PB94-963835
EPA/ROD/R02-94/230
January 1995

EPA Superfund Record of Decision:

Chemical Leaman Tank Lines Inc., Bridgeport, NJ 10/5/1993

RECORD OF DECISION FACT SHEET
EPA REGION II

Site:

Site name: Chemical Leaman Tank Lines, Inc.

Site location: Bridgeport, New Jersey

HRS score: 47.53

Record of Decision:

Date signed: October 5, 1993

Selected remedy: Alternative 3B:70XExcavation the Swale Area, the Ponded Area and the Adjacent Impacted Area, Off-site Disposal, and Revegetation/Wetlands Restoration, Surface Water Runoff Control, Wetlands Access Restriction and Long-term Monitoring

Operable Unit: OU-3

Capital cost: $6,314,110

O & M cost: $88,094

Present-worth cost: $7,232,391

Lead:

EPA

Primary Contact: David Rosoff (212) 264-5397

Secondary Contact: Kim O'Connell (212) 264-8127

Main PRPs: Chemical Leaman Tank Lines Inc. (CLTL) (215) 363-4204

Waste:

Waste type: Metals, volatile and semi-volatile organics, and pesticides

Waste origin: CLTL's previous wastewater disposal activities

Estimated waste quantity: 11,500 cubic yards

Contaminated medium: surface water, soils and sediment

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Chemical Leaman Tank Lines, Inc.
Logan Township, Gloucester County, New Jersey

STATEMENT OF BASIS AND PURPOSE

This Record of Decision documents the selected remedial action for contaminated wetlands at the Chemical Leaman Tank Lines, Inc. site. The remedy was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. §9601 et seq. and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. An administrative record for the site, established pursuant to the NCP, contains the documents that form the basis for the selection of the remedial action.

The New Jersey Department of Environmental Protection and Energy has been consulted on the planned remedial action and concurs with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Chemical Leaman site, if not addressed by implementing the response action selected in this Record of Decision, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The remedy described in this document represents the third of three planned remedial phases or operable units for the Chemical Leaman site. It addresses wetlands contamination at the site. A Record of Decision for the first operable unit, which addresses ground water underlying the site, was issued on September 28, 1990.

The second operable unit includes the former lagoon soils and residual sludges. The selection of a remedial action for the lagoon contamination will be made after implementation and evaluation of the ground-water remedy.

The selected remedy for the third operable unit involves the excavation of contaminated soils and sediments within the wetlands followed by restoration and revegetation of the excavated areas. By excavating contaminated soils and sediments from the most highly contaminated areas in the wetlands, the selected remedial action will address the principle ecological threats by significantly reducing the contamination available to ecologic receptors. The remedy also includes controls to ensure that potentially contaminated surface runoff from the Chemical Leaman facility does not impact the remediated wetlands through the construction of a berm/drainage system. To ensure that ecological risks, contaminant migration and wetlands quality are appropriately managed, a long-term monitoring program of the wetlands is included as part of the selected remedy.

The major components of the selected remedy include the following:

- Excavation of the Swale Area, the Ponded Area and the Adjacent Impacted Area;
- Off-site disposal of contaminated soils and sediments at an appropriate facility;
- Backfilling with clean soil and revegetation/wetlands restoration;
- Construction of a berm/drainage system along the wetlands adjacent to the Chemical Leaman facility;
- Wetlands access restriction through fence maintenance and sign posting; and
- Long-term monitoring to ensure the effectiveness of the remedy

DECLARATION OF STATUTORY DETERMINATIONS

The selected remedy meets the following requirements for remedial actions set forth in CERCLA §121, 42 U.S.C. §9621: (1) it is protective of human health and the environment; (2) complies with the legally applicable or relevant and appropriate requirements under federal and state laws; (3) is cost effective; and (4) utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

The remedy does not satisfy the statutory preference for remedies that employ treatment to reduce the toxicity, mobility, or volume of the hazardous substances, pollutants or contaminants at the site. However, the Environmental Protection Agency has concluded that it is not practicable to treat the hazardous substances, pollutants or contaminants at the site, because available treatment alternatives have limited applicability to the site-specific contamination and there is restricted implementability in this wetlands environment.

Because this remedy will result in hazardous substances remaining on the site above ecological risk-based levels, a review of the remedial action pursuant to CERCLA §121(c), 42 U.S.C. §9621(c), will be conducted five years after commencement of the remedial action to ensure that it continues to provide adequate protection to human health and the environment.

William J. Muszynski, P.E.
Acting Regional Administrator

10/5/93
Date

RECORD OF DECISION
DECISION SUMMARY

Chemical Leaman Tank Lines, Inc. Site
Operable Unit Three

Logan Township, Gloucester County, New Jersey

United States Environmental Protection Agency
Region II
New York, New York

TABLE OF CONTENTS

ATTACHMENTS

SITE NAME, LOCATION AND DESCRIPTION

The Chemical Leaman Tank Lines, Inc. (CLTL) Bridgeport terminal is located in Logan Township, Gloucester County, New Jersey, approximately two miles south of the Delaware River and one mile east of the town of Bridgeport (Figure 1).

The CLTL property encompasses approximately 31.4 acres. It includes: an active terminal used for the dispatching, storing, maintaining and cleaning of tanker trucks and trailers; fallow farmland adjacent to the terminal; and wetlands (Great Cedar Swamp) bordering the terminal to the east and southeast. Moss Branch Creek drains portions of Cedar Swamp into Cooper Lake which is located approximately 1,000 feet north of the CLTL terminal (Figure 2). Surface structures on the CLTL property include the terminal building, an enclosed wastewater settling tank building, and a concrete wastewater holding tank (Figure 2). Former subsurface structures include seven earthen settling and aeration lagoons which have been backfilled and regraded (Figure 2).

The population of Logan Township is approximately 5,100. Nine residences are located within 1,200 feet of the CLTL property. The U.S. Environmental Protection Agency (EPA) determined that all of these homes were impacted or imminently threatened by the CLTL-related ground-water contaminant plume. Removal Actions conducted by EPA in 1987 and 1993 connected these homes to the Bridgeport Municipal Water System.

Several New Jersey State designated threatened or endangered species have been observed at the site. These include the American Bittern, Bog Turtle and Barred Owl.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

CLTL transports chemical commodities in bulk quantities, some of which are classified as hazardous. Table 1 lists some of the hazardous materials historically transported by the company. The CLTL terminal has been in operation since the early 1960s. Past wastewater handling and disposal practices at the CLTL site have resulted in organic and inorganic contamination of soil, ground water and the adjacent wetlands.

Prior to 1975, wastewater generated in the washing and rinsing operations was impounded in a series of unlined settling and/or aeration lagoons and subsequently discharged to the adjacent wetlands. The lagoons were located in two different areas on the terminal property. The primary settling lagoons were situated east of the terminal building and the aeration and final settling lagoons were located southwest of the terminal building (Figure 2).

In 1975, the lagoons were taken out of service when CLTL was required to install a wastewater containment system at the terminal. In 1977, liquid and sludge in the primary settling lagoons were removed prior to backfilling with fill and construction debris. The aeration and final settling lagoons were drained, but no lagoon materials were removed prior to backfilling. In 1982, CLTL excavated visible sludge and contaminated soil from the former primary settling lagoons to an approximate maximum depth of twelve feet below the surface, and the excavation was backfilled with sand.

In 1980-81, the New Jersey Department of Environmental Protection and Energy (NJDEPE) documented contamination in the ground water beneath the CLTL site. In 1981, CLTL conducted a hydrogeologic investigation to determine the extent of the ground-water contamination. Twenty-five (25) monitoring wells were installed, and between 1981 and 1983, these wells were sampled on a quarterly basis.

In 1985, EPA added the CLTL site to the National Priorities List of Superfund sites. An Administrative Order on Consent (Index No. II CERCLA 50111) between EPA and CLTL was signed in July 1985 pursuant to which CLTL agreed to conduct a Remedial Investigation and Feasibility Study (RI/FS) to delineate the nature and extent of site-related contamination in the ground water, soils and surface water at the CLTL site.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

The RI report, FS report, and the Proposed Plan for the site were released to the public for comment on July 30, 1993. These documents were made available to the public in the administrative record file at the EPA Docket Room in Region II, New York, New York and the information repository at the Logan Township Municipal Building, 73 Main Street, Bridgeport, New Jersey. The notice of availability for the above-referenced documents was published in the Gloucester County Times on July 30, 1993. The public comment period on these documents was held from July 30, 1993 to August 28, 1993. At the request of CLTL, the public comment period was extended to September 13, 1993.

On August 10, 1993, EPA conducted a public meeting at the Logan Township Municipal Building to inform local officials and interested citizens about the Superfund process, to review current and planned remedial activities at the site, and to respond to any questions from area residents and other attendees.

Responses to the comments received at the public meeting and in writing during the public comment period are included in the Responsiveness Summary (see Appendix V).

SCOPE AND ROLE OF OPERABLE UNIT THREE

As with many Superfund sites, the problems at the Chemical Leaman site are complex. As a result, EPA divided the site remediation into three phases or operable units. Operable Unit One addresses the ground water at the site, Operable Unit Two, the former lagoon soils and residual sludges, and Operable Unit Three, the adjacent wetlands on and around the CLTL property. These wetlands include surface waters, soils and sediments in Cooper Lake, Moss Branch and Cedar Swamp (Figure 3).

EPA finalized the RI/FS and Risk Assessment documents for Operable Unit One in July 1990. A Record of Decision for Operable Unit One (ground-water contamination) was issued on September 28, 1990.

An RI Report and Risk Assessment were completed for Operable Unit Two in 1991, however, the selection of a remedy for the soils contamination was postponed pending the preliminary results of the Operable Unit One Remedial Design and Remedial Action. These results will be reviewed to determine if the residual soil contamination within the former lagoons is a significant source of ground-water contamination. Operable Unit One is presently in the Remedial Design phase.

This Record of Decision (ROD) addresses the third operable unit for the site (wetlands contamination). The contaminated wetlands pose a threat at this site because of the present and future impact to ecological receptors.

SUMMARY OF SITE CHARACTERISTICS

The RI for Operable Unit Three was performed in two phases. The first phase involved a limited sampling of the wetlands associated with CLTL's initial RI field work at the site in 1986. The majority of the wetland sampling was completed by EPA during a second phase of field work in 1991 and 1992. In 1986, three surface soil samples and eleven surface water and sediment samples were collected in the Cedar Swamp wetland adjacent to the CLTL facility. Eight of the eleven surface water and sediment samples were collected in Moss Branch Creek. Four surface water and sediment samples from Cooper Lake were also collected in 1986.

As part of the 1991/1992 RI field work, EPA collected and analyzed 24 surface soil, 12 surface water and 34 sediment samples in Cedar Swamp adjacent to the CLTL facility. Nine surface water and sediment samples were collected from Cooper Lake. Three surface soil samples from the south shore of Cooper Lake were also obtained.

Soil and sediment sampling in Cedar Swamp indicates that site-related contaminants are scattered throughout the wetlands. However, the majority of contaminants are concentrated in and around the drainage swale ("the swale area") south of the terminal building and in the area of ponded water ("the ponded area") east of the terminal building (Figure 4). Both of these areas received direct discharge of wastewater from the former lagoons. The Cedar Swamp wetland directly adjacent to these areas is also contaminated, but to a lesser degree. Samples collected in Cedar Swamp further away from the CLTL facility showed a decrease in both the frequency of contaminants detected and the concentration of those contaminants. However, some contaminants have been detected in samples collected at the perimeter of the wetland study area.

Contaminants detected in the Cedar Swamp wetlands include volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs) and metals (Table 2). Metals, including arsenic, cadmium, chromium and lead, and SVOCs, including phthalates and polycyclic aromatic hydrocarbons (PAHs), are the contaminants present most frequently and in the highest concentrations above background ranges in the wetlands at the site.

Pesticides, including 4,4-DDE, 4,4-DDD, 4,4-DDT, and endosulfan sulfate, were widespread in both the sediment and surface soil samples in the wetlands of Cedar Swamp adjacent to the CLTL facility and in the background locations. The ubiquitous presence of pesticides and the nature of land use in the area (extensive farming) suggest that some contribution of the pesticides at the site may not be from the CLTL facility. PCBs were detected in 6 of 21 soil samples and 2 of 30 sediment samples at low levels. PCBs were not detected over most of the Cedar Swamp wetlands area.

Table 3 provides a summary of contaminants detected in the ponded and swale areas as well as the adjacent areas of Cedar Swamp defined in the RI. These adjacent areas were defined to aid in presenting and discussing the data and to provide geographical reference points within the wetlands. Table 3 also summarizes contaminant data from Cooper Lake.

Metals, including arsenic, cadmium, chromium and lead, were detected at elevated levels in Cedar Swamp surface waters and were concentrated in the ponded area (Table 4). Cedar Swamp surface water samples only showed trace concentrations of SVOCs and pesticides. VOCs and PCBs were not detected in the surface waters of Cedar Swamp.

Cooper Lake surface water samples had metals concentrations at or below background levels. Phthalates were detected at trace concentrations in two surface water samples. No other organic contaminants or pesticides were detected in Cooper Lake surface waters.

Chromium and nickel concentrations were detected slightly above background levels in one Cooper Lake sediment sample. Four VOCs and one phthalate (at trace concentrations) were also detected in Cooper Lake sediments. The maximum total VOCs level in the sediments was 2 parts per million (ppm). Endosulfan sulfate was the only pesticide detected in Cooper Lake sediments. The soils collected on the south shore of Cooper Lake contained metals at or below background levels, total SVOCs at a maximum of 210 parts per billion (ppb), and one VOC, toluene, at trace concentration. Endosulfan sulfate was detected at low concentrations. Cooper Lake sampling data is summarized in Table 5.

SUMMARY OF SITE RISKS

EPA conducted a baseline risk assessment to evaluate the potential risks to human health and the environment associated with Operable Unit Three of the CLTL site in its current state. The Risk Assessment focused on contaminants in the soils, sediments and surface waters of the wetlands adjacent to the CLTL facility which may pose significant risks to human health and the environment. The summary of the contaminants of concern in sampled matrices is listed in Tables A and G for human and environmental receptors, respectively.

Human Health Risk

EPA's baseline human health risk assessment addressed the potential risks to human health by identifying potential exposure pathways by which the public may be exposed to contaminant releases at the site under current and future land-use conditions. Exposure pathways were evaluated for adolescent trespassers in the swale area of the wetlands (Table B). Adolescent trespassers were considered to be the most likely human receptors for contamination at the site, as the wetlands cannot be developed for residential or industrial purposes in the future under current laws protecting such areas in the State of New Jersey. The swale is the most highly contaminated area in the wetlands which is accessible to trespassers. The baseline risk assessment evaluated potential health effects which could result from dermal contact with and ingestion of contaminated soils and sediments in the area of the swale by adolescent trespassers. The reasonable maximum exposure was evaluated.

Under current EPA guidelines, the likelihood of carcinogenic (cancer-causing) and noncarcinogenic effects due to exposure to site chemicals are considered separately. It was assumed that the toxic effects of the site-related chemicals would be additive. Thus, carcinogenic and noncarcinogenic risks associated with exposures to individual compounds of concern were summed to indicate the potential risks associated with mixtures of potential carcinogens and noncarcinogens, respectively.

