# Record of Decision

## Malone Service Company Superfund Site
## Texas City, Texas

**September 2009**

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
**REGION 6**

9109310

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# PART 1: THE DECLARATION

## A. SITE NAME AND LOCATION

The Malone Service Company, Inc. (MSC) Superfund Site (hereinafter "the Site) is located on Campbell Bayou Road in Texas City, Galveston County, Texas (see Figure 1 - Site Location Map). The National Superfund Database Identification Number is TXD980864789. The Site is an inactive waste disposal facility on the shores of Swan Lake and Galveston Bay.

During operations by the Malone Service Company, approximately 75 acres of the 150-acre Site were developed for storage, processing and disposal of industrial hazardous wastes. For the purposes of the Remedial Investigation (RI), the Site was divided into three study areas: source material (sludge), soils, and ground water. This Record of Decision (ROD) addresses all areas and media within the Site, including the sludge, soils, and ground water, as one Operable Unit (OU).

## B. STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedy for the MSC Superfund Site in Texas City, Texas, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 United States Code §§ 9601, et seq., as amended, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) Part 300, as amended.

This decision was based on the Administrative Record for this Site, which has been developed in accordance with Section 113(k) of CERCLA, 42 U.S.C. § 9613(k), and which is available for review at the Moore Memorial Public Library in Texas City, Texas, and at the Texas Commission on Environmental Quality in Austin, Texas. The Administrative Record Index (Appendix A to the ROD) identifies each of the items comprising the Administrative Record upon which the selection of the remedial action is based.

The State of Texas, acting through the Texas Commission on Environmental Quality (TCEQ), concurs with the selected remedy.

## C. ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Past operations at this facility have resulted in the release of hazardous substances, pollutants and contaminants to Site soils and ground water, and source material (oily sludge) remains present in the Site Earthen Impoundment, American Petroleum Institute (API) separators, above-ground storage tanks (ASTs), and in subsurface soils. If not addressed, the sludge, contaminated soils, and contaminated ground water pose an unacceptable risk to human health and the environment.

## D. DESCRIPTION OF THE SELECTED REMEDY

This ROD sets forth the selected remedy for the Site to address sludge, soil and ground water contamination resulting from past operations at the facility. The remedy for the Site oily sludge, which is

the principal threat source material at the Site, includes use of a technology, solidification, that permanently reduces the toxicity, mobility, and/or volume of hazardous substances present at the Site. The solidified sludge will be consolidated into a Resource Conservation and Recovery Act (RCRA) Subtitle C equivalent cell, removing or minimizing exposure to human and ecological receptors. The remedy also includes remediation of Site soils, because the Site risk assessment identified soils as a potential threat to human health and the environment. The contaminated soils also will be consolidated into the RCRA Subtitle C equivalent cell. The contaminated shallow ground water plumes at the Site originate from the source areas; the shallow ground water is non-potable (non-drinking water), the contaminated plumes appear to remain on-site, and the risk posed is only from potential inhalation of vapors from the ground water. The remedy for the ground water is monitoring to detect if there is off-site migration or migration to uncontaminated aquifers above the TCEQ Class 3 Protective Concentration Levels (PCL; 30 Texas Administrative Code [TAC], Chapter 350, Subchapter D) for commercial/industrial and background levels (specifically for metals). If EPA determines that a contaminated ground water plume has the potential to migrate off-site or to an uncontaminated aquifer, an active remedy, such as containment or a treatment remedy may be required. Institutional controls will be used to mitigate risks of vapor inhalation from the contaminated ground water.

The major components of the selected remedy, which are summarized below and further described in Section 2.12 (Selected Remedy), are:

- **Sludge (Principal Threat Waste):** Remove Site sludge, including all sludge from the Earthen Impoundment (which includes the Sludge Pit and Oil Pit), API separators, ASTS (tanks), and source material located in other areas of the Site below ground surface (in subsurface soils), and solidify. Transfer and consolidate solidified sludge into an on-site, aboveground Resource Conservation and Recovery Act (RCRA) Subtitle C equivalent cell.

- **Soil:** Remove and consolidate soils with contamination exceeding the Site remediation levels into the RCRA Subtitle C equivalent cell. Backfill excavated areas to ground surface with clean soil.

- **Ground Water:** Install ground water monitoring wells to monitor Site ground water and the RCRA Subtitle C equivalent cell. Ground water monitoring of contaminated ground water plumes will document if natural attenuation (NA) is effective in degrading the plumes, and will detect any off-site migration or migration to uncontaminated aquifers of contaminants in ground water above the TCEQ Class 3 Groundwater PCLs and metals concentrations greater than TCEQ PCLs and background levels. If the U.S. Environmental Protection Agency (EPA) determines that contaminants in ground water are migrating to a Site boundary monitoring well, and potentially off-site, or migrating to an aquifer not currently known to be contaminated, an active remedy (e.g., extraction, containment) may be required. Monitoring will be required for a minimum of 30 years, or until the ground water is found to be uncontaminated. The location of additional monitoring wells to achieve the remedial action objectives will be determined during the remedial design. It may be determined during the remedial action that additional monitoring wells are needed.

- **Institutional Controls (ICs):** ICs such as a notification, information device, deed restriction and/or easement, will be placed on the Site property to protect the integrity of the remedy and to prevent exposure to hazardous substances. The ICs will be prepared and recorded in the appropriate land records office and will show the location and concentrations of Contaminants of Concern (COCs) present in the ground water underlying the Site. For the IC component for ground water, information on the nature and extent of ground water contamination will be updated annually. ICs, such as prohibiting construction of buildings in areas impacted by contaminated ground water, will be used to prevent inhalation exposure from vapor intrusion. The ICs will restrict any excavation or drilling to

ground water, and will also prohibit disturbance of the on-site cap. ICs will provide long-term protection by reducing the potential risk for people to be exposed.

The selected remedy has an estimated present value cost of approximately $56.4 million dollars. It is estimated that it will take 18 months to complete the design phase and 48 months to implement the remedy. The RCRA Subtitle C equivalent cell will remain for as long as the contained waste remains hazardous.

The Site Feasibility Study assumes that the future use of the Site will be as a nature conservancy, and the selected remedy will reduce the concentration of hazardous substances present in the Site soils to levels allowing for limited reuse of the property as a natural preservation area or conservancy. This assumption was made because the Malone Cooperating Parties (MCP), a group of private companies who committed to perform the RI/FS, reached a court-approved settlement agreement in November 2007 with the former Site owner. The court-approved settlement enables the MCP to impose an institutional control (IC) on the property prohibiting residential, commercial, and industrial development. The settlement further requires that the land eventually be transferred to an environmental non-profit organization or, if such a transfer cannot be completed, requires that the land be used in the future only to complete the response action and for purposes not inconsistent with final use as a natural preservation or conservation area.

# E. STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, and is cost effective. It utilizes permanent solutions and treatment technologies to the maximum extent practicable. The selected remedy complies with the statutory preference for treatment as a principal element (i.e., it reduces the toxicity, mobility, or volume of hazardous substances through treatment) because solidification of the Site source material (the sludge) will reduce the mobility of hazardous substances.

Because the selected remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure (UU/UE), statutory five-year reviews will be conducted beginning five years after initiation of the remedial action to ensure that the remedy continues to be protective of human health and the environment (42 U.S.C. § 9621(c)). Subsequent reviews will occur every five years thereafter.

# F. DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD (Part 2). Additional information can be found in the Administrative Record file for this Site.

- COCs and their respective concentrations (Section 2.5.6, page 2-20)
- Source materials constituting principal threat wastes which have been identified at this Site (Section 2.5.5, page 2-19)
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of ground water used in the Baseline Human Health Risk Assessment and ROD (Section 2.6, page 2-27)
- Baseline risk represented by the COCs (Section 2.7, pages 2-28 to 2-45)

- Remediation (cleanup) levels established for COCs and the basis for these levels (Section 2.8, pages 2-45 to 2-49)
- How source materials constituting principal threats are addressed (Section 2.11, page 2-71 and Section 2.13.5, pages 2-76)
- Potential land and ground water use that will be available at the Site as a result of the selected remedy (Section 2.12.4, page 2-73 to 2-74)
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected (Section 1.D, page 1-2 and Section 2.12.3, page 2-73)
- Key factor(s) that led to selection of the final remedial alternative (Section 2.12.1, page 2-71 to 2-72)

## G. AUTHORIZING SIGNATURE

This Record of Decision documents the selected remedy for source material, contaminated soils, and contaminated ground water at the Malone Service Company Superfund Site. This remedy was selected by the EPA with the concurrence of the TCEQ. The Director of the Superfund Division, Region 6, has been delegated the authority to approve and sign this Record of Decision.

U.S. Environmental Protection Agency (Region 6)
By:

/s/ for Samuel Coleman 9-30-09

Samuel Coleman, P.E. Date
Director, Superfund Division

**CONCURRENCE PAGE**
**RECORD OF DECISION FOR OPERABLE UNIT 1**
**MALONE SERVICE COMPANY SUPERFUND SITE**

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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AOC | Area of Contamination |
| ARAR | Applicable or Relevant and Appropriate Requirement |
| AST | Aboveground Storage Tank |
| ASTM | American Society for Testing and Materials |
| ATSDR | Agency for Toxic Substances and Disease Registry |
| AUF | Area-Specific Use Factor |
| BERA | Baseline Ecological Risk Assessment |
| bgs | Below Ground Surface |
| BHHRA | Baseline Human Health Risk Assessment |
| CDI | Chronic Daily Intake |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CERCLIS | Comprehensive Environmental Response, Compensation, and Liability Information System |
| CFR | Code of Federal Regulations |
| CIP | Community Involvement Plan |
| cm/sec | Centimeters Per Second |
| COC | Contaminant of Concern |
| COPC | Chemical of Potential Concern |
| CPT | Cone Penetrometer Testing |
| CSM | Conceptual Site Model |
| DNAPL | Dense Non-Aqueous Phase Liquid |
| DPT | Direct Push Technology |
| E&E | Ecology and Environment |
| ELCR | Excess Lifetime Cancer Risk |
| EPA | U.S. Environmental Protection Agency Region 6 |
| EPC | Exposure Point Concentration |
| ESD | Explanation of Significant Differences |
| ºF | Degrees Fahrenheit |
| FEMA | Federal Emergency Management Agency |
| FRL | Federal Register Listing |
| FS | Feasibility Study |
| GCL | Geosynthetic Clay Liner |
| GCWDA | Gulf Coast Waste Disposal Authority |
| GBNEP | Galveston Bay National Estuary Program |
| GSI | Groundwater Services, Inc. |
| GWBU | Ground Water Bearing Unit |
| HDPE | High-Density Polyethylene |
| HEAST | Health Effects Assessment Summary Tables |
| HI | Hazard Index |
| HQ | Hazard Quotient |
| HAS | Hollow Stem Auger |
| HW | Hazardous Waste |
| IC | Institutional Control |
| IRIS | Integrated Risk Information System |
| Kg | Kilograms |
| LDR | Land Disposal Restrictions |
| LOAEL | Lowest Observable Adverse Effect Level |
| $m^3$/day | Cubic Meters Per Day |

| | |
|---|---|
| MCL | Maximum Contaminant Level |
| MCP | Malone Cooperating Parties |
| mg/kg | Milligrams Per Kilogram |
| mg/kg-day | Milligrams Per Kilogram Per Day |
| mg/L | Milligrams Per Liter |
| MNA | Monitored Natural Attenuation |
| MRL | Minimal Risk Level |
| MSC | Malone Service Company, Inc. |
| msl | Mean Sea Level |
| MSSL | Medium-Specific Screening Level |
| NA | Natural Attenuation |
| NAPL | Non-Aqueous Phase Liquid |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NOAEL | No Observable Adverse Effect Level |
| NPL | National Priorities List |
| O&M | Operations and Maintenance |
| OU | Operable Unit |
| PAH | Polycyclic Aromatic Hydrocarbon |
| PCB | Polychlorinated Biphenyl |
| PCDD | Polychlorinated Dibenzo-Dioxin |
| PCDF | Polychlorinated Dibenzo-Furan |
| PCE | Tetrachloroethene |
| PCL | Protective Concentration Level |
| PEF | Particle Emission Factor |
| PID | Photoionization Detector |
| PMZ | Plume Management Zone |
| POE | Point of Exposure |
| ppb | Parts Per Billion |
| ppm | Parts Per Million |
| PPRTV | Provisional Peer Reviewed Toxicity Values |
| PR | Preliminary Review |
| PRAER | Preliminary Remedial Alternatives Evaluation Report |
| PRG | Preliminary Remediation Goal |
| PRP | Potentially Responsible Party |
| PSCR | Preliminary Site Characterization Report |
| psi | Pounds Per Square Inch |
| QA | Quality Assurance |
| QAPP | Quality Assurance Project Plan |
| QC | Quality Control |
| RA | Remedial Action |
| RAO | Remedial Action Objective |
| RfC | Reference Concentration |
| RfD | Reference Dose |
| RI | Remedial Investigation |
| RME | Reasonable Maximum Exposure |
| ROD | Record of Decision |
| S/S | Solidification/Stabilization |
| SARA | Superfund Amendments and Reauthorization Act |
| SF | Slope Factor |
| Site | Malone Service Company, Inc. Superfund Site |
| SLERA | Screening Level Ecological Risk Assessment |

| | |
|---|---|
| SPLP | Synthetic Precipitation Leaching Procedure |
| SSI | Screening Site Inspection |
| SVOC | Semivolatile Organic Compound |
| SWL | Southwest Laboratories |
| SWMP | Storm Water Management Plan |
| SWMU | Solid Waste Management Unit |
| TAC | Texas Administrative Code |
| TCDD | Tetrachlorodibenzo-P-Dioxin |
| TCE | Trichloroethene |
| TCEQ | Texas Commission on Environmental Quality |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TDS | Total Dissolved Solids |
| TEQ | Toxic Equivalent |
| TNRCC | Texas Natural Resource Conservation Commission (predecessor agency of TCEQ) |
| TRV | Toxicity Reference Value |
| UCL | Upper Confidence Limit |
| UCS | Unconfined Compressive Strength |
| UF | Uncertainty Factors |
| UIC | Underground Injection Control |
| USACHPPM | U.S. Army Center for Health Promotion and Preventive Medicine |
| VOC | Volatile Organic Compound |
| VSI | Visual Site Inspection |
| $yd^3$ | Cubic Yards |
| $\mu g/m^3$ | Micrograms Per Cubic Meter |

# GLOSSARY OF TERMS

***Applicable or Relevant and Appropriate Requirements (ARARs)*** – Generally, any Federal, State, or local requirements or regulations that would apply to a Remedial Action if it were not being conducted under CERCLA, or that, while not strictly applicable, are relevant in the sense that they regulate similar situations or actions, and are appropriate during implementation of a particular Remedial Action. These requirements may vary among sites and alternatives.

***Cap*** – A layer of clay or other impermeable material installed over the top of a closed cell/landfill to prevent entry of rainwater, minimize leachate, and prevent wind dispersal of waste materials. Caps can be composed of natural materials (clay), or geosynthetic clay liners [GCLs]), or artificial substances (high-density polyethylene [HDPE], or linear low-density polyethylene [LLDPE]).

***Class 3 Ground Water*** – non-potable ground water; not used as a drinking water source due to a saline or total dissolved solids content of greater than 10,000 parts per million (TAC Title 30, Part 1, Chapter 350, Rule §350.52).

***Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*** – Also known as Superfund. CERCLA is a Federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act. The Acts created a special tax that goes into a Trust Fund, commonly known as Superfund, to investigate and clean up abandoned or uncontrolled hazardous waste sites. Under the program, EPA can either: (1) pay for site cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work; or (2) take legal action to force parties responsible for site contamination to clean up the site or pay back the Federal government for the cost of cleanup.

***Contaminant of Concern (COC)*** – A contaminant at a Superfund site that is considered among the most abundant and/or the most toxic chemicals. When a contaminant of concern is targeted for cleanup, other chemicals that may be present typically will also be removed.

***Ecological Risk Assessment (ERA)*** – The application of a formal framework, analytical process, or model to estimate the effects of human actions(s) on a natural resource and to interpret the significance of those effects in light of the uncertainties identified in each component of the assessment process. Such analysis includes initial hazard identification, exposure and dose-response assessments, and risk characterization.

***Feasibility Study (FS)*** – A detailed evaluation of alternatives for cleaning up a site.

***Ground Water*** – Water found beneath the ground surface that fills the pores between soil, sand, and gravel particles to the point of saturation. When it occurs in a sufficient quantity and quality, ground water can be used as a water supply.

***Hazard Quotient (HQ)*** – The ratio of estimated site-specific exposure to a single chemical from a site over a specified period to the estimated daily exposure level at which no adverse health effects are likely to occur.

***Human Health Risk Assessment (HHRA)*** – Estimates the current and possible future risk if no action were taken to clean up a site. EPA's Superfund risk assessors determine how threatening a hazardous waste site is to human health and the environment. They seek to determine a safe level for each

potentially dangerous contaminant present (e.g., a level at which ill health effects are unlikely and the probability of cancer is very small).

***Institutional Controls (ICs)*** – Administrative and/or legal instruments that reduce the potential for human exposure to contaminated soil, soil vapor, or ground water by placing restrictions on the use or development of land and ground water within a defined area. IC instruments include restrictive covenants, deed notices, ordinances, zoning restrictions, building and excavation permits, easements, well drilling prohibitions, or the like, or any combination thereof. The selection of IC instruments must be mutually acceptable to the TCEQ and the EPA.

***Cell/Landfill*** – (1) Sanitary landfills are disposal sites for non-hazardous solid wastes spread in layers, compacted to the smallest practical volume, and covered by material applied at the end of each operating day. (2) Secure chemical landfills are disposal sites for hazardous waste, selected and designed to minimize the chance of release of hazardous substances into the environment.

***Leachate*** – Water that collects contaminants as it trickles through wastes, pesticides, or fertilizers. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, ground water, or soil.

***Leachate Collection System*** – A system that gathers leachate and pumps it to the surface for treatment.

***Liner*** – A relatively impermeable barrier designed to keep leachate inside a landfill. Liner materials can be composed of natural materials (clay or geosynthetic clay liners [GCLs]) or artificial substances (high density polyethylene [HDPE] or linear low density polyethylene [LLDPE]).

***Maximum Contaminant Level (MCL)*** – MCLs are established under the Safe Drinking Water Act and are protective levels set for human exposure to a chemical in a drinking water source.

***Monitoring*** – Monitoring is the ongoing collection of information about the environment that helps gauge the effectiveness of a cleanup action. Monitoring wells and probes installed at different locations/depths/ levels at a site are used to detect the presence of COCs in ground water and soil.

***National Oil and Hazardous Substances Pollution Contingency Plan (NCP)*** – The NCP is the Federal regulation that guides determination of the sites to be corrected under both the Superfund program and the program to prevent or control spills into surface waters or elsewhere.

***National Priorities List (NPL)*** – EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term Remedial Action under Superfund. A site must be on the NPL to receive money from the Trust Fund for Remedial Action.

***Natural Attenuation (NA)*** – NA refers to the natural degradation processes that achieve site-specific remedial objectives. The natural attenuation processes that are at work in such a remedial approach include a variety of physical, chemical, and/or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil and ground water. These *in situ* processes include biodegradation, dispersion, dilution, sorption, volatilization, and chemical or biological stabilization, transformation, or destruction of contaminants. Under the proper conditions, natural attenuation can contribute significantly to remediation of COCs.

***Non-Aqueous Phase Liquids (NAPL)*** – A NAPL is an organic substance that is relatively insoluble in water and may be lighter or heavier than water. "Light" NAPL tend to float on the water table, while "dense" NAPL tend to sink.

***Operable Unit*** – An operable unit is a discrete action that comprises an incremental step toward comprehensively addressing site contamination.

***Point of Compliance*** – As a general definition, the point of compliance for ground water is where a facility should monitor ground water quality and/or achieve Ground Water Standards to meet specific goals (definition at 40 CFR 264.95). The regulations require facilities to take action, if necessary, to achieve cleanup or containment levels within the volume of contaminated ground water at and beyond the point of compliance. Regulated Units are defined in 40 CFR 264.90 as surface impoundments, waste piles, land treatment units, and landfills. If the final ground water cleanup objective is to contain a plume rather than to return the ground water to its maximum beneficial use, the point of compliance should generally be located at and, if appropriate, beyond the boundary of the containment zone.

***Preliminary Remediation Goal (PRG)*** – PRGs are upper concentration limits for individual chemicals in environmental media and land use combinations that are anticipated to protect human health or the environment. For clarity, in the process of screening a soil against a certain contaminant, we define the health-risk-based preliminary remediation goal (PRG) as the contaminant concentration above which some remedial action may be required. Thus, PRG is the first standard (or guidance) for judging a site. The PRG levels developed for this Site subsequently became the remediation levels for the Site.

***Principal Threat Wastes*** – Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. Wastes that generally will be considered to constitute principal threats include, but are not limited to, the following: (1) Liquid Source Material – waste contained in drums, lagoons or tanks, free product in the subsurface containing contaminants of concern; (2) Mobile Source Material – surface soil or subsurface soil containing high concentrations of COCs that are (or potentially are) mobile due to wind entrainment, volatilization (e.g., volatile organic compounds [VOCs]), surface runoff, or subsurface transport; (3) Highly-Toxic Source Material – buried drummed non-liquid wastes, buried tanks containing non-liquid wastes, or soils containing significant concentrations of highly toxic materials.

***RCRA Subtitle C Equivalent Cell (Landfill) and Cap*** – Generally, a cell (e.g., landfill) constructed to prevent movement of solids or liquids into or from the cell. During construction, the cell is lined on all sides and below with natural and synthetic (man-made) materials, and a leachate collection system is installed. Once the waste material has been placed into the cell, the cell is capped with a RCRA Subtitle C-compliant cap, which is a combination of natural and synthetic layers which prevent moisture from entering the waste area of the cell. The leachate collection and removal systems are installed to collect and convey liquids/leachate which may be released from the overlying waste and control the depth of leachate above the liner. A leak detection system is designed to detect leachate that may have escaped the primary liner.

***Record of Decision (ROD)*** – A ROD is a public document that provides the justification for the remedial action (cleanup) chosen at a National Priority Listed (Superfund) site. It also contains site history, site description, site characteristics, community participation, enforcement activities, past and present activities, contaminated media, the contaminants present, and the scope and role of the response action.

***Remedial Action*** – The actual construction or implementation phase of a Superfund site cleanup that follows Remedial Design.

***Remedial Action Objective (RAO)*** – Objective established for CERCLA remedial actions that define the extent to which sites require cleanup to meet the objective of protecting human health and the environment.

***Remedial Design*** – A phase of Remedial Action that follows the Remedial Investigation/Feasibility Study and includes development of engineering drawings and specifications for a site cleanup.

***Remedial Investigation (RI)*** – The collection and assessment of data to determine the nature and extent of contamination at a site.

***Remediation Levels –*** Remediation levels establish acceptable exposure levels (i.e., contaminant concentration levels) that are protective of human health and the environment, and are developed considering applicable, relevant, and appropriate requirements (ARARs), as specified in the NCP. The remediation levels for the Site are the same as the PRGs established in the FS. The term "remediation level" is used in order to make clear that the selected remedy establishes binding requirements to ensure that RAOs are satisfied. Remediation levels are the basis for defining the areas and volumes of environmental media subject to remedial action; the lower of the human health or ecological remediation level will be used in this determination.

***Resource Conservation and Recovery Act (RCRA)*** – The Federal act that established a regulatory system to track hazardous wastes from the time they are generated to their final disposal. RCRA also provides for safe hazardous waste management practices and imposed standards for transporting, treating, storing, and disposing of hazardous waste.

***Screening Criteria*** – Values or concentrations used with very conservative assumptions of risk (1$^{st}$ Tier checking of environmental data); do not include site-specific information.

***Source Material*** – A source material is material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to ground water, surface water, or air, or acts as a source for direct exposure.

***Sources of Contamination*** – EPA typically describes sources as contaminated material that acts as a reservoir for the continued migration of contamination to surrounding environmental media (i.e., soil, ground water, surface water, sediment, or air), or provides a direct threat to a receptor.

***Texas Commission on Environmental Quality (TCEQ)*** – The State of Texas regulatory entity responsible for environmental matters for the State including the permitting and cleanup of the Site. TCEQ includes and is used interchangeably in this ROD with its predecessor agencies including the Texas Natural Resource Conservation Commission (TNRCC), the Texas Water Commission (TWC), the Texas Department of Water Resources (TDWR), and the Texas Water Quality Board (TWQB).

***Vapor Intrusion*** – Vapor phase migration of volatile organic and/or inorganic compounds into occupied buildings from underlying contaminated ground water and/or soil. Vapor Intrusion issues are addressed in EPA guidance documents, including but not limited to, OSWER – EPA530-D-02-004, November 2002.

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# PART 2: THE DECISION SUMMARY

This Decision Summary provides a description of the site-specific factors and analyses that led to the selection of the sludge, contaminated soil, and ground water remedy for the Site. It includes background information about the Site, the nature and extent of contamination observed in environmental media, the assessment of human health and environmental risks associated with potential exposure to the contaminants present in environmental media, and the identification and evaluation of remedial action alternatives for the Site.

## 2.1 SITE NAME, LOCATION, AND BRIEF DESCRIPTION

The Malone Service Company, Inc. (MSC) Superfund Site (the Site), which operated from approximately 1964 to 1996, is a former waste disposal facility and reclamation plant for waste oils and chemicals. The National Superfund Database Identification Number is TXD980864789. The former facility consisted of approximately 150 total acres, with approximately 75 acres developed for operations. The Site is located on Campbell Bayou Road in Texas City, Galveston County, Texas (Figure 1). The Site is bordered to the east by Galveston Bay and to the northeast by Swan Lake, which is an embayment of Galveston Bay. The closed Solutia South 20 Site borders the Site on the southwest. The land directly north and west (approximately 200 acres) is owned by Gulf Coast Waste Disposal Authority (GCWDA); GCWDA provides landfill disposal of non-hazardous wastes to area industrial facilities. The former Texas City Municipal Landfill is located adjacent to and north of the GCWDA property, and northwest of the Site. Undeveloped marsh and wetlands owned by Scenic Galveston, a non-profit land trust and conservation organization, border the southern portions of the Site; Scenic Galveston owns the remaining 1,500-acre property surrounding GCWDA and the Site, and controls access to the Site.

The MSC Site is enclosed by a storm surge levee with an average elevation of 18 feet and a maximum elevation inside the levee of approximately 5 feet above sea level. All precipitation which falls on the Site is collected in hazardous waste management units or in site drainage ditches. While the access road is gated, the Site is otherwise unfenced.

The facility is approximately two miles south of the Texas City Industrial Complex, which includes several oil refineries, oil tank farms, chemical plants, loading docks, shipyards, and municipal and hazardous waste landfills. The geographic coordinates are latitude 29° 19’ 59” north and longitude 94° 54’ 18” west. The nearest residential center to the Site is Bayou Vista, approximately 1.5 miles to the west. No public water supply or domestic drinking water wells were identified within a 1-mile radius of the Site. GCWDA has one active industrial well on-site; the well is screened from 260 to 280 feet. Water from this well is not used for drinking water, but the well is connected to a shower and sink.

The Site was operated by the Malone Service Company (MSC) as a permitted waste disposal facility for more than thirty years. The MSC facility was permitted as a commercial storage, processing, and disposal facility authorized to store and process industrial solid waste and hazardous wastes. The facility was also permitted in 1970 to dispose of liquid hazardous and non-hazardous waste by means of deep well injection. The permit authorized the discharge of storm water runoff. The State of Texas revoked the facility permits on May 6, 1997, due to repeated permit violations.

Contaminants of concern (COCs) identified at the Site include metals, semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), dioxin, and polychlorinated biphenyls (PCBs). Contaminants exist in sludge, soil, and ground water. The COCs in soil and sludge are presented on Tables 1 and 2. A more complete description of the Site can be found in Section 1.0 of the Remedial

Investigation Report (URS 2006a). The U.S. Environmental Protection Agency (EPA) was the lead agency during the RI/FS and for the preparation of the Record of Decision (ROD); the TCEQ is the support agency. There are potentially responsible parties (PRPs) identified for the Site; a group of PRPs, known as the Malone Cooperating Parties, funded and conducted the Remedial Investigation/Feasibility Study (RI/FS) pursuant to an administrative order on consent with EPA.

## 2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

This section of the ROD provides the history of the Site and a brief summary of TCEQ's, MSC's, EPA's, and the Malone Cooperating Parties' (MCP's) investigation work, as well as TCEQ's and EPA's enforcement efforts.

### 2.2.1 History of Site Operations/Activities

MSC began operating the Site in 1964 as a reclamation plant and disposal facility for waste oils and chemicals. Six storage and disposal pits, reclaiming tanks, and a burning pit were permitted. The facility was permitted to dispose of liquid hazardous and non-hazardous waste by means of deep well injection; two injection wells were used—WDW-73 (permitted 1970) and WDW-138 (permitted 1977). The MSC facility was permitted as a commercial storage, processing, and disposal facility authorized to store and process industrial waste under a Texas Natural Resources Conservation Commission (TNRCC – predecessor agency of TCEQ) Hazardous Waste (HW) permit on September 14, 1984. The permit authorized the receipt of Class 1 (hazardous) and Class 2 (non-hazardous) industrial solid waste, and authorized the discharge of storm water runoff.

MSC received a variety of waste products from surrounding industries, including acids and caustics; contaminated residues and solvents; spent drilling fluids; acids containing heavy metals, inorganic slurries, gasoline and crude oil tank bottoms; contaminated earth and water from chemical spill cleanups; general industrial plant wastes; phenolic tars; and waste oils. The recent RI Report documented that the COCs at the Site include metals, SVOCs, VOCs, as well as dioxin and PCBs (Tables 1 and 2).

The identified operating areas at the Site included the Earthen Impoundment (Sludge Pit and Oil Pit); the Unit 100 API Separator; the Unit 1200 Separator; the WDW-138 injection well; the WDW-73 injection well; the Unit 900 Distillation Area; and the Unit 300, Unit 400, Unit 700, and Unit 800 tanks. Non-operating areas at the Site include the surface water features, the drainage ditch system, the Cemetery Area, and the Laydown Area. In addition, other portions of the Site, designated as Unused Area 1, Unused Area 2, and the Borrow Area, are included in the non-operating areas (Figure 2).

The liquids injected into the two deep wells included wastewater submitted to the facility for disposal; storm water from the Sludge Pit, the Oil Pit, and the separators; and decontamination water collected in the separators. During MSC operations, waste materials accumulated in the Earthen Impoundment, API separators, and tanks.

### 2.2.2 Enforcement Actions/Activities

The State of Texas ordered MSC to take the Earthen Impoundment (i.e., the Sludge Pit and Oil Pit) out of service in 1979. MSC began closure of the impoundment as a unit not subject to Resource Conservation and Recovery Act (RCRA) regulations in 1983. A synthetic cover/liner and sand were placed in one portion of the impoundment and a leachate collection system was installed around the perimeter of the impoundment. The Oil Pit portion of the Earthen Impoundment was capped with soil.

The State of Texas filed suit against MSC alleging improper waste disposal and waste permit violations. Based upon a jury finding that MSC seriously violated its permits, judgment was entered against MSC on August 14, 1989, and became final in 1993. In May 1997, the TNRCC revoked MSCs hazardous waste storage and injection well permits. In January 1996, prior to the final Order revoking the permits, all waste shipments to the Site ceased (TNRCC 1998).

In July 1998, the TNRCC and the State of Texas Office of the Attorney General filed to force MSC into involuntary Chapter 7 bankruptcy. Subsequently, the property was auctioned in Federal Bankruptcy Court and was awarded to Southeast Texas Environmental LLC in September 1999. The MSC Site was proposed for placement on the National Priorities List (NPL) on August 24, 2000. The Final NPL Listing was effective on July 16, 2001. The Site was subsequently acquired by Regor Properties in December 2001.

On September 29, 2003, EPA entered into an Administrative Order on Consent (Order No. 06-18-03) with the MCP to conduct an RI/FS. The MCP is composed of private companies who committed to perform the RI/FS. The MCP assumed storm water management activities at the Site from EPA in 2004; the Order was amended on July 19, 2004, to document this transfer of responsibilities.

In November 2007, the MCP reached a court-approved settlement agreement with the former Site owner, which requires that the land eventually be transferred to an environmental non-profit organization or, if such a transfer cannot be completed, requires that the land be used in the future only to complete the response action and for purposes not inconsistent with final use as a natural preservation or conservation area.

### 2.2.3 History of Federal and State Investigations

Historic investigations were conducted by MSC and predecessor agencies of TCEQ. MSC conducted a ground water assessment for the closure of the Earthen Impoundment in May 1982 (Law 1982). Results of the assessment were submitted to the TWC. The assessment consisted of exploratory soil borings for stratigraphy data and geotechnical parameters, and collection of water quality samples from piezometers (wells) and the deep water supply well.

EPA conducted a preliminary review (PR) of the available site information followed by a visual site inspection (VSI) in August 1988 (Kearney et. al. 1989). The purpose of these activities was to identify releases or potential releases requiring investigation at hazardous waste management facilities. Solid waste management units (SWMUs) and other areas of concern were identified during the inspection. The histories of the SWMUs and waste handling activities were documented in the PR/VSI report submitted to EPA (Kearney et. al. 1989).

