Off-site land-farming is retained for further consideration as a component of off-site treatment/disposal.

2.5.5.2 Physical/Chemical Treatment

The focus of this category of remedial technology is to reduce the toxicity, mobility, and/or volume of contaminants through physical/chemical processes. Physical/ chemical treatment includes both in-situ and ex-situ remedial technologies (e.g., electrokinetic technologies, soil washing, and soil flushing) as well as those performed in conjunction with removal actions.

2.5.5.2.1 Chemical Oxidation

In-situ chemical oxidation (ISCO) is an aggressive approach that involves injecting chemical oxidants into the subsurface to destroy organic contaminants in soil. Complete oxidation of TPHs and PCBs results in their breakdown into less toxic compounds such as carbon dioxide, water, and/or chloride. A number of factors affect the performance of this technology, including the delivery of the oxidant to the subsurface, oxidant type, dose of oxidant, contaminant type and concentration, and soil contaminant oxidant demand. Repeat application of the oxidant is generally required due to mass transfer from areas of low permeability into areas of higher permeability.

Effectiveness – ISCO is an effective treatment to reduce TPH levels and is used most often at source areas. ISCO is generally not used for areas with non-aqueous phase liquids (NAPLs), which is the case at this Site. An application of heated persulfate may be required due to the presence of PCBs. The effectiveness of ISCO depends on adequate contact between the oxidants and contaminants. Subsurface heterogeneities could affect delivery of the oxidant. In addition, oxidants would need to overcome the soil oxidant demand, which is anticipated to be high based on the soil type encountered during the field investigation (rich in organic content). A bench-scale test for soil oxidant demand would be necessary to determine oxidant loading. ISCO is not effective in removing metals, and hence would need to be coupled with some other remedial technology to treat these contaminants.

Implementability – ISCO is generally used to treat soil contamination within small areas. Oxidants can be injected into the subsurface through injection wells or temporary injection points using direct push technology. The distance between injection wells or injection points is generally small, approximately 30 feet. To treat the large soil treatment zone at the Site, a large number of injection points and significant amount of oxidants would be required, which would be difficult to implement.

Relative Cost – This process involves relatively high capital and low O&M costs. The cost to treat NAPLs would be prohibitively high.

Conclusion – ISCO is eliminated from further consideration because of the anticipated high soil oxidant demand that could significantly reduce the effectiveness of chemical oxidation. It would also be difficult to implement and would be prohibitively expensive.

2.5.5.2.2 *Electrokinetics*

Electrokinetics involves application of a low-density (milliampere per square centimeter) direct current through the soil matrix between electrodes that are divided into a cathode array and an anode array, and thus induce a series of electrokinetic phenomena (e.g., electromigration, electroosmosis, electrolysis, etc.) that can mobilize and transport contaminants from soil pore water into treatment zones, where the contaminants can be captured. Primary components of the technology include the following:

- Electrodes energized by direct current to treat soil, which causes water and soluble contaminants to move into or through the treatment layers
- Treatment zones containing reagents that decompose the soluble organic contaminants or adsorb contaminants for immobilization or subsequent removal and disposal
- Water management systems that recycles water that accumulates at the cathode (high pH) back to the anode (low pH) for acid-base neutralization

Based on the electrokinetic technology, an integrated and in-situ remediation technology, Lasagna™ has been developed by an industrial consortium consisting of Monsanto Company, E.I. DuPont de Nemours & Co., Inc., and General Electric Company, with participation from the Department of Energy (DOE) Office of Environmental Management, Office of Science and Technology, and the EPA Office of Research and Development. The process can be applied in either a vertical or a horizontal configuration, although fieldwork is more advanced for the vertical configuration.

Effectiveness – Electrokinetics is an effective treatment in removing metals and works well even in low-permeability soil. It is potentially effective in both saturated and unsaturated soil but would require a minimum soil moisture content for the latter. Preliminary results suggested the optimum soil moisture content ranged between 10% and 20%. However, this process has limited effectiveness in removing petroleum products, TPHs and PCBs.

Implementability – Commercially available electrokinetics processes, such as Lasagna™, have been implemented at other sites with documented successes for treating a variety of contaminants. Extensive surface geophysical surveys and underground utility surveys would be required at the Site prior to field implementation. However, the Site does not appear to be amenable to this technology due to the presence of subsurface barriers/debris that were encountered during the historical investigations. These features may induce variability in the electrical conductivity of the soil and thus render the technology inefficient.

Relative Cost – This process involves medium capital and relatively high O&M costs.

Conclusion – Electrokinetics is eliminated from further consideration because of the limited effectiveness in removing petroleum hydrocarbons and PCBs, and, moreover, the uncertainty in implementability.

2.5.5.2.3 Soil Vapor Extraction

Soil Vapor Extraction (SVE) uses a vacuum to force air through the unsaturated zone. The effectiveness of SVE is primarily dictated by contaminant volatility and availability to air channels, which is mainly governed by contaminant solubility and tendency to sorb to solid surfaces and soil properties.

Effectiveness – SVE is effective in treating soils contaminated with VOCs such as BTEX. However, it is not effective in addressing PCBs, TPH or metal-contaminated soils. In addition, this technique would only be effective in the unsaturated zone, whereas a considerable amount of contaminated soil is located within the saturated zone at the Site.

Implementability – Much of the contamination is in the saturated zone, which renders this technology impractical at this Site.

Relative Cost - This process involves medium capital and medium O&M costs.

Conclusion – SVE is eliminated from further consideration due to effectiveness and implementability considerations as discussed above.

2.5.5.2.4 Solidification/Stabilization

This category of remedial technology reduces the mobility of contaminants by various processes. It would not reduce the toxicity or volume of the contaminants.

Solidification/stabilization of contaminated soil includes both in-situ and ex-situ remedial technologies. In-situ processes generally involve using a stabilizing agent that is applied to the contaminated soil zone in-situ to bind the contaminants in place. The binding agent (e.g., silica or cement-based, pozzolanic-based, proprietary agent, polymeric, or thermoplastic) is injected into the subsurface via a jet nozzle, or applied using large augers to mix the agent with the contaminated soil. Ex-situ processes generally involve using a stabilizing agent that is applied to the excavated contaminated media. The contaminated media is first excavated, transported to the treatment area, and thoroughly mixed with the binding agent (e.g., silica or cement-based, pozzolanic-based, proprietary agent, polymeric, or thermoplastic). Soil treated ex-situ can be backfilled onsite or disposed of off site as hazardous or non-hazardous waste, depending on TCLP results.

The processes immobilize contaminants within the stabilized mass or bind them in place, thereby reducing their mobility (and their leaching potential). The volume may increase from the addition of agents. Many vendors with proprietary binding agents are available. A treatability study would be required to determine the proper formula. In-situ mixing is less established than ex-situ techniques, primarily because specialized injection and mixing equipment must be used and homogeneous treatment is difficult to ensure. Long-term monitoring would be required for this process to assess leaching into groundwater over time.

Effectiveness– The process is effective in reducing the mobility of metal-contaminated soil with a properly selected binder. Volume may increase due to the addition of agents. Performance is dependent upon mixing efficiency. A treatability study would be required to determine the proper formula. It is not effective at treating TPH or PCB contaminated soil.

Implementability – Various treatment techniques and vendors are available. In-situ processes can be used on deep and difficult to excavate zones of contamination; however, in shallow excavations, other methods such as rototilling can be utilized. The volume may increase from the addition of agents, producing changes in grade. Long-term monitoring would be required for this process, if backfilled onsite, to assess leaching into groundwater over time. Use of this approach would not allow unrestricted future use of the property unless soils were disposed of off site.

Relative Cost – These processes involve medium capital and low O&M costs.

Conclusion - Onsite solidification/stabilization will not be retained for further consideration, due to the limited effectiveness in treating TPH or PCB-contaminated soil. However, off-site solidification/stabilization may be used as a component of off-site treatment/disposal (e.g., metal-contaminated soils).

2.5.5.3 Thermal Treatment

This category of remedial technology reduces the toxicity, mobility, and/or volume of contaminants by thermal processes. Thermal treatment uses high temperature oxidation under controlled conditions to degrade organic substances in the soil into gaseous products, such as CO_2, NOx, SO_2, HCl, and H_2O vapor. The process options included in this technology category for screening are incineration and low temperature thermal desorption (LTTD).

2.5.5.3.1 Onsite and Off-Site Incineration

Incineration should achieve the equivalent of 99.99 percent destruction efficiency for organic hazardous constituents, and 99.9999 percent destruction efficiency for PCBs and dioxin (dioxin was not identified at the Site but may potentially be generated during PCB incineration).

Incineration units such as multiple hearth, rotary kiln, and infrared systems are all applicable and would successfully treat the organic contaminated soils at a high temperature (1,500°F to 2,000°F). An onsite mobile incinerator can process approximately five tons of soil per hour. The incineration process evaporates excess water from the soil, vaporizes all volatile substances, and destroys organic matter. However, it will not remove or immobilize the metals present in the soil. Ash and residue generated from incineration may require further treatment for metals. Arsenic contaminated soils would need to be segregated for separate treatment. Additionally, TSCA waste (i.e., PCB concentrations greater than 50 mg/kg) must be treated separately.

Effectiveness – This proven technology is very effective at destroying hydrocarbons such as PCBs in soil. Incinerator ash can be safely disposed in a landfill; in some cases, it must be treated or confined to prevent the leaching of metals. Hazardous waste incinerators and similar processes are commonly used for highly efficient destruction of hazardous waste, including contaminated soils.

Implementability – Off-site PCB incinerators for burning contaminated soil are available from several sources. However, many facilities are processing at their capacity limits. A limited number of onsite incineration vendors have transportable incinerators to treat PCB-contaminated soil. As previously discussed, much of the contamination is in the saturated zone, which would affect the implementability of this technology (e.g., difficulty in feeding wet soil to incineration unit).

Relative Cost – Onsite incineration would involve relatively high capital cost, while off-site incineration would involve medium capital cost. Neither option would involve O&M costs.

Conclusion – Off-site and onsite incineration are eliminated from further consideration because of the limited number of onsite incineration vendors that have transportable units, permitting to mobilize/setup such onsite treatment unit, and more importantly, cost, especially given that in-situ thermal desorption (ISTD) or LTTD has the capability of treating PCB-contaminated soils at a much lower cost.

2.5.5.3.2 Vitrification

Vitrification is another form of solidification/stabilization process. This process uses electric current to melt soil (or other earthen materials) at extremely high temperatures, thereby destroying organic contaminants via pyrolysis and immobilizing most inorganic contaminants. The inorganic compounds are incorporated within the vitrified glass and crystalline structure. Water vapor and the pyrolysis products are typically captured/collected and treated. The vitrification product is a chemically durable, leach resistant, vitreous mass.

Effectiveness - Vitrification is effective in destroying organic compounds and reducing the mobility of metal wastes, and has documented successes in treating soils contaminated with volatile and semi-volatile compounds and most inorganic constituents.

Implementability - Vitrification has been shown to be effective at shallow depths (i.e., up to six meters) in relatively homogenous soils. However, in heterogeneous conditions as encountered at the Site, the achievable depth is limited. Much of the contamination at the Site is located in the saturated zone, which renders this technology very costly. The creation of secondary (off-gas) waste is also a concern.

Relative Cost - Vitrification has high capital costs, and no O&M costs.

Conclusion - Vitrification will not be further considered based upon the implementability and cost (ISTD can achieve similar results at much lower cost).

2.5.5.3.3 *In-Situ Thermal Desorption*

ISTD can treat a wide variety of organic compounds, including free product in the form of light or dense NAPLs. This system works in essentially the same way as ex-situ thermal desorption processes but uses conductive heating and vacuum to remediate soil. Heat and vacuum are applied simultaneously to subsurface soils, with either an array of vertical heater/vacuum wells or horizontally positioned heaters under imposed vacuum. Heat is applied to soil from a high-temperature surface in contact with the soil, so that radiation and thermal conduction heat transfer are effective near the heater. As a result, thermal conduction and convection occur across the soil volume, and create a zone of very high temperature (>1,000^{o}F) near the heaters, which can oxidize or pyrolize contaminants drawn into the zone. As the soil is heated, contaminants are vaporized and/or destroyed by a number of mechanisms: evaporation into the air stream, steam distillation, boiling, oxidation, or pyrolysis. The vaporized water and contaminants are drawn counter-current to the heat flow into the vacuum extraction wells. The soil can be heated to the boiling points of the contaminants and maintained at these temperatures for several days. Treatment of the contaminants in the heated soil is virtually complete, with a displacement efficiency approaching 100 percent.

Most contaminants are destroyed within the soil before they reach the extraction wells and are conveyed to the surface. For the contaminants that do reach the surface, the vapor treatment train includes a carbon adsorption system and vacuum blowers.

Effectiveness – ISTD is an effective process normally applied to media with high concentrations of volatile and semi-volatile organics, including LNAPLs and DNAPLs, but it is not effective in removing metals from contaminated soils.

Moreover, the remedy to be selected by the FFS is anticipated to improve the effectiveness and efficiency of the existing OU1 remedy that is currently in place, whereas ISTD will not be able to achieve that objective based on its lack of components such as excavating contaminated soils and removing debris that is impeding groundwater flow.

Implementability – There are multiple vendors available for this service. Remediation experience has included several full-scale projects, as well as pilot-scale applications. Thermal desorption is most effective with sandy soils. Off-gas treatment may be necessary to capture any organics that are vaporized during treatment.

Relative Cost – The process involves relatively high capital and high O&M costs; however, it can eliminate or significantly minimize the need for disposal of soil with PCB concentrations exceeding 50 ppm in a TSCA landfill, and thus achieve some cost savings therein.

Conclusion – ISTD will not be further considered primarily based upon the limited effectiveness in improving the effectiveness and efficiency of the existing OU1 remedy that is currently in place.

2.5.5.3.4 Low Temperature Thermal Desorption

LTTD is an ex-situ remedial technology, which is designed to heat excavated soil to sufficient temperature to allow contaminants to volatilize and desorb from the soil. The off-gas is generally collected and treated prior to discharge. The required treatment temperature is dependent upon the specific types of contaminants to be treated. For contaminants with relatively low boiling points (i.e., below 600°F) such as VOCs, the temperature of the LTTD unit generally ranges between 300°F and 600°F. Other contaminants that have higher boiling points, such as PCBs, generally require temperatures over 700°F.

One example of LTTD units that operate at the higher temperature end is a continuous-feed indirect-contact system owned by Maxymillian Technologies, which is designed to treat soils contaminated with a range of contaminants, including PCBs. This system reportedly uses a double-shell rotary dryer, with several burners mounted in the annular space between the two shells. The burners heat the exterior of the inner shell containing the waste as it rotates. Neither the burner flame nor the burner combustion gas contacts the contaminated materials or off-gas emanating from the materials, the thermal desorption system is considered to use an “indirect” mode of heating. The rotating action of the inner shell help breaks up the material, which enhances heat transfer and causes the soil to move laterally along the downward-sloped angle of the dryer assembly. The off-gas treatment system used in this system employs condensation and oil/water separation steps to remove the contaminants from the off-gas and residual streams. The concentrated liquid contaminants removed from the system are then collected for appropriate off-site treatment.

Effectiveness – Similar to ISTD, LTTD can treat a wide variety of organic compounds, including free product in the form of LNAPLs or DNAPLs. However, only LTTD units that operate above 700°F can treat soils contaminated by PCBs. In addition, LTTD cannot be used to treat soils contaminated by metals (e.g., arsenic), for which other remedial technologies (e.g., excavation and off-site disposal) will be required. Depending on the lack or presence of other commingling contaminants that cannot be treated by LTTD, the treated soil could be backfilled onsite without long-term management, or it will need to be disposed of in an off-site non-hazardous waste (RCRA Subtitle D) landfill or hazardous waste (RCRA Subtitle C) landfill. LTTD would be less desirable if the treated soil still has to be disposed of at a RCRA Subtitle C landfill subsequent to soil treatment.

Implementability – There are multiple vendors available for this service. Remediation experience has included a full-scale Superfund project in New Jersey where LTTD treatment of PCB-contaminated soils is on-going.

Because of the shallow groundwater table at the Site, most of the contaminated soils are expected to be saturated when excavated. As such, draining of the excavated soils to be treated would be required prior to treatment by the continuous-feed indirect-contact system due to processing issues caused by excessive moisture (ideal moisture content for the continuous-feed indirect-contact system is between 10 percent and 14 percent)

Relative Cost – The process involves relatively medium/high capital and no O&M costs.

Conclusion – LTTD will be retained for further consideration, but is anticipated to be coupled with other remedial technologies for metals and/or PCB contamination.

2.5.6 Disposal

2.5.6.1 Onsite Backfill

Onsite backfilling consists of depositing successfully treated soil back into the excavation area.

Effectiveness – Backfilling treated soil is a cost-effective method of depositing the treated soil.

Implementability – Onsite backfilling is implementable if the treated soil meets the PRGs.

Relative Cost – The process involves relatively low capital and no O&M costs.

Conclusion - Onsite backfill will be retained for further consideration in support of other technologies.

2.5.6.2 Off-Site Non-Hazardous Waste (RCRA Subtitle D) Landfill

This option involves disposing of the contaminated soil at an off-site non-hazardous waste (RCRA Subtitle D) disposal facility. Off-site landfills are commercially owned, permitted facilities that minimize potential environmental impacts of disposed waste.

Landfilling is considered a non-treatment alternative and is considered less desirable than treatment alternatives by CERCLA. Soil with low concentrations of PCBs may be disposed of in a non-hazardous waste landfill, subject to permit requirements.

Effectiveness - Landfill disposal is effective in preventing direct contact and in reducing the mobility of contaminants. The volume and toxicity of the waste are not reduced.

Implementability - This technology is implementable.

Relative Cost - This process involves medium capital and no O&M costs.

Conclusion – Off-site non-hazardous waste landfill disposal will be retained for further consideration for soil with low PCB concentrations.

2.5.6.3 Off-Site Hazardous Waste (RCRA Subtitle C) or Chemical Waste (TSCA) Landfill

Soil with PCB concentrations up to 50 mg/kg could be disposed of in a RCRA Subtitle C landfill as hazardous waste. Soil with PCB concentrations above 50 mg/kg would need to be disposed of in a TSCA landfill. Off-site landfills are commercially owned, permitted facilities that minimize potential environmental impacts of disposed waste. Landfilling is considered a non-treatment alternative and is considered less desirable than treatment alternatives by CERCLA.

Effectiveness - Landfill disposal is effective in preventing direct contact and in reducing the mobility of contaminants. The volume and toxicity of the waste are not reduced.

Implementability - RCRA Subtitle C and TSCA landfills that accept PCB-contaminated soils are available.

Relative Cost - This process involves relatively high capital and no O&M costs.

Conclusion - Off-site hazardous waste and TSCA landfill disposal will be retained for further consideration.

Section 3
Development of Remedial Action Alternatives

The objective of this section is to form a range of remedial action alternatives to remediate contaminated soil at the Site. To address the site-specific RAOs, a variety of alternatives were formulated by combining the technologies and process options retained in Section 2.

3.1 Development of Remedial Action Alternatives for Soil

The technologies and process options for soils retained in the screening process presented in Section 2 include:

- No Action
- Removal: soil excavation
- Treatment: LTTD thermal treatment
- Disposal: on-site backfilling, off-site non-hazardous waste (RCRA Subtitle D) landfilling, and off-site hazardous waste (RCRA Subtitle C) and chemical (TSCA) waste landfilling.

The technologies and process options retained after the screening step were combined into three alternatives designed to satisfy the RAOs presented in Section 2.1. To develop remedial alternatives for the Site, representative process options were selected from the same groups of remedial technologies, as appropriate. However, each process option may still be applicable and should be considered during final remedy development. The No Action alternative was retained in accordance with the NCP to serve as a baseline for comparison with the other alternatives for the Site. Since the FFS focuses on soil remediation, the alternatives presented herein will not address the onsite CWTS (constructed as part of OU1 remedy), whose operation, however, will continue through the completion of the soil remediation activities and the subsequent optimization study of the groundwater extraction system. The following alternatives will be evaluated and are described in detail below:

- Alternative S1: No Action
- Alternative S2: Excavation and Off-site Treatment/Disposal; Backfilling with Imported Clean Fill; and Institutional/Engineering Controls.
- Alternative S3: Excavation; On-site Low Temperature Thermal Desorption of Excavated Soil Characterized as necessary followed by On-site Backfilling or Off-site Disposal; Backfilling with Imported Clean Fill; and Institutional/Engineering Controls.

3.2 Description of Remedial Action Alternatives for Soil

3.2.1 Alternative S1 – No Action

The No Action alternative is considered in accordance with NCP requirements and provides a baseline for comparison with the other alternatives. Under this alternative, no further action would be implemented, and the current status of the Site would remain unchanged. Institutional controls would not be implemented to restrict future site development or use. With the exception of the existing security fences, engineering controls would not be implemented to prevent site access or exposure to site contaminants.

3.2.2 Alternative S2 - Excavation and Off-Site Treatment/Disposal; Backfilling with Imported Clean Fill; and Institutional/Engineering Controls

Since the Site is located in an industrialized area, the objective of this alternative is to prevent human exposure to contaminated soil. This alternative would include the following major components:

- Pre-design investigation
- Excavation of onsite soils exceeding PRGs as defined in Section 2.3
- Post remediation sampling to verify achievement of PRGs, as listed in Table 4-1
- Disposal of excavated soils at off-site facilities in accordance with applicable regulatory requirements
- Backfilling of excavated areas with imported clean fill
- Backfilling recovered existing gravel from completed excavation areas to the bottom portion of the subsurface excavation
- Implementation of institutional/engineering controls as necessary, due to the presence of soil contamination exceeding the PRGs
- Implementation of a soil management plan

The excavated soil may be disposed of as either chemical waste in a TSCA landfill, if the PCB concentrations are above 50 mg/kg; Subtitle C landfill waste, if it fails TCLP (off-site treatment, however, may be required to meet Land Disposal Restriction prior to disposal in a RCRA Subtitle C landfill), or; non-hazardous waste in an industrial waste landfill, if it passes TCLP.

3.2.3 Alternative S3 – Excavation; On-Site Low Temperature Thermal Desorption of Excavated Soil Characterized as Necessary Followed by On-Site Backfilling or Off-Site Disposal; Backfilling with Imported Clean Fill; and Institutional/Engineering Controls

Since the Site is located in an industrialized area, the objective of this alternative is to prevent human exposure to contaminated soil. This alternative includes the following major components:

- Pre-design investigation
- Excavation of onsite soils exceeding PRGs as defined in Section 2.3
- Post remediation sampling to verify achievement of PRGs, as listed in Table 4-1
- On-site LTTD treatment of excavated soils characterized as TSCA waste or RCRA hazardous waste
- Disposal of excavated non-hazardous soils at off-site facilities in accordance with applicable regulatory requirements
- Backfilling of excavated areas with recovered gravel and clean fill or the LTTD-treated soils
- Implementation of institutional/engineering controls as necessary, due to the presence of soil contamination exceeding the PRGs
- Implementation of a soil management plan

3.3 Screening of Remedial Alternatives

Since only a limited number of remedial alternatives were developed, all alternatives will be carried forward for detailed analysis in Section 4. Screening of remedial alternatives will not be performed.

Section 4
Detailed Analysis of Remedial Action Alternatives

In this section, detailed descriptions and preliminary design assumptions are presented for each alternative. These details are used to complete alternative evaluations and to estimate costs. The preliminary design assumptions were based on existing site information and data, and are expected to represent the site conditions that would be encountered during remedial action. The final configuration of the remedial action alternative selected for implementation would be determined during the remedial design phase of this project. In addition, the alternatives are analyzed and compared against seven of the nine criteria set forth in the NCP. State and community acceptance will be addressed in the ROD.

4.1 Evaluation Criteria

In the NCP, EPA has outlined nine evaluation criteria to be used to assess remedial alternatives. These criteria take into consideration the statutory requirements specified in Section 121 of CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986. In addition, EPA has issued additional guidance on the evaluation criteria in "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (1988). The criteria are classified into the three groups described below.

Threshold Criteria - Threshold criteria are requirements that each alternative must meet in order to be eligible for selection.

- Overall Protection of Human Health and the Environment
- Compliance with ARARs

Primary Balancing Criteria - These criteria are used to distinguish the relative effectiveness of each alternative so that decision makers can evaluate the strengths and weaknesses of each alternative.

- Long-term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume (TMV) Through Treatment
- Short-term Effectiveness
- Implementability
- Cost

Modifying Criteria - These factors are typically considered following review of this document and the Proposed Plan by the regulatory agencies and the public, and are formally documented as part of the ROD. These criteria are not evaluated in this FFS.

- Support Agency (State) Acceptance
- Community Acceptance

Brief discussions for each of the above criteria based on the CERCLA FS guidance (EPA 1988) are provided below.

- **Overall Protection of Human Health and the Environment** - This overall assessment is based on other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs. The evaluation focuses on a specific alternative's ability to provide adequate protection of human health and the environment, and how site risks associated with each pathway are eliminated, reduced or controlled through treatment, engineering or institutional controls. This criterion considers any unacceptable short-term or synergistic (e.g., cross-media) effects posed by an alternative.

- **Compliance with ARARs** - Alternatives are assessed as to whether they attain legally applicable or relevant and appropriate requirements of Federal and State environmental and public health laws, as well as non-promulgated advisories, criteria, and guidance.

- **Long-term Effectiveness and Permanence** - Alternatives are assessed for the long-term effectiveness and permanence they afford along with the degree of certainty that the remedy will prove successful. Factors which are considered include the magnitude of residual risks remaining following remedial action, and adequacy and reliability of the engineering and institutional controls, if used to manage untreated wastes or treatment residuals.

- **Reduction of Toxicity, Mobility, or Volume Through Treatment** - This evaluation criterion addresses the statutory preference to select remedial actions that use treatment technologies to permanently and significantly reduce the TMV of the hazardous substances as their principal element.

- **Short-term Effectiveness** - This criterion addresses the effects of the alternative on human health and the environment during construction and implementation of the remedial action. Factors that are considered include protection of remediation workers and the community during remedial actions, environmental impacts, and time until the remedial action is completed.

- **Implementability** - This criterion addresses the technical and administrative feasibility of implementing the alternative, and the availability of services and materials required for its implementation. The specific components of this criterion are described below.

- Technical feasibility includes: (a) construction and operation, including technical difficulties and unknowns associated with the technologies included in the alternative; (b) reliability of the technologies; (c) ease of undertaking additional remedial actions (more significant at sites for which an interim action is being conducted); and (d) monitoring considerations.

- Administrative feasibility refers primarily to the necessary coordination with other offices and agencies to obtain, for example, discharge permits, as well as site access. Availability of services and materials includes assessment of the availability of the treatment, storage, and disposal services necessary to implement the alternative; the availability of the technologies; and the availability of additional equipment or specialists. The CERCLA FS guidance (EPA 1988) also includes the potential to obtain competitive bids as part of this criterion.

■ **Cost** - An estimate of the cost for each alternative is determined so the costs can be compared to the level of protectiveness that each alternative provides. The typical cost estimate made during the FS is intended to provide an accuracy of +50 percent to -30 percent, as discussed in the EPA RI/FS guidance document. The types of costs that are assessed include the capital costs, O&M costs, and present worth costs.

- Capital Costs - The capital costs include both the direct and indirect capital costs required to implement the remedial action. Direct costs are comprised of construction costs for equipment, labor, materials, transportation, and disposal. Indirect costs include license and permit costs, startup and shakedown costs, engineering, services during construction, and contingencies. For the purposes of this FFS, mobilization and demobilization costs, start-up and health and safety expenses are included as capital costs.

- O&M Costs - These costs include labor and materials associated with O&M following the remedial action, such as cap maintenance or long-term monitoring costs. The EPA RI/FS guidance document recommends that O&M costs be determined for 30 years.

- Present Worth Costs - The present worth value of the capital and O&M costs is determined to evaluate expenditures that occur over different time periods so that the costs for remedial alternatives can be compared on the basis of a single figure. The present worth cost has been calculated based on federal policy which recommends assuming a 7% discount rate after inflation. Capital costs and O&M costs incurred after the first year were discounted for the net present worth analysis. Pursuant of the EPA RI/FS guidance document (EPA 1988), the costs are expected to be within -30 to +50 percent accuracy.

Analysis of costs was performed using vendor-supplied information, A Guide to Developing and Documenting Cost Estimates During the Feasibility Study (EPA

540-R-00-002, July 2000), and other references (e.g., RS Means 2010), supplemented by CDM's experience and vendor data.

- **Support Agency (State) Acceptance** - This criterion addresses technical and administrative preferences and issues that the State of New Jersey may have regarding each alternative. Alternatives are evaluated based upon their support/acceptance by NJDEP and other regulatory agencies. Support agency acceptance is typically considered following review of this document and the Proposed Plan by the regulatory agencies, and is formally documented in the ROD.

- **Community Acceptance** -This criterion will incorporate public comments which have been provided to federal and state agencies during the RI/FS process. The assessment of community acceptance will address those alternatives that the community formally supports or opposes. The preferred remedy will be presented to the public in the Proposed Plan. Community input on the FFS Report will be solicited during the public comment period, during which time the FFS Report will be available for public review. A responsiveness summary will be prepared to address comments received during the public comment period. A summary of the public comments and responses will be included in the ROD. As a result, no assessment or estimate of community acceptance will be made in this FFS Report.

4.2 Detailed Analysis of Remedial Action Alternatives for Soil

4.2.1 Alternative S1 – No Action

4.2.1.1 Detailed Description of Alternative

The No Action alternative is considered in accordance with NCP requirements and provides a baseline for comparison with the other alternatives. Under this alternative, no further action would be implemented , and the current status of the Site would remain unchanged. Institutional controls would not be implemented to restrict future site development or use. With the exception of the existing security fences, engineering controls would not be implemented to prevent site access or exposure to site contaminants. Any existing security fences would remain present, but they would not be monitored or maintained.

4.2.1.2 Individual Evaluation of Alternative

Alternative S1 is evaluated using the seven criteria discussed in Section 4.1.

Overall Protection of Human Health and the Environment

The site-specific HHRA indicates that the onsite soil might pose potential risks to human health through direct contact. As discussed in Section 1.8, for cancer risks, site workers (8×10^{-4}) and construction/utility workers (6×10^{-4}) under the future land-use scenario had cancer risks above the NCP's acceptable risk range of 1×10^{-6} to 1×10^{-4}; whereas for non-cancer health hazards, all receptors had non-cancer hazards above EPA's threshold of 1. Therefore, the No Action alternative would not be protective of human health.

This alternative would not meet any of the four RAOs established in Section 2. It would not reduce or eliminate the direct contact risks associated with contaminated soil to levels protective of a commercial/industrial use, nor would it improve the effectiveness and efficiency of the existing OU1 remedy that is currently in place, remediate Principal Threat Waste, or provide restricted (industrial) reuse of the Site.

Compliance with ARARs

This alternative would not meet the PRGs for contaminated soil. This alternative involves no action, therefore there are no location-specific or action-specific ARARs involved.

Long-term Effectiveness and Permanence

Magnitude of Residual Risk - The magnitude of residual risk would be the same as the existing site conditions. The contaminants would not be destroyed or degraded. The contaminant concentrations are not likely to decrease over time. The soil contamination could be a continuous source of contamination for other media.

Adequacy of Controls - Currently there are potential risks to human health. This alternative would not provide adequate controls of risks to human health over the long-term because there are no mechanisms to prevent future exposure.

Reliability of Controls - Under this alternative no mechanism would be in place to prevent future risk to human health and the environment; therefore, this alternative would not be considered reliable.

Reduction of Toxicity, Mobility or Volume through Treatment

The implementation of this alternative would not affect the TMV of the contaminants. Biodegradation of some of the COCs would not be likely because of the persistent nature of the contaminants (e.g., PCBs and arsenic).

Short-term Effectiveness

This alternative would not include a remedial action. Therefore, it would have no short-term impact to workers or the community. There would be no adverse environmental impacts to habitats or vegetation since no remedial action is taken under this alternative.

Implementability

This alternative is easily implemented, since no services or permits would be required.

Cost

There would be no cost under this alternative.

4.2.2 Alternative S2 - Excavation and Off-Site Treatment/Disposal; Backfilling with Imported Clean Fill; and Institutional/Engineering Controls

4.2.2.1 Detailed Description of Alternative

Alternative S2 consists of the following major activities:

- Pre-design investigation
- Excavation of onsite soils exceeding PRGs as defined in Section 2.3
- Post remediation sampling to verify achievement of PRGs
- Disposal of excavated soils at off-site facilities in accordance with applicable regulatory requirements
- Backfilling of excavated areas with imported clean fill
- Backfilling recovered existing gravel from completed excavation areas to the bottom portion of the subsurface excavation
- Implementation of institutional/engineering controls
- Implementation of a soil management plan
- Five year review

Pre-Design Investigation - The volumes of soils to be remediated were determined based on existing soil sampling data. The proposed remediation areas, where COC concentrations exceed the PRGs, are shown on Figure 2-1. A pre-design investigation would be required to further delineate the areal extent of contamination, and the area and volume of contaminated soil would be more accurately determined during the remedial design (RD). For the purposes of this FFS, it is assumed that no contaminated soil exceeding the PRGs is underneath the onsite buildings. However, this would be verified during the pre-design investigation. If it appears that contamination extends below the buildings, demolition may be needed to allow for further investigation. Similarly, if contamination is in close proximity to the buildings they may need to be demolished based on the conclusions of the Building Assessment Report prepared by Berger in May 2006.

Additionally, waste characterization sampling would be performed to determine the disposal destination of the contaminated soil to be remediated. Soil with PCB concentrations above 50 mg/kg is regulated under TSCA and thus would need to be disposed of in a chemical waste (TSCA) landfill. Soil with PCB concentrations below 50 mg/kg is not regulated under TSCA, and may be disposed of in a Subtitle C landfill or industrial landfill, depending upon the waste characterization determination.

Excavation - This alternative involves the removal of soils exhibiting contaminant concentrations above the PRGs in areas as defined in Section 2.3. Contaminated soils would be excavated using standard construction equipment. Excavations would consist of the following components:

- Surface excavation to reduce unacceptable direct contact risk (i.e., above a hazard index of 1 and/or carcinogenic risk above $1x10^{-6}$) - excavation of the top two feet of the soils beneath the existing gravel layer or concrete slab within Area A and Area B (see Figure 4-1), if present.

- Subsurface excavation to remove PCB Principal Threat Waste and to enhance groundwater flow - excavation of contaminated soils from areas exhibiting presence of PCB Principal Threat Waste (i.e., Area D with PCB concentrations above 500 mg/kg) or free product contaminated with PCBs (Area E and Area F), or areas likely to have free product contaminated with PCBs (Area C), which may impede the groundwater flow. The areas are all located within the Southwestern Area (see Figure 4-1). The excavation depth within individual areas is as follows:

  - Area C – 12.5 feet bgs
  - Area D – 8.5 feet bgs
  - Area E – 12.5 feet bgs
  - Area F – 9 feet bgs

Table A-1 in Appendix A presents the estimated areal extent and volume of contaminated soil to be remediated. The estimated quantity of contaminated soil to be excavated is approximately 39,000 CY (62,400 tons). Excavation areas were estimated using several conservative assumptions as discussed in Section 2 (e.g., external horizontal limits of soil to be remediated are generally bound by soil borings exhibiting soil sampling results below the PRGs, etc.).

It is important to perform excavation in such a manner to minimize damage to the existing slurry wall and groundwater collection trench system (through an alternate trenching method under which only a limited length of the slurry wall and/or groundwater collection trench system would be exposed at any time of the excavation, or sloping the excavation adjacent to the slurry wall or groundwater collection trench system).