Noncarcinogenic risks were assessed using a hazard index (HI) approach, based on a comparison of expected contaminant intakes and safe levels of intake (Reference Doses). Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects. RfDs, which are expressed in units of milligrams/kilogram-day (mg/kg-day), are estimates of daily exposure levels for humans which are thought to be safe over a lifetime (including sensitive individuals). Estimated intakes of chemicals from environmental media (*e.g.*, the amount of a chemical ingested from contaminated sediments) are compared to the RfD to derive the hazard quotient for the contaminant in the particular medium. The HI is obtained by adding the hazard quotients for all compounds across all media that impact a particular receptor population.

An HI greater than 1.0 indicates that the potential exists for noncarcinogenic health effects to occur as a result of site-related exposures. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. The reference doses for the contaminants of concern at the site are presented in Table C. A summary of the noncarcinogenic risks associated with these chemicals across various exposure pathways is found in Table D.

It can be seen from Table D that the HI for noncarcinogenic effects from exposure to contaminated soils and sediments in the CLTL wetlands is 0.02, therefore, noncarcinogenic effects would not be expected to occur from the exposure routes evaluated in the risk assessment.

Potential carcinogenic risks were evaluated using the cancer slope factors developed by EPA for the contaminants of concern. Cancer slope factors (SFs) have been developed by EPA's Carcinogenic Risk Assessment Verification Endeavor for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. SFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to generate an upper-bound estimate of the excess lifetime cancer risk associated with exposure to the compound at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SFs. Use of this approach makes the underestimation of the risk highly unlikely. The SFs for the contaminants of concern are presented in Table E.

For known or suspected carcinogens, EPA considers excess upper-bound individual lifetime cancer risks of between 10^{-4} to 10^{-6} to be acceptable. This level indicates that an individual has not greater than a one in ten thousand to one in a million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year period under specific exposure conditions at the site. The baseline risk assessment estimated that the cumulative upper-bound carcinogenic risk for trespassers at the site is 2×10^{-6}. This risk number means that two additional persons out of one million trespassers at the site would potentially be at risk of developing cancer if the swale were not remediated (Table F). This risk is within EPA's acceptable risk range as provided in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

The results of the human health risk assessment at the site suggest that no carcinogenic or noncarcinogenic risks exceed EPA's recommended guidelines for protection of human health from the wetland surface water, sediment, or soil.

Ecological Risk

Potential risks to the environmental receptors associated with Operable Unit Three of the CLTL site were identified in the ecological risk assessment. The ecological risk assessment identified the Barred Owl, Bog Turtle, Bullfrog, Green Heron, Snapping Turtle, Vole, Sunfish, and Earthworm as potential receptors threatened by the site contaminants in the wetlands (Table H). These receptors can be exposed to contaminated soil, sediment and/or surface water via dermal absorption, inhalation of particulate or vapor, and ingestion. However, the most acute exposure would be through ingestion, which was analyzed in detail in the ecological risk assessment (Table I). The Cedar Swamp wetland is situated to the south and east of the CLTL facility at the topographically lowest point on the site, and acts as a receiving area for runoff from the higher elevation areas on site. These areas include both the former wastewater lagoons and the current active facility. The overflow from the former lagoons has accounted for the significant accumulations of CLTL-related contaminants measured in wetland surface water, sediment and soil. Based on data from current literature, it is clear that the selected contaminants of concern (Table J) provide a significant risk to ecological receptors. The following are conclusions derived in the ecological risk assessment:

- Surface water and sediment contamination levels will impact amphibian reproduction. Metals contamination exceeded the Lethal Concentration 50% (LC50) dose for bluegill and tadpole. LC50 represents the concentration that is lethal to 50% of the population acutely exposed. Concentrations of DDT and its metabolites were reported within the sediment and surface water at levels that could readily affect avian reproduction and cause death in invertebrate species. Surface soil metal concentrations, specifically chromium, copper, and lead, were found to be above the known toxic effect levels for earthworms (Table K).

- Metals contaminant concentrations in site surface water exceeded EPA's established Ambient Water Quality Criteria for the protection of aquatic life (Table L). The maximum exceedances occurred in the ponded area. Copper, aluminum, and lead concentrations in this area are expected to significantly impact the reproductive success of amphibians and reptiles.

- Metals contaminant concentrations in the ponded area and in the adjacent impacted area exceeded adverse biological effect levels used by the National Oceanic and Atmospheric Administration (NOAA) in developing sediment contaminant guidelines (Table M).

- The central and eastern portion of the site, including the swale and the adjacent impacted area, is dominated by common reed (Phragmites sp.) and purple loosetrife, "nuisance" plant species that are common throughout New Jersey. These two species typically occur in areas of disturbed habitat. Their widespread presence in the central portion of the site, where significant wetland impacts have occurred through intrusive activities, such as the discharge of contaminated wastewater from the CLTL facility, are indicative of wetland disturbance. Phragmites and/or purple loosetrife dominates in areas where other species are less tolerant of the intrusive activities. The infiltration of these species creates a less diverse floral community and a lower quality wetland. The abundance of stressed vegetation and the absence of diverse wetland cover in areas that formerly provided diverse functional value represent significant negative wetland impacts associated with the CLTL facility.

New Jersey State designated threatened or endangered species have been observed at the site. These include the American Bittern and Bog Turtle.

Uncertainties

The procedures and inputs used to assess risks in this evaluation, as in all such assessments, are subject to a wide variety of uncertainties. In general, the main sources of uncertainty include:

- environmental chemistry sampling and analysis
- environmental parameter measurement
- fate and transport and/or food chain modeling
- exposure parameter estimation
- toxicological data.

Uncertainty in environmental sampling arises in part from the potentially uneven distribution of chemicals in the media sampled. Consequently, there is significant uncertainty as to the actual levels present. Environmental chemistry-analysis error can stem from several sources including the errors inherent in the analytical methods and characteristics of the matrix being sampled.

Uncertainties in the human health exposure assessment are related to estimates of how often an individual would actually come in contact with the chemicals of concern, the period of time over which such exposure would occur, and in the models used to estimate the concentrations of the chemicals of concern at the point of exposure. Uncertainties in the ecological exposure assessment are related to the selection of representative species and assumptions regarding their interactions with affected media.

In the Human Health Risk Assessment, uncertainties in toxicological data occur in extrapolating both from animals to humans and from high to low doses of exposure, as well as from the difficulties in assessing the toxicity of a mixture of chemicals. These uncertainties are addressed by making conservative assumptions concerning risk and exposure parameters throughout the assessment. As a result, the Risk Assessment provides upper-bound estimates of the risks to populations near the site, and is highly unlikely to underestimate actual risks related to the site.

In the Ecological Risk Assessment, uncertainties associated with toxicological data arise from dose-response differences between species, differential responses elicited by laboratory test organisms and organisms on site, and difficulties associated with assessment of chemical mixtures.

More specific information concerning public health and ecological risks, are presented in the Risk Assessment Reports.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to the public health, welfare, or the environment.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives are specific goals developed to protect human health and the environment.

The following remedial action objectives were established for Operable Unit Three of the CLTL site:

- Reduce potential for exposure of contaminated soils, sediments and surface water by ecological receptors;
- Restore the most severely degraded areas of the wetlands to a viable plant community;
- Reduce off-site transport of contaminants in the sediments, soils and surface water;
- Prevent potential migration of contaminants into the wetlands via overland runoff from the CLTL facility; and
- Prevent Further degradation of the wetlands.

DESCRIPTION OF REMEDIAL ALTERNATIVES

Section 121(b)(1) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, 42 U.S.C. §9621(b)(1), mandates that a remedial action must be protective of human health and the environment, cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which employ, as a principal element, treatment to permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants and contaminants at a site. CERCLA §121(d), 42 U.S.C. §9621(d), further specifies that a remedial action must attain a level or standard of control of the hazardous substances, pollutants, and contaminants, which at least attains applicable or relevant and appropriate requirements (ARARs) under federal and state laws, unless a waiver can be justified pursuant to CERCLA §121(d)(4), 42 U.S.C. §9621(d)(4).

This ROD evaluates, in detail, six remedial alternatives for addressing the contamination associated with Operable Unit Three of the CLTL site. The time to implement a remedial alternative reflects only the time required to construct or implement the remedy and does not include the time required to design the remedy, negotiate with the responsible party, procure contracts for design and construction, or conduct operation and maintenance activities.

It must be noted that the excavation and soil emplacement alternatives described below are all considered limited actions. They are limited in that they propose remediation for only the most degraded and contaminated portions of the wetlands. The RI showed that contaminants are concentrated in and around the drainage swale ("the swale area") south of the terminal building and in the area of ponded water ("the ponded area") east of the terminal building (Figure 5). Both of these areas received direct discharge of wastewater from the former lagoons. The Cedar Swamp wetland directly adjacent to these areas ("the impacted area") is also considered a "hot spot" of contamination (Figure 5). More diverse, ecologically functional portions of Cedar Swamp located further from the CLTL facility are not considered for remediation in this ROD. Compared with the areas of the wetlands addressed in the alternatives described below, these areas contain significantly lower frequencies of contaminants. To ensure that ecological risks, contaminant migration and wetlands degradation are appropriately managed, a long-term monitoring program of the wetlands is included as part of each alternative described below. Some of the alternatives described below include excavation and/or soil emplacement as principal elements. Contaminants would be removed from the site and treated and disposed of off site. On-site treatment technologies were evaluated in the FS, but were screened out due to their technical infeasibility in a wetland environment and their limited applicability to wetland soils.

The remedial alternatives are:

Alternative 1: No Action.

Capital Cost: $0
Annual O&M Costs: $33,968(30 years)
Present Worth Cost: $386,244

Implementation Time: Not Applicable

Under the NCP, EPA evaluates the No Action alternative for every Superfund site to establish a baseline for comparison to other alternatives. Under the No Action alternative, no further remedial action would be taken to address the wetlands contamination.

However, the No Action alternative would consist of a basic monitoring program involving two components: chemical contaminant monitoring and wetland vegetation monitoring. If the two component monitoring program shows further degradation of the wetlands, a macro-invertebrate monitoring program may be added at a later time. The monitoring program would be long-term, with re-evaluation occurring every five years.

Alternative 2: Surface Runoff Control, Wetlands Access Restriction and Long-Term Monitoring.

Capital Cost: $501,526
Annual O&M Costs: $88,094
Present Worth Cost: $1,419,807

Implementation Time: 3 months

Under this alternative, surface stormwater runoff from the active CLTL terminal to the wetlands would be contained. Containment would be achieved through the construction of a berm along the southern and eastern perimeter of the terminal facility. The berm would consist of a concrete curb and sections of gutter. Approximately 1,100 linear feet of berm would be constructed. The berm would be constructed to a height that could contain stormwater from a 100-year storm. Runoff would be collected in sumps and pumped to above-ground storage tanks. The water would be either discharged to the Operable Unit One treatment system, if applicable, or sent off site for treatment and disposal. This containment alternative eliminates the potential for contaminated runoff to enter the wetlands.

Post-construction long-term monitoring of Cedar Swamp, as described under Alternative 1, would be conducted to assess any remaining risk to ecological receptors, bioavailability of contaminants and the potential for contaminant migration from the wetland areas presently impacted by CLTL-related contamination.

In addition to the containment of stormwater runoff, this alternative calls for the maintenance of existing fences on the perimeter of the wetlands, as well as the posting of warning signs to discourage trespassing in the wetlands. Restriction of human access to the wetlands would ensure that the human health risk remains within EPA's acceptable range.

This alternative would require a review of the remedial action every five years pursuant to CERCLA §121(c), 42 U.S.C. §9621(c), because implementing this alternative would result in hazardous substances remaining on site above ecological risk-based levels. Additional remedial actions could be required depending on the results of such a review.

Alternative 3A: Excavation of the Swale Area and the Ponded Area, Off-Site Disposal, and Revegetation/Wetlands Restoration. Surface Runoff Control, Wetlands Access Restriction and Long-Term Monitoring.

Capital Cost: $ 3,067,877
Annual O&M Costs: $88,094
Present Worth Cost: $3,986,158

Implementation Time: 1 year

This alternative incorporates runoff containment, site access restriction, and long-term monitoring, as described in Alternative 2, with excavation and removal of contaminated soils and sediments from the ponded and swale areas (Figure 5), backfilling and revegetation of excavated areas, and off-site disposal of excavated soil and sediment. The ponded and swale areas would be excavated to a depth of approximately one foot. The areal extent of the ponded and swale areas is approximately 2.8 acres. The approximate volume of soil and sediment to be excavated from these areas would be 4,500 cubic yards.

The exact depth and areal extent to be excavated would be refined during the Remedial Design and/or Remedial Action phases of the project. Post-excavation sampling would be utilized to determine if further excavation is necessary to address any unacceptable ecological risk. This evaluation will be based on a qualitative risk analysis.

It is expected that the sediments in the ponded area would have a high moisture content and would require removal by dredging and dewatering on site prior to transport and off-site disposal at an approved facility under the Resource Conservation and Recovery Act (RCRA). Water would be pumped to a storage tank and treated and disposed of on the site within the Operable Unit One treatment system, if applicable, or off-site.

A revegetation program would be instituted to establish wetland communities that would restore functional value to the excavated wetlands.

Because the ground-water contaminant plume beneath the CLTL facility may be a continuing source of wetlands contamination, excavation would not take place until the ground-water extraction and treatment system under the Operable Unit One remedy is operational. However, construction of the stormwater berm and the remedial design of the this alternative, which would include pre-design monitoring, could take place prior to the Operable Unit One Remedial Action.

This alternative would require a review of the remedial action every five years pursuant to CERCLA §121(c), 42 U.S.C. §9621(c), because implementing this alternative would result in hazardous substances remaining on-site above ecological risk-based levels. Additional remedial actions could be required depending on the results of such a review.

Alternative 3B: Excavation of the Swale Area, the Ponded Area and Adjacent Impacted Area, Off-Site Disposal, and Revegetation/Wetlands Restoration. Surface Runoff Control, Wetlands Access Restriction and Long-Term Monitoring.

Capital Cost: $6,314,110
Annual O&M Costs: $88,094
Present Worth Cost: $7,232,391

Implementation Time:1 year

This alternative incorporates all of the components of Alternative 3A. It differs in that the impacted area south of the ponded area and south and east of the swale area is included in the excavation (Figure 5). The aerial extent of the total area to be excavated under this alternative is estimated to be 7.3 acres. The total volume of soil and sediment to be excavated would be approximately 11,500 cubic yards.

This alternative would require a review of the remedial action every five years pursuant to CERCLA §121(c), 42 U.S.C. §9621(c), because implementing this alternative would result in hazardous substances remaining on site above ecological risk-based levels. Additional remedial actions could be required depending on the results of such a review.

Alternative 4A: Soil Emplacement in the Swale Area and the Ponded Area, Revegetation/Wetlands Restoration. Surface Water Runoff Control, Wetlands Access Restriction and Long-Term Monitoring.

Capital Cost: $1,329,718
Annual O&M Costs: $88,094
Present Worth Cost: $2,247,999

Implementation Time: 1 year

This alternative incorporates all of the components of Alternative 2 in addition to the replacement of the lost function and value of the contaminated wetlands through soil emplacement and revegetation. Under this alternative, the ponded and swale areas would be contoured to form hummocks (low mounds or ridges of earth) and inundated low areas (Figure 6). Hummocks, or upland islands, would be covered with permeable soil, and vegetated with shrub and wooded species (Figure 7, Table 5). Hummocks are added to increase wetland topography and enhance seedling survival. The elevation of the hummocks would vary from six inches to two feet above the standing water level. Occasional inundation would not harm seedlings planted in this manner. Portions of the 2.8 acres comprising the ponded and swale areas (approximately 10 percent of this area) would be excavated to a depth of two feet below the anticipated water surface to create inundated areas. This alternative would require approximately 8,100 cubic yards of clean soil and would produce approximately 1,400 cubic yards of excavated soil for dewatering and off-site disposal. This alternative would help reduce ecological risk and create a higher quality wetland.