The TNRCC conducted a Screening Site Inspection (SSI) in January 1997. SSI activities included on-site and off-site reconnaissance, record searches, on-site and off-site sample collection, and interviews with site representatives (TNRCC 1998). The EPA Region 6 Response and Prevention Branch conducted removal assessment activities at the Site in 1999.

EPA and the MCP (the PRPs) conducted several investigations from 2004 to 2008. Historic documents were reviewed to develop an understanding of Site operations and Site soils and ground water contamination. The Preliminary Site Characterization Report (PSCR) (URS 2004a) and the Preliminary Remedial Alternatives Evaluation Report (PRAER) (URS 2004b) documents were developed following the review. The MCP began active sampling of the Site in July 2005 through 2007 to define nature and

extent of contamination in soils and ground water, and define the risks to human health and ecological receptors. The documents developed in this period were the RI Report (URS 2006a), which determined the nature and extent of contamination; the Baseline Human Health Risk Assessment (BHHRA) Report (URS 2007a); and the Baseline Ecological Risk Assessment (BERA) Report (URS 2007b). The Stabilization/Solidification Treatability Study Report (Shaw 2008) was completed to determine effective reagents, which would solidify the sludge for placement in a RCRA Subtitle C or D cell (landfill). The FS Report (URS 2008) was developed to present potential remedies for Site wastes.

### 2.2.4 History of CERCLA Removal Actions

The EPA Region 6 Response and Prevention Branch conducted removal assessment activities at the Site between July and October 1999. Objectives of the assessment included: (1) identify the quality of actual and potential runoff from the Site; (2) determine the available freeboard of on-site containment; (3) evaluate the condition of on-site tanks and characterize tank contents; (4) inventory facility laboratory contents; (5) inventory and characterize on-site drums, buckets, and containers; 6) evaluate and characterize the two API separators; (7) perform preliminary inspection of settling basin (sludge pit) impoundment containment, and (8) evaluate the condition of the two on-site Class 1 injection wells.

Following the removal assessment activities, the EPA Region 6 Response and Prevention Branch conducted an emergency response action in April and May 2000 (Ecology and Environment [E&E] 2000). Approximately 1,767,196 gallons of material were removed from the tanks with approximately 1,987,807 gallons of solids and sludge remaining in the tanks. Approximately 918,024 gallons of oil were sent to recyclers and cement kilns (E&E 2000). In addition, underground injection well WDW-138 was rehabilitated during November 1999 to receive hazardous liquids during the response action. Water that accumulated in the surface impoundments and tank containment areas during rain events was pumped to the WDW-138 injection well. Approximately 3,227,867 gallons of tank liquids and storm water were disposed of in WDW-138 between December 1999 and May 2000.

Following the September 29, 2003, Administrative Order on Consent (the Order) agreement between EPA and the MCP, the MCP agreed to an Order amendment (signed July 19, 2004), whereby the MCP assumed storm water management activities from the EPA Region 6 Response and Prevention Branch. To date, the MCP continues management of storm water. The Storm Water Management Plan (SWMP) – Deep Well Operations and Maintenance Plan (URS 2005a), sets forth the requirements to manage the storm water runoff from the Site pursuant to Paragraph 34 of the Administrative Order on Consent (Order Number 06-18-03), as amended. Storm water management activities include: (1) the management of precipitation that falls on the Site, but not in hazardous waste management units, to be directed to the surface discharge point to Galveston Bay via drainage ditches; prior to discharge the storm water is sampled, following analytical parameters in the SWMP, and discharged off-site into Galveston Bay; (2) precipitation which falls within the hazardous waste management units, and requires extraction to maintain freeboard, is pumped from the bermed containment areas to the on-site injection well for disposal following injection well disposal parameters in the SWMP.

The EPA approved a request from the MCP to remove tank liquid contents; the Addendum No. 1 to the SWMP (URS 2007c) was approved by EPA in November 2007. To enhance the storm water management program, the MCP removed oil and water-phase liquids from deteriorated tanks located at the Site from October through December 2007. The purpose of the removal was to reduce fluid levels, consisting of varying amounts of oil and water, within the tanks and thereby lessen the potential for uncontrolled releases within the Site. Tanks on the Site contained varying amounts of oil, water, and sludge. Oil consisted of the residual oil remaining after the EPA removal action in 2000 (E&E 2000). Water in the tanks consisted of rainwater accumulated over time through holes in the tank roofs. Residual

sludge in the tanks included a thick oily residue and non-pumpable oil/water emulsion and solids. Approximately 169,100 gallons (4,025 barrels) of oil were recycled off-site. Approximately 461,251 gallons (10,892 barrels) of water were disposed in the on-site injection well, WDW-138. Approximately 43,680 gallons (1,040 barrels) of water were placed in the separators for future disposal into the on-site injection well. The action was completed on January 10, 2008. The residual sludge remaining in the tanks includes a thick oily residue and non-pumpable oil/water emulsion and solids, which will be managed during the Remedial Action (RA) phase of the project.

### 2.2.5 Site Listed to NPL

The EPA published a proposed rule on August 24, 2000 (Federal Register Listing [FRL] 6856-7, Vol. 65, No. 165, pages 51567-51572), to add the Malone Service Company Site to the NPL of Superfund sites. The Site was added to the NPL in a final rule published on June 14, 2001 (FRL 6994-4, Vol. 66, No. 115, pages 32235-32242). The effective date of the amendment to the NCP listing the Site on the NPL was July 16, 2001.

## 2.3 COMMUNITY PARTICIPATION

Following the Site's NPL listing, EPA has kept the community informed on Site activities through informational meetings, public meetings, issuance of Fact Sheets, maintenance of a public website (http://www.epa.gov/earth1r6/6sf/pdffiles/0602922.pdf), as well as meetings and communications with Texas City officials. Specific information on community participation is summarized in the following subsections.

### 2.3.1 Community Involvement Plan

A Community Involvement Plan (CIP) (U.S. EPA 2005a) was prepared to facilitate two-way communication between the local community and EPA and to encourage community involvement in Site activities. EPA utilizes the CIP to ensure that residents are informed and provided with opportunity to participate in Site decisions. A copy of the CIP, dated May 1, 2005, is provided in the Administrative Record.

### 2.3.2 Community Participation Activities

Community participation to date has included the following activities:

- Fact sheets sent to citizens on the Site mailing list;
- Meetings with citizens and Texas City representatives; and
- Public Meeting following issuance of the Proposed Plan.

A Fact Sheet was distributed to the community to announce the availability of the Proposed Plan. The Proposed Plan for the Site was made available to the public in May 2009 and can be found in the Administrative Record maintained with the TCEQ, EPA Region 6, and at the Moore Memorial Public Library in Texas City. The notice of the availability of the Proposed Plan was published in the *Galveston County Daily News* on May 20, 2009. A public comment period was held from May 22 to June 22, 2009. In addition, a public meeting was held in Texas City on June 9, 2009, to present the Proposed Plan to the community. At this meeting, representatives from EPA and the TCEQ answered questions about the Site and the remedial alternatives presented in the Proposed Plan. EPA's responses to the comments received

during the public comment period for the Proposed Plan are included in the Responsiveness Summary (Part 3) of this ROD.

### 2.3.3 Local Site Repository

The purpose of the local Site Repository is to provide the public a location near the community to review and copy background and current information about the Site. The Site's repositories are located at:

**EPA Region 6**
7th Floor Reception Area
1445 Ross Avenue, STE 12D13
Dallas, TX 75202-2733
Toll free: 1-800-533-3508 or (214) 665-6597
Monday – Friday, 7:30 – 11:00 a.m./1:00 – 4:00 p.m.

**Texas Commission on Environmental Quality**
Records Management Center
Technical Park Center Bldg. E., 1st Floor
12100 Park Circle
Austin, TX 78753
Toll free: 1-800 633-9363 or (512) 239-9363
Monday – Friday, 8:00 a.m. – 5:00 p.m.

**Moore Memorial Public Library, Texas City**
1701 9th Avenue N.
Texas City, TX 77590
(409) 643-5979
Monday – Wednesday, 9:00 a.m. – 9:00 p.m.
Thursday – Friday, 9:00 a.m. – 6:00 p.m.
Saturday, 10:00 a.m. – 4:00 p.m.

## 2.4 SCOPE AND ROLE OF RESPONSE ACTION

EPA has chosen to address Site contamination with only one operable unit for this Site; the selected RA addresses all contaminated environmental media (sludge, soil, and ground water) in this operable unit. This response action is the final Site remedy and is intended to address fully the threats to human health and the environment posed by the conditions at this Site.

The selected remedy was developed by combining components of different source control and management of migration alternatives to obtain a comprehensive approach for Site remediation. The purpose of this response action is to implement a site-wide strategy to: (1) reduce risks to human health and ecological receptors from the Site sludge (the principal threat waste/source material) and contaminated soils by solidifying the sludge and placing the solidified material, as well as unsolidified contaminated soils, in an on-site RCRA Subtitle C equivalent cell (landfill); and (2) monitor ground water for degradation of chemical constituents and to detect and mitigate any off-site migration of ground water above the TCEQ Class 3 Groundwater Protective Concentration Levels (30 Texas Administrative Code [TAC], Chapter 350, Subchapter D) for commercial/industrial settings, and prevent exposure to contaminated ground water onsite through institutional controls. This RA will remediate the Site to levels

appropriate for reuse as a preserve or conservancy. The remedial methods can be found in Section 2.9 of this ROD.

TCEQ Class 3 PCL values are greater than the MCL values because Class 3 ground water is non-potable; in contrast, MCLs address drinking water aquifers. The TCEQ, as partner with EPA Region 6, uses its "Tier 1 Groundwater PCLs" to address Class 2 and 3 ground water. The TCEQ PCLs for Class 3 ground water values will be used to define the plume concentrations, above which, the plume cannot migrate off-site. Off-site migration must be addressed with action levels because a surface water discharge point is not known.

# 2.5 SITE CHARACTERISTICS

This section of the ROD provides a brief description of the Site's characteristics, and the RI sampling strategy and results. This section also presents the Conceptual Site Model (CSM), which illustrates contaminant sources, release mechanisms, exposure pathways, migration pathways, and potential receptors. Detailed information on the Site's characteristics and RI findings can be found in the RI Report (URS 2006a). Section 2.0 of the FS contains an overview of the RI (URS 2008). The significant findings of the RI are summarized below.

## 2.5.1 Conceptual Site Model

The CSM is a three-dimensional "picture" of site conditions that illustrates contaminant sources, release mechanisms, exposure pathways, migration routes, and potential human and ecological receptors. It documents current and potential future site conditions and shows what is known about human and environmental exposure through contaminant release and migration to potential receptors. The risk assessment and response action for the sludge, contaminated soil, and ground water is based on this CSM. The CSM for the site is presented in the BHHRA and BERA, which relate to specific media and investigative areas of the Site (see Figure 2 – Investigative Areas).

The primary identified sources of contamination at the Site are oily sludge located in the Earthen Impoundment, the Unit 100 APU Separator, the Unit 1200 API Separator, and Aboveground Storage Tanks (ASTs). Estimates for the total sludge volume range from approximately 184,000 to 246,000 cubic yards ($yd^3$) with an average of 215,000 $yd^3$. The other sources of oily sludge are buried pits and source material which has migrated into subsurface soils.

The primary release mechanisms leading to ground water contamination include the 5-acre Sludge Pit and 0.5-acre Small Oil Pit in the Earthen Impoundment area, both of which are 37 feet deep and extend into the paleochannel aquifer. An earthen berm surrounds the pits, and approximately 23 feet of the pits are below the original ground surface. Additional release mechanisms include leaks and spills from ASTs, two API oil/water separators, and two buried pits containing a soil-sludge mixture, all of which add some subsurface contamination.

Secondary sources of contamination are contaminated soils, which exist due to general Site operations, such as spills from stockpiling of materials and equipment, and construction of shallow pits used for burning or short-term storage. Leaching to ground water is a potential secondary release mechanism from the contaminated soils. VOCs may partition into the vapor phase from the dissolved-phase ground water.

Class 3 ground water contaminant concentrations appear to be relatively minor but constant, with the ground water plume remaining near the specific source areas (Figure 3). Ground water contamination has

been documented in some parts of the shallow paleochannel aquifer, with minor contamination in the floodplain silts (overbank material), which exist along both sides of the paleochannel. A more detailed analysis of the hydrogeology of the Site is given below. No public or private off-site wells exist within one mile of the Site.

Potentially sensitive populations, such as residential receptors, are not expected for the Site because it is an isolated facility in an industrial area. Long-term continuous exposure to Site conditions is also not expected. However, complete exposure pathways to surface soil, subsurface soil and ground water were identified for construction workers, industrial workers, and recreational bird watchers, and a complete exposure pathway to surface water was identified for recreational waders, fishers or swimmers (BHHRA Report). Full detail of the potential exposure pathways for each area are contained in the BHHRA.

The only feature on the Site which may be considered an archaeological or historic feature is a cemetery dating to the 1800s (approximately 75 feet by 75 feet).

**Site Hydrogeology**

The dominant hydrogeologic unit beneath the MSC Superfund Site is the paleochannel. A secondary distributary channel bifurcates from the main channel in the area between the Freshwater Pond and Earthen Impoundment.

The vadose zone (the unsaturated zone above the water table) is fairly uniform across the Site. The vadose zone in the vicinity of the plume areas ranges in thickness from 10 to 12 feet, and consists of predominantly clays with some minor silty clay lenses (Figures 4 and 5); due to the overlying clays, the shallow paleochannel aquifer and associated floodplain silts are confined.

Shallow ground water beneath the MSC Superfund Site is primarily restricted to the fine silty sands in the buried paleochannel. Three additional transmissive or potentially transmissive zones have also been identified outside the paleochannel (the –10 zone, the –20 zone, and the –40 zone). These zones generally consist of interbedded silty clay, silty and clayey to silty sand layers. Beneath some parts of the Site, these transmissive or potentially transmissive zones are laterally continuous, whereas they are thin or absent in other areas. In areas where the paleochannel is present, the upper part of the paleochannel may coincide with the –10 zone, and may be continuous into the underlying –20 zone. The -40 zone is underlain by a thick clay to at least 80 feet below ground surface.

Considering the confined nature of the shallow paleochannel aquifer, infiltration of contaminants to ground water from surface soils is assumed to be minor; the primary source of contaminants to ground water appears to be from pits excavated through the shallow clays into the paleochannel or floodplain silts, as evidenced on Figures 5, 6, and 7. The saturated paleochannel varies in thickness from approximately 14 to 20 feet, and consists of unconsolidated sands and silty sands; the associated floodplain silts are approximately 2 to 4 feet thick.

Ground water at the Site was evaluated site-wide. Using the TCEQ Ground Water Resource Classification Logic Diagram, the applicable ground water classification for the contaminated shallow ground water is Class 3; Class 3 ground water resources are not considered usable as drinking water and are not subject to drinking water criteria. The shallow aquifer or Ground Water Bearing Unit (GWBU), at the Site does not meet the requirements to be designated as Class 1, because the affected ground water is greater than 1 mile from a public water supply well; the GWBU is shallower than 800 feet; and the water is saline (total dissolved solids [TDS] greater than 10,000 milligrams per liter [mg/L]). In addition, the GWBU does not meet the Class 2 criteria of a production zone within 0.5 mile of the Site that is used for human consumption, agriculture, or other exposure that could result in human or ecological exposure.

Class 3 ground water is non-potable; however, Class 3 ground water contaminant levels are applicable. Concentrations of benzene, 1,2-dichloroethane, and trichloroethene have been detected in ground water in excess of the TCEQ Class 3 Groundwater Protective Concentration Levels (PCLs). The contaminated shallow ground water is localized near three areas of former operations. Because the ground water is not usable as drinking water, the potential risk was evaluated in the BHHRA based on inhalation of volatile emissions from impacted ground water.

Twenty-two site monitoring wells (four are duals) were completed in the late 1970s and early 1980s; an additional seven monitoring wells were completed in 2006. Several historic ground water gauging periods have documented that ground water flow is at times in to the Site or out to Galveston Bay. It appears that tidal effect, at times, redirects the flow of ground water from and into the Site. Although ground water flow velocity could be calculated, the values would be inaccurate and the data would be unusable in a numerical transport model due to the change in ground water gradient – flow direction. Regardless of the flow direction, ground water flow is along the center of the paleochannel, which consists of one channel entering at the west corner of the site, bifurcating at the center of the Site, with each bifurcated channel exiting east and south of the Site (Figure 7). The apparent stable nature of the contaminant plumes, based on available historic analytical data, is possibly due to one or a combination of low contaminant source dissolution, relatively rapid degradation rates, and/or low mobility/transport velocity due to tidal affect on ground water.

The Site is enclosed by an 18-foot-high storm surge levee; all precipitation which falls on the Site is collected in hazardous waste management units or in site drainage ditches. Water within hazardous waste units is pumped to the injection well for disposal; all remaining storm water is redirected by the drainage ditches to a sump, and is discharged to Galveston Bay if storm water samples meet the SWMP parameters.

### 2.5.2 Site Overview

The Site encompasses approximately 150 acres, with the former MSC operations occupying approximately 75 acres (Figure 1). The Site is located within the Texas City limits, but in a remote location southeast of the City. The Census Bureau estimated in 2006 that Texas City is home to approximately 45,070 residents. The city is approximately 167.2 square miles in size, of which 62.4 square miles are land and 104.9 square miles are water (some sections of water within the Texas City limits are within Chambers County), and has a population density of approximately 665 persons per square mile. The nearest residential center to the Site is Bayou Vista, approximately 1.5 miles to the west.

The climate for the Texas City area is characterized by high humidity and mild climate. Average temperatures in winter are 55 degrees Fahrenheit (°F) and 82°F in summer (U.S. Department of Agriculture [USDA] 1988). The average annual rainfall from 1964 to 2002 was 50.6 inches, with heavy rains in winter and early spring. The annual lake surface evaporation rate for the same period was 48.0 inches. Since 1964, several major tropical storms and hurricanes have passed through or near the Galveston-Houston area. The 24-hour rainfall record (43 inches) for the continental United States was recorded in Alvin, Texas during Tropical Storm Claudette in 1979. A maximum storm surge of 22 feet was recorded during Hurricane Carla in 1961 (URS 2006a).

The Site is located adjacent to marsh land and the west bank of Galveston Bay. The topography of the Site is generally flat. The Virginia Point 7.5-minute, topographic quadrangle map shows the Site land surface averaging about 5 feet above mean sea level (msl). The waste management facilities were

constructed inside the 18-foot-high flood protection levee, which completely surrounds the Site, are at elevations ranging from approximately 5 to 8 feet above msl (U.S. Geological Survey [USGS] 1994).

The Site is approximately 2 miles south of the Texas City Industrial Complex. No public water supply or domestic drinking water wells were identified within a 1-mile radius of the Site. There are no known or suspected surface water drinking intakes located in the Lower Galveston Bay segment.

## 2.5.3 Site Features

Site features can be found on Figure 2. The key Site facility components are:

Earthen Impoundment (Sludge Pit and Oil Pit)
Other Pits
Freshwater Pond
Unit 100 API Separator
Unit 1200 API Separator
ASTs
Sumps
Distillation Unit
Injection Wells
Buildings, Utilities, and Wells
Decanning Area
Cemetery
Laydown Area

Of these, the former operating areas at the Site include the Earthen Impoundment (the Sludge Pit and the Oil Pit), the Unit 100 API Separator, the Unit 1200 Separator, the WDW-138 injection well, the WDW-73 injection well, the Unit 900 Distillation Area, and the Unit 300, Unit 400, Unit 700, and Unit 800 tanks. The primary locations of residual waste materials at the MSC Superfund Site are the Earthen Impoundment (the Sludge Pit and the Oil Pit), the Unit 100 API Separator, the Unit 1200 API Separator, and the ASTs, all of which contain oily sludge. Oily sludge has been found in soils in the Maintenance Area, near the Tank 800 Area, and in the Cemetery Area, discussed below.

Non-operating areas at the Site include the surface water features, the drainage ditch system, the Cemetery Area, and the Laydown Area. In addition, other portions of the Site, designated as Unused Area 1, Unused Area 2, and the Borrow Area for the purposes of the RI, are included in the non-operating areas. While these areas are called "non-operating," significant contamination has been identified in at least two of these areas, the Cemetery Area and the Laydown Area; subsurface soils in the Cemetery Area also contain source material. Surface water features at the Site include the drainage ditches and the Freshwater Pond; the off-site surface feature investigated during the RI is the Marsh Area, northeast of the Site, between the levee and Swan Lake, which received storm water discharge from the Site.

The following is a description of the operating and non-operating areas of the Site. These areas are depicted on Figure 2.

### 2.5.3.1 Non-Operating Areas

*Laydown Area*

MSC used the Laydown Area for storage of miscellaneous equipment, debris, and concrete rubble that remains on-site. There is no evidence of waste disposal activities in the Laydown Area, but the miscellaneous equipment, debris, and concrete rubble may have contained waste materials. Soil surfaces in some portions of the Laydown Area contain asphaltic-like materials and sulfur. Visual observations demonstrate the discharge/runoff from on-site drainage ditches was (and is currently) channeled to the Freshwater Pond and the Laydown area.

*Cemetery Area*

The Campbell Bayou Cemetery is located on the property, between Unit 900 and the Oil Pit, and is part of the investigative area referred to as the Cemetery Area. The cemetery, which served the settlers of Campbell Bayou, is mentioned on a historical marker located near Interstate 45. Reportedly, James and Mary Campbell settled on a one-third league of land (1,476 acres) on Campbell's Bayou at Swan Lake in 1838. The Campbells and other residents of Campbell Bayou are reportedly buried in the Campbell Bayou Cemetery.

Sludges and releases of hazardous substances exist in the cemetery area, but the area contains debris and rubble. Additional pre- and post-construction activities will be needed to address the presence of the cemetery at the Site. Pre-construction activities include an archaeological survey of the cemetery area. To afford placement of the cell in the proposed location as depicted on Figure 9, potential relocation of the cemetery may be required. This potential need is being discussed with all relevant local, State, and Federal authorities, and relatives of those buried in the cemetery. If the cemetery cannot be relocated, the relocation of the proposed RCRA Subtitle C equivalent cell will be required.

*Unused Areas*

Unused Area 1 is located between the Freshwater Pond and the hurricane levee adjacent to the closed Solutia South 20 Site (Figure 2). There is no evidence that wastes were disposed of or stored in Unused Area 1. The Earthen Impoundment soils area is located southeast of the bermed Sludge Pit (Figure 2). Unused Area 1 and the Earthen Impoundment soil areas were combined for the risk assessments because soil chemical of potential concern (COPC) concentrations were similar and land usage by current and future receptors would be similar.

Unused Area 2 is located between the operating areas, the Borrow Area, and the closed Solutia South 20 Site (Figure 2). Unused Area 2 includes the Unit 1200 Separator and the WDW-138 injection well. Most of the waste that entered the plant was treated in the Unit 100 API separator; the Unit 1200 API separator served as a backup. The Unit 1200 API Separator is currently operated as a settlement basin for the storm water management program (URS 2005a; URS 2005b). Injection Well WDW-138 is located in the east corner of Unused Area 2 and was part of the Unit 1100 waste disposal area. Wastewater is injected for disposal into the Miocene sands at a subsurface interval between 3800 and 5300 feet. WDW-138 has passed the most recent mechanical integrity tests (Sandia 2005). The well is currently operated to manage Site storm water under a TCEQ and EPA approved Storm Water Management Plan and Operations and Maintenance Plan (URS 2005a, URS 2005b). One 2,200-gallon concrete-lined sump is located in Unit 1100 adjacent to WDW-138.

*Borrow Area, Office, and Wells*

The Borrow Area is located south of the main operating area and is separated from the main facility by an interior hurricane levee (Figure 2). The Borrow Area is undeveloped and there is no information demonstrating that the area has ever been used for handling or storage of waste.

An office building containing a garage and laboratory are located near the entrance to the Site. Across from the laboratory is the weigh room. One septic tank is located adjacent to the office on the west side, and three laboratory waste holding tanks are located on the west side of the laboratory.

A non-potable water well is located in Unit 700; the well is screened from 183 to 198 feet below ground surface (bgs). According to available information, this well was not used as a drinking water source during facility operations and is currently not used as a drinking water source. GCWDA has one active

industrial well on its property; the well is screened from 260 to 280 feet. Water from this well is not used for drinking water, but the well is connected to a shower and sink in a bathroom (Eckenrod 2005). No public water supply or domestic drinking water wells were identified within a 1-mile radius of the MSC Superfund Site.

### 2.5.3.2 Operating Areas

*Earthen Impoundment*

MSC reportedly operated the Earthen Impoundment from 1964 to 1979. The impoundment consists of two pits; the large pit is termed the "Sludge Pit," and the small pit is termed the "Oil Pit." MSC used the Sludge Pit as a waste receiving/treatment unit for the separation of oil, water, and solids from a variety of industrial waste streams. Volume estimates for the Sludge Pit range from 150,000 to 190,000 $yd^3$ (URS 2008). Most of the volume variation is due to the differences in estimating the depth of the earthen impoundments (dikes), which is approximately 37 to 40 feet below the crest of the approximate 15-foot-high levee/berm, which surrounds the pit. The Oil Pit is approximately 33 feet deep from the top of the berm. Volume estimates for the Oil Pit range from 20,000 to 39,000 $yd^3$ (URS 2008).

*Maintenance Area*

The Maintenance Area consists of the Unit 300, Unit 400, Unit 700 and Unit 900 series aboveground storage tanks, the maintenance shop building, and former pits areas. In addition, the area includes the Former Backwash Pit and five oil/water pits (slop oil pits), which are described further below.

*Backwash Pit*

MSC reportedly operated a Backwash Pit from 1970 to 1982. The Backwash Pit was located approximately 100 feet south of the Unit 700 area and directly east of the Oil Pit. The pit volume was approximately 465 $cy^3$ (50 feet by 50 feet by 5 feet). MSC used the pit to dispose of the Unit 700 (WDW-73) filter backwash water. In 1982 (or later), MSC excavated the pit until the natural clay was visible. No confirmatory sampling was performed. Excavated soils were reportedly placed in the Sludge Pit and the Backwash Pit was backfilled and returned to the original surface grade.

*Other Pits*

A 1969 aerial photograph of the Site shows five oil/water pits (slop oil pits) near the Sludge Pit. The location of one pit appears to be under the paved area behind the shop and north of the Earthen Impoundment, and two pits were located in the current Tank 300 area. The other two pits were located in a cleared area north of the Tank 300 area and east of the 400 series tanks. The pits do not appear on a 1978 aerial photograph. Closure records for these pits have not been located.

*Drainage Ditches and Freshwater Pond*

The drainage ditch system throughout the facility discharged into the Freshwater Pond located on the west side of the MSC Superfund Site. The drainage system collected storm water and any spills that escaped the containment areas in the plant process areas. The Freshwater Pond is an excavated pit with a volume of approximately 20,000,000 gallons (267,000 cubic feet).

*Unit 100 API Separator*

The Unit 100 API separator is an in-ground, concrete unit consisting of four separate basins and a system of baffles and/or weirs. MSC used the separator for the equalization of various waste streams and separation into aqueous, organic, and solid phases. The oil fraction was removed from the surface of the separator and pumped or trucked to the oil blending tanks for reclamation. The aqueous phase was ultimately pumped to one of the injection wells for disposal. Solids were removed with a backhoe to a solids handling area on the far side of Basin A or to the Solids Mixing Bin. Reportedly, acid neutralization, caustic neutralization, and flocculation also occurred in the separator. The volume of the Unit 100 API separator was estimated by EPA as 23,150 $yd^3$. The separator is approximately 6 feet deep, and located above the main distributary paleochannel that crosses beneath the MSC Superfund Site.

*Unit 1200 API Separator*

MSC operated one additional concrete lined separator, designated as the Unit 1200 API separator (Figure 2). This separator, installed in 1987, served the same purpose as the Unit 100 API separator. The volume of the separator is approximately 5,630 $yd^3$. A sludge profile generated during the 1999 removal assessment showed the sludge depths to be approximately 1 to 6.8 feet. During facility operations, sludge was mixed with fly ash and gypsum in the solids treatment area using a small front-end loader. The solidified solids from the Unit 100 API separator were also placed in the solids treatment area. After solidification, solids were loaded into dump trucks and reportedly hauled off-site for disposal.

*Distillation Unit*

The distillation unit (Unit 900) was constructed in 1978 to treat incoming oil wastes by distillation. The unit was reportedly only used once, in 1985, when crude oil was distilled into light (naphtha and kerosene) and heavy fractions. The unit consisted of two distillation columns, one boiler, and 13 tanks (901 – 913). The unit is located on a concrete pad and is surrounded by a three-foot-high concrete wall.

*Injection Wells*

MSC operated two deep hazardous waste injection wells (WDW-138 and WDW-73). Injection well WDW-138 is located in the northeast corner of the plant process area and was part of the Unit 1100 waste disposal area. This well was the facility's primary injection well, disposing of most of the wastewater treated at the plant. Wastewater was injected for disposal into the Miocene sands at a subsurface interval between 3,800 and 5,300 feet. A concrete-lined 2,200-gallon capacity sump was located directly east of the wellhead. Two wastewater tanks, Tanks 1102 and 1103, stored wastewater prior to injection. The tanks were located on the Unit 1100 concrete pad, which was surrounded by a 3-foot-high concrete wall. The concrete pad drained to the Unit 1100 sump. The well is currently operated to manage Site storm water under a TCEQ and EPA approved Storm Water Management Plan and Operations and Maintenance Plan (URS 2005a, URS 2005b).

Injection well WDW-73 is part of the Unit 700 area. Filtered wastewater was injected for disposal at a subsurface interval of 4,650 to 5,300 feet in the Miocene Sands. This injection well is inoperable due to a tubing leak (E&E 1999). The unit contained a concrete-lined transfer sump at Tank 700. The sump collected spilled material during transfers in and out of Tank 700. The capacity of the sump was approximately 100 gallons. Five storage tanks were associated with the unit: tanks 700, 704, 705, 709 and 710.

*ASTs*

Numerous ASTs were constructed at the facility. Tanks located in Unit 300, Unit 400, and Unit 800 accepted oils pumped or transported by vacuum truck from the Unit 100 or Unit 1200 separators. The

Unit 300 Tank Farm contained 46 tanks. Tanks 301 – 336 (36 tanks) were used to store/blend reclaimed oil. These tanks are within the same secondary concrete containment berm. Two tanks (Tanks 337 and 339) were used as final product storage for reclaimed oil. These tanks are within the same secondary earthen containment berm. Tanks 338 and 340 were reportedly unused because of unstable soil conditions at the proposed tank locations. Six tanks (Tanks 341 – 346) stored materials used in the plant processes such as brine water and barite.

The Unit 400 Tank Farm contained six tanks (Tanks 401 – 406) that were used to blend reclaimed oils. Only Tanks 405 and 406 remain at the Site and are within a secondary concrete containment berm. A transfer sump for the Unit 400 Tank Farm collected spilled material during transfers in and out of the tanks. The sump capacity was approximately 100 gallons.

The Unit 800 tank farm consisted of six ASTs (Tanks 801 – 806). The tanks were used to store and blend reclaimed fuel oil. Three transfer sumps were located approximately 200 feet apart on the southern border of the Unit 800 Tank Farm. The capacity of each sump was approximately 100 gallons.

*Sumps*

Five "transfer" sumps were located around the inlet and outlet pump lines of several tanks. These sumps were reportedly used to collect any spills from pumping oil or wastewater in or out of these tanks. Three sumps were located in the Unit 800 Tank Farm, one at Tank 700, and one at the southern end of the Unit 400 Tank Farm. An unused sump (identified in 1988 during the EPA PR/VSI) was located at the north end of the Unit 400 Tank Farm. In addition, two 2,200-gallon concrete-lined sumps were located at the wastewater disposal areas (Units 700 and 1100). Materials collected in the sumps were reportedly pumped into a vacuum truck and taken back to the Unit 100 API separator.

Storm water collected from the undeveloped areas was reportedly routed through drainage ditches to a control retention area then discharged through gravity flow outside the flood protection levee to Galveston Bay. EPA and the MCP continue to manage storm water in waste management units and un-impacted/undeveloped areas in this manner; however, storm water discharged to Galveston Bay is sampled to meet EPA SWMP parameters prior to discharge. Two storm water discharge sumps are located on the northern side of the facility. Each sump contains a plate that can be lowered to block the discharge. The sumps are connected to the storm water outlet that discharges through the flood protection levee into the Marsh Area between the MSC Superfund Site and Swan Lake. Storm water discharge from the sumps is currently managed under a TCEQ and EPA approved Storm Water Management Plan (URS 2005a).

*Decanning Area*

In August 1981, MSC notified the TCEQ of its intent to process approximately one million gallons of Silvex by shredding the containers, allowing the Silvex to flow into a surge tank prior to transfer to a bulk storage tank. The decanning process area was designated in the northeast portion of the facility, east of the Tank 800 area and north of Unit 1100. The 1996 Notice of Registration lists three tanks (105 through 107) as decanning unit tanks. It is unknown whether the decanning process was ever constructed or operational.

## 2.5.4 Sampling Strategy

The nature and extent of contamination at the Site was defined by using screening criteria. The screening criteria were included in the Quality Assurance Project Plan (QAPP) developed for the Site RI (URS

2005c) and are referred to as the QAPP screening criteria. These screening criteria are not intended as target remediation criteria. Rather, the screening criteria are used to determine the need for additional sampling activities in areas with analyte concentrations exceeding these conservative criteria and therefore may present a risk to ecological or human receptors. In addition these screening criteria are used to determine those analytes that would be carried forward into the BHHRA and the Screening Level Ecological Risk Assessment (SLERA).