Stormwater runon and runoff would be controlled at excavation areas during remedial construction by installing temporary storm water/erosion control features, such as berms, ditches, rock-lined check dams, erosion control blankets, and silt fencing to divert storm water runon away from excavation areas, minimize storm water runoff from excavation areas, and prevent erosion and transport of contaminated soils to downgradient areas. Dust would be controlled through the use of water or commercial dust suppressants.

Groundwater at the Site is very shallow, so excavation is expected to extend below the water table. Dewatering will be an element of the remediation. It is assumed that the excavation dewatering will be accomplished by well points. Additionally, stockpile areas likely will also be built at the Site to facilitate passive drying of wet excavated materials prior to appropriate off-site disposal.

It is assumed that water generated from excavation dewatering and from stockpiles will be treated by the existing groundwater treatment system prior to discharging to the surface water (Passaic River).

Disposal - Contaminated soils would be transported off site and disposed of at an appropriate facility according to the following:

- For soil that is characterized as TSCA waste (refer to Figure 4-1 for the estimated areal extent), the soil would need to be disposed of in a chemical waste (TSCA) landfill.

- For soil that is characterized as RCRA hazardous waste (refer to Figure 4-1 for the estimated areal extent), the soil would need to be disposed of in a Subtitle C landfill. However, in some cases the soil may need treatment at off-site facilities prior to disposal (e.g., contaminant concentration exceeds 10 times the universal treatment standard [UTS]). For instance, it is assumed that 25% of the soil excavated from Area C (free product was not encountered in Area C during the 2008 data gap field investigation, but suspected to be potentially present based on historical investigation results) and one third of the soil excavated from Areas E and F would require thermal treatment prior to disposal in a Subtitle C landfill, whereas the remaining excavated soils from those areas could be disposed of directly in a Subtitle C landfill without any treatment.

- For soil that is characterized as non-hazardous waste, the soil would be disposed of in a Subtitle D landfill.

Based on existing sample results, it is estimated that 9,600 tons of contaminated soil would be disposed of in a TSCA landfill; 28,800 tons of contaminated soil would be disposed of in a Subtitle C landfill but 9,600 tons of which would require thermal treatment prior to disposal; and 24,000 tons of contaminated soil would be disposed of in a Subtitle D landfill.

Backfilling - For surface excavations, the excavation would be backfilled with imported clean fill, with an uppermost 6-inch topsoil layer. For subsurface excavations, the excavation would be backfilled with existing gravel recovered from the completed excavation activities, followed by backfilling with clean fill with an uppermost 6-inch topsoil layer which will be seeded.

Institutional/Engineering Controls - The following controls would be implemented:

- Imposing deed notices on the Site to restrict future site development or use and prevent intrusive subsurface activities, and to require mitigation measures to prevent vapor intrusion to any buildings to be constructed in the future.
- Long-term maintenance of the protective cover (i.e., the newly emplaced clean fill with an uppermost 6-inch topsoil layer).

Soil Management Plan - Due to the presence of soil contamination that would remain on site following remedial action, a soil management plan would be prepared to clearly identify the remaining soil contamination requiring management, and present a plan for management of contaminated soil in a manner that will be protective of human health and environment.

The soil management plan is anticipated to consist of the following components:

- Obligation to maintain and inspect the condition of the protective cover on a periodic basis.
- Prohibiting relocation and/or reduction of the protective cover with the exception of cases where one type of protective cover is substituted for another within the existing footprint of protective cover for the purpose of property improvement/re-development.
- Intrusive subsurface activities within the areas of identified soil contamination that remains on site should generally be avoided. If such activities are necessary for the purpose of property improvement/re-development, they would be performed only in accordance with an EPA-approved health and safety plan which addresses possible worker exposure and proper management of impacted soil, ground water and other materials and any controls that may be required.

Five Year Review - Because this alternative will result in contaminants remaining on the Site above levels which allows for unrestricted use and unlimited exposure, a review of the remedy will be conducted no less than every five years pursuant to Section 121(c) of CERCLA.

Duration of Remediation - It is estimated that construction for this alternative could be completed within 32 months of mobilization.

4.2.2.2 Individual Evaluation of Alternative

Alternative S2 is evaluated using the seven criteria discussed in Section 4.1.

<u>Overall Protection of Human Health and the Environment</u>

This alternative would be protective of human health and the environment. Contaminated surface soil exceeding the PRGs and Principal Threat Waste would be permanently removed from the Site. In addition, institutional and engineering controls and soil management plan will be implemented due to the presence of soil contamination exceeding the PRGs.

This alternative would meet all four RAOs:

- Reducing or eliminating the direct contact risks associated with contaminated soil to levels protective of a commercial/industrial use would be achieved by removing contaminated surface soils exceeding PRGs, and implementing appropriate institutional and engineering controls to prevent contact of subsurface soil.
- The effectiveness and efficiency of the existing OU1 remedy that is currently in place would be improved by removing free product contaminated with PCBs, which may impede the groundwater flow.
- All Principal Threat Waste (located within the shaded areas C through F on Figure 4-1), which acts as continuing sources of contamination, would be remediated.
- Address potential future exposure through inhalation of vapors that may migrate from contaminated soils.
- Restricted (industrial) reuse of the Site would be achieved by implementation of appropriate institutional controls.

Compliance with ARARs

This alternative would meet the PRGs for the contaminated surface soil. Since surface soil with contamination above the PRGs would be excavated and disposed of off site, it is expected that this alternative would achieve the RAOs.

This alternative would meet location- and action-specific ARARs/TBCs. No wetlands exist near or within the soil remediation areas. No federally listed endangered or threatened species are known to exist at the Site. Off-site waste transportation and disposal would be performed in accordance with applicable RCRA, Department of Transportation (DOT), and NJDEP requirements; only TSCA-permitted disposal facilities, Subtitle C landfills and Subtitle D landfills approved by the EPA would be used. Tables 2-2 and 2-3 summarize the requirements of the location- and action-specific ARARs and their FFS considerations.

Long-term Effectiveness and Permanence

This alternative would be permanent and effective in the long term. Contaminated soil disposed of in the landfills would be contained and controlled in the long term, and would not pose a threat to human health and the environment.

This alternative would provide long-term effectiveness and permanence as the alternative would achieve the PRGs. Contaminated surface soil above the PRGs and Principal Threat Waste would be excavated and disposed of in the appropriate permitted off-site landfills. Residual risk would be managed through implementation of a combination of institutional and engineering controls as discussed in Section 4.2.2.1.

Excavation and off-site disposal is a reliable technology. Soil with contaminant concentrations above the PRGs would be removed from the Site. Off-site disposal/treatment in a permitted landfill would provide adequate control of the contaminant mass removed. Clean backfill would require some maintenance (e.g., erosion control).

Institutional and engineering controls would be used to limit residual risks present and potential risks to future users of the Site. If properly enforced, these controls would be adequate and reliable, and long-term enforcement of institutional controls should not prove difficult. Because this alternative leaves contaminants on site, a review would be conducted every five years to ensure that the remedy continues to provide adequate protection of human health and the environment in accordance with CERCLA 121(c).

Reduction of Toxicity, Mobility or Volume through Treatment

With the exception of the soil that may need treatment in off-site facilities prior to disposal as RCRA hazardous waste, this alternative would provide no reduction of TMV through treatment. However, this alternative would achieve reduction of mobility for excavated and disposed soils. Toxicity would not be reduced through this alternative, but the onsite volume of contaminated material would be eliminated due to off-site disposal.

Short-term Effectiveness

This alternative would include construction work and would have moderate short-term impact to the communities and workers. During earthwork activities, dust suppression efforts would need to be utilized to minimize exposure to onsite personnel. Due to transportation of materials off site, there is an increased possibility of a trucking accident leading to release of materials during transport. Use of personal protective equipment (PPE) by workers during construction would minimize exposure. Risk posed to the environment due to stormwater runoff would be controlled through the use of conventional, temporary storm water/erosion control features (e.g. berms, ditches, or silt fences).

It is estimated that it would take approximately 32 months to implement this alternative.

Implementability

Technically, this alternative would be easily implemented. Excavation would use conventional construction equipment. No special techniques, materials, permits, or labor would be required to excavate the soil and place backfill; supplies and services would be readily obtainable. Clean soil and topsoil would be needed to backfill and resurface excavation areas. Disposal facilities with appropriate permits are available; however, there are only a few TSCA landfills in the country.

Cost

The total present worth cost for Alternative S2 is approximately $21.5 million. No O&M costs are associated with this alternative. Detailed cost estimates are presented in Appendix B-1.

4.2.3 Alternative S3 – Excavation; On-Site Low Temperature Thermal Desorption of Excavated Soil Characterized as Necessary Followed by On-Site Backfilling or Off-Site Disposal; Backfilling with Imported Clean Fill; and Institutional/Engineering Controls

4.2.3.1 Detailed Description of Alternative

Alternative S3 consists of the following major activities:

- Pre-design investigation
- Excavation of onsite soils exceeding PRGs as defined in Section 2.3
- Post remediation sampling to verify achievement of PRGs
- On-site LTTD treatment of excavated soils characterized as TSCA waste or RCRA hazardous waste
- Disposal of excavated non-hazardous soils at off-site facilities in accordance with applicable regulatory requirements
- Backfilling of excavated areas with clean fill or LTTD treated soil
- Implementation of institutional/engineering controls
- Implementation of a soil management plan
- Five year review

Pre-Design Investigation - A pre-design investigation would be conducted in the same manner as that discussed in Alternative S2, in order to further delineate the areal extent of contamination, and the area and volume of contaminated soil would be more accurately determined during the RD. The same assumptions regarding contamination beneath the buildings apply to Alternative S3.

Excavation - This alternative involves the removal of soils exhibiting contaminant concentrations above the PRGs in the same manner as discussed in Alternative S2. Excavations would be performed within the remediation area depicted in Figure 4-2, and the excavation depth within individual areas is as follows:

- Area A – 2 feet beneath the existing gravel layer or concrete slab within Area A, if present
- Area B – 2 feet beneath the existing gravel layer or concrete slab within Area B, if present
- Area C – 12.5 feet bgs
- Area D – 8.5 feet bgs
- Area E – 12.5 feet bgs
- Area F – 9 feet bgs

Table A-2 in Appendix A presents the estimated areal extent and volumes of contaminated soil to be remediated. The estimated quantity of contaminated soil to be excavated is approximately 39,000 CY (62,400 tons). However, unlike Alternative S2 which requires off-site disposal for all excavated soils, this alternative involves on-site LTTD treatment followed by on-site backfilling for the soils excavated within the shaded area on Figure 4-2 that represents the estimated extent of TSCA waste and RCRA hazardous waste.

Excavation would be performed in such a manner to minimize damage to the existing slurry wall and groundwater collection trench system (through an alternate trenching method under which only a limited length of the slurry wall and/or groundwater collection trench system wouldbe exposed at any time of the excavation, or sloping the excavation adjacent to the slurry wall or groundwater collection trench system).

Stormwater runon and runoff control, dewatering, and treatment of water generated from excavation dewatering and from stockpiles prior to discharge to the surface water (Passaic River) would be conducted in the same manner as discussed in Alternative S2.

LTTD Treatment - Excavated soils that are characterized as TSCA waste or RCRA hazardous waste (refer to Figure 4-2 for the estimated areal extents) would be subject to LTTD treatment. The LTTD unit currently under consideration is a continuous-feed indirect-contact system, which operates at a temperature over 700°F. Contaminants are desorbed from the soil under elevated temperature in the LTTD treatment unit. The contaminant-laden off-gas is then condensed into a concentrated liquid form which would be subsequently transported for off-site treatment or disposal (e.g., commercial incinerator). Non-condensable off-gas exiting the condenser can be treated by a vapor-phase activated carbon treatment system. Therefore, the contaminants are not destroyed via thermal oxidation in this LTTD unit, rather they are separated from the contaminated soil for subsequent treatment /disposal elsewhere. The soil treated by the LTTD unit would meet the PRGs and reduce the volume of contaminated media that would require further treatment.

The ideal moisture content for this continuous-feed indirect-contact LTTD treatment unit ranges between 10 and 14 percent (for ease of feeding/handling soil, and energy efficiency as moisture is also volatilized and leaves with the off-gas). Since much of the excavated soil is anticipated to be saturated, engineering measures may be critical to expedite the drying of the excavated soil requiring LTTD treatment.

The quantity of contaminated soil requiring LTTD treatment is estimated to be 24,000 CY (38,000 tons). The treated soil would be required to meet the PRGs and confirmed by analytical results prior to reuse as backfill on site. An LTTD feed rate of approximately 14 tons per hour was reported at another Superfund site (which equates to 336 tons per day). However, the actual LTTD feed rate can be significantly reduced due to the extra waste handling efforts prior to LTTD treatment (e.g., drying, removal of debris that is not amenable to LTTD treatment).

Disposal - As discussed above, soil excavated from the estimated extent of TSCA waste and RCRA hazardous waste (refer to Figure 4-2) would be treated with LTTD. Post-treatment confirmatory samples would be collected from the treated soils, which would be used to backfill excavated areas if demonstrated to be in compliance with the PRGs. The rest of the excavated soils would be considered non-hazardous waste, for which LTTD treatment is more costly compared to off-site disposal. Therefore, the non-hazardous waste would be disposed of as such at off-site facilities (e.g., Subtitle D landfill).

Backfilling - For surface excavations, the excavation would be backfilled with imported clean fill with an uppermost 6-inch topsoil layer. For subsurface excavations, the excavation would be backfilled with existing gravel recovered from the completed excavation activities, followed by backfilling with soil treated by LTTD which has been demonstrated to be in compliance with the PRGs, and an uppermost 6-inch topsoil layer which will be seeded. For the purposes of this FFS, it is assumed that 75% of the material volume would be recovered from the LTTD treatment and re-used as fill.

Institutional/Engineering Controls - The following controls would be implemented:

- Imposing deed notices on the Site to restrict future site development or use and prevent intrusive subsurface activities, and to require mitigation measures to prevent vapor intrusion to any buildings to be constructed in the future.
- Long-term maintenance of the protective cover (i.e., the newly emplaced clean fill with an uppermost 6-inch topsoil layer).

Soil Management Plan - Due to the presence of soil contamination that would remain on site following remedial action, a soil management plan would be prepared to clearly identify the remaining soil contamination requiring management, and present a plan for management of contaminated soil in a manner that will be protective of human health and environment.

The soil management plan is anticipated to consist of the following components:

- Obligation to maintain and inspect the condition of the protective cover (i.e., the newly emplaced clean fill with an uppermost 6-inch topsoil layer) on a periodic basis.

- Prohibiting relocation and/or reduction of the protective cover with the exception of cases where one type of protective cover is substituted for another within the existing footprint of protective cover for the purpose of property improvement/re-development.

- Intrusive subsurface activities within the areas of identified soil contamination that remains on site should generally be avoided. If such activities are necessary for the purpose of property improvement/re-development, they would be performed only in accordance with an EPA-approved health and safety plan which addresses possible worker exposure and proper management of impacted soil, ground water and other materials and any controls that may be required.

Five Year Review - Because this alternative will result in contaminants remaining on the Site above levels which allows for unrestricted use and unlimited exposure, a review of the remedy will be conducted no less than every five years pursuant to Section 121(c) of CERCLA.

Duration of Remediation - It is estimated that construction for this alternative could be completed within 35 months of mobilization. No post-remediation monitoring would be required under this alternative.

4.2.3.2 Individual Evaluation of Alternative

Alternative S3 is evaluated using the seven criteria discussed in Section 4.1.

<u>Overall Protection of Human Health and the Environment</u>

This alternative would be protective of human health and the environment. Contaminated surface soil exceeding the PRGs and Principal Threat Waste would be either permanently removed from the Site or reduced below the PRGs through LTTD treatment. In addition, institutional and engineering controls and soil management plan would be implemented due to the presence of soil contamination exceeding the PRGs.

This alternative would meet the four RAOs:

- Reducing or eliminating the direct contact risks associated with contaminated soil to levels protective of a commercial/industrial use would be achieved by removing contaminated surface soils exceeding PRGs, and implementing appropriate institutional and engineering controls to prevent contact of subsurface soil.

- The effectiveness and efficiency of the existing OU1 remedy that is currently in place would be improved by removing free product contaminated with PCBs, which may impede the groundwater flow.

- All Principal Threat Waste (located within the shaded areas C through F on Figure 4-2), which acts as continuing sources of contamination, would be remediated.

- Restricted (industrial) reuse of the Site would be achieved by implementation of appropriate institutional controls.

Compliance with ARARs

This alternative would meet the PRGs for the contaminated soil. Since surface soil with contamination above the PRGs and Principal Threat Waste would be excavated, and subsequently either disposed of off site or treated to levels below the PRGs prior to backfilling on site, it is expected that this alternative would achieve the RAOs.

This alternative would meet location- and action-specific ARARs/TBCs. No wetlands exist near to or within the soil remediation areas. No federally listed endangered or threatened species are known to exist at the Site. All contaminated soils characterized as TSCA waste and RCRA waste would be treated on site using a permitted LTTD, and would only be used for on-site backfilling after compliance with the PRGs has been demonstrated through the post-treatment confirmatory sampling. Off-site waste transportation and disposal would be performed in accordance with applicable RCRA, DOT, and NJDEP requirements. Tables 2-2 and 2-3 summarize the requirements of the location- and action-specific ARARs and their FFS considerations.

Long-term Effectiveness and Permanence

This alternative would be permanent and effective in the long term. Both Principal Threat Waste and hazardous wastes would be treated under this alternative. Only non-hazardous wastes would be disposed of off site.

This alternative would provide long-term effectiveness and permanence as the alternative would achieve the PRGs. Principal Threat Waste and hazardous wastes above the PRGs would be excavated, and treated below the PRGs prior to on-site backfilling. The treatment process would reduce the toxicity and volume of the contaminants and is preferred by the NCP. Non-hazardous contaminated soil above the PRGs would be excavated and disposed of off site. In addition, residual risk would be managed through implementation of a combination of institutional and engineering controls as discussed in Section 4.2.3.1.

Adequacy and Reliability of Controls - LTTD treatment of contaminated soil is an irreversible process that is considered to be a reliable technology. LTTD is a proven technology recognized by EPA and has been employed at the Cornell-Dubilier Electronics Superfund Site located in South Plainfield, New Jersey, for the OU2 soil remediation. As such, contaminated soils exceeding the PRGs would be either permanently removed from the Site and disposed of in permitted off-site landfills, or treated to levels below the PRGs prior to on-site backfilling. Clean backfill would require some maintenance (e.g., erosion control).

Institutional and engineering controls would be used to limit residual risks present and potential risks to future users of the Site. If properly enforced, these controls would be adequate and reliable, and long-term enforcement of institutional controls should not prove difficult. Because this alternative leaves contaminants on site, a review would be conducted every five years to ensure that the remedy continues to provide adequate protection of human health and the environment in accordance with CERCLA 121(c).

Reduction of Toxicity, Mobility or Volume through Treatment

Off-site disposal of the excavated soils characterized as non-hazardous waste would provide no reduction of TMV through treatment, but would achieve reduction of mobility for excavated and disposed soils. On the other hand, LTTD of the excavated soils characterized as TSCA waste or RCRA hazardous waste would achieve reduction of TMV through treatment.

Short-term Effectiveness

This alternative would include construction work and would have moderate short-term impact to the communities and workers. During earthwork activities, dust suppression efforts would need to be utilized to minimize exposure to onsite personnel. Due to transportation of materials off site, there is an increased possibility of a trucking accident leading to release of materials during transport. Use of PPE by workers during construction would minimize exposure. The LTTD unit would be operated and maintained 24 hours a day, 7 days a week while in operation by properly trained staff. Risks posed to the environment due to stormwater runoff would be controlled through the use of conventional, temporary storm water/erosion control features (e.g. berms, ditches, or silt fences). There would be no long-term adverse environmental impacts to habitats or vegetation due to the implementation of this alternative. The Site would be available for beneficial use at the completion of the remedy.

Within an estimated 35 months of beginning construction, the soil would be excavated, disposed of or treated, backfilled, and covered with clean soil, preventing direct exposure to contaminated soil. The Site would be available for beneficial use, with some restrictions, at the completion of this remedy.

Implementability

This alternative is technically implementable. This alternative would be implemented using conventional construction methods and equipment for excavation. LTTD treatment is a proven technique under appropriate conditions, but special materials or labor would be required to treat the contaminated soils characterized as TSCA waste or RCRA hazardous waste. Moreover, there are many factors affecting the effectiveness of LTTD, including but not limited to (Foster Wheeler Environmental Corporation and Battelle Corporation 1998):

- Particle size distribution - Fine material is more prone to exit the LTTD unit entrained in the off-gas instead of remaining as treated residue, and would thus overload the downstream off-gas treatment equipment.

- Soil composition – In general, coarse materials such as sand and gravel are more readily treated by LTTD, while clay may result in poor LTTD performance due to its increased tendency to form agglomerates with low surface area to volume ratio and thus inhibiting heat and mass transfer. In addition, the presence of considerable amounts of debris such as large rocks would also cause undesirable LTTD performance.

- Moisture content – The higher than ideal moisture content can adversely impact operating costs because moisture would be evaporated in the LTTD treatment process. Some of the heating input would need to be used to vaporize the water in the waste feed, and could cause reduction of the waste feed rate to allow adequate heating to achieve satisfactory contaminant desorption.

- Alkali salt content – Undesirable alkali salt content could result in material handling problem caused by fusing or "slagging" of the treated residue.

To better predict the actual performance of LTTD treatment, more investigation would need to be conducted at the Site to collect related physical and chemical characteristics of the soil requiring LTTD treatment, and to examine their respective impact on the performance of LTTD treatment.

Cost

The total present worth cost for Alternative S3 is approximately $26.8 million. No O&M costs are associated with this alternative. Detailed cost estimates are presented in Appendix B-2.

4.3 Comparative Analysis of Alternatives

This section compares the alternatives using the seven criteria. Table 4-1 summarizes the comparison among the three soil alternatives.

4.3.1 Overall Protection of Human Health and the Environment

There is potential human health risk associated with the contaminated soils at the Site. Alternative S1 would not reduce or eliminate the direct contact risks associated with contaminated soil to levels protective of a commercial/industrial use, since contamination exceeding the PRGs would remain on site. Both Alternatives S2 and S3 would achieve the RAOs and would be protective of human health and the environment by reducing or eliminating the direct contact risks associated with contaminated soil to levels protective of a commercial/industrial use, remediating the Principal Threat Waste at the Site, and implementing institutional and engineering controls as appropriate. Alternative S2 would remove contaminated surface soil exceeding the PRGs and Principal Threat Waste for disposal at off-site landfills, while Alternative S3 consists of removal of contaminated surface soil exceeding the PRGs and Principal Threat Waste for either disposal at off-site landfills (for soil characterized as non-hazardous waste) or LTTD treatment prior to on-site backfilling (for soil characterized as TSCA waste or RCRA hazardous waste).

4.3.2 Compliance with ARARs

Alternative S1 would not meet the PRGs since no action would be taken. Alternative S2 would meet the PRGs since contaminated surface soil exceeding the PRGs and Principal Threat Waste would be removed from the Site. Alternative S3 would also meet the PRGs since contaminated surface soil exceeding the PRGs and Principal Threat Waste would either be removed from the Site or be treated to below the PRGs prior to placement back on the Site. Both Alternatives S2 and S3 would comply with location- and action-specific ARARs.

4.3.3 Long-Term Effectiveness and Permanence

Alternative S1 would not achieve long-term effectiveness and permanence. Both Alternatives S2 and S3 would be effective in the long term and likely would require minimal, infrequent maintenance. Under Alternatives S2 and S3, the contaminated surface soil above the PRGs would be removed and transported for off-site disposal and/or treated on site to levels below the PRGs prior to placement back on the Site. Alternative S3 would treat the Principal Threat Waste and hazardous wastes and would be more effective in the long term. Treatment is preferred by NCP over off-site disposal.

4.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative S1 would not reduce TMV as no active treatment of contaminated soil would occur. Alternative S2 may reduce TMV for the contaminated soils that may require treatment prior to disposal of in a Subtitle C landfill. Alternative S3, on the other hand, would involve LTTD treatment for contaminated soil characterized as TSCA waste or RCRA hazardous waste and would thus achieve reduction of TMV for the treated soil.

4.3.5 Short-Term Effectiveness

Alternative S1 would achieve the highest degree of short-term effectiveness because no action would be taken at the Site and construction workers would not be subjected to any potential risks. Both Alternative S2 and S3 are considered to have a lower degree of short-term effectiveness since excavated materials would require off-site transportation to disposal facilities, increasing the potential for a release to occur during shipment, as well as potential traffic and noise issues.

Alternatives S2 and S3 would have short-term impact to the community due to nuisances associated with construction and to the construction workers due to handling the contaminated material during treatment. However, air monitoring, engineering controls, and/or appropriate worker PPE would be used to protect the community and workers. The potential risks posed by the LTTD treatment unit under Alternative S3 would be mitigated by full-time operation and maintenance with properly trained staff.

4.3.6 Implementability

Alternative S1 would be easiest both technically and administratively to implement because no additional work would be performed at the Site. Alternative S2 would be relatively simple to implement since only earthwork activities would be involved, but all confined to the site area. Disposal facilities with appropriate permits are available, even though there are only a few TSCA landfills in the country which would be required under Alternative S2. Alternative S3 involves the greatest degree of difficulty to implement due to the processing issues related to the LTTD treatment of contaminated soil (e.g., soil type, moisture content control).

4.3.7 Cost

Alternative S1 has no cost. The total present worth costs for Alternative S2 and S3 are $21.5 million and $26.8 million, respectively. Table 4-2 compares the cost estimates for Alternatives S2 and S3.

A cost sensitivity analysis has been performed for Alternative S2 and S3, by adjusting the volume of soil to be remediated and transportation and disposal unit costs, respectively. The results are presented in Table 4-3. In summary, a 20 percent increase in the volume of soil to be remediated would result in 14.2 percent and 13.6 percent increase in total present worth costs for Alternatives S2 and S3, respectively. A10 percent increase in the transportation and disposal unit costs of the waste would result in 6.5 percent and 0.9 percent increase in total present worth costs for Alternatives S2 and S3, respectively.

Section 5
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Table 1-1
September 2006 Water Level Data
Syncon Resins Superfund Site
Kearny, New Jersey

Well Number	TOC [1]	Ground Elevation	TD [2]	Length of Screen	Top of Screen [3]	Bottom of Screen [3]	September 2006			
							DTW [4]	DTP [5]	FP [6] (Thickness)	GW Elev. [7]
MW-04	10.99	8.93	20.40	8.00	-3.47	-11.47	6.94	----	-----	4.05
MW-05	11.08	9.46	20.07	8.00	-2.61	-10.61	6.25	----	-----	4.83
MW-06 [8]	10.16	9.48	6.52	8.00	10.96	2.96	6.51	----	-----	See Note 8
MW-07	8.88	6.39	15.40	8.00	-1.01	-9.01	3.38	----	-----	5.50
MW-10R	10.10	7.70	14.80	8.00	0.90	-7.10	5.21	----	-----	4.89
MW-11	9.88	8.49	15.38	8.00	1.11	-6.89	4.46	----	-----	5.42
MW-12 [9]	9.23	7.73	30.80	8.00	-15.07	-23.07	8.10	----	-----	1.13
MW-14R2 [10]	8.64	7.50	11.00	8.00	4.50	-3.50	4.13	4.00	0.13	4.64
MW-17	9.32	6.93	12.90	8.00	2.03	-5.97	6.50	----	-----	2.82
MW-18 [8]	8.27	5.44	12.60	8.00	0.84	-7.16	7.62	----	-----	See Note 8
MW-19 [10]	10.28	7.20	12.00	8.00	3.20	-4.80	5.81	5.30	0.51	4.98
MW-20R	10.83	7.74	7.30	8.00	8.44	0.44	6.01	----	-----	4.82

Notes:

(1) = Top of Casing (TOC) is the surveyed elevation of the top of PVC casing in feet above mean sea level.

(2) = Total Depth (TD) was measured from the ground surface in feet.

(3) = Well screen interval measured in feet above mean sea level.

(4) = Depth to Water (DTW) was measured from the top of casing in feet.

(5) = Depth to Product (DTP) was measured from the top of casing in feet.

(6) = Floating Product (FP) is the Thickness between DTW and DTP.

(7) = Ground Water (GW) elevation in feet above mean sea level which is calculated as TOC-DTW (or DTP).

(8) = Well is damaged and thus the measurement is not reliable.

(9) = Well MW-12 is a deep well.

(10) = Product was found in the well.

NA = Not Available

Table 1-2
Summary of Cancer Risks and Non-Cancer Health Hazards (1)
Reasonable Maximum Exposure
Syncon Resins Superfund Site
Kearny, New Jersey

Receptor	Cancer Risk		Non-cancer Health Hazards	
	Risk	NCP Acceptable Range ($1x10^{-4}$ to ($1x10^{-6}$)	Hazard Index	EPA Threshold (1)
Current/Future Land-Use Scenario				
Trespasser	1×10^{-4}	At the upper end of NCP's acceptable range due to Aroclor 1248 ($9x10^{-5}$)	6.5	Above EPA threshold of 1 Target Organ:Immune system due to Aroclor 1248 (HI=6.4)
Future Land-Use Scenario				
Site Worker	8×10^{-4}	Above NCP's acceptable range due to Aroclor 1248 ($7x10^{-4}$)	52.0	Above EPA threshold of 1 Target Organ:Immune system due to Aroclor 1248 (HI=51)
Construction/Utility Worker	6×10^{-4}	Above NCP's acceptable range due to Aroclor 1248 ($6x10^{-4}$)	980.0	Above EPA threshold of 1 Target Organ:Immune system due to Aroclor 1242, 1248, and 1254 (HI=980)

Cancer risks: An excess lifetime cancer risk of $1x10^{-6}$ indicates that an individual experiencing the reasonable maximum exposure has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. NCP's acceptable risk range for site-related exposures is $1×10^{-6}$ to $1×10^{-4}$ (one in million to one in ten thousand).
Noncancer hazards: EPA Risk Assessment Guidance for Superfund (EPA 1989) states that, generally, a hazard index (HI) greater than 1 indicates the potential for adverse non-cancer effects.

(1) Risk assessment was performed by the USEPA Region 2.

Table 2-1
Chemical-specific ARARs, Criteria, and Guidance
Syncon Resins Superfund Site
Kearny, New Jersey

Regulatory Level	ARAR Identification	Status	Requirement Synopsis	Feasibility Study Consideration
Federal	Federal Toxic Substance Control Act (TSCA) Spill Cleanup Policy (40 CFR Part 761 (c))	Applicable	Provides guidance for risk-based cleanup for PCB remediation waste	Establish cleanup levels, treatment and disposal of PCBs
Federal	Guidance on Remedial Actions for Superfund Sites with PCB Contamination (OSWER Directive No. 9355.4-01)	To Be Considered	Provides guidance on selection of preliminary remediation goals and remedial actions for PCBs at a Superfund Site	Cleanup levels set for superfund site soil contamination
Federal	EPA Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites	To Be Considered	Provides risk-based screening levels for chemical contaminants at a Superfund Site	The RSLs for industrial soil will be considered to select preliminary remediation goals
Federal	A Guide to Principal Waste and Low Level Threat Wastes	To Be Considered	Provides considerations that should be taken into account in categorizing waste for which treatment or containment generally will be suitable, and provides definitions, examples, and ROD documentation requirements related to waste that constitute a principal or low level threat.	Treatment rather than containment method will be required to address Principal Threat Waste
State	New Jersey Soil Remediation Standard (N.J.A.C. 7:26D)	Applicable	Establishes soil cleanup criteria based on risk and impact to groundwater	The direct contact criteria will be considered; site-specific risk based value will be considered instead of the generic value in this document

Table 2-2
Location-specific ARARs, Criteria, and Guidance
Syncon Resins Superfund Site
Kearny, New Jersey

Regulatory Level	ARARs	Status	Requirement Synopsis	Action to be Taken to Attain ARARs
Federal	Statement on Procedures on Floodplain Management and Wetlands protection (40 CFR 6 Appendix A)	Applicable	This Statement of Procedures sets forth Agency policy and guidance for carrying out the provisions of Executive Orders 11988 and 11990.	Alternatives will take into consideration floodplain management and wetland protection.
Federal	Policy on Floodplains and Wetland Assessments for CERCLA Actions (OSWER Directive 9280.0-12, 1985)	To be considered	Superfund actions must meet the substantive requirements of E.O. 11988, E.O. 11990, and 40 CFR part 6, Appendix A.	Alternatives will take into consideration floodplain management and wetland protection.
Federal (Non-Regulatory)	Floodplains Executive Order (Executive Order 11988)	Applicable	Federal agencies are required to reduce the risk of flood loss, to minimize impact of floods, and to restore and preserve the natural and beneficial values of floodplains.	The potential effects of any action will be evaluated to ensure that the planning and decision making reflect consideration of flood hazards and floodplains management, including restoration and preservation of natural undeveloped floodplains.
Federal (Non-Regulatory)	Wetlands Executive Order (Executive Order 11990)	Applicable	Federal agencies are required to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance natural and beneficial values of wetlands.	Remedial alternatives that involve construction must include all practicable means of minimizing harm to wetlands. Wetlands protection considerations must be incorporated into the planning and decision making of remedial alternatives.

Table 2-2
Location-specific ARARs, Criteria, and Guidance
Syncon Resins Superfund Site
Kearny, New Jersey

Regulatory Level	ARARs	Status	Requirement Synopsis	Action to be Taken to Attain ARARs
Federal Endangered Species Act	Protection of threatened and endangered species (16 USC 1531 et seq. 40 CFR 400)	Applicable	Statute regarding the special preservation and protection of threatened and endangered species of fish and wildlife.	The potential effects of any action will be evaluated to ensure that any endangered or threatened species would not be affected.
Federal Fish and Wildlife Conservation Act	Statement of Procedures for non-game fish and wildlife protection (16 usc 2901 et seq.)	Applicable	Establishes EPA policy and guidance for promoting the conservation of non-game fish and wildlife and their habitats. Action must protect fish or wildlife.	Applicable for construction activities with may potentially impact non-game fish or wildlife and their habitats.
Federal National Historic Preservation Act	Procedures for preservation of historical and archeological data (40 CFR 6.301**)**	Applicable	Establishes procedures to provide for preservation of historical and archeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.	Cultural resources survey would be performed to assess if historical or archeological data could potentially be encountered during remediation.
State	New Jersey Freshwater Wetland Protection Act rules (N.J.A.C.7:7A)	Applicable	Establish requirements for the protection of freshwater wetlands. Requires permits for construction within wetland areas.	Applicable for construction activities performed in the vicinity of a wetland or waterway.
State	New Jersey Floodplain Use and Limitations (N.J.A.C. 7:13)	Applicable	State standards for activities within floodplains	Applicable for construction activities performed in the vicinity of a wetland or waterway.
State	New Jersey Protection of threatened and endangered species (N.J.S.A. 23:2A-1 to 13)	Applicable	Standard for the protection of endangered, non-game and exotic wildlife	The potential effects of any action will be evaluated to ensure that any endangered or threatened species would not be affected.