This alternative would require a review of the remedial action every five years pursuant to CERCLA §121(c), 42 U.S.C. §9621(c), because implementing this alternative would result in hazardous substances remaining on site above ecological risk-based levels. Additional remedial actions could be required depending on the results of such a review.

Alternative 4B: Soil Emplacement in the Swale Area, the Ponded Area and Adjacent Impacted Area, Revegetation/Wetlands Restoration. Surface Water Runoff Control, Wetlands Access Restriction and Long-Term Monitoring.

Capital Cost: $2,429,204
Annual O&M Costs: $88,094
Present Worth Cost: $3,347,485

Implementation Time: 1 year

This alternative incorporates all of the components of Alternative 4A, however, it is different in that the impacted area south of the ponded area and south and east of the swale area is included (Figure 5). Under this alternative, the extent of the area to be addressed is estimated to be 7.3 acres. As a result, the total volume of soil to be used to cover upland areas would be approximately 22,000 cubic yards. Approximately 2,700 cubic yards of excavated soil and sediment would be produced for dewatering and off-site disposal by excavation to create inundated areas.

This alternative would require a review of the remedial action every five years pursuant to CERCLA §121(c), 42 U.S.C. §9621(c), because implementing this alternative would result in hazardous substances remaining on site above ecological risk-based levels. Additional remedial actions could be required depending on the results of such a review.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

In selecting a remedy, EPA considered the factors set out in CERCLA §121, 42 U.S.C. §9621, by conducting a detailed analysis of the viable remedial alternatives pursuant to the NCP, 40 CFR §300.430(e)(9) and OSWER Directive 9355.3-01. The detailed analysis consisted of an assessment of the individual alternatives against each of nine evaluation criteria and a comparative analysis focusing upon the relative performance of each alternative against those criteria.

The following "threshold" criteria must be satisfied by any alternative in order to be eligible for selection:

1. *Overall protection of human health and the environment* addresses whether or not a remedy provides adequate protection and describes how risks posed through each exposure pathway (based on a reasonable maximum exposure scenario) are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. *Compliance with ARARs* addresses whether or not a remedy would meet all of the applicable (legally enforceable), or relevant and appropriate (requirements that pertain to situations sufficiently similar to those encountered at a Superfund site such that their use is well suited to the site) requirements of federal and state environmental statutes and requirements or provide grounds for invoking a waiver.

The following "primary balancing" criteria are used to make comparisons and to identify the major trade-offs between alternatives:

3. *Long-term effectiveness and permanence* refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met. It also addresses the magnitude and effectiveness of the measures that may be required to manage the risk posed by treatment residuals and/or untreated wastes.

4. *Reduction of toxicity, mobility, or volume via treatment* refers to a remedial technology's expected ability to reduce the toxicity, mobility, or volume of hazardous substances, pollutants or contaminants at the site.

5. *Short-term effectiveness* addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation periods until cleanup goals are achieved.

6. *Implementability* refers to the technical and administrative feasibility of a remedy, including the availability of materials and services needed.

7. *Cost* includes estimated capital and operation and maintenance costs, and the present-worth costs.

The following "modifying" criteria are considered fully after the formal public comment period on the Proposed Plan is complete:

8. *State acceptance* indicates whether, based on its review of the RI/FS and the Proposed Plan, the State supports, opposes, and/or has identified any reservations with the preferred alternative.

9. *Community acceptance* refers to the public's general response to the alternatives described in the Proposed Plan and the RI/FS reports. Factors of community acceptance to be discussed include support, reservation, and opposition by the community.

A comparative analysis of the remedial alternatives based upon the evaluation criteria noted above follows.

- Overall Protection of Human Health and the Environment

Alternatives 3A, 3B, 4A and 4B all address ecological risks posed by the site to varying degrees. Alternatives 3A, 3B, 4A and 4B all would eliminate potential contaminant loading to the wetlands via stormwater control. Alternative 3B would substantially reduce the risk to ecological receptors through removal of the majority of contaminated soils and sediments. Stressed wetlands would be restored to wetlands of higher functional value. Alternatives 3A and 4A would leave a larger portion of contaminated wetland unremediated, resulting in a greater risk to ecological receptors compared to Alternative 3B. Alternative 4B would emplace soil over and revegetate the entire area considered for remediation, however, contamination would remain in the ecosystem. Alternatives 1 (No Action) and 2 would not reduce the current risk to ecological receptors and would not restore the functional value of the wetlands. The No Action alternative is not protective of the environment and would not provide stormwater runoff control.

- Compliance with ARARs

There are no chemical-specific ARARs for the contaminated sediments and soils in the wetlands adjacent to the CLTL site. EPA has identified, through the performance of the RI/FS, several areas of elevated levels of contamination. A number of the remedial alternatives developed in the FS report and presented in this ROD address a portion, or all of these areas representing major sources of risk to ecological receptors. The Federal Ambient Water Quality Criteria (AWQC) established pursuant to the Clean Water Act are ARARs for contaminated surface water on the site. The ponded area contains surface waters that exceed the AWQC for some contaminants. Alternatives 3A, 3B, 4A and 4B would all remediate the contaminated surface water in the ponded area through removal and off-site treatment and disposal in association with sediment remediation. However, the AWQC for surface water is expected to be maintained only if the remedial alternative is combined with the Operable Unit One groundwater treatment remedy and overland runoff containment.

All of the alternatives could be performed in compliance with action/location-specific ARARs for remedial activities in wetlands and floodplains, such as the Clean Water Act and the New Jersey Freshwater Wetlands Protection Act. In addition, Alternatives 3A, 3B, 4A and 4B involve off-site disposal of excavated soils and sediments from the site. For each of these alternatives, the excavated material would be tested to determine if it is characteristic RCRA waste prior to disposal. If it is determined to be characteristic waste, based on this testing, additional treatment (solidification/stabilization) would be required prior to disposal.

- Long-Term Effectiveness and Permanence

Alternatives 3A and 3B are protective over the long term. Potential contaminant loading to the wetlands would be eliminated, a large portion of the existing contamination would be removed, and the wetlands would be restored to provide higher functional value. Alternative 3B would remove a larger portion of the contamination and, as a result, is more protective than Alternative 3A. Alternatives 4A and 4B are not as effective as Alternatives 3A and 3B since the contaminated sediments and soils remaining after the remediation may continue to cause risk to ecological receptors and may continue to degrade the wetlands. Alternatives 4A and 4B do not ensure that contaminants left in the ecosystem would not become bioavailable over time. Bioturbation and/or soil erosion could expose contaminants to receptors in the future. Maintenance of soil emplacement areas may be difficult following revegetation. Alternative 2 is effective in eliminating potential source loading to the wetlands but does not address existing soil and sediment contamination in the wetlands. The No Action alternative is not effective in reducing risk to ecological receptors. All alternatives will include a long-term monitoring program.

- Reduction in Toxicity, Mobility, or Volume via Treatment

Alternatives 3A and 3B would achieve a reduction in the toxicity, mobility, and volume of the contaminants in wetland areas. Alternative 3B would reduce the toxicity, mobility and volume of contaminants to the greatest degree since the majority of contaminants in the wetlands would be permanently removed. Alternative 3A would allow more of the contaminated soils and sediments to remain in the wetlands at levels that may cause risk to ecological receptors compared to Alternative 3B. Alternatives 4A and 4B do not significantly reduce the toxicity or volume of the contaminants. Due to the likelihood of contaminant leaching over time, these alternatives will limit, but not permanently eliminate contaminant mobility.

Under Alternatives 3A, 3B, 4A, and 4B, excavated material would be disposed of at an appropriate off-site facility. All materials would be sampled, treated (if necessary) and disposed of in accordance with RCRA regulations.

The No Action alternative and Alternative 2 would not reduce contaminant toxicity, mobility, or volume in the wetlands.

- Short-Term Effectiveness

All of the alternatives involving excavation and clearing and grubbing of the wetlands (3A, 3B, 4A, and 4B) would have some short-term negative impact on the ecosystem. Of these alternatives, 4A and 4B, which do not involve significant excavation (i.e. they address approximately 10% of the identified areas), would have the least short-term impact on the wetlands. However, all four alternatives would be implemented in stressed areas of low functional value and would include restoration of the wetlands. Alternatives 3A, 3B, 4A, and 4B would pose a low-level risk to on-site workers during remedial action, however, this risk can be managed by appropriate health and safety measures. The risk to the community associated with these alternatives would be low.

Alternative 2 would have little or no short-term impacts on the wetland ecosystem. Berm construction, under this alternative, would pose a low-level risk to on-site workers during construction which could be easily managed through proper health and safety controls.

The No Action alternative is not applicable to this criterion since no remedial action would be implemented.

- Implementability

All six alternatives are readily implementable as the equipment and technologies involved are standard and commercially available. Alternative 1, No Action, is the most easily implemented as it involves a minimal amount of site work. Alternative 2 would require more planning and site work than Alternative 1, but is still easily implemented. Alternatives 3A, 3B, 4A, and 4B are less readily implementable than Alternatives 1 and 2. These alternatives involve more planning and more extensive site work than Alternatives 1 and 2.

Alternatives 2, 3A, 3B, 4A, and 4B can all be implemented using standard construction equipment and techniques. All technologies that would be used in this alternative are standard and commercially available.

Stormwater controls, dredging, dewatering and off-site disposal are routine construction operations. Moderate difficulty would be posed by the operation of heavy excavating equipment on inundated unstable soils. Barging timbers would be used to provide stability for the dredging cranes.

Additional truck traffic for construction activities would not be a significant concern since the CLTL terminal is an active trucking facility.

Cost

The total capital cost and present worth of the remedial alternatives are:

	Capital Cost	Present Worth
Alternative 1:	$0	$386,244
Alternative 2:	$501,526	$1,419,807
Alternative 3A:	$3,067,877	$3,986,158
Alternative 3B:	$6,314,110	$7,232,391
Alternative 4A:	$1,329,718	$2,247,999
Alternative 4B:	$2,429,204	$3,347,485

The annual operation and maintenance cost for Alternative 1 is $33,968. This cost is for long-term monitoring of the wetland. The annual operation and maintenance cost for Alternatives 2, 3A, 3B, 4A and 4B is $88,094. This cost is for long-term monitoring of the wetlands and operation and maintenance of the stormwater berm under each alternative. Cost estimates assume that soils and sediments will be excavated to a depth of one foot.

- State Acceptance

The State of New Jersey concurs with the selected remedy.

- Community Acceptance

The community supports the selected remedy. Issues raised at the public meeting and during the public comment period are addressed in the Responsiveness Summary section of this Record of Decision.

SELECTED REMEDY

EPA and NJDEPE have determined after reviewing the alternatives and public comments, that Alternative 3B is the appropriate remedy for the site, because it best satisfies the requirements of CERCLA §121, 42 U.S.C. §9621, and the NCP's nine evaluation criteria for remedial alternatives, 40 CFR §300.430(e)(9).

The major components of the selected remedy are as follows:

Excavation of the Swale Area, the Ponded Area and the Adjacent Impacted Area, Off-Site Disposal, and Revegetation/Wetlands Restoration, Surface Water Runoff Control, Wetlands Access Restriction and Long-Term Monitoring.

By excavating approximately one foot of contaminated soils and sediments from the most highly contaminated areas in the wetlands and removing contaminated surface water from the ponded area, the selected alternative will address the principle ecological threat by significantly reducing the contamination available to ecologic receptors. The selected remedy will also restore these degraded wetlands to a higher functional value through revegetation. Human health risks are currently at acceptable levels.

The selected alternative addresses 7.3 acres of contaminated wetlands which constitutes 11,500 cubic yards of contaminated soils and sediment. This contaminated soil and sediment will be disposed of at an appropriate off-site facility. The capital, operation and maintenance, and present worth costs are estimated at $6,314,110, $88,094 and $7,232,391, respectively.

Although the selected alternative substantially addresses the ecological risk posed by contamination in the wetlands, it does not address all wetland areas impacted by CLTL-related contamination. The selected alternative addresses areas of contamination that pose the greatest risk to ecological receptors. Furthermore, the selected alternative restores functional value to the most damaged and degraded portions of the wetlands adjacent to the CLTL facility while leaving intact the higher quality wetland. As a result, the selected alternative is cost effective both financially and environmentally when compared to a total removal and replacement of all wetlands in Cedar Swamp adversely impacted by CLTL-related contamination.

STATUTORY DETERMINATIONS

As previously noted, CERCLA §121(b)(1), 42 U.S.C. §9621(b)(1), mandates that a remedial action must be protective of human health and the environment, cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which employ treatment to permanently and significantly reduce the toxicity, mobility and volume of the hazardous substances, pollutants, or contaminants at a site. CERCLA §121(d), 42 U.S.C. §9621(d), further specifies that a remedial action must attain a degree of cleanup that satisfies ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA §121(d)(4), 42 U.S.C. §9621(d)(4).

For the reasons discussed below, EPA has determined that the selected remedy meets the requirements of CERCLA §121, 42 U.S.C. §9621:

Overall Protection of Human Health And The Environment

Control of surface runoff will eliminate the potential for loading of contaminants to the wetlands from the CLTL facility. The removal of contaminated soils and sediments from the three areas (ponded, swale, and adjacent impacted areas) will eliminate a persistent source of contamination in the wetlands and will reduce the risk to ecological receptors. This alternative includes the restoration of the degraded wetlands' functions and values and will create a habitat of considerably greater value than what currently exists.

Compliance with ARARs

This alternative will comply with all chemical, location and action-specific ARARs including RCRA requirements for transport and disposal of excavated soils and sediments and wetland mitigation requirements of the Clean Water Act and the Freshwater Wetlands Protection Act.

Cost Effectiveness

The capital cost for this alternative is estimated at $6,314,110. This cost estimate assumes that soils and sediments will be excavated to a depth of one foot. The annual operation and maintenance cost is estimated at $88,094. The present worth cost, based on a rate of return of 8%, will be $7,232,391. This alternative is the most protective of all alternatives evaluated and is cost effective when compared to the cost of remediating all wetlands impacted by past CLTL-related activities.

Preference for Treatment as a Principal Element

Although this alternative does not satisfy the statutory preference for treatment, EPA has concluded that the available treatment alternatives have limited applicability to the site-specific contamination and restricted implementability in a wetlands environment. The infeasibility of constructing on-site treatment system in the wetlands and the shortage of applicable treatment technologies for organic rich wetland soils were the main factors considered in ruling out on-site treatment as a remedial alternative. However, any excavated material determined to be a RCRA characteristic waste will be appropriately treated off-site prior to disposal.