The RI field activities, conducted in 2005, were performed using standard sampling techniques. Contaminants in the environmental media were analyzed using both field screening and laboratory definitive analyses. The nature and extent of contamination were characterized by representative sampling of the various environmental media including surface and subsurface soils, ground water, on-site and off-site sediment, and on-site and off-site surface water. Soil sample locations were placed across each area with approximately one sample per acre, using professional judgment to determine the field sample locations while maintaining the approximately one sample per acre grid spacing. Within the grid spacing, sample locations were placed at or near potential sources, such as stained areas, equipment, piping, etc. Representative samples of waste materials also were collected for the treatability study (to evaluate solidification of sludge) and limited chemical characterization. Given the history of permit violations by the facility operators, and given the amount of contamination found in 'non-operating' areas, however, it is possible additional soil contamination exists at the Site which is not specifically identified in the RI. Additional sampling during the remedial design is often required to define volumes of contaminated media and conduct a cost-effective remedial response. The project involved sampling environmental media using standard sampling tools and techniques including:

- Stratigraphic characterization using cone penetrometer testing (CPT);
- Surface soil sampling using a direct push technology (DPT);
- Subsurface soil sampling by hollow stem auger (HSA) or DPT;
- Ground water sampling by pumps;
- Sediment sampling by trowel, bucket auger, or push core;
- Surface water sampling by dip sampler or pump; and
- Waste sampling with pumps, push cores, bailers, or thieves.

The following subsections describe the sampling and discuss the area and media investigated, and the sampling approach used.

### 2.5.4.1 Sampling Strategy – Sludge

Sludge samples were collected with a double-walled pond-bottom sludge sampler (designed for semi-solid sludge) from seven locations within the Sludge Pit. The double-walled pond-bottom sludge sampler did not penetrate more than 25 feet below the water surface. Sludge from each location was composited and submitted to the contract chemical laboratory for analyses. Additional samples were collected from the Sludge Pit using a portable drill rig mounted on a pontoon boat. Sampling was to approximately the 38-foot depth where clay bottom was encountered. Approximately 12 to 15 gallons of sludge were removed from each location. Approximately 70 gallons of sludge samples were submitted to the treatability laboratory for compositing. The composited sludge sample was used for the various treatability studies as described in the Treatability Study Work Plan (URS 2005d). During sampling and compositing activities, ambient air was monitored using an 11.7-eV photoionization detector (PID) in accordance with the procedures described in the project Health and Safety Plan.

The Oil Pit was sampled as described in the Field Sampling Plan (URS 2005e). A HSA drilling platform installed a 4-inch boring until the underlying clay was encountered (as evaluated from the drill cuttings).

The ambient air and drill cuttings were monitored with an 11.7-eV PID. As the HSA was removed from the boring, sludge was consolidated from the auger flights into a 5-gallon plastic bucket. This procedure was repeated for each sample location. Approximately 25 gallons of sludge were submitted to the treatability study laboratory.

Sludge samples were collected from the API-100 and API-1200 separators. Samples were collected with a double-walled pond-bottom sludge sampler. Sludge from each separator was composited into 5-gallon plastic buckets for shipment to the treatability study laboratory. In addition, one sample was collected from the Unit 100 API Separator sludge for analyses of selected chemical parameters. Ambient air above the sludge containers was monitored using an 11.7-eV PID in accordance with the procedures described in the project Health and Safety Plan.

Each AST was surveyed and the results compared to the tank inventory prepared by E&E (URS 2004a). The tanks were accessed with either a ladder or a mobile platform with a telescoping boom and man lift basket. First, the atmosphere in the tank was measured with a four-gas (oxygen, carbon monoxide, hydrogen sulfide, and hydrocarbon) monitor. Second, the atmosphere in the tank was field monitored with an organic vapor monitor. If the atmospheric monitoring demonstrated that it was safe, the tank was visually inspected for the presence of liquids or sludge. If the liquid or sludge was accessible, a small sample was obtained for treatability studies. Tanks 700, 801, 803, 804, 805, and 806 were sampled. If a sufficient amount of sludge was present, a representative sludge sample was also collected from each remaining tank series (100, 300, 400, 600, 700, 900, and 1100). If the tanks contained unpumpable liquids, a composite sample was collected. No attempts were made to collect samples from tanks with a small amount of sludge or liquids.

#### 2.5.4.2 Sampling Strategy – Ground Water

Twenty-five monitoring wells were installed between 1976 and 1984. These monitoring wells were evaluated for structural integrity prior to well development and sampling, and refurbished if necessary. Seven new monitoring wells, MW-26 through MW-32, were completed at the Site by the PRPs in December 2005 to augment the existing monitoring well network. Information for the on-site monitoring wells is located in Table 3.

Monitoring wells at the Site were purged and sampled in order to obtain accurate ground water chemical data for current Site conditions. Sampling began at the monitoring well with the lowest historical contamination and proceeded systematically to the monitoring well with the highest contamination. Field parameters (pH, specific conductance, temperature, dissolved oxygen, and redox potentials) were measured, to obtain stable parameter readings, during well purging and before the collection of ground water samples. After stabilization, the monitoring well was immediately sampled.

Historical lithologic and hydrogeologic information for the MSC Superfund Site was limited to the upper 50 feet bgs. The CPT investigation was designed to provide subsurface lithologic information to enhance the hydrogeologic understanding at the Site.

The CPT is a direct push tool which measures the tip resistance and sleeve friction, and electrical conductivity of the soil to collect lithologic data. The objectives of the CPT investigation included: (1) verifying the lateral extent of the paleochannel, (2) identifying and verifying the existence and extent of distributary sand channels, and (3) verifying the lateral continuity of the upper clay unit beneath the Site.

CPT borings were placed at locations identified as being outside the buried paleochannel. If these CPT borings were pushed to the target depth without encountering the buried paleochannel, CPT step-out

locations (approximately 75 to 100 feet) were placed in the predicted direction of the channel. The additional step-out CPT borings for delineation of the buried paleochannel had a target depth of 50 feet bgs.

CPT borings were placed in locations to identify distributary sand channels and to delineate their lateral extent. The primary objective for this area was to determine whether the sand layers were isolated overbank flood deposits, or whether the sand layers were smaller distributary sand channels bifurcating from the main buried paleochannel. The target depth for these borings was 50 feet bgs. CPT data and lithologic data from soil borings drilled during the subsurface soils investigation were used to verify the existence and to delineate this sand layer.

Perimeter CPT borings were installed in areas CPT-1 through CPT-5 to correlate the subsurface lithologic information from the GCWDA to the west and to provide deeper lithologic information beneath the Site. The target depth for the perimeter borings was 80 feet bgs.

Seven additional permanent monitoring wells were installed to augment the existing monitoring well network. Appendix F of the RI Report (URS 2006a) contains the logs for the monitoring wells installed in December 2005. Summary information for the on-site monitoring wells is located in Table 3.

### 2.5.4.3 Sampling Strategy – Soil

The soils investigation focused on the vertical and horizontal delineation of impacted soils. The Site was divided in similar areas (investigation units) based on operational history, evidence of a release, and risk before or after implementation of a preliminary remedial alternative. The facility investigation areas are presented on Figure 2.

The objectives of the soils investigation were to:

- Collect sufficient soil analytical data to answer the critical questions for the respective investigation units;
- Obtain chemical data meeting the level of required performance to evaluate whether analyte concentrations exceed site-specific human health and ecological screening levels;
- Determine the vertical and horizontal extent of analyte concentrations to the level necessary to evaluate the preliminary remedial alternatives; and
- Collect subsurface lithologic data to support a site-wide geologic and hydrologic model.

Surface soil is defined by EPA as the soil interval ranging from 0 to 2 feet bgs for human health risk and 0 to 0.5 foot bgs for ecological risk. The sampling strategy used soil borings to collect samples to evaluate human health and ecological risk. Sample locations were placed across each area with approximately one sample per acre. Professional judgment was used to determine the field sample locations while maintaining the approximately one sample per acre grid spacing.

Surface and subsurface soil samples were collected from the soil cores. The samples were placed in glass containers with appropriate preservatives for submittal to the contract analytical laboratory. Geotechnical samples were collected in Shelby tubes or securely wrapped with foil for submittal to the geotechnical laboratory.

**Shallow Soil Borings**

Typically, the shallow soil samples were collected from soil cores obtained using or DPT or from HSA drilling equipment. Due to access limitations, a limited number of surface soil samples were collected using a hand auger. The shallow soil borings were field monitored for organic vapors using an 11.7-eV PID. One surface soil sample was collected from both the 0- to 0.5-foot and the 1- to 2-foot depth interval in the shallow borings.

**Deep Soil Borings**

Deeper soil borings (to approximately 20 feet bgs) were drilled to obtain lithologic information, to obtain geotechnical samples, and to evaluate vertical extent of impacted soils for potential for migration to ground water and for the extent of remedial action. Appendix G of the RI Report (URS 2006a) contains the soil boring logs. These deeper soil borings were drilled using HSA drilling equipment. Soil cores from each borehole were examined and described by a qualified field geologist. The deeper soil borings were continuously logged for lithology from the surface to the target depth and field monitored for organic vapors using an 11.7-eV PID. Surface and subsurface soil samples were collected from the soil cores. A maximum of five soil samples, including both the 0- to 0.5-foot and the 1- to 2-foot sample, were collected from the deeper soil borings based on visual observations, field monitoring, or other criteria. Intervals for the collection of subsurface soil samples included:

- Interval with the highest organic vapor meter reading;
- Interval directly below an interval of obvious or apparent visual soil impact;
- Bottom of the soil boring if no PID reading above background or other indications of impacted soils (visual/olfactory) was encountered; and/or
- Interval directly above saturated zone.

### 2.5.4.4 Sampling Strategy - Sediment

Sediment samples were collected from areas of the Site that could provide habitat for ecological receptors: drainage ditches, the Freshwater Pond, and the Marsh Area between the levees and Swan Lake. The Drainage Area consists of drainage ditches surrounding the operating areas that channel discharge/runoff from the undeveloped areas to the Freshwater Pond, the Laydown Area, or through the storm water discharge outfall to Swan Lake. The Freshwater Pond is located in the northwest part of the MSC Superfund Site and was constructed by excavating the sands from the paleochannel. The Freshwater Pond is hydraulically connected with the paleochannel and receives storm water runoff/discharge from the undeveloped areas routed through the Drainage Area ditches. The transitional zone (Marsh Area) is located outside the MSC Superfund Site hurricane levee and separates the Site from Swan Lake. Shallow drainage channels have incised into the Marsh Area from storm water discharge from the MSC Superfund Site and from tidal action in Swan Lake.

Appendix H of the RI Report (URS 2006a) contains the sampling report for the July 2005 sediment sampling events. Sediment sample locations in the drainage ditches were accessed by carefully wading into the shallow drainage ditch and collecting the sediment samples using a trowel or a Ponar dredge. Sediment samples from the Freshwater Pond and the transitional zone (Marsh Area) between the hurricane levee and Swan Lake were collected from a sampling boat in accordance with a Ponar dredge. The sediments were transferred into glass sample containers.

#### 2.5.4.5 Sampling Strategy – Surface Water

Surface water samples were collected by compositing the surface water column at each sample location in the Freshwater Pond and the transitional zone (Marsh Area) between the hurricane levee and Swan Lake. Prior to the collection of these surface water samples, water quality data were collected. These surface water samples were collected from a boat using a peristaltic sampling pump and dedicated tubing. Appendix H of the RI Report contains the sampling report for the July and August 2005 surface water sampling in the Freshwater Pond and the Marsh Area.

Surface water samples from the Sludge Pit were collected from the side of a boat using a dip sampler. Field personnel waded into the ditch and collected surface water samples using a dip sampler. Samples were then transferred to appropriate containers.

#### 2.5.4.6 Analytical Parameters

During the Phase I RI conducted in July and August 2005, samples were analyzed for the metals, VOC, and SVOC analytes listed in the QAPP (URS 2005c). Ground water samples were also analyzed for TDS. Soil samples were screened in the field using SiteLab® UV-fluorescence kits for total polycyclic aromatic hydrocarbons (PAHs). The soil sample from each investigation unit with the highest total PAH reading was chosen for extended analyses of hexavalent chromium, pesticides, PCBs, and polychlorinated dibenzo-dioxins / polychlorinated dibenzo-furans (PCDDs/PCDFs). One sediment and surface sample from the Freshwater Pond and one ground water sample were arbitrarily chosen for extended analyses. In addition to metals, VOCs, and SVOCs, the sediments from the Marsh Area were analyzed for pesticides and PCBs. One sediment sample from the Marsh Area was arbitrarily chosen for hexavalent chromium and PCDD/PCDF analyses. One surface water samples from the Marsh Area was arbitrarily chosen for extended analyses.

During the Phase II RI conducted in December 2005, soil samples were analyzed for metals, VOCs, and SVOCs. Surface (0-0.5 foot) soils in the Laydown Area were also analyzed for PCBs. Sediment samples from the drainage ditches were analyzed for metals, VOCs, and SVOCs. Sediment samples from the Freshwater Pond and Marsh Area were analyzed for selected parameters as necessary to augment the understanding of impacts to these areas. Ground water samples from the January 2006 sample event were analyzed for monitored natural attenuation parameters (ferrous iron, sulfate, and nitrate) as well as metals, VOCs, and SVOCs.

### 2.5.5 Sources of Contamination

The primary source (source with the largest volume of impacted media) of contamination identified at the Site is the sludge in the Earthen Impoundment (the Sludge Pit and the Oil Pit), the Unit 100 API Separator, the Unit 1200 API Separator, and the aboveground tanks. Sludge has also been found in buried pits and where source material has migrated to subsurface soils. Miscellaneous potential sources (sources which may have released contaminants to soils and ground water) including the Former Backwash Pit, the Laydown Area, the distillation unit, ancillary piping, the filters and pumps associated with the injection wells, the laboratory sumps, and the proposed decanning area may have contributed to impacted soil and ground water, but the current data are inadequate to make a determination.

Figure 3 shows the location of primary and potential sources of contamination at the Site. During the 1999 START removal action, E&E collected samples from potential sources, including the API separators and the tanks. During the MCP RI field activities, composite samples were collected from the Sludge Pit portion of the Earthen Impoundment and from the Unit100 API Separator. Table 15 of the RI

Report (URS 2006a) summarizes the analytes from the START removal action and RI samples that exceeded the soil QAPP screening criteria.

An estimated volume of 260,000 $yd^3$ of sludge (to account for over-excavation of impacted soils), and approximately 160,000 $yd^3$ of contaminated soil, was used for screening technologies, cost estimates, and alternatives analysis. Sludge (source) areas, as outlined below, are depicted on Figure 3.

| Source | Minimum ($yd^3$) | Average ($yd^3$) | Maximum ($yd^3$) | Estimated Volumes ($yd^3$) |
|---|---|---|---|---|
| 1 - Sludge Pit | 150,000 | 172,000 | 190,000 | 200,000 |
| 1 - Oil Pit | 20,000 | 28,000 | 39,000 | 40,000 |
| 1 - Unit 100 API Separator | 1,500 | 2,200 | 3,000 | 5,000 |
| 1 - Unit 1200 API Separator | 2,500 | 2,900 | 3,500 | 5,000 |
| 22 - Aboveground Storage Tanks (96 total tanks) | 9,800 | 10,000 | 10,200 | 10,000 |
| Sums (Rounded) | 184,000 | 215,000 | 246,000 | 260,000 |

## 2.5.6 Types of Contamination

The COCs at the Site are toxic, mobile, carcinogenic, and non-carcinogenic. The COCs in sludge and soil are presented on Tables 1 and 2. These tables include the remediation levels which are discussed in Section 2.7.

Metals concentrations, such as antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc, exceeded QAPP screening criteria for soil in at least one source sample. Barium was not listed as detected in the tank and container samples, since it was not included on the removal action (E&E 1999) analyte list. However, barium was reported as present in the 21 samples analyzed for toxicity characteristic leaching procedure (TCLP) metals.

The SVOCs detected in the source areas (sludge) included PAHs, phenolic compounds, and phthalate esters. The most frequently detected SVOCs were naphthalene, 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, phenol, phenanthrene, 1,2,4-trichlorobenzene, and acenaphthene. VOCs detected in the impoundments, separators, and tanks included the aromatic and chlorinated hydrocarbons. The most frequently detected VOCs were total xylenes, ethylbenzene, tetrachloroethene, toluene, 1,1,1-trichloroethane, styrene, trichloroethene, and benzene.

As shown in Table 15 of the RI Report, the SVOCs in the source areas that exceeded soil screening criteria included PAHs, phenolic compounds, hexachlorobenzene, hexachlorobutadiene, and phthalate esters. Aromatic and chlorinated hydrocarbons VOCs such as benzene, trichloroethene, vinyl chloride, and styrene also exceeded soil screening criteria. Concentrations of five pesticides (alpha- and gamma-chlordane, beta-BHC, dieldrin, and heptachlor) and one Aroclor (Aroclor 1260) exceeded soil screening criteria in the samples analyzed from the Sludge Pit and Unit 100 API Separator for pesticides and PCBs. The 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) toxic equivalent (TEQ) (mammal) concentrations were 1.33E-03 and 1.60E-03 milligrams per kilogram (mg/kg) for the Earthen Impoundment and API 100 separator sludge samples, respectively. These concentrations exceed the EPA Human Health Medium-Specific Screening Level (U.S. EPA 2005b) for an industrial outdoor worker of 1.80E-05 mg/kg.

## 2.5.7 Location of Contamination

Sludge (principal threat waste/source material), and contaminated soil and ground water exist on-site (see Figure 3). Sludge exists in the earthen impoundment (Sludge Pit and Oil Pit), API separators (API-100 and API-1200), and ASTs. Source material exists in subsurface soils in the Cemetery Area, the Maintenance Area, and near the Tank 800. Data demonstrate that releases of hazardous substances to soils have occurred in the western portion of the Laydown Area, the Cemetery Area, the Maintenance Area where slop oil/water pits and landfarming activities occurred, the Maintenance Area around MASS17, the Tank 800 Area, and the Oil Pit surface soils (see Figure 3 for contamination areas identified through the RI). Typically, the contaminants that exceeded screening criteria were 1,2-dichloroethane, benzene, trichloroethene, tetrachloroethene, hexachlorobenzene, hexachlorobutadiene, PAHs, and PCBs.

The contaminated shallow ground water is non-potable (Class 3 ground water – non-drinking water); historic and recent ground water analytical data appears to support stable plumes and indicate that the ground water plumes remain on-site. Ground water is contaminated in areas where source material has been managed (sludge pits and API separators). There are other localized areas, which appear to be non-operational areas, where source material has entered the subsurface soils and contaminated ground water with dissolved constituents, whereby a plume has developed. The highest concentrations of contaminants are detected in the wells adjacent to the Earthen Impoundment (MW-04, MW-25, MW-12U, MW-12D, and MW-09), in a well installed outside the former Unit 900 distillation area (MW-08) and in a monitoring well installed in the Maintenance Area (MW-32). Benzene, 1,2-dichloroethane, and vinyl chloride concentrations exceeded the screening criteria in these wells. Ground water has been contaminated with dissolved constituents only; there is no direct evidence of source material (NAPL) in ground water.

## 2.5.8 Hydrogeology

The following sections discuss the regional and site hydrogeology.

### 2.5.8.1 Regional Hydrogeologic Setting

The MSC Superfund Site is located in the Gulf Coastal Plain of Southeast Texas (Aronow and Barnes 1982). The stratigraphic units that underlie the Texas coastal plain and form the principal hydrologic units from oldest to youngest (Jorgensen 1975) include:

- The Fleming Formation of Miocene age;
- The Goliad Sand of Pliocene age;
- The Willis Sand, Bentley Formation, Montgomery Formation, and Beaumont Formation of Pleistocene age; and
- The alluvium of Quaternary age.

Collectively, these sediments attain a thickness in excess of several thousand feet along the coastline and consist primarily of interbedded sands and clays with subordinate beds of silt and gravel. The lithologic similarity of the post-Miocene age sediments makes delineation of the stratigraphic and hydrologic sections difficult in the subsurface. Regionally, these stratigraphic units dip toward the Gulf of Mexico and tend to thicken and occur progressively deeper basinward (Baker 1986).

Surface outcrops in southeast Texas generally parallel the coastline, with older formations found progressively inland. The Site is located on outcrops of the Beaumont Formation that covers most of Galveston County (Figure 8). The Beaumont Formation consists of fluvial and deltaic sediments including low permeability clays interbedded with more permeable discontinuous silt and sand lenses. These sediments include stream channel and point bar, natural levee, backswamp, and, to a lesser extent, coastal marshes and mud flat deposits (Aronow and Barnes 1982).

Growth faults are common structural features associated with the coastal plain in Texas. These growth faults tend to have gradual rather than episodic movements and show only minor surface expression. Historically, the Houston-Galveston area has undergone subsidence due to over-pumping of the underlying aquifers (Gabrysch 1984). This subsidence has resulted in increased ground movement across the faults (Kreitler 1976). Regulations enforced by the Harris-Galveston Coastal Subsidence District limiting the installation of new water wells and ground water withdrawal has greatly reduced the rate of subsidence in the Houston-Galveston area.

No known surface faults or subsurface faults have been extrapolated to the surface across the Site. The nearest surface fault is reported approximately one-half mile north of the MSC Superfund Site trending in a northeasterly direction and traversing the northern part of Swan Lake (MSC 1994).

### 2.5.8.2 Site Aquifers

The subsurface is comprised of approximately 15 feet of clay and silty clay, and a shallow Class 3 (non-potable – non-drinking water) paleochannel aquifer (sand) that extends from approximately 15 feet to approximately 30 feet bgs (see Figure 5). The contaminated paleochannel aquifer, and associated overbank silts, is confined due to the approximate 15 feet of clay overlying it. Three additional minor silty-sandy clay members exist below the paleochannel sand and silt members to a depth of approximately 55 feet. RI borings were drilled 30 feet into the lower clay member (below the paleochannel and silt member), which exists at approximately 50 feet bgs.

The RI investigation provided subsurface lithologic information to a maximum depth of 80 feet bgs. The RI noted that "[v]ertical migration of the potential COCs to the next transmissive zone will be influenced by the thickness of the clay and the permeability of the non-transmissive zone." The RI also stated that the "potential for vertical migration was evaluated by characterization of the stratigraphy to determine if a substantial, competent clay stratum, such as that observed at MOTCO and GCWDA exists beneath the MSC Superfund Site." However, the RI presented no conclusions regarding vertical migration of contamination at the Site. A comparison of the Site hydrogeology to that of the MOTCO Superfund site (approximately 1.5 miles away) and the GCWDA site (immediately adjacent to the Site to the west) suggests that the next underlying permeable zone (GCWDA - 4 feet thick mixed silt and sand zone at 88 feet bgs) may be just below the depth of the Malone Site investigation (80 bgs). At the MOTCO site, deep wells confirm that the next underlying permeable unit (approximately 15 feet thick) after the three shallow geologic units is generally found between 90 to 105 feet below msl and is the uppermost permeable zone of the Chicot aquifer (identified at the MOTCO site as unit UC-1). UC-1 is underlain by a clay unit to a depth of approximately 150 feet below msl, where the next significant sand unit is encountered, the UC-2. At the GCWDA site, the shallow ground water is underlain by uniform gray clay to a depth of approximately 88 feet below ground surface (bgs) before the next significant permeable zone is encountered (four feet thick silt and sand zone at 88 feet bgs).

The RI notes that one ground water supply well was reportedly drilled at the Site in 1975 to a depth of 200 feet bgs and screened across a sand interval between 185 and 198 feet bgs. Information from the Malone Service Company regarding this well indicates that a thick clay interval more than 100 feet thick

reportedly separates the buried paleochannel sand aquifer from the lower sand aquifer (MSC 1994b). The one non-potable well found on-site during the RI, located on the northwest portion of the MSC Site in Unit 700, was not logged for natural gamma counts to verify this report. The RI relied instead on correlation borings and CPT data to address the deeper stratigraphy for the Site. Based on this information, EPA may require subsequent subsurface investigations to document the thickness of the clay below the silt and sand zones within the Site.

### 2.5.8.3 Site Hydrogeology

During the RI, additional subsurface investigations (in addition to the historic information) were conducted at the MSC Superfund Site to enhance the understanding of the Site stratigraphy, ground water flow directions, and for delineation of impacted ground water. These subsurface investigations included:

- CPT investigation to define the paleochannel boundary and to provide subsurface lithologic information to a maximum depth of 80 feet bgs; including perimeter CPT borings with a target depth of 80 feet bgs.
- Shallow soil borings for the collection of soil samples for chemical analysis and shallow subsurface lithology (depth of up to 2 feet for surface and shallow soil samples, with deeper soil borings to approximately 20 feet deep);
- Correlation soil borings adjacent to five CPT locations to verify CPT interpreted lithology (with a target depth of 50 feet bgs); and
- Soil borings drilled during the installation of seven monitoring wells for subsurface lithology (to a maximum depth of 35 feet).

Previous subsurface investigations, as well as information collected in the 2005-2006 RI, have shown that the shallow hydrogeology in the vicinity of the Site is dominated by the southeasterly meandering, buried paleochannel that crosses beneath the GCWDA facility west of the Site, forms a wide arch and bifurcates beneath the Site, and continues to the south beneath the closed Solutia South 20 Site (GCWDA 1999; Groundwater Services, Inc. [GSI] 1999; Law 1982; Law 1992; MSC 1994). A distributary channel bifurcates from the main channel beneath the Site and extends east-southeast toward Swan Lake (Figure 7). The locations of the existing monitoring wells, CPT borings, and subsurface soil borings are shown on Figure 4.

Lithologic data collected during the RI demonstrate the presence of three additional transmissive or potentially transmissive zones in the upper 50 to 60 feet bgs that were not previously documented in historic documents for the Site.

The existence of the paleochannel has been well documented beneath the GCWDA facility to the west of the Site (GCWDA 1999; GCWDA 2003), beneath the Site (Southwest Laboratories [SWL] 1979; Law 1982; MSC 1994), and beneath the closed Solutia South 20 Site to the southeast (Law 1992; GSI 1999; GSI 2000). Descriptions and test results tend to be rather consistent, showing the paleochannel to consist of 20 to 30 feet of tan to light gray silty sand with hydraulic conductivity values ranging from about $10^{-5}$ to $10^{-3}$ centimeters per second (cm/sec). The results from the RI investigations are generally consistent with the results from the previous investigations. Beneath the Site, the top of the paleochannel is generally found at depths ranging from 8 to 12 feet bgs, with the base of the channel sitting on top of stiff, reddish brown clay between 30 and 35 feet bgs. The upper part of the channel often shows a fining upward trend into 1 to 5 feet of sandy clay. Thin sandy clay or silty sand seams are also common in the lower part of the channel.

Outside the paleochannel, the subsurface lithology generally consists of upper silty clay overlying three potentially transmissive zones separated by reddish brown clay or silty clay (Figure 6). A sample of the upper silty clay from a depth of 10 to 12 feet bgs in the Borrow Area (Table 4) had a coefficient of permeability of 1.38 x $10^{-7}$ cm/sec. Samples of the reddish brown clay underlying the –10 zone at 20 to 21.5 feet bgs and the –20 zone at 40 to 42 feet bgs have coefficient of permeability values of 2.6 x $10^{-7}$ cm/sec and 1.5 x $10^{-7}$ cm/sec, respectively (Table 4). These coefficients of permeability values are consistent with those reported for the fine-grained sediments outside the paleochannel ranging from $10^{-9}$ to $10^{-6}$ cm/sec (MSC 1994).

The presence of the transmissive or potentially transmissive zones identified during the CPT investigation was verified by drilling correlation soil borings adjacent to specific CPT locations. These transmissive or potentially transmissive zones are identified based on their relative depth as the –10 zone, the –20 zone, and the –40 zone (Figure 6).

The –10 zone is typically found between 0 and –10 feet msl. This zone is thin or absent in the northern part of the Site and has a maximum thickness of about 7 feet near the center of the Site. The CPT stratigraphic columns demonstrate that the –10 zone consists primarily of thin interbeds of sand/silt/clay. At some CPT locations, individual sand layers up to about 1-foot thick are included in the –10 zone. Field observations on soil cores collected near the center of the Site demonstrate that the –10 zone consists primarily of silty to sandy clay, clayey sand, and silt. The coarser-grained intervals are typically about 0.5 feet thick and are very moist to saturated; the finer-grained layers are slightly thicker.

In areas where the paleochannel is present, the upper part of the paleochannel may coincide with the –10 zone, and may be continuous into the underlying –20 zone. This is evident along the eastern part of the Site adjacent to the marsh area, where the –10 zone and the –20 zone appear as a single unit with very minor amounts of clay between about 0 and –28 feet msl. The RI notes that potential COCs have migrated vertically to the shallow ground water from source areas in the potentially transmissive zones outside the paleochannel boundary.

The –20 zone is typically found between –16 and –29 feet msl and is separated from the overlying –10 zone by 10 to 15 feet of stiff, reddish brown clay. The laboratory coefficient of permeability measurement for a sample of this clay from MW-29 at 20 to 21.5 foot was 2.6 x$10^{-7}$ cm/sec. It typically consists of either a single transmissive unit ranging from about 6 to 8 feet thick (CPT-12W1 and correlation boring CB-02), or several thin transmissive layers separated by several feet of clay (CPT-05). These coarser-grained transmissive or potentially transmissive layers are saturated. In the northern part of the Site, the log for CPT-02 shows the –20 zone consists of a 4-foot sand unit overlying a 2-foot-thick sand/silt/clay unit that is continuous to the south towards the paleochannel. The correlation boring at this location shows the –20 zone consisting of about 1 foot of silty sand overlying 2 feet of sandy clayey silt and 2 feet of silty clay. The –20 zone may underlie the paleochannel as observed in the logs for CPT-11E2 and CPT-17N2; it may be continuous with the lower part of the paleochannel as observed in the log for CPT-19; or it may be absent as observed in the log for CPT-01. In general, it appears that the –20 zone becomes slightly deeper toward the southern part of the Site (CPT-04W1 and correlation boring CB-04).

The –40 zone, typically found between –34 and –48 feet msl, is the most heterogeneous of the potential transmissive zones. The CPT logs show the –40 zone to generally consist of thin interbeds of clay/silt/sand mixtures with minor thin sand seams. These thin sand seams appear to be laterally discontinuous and generally cannot be correlated between CPT locations. In some CPT borings, the –40 zone is totally absent or relatively thin (on the order of 1 to 2 feet). The –40 zone was encountered in all the deeper 80-foot CPT perimeter borings at depths of between –36 and –38 feet msl and was fully penetrated. The maximum thickness of the –40 zone was about 13 feet in CPT-02, CPT-05, and CPT-20.

The –40 zone consists of thin, gradational interbedded layers of silty to very silty clay and clayey silt. At some locations, the interbedded layers of the –40 zone are slightly moist to moist, but at other locations these layers are saturated. It appears that the amount of coarser-grained sediments is less in the –40 zone than is observed in the overlying –10 zone or –20 zone. Based on the CPT data from the deeper 80-foot CPT perimeter borings, the –40 zone is underlain by a clay member at least 30 feet thick.

Outside the paleochannel boundary, limited information is available regarding the lithology across which many of the monitoring wells are screened. It appears that some monitoring wells may be screened only across the –10 zone (e.g., MW-02), across the –20 zone (e.g., MW-03), across both the –10 and –20 zones (e.g., MW-06) or across all three transmissive or potentially transmissive zones (e.g., MW-10, MW-11, and MW-20). Seven new monitoring wells, MW-26 through MW-32, were completed at the MSC Superfund Site in December 2005. Monitoring wells MW-26 through MW-28 and MW-30 were completed and screened across the silty sands in the paleochannel. Monitoring wells MW-29, MW-31 and MW-32 were completed outside the boundary of the paleochannel. Monitoring wells MW-29 and MW-32 were screened across the –10 zone and monitoring well MW-31 was screened across both the –10 and –20 zones.

### 2.5.8.4 Ground Water Flow

Twenty-two Site monitoring wells (four are duals) were completed in the late 1970s and early 1980s; an additional seven monitoring wells were completed in 2006 during the RI. The greater volume of shallow ground water flow beneath the Site is primarily restricted to the fine silty sands in the paleochannel. Ground water flow in the paleochannel has been shown to be variable, primarily controlled by the recharge or evaporation pattern in the Freshwater Pond. Additional hydraulic boundary conditions potentially influencing ground water movement include liquid and sludge stored in the Earthen Impoundment and tidal influences from Swan Lake/Galveston Bay. It exits the Site to the southeast at the closed Solutia South 20 Site. A secondary distributary channel bifurcates from the main channel in the area between the Freshwater Pond and Earthen Impoundment. The distributary channel has a minimum width of about 125 feet where it bifurcates from the main channel, and an apparent maximum width of about 400 feet adjacent to the Marsh Area . Flow in the secondary distributary channel is generally to the northeast from monitoring well MW-05 toward Swan Lake. The RI states that the distributary channel appears to exit the Site into the Marsh Area in the Borrow Area.

Analytical results for the ground water samples collected during the RI (Section 4.3, URS 2006a), indicate that significant contaminant migration has not occurred away from the source areas along the axis of the buried paleochannel or into the transmissive or potentially transmissive zones along the buried paleochannel. Generally, ground water flow is to the northeast and south along the bifurcated paleochannel. It is unclear whether the transmissive zones are viable and continuous preferential pathways, because beneath some parts of the Site, these transmissive or potentially transmissive zones are laterally continuous, whereas they are thin or absent in other areas. The RI does not document information regarding off-site ground water to surface water discharge points.