Table 2-2
Location-specific ARARs, Criteria, and Guidance
Syncon Resins Superfund Site
Kearny, New Jersey

Regulatory Level	ARARs	Status	Requirement Synopsis	Action to be Taken to Attain ARARs
State	New Jersey Protection of endangered plant species (N.J.S.A. 13.1B-1; 15.151 to 15.158 N.J.A.C. 7:5B)	Applicable	Standard for protection of endangered plant	The potential effects of any action will be evaluated to ensure that any endangered plant would not be affected

Table 2-3
Action-specific ARARs for Site Remediation
Syncon Resins Superfund Site
Kearny, New Jersey

Regulatory Level	ARARs	Status	Requirement Synopsis	FS Consideration
General Requirement for Site Remediation				
Federal	RCRA Identification and Listing of Hazardous Wastes (40 CFR 261)	Applicable	Describes methods for identifying hazardous wastes and lists known hazardous wastes.	Applicable to the identification of hazardous wastes that are generated, treated, stored, or disposed during remedial activities.
Federal	RCRA Standards Applicable to Generators of Hazardous Wastes (40 CFR 262)	Applicable	Describes standards applicable to generators of hazardous wastes.	Standards will be followed if any hazardous wastes are generated onsite.
Federal	RCRA - Standards for Owners/Operators of Permitted Hazardous Waste Facilities (40 CFR 264.10–164.18)	Relevant and Appropriate	This regulation lists general facility requirements including general waste analysis, security measures, inspections, and training requirements.	Facility will be designed, constructed, and operated in accordance with this requirement. All workers will be properly trained.
Federal	RCRA - Preparedness and Prevention (40 CFR 264.30–264.31)	Relevant and Appropriate	This regulation outlines the requirements for safety equipment and spill control.	Safety and communication equipment will be installed at the site. Local authorities will be familiarized with the site.
Federal	RCRA - Contingency Plan and Emergency Procedures (40 CFR 264.50–264.56)	Relevant and Appropriate	This regulation outlines the requirements for emergency procedures to be used following explosions, fires, etc.	Emergency Procedure Plans will be developed and implemented during remedial design. Copies of the plans will be kept on site.
Federal	Federal Toxic Substance Control Act (TSCA) Spill Cleanup Policy (40 CFR Part 761)	Applicable	Regulates the cleanup, treatment, and disposal of PCBs	Establish requirements for disposal of PCBs

Table 2-3
Action-specific ARARs for Site Remediation
Syncon Resins Superfund Site
Kearny, New Jersey

Regulatory Level	ARARs	Status	Requirement Synopsis	FS Consideration
State	New Jersey Technical Requirements for Site Remediation (N.J.A.C 7:26E)	Applicable	Establishes minimum regulatory requirements for investigation and remediation of contaminated sites in New Jersey.	Operation of the treatment facility must comply with the regulation.
State	New Jersey Identification and Listing of Hazardous Waste (N.J.A.C. 7:26 G-5)	Applicable	Listed federal regulations describing methods for identifying hazardous wastes and lists known hazardous wastes	Applicable to the identification of hazardous wastes that are generated, treated, stored, or disposed during remedial activities.
State	Vapor Intrusion Control	Relevant and Appropriate	Provides guidance in determining whether vapor intrusion of site related contaminants is occurring and to highlight what actions are appropriate.	Need to be considered in determining appropriate institutional/engineering controls to be implemented.
State	New Jersey Noise Control Act of 1971 – Noise Control (N.J.A.C. 7:29)	Applicable	Limits the noise generated from any industrial, commercial, public service or community service facility.	Limits the noise that can be generated during remedial activities.
State	New Jersey Soil Erosion and Sediment Control (N.J.A.C. 16:25A)	Applicable	Requires erosion mitigation during construction activities.	Requires erosion control consideration during construction activities.
State	New Jersey Flood Hazard Area Control Act (N.J.A.C. 7:13-3.3, 3.4)	Applicable	Additional requirements for soil erosion controls under New Jersey flood hazard area control act	Requires erosion control consideration during construction activities.

Table 2-3
Action-specific ARARs for Site Remediation
Syncon Resins Superfund Site
Kearny, New Jersey

Regulatory Level	ARARs	Status	Requirement Synopsis	FS Consideration
Waste Transportation and Disposal				
Federal	Department of Transportation (DOT) Rules for Transportation of Hazardous Materials (49 CFR Parts 107, 171, 172, 177 to 179)	Applicable	This regulation outlines procedures for the packaging, labeling, manifesting, and transporting hazardous materials.	Any company contracted to transport hazardous material from the site will be required to comply with this regulation.
Federal	RCRA Standards Applicable to Transporters of Hazardous Waste (40 CFR 263)	Applicable	Establishes standards for hazardous waste transporters.	Any company contracted to transport hazardous material from the site will be required to comply with this regulation.
Federal	RCRA Standards Applicable to Hazardous Waste (40 CFR 268)	Applicable	Identifies hazardous wastes that are restricted from land disposal and defines those limited circumstances under which an otherwise prohibited waste may continue to be land disposed.	Contractor transport and dispose hazardous material from the site will comply with the requirements
State	New Jersey Department of Transportation - Transportation of hazardous materials (N.J.A.C. 16:49)	Applicable	Regulates shipping and transportation of hazardous material	Contractor transport hazardous material from the site will comply with the requirements
State	Standard applicable to hazardous waste (N.J.A.C. 7:26G) including Land Disposal Restrictions (N.J.A.C. 7:26G-11)	Applicable	Regulates the transporter and disposal facility of hazardous waste	Contractor transport and dispose hazardous material from the site will comply with the requirements

Table 2-3
Action-specific ARARs for Site Remediation
Syncon Resins Superfund Site
Kearny, New Jersey

Regulatory Level	ARARs	Status	Requirement Synopsis	FS Consideration
Discharge of Groundwater or Wastewater				
Federal	Federal Clean Water Act - National Pollution Discharge Elimination System (40 CFR 100 *et seq.*)	Applicable	Issues permits for discharge into navigable waters. Establishes criteria and standards for imposing treatment requirements on permits.	Disposal of treated groundwater to the surface water. NPDES permit may not be required since New Jersey has an approved State Pollutant Discharge Elimination System (SPDES) permit program.
Federal	Federal Clean Water Act - Effluent Guidelines and Standards for the Point Source Category (40 CFR 131.36)	Applicable	Establishes criteria for surface water quality based on toxicity to aquatic organisms and human health.	Disposal of treated groundwater to the surface water. Federally approved New Jersey groundwater and surface water standards take precedence over the Federal criteria.
Federal	Federal Clean Water Act - Ambient Water Quality Criteria (40 CFR 144 and 146)	Applicable	Establishes performance standards, well requirements, and permitting requirements for groundwater reinjection wells.	Must comply with requirements for injection of treated groundwater..
State	New Jersey Pollutant Discharge Elimination System (N.J.A.C. 7:14A)	Applicable	Establishes standards for discharge of pollutants to surface water and groundwater.	New Jersey has a state approved program. Disposal of treated groundwater to surface water or back to the aquifer will require a NJPDES permit.

Table 2-3
Action-specific ARARs for Site Remediation
Syncon Resins Superfund Site
Kearny, New Jersey

Regulatory Level	ARARs	Status	Requirement Synopsis	FS Consideration
Off-gas Treatment				
Federal	Federal Clean Air Act - National Ambient Air Quality Standards (40 CFR 50)	Applicable	Provides standards for ambient air quality that are protective of human health.	Need to meet air quality standards when discharging off-gas.
Federal	Federal Clean Air Act - Standards of Performance for New Stationary Sources (40 CFR 60)	Applicable	Provides emission requirements for new stationary sources.	Need to meet requirements when discharging off-gas.
Federal	Federal Clean Air Act - National Emission Standards for Hazardous Air Pollutants (40 CFR 61)	Applicable	Provides emission standards for 8 contaminants including benzene and vinyl chloride. Identifies 25 additional contaminants as having serious health effects, but does not provide emission standards for these contaminants.	Need to meet requirements when discharging off-gas.
Federal	Federal Directive - Control of Air Emissions from Superfund Air Strippers (OSWER Directive 9355.0-28)	To Be Considered	Provides guidance on the use and controls for Superfund site air strippers as well as other vapor extraction techniques in attainment and non-attainment areas for ozone.	Applicable to remediation alternatives which involve air stripping and vapor extraction process.
State	New Jersey Air Pollution Control Act - Air Permits and Certificates (N.J.A.C. 7:27-22)	Applicable	Describes requirements and procedures for obtaining air permits and certificates.	Applicable to remediation alternatives which involve discharge of vapor.

Table 2-3
Action-specific ARARs for Site Remediation
Syncon Resins Superfund Site
Kearny, New Jersey

Regulatory Level	ARARs	Status	Requirement Synopsis	FS Consideration
State	New Jersey Air Pollution Control Act - Standards for Hazardous Air Pollutants (N.J.A.C. 7:27f)	Applicable	Rules that govern the emission of and such activities that result in the introduction of contaminants into the ambient atmosphere. Also set the ambient air quality standards	Need to meet requirements when discharging off-gas.
State	New Jersey Air Pollution Control Act - Ambient Air Quality Standards (N.J.A.C. 7:27-13)	Applicable	Provides standards for ambient air quality that are protective of human health.	Need to meet air quality standards when discharging off-gas.

Table 2-4
Preliminary Remediation Goals for Soil
Syncon Resins Superfund Site
Kearny, New Jersey

Contaminant	NJDEP Soil Remediation Standard	EPA Regional Screening Levels	OSWER Guidance on Remedial Actions for Superfund Sites with PCB Contamination (1)	Site-Specific Site Background 95% UPL (2)		Principal Threat Waste Requirements (3)	Preliminary Remediation Goals (4)(5)
	Non-Residential Direct Contact Soil Remediation Standard	Industrial		Surface Soil	Subsurface Soil		
VOCs							
Benzene	5	5.6	N/A	--	0.01 (ND)	N/A	5
Ethylbenzene	110,000	29	N/A			N/A	29
Toluene	91,000	46,000	N/A			N/A	46,000
Xylenes (total)	170,000	2,600	N/A			N/A	2,600
PAHs							
Naphthalene	17	20	N/A	0.102	--	N/A	17
Pesticides/PCBs							
Aldrin	0.2	0.1	N/A			N/A	0.1
Dieldrin	0.2	0.11	N/A	0.00407	0.0061 (ND)	N/A	0.11
4,4'-DDD	13	7.2	N/A	0.00446	0.0144	N/A	7.2
4,4'-DDT	8	7	N/A	--	0.0747	N/A	7
Heptachlor	0.7	0.38	N/A			N/A	0.38
Polychlorinatedbiphenyls(PCBs)	1	0.74	10 (surface soil) 25 (subsurface soil)			500	1 (use engineering control) 10 (surface soil) 500 (remove as Principal Threat Waste)
Metals							
Arsenic	19	1.6	N/A	38.86	--	N/A	38.86
Cadmium	78	800	N/A	2.86	5.286	N/A	78
Petroleum Free Product							
Petroleum free product containing PCBs	N/A	N/A	N/A	N/A	N/A	Remove any petroleum free product contaminated with PCBs and grossly contaminated soils with petroleum free product contaminated with PCBs	Remove any petroleum free product contaminated with PCBs and grossly contaminated soils with petroleum free product contaminated with PCBs

Notes:
All units in mg/kg
NA: non-applicable
ND: non-detect
(1) Guidance on Remedial Actions for Superfund Sites with PCB Contamination (OSWER Directive No. 9355.4-01) provides guidance on selection of PRGs and remedial actions for PCBs at a Superfund site
(2) UPL: Upper Prediction Level based on EPA statistical analysis of background data
(3) According to the EPA guidance - A Guide to Principal Threat and Low Level Threat Wastes (November 1991), Principal Threat Waste refers to those source area materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present significant risk to human health or the environment should exposure occur.
(4) All Principal Threat Waste will need to be removed for subsequent off-site treatment/disposal or onsite treatment. Contaminant concentrations above the preliminary remediation goals (PRGs) remaining onsite after remediation will require engineering/institutional control.
(5) The selection of the PRGs, with the exception of those for PCBs and free product, involves a two-step process: the PRGs were selected such that they represent the more stringent criteria between the NJDEP NRDCSRS and the EPA Regional Screening Level (RSL) for industrial soil (2) the PRGs would be the higher of the standards/screening levels and the site-specific background levels. For PCBs, the NJDEP NRDCSRS, OSWER Guidance on Remedial Actions for Superfund Sites with PCBs Contamination, and Principal Threat Waste requirements were used to establish the PRGs.
Numbers highlighted in yellow are selected as the Preliminary Remediation Goals

Table 2-5
Technology Evaluation for Soil
Syncon Resins Superfund Site
Kearny, New Jersey

General Response Action	Remedial Technology	Process/Remedial Option	Description	Effectiveness	Implementability	Relative Cost	Retained
No Action	None	None	No action is performed at the site.	Does not reduce toxicity, mobility, or volume of contamination. No Action alternative retained as baseline for comparison with other alternatives as required by NCP.	Highly implementable. No significant administrative difficulties anticipated.	None	Yes
Institutional/ Engineering Controls	Fencing	Fencing	Fence contaminated portions of site. Limit access to the contaminated area.	Would reduce human contact but would not prevent contaminants migrating off-site. Would not reduce ecological risks.	Implementable since the site is already fenced. Requires long term maintenance of fence.	Low Capital Cost Low O&M Cost	Yes
	Deed Restrictions	Deed Restrictions	Prevents certain types of uses of areas of the site (e.g., prevents intrusive subsurface activities, irrigation, or new construction).	Effectiveness depends on proper enforcement. Does not reduce contamination.	Highly implementable. Requires legal authority to enforce restrictions. Not sufficient for the contamination identified at the site as a stand-alone technology, must be coupled with other remedial alternatives to be effective.	Low Capital Cost No O&M Cost	Yes
	Long-Term Monitoring	Long-term Monitoring	Long-term monitoring includes periodic sampling and analysis of groundwater. This would provide an indication of whether the impact of the migration of contaminant in unsaturated soil on the groundwater quality has been maintained below acceptable level.	Long-term monitoring would not alter the effects of the contamination on human health risk and the environment. Monitoring is only reliable for tracking the breakdown of contaminants via naturally occurring processes and the migration of contaminants.	Highly implementable, yet not sufficient for the contamination identified at the site as a stand-alone technology, must be coupled with other remedial alternatives to be effective.	Low Capital Cost Medium O&M Cost	Yes
	Capping	Non-RCRA Cap	Compacted clay/soil, or layers of sand/stone/gravel, filter fabric, asphalt/concrete, or other material over areas of contamination, including periodic inspection of cap/cover materials.	Effective in preventing direct contact with and migration of soil. Susceptible to cracking, weathering, and erosion. No reduction in toxicity, mobility or volume of contamination is provided. Monitoring and inspection are required to track the durability and integrity of capping and cover materials and ensuring consolidated materials remain isolated.	Easily implementable. Long-term reliability requires maintenance. Issues with flooding could reduce implementability. Would restrict future use of capped areas.	Low Capital Cost Low O&M Cost	Yes
		RCRA Cap	A multi-media cap meeting RCRA hazardous waste disposal requirements.	Effective in preventing direct contact and minimizing infiltration, but not effective in addressing existing groundwater contamination. No reduction in toxicity, mobility or volume of contamination.	Would restrict future use of capped areas. Easily implementable but is not more advantageous than a non-RCRA cap in terms of preventing direct contact with contaminated soil, moreover, it may hinder the effectiveness of OU-1 remedy by minimizing vertical infiltration and subsequent flushing.	High Capital Cost Medium O&M Cost	No
Removal	Soil Excavation	Excavation	Excavation of contaminated soil.	Effective in removing impacted soils in both unsaturated and saturated zone. A support technology for treatment or disposal options. Relocates, but does not reduce toxicity, mobility or volume of contamination.	Technically and administratively feasible, involving commercially available equipment.	Low/Medium Capital No O&M Cost	Yes
	Demolition	Demolition	Demolition of on-site building(s) that is located within the target soil treatment area.	Effective in removing physical barrier of accessing/remediating impacted soils.	Technically and administratively feasible, involving commercially available equipment.	Low/Medium Capital No O&M Cost	Yes

Table 2-5
Technology Evaluation for Soil
Syncon Resins Superfund Site
Kearny, New Jersey

General Response Action	Remedial Technology	Process/Remedial Option	Description	Effectiveness	Implementability	Relative Cost	Retained
In Situ Treatment	Biological Treatment	In Situ Bioremediation	In situ bioremediation involves the injection of nutrients/substrate (in some cases augmented by addition of biomass if necessary) into subsurface coupled with biosparging or injection of oxygen release compounds to enhance aerobic biodegradation of contaminants in subsurface.	Effective in removing BTEX, TPHs, and petroleum product.	Implementable, but may need to couple with other remediation technology to address PCBs and metal contaminants. Potential complications may arise during the implementation of the in-situ bioremediation, such as preferential colonization of microbes resulting in delivery system clogging. Treatment may take a long time depending upon specific site conditions.	Medium Capital Cost Low/Medium O&M	No
	Physical/Chemical Treatment	Chemical Oxidation	ISCO involves the injection of chemical oxidants into the subsurface to destroy organic contaminants in subsurface. Complete oxidation of contaminants results in their breakdown into less toxic compounds, such as carbon dioxide, water, and minerals. Repeat application of oxidant is generally required due to mass transfer from low permeable area into areas of higher permeability.	Effective in removing BTEX, TPHs, PAHs, and PCBs in some cases (but requires application of heated persulfate), but not metals. Generally not used for areas with NAPLs which is the case at the site. ISCO is dependent upon achieving adequate contact between oxidants and contaminants. Subsurface heterogeneities can affect delivery of the oxidant. Adequate site characterization of contaminant distribution and subsurface geology is critical for the success of ISCO. Sufficient amount of oxidants need to be applied.	Implementable, but may need to couple with other remediation technology to address metal contaminants. Also may need application of heated persulfate due to PCBs presence. In addition, high soil oxidant demand could significantly reduce the effectiveness so a bench scale test would be warranted. To treat the large soil treatment zone at the Site, a large number of injection points and significant amount of oxidants would be required, which would be difficult to implement.	High Capital Cost Low O&M Cost	No
		Electrokinetic Remediation	Application of a low-intensity (mA/cm2) direct current through the soil between electrodes that are divided into a cathode array and an anode array, inducing a series of electrokinetic phenomena (e.g., electromigration, electroosmosis, electrolysis etc.) that can mobilize and collect contaminants in soil.	Emerging technology, effective in removing metals and working well even in low-permeability soil. Potentially effective in both saturated and unsaturated soil but would a require a minimum soil moisture content for the latter, some study suggested the optimum soil moisture content ranged between 10% and 20%. Limited effectiveness in removing petroleum product and PCBs.	Not implementable due to limited effectiveness in removing petroleum hydrocarbons and PCBs. In addition, even though commercially available LASAGNA™ processes have been implemented, there is considerable complexity in system O&M. Extensive surface geophysical survey & underground utility survey would also be required.	Medium Capital Cost High & Medium O&M	No
		Soil Flushing	Soil flushing involves the injection of surfactant (for petroleum product, PAHs, and PCBs), and acids/bases or chelating agents (for metals) to mobilize and collect contaminants in subsurface. May couple with amendment (e.g., nutrients, oxygen release compounds etc.) injection and/or biosparging to enhance in situ biological treatment.	The technology has not been well demonstrated and the effectiveness is uncertain.	Implementable, but may need specialized equipment to perform the process. It would be technically and administratively difficult to demonstrate and ensure that mobilized contaminants have been completely captured and not migrated off-site or areas that previously have no known contamination.	High Capital Cost High O&M Cost	No
		Soil Vapor Extraction	Require installation of shallow vacuum extraction points within the VOC-contaminated soil to volatilize and extract VOCs. Off-gas requires treatment prior to discharge.	Effective in removing VOCs and petroleum product from saturated zone only.	Much of the contamination is in the saturated zone, which renders this technology impractical at this Site.	Medium Capital Cost Medium O&M Cost	No
		Solidification/Stabilization	Physically and/or chemically binding metals in contaminated soil to reduce leachable concentrations. Soil can be mixed with a stabilizing agent (e.g., cement, pozzolanic, or thermoplastic) using an auger.	Effective in reducing mobility, but not volume and toxicity of the waste. Performance depends on mixing efficiency. Treatability study would be required to determine proper formula.	Implementable. Multiple vendors available for this service. A treatability study would be required. Large target area of shallow depth might involve high costs.	Medium Capital Cost Low O&M Cost	No
	Thermal Treatment	Vitrification	Uses an electric current to melt soil or other earthen materials at extremely high temperatures (1,600 to 2,000 °C) and thus immobilize metals by forming an unleachable monolith and destroy organic pollutants by pyrolysis. Inorganic pollutants are incorporated within the vitrified glass and crystalline mass. Water vapor and organic	Effective in destroying organic compounds and immobilizing metals. However, off-gas treatment may be necessary to capture any organics that are vaporized during treatment.	Only limited vendors available that can perform the services. Much of the contamination at the Site is located in the saturated zone, which renders this technology very costly. The creation of secondary (off-gas) waste is also a concern.	High Capital Cost No O&M Cost	No
		In Situ Thermal Desorption	Uses conductive heating and vacuum to remediate soil. Heat and vacuum are applied simultaneously to subsurface soils, with either an array of vertical heater/vacuum wells or horizontally positioned heaters under imposed vacuum. Heat is applied to soil from a high-temperature surface in contact with the soil, so that radiation and thermal conduction heat transfer are effective near the heater. As a result, thermal conduction and convection occur across the soil volume, and creates a zone of very high temperature (>1000oF) near the heaters, which can oxidize or pyrolyze contaminants drawn into the zone. As the soil is heated, contaminants are vaporized and/or destroyed by a number of mechanisms: evaporation into the air stream, steam distillation, boiling, oxidation, or pyrolysis. The recovered contaminants can then be processed/treated at the surface.	Effective in removing volatile and semi-volatile organics from soil, however, off-gas treatment may be necessary to capture any organics that are vaporized during treatment. Not effective in removing metals. More importantly, not effective in improving the effectiveness and efficiency of the existing OU1 remedy that is currently in place.	Implementable, multiple vendors available for this service. However, other remediation technology will be needed to address the metal contamination in soil.	High/Medium Capital Cost High O&M Cost	No

Table 2-5
Technology Evaluation for Soil
Syncon Resins Superfund Site
Kearny, New Jersey

General Response Action	Remedial Technology	Process/Remedial Option	Description	Effectiveness	Implementability	Relative Cost	Retained
Ex Situ Treatment	Biological Treatment	Landfarming	Involves placement of excavated contaminated soils, sediments, or sludges onto lined beds (coupled with other methods to control leaching of contaminants) and periodically turned over or tilled to aerate the waste. Soil are maintained at appropriate conditions to optimize the rate of contaminant degradation, and the controlled conditions normally include moisture, aeration, pH, and nutrients etc. Contaminated media is usually treated in lifts, and one lift will be removed once the target treatment level has been achieved followed up construction of new lift.	Effective in treating petroleum hydrocarbons but the degradation rate generally deceases as the molecular weight gets higher. Field success demonstrated for diesel fuel, No. 2 and No. 6 fuel oils, and oily sludge. Not effective in removing PCBs or metals.	Proven technique for TPH contaminated soil, implementable with vendor available for this service. However, landfarming would require the use of a large amount of space for a relatively long time, and thus may not be administratively implementable due to the site location (within 100-year flood zone). Not effective in removing PCBs or metals, and hence need to couple with some other technology to treat these contaminants.	Medium Capital Cost Medium O&M Cost	Yes for off-site treatment
	Physical/Chemical Treatment	Soil Washing	Involves using wash water (can be augmented by basic leaching agent, surfactant, or chelating agent) to segregate sands from fines which are often more heavily contaminated, and thus reduce the amount of soil needing further cleanup.	Not very effective for sites with high clay or silt content as no significant volume reduction can be anticipated.	Implementable but with limited effectiveness	Medium Capital Cost No O&M Cost	No
		Solidification/Stabilization	Physically and/or chemically binding metals in contaminated soil to reduce leachable concentrations. The excavated soil is then mixed with a stabilizing agent (e.g., cement, pozzolanic, or thermoplastic) using batch reactor (ex situ).	Effective in reducing mobility, but not volume and toxicity of the waste. Performance depends on mixing efficiency. Treatability study would be required to determine proper formula. Onsite landfilling would limit future use. Not necessary prior to offsite landfilling.	Implementable but likely more appropriate as a supplemental component of the remedial actions. Multiple vendors available for this service. A treatability study would be required.	Medium Capital Cost Low O&M Cost	Yes for off-site treatment
	Thermal Treatment	Incineration	Incineration units such as multiple hearth, rotary kiln, and infrared systems are all applicable and would successfully treat the organic contaminated soils at a high temperature (1,500 ºC to 2,000 ºC), evaporating excess water from the soil, destroying organic matter, and vaporizing all volatile substances.	Proven technology, commonly used for highly efficient destruction of hazardous waste, including PCB-contaminated soils. Incinerator ash can be safe for disposal in a landfill. An on-site mobile incinerator can process approximately 5 tons of soil per hour.	Off-site incinerators are available from several sources; capacity can be an issue. A limited number of on-site incineration vendors have transportable units, however permitting to mobilize/setup for treatment on-site can become an issue.	High/Medium Capital Cost No O&M Cost	No
		Low Temperature Thermal Desorption via Thermally Enhanced Soil Vapor	Mixes excavated contaminated soil in a soil stack (Burrito) and heat the soil to 60 ºC - 200 ºC with hot air ; desorbs and extract the contaminants for off-gas treatment. 5 - 7 days treatment and 500 - 1,200 tons per Burrito/Batch reported. As an alternative, a constant-feed indirect-contact LTTD unit (such as the system owned by Maxymillian Technologies) can be employed to heat the soil to 400 ºC such that PCB contamination can be treated; desorbs and extract the contaminants for off-gas treatment.	Normally applied to media with high concentrations of contaminants. Effective in removing volatile organic compounds, chlorinated solvents, TPHs, and/or PCBs (depending upon treatment temperature) from both sandy soils and clay.	Implementable. Vendors have production units available. Remediation experience has included several full-scale projects. Not effective in removing metals other than mercury, and hence need to couple with some other technology to address these contaminants (e.g., excavation and disposal). The continuous-feed indirect-contact LTTD units will require prior soil processing (i.e., draining of excavated soils) before treatment.	Medium/High Capital No O&M Cost	Yes
Disposal		On-site Backfill	Backfilling treated soil to the excavation area or to a single consolidation area.	Effective method of disposing of treated soil. (Volume, toxicity, and/or mobility of waste reduced by prior treatment).	Easily implementable. Technically and administratively feasible if soil is treated to remedial goals and is determined not a hazardous waste.	Low Capital Cost No O&M Cost	Yes
		Off-site Non-Hazardous Waste Landfill	Disposal of excavated soil in an off-site non-hazardous waste landfill.	Disposal in non-hazardous waste landfill is effective in preventing direct contact and in reducing mobility of contaminants; however, the volume and toxicity of the waste is not reduced.	Implementable for disposal of treated soils that meet non-hazardous waste definition. There is a non-hazardous waste landfill within an appropriate distance from site.	Medium Capital Cost No O&M Cost	Yes
		Off-site Hazardous Waste Landfill	Disposal of excavated soil in an off-site, permitted, RCRA hazardous waste landfill.	Highly effective for disposal of hazardous wastes that meet required treatment under the RCRA LDRs. Effective in preventing direct contact and in reducing mobility of contaminants; however, the volume and toxicity of the waste is not reduced.	Implementable for disposal of treated soils that meet hazardous waste definition. There is a hazardous waste landfill within reasonable transportation distance from the site.	High Capital Cost No O&M Cost	Yes

NOTES:

[shaded box]: Technology eliminated from further evaluation.

Table 4-1
Summary of Comparative Analysis of Soil Remedial Alternatives
Syncon Resins Superfund Site
Kearny, New Jersey

EVALUATION CRITERION	ALTERNATIVE S1 NO ACTION	ALTERNATIVE S2 EXCAVATION AND OFF-SITE DISPOSAL; BACKFILLING WITH IMPORTED CLEAN FILL; AND INSTITUTIONAL/ENGINEERING CONTROL	ALTERNATIVE S3 EXCAVATION; ON-SITE LOW TEMPERATURE THERMAL DESORPTION OF EXCAVATED SOIL CHARACTERIZED AS TSCA WASTE OR RCRA HAZARDOUS WASTE FOLLOWED BY ON-SITE BACKFILLING; OFF-SITE DISPOSAL OF EXCAVATED SOIL CHARACTERIZED AS NON-HAZARDOUS WASTE; BACKFILLING WITH IMPORTED CLEAN FILL; AND INSTITUTIONAL/ENGINEERING CONTROL
Summary of Components	• No action	▪ Pre-design investigation ▪ Excavation of onsite soils exceeding PRGs as defined in Section 2.3 ▪ Post remediation sampling to verify achievement of PRGs ▪ Disposal of excavated soils at off-site facilities in accordance with applicable regulatory requirements ▪ Backfilling of excavated areas with imported clean fill ▪ Backfilling recovered existing gravel from completed excavation areas to the bottom portion of the subsurface excavation ▪ Implementation of institutional/engineering controls as necessary, due to the presence of soil contamination exceeding the PRGs ▪ Implementation of a soil management plan	▪ Pre-design investigation ▪ Excavation of onsite soils exceeding PRGs as defined in Section 2.3 ▪ Post remediation sampling to verify achievement of PRGs ▪ On-site LTTD treatment of excavated soils characterized as TSCA waste or RCRA hazardous waste ▪ Post remediation sampling to verify effectiveness of treatment ▪ Disposal of excavated non-hazardous soils at off-site facilities in accordance with applicable regulatory requirements ▪ Backfilling of excavated areas with recovered gravel and clean fill or the LTTD-treated soils ▪ Implementation of institutional/engineering controls as necessary, due to the presence of soil contamination exceeding the PRGs ▪ Implementation of a soil management plan
Overall Protection of Human Health and the Environment	Contaminated soil poses risk to human health. No means would be available to prevent current and future exposure.	Would be protective of human health and the environment. Contaminated surface soil exceeding the PRGs and Principal Threat Waste would be permanently removed from the Site. In addition, institutional and engineering controls and soil management plan will be implemented due to the presence of soil contamination exceeding the PRGs.	Would be protective of human health and the environment through treatment of Principal Threat Waste to below the PRGs, and by excavation and off-site disposal of non-hazardous contaminated surface soil exceeding the PRGs. In addition, institutional and engineering controls and soil management plan will be implemented due to the presence of soil contamination exceeding the PRGs.
Compliance with ARARs	Would not meet PRGs.	Would meet PRGs. Works will be conducted in accordance with location- and action-specific ARARs.	Would meet PRGs. Works will be conducted in accordance with location- and action-specific ARARs.
Long-term Effectiveness and Permanence	Not effective in the long term as there is no mechanism to monitor contaminant migration.	Effective in the long term as contaminated surface soil and Principal Threat Waste would be permanently removed from the Site. Institutional and engineering controls would be used to limit residual risks present and potential risks to future users of the Site. Would rely on the permitting process to control the wastes disposed in the offsite landfills.	Effective in the long term as contaminated surface soil and Principal Threat Waste would be permanently removed from the site, or treated to below the PRGs and backfilled on site. Institutional and engineering controls would be used to limit residual risks present and potential risks to future users of the Site. Would rely on the permitting process to control the wastes disposed in the offsite landfills.