The selected alternative will provide the best balance of trade-offs among the alternatives with respect to the evaluating criteria. EPA and the NJDEPE believe that the preferred alternative will be protective of human health and the environment, will comply with

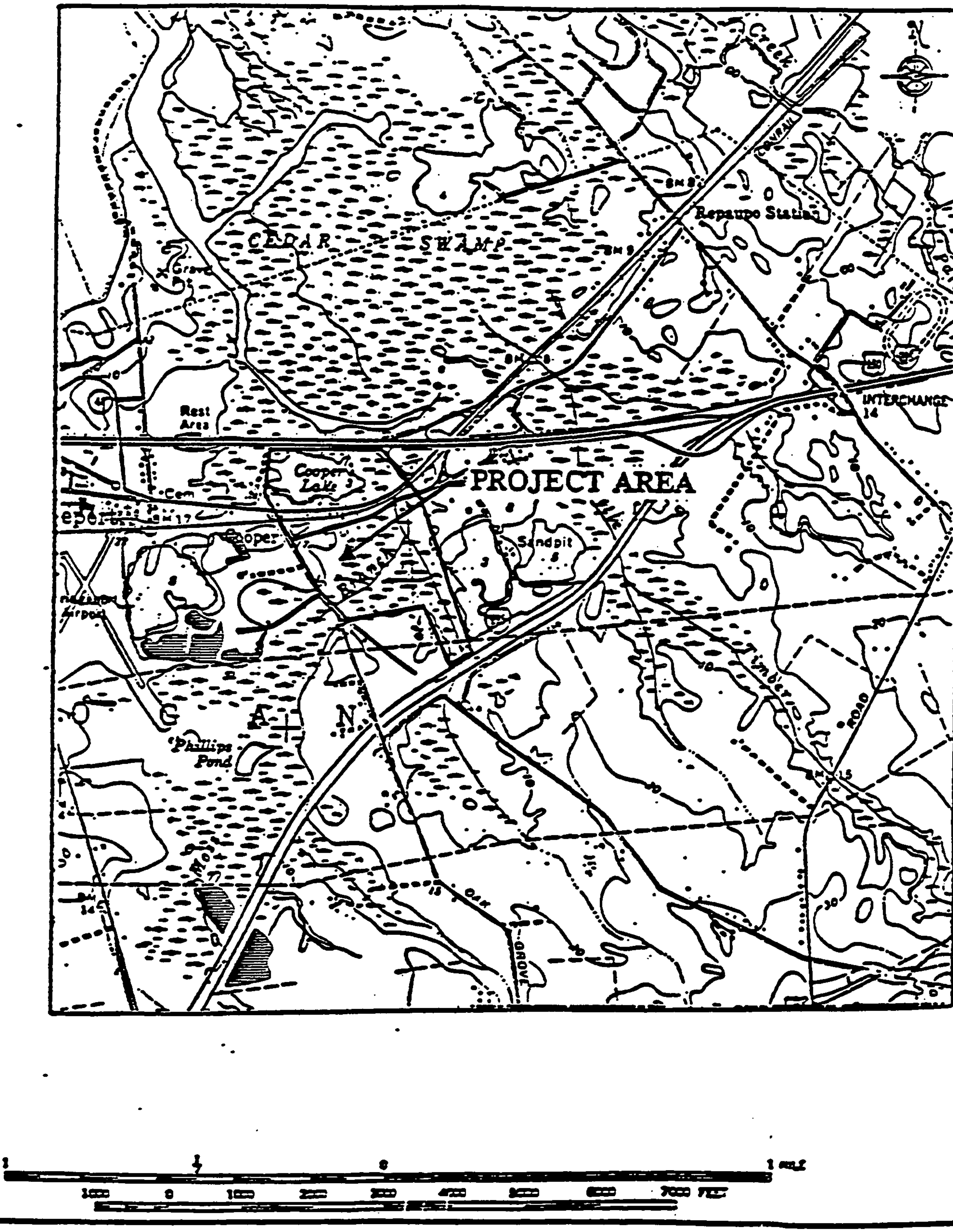
ARARs, is cost effective, and will utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. Because this action will result in contamination remaining on site, in areas of the wetlands not included in the "hot spot" areas to be remediated, CERCLA requires that the site be reviewed every five years. If justified by the review, EPA will revise the remedial decision as necessary.

DOCUMENTATION OF SIGNIFICANT CHANGES

There are no significant changes from the preferred alternative presented in the Proposed Plan.