All borings, CPTs, and monitor well observations document that no non-aqueous phase liquid (NAPL) (free product/source) exists in the shallow ground water bearing zones in those locations. Borings and CPTs document the on-site or near-site thickness and the permeability of the clay beneath the paleochannel. The closed Solutia South 20 Site and GCWDA data demonstrate thick lower confining clay under the paleochannel. Vertical migration of the COCs to the next/deeper sand/aquifer will be influenced by the thickness of the lower confining clay and the permeability of that clay.

## 2.5.9 Surface Hydrology

Swan Lake and the western shore of Lower Galveston Bay are separated by a series of north-south trending islands (now supplemented with intermittent rock jetties as part of the Tex-Tin Superfund Site OU-4 Remedy) that are contiguous and connected through Campbell Bayou. Swan Lake and the western shore of Lower Galveston Bay are part of the Galveston Bay System. Lower Galveston Bay is designated as Texas Water Quality Segment 2439 of the Texas Bays and Estuaries. The Lower Galveston Bay Segment is connected with Texas Water Quality Segment 2421 (Galveston Bay), Segment 2422 (Trinity Bay), Segment 2423 (East Bay), Segment 2424 (West Bay), and the Gulf of Mexico (TNRCC 2000). The Galveston Bay system constitutes the seventh largest estuary in the United States and is designated as a National Estuary as part of the National Estuary Program (Galveston Bay National Estuary Program [GBNEP] 1992).

A flood protection levee completely surrounds the Site (and the waste management units); the levee has an average crest elevation of 18 feet above msl. Three potential off-site surface water migration routes from the Site were identified. Two of the potential routes are the vehicle access gates located at the northwest and southwest corners of the facility. These gates were constructed to allow vehicular traffic to access the facility, but were to be closed during periods of extreme floods to prevent inundation of the facility. The vehicle access gate in the northwest part of the Site has been permanently closed by GCWDA. The gate structure for the vehicle access gate in the southwest part of the Site is missing. The other surface water migration route is through the storm water discharge outfall on the northeast side of the Site. This outfall has large hand-screw operated flapper-gates that can be closed manually to prevent water flow in either direction.

During facility operations, rainfall runoff collected within the waste management areas was reportedly disposed through deep well injection. Storm water collected from the undeveloped areas was reportedly routed through drainage ditches to a control retention area then discharged through gravity flow, through the storm water discharge outfall, outside the flood protection levee to Galveston Bay (MSC 1994b). EPA and the MCP continue to manage storm water in waste management units and un-impacted/undeveloped areas in this manner; however, storm water discharged to Galveston Bay is sampled to meet EPA Storm Water Management Plan (URS 2005a) parameters prior to discharge. Some of the undeveloped areas drain toward the Freshwater Pond in the northwest part of the MSC Superfund Site. The Freshwater Pond was excavated into and believed to be hydraulically connected to the uppermost aquifer beneath the Site, and water level variations in the pond appear to influence ground water flow in the aquifer (MSC 1994b). The Freshwater Pond appears to be the only direct surface water to ground water path on-site; however, the ground water plumes exist below source areas and support that rainwater infiltrates through the source material and delivers dissolved constituents to ground water.

E&E conducted a flooding potential evaluation for the MSC Superfund Site using elevation survey data, historical storm-total rainfall extreme values, and rainfall runoff estimates (E&E 1999). E&E concluded that a maximum storm surge and associated high winds comparable to those observed during Hurricane Carla in 1961 could result in breaching of the flood protection levee and inundation of the Site. Predicted flood volume estimates based upon rainfall amounts comparable to known storm events demonstrate that a 10-inch rainfall event would inundate most of the western and southern parts of the MSC Superfund Site. A rainfall event comparable to the historical rainfall of 43 inches observed at Alvin, Texas would inundate the entire MSC Superfund Site within the flood protection levee.

The Federal Emergency Management Agency (FEMA) Flood Rate Insurance Map for Texas City, Texas shows the area south of Texas City and east of Highway Loop 197 located within the 100-year floodplain. The Site and the area south to Virginia Point are designated as V19 (base elevations ranging from 14 to

16 feet), corresponding to areas of 100-year coastal flood with velocity (wave action). The areas north and northeast of the Site are designated as A-14, corresponding to areas of 100-year flood (FEMA 2004).

# 2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Waste operations at the MSC facility ceased in 1996, prior to the State's revocation of the facility's permits in 1997. The land surrounding the facility, from Interstate 45 north to Texas City is zoned for heavy industry (Texas City 2006). The facility is approximately 2 miles south of the Texas City Industrial Complex, which includes several oil refineries, oil tank farms, chemical plants, loading docks, shipyards, and municipal and hazardous waste landfills. The GCWDA, which is located adjacent to and northwest of the Site, provides landfill disposal of non-hazardous wastes to area industrial facilities. The former Texas City Municipal Landfill is located northwest of the GCWDA. The closed Solutia South 20 Site is adjacent to the Site to the southeast. Two Federal Superfund sites, the Tex-Tin Superfund Site and the MOTCO Superfund Site, are located approximately 1.5 miles to the northwest of the Site. Scenic Galveston, Inc., a nature conservancy, owns the remaining 1,500-acre property surrounding GCWDA and the Site.

The nearest residential center to the Site is Bayou Vista, approximately 1.5 miles to the southwest across Interstate 45 along State Highway 6. The population of Bayou Vista in 2000 was 1,664. The Tiki Island residential area is located approximately 2 miles to the southwest of the Site. A residential section of Texas City and Galveston Island are approximately 4 miles from the Site.

## 2.6.1 Land and Ground Water Use

The Site was operated by the Malone Service Company as a commercial storage, processing, and waste disposal facility, and ceased operations in 1997. The Site was acquired by Regor Properties in December 2001; however, no operations were conducted by Regor Properties. In November 2007, the MCP reached a court-approved settlement agreement with the Site owner. The court-approved settlement enables the MCP to impose on the property an institutional control prohibiting residential, commercial, and industrial development. The settlement further requires that the land eventually be transferred to Scenic Galveston or a similar environmental non-profit organization or, if such a transfer cannot be completed, requires that the land be used in the future only to complete the response action and for purposes not inconsistent with final use as a natural preservation or conservation area.

There are no anticipated uses for the shallow ground water. Ground water is classified as Class 3 (non-potable) due to salinity and is not a drinking water source. Ground water contamination remains on-site and is localized; therefore, an institutional control (restriction) will be placed on the property which will restrict access to ground water. No public water supply or domestic drinking water wells were identified within a one-mile radius of the Site. There are no known or suspected surface water drinking intakes located in the Lower Galveston Bay segment.

A non-potable water well is located on-site in Unit 700. The well is screened from 185 to 198 feet bgs, below the shallow contaminated ground water zones (i.e., the paleochannel aquifer and associated silt members). According to available information, this well was not used as a drinking water source during facility operations and is currently not used for drinking water or equipment cleaning; this well will be properly plugged and abandoned during the remedial action. GCWDA, located adjacent to and north of the Site, has one active industrial well on-site; the well is screened from 260 to 280 feet bgs; the well is connected to a shower and sink and is not used for drinking water.

## 2.7 SUMMARY OF SITE RISKS

Under the NCP, 40 CFR § 300.430, the role of the baseline risk assessment is to quantify the risk associated with potential exposure to hazardous substances at a site in the absence of any remedial action or control, including institutional controls. A baseline risk assessment was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site assuming no remedial action was taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the baseline human health risk assessment (BHHRA) and baseline ecological risk assessment performed for the Site (URS 2007a, 2007b).

### 2.7.1 Baseline Human Health Risk Assessment

As part of the RI, a BHHRA was conducted to evaluate the current and future effects of contaminants on human health.

#### 2.7.1.1 Summary of Baseline Human Health Risk Assessment Approach

The BHHRA was performed based on scenarios that estimated the reasonable maximum exposure (RME) to human health. The RME is defined as the highest contaminant exposure that is reasonably expected to occur at a site. The RME is estimated for individual exposure pathways. If a population is exposed by more than one pathway, the combination of exposures across multiple pathways also represents the RME. The intent of the RME is to develop a conservative (i.e., safe) estimate of exposure that is still within the range of possible exposures.

A four-step process was utilized for assessing human health risks in the BHHRA, these steps included:

- Identification of COCs – Contaminants of Potential Concern (COPCs) are those contaminants that are carried forward through the BHHRA. COCs are a subset of the COPCs that are identified in the RI/FS as needing to be addressed by the response action proposed in the ROD.
- Exposure Assessment – estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., ingestion of contaminated soil) by which humans are potentially exposed.
- Toxicity Assessment – determines the types of adverse health effects associated with chemical exposures, and the relationship between the magnitude of exposure (dose) and severity of adverse effects (response).
- Risk Characterization (including the uncertainty analysis) – summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of health risks.

With the completion of this four-step risk assessment process, those exposure pathways and site-related COCs determined to pose actual or potential threats to human health are identified for remedial action.

**Identification of COCs**

The selection of COPCs in the BHHRA was based primarily on information regarding the source(s) of the release and the detection of released contaminants in soil, sediment, surface water, sludge, and ground water samples. Given that there were many sources of contamination, a wide range of COPCs was

evaluated in the BHHRA. From this, a subset of the chemicals were identified in the FS as presenting a significant current or future risk and are referred to as the COCs.

EPA defines COCs as those chemicals that pose an Excess Lifetime Cancer Risk (ELCR) to human health greater than 1 cancer case in 1,000,000 individuals ($1 \times 10^{-6}$), have a non-carcinogenic hazard index (HI) greater than (>) 1, or are found in Site ground water at concentrations that exceed drinking water Maximum Contaminant Levels (MCLs). However, ground water at the Site is classified as Class 3 (non-potable) due to salinity. Therefore, ground water is not a drinking water source and MCLs are not applicable to the Site.

COCs identified at the Site included metals, SVOCs, and VOCs as presented in Table 5. There are numerous COCs for the Site because the facility received multiple waste streams and the Site was evaluated in multiple exposure areas. Table 5 also contains the exposure point concentrations used to evaluate the RME scenario in the BHHRA.

**Exposure Assessment**

The objectives for the exposure assessment are to evaluate potential current and future human exposures to COPCs in all media of concern. In the exposure assessment part of the BHHRA, a detailed evaluation was completed for each potential exposure scenario at the Site. This evaluation included identification and characterization of contaminant sources and release mechanisms, transport media, exposure points, exposure routes, and human receptors. Exposure pathways and receptors are illustrated in the conceptual exposure models presented in Attachment 1- BHHRA Figures.

*Receptors*

The current and potential future human receptors were determined by the Site's geography, land and water use, and activity patterns. Receptors were identified for both current and potential future site conditions.

The Site was previously considered industrial, due to its past usage. In addition, future use of the Site included the option for recreational reuse. Therefore, the BHHRA characterized risk for a future on-site industrial worker, a future on-site construction worker, a future on-site recreational bird watcher, and a current off-site recreational bird watcher. Since there are no schools, residential areas, or day care centers within 1.5 miles of the Site, risk to child receptors was not evaluated.

After the BHHRA was completed, stakeholders were concerned that the recreational bird watcher scenario was not protective enough for future reuse as a natural preserve or conservation area. Therefore, remediation levels were developed to be protective of a conservancy worker.

*Exposure Pathways*

The BHHRA identified potential exposure pathways and in each case, determined whether a complete exposure pathway exists. In a BHHRA, exposure pathways are means by which hazardous substances move through the environment from a source to a point of contact with human receptors. To be complete an exposure pathway must have four parts: (1) a source of contamination; (2) a mechanism for transport of a substance from the source to the air, surface water, ground water, and/or soil; (3) a point where human receptors come in contact with contaminated air, surface water, ground water, or soil (the exposure point); and (4) a route of entry into the body. Routes of entry can be eating or drinking contaminated materials (ingestion), breathing contaminated air (inhalation), or absorbing contaminants through the skin (dermal contact). Risks are assessed only when an exposure pathway is complete. If any part of an exposure pathway is absent, the pathway is said to be incomplete and no exposure or risk is possible.

In some cases, although a pathway is complete, the likelihood that significant exposure will occur is very small. Risk assessments include a "pathway analysis" to identify those pathways that are complete and most likely to produce significant exposure. Potentially complete exposure pathways quantitatively addressed in the BHHRA included:

- Soil Exposure Pathways – Included incidental ingestion, dermal contact, and inhalation of particulates and VOCs.
- Surface Water Pathways – Included dermal contact and volatile emissions (recreational scenarios only).
- Sediment Exposure Pathways – Included incidental ingestion and dermal contact during wading and/or recreation.
- Sludge Exposure Pathways – Included incidental ingestion, dermal contact, and inhalation of particulates and VOCs.
- Ground Water Exposure Pathways – Included inhalation of volatile emissions.

Chemical intakes and associated risks have been quantified for complete exposure pathways. The conservancy worker exposure scenario was not evaluated in the BHHRA. Nevertheless, the exposure pathways for the nature conservancy worker are the same as for the on-site recreational receptor.

*Exposure Point Concentrations*

The exposure assessment also includes calculation of the exposure point concentrations (EPCs) which are based on measured or modeled COPC concentrations present at the Site. The EPC used in the BHHRA for the RME scenario is the maximum detected concentration in each exposure area. EPCs are presented for COCs in Table 5.

*Exposure Parameters*

Tables 6.A through 6.E present the variables used in estimating doses and the assumptions (exposure parameters) which are used in the risk assessment calculations. These parameters include: daily ingestion rate of water, exposure duration, and body weight. In general, the exposure parameters that were used are standard values recommended by national and EPA Region 6 guidance. Regardless of the exposure route, the intake is presented as an estimated daily dose in units of milligrams of chemical per kilogram of body weight per day (mg/kg-day).

The conservancy worker exposure scenario was not evaluated in the BHHRA. Nevertheless, the exposure parameters for the nature conservancy worker are the same as for the on-site recreational birdwatcher receptor except the particle emission factor (PEF) was set to 150 acres (site-wide) and the exposure frequency was set to 150 days.

**Toxicity Assessment**

The toxicity assessment determines the relationship between the magnitude of exposure to a COPC and the adverse health effects (both carcinogenic and non-carcinogenic). The BHHRA evaluated COPCs for carcinogenic and non-carcinogenic systemic toxicity. Toxicity for carcinogenic (slope factors) and non-carcinogenic (reference dose) COCs are presented in Tables 7.A and 7.B.

*Carcinogenic Toxicity Values*

Information and toxicity values used to evaluate carcinogenic effects include the following:

- Weight of Evidence Classification and Hazard Descriptors under the EPA's Guidelines for Carcinogenic Risk Assessment;
- Slope factor in units of $(mg/kg\text{-}day)^{-1}$; and
- Inhalation unit risk in units of $(\mu g/m^3)^{-1}$.

The weight of evidence classification is an EPA classification system for characterizing the extent to which the available data indicate that an agent is a human carcinogen. To determine the carcinogenic potential of a chemical, EPA classifies the chemical into one of the following groups according to the weight of evidence from epidemiological studies and animal studies:

- Group A: Human carcinogen (sufficient evidence of carcinogenicity in humans);
- Group B: Probable human carcinogen (B1 – limited evidence of carcinogenicity in humans; B2 – sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans);
- Group C: Possible human carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data);
- Group D: Not classifiable as to human carcinogenicity (inadequate or no evidence); or
- Group E: Evidence of non-carcinogenicity for humans (no evidence of carcinogenicity in adequate studies).

EPA's Guidelines for Carcinogen Risk Assessment emphasizes the importance of weighing all of the evidence in reaching conclusions about the human carcinogenic potential of agents and promote the use of hazard descriptors as well as establishing the mode of action and emphasizing epidemiological data to facilitate clarity in describing carcinogenic conclusions. The following five descriptors are discussed in the guidelines:

- Carcinogenic to Humans;
- Likely to be Carcinogenic to Humans;
- Suggestive Evidence of Carcinogenic Potential;
- Inadequate Information to Assess Carcinogenic Potential; and
- Not Likely to be Carcinogenic in Humans.

EPA performs quantitative carcinogenic risk assessments for constituents that are carcinogenic to humans or likely to be carcinogenic to humans on a case-by-case basis for constituents with suggestive evidence of carcinogenic potential.

Slope factors for some constituents have been derived for oral and/or inhalation exposure since the carcinogenic potential of a constituent can be dependent on the route of exposure. The inhalation unit risk is the quantitative estimate of incremental risk in terms of risk per microgram per cubic meter $(\mu g/m^3)$ air breathed. The inhalation unit risk estimates, in units of $(\mu g/m^3)^{-1}$, are converted to inhalation slope factors, in units of $(mg/kg\text{-}day)^{-1}$, assuming that a 70-kilogram (kg) person breathes at a rate of 20 cubic meters per day $(m^3/day)$.

*Non-Carcinogenic Toxicity Values*

Toxicity values used to evaluate non-carcinogenic effects (effects other than cancer) include the following:

- Oral reference doses (RfD) in units of mg/kg-day; and
- Inhalation reference concentrations (RfC) in units of $\mu g/m^3$.

Chronic oral RfDs and inhalation RfCs are estimates (with uncertainty spanning perhaps three orders of magnitude) of the daily exposure to the human population (including sensitive subgroups) likely to be without an appreciable risk of deleterious effects during a lifetime. Chronic RfDs and RfCs are specifically developed to be protective for long-term exposure to a constituent. Chronic RfDs and RfCs are preferentially used to evaluate all exposure scenarios; subchronic RfDs and RfCs are used when chronic RfDs and RfCs are not available.

Reference doses have been developed by EPA and they represent a level to which an individual may be exposed that is not expected to result in deleterious effect. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur.

*Sources of Toxicity Values*

The following sources of information, in order of priority, were used to identify toxicity values for COPCs with potential for human exposure:

- EPA's Integrated Risk Information System (IRIS) – IRIS is updated regularly, provides verified reference doses, reference concentrations, slope factors (SFs), and unit risk factors, and is the agency's preferred source of toxicity information;
- EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) – The Office of Research and Development/National Center for Environmental Assessment/Superfund Health Risk Technical Support Center develops PPRTVs on a chemical-specific basis when requested by EPA's Superfund program staff;
- Provisional or interim toxicity values recommended by EPA's National Center for Environmental Assessment, as published in the EPA Region 6 Medium-Specific Screening Level (MSSL) tables;
- Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs) are peer-reviewed estimates of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure; and
- EPA's Health Effects Assessment Summary Tables (HEAST) – HEAST provides information on interim (not yet verified by EPA workgroups) RfDs and SFs.

If toxicity values from these sources were not available for a constituent detected at a site, and an alternative toxicity value is not justifiable, the lack of toxicity values is discussed in the uncertainty assessment.

Route-to-route extrapolations from oral toxicity values to derive inhalation values, and vice versa, are not made. For example, if there is an oral RfD for a constituent, but an inhalation RfC is not available, then only the oral routes of exposure were quantitatively evaluated in the BHHRA.

Dermal toxicity values are not available in IRIS or HEAST. For evaluating risk/hazard from dermal routes of exposure, the most recent EPA dermal guidance was followed (U.S. EPA 2004). This guidance recommends adjusting oral toxicity values using gastrointestinal absorption factors to evaluate dermal exposure routes for some constituents. The oral-to-dermal adjustment is not required for other constituents.

## Risk Characterization

The risk characterization portion of the BHHRA combines the outputs of the exposure and toxicity assessments to quantify the health risks associated with the Site. The BHHRA organized the types of risk at the Site according to various exposure scenarios. Each exposure scenario specifies the type of human receptor (e.g., industrial worker), the exposure pathway (e.g., ingestion), and the COC. If a contaminant or exposure scenario is found to produce a risk which will require a remedial action (based on either the carcinogenic risk or the non-cancer hazard index) that contaminant or exposure scenario is said to "drive the risk" or "drive" the need for action. A remediation level is set for site-related COCs that drive risk.

Risk characterization also considers the nature of and weight of evidence supporting the estimates, as well as the magnitude of uncertainty surrounding such estimates. Although the risk assessment produces numerical estimates of risk, these numbers do not predict actual health outcomes. The estimates are calculated to overestimate risk, and thus any actual risks are likely to be lower than these estimates, and may even be zero.

*Carcinogens*

For carcinogenic COCs, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. ELCR is calculated from the following equation:

$$ELCR = CDI \times SF$$

Where:

ELCR = a unitless probability (e.g., $2 \times 10^{-5}$) of an individual developing cancer

CDI = chronic daily intake averaged over 70 years (mg/kg-day)

SF = slope factor, expressed as $(mg/kg\text{-}day)^{-1}$.

A calculated risk value of $1 \times 10^{-6}$ indicates that an individual experiencing the RME has a one in one million chance of developing cancer as a result of site-related exposure. This is referred to as the ELCR because it would be in addition to the cancer risks individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three. Generally, EPA considers remedial action to be warranted at a site when the ELCR exceeds $1 \times 10^{-4}$. The need for remedial action when the ELCR falls within the $1 \times 10^{-4}$ to $1 \times 10^{-6}$ range is generally judged on a case-by-case basis (unless applicable or relevant and appropriate requirements are exceeded). Risks less than $1 \times 10^{-6}$ generally do not require remedial action.

*Non-Carcinogens*

The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with an RfD derived for a similar exposure period. The RfD is the dose at which a harmful effect is unlikely to occur. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ less than 1 indicates that a receptor's dose from a single contaminant is less than the RfD,

and that toxic non-carcinogenic effects from that chemical are unlikely. The HI is generated by adding the HQs for all COPCs that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed.

The non-cancer HQ is calculated from the following:

$$HQ = CDI/RfD$$

Where:

HQ = hazard quotient

CDI = chronic daily intake

RfD = reference dose.

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

An HI less than 1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, adverse non-carcinogenic effects from all contaminants are unlikely. An HI greater than 1 indicates that site-related exposures may present a risk to human health.

A summary of the non-carcinogenic toxicity data relevant to the COCs is presented in Table 7.B.

### 2.7.1.2 Summary of Human Health Risk Assessment Results

The BHHRA Report utilized the maximum concentration detected in each exposure area and conservative exposure and toxicity assessment parameters to produce a protective risk characterization for a future on-site industrial worker, a future on-site construction worker, a future on-site recreational bird watcher, and a current off-site recreational bird watcher. As discussed above, the conservancy worker exposure scenario was not evaluated in the BHHRA. Nevertheless, the exposure parameters for the nature conservancy worker are the same as for the on-site recreational birdwatcher receptor except the particle emission factor (PEF) was set to 150 acres (site-wide) and the exposure frequency was set to 150 days. In addition, the Site sludge areas were not evaluated in the BHHRA, because it was assumed that the sludge required remediation as the source media.

The BHRRA determined that an exposure area was not likely to warrant remedial action based on potential unacceptable risk to human health if the estimated cumulative excess cancer risk level is within or below EPA's acceptable risk range of $10^{-4}$ (one in ten thousand) to $10^{-6}$ (one in one million) [40 CFR 300.430(e)(2)(i)(A)(2)]. For non-carcinogens, target endpoint HI that are 1 or less indicate there is little likelihood of an adverse effect [40 CFR 300.430(e)(2)(i)(A)(1)].

Within each soils exposure area, the soil media were divided into surface and subsurface soil data groups. Surface soil is defined in the BHHRA to include 0- to 2-foot sample intervals; sample intervals greater than 2 feet are classified as subsurface soil.

Surface water and sediment data were evaluated for the on-site Freshwater Pond, and from the off-site Marsh Area between the levee and Swan Lake. Sediment and surface water media collected in the on-site drainage ditches were not evaluated for human health exposure. Contact recreation is not a reasonable exposure pathway for the intermittent drainage ditches at the Site. The steep sides of the drainage ditches

preclude significant exposure, as it is unlikely that a receptor would climb down and up in order to cross the drainage ditches.

Impacted ground water is localized to a few areas, immediate to the source areas, within the Site boundaries and was estimated not to present an unacceptable risk to human health in the BHHRA because of an incomplete pathway. Ground water does not meet TCEQ criteria for potable water. Vapor intrusion modeling (using the Johnson and Ettinger vapor intrusion model [Johnson and Ettinger 1991]) of soil and ground water data suggests that vapor intrusion may pose an unacceptable risk to future receptors in occupied structures, if structures are constructed.

Using the above methodology, the BHHRA estimated which exposure areas present a potential unacceptable risk to human health for the on-site industrial worker, on-site construction worker, and future on-site recreational bird watcher exposure scenarios based on current sampling data. However, the BHHRA did not evaluate an exposure scenario based on future use of the Site as a nature conservancy. As part of the Site FS, preliminary remediation goals, which became the Site remediation levels, were developed based on the nature conservancy worker exposure scenario, as discussed below. Soils requiring remedial action will be defined by whether the soils exceed the remediation levels.

The BHHRA estimated that the following exposure areas present a potential unacceptable risk to human health for the on-site industrial worker, on-site construction worker, and future on-site recreational bird watcher exposure scenarios. These exposure areas were prioritized using the magnitude of the risk for the RME exposures (as summarized on Tables 8 and 9) and the size of the exposure areas. The priority order for the exposure areas based on risk are:

- Earthen Impoundment (Oil Pit) surface soil;
- Earthen Impoundment (Sludge Pit) surface water;
- Laydown Exposure Area surface soils;
- Cemetery Exposure Area surface and subsurface soils;
- Maintenance Area – Pits Exposure Area surface and subsurface soils; and
- Tank 800 Exposure Area subsurface soils.

Tables 8 and 9 present the carcinogenic and non-carcinogenic risk summary for the COCs in the exposure areas evaluated in the BHHRA. Only those exposure pathways deemed relevant to the remedy being proposed are presented in this ROD. Readers are referred to the BHHRA for a more comprehensive risk summary of all exposure pathways evaluated for all COPCs and for estimates of the central tendency risk.

**Preliminary Remediation Goals**

During the FS document development, the MCP reached agreement with the former property owner that reuse would be as a conservancy. Therefore, future use for the Site will not involve industrial, commercial, or residential development, which will be prohibited via institutional controls. Therefore, soil Preliminary Remediation Goals (PRGs) were calculated for the on-site recreational receptors using the same exposure assumptions as presented in the BHHRA, except the PEF was set to 150 acres (site-wide) and the exposure frequency was set to 150 days. The exposure frequency was increased to account for the number of potential days at the Site by a nature conservancy volunteer worker. Table 1 of the FS Report summarizes the human health PRGs. PRGs were not calculated for sludge (inclusive of the surface water and soil overlying the Sludge Pit and the Oil Pit), as all sludge is to be remediated as source media. The PRGs are now the Site remediation levels, and are listed on Table 1 of this ROD.

### 2.7.1.3 Summary of Human Health Risk Assessment Uncertainty Analysis

Some level of uncertainty is introduced into the risk characterization process every time an assumption is made. In regulatory risk assessment, the methodology dictates that assumptions err on the side of overestimating potential exposure and risk. The effect of using numerous assumptions that each overestimates potential exposure provides a conservative (safer) estimate of potential risk.

The principal uncertainties affecting the BHHRA results included:

- **Identification of COPCs** – Uncertainties are introduced in the first step of the risk assessment process if samples do not represent site media, if analytical methods are not adequate for site constituents and matrices, if substantial amounts of analytical data are qualified or rejected, and if constituents are included in the risk assessment that are not related to historical site operations. Uncertainties can also be introduced in the COPC identification process if evaluations such as background comparisons for inorganic constituents, examination of frequency of detection, and a weight-of-evidence evaluation of the relationship of a constituent to the site are utilized to eliminate analytes for the screening process.
- **Exposure Assessment** – Uncertainties are introduced into the exposure assessment if major potential pathways of exposure are not evaluated, if the measured concentrations do not represent future concentrations, if the exposure point concentrations are over- or under-estimated, if modeling results are used in lieu of laboratory or field data, and if exposure parameters do not reflect actual exposure at the site. The uncertainty associated with models generally comes from the data used in the model, regardless of the source. Model uncertainty increases when it has not been field-validated and when default values are utilized.
- **Exposure Pathways** – The potential pathways of exposure to soil-related constituents (incidental ingestion, dermal contact, and inhalation of volatile emissions) were evaluated for the industrial worker, construction worker, and recreational bird watcher. The industrial worker, construction worker, and recreational bird watcher were evaluated at all land-based sites regardless of potential worker exposure patterns or potential recreational usage patterns.
- **Modeling Environmental Factors** – Particulate emission factors from windblown dust and volatilization factors from volatiles in soil were used to estimate concentrations in air. There is generally a higher level of uncertainty associated with the use of modeled concentrations than in the use of measured concentrations if valid measurement data are available for the exposure medium and exposure location.
- **Exposure Parameter Estimation** – Most of the exposure parameter values for the RME are high-end estimates of exposure, leading to risks that are biased high.
- **Toxicity Assessment** – Toxicity assessment uncertainties are introduced if unverified toxicity values are used in the BHHRA, if the basis for the derivation of the toxicity values is biased, or if dose-response factors are not available for detected constituents. There is a higher level of uncertainty associated with provisional values than there is for consensus values listed in IRIS. Use of provisional values could overestimate or underestimate risk/hazard. Sources of uncertainty in the derivation of toxicity values impact all risk assessments and are not specific to the risk assessment for this Site.

### 2.7.1.4 Human Health Risk Assessment Conclusions

Sludge and contaminated soils pose an unacceptable risk to human health, which will be mitigated via the implementation of remedial alternatives. The future use will be restricted to a natural preservation or

conservation area via an institutional control. Therefore, health effects from exposure to contaminated media by adults assumed to be on-site for a maximum of 150 days per year for conservancy work were evaluated for future reuse.

Table 1 of this ROD summarizes the human health remediation levels; these remediation levels are the remediation levels for the Site soils and define the areas and volumes of environmental media subject to Remedial Action. Areas of the MSC site with identified remediation level exceedances in Table 1are portions of the surface soils in the Laydown Area and portions of the surface and subsurface soil in the Cemetery Area, Maintenance Area – Pits, Maintenance Area – 900, and Tank 800 Area.

Remediation levels in Table 1 are divided into remediation levels for surface soil and subsurface soil. EPA guidance recommends an evaluation of surface soil from 0 to 2 feet bgs, while TCEQ guidance recommends surface soil from 0 to 5 feet bgs. EPA has determined that the surface soil depth interval for remediation of Site soils will extend to 2 feet bgs; therefore, institutional controls will be imposed upon the 2- to 5-foot depth interval to prevent exposure to soils with contamination levels above the surface soil remediation levels because the TCEQ considers that to be surface soil. All Site sludge in the Sludge Pit, Oil Pit, API separators and ASTs will be remediated, as well as oily waste (principal threat waste) found in subsurface soils which extend to a depth of 15 feet bgs.

Vapor intrusion modeling suggests that vapor intrusion may pose an unacceptable risk to future receptors in occupied structures. Therefore, an institutional control will be placed on the property to prohibit the construction of facilities or buildings within a prescribed distance from contaminated areas of the Site. Per EPA guidance, OSWER EPA 530-D-02-004, a vapor intrusion study should be performed prior to construction or use of buildings.

In addition, although sludge and soils will have an active remedy applied, ground water contamination is localized and apparently not moving off-site or to another aquifer; therefore, an institutional control (restriction) will be placed, which will restrict access to and use of ground water.

## 2.7.2 Baseline Ecological Risk Assessment

As part of the RI, a BERA was conducted to evaluate the current and future effects of contaminants on the environment.

### 2.7.2.1 Summary of Ecological Risk Assessment Approach

The Site is located adjacent to the southwest shore of Swan Lake and the western shore of Galveston Bay. Marsh areas are located directly adjacent to the Site on the east and northwest, extending to the shore of Swan Lake and Galveston Bay and to the south. The Site area and areas adjacent to the Site to the north, west, and south are shown as being primarily uplands. The wetlands and marshes in the area are tidally influenced.

Designated water uses for the Lower Galveston Bay segment include aquatic life use, contact recreation use, general use, fish consumption use, and restricted oyster waters use. The Galveston Bay system is designated as a National Estuary as part of the National Estuary Program.

The major sections of the ecological risk assessment included: (1) Identification of COCs; (2) Exposure Assessment; (3) Ecological Effects Assessment; and (4) Ecological Risk Characterization. With the completion of this four-step risk assessment process, those exposure pathways and site-related COCs determined to pose actual or potential ecological risk are identified for remedial action.

**Identification of COCs**

*Terrestrial Exposure Areas*

The Screening Level Ecological Risk Assessment (SLERA) identified COPCs (including metals, SVOCs, PCBs, PAHs, pesticides, and PCDDs/PCDFs) for each exposure area by comparing screening level benchmarks from a variety of published sources to the maximum detected concentration for each exposure area or the presence of bioaccumulative compounds.

Soil data were compared to soil invertebrate and plant toxicity ecological benchmarks and evaluated to determine the impact of the COPCs in soil on soil invertebrate and terrestrial plant communities. HQs were developed to determine if terrestrial avian and mammalian receptors are potentially at risk as a result of the presence of COPCs in soil at the terrestrial ecological exposure areas.

Surface soil data were evaluated even if the sample was taken from below concrete to address potential future exposure potential. The SLERA determined that, based on exceedances of conservative screening values, a potential for ecological risk existed for the exposure areas from various COPCs.

*Aquatic Exposure Areas*

The Drainage Area and Freshwater Pond exposure areas provide freshwater aquatic resources such as benthic and water column communities, and therefore food for upper trophic level receptors such as birds, mammals, reptiles, and amphibians. The Marsh Area provides similar resources for the tidally influenced estuarine community. There are detections of metals, PCBs, PAHs, pesticides, and PCDDs/PCDFs in sediments at concentrations that potentially could affect ecological receptors.