Table 4-1
Summary of Comparative Analysis of Soil Remedial Alternatives
Syncon Resins Superfund Site
Kearny, New Jersey

EVALUATION CRITERION	ALTERNATIVE S1 NO ACTION	ALTERNATIVE S2 EXCAVATION AND OFF-SITE DISPOSAL; BACKFILLING WITH IMPORTED CLEAN FILL; AND INSTITUTIONAL/ENGINEERING CONTROL	ALTERNATIVE S3 EXCAVATION; ON-SITE LOW TEMPERATURE THERMAL DESORPTION OF EXCAVATED SOIL CHARACTERIZED AS TSCA WASTE OR RCRA HAZARDOUS WASTE FOLLOWED BY ON-SITE BACKFILLING; OFF-SITE DISPOSAL OF EXCAVATED SOIL CHARACTERIZED AS NON-HAZARDOUS WASTE; BACKFILLING WITH IMPORTED CLEAN FILL; AND INSTITUTIONAL/ENGINEERING CONTROL
Reduction of Toxicity, Mobility, or Volume (TMV) through Treatment	No reduction in TMV.	With the exception of the soil that may need treatment in off-site facilities prior to disposal as RCRA hazardous waste, this alternative would provide no reduction of TMV through treatment, but would reduce mobility through landfilling.	LTTD would achieve reduction of TMV through treatment. Excavation and off-site disposal would provide no reduction of TMV through treatment, but would achieve reduction of mobility for excavated and disposed soils.
Short-term Effectiveness	There is no short-term impact to workers or the community as there is no remedial activity under this alternative.	Some short-term risks to remediation workers and the community during construction. Operational controls would be established to minimize the impact. Use of PPE by workers would minimize exposure.	Some short-term risks to remediation workers and the community during construction. Operational controls would be established to minimize the impact. Use of PPE by workers would minimize exposure. The LTTD unit would be operated and maintained 24 hours a day, 7 days a week while in operation by properly trained staff.
Implementability	Would be easy to implement.	Would be easy to implement since there are only excavation and disposal facility issues to resolve.	Would be technically implementable. This alternative would be implemented using conventional construction methods and equipment for excavation but there are many factors affecting the effectiveness of LTTD (e.g., soil composition, moisture content etc.) for which additional investigation is warranted to determine their impact on effectiveness and design parameters.
Total Present Worth Cost	$0	$21.5 million	$26.8 million

Table 4-2
Comparison of Total Present Worth Costs for Alternatives S2 and S3
Syncon Resins Superfund Site
Kearny, New Jersey

Item	Feature of Work	Alternative S2 Total Present Worth Cost	Alternative S3 Total Present Worth Cost
A	**General Requirements**		
01	General Conditions	$813,171	$990,480
02	Permits	$69,875	$87,344
03	Safety and Health Requirements	$155,472	$509,215
04	Temporary Facilities and Utilities	$54,153	$66,381
05	Security	$123,155	$159,839
06	Surveying	$145,864	$194,777
07	Erosion Control	$46,292	$50,659
08	Decontamination	$36,684	$42,798
B	**Pre-Design**		
	Pre-Design Investigation and Analysis	$400,000	$400,000
	allowance, based on past project experience.		
C	**Remedial Design**		
	Remedial Design	$934,579	$1,869,159
	allowance, based on past project experience.		
D	**Site Preparation**		
9	Concrete Slab Demolition	$595,685	$595,685
10	Perimeter Wellpoint Dewatering System	$303,083	$303,083
11	Onsite Water Treatment System	$280,374	$646,345
E	**Excavation, Sampling, and Backfill**		
12	Excavation	$673,421	$1,053,367
13	Post-Excavation Sampling	$130,142	$130,142
14	Backfill	$931,959	$665,560
F	**Low-Temperature Thermal Treatment**	$0	$10,131,889
G	**Transportation and Disposal**		
15	TSCA Waste for TSCA Landfill	$1,639,444	$0
16	Hazardous Waste Requiring Thermal Treatment	$3,712,988	$0
17	Hazardous Waste Not Requiring Thermal Treatment (Subtitle C)	$3,278,889	$0
18	Non-Hazardous Waste (Subtitle D)	$1,446,415	$1,446,415
19	Product Oil Recovered from Dewatering (TSCA waste)	$161,586	$161,586
H	**Final Site Restoration**		
20	Final Site Restoration (Allowance)	$43,672	$43,672
I	**Closure Documents**		
21	RA Report and As-Built Drawings (Allowance)	$87,344	$87,344

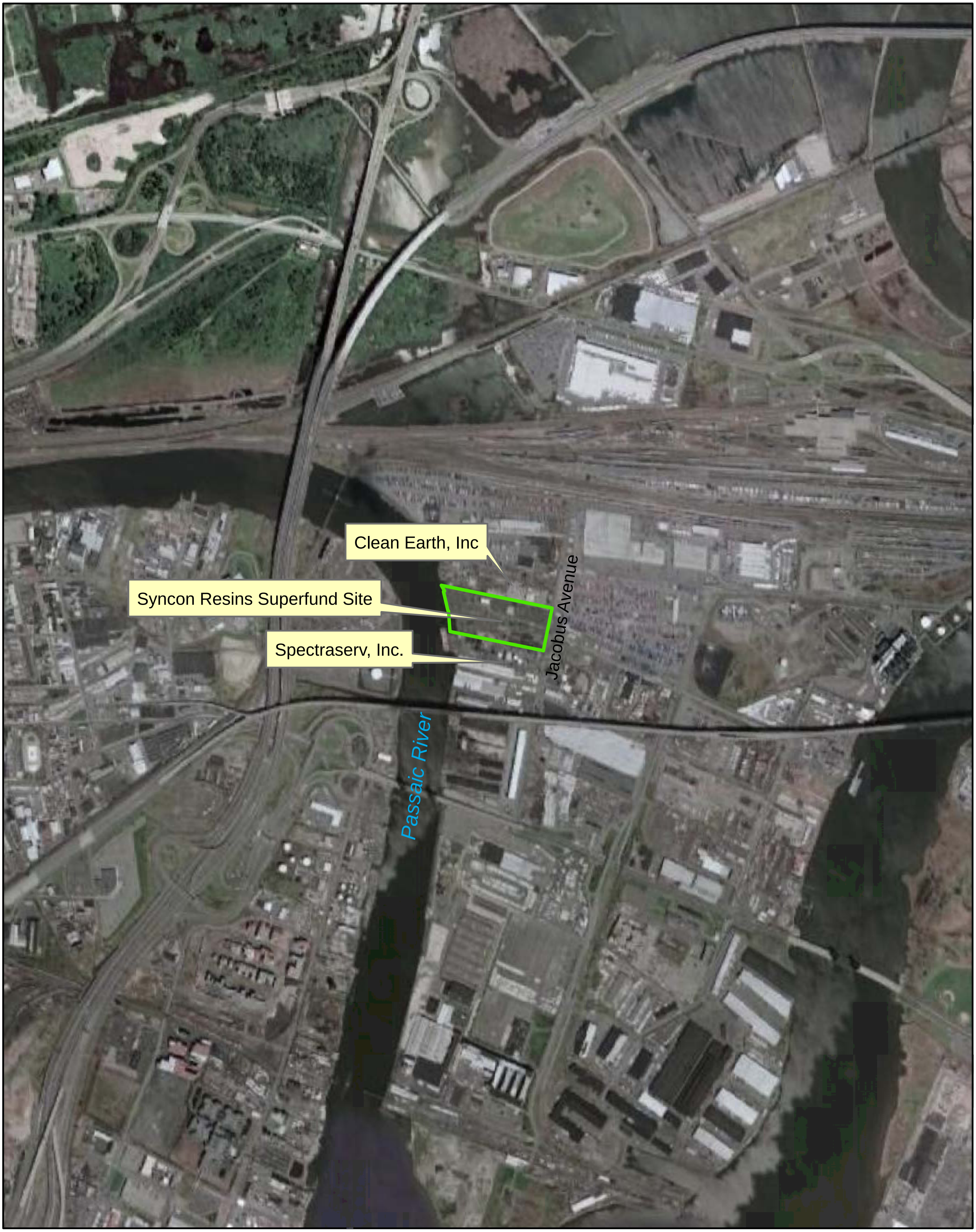
Table 4-2
Comparison of Total Present Worth Costs for Alternatives S2 and S3
Syncon Resins Superfund Site
Kearny, New Jersey

Item	Feature of Work	Alternative S2 Total Present Worth Cost	Alternative S3 Total Present Worth Cost
	PRE-DESIGN INVESTIGATION AND REMEDIAL DESIGN COSTS		
	Pre-Design Investigation	$400,000	$400,000
	Remedial Design	$934,579	$1,869,159
	Total A/E Firm Cost	**$1,335,000**	**$2,270,000**
	RA CONTRACTOR COSTS		
	Prime Contractor Own Work	$3,637,870	$4,322,647
	Subcontractors		
	Security Subcontractor	$123,155	$159,839
	Surveying Subcontractor	$145,864	$194,777
	Dewatering Subcontractor	$303,083	$303,083
	Water Treatment Subcontractor	$280,374	$646,345
	Treatment Subcontractor	$0	$10,131,889
	T&D Subcontractor	$10,239,322	$1,608,001
	Subtotal RA Contractor Cost	**$14,730,000**	**$17,367,000**
	G&A (5%)	$737,000	$869,000
	Subtotal RA Contractor Cost with G/A	**$15,467,000**	**$18,236,000**
	Profit, except on T&D (8%)	$419,000	$1,331,000
	Profit, T&D, reduced fee (2%)	$205,000	$33,000
	Subtotal RA Contractor Cost with Profit	**$16,091,000**	**$19,600,000**
	Bond (1.5%)	$242,000	$294,000
	Contingency (10%)	$1,610,000	$1,960,000
	TOTAL RA CONTRACTOR COST	**$17,943,000**	**$21,854,000**
	ENGINEERING DURING CONSTRUCTION COSTS		
	Supervision, Inspection, and Management/Title II (9.8%)	$1,758,414	$2,141,692
	TOTAL ENGINEERING DURING CONSTRUCTION COSTS	**$1,759,000**	**$2,142,000**
	TOTAL PROJECT COST		
	A/E COST	$1,335,000	$2,270,000
	RA CONTRACTOR COST	$17,943,000	$21,854,000
	ENGINEERING DURING CONSTRUCTION COSTS	$1,759,000	$2,142,000
	SUBTOTAL PROJECT COST	**$21,037,000**	**$26,266,000**
	Escalation (2%)	$421,000	$526,000
	TOTAL PROJECT COST	**$21,458,000**	**$26,792,000**

Table 4-3
Summary of Cost Sensitivity Analysis for Alternatives S2 and S3
Syncon Resins Superfund Site
Kearny, New Jersey

Alternative	Original Total Present Worth Cost	Total Present Worth Cost after 20% Increase in Volume of Soil to be Remediated	Total Present Worth Cost after 10% Increase in T&D Unit Cost Increase
S2	$21,458,000	$24,498,000	$22,862,000
S3	$26,792,000	$30,421,000	$27,038,000

Notes:
T&D - transportation and disposal



CDM

0 0.25 0.5 Miles

N

Image Source: Sanborn 2008

500783

Figure 1-1
Site Location
Syncon Resins Superfund Site
South Kearny, New Jersey

CDM

Figure 1-2
Surficial Geology Map
Syncon Resins Facility and Vicinity
Syncon Resins Superfund Site
South Kearny, New Jersey

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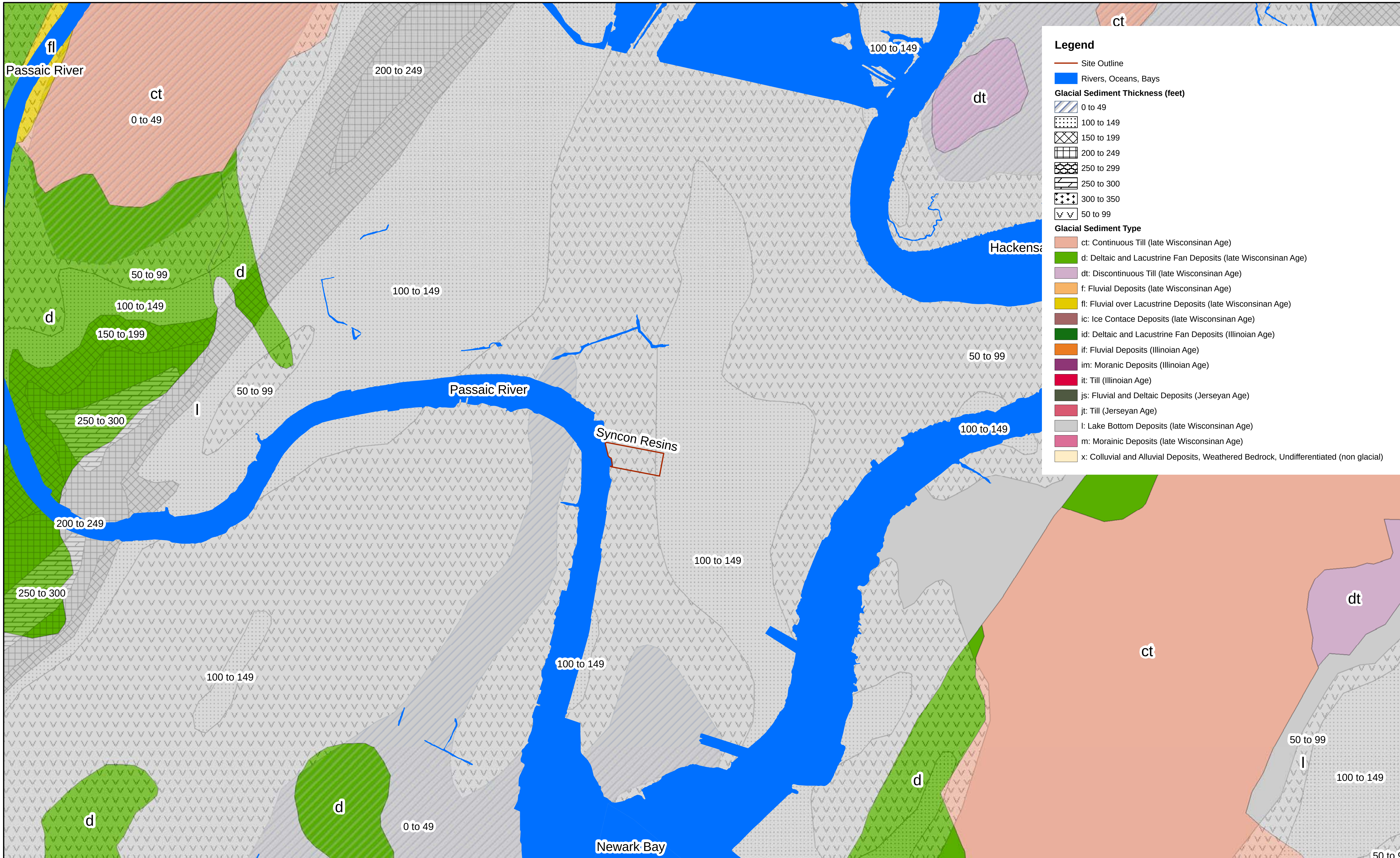
Source: DGS96-1 Glacial Sediments of NJ

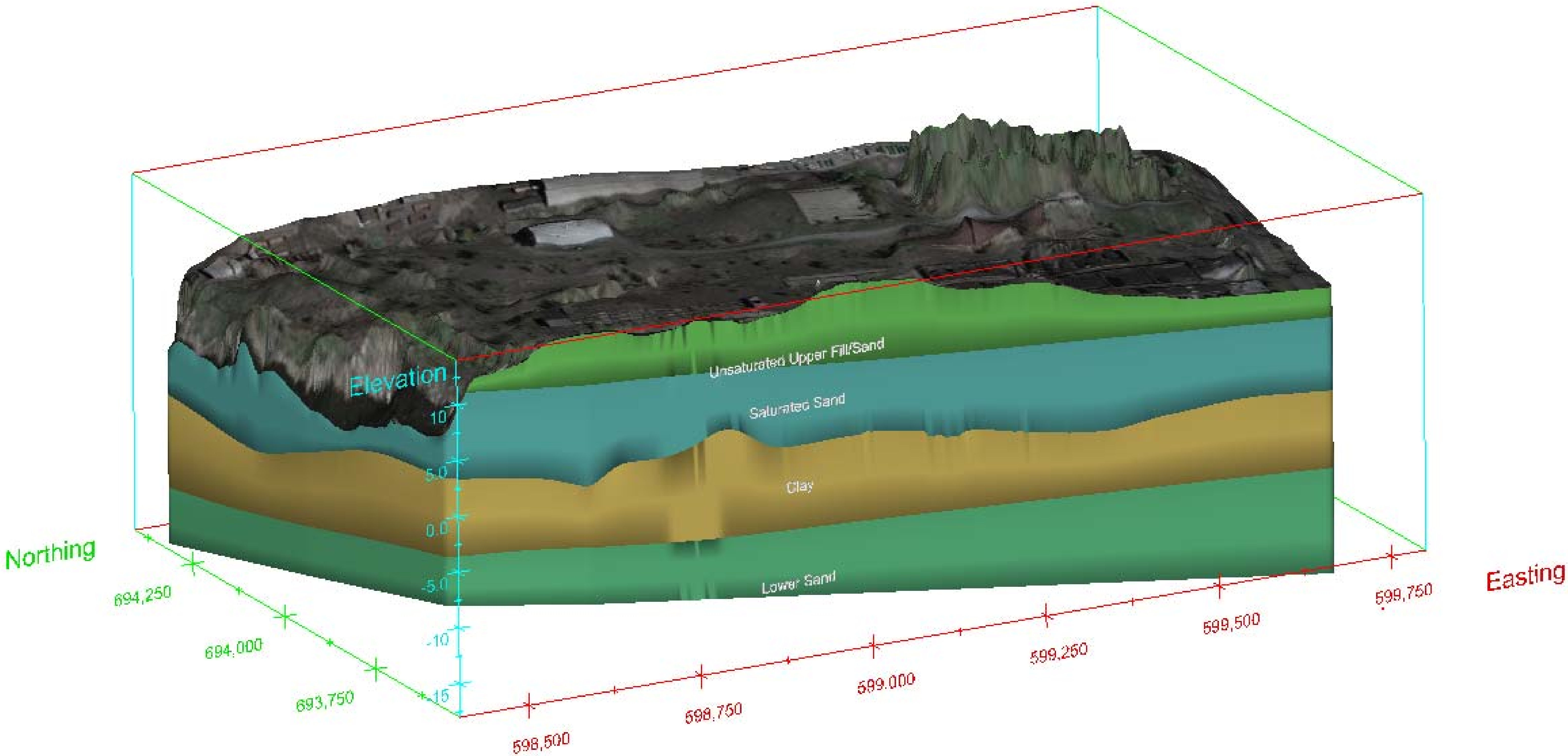


CDM

Source: DGS96-1 Glacial Sediments of NJ

Figure 1-3
Glacial Sediments and Geologic Map
Syncon Resins Facility and Vicinity
Syncon Resins Superfund Site
South Kearny, New Jersey

500785



Horizontal scale: 1” = 130 feet
Vertical scale: 1” = 11 feet
Vertical Exaggeration: 12

Source: Stratigraphywith2007Aerial.4d

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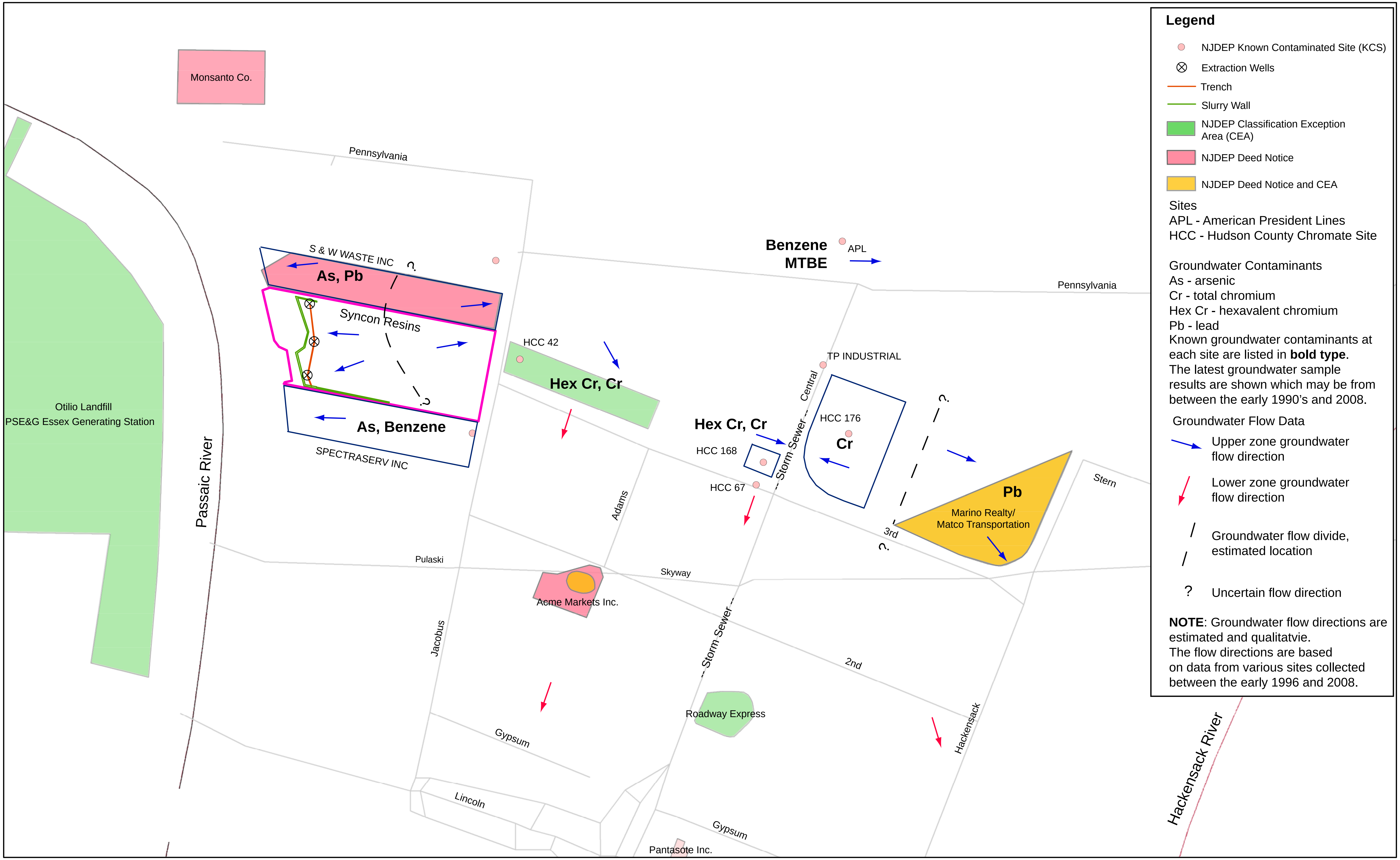
Figure 1-4
Lithologic Cross Section
Syncon Resins Superfund Site
South Kearny, New Jersey



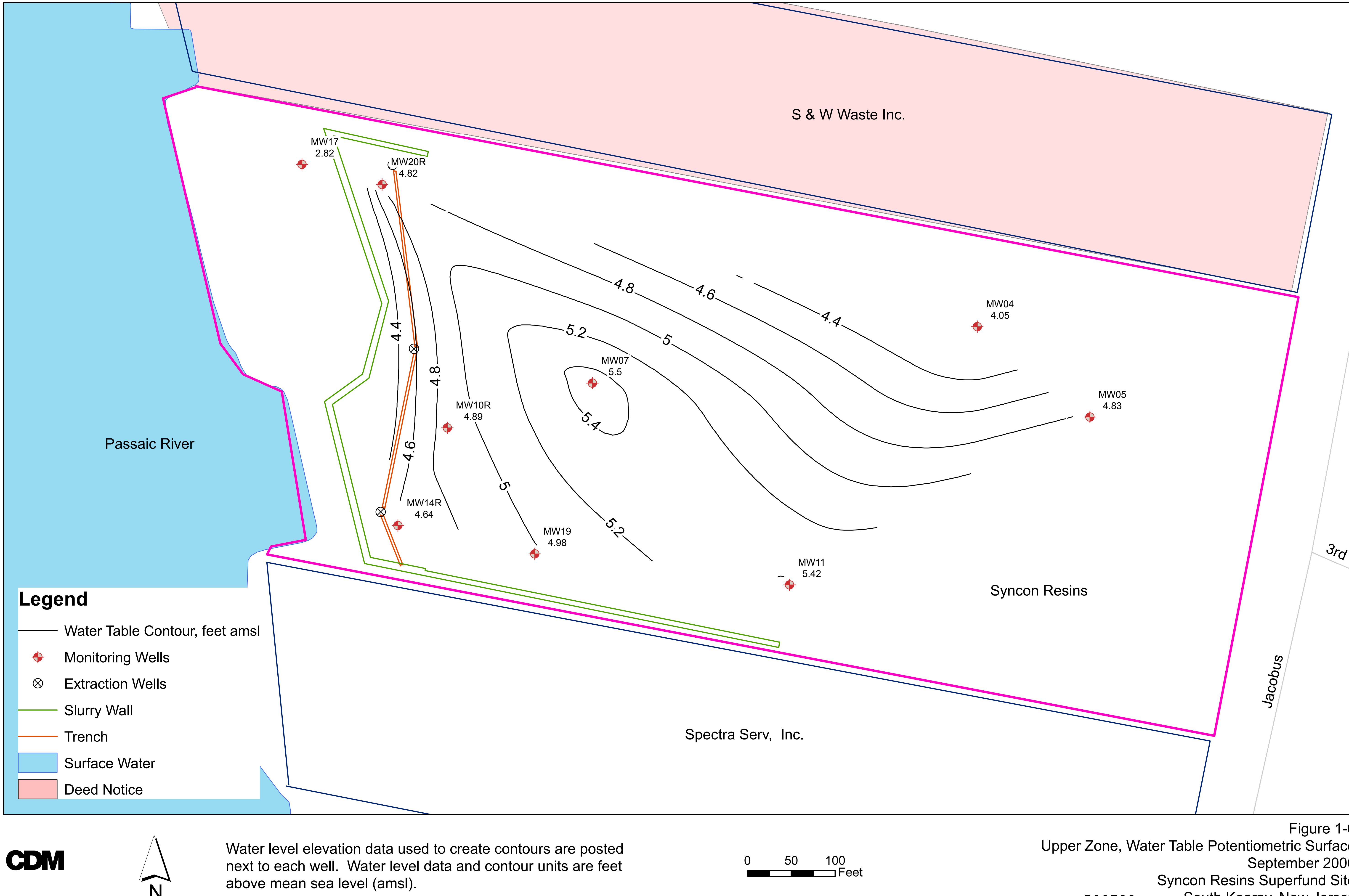
CDM

0 250 500 1,000
Feet

N

Figure 1-5
Area Groundwater Flow Characteristics
Syncon Resins Facility and Vicinity
Syncon Resins Superfund Site
South Kearny, New Jersey

500787



CDM

Water level elevation data used to create contours are posted next to each well. Water level data and contour units are feet above mean sea level (amsl).

Figure 1-6
Upper Zone, Water Table Potentiometric Surface
September 2006
Syncon Resins Superfund Site
South Kearny, New Jersey

500788

2008 SAMPLE RESULTS – SOUTHWEST AREA

SAMPLE ID	SB-46-A	SB-46-B	SB-46-C
SAMPLE INTERVAL	1.9'-3.9'	4'-6'	8.5'-10.5'
CONTAMINANT			
BENZO(A)PYRENE	0.33 J	0.54	0.39
PCBS(TOTAL)	4	1.4	–
ARSENIC	23.1 J	2.4 J	1.7 J
MANGANESE	113 J	46.8 J	42.8 J
TPH-TOTAL	15,214 J	–	–

SAMPLE ID	SB-47-A	SB-47-B	SB-47-C
SAMPLE INTERVAL	2.1'-4.1'	5.6'-7.6'	9'-11'
CONTAMINANT			
TOLUENE	–	12	5.5
BENZENE	1.1 J	–	0.032 J
BENZO(A)PYRENE	–	–	0.76
PCBS(TOTAL)	2.8	4.4	–
ARSENIC	3.6 J	1.9 J	1.6 J
MANGANESE	158 J	–	42 J
TPH-TOTAL	–	13,520 J	–

SAMPLE ID	SB-48-A	SB-48-B	SB-48-C
SAMPLE INTERVAL	4.5'-6.5'	8.5'-10.5'	11.5'-13.5'
CONTAMINANT			
TOLUENE	37	–	–
BENZO(A)PYRENE	–	0.53	–
HEPTACHLOR	7 J	–	–
PCBS(TOTAL)	1,700	0.9	0.57
ARSENIC	3.3 J	2.6 J	9.3 J
MANGANESE	54.8 J	58.4 J	221 J

SAMPLE ID	SB-49-A	SB-49-B	SB-49-C
SAMPLE INTERVAL	4.5'-6.5'	9.5'-10.5'	12.5'-14.5'
CONTAMINANT			
ETHYLBENZENE	290 J	370 J	–
TOLUENE	14,000	18,000	–
XYLENES(TOTAL)	1,450 J	1,690 J	–
PCBS(TOTAL)	–	0.25	–
ARSENIC	3.7 J	5.2 J	8.2 J
MANGANESE	1,130 J	835 J	310 J
TPH-TOTAL	–	8,636 J	–

SAMPLE ID	SB-50-A	SB-50-B	SB-50-C
SAMPLE INTERVAL	2.4'-4.4'	5.6'-8.6'	9.5'-11.5'
CONTAMINANT			
ETHYLBENZENE	250	350	–
TOLENE	3,200	7,200	–
BENZENE	–	–	0.005 J
XYLENES (TOTAL)	1,440	1,940	–
PCBS (TOTAL)	2	0.51 JN	–
ARSENIC	5 J	1.5 J	3.6 J
LEAD	341 J	–	147 J
MANGANESE	408 J	47.6 J	109 J
TPH-TOTAL	28,000 J	13,170 J	–

SAMPLE ID	SB-51-A	SB-51-B	SB-51-C
SAMPLE INTERVAL	3.2'-5.2'	6'-8'	10.8'-12.8'
CONTAMINANT			
ETHYLBENZENE	160 J	–	–
TOLENE	7,200	–	–
BENZENE	–	0.023	–
XYLENES (TOTAL)	760 J	–	–
BENZO(A)PYRENE	0.26 J	–	–
PCBS (TOTAL)	7.2	–	–
ARSENIC	5.5 J	3 J	6.5 J
LEAD	66.7 J	–	–
MANGANESE	68.3 J	90.5 J	190 J
TPH-TOTAL	16,610 J	–	–

SAMPLE ID	SB-52-A	SB-52-B	SB-52-B-D
SAMPLE INTERVAL	3.5'-5.5'	6.5'-9.5'	6.5'-9.5'
CONTAMINANT			
ETHYLBENZENE	240 J	–	–
TOLENE	6,500	–	–
BENZENE	–	0.009	–
XYLENES (TOTAL)	1,440 J	–	–
BENZO(A)PYRENE	–	0.21 J	–
PCBS (TOTAL)	0.85	0.16	–
ARSENIC	3 J	2.2 J	5.9 J
MANGANESE	200 J	70.7 J	164 J

SAMPLE ID	SB-53-A	SB-53-B	SB-53-C
SAMPLE INTERVAL	2'-6'	6.5'-8'	9'-11'
CONTAMINANT			
BENZENE	0.031 J	–	–
BENZO(B)FLUORANTHENE	–	–	3.3
BENZO(A)PYRENE	0.31	–	2.4
BENZO(A)ANTHRACENE	–	–	3.2
PCBS (TOTAL)	0.33	–	–
ARSENIC	3.6	2.7	4.5
MANGANESE	111	51.2	121

SAMPLE ID	SB-62-A	SB-62-B	SB-62-B-D	SB-62-C
SAMPLE INTERVAL	1.5'-3.4'	5'-7.5'	5'-7.5'	11'-13'
CONTAMINANT				
ETHYLBENZENE	240 J	–	–	–
TOLUENE	2,800	7.6	32	18
BENZENE	–	–	–	0.0081
XYLENES (TOTAL)	1,020 J	–	–	–
BENZO(A)PYRENE	–	0.4	–	0.4
PCBS (TOTAL)	0.97	–	–	–
ARSENIC	5.7 J	3.7 J	2.7 J	2.6 J
MANGANESE	155 J	130 J	73.7 J	91.1 J

2008 SAMPLE RESULTS – SOUTHEAST AREA

SAMPLE ID	SB-40-A	SB-40-B	SB-40-C
SAMPLE INTERVAL	2'-4'	5'-7'	9.3'-11.3'
CONTAMINANT			
ARSENIC	3.1	2.6	6.4
MANGANESE	105	48.1	121

SAMPLE ID	SB-41-A	SB-41-B	SB-41-C
SAMPLE INTERVAL	2'-4'	4'-6'	9'-11'
CONTAMINANT			
BENZO(A)PYRENE	–	–	0.32
ARSENIC	6.9	2.4	4.1
LEAD	95.5	–	–
MANGANESE	144	63.4	115

SAMPLE ID	SB-42-A	SB-42-B	SB-42-B-D	SB-42-C
SAMPLE INTERVAL	2.5'-3.3'	5'-8.5'	5'-8.5'	10'-12'
CONTAMINANT				
BENZO(A)PYRENE	0.23 J	–	–	–
PCBS (TOTAL)	0.25	9.8	16	–
ARSENIC	13.5 J	8 J	3.2 J	7.4 J
MANGANESE	74.1 J	193 J	–	156 J

SAMPLE ID	SB-43-A	SB-43-B	SB-43-C
SAMPLE INTERVAL	4'-6'	8'-10'	11.1'-13.1'
CONTAMINANT			
INDENO(1,2,3-CD)PYRENE	2.7 J	–	–
BENZO(B)FLUORANTHENE	4.9 J	–	–
BENZO(A)PYRENE	2.8 J	–	–
DIBENZ(A,H)ANTHRACENE	0.81 J	–	–
BENZO(A)ANTHRACENE	4.3	–	–
PCBS (TOTAL)	2.2	–	–
ARSENIC	10.1 J	2.9 J	6.7 J
LEAD	70 J	–	–
MANGANESE	477 J	48.2 J	166 J

SAMPLE ID	SB-44-A	SB-44-B	SB-44-C
SAMPLE INTERVAL	1.5'-3.2'	5'-6.8'	9'-11'
CONTAMINANT			
BENZO(A)PYRENE	0.22 J	–	–
ARSENIC	6.7 J	2.9 J	12.7 J
MANGANESE	750 J	72.6 J	166 J

SAMPLE ID	SB-45-A	SB-45-B	SB-45-C
SAMPLE INTERVAL	3.5'-5.5'	6.2'-8.2'	10.5'-12.5'
CONTAMINANT			
ARSENIC	6.8 J	1.8 J	6.6 J
MANGANESE	319 J	46.7 J	158 J

SAMPLE ID	SB-54-A	SB-54-B	SB-54-C
SAMPLE INTERVAL	0'-1.5'	5'-7'	10'-12'
CONTAMINANT			
BENZO(A)PYRENE	0.88	–	1.3
ARSENIC	4.8	1.3	1.8
MANGANESE	55.2	57.1	55.3

SAMPLE ID	SB-55-A	SB-55-B	SB-55-C
SAMPLE INTERVAL	1.9'-3.4'	5'-7'	10'-12'
CONTAMINANT			
BENZO(A)PYRENE	0.65	–	–
PCBS (TOTAL)	0.23	–	–
ARSENIC	4.5 J	1.8 J	8.1 J
MANGANESE	55.1 J	44.8 J	164 J

SAMPLE ID	SB-56-A	SB-56-B
SAMPLE INTERVAL	4'-6'	8'-10'
CONTAMINANT		
BENZO(A)PYRENE	0.87	0.3
ARSENIC	7.8	2.1
MANGANESE	105	74.6

SAMPLE ID	SB-57-A	SB-57-B	SB-57-C
SAMPLE INTERVAL	2'-4'	6'-8'	11'-14'
CONTAMINANT			
BENZENE	–	–	0.0069
ARSENIC	3.5	2.1	5.5
MANGANESE	55.6	67.6	138

SAMPLE ID	SB-58-A	SB-58-B	SB-58-B-D	SB-58-C
SAMPLE INTERVAL	0.8'-2.2'	5'-8'	5'-8'	10'-12'
CONTAMINANT				
BENZO(B)FLUORANTHENE	–	2.6 J	–	–
BENZO(A)PYRENE	0.42	1.5 J	–	0.42
BENZO(A)ANTHRACENE	–	2	–	–
PCBS (TOTAL)	0.93	–	–	–
ARSENIC	4	4.3	3.3	5.8
LEAD	–	85.6	–	–
MANGANESE	54.1	95	65.8	119

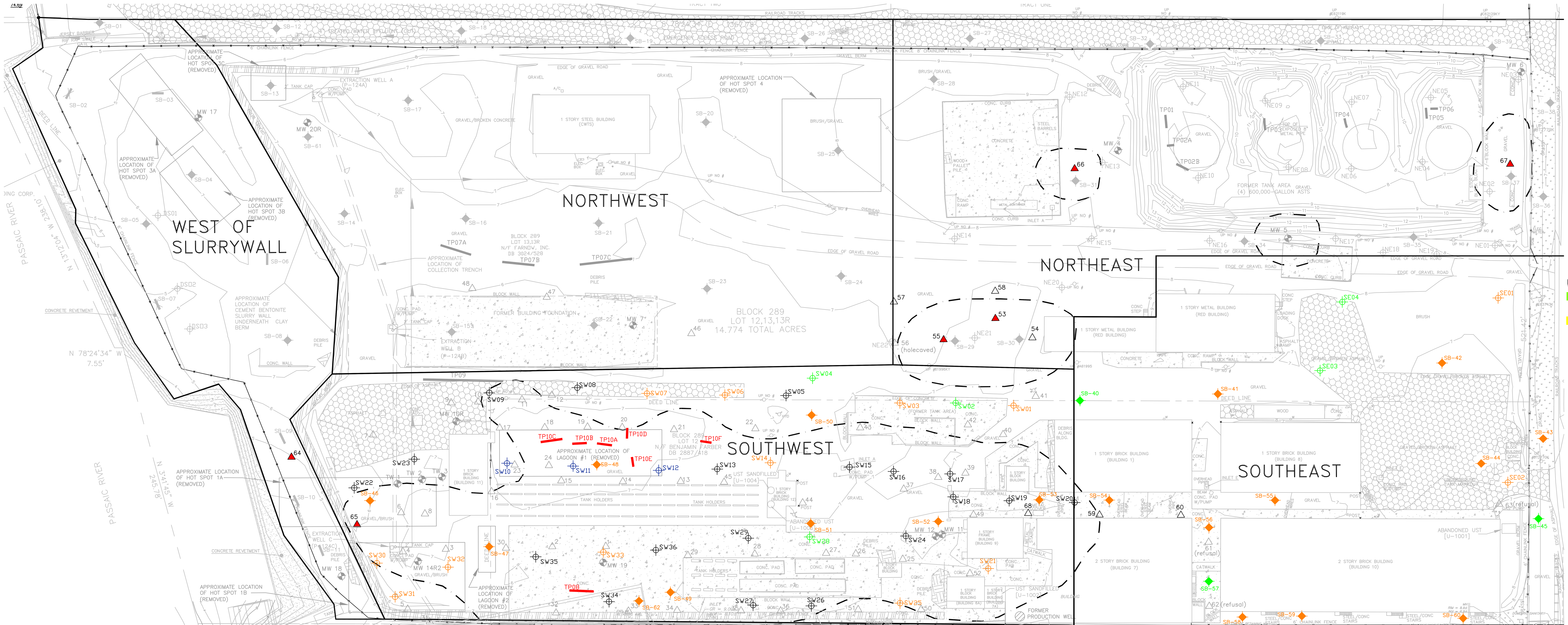
SAMPLE ID	SB-59-A	SB-59-B	SB-59-C
SAMPLE INTERVAL	2'-4'	5'-7'	9'-11'
CONTAMINANT			
BENZO(B)FLUORANTHENE	–	–	2
BENZO(A)PYRENE	1.2	0.34	2.3
BENZO(A)ANTHRACENE	–	–	2.8
ARSENIC	5.5	2.2	6.2
LEAD	74.4	–	–
MANGANESE	63	52.1	164