APPENDIX I

FIGURES



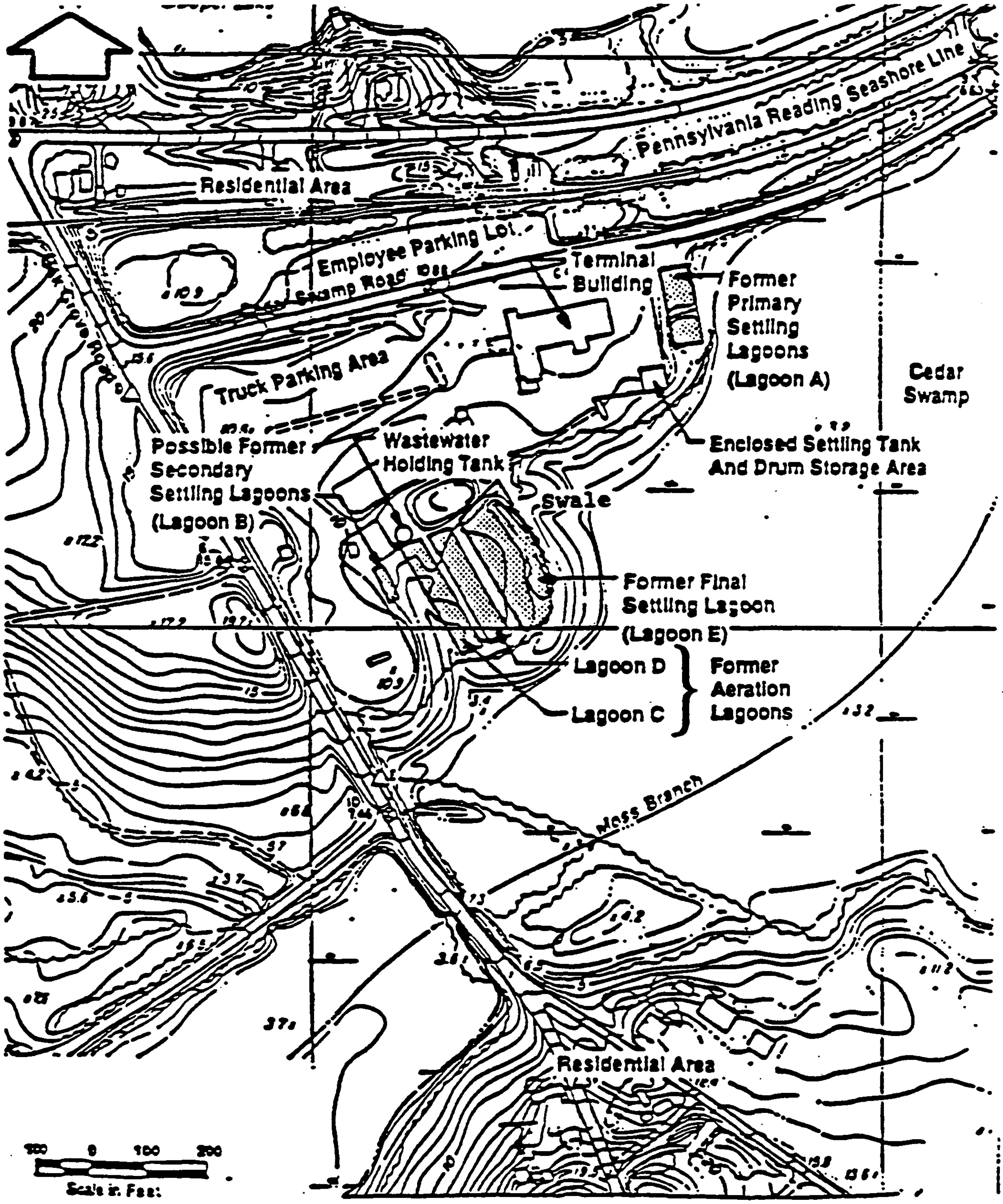
CDM

environmental engineers, scientists, planners & management consultants

CHEMICAL LEAMAN

SITE LOCATION MAP

Figure No. 1



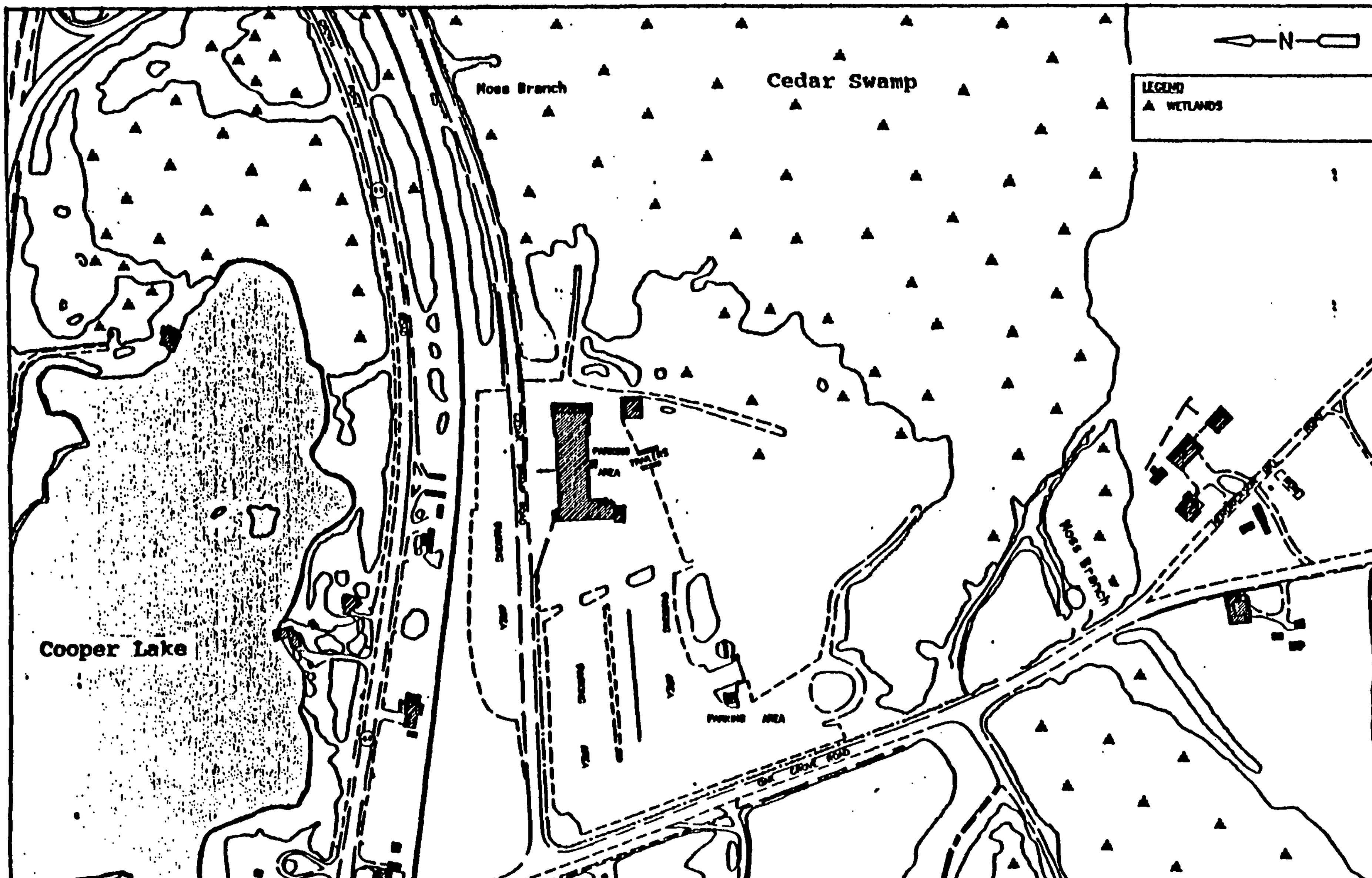
CDM

environmental engineers, scientists, planners & management consultants

CHEMICAL LEAMAN

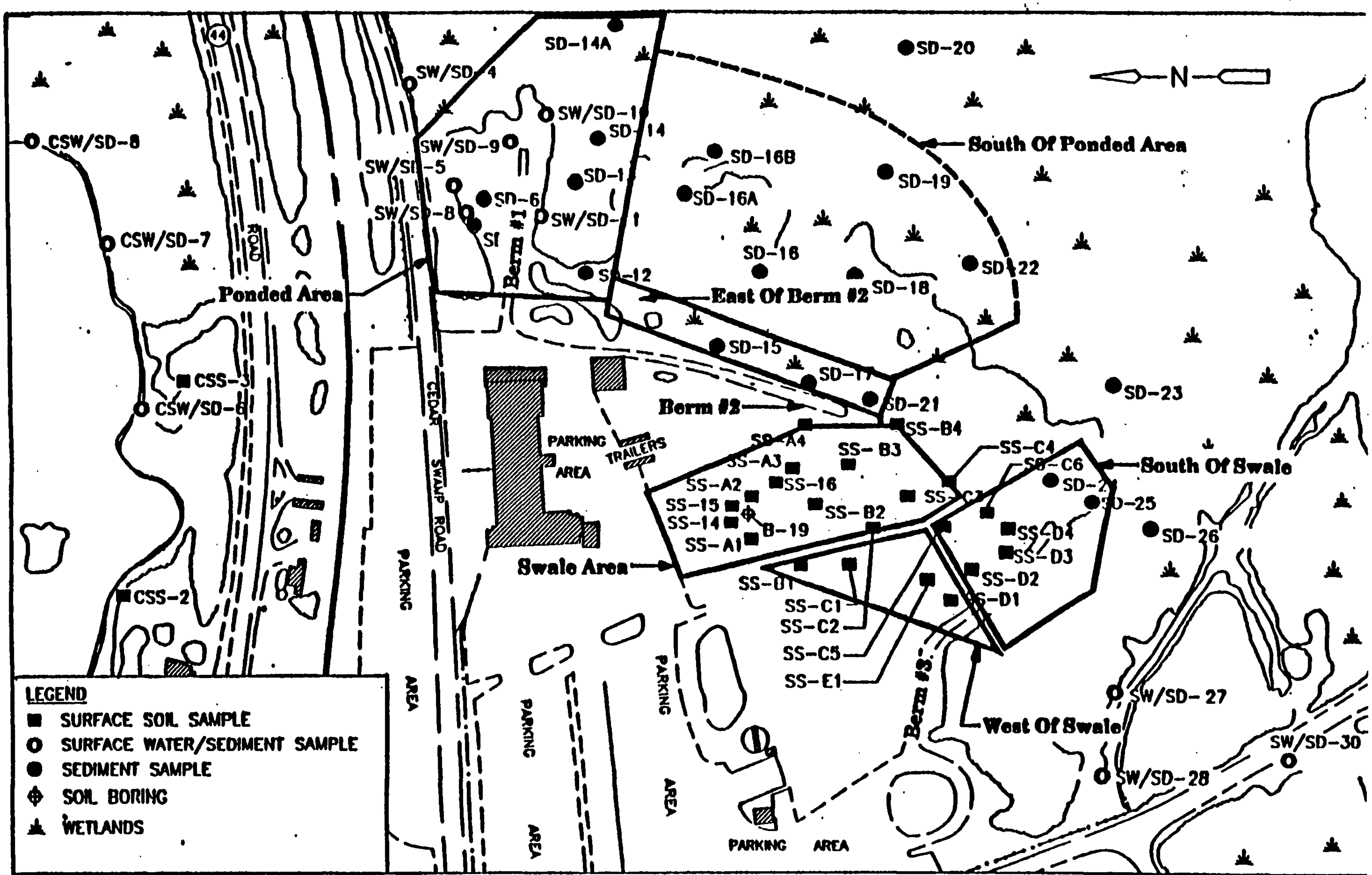
SITE MAP

Figure No. 2



CHEMICAL LEAMAN
STUDY AREA

Figure No. 3



CHEMICAL LEAMAN

AREA DELINEATION MAP

Figure No. 4

CDM
environmental engineers, scientists, planners, & management consultants

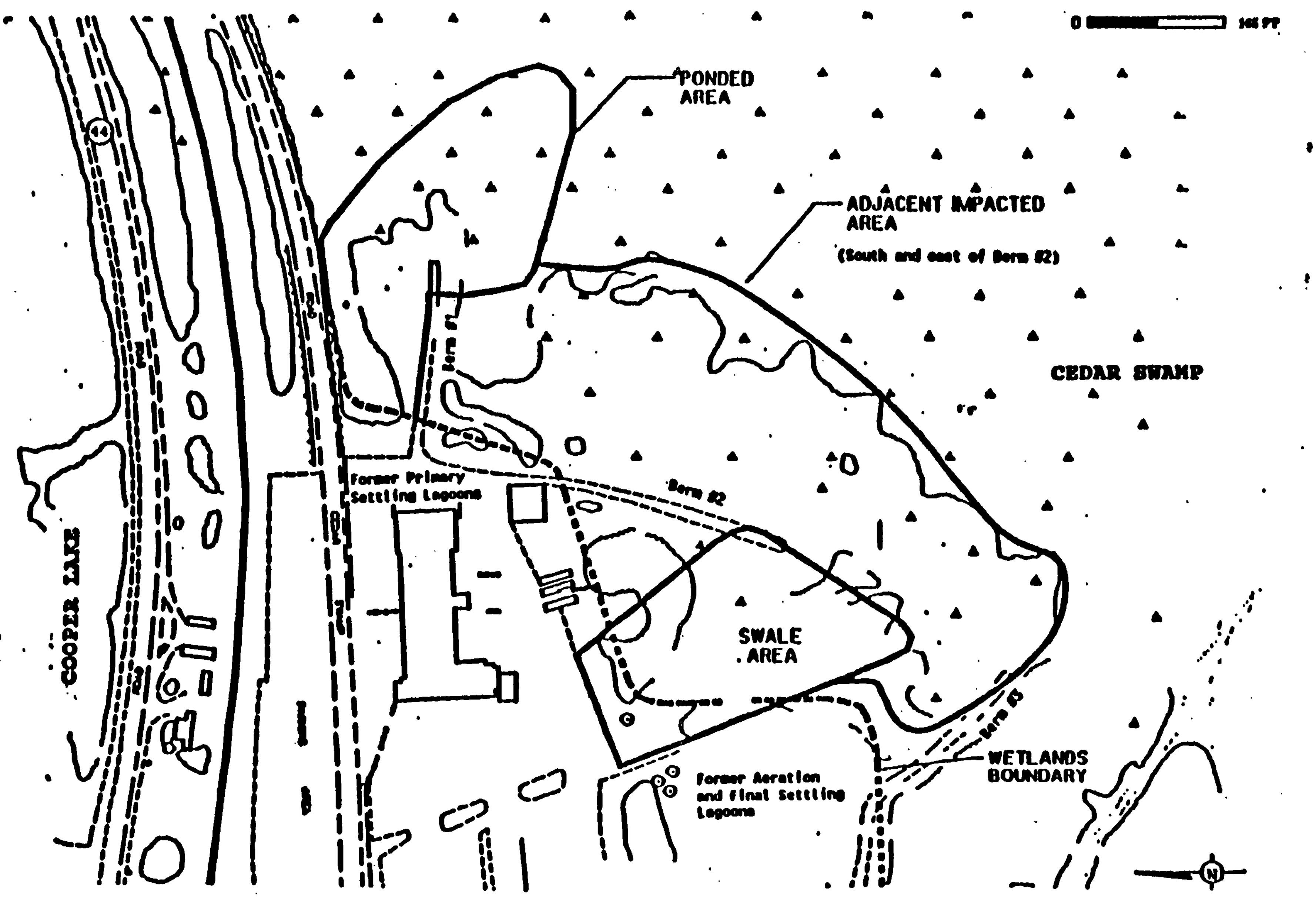


Figure 5

CONTAMINATED AREAS

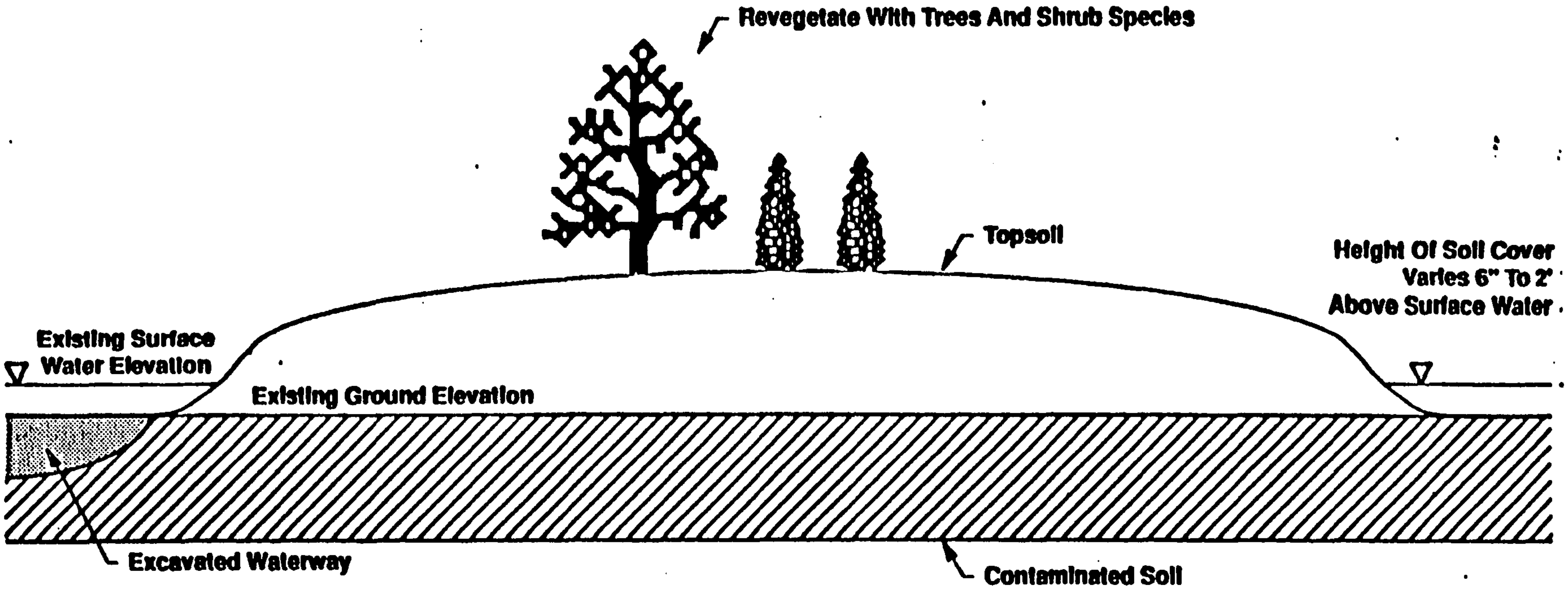
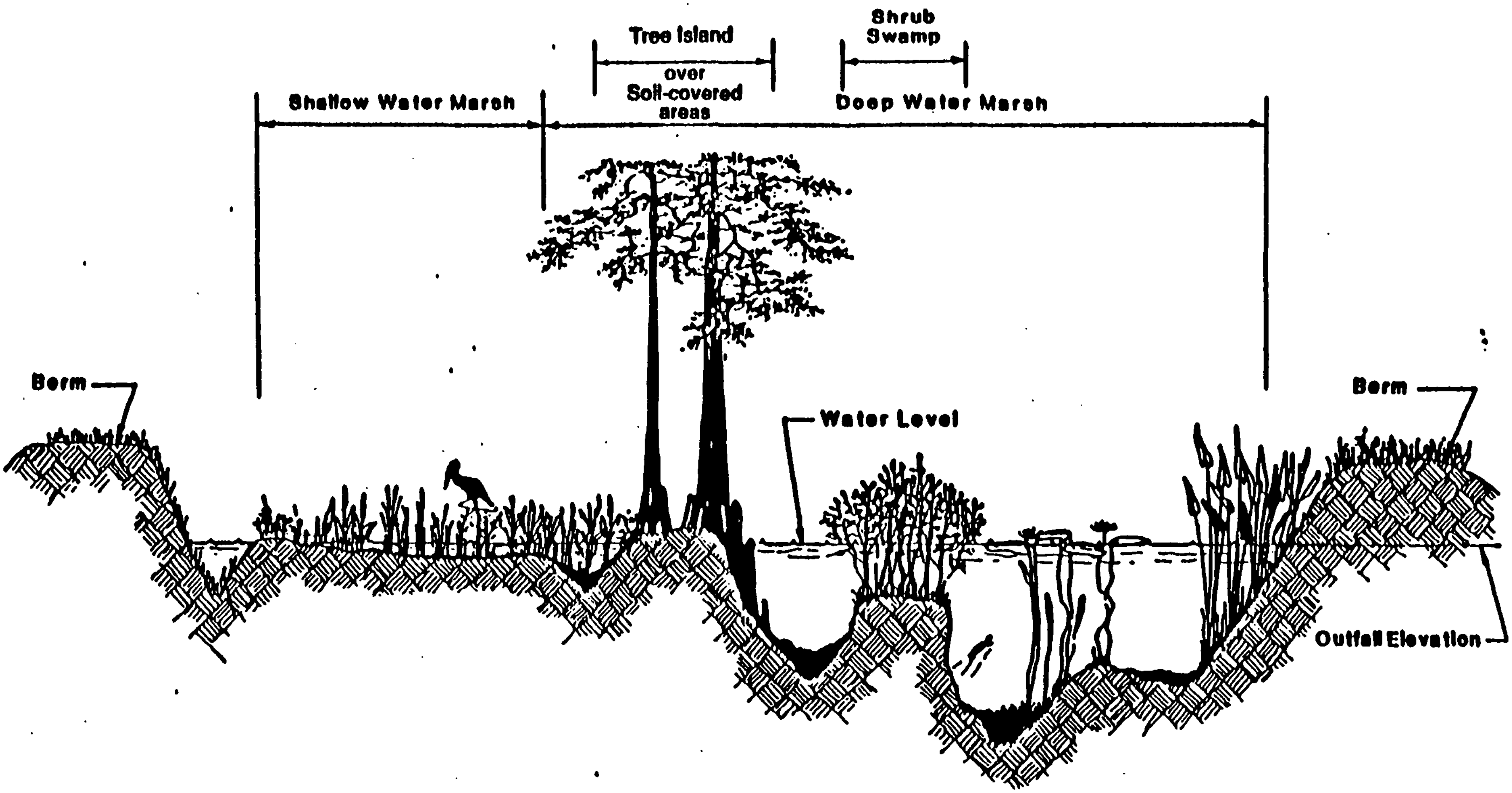


Figure 6

Schematic Of Soil Cover Over Contaminated Areas

CDM Camp Dresser & McKee

Chemical Leaman



Cross section of a typical wetland area showing soil-covered areas as revegetated hummock tree islands. The variation in topography maximizes habitat values. Shallow marshes are planted with marsh grasses, deeper marshes with emergents and floating leaved herbaceous species. Hummocks are planted with wetland tree and shrub species.

Figure - 7

Revegetation Cross Section of Soil-covered Areas

CDM Camp Dresser & McKee

Chemical Leaman

APPENDIX II

TABLES

TABLE 1

LIST OF HAZARDOUS MATERIALS
TRANSPORTED BY CLTL

Allyl alcohol	2,3-Dinitrophenol
2-sec-Butyl-4,6,-dinitrophenol	2,4-Dinitrotoluene
p-Chloroaniline	Di-n-Octyl phthalate
Ethylenediamine	Dipropylamine
Acrylic Acid	Ethyl acetate
Aniline	Ethyl acrylate
Benzene	Ethyl ether
n-Butyl alcohol	Ethyl methacrylate
Chlorobenzene	Formaldehyde
Chloroethene	Formic acid
Chloroform	Furfural
Chloromethane	Hydrazine
2-Chlorophenol	Isobutyl alcohol
Creosote	Maleic anhydride
Cresols	Maleic hydrazine
Cresylic acid	Methanol
Cumene	Methyl ethyl ketone (MEK)
Cyclohexane	Methyl isobutyl ketone
Di-n-Butyl phthalate	Naphthalene
1,2-Dichlorobenzene	Nitrobenzene
1,1-Dichloroethene	Paraldehyde
Diethyl phthalate	Phenol
Dimethylamine	Phthalic anhydride
Dimethylcarbamoyl chloride	N-Propylamine
1,1-Dimethyl hydrazine	Pyridine
Dimethyl phthalate	1,1,1,2-Tetrachloroethane
Tetrachloromethane	Toluene
Toluenediamine	Toluene diisocyanate
Toxaphene	Tribromomethane
1,1,2-Trichloroethane	Trichloroethene
Urethane	Xylene

TABLE 2

Chemical Leaman Analytical Results
SURFACE SOIL

Summary of Volatile Compounds Detected

Parameter		Hits/Samples		Minimum	-	Maximum	Average
CHLOROMETHANE	ug/kg	1	10	33.00	-	33.00	33.00
BROMOMETHANE	ug/kg	1	10	440.00	-	440.00	440.00
METHYLENE CHLORIDE	ug/kg	7	14	17.00	-	340.00	160.71
ACETONE	ug/kg	3	12	150.00	-	930.00	403.33
CARBON DISULFIDE	ug/kg	2	10	4.00	-	10.00	7.00
1,2-DICHLOROETHENE (TOTA	ug/kg	2	11	6.00	-	21.00	13.50
TRICHLOROETHYLENE	ug/kg	4	12	11.00	-	120.00	43.00
BENZENE	ug/kg	2	9	12.00	-	590.00	301.00
TETRACHLOROETHYLENE	ug/kg	6	13	10.00	-	690.00	142.67
1,1,2,2-TETRACHLOROETHAN	ug/kg	1	9	13.00	-	13.00	13.00
TOLUENE	ug/kg	9	13	1.00	-	3200.00	373.11
CHLOROBENZENE	ug/kg	5	12	5.00	-	7400.00	1510.40
ETHYLBENZNE	ug/kg	2	9	110.00	-	9700.00	4905.00
STYRENE	ug/kg	1	9	9.00	-	9.00	9.00
XYLENES (TOTAL)	ug/kg	1	9	57000.00	-	57000.00	57000.00

1) The minimum and maximum range, and average include hits only.
2) Duplicate samples were not included in the calculations.
3) Data qualifiers were not considered.

Samples represented in this table include:

B19, SS-A1, SS-A2, SS-A3, SS-A4
SS-B1, SS-B2, SS-B3, SS-B4, SS-C1
SS-C2, SS-C3, SS-C4, SS-C5, SS-C6
SS-D1, SS-D2, SS-D3, SS-D4, SS-14
SS-15, SS-16.

TABLE 2

Chemical Leaman Analytical Results
SEDIMENT

Summary of Volatile Compounds Detected

Parameter		Hits/Samples		Minimum	-	Maximum	Average
CHLOROMETHANE	ug/kg	2	8	52.00	-	190.00	121.00
VINYL CHLORIDE	ug/kg	1	7	44.00	-	44.00	44.00
METHYLENE CHLORIDE	ug/kg	22	28	21.00	-	260.00	126.50
ACETONE	ug/kg	26	30	18.00	-	6400.00	1094.69
CARBON DISULFIDE	ug/kg	6	12	9.00	-	25.00	13.67
1,2-DICHLOROETHENE (TOTA	ug/kg	3	8	20.00	-	31.00	26.67
CHLOROFORM	ug/kg	1	7	7.00	-	7.00	7.00
2-BUTANONE	ug/kg	15	18	30.00	-	3100.00	444.00
BENZENE	ug/kg	1	7	20.00	-	20.00	20.00
TOLUENE	ug/kg	27	30	2.00	-	650.00	132.22
CHLOROBENZENE	ug/kg	6	11	8.00	-	73.00	28.83
XYLENES (TOTAL)	ug/kg	2	8	50.00	-	57.00	53.50

1) The minimum and maximum range, and average include hits only.
2) Duplicate samples were not included in the calculations.
3) Data qualifiers were not considered.