The SLERA determined that further assessment of the sediments in the Drainage Area, Freshwater Pond, and Marsh Area was warranted. Sediment and tissue samples were collected in the BERA field investigation from Site aquatic areas and from a reference salt marsh in Gangs Bayou along the north shore of Galveston Island and a reference freshwater pond located in Galveston Island State Park. HQs were also developed to determine if aquatic avian and mammalian receptors are potentially at risk as a result of the presence of COPCs in sediments at the aquatic ecological exposure areas.

Surface water concentrations did not indicate a potential for adverse impact on ecological receptors, since few analyte concentrations exceeded ecological benchmarks and none of the bioaccumulator concentrations exceeded ecological benchmarks. None of the detected concentrations in the surface water samples at the Drainage Area exceeded their respective ecological benchmarks. The maximum manganese and cyanide concentrations in the Freshwater Pond and the maximum antimony (total), cadmium (dissolved), silver (dissolved), and thallium (total) in the Marsh Area exceeded the ecological screening benchmarks. There is limited information on the aquatic toxicity of manganese and the benchmark value does not account for hardness. In addition, the analytical methodology for total cyanide measurements overstates the concentrations for a benchmark based on measurements of cyanide amenable to chlorination. There is uncertainty in evaluation of surface water concentrations, especially naturally occurring inorganic constituents, in tidally influenced dynamic systems.

Sediment data, toxicity tests, tissue sampling, and habitat observations address the assessment of risk to the aquatic community receptors (i.e., benthic invertebrates and water column) and therefore a discussion of sediment and surface water concentrations compared to sediment and surface water benchmarks was not presented.

*Contaminants of Concern*

The BERA identified COCs, which were chemicals that had Lowest Observed Adverse Effect Level (LOAEL) based HQs greater than unity after the application of an area-specific use factor (AUF). COCs identified at the Site included metals and SVOCs as presented in Table 10. Table 10 also contains the exposure point concentrations used in the BERA.

**Exposure Assessment**

The objectives for the exposure assessment are to evaluate potential current and future ecological exposures to COPCs in media of concern. In the exposure assessment part of the BERA, a detailed evaluation was completed for each potential exposure scenario at the Site. The food web for the various exposure areas are presented in Attachment 2 – BERA Figures.

*Exposure Areas*

The Site has a blend of terrestrial and aquatic exposure areas that were evaluated in the BERA, which included the following terrestrial exposure areas:

- Laydown Area;
- Cemetery Area;
- Unused Area 1 combined with the operating area designated as Earthen Impoundment Soils (soils outside bermed pits);
- Unused Area 2 combined with the WDW-138 (injection well) Area and the Unit 1200 API separator operating areas;
- Borrow Area;
- Laboratory/Office Area combined with the Unit 100 API separator;
- Maintenance Area divided into three exposure areas (Pits, Warehouse, and 900);
- Tank 800 Area; and
- Soils overlying the Oil Pit portion of the Earthen Impoundment.

The Laydown Area was evaluated as both a terrestrial system and as a wetland or aquatic exposure area. The other terrestrial areas were evaluated for terrestrial exposure only. In addition, the BERA identified the following areas as aquatic exposure areas:

- Drainage Ditches;
- Freshwater Pond; and
- Marsh Area between the levee and Swan Lake.

A site-wide aquatic assessment was also completed using the Drainage Ditch, Freshwater Pond, and Marsh Areas combined for those receptors that could potentially utilize all three habitats. The BERA analyzed risks to ecological receptors, including plants, invertebrates, birds, and mammals, for ecological COPCs.

*Terrestrial Receptors*

Representative avian receptors are likely to forage or capture prey species in the grass areas of the terrestrial exposure areas. Avian receptors chosen to represent feeding guilds of birds at the Site include the barn owl, snowy egret, mourning dove, and red-winged blackbird.

Representative mammalian receptors are likely to forage or capture prey species in the grass areas of the terrestrial exposure areas. Mammalian receptors chosen to represent feeding guilds of mammals include the deer mouse, coyote, least shrew, and raccoon.

*Aquatic Receptors*

Avian and mammalian receptors utilizing the aquatic food web were evaluated to determine if these ecological receptors might be at risk in the aquatic exposure areas. The avian receptors selected to represent aquatic exposure were the mallard duck, snowy egret, and spotted sandpiper. The mammalian receptors selected to represent aquatic exposure were the marsh rice rat and the raccoon. The spotted sandpiper was considered an appropriate surrogate for the piping plover and reddish egret and the snowy egret was considered an appropriate surrogate for the white-faced ibis when the diet is adjusted to 100 percent invertebrates to better represent the diet of the white-faced ibis.

*Exposure Point Concentrations*

The exposure assessment also includes calculation of the EPCs, which are based on measured or modeled COPC concentrations present at the Site. To assess risks to terrestrial community-level receptors (i.e., terrestrial plants and soil invertebrates), surface soil EPCs, which were the 95 percent upper confidence limit (UCL) or maximum detected concentration of constituents within each exposure area, were utilized. For the aquatic exposure areas, the maximum detected value was used for each sample type for the EPC. EPCs are presented for COCs in Table 11.

**Ecological Effects Assessment**

The BERA Problem Formulation determined that fish tissue and benthic invertebrate tissue samples were needed to fill data gaps.

*Benthic Invertebrate and Fish Sampling*

Benthic or substrate-associated macroinvertebrate and/or small fish (depending upon availability) were collected from the Drainage Area (ditches), Freshwater Pond, the Marsh Area, and reference marsh. Small fish are defined as individuals, 10- to 80-millimeter total length, considered to represent prey of larger fish, many semi-aquatic tetrapod vertebrates (wildlife), and birds. Benthic species were not captured from the reference pond.

*Bioassays*

Sediment samples were used in sediment toxicity tests for both marine and freshwater systems. The following EPA test methods were conducted on sediment samples from the Drainage Area, the Freshwater Pond, and the reference pond:

- Test Method 100.1: *Hyalella azteca* 10-day Survival and Growth Test for Sediments; and
- Test Method 100.2: *Chironomus tentans* 10-day Survival and Growth Test for Sediments.

The following tests were conducted on sediment samples from the Marsh Area and reference marsh:

- American Society for Testing and Materials (ASTM) Method E1367-03e: Standard Test Method for Measuring the Toxicity of Sediment-Associated-Contaminants with Estuarine and Marine Invertebrates, *Leptocheirus plumulosus*; and
- ASTM Method E1367-03e: Standard Test Method for Measuring the Toxicity of Sediment-Associated-Contaminants with Estuarine and Marine Invertebrates, *Ampelisca abdita*.

These species were chosen as representative species for the toxicity testing because they are commonly used as indicator species in toxicity testing.

**Risk Characterization**

The BERA utilized soil, sediment, surface water, tissue, and toxicity data from the BERA field investigation to evaluate risk to ecological receptors.

To assess risks to terrestrial community-level receptors (i.e., terrestrial plants and soil invertebrates), surface soil EPCs were compared to terrestrial plant and soil invertebrate toxicity benchmarks. This differs from the SLERA benchmark screening, because only benchmarks derived specifically for protection of plants or invertebrates were used in the BERA (the SLERA used the lowest benchmark irrespective of the organism the benchmark was designed to protect).

In order to address the following risk questions, HQ analyses were used to evaluate ecological impacts to upper trophic-level receptors to determine if these receptors might be at risk as a result of the presence of COPCs in sediment or soils at the Site.

1. Are avian and mammalian receptors at risk from ingestion of soil invertebrates, terrestrial plants, and/or other prey that have accumulated COPCs from the soil?
2. Are the avian and mammalian receptors at risk from ingestion of the benthic invertebrates that have accumulated COPCs from the sediments?
3. Are the avian and mammalian receptors at risk from ingestion of the fish that have accumulated COPCs from the sediments?

The HQ was calculated for each constituent by dividing the estimated constituent intake (dose) by the toxicity reference value (TRV).

*Doses*

A detailed description of the HQ calculation process can be found in Section 8.5.2 of the SLERA/BERA Workplan (URS 2006b). The total COPC exposure dose for each representative species is equal to the sum of the doses from incidental ingestion of water, soil, plant material, invertebrate prey, and vertebrate prey. The exposure assumptions (i.e., body weight, food ingestion rate, water ingestion rate, and soil ingestion percentage) for avian and mammalian terrestrial receptors, and dietary composition assumptions (i.e., diet composition) for each receptor are provided in the BERA. In addition, the BERA provides the exposure assumptions (i.e., body weight, food ingestion rate, water ingestion rate, and soil ingestion percentage) and dietary composition assumptions (i.e., diet composition) for the avian and mammalian aquatic receptors.

Doses for the Laydown Aquatic Area were obtained from the median benthic and fish tissue concentrations for the Freshwater Pond and Drainage Areas and the Freshwater Pond surface water, from

the soil EPCs for the Laydown Area, and from sediments (the maximum of the concentrations for the aquatic area). Laydown Area sediment data was used as proxy values to calculate HQs for COPCs that were not detected in fish or benthic tissue. One bioaccumulator, hexachlorobenzene, was not detected in the fish tissue. The hexachlorobenzene benthic tissue concentration was used as the proxy value for the fish tissue concentration.

The Site-wide aquatic doses for tissue, surface water, and sediments were calculated using the average of the Freshwater Pond, Drainage Ditches, and Marsh Area. The Site-wide aquatic doses for soils ingestion were calculated using the Site-wide (excluding the Laydown Area, Tank 800 Area, and Oil Pit Area) soils data. Doses were calculated using one-half the detection limit for non-detected analytes.

*Toxicity Reference Values*

The strategy for selection of a TRV was based on several key factors:

- Preference for chronic (i.e., long-term) endpoints, especially those that include critical life stages (see below for more information);
- Preference for the use of the ecological receptor as a test organism; and
- Preference for food studies over gavage or oral intubation studies (intraperitoneal or intravenous studies were not used for ingestion-based TRVs), and direct inhalation exposure studies were used for inhalation-based TRVs.

No observable adverse effect level (NOAEL) and LOAEL TRVs were utilized in the HQ calculations (see Table 10). TRVs were not extrapolated across taxonomic classes because physiological differences between taxonomic classes are assumed to be too great to make any extrapolation useful in predicting effects to another taxonomic class of animals (e.g., using mammal data for birds or bird data for amphibians). The TRVs for ecological COPCs were adjusted for the ecological receptor by incorporating exposure duration uncertainty factors (UFs). The UFs were used to account for differences in exposure duration and endpoints. UF adjustments for LOAELs to NOAELs and to adjust from acute to chronic duration or subchronic to chronic duration followed the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM 2000) guidelines.

### 2.7.2.2 Summary of Ecological Risk Assessment Results

**Terrestrial Exposure Areas**

Multiple lines of evidence, including (1) field observations, (2) number of COPCs, (3) number of LOAEL-HQs exceeding 1, (4) AUFs, (5) bioavailability, (6) the comparability of background LOAEL-HQs to exposure area LOAEL-HQs, and (7) an evaluation of the Site risk (i.e., an assessment of exposure areas post-remedial action), were used to interpret the risk from the terrestrial assessment. LOAEL-based HQs were considered applicable because there are no protected terrestrial species associated with the Site. The Borrow Area was chosen to represent the background concentrations of PAHs and PCDDs/PCDFs at the Site because of the lack of Site activities in that area.

Based on the multiple lines of evidence, the BERA recommended inclusion of the following soil exposure areas in the FS because of potentially unacceptable risk to terrestrial receptors:

- Laydown Area;
- Cemetery Area;

- Tank 800 Area; and
- Oil Pit.

Table 2 summarizes the ecological remediation levels for terrestrial receptors.

Multiple lines of evidence, including the comparability of background LOAEL-HQs to exposure area LOAEL-HQs, AUFs, and uncertainty in TRVs, uptake factors, and bioavailability, indicate the remaining terrestrial exposure areas did not warrant response action based on ecological risk.

**Aquatic Exposure Areas**

Multiple lines of evidence, including (1) toxicity testing of the sediment, (2) tissue analysis, (3) field observations, (4) an evaluation of LOAEL-based HQs, (5) an evaluation of NOAEL-based HQs for protected species, (6) AUFs and bioavailability, and (7) a comparison of risk from the reference areas were used to interpret risk from the aquatic areas. Based on these lines of evidence, the three aquatic exposure areas, Drainage Area, Freshwater Pond, and Marsh Area, do not warrant response action based on ecological risk. Ten-day sediment toxicity tests did not indicate toxicity, as measured by survival and growth, from sediment exposure to the benthic invertebrate community. Based on the toxicity tests, the sediments of these three areas are not adversely affecting the benthic invertebrate community. The analysis of the invertebrate and fish tissue did not indicate that COPCs are at concentrations that are impacting these communities. The trophic analysis showed very little risk to the populations of birds and mammals that may utilize these areas for foraging. The protected species (white-faced ibis in the Drainage Area and Freshwater Pond, and piping plover and reddish egret in the Marsh Area) show minor risk from the naturally occurring metals and the low detections of 2,3,7,8-TCDD toxic equivalent (TEQ). Comparison of the risk from the reference areas shows that the risk from the metals (e.g., aluminum, chromium, vanadium, and zinc) is largely contributed by naturally occurring background concentrations.

The Freshwater Pond provides a freshwater resource in an estuarine area. Destruction of the Freshwater Pond would unnecessarily remove ecological services for a hypothetical risk that is not supported by the multiple lines of evidence (viable aquatic habitat, lack of toxicity, low tissue burdens, and low HQs). Destruction of the Marsh Area would unnecessarily remove ecological services for foraging, nursery, and nesting habitat based on a hypothetical risk that is not supported by multiple lines of evidence (viable aquatic habitat, lack of toxicity, low tissue burdens, and low HQs). The present risk from the Marsh Area is currently low and is not expected to increase as siltation deposits clean sediment into the Marsh Area.

### 2.7.2.3 Summary of Ecological Risk Assessment Uncertainty Analysis

Some level of uncertainty is introduced into the risk characterization process every time an assumption is made. In regulatory risk assessment, the methodology dictates that assumptions err on the side of overestimating potential exposure and risk. The effect of using numerous assumptions that each overestimates potential exposure provides a conservative (safer) estimate of potential risk.

The principal uncertainties affecting the BERA results included:

- Uncertainties with the Use of Background Concentrations;
- Uncertainties with Exposure Analysis, including:
  - Laydown Aquatic Exposure,
  - Use of SLERA Surface Water Data to Represent Drinking Water Exposure,
  - Bioavailability,
  - Influences on the Toxicity of Metals,

  - Uptake Factors,
  - Food Chain Multipliers,
  - Metabolism of PAHs in Vertebrates (Birds, Mammals, and Fish),
  - Area Use Factors,
  - Synergistic or Antagonistic Effects of Constituents, and
  - Use of Tissue Concentrations to Estimate Toxicity;

- Uncertainties with TRVs and Community Screening Values, including:
  - Toxicity Data Selection,
  - Conservatism of Toxicity Data,
  - Surrogate Toxicity Values,
  - Uncertainty Factors Used in TRV Development,
  - Uncertainty Associated with Least Shrew Exposure to PCBs,
  - Lack of Toxicity Data and Screening Values,
  - Phytotoxicity Benchmarks,
  - Soil Invertebrate Toxicity Benchmarks, and
  - Amphibians and Reptiles;

- Uncertainties in Risk Characterization;
- Uncertainties in the Comparison of Site Freshwater Areas to Reference Pond;
- Uncertainties Associated with the Tissue Sampling; and
- Uncertainties Associated with Toxicity Testing.

#### 2.7.2.4 Ecological Risk Assessment Conclusions

**Terrestrial Ecological Risk**

Based on the BERA analysis, the following exposure areas warrant response action based on ecological risk: Laydown Area, Cemetery Area (a small portion), Tank 800, and the Oil Pit. Each of these exposure areas has LOAEL-based HQs above 1 for multiple bioaccumulative analytes for multiple species. LOAEL-based HQs are an adequate assessment of terrestrial ecological risk because there are no threatened and endangered species associated with the terrestrial habitat.

The Laydown Area has LOAEL-based HQs (after adjustments for AUFs) above 1 for 2-methylnaphthalene, hexachlorobenzene, hexachlorobutadiene, high molecular weight PAHs, metals, PCDDs/PCDFs, phenanthrene, and PCBs. The Cemetery Area (one portion) has a LOAEL-based HQ above 1 for high molecular weight PAHs. The Tank 800 soils have LOAEL-based HQs greater than 1 for bis(2-ethylhexyl) phthalate, hexachlorobenzene, high molecular weight PAHs, and metals. The Oil Pit soils have LOAEL-based HQs greater than 1 for hexachlorobutadiene, high molecular weight PAHs, and metals.

Multiple lines of evidence, including the comparability of background LOAEL-HQs to exposure area LOAEL-HQs, AUFs, and uncertainty in TRVs, uptake factors, and bioavailability, indicate the remaining terrestrial exposure areas do not warrant response action based on ecological risk.

**Aquatic Ecological Risk**

Based on multiple lines of evidence, the Drainage Area, Freshwater Pond, and Marsh Area do not warrant response action based on ecological risk. Relevant lines of evidence include: (1) toxicity testing of the sediment, (2) tissue analysis, (3) field observations, (4) an evaluation of LOAEL-based HQs, (5) an evaluation of NOAEL-based HQs for protected species, (6) AUFs and bioavailability, and (7) a comparison of risk from the reference areas. Ten-day sediment toxicity tests did not indicate toxicity, as measured by survival and growth, from sediment exposure to the benthic invertebrate community. The analysis of invertebrate and fish tissue did not indicate that COPCs are at concentrations that are impacting the fish community. The trophic analysis showed very little risk to the populations of birds and mammals that may utilize these areas for foraging. The protected species (white-faced ibis, piping plover, and reddish egret) show minor risk from the naturally occurring metals and the low detections of 4,4'-DDT and 2,3,7,8-TCDD TEQ. Comparison of the risk from the reference areas shows that the risk from the metals (e.g., aluminum, chromium, vanadium, and zinc) is largely contributed by naturally occurring background concentrations.

**Ecological Remediation Levels**

The potential for significant exposure of wildlife to site-related contaminants does occur within contaminated portions of the Site. The remediation levels listed in Table 2 are the basis for defining the areas and environmental media subject to Remedial Action based on ecological receptor protection. All the receptors, exposure factors, including the AUFs, and uptake factors discussed in the BERA were used to calculate ecological remediation levels.

Ecological risk attributed to contaminated soils (terrestrial) was evaluated mostly through food chain modeling of small mammals and predatory birds. After the decision was made for future land use to be a land conservancy, the vast majority of ecological risk was ameliorated by human health risk and cleanup values (i.e., the human health values were more stringent). However, there was one small parcel of land (immediate to and east-southeast of the Tank 800 berm, along the road [Figure 3]) in which ecological cleanup values were the more stringent. In this case, risk and associated remedial levels were based on the least shrew (a primary food source for predatory birds) (see Table 2).

### 2.7.3 Basis for Remedial Action

The response action selected in this ROD is necessary to protect human health and the environment from actual or threatened releases of hazardous substances. The 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 public health, welfare, or the environment.

## 2.8 REMEDIAL ACTION OBJECTIVES

According to the NCP, 40 CFR §300.430(a)(1)(i), the "national goal of the remedy selection process is to select remedies that are protective of human health and the environment, that maintain protection over time, and that minimize untreated waste." Based on information relating to types of contaminants, environmental media of concern, and potential exposure pathways, remedial action objectives (RAOs) were developed to aid in the development and screening of remedial alternatives.

### 2.8.1 Remedial Action Objectives and Media-Specific Remediation Levels

Under the NCP, 40 CFR § 300.430(e)(2)(i), EPA is to establish RAOs that provide a general description of what the cleanup will accomplish. Therefore, RAOs were developed for the Site. Table 12 summarizes the results of the RI and risk assessments and presents the RAOs for each environmental medium. The RAOs presented in this table serve as the design basis for remedial alternatives, which will be presented in the next section.

Remediation levels establish acceptable exposure levels (i.e., contaminant concentration levels) that are protective of human health and the environment, and are developed considering applicable, relevant, and appropriate requirements (ARARs), as specified in the NCP. The remediation levels for the Site are the same as the PRGs established in the FS. The term "remediation level" is used in order to make clear that the selected remedy establishes binding requirements to ensure that RAOs are satisfied. Remediation levels are the basis for defining the areas and volumes of environmental media subject to remedial action; the lower of the human health or ecological remediation level will be used in this determination.

**Human Health Remediation Levels**

Risk-based calculations set human health remediation levels using carcinogenic or non-carcinogenic toxicity values and site-specific exposure conditions. Remediation levels were calculated to obtain a COC specific carcinogenic risk less than or equal to $10^{-6}$ or non-carcinogenic HQ less than or equal to 1 for the on-site nature conservancy worker. However, if the cumulative carcinogenic risk exceeded $10^{-4}$ or a cumulative non-carcinogenic HQ was greater than or equal to 10 for the surface or subsurface soils media, then allowable soil concentrations were adjusted downward until the cumulative carcinogenic risk was less than $10^{-4}$ or a cumulative non-carcinogenic HQ was less than or equal to 10.

**Ecological Remediation Levels**

Remediation levels for ecological receptors were determined on a site-specific basis and take into account multiple factors. They correspond to acceptable levels of risk for the ecological receptor or habitat. Ecological remediation levels were calculated for soils.

Remediation levels for protection of human health and the environment are presented in Tables 1 and 2.

The RAOs and remediation levels for the Site include:

### 2.8.1.1 Sludge

The RAOs for sludge (including soils and surface water overlying the sludge) are to:

- Prevent the potential direct contact/inhalation of carcinogenic and non-carcinogenic COCs by human receptors above risk-based remediation levels;
- Prevent the release of carcinogenic and non-carcinogenic COCs from sludge to surface soils and sediments above risk-based remediation levels;
- Prevent the migration of carcinogenic and non-carcinogenic COCs from sludge to ground water above risk-based remediation levels for inhalation from ground water contaminants by human receptors;
- Prevent the release of COCs from sludge to surface soils and sediments above ecological risk-based remediation levels; and
- Prevent the release of COCs from sludge to surface water above ecological risk-based remediation levels.

Remediation levels were not calculated for sludge (inclusive of the surface water and soil overlying the Sludge Pit and the Oil Pit), because it was determined that all sludge is to be remediated as source media. Any surface water remaining in the Sludge Pit will need to meet the Texas Surface Water Quality Standards (30 TAC 307) or other values, such as those used to evaluate surface water in the SLERA, and the pit will be backfilled with clean soil to ground surface.

#### 2.8.1.2 Soil

The studies found that surface and subsurface soils in some areas need to be remediated. The RAOs for soil are to:

- Prevent ingestion/direct contact/inhalation by human receptors of carcinogenic and non-carcinogenic COCs from surface soils above risk-based remediation levels;
- Prevent migration of COCs to ground water from soils with subsequent emanation of vapors above risk-based remediation levels for the prevention of inhalation of contaminants by human receptors;
- Prevent ingestion by ecological receptors of COCs from surface soils above risk-based remediation levels;
- Prevent ingestion by avian and mammalian receptors of soil invertebrates, terrestrial plants, and/or other prey that have accumulated COCs from the soil; and
- Prevent inhalation by human receptors of carcinogenic and non-carcinogenic COCs from subsurface soils above risk-based remediation levels.

Areas of the Site with human health remediation level (Table 1) exceedances include portions of the surface soils in the Laydown Area and portions of the surface and subsurface soil in the Cemetery Area, Maintenance Area – Pits, Maintenance Area – 900, and Tank 800 Area (Figure 2). Areas of the Site with ecological remediation level (Table 2) exceedances include portions of the surface soils in the Oil Pit Area, the Laydown Area, the Cemetery Area, and the Tank 800 Area (Figure 2).

After the decision was made for future land use to be a land conservancy, the vast majority of ecological risk was ameliorated by human health risk and remediation levels (i.e., the human health values were more stringent). However, there was one small parcel of land (immediate to and east-southeast of the Tank 800 berm, along the road) in which ecological remediation levels were the more stringent. In this case, the remediation levels were based on the least shrew (a primary food source for predatory birds) (see Table 2).

EPA soil screening guidance (U.S. EPA 2002) (supplemental guidance for developing soil screening levels for Superfund sites) recommends an evaluation of surface soil from 0 to 2 feet bgs, while TCEQ guidance recommends evaluation of surface soil from 0 to 5 feet bgs. EPA has determined that the surface soil depth interval for remediation will extend to 2 feet bgs; therefore, institutional controls will be imposed upon soils in the 2- to 5-foot depth interval and below to prevent exposure to soils that the TCEQ classifies as surface soil and which have contamination exceeding the surface soil remediation levels. Subsurface soils extending to the top of the uppermost water-bearing unit which contain source material or which exceed the subsurface soil remediation levels will be remediated, so that all source material will be excavated and remediated, including soils in the Cemetery Area, Maintenance Area – Pits, Maintenance Area – 900, and the Tank 800 Area.

Vapor intrusion modeling of soil data suggests that vapor intrusion may pose an unacceptable risk to future receptors in occupied structures, if present. Therefore, institutional controls will be placed on the property to protect occupants from potential vapor intrusion from impacted soil. A vapor intrusion study should be performed prior to construction or use of buildings (OSWER EPA530-D-02-004, November 2002).

#### 2.8.1.3 Ground Water

The BHHRA determined that ground water at the Site does not present a potential unacceptable risk to human health for those exposure pathways evaluated in the BHHRA, although, as discussed below, an unacceptable risk from potential vapor intrusion from the shallow ground water exists. Because the aquifer is considered a Class 3 aquifer (>10,000 parts per million [ppm] TDS), it is not suitable for drinking water. The RI concluded that shallow ground water contamination remains localized near operational areas on-site; the plumes of contamination appear stable and do not appear to be migrating off-site; and that source material has not been found in the shallow ground water. The RI also presents information indicating that the clays underlying the shallow ground water may prevent vertical migration. Nevertheless, shallow ground water has been impacted by operations. Therefore, based on the information presented in the RI, the RAO for ground water is to:

- Prevent migration of COCs beyond the Site boundary or into uncontaminated aquifers at concentrations exceeding Texas Class 3 ground water protective concentration levels.

Source material was discovered in subsurface soil, but not in ground water, during the RI. Therefore, it is anticipated that once the source material in subsurface soil above these localized ground water contaminant plumes has been removed, the ground water will naturally attenuate. Because there is the potential for ground water to travel off-site or to discharge to surface water, ground water will be monitored at the point of compliance (property boundary). Ground water COC selection was based on the detection above TCEQ Class 3 PCLs, degradation products, and mobility. COCs will include the ground water analytes as identified in Table 15. In addition, ground water will be monitored for those constituents necessary to evaluate natural attenuation potential, of which most are not part of the COCs listed on Table 15 but must be determined during the design.

A containment or treatment remedy will be required if any of the following conditions are met:

(1) Organic COCs are detected in a boundary well in concentrations above the TCEQ PCLs;
(2) Metal concentrations are greater than TCEQ PCLs and background levels in a boundary monitoring well(s); and
(3) Information suggests to EPA that the plume (metals or organics) has the potential to migrate off-site.

In addition, if EPA determines that contamination in the shallow ground water is migrating to an aquifer not currently known to be contaminated, additional actions may be required. In the future, EPA may select additional COCs based on new information or input from its Federal and State partners.

Vapor intrusion modeling of ground water data suggests that vapor intrusion may pose an unacceptable risk to future receptors in occupied structures, if present. Therefore, institutional controls will be placed on the property to protect human receptors from potential vapor intrusion from impacted ground water.

#### 2.8.1.4 Sediment and Surface Water

RAOs for the protection of human health or ecological receptors from COCs in sediments and surface water were not developed, because the BHHRA and BERA determined that sediments and surface water in the aquatic areas do not present a potential unacceptable risk. RAOs for surface water overlying the Sludge Pit were not developed; the RAOs for surface water overlying the Sludge Pit are included in the RAOs for sludge and liquid wastes.

### 2.8.2 Basis and Rationale for Remedial Action Objectives

The basis for the sludge and contaminated soil RAOs is to remediate these media to on-site conservancy worker and ecological remediation levels to maintain and allow for future land use as a preserve or conservancy. In addition, the sludge is a principal threat waste and requires a response per NCP requirements (40 CFR 300.430).

The ground water is Class 3 (non-potable), and is therefore, not a drinking water aquifer. The shallow contaminated ground water is not anticipated to be used as a drinking water source in the future due to its high salinity content. However, an off-site surface water discharge point for contaminated ground water is not known, and in consideration of the TCEQ Class 3 Groundwater PCLs requirement, the ground water will be monitored to prevent off-site migration at those respective TCEQ PCLs.

## 2.9 DESCRIPTION OF ALTERNATIVES

### 2.9.1 Statutory Requirements/Response Objectives

Remedial alternatives were developed to address the RAOs for the Site and to be consistent with the statutory requirements and preferences found in Section 121 of CERCLA, 42 U.S.C. § 9621, and further detailed in the NCP, 40 CFR § 300.430. Each remedial alternative selected at a Superfund site must be protective of human health and the environment. In addition statutory requirements and preferences include: a requirement that EPA's remedial action must comply with all applicable or relevant and appropriate Federal and more stringent State environmental and facility siting standards, requirements, criteria, or limitations, unless a waiver is invoked; a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment that permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances is a principal element over remedies not involving such treatment.

### 2.9.2 Technology and Alternative Development and Screening

CERCLA and the NCP set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, the FS Report (URS 2008) developed a range of remedial alternatives to achieve the RAOs and remediation levels described in Section 2.8.

With respect to source control, the FS developed a range of alternatives in which treatment that reduces the toxicity, mobility, or volume of the hazardous substances is a principal element. This range included an alternative that removes or destroys hazardous substances to the maximum extent feasible, eliminating or minimizing to the degree possible the need for long-term management. This range also included alternatives that treat the principal threats posed by the Site, but vary in the degree of treatment employed

and the quantities and characteristics of the treatment residuals and untreated waste that must be managed; alternatives that involve little or no treatment but provide protection through engineering or institutional controls; and a no-action alternative. The alternatives are summarized in Table 13 and discussed further in the following sections. These alternatives are numbered to correspond with the descriptions provided in the FS Report.

With respect to ground water response action, the FS developed only one remedial alternative that attains site-specific goals. The sludge, contaminated soil, and ground water were addressed inclusively in each alternative discussed (i.e., there is only one Operable Unit for the Site).

Remedial alternatives for the Site were assembled using an array of presumptive and innovative technologies. Presumptive technologies are preferred technologies for common categories of sites based on historical patterns of remedy selection and EPA's scientific and engineering evaluation of presumptive technology performance. Presumptive technologies that were screened for use at this Site and utilized in developing remedial alternatives included: source (sludge) ex-situ solidification, source in-situ solidification, thermal desorption of sludge, bioremediation of sludge, and RCRA Subtitle C equivalent cell (containment). As previously stated, ground water will be monitored only.

Innovative technologies are relatively new or emerging remediation methods that offer the potential for comparable or superior treatment effectiveness, less intrusive implementation, reduced adverse affects, or lower costs for comparable levels of performance than other demonstrated technologies. Innovative technologies, such as chemical oxidation of soil and sludge were considered, but are less cost-effective and afford no more comparable level of performance than the presumptive remedies.

As discussed in Section 4.1 of the FS Report (URS 2008), sludge and soil treatment technology options were indentified, assessed, and screened based on implementability, effectiveness, and cost. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Each alternative was then evaluated in detail in Section 5 of the FS Report.

The alternatives are:

- Alternative 1 – No Action;
- Alternative 2 – Engineered Containment of Unsolidified Sludge and RCRA Subtitle C Containment of Soils;
- Alternative 3 – Engineered Containment of Solidified Sludge and RCRA Subtitle C Containment of Soils;
- Alternative 4 – RCRA Subtitle C Containment of Solidified Sludge and Untreated Soils; and
- Alternative 5 – Slurry-Phase Bioremediation of Sludge and RCRA Subtitle C Containment of Treated Sludge and Untreated Soils.

Alternatives were developed to span the range of possible remedies for the Site from "no action" to "clean closure" with intermediate options providing varying degrees of protectiveness. Table 14 lists the appropriate treatment technology for each medium and the alternative(s), which include the specific treatment technology. The construction time for each alternative reflects only the time required to construct or implement the remedy and does not include the time required to design the remedy or procure contracts for construction.

After the alternatives are described, differences between alternatives with respect to effectiveness, implementability, and cost are identified. Although seven alternatives were screened, Alternatives 6 (Thermal Desorption and RCRA Subtitle C Landfill) and 7 (Off-site Incineration) were not included in the remedial alternative development. Alternative 6 ($105–$115 million) was not included in the remedial alternative development because the additional remedial cost of $25 million over Alternative 5 (Bioremediation) was not supported by any increase in effectiveness or implementability. Since thermal desorption preferentially removes VOCs, mobility of the waste is also reduced; however, it would not address metals concentrations which would have to be addressed through another treatment such as solidification. In addition, the community may have the same concerns for thermal desorption as with incineration—air quality. Alternative 7 was also not included in the remedial alternative development because of the grossly excessive costs ($450–$500 million) for the effectiveness provided. Short-term risks to the community would be increased with this alternative; approximately 23,500 truckloads of sludge would be moved from the Site to an off-site incineration facility. In addition, the sludge would still require solidification for transport to the incineration facility.