SAMPLE ID	SB-60-A	SB-60-B	SB-60-C
SAMPLE INTERVAL	1.3'-3.3'	5'-7'	8'-10'
CONTAMINANT			
BENZO(A)PYRENE	–	0.29	–
ARSENIC	2.9 J	4.2 J	9.8 J
MANGANESE	80.6 J	129 J	182 J

SOIL DELINEATION CRITERIA (MG/KG)

CONTAMINANT	NJDEP SOIL REMEDIATION STANDARD	
	NRDCSRS	DEFAULT IGWSRS
VOCs		
Benzene	5	0.005
1,2-Dibromo-3-chloropropane	0.2	0.005
1,2-Dichloropropane	5	0.005
Ethylbenzene	110000	8
Toluene	91000	4
Xylenes (total)	170000	12
SVOCs		
Benzo(a)anthracene	2	0.52
Benzo(a)pyrene	0.2	0.2
Benzo(b)fluoranthene	2	1.6
Dibenz(a,h)anthracene	0.2	0.49
Indeno(1,2,3-cd)pyrene	2	4.5
Naphthalene	17	16
Pest/PCBs		
Aldrin	0.2	0.13
Dieldrin	0.2	0.003
4,4'-DDD	13	2.6
4,4'-DDT	8	6.8
Heptachlor	0.7	0.29
PCBs TOTAL	1	0.16
Metals		
Arsenic	19	1
Cadmium	78	1.2
Lead	800	59
Manganese	5900	42
TPH-Total	8000	N/A

Groundwater (2006) Results Exceeds NJDEP Groundwater Quality Criteria



LEGEND

- 4.7 D — SAMPLE RESULT GREATER THAN OR EQUAL TO IGWSRS AND LESS THAN NRDCSRS (APPLICABLE TO THE COMPOUNDS EXCEEDING THE NJDEP GW QUALITY CONTROL)
- 3.2 D — SAMPLE RESULT GREATER THAN OR EQUAL TO NRDCSRS
- TP08 — FAILED FOR TCLP AND/OR RCRA CHARACTERISTIC PARAMETERS
- 2008 BORING BELOW SOIL DELINEATION CRITERIA
- 2008 BORING EXCEEDS NRDCSRS
- 2008 BORING EXCEEDS DEFAULT IGWSRS
- 2006 BORING EXCEEDS NRDCSRS
- 2006 BORING EXCEEDS DEFAULT IGWSRS
- 2006 BORING EXCEEDS SOIL DELINEATION CRITERIA FOR PCBs AND TSCA CRITERIA
- 2006 BORING BELOW SOIL DELINEATION CRITERIA
- 2008 TEST PIT
- 2008 TEST PIT NOT SAMPLED
- TP — 2006 TEST PIT- NO SAMPLES COLLECTED
- TP — 2006 TEST PIT – TP05 SAMPLE COLLECTED FOR TCLP AND RCRA CHARACTERISITCS
- TP — 2006 TEST PIT – EXCEEDS SOIL DELINEATION CRITERIA
- MW 14R2 — MONITORING WELL
- 54 — 1997 CPT LOCATION – DATA NOT AVAILABLE
- 54 — 1997 CPT LOCATION – NO VISUAL IDENTIFICATION OF ODOR OR PRODUCT
- 53 — 1997 CPT LOCATION – ODOR/PRODUCT
- FORMER PRODUCTION WELL
- – ESTIMATED EXTENT OF PRODUCT IMPACT (1997)
- – BELOW SOIL CLEANUP DELINEATION OR NON-DETECT

2006-SAMPLES ANALYZED FOR PCBs ONLY – SOUTHWEST AREA

SAMPLE ID	SW01-A
SAMPLE INTERVAL	0'-2'
CONTAMINANT	
PCBS (TOTAL)	9.3 D

SAMPLE ID	SW06-C
SAMPLE INTERVAL	5'-6'
CONTAMINANT	
PCBS (TOTAL)	1.6 D

SAMPLE ID	SW12-A
SAMPLE INTERVAL	0'-2'
CONTAMINANT	
PCBS (TOTAL)	86 D

SAMPLE ID	SW28-A
SAMPLE INTERVAL	0'-2'
CONTAMINANT	
PCBS (TOTAL)	0.97 D

SAMPLE ID	SW33-A
SAMPLE INTERVAL	0'-2'
CONTAMINANT	
PCBS (TOTAL)	4 D

SAMPLE ID	SW02-C
SAMPLE INTERVAL	5'-6'
CONTAMINANT	
PCBS (TOTAL)	0.46 P

SAMPLE ID	SW07-A
SAMPLE INTERVAL	0'-2'
CONTAMINANT	
PCBS (TOTAL)	4.6 D

SAMPLE ID	SW14-A	SW14-B
SAMPLE INTERVAL	0'-2'	2'-2.7'
CONTAMINANT		
PCBS (TOTAL)	19 D	0.53

SAMPLE ID	SW30-A
SAMPLE INTERVAL	0'-1.2'
CONTAMINANT	
PCBS (TOTAL)	11.16 D

SAMPLE ID	SW03-A
SAMPLE INTERVAL	0'-2'
CONTAMINANT	
PCBS (TOTAL)	13 D

SAMPLE ID	SW10-A	SW10-B	SW10-C
SAMPLE INTERVAL	0'-2'	5'-6'	6'-6.5'
CONTAMINANT			
PCBS (TOTAL)	5,300 D	3,400 D	5.7 D

SAMPLE ID	SW21-A
SAMPLE INTERVAL	0'-2'
CONTAMINANT	
PCBS (TOTAL)	12 D

SAMPLE ID	SW31-A
SAMPLE INTERVAL	0'-1.3'
CONTAMINANT	
PCBS (TOTAL)	13.36 D

SAMPLE ID	SW04-A
SAMPLE INTERVAL	5'-6'
CONTAMINANT	
PCBS (TOTAL)	0.6 P

SAMPLE ID	SW11-A	SW11-B
SAMPLE INTERVAL	0'-2'	5'-6'
CONTAMINANT		
PCBS (TOTAL)	290 D	25 D

SAMPLE ID	SW25-A
SAMPLE INTERVAL	0'-2'
CONTAMINANT	
PCBS (TOTAL)	1.62

SAMPLE ID	SW32-A	SW32-B
SAMPLE INTERVAL	0'-2'	5'-6'
CONTAMINANT		
PCBS (TOTAL)	22 D	2.8 DP

2006 SAMPLE RESULTS – SOUTHWEST AREA

SAMPLE ID	TP08	TP10
CONTAMINANT		
BENZENE	2,330	NOT ANALYZED
ETHYLBENZENE	1,520	
TOLUENE	40,900	
XYLENES(TOTAL)	5,930	
NAPHTHALENE	45.9	
PCBS (TOTAL)	8.54	3.92

SAMPLE ID	SWC01A*	SWC01B*	SWC01BD*
SAMPLE INTERVAL	0'-5'	5'-10'	5'-10'
CONTAMINANT			
BENZENE	5.3	–	–
ETHYLBENZENE	20	–	–
XYLENE(TOTAL)	100	–	–
BENZENE(A)PYRENE	0.52 J	0.45	0.28
PCBS(TOTAL)	2.3 D	–	–
ARSENIC	4.1	2.8	2.1
MANGANESE	83.4	135	107

* – COMPOSITE OF SW-33, SW-34, SW-35 AND SW-36

2006 SAMPLE RESULTS – SOUTHEAST AREA

SAMPLE ID	SE01A	SE01A-D	SE01B
SAMPLE INTERVAL	1'-1.5'	1'-1.5'	5'-5.5'
CONTAMINANT			
1,2-DIBROMO-3-CHLOROPROPANE	–	2.5 J	–
1,2-DICHLOROPROPANE	–	7.2	–
BENZO(A)PYRENE	–	–	0.21
ARSENIC	11.7	7.3	1.1
MANGANESE	76.9	77.1	65.1
TPH-TOTAL	14,995	–	10,232

SAMPLE ID	SE02A	SE02B
SAMPLE INTERVAL	1.5'-2'	7.9'-8.4'
CONTAMINANT		
BENZO(A)ANTHRACENE	8.4 D	–
BENZO(A)PYRENE	11 D	0.68
BENZO(B)FLUORANTHENE	6.4 D	–
INDENO(1,2,3-CD)PYRENE	3	–
ARSENIC	–	12.5
MANGANESE	43.6	245

SAMPLE ID	SE03A	SE03B
SAMPLE INTERVAL	1.75'-2.25'	6.5'-7'
CONTAMINANT		
ARSENIC	3.6	4.8
MANGANESE	46	–

SAMPLE ID	SE04A	SE04A-D	SE04B
SAMPLE INTERVAL	1'-1.5'	1'-1.5'	2'-2.5'
CONTAMINANT			
ARSENIC	–	–	1.3
MANGANESE	45	47.2	42.4

ABBREVIATIONS

CPT	CONE PENETROMETER TEST
IGWSRS	IMPACT TO GROUNDWATER SOIL REMEDIATION STANDARD
NA	NOT AVAILABLE
NJDEP	NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
NRDCSRS	NON-RESIDENTIAL DIRECT CONTACT SOIL REMEDIATION STANDARD
PCBs	POLYCHLORINATED BIPHENYLS
RCRA	RESOURCE CONSERVATION RECOVERY ACT
TCLP	TOXICITY CHARACTERISTIC LEACHING PRODEDURE
TP	TEST PIT
TPH	TOTAL PETROLEUM HYDROCARBON
SVOCs	SEMI-VOLATILE ORGANIC COMPOUNDS
TSCA	TOXIC SUBSTANCE CONTROL ACT
VOCs	VOLATILE ORGANIC COMPOUNDS

DATA QUALIFIERS

U	NON -DETECT
J	ESTIMATED VALUE
D	DILUTED
P	RESULT DIFFERENCE IS GREATER THAN 25% BETWEEN TWO GC COLUMNS

NOTE:

1. ALL RESULTS ARE PRESENTED IN MG/KG.

1" = 40'
20 0 40

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	12/15	D.W.	M.R.	

DESIGNED BY: M. RAHMANI
DRAWN BY: D. WALDRON
SHEET CHK'D BY: M. RAHMANI
CROSS CHK'D BY: T. MATHEW
APPROVED BY: T. MATHEW
DATE: JULY 2010

CDM Federal Programs Corporation

U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT

SYNCON RESINS SUPERFUND SITE
KEARNY TOWNSHIP, HUDSON COUNTY, NEW JERSEY

SOIL EXCEEDANCE MAP
SOUTHWEST AND
SOUTHEAST AREAS

PROJECT NO.
FILE NAME:

FIGURE 1-7

500789

2008 SAMPLE RESULTS - WEST OF SLURRYWALL AREA

SAMPLE ID	SB-01-A	SB-01-B
SAMPLE INTERVAL	3'-5'	6.6'-8.6'
CONTAMINANT		
BENZO(A)PYRENE	0.61	0.43
ARSENIC	6.4 J	13 J
LEAD	558 J	264 J
MANGANESE	301 J	518 J

SAMPLE ID	SB-03-A	SB-03-B	SB-03-B-D
SAMPLE INTERVAL	6'	7'	7'
CONTAMINANT			
BENZO(B)FLUORANTHENE	-	4.5	-
BENZO(A)PYRENE	0.51	2.5 J	0.54
DIBENZO(A,H)ANTHRACENE	-	0.61 J	-
BENZO(A)ANTHRACENE	-	4.5	-
ARSENIC	13.5 J	NO DATA	33.7 J
LEAD	179		360
MANGANESE	164 J		424 J

SAMPLE ID	SB-04-A	SB-04-B
SAMPLE INTERVAL	4'-6.5'	10'-12'
CONTAMINANT		
BENZO(A)PYRENE	0.35	1.4
PCBS (TOTAL)	0.59 JN	-
ARSENIC	31.3	64.1
LEAD	336	254
MANGANESE	252	208

SAMPLE ID	SB-05-A	SB-05-B	SB-05-C
SAMPLE INTERVAL	1'-3'	6'-8'	12'-14'
CONTAMINANT			
BENZENE	0.0078 J	-	-
INDENO(1,2,3-CD)PYRENE	-	-	2.6
BENZO(B)FLOURANTHENE	2	2.6	6.5
BENZO(A)PYRENE	1.3	1.8	6.5
DIBENZO(A,H)ANTHRACENE	-	0.49	1.4
BENZO(A)ANTHRACENE	2	2.5	11
PCBS(TOTAL)	0.68 J	-	-
ARSENIC	14.7	13.5 J	125
LEAD	311	430	443
MANGANESE	165	299 J	521

SAMPLE ID	SB-06-A	SB-06-B	SB-06-C
SAMPLE INTERVAL	3'	6'	10'
CONTAMINANT			
BENZO(A)PYRENE	0.35	-	-
PCBS(TOTAL)	1.8	-	-
ARSENIC	38.1 J	6.7 J	24.2 J
LEAD	142	-	78
MANGANESE	252 J	86.7 J	233 J

SAMPLE ID	SB-08-A	SB-08-B	SB-08-C
SAMPLE INTERVAL	0'-2'	4'-6.5'	10'-11.5'
CONTAMINANT			
DIELDRIN	0.57 JN	-	-
PCBS(TOTAL)	3 J	-	-
ARSENIC	30.7 J	1.7 J	8 J
LEAD	153 J	-	-
MANGANESE	289 J	-	305 J

SAMPLE ID	SB-09-A
SAMPLE INTERVAL	3'
CONTAMINANT	
BENZO(A)PYRENE	0.42
PCBS(TOTAL)	3.5
ARSENIC	17.6 J
LEAD	1,690
MANGANESE	312 J

SAMPLE ID	SB-10-A
SAMPLE INTERVAL	2.5'
CONTAMINANT	
4,4'-DDD	48 J
ALDRIN	0.28 J
PCBS(TOTAL)	17 J
ARSENIC	42 J
LEAD	527
MANGANESE	230 J

2008 SAMPLE RESULTS - WEST OF SLURRYWALL AREA

2008 SAMPLE RESULTS- NORTHWEST AREA

SAMPLE ID	SB-11-A
SAMPLE INTERVAL	2.5'
CONTAMINANT	
BENZENE	0.0073 J
BENZO(A)PYRENE	0.26 J
4'4'-DDD	87 J
PCBS(TOTAL)	13 J
ARSENIC	85.7 J
LEAD	447
MANGANESE	144 J

SAMPLE ID	SB-12-A	SB-12-B	SB-12-C
SAMPLE INTERVAL	2.3'-4.3'	5'-7'	16'-18'
CONTAMINANT			
BENZO(A)PYRENE	-	0.32	-
ARSENIC	5.2 J	5.2 J	1.2 J
LEAD	101 J	-	-
MANGANESE	873 J	971 J	83.4 J

SAMPLE ID	SB-13-A	SB-13-C
SAMPLE INTERVAL	0.5'-2'	11'-13'
CONTAMINANT		
BENZO(B)FLUORANTHENE	2.9	-
BENZO(A)PYRENE	2	-
BENZO(A)ANTHRACENE	2.8 J	-
ARSENIC	24.1 J	6 J
LEAD	517 J	-
MANGANESE	167 J	202 J

SAMPLE ID	SB-14-A	SB-14-B	SB-14-B-D
SAMPLE INTERVAL	2.3'-4.3'	10'-13'	10'-13'
CONTAMINANT			
BENZO(A)PYRENE	0.43	-	-
ARSENIC	62.1 J	8 J	4.2 J
LEAD	83.1 J	-	-
MANGANESE	334 J	171 J	189 J

SAMPLE ID	SB-15-A	SB-15-B	SB-15-C
SAMPLE INTERVAL	3.5'-5.5'	5'-7'	14.5'-16.5'
CONTAMINANT			
BENZO(A)PYRENE	0.25	-	-
ARSENIC	3.8 J	1.2 J	6.9 J
MANGANESE	84.8 J	50.2 J	197 J

SAMPLE ID	SB-16-A	SB-16-B
SAMPLE INTERVAL	7.5'-9.5'	10.5'-13.5'
CONTAMINANT		
BENZO(A)PYRENE	0.43	-
ARSENIC	1.8 J	9.6 J
MANGANESE	69 J	151 J

SAMPLE ID	SB-17-A	SB-17-B
SAMPLE INTERVAL	5'-7'	11'-13'
CONTAMINANT		
BENZO(A)PYRENE	0.38	-
ARSENIC	13.2 J	7.8 J
MANGANESE	77.5 J	174 J

SAMPLE ID	SB-18-A	SB-18-B	SB-18-C
SAMPLE INTERVAL	2.5'-4.5'	6'-8'	12'-14'
CONTAMINANT			
BENZENE	0.039 J	-	-
BENZO(A)PYRENE	0.89 J	-	-
BENZO(A)ANTHRACENE	2 J	-	-
ARSENIC	20.5 J	1.7 J	3.4 J
LEAD	303	-	-
MANGANESE	2,430 J	60.9 J	111 J

SAMPLE ID	SB-19-A	SB-19-B	SB-19-C
SAMPLE INTERVAL	2'-4'	6'-8'	14'-16'
CONTAMINANT			
ARSENIC	15.6 J	2.7 J	2.7 J
LEAD	210	-	-
MANGANESE	8,460 J	61.1 J	69.5 J

SAMPLE ID	SB-20-A	SB-20-B	SB-20-B-D	SB-20-C
SAMPLE INTERVAL	2.6'-4.6'	6'-8'	6'-8'	9.5'-12.5'
CONTAMINANT				
BENZO(A)PYRENE	-	-	0.32	0.23 J
ARSENIC	24.4 J	6.8 J	2.6 J	6.9 J
MANGANESE	63 J	46.7 J	-	174 J

SAMPLE ID	SB-21-A	SB-21-B	SB-21-C
SAMPLE INTERVAL	2.5'-4.5'	4.8'-6.8'	8.5'-10.5'
CONTAMINANT			
ARSENIC	11.9 J	2.1 J	3.5 J
LEAD	65.5 J	-	-
MANGANESE	130 J	58.1 J	121 J

SAMPLE ID	SB-22-A	SB-22-B	SB-22-C
SAMPLE INTERVAL	2.3'-4.3'	4.3'-7.3'	9'-11'
CONTAMINANT			
BENZENE	0.01 J	-	-
BENZO(A)PYRENE	-	0.38	-
ARSENIC	3.1 J	4.4 J	3.1 J
MANGANESE	52.9 J	151 J	96.6 J

SAMPLE ID	SB-23-A	SB-23-B	SB-23-C
SAMPLE INTERVAL	3'-5'	6.5'-8.5'	9.5'-11.5'
CONTAMINANT			
BENZO(A)PYRENE	0.32	-	-
PCBS (TOTAL)	1.9 J	-	-
ARSENIC	16.6 J	4.5 J	3.1 J
LEAD	108 J	-	-
MANGANESE	101 J	181 J	96.1 J

SAMPLE ID	SB-24-A	SB-24-B	SB-24-C
SAMPLE INTERVAL	2.6'-4.6'	6'-8'	9.5'-11.5'
CONTAMINANT			
BENZENE	-	-	0.0087 J
ARSENIC	12.7 J	5.2 J	3 J
LEAD	91 J	-	-
MANGANESE	310 J	101 J	90.1 J

SAMPLE ID	SB-25-A	SB-25-B	SB-25-C
SAMPLE INTERVAL	3'-5'	5'-7'	9'-11'
CONTAMINANT			
BENZO(A)PYRENE	0.44	0.33	-
PCBS (TOTAL)	2.9	0.34	-
ARSENIC	16 J	8.2 J	3.8 J
MANGANESE	99.6 J	65.5 J	43.4 J

SAMPLE ID	SB-26-A	SB-26-B	SB-26-C
SAMPLE INTERVAL	3'-5'	6'-8'	14'-16'
CONTAMINANT			
ARSENIC	2.8	1.4	2.1
LEAD	82.2	-	-
MANGANESE	2,170	82.4	81.3

SAMPLE ID	SB-61-A	SB-61-B	SB-61-C
SAMPLE INTERVAL	1.4'-3.4'	4.7'-6.7'	12'-14'
CONTAMINANT			
BENZENE	-	0.036 J	-
BENZO(A)PYRENE	0.33	-	-
DIELDRIN	0.52 JN	-	-
ARSENIC	155 J	265 J	10.2 J
LEAD	88.5 J	425 J	-
MANGANESE	174 J	724 J	177 J

2008 SAMPLE RESULTS- NORTHWEST AREA

2008 SAMPLE RESULTS- NORTHEAST AREA

SAMPLE ID	SB-27-A	SB-27-B	SB-27-C
SAMPLE INTERVAL	4'-6'	8'-10'	10'-12'
CONTAMINANT			
ARSENIC	1.4	1.3	2.5
MANGANESE	328	1,870	69.3

SAMPLE ID	SB-28-A	SB-28-B	SB-28-C
SAMPLE INTERVAL	2'-3.5'	5'-7'	5'-7'
CONTAMINANT			
BENZENE	0.017 J	-	-
BENZO(A)PYRENE	1.1	-	-
BENZO(A)ANTHRACENE	2.5	-	-
PCBS(TOTAL)	0.34 J	-	-
ARSENIC	4.9 J	1.1 J	5.5 J
MANGANESE	70 J	-	186 J

SAMPLE ID	SB-29-A	SB-29-B	SB-29-B-D	SB-29-C
SAMPLE INTERVAL	2'-5'	5'-9'	5'-9'	10'-12'
CONTAMINANT				
ARSENIC	68.5 J	7.3 J	10.5 J	7.9 J
MANGANESE	62.1 J	91.3 J	77.3 J	243 J

SAMPLE ID	SB-30-A	SB-30-B	SB-30-C
SAMPLE INTERVAL	2'-3.7'	5'-7'	10'-13'
CONTAMINANT			
ARSENIC	100 J	99.6 J	8.3 J
MANGANESE	45.9 J	51 J	370 J

SAMPLE ID	SB-31-A	SB-31-B	SB-31-C
SAMPLE INTERVAL	1'-3'	6'-7.5'	10'-11.5'
CONTAMINANT			
ARSENIC	16.5 J	4.2 J	10.3 J
MANGANESE	58.4 J	48.3 J	177 J

SAMPLE ID	SB-32-A	SB-32-B	SB-32-C
SAMPLE INTERVAL	4.5'-6.5'	6.5'-8.5'	8.5'-12'
CONTAMINANT			
ARSENIC	1.1	2.8	4.6
MANGANESE	81.9	8,180	148

SAMPLE ID	SB-33-A	SB-33-B	SB-33-B-D	SB-33-C
SAMPLE INTERVAL	3'-5'	5'-8'	5'-8'	9'-11'
CONTAMINANT				
ARSENIC	21.3	1.7	1.6 J	2.5
LEAD	278	-	-	-
MANGANESE	4,460	60.1	51.5 J	61.5

SAMPLE ID	SB-34-A	SB-34-B	SB-34-C
SAMPLE INTERVAL	1.2'-3.2'	5'-8.5'	9.5'-11.5'
CONTAMINANT			
BENZO(A)PYRENE	-	0.22	0.22 J
ARSENIC	7.5 J	5 J	11.5 J

SAMPLE ID	SB-35-A	SB-35-B	SB-35-C
SAMPLE INTERVAL	2'-3.4'	5'-7'	10'-12'
CONTAMINANT			
PCBS (TOTAL)	1.9	-	-
ARSENIC	21.2 J	2.6 J	33.6 J
LEAD	150 J	-	254 J
MANGANESE	181 J	-	241 J

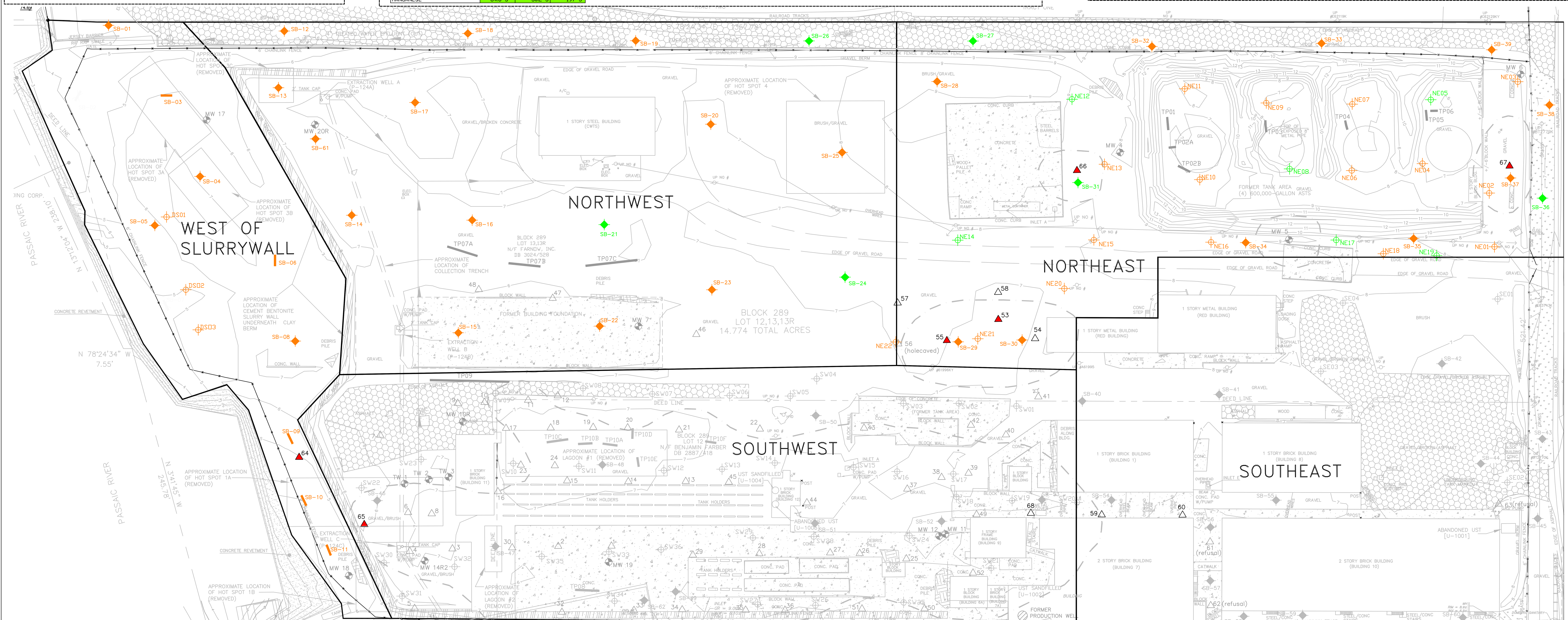
SAMPLE ID	SB-36-A	SB-36-B	SB-36-C
SAMPLE INTERVAL	3'-5'	7.6'-9.6'	10'-12'
CONTAMINANT			
BENZENE	-	0.07 J	-
ARSENIC	12.3 J	4.2 J	7.9 J
LEAD	68.8 J	-	-
MANGANESE	309 J	99.5 J	313 J

SAMPLE ID	SB-37-A	SB-37-B	SB-37-C
SAMPLE INTERVAL	1'-3'	5'-7'	10'-11.5'
CONTAMINANT			
BENZO(A)PYRENE	0.81 J	0.39 J	-
ARSENIC	10.2 J	3.1 J	9.3 J
LEAD	154 J	-	-
MANGANESE	81.8 J	59.7 J	253 J

SAMPLE ID	SB-38-A	SB-38-B	SB-38-C
SAMPLE INTERVAL	2'-4'	7.2'-9.2'	11.2'-13.2'
CONTAMINANT			
BENZO(A)PYRENE	0.35	-	-
PCBS (TOTAL)	0.33	-	-
ARSENIC	13.9 J	2.3 J	6.7 J
LEAD	373 J	-	-
MANGANESE	176 J	45.6 J	160 J

SAMPLE ID	SB-39-A	SB-39-B	SB-39-B-D	SB-39-C
SAMPLE INTERVAL	2'-4.1'	5'-9'	5'-9'	10'-12'
CONTAMINANT				
BENZO(A)PYRENE	-	0.26	-	-
PCBS (TOTAL)	-	-	-	0.34 NJ
ARSENIC	6.2 J	2.7 J	1.6 J	6.2 J
MANGANESE	2,800	-	-	198 J

2008 SAMPLE RESULTS- NORTHEAST AREA



SOIL DELINEATION CRITERIA (MG/KG)

CONTAMINANT	NJDEP SOIL REMEDIATION STANDARD	
	NRDCSRS	DEFAULT IGWSRS
VOCs		
Benzene	5	0.005
1,2-Dibromo-3-chloropropane	0.2	0.005
1,2-Dichloropropane	5	0.005
Ethylbenzene	110000	8
Toluene	91000	4
Xylenes (total)	170000	12
SVOCs		
Benzo(a)anthracene	2	0.52
Benzo(a)pyrene	0.2	0.2
Benzo(b)fluoranthene	2	1.6
Dibenz(a,h)anthracene	0.2	0.49
Indeno(1,2,3-cd)pyrene	2	4.5
Naphthalene	17	16
Pest/PCBs		
Aldrin	0.2	0.13
Dieldrin	0.2	0.003
4,4'-DDD	13	2.6
4,4'-DDT	8	6.8
Heptachlor	0.7	0.29
PCBs TOTAL	1	0.16
Metals		
Arsenic	19	1
Cadmium	78	1.2
Lead	800	59
Manganese	5900	42
TPH-Total	8000	N/A

Groundwater (2006) Results Exceeds NJDEP Groundwater Quality Criteria

LEGEND

- 4.7 D — SAMPLE RESULT GREATER THAN OR EQUAL TO IGWSRS AND LESS THAN NRDCSRS (APPLICABLE TO THE COMPOUNDS EXCEEDING THE NJDEP GW QUALITY CONTROL)
- 3.2 D — SAMPLE RESULT GREATER THAN OR EQUAL TO NRDCSRS
- TP08 — FAILED FOR TCLP AND/OR RCRA CHARACTERISTIC PARAMETERS
- 2008 BORING BELOW SOIL DELINEATION CRITERIA
- 2008 BORING EXCEEDS NRDCSRS
- 2008 BORING EXCEEDS DEFAULT IGWSRS
- 2006 BORING EXCEEDS NRDCSRS
- 2006 BORING EXCEEDS DEFAULT IGWSRS
- 2006 BORING EXCEEDS SOIL DELINEATION CRITERIA FOR PCBs AND TSCA CRITERIA
- 2006 BORING BELOW SOIL DELINEATION CRITERIA
- 2008 TEST PIT
- 2008 TEST PIT NOT SAMPLED
- TP — 2006 TEST PIT- NO SAMPLES COLLECTED
- TP — 2006 TEST PIT - TP05 SAMPLE COLLECTED FOR TCLP AND RCRA CHARACTERISITCS
- TP — 2006 TEST PIT - EXCEEDS SOIL DELINEATION CRITERIA
- MW 14R2 — MONITORING WELL
- 54 — 1997 CPT LOCATION - DATA NOT AVAILABLE
- 54 — 1997 CPT LOCATION - NO VISUAL IDENTIFICATION OF ODOR OR PRODUCT
- 53 — 1997 CPT LOCATION - ODOR/PRODUCT
- FORMER PRODUCTION WELL
- - ESTIMATED EXTENT OF PRODUCT IMPACT (1997)
- "-" - BELOW SOIL DELINEATION CRITERIA OR NON-DETECT

ABBREVIATIONS

CPT	CONE PENETROMETER TEST
IGWSRS	IMPACT TO GROUNDWATER SOIL REMEDIATION STANDARD
NA	NOT AVAILABLE
NJDEP	NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
NRDCSRS	NON-RESIDENTIAL DIRECT CONTACT SOIL REMEDIATION STANDARD
PCBs	POLYCHLORINATED BIPHENYLS
RCRA	RESOURCE CONSERVATION RECOVERY ACT
TCLP	TOXICITY CHARACTERISTIC LEACHING PRODEDURE
TP	TEST PIT
TPH	TOTAL PETROLEUM HYDROCARBON
SVOCs	SEMI-VOLATILE ORGANIC COMPOUNDS
TSCA	TOXIC SUBSTANCE CONTROL ACT
VOCs	VOLATILE ORGANIC COMPOUNDS

DATA QUALIFIERS

U	NON -DETECT
J	ESTIMATED VALUE
D	DILUTED
P	RESULT DIFFERENCE IS GREATER THAN 25% BETWEEN TWO GC COLUMNS

NOTE:
1. ALL RESULTS ARE PRESENTED IN MG/KG.