Samples represented in this table include:

SD-1, SD-2, SD-3, SD-4, SD-5
SD-6, SD-7, SD-8, SD-9, SD-10
SD-11, SD-12, SD-13, SD-14, SD-14A
SD-15, SD-16, SD-16A, SD-16B, SD-17
SD-18, SD-19, SD-20, SD-21, SD-22
SD-23, SD-24, SD-25, SD-26, SD-27
SD-28.

Chemical Leaman Analytical Results
SURFACE SOIL

Summary of Semivolatile Compounds Detected

Parameter		Hits/Samples		Minimum	-	Maximum	Average
PHENOL	ug/kg	6	21	120.00	-	590.00	301.67
1,4-DICHLOROBENZINE	ug/kg	1	20	400.00	-	400.00	400.00
1,2-DICHLOROBENZENE	ug/kg	4	21	130.00	-	2000.00	785.00
BIS(2-CHLOROISOPROPYL)ET	ug/kg	1	20	150.00	-	150.00	150.00
BENZOIC ACID	ug/kg	3	20	520.00	-	1100.00	776.67
2,4-DICHLOROPHENOL	ug/kg	2	20	420.00	-	510.00	465.00
1,2,4-TRICHLOROBENZENE	ug/kg	4	20	170.00	-	3700.00	1415.00
NAPHTHALENE	ug/kg	6	21	110.00	-	5500.00	1028.33
2-METHYLNAPHTHALENE	ug/kg	7	21	85.00	-	16000.00	2413.57
DIMETHYLPHTHALALTE	ug/kg	1	20	390.00	-	390.00	390.00
ACENAPHTHENE	ug/kg	1	20	1300.00	-	1300.00	1300.00
DIBENZOFURAN	ug/kg	2	20	150.00	-	590.00	370.00
N-NITROSODIPHENYLAMINE	ug/kg	7	21	280.00	-	11000.00	2648.57
PHENANTHRENE	ug/kg	9	21	120.00	-	5600.00	916.67
ANTHRACENE	ug/kg	9	21	84.00	-	550.00	195.56
DI-N-BUTYLPHTHALATE	ug/kg	7	20	100.00	-	14000.00	2144.29
FLUORANTHENE	ug/kg	11	21	140.00	-	1600.00	521.82
PYRENE	ug/kg	11	21	130.00	-	2100.00	853.64
BUTYLBENZYLPHTHALATE	ug/kg	5	20	270.00	-	30000.00	6494.00
3,3'-DICHLOROBENZIDINE	ug/kg	2	20	1900.00	-	1900.00	1900.00
BENZO (A) ANTHRACENE	ug/kg	7	21	83.00	-	1000.00	449.00
CHRYSENE	ug/kg	8	21	130.00	-	1000.00	510.00
BIS (2-ETHYLHEXYL) PHTHA	ug/kg	18	21	310.00	-	84000.00	15547.78
DI-N-OCTYLPHTHALATE	ug/kg	3	20	100.00	-	4400.00	1546.67
BENZO(B)FLUORANTHENE	ug/kg	13	21	220.00	-	2000.00	803.85
BENZO(K) FLUORANTHENE	ug/kg	12	21	170.00	-	1200.00	565.00
BENZO (A) PYRENE	ug/kg	8	20	230.00	-	1200.00	856.25
INDENO (1,2,3-CD) PYRENE	ug/kg	7	20	260.00	-	1900.00	1000.00
BENZO (G,H,I) PERYLENE	ug/kg	10	20	410.00	-	2800.00	1251.00

1) The minimum and maximum range, and average include hits only.
2) Duplicate samples were not included in the calculations.
3) Data qualifiers were not considered.

Samples represented in this table include:

B19, SS-A1, SS-A2, SS-A3, SS-A4
SS-B1, SS-B2, SS-B3, SS-B4, SS-C1
SS-C2, SS-C3, SS-C4, SS-C5, SS-C6
SS-D1, SS-D2, SS-D3, SS-D4, SS-14
SS-15, SS-16.

TABLE 2

Chemical Leamen Analytical Results

SEDIMENT

Summary of Semivolatile Compounds Detected

Parameter		Hits/Samples		Minimum	-	Maximum	Average
PHENOL	ug/kg	4	27	190.00	-	880.00	567.50
BENZOIC ACID	ug/kg	2	27	980.00	-	1700.00	1340.00
1,2,4-TRICHLOROBENZENE	ug/kg	2	26	270.00	-	1400.00	835.00
2-METHYLNAPHTHALENE	ug/kg	1	26	290.00	-	290.00	290.00
DIMETHYLPHTHALALTE	ug/kg	2	26	670.00	-	1500.00	1085.00
ACENAPHTHENE	ug/kg	1	26	190.00	-	190.00	190.00
DIETHYLPHTHALATE	ug/kg	1	26	2800.00	-	2800.00	2800.00
N-NITROSODIPHENYLAMINE	ug/kg	6	28	140.00	-	1600.00	955.00
PHENANTHRENE	ug/kg	2	26	140.00	-	860.00	500.00
ANTHRACENE	ug/kg	5	27	130.00	-	700.00	404.00
FLUORANTHENE	ug/kg	2	26	170.00	-	1100.00	635.00
PYRENE	ug/kg	8	27	250.00	-	1000.00	585.00
BUTYLBENZYLPHTHALATE	ug/kg	1	26	320.00	-	320.00	320.00
3,3'-DICHLOROBENZIDINE	ug/kg	1.	26	3100.00	-	3100.00	3100.00
BENZO (A) ANTHRACENE	ug/kg	2	26	390.00	-	1100.00	745.00
CHRYSENE	ug/kg	3	26	460.00	-	1200.00	920.00
BIS (2-ETHYLHEXYL) PHTHA	ug/kg	22	31	100.00	-	49000.00	13932.95
DI-N-OCTYLPHTHALATE	ug/kg	3	26	230.00	-	710.00	450.00
BENZO(B)FLUORANTHENE	ug/kg	8	28	270.00	-	980.00	578.75
BENZO(K) FLUORANTHENE	ug/kg	7	27	210.00	-	430.00	348.57
BENZO (A) PYRENE	ug/kg	8	27	220.00	-	1800.00	925.00
INDENO (1,2,3-CD) PYRENE	ug/kg	8	28	270.00	-	1100.00	642.50
BENZO (G,H,I) PERYLENE	ug/kg	7	28	260.00	-	1800.00	774.29

1) The minimum and maximum range, and average include hits only.
2) Duplicate samples were not included in the calculations.
3) Data qualifiers were not considered.

Samples represented in this table include:

SD-1, SD-2, SD-3, SD-4, SD-5
SD-6, SD-7, SD-8, SD-9, SD-10
SD-11, SD-12, SD-13, SD-14, SD-14A
SD-15, SD-16, SD-16A, SD-16B, SD-17
SD-18, SD-19, SD-20, SD-21, SD-22
SD-23, SD-24, SD-25, SD-26, SD-27
SD-28.

TABLE 2

Chemical Leaman Analytical Results
SURFACE SOIL

Summary of Inorganic Analytes Detected

Parameter		Hits/Samples		Minimum	-	Maximum	Average
ALUMINUM	mg/kg	21	21	3810.00	-	28600.00	11803.33
ANTIMONY	mg/kg	3	18	13.80	-	15.10	14.60
ARSENIC	mg/kg	22	22	3.60	-	94.90	27.58
BARIUM	mg/kg	21	21	34.80	-	2210.00	477.37
BERYLLIUM	mg/kg	18	21	0.24	-	2.50	1.05
CADMIUM	mg/kg	20	22	1.70	-	33.10	11.68
CALCIUM	mg/kg	21	21	331.00	-	50200.00	17714.24
CHROMIUM	mg/kg	22	22	5.00	-	197.00	52.77
COBALT	mg/kg	21	21	1.70	-	24.30	10.05
COPPER	mg/kg	20	22	16.00	-	184.00	61.84
IRON	mg/kg	21	21	7540.00	-	30700.00	16615.24
LEAD	mg/kg	22	22	5.90	-	600.00	236.94
MAGNESIUM	mg/kg	21	21	413.00	-	28000.00	10198.48
MANGANESE	mg/kg	21	21	22.10	-	315.00	166.42
MERCURY	mg/kg	12	22	0.12	-	1.40	0.59
NICKEL	mg/kg	21	22	2.20	-	41.90	21.69
POTASSIUM	mg/kg	21	21	170.00	-	2180.00	818.67
SELENIUM	mg/kg	3	21	0.89	-	3.10	1.76
SODIUM	mg/kg	18	18	45.00	-	525.00	191.49
THALLIUM	mg/kg	1	21	0.69	-	0.69	0.69
VANADIUM	mg/kg	21	21	10.60	-	76.50	37.56
ZINC	mg/kg	22	22	8.80	-	767.00	257.61
PHENOLS	mg/kg	1	1	4.55	-	4.55	4.55

1) The minimum and maximum range, and average include hits only.
2) Duplicate samples were not included in the calculations.
3) Data qualifiers were not considered.

Samples represented in this table include:

B19, SS-A1, SS-A2, SS-A3, SS-A4
SS-B1, SS-B2, SS-B3, SS-B4, SS-C1
SS-C2, SS-C3, SS-C4, SS-C5, SS-C6
SS-D1, SS-D2, SS-D3, SS-D4, SS-14
SS-15, SS-16.

TABLE 2

Chemical Leaman Analytical Results
SEDIMENT

Summary of Inorganic Analytes Detected

Parameter		Hits/Samples		Minimum	-	Maximum	Average
ALUMINUM	mg/kg	31	31	702.00	-	33000.00	10130.71
ANTIMONY	mg/kg	4	31	18.20	-	38.60	24.45
ARSENIC	mg/kg	31	31	0.87	-	303.00	58.10
BARIUM	mg/kg	31	31	3.30	-	2330.00	459.99
BERYLLIUM	mg/kg	4	31	1.40	-	2.40	1.68
CADMIUM	mg/kg	14	31	5.30	-	31.90	12.43
CALCIUM	mg/kg	31	31	81.60	-	12700.00	6151.60
CHROMIUM	mg/kg	31	31	2.50	-	182.00	48.56
COBALT	mg/kg	30	31	1.20	-	38.20	14.56
COPPER	mg/kg	31	31	2.90	-	196.00	76.50
IRON	mg/kg	31	31	578.00	-	27200.00	12971.87
LEAD	mg/kg	31	31	1.40	-	568.00	219.85
MAGNESIUM	mg/kg	31	31	44.90	-	6070.00	1795.90
MANGANESE	mg/kg	31	31	4.10	-	318.00	110.81
MERCURY	mg/kg	17	31	0.13	-	2.10	1.08
NICKEL	mg/kg	30	31	3.40	-	65.20	32.38
POTASSIUM	mg/kg	31	31	83.60	-	2020.00	718.15
SELENIUM	mg/kg	6	30	2.50	-	7.70	5.13
SODIUM	mg/kg	16	16	38.80	-	445.00	255.49
THALLIUM	mg/kg	1	31	0.82	-	0.82	0.82
VANADIUM	mg/kg	31	31	5.30	-	104.00	54.24
ZINC	mg/kg	28	28	18.60	-	759.00	270.91
CYANIDE	mg/kg	1	31	16.20	-	16.20	16.20

1) The minimum and maximum range, and average include hits only.
2) Duplicate samples were not included in the calculations.
3) Data qualifiers were not considered.

Samples represented in this table include:

SD-1, SD-2, SD-3, SD-4, SD-5
SD-6, SD-7, SD-8, SD-9, SD-10
SD-11, SD-12, SD-13, SD-14, SD-14A
SD-15, SD-16, SD-16A, SD-16B, SD-17
SD-18, SD-19, SD-20, SD-21, SD-22
SD-23, SD-24, SD-25, SD-26, SD-27
SD-28.

Chemical Leaman Analytical Results
SURFACE SOIL

Summary of Pesticide Compounds Detected

Parameter		Hits/Samples		Minimum	-	Maximum	Average
4,4'-DDE	ug/kg	16	22	0.99	-	3300.00	573.37
ENDRIN, TOTAL	ug/kg	1	21	65.00	-	65.00	65.00
4,4'-DDD	ug/kg	10	22	0.40	-	220.00	112.44
ENDOSULFAN SULFATE	ug/kg	10	21	50.00	-	800.00	205.10
4,4'-DDT	ug/kg	2	21	24.00	-	93.00	58.50
AROCLOR-1248	ug/kg	1	21	1600.00	-	1600.00	1600.00
AROCLOR-1254	ug/kg	5	21	1300.00	-	3100.00	2160.00

1) The minimum and maximum range, and average include hits only.
2) Duplicate samples were not included in the calculations.
3) Data qualifiers were not considered.

Samples represented in this table include:

B19, SS-A1, SS-A2, SS-A3, SS-A4
SS-B1, SS-B2, SS-B3, SS-B4, SS-C1
SS-C2, SS-C3, SS-C4, SS-C5, SS-C6
SS-D1, SS-D2, SS-D3, SS-D4, SS-14
SS-15, SS-16.

TABLE 2

Chemical Leamen Analytical Results

SEDIMENT

Summary of Pesticide Compounds Detected

Parameter		Hits/Samples		Minimum	-	Maximum	Average
4,4'-DDE	ug/kg	19	31	18.00	-	4300.00	841.11
4,4'-DDD	ug/kg	10	30	150.00	-	44000.00	4896.00
ENDOSULFAN SULFATE	ug/kg	1	30	360.00	-	360.00	360.00
4,4'-DDT	ug/kg	1	31	240.00	-	240.00	240.00
AROCLOR-1254	ug/kg	2	30	2900.00	-	7400.00	5150.00

1) The minimum and maximum range, and average include hits only.
2) Duplicate samples were not included in the calculations.
3) Data qualifiers were not considered.

Samples represented in this table include:

SD-1, SD-2, SD-3, SD-4, SD-5
SD-6, SD-7, SD-8, SD-9, SD-10
SD-11, SD-12, SD-13, SD-14, SD-14A
SD-15, SD-16, SD-16A, SD-16B, SD-17
SD-18, SD-19, SD-20, SD-21, SD-22
SD-23, SD-24, SD-25, SD-26, SD-27
SD-28.