Each of the five remaining alternatives are individually assessed against the nine NCP criteria, and a comparative analysis of Alternatives 1 through 5 is conducted to evaluate the relative advantages and disadvantages of the alternatives in relation to each of the specific criteria.

### 2.9.3 Common Elements

The following remedial elements (activities or remedial technologies) are shared (*common elements*) by all five alternatives discussed below, with the exception of the "No Action" alternative (i.e., Alternative 1):

- *Preconstruction Activities*: Phase 1- includes pre-construction activities, management of tank contents, and tank demolition. The pre-construction phase includes the remedy design; planning facility and demolition work; preparation of submittals; mobilization and construction of project facilities and utilities; improving site roads; plugging and abandoning of existing monitoring wells; transfer of tank water to the on-site injection well; abatement and off-site disposal of asbestos and lead paint; off-site disposal of laboratory chemicals, drums, and bucket wastes; tank structure and piping demolition; hauling scrap metal to an off-site processor; and demobilization of Phase 1 equipment and personnel. Additional pre- and post-construction activities will be needed to address the presence of the cemetery at the Site. Pre-construction activities include an archaeological survey of the cemetery area; due to community concerns regarding the cemetery, either the cemetery or the RCRA Subtitle C equivalent cell will be relocated according to federal, State, and local requirements.

- *Air Monitoring*: To evaluate the potential for releases to ambient air and to develop fence-line and remediation worker safety monitoring programs for remedy implementation. Ambient air monitoring consists of short-term monitoring and time-integrated monitoring. In addition to ambient air monitoring, remediation worker safety monitoring programs would be implemented during the remediation phase of the project by the remediation contractor.

- *Sludge Pit Improvements*: The perimeter berms will be enlarged to allow for access of construction equipment, and a subsurface barrier wall (slurry wall) is proposed to control infiltration of ground water into the Sludge Pit during remedy implementation (see *Slurry Wall Barrier* below).

- *Solidification*: Solidification refers to a physical process where a semi-solid material or sludge is treated to render it solid with no free water. Solidification/stabilization refers to a group of remediation methods that prevent or slow the release of harmful chemicals from contaminated soil or sludge. These methods usually do not destroy the chemicals; they protect human health and the

environment by preventing the chemicals from moving into the environment. These two methods are often used together to prevent exposure to harmful chemicals. Solidification enhances the structural integrity and durability of the waste material, increasing compressive strength and load-bearing capacity and decreasing permeability. Solidification is a technology implemented by mixing a pozzolanic reagent, such as organophilic clay, Portland cement, cement kiln dusts, Class C (calcareous) or Class F (siliceous) fly ash, lime, or bentonite into contaminated soil or sludge. Stabilization, or chemical fixation, transforms contaminants into less toxic and/or less mobile form, thereby reducing their impact on the environment and human health. The treatability study demonstrates that solidification is a viable technology for Site sludge. The results of solidification treatability testing are presented in the Stabilization/ Solidification Treatability Study Report (Shaw 2008) and in Section 2.9.5.4 of this ROD.

- *Solidification/Stabilization Treatability Study*: Considering that four of the five source control alternatives require solidification/stabilization (S/S) as a principal remedial component, a bench-scale (laboratory tests) treatability study (Shaw 2008) conducted for Site sludge evaluated the chemical and physical characteristics of solidified/stabilized sludge to determine formulations that should produce a treated material which is appropriate for placement in an on-site RCRA Subtitle C or D disposal cell. Four tiers of formulations were tested; the formulations were various combinations of reagents that have been used at RCRA and CERCLA remediation sites for the S/S of total petroleum hydrocarbons in soil and sludge. Each tier was designed in conjunction with EPA. The S/S testing used a combination of lime-based reagents (Portland cement, quicklime, hydrated lime), fly ash, and other specialty reagents.

  The primary objective of the solidification/stabilization bench-scale treatability study was to develop and verify treatment formulations for each of the waste types (Sludge Pit, Oil Pit, and API-100 separator sludge) such that the treated material meets requirements for disposal in either a RCRA C or D equivalent cell on site. Secondary objectives were to provide information to: 1) produce a treated material with no free liquids due to compaction or compression; 2) determine the physical (unconfined compressive strength [UCS]), consolidation, and permeability properties of the solidified/stabilized material; 3) demonstrate the leachability characteristics, using the Synthetic Precipitation Leaching Procedure (SPLP) of the solidified/stabilized material; and 4) determine how the physical and chemical properties of the solidified/stabilized material may influence the final design of the on-site disposal cell.

  For placement in a RCRA C equivalent disposal cell, EPA determined that the treated material should have a UCS greater than 25 pounds per square inch (psi) with no free liquids expressed during the UCS testing. For placement in a RCRA D equivalent cell, EPA determined that the treated material should have a UCS of greater than 50 psi with no free liquids expressed during UCS testing, a permeability of less than $1 \times 10^{6}$ cm/sec, and contaminant concentrations in the SPLP leachate less than the Texas Class 3 ground water standards under commercial/industrial use.

  The conclusions of the bench-scale treatability study (Shaw 2008) were that no formulations attempted in the first three tiers of formulations met the leaching criteria for placement in a Subtitle D equivalent cell. The concentrations of hazardous contaminants such as benzene, methylene chloride, 1,2-dichloroethane, trichloroethylene, and tetrachloroethylene in the SPLP leachate for the formulations were often much higher than the TCEQ Class 3 Groundwater PCLs. Including a 0.03 or 0.05 mix ratio of activated carbon in the formulation (at a cost approximately $30 to $50 per ton treated) did not significantly reduce the contaminant concentrations in the SPLP leachate. More than $150 per ton treated would likely be required to reduce contaminant concentrations in the SPLP leachate to near the Class 3 ground water standards. Based on these results, the placement of treated

material on-site in a RCRA Subtitle D cell would not be cost-effective; therefore, a RCRA Subtitle C cell is required for the solidified sludge.

The treatability study also concluded that, based on observations of water/oil bleed during loading of UCS samples, all Tier 2, 3, and 4 formulations did not show evidence of free liquids due to compaction or compression. The treatability study further determined formulations which should develop 25 psi UCS in 28 days for sludge materials from the different Site areas. The Treatabilty Study also concluded that concentrations of benzene, 1,2-dichloroethane, and trichloroethene in untreated soil samples from the Cemetery Area, Maintenance Area – Pits, and Tank 800 area leached in excess of the TCEQ Class 3 Groundwater PCLs, and that untreated soils from the Laydown Area did not leach in excess of the TCEQ Class 3 Groundwater PCLs

- *RCRA Subtitle C Equivalent Cell*: The RCRA Subtitle C equivalent cell includes both a cap and leachate collection and leak detection system as depicted on Figure 10. During the Remedial Design, it will be determined whether the on-site cemetery must be moved in compliance with all Federal, State, and local requirements, and in consultation with relatives of the deceased, or whether the cell can be designed around the cemetery so that it will remain in place. The typical elements of the RCRA cell cover include a clay layer, a synthetic drainage layer (geonet with geotextile on top), high-density polyethylene (HDPE) geomembrane liner, geosynthetic clay liner (GCL) with geotextile on to p and bottom, and gas vent layer (geonet with geotextile on top and bottom). The typical elements of the RCRA leachate collection and leak detection system include geotextile, geomembrane with a drain pipe in the leachate collection system, geomembrane, geotextile, and a drain pipe in the leak detection system, and an underlying compacted clay layer with geotextile on top and bottom.

- *General Site Improvements*: Common activities for general site improvements are mobilization/demobilization and abandoning monitoring wells, injection wells, and water supply wells. General site improvements for the on-site actions include site grading to minimize accumulation of storm water during construction activities and construction of drainage ditches for storm water management, and improving the levee along the Marsh Area with additional soil for slope and adding rip-rap to address possible storm surge.

- *Storm Water Discharge*: The existing storm water discharge point, which allows water that accumulates on the Site to be discharged to Galveston Bay, would be utilized for storm water discharge during and after remedy implementation – following Storm Water Management Plan (SWMP – URS 2005a) requirements.

- *Institutional Controls (ICs)*: ICs are administrative and/or legal instruments that reduce the potential for human exposure to contaminated soil, soil vapor, or ground water by placing restrictions on the use or development of land and ground water within a defined area. Typical IC instruments include restrictive covenants, deed notices, ordinances, zoning restrictions, building and excavation permits, easements, and well drilling prohibitions, or the like, or any combination thereof.

  As previously stated, the court-approved settlement, which requires that the land be used in the future for purposes not inconsistent with final use as a natural preservation or conservation area, gives the MCP the ability to impose on the property an IC prohibiting residential, commercial, and industrial development. Consistent with reuse, a notification device or restrictive covenant should include a vicinity map showing areas of residual contaminant concentrations. The IC will also restrict any excavation below 2 feet, and restrict any drilling to or use of ground water below the Site. A vapor intrusion study should be performed prior to construction or use of buildings (OSWER EPA530-D-02-004, November 2002).

- *RA Monitoring*: RA monitoring consists of periodic sample collection, laboratory testing, data evaluation and reporting for the purposes of confirming that the RA is performing in accordance with expectations, to identify opportunities for RA enhancement and optimization, and to verify that RAOs have been achieved.

- *Ground Water Monitoring*: Monitoring will be required to track the remedial action progress; i.e., to document that natural processes (natural attenuation) are degrading the contaminant plume and that the existing contaminant plumes do not migrate off-site at concentrations above TCEQ Class 3 Groundwater PCLs and background levels (metals). If ground water at TCEQ PCLs and metals background levels migrates to the Site boundary, then an action such as ground water extraction and disposal or containment may be implemented. The ground water element includes the installation of permanent ground water monitoring wells and monitoring to demonstrate compliance with the ground water RAOs of no migration of contaminants beyond the Site boundaries at concentrations exceeding the TCEQ Class 3 PCLs and metals background levels. Possible modifications to the final monitoring program will be identified in periodic performance evaluation reports and/or five-year reviews.

- *RCRA Subtitle C Equivalent Cell Monitoring*: Following remediation, the RCRA Subtitle C equivalent cell will be maintained and monitored as part of the post closure care. Monitoring wells will be placed at strategic locations around the RCRA Subtitle C equivalent cell to monitor for any potential leachate that may move from the solidified waste to ground water. Although a monitoring system is required for contingencies, the probability of leachate leaving a RCRA Subtitle C cell is very remote due to its design/construction.

- *Slurry Wall Barrier*: The solidification remedy requires excavation of sludge from the Sludge Pit and solidification within a treatment unit. To accomplish this, the sludge must be dewatered and the ground water must be captured to prevent it from re-entering the sludge in the Sludge Pit. Constructing a subsurface barrier wall around the Sludge Pit and installing a hydraulic gradient control recovery system (i.e., ground water extraction wells) within the barrier wall surrounding the Sludge Pit will accomplish dewatering of the sludge.

- *Ground Water Extraction and Injection Well Disposal – Sludge Pit Containment*: Subsequent to extraction from within the barrier constructed around the Sludge Pit, ground water can be treated or injected into the on-site operating Class 1 (hazardous waste) injection well. The slurry wall barrier constructed around the Sludge Pit is to prevent ground water from entering the pit during solidification activities.

- *Five-Year Review*: Because the selected remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unrestricted use and unrestricted exposure, a statutory review will be conducted within 5 years after initiation of the remedial action to ensure that the remedy is protective of human health and the environment. Subsequent reviews will occur every 5 years thereafter. These future reviews are also used to identify needed remedy modifications or enhancements to assure that RAOs are achieved in a timely manner.

- *Injection Well Disposal*: The injection well system for disposal of aqueous wastes during the remedial action has high long-term effectiveness. Injecting aqueous liquids, such as water remaining in tanks, contact storm water, or ground water, into the on-site deep hazardous waste well reduces the volume of wastes and meets the RAOs for liquid wastes. Injection shall follow the Storm Water Management

Plan requirements. All wells will be plugged and abandoned following agency Underground Injection Control requirements after completion of the remedial action.

- *Fencing*: A permanent fence will be required for the perimeter of the RCRA Subtitle C equivalent cell (landfill). Although the RCRA Subtitle C cap is constructed with clean soil, a fence is required to prevent any disturbance of the cap, which may lead to erosion, by trespassers.

- *Backfilling*: All excavated soil areas will be backfilled to ground surface with clean soil, with the possible exception of the excavated sludge pit, which may be used as a pond for wildlife.

- *Design Investigations*: During the design phase, additional investigations may be needed to determine locations for new monitoring wells to (1) monitor around the RCRA Subtitle C equivalent cell to address point of compliance (i.e., to demonstrate that leachate is not escaping the cell), and (2) monitor the ground water plumes. The ground water well network would consist of wells, which would be screened in the upper and lower portion of the paleochannel and in the potentially transmissive zones (i.e., floodplain silts). The design will also provide for sampling to fully delineate the areas requiring remediation. A design pilot study will also be required to demonstrate that the solidification mixture will address all solidification criteria.

- *Operations and Maintenance (O&M)*: O&M activities will be required to maintain the integrity of the remedy (i.e., maintain integrity of RCRA cell and monitoring wells).

### 2.9.4 Contaminated Ground Water (Plume) Alternative

The RI concludes that:

- Shallow ground water beneath the Site does not meet the EPA and TCEQ criteria for potable water (i.e., it is not a drinking water aquifer). The applicable ground water classification for the Site is Class 3 based on TDS concentrations (for salinity) in the monitoring wells, and therefore, the shallow ground water is not a drinking water source.
- Shallow ground water at the MSC Site was evaluated site-wide; concentrations of benzene, 1,2-dichloroethane, and trichloroethene in soil samples have leached into ground water in excess of the respective TCEQ Class 3 Groundwater PCLs.
- Impacted ground water is presently contained within the Site boundaries and limited to portions of four areas (Cemetery Area, Maintenance Area – Pits, Maintenance Area – 900, and around the Earthen Impoundments).

In addition to the primary/major source areas, there are localized areas where source material has entered the subsurface soils. However, ground water has been contaminated with dissolved constituents only (i.e., the RI found no direct evidence of source material in ground water). EPA recommends a passive approach to contaminated Class 3 ground water. Through historic ground water analytical data review, it appears the localized ground water plumes (i.e., contaminated ground water) have not migrated a great distance from the source areas, and it appears that current contaminant concentrations are similar to or lower than historic concentrations. The evaluation would suggest that degradation of the chemical constituents in ground water is occurring and stabilizing the plume. The RI contains no conclusions regarding potential vertical migration of contaminants, nor does it contain site-specific information regarding hydrology below 80 feet bgs.

Since the shallow contaminated aquifer is classified as Class 3 (i.e., non-drinking water), there is no complete exposure pathway or risk associated with exposure to COCs present in ground water. However, the ground water off-site discharge point to surface water was not determined in the RI and is not known. Because ground water containing COCs at concentrations exceeding the TCEQ PCLs or background levels for metals may migrate off-site and discharge to surface water, and considering that no surface water discharge point has been evaluated, contaminated ground water will be addressed at the Site boundary. EPA proposes to use the TCEQ PCLs for Class 3 ground water to define the plume concentrations, above which the plume cannot migrate off-site, and additional remedial actions such as containment or extraction may be required. In addition, if any of the information or conclusions in the RI are found to be incorrect, or if there is new information regarding vertical migration of contaminants or migration of contaminants to an aquifer not currently documented as contaminated, then additional remedial actions may be required.

In this ROD, the sludge and soils alternatives were defined as Alternative 1 through Alternative 5; however, to distinguish ground water from sludge and soil, the ground water alternatives have been titled Alternative GW-1 and Alternative GW-2 as identified below.

Under this ROD, EPA has selected only one ground water alternative (Natural Attenuation with Monitoring), in addition to the "No Action" alternative, to address Class 3 ground water contamination.

### 2.9.4.1 Alternative GW-1: No Action

*Estimated Capital Cost: $0*
*Estimated Annual O&M Costs: $0*
*Estimated Present Worth Cost (4.5%): $0*
*Estimated Implementation Time: 0 Months*

*This alternative was not selected.* Under the NCP, 40 CFR § 340.430(e), EPA is to develop a range of remedial alternatives in the FS including a "no action" alternative to be used as a baseline for comparison against the other alternatives. Under the no action alternative, EPA would have taken no action to prevent exposure or to reduce COC concentrations in Source Area ground water. An allowance to conduct reviews every 5 years would have been included. Considering that no off-site ground water to surface water discharge point has been evaluated, and Site ground water has been impacted with contaminants, a "no action" remedy is inappropriate.

### 2.9.4.2 Alternative GW-2 (Selected Remedy): Monitoring

*Estimated Capital Cost: $300,000*
*Estimated Annual O&M Costs: $102,000*
*Estimated Present Worth Cost (4.5%): $3,300,000*
*Estimated Implementation Time: 30 Years*

*This alternative is the selected remedy.* The specifics of the selected ground water remedy are:

- Monitoring: Ground water will be monitored at the point of compliance (property boundary). COCs will include the ground water analytes as identified in Table 15. In addition, ground water will be monitored for those constituents necessary to evaluate natural attenuation potential, of which most are not part of the COCs listed on Table 15 but must be determined during the design. Additional monitoring analytes are further discussed in this section. A containment or treatment remedy may be required if any of the following conditions are met:

(1) Organic COCs are detected in a boundary well in concentrations above the TCEQ PCLs;
(2) Metal concentrations are greater than TCEQ PCLs and background levels in a boundary monitoring well(s); and
(3) Information suggests to EPA that the plume (metals or organics) has the potential to migrate off-site.

Additional ground water remedial action may be required if it is demonstrated that Site contamination has migrated to an aquifer not currently known to be contaminated. EPA may select additional COCs or removed them based on new information or input from its Federal and State partners.

- ICs: ICs will be required to prevent access and exposure to Site ground water.
- New monitoring wells: Strategic locations for new monitoring wells will be identified to monitor around the RCRA Subtitle C equivalent cell to address point of compliance (i.e., to demonstrate that no leachate is escaping the cell) and also to monitor the contaminated ground water plumes.

Only one alternative is proposed for contaminated ground water – monitoring (no active remediation). The primary ground water remedy requirement is that contaminated ground water does not migrate across the Site boundary at concentrations above the TCEQ Class 3 Groundwater PCLs and background levels for metals. EPA has determined that Class 3 PCLs and background levels for metals are the appropriate levels for monitoring of COCs at the Site boundary. This justification is based on the findings that the marsh surface water and sediments immediate to the boundary did not pose unacceptable risks. Although monitoring for Natural Attenuation (NA) (natural contaminant degradation) is a part of the ground water remedial component, the remedy will not be considered ineffective if it is determined that NA alone is not reducing on-site concentrations. NA is expected to document that contaminants in ground water are degrading over time and is anticipated to prevent the migration of impacted ground water beyond the Site boundary. Presently, the plumes are localized immediate to surface and subsurface source areas and remain on-site; therefore, NA is selected to aid in support of a stable plume, and consequently, no migration/expansion of that plume. The monitoring program will monitor for plume stability and any off-site migration of the plume across the Site boundary.

NA with monitoring is used to demonstrate ground water plume stability and to prevent exposure of human or ecological receptors to COCs. NA with monitoring can be implemented with a plume management zone (PMZ) (TNRCC 2001). A PMZ allows control and prevents the use of and exposure to the ground water within the PMZ. The ground water point of exposure (POE) is relocated from within and throughout the impacted ground water to an alternate location down-gradient of the impacted ground water. As part of the ground water monitoring program, the hydraulic gradient is monitored and attenuation monitoring points are established to provide data on plume stability. This is not a true "no action" alternative because regular monitoring is used to ensure protectiveness.

Monitoring of the ground water will consist of one comprehensive ground water event for the analysis of metals, SVOCs, VOCs, and other parameters such as sulfate, nitrate, ferrous iron, and ethane. Seven subsequent quarterly monitoring events will be analyzed for the COCs identified on Table 15 and other parameters deemed necessary based on analytical results, as determined by EPA. Years three through five will consist of semiannual monitoring events and years six through thirty will consist of one annual monitoring event per year for the COCs identified on Table 15 and other parameters deemed necessary. As EPA and TCEQ gain confidence in RA performance, the frequency of sample collection may be reduced. Modifications to the final monitoring program will be identified in periodic performance evaluation reports and/or five-year reviews.

If contaminated ground water above TCEQ Class 3 Groundwater PCLs and background levels (metals) is detected at a boundary well, an active ground water option will be evaluated and implemented, at the direction of EPA. Actions, such as hydraulic containment, may entail the extraction and then treatment of that ground water for disposal or discharge.

Ground water monitoring wells will be placed at strategic locations at the Site to monitor plume movement, and to monitor ground water around the RCRA Subtitle C equivalent cell. The plumes will be monitored to document that Natural Attenuation (NA – natural contaminant degradation) processes are at work and that the plumes are not migrating any further from the source areas. NA is expected to document that contaminants in ground water are degrading over time, and is anticipated to prevent the migration of impacted ground water beyond the Site boundary.

RI borings were drilled only 30 feet into the lower clay member (below the paleochannel and silt member), which exists at approximately 55 feet bgs. If evidence is found of non-aqueous phase liquids in the Site ground water during the remedial action, or there is evidence of downward migration found during the remediation of the Site sludge or contaminated subsurface soils, then additional actions may be required.

ICs to restrict access to ground water, and in turn, prevent exposure to contaminated ground water, will be put in place. The ICs component of this ground water remedy would provide long-term protection by reducing the potential risk for people to be exposed. Information on the nature and extent of ground water contamination would be prepared and updated annually. ICs will be effective in preventing exposure to contaminated ground water; for example, an IC could be placed on the property to prohibit the construction of facilities or buildings within 100 feet of contaminated ground water areas of the Site to prevent inhalation exposure, or the construction of buildings could be restricted.

The only active ground water collection presently proposed (which will cease following completion of the selected remedy) will be the ground water collection system (i.e., extraction wells) within the subsurface barrier/slurry wall constructed around the Sludge Pit, which is constructed to prevent flow of ground water into the Sludge Pit during remedial operations within that pit. The internal gradient control maintained via extraction wells/pumps within the barrier wall would mitigate the migration of COCs to ground water by minimizing infiltration of water through the sludge. The subsurface barrier wall and the internal ground water recovery system also mitigate potential releases of COCs to the ground water outside of the enclosure.

### 2.9.5 Sludge (Principal Threat Waste) and Contaminated Soil Alternatives

Sludge and contaminated soil pose a current and future health risk. Remedial alternatives to address sludge are needed to prevent exposure to sludge, and minimize the affect of COCs leaching from sludge to contaminate soils and ground water. Remedial alternatives are needed to address contaminated soil to prevent exposure of future on-site conservancy workers to COCs in soil, and to minimize the affect of COCs potentially leaching from contaminated soil to ground water. As shown in Table 13 and described in the following sections, the FS developed five different alternatives for addressing sludge, contaminated soil, and ground water.

As documented in this ROD, EPA has selected Alternative 4 (RCRA Subtitle C Containment of Solidified Sludge and Untreated Soils) as the selected remedy for Site sludge and contaminated soil. For the reasons discussed above, ground water is addressed by NA and monitoring (Alternative GW-2) only for all alternatives evaluated.

The following alternatives were assembled and evaluated in the selection process:

### 2.9.5.1 Alternative 1: No Action

*Estimated Implementation Time: 0 Months*
*Estimated Capital Cost: $0*
*Estimated Annual O&M Costs: $0*
*Estimated Present Worth Cost (4.5%): $0*

*This alternative was not selected.* As required by the NCP, 40 CFR § 300.430(e)(6), the alternatives for soil/sludge must include the "no action" alternative. This is to be used as the baseline alternative against which the effectiveness of all other remedial alternatives are judged. Under this alternative, no remedial actions would be conducted to address contaminated soil or sludge. Soil and sludge contaminants would remain in place and would be subject to environmental influences. No institutional controls would be implemented for the soils and sludge. This response was not selected because it does not address the risks posed by the Site, and it does not reduce the volume, toxicity, or mobility of hazardous substances present at the Site.

### 2.9.5.2 Alternative 2: Engineered Containment of Unsolidified Sludge and RCRA Subtitle C Containment of Soils

*Estimated Capital Cost: $24,900,000*
*Estimated Annual O&M Costs: $376,000*
*Estimated Present Worth Cost (4.5%): $31,200,000*
*Estimated Implementation Time: 36 Months*

*This alternative was not selected.* With this alternative, the majority of the sludge within the Sludge Pit would not be solidified; only the upper portion of the sludge would be solidified in-situ sufficiently to support a RCRA cap. In addition, a RCRA Subtitle C equivalent cell would be constructed to contain the unsolidified contaminated soil. ICs would be in place as discussed in Section 2.9.3 (Common Elements). In addition to the common elements discussed above, this alternative includes the following specific components:

- Consolidate sludge in the Sludge Pit and construct a RCRA Subtitle C cap supported by a solidified bridge cap over the Sludge Pit.
- Excavate and consolidate contaminated soils, debris, and rubble in a RCRA Subtitle C equivalent cell.

Components of the Sludge Pit containment area include:

- Constructing a subsurface barrier wall around the Sludge Pit and installing a hydraulic gradient control recovery system within the barrier wall.
- Consolidating sludge from the Oil Pit, the tanks, the API 100 separator, and the API 1200 separator into the Sludge Pit.
- Solidifying the upper 10 feet of sludge in the Sludge Pit with a pozzolanic reagent or reagent mixture to a compressive strength sufficient to support a RCRA Subtitle C cap.
- Constructing a RCRA Subtitle C cap.

Applying reagent to the surface of the Sludge Pit with a hydraulic excavator and mixing the reagent with the sludge accomplishes solidification. The depth of the mixing and reagent choice is a function of the strength required to support the RCRA Subtitle C cap.

Components of the soils cell include:

- Constructing a RCRA Subtitle C leachate collection and leak detection system for a cell to contain excess solidified sludge and contaminated soils.
- Consolidating affected surface soils from the Laydown Area and surface and subsurface soils from the Cemetery Area, the Maintenance Area – Pits, the Maintenance Area – 900, and Unit 800 Area (Figure 2) into the RCRA Subtitle C equivalent cell.
- Constructing a RCRA Subtitle C cap over the consolidated soils.
- Backfilling the excavated soil areas to ground surface with clean soil.

Only the upper portion of the sludge would be solidified sufficiently to support a RCRA cap. The engineered containment of the Sludge Pit would eliminate direct contact and inhalation of COCs by on-site conservancy workers, as well as the potential release of COCs from the sludge to surface soils, sediments, and surface water. The RCRA Subtitle C cap, barrier wall immediate to and surrounding the Sludge Pit, and internal gradient control of ground water within the barrier wall via pump/disposal would mitigate the migration of COCs to ground water by minimizing infiltration of water through the sludge. The subsurface barrier wall and the internal ground water recovery system would also mitigate potential releases of COCs to the ground water.

The RCRA Subtitle C containment of soils with COC concentrations exceeding risk-based criteria would reduce the pathways of direct contact/ingestion/inhalation by on-site nature conservancy workers and terrestrial ecological receptors to soil COCs and the potential for COC migration from soils to sediments and surface water. Impacted subsurface soils would be excavated from above the top of the uppermost water-bearing unit. The RCRA Subtitle C equivalent cell would control the migration of COCs to ground water by greatly reducing infiltration of water through the consolidated soils.

This alternative retains a risk of migration of COCs from sludge to ground water because unsolidified source material would remain in the paleochannel. Since construction details for the existing Sludge Pit liner system are not available and the integrity of the system cannot be evaluated, there is potential for future failure. The potential for impacted ground water to migrate to the property boundary is mitigated by the presence of a barrier wall with ground water recovery to maintain an inward gradient within the contained Sludge Pit area. Because unsolidified wastes would be left in place in the paleochannel, the ground water monitoring component provides additional protection for the environment with periodic evaluations to reconfirm the stability of the impacted ground water plumes.

The RI concludes that impacted ground water has not migrated to the Site boundary in the paleochannel or through the potentially transmissive zones even though the Site is uncontrolled. Additional long-term protective components for ground water include the inward gradient maintained around the Sludge Pit with the barrier wall and ground water recovery wells and the ground water monitoring program. The goal of these components is to mitigate the potential for ground water impacted by or in contact with sludge to migrate off-site to adjacent properties or to the Marsh Area. The wall integrity should be routinely monitored as part of the O&M process for long-term effectiveness.

### 2.9.5.3 Alternative 3: Engineered Containment of Solidified Sludge and RCRA Subtitle C Containment of Soils

*Estimated Capital Cost: $35,400,000*
*Estimated Annual O&M Costs: $381,000*
*Estimated Present Worth Cost (4.5%): $41,800,000*
*Estimated Implementation Time: 42 Months*

*This alternative was not selected.* This alternative consists of complete in-situ solidification of the Sludge Pit and placement of contaminated soils in a RCRA Subtitle C equivalent cell. In addition to the common components discussed above, Alternative 3 includes the following specific components:

- Consolidate sludge in the Sludge Pit, solidify sludge in situ, and construct a RCRA Subtitle C cap over the Sludge Pit.
- Excavate and consolidate excess sludge, contaminated soils, debris, and rubble in a RCRA Subtitle C equivalent cell.

Components of the Sludge Pit containment include:

- Constructing a subsurface barrier wall around the Sludge Pit and installing a hydraulic gradient control recovery system within the barrier wall.
- Consolidating sludge from the Oil Pit, the tanks, the API 100 separator, and the API 1200 separator into the Sludge Pit.
- Solidifying the entire sludge depth in the Sludge Pit with a pozzolanic reagent or reagent mixture to a compressive strength sufficient to support a RCRA Subtitle C cap.
- Construct a RCRA Subtitle C cap.

Components of the soils containment include:

- Constructing a RCRA Subtitle C leachate collection and leak detection system for a cell to contain excess solidified sludge and contaminated soils.
- Consolidating excess solidified sludge from the Sludge Pit into the RCRA Subtitle C equivalent cell.
- Consolidating affected soils above the Site remediation levels, including surface soils from the Laydown Area and surface and subsurface soils from the Cemetery Area, the Maintenance Area – Pits, the Maintenance Area – 900, and Unit 800 Area into the RCRA Subtitle C equivalent. Soil areas for remediation are depicted in Figure 3.
- Constructing a RCRA Subtitle C cap over the excess solidified sludge and consolidated soils.

In situ solidification uses auger/caisson systems and injector head systems to add binders to the contaminated soil or waste without excavation, leaving the resultant material in place. For example, in situ solidification in the Sludge Pit could be accomplished with a crane equipped with a 12-foot-diameter auger that solidifies in columns; the solidification process continues in this manner until complete.

The above- and below-ground engineered containment of the Sludge Pit would reduce direct contact and inhalation of COCs by on-site nature conservancy workers as well as the potential release of COCs from the solidified sludge to surface soils, sediments, ground water, and surface water above ecological risk-based criteria. The RCRA Subtitle C cap, barrier wall, and internal gradient control via pump/disposal would mitigate the migration of COCs to ground water by minimizing infiltration of water through the sludge. This alternative integrates the existing Sludge Pit liner system with a solidified sludge matrix.

However, implementation of this alternative may damage the liner system as the augers mix at the bottom of the Sludge Pit.

The RCRA Subtitle C equivalent cell containment of soils with COC concentrations exceeding risk criteria would eliminate the potential for ingestion/direct contact by on-site nature conservancy workers and terrestrial ecological receptors to soil COCs and the potential for COC migration from soils to sediments and surface water. Impacted subsurface soils would be excavated from above the top of the uppermost water-bearing unit. The RCRA Subtitle C equivalent cell would control the migration of COCs to ground water by reducing infiltration of water through the consolidated soils.

This alternative provides protection for migration of COCs from sludge to ground water since wastes would be solidified throughout the depth of the Sludge Pit to remove free liquids. The removal of free liquids reduces migration potential. The potential for impacted ground water to migrate to the property boundaries is mitigated by the presence of a barrier wall with ground water recovery to maintain an inward gradient toward the Sludge Pit. Since solidified wastes would be left in place in the paleochannel, the ground water monitoring component provides additional protection to the environment with periodic evaluations of the stability of the impacted ground water plumes.

### 2.9.5.4 Alternative 4 (Selected Remedy): RCRA Subtitle C Containment of Solidified Sludge and Untreated Soils

*Estimated Capital Cost: $52,600,000*
*Estimated Annual O&M Costs: $101,000*
*Estimated Present Worth Cost (4.5%): $53,100,000*
*Estimated Implementation Time: 48 Months*

*This alternative is the selected remedy.* It addresses current or potential future risk associated with exposure to sludge and contaminated soil, by extracting and placing solidified sludge and unsolidified contaminated soils in a RCRA Subtitle C equivalent cell. The ICs component under this alternative, as described in Section 2.9.3 (i.e., Common Elements) will protect the Subtitle C cell integrity and reduce the potential for further contamination of ground water by removing the source of ground water contamination. Implementing the long-term maintenance and monitoring must also be performed to protect the cell's integrity.

In addition to the common components discussed above, this alternative includes the following specific components:

- Remove all sludge from tanks, Sludge Pit, Oil Pit, API separators, and place in solidification area.
- Source material in subsurface soil will be excavated; if the material passes the solidification/stabilization standards it can be placed in the on-site Subtitle C equivalent cell, otherwise, it will require solidification before placement in the cell.
- Solidify sludge in solidification area.
- Construct containment area berms and a RCRA Subtitle C leachate collection and leak detection system to contain solidified sludge and contaminated soils.
- Transfer and consolidate solidified sludge into the aboveground RCRA Subtitle C equivalent cell.
- Consolidate contaminated soils above Site remediation levels, including surface soils from the Laydown Area and surface and subsurface soils from the Sludge Pit, the Oil Pit, the Cemetery Area, the Maintenance Area – 900, and Unit 800 Area into the single RCRA Subtitle C equivalent cell.