1" = 40'
20 0 40

2006 SAMPLE RESULTS - WEST OF SLURRYWALL AREA

SAMPLE ID	DS01
SAMPLE INTERVAL	1.8'-2.4'
CONTAMINANT	
BENZO(A)ANTHRACENE	2.3
BENZO(A)PYRENE	1.8
BENZO(B)FLUORANTHENE	3
ARSENIC	16.8
LEAD	362
MANGANESE	80.4

SAMPLE ID	DS02
SAMPLE INTERVAL	2'-2.5'
CONTAMINANT	
BENZO(A)ANTHRACENE	7.8 D
BENZO(A)PYRENE	6.2 D
BENZO(B)FLUORANTHENE	6.3 D
ARSENIC	15.1
LEAD	320
MANGANESE	98.3

SAMPLE ID	DS03
SAMPLE INTERVAL	1.5'-2'
CONTAMINANT	
BENZO(A)ANTHRACENE	5 D
BENZO(A)PYRENE	4.3 D
BENZO(B)FLUORANTHENE	3.2 D
ARSENIC	9.6
LEAD	102
MANGANESE	159

2006 SAMPLE RESULTS - WEST OF SLURRYWALL AREA

2006 SAMPLE RESULTS -NORTHEAST AREA

SAMPLE ID	NE01A	NE01B
SAMPLE INTERVAL	0.5'-1'	8.9'-9.4'
CONTAMINANT		
BENZO(A)PYRENE	0.39 J	1.3
ARSENIC	10.3	2.8
LEAD	499	-
MANGANESE	201	162
TPH-TOTAL	31,604	-

SAMPLE ID	NE02A	NE02B
SAMPLE INTERVAL	3'-3.5'	9.5'-10'
CONTAMINANT		
BENZENE	0.22 J	-
BENZO(A)PYRENE	0.39 J	0.3
ARSENIC	20.3	25.5
CADMIUM	122	-
LEAD	187	156
MANGANESE	207	334

SAMPLE ID	NE03A	NE03B
SAMPLE INTERVAL	3.5'-4'	9.5'-10'
CONTAMINANT		
BENZO(A)PYRENE	1.9	0.29
BENZO(B)FLUORANTHENE	2.1	-
ARSENIC	11.9	1.6
LEAD	99.4	-
MANGANESE	196	72.8

SAMPLE ID	NE04A	NE04B
SAMPLE INTERVAL	1.5'-2'	9.5'-10'
CONTAMINANT		
BENZENE	0.78 J	-
TOLULENE	5.7	-
XYLENES (TOTAL)	16	-
BENZO(A)PYRENE	-	0.51
ARSENIC	21	4.4
LEAD	98.2	-
MANGANESE	54	230
TPH-TOTAL	17,960	-

SAMPLE ID	NE05A	NE05B
SAMPLE INTERVAL	2.5'-3'	8.8'-9.3'
CONTAMINANT		
ARSENIC	2.5	5.6
MANGANESE	50.9	260

SAMPLE ID	NE06A	NE06B
SAMPLE INTERVAL	2'-2.5'	8.5'-9'
CONTAMINANT		
BENZO(A)PYRENE	-	0.44
ARSENIC	3.6	17.3
LEAD	-	69.7
MANGANESE	-	316

SAMPLE ID	NE07A	NE07B
SAMPLE INTERVAL	1.5'-2'	4.5'-5'
CONTAMINANT		
ARSENIC	2.3	-
MANGANESE	-	49.9
TPH-TOTAL	11,644	-

SAMPLE ID	NE08A	NE08B
SAMPLE INTERVAL	1.5'-2'	8.8'-9.3'
CONTAMINANT		
ARSENIC	1.1	13.7
LEAD	-	68.1
MANGANESE	-	510

SAMPLE ID	NE09A	NE09B
SAMPLE INTERVAL	1.5'-2'	6'-6.5'
CONTAMINANT		
BENZO(A)PYRENE	-	0.67
ARSENIC	-	1.2
MANGANESE	-	64.2

SAMPLE ID	NE10A	NE10B
SAMPLE INTERVAL	2'-2.5'	6.5'-7'
CONTAMINANT		
XYLENE(TOTAL)	55	-
BENZO(A)PYRENE	-	0.79
MANGANESE	42.8	65.8

SAMPLE ID	NE11A	NE11B
SAMPLE INTERVAL	1'-1.5'	4'-4.5'
CONTAMINANT		
ARSENIC	-	1.6
MANGANESE	44	44.5
TPH-TOTAL	16,678	-

SAMPLE ID	NE12A	NE12B
SAMPLE INTERVAL	2'-2.5'	4'-4.5'
CONTAMINANT		
ARSENIC	1.1	-
MANGANESE	48.2	48.9

SAMPLE ID	NE13A	NE13B
SAMPLE INTERVAL	4.5'-5'	4.5'-5'
CONTAMINANT		
BENZO(A)PYRENE	-	0.31
ARSENIC	11.2	5.8
MANGANESE	-	48.2

SAMPLE ID	NE14A	NE14B
SAMPLE INTERVAL	2'-2.5'	6.5'-7'
CONTAMINANT		
ARSENIC	1.3	1.7
MANGANESE	97.2	82.5

SAMPLE ID	NE15A	NE15B
SAMPLE INTERVAL	2.5'-3'	8.7'-9.2'
CONTAMINANT		
BENZO(A)PYRENE	-	0.68
ARSENIC	8.9	10.3
MANGANESE	-	352

SAMPLE ID	NE16A	NE16B
SAMPLE INTERVAL	0.5'-1'	6'-6.5'
CONTAMINANT		
XYLENES (TOTAL)	13	-
BENZO(A)PYRENE	1	-
PCBS(TOTAL)	-	0.16 P
ARSENIC	8.7	-
LEAD	71	-

SAMPLE ID	NE17A	NE17B
SAMPLE INTERVAL	2'-2.5'	4'-4.5'
CONTAMINANT		
ARSENIC	1.2	2.8

SAMPLE ID	NE18A	NE18B
SAMPLE INTERVAL	1.5'-2'	5'-5.5'
CONTAMINANT		
BENZO(A)PYRENE	0.54	-
PCBS (TOTAL)	0.39 P	-
ARSENIC	25	1
LEAD	896	-
MANGANESE	176	54.2

SAMPLE ID	NE19A	NE19B
SAMPLE INTERVAL	1'-1.5'	5'-5.5'
CONTAMINANT		
ARSENIC	4.8	-
MANGANESE	49.7	146

SAMPLE ID	NE20A	NE20B
SAMPLE INTERVAL	0.5'-1'	7'-7.5'
CONTAMINANT		
BENZO(A)PYRENE	0.22 J	0.77
PCBS (TOTAL)	1.9	-
ARSENIC	71.3	4.7
LEAD	285	-
MANGANESE	76.4	146

SAMPLE ID	NE21A	NE21B
SAMPLE INTERVAL	0.6'-1.1'	2'-2.5'
CONTAMINANT		
BENZENE	0.27 J	-
BENZO(A)PYRENE	0.2 J	-
4,4'-DDD	190 D	-
4,4'-DDT	66 D	-
PCBS (TOTAL)	39 D	-
ARSENIC	260	14
LEAD	135	-
MANGANESE	118	69.7
TPH-TOTAL	-	10,000

SAMPLE ID	NE22A	NE22B
SAMPLE INTERVAL	0.7'-1.2'	2'-2.5'
CONTAMINANT		
BENZO(A)PYRENE	0.21 J	-
PCBS (TOTAL)	0.45 P	-
ARSENIC	72.1	5.5
LEAD	156	-
MANGANESE	124	102

2006 SAMPLE RESULTS -NORTHEAST AREA

REV. NO.	DATE	DRWN	CHKD	REMARKS
1	12/15	D.W.	M.R.	

DESIGNED BY: M. RAHMANI
DRAWN BY: D. WALDRON
SHEET CHK'D BY: M. RAHMANI
CROSS CHK'D BY: T. MATHEW
APPROVED BY: T. MATHEW
DATE: JULY 2010

CDM Federal Programs Corporation

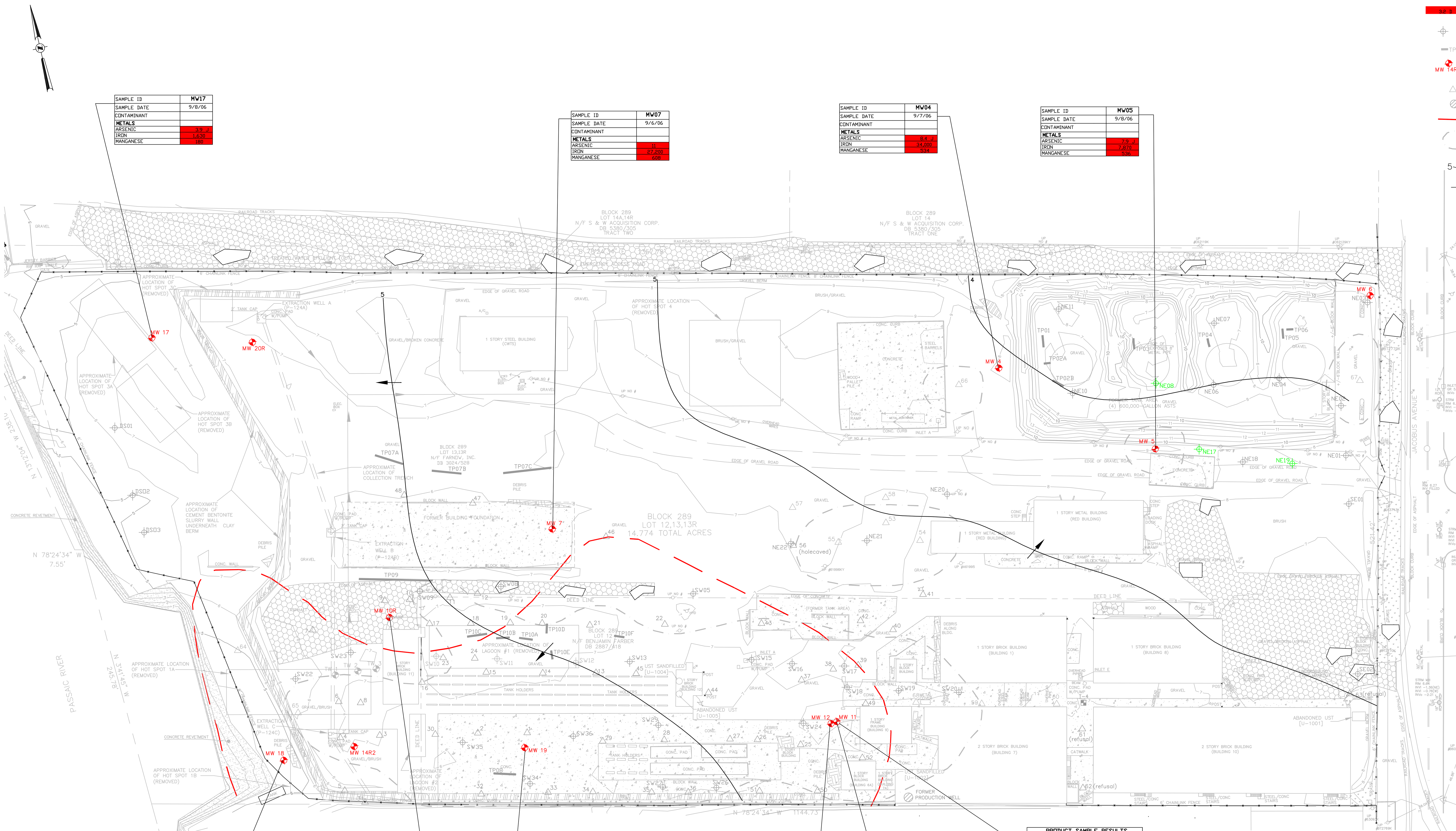
U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT

SYNCON RESINS SUPERFUND SITE
KEARNY TOWNSHIP, HUDSON COUNTY, NEW JERSEY

SOIL EXCEEDANCE MAP
WEST OF SLURRYWALL, NORTHWEST AND NORTHEAST AREAS

PROJECT NO.
FILE NAME:

FIGURE 1-8



SAMPLE ID	MW17
SAMPLE DATE	9/8/06
CONTAMINANT	
METALS	
ARSENIC	3.9 J
IRON	1,630
MANGANESE	180

SAMPLE ID	MW07
SAMPLE DATE	9/6/06
CONTAMINANT	
METALS	
ARSENIC	11
IRON	27,200
MANGANESE	608

SAMPLE ID	MW04
SAMPLE DATE	9/7/06
CONTAMINANT	
METALS	
ARSENIC	8.4 J
IRON	34,000
MANGANESE	534

SAMPLE ID	MW05
SAMPLE DATE	9/8/06
CONTAMINANT	
METALS	
ARSENIC	7.9 J
IRON	7,870
MANGANESE	536

SAMPLE ID	MW10R
SAMPLE DATE	9/7/06
CONTAMINANT	
METALS	
ARSENIC	3.3 J
IRON	5,650
MANGANESE	148

SAMPLE ID	MW18
SAMPLE DATE	9/7/06
CONTAMINANT	
METALS	
ARSENIC	6
IRON	469
MANGANESE	50.3
SODIUM	1,750,000

SAMPLE ID	MW12
SAMPLE DATE	9/7/06
CONTAMINANT	
METALS	
ARSENIC	3.7 J
IRON	4,850
MANGANESE	394
SODIUM	1,070,000

SAMPLE ID	MW11
SAMPLE DATE	9/7/06
CONTAMINANT	
VOCs	
TOLUENE	61,000 D
BENZENE	250
XYLENES(TOTAL)	4,400
SVOCs	
2,4-DIMETHYLPHENOL	150 D
METALS	
ARSENIC	3.2 J
IRON	84,300
MANGANESE	1,460
THALLIUM	7 J

PRODUCT SAMPLE RESULTS

CONTAMINANT	MW-19- 2/11/97	MW-19 9/6/06
VOCs		
ETHYLBENZENE	[illegible]	[illegible]
TOLUENE	[illegible]	NA
CHLOROBENZENE	U	[illegible]
BENZENE	[illegible]	NA
XYLENES(TOTAL)	[illegible]	[illegible]
SVOCs		
BIS(2-ETHYLHEXYL)PHTHALATE	U	[illegible]
ANTHRACENE	[illegible]	[illegible]
PYRENE	[illegible]	[illegible]
DIBENZOFURAN	U	84,500
BENZO(G,H,I)PERYLENE	U	NA
INDENO(1,2,3-CD)PYRENE	U	NA
BENZO(B)FLUORANTHENE	U	NA
FLUORANTHENE	[illegible]	[illegible]
BENZO(K)FLUORANTHENE	U	NA
ACENAPHTHYLENE	11,300	NA
CHRYSENE	[illegible]	[illegible]
BENZO(A)PYRENE	U	NA
BENZO(A)ANTHRACENE	[illegible]	[illegible]
ACENAPHTHENE	[illegible]	[illegible]
DI-N-BUTYLPHTHALATE	[illegible]	[illegible]
PHENANTHRENE	264,000	247,000
FLUORENE	[illegible]	[illegible]
CARBAZOLE	U	4,950 J
NAPHTHALENE	[illegible]	[illegible]
2-METHYLNAPHTHALENE	U	195,000
PCBs		
AROCLOR-1248	[illegible]	[illegible]
OTHERS		
IGNITABILITY	94	110
TPH-GRO	NA	407,000
GASOLINE	NA	38,600

PRODUCT SAMPLE RESULTS

CONTAMINANT	MW-11- 2/11/97
VOCs	
ETHYLBENZENE	[illegible]
TOLUENE	[illegible]
CHLOROBENZENE	U
BENZENE	[illegible]
XYLENES(TOTAL)	[illegible]
SVOCs	
BIS(2-ETHYLHEXYL)PHTHALATE	[illegible]
ANTHRACENE	[illegible]
PYRENE	[illegible]
DIBENZOFURAN	
BENZO(G,H,I)PERYLENE	18,100 J
INDENO(1,2,3-CD)PYRENE	[illegible]
BENZO(B)FLUORANTHENE	[illegible]
FLUORANTHENE	[illegible]
BENZO(K)FLUORANTHENE	[illegible]
ACENAPHTHYLENE	19,500 J
CHRYSENE	[illegible]
BENZO(A)PYRENE	[illegible]
BENZO(A)ANTHRACENE	[illegible]
ACENAPHTHENE	[illegible]
DI-N-BUTYLPHTHALATE	[illegible]
PHENANTHRENE	107,000
FLUORENE	[illegible]
CARBAZOLE	U
NAPHTHALENE	[illegible]
2-METHYLNAPHTHALENE	U
PCBs	
AROCLOR-1248	[illegible]
OTHERS	
IGNITABILITY	118
TPH-GRO	NA
GASOLINE	NA

NOTE:
FREE PRODUCT WAS OBSERVED IN MW-14R2 AND MW-19 DURING THE EXISTING MONITORING WELL SURVEY PERFORMED BY CDM IN SEPTMEBER 2008.

MONITORING WELL INFORMATION

WELL NUMBER	GROUND ELEV (ft-MSL)	TOTAL DEPTH (FEET -BGS)	LENGTH OF SCREEN (FT)	TOP OF SCREEN (ft-MSL)	BOTTOM OF SCREEN (ft-MSL)
MW04	7.93	18.00	15.00	4.93	-10.07
MW05	8.82	18.00	15.00	5.82	-9.18
MW06	8.45	12.00	10.00	6.45	-3.55
MW07	6.39	13.00	10.00	3.39	-6.61
MW10R	6.70	12.00	10.00	4.7	-5.30
MW11	7.41	13.50	10.00	3.91	-6.09
MW12	7.53	29.00	10.00	-11.47	-21.47
MW14R	6.71	10.00	8.00	4.71	-3.29
MW17	5.98	11.00	8.00	2.98	-5.02
MW18	4.65	10.5	8.00	2.15	-5.85
MW19	6.34	10.00	8.00	4.34	-3.66
MW20R	6.73	10.00	8.00	4.73	-3.27

LEGEND

- 3.9 J — SAMPLE RESULT EXCEEDS NJDEP GROUNDWATER QUALITY CRITERIA
- 2006 BORING LOCATION
- TP — 2006 TEST PIT
- MW 14R2 — MONITORING WELL EXCEEDS NJDEP GROUNDWATER QUALITY CRITERIA
- 54 — 1997 CPT LOCATION
- FORMER PRODUCTION WELL
- ESTIMATED EXTENT OF VOC > NJSCC (1994)
- ESTIMATED EXTENT OF PRODUCT IMPACT (1997)
- 5 — GROUNDWATER ELEVATION CONTOUR (SOURCE: 2007 PDIR)
- GROUNDWATER FLOW DIRECTION (SOURCE: 2007 PDIR)

ABBREVIATIONS

BGS	BELOW GROUND SURFACE
CPT	CONE PENETROMETER TEST
ELEV	ELEVATION
FT	FEET
GW	GROUNDWATER
MSL	MEAN SEA LEVEL
NA	NOT ANALYZED OR DATA NOT AVAILABLE
NJDEP	NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
NJSCC	NEW JERSEY SOIL CLEANUP CRITERIA
PCBs	POLYCHLORINATED BIPHENYLS
PDIR	PRE-DESIGN INVESTIGATION REPORT
TP	TEST PIT
SVOCs	SEMI-VOLATILE ORGANIC COMPOUNDS
VOCs	VOLATILE ORGANIC COMPOUNDS

DATA QUALIFIERS

U	NON -DETECT
J	ESTIMATED VALUE
D	DILUTED

NOTE: ALL RESULTS ARE PRESENTED IN UG/L.

GROUNDWATER CLEANUP CRITERIA (UG/L)

CONTAMINANT	NJDEP GW QUALITY CRITERIA
VOCs	
TOLUENE	600
BENZENE	1
XYLENES(TOTAL)	1,000
SVOCs	
2,4-DIMETHYLPHENOL	100
METALS	
ARSENIC	3
IRON	300
MANGANESE	50
SODIUM	50,000
THALLIUM	2

1" = 40'
20 0 40

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: J. MA
DRAWN BY: E. LARSON
SHEET CHK'D BY: J. MA
CROSS CHK'D BY: C. JULIAS
APPROVED BY: T. MATHEW
DATE: JULY 2010

CDM Federal Programs Corporation

U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT

SYNCON RESINS SUPERFUND SITE
KEARNY TOWNSHIP, HUDSON COUNTY, NEW JERSEY

GROUNDWATER EXCEEDANCE MAP

PROJECT NO.
FILE NAME:

FIGURE 1-9

500791

SB-14	
2.3' - 4.3'	A↑
10' - 13'	A↓

SB-61	
1.4' - 3.4'	A↑
4.7' - 6.7'	A↓
12' - 14'	A↓

NORTHWEST AREA

SB-29	
2' - 5'	A↑
5' - 9'	A↓
10' - 12'	A↓

SB-30	
2' - 3.7'	A↑
5' - 7'	A↓
10' - 13'	A↓

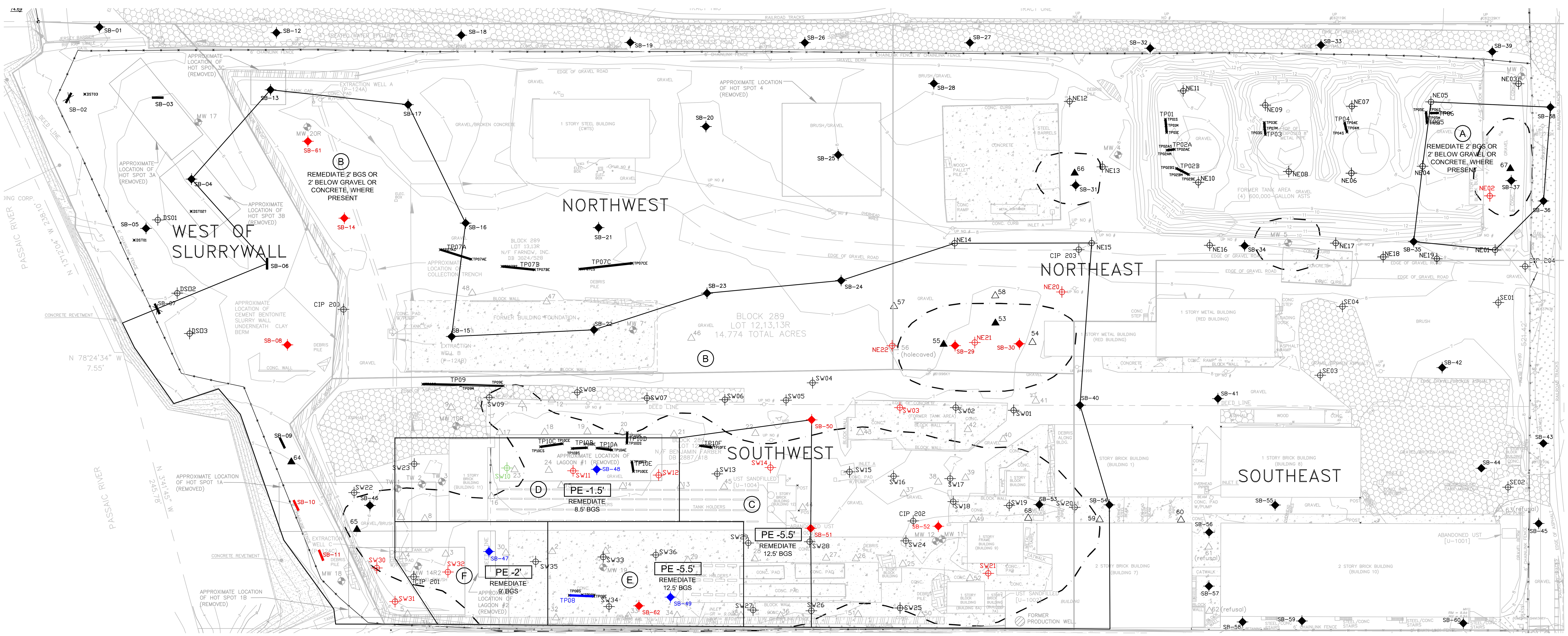
NE02	
3' - 3.5'	A↑
9.5' - 10'	A↓

NE20	
0.5' - 1'	A↑
7' - 7.5'	A↓

NE21	
0.6' - 1.1'	A↑
2' - 2.5'	A↓

NE22	
0.7' - 1.2'	A↑
2' - 2.5'	A↓

NORTHEAST AREA



CONTAMINANT	PRELIMINARY REMEDIATION GOAL (mg/kg)
VOCs	
Benzene	5
Ethylbenzene	29
Toluene	46000
Xylenes (total)	2600
PAHs	
Naphthalene	17
Pesticides/PCBs	
Aldrin	0.1
Dieldrin	0.11
4,4'-DDD	7.2
4,4'-DDT	7
Heptachlor	0.38
PCBs Total	1 (use engineering control) 10 (surface soil) 500 (remove as Principal Threat Waste)
Metals	
Arsenic	38.86
Cadmium	78
Petroleum Free Product	
Petroleum free product containing PCBs	Remove any petroleum free product containing PCBs and grossly contaminated soils with petroleum free product containing PCBs

FIGURE LEGEND

- 2008 BORING EXCEEDS PRGs FOR SURFACE SOIL
- 2008 BORING EXCEEDS PRGs RELATED TO PRINCIPAL THREAT WASTE FOR SUBSURFACE SOIL
- 2008 BORING EXCEEDS BOTH PRGs FOR SURFACE SOIL AND PRGs RELATED TO PRINCIPAL THREAT WASTE FOR SUBSURFACE SOIL
- 2008 BORING BELOW BOTH PRGs FOR SURFACE SOIL AND PRGs RELATED TO PRINCIPAL THREAT WASTE FOR SUBSURFACE SOIL
- 2006 BORING EXCEEDS PRGs FOR SURFACE SOIL
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- 2006 BORING BELOW BOTH PRGs FOR SURFACE SOIL AND PRGs RELATED TO PRINCIPAL THREAT WASTE FOR SUBSURFACE SOIL
- 2008 TEST PIT EXCEEDS PRGs FOR SURFACE SOIL
- 2008 TEST PIT BELOW BOTH PRGs FOR SURFACE SOIL AND PRGs RELATED TO PRINCIPAL THREAT WASTE FOR SUBSURFACE SOIL
- 2008 TEST PIT NOT SAMPLED
- TP 2006 TEST PIT EXCEEDS PRGs RELATED TO PRINCIPAL THREAT WASTE FOR SUBSURFACE SOIL
- TP 2006 TEST PIT BELOW BOTH PRGs FOR SURFACE SOIL AND PRGs RELATED TO PRINCIPAL THREAT WASTE FOR SUBSURFACE SOIL
- MW 14R2 MONITORING WELL
- 54 1997 CPT LOCATION - DATA NOT AVAILABLE
- 54 1997 CPT LOCATION - NO VISUAL IDENTIFICATION OF ODOR OR PRODUCT
- 53 1997 CPT LOCATION - ODOR/PRODUCT
- FORMER PRODUCTION WELL
- ESTIMATED EXTENT OF PRODUCT IMPACT (1997)
- A↑ SAMPLE EXCEEDS PRGs FOR SURFACE SOIL
- A↑ SAMPLE EXCEEDS PRGs RELATED TO PRINCIPAL THREAT WASTE FOR SUBSURFACE SOIL
- A↑* SAMPLE POTENTIALLY EXCEEDS PRGs RELATED TO PRINCIPAL THREAT WASTE FOR SUBSURFACE SOIL BASED ON ELEVATED VOC CONCENTRATIONS
- A↑ SAMPLE EXCEEDS BOTH PRGs FOR SURFACE SOIL AND PRGs RELATED TO PRINCIPAL THREAT WASTE FOR SUBSURFACE
- A↓ SAMPLE BELOW BOTH PRGs FOR SURFACE SOIL AND PRGs RELATED TO PRINCIPAL THREAT WASTE FOR SUBSURFACE SOIL

SB-08	
0' - 2'	A↑
4' - 6.5'	A↓
10' - 11.5'	A↓

SB-10	
2.5'	A↑

SB-11	
2.5'	A↑

WEST OF SLURRY WALL

SB-47	
2.1' - 4.1'	A↓
5.6' - 7.6'	A↑
9' - 11'	A↓

SB-48	
4.5' - 6.5'	A↑
8.5' - 10.5'	A↓
11.5' - 13.5'	A↓

SB-49	
4.5' - 6.5'	A↑*
9.5' - 10.5'	A↑*
12.5' - 14.5'	A↓

SB-50	
2.4' - 4.4'	A↑
5.6' - 8.6'	A↓
9.5' - 11.5'	A↓

SB-51	
3.2' - 5.2'	A↑
6' - 8'	A↓
10.8' - 12.8'	A↓

SB-52	
3.3' - 5.5'	A↑
6.5' - 9.5'	A↓

SB-62	
1.5' - 3.4'	A↑
5' - 7.5'	A↓
11' - 13'	A↓

SW03	
0' - 2'	A↑

SW10	
0' - 2'	A↑
5' - 6'	A↑
6' - 6.5'	A↓

SW11	
0' - 2'	A↑
5' - 6'	A↓

SW12	
0' - 2'	A↑

SW14	
0' - 2'	A↑
2' - 2.7'	A↓

SW21	
0' - 2'	A↑

SW30	
0' - 1.2'	A↑

SW31	
0' - 1.3'	A↑

SW32	
0' - 2'	A↑
5' - 6'	A↓

SW33/34/35/36	
0' - 5'	A↑
5' - 10'	A↓

TP08	
0' - 10'	A↑

SOUTHWEST AREA

AREAS A THROUGH F
ARE TO BE REMEDIATED

ABBREVIATIONS

CPT	CONE PENETROMETER TEST
MG/KG	MILLIGRAMS PER KILOGRAM
PAHs	POLYCYCLIC AROMATIC HYDROCARBON
PCBs	POLYCHLORINATED BIPHENYLS
PE	BOTTOM ELEVATION OF SOIL TO BE REMEDIATED
PRG	PRELIMINARY REMEDIATION GOAL
RCRA	RESOURCE CONSERVATION RECOVERY ACT
TCLP	TOXICITY CHARACTERISTIC LEACHING PROCEDURE
TP	TEST PIT
TPH	TOTAL PETROLEUM HYDROCARBON
VOCs	VOLATILE ORGANIC COMPOUNDS

NOTE:

1. ALL RESULTS ARE PRESENTED IN MG/KG.

1" = 40'

20 0 40

REV. NO.	DATE	DRWN	CHKD	REMARKS
2	2/5	D.W.	M.R.	REVISED BASED ON NEW IGWSRS (DECEMBER 2008)
1	12/15	D.W.	M.R.	

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DRAWN BY: E. LARSON
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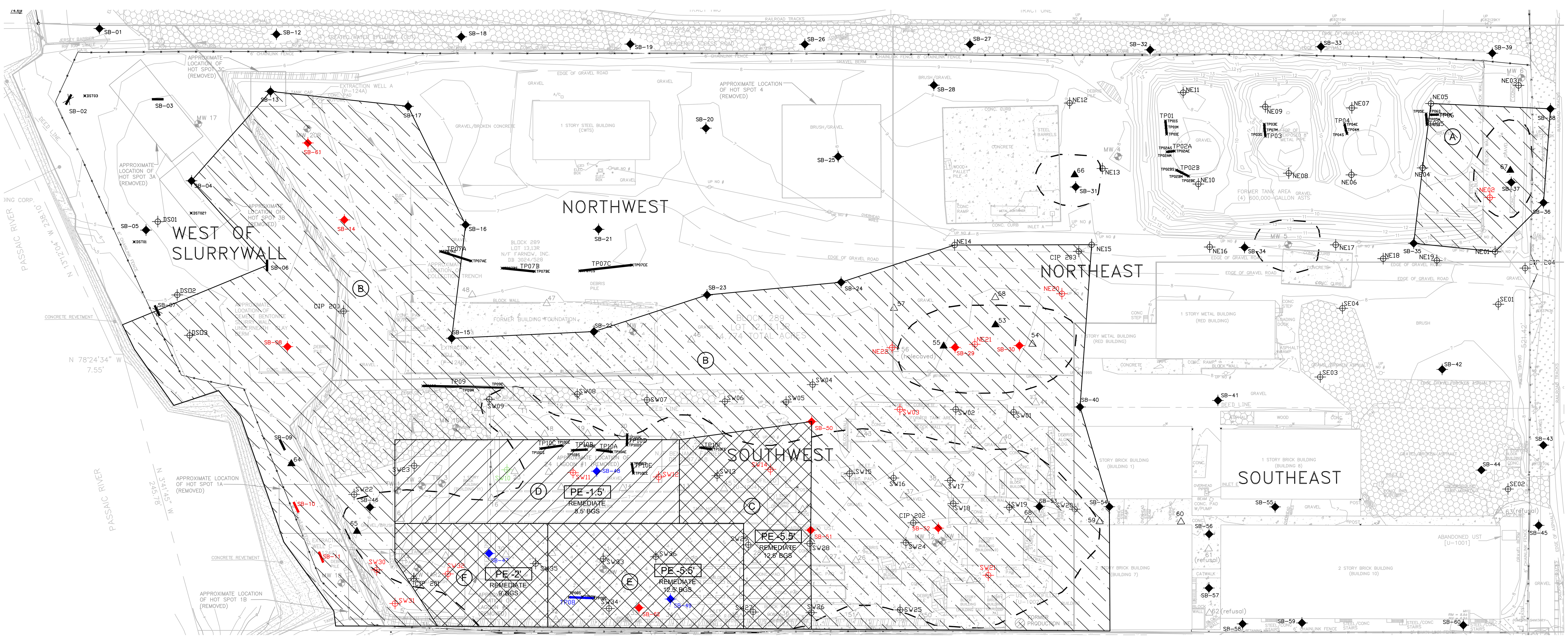
U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT

SYNCON RESINS SUPERFUND SITE
KEARNY TOWNSHIP, HUDSON COUNTY, NEW JERSEY

APPROXIMATE AREA OF SOIL TO BE REMEDIATED

PROJECT NO.
FILE NAME:

FIGURE 2-1



CONTAMINANT	PRELIMINARY REMEDIATION GOAL (mg/kg)
VOCs	
Benzene	5
Ethylbenzene	29
Toluene	46000
Xylenes (total)	2600
PAHs	
Naphthalene	17
Pesticides/PCBs	
Aldrin	0.1
Dieldrin	0.11
4,4'-DDD	7.2
4,4'-DDT	7
Heptachlor	0.38
PCBs Total	1 (use engineering control) 10 (surface soil) 500 (remove as Principal Threat Waste)
Metals	
Arsenic	38.86
Cadmium	78
Petroleum Free Product	
Petroleum free product containing PCBs	Remove any petroleum free product containing PCBs and grossly contaminated soils with petroleum free product containing PCBs

FIGURE LEGEND

- 2008 BORING EXCEEDS PRGs FOR SURFACE SOIL
- 2008 BORING EXCEEDS PRGs RELATED TO PRINCIPAL THREAT WASTE FOR SUBSURFACE SOIL
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- FORMER PRODUCTION WELL
- ESTIMATED EXTENT OF PRODUCT IMPACT (1997)

HATCHING LEGEND

- APPROXIMATE AREA OF SUBSURFACE SOIL EXCAVATION DUE TO PCB PRINCIPAL THREAT WASTE
- APPROXIMATE AREA OF SUBSURFACE SOIL EXCAVATION DUE TO FREE PRODUCT IMPACT
- APPROXIMATE AREA OF SURFACE SOIL EXCAVATION

ABBREVIATIONS

CPT	CONE PENETROMETER TEST
MG/KG	MILLIGRAMS PER KILOGRAM
PAHs	POLYCYCLIC AROMATIC HYDROCARBON
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20 0 40

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U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT

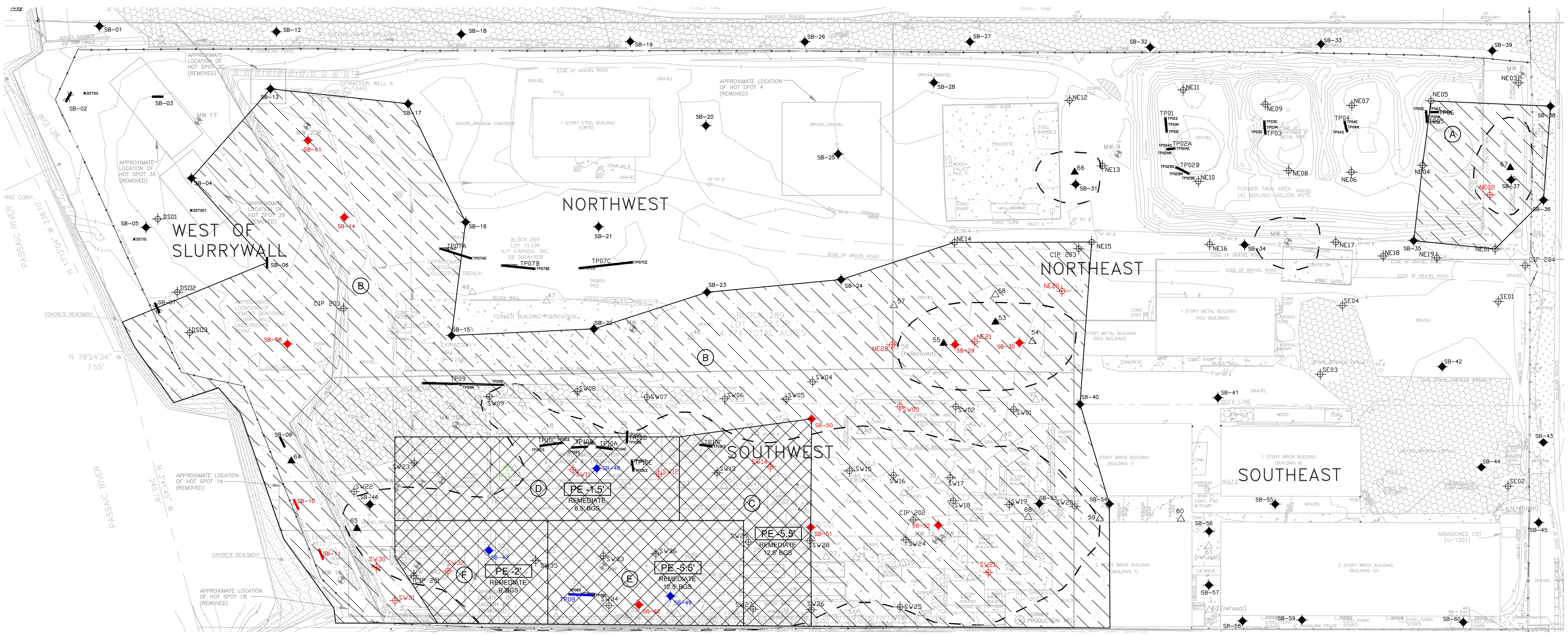
SYNCON RESINS SUPERFUND SITE
KEARNY TOWNSHIP, HUDSON COUNTY, NEW JERSEY

APPROXIMATE AREA OF SOIL TO BE REMEDIATED UNDER ALTERNATIVE S2

PROJECT NO.
FILE NAME:

FIGURE 4-1

O:\Project_Files_KC_Corps1\Syncon Resins\Figure\ FIG-4-1 08/10/10 15:45 Larsonej



CONTAMINANT	PRELIMINARY REMEDIATION GOAL (mg/kg)
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Toluene	46000
Xylenes (total)	2600
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- 53 1997 CPT LOCATION - ODOR/PRODUCT
- FORMER PRODUCTION WELL
- ESTIMATED EXTENT OF PRODUCT IMPACT (1997)

HATCHING LEGEND

- APPROXIMATE AREA OF SOIL THAT WOULD BE TREATED BY LTTD PRIOR TO ONSITE BACKFILLING
- APPROXIMATE AREA OF SOIL THAT WOULD BE DISPOSED OF AS NON-HAZARDOUS WASTE

ABBREVIATIONS

CPT	CONE PENETROMETER TEST
MG/KG	MILLIGRAMS PER KILOGRAM
PAHs	POLYCYCLIC AROMATIC HYDROCARBON
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1" = 40'
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SYNCON RESINS SUPERFUND SITE
KEARNY TOWNSHIP, HUDSON COUNTY, NEW JERSEY

APPROXIMATE AREA OF SOIL TO BE REMEDIATED
UNDER ALTERNATIVE S3

PROJECT NO.
FILE NAME:

FIGURE 4-2

Table A-1
Estimated Volume to be Remediated of Soil Exceeding Preliminary Remediation Goals under Alternative S2
Syncon Resins Superfund Site
Kearny, New Jersey

Location	Total Area (sf)	Total Depth (feet bgs)	Total Volume (cf)	PCB Principal Threat Waste Volume (cf) (1)	Volume of Hazardous Waste Requiring Treatment (cf) (2)(3)(4)	Volume of Hazardous Waste Not Requiring Treatment (cf) (2)(3)(4)	Volume of Non-Hazardous Waste (cf)
Area A	12,250	2	24,500	0	0	0	24,500
Area B	187,653	2	375,306	0	0	0	375,306
Area C	14,294	12.5	178,675	0	44,669	134,006	0
Area D	17,617	8.5	149,745	149,745	0	0	0
Area E	15,116	12.5	188,950	0	62,983	125,967	0
Area F	10,591	9	95,319	0	31,773	63,546	0
		TOTAL (cf)	*1,012,495*	*149,745*	*139,425*	*323,519*	*399,806*
		TOTAL (CY):	***39,000***	***6,000***	***6,000***	***12,000***	***15,000***
		TOTAL (Tons):	***62,400***	***9,600***	***9,600***	***19,200***	***24,000***

Notes:
bgs: below ground surface
cy: cubic yard
cf: cubic feet
sf: square feet
(1) Within Area D, there is an area of approximately 18,208 sf (containing SW10 and SB-48) where PCB concentrations exceed 500 mg/kg and would be characterized as TSCA waste and be disposed of as such.
(2) Soil waste characterization samples collected from SB-47 and SB-49 (located within Area F and Area E, respectively) during 2008 data gap field investigation exhibited ignitability below 140^{o}F, and would thus be characterized as RCRA hazardous waste.
(3) It is assumed that 25% of the RCRA hazardous waste located within Area C would need treatment prior to disposal at Subtitle C landfill, whereas the remaining 75% of the RCRA hazardous waste located within Area C can be disposed of directly at Subtitle C landfill without treatment.
(4) It is assumed that one third of the RCRA hazardous waste located within Areas E and F would need treatment prior to disposal at Subtitle C landfill, whereas the remaining two thirds of the RCRA hazardous waste located within Areas E and F. can be disposed of directly at Subtitle C landfill without treatment.