TABLE 3

SUMMARY OF THE OU3 MEAN AREA CONTAMINANT CONCENTRATION

Contaminant	Mean Contaminant Concentrations										
	Surface Soil Samples			Sediment Samples					Surface Water	Cooper Lake Samples	
	Swale Area	South of Swale	West of Swale	Ponded Area	South of Ponded Area	East of Berm #2	South of Swale	Site Perimeter		Surface Water	Sediment
VOLATILES (ppb)											
CHLOROMETHANE	33	ND	ND	190	ND	ND	NA(1)	52	ND	ND	ND
BROMOMETHANE	440	ND	ND	ND	ND	ND	NA(1)	ND	ND	ND	ND
VINYL CHLORIDE	ND	ND	ND	ND	ND	ND	NA(1)	44	ND	ND	ND
METHYLENE CHLORIDE	106	170	ND	120	143	71	NA(1)	148	ND	ND	ND
ACETONE	150	745	ND	1574	1087	133	NA(1)	1009	ND	ND	1130
CARBON DISULFIDE	7	ND	ND	13	ND	ND	NA(1)	14	ND	ND	ND
1,2-DICHLOROETHENE (TOTAL)	14	ND	ND	20	ND	ND	NA(1)	30	ND	ND	ND
2-BUTANONE	ND	260	ND	602	420	30	NA(1)	178	ND	ND	249
CHLOROFORM	ND	ND	ND	7	ND	ND	NA(1)	ND	ND	ND	ND
TRICHLOROETHENE	43	ND	ND	ND	ND	ND	NA(1)	ND	ND	ND	ND
BENZENE	12	ND	590	20	ND	ND	NA(1)	ND	ND	ND	ND
TETRACHLOROETHENE	33	ND	690	ND	ND	ND	NA(1)	ND	ND	ND	ND
1,1,1-TRICHLOROETHANE	ND	ND	ND	ND	ND	ND	NA(1)	ND	ND	ND	46
1,1,2,2-TETRACHLOROETHANE	13	ND	ND	ND	ND	ND	NA(1)	ND	ND	ND	ND
TOLUENE	21	24	3200	189	129	40	NA(1)	108	ND	ND	66
CHLOROBENZENE	38	ND	7400	26	35	ND	NA(1)	33	ND	ND	ND
ETHYLBENZENE	110	ND	9700	ND	ND	ND	NA(1)	ND	ND	ND	ND
STYRENE	9	ND	ND	ND	ND	ND	NA(1)	ND	ND	ND	ND
XYLENE (TOTAL)	ND	ND	57000	50	57	ND	NA(1)	ND	ND	ND	ND
TOTAL VOCs	1028	1199	78580	2811	1871	273	0	1617	0	0	1491
SEMIVOLATILES (ppb)											
PHENOL	302	ND	ND	880	530	430	NA(1)	ND	ND	ND	ND
1,4-DICHLOROBENZENE	400	ND	ND	ND	ND	ND	NA(1)	ND	ND	ND	ND
1,2-DICHLOROBENZENE	380	ND	2000	ND	ND	ND	NA(1)	ND	ND	ND	ND
BIS(2-CHLOROISOPROPYL)ETHER	150	ND	ND	ND	ND	ND	NA(1)	ND	ND	ND	ND
BENZOIC ACID	905	520	ND	ND	1700	980	NA(1)	ND	ND	ND	ND
2,4-DICHLOROPHENOL	465	ND	ND	ND	ND	ND	NA(1)	ND	ND	ND	ND
1,2,4-TRICHLOROBENZENE	895	ND	1935	ND	1400	270	NA(1)	ND	ND	ND	ND
NAPHTHALENE	134	ND	5500	ND	ND	ND	NA(1)	ND	ND	ND	ND
2-METHYLNAPHTHALENE	149	ND	16000	ND	ND	290	NA(1)	ND	ND	ND	ND

TABLE 3 (Continued)

SUMMARY OF THE OU3 MEAN AREA CONTAMINANT CONCENTRATION

Contaminant	Mean Contaminant Concentrations										
	Surface Soil Samples			Sediment Samples					Surface Water	Cooper Lake Samples	
	Swale Area	South of Swale	West of Swale	Ponded Area	South of Ponded Area	East of Berm #2	South of Swale	Site Perimeter		Surface Water	Sediment
DIMETHYL PHTHALATE	390	ND	ND	1500	ND	670	NA(1)	ND	ND	ND	ND
ACENAPHTHENE	ND	ND	1300	ND	ND	ND	NA(1)	190	ND	ND	ND
DIBENZOFURAN	370	ND	ND	ND	ND	ND	NA(1)	ND	ND	ND	ND
DIETHYLPHTHALATE	ND	ND	76	2800	ND	ND	NA(1)	ND	ND	ND	ND
N-NITROSODIPHENYLAMINE	1248	1300	11000	1500	ND	545	NA(1)	140	ND	ND	ND
PHENANTHRENE	270	760	5600	ND	ND	ND	NA(1)	300	ND	ND	ND
ANTHRACENE	131	212	550	700	410	390	NA(1)	130	ND	ND	ND
DI-N-BUTYLPHTHALATE	180	190	7050	ND	ND	ND	NA(1)	ND	ND	ND	ND
FLUORANTHENE	339	797	980	ND	ND	170	NA(1)	1100	ND	ND	ND
PYRENE	765	810	1200	560	853	285	NA(1)	750	ND	ND	ND
BUTYL BENZYL PHTHALATE	695	270	15405	320	ND	ND	NA(1)	ND	ND	ND	ND
3,3'-DICHLOROBENZIDINE	1900	1900	ND	ND	ND	3100	NA(1)	ND	ND	ND	ND
BENZO(A)ANTHRACENE	373	793	ND	ND	ND	ND	NA(1)	390	ND	ND	ND
CHRYSENE	462	718	ND	ND	1200	ND	NA(1)	460	ND	ND	ND
BIS(2-ETHYLHEXYL)PHTHALATE	15117	17443	20480	10931	25000	7600	NA(1)	3589	4	6	252
DI-N-OCTYLPHTHALATE	120	ND	4400	ND	560	230	NA(1)	ND	ND	ND	ND
BENZO(B)FLUORANTHENE	866	824	330	400	693	405	NA(1)	410	ND	ND	ND
BENZO(K)FLUORANTHENE	605	545	170	430	365	240	NA(1)	390	ND	ND	ND
BENZO(A)PYRENE	942	1237	230	450	1180	610	NA(1)	390	ND	ND	ND
INDENO(1,2,3-CD)PYRENE	925	1100	ND	650	620	630	NA(1)	270	ND	ND	ND
BENZO(G,H,I)PERYLENE	820	1960	410	660	720	630	NA(1)	260	ND	ND	ND
TOTAL SVOCs	30297	31378	94616	21781	35032	17475	0	8969	4	6	252
TOTAL PAHs	6781	9755	32270	3850	5842	3650	0	5240	0	0	0
TOTAL PHTHALATES	16502	17903	47411	15551	25560	8500	0	3589	4	6	252
TOTAL AROMATICS	3347	520	3935	880	3630	1680	0	0	0	0	0
PESTICIDES/PCBs (ppb)											
ALDRIN	ND	ND	ND	ND	ND	ND	NA(1)	ND	0.05	ND	ND
4,4'-DDE	797	426	185	213	1390	823	NA(1)	896	0.10	ND	ND
ENDRIN	65	ND	ND	ND	ND	ND	NA(1)	ND	0.03	ND	ND
4,4'-DDD	95	141	ND	555	330	ND	NA(1)	7895	0.13	ND	ND
ENDOSULFAN SULFATE	291	101	53	ND	360	ND	NA(1)	ND	ND	ND	70.71

TABLE 3 (Continued)

SUMMARY OF THE OU3 MEAN AREA CONTAMINANT CONCENTRATION

Contaminant	Mean Contaminant Concentrations										
	Surface Soil Samples			Sediment Samples					Surface Water	Cooper Lake Samples	
	Swale Area	South of Swale	West of Swale	Ponded Area	South of Ponded Area	East of Berm #2	South of Swale	Site Perimeter		Surface Water	Sediment
4,4'-DDT	93	24	ND	ND	ND	240	NA(1)	ND	ND	ND	ND
AROCHLOR-1248	1600	ND	ND	ND	ND	ND	NA(1)	ND	ND	ND	ND
AROCHLOR-1254	2133	2200	ND	ND	7400	ND	NA(1)	2900	ND	ND	ND
TOTAL PEST	1340	692	238	768	2080	1063	0	8791	0	0	71
TOTAL PCBs	3733	2200	0	0	7400	0	0	2900	0	0	0
INORGANICS (ppm)											
ARSENIC	34.29	21.20	6.23	102.50	47.60	52.30	19.70	21.28	0.07	ND	5.57
BARIUM	592.98	317.40	192.78	356.00	808.50	1250.30	327.00	120.83	0.42	0.03	33.21
CADMIUM	13.31	5.94	15.45	10.50	18.20	14.60	6.25	ND	0.02	0.00	ND
CHROMIUM	62.01	45.60	19.55	44.30	70.30	125.50	46.30	14.16	0.07	ND	14.28
COBALT	10.93	10.60	4.65	14.30	17.80	26.80	11.30	9.30	0.04	0.00	5.73
COPPER	70.07	52.90	21.60	75.50	104.70	136.10	72.40	40.02	0.10	ND	26.48
LEAD	289.91	196.80	43.65	219.80	308.80	405.00	300.00	81.07	0.13	0.00	19.30
MERCURY	0.61	0.49	ND	1.20	1.48	1.12	0.58	0.31	0.00	ND	ND
NICKEL	22.65	27.30	7.30	32.10	44.70	46.70	36.20	18.92	0.07	ND	10.08
ZINC	278.02	295.00	79.68	310.90	390.40	417.70	226.50	125.47	0.47	0.02	ND

Notes:
1. ND denotes not detected.
2. NA(1) denotes organic data not available for this area. Data has been included with surface soil data.

File: tab4-24.wk3
Last Rev: 05/14/93

TABLE 4

Chemical Leaman Analytical Results
SURFACE WATER

Summary of Inorganic Analytes Detected

Parameter		Hits/Samples		Minimum	-	Maximum	Average
ALUMINUM	ug/l	10	10	147.00	-	49500.00	13229.00
ANTIMONY	ug/l	3	10	14.30	-	21.20	16.70
ARSENIC	ug/l	10	10	3.40	-	285.00	74.37
BARIUM	ug/l	10	10	42.80	-	1260.00	415.34
BERYLLIUM	ug/l	3	10	2.80	-	4.40	3.33
CADMIUM	ug/l	2	10	18.00	-	28.90	23.45
CALCIUM	ug/l	10	10	11100.00	-	150000.00	45580.00
CHROMIUM	ug/l	5	10	6.40	-	116.00	67.84
COBALT	ug/l	7	10	5.20	-	101.00	41.07
COPPER	ug/l	6	10	3.20	-	246.00	96.97
IRON	ug/l	10	10	3890.00	-	142000.00	45592.00
LEAD	ug/l	9	10	0.00	-	644.00	129.81
MAGNESIUM	ug/l	10	10	5040.00	-	66200.00	17879.00
MANGANESE	ug/l	10	10	264.00	-	2240.00	1009.10
MERCURY	ug/l	1	10	0.88	-	0.88	0.88
NICKEL	ug/l	6	10	5.70	-	165.00	72.78
POTASSIUM	ug/l	10	10	3410.00	-	310000.00	38083.00
SODIUM	ug/l	10	10	5120.00	-	18400.00	11718.00
VANADIUM	ug/l	6	10	11.00	-	260.00	118.77
ZINC	ug/l	10	10	0.00	-	2120.00	472.04

1) The minimum and maximum range, and average include hits only.
2) Duplicate samples were not included in the calculations.
3) Data qualifiers were not considered.

Samples represented in this table include:

SW-1, SW-2, SW-3, SW-4, SW-8
SW-9, SW-10, SW-11, SW-27, SW-28

TABLE 4

Chemical Leaman Analytical Results
SURFACE WATER

Summary of Volatile Compounds Detected

Parameter	Hits/Samples	Minimum - Maximum	Average

Summary of Semivolatile Compounds Detected

Parameter		Hits/Samples		Minimum	-	Maximum	Average
BIS (2-ETHYLHEXYL) PHTHA	ug/l	2	9	4.00	-	17.00	10.50

Summary of Pesticide Compounds Detected

Parameter		Hits/Samples		Minimum	-	Maximum	Average
ALDRIN	ug/l	1	10	0.05	-	0.05	0.05
4,4'-DDE	ug/l	5	10	0.02	-	0.24	0.07
ENDRIN, TOTAL	ug/l	1	10	0.03	-	0.03	0.03
4,4'-DDD	ug/l	2	10	0.13	-	0.24	0.19
ALPHA-CHLORDANE	ug/l	1	10	0.03	-	0.03	0.03
GAMMA-CHLORDANE	ug/l	1	10	0.02	-	0.02	0.02

1) The minimum and maximum range, and average include hits only.
2) Duplicate samples were not included in the calculations.
3) Data qualifiers were not considered.

Samples represented in this table include:

SW-1, SW-2, SW-3, SW-4, SW-8
SW-9, SW-10, SW-11, SW-27, SW-28

TABLE 4
Chemical Leaman Analytical Results
COOPER LAKE SEDIMENT SAMPLES
Organic/Inorganic Detects

SAMPLE NAME ->		BACKGROUND SD-30	SD-31	SD-32	CSD-1	CSD-2	CSD-3	CSD-4	CSD-5	CSD-6	CSD-7	CSD-8	CSD-9
GROUP: VOLATILES													
ACETONE	ug/kg	600.00 J	270.00 J	300.00 J	-----	-----	760.00 J	1500.00 J	-----	-----	-----	-----	-----
2-BUTANONE	ug/kg	220.00 J	47.00 J	-----	-----	36.00 J	240.00 J	470.00 J	-----	-----	-----	-----	-----
1,1,1-TRICHLOROETHANE	ug/kg	7.00 J	-----	-----	-----	-----	-----	46.00 J	-----	-----	-----	-----	-----
TOLUENE	ug/kg	16.00 J	450.00 J	34.00 J	-----	-----	-----	130.00 J	-----	-----	-----	2.00 J	-----
GROUP: SEMIVOLATILES													
BIS (2-ETHYLHEXYL) PHTHALATE	ug/kg	-----	-----	-----	190.00 J	-----	430.00 J	-----	-----	-----	180.00 J	210.00 J	250.00 J
GROUP: PESTICIDES/PCBs													
ENDOSULFAN SULFATE	ug/kg	-----	-----	-----	53.00	71.00 J	86.00 J	160.00 J	37.00 J	-----	-----	45.00	43.00
GROUP: INORGANICS													
ALUMINUM	mg/kg	17000.00	2910.00	8210.00	1200.00	6940.00	6810.00	17500.00	950.00	1890.00	2850.00	881.00	1900.00
ARSENIC	mg/kg	24.20 *J	4.40 *J	13.80 *J	0.91 BN*J	8.00 NJ	9.60 NJ	21.90 NJ	1.50 BN*	2.20 N*J	3.10 N*J	1.10 BN*J	1.80 BN*J
BARIUM	mg/kg	161.00 J	29.80 BJ	168.00 J	4.20 B	44.80 BJ	52.30 BJ	168.00 BJ	4.40 B	5.70 B	8.90 B	4.20 B	6.40 B
CHROMIUM	mg/kg	37.60 J	6.80 J	14.40 J	3.40	25.20 J	27.00 J	50.80 J	3.20	4.10	6.50	3.50	4.80
COBALT	mg/kg	10.50 BJ	2.30 BJ	6.50 BJ	-----	7.00 BJ	10.00 BJ	13.40 BJ	-----	1.00 B	1.50 B	-----	1.50 B
COPPER	mg/kg	40.90 EJ	10.70 EJ	46.90 EJ	16.60	21.70 J	24.60 J	43.00 J	-----	-----	-----	-----	-----
IRON	mg/kg	20900.00	5140.00	9720.00	799.00	14400.00	14100.00	34400.00	1620.00	3380.00	6220.00	3270.00	4230.00
LEAD	mg/kg	136.00 J	48.00 J	222.00 J	2.70	31.80 J	43.80 J	82.00 J	2.40	3.70	2.50	3.00	1.80
NICKEL	mg/kg	24.00 BJ	5.40 BJ	21.90 BJ	-----	11.80 BJ	14.80 BJ	27.30 BJ	-----	-----	2.10 B	2.20 B	2.30 B

QUALIFIERS:
B = Value is less than the CRDL but greater than the IDL.
J = Estimated
N = Spiked sample recovery not within control limits.
R = Rejected
U = Undetected
W = Post-digestion spike out of control limits.
* = Duplicate analysis not within control limits.