- Construct a RCRA Subtitle C cap with an 18-inch clay layer, a synthetic drainage layer (geonet with geotextile on top), HDPE geomembrane liner, GCL with geotextile on top and bottom, and gas vent layer (geonet with geotextile on top and bottom) as depicted in Figure 10.
- Backfill the Sludge Pit and other excavated area to ground surface with clean soil. As an option, partial backfill of the Sludge Pit excavation to create a shallow freshwater pond may be considered during the remedial design.

The RCRA Subtitle C equivalent cell for the solidified sludge and untreated soils would reduce direct contact and inhalation of COCs as well as the potential release of COCs from the sludge to surface soils, sediments, ground water, and surface water. The solidified sludge would be removed from below the water table in the Sludge Pit and other source areas and located on a RCRA cell liner consisting of a primary leachate collection/secondary leachate detection system. Therefore, as compared to Alternatives 2 and 3, this alternative would further reduce the potential for infiltration of water through the solidified sludge and migration of COCs to ground water by removing solidified sludge waste from the ground water-bearing zone. The long-term effectiveness and reductions in toxicity, mobility, and volume are similar for this alternative and Alternative 3. However, in this alternative, the sludge is solidified within a solidification area and moved to a RCRA Subtitle C equivalent cell.

The ability to exercise quality control over the solidification process is enhanced in this alternative over Alternatives 2 and 3, because each lift of material can be tested for strength during placement in the RCRA Subtitle C equivalent cell, as opposed to testing within the Sludge Pit. If necessary, the solidified sludge could be reworked in the cell or the solidification area.

The consolidation and capping of soils with COC concentrations exceeding risk-based criteria would eliminate the potential for ingestion/direct contact to soil COCs and the potential for COC migration from soils to sediments and surface water. Impacted subsurface soils would be excavated from above the top of the uppermost water-bearing unit. The RCRA Subtitle C equivalent cell would control the migration of COCs to ground water by limiting infiltration of water into the solidified sludge and consolidated soils and by controlling migration of leachate from the cell into ground water.

Since solidified wastes would remain on-site, the ground water monitoring component provides additional protection to the environment with periodic evaluations of the stability of the impacted ground water plumes.

### 2.9.5.5 Alternative 5: Slurry Phase Bioremediation of Sludge and RCRA Subtitle C Containment of Treated Sludge and Untreated Soils

*Estimated Capital Cost: $82,600,000*
*Estimated Annual O&M Costs: $186,000*
*Estimated Present Worth Cost (4.5%): $85,800,000*
*Estimated Implementation Time: 72 Months*

*This alternative was not selected.* This alternative includes the following specific components:

- Consolidate sludge within the Sludge Pit.
- Slurry-phase bioremediate consolidated sludge within the Sludge Pit.
- Solidify sludge residual from the slurry-phase bioremediation to a compressive strength sufficient to place in a RCRA Subtitle C equivalent cell.

- Construct containment area berms and a RCRA Subtitle C leachate collection and leak detection system to contain solidified sludge residual and contaminated soils.
- Consolidate solidified sludge residuals into the RCRA Subtitle C equivalent cell.
- Consolidate contaminated soils into the RCRA Subtitle C equivalent cell.
- Construct a RCRA Subtitle C cap.
- Backfill the Sludge Pit and excavated soil areas to ground surface with clean soil. As an option, partial backfill of the excavation to create a shallow freshwater pond may be considered during the remedial design.

Slurry phase bioremediation utilizes microorganisms existing in the sludge or overlying water to destroy the organic compounds within the sludge and break down the sludge organic/water/inert solids emulsion structure, and thus reduce sludge volume. The slurry phase bioremediation system includes an oxygenation process, oxygen mixing system, sludge mixing system, and chemical addition system. During bioremediation, a variety of parameters would be measured. These can be divided into controlling parameters to manage the bioremediation process and monitoring parameters to demonstrate the degradation of targeted sludge components or surrogates. Controlling parameters could include microbial plate count, toxicity analyses, pH, temperature, dissolved oxygen, oxygen uptake rate, ammonia and nitrate/nitrite nitrogen, ortho-phosphorus, total and volatile suspended solids, and total petroleum hydrocarbons. Monitoring parameters could include particular VOCs, SVOCs, and similar organic compounds.

The long-term effectiveness and reductions in toxicity, mobility, and volume are similar for this alternative and Alternative 4. However, in this alternative, the slurry-phase bioremediation should reduce both organic COC concentrations in the sludge and volume of sludge. Biodegradation of organic compounds is irreversible and generally results, depending on the extent of treatment, in the generation of innocuous end products such as water, carbon dioxide, and various inorganic salts, with only residual concentrations of organic constituents.

After completion of each phase of the biotreatment, the sludge residuals are transferred to a solidification area, solidified, and consolidated along with contaminated soils in a RCRA Subtitle C equivalent cell. No sludge, solidified or unsolidified, would remain within the paleochannel, minimizing long-term risk for potential COC migration from wastes to ground water and improving the ability of this alternative to meet the RAO for mitigating potential migration of COCs from wastes.

# 2.10 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The EPA uses nine criteria to evaluate remedial alternatives to facilitate selection of the selected remedial alternative for the cleanup of an NPL site. These nine criteria are categorized into three groups: threshold, balancing, and modifying. The threshold criteria must be met for an alternative to be eligible for selection. The threshold criteria are: overall protection of human health and the environment and compliance with ARARs. The balancing criteria are used to weigh major tradeoffs among alternatives. The five balancing criteria are: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. The modifying criteria are State acceptance and community acceptance. Each of the evaluation criteria are briefly summarized below, followed by an evaluation of how each alternative evaluated complies with the criteria. The FS Report provides a detailed alternatives evaluation in Table 7 and a comparative evaluation in Table 8 (URS 2008); a summary of comparative evaluation of alternatives is provided in Table 13 of this ROD.

## 2.10.1 Overall Protection of Human Health and the Environment

This criterion is used to determine whether an alternative can adequately protect human health and the environment, in both the short- and long-term, from unacceptable risks associated with exposure to COCs by eliminating, reducing, or controlling exposure. The overall protection of human health and the environment determination draws upon assessments of other criteria including long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

For the sludge and soil alternatives, each of the described remedial alternatives other than Alternative 1 (No Action) meets the RAOs for the Site and provides overall protection of human health and the environment. Each active alternative isolates the Site sludge and contaminated soil from the environment and would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through a combination of engineering and institutional controls and/or treatment. All alternatives would achieve protection by removing the direct contact exposure to sludge and contaminated soil. Alternative 2 provides the lowest degree of treatment of Site materials, while Alternative 5 provides the highest degree of treatment; however, the effectiveness of biological treatment in destroying the COCs in the sludge materials at the Site has not yet been tested in Site-specific treatability studies and is uncertain.

Alternatives 2, 3, and 4 provide increasing levels of protection at increasing costs. Alternatives 2 and 3 either partially or fully solidify sludge *in situ*, allowing material to reside in the paleochannel in a low-leachability state, thus resulting in greater uncertainty regarding the long-term protectiveness of those alternatives. Alternative 4 removes the long-term potential threat to ground water by removing sludge from the Sludge Pit, the Oil Pit, tanks, and API separators, treating the sludge in a solidification area, and consolidating the treated sludge in a RCRA Subtitle C equivalent cell, thereby providing overall protectiveness with minimum uncertainty. While the slurry-phase bioremediation component of Alternative 5 is not as commonly implemented as containment, it provides for a reduction in volume and concentration of the contaminated sludge. Alternative 5 provides similar short- and long-term effectiveness and is only slightly more protective of human health and the environment than Alternative 4. In addition, Alternative 5 is estimated to require 50 percent more time (an additional 2 years) to implement relative to Alternative 4; Site materials would continue to be exposed to the environment (including possible severe storm events) and to human and ecological receptors during this period.

The ground water alternative, except "no action," would provide protection of human health by preventing direct contact with, or vapor intrusion from, contaminated ground water through ICs within the Site boundary until natural attenuation processes reduce COC concentrations at or below protective levels.

## 2.10.2 Compliance with ARARs

Section 121(d) of CERCLA, 42 U.S.C. § 9621(d), and NCP § 300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites must attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations (collectively referred to as ARARs) unless such ARARs are waived under CERCLA §121(d)(4). Remedial alternatives shall be assessed to determine whether they attain ARARs, or provide grounds for invoking a waiver. Federal and State of Texas ARARs potentially applicable to the development and selection of a remedial alternative for this Site are summarized in Tables 16A through 16C. State standards that constitute ARARs are those regulations that are promulgated, substantive in nature, more stringent than Federal requirements, consistently applied and identified by the State in a timely manner. The ARARs are divided into three categories: (1) location-specific, (2) chemical-specific, and (3) action-specific.

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site.

Each of the described remedial alternatives other than Alternative 1 (No Action) and Alternative 2 meet the ARARs for the Site. The "no action" alternative does not comply with ARARs, and therefore this alternative cannot be selected unless an ARAR waiver is invoked. Alternative 2 does not meet the requirements of 40 CFR 264.228 for closure of surface impoundments since free liquids will not be eliminated by solidifying sludge throughout the entire depth of the Sludge Pit.

Under CERCLA and the NCP, response actions must comply with regulatory standards from other Federal or State environmental programs if they are "applicable" or if they are "relevant and appropriate" to the specific circumstances of a site. 42 U.S.C. Section 9621(d)(2); 40 CFR Section 300.400(g). RCRA Subtitle C, the nation's hazardous waste management program, imposes regulatory requirements on the management of hazardous wastes. Land disposal restrictions (LDRs) are an element of the RCRA hazardous waste program. EPA guidance for determining if LDRs are "applicable" to CERCLA response actions remediation wastes states that applicability depends on whether the response action meets the definition of "placement," whether the substance being "placed" qualifies as an RCRA hazardous waste, and whether the RCRA hazardous waste is restricted under the LDRs (MCP 2006).

EPA uses the AOC concept to determine whether "placement" is occurring for LDR purposes. An AOC is delineated by the areal extent (or boundary) of contiguous contamination at a site. Contamination within an AOC may contain varying types and concentrations of hazardous substances, and it is generally appropriate to consider CERCLA areas of contamination as a single RCRA land-based unit unless certain

areas of contamination are discrete or widely separated. In-situ treatment, movement or consolidation of waste within an AOC, processing within an AOC to improve structural stability, and capping in place do not constitute placement. Placement, however, does occur if wastes are consolidated from different AOCs into a single AOC, or if wastes are moved outside an AOC for storage or treatment and then returned to the AOC. For example, placement occurs if the waste is excavated, placed in a separate unit such as a tank or incinerator within the areal extent of the AOC, and then redeposited on the land within an AOC (MCP 2006).

The MSC Site is largely composed of one AOC delineated by the areal extent of contamination that includes not only the Earthen Impoundment, Units 100 and 1200 API Separators, ASTs, the Cemetery Area, and the Laydown Area, but also the soil areas surrounding and linking these residual waste locations (MCP 2006). Because the solidification and consolidation of the sludge on-site would occur within the defined AOC, it would not involve "placement" of the materials, and would therefore, be exempt from LDRs.

Contaminated aqueous phase materials would be injected in the on-site deep hazardous waste injection well in accordance with the current usage of the well, as well as applicable Underground Injection Control requirements for injection of wastes into the on-site hazardous waste injection well. Any surface water discharges of storm water would meet appropriate water discharge standards. Solidified sludge would be sequestered in a RCRA Subtitle C equivalent cell in Alternatives 4 and 5, thus meeting the landfill ARARs. Pursuant to CERCLA, acquisition of permits will not be necessary for on-site treatment of sludge and soils or the use of the on-site hazardous waste injection well for the disposal of ground water.

The ARARs for this Site include:

Location-specific ARARs: Floodplain and Wetlands Protection, at 40 CFR 230 and 264.18, designates procedures for the protection of wetlands and construction within a 100-year floodplain. Requirements at 50 CFR 17 and 31 Texas Administrative Code (TAC) 65.175 identify those species of wildlife and plants determined to be endangered or threatened. 50 CFR 17 requires that proposed actions minimize effects on endangered species; one protected bird species potentially exists on-site. A cemetery on-site is subject to the Texas Health and Safety Code Chapter 711 and 40 CFR Part 800 which requires agencies to take into account the effects of their actions relative to cemeteries.

Chemical-specific ARARs: The Texas Class 3 Groundwater Protective Concentration Levels (30 TAC Chapter 350 Subchapter D) apply to contaminated ground water; i.e., prevent off-site migration at these levels; off-site discharge is being addressed because an off-site surface water discharge point for ground water is unknown. 40 CFR 300.150 is applicable to worker safety.

Action Specific ARARs: Management of solid hazardous wastes, and underground injection of hazardous liquids (40 CFR 144, 146 and 148; 30 TAC 331.64(d)) are applicable; the on-site hazardous waste injection well is being used for disposal of liquids in waste management units, and will be used during the RA to dispose of hazardous liquids generated during the response. Requirements for owner operators of hazardous waste facilities are at 40 CFR 264 and 761. 30 TAC 307.4 and 307.6 may be also applicable to the extent that surface water is discharged from the Site during the remedial action or after completion of the remedy. 40 CFR 122 and 445, and 30 TAC 319.22 address the discharge of water from the Site. Closure of landfills and RCRA Subtitle C cell construction requirements are applicable and found at 40 CFR 264 and 30 TAC 335.5. Classification, managing and transport of hazardous wastes will be part of the overall remedial response; these activities are subject to 40 CFR 261, 262 and 171, and 30 TAC 335.505 to 335.508. National Emissions Standards for Hazardous Air Pollutants (NESHAPs) and NESHAPs for hazardous waste combustors, 40 CFR 61 and 63, are also applicable.

## 2.10.3 Long-Term Effectiveness and Permanence

This criterion refers to expected residual risk and the ability to maintain reliable protection of human health over time, once remediation levels have been met.

Alternative 4 is the selected remedy and is expected to achieve and maintain the highest degree of long-term protectiveness and permanence over time. It removes all of the sludge, solidifies the sludge, and contains the solidified sludge and contaminated soil in an aboveground surface RCRA Subtitle C equivalent cell. Alternative 4 removes the risk from the surface and addresses the ground water contamination with monitoring to prevent off-site migration.

The long-term effectiveness and reductions in mobility are similar for Alternative 5 and Alternative 4. However, metals concentrations are unlikely to be reduced with bioremediation; therefore, a RCRA Subtitle C equivalent cell, as in Alternative 4, would still be required.

In Alternative 3, all sludge within the Sludge Pit containment area is solidified through in-situ solidification and the RCRA Subtitle C cap is supported by solidified sludge (instead of unsolidified sludge below a bridge cap, as in Alternative 2). However, since the solidified sludge still remains within the paleochannel sand aquifer, there is long-term risk for potential COC migration from wastes to ground water. In addition, it may be difficult to verify the completeness of the solidification process using conventional strength testing procedures due to the depth of the sludge in the Sludge Pit, which is 37 feet. Incomplete solidification would result in similar risks as described in Alternative 2 for the bridge cap and migration of COCs.

Alternative 2 partially solidifies the sludge in the Sludge Pit and places a barrier wall around the Pit to control infiltration of ground water into the unsolidified sludge in the Pit. Over the long term, the barrier wall may fail due to material incompatibility associated with unconfined sludge, making this alternative less protective in the long-term. In addition, if a decision is made to switch to a different treatment technology because the remedial objectives are not met, it may be difficult to remove the wall. In addition, this alternative relies upon a bridge cap to support the RCRA Subtitle C cap. Since the bridge cap rests on unsolidified sludge, a potential risk to the long-term effectiveness of this remedy is the settlement or collapse of the bridge cap with subsequent settlement of the RCRA Subtitle C cap. In this scenario, the sludge could potentially emerge onto the surface of the cap.

The ground water remedy maintains long-term effectiveness and permanence through maintaining a ground water monitoring system to implement an active remedy (e.g., extraction and treatment for containment purposes) if contaminated ground water above the TCEQ Class 3 Groundwater PCLs and background levels (metals) is detected in a boundary monitoring well, or if contamination is migrating to an aquifer not currently known to be contaminated.

## 2.10.4 Reduction in Toxicity, Mobility, and Volume

This criterion relates primarily to the degree of toxicity, mobility, or volume reduction that will be achieved by each alternative through treatment of COC-contaminated media.

Each of the remedial alternatives, other than the No Action alternative provides some reduction of toxicity, mobility, or volume of hazardous substances. Alternative 5 provides the most predicted reduction in toxicity and volume through treatment, because biological treatment is used to destroy COCs

in sludge prior to solidification and RCRA Subtitle C containment. However, the effectiveness of biological treatment in destroying the COCs in the sludge materials at the Site has not yet been tested, and the degree of COC destruction is uncertain and unpredictable.

Solidification of the sludge provides some reduction of the mobility of the COCs in the sludge, with the degree of reduction dependent on the nature of the compound. Alternative 2, which involves only enough sludge solidification to support a RCRA Subtitle C cap, provides the least amount of treatment relative to the other alternatives. Alternative 3 does not address fully the reduction in toxicity and mobility because the in-situ treatment of the total sludge area is difficult to document, and the mobility of sludge contaminants through infiltration and leaching of contaminants may move dissolved contaminants into ground water and may allow migration of the ground water plume off-site. Alternatives 4 and 5 provide the most reduction in toxicity, mobility, and volume. Alternatives 2 through 5 provide for removal of contaminated soils and placement within a RCRA Subtitle C equivalent cell and are considered equivalent relative to addressing soil contamination.

### 2.10.5 Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement and operate the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction.

Each alternative involves significantly different short-term effectiveness. The No Action alternative is immediately implementable and presents no incremental risks to the community, remediation workers, or the environment during implementation; however, the current risks would remain. The in-situ solidification process in Alternatives 2 and 3 may involve potential exposure of remediation workers and any other nearby receptors to volatile emissions, but air monitoring will occur and engineering steps can be implemented if necessary to control such emissions. The excavation and transport of sludge to a solidification area followed by solidification and subsequent transport to the RCRA Subtitle C equivalent cell in Alternative 4 potentially may result in exposure of remediation workers and other nearby receptors to volatile and particulate emissions. The use of a solidification area minimizes the risk of uncontrolled exothermic reaction since temperature control should be easier to maintain in the solidification area. This precaution adds handling steps and requires additional time to implement. Alternative 5 includes in-situ biological treatment of the sludge prior to solidification, which reduces the potential for volatile emissions during solidification and consolidation of the sludge material.

Of the alternatives involving active remediation, Alternative 2 can be implemented most rapidly, with an estimated implementation duration (following completion of remedial design) of 36 months. As a result, Alternative 2 would provide the most prompt protection of human health and the environment.

Alternative 3 is the next most rapid, with an estimated implementation time of 42 months. Alternative 4 is only slightly longer, with an estimated duration of 48 months. With an estimated implementation time of 72 months, Alternative 5 will require 50 percent more time (2 more years) to implement than Alternative 4; human and ecological receptors would continue to be exposed to Site materials during this period.

The primary risks to the worker during the remedial action would be from VOCs emitted from sludge handling and VOCs and PCBs from soils handling. In general, the remedial actions have minimal impact upon the community, considering that the Site is accessed by a private gate, which is located over 1 mile from a public road, and the nearest community is 1.5 miles from the Site. Potential increased emissions during solidification resulting in increased risk to the worker should be minimized with these alternatives.

Some limited increased risk may occur during consolidation of sludge and contaminated soil. Depending on the choice and concentration of solidification reagents, there is the risk of uncontrolled exothermic reactions from the heat generated during the solidification reaction.

### 2.10.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Each of the remedial alternatives is implementable. Contractors, pozzolanic reagents, and cap materials are readily available. Construction of the bridge cap in Alternative 2 would require careful engineering, which would bring into question the implementability of Alternative 2. The construction techniques required for Alternatives 3 and 4 are routine. The feasibility of solidification has been demonstrated with the Treatability Study (Shaw 2008). RCRA Subtitle C equivalent cells are routinely constructed for landfills and are highly reliable if properly designed, constructed, monitored, and maintained. Each alternative includes routine cap and cell inspections and site maintenance. In addition to the RCRA Subtitle C equivalent cell for the sludge residual and solids containment, Alternative 5 requires the construction and operation of a slurry-phase bioremediation system for several years. Such systems have been implemented at other sites, but the implementability of such a system with respect to the particular sludge materials at the MSC Superfund Site has not been verified. At a minimum, the slurry-phase bioremediation system will require additional treatability studies and additional design effort. In addition, slurry-phase bioremediation experience with a system of this size is limited.

### 2.10.7 Cost

The estimated capital and annual O&M cost for each alternative is provided on Table 17. Alternative 2 is estimated to cost $31,200,000. Alternative 3, which involves more solidification than Alternative 2, is estimated to cost $41,800,000. Alternative 4, which involves the same amount of solidification as Alternative 3 but consolidates all solidified material and contaminated soil into a single RCRA Subtitle C equivalent cell, is estimated to cost $56,400,000. Alternative 5 is estimated to cost $85,800,000. The uncertainties in the bioremediation costs are significant cost drivers for this alternative.

### 2.10.8 State Acceptance

The State of Texas, as the support agency, has been an active participant in preparation of the RI and FS reports, the development of the Proposed Plan, as well as this ROD. The State of Texas has provided its concurrence on these documents and the selected remedy components.

### 2.10.9 Community Acceptance

Community acceptance of the selected remedy was determined through the Public Comment process (see Responsiveness Summary – Part 3). Based on EPA's interpretation of comments received during the public comment period and the questions received at the public meeting, the community concurs with the selected remedy identified in this ROD.

# 2.11 PRINCIPAL AND LOW-LEVEL THREAT WASTE

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable, 40 CFR §300.430(a)(l)(iii)(A). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. Source material is any material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to ground water, surface water, air, or acts as a source for direct exposure. Identifying principal threat wastes combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. Conversely, low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied. The decision to treat these wastes is made on a site-specific basis through a detailed analysis of remedial alternatives using the nine remedy selection criteria. This analysis provides the basis for making a statutory finding that the selected remedy uses a proven treatment technology as a principal element.

As stated previously, the Site contains approximately 260,000 $yd^3$ of sludge (principal threat waste/source material) located in surface pits, API separators, ASTs, and in subsurface soils; dissolved contaminants have migrated from these primary source areas to ground water. There are localized areas where principal threat waste has migrated to some degree into the immediate subsurface soils; however, this volume is relatively small. The majority of the sludge, or principal threat waste, is confined in impoundments, API separators, and ASTs.

In addition, there are approximately 160,000 $yd^3$ of contaminated soils, which poses an unacceptable human health and/or ecological risk. Soil contamination does exist on site and is considered a low-level threat waste. Low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. Wastes that are generally considered to be low-level threat wastes include non-mobile contaminated source material of low to moderate toxicity, surface soil containing chemicals of concern that are relatively immobile in air or ground water, low leachability contaminants, or low toxicity source material.

# 2.12 SELECTED REMEDY

## 2.12.1 Summary of the Rationale for the Selected Remedy

In selecting the remedy for the MSC Site, EPA compared the remedial alternatives against the nine evaluation criteria and the ability to achieve the RAOs. The selected remedy is Alternative 4 (RCRA Subtitle C Containment of Solidified Sludge and Untreated Soils) for the sludge and contaminated soil, and Alternative GW-2 (Monitoring) for the ground water.

Based on the information available at this time, EPA believes the selected remedy will be protective of human health and the environment, will comply with ARARs, will be cost-effective, and will utilize both permanent solutions and alternative treatment technologies to the maximum extent practicable.

Alternative 4 was selected based on cost and effectiveness compared to other sludge alternatives. Alternative 4 also addresses the risks posed by Site sludge; all sludge is removed and placed in a RCRA Subtitle C equivalent cell, which removes the direct contact exposure and prevents further contamination

of ground water. The selected ground water alternative, Alternative GW-2, addresses Class 3 ground water contamination through monitoring and a contingency, which would require extraction/or containment if the ground water information indicates to EPA that ground water, above TCEQ Class 3 Groundwater PCLs and background levels for metals, has the potential to move off-site, or into aquifers not currently known to be contaminated. Alternative GW-2 is the most cost-effective alternative for ground water based on the present ground water information. The TCEQ on behalf of the State of Texas concurs with this remedy.

The permanent ICs provision under both alternatives will reduce or eliminate the potential for inadvertent exposure, thereby protecting human health until RAOs are achieved.

Because it aggressively treats source material (sludge) the remedy meets the statutory preference for selection of a remedy that involves treatment as a principal element.

## 2.12.2 Description of the Selected Remedy

The following is a description of the selected remedial alternative for sludge and contaminated soil (Alternative 4) and Class 3 ground water (Alternative GW-2). These two alternatives comprise the overall selected remedy for the Site.

*Alternative 4 – RCRA Subtitle C Containment of Solidified Sludge and Untreated Soils*

**Placement of Solidified Sludge (source material) and Unsolidified Contaminated Soil in RCRA Subtitle C Equivalent Cell; Monitoring for Cell Leachate and ICs:** This element of the selected remedy addresses the current and future direct contact pathway risk, associated with exposure to sludge and contaminated soil, by excavating the sludge, the most probable source of the contaminated soil and ground water, construction of the RCRA Subtitle C equivalent cell, O&M of the cell, and ICs to protect the integrity of the cell as discussed in Section 2.9.3 (Common Elements). The actual construction of the selected remedy will take approximately 48 months to complete, but will be monitored as long as the waste remains hazardous. The remedy will remove all surface exposure to sludge and contaminated soil.

The Site sludge will be solidified on-site and placed in a RCRA Subtitle C equivalent cell along with the unsolidified contaminated soil. The RCRA Subtitle C equivalent cell for the solidified sludge and untreated soils would eliminate direct contact and inhalation of COCs by on-site nature conservancy workers as well as the potential release of COCs from the sludge to surface soils, sediments, and surface water. The solidified sludge and contaminated soil would be located on a RCRA cell liner consisting of a primary leachate collection/secondary leachate detection system; the cell would then be covered by a RCRA cap.

EPA expects the sludge and contaminated soil remedy to be implemented in phases such that information gained in early phases can be used to improve the design and construction of the remedy. It is anticipated that during the initial phase, a field-scale solidification pilot test will be implemented to determine the most effective reagents that will solidify the sludge to meet the solidification criteria for placement in the RCRA Subtitle C equivalent cell. Because this remedy will result in hazardous substance, pollutants, or contaminants remaining onsite above levels that allow for unrestricted use or exposure, statutory five-year reviews will be required.

**NA and Ground Water Monitoring and ICs:** This portion of the selected remedy addresses the potential for a contaminated ground water plume to migrate across the Site boundary above the TCEQ Class 3 Groundwater PCLs and background levels (specifically for metals). The ICs component under this alternative, as described in Section 2.9.3 (Common Elements), will reduce the potential for exposure to contaminated ground water. To prevent inadvertent exposure to Site ground water, ICs will restrict access to ground water.

The ground water monitoring system will consist of approximately 40 wells. Monitoring wells will be located around the RCRA Subtitle C equivalent cell at strategic positions to monitor for any potential leachate movement into the immediate ground water. Monitoring wells will also be placed at strategic locations to monitor the ground water contaminant plumes, to detect any potential off-site migration of those plumes above the TCEQ Class 3 Groundwater PCLs and background levels for metals. The plumes will also be monitored for NA potential; NA monitoring has the potential to document that the plume is stable, and therefore there is no potential for off-site migration. As previously stated, if EPA determines, through ground water analytical data, that the plume has the potential to migrate off-site, an active remedy such as containment or extraction, treatment, and disposal will be implemented. Considering that no off-site ground water to surface water discharge point is known, this approach will assure that the potential for discharge to surface water is addressed.

If monitoring data supports that NA is effective in containing or decreasing the plumes, the monitoring period may be modified, as determined by EPA. The ultimate objective for the ground water portion of this remedial action is to mitigate off-site migration of the ground water contaminant plume above the TCEQ Class 3 Groundwater PCLs and background levels for metals. Information obtained from the monitoring and data evaluation effort will document ground water plume stability or plume migration; if EPA determines that the plume has the potential to move across the Site boundary, or to an aquifer not currently known to be contaminated, EPA will require an active remedy to address contaminated ground water. However, it is anticipated that once the surface and subsurface source material has been removed, the plume should degrade within a relatively short period of time.

## 2.12.3 Summary of the Estimated Remedy Costs

Table 18 shows a summary of the estimated cost for the selected sludge and contaminated soils and ground water remedy. The cost summary is based on the capital and annual O&M cost to implement the remedy. The information in the cost summary is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes in cost for the selected remedy may be documented in the form of a memorandum to the file, an Explanation of Significant Difference (ESD), or an Amendment to the ROD, depending on NCP requirements for the change in question. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30 percent of the actual project cost. The discount factor used in FS to estimate the present worth cost is 4.5 percent. A more complete breakdown of the cost estimate and associated work sheets is provided in Appendix C of the FS Report. Tables 18 and 19 contain cost information and respective discount rates.

## 2.12.4 Expected Outcomes of the Selected Remedy

Once the sludge and contaminated soil are remediated, the selected remedy is expected to restore the Site for use as a preserve or conservancy.

### Available Uses of Land

The selected remedy will address the COCs in sludge and soil, such that the Site is made safe for use as a preserve or conservancy. Restricted land use (i.e., preserve or conservancy) will be available once the sludge and contaminated soil are placed in the RCRA Subtitle C equivalent cell, the ground water monitoring program is implemented, and ICs are in place.

### Institutional Controls

The selected remedy will utilize ICs to preserve the integrity of the RCRA cell remedy, and to minimize the potential for human exposure to contaminated ground water through restriction of access to that ground water. As part of the RD/RA, a plan will be developed to identify ICs for the Site and implement them. The ICs will limit land and ground water access by providing information that will help guide human behavior at the Site and by preventing excavation to ground water or the construction of wells to and through the shallow aquifer. Although not all inclusive, ICs will address (1) land use, (2) soil between 2 and 5 feet, (3) ground water access, and (4) vapor intrusion.

#### Available Uses of Ground Water

There is no current human health risk posed by the Site's ground water for those exposure pathways evaluated in the BHHRA, since the ground water is classified as Class 3 – non-potable/non-drinking water. However, the selected remedy will address the potential migration of the ground water plume to address the potential, but unknown, contaminated ground water migration or exposure pathways (e.g., ground water to surface water; vapor intrusion).

### Final Remediation Levels

The results of the risk assessment indicate that the Site, if left un-remediated, will present an unacceptable risk to on-site conservancy workers as a result of exposure to COCs present in sludge and soil above remediation levels. The RAOs and remediation levels developed for this Site are protective of human health and the environment and will ensure human exposure to COCs is prevented.

Remediation (cleanup) levels were not calculated for sludge, as all sludge is to be remediated as source media. All sludge is to be removed, solidified, and placed in the RCRA Subtitle C cell. All contaminated soil, exceeding the remediation levels presented on Tables 1 and 2, is to be excavated and placed in the cell as well. Contaminated Site ground water will be monitored for migratory potential, and contingency remedies will be implemented as necessary.

## 2.13 STATUTORY DETERMINATIONS

Under CERCLA, 42 U.S.C. § 6921, and the NCP, 40 CFR §300.430(f)(5)(ii), EPA must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as a principal element, and it includes a bias against off-site disposal of untreated wastes.

The following sections discuss how the selected remedy meets these statutory requirements.

### 2.13.1 Protection of Human Health and the Environment

The sludge and contaminated soil selected remedy (Alternative 4) and the ground water selected remedy (Alternative GW-2) protect human health and the environment by eliminating, reducing, or controlling risk through a combination of treatment, engineering, and IC measures. The use of a RCRA Subtitle C equivalent cell to contain solidified sludge and untreated soil achieves protection by reducing direct contact with sludge and contaminated soil. Containment of the sludge reduces the potential for leachate from the sludge to move from the cell and contaminate ground water. The use of ICs prevents inadvertent exposure to contaminated environmental media.

The selected ground water remedy protects human health by preventing direct contact through ICs that restrict access to Site ground water. The selected alternative GW-2 protects the environment by monitoring possible expansion of the contaminant plume. Human health and the environment are protected by the contingency provision of this alternative if EPA determines that the plume has the potential to migrate.

### 2.13.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will comply with all Federal and any more stringent State ARARs that pertain to the Site.

### 2.13.3 Cost-Effectiveness

The selected remedy is cost-effective because the remedy costs are proportional to its overall effectiveness (see 40 CFR §300.430(f)(l)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all Federal and any more stringent State ARARs, or as appropriate, waive ARARs). Overall effectiveness was evaluated (in the FS Report) by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). The overall effectiveness of each alternative was then compared to each alternative's cost to determine cost-effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence represents a reasonable value.

### 2.13.4 Utilization of Permanent Solutions to the Maximum Extent Practicable

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the media-specific selected remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element, bias against off-site treatment and disposal, and considering State and community acceptance. The selected remedy is necessary to ensure the long-term effectiveness and permanence of this cleanup.

### 2.13.5 Preference for Treatment as a Principal Element

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy. Treatment is the primary component of the preferred alternative. The sludge and contaminated soil will be excavated; the sludge will be solidified and the solidified sludge and untreated contaminated soil will be placed in a RCRA Subtitle C equivalent cell.