Table A-2
Estimated Volume to be Remediated of Soil Exceeding Preliminary Remediation Goals under Alternative S3
Syncon Resins Superfund Site
Kearny, New Jersey

Location	Total Area (sf)	Total Depth (feet bgs)	Total Volume (cf)	PCB Principal Threat Waste Volume (cf) (1)	Volume of Hazardous Waste Requiring Treatment (cf) (2)(3)	Volume of Waste to be Treated by LTTD (cf) (2)(3)(4)	Volume of Non-Hazardous Waste (cf)
Area A	12,250	2	24,500	0	0	0	24,500
Area B	187,653	2	375,306	0	0	0	375,306
Area C	14,294	12.5	178,675	0	178,675	178,675	0
Area D	17,617	8.5	149,745	149,745	0	149,745	0
Area E	15,116	12.5	188,950	0	188,950	188,950	0
Area F	10,591	9	95,319	0	95,319	95,319	0
		TOTAL (cf)	*1,012,495*			*612,689*	*399,806*
		TOTAL (CY):	***39,000***			***24,000***	***15,000***
		TOTAL (Tons):	***62,400***			***38,400***	***24,000***

Notes:
bgs: below ground surface
cy: cubic yard
cf: cubic feet
sf: square feet
(1) Within Area D, there is an area of approximately 18,208 sf (containing SW10 and SB-48) where PCB concentrations exceed 500 mg/kg and would be characterized as TSCA waste.
(2) Soil waste characterization samples collected from SB-47 and SB-49 (located within Area F and Area E, respectively) during 2008 data gap field investigation exhibited ignitability below 140^{o}F, and would thus be characterized as RCRA hazardous waste.
(3) No free product was encountered in Area C during the 2008 data gap field investigation, but there were no other soil boring installed in this area than the two eastern-most borings SB-50 and SB-51. As such, to be conservative, Area C is included as an area with potential free product presence and the soil thereof would thus be characterized as RCRA hazardous waste.
(4) It is assumed that all TSCA waste and RCRA hazardous waste will be treated by LTTD, and re-used as backfill if demonstrated to meet the PRGs following LTTD treatment.

Appendix B-1
Revised Cost Estimate for Alternative S2
Syncon Resins Superfund Site
Kearny, New Jersey

Component	Contractor or Sub	3-Year Cost [1]	3-Year Present Cost [1][2]
TOTAL A/E Cost			
Pre-Design Investigation (Allowance)		$400,000	$400,000
Remedial Design (Allowance)		$1,000,000	$934,579
Total A/E Cost		**$1,400,000**	**$1,335,000**
RA CONTRACTOR COSTS			
General Requirements			
01. General Conditions	Prime	$931,000	$813,171
02. Permits	Prime	$80,000	$69,875
03. Safety and Health Requirements	Prime	$178,000	$155,472
04. Temporary Facilitites and Utilities	Prime	$62,000	$54,153
05. Security	Security	$141,000	$123,155
06. Surveying	Surveyor	$167,000	$145,864
07. Erosion Control	Prime	$53,000	$46,292
08. Decontamination	Prime	$42,000	$36,684
Site Preparation			
09. Concrete Slab Demolition	Prime	$682,000	$595,685
10. Perimeter Wellpoint Dewatering System	Dewatering	$347,000	$303,083
11. On-Site Water Treatment System	Water Treatment	$321,000	$280,374
Excavation, Sampling, and Backfill			
12. Excavation	Prime	$771,000	$673,421
13. Post-Excavation Sampling	Prime	$149,000	$130,142
14. Backfill	Prime	$1,067,000	$931,959
Transportation and Disposal			
15. TSCA Waste for TSCA Landfill	T&D	$1,877,000	$1,639,444
16. Hazardous Waste Requiring Thermal Treatment	T&D	$4,251,000	$3,712,988
17. Hazardous Waste Not Requiring Thermal Treatment (Subtitle C)	T&D	$3,754,000	$3,278,889
18. Non-Hazardous Waste (Subtitle D)	T&D	$1,656,000	$1,446,415
19. Product Oil Recovered from Dewatering (TSCA waste)	T&D	$185,000	$161,586
Final Site Restoration			
20. Final Site Restoration (Allowance)	Prime	$50,000	$43,672
Closure Documents			
21. RA Report and As-Built Drawings (Allowance)	Prime	$100,000	$87,344
Subtotal RA Contractor Cost		**$16,864,000**	**$14,729,671**
G&A (5%)		$844,000	$737,000
Subtotal RA Contractor Cost with G/A		**$17,708,000**	**$15,467,000**
Profit, except on T&D (8%)		$479,000	$419,000
Profit, T&D, reduced fee (2%)		$235,000	$205,000
Subtotal RA Contractor Cost with Profit		**$18,422,000**	**$16,091,000**
Bond (1.5%)		$277,000	$242,000
Contingency (10%)		$1,843,000	$1,610,000
TOTAL RA CONTRACTOR COST		**$20,542,000**	**$17,943,000**
ENGINEERING DURING CONSTRUCTION COSTS			
Supervision, Inspection, and Management/Title II (9.8%)		$2,013,116	$1,758,414
TOTAL ENGINEERING DURING CONSTRUCTION COSTS		**$2,014,000**	**$1,759,000**

Appendix B-1
Revised Cost Estimate for Alternative S2
Syncon Resins Superfund Site
Kearny, New Jersey

Component	Contractor or Sub	3-Year Cost [1]	3-Year Present Cost [1][2]
PROJECT COST			
A/E COST		$1,400,000	$1,335,000
RA CONTRACTOR COST		$20,542,000	$17,943,000
ENGINEERING DURING CONSTRUCTION COSTS		$2,014,000	$1,759,000
SUBTOTAL PROJECT COST		**$23,956,000**	**$21,037,000**
Escalation (2%)		$480,000	$421,000
TOTAL PROJECT COST		**$24,436,000**	**$21,458,000**

Note:
(1) The project cost presented herein represents only feasibility study level, and is thus subject to change pending the results of the pre-design investigation, which is intended to collect sufficient data to assist in the development of remedial design and associated detailed cost estimate.
(2) Assumes discount rate is 7%.

Description: FFS Cost Estimate - Individual Cost Item Backup

0001 - General Conditions

General conditions to include the project-dedicated site supervisory staff, development of work plans, site photographs/videos, project signs, insurance, mobilization/demobilization, and costs not covered elsewhere.

Estimate assumes that following the remedial design, the RA Contractor will mobilize to the site and complete the remedial action including the site preparation, excavation, off-site transportation and disposal, backfill and compaction, final grading, and site restoration prior to project end.

Project Schedule

Assume the following project schedule:

Project Start Date	January 2011			
Pre-Design Investigation*	6	months		
Remedial Design*	12	months		
Procurement*	3	months		
Field Trailer Compound Establishment	1	months		
Pre-Construction Work Plans and Meetings (RA Work)	1	months		
Site Preparation (Water Treatment, Wellpoints)	1	months		
Remedial Excavation, T&D, Backfill and Compaction	7	months		
Final Site Restoration and Demob	1	months		
Total Project Duration	**32**	**months**	**139**	**weeks**
Total Construction Duration	11	months	48	weeks

* Assumes the Contractor's Supervisory Staff demobilizes from the site during the PD, RD and procurement phases, and then returns for the remedial action

General Condition Costs

A) Site Supervisory Staff

Assume the following Site Supervisory Staff for duration of construction (see labor/equipment backup page for rates):

Project Manager	$95	per hour
Site Superintendant	$87	per hour
Construction Foreman	$77	per hour
Project Engineer	$65	per hour
Environmental Technician (QC)	$50	per hour
Pickup Truck #1	$8	per hour
Pickup Truck #2	$8	per hour
	$390	per hour
	$67,600	per month

Total Site Supervisory Staff for Construction Duration (11 months) **$744,000**

B) Work Plan Preparation

Estimated # of Pre-Construction Work Plans Required:	10	work plans
Estimated # of Engineer Hours Required per Work Plan:	120	hours
Professional Engineer	$65	per hour

Total Work Plan Preparation Cost: **$78,000**

C) Mobilization/Demobilization Fees

Assume 10 large pieces of equipment to be used throughout remedial action.

Per MEANS 01-54-36.50-0100 Mobilization (one-way), 25 mile trip, Cost is approximately $440 (including NJ adjustment)

Total Mobilization/Demobilization Cost: **$9,000**

D) Project Insurance

Per MEANS 01-31-13.30-0020 Builder's Risk Insurance, 0.24% of job cost. Allow $100,000 based on project size.

Estimated Project Insurance Cost: **$100,000**

TOTAL GENERAL CONDITION COST: $931,000

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PROJECT: Syncon Resins	COMPUTED BY : JM	CHECKED BY: TM	
JOB NO.: 74537.6402.017	DATE : 7/6/2010	DATE CHECKED: 7/7/2010	
CLIENT: USACE		PAGE NO. : 1	

Description: FFS Cost Estimate - Individual Cost Item Backup

0002 - Permits

Assume the following permit equivalencies may potentially be required for the remedial action:

1 ***NJDEP - Site Remediation Program***
state approval of ROD for this operable unit

2 ***NJDEP - Div of Land Use Regulation (DLUR)***
Flood Hazard Area Permit

3 ***NJDEP - NJPDES DSW***
discharge to surface water

4 ***NJDEP - NJPDES RFA for Stormwater Discharge During Construction***

5 ***Hudson, Essex, and Passaic Soil Conservation District***
Soil Erosion and Sediment Control (SESC) Plan Certification

6 ***NJDEP - NJPDES TWA***
Treatment Works Approval (for temporary water treatment system)

7 ***NJDEP - Air Quality Permit Program (AQPP)***
Air Permit (for temporary water treatment system stack discharge)

8 ***NJDEP - Bur of Water Allocation***
temporary dewatering during construction
if dewatering exceeds 100K gpd for more than 30 days
** needs WQMP consistency determination

9 ***Local Site Plan Approval***

10 ***Road Opening Permits (local, county, state)***

Assume 80 hours required on average for each permit @ $100/hour rate

Total Estimated Allowance for Permitting: $80,000.00

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PROJECT:	Syncon Resins	COMPUTED BY :	JM	CHECKED BY:	TM
JOB NO.:	74537.6402.017	DATE :	7/6/2010	DATE CHECKED:	7/7/2010
CLIENT:	USACE			PAGE NO. :	1

Description: FFS Cost Estimate - Individual Cost Item Backup

0003 - Safety and Health Requirements

Safety and Health Requirements to include the Site Health and Safety Officer, personnel protective equipment and supplies, and additional safety and air monitoring equipment/testing.

Total Construction Duration:	11	months
	48	weeks
	238	work days

A) Site Health and Safety Officer

Full time SHSO During Construction

Industrial Hygienist (SHSO) $69 per hour (for 10 months of field construction) **$120,000**

B) PPE Costs

Assume PPE required for 20 people per work day for duration of demolition and construction.

Estimate $10 per day per worker for PPE and incidental safety equipment/testing. **$48,000**

C) Additional Safety and Air Monitoring Equipment

Add 20% to PPE Costs for additional safety and air monitoring equipment: **$10,000**

TOTAL SAFETY AND HEALTH REQUIREMENTS COST: $178,000

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PROJECT: Syncon Resins	COMPUTED BY : JM	CHECKED BY: TM	
JOB NO.: 74537.6402.017	DATE : 7/6/2010	DATE CHECKED: 7/7/2010	
CLIENT: USACE		PAGE NO. : 1	

Description: FFS Cost Estimate - Individual Cost Item Backup

0004 - Temporary Facilities

Temporary Facilities to include the field trailers, utilities, cleaning services, and office equipment and supplies.

A) Field Trailers

Assume a total of 4 project trailers required (2 for Contractor, 1 for USEPA/USACE, and 1 shower trailer).

The trailer compound will be mobilized at project start and will be used for entire project duration (not just the construction).

Total Duration for Field Portion of Project: 10 months

MEANS 01-52-13.20-0550 Field Trailer Rental, 50' x 12', furnished	$360
MEANS 01-52-13.20-0700 Add for Air Conditioning	$41
	$401
NJ Location Adjustment Factor	1.118
	$448
Field Trailer Cost per Trailer for 10 month rental:	$5,000
Total Field Trailer Rental Cost for 4 trailers:	**$20,000**

B) Utilities and Cleaning Services for Field Trailers

Assume following utilities per month per trailer:

Electricity	$600	per month per trailer
Phone/Internet	$80	per month per trailer
Water	$40	per month per trailer
Sewer	$30	per month per trailer
Cleaning Services	$50	per month per trailer
	$800	per month per trailer

Utilities for Trailers only Needed for On-Site Construction Period (not needed during PD and RD)

Total Duration for Field Portion of Project: 10 months

Total Utilities and Cleaning Services for 4 trailers: **$32,000**

C) Miscellaneous Office Supplies

Item	QTY	UOM	Unit Cost	Extended Cost
Computers	3	each	$2,000	$6,000
Fax Machines	3	each	$300	$900
Printers	3	each	$500	$1,500
Office Supplies	10	months	$100	$1,000

Total Miscellaneous Office Equipment/Supplies: **$10,000**

TOTAL COST FOR TEMPORARY FACILITIES: **$62,000**

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	JOB NO.:	74537.6402.017	DATE :	7/6/2010	DATE CHECKED:	7/7/2010
	CLIENT:	USACE			PAGE NO. :	1

Description: FFS Cost Estimate - Individual Cost Item Backup

0005 - Security

Assume for duration of construction requires 16-hour security guard for weekdays and 24-hour security guard for weekends.

Total Field Duration:	10	months
	43	weeks
	5,547	hours

A) Security Guard

Security Guard	$25	per hour

Total Security Guard Cost: **$139,000**

B) Security Trailer

MEANS 01-52-13.20-1100 Portable Office, prefab on skids, 8' x 12'	$99
NJ Location Adjustment Factor	1.118
	$111

Total Security Trailer Cost for 10 months: **$2,000**

TOTAL COST FOR SITE SECURITY: **$141,000**

0006 - Surveying

Assume surveying will be required for the following tasks/durations:

Existing Conditions Survey prior to Site Preparation	1 month
Excavation and Backfill Period (for depth verification, quantity measurement, post-exc samples, final grading)	7 months
	8 months

Total Surveying Duration:	8	months
	35	weeks
	173	work days

Survey Cost

Assume full-time 2-person survey team for the surveying work:

Surveyor #1	$53	per hour
Surveyor #2	$53	per hour
	$106	per hour
	$848	per day
As-built Drawing Preparation	$20,000	LS

TOTAL COST FOR SURVEYING (8 months): **$167,000**

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PROJECT:	Syncon Resins	COMPUTED BY :	JM	CHECKED BY:	TM
JOB NO.:	74537.6402.017	DATE :	7/6/2010	DATE CHECKED:	7/7/2010
CLIENT:	USACE			PAGE NO. :	1

Description: FFS Cost Estimate - Individual Cost Item Backup

0007 - Erosion Control

Total Field Duration: 10 months

43 weeks

A) Installation and Maintenance of Erosion Control Devices

Assume 2 laborers for 4 hours per week to install, maintain, and remove erosion control devices throughout construction:

Laborer	$50	per hour
Laborer	$50	per hour
	$100	per hour

Total Cost for Erosion Control Installation: **$18,000**

B) Erosion Control Devices/Materials

MEANS 31-25-13.10-1100 Silt Fence, 3' high, averse conditions	$0.96	per LF
MEANS 31-25-13.10-1250 Hay Bales, staked	$6.60	per LF
NJ Location Adjustment Factor	1.118	
	$8.45	per LF

Assume silt fence and hay bales installed around outer site perimeter

north property line	1000	LF
south property line	1000	LF
east property line	500	LF
west property line (along river)	800	LF
	3300	LF
add 25% for material replacement	4125	LF

Total Cost for Erosion Control Devices/Materials: **$35,000**

TOTAL COST FOR EROSION CONTROL: $53,000

0008 - Decontamination

Assume decontamination pad required during construction duration only.

A) Construct Decontamination Pad

Allowance for Construction of Decontamination Pad: **$20,000**

B) Decon Pad Operations

Assume 2 laborers for 2 hours per day to perform equipment decontamination on-site, including T&D trucks:

Laborer	$50	per hour
Laborer	$50	per hour
	$100	per hour

1 hours per day, 5 days a week, 43 weeks

Total Cost for Decon Pad Operations: **$22,000**

TOTAL COST FOR DECONTAMINATION: $42,000

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CDM Federal Programs Corporation	PROJECT:	Syncon Resins	COMPUTED BY :	JM	CHECKED BY:	TM
	JOB NO.:	74537.6402.017	DATE :	7/6/2010	DATE CHECKED:	7/7/2010
	CLIENT:	USACE			PAGE NO. :	1

Description: FFS Cost Estimate - Individual Cost Item Backup

0009 - Concrete Slab Demolition

Quantities are based on 2006 Pre-Design Investigation Report and 2006 Building Assessment Report, Louis Berger Group assumes 18" thick reinforced concrete slab beneath Buildings 11 and 12 to be demolished because they are located within susbsurface excavation area.

A) Concrete Slab Demolition

Concrete Selective Demolition, MEANS 03-05-05.10-0060, $98.05 per CY * NJ Location Factor = $110/CY

1. Southwest Area - Removal of foundation/concrete slab (former AST area)	3,750	CY
2. Building 11 (75' * 40' * 25') concrete slab	167	CY
3. Building 12 (40' * 40' * 10') concrete slab	89	CY
	4,006	CY

Total Concrete Slab Demolition Cost	**$440,611**

C) Concrete Slab Disposal

assume 150 lbs/CF reinforced concrete density

Non-Haz C&D Debris Tipping Fee, assume $60/CY.

Concrete Slabs, volume for disposal	4,006	CY
T&D Cost, Concrete Slab Debris	**$241,000**	

TOTAL CONCRETE SLAB DEMOLITION SUBTOTAL	**$682,000**

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	JOB NO.: 74537.6402.017	DATE : 7/6/2010	DATE CHECKED: 7/7/2010
	CLIENT: USACE		PAGE NO. : 1

Description: FFS Cost Estimate - Individual Cost Item Backup

0010 - Perimeter Wellpoint Dewatering System

Assumes that excavation dewatering will be accomplished by both excavation sump pits (incidental to excavation costs) and the installation of a perimeter dewatering wellpoint system around the deeper excavation areas.

Assume wellpoints to be installed along the deep excavation within the Southwest Area:

Southwest Area of Site, Deep Excavation, North of Slurry Wall	710	LF
	710	LF

Wellpoint System Costs

MEANS, Complete Installation, operation, equipment rental, fuel & removal of system

1000' long header, 10" diameter, 2" wellpoints @ 5' on center

first month (MEANS 31-23-19.40-1600)	$161	per LF of header
monthly thereafter (MEANS 31-23-19.40-1700)	$55	per LF of header
Wellpoint System Subtotal, assume 6 months	$436	per LF of header
NJ Location Factor Adjustment	**$487**	**per LF of header**

TOTAL WELLPOINT DEWATERING COST **$347,000**

0011 - Water Treatment System

Assumes the rental of a temporary on-site water treatment system to treat dewatering volume from both wellpoints and excavation sump pits. Quote obtained for an approximate 200 gpm treatment system with frac tank, oil/water seperator, bag and cartridge filtration system, air stripper, carbon treatment, and ion exchange units to remove arsenic.

Add a full-time N2 Operator for operations and maintenance of the treatment system.

Assume system used during duration of excavation and backfill operations for deep excavation (3 months, 65 days).

Mobilization Fee	$112,000
Demobilization Fee	$9,000
Monthly Rental Fee, $17000 per month	$51,000
Bag Filters, $5 each @ 18 per day	$5,850
Cartridge Filters, $7.50 each @ 44 per day	$21,450
Carbon Media Changeout, assume 1 changeout total, $17,500 per changeout (quote)	$17,500
Ion Exchange Resin Media Changeout, 1 changeout total, $48,000 per changeout (quote)	$48,000
Total Estimated Treatment System Cost	**$265,000**

Add a 2,000 gallon double-walled product oil storage tank for recovered product **$8,000**

*disposal of recovered product oil is covered under Waste T&D

Water Treatment Plant Operations

Assume full-time N2 operator, 8 hours per day, for duration of treatment system.	$91	per hour
Estimated number of hours	520	hours
N2 Operator Labor Cost	**$48,000**	

TOTAL WATER TREATMENT SYSTEM COST **$321,000**

500806

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	JOB NO.: 74537.6402.017	DATE: 7/6/2010	DATE CHECKED: 7/7/2010
	CLIENT: USACE		PAGE NO.: 1

Description: FFS Cost Estimate - Individual Cost Item Backup

0012 - Excavation

A) Total Excavation Volume (see excavation calculation, Appendix A) 59,157 CY

Soil excavation	44,850	CY
Concrete slab demolition	4,006	CY
Clean gravel excavation	10,301	CY

B) Excavation Duration

Assume 500 CY/day production rate for excavation of soil and gravel, and 200 CY/day production rate for concrete slab demolition

Total Excavation Period, workdays	130	DAYS
Total Excavation Period, work hours (8 hours per day)	1,043	HOURS
Total Excavation Period, work weeks	26	WEEKS
Total Excavation Period, months	7	MONTHS

*Assume backfill is concurrent with excavation (by separate crew), but lags behind by one month

C) Excavation Labor/Equipment Costs

Excavating Crew

Excavator, Hydraulic, 2 CY	$85	per hour
Equip. Op. Heavy	$101	per hour
Dump Truck	$50	per hour
Truck Dr. Heavy	$90	per hour
Loader	$75	per hour
Equip. Op. Heavy	$101	per hour
Laborer Foreman	$81	per hour
Laborer (Semi-Skilled)	$78	per hour
Laborer (Semi-Skilled)	$78	per hour
Excavation Crew Unit Cost	**$739**	per hour

TOTAL EXCAVATION COST **$771,000**

0013 - Post-Excavation Confirmation Sampling

to meet NJDEP verification requirements:

1 bottom sample per 900 SF of excvation floor

1 sidewall sample per 30 LF of exterior or interior excavation sidewall exposed

A) Estimated # of Post-Excavation Samples

Total Subsurface Excavation Area, plan area:	60000	SF
Estimated # of bottom samples:	67	bottom samples
For sidewall samples, assume 250% of the bottom sample quantity		
Estimated # of sidewall samples:	168	sidewall samples
Total # of post-excavation samples (base):	235	samples
Add 10% for QC samples for duplicates:	**259**	**samples**

B) Laboratory Analysis Fees

assume the following analysis parameters for site compounds of concern:

Analysis	Standard Turnaroud		Add 70% for Quick Turnaround	
1) BTEX	$55	per sample	$94.00	per sample
3) Arsenic and Cadmium	$24	per sample	$41.00	per sample
4) Napthalene	$50	per sample	$85.00	per sample
5) PCBs and Pesticides	$130	per sample	$221.00	per sample
	$259	**per sample**	**$441.00**	**per sample**

assume quick turnaround required for all post-excavation samples to facilitate backfilling operations:

Total Post-Excavation Laboratory Analysis Costs: **$114,219.00**

C) Post-Excavation Sample Collection

Assume 1 hour per sample for an environmental technician to collect each sample

Environmental Technician $50 per hour **$11,750**

D) Sample Packaging and Shipping Costs

Assume $10 per sample for jars, paperwork, coolers, and shipping costs: **$2,350**

E) Data Validation of Post-Excavation Samples

Assume 50% of the total post-excavation samples will be used as clean final verification samples requiring validation.

# of samples requiring validation (50% of total):	129.5	samples
Assume 1 hour per sample for data validation by a chemist	129.5	hours
Add 200 hours for QCSR report:	200	hours
Total Chemist Hours:	329.5	hours

Chemist $61 per hour **$20,100**

TOTAL POST-EXCAVATION SAMPLING: **$149,000.00**

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PROJECT: Syncon Resins	COMPUTED BY: JM	CHECKED BY: TM	
JOB NO.: 74537.6402.017	DATE: 7/6/2010	DATE CHECKED: 7/7/2010	
CLIENT: USACE		PAGE NO.: 1	

Description: FFS Cost Estimate - Individual Cost Item Backup

0014 - Backfill

A) Total Excavation Volume		59,157	CY
B) Backfill Duration			
Assume backfill runs concurrent to excavation, but lags behind by one month			
Total Backfill Period, workdays		59	DAYS
Total Backfill Period, work hours (8 hours per day)		473	HOURS
Total Backfill Period, work weeks		12	WEEKS
Total Backfill Period, months		3	MONTHS
C) Backfill Labor/Equipment Costs			
Backfill Crew			
Dozer	$65	per hour	
Equip. Op. Heavy, for dozer	$101	per hour	
Vibratory Roller	$63	per hour	
Equip. Oper Medium	$99	per hour	
Walk-Behind Compactor	$3	per hour	
Laborer (Semi-Skilled)	$78	per hour	
Backfill Crew Hourly Rate	**$409**	**per hour**	
Total Backfill Crew Cost	**$194,000**		
D) Backfill Material Costs			
Backfill Material Unit Costs:			
Common Fill Unit Cost	$13	per CY	
Topsoil (6" deep) Unit Cost	$36	per CY	
Seeding Unit Cost	$4,837	per Acre	
Backfill Material Quantities			
1. Assume the top 6" of excavations will be imported Topsoil, 6" deep, and remainder of void with clean fill.			
Furnish & Place imported Topsoil, 6" deep in all excavation areas			
Total Excavation Surface Area		258,000	SF
Total Topsoil Layer (6")		129,000	CF
Total Topsoil Needed:		5,000	CY
Total Seeding Area Needed:		5.9	Acre
Topsoil Material Cost:	**$181,000**		
Seeding Material Cost:	**$29,000**		
note no loss in material volume due to compaction of gravel			
i.e. embankment yards = loose cubic yards			
2. Common fill for remainder of excavation void.			
Total Excavation Volume:		59,157	CY
Less the Re-usable Clean Gravel Volume:		48,856	CY
Less the Topsoil Volume:		43,856	CY
Imported Clean Fill needed (with 90% Compaction)		48,728	CY
Common Fill Material Cost:	**$634,000**		
E) Backfill Material Testing			
Requires one sample for every 5,000 cubic yards imported to the site, analyzed for full parameters			
including sieve analyses, moisture content, chemical compounds, and Ra-226:			
Assume $1500 per sample analysis fee			
# of Backfill Material Samples Required:		11	samples
Backfill Testing Cost:	**$16,500**		
F) Soil Density Testing			
Assume $500 per visit by soil density testing technician, 2 visits per week, during backfill operations.			
# of Backfill Visits Required:		24	visits
Soil Density Testing Cost:	**$12,000**		
TOTAL BACKFILL COST:	**$1,067,000**		

Description: FFS Cost Estimate - Individual Cost Item Backup

0015-0018 Transportation and Disposal of Excavated Waste Material

A) Quantity Calculation at time of FFS based on existing data (see separate quantity calc, Appendix A)

assumes 1.6 tons per CY for soil density

Waste Category	Quantity (CY)	Quantity (tons)	Disposal Type
1. TSCA Waste	6,000	9,600	TSCA Landfill
2. Hazardous Waste Requiring Thermal Treatment	6,000	9,600	Thermal w/Subtitle C Disposal
3. Hazardous Waste Not Requiring Thermal Treatment	12,000	19,200	Subtitle C Landfill
4. Non-Hazardous Waste	15,000	24,000	Subtitle D Landfill
Subtotal Waste Volume	**39,000**	**62,400**	

B) Add 15% additional volume to account for results of pre-design investigation, potential excavation beneath buildings, and secondary excavation following the results of the post-excavation samples after primary excavation.

Waste Category	Quantity (CY)	Quantity (tons)	T&D Unit Costs (per ton)	Extended Costs
1. TSCA Waste	6,900	11,040	$170	$1,877,000
2. Hazardous Waste Requiring Thermal Treatment	6,900	11,040	$385	$4,251,000
3. Hazardous Waste Not Requiring Thermal Treatment	13,800	22,080	$170	$3,754,000
4. Non-Hazardous Waste	17,250	27,600	$60	$1,656,000
TOTAL T&D Waste for Disposal (Soil)	**44,850**	**71,760**		**$11,538,000**

0019 Transportation and Disposal of Product Oil Recovered from Dewatering (TSCA waste)

In addition to the excavated soil, there will be recovered product oil from the excavation dewatering and water treatment processes. Fingerprinting analysis indicated that the product was of a mix of diesel fuel, #4/5/6 fuel oil, creosote, mineral spirits and hydraulic oil, essentially on the heavier oil end. The recovered free product will likely be TSCA waste as it contains PCBs slightly exceeding 50 ppm.

Estimated Cost per Gallon for Incineration of Product Liquid: $5 per gallon

Quote pending from Clean Harbors

Estimated Quanitity of Product for Incineration: 37,000 gallons

(see Volume Calc, Appendix A)

Estimated Cost for Product Disposal: **$185,000**

CDM

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PROJECT:	Syncon Resins	COMPUTED BY :	AMR	CHECKED BY:	JM
JOB NO.:	74537.6402.017	DATE :	2/15/2010	DATE CHECKED:	2/19/2010
CLIENT:	USACE			PAGE NO. :	1

Description: Determination of wage rates for the professional and craft labor and equipment rates for use in Syncon FFS cost estimate. Craft labor rated based on latest Hudson County Davis-Bacon Wage Determinations, October 2009. Professional rates based on SalaryExpert.com average annual salary estimates and previous project experience.

Number of work hours per year:	**2080**	*52 weeks x 40 hours per week*
Tax and insurance rate:	**28.97%**	*Based on FICA, insurance, workmans comp, etc. in MEANS 2009.*
Labor overhead applied to craft labor:	**20.00%**	*Varies based on RA Contractor markup structure*

Professional Labor

Labor Category	Salary	Bonus (6%)	Fringes (15%)	Base Adjusted Hourly Salary	Total with Tax & Insurance
1. Project Manager	$125,000	$7,500	$18,750	$73.00	**$95**
2. Site Superintendant	$115,000	$6,900	$17,250	$67.00	**$87**
3. Construction Foreman	$100,000	$6,000	$15,000	$59.00	**$77**
4. Professional Engineer	$85,000	$5,100	$12,750	$50.00	**$65**
5. Engineer	$75,000	$4,500	$11,250	$44.00	**$57**
6. Environmental Technician	$65,000	$3,900	$9,750	$38.00	**$50**
7. Surveyor	$70,000	$4,200	$10,500	$41.00	**$53**
8. Drafter	$60,000	$3,600	$9,000	$35.00	**$46**
9. Chemist	$80,000	$4,800	$12,000	$47.00	**$61**
10. N2 Operator (Water Treatment)	$120,000	$7,200	$18,000	$70.00	**$91**
11. Industrial Hygienist (SHSO)	$90,000	$5,400	$13,500	$53.00	**$69**
12. Security Guard	$32,000	$1,920	$4,800	$19.00	**$25**

Craft Labor

Labor Category	Base Hourly	Fringes	Payroll Tax & Insurance	Base Hourly Rate	Adjusted Hourly Rate with Labor OH Markup
Laborer Foreman	$32.45	$19.40	$15.02	$67	**$81**
Laborer (Semi-Skilled)	$30.45	$19.40	$14.44	$65	**$78**
Equip. Op. Heavy	$42.02	$22.50	$18.69	$84	**$101**
Equip. Oper Medium	$40.43	$22.50	$18.23	$82	**$99**
Equip. Op. Light	$36.89	$22.50	$17.21	$77	**$93**
Truck Dr. Heavy	$35.00	$22.68	$16.71	$75	**$90**
Truck Dr. Light	$34.85	$22.68	$16.67	$75	**$90**
Electrician	$47.37	$25.58	$21.13	$95	**$114**
Carpenter	$37.00	$27.02	$18.55	$83	**$100**
Plumber	$24.05	$13.67	$10.93	$49	**$59**
Steel Worker	$37.14	$35.60	$21.07	$94	**$113**

Equipment

Equipment	Total Hourly Cost (from MII Equipment Rate Database)
Excavator, Hydraulic, 2 CY	**$85**
Dozer	**$65**
Loader	**$75**
Dump Truck	**$50**
Forklift	**$20**
Air Compressor	**$30**
Concrete Saw	**$25**
Vibratory Roller	**$63**
Walk-Behind Compactor	**$3**
Pickup Trucks	**$8**

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PROJECT:	Syncon Resins	COMPUTED BY :	JM	CHECKED BY:	TM
JOB NO.:	74537.6402.017	DATE :	7/6/2010	DATE CHECKED:	7/7/2010
CLIENT:	USACE			PAGE NO. :	1

Description: FFS Cost Estimate - Individual Cost Item Backup

Pre-Design Investigation and Remedial Design

assumes after the building demolition is complete, the RA contractor demobilizes from the site during PD/Remedial Design.

assumes pre-design investigation and remedial design performed by AE Firm.