TABLE 4
Chemical Leaman Analytical Results
COOPER LAKE SOIL SAMPLES
Organic/Inorganic Detects

SAMPLE NAME ->		BACKGROUND SS-BG1	SS-BG2	SS-BG3	CSS-1	CSS-2	CSS-3
SAMPLE TYPE ->		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
GROUP: VOLATILES							
TOLUENE	ug/kg	R	R	-----	3.00 J	-----	-----
GROUP: SEMIVOLATILES + BENZIDINE							
BIS (2-ETHYLHEXYL) PHTHALATE	ug/kg	160.00 J	150.00 J	94.00 J	210.00 J	190.00 J	130.00 J
GROUP: PESTICIDES/PCBs							
ENDOSULFAN SULFATE	ug/kg	-----	45.00 J	37.00 J	50.00	38.00	-----
GROUP: INORGANICS							
ALUMINUM	mg/kg	9910.00	7480.00	3600.00	2020.00	6010.00	2960.00
ARSENIC	mg/kg	14.00 *J	8.10 *J	5.90 *J	2.10 N*J	13.70 N*J	14.00 N*J
BARIUM	mg/kg	66.10 J	46.00 BJ	17.80 B	11.40 B	33.60 B	18.70 B
CHROMIUM	mg/kg	15.20 J	12.00 J	6.00 J	6.40	9.10	3.90
COBALT	mg/kg	4.90 B	4.10 B	1.90 B	1.40 B	2.60 B	1.60 B
COPPER	mg/kg	9.80 BJ	8.40 BJ	4.80 B	2.70 B	8.10	2.90 B
IRON	mg/kg	13700.00	12200.00	7600.00	3570.00	7540.00	4140.00
LEAD	mg/kg	36.90 J	26.20 J	27.60 J	9.50	25.10	15.30
NICKEL	mg/kg	8.00 B	6.50 B	2.00 B	1.90 B	5.10 B	3.00 B

QUALIFIERS:
B = Value is less than the CRDL but greater than the IDL.
J = Estimated
N = Spiked sample recovery not within control limits.
R = Rejected
U = Undetected
W = Post-digestion spike out of control limits.
* = Duplicate analysis not within control limits.

TABLE 5

CREATED WETLAND PLANT LIST

Botanical Name	Common Name
Tree and Shrubs	
Acer rubrum L.	Red maple
Alnus rugosa	Speckled alder
Chamaecyparis thyoides	Atlantic White Cedar
Cephalanthus occidentalis L.	Common buttonbush
Ilex laevigata	Smooth holly
Fraxinu pennsylvanica Marsh.	Green ash
Fraxinus nigra	Black ash
Gleditsia aquatica Marshall	Water-locust
Juniperus Virginiana	Eastern Red Cedar
Magnolia virginiana L.	Sweetbay
Nyssa sylvatica Marsh.	Swamp tupelo
Persea borbonia (L.) Spreng.	Red bay
Quercus bicolor	Swamp white oak
Salix species	Willow
Ulmus americana L.	American elm
Herbs and Ground Cover	
Carex species	Sedge
Cyperus species	Flatsedge
Dulichium arundinaceum (L.)	BrittonThree-way sedge
Eleocharis species	Spike rush
Hydrocotyle umbellata L.	Marsh pennywort
Leersia oryzoides	Rice cutgrass
Juncus effusus L.	Soft rush
Juncus scirpoides Lam.	Needle-pod rush
Nymphaea odorata Ait.	Fragrant white water-lily
Panicum species	Panic grass
Peltandra virginica (L.)	KunthGreen arum
Polygonum punctatum Ell.	Dotted smartweed
Pontederia cordata L.	Pickerelweed
Rhynchospora inundata (Oakes) Fern.	Inundated beakrush
Scirpus species	Bulrush
Sagittaria species	Arrowhead

Table A

Chemical Leaman Operable Unit Three

Summary of Sediment/Soil Constituent Concentrations (mg/kg)

COMPOUND	FREQ. OF DETECTION	MEAN CONC.	95% UCL	MAXIMUM CONC.
Endosulfan Sulfate	8/17	0.13	0.22	0.8
PCB (1248)	1/17	0.42	0.8	1.6
PCB (1254)	3/17	0.81	1.5	2.9
Benzo(b) Fluoranthene	9/17	0.8	1.2	2.0
Benzo(a)Pyrene	6/16	0.75	0.98	1.2
Ideno(1,2,3-CD) Pyrene	4/16	0.80	1.1	1.5
Aluminum	17/17	11,370	21637	28600
Antimony	2/14	4.5	10	14.9
Arsenic	18/18	28	68.6	94.9
Barium	17/17	499	1416	2210
Beryllium	15/18	0.67	1.4	2
Cadmium	15/18	11.4	59.8	33.1
Lead	18/18	235	1298	600
Vanadium	17/17	33.5	64.5	59.6

Table B

Exposure Pathways Considered in Human Health Risk Assessment

Current and Future Scenario

Adolescent Trespasser

- Incidental ingestion of sediments and soils of swale
- Dermal contact with sediments and soils of swale

The trespasser is assumed to visit the site once a week, four months out of the year, for twelve years.

Table C

Noncarcinogenic Toxicity Factors for the Contaminants of Concern

Contaminant	RfD
Endosulfan Sulfate	5×10^{-5} (i)
PCB 1248	7×10^{-5}* (i)
PCB 1254	7×10^{-5}* (i)
Benzo (b) Fluoranthene	NA
Benzo (a) Pyrene	NA
Ideno (123cd) Pyrene	NA
Aluminum	2 (o)
Antimony	4×10^{-4} (i)
Arsenic	3×10^{-4} (i)
Barium	7×10^{-2} (i)
Beryllium	5×10^{-3} (i)
Cadmium	5×10^{-4} (i)
Lead	NA
Vanadium	7×10^{-3}

Notes:

i = Toxicity Factor from USEPA IRIS Database
NA = Toxicity Factor is Not Available for the Compound
NAP = Toxicity Factor is Not Applicable for the Compound
o = Toxicity Factor from Other USEPA Documents
* = Toxicity Factor for Aroclor 1016 was used for Other PCB compounds

Table D

Noncarcinogenic Risk Estimates for Adolescent Trespasser in Current and Future Scenario

Contaminant	Estimated Daily Intake (mg/kg)	Hazard Quotient
Endosulfan Sulfate	2.1×10^{-8}	2.7×10^{-4}
PCB 1248	8.8×10^{-8}†	7.4×10^{-4}
PCB 1254	1.7×10^{-7}†	1.3×10^{-3}
Benzo (b) Fluoranthene	9.5×10^{-8}	NA
Benzo (a) Pyrene	9.7×10^{-8}	NA
Ideno (123cd) Pyrene	1.1×10^{-7}	NA
Aluminum	1.1×10^{-3}	6.8×10^{-4}
Antimony	8.9×10^{-7}	1.5×10^{-3}
Arsenic	2.9×10^{-6}	1.4×10^{-2}
Barium	1×10^{-4}	1.2×10^{-3}
Beryllium	8.1×10^{-8}	1.7×10^{-5}
Cadmium	2.1×10^{-6}†	4.1×10^{-3}
Lead	3.7×10^{-6}	NA
Vanadium	3.5×10^{-6}	5.4×10^{-4}
TOTAL HI		2.4×10^{-2}

Notes:

† = Includes Dermal Exposure

NA Noncarcinogenic toxicity factor is not available for this compound

Table E

Carcinogenic Slope Factors (SFs) for Contaminants of Concern

Contaminant	SF
Endosulfan Sulfate	NA
PCB 1248	7.7 (i)
PCB 1254	7.7 (i)
Benzo (b) Fluoranthene	0.73 (e)
Benzo (a) Pyrene	7.3 (e)
Ideno (123cd) Pyrene	0.73 (e)
Aluminum	NC
Antimony	NC
Arsenic	1.75 (o)
Barium	NC
Beryllium	4.3 (i)
Lead	NA
Vanadium	NC

Notes:

e = Toxicity factor from USEPA Environmental Criteria and Assessment Office in Cincinnati, OH
i = Toxicity factor from USEPA IRIS Database
NA = Toxicity factor is not available for the compound
NC = The compound is a non-carcinogen and has no slope factor
o = Toxicity factor from other USEPA documents
* = Toxicity factor for Aroclor 1016 was used for other PCB compounds

Table F

Carcinogenic Risk Estimates for Adolescent Trespasser in Current and Future Scenario

Contaminant	Estimated Daily Intake (mg/kg)	Cancer Risk
PCB 1248	8.8×10^{-8}†	6.6×10^{-8}
PCB 1254	1.7×10^{-7}†	1.2×10^{-7}
Benzo (b) Fluoranthene	9.5×10^{-8}	9.6×10^{-9}
Benzo (a) Pyrene	9.7×10^{-8}	7.3×10^{-8}
Ideno (123cd) Pyrene	1.1×10^{-7}	8.6×10^{-9}
Arsenic	2.9×10^{-6}	1.3×10^{-5}
Beryllium	8.1×10^{-8}	6.5×10^{-8}
TOTAL RISK		1.6×10^{-5}

Notes:

† = Includes Dermal Exposure

Table G - 1

Contaminant Concentration Data in Surface Water Used in the Environmental Evaluation (all values ug/l)

Contaminant	Frequency of Detection	Minimum - Maximum	Average
Aluminum	10/10	147 - 49,500	13,229
Arsenic	10/10	3.4 - 285	74
Cadmium	2/10	18 - 29	23
Chromium	5/10	6.4 - 116	68
Copper	6/10	3.2 - 246	97
Iron	10/10	3890 - 142,000	45,592
Lead	9/10	0 - 644	130
Mercury	1/10	0.88	0.88
Nickel	6/10	6 - 165	73
Zinc	10/10	1 - 2120	472
Aroclor 1254	0/10	0	0
DDT	0/10	0	0
Endosulfan Sulfate	0/10	0	0

Table G - 2

Contaminant Concentration Data in Sediment
Used in the Environmental Evaluation (all values mg/kg)

Contaminant	Frequency of Detection	Minimum - Maximum	Average
Aluminum	31/31	702 - 33,000	10,131
Arsenic	31/31	1 - 303	58
Cadmium	14/31	5 - 32	12
Chromium	31/31	3 - 182	49
Copper	31/31	3 - 196	77
Iron	31/31	578 - 27,200	12,972
Lead	31/31	1 - 568	220
Mercury	17/31	0.13 - 2.1	1
Nickel	30/31	3.4 - 65	32
Zinc	28/28	19 - 759	271
Aroclor 1254	2/30	2.9 - 7.4	5.2
DDT	1/31	0.24	0.24
Endosulfan Sulfate	1/30	0.36	0.36

Table G - 3

Contaminant Concentration Data in Surface Soil Used in the Environmental Evaluation (all values mg/kg)

Contaminant	Frequency of Detection	Minimum - Maximum	Average
Aluminum	21/21	3810 - 28,600	11,803
Arsenic	22/22	3.6 - 95	27.6
Cadmium	20/22	1.7 - 33	12
Chromium	22/22	5 - 197	53
Copper	20/22	16 - 184	62
Iron	21/21	7540 - 30,700	16,615
Lead	22/22	5.9 - 600	237
Mercury	12/22	0.12 - 1.4	0.6
Nickel	21/22	2.2 - 42	22
Zinc	22/22	8.8 - 767	258
Aroclor 1254	5/21	1.3 - 3.1	2.2
DDT	2/21	0.024 - 0.093	0.059
Endosulfan Sulfate	10/21	0.05 - 0.8	0.2

TABLE II POTENTIAL RECEPTORS CHEMICAL LEAMAN

SUBJECTS	Body Weight	EXPOSURE	DIET
Barred owl* Strix varia	462 grams	Rests in swamp/ forest. Forages near rivers and wet woods	Rodents/birds/crayfish
Green heron** *Butorides striatus*	162 grams	Fringe zones of swamps / ponds/ marshes. Forages in mud. Prefers thickets with snags in water ,slow moving streams	Fish 40%/ Insects 30%and 24% crustaceans(Eckert,A.W., 1987)
Bog turtle**** *Clemmys muhlenbergii* (turtles)	+100 grams	Muddy streams/ marshy pastures	Aquatic insects
Sunfish*** *Centrarchidae sp?*	+100 grams	Water's edge under logs vegetation	Dominant invertebrates
Vole(t) *Microtus sp?*	+ 20 grams	Nests and rests in underground burrows	Approximately 50% vegetation and invertebrates
Snapping turtle***** *Chelydra serpentina*	10 to 35 lbs	Prefers shallow streams with muddy bottom 12 months over wintering in mud or dens	Approximately 36% vegetation and carrion/ amphibia (Ernst,C.H. 1972)
Bullfrog**** Rana catesbeiana	+ 200 grams	Rivers or ponds winters in bottom in mud	Prefers invertebrates including crayfish and beetles, dragonflies and spiders(Johnson, T.R. 1987)
INVERTEBRATES	————	Stream bed/ mud/surface water	Vegetation/invertebrates

*SITING DYNAMAC:LOCATION NOT REPORTED(1992)
**SITING (R.BARNETT MAY 1991)EAST ACCESS ROAD- YOUNG AND ADULTS
****SITING (R. BARNETT JUNE, 1991) INLET CREEK WESTERN GROVE ROAD 9:00AM
*****SITING(R. BARNETT MAY,1991) ON SITE WESTERN ASPECT BY PARKING LOT NUMEROUS INCLUDING EGG LAYING
(t) Tracks observed

Table I Potential Ecological Receptor Pathways

Receptor	Activity: Foraging	Activity: Nesting	Activity: Resting	Definition
Bullfrog *Rana catesbeinana*	High: site wide	→	→	Low Infrequent probability of exposure due to habitat requirements and /or subject behavior
Bog Turtle *Clemmys muhlenbergii*	Low: Siting on southern boundary of site prefer streams. Habitat not desirable site wide	→	→	Moderate Occasional exposure that may be limited by migration and /or subject number and /or foraging range
Barred Owl *Strix varia*	Low: prefers running water for foraging	Low: Solitary subject. Avoids intrusive activities of humans	Low: prefers resting in canopy	High Desirable habitat with frequent foraging resting and nesting opportunities largely confined to site
Green Heron *Butrorides striatus*	Moderate: Forages within sediment. Range 0.5 to 1.0 Km. reduces frequency of exposure	Moderate: Nesting actvity observed in area I	Low: Rest in canopy and scrubs	
Snapping Turtle *Chelyda serpentina*	Low to Moderate: prefers slow moving streams	Moderate: travels overland to nest in upland areas (numerous siting on site-includes nesting on site)	Moderate: in mud	
Invertebrates	High: site wide	→	→	

Potential Ecological Receptor Pathways continued

Receptor	Actvity		
	Foraging	Nesting	Resting
Vole *Microtus sp?*	High: site wide	⟶	⟶
Sunfish *Centrarchida sp?*	Low: Siting on southern boundary of site, prefer streams. Habitat not desirable site wide	⟶	⟶
Definitions	<u>Low</u> Infrequent probability of exposure due to habitat requirements and /or subject behavior	<u>Moderate</u> Occasional exposure that may be limited by migration and /or subject number and /or foraging range	<u>High</u> Desirable habitat with frequent foraging, resting and nesting opportunities largely confined to site