Pre-Design Investigation

To include the development of the investigation work plan, performance of field work, and review and analysis of investigation results. Assumes collection of investigation samples for analysis by CLP laboratory for compounds of concern, collection of TCLP sample results for waste disposall characterization estimates, and a MIP Investigation.

Based on past project experience, allowance $400,000

Remedial Design

To include the analysis of investigation results and existing data, preparation of the remedial design including draft, pre-final, and final design packages consisting of specifications, drawings, design analysis report, and construction cost estimate.

Based on past project experience, allowance $1,000,000

Appendix B-2
Revised Cost Estimate for Alternative S3
Syncon Resins Superfund Site
Kearny, New Jersey

Component	Contractor or Sub	3-Year Cost [1]	3-Year Present Cost [1][2]
TOTAL A/E Cost			
Pre-Design Investigation (Allowance)		$400,000	$400,000
Remedial Design (Allowance)		$2,000,000	$1,869,159
Total A/E Cost		**$2,400,000**	**$2,270,000**
RA CONTRACTOR COSTS			
General Requirements			
01. General Conditions	Prime	$1,134,000	$990,480
02. Permits	Prime	$100,000	$87,344
03. Safety and Health Requirements	Prime	$583,000	$509,215
04. Temporary Facilitites and Utilities	Prime	$76,000	$66,381
05. Security	Security	$183,000	$159,839
06. Surveying	Surveyor	$223,000	$194,777
07. Erosion Control	Prime	$58,000	$50,659
08. Decontamination	Prime	$49,000	$42,798
Site Preparation			
09. Concrete Slab Demolition	Prime	$682,000	$595,685
10. Perimeter Wellpoint Dewatering System	Dewatering	$347,000	$303,083
11. On-Site Water Treatment System	Water Treatment	$740,000	$646,345
Excavation, Sampling, and Backfill			
12. Excavation	Prime	$1,206,000	$1,053,367
13. Post-Excavation Sampling	Prime	$149,000	$130,142
14. Backfill	Prime	$762,000	$665,560
Treatment, Transportation and Disposal			
15. On-Site Low Temperature Thermal Desorption	Treatment	$11,600,000	$10,131,889
16. Non-Hazardous Waste (Subtitle D)	T&D	$1,656,000	$1,446,415
17. Product Oil Recovered from Dewatering (TSCA waste)	T&D	$185,000	$161,586
Final Site Restoration			
18. Final Site Restoration (Allowance)	Prime	$50,000	$43,672
Closure Documents			
19. RA Report and As-Built Drawings (Allowance)	Prime	$100,000	$87,344
Subtotal RA Contractor Cost		**$19,883,000**	**$17,366,582**
G&A (5%)		$995,000	$869,000
Subtotal RA Contractor Cost with G/A		**$20,878,000**	**$18,236,000**
Profit, except on T&D (8%)		$1,523,000	$1,331,000
Profit, T&D, reduced fee (2%)		$37,000	$33,000
Subtotal RA Contractor Cost with Profit		**$22,438,000**	**$19,600,000**
Bond (1.5%)		$337,000	$294,000
Contingency (10%)		$2,244,000	$1,960,000
TOTAL RA CONTRACTOR COST		**$25,019,000**	**$21,854,000**
ENGINEERING DURING CONSTRUCTION COSTS			
Supervision, Inspection, and Management/Title II (9.8%)		$2,451,862	$2,141,692
TOTAL ENGINEERING DURING CONSTRUCTION COSTS		**$2,452,000**	**$2,142,000**

Appendix B-2
Revised Cost Estimate for Alternative S3
Syncon Resins Superfund Site
Kearny, New Jersey

Component	Contractor or Sub	3-Year Cost [1]	3-Year Present Cost [1][2]
PROJECT COST			
A/E COST		$2,400,000	$2,270,000
RA CONTRACTOR COST		$25,019,000	$21,854,000
ENGINEERING DURING CONSTRUCTION COSTS		$2,452,000	$2,142,000
SUBTOTAL PROJECT COST		**$29,871,000**	**$26,266,000**
Escalation (2%)		$598,000	$526,000
TOTAL PROJECT COST		**$30,469,000**	**$26,792,000**

Note:
(1) The project cost presented herein represents only feasibility study level, and is thus subject to change pending the results of the pre-design investigation, which is intended to collect sufficient data to assist in the development of remedial design and associated detailed cost estimate.
(2) Assumes discount rate is 7%.

CDM CDM Federal Programs Corporation	PROJECT: Syncon Resins	COMPUTED BY : JM	CHECKED BY: TM
	JOB NO.: 74537.6402.017	DATE : 7/6/2010	DATE CHECKED: 7/7/2010
	CLIENT: USACE		PAGE NO. : 1

Description: FFS Cost Estimate - Individual Cost Item Backup

0001 - General Conditions

General conditions to include the project-dedicated site supervisory staff, development of work plans, site photographs/videos, project signs, insurance, mobilization/demobilization, and costs not covered elsewhere.

Estimate assumes that following the remedial design, the RA Contractor will mobilize to the site and complete the remedial action including the site preparation, excavation, off-site transportation and disposal, backfill and compaction, final grading, and site restoration prior to project end.

Project Schedule

Assume the following project schedule:

Project Start Date	January 2011			
Pre-Design Investigation*	6	months		
Remedial Design*	12	months		
Procurement*	3	months		
Field Trailer Compound Establishment	1	months		
Pre-Construction Work Plans and Meetings (RA Work)	1	months		
Site Preparation (Water Treatment, Wellpoints)	1	months		
Remedial Excavation, T&D, Backfill and Compaction	10	months		
Final Site Restoration and Demob	1	months		
Total Project Duration	**35**	**months**	**152**	**weeks**
Total Construction Duration	14	months	61	weeks

* Assumes the Contractor's Supervisory Staff demobilizes from the site during the PD, RD and procurement phases, and then returns for the remedial action

General Condition Costs

A) Site Supervisory Staff

Assume the following Site Supervisory Staff for duration of construction (see labor/equipment backup page for rates):

Project Manager	$95	per hour	
Site Superintendant	$87	per hour	
Construction Foreman	$77	per hour	
Project Engineer	$65	per hour	
Environmental Technician (QC)	$50	per hour	
Pickup Truck #1	$8	per hour	
Pickup Truck #2	$8	per hour	
	$390	per hour	
	$67,600	per month	
Total Site Supervisory Staff for Construction Duration (14 months)			**$947,000**

B) Work Plan Preparation

Estimated # of Pre-Construction Work Plans Required:		10	work plans
Estimated # of Engineer Hours Required per Work Plan:		120	hours
Professional Engineer	$65	per hour	
Total Work Plan Preparation Cost:		**$78,000**	

C) Mobilization/Demobilization Fees

Assume 10 large pieces of equipment to be used throughout remedial action.

Per MEANS 01-54-36.50-0100 Mobilization (one-way), 25 mile trip, Cost is approximately $440 (including NJ adjustment)

Total Mobilization/Demobilization Cost: **$9,000**

D) Project Insurance

Per MEANS 01-31-13.30-0020 Builder's Risk Insurance, 0.24% of job cost. Allow $100,000 based on project size.

Estimated Project Insurance Cost: **$100,000**

TOTAL GENERAL CONDITION COST: **$1,134,000**

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PROJECT:	Syncon Resins	COMPUTED BY :	JM	CHECKED BY:	TM
JOB NO.:	74537.6402.017	DATE :	7/6/2010	DATE CHECKED:	7/7/2010
CLIENT:	USACE			PAGE NO. :	1

Description: FFS Cost Estimate - Individual Cost Item Backup

0002 - Permits

Assume the following permit equivalencies may potentially be required for the remedial action:

1 ***NJDEP - Site Remediation Program***
state approval of ROD for this operable unit

2 ***NJDEP - Div of Land Use Regulation (DLUR)***
Flood Hazard Area Permit

3 ***NJDEP - NJPDES DSW***
discharge to surface water

4 ***NJDEP - NJPDES RFA for Stormwater Discharge During Construction***

5 ***Hudson, Essex, and Passaic Soil Conservation District***
Soil Erosion and Sediment Control (SESC) Plan Certification

6 ***NJDEP - NJPDES TWA***
Treatment Works Approval (for temporary water treatment system)

7 ***NJDEP - Air Quality Permit Program (AQPP)***
Air Permit (for temporary water treatment system stack discharge)

8 ***NJDEP - Bur of Water Allocation***
temporary dewatering during construction
if dewatering exceeds 100K gpd for more than 30 days
** needs WQMP consistency determination

9 ***Local Site Plan Approval***

10 ***Road Opening Permits (local, county, state)***

Assume 80 hours required on average for each permit @ $100/hour rate

11 **Additionall Permit for Alternative S3 (specific to onsite treatment system remedy)**
Assume 200 hours required for these permits @ $100/hour rate

Total Estimated Allowance for Permitting: $100,000.00

500815

CDM CDM Federal Programs Corporation	PROJECT:	Syncon Resins	COMPUTED BY :	JM	CHECKED BY:	TM
	JOB NO.:	74537.6402.017	DATE :	7/6/2010	DATE CHECKED:	7/7/2010
	CLIENT:	USACE			PAGE NO. :	1

Description: FFS Cost Estimate - Individual Cost Item Backup

0003 - Safety and Health Requirements

Safety and Health Requirements to include the Site Health and Safety Officer, personnel protective equipment and supplies, and additional safety and air monitoring equipment/testing.

Total Construction Duration:	14	months
	61	weeks
	303	work days

A) Site Health and Safety Officer

Full time SHSO During Construction

Industrial Hygienist (SHSO)	$69	per hour	(for 13 months of field construction)	$156,000

Additional SHSO Hours during 9 Month LTTD Period to be on-site 24 hours

Industrial Hygienist (SHSO)	$69	per hour	$332,000
Estimated Number of Hours:	4807	hours	

B) PPE Costs

Assume PPE required for 20 people per work day for duration of demolition and construction.

Estimate $10 per day per worker for PPE and incidental safety equipment/testing. $79,000

C) Additional Safety and Air Monitoring Equipment

Add 20% to PPE Costs for additional safety and air monitoring equipment: $16,000

TOTAL SAFETY AND HEALTH REQUIREMENTS COST: $583,000

CDM	PROJECT:	Syncon Resins	COMPUTED BY :	JM	CHECKED BY:	TM
	JOB NO.:	74537.6402.017	DATE :	7/6/2010	DATE CHECKED:	7/7/2010
CDM Federal Programs Corporation	CLIENT:	USACE			PAGE NO. :	1

Description: FFS Cost Estimate - Individual Cost Item Backup

0004 - Temporary Facilities

Temporary Facilities to include the field trailers, utilities, cleaning services, and office equipment and supplies.

A) Field Trailers

Assume a total of 4 project trailers required (2 for Contractor, 1 for USEPA/USACE, and 1 shower trailer).

The trailer compound will be mobilized at project start and will be used for entire project duration (not just the construction).

Total Duration for Field Portion of Project: 13 months

MEANS 01-52-13.20-0550 Field Trailer Rental, 50' x 12', furnished	$360
MEANS 01-52-13.20-0700 Add for Air Conditioning	$41
	$401
NJ Location Adjustment Factor	1.118
	$448
Field Trailer Cost per Trailer for 13 month rental:	$6,000
Total Field Trailer Rental Cost for 4 trailers:	**$24,000**

B) Utilities and Cleaning Services for Field Trailers

Assume following utilities per month per trailer:

Electricity	$600	per month per trailer
Phone/Internet	$80	per month per trailer
Water	$40	per month per trailer
Sewer	$30	per month per trailer
Cleaning Services	$50	per month per trailer
	$800	per month per trailer

Utilities for Trailers only Needed for On-Site Construction Period (not needed during PD and RD)

Total Duration for Field Portion of Project: 13 months

Total Utilities and Cleaning Services for 4 trailers: **$42,000**

C) Miscellaneous Office Supplies

Item	QTY	UOM	Unit Cost	Extended Cost
Computers	3	each	$2,000	$6,000
Fax Machines	3	each	$300	$900
Printers	3	each	$500	$1,500
Office Supplies	13	months	$100	$1,300

Total Miscellaneous Office Equipment/Supplies: **$10,000**

TOTAL COST FOR TEMPORARY FACILITIES: **$76,000**

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PROJECT:	Syncon Resins	COMPUTED BY :	JM	CHECKED BY:	TM
JOB NO.:	74537.6402.017	DATE :	7/6/2010	DATE CHECKED:	7/7/2010
CLIENT:	USACE			PAGE NO. :	1

Description: FFS Cost Estimate - Individual Cost Item Backup

0005 - Security

Assume for duration of construction requires 16-hour security guard for weekdays and 24-hour security guard for weekends.

Total Field Duration:	13	months
	56	weeks
	7,211	hours

A) Security Guard

Security Guard	$25	per hour

Total Security Guard Cost: **$181,000**

B) Security Trailer

MEANS 01-52-13.20-1100 Portable Office, prefab on skids, 8' x 12'	$99
NJ Location Adjustment Factor	1.118
	$111

Total Security Trailer Cost for 13 months: **$2,000**

TOTAL COST FOR SITE SECURITY: **$183,000**

0006 - Surveying

Assume surveying will be required for the following tasks/durations:

Existing Conditions Survey prior to Site Preparation	1 month
Excavation and Backfill Period (for depth verification, quantity measurement, post-exc samples, final grading)	10 months
	11 months

Total Surveying Duration:	11	months
	48	weeks
	238	work days

Survey Cost

Assume full-time 2-person survey team for the surveying work:

Surveyor #1	$53	per hour
Surveyor #2	$53	per hour
	$106	per hour
	$848	per day

As-built Drawing Preparation	$20,000	LS

TOTAL COST FOR SURVEYING (11 months): **$223,000**

CDM CDM Federal Programs Corporation	PROJECT:	Syncon Resins	COMPUTED BY :	JM	CHECKED BY:	TM
	JOB NO.:	74537.6402.017	DATE :	7/6/2010	DATE CHECKED:	7/7/2010
	CLIENT:	USACE			PAGE NO. :	1

Description: FFS Cost Estimate - Individual Cost Item Backup

0007 - Erosion Control

Total Field Duration:	13	months
	56	weeks

A) Installation and Maintenance of Erosion Control Devices

Assume 2 laborers for 4 hours per week to install, maintain, and remove erosion control devices throughout construction:

Laborer	$50	per hour
Laborer	$50	per hour
	$100	per hour

Total Cost for Erosion Control Installation: **$23,000**

B) Erosion Control Devices/Materials

MEANS 31-25-13.10-1100 Silt Fence, 3' high, averse conditions	$0.96	per LF
MEANS 31-25-13.10-1250 Hay Bales, staked	$6.60	per LF
NJ Location Adjustment Factor	1.118	
	$8.45	per LF

Assume silt fence and hay bales installed around outer site perimeter

north property line	1000	LF
south property line	1000	LF
east property line	500	LF
west property line (along river)	800	LF
	3300	LF
add 25% for material replacement	4125	LF

Total Cost for Erosion Control Devices/Materials: **$35,000**

TOTAL COST FOR EROSION CONTROL: $58,000

0008 - Decontamination

Assume decontamination pad required during construction duration only.

A) Construct Decontamination Pad

Allowance for Construction of Decontamination Pad: **$20,000**

B) Decon Pad Operations

Assume 2 laborers for 2 hours per day to perform equipment decontamination on-site, including T&D trucks:

Laborer	$50	per hour
Laborer	$50	per hour
	$100	per hour

1 hours per day, 5 days a week, 56 weeks

Total Cost for Decon Pad Operations: **$29,000**

TOTAL COST FOR DECONTAMINATION: $49,000

PROJECT:	Syncon Resins	COMPUTED BY :	JM	CHECKED BY:	TM
JOB NO.:	74537.6402.017	DATE :	7/6/2010	DATE CHECKED:	7/7/2010
CLIENT:	USACE			PAGE NO. :	1

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Description: FFS Cost Estimate - Individual Cost Item Backup

0009 - Concrete Slab Demolition

Quantities are based on 2006 Pre-Design Investigation Report and 2006 Building Assessment Report, Louis Berger Group assumes 18" thick reinforced concrete slab beneath Buildings 11 and 12 to be demolished because they are located within susbsurface excavation area.

A) Concrete Slab Demolition

Concrete Selective Demolition, MEANS 03-05-05.10-0060, $98.05 per CY * NJ Location Factor = $110/CY

1. Southwest Area - Removal of foundation/concrete slab (former AST area)	3,750	CY
2. Building 11 (75' * 40' * 25') concrete slab	167	CY
3. Building 12 (40' * 40' * 10') concrete slab	89	CY
	4,006	CY

Total Concrete Slab Demolition Cost **$440,611**

C) Concrete Slab Disposal

assume 150 lbs/CF reinforced concrete density

Non-Haz C&D Debris Tipping Fee, assume $60/CY.

Concrete Slabs, volume for disposal	4,006	CY
T&D Cost, Concrete Slab Debris	**$241,000**	

TOTAL CONCRETE SLAB DEMOLITION SUBTOTAL **$682,000**

CDM CDM Federal Programs Corporation	PROJECT: Syncon Resins	COMPUTED BY : JM	CHECKED BY: TM
	JOB NO.: 74537.6402.017	DATE : 7/6/2010	DATE CHECKED: 7/7/2010
	CLIENT: USACE		PAGE NO. : 1

Description: FFS Cost Estimate - Individual Cost Item Backup

0010 - Perimeter Wellpoint Dewatering System

Assumes that excavation dewatering will be accomplished by both excavation sump pits (incidental to excavation costs) and the installation of a perimeter dewatering wellpoint system around the deeper excavation areas.

Assume wellpoints to be installed along the deep excavation within the Southwest Area:

Southwest Area of Site, Deep Excavation, North of Slurry Wall	710	LF
	710	LF

Wellpoint System Costs

MEANS, Complete Installation, operation, equipment rental, fuel & removal of system

1000' long header, 10" diameter, 2" wellpoints @ 5' on center

first month (MEANS 31-23-19.40-1600)	$161	per LF of header
monthly thereafter (MEANS 31-23-19.40-1700)	$55	per LF of header
Wellpoint System Subtotal, assume 6 months	$436	per LF of header
NJ Location Factor Adjustment	**$487**	**per LF of header**

TOTAL WELLPOINT DEWATERING COST **$347,000**

0011 - Water Treatment System

Assumes the rental of a temporary on-site water treatment system to treat dewatering volume from both wellpoints and excavation sump pits. Quote obtained for an approximate 200 gpm treatment system with frac tank, oil/water seperator, bag and cartridge filtration system, air stripper, carbon treatment, and ion exchange units to remove arsenic.

Add a full-time N2 Operator for operations and maintenance of the treatment system.

Assume system used during duration of excavation and backfill operations (10 months, 204 days).

Mobilization Fee	$112,000
Demobilization Fee	$9,000
Monthly Rental Fee, $17000 per month	$170,000
Bag Filters, $5 each @ 18 per day	$18,360
Cartridge Filters, $7.50 each @ 44 per day	$67,320
Carbon Media Changeout, assume 3 changeouts total, $17,500 per changeout (quote)	$52,500
Ion Exchange Resin Media Changeout, 3 changeouts total, $48,000 per changeout (quote)	$144,000
Total Estimated Treatment System Cost	**$574,000**
Add a 2,000 gallon double-walled product oil storage tank for recovered product	**$8,000**

*disposal of recovered product oil is covered under Waste T&D

Water Treatment Plant Operations

Assume full-time N2 operator, 8 hours per day, for duration of treatment system.	$91	per hour
Estimated number of hours	1733	hours
N2 Operator Labor Cost	**$158,000**	

TOTAL WATER TREATMENT SYSTEM COST **$740,000**

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PROJECT: Syncon Resins	COMPUTED BY: JM	CHECKED BY: TM	
JOB NO.: 74537.6402.017	DATE: 7/6/2010	DATE CHECKED: 7/7/2010	
CLIENT: USACE		PAGE NO.: 1	

Description: FFS Cost Estimate - Individual Cost Item Backup

0012 - Excavation

A) Total Excavation Volume (see excavation calculation, Appendix A) 59,157 CY

Soil excavation	44,850	CY
Concrete slab demolition	4,006	CY
Clean gravel excavation	10,301	CY

B) Excavation Duration

Assume 300 CY/day production rate for excavation of soil and gravel, and 200 CY/day production rate for concrete slab demolition

Total Excavation Period, workdays	204	DAYS
Total Excavation Period, work hours (8 hours per day)	1,631	HOURS
Total Excavation Period, work weeks	41	WEEKS
Total Excavation Period, months	10	MONTHS

*Assume backfill is concurrent with excavation (by separate crew), but lags behind by one month

C) Excavation Labor/Equipment Costs

Excavating Crew

Excavator, Hydraulic, 2 CY	$85	per hour
Equip. Op. Heavy	$101	per hour
Dump Truck	$50	per hour
Truck Dr. Heavy	$90	per hour
Loader	$75	per hour
Equip. Op. Heavy	$101	per hour
Laborer Foreman	$81	per hour
Laborer (Semi-Skilled)	$78	per hour
Laborer (Semi-Skilled)	$78	per hour
Excavation Crew Unit Cost	**$739**	per hour

TOTAL EXCAVATION COST **$1,206,000**

0013 - Post-Excavation Confirmation Sampling

to meet NJDEP verification requirements:

1 bottom sample per 900 SF of excvation floor

1 sidewall sample per 30 LF of exterior or interior excavation sidewall exposed

A) Estimated # of Post-Excavation Samples

Total Subsurface Excavation Area, plan area:	60000	SF
Estimated # of bottom samples:	67	bottom samples
For sidewall samples, assume 250% of the bottom sample quantity		
Estimated # of sidewall samples:	168	sidewall samples
Total # of post-excavation samples (base):	235	samples
Add 10% for QC samples for duplicates:	**259**	**samples**

B) Laboratory Analysis Fees

assume the following analysis parameters for site compounds of concern:

Analysis	Standard Turnaroud		Add 70% for Quick Turnaround	
1) BTEX	$55	per sample	$94.00	per sample
3) Arsenic and Cadmium	$24	per sample	$41.00	per sample
4) Napthalene	$50	per sample	$85.00	per sample
5) PCBs and Pesticides	$130	per sample	$221.00	per sample
	$259	**per sample**	**$441.00**	**per sample**

assume quick turnaround required for all post-excavation samples to facilitate backfilling operations:

Total Post-Excavation Laboratory Analysis Costs: **$114,219.00**

C) Post-Excavation Sample Collection

Assume 1 hour per sample for an environmental technician to collect each sample

Environmental Technician $50 per hour **$11,750**

D) Sample Packaging and Shipping Costs

Assume $10 per sample for jars, paperwork, coolers, and shipping costs: **$2,350**

E) Data Validation of Post-Excavation Samples

Assume 50% of the total post-excavation samples will be used as clean final verification samples requiring validation.

# of samples requiring validation (50% of total):	129.5	samples
Assume 1 hour per sample for data validation by a chemist	129.5	hours
Add 200 hours for QCSR report:	200	hours
Total Chemist Hours:	329.5	hours

Chemist $61 per hour **$20,100**

TOTAL POST-EXCAVATION SAMPLING: **$149,000.00**

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PROJECT:	Syncon Resins	COMPUTED BY :	JM	CHECKED BY:	TM
JOB NO.:	74537.6402.017	DATE :	7/6/2010	DATE CHECKED:	7/7/2010
CLIENT:	USACE			PAGE NO. :	1

Description: FFS Cost Estimate - Individual Cost Item Backup

0014 - Backfill

A) Total Excavation Volume		59,157	CY
B) Backfill Duration			
Assume backfill runs concurrent to excavation, but lags behind by one month			
Total Backfill Period, workdays		59	DAYS
Total Backfill Period, work hours (8 hours per day)		473	HOURS
Total Backfill Period, work weeks		12	WEEKS
Total Backfill Period, months		3	MONTHS
C) Backfill Labor/Equipment Costs			
Backfill Crew			
Dozer	$65 per hour		
Equip. Op. Heavy, for dozer	$101 per hour		
Vibratory Roller	$63 per hour		
Equip. Oper Medium	$99 per hour		
Walk-Behind Compactor	$3 per hour		
Laborer (Semi-Skilled)	$78 per hour		
Backfill Crew Hourly Rate	**$409 per hour**		
Total Backfill Crew Cost	**$194,000**		
D) Backfill Material Costs			
Backfill Material Unit Costs:			
Common Fill Unit Cost	$13 per CY		
Topsoil (6" deep) Unit Cost	$36 per CY		
Seeding Unit Cost	$4,837 per Acre		
Backfill Material Quantities			
1. Assume the top 6" of excavations will be imported Topsoil, 6" deep, and remainder of void with clean fill			
Furnish & Place imported Topsoil, 6" deep in all excavation areas			
Total Excavation Surface Area		258,000	SF
Total Topsoil Layer (6")		129,000	CF
Total Topsoil Needed:		5,000	CY
Total Seeding Area Needed:		5.9	Acre
Topsoil Material Cost:	**$181,000**		
Seeding Material Cost:	**$29,000**		
note no loss in material volume due to compaction of grave			
i.e. embankment yards = loose cubic yards			
2. Common fill for remainder of excavation void.			
Total Excavation Volume:		59,157	CY
Less the Re-usable Clean Gravel Volume:		48,856	CY
Less the Topsoil Volume:		43,856	CY
Quantity of Soil Being Treated by LTTD:		27,600	CY
Assume 75% of the material volume is recovered for use as fill			
		20,700	CY
Imported Clean Fill needed (with 90% Compaction)		25,728	CY
Common Fill Material Cost:	**$335,000**		
E) Backfill Material Testing			
Requires one sample for every 5,000 cubic yards imported to the site, analyzed for full parameters			
including sieve analyses, moisture content, chemical compounds, and Ra-226			
Assume $1500 per sample analysis fee			
# of Backfill Material Samples Required:		7	samples
Backfill Testing Cost:	**$10,500**		
F) Soil Density Testing			
Assume $500 per visit by soil density testing technician, 2 visits per week, during backfill operations			
# of Backfill Visits Required:		24	visits
Soil Density Testing Cost:	**$12,000**		
TOTAL BACKFILL COST:	**$762,000**		

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PROJECT:	Syncon Resins	COMPUTED BY :	JM	CHECKED BY:	TM
JOB NO.:	74537.6402.017	DATE :	7/6/2010	DATE CHECKED:	7/7/2010
CLIENT:	USACE			PAGE NO. :	1

Description: FFS Cost Estimate - Individual Cost Item Backup

0015 - Low Temperature Thermal Desorption Treatment & 0016 - Off-Site T&D of Non-Haz Material

For the treatment of excavated soil by an on-site treatment system

Treatment cost (quote) is $240 per ton, based on a 24 hour continuous operation, all inclusive rate including mob/demob

Production rate is 7 tons per hour, based on a 24 hour continuous operation = 168 tons per day

Waste streams to be treated by the onsite treatment system include TSCA Waste and Hazardous Waste

Non-Hazardous waste to continue to be transported and disposed of off-site.

Additional site supervision has been included under Items 01 and 03 to provide 24-hour operations for 9 month duration.

LTTD treatment of 44,160 tons of material @ 168 tons per day = 263 days = 38 weeks = 9 months

For those 9 months, additional site supervisory staff and an additional work crew will be required during the 24-hour operations.

A) Quantity Calculation at time of FFS based on existing data (see separate quantity calc, Appendix A)

assumes 1.6 tons per CY for soil density

Waste Category	Quantity (CY)	Quantity (tons)	Disposal Type
A) Waste for On-Site Treatment by LTTD System			
1. TSCA Waste	6,000	9,600	to be treated by on-site LTTD
2. Hazardous Waste Requiring Thermal Treatment	6,000	9,600	to be treated by on-site LTTD
3. Hazardous Waste Not Requiring Thermal Treatment	12,000	19,200	to be treated by on-site LTTD
Subtotal Waste for On-Site Treatment	**24,000**	**38,400**	to be treated by on-site LTTD
B) Waste for Off-Site Transportation and Disposal			
4. Non-Hazardous Waste	15,000	24,000	Subtitle D Landfill
Subtotal Waste for Off-Site T&D	**15,000**	**24,000**	
Subtotal Waste Volume	**39,000**	**62,400**	

B) Add 15% additional volume to account for results of pre-design investigation, potential excavation beneath buildings, and secondary excavation following the results of the post-excavation samples after primary excavation.

Waste Category	Quantity (CY)	Quantity (tons)	Treatment Cost by LTTD (per ton)	Extended Costs
A) Waste for On-Site Treatment by LTTD System				
1. Trial Burn of LTTD System				$1,000,000
2. TSCA Waste	6,900	11,040	$240	$2,650,000
3. Hazardous Waste Requiring Thermal Treatment	6,900	11,040	$240	$2,650,000
4. Hazardous Waste Not Requiring Thermal Treatment	13,800	22,080	$240	$5,300,000
Subtotal Waste for On-Site Treatment	**27,600**	**44,160**	**-**	**$11,600,000**
B) Waste for Off-Site Transportation and Disposal				
5. Non-Hazardous Waste	17,250	27,600	$60	$1,656,000
Subtotal Waste for Off-Site T&D	**17,250**	**27,600**	**-**	**$1,656,000**
TOTAL Waste Cost (LTTD and Non-Haz)	**44,850**	**71,760**		**13,256,000**

0017 Transportation and Disposal of Product Oil Recovered from Dewatering (TSCA waste)

In addition to the excavated soil, there will be recovered product oil from the excavation dewatering and water treatment processes. Fingerprinting analysis indicated that the product was of a mix of diesel fuel, #4/5/6 fuel oil, creosote, mineral spirits and hydraulic oil, essentially on the heavier oil end. The recovered free product will likely be TSCA waste as it contains PCBs slightly exceeding 50 ppm.

Estimated Cost per Gallon for Incineration of Product Liquid: $5 per gallon

Quote pending from Clean Harbors

Estimated Quanitity of Product for Incineration: 37,000 gallons

(see Volume Calc, Appendix A)

Estimated Cost for Product Disposal: **$185,000**

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PROJECT:	Syncon Resins	COMPUTED BY :	AMR	CHECKED BY:	JM
JOB NO.:	74537.6402.017	DATE :	2/15/2010	DATE CHECKED:	2/19/2010
CLIENT:	USACE			PAGE NO. :	1

Description: Determination of wage rates for the professional and craft labor and equipment rates for use in Syncon FFS cost estimate. Craft labor rated based on latest Hudson County Davis-Bacon Wage Determinations, October 2009. Professional rates based on SalaryExpert.com average annual salary estimates and previous project experience.

Number of work hours per year:	**2080**	*52 weeks x 40 hours per week*
Tax and insurance rate:	**28.97%**	*Based on FICA, insurance, workmans comp, etc. in MEANS 2009.*
Labor overhead applied to craft labor:	**20.00%**	*Varies based on RA Contractor markup structure*

Professional Labor

Labor Category	Salary	Bonus (6%)	Fringes (15%)	Base Adjusted Hourly Salary	Total with Tax & Insurance
1. Project Manager	$125,000	$7,500	$18,750	$73.00	**$95**
2. Site Superintendant	$115,000	$6,900	$17,250	$67.00	**$87**
3. Construction Foreman	$100,000	$6,000	$15,000	$59.00	**$77**
4. Professional Engineer	$85,000	$5,100	$12,750	$50.00	**$65**
5. Engineer	$75,000	$4,500	$11,250	$44.00	**$57**
6. Environmental Technician	$65,000	$3,900	$9,750	$38.00	**$50**
7. Surveyor	$70,000	$4,200	$10,500	$41.00	**$53**
8. Drafter	$60,000	$3,600	$9,000	$35.00	**$46**
9. Chemist	$80,000	$4,800	$12,000	$47.00	**$61**
10. N2 Operator (Water Treatment)	$120,000	$7,200	$18,000	$70.00	**$91**
11. Industrial Hygienist (SHSO)	$90,000	$5,400	$13,500	$53.00	**$69**
12. Security Guard	$32,000	$1,920	$4,800	$19.00	**$25**

Craft Labor

Labor Category	Base Hourly	Fringes	Payroll Tax & Insurance	Base Hourly Rate	Adjusted Hourly Rate with Labor OH Markup
Laborer Foreman	$32.45	$19.40	$15.02	$67	**$81**
Laborer (Semi-Skilled)	$30.45	$19.40	$14.44	$65	**$78**
Equip. Op. Heavy	$42.02	$22.50	$18.69	$84	**$101**
Equip. Oper Medium	$40.43	$22.50	$18.23	$82	**$99**
Equip. Op. Light	$36.89	$22.50	$17.21	$77	**$93**
Truck Dr. Heavy	$35.00	$22.68	$16.71	$75	**$90**
Truck Dr. Light	$34.85	$22.68	$16.67	$75	**$90**
Electrician	$47.37	$25.58	$21.13	$95	**$114**
Carpenter	$37.00	$27.02	$18.55	$83	**$100**
Plumber	$24.05	$13.67	$10.93	$49	**$59**
Steel Worker	$37.14	$35.60	$21.07	$94	**$113**

Equipment

Equipment	Total Hourly Cost (from MII Equipment Rate Database)
Excavator, Hydraulic, 2 CY	**$85**
Dozer	**$65**
Loader	**$75**
Dump Truck	**$50**
Forklift	**$20**
Air Compressor	**$30**
Concrete Saw	**$25**
Vibratory Roller	**$63**
Walk-Behind Compactor	**$3**
Pickup Trucks	**$8**

PROJECT:	Syncon Resins	COMPUTED BY :	JM	CHECKED BY:	TM
JOB NO.:	74537.6402.017	DATE :	7/6/2010	DATE CHECKED:	7/7/2010
CLIENT:	USACE			PAGE NO. :	1

Description: FFS Cost Estimate - Individual Cost Item Backup

Pre-Design Investigation and Remedial Design

assumes after the building demolition is complete, the RA contractor demobilizes from the site during PD/Remedial Design.

assumes pre-design investigation and remedial design performed by AE Firm.

Pre-Design Investigation

To include the development of the investigation work plan, performance of field work, and review and analysis of investigation results. Assumes collection of investigation samples for analysis by CLP laboratory for compounds of concern, collection of TCLP sample results for waste disposall characterization estimates, and a MIP Investigation.

Based on past project experience, allowance — $400,000

Remedial Design

To include the analysis of investigation results and existing data, preparation of the remedial design including draft, pre-final, and final design packages consisting of specifications, drawings, design analysis report, and construction cost estimate.

Based on past project experience, allowance — $2,000,000