### 2.13.6 Five-Year Review Requirements

Section 121(c) of CERCLA and the NCP, 40 CFR §300.430(f)(5)(iii)(C), provide the statutory and legal basis for conducting five-year reviews. Because hazardous substances will remain on-site, a statutory review will be conducted within 5 years after initiation of the RA, and every 5 years thereafter, to ensure that the remedy is, or will continue to be, protective of human health and the environment.

## 2.14 DOCUMENTATION OF SIGNIFICANT CHANGES FROM PREFERRED ALTERNATIVE OF PROPOSED PLAN

EPA has not made any significant changes to the remedy, as originally identified in the Proposed Plan. The Proposed Plan was released for public comment for 30 days, from May 22, 2009 to June 22, 2009. EPA held a public meeting on June 9, 2009, to present the preferred alternative in the Proposed Plan. Few written comments were received during the public comment period. EPA did review and respond to written comments and verbal comments submitted during the public meeting in the Responsiveness Summary in Part 3 of this ROD.

### 2.14.1 State Role

The Texas Commission on Environmental Quality, on behalf of the State of Texas, has reviewed the various alternatives and has indicated its support for the selected remedy.

The TCEQ has also been actively involved during the RI and FS process and reviewed the subsequent RI Report (URS 2006a) and FS Report (URS 2008) to determine if the selected remedy is in compliance with applicable or relevant and appropriate State environmental laws and regulations. The State of Texas concurs with the selected remedy for the Site.

# PART 3: RESPONSIVENESS SUMMARY

The Responsiveness Summary summarizes information about the views of the public and the support agency regarding both the remedial alternatives and general concerns about the Site submitted during the public comment period.

**Question 1:** Scenic Galveston (conservancy) (pertaining to the location of the on-site cemetery and the proposed location of the cell/landfill, which, as proposed, would cover the cemetery): *The largest concern of most on our board remains the eventual disposition of the historic Dick-Campbell cemetery. We are well aware that while the cap is still being designed, it and the cemetery are in fundamental conflict, and that this may be irreconcilable. We understand that a ground-penetrating study is currently underway to learn more about what is underground, and also that a salvage archeology re-location may be the best (if not the only feasible) solution. While we are not altogether happy with that plan, it seems preferable to leaving the underground remains under the cap, with relocated surface materials on top. We understand the Malone Parties and EPA are in contact with the Texas Historical Commission and family member, so we will continue to stand by.*

**EPA's Response:** All Federal, State and local requirements to address the on-site cemetery will be followed. The MCP has been/is in contact with relatives to address their concerns. An archeological survey to define grave sites and the extent of the cemetery will be conducted. The EPA is currently examining the options of either moving the cemetery to an alternate location or relocating the RCRA Subtitle C cell. The decision on the cemetery will take into account the need to protect human health and the environment, the federal, state, and local requirements, and the wishes of the public.

**Question 2:** Scenic Galveston (conservancy) (pertaining to retaining one of the Storm Levees): *Post-Ike; we wonder about potentially retaining the inner south levee to protect both the cap and any restored freshwater or treed habitats from future storm surge.*

**EPA's Response:** The storm levees will be addressed during the remedial design phase. The EPA will take into account the future storm surge issues at the Site during remedial design.

**Question 3:** Scenic Galveston (conservancy) (pertaining to retaining on-site building): *We continue to be interested in retaining the main office building and attached warehouse, if possible, in concept.*

**EPA's Response:** The Site is being cleaned up to a nature conservancy worker level. This means that the exposure levels are safe for someone who visits once every 150 days. This cleanup level may be contrary to the intentions of Scenic Galveston in maintaining a constant presence at the Site. The remedial action contemplates removing all structures on-site. If any building has hazardous substances (e.g., asbestos), creates an obstacle to the remedial action, or is structurally unstable, it could be removed.

**Question 4:** Scenic Galveston (conservancy) (pertaining to retaining on-site separators for conservancy work): *We continue to be interested in rehabilitating some of the old separators as a wetland nursery, but we are aware, too, that soil contamination may preclude this.*

**EPA's Response:** The separators contain sludge (source material/principal threat waste) hazardous waste within the concrete pits and must be removed. The separators may have cracks, which, if containing liquid of any kind, has the potential to drive dissolved contaminants into the ground water, or further mobilize the existing plume. Therefore, rehabilitating the separators may not be feasible.

**Question 5:** Scenic Galveston (conservancy) (pertaining to ecological habitat): *We are happy that the freshwater pond habitat has been avoided, and we would like to see the largest habitat buffers achievable around this site feature as the site develops.*

**EPA's Response:** The Resource Trustees have voiced a similar concern. The remedial action will address all habitat concerns appropriately. The trustees and EPA will meet with the Potential Responsible Parties (PRPs) to discuss habitat within the Site during the remedial design phase.

**Question 6:** Scenic Galveston (conservancy) (pertaining to native grasses on the cell cap): *Our interest in working with the project on a native vegetation scheme for the cap (and, of course, other portions of the site) remains high. We have been discussing the concept of finding a suitable native prairie under threat of development and relocating it wholesale to the Malone site. This sounds like science fiction, but it could be, by far, the easiest way to ensure rapid vegetative cover. We hope the cap will be designed to accommodate relatively deep-rooted non-woody prairie versus turf type grass.*

**EPA's Response:** Native plants are considered for all sites with a cell remedial component. To protect the integrity of the High-Density Polyethylene (HDPE – heavy duty plastics) liner at the base of the cap, no plants which may extend roots into the HDPE will be used. To protect the integrity of the cap, no public access will be allowed on the cap.

**Question 7:** Scenic Galveston (conservancy) (pertaining to access to water supply): *Freshwater sources for both future preserve support facilities (nursery, maintenance sheds) and to serve re-establishment of vegetative cover on denuded portions of the site remains a quandary for us, but the presence of the pond and the ability to pump water out of it for this purpose helps. (We note presence of old pump equipment and fire hydrants.) If an un-contaminated water well is present, we would be interested in learning more about it.*

**EPA's Response:** Only one water supply well was used by Malone Service; it was reported that this well was not used for drinking water purposes. This site well may present a potential avenue for contaminants in the shallow ground water to migrate to a deeper aquifer. All wells on-site (with the exception of the shallow ground water monitoring wells) will be plugged and abandoned. In addition, institutional controls will be placed on the Site to restrict access to the ground water.

**Question 8:** Mr. Richard Greer (pertaining to plugging of wells): "*The deep wells that are on the site, are they going to be left there? I mean, are they going to be plugged up, or what's going to happen to them?"*

**EPA's Restatement of Question:** *Will the ground water wells that are separated from and exist in sands below the contaminated aquifer be plugged and abandoned?*

**EPA's Response:** There are three deep wells on-site. One is the Malone Service Company water supply well, which is screened (accessing ground water) from 183 feet below ground surface; this well will be plugged because it may present an avenue for movement of shallow contaminated ground water to the 183-foot sand. There are two on-site hazardous waste disposal wells, one operable and the other inoperable due to a casing problem. These wells are screened at approximately 4,800 feet below ground surface and are proposed to be plugged following completion of the remedy.

**Question 9:** Mr. Richard Greer (pertaining to ground water monitoring wells): *the ground water wells, how long are they going to be left there in place?*

**EPA's Restatement of Question:** *How long will the monitoring wells, which will monitor ground water for any movement of contaminated ground water, be left in place?*

**EPA's Response:** The shallow ground water monitoring wells are put in place to monitor the effectiveness of the cell in preventing movement of any contaminants from that cell, and to monitor for any off-site movement of the existing dissolved contaminant plumes. The monitoring wells will exist for as long as the cell contains hazardous waste.

**Question 10:** Mr. Thomas (pertaining to the remedial schedule): *"What about the schedule?"*

**EPA's Restatement of Question:** *How long will it take to complete the remedial action (the cleanup) – what is the schedule?*

**EPA's Response:** First, EPA will finalize the decision document (the Record of Decision), which presents the selected remedy. Then EPA will attempt to negotiate an agreement with the potentially responsible parties (PRPs) to conduct the remedial action. The Remedial Design, which designs all components of the remedy, will require approximately 1.5 years. The construction of the selected remedy is projected to take approximately 2 years to complete.

**Question 11:** Mr. Frank Dick (pertaining to the on-site cemetery): *The soil in the Campbell Bayou Cemetery has never been tested for any kind of contamination. My family and also the families of the Parr and Campbell families want the soil "inside" the cemetery fence tested. If no contamination is found, we do not want the graves disturbed in any way, fashion or form.*

**EPA's Response:** The soil in the cemetery area will be sampled during the remedial design stage. The remedial action will follow all Federal, State, and local laws in addressing this issue, as well as discussing concerns of relatives. Following appropriate assessment, either the cemetery or the RCRA cell will be relocated.

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# Tables

## Table 1. Remediation Levels for Human Health

| Exposure Point | Contaminant of Concern | Remediation Level or PRG (mg/kg) |
|---|---|---|
| Surface Soil | 1,1,2,2-Tetrachloroethane | 1.2 |
| | 1,1,2-Trichloroethane | 2.2 |
| | 1,2-Dibromoethane | 0.80 |
| | 1,2-Dichloroethane | 7.0 |
| | 2,3,7,8-TCDD TEQ (Mammal) | 0.005 [a] |
| | Aldrin | 1.0 |
| | Arsenic | 32 |
| | Benzene | 20 |
| | Benzo(a)anthracene | 22 |
| | Benzo(a)pyrene | 4.5 |
| | Benzo(b)fluoranthene | 4.5 |
| | bis(2-Ethylhexyl)phthalate | 315 |
| | Chloroform | 0.65 |
| | Dibenz(a,h)anthracene | 2.2 |
| | Hexachlorobenzene | 13 |
| | Hexachlorobutadiene | 18 |
| | Indeno(1,2,3-cd)pyrene | 4.5 |
| | Methylene chloride | 27 |
| | Naphthalene | 70 |
| | Tetrachloroethene | 112 |
| | Total Polychlorinated Biphenyls | 15 [b] |
| | Total Xylenes | 225 |
| | Trichloroethene | 83 |
| | Vinyl chloride | 4.8 |
| Subsurface Soil | 1,2-Dichloroethane | 7.0 |
| | 2,3,7,8-TCDD TEQ (Mammal) | 0.005 [a] |
| | 2-Methylnaphthalene | 6,750 |
| | Aldrin | 11 |
| | Arsenic | 75 |
| | Benzene | 20 |
| | Benzo(a)anthracene | 280 |
| | Benzo(a)pyrene | 78 |
| | Benzo(b)fluoranthene | 425 |
| | bis(2-Ethylhexyl)phthalate | 1,000 |
| | Chloroform | 6.5 |
| | Dibenz(a,h)anthracene | 285 |
| | Hexachlorobenzene | 25 |
| | Hexachlorobutadiene | 39 |
| | Indeno(1,2,3-cd)pyrene | 730 |
| | Methylene chloride | 275 |
| | Naphthalene | 70 |
| | Tetrachloroethene | 240 |
| | Total Polychlorinated Biphenyls | 20 [b] |
| | Total Xylenes | 225 |
| | Trichloroethene | 83 |
| | Vinyl chloride | 5.0 |

[a] 2,3,7,8-TCDD TEQ (Mammal) Preliminary Remediation Goal (PRG) based on EPA directive and TCEQ regulations (OSWER Directive 9200.4-26 and 30 TAC 350.76[e][3], respectively)

[b] Total PCBs PRG based on Toxic Substance Control Act regulations (40 CFR 761.61)

Remediation Levels were developed from PRGs based on $10^{-5}$ Individual Risk and/or Hazard Quotient (HQ) < 1 and Cumulative Risk < $10^{-4}$ and/or HQ < 10

2,3,7,8-TCDD - 2,3,7,8-Tetrachlorodibenzo-p-Dioxin

mg/kg – milligram(s) per kilogram

## Table 2. Remediation Levels for Ecological Receptors (mg/kg)

| Exposure Point | Contaminant of Concern | Midpoint LOAEL/NOAEL (all receptors) | Midpoint LOAEL/NOAEL (mobile receptors) | Remediation Levels |
|---|---|---|---|---|
| Laydown Area | 2,3,7,8-TCDD TEQ (Mammal) | 3.19E-05 [6] | ***2.80E-04*** [4] | **2.80E-04** |
| Laydown Area | 2,3,7,8-TCDD TEQ (Avian) | 5.20E-05 [6] | ***5.20E-05*** [6] | **5.20E-05** |
| Laydown Area | 2-Methylnaphthalene | 8.0 [1] | ***8.1*** [1] | **8.1** |
| Laydown Area | Hexachlorobenzene | 8.0 [2] | ***9.5*** [1] | **9.5** |
| Laydown Area | Hexachlorobutadiene | 2.5 [3] | ***60*** [1] | **60** |
| Laydown Area | High Molecular Weight PAHs | 5 [3] | ***5.6*** [1] | **5.6** |
| Laydown Area | Phenanthrene | 10.5 [1] | ***10.5*** [1] | **10.5** |
| Laydown Area | Total PCBs | 0.055 [3] | ***1.35*** [1] | **1.35** |
| Oil Pit Area | Hexachlorobutadiene | 2.5 [3] | ***725*** [1] | **725** |
| Oil Pit Area | High Molecular Weight PAHs | 5.0 [3] | ***70*** [1] | **70** |
| Cemetery Area | High Molecular Weight PAHs | 5.0 [3] | ***19.2*** [1] | **19.2** |
| Tank 800 Area | bis(2-Ethylhexyl)phthalate | ***33*** [1] | 33 [1] | **33** |
| Tank 800 Area | Cadmium | ***1.3*** [3] | 9.5 [1] | **1.3** |
| Tank 800 Area | Chromium | ***30*** [5] | 90 [1] | **30** |
| Tank 800 Area | Copper | ***115*** [3] | 4,100 [1] | **115** |
| Tank 800 Area | High Molecular Weight PAHs | ***5*** [3] | 14 [1] | **5** |
| Tank 800 Area | Nickel | ***10.5*** [3] | 2,700 [1] | **10.5** |
| Tank 800 Area | Zinc | ***30*** [5] | 30 [5] | **30** |

***Bold-italicized*** values are considered the ecological remediation levels for surface soils from 0 - 6 inches below ground surface. Portions of the Tank 800 Area that will not be covered by either the Subtitle C Landfill or by a minimum of 6 inches of soil will be subject to ecological remediation levels for all receptors. Otherwise, ecological remediation levels for mobile receptors apply.

2,3,7,8-TCDD - 2,3,7,8-Tetrachlorodibenzo-p-Dioxin; mg/kg – milligram(s) per kilogram

[1] Red-winged Blackbird
[2] Deer Mouse
[3] Least Shrew
[4] Raccoon
[5] State Background
[6] Borrow Pit Background

**Table 3. Monitoring Well Information**

| Well I.D. | Installation Date | Total Depth (feet) | Screened Interval (feet) | Total Depth (feet) | Screened Interval (feet) | Screen Material | Casing |
|---|---|---|---|---|---|---|---|
| MW-01 | 5/11/1982 | 40 | 11 - 18 | 16.4 | 10- 16.4 | 0.014-inch | 2-inch PVC |
| MW-02 | 12/19/1978 | 20 | 5 - 20 | Not Measured | Not Measured | 0.006-inch perf. | 2-inch PVC |
| MW-03 | 7/2/1980 | 30 | 15 - 30 | 27.5 | 13 - 27.5 | 0.006-inch perf. | 4-inch PVC |
| MW-04 | 7/2/1980 | 26 | 6 - 26 | 25 | 5 - 25 | 0.006-inch perf. | 4-inch PVC |
| MW-05U | 5/14/1982 | 15 | 8 - 15 | 15 | 8 - 15 | 0.014-inch | 2-inch PVC |
| MW-05D | 5/14/1982 | 30 | 20 - 30 | 30 | 20.5 - 30 | 0.014-inch | 2-inch PVC |
| MW-06 | 12/22/1978 | 35 | 5 - 35 | 27.5 | 5 - 27.5 | 0.006-inch perf. | 2-inch PVC |
| MW-07U | 5/14/1982 | 16 | 9 - 16 | 15.6 | 8 - 15.6 | 0.014-inch | 2-inch PVC |
| MW-07D | 5/14/1982 | 28 | 18 - 28 | 28.3 | 19 - 28.3 | 0.014-inch | 2-inch PVC |
| MW-08 | 1/15/1976 | 35 | 25 - 35 | 34.7 | 26 - 34.7 | 0.006-inch perf. | 4-inch PVC |
| MW-09 | 7/2/1980 | 26 | 6 - 26 | 37.8 | 20 - 37.8 | Unknown | 4-inch PVC |
| MW-10 | 12/15/1978 | 45 | 5 - 45 | 46.5 | 7 - 46.5 | 0.006-inch perf. | 2-inch PVC |
| MW-11 | 12/15/1978 | 45 | 5 - 45 | 42.6 | 5 - 42.6 | 0.006-inch perf. | 2-inch PVC |
| MW-12U | 5/11/1982 | 16 | 8 - 16 | 19.7 | 12 - 17.6 | 0.014-inch | 2-inch PVC |
| MW-12D | 5/11/1982 | 33 | 23 - 33 | 34 | 24 - 34 | 0.014-inch | 2-inch PVC |
| MW-13 | 5/12/1982 | 33 | 23 - 33 | 31 | 24 - 31 | 0.014-inch | 2-inch PVC |
| MW-14 | 7/1/1980 | 32 | 9 - 32 | 32.5 | 10 - 32.5 | Unknown | 4-inch PVC |
| MW-15U | 5/11/1982 | 16 | 9 - 16 | Not Measured | Not Measured | 0.014-inch | 2-inch PVC |
| MW-15D | 5/11/1982 | 30 | 20 - 30 | 32 | 22.5 - 32 | 0.014-inch | 2-inch PVC |
| MW-16 | 4/30/1984 | 44 | 28 - 38 | 38.4 | 29 - 38.4 | Unknown | 2-inch PVC |
| MW-17 | 4/30/1984 | 40 | 30 - 40 | 41.5 | 30 - 41.5 | Unknown | 2-inch PVC |
| MW-18 | 4/30/1984 | 40 | 30 - 40 | 40.5 | 10 - 40.5 | Unknown | 2-inch PVC |
| MW-19 | 4/30/1984 | 40 | 30 - 40 | Not Measured | Not Measured | Unknown | 2-inch PVC |
| MW-20 | 12/14/1978 | 45 | 5 - 45 | Not Measured | Not Measured | 0.006-inch perf. | 2-inch PVC |
| MW-24 | 6/30/1980 | 18 | 8 - 18 | 18.5 | 9 - 18.5 | 0.01 | 4-inch PVC |
| MW-25 | 5/12/1982 | 18 | 9.5 - 18 | 18.3 | 9.5 - 18.3 | 0.014-inch | 2-inch PVC |
| MW-26 | 12/27/2005 | 31 | 6 - 31 | Not Measured | Not Measured | 0.010-inch | 2-inch PVC |
| MW-27 | 12/27/2005 | 33 | 13 - 33 | Not Measured | Not Measured | 0.010-inch | 2-inch PVC |
| MW-28 | 12/27/2005 | 35 | 10 - 35 | Not Measured | Not Measured | 0.010-inch | 2-inch PVC |
| MW-29 | 12/28/2005 | 15 | 5 - 15 | Not Measured | Not Measured | 0.010-inch | 2-inch PVC |
| MW-30 | 12/28/2005 | 34 | 9 - 34 | Not Measured | Not Measured | 0.010-inch | 2-inch PVC |
| MW-31 | 12/28/2005 | 30 | 10 - 30 | Not Measured | Not Measured | 0.010-inch | 2-inch PVC |
| MW-32 | 12/29/2005 | 25 | 10 - 25 | Not Measured | Not Measured | 0.010-inch | 2-inch PVC |

The monitoring wells with the same identification number are nested wells, installed in a single soil test boring that was reamed to 5 7/8 inches. “U” denotes wells completed at the phreatic surface and “D” denotes completion in the center of the paleochannel sand.

## Table 4. Geotechnical Data Summary

| Sample Identification | Depth (feet) | Visual Classification | Unified Soil Classification | Moisture Content (Percent) | Dry Unit Weight (pcf) | Wet Unit Weight (pcf) | Liquid Limit (Percent) | Plastic Limit (Percent) | Coefficient of Permeability (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|
| BASS-15 | 8 - 10 | Yellowish brown silty clay, with sand seams and ferrous nodules | CL | 26.2 | NA | NA | 30 | 17 | NA |
| BASS-13 | 10 - 12 | Yellowish brown silty clay, with sand seams and ferrous nodules | CL | 22.4 | 127.6 | 101 | 32 | 18 | $1.38 \times 10^{-7}$ |
| MW-29 | 20 - 21.5 | Reddish brown clay with calcareous and ferrous nodules and silt seams | CH | 30.2 | 88 | 114.6 | 58 | 24 | $2.6 \times 10^{-7}$ |
| CB-03 @ CPT-17N2 | 40 - 42 | Brown clay with calcareous and ferrous nodules and sand seams | CH | 26.5 | 99.9 | 126.4 | 58 | 24 | $1.5 \times 10^{-7}$ |

CH - Inorganic clays of high plasticity
CL - Inorganic clays of low to medium plasticity
cm/sec - Centimeters per second
NA - Not applicable
pcf - Pounds per cubic foot

**Table 5. Summary of Contaminants of Concern and Medium-Specific Exposure Point Concentrations**
**Baseline Human Health Risk Assessment**

| | Scenario Timeframe: Current<br>Medium: Soil<br>Exposure Medium: Soil | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Concentration Detected | | | | | | |
| Exposure Point | Exposure Area | Contaminant of Concern | Min | Max | Units | Frequency of Detection | Exposure Point Concentration | Exposure Point Concentration Units | Statistical Measure |
| Surface Soil | Earthen Impoundment - Oil Pits | Arsenic | 3.5 | 20.8 | mg/kg | 2/2 | 20.8 | mg/kg | MAX |
| Surface Soil | Earthen Impoundment - Oil Pits | 1,1,2,2-Tetrachloroethane | 5.5 | 960 | mg/kg | 2/2 | 960 | mg/kg | MAX |
| Surface Soil | Earthen Impoundment - Oil Pits | 1,1,2-Trichloroethane | 8.6 | 1200 | mg/kg | 2/2 | 1200 | mg/kg | MAX |
| Surface Soil | Earthen Impoundment - Oil Pits | 1,2-Dibromoethane | 0.27 | 45 | mg/kg | 2/2 | 45 | mg/kg | MAX |
| Surface Soil | Earthen Impoundment - Oil Pits | 1,2-Dichloroethane | 37 | 4300 | mg/kg | 2/2 | 4300 | mg/kg | MAX |
| Surface Soil | Earthen Impoundment - Oil Pits | Benzene | 15 | 1600 | mg/kg | 2/2 | 1600 | mg/kg | MAX |
| Surface Soil | Earthen Impoundment - Oil Pits | Chloroform | 0.37 | 52 | mg/kg | 2/2 | 52 | mg/kg | MAX |
| Surface Soil | Earthen Impoundment - Oil Pits | Methylene chloride | 33 | 3100 | mg/kg | 2/2 | 3100 | mg/kg | MAX |
| Surface Soil | Earthen Impoundment - Oil Pits | Tetrachloroethene | 35 | 2700 | mg/kg | 2/2 | 2700 | mg/kg | MAX |
| Surface Soil | Earthen Impoundment - Oil Pits | Trichloroethene | 36 | 4300 | mg/kg | 2/2 | 4300 | mg/kg | MAX |
| Surface Soil | Earthen Impoundment - Oil Pits | Vinyl chloride | 0.14 | 16 | mg/kg | 2/2 | 16 | mg/kg | MAX |
| Surface Soil | Earthen Impoundment - Oil Pits | Benzo(a)anthracene | 1.8 | 15 | mg/kg | 2/2 | 15 | mg/kg | MAX |
| Surface Soil | Earthen Impoundment - Oil Pits | Benzo(a)pyrene | 0.98 | 5.4 | mg/kg | 2/2 | 5.4 | mg/kg | MAX |
| Surface Soil | Earthen Impoundment - Oil Pits | Benzo(b)fluoranthene | 1.5 | 11 | mg/kg | 2/2 | 11 | mg/kg | MAX |
| Surface Soil | Earthen Impoundment - Oil Pits | bis(2-Chloroethyl)ether | 0.43 | 11 | mg/kg | 2/2 | 11 | mg/kg | MAX |
| Surface Soil | Earthen Impoundment - Oil Pits | Hexachlorobenzene | 17 | 66 | mg/kg | 2/2 | 66 | mg/kg | MAX |
| Surface Soil | Earthen Impoundment - Oil Pits | Hexachlorobutadiene | 93 | 390 | mg/kg | 2/2 | 390 | mg/kg | MAX |
| Surface Water | Earthen Impoundment - Sludge Pit | Arsenic | 0.583 | 0.587 | mg/L | 3/3 | 0.587 | mg/kg | MAX |
| Surface Water | Earthen Impoundment - Sludge Pit | Vinyl chloride | 0.013 | 0.015 | mg/L | 3/3 | 0.015 | mg/kg | MAX |
| Surface Water | Earthen Impoundment - Sludge Pit | Benzo(a)anthracene | 0.0014 | 0.0018 | mg/L | 2/3 | 0.0018 | mg/kg | MAX |
| Surface Water | Earthen Impoundment - Sludge Pit | bis(2-Ethylhexyl)phthalate | 0.045 | 0.094 | mg/L | 3/3 | 0.094 | mg/kg | MAX |
| Surface Water | Earthen Impoundment - Sludge Pit | Hexachlorobenzene | 0.0014 | 0.0022 | mg/L | 2/3 | 0.0022 | mg/kg | MAX |
| Surface Water | Earthen Impoundment - Sludge Pit | Pentachlorophenol | 0.0034 | 0.0049 | mg/L | 3/3 | 0.0049 | mg/kg | MAX |
| Surface Soil | Laydown Area | 2,3,7,8-TCDD TEQ (Mammal) | 0.000189 | 0.000189 | mg/kg | 1/1 | 0.000189 | mg/kg | MAX |
| Surface Soil | Laydown Area | Arsenic | 0.94 | 49 | mg/kg | 42/42 | 49 | mg/kg | MAX |
| Surface Soil | Laydown Area | Total PCBs | 0.006 | 219 | mg/kg | 18/18 | 219 | mg/kg | MAX |
| Surface Soil | Laydown Area | Benzo(a)anthracene | 0.0021 | 11 | mg/kg | 30/42 | 11 | mg/kg | MAX |
| Surface Soil | Laydown Area | Benzo(a)pyrene | 0.0031 | 9.5 | mg/kg | 32/42 | 9.5 | mg/kg | MAX |
| Surface Soil | Laydown Area | Benzo(b)fluoranthene | 0.0038 | 14 | mg/kg | 32/42 | 14 | mg/kg | MAX |
| Surface Soil | Laydown Area | Dibenz(a,h)anthracene | 0.0031 | 1.5 | mg/kg | 18/42 | 1.5 | mg/kg | MAX |
| Surface Soil | Laydown Area | Hexachlorobenzene | 0.0025 | 94 | mg/kg | 38/42 | 94 | mg/kg | MAX |
| Surface Soil | Laydown Area | Hexachlorobutadiene | 0.002 | 310 | mg/kg | 34/42 | 310 | mg/kg | MAX |
| Surface Soil | Laydown Area | Indeno(1,2,3-cd)pyrene | 0.0027 | 5.3 | mg/kg | 30/42 | 5.3 | mg/kg | MAX |
| Surface Soil | Cemetery | 2,3,7,8-TCDD TEQ (Mammal) | 0.0047 | 0.0047 | mg/kg | 1/1 | 0.0047 | mg/kg | MAX |
| Surface Soil | Cemetery | Arsenic | 0.81 | 7.6 | mg/kg | 28/28 | 7.6 | mg/kg | MAX |
| Surface Soil | Cemetery | Total PCBs | 131 | 131 | mg/kg | 1/1 | 131 | mg/kg | MAX |

**Table 5. Summary of Contaminants of Concern and Medium-Specific Exposure Point Concentrations**
**Baseline Human Health Risk Assessment**

| | Scenario Timeframe: Current<br>Medium: Soil<br>Exposure Medium: Soil | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Concentration Detected | | | | | | |
| Exposure Point | Exposure Area | Contaminant of Concern | Min | Max | Units | Frequency of Detection | Exposure Point Concentration | Exposure Point Concentration Units | Statistical Measure |
| Surface Soil | Cemetery | 1,2-Dichloroethane | 0.0012 | 68 | mg/kg | 4/28 | 68 | mg/kg | MAX |
| Surface Soil | Cemetery | Benzene | 0.00099 | 800 | mg/kg | 16/28 | 800 | mg/kg | MAX |
| Surface Soil | Cemetery | Vinyl chloride | 0.00088 | 39 | mg/kg | 4/28 | 39 | mg/kg | MAX |
| Surface Soil | Cemetery | Benzo(a)anthracene | 0.0025 | 16 | mg/kg | 26/28 | 16 | mg/kg | MAX |
| Surface Soil | Cemetery | Benzo(a)pyrene | 0.0021 | 7.5 | mg/kg | 24/28 | 7.5 | mg/kg | MAX |
| Surface Soil | Cemetery | Benzo(b)fluoranthene | 0.0084 | 6 | mg/kg | 23/28 | 6 | mg/kg | MAX |
| Surface Soil | Cemetery | Hexachlorobenzene | 0.0056 | 2 | mg/kg | 19/28 | 2 | mg/kg | MAX |
| Surface Soil | Cemetery | Indeno(1,2,3-cd)pyrene | 0.0048 | 2.9 | mg/kg | 21/28 | 2.9 | mg/kg | MAX |
| Surface Soil | Cemetery | Naphthalene | 0.0014 | 600 | mg/kg | 23/28 | 600 | mg/kg | MAX |
| Subsurface Soil | Cemetery | 1,2-Dichloroethane | 0.16 | 370 | mg/kg | 9/13 | 370 | mg/kg | MAX |
| Subsurface Soil | Cemetery | Benzene | 0.0015 | 1000 | mg/kg | 11/13 | 1000 | mg/kg | MAX |
| Subsurface Soil | Cemetery | Chloroform | 0.029 | 2.3 | mg/kg | 3/13 | 2.3 | mg/kg | MAX |
| Subsurface Soil | Cemetery | Methylene chloride | 0.082 | 150 | mg/kg | 9/13 | 150 | mg/kg | MAX |
| Subsurface Soil | Cemetery | Total Xylenes | 0.0125 | 2480 | mg/kg | 11/13 | 2480 | mg/kg | MAX |
| Subsurface Soil | Cemetery | Tetrachloroethene | 0.00039 | 79 | mg/kg | 10/13 | 79 | mg/kg | MAX |
| Subsurface Soil | Cemetery | Trichloroethene | 0.00071 | 350 | mg/kg | 10/13 | 350 | mg/kg | MAX |
| Subsurface Soil | Cemetery | Vinyl chloride | 0.083 | 39 | mg/kg | 8/13 | 39 | mg/kg | MAX |
| Subsurface Soil | Cemetery | Naphthalene | 0.12 | 9700 | mg/kg | 10/12 | 9700 | mg/kg | MAX |
| Subsurface Soil | Cemetery | 2-Methylnaphthalene | 0.23 | 7600 | mg/kg | 10/12 | 7600 | mg/kg | MAX |
| Subsurface Soil | Cemetery | Benzo(a)anthracene | 0.017 | 190 | mg/kg | 9/12 | 190 | mg/kg | MAX |
| Subsurface Soil | Cemetery | Benzo(a)pyrene | 0.0071 | 62 | mg/kg | 5/12 | 62 | mg/kg | MAX |
| Surface Soil | Maintenance Pits Area | 2,3,7,8-TCDD TEQ (Mammal) | 0.000946 | 0.00094587 | mg/kg | 1/1 | 0.00094587 | mg/kg | MAX |
| Surface Soil | Maintenance Pits Area | Arsenic | 0.69 | 6.86 | mg/kg | 17/17 | 6.86 | mg/kg | MAX |
| Surface Soil | Maintenance Pits Area | Aldrin | 0.91 | 0.91 | mg/kg | 1/1 | 0.91 | mg/kg | MAX |
| Surface Soil | Maintenance Pits Area | Total PCBs | 54.39 | 54.39 | mg/kg | 1/1 | 54.39 | mg/kg | MAX |
| Surface Soil | Maintenance Pits Area | Benzo(a)anthracene | 0.0038 | 26 | mg/kg | 15/17 | 26 | mg/kg | MAX |
| Surface Soil | Maintenance Pits Area | Benzo(a)pyrene | 0.0051 | 12 | mg/kg | 14/17 | 12 | mg/kg | MAX |
| Surface Soil | Maintenance Pits Area | Benzo(b)fluoranthene | 0.0022 | 13 | mg/kg | 13/17 | 13 | mg/kg | MAX |
| Surface Soil | Maintenance Pits Area | Dibenz(a,h)anthracene | 0.019 | 1.4 | mg/kg | 4/17 | 1.4 | mg/kg | MAX |
| Surface Soil | Maintenance Pits Area | Hexachlorobenzene | 0.035 | 1.9 | mg/kg | 12/17 | 1.9 | mg/kg | MAX |
| Surface Soil | Maintenance Pits Area | Indeno(1,2,3-cd)pyrene | 0.013 | 3.8 | mg/kg | 11/17 | 3.8 | mg/kg | MAX |
| Subsurface Soil | Maintenance Pits Area | 1,2-Dichloroethane | 0.18 | 7.7 | mg/kg | 3/23 | 7.7 | mg/kg | MAX |
| Subsurface Soil | Maintenance Pits Area | Benzene | 0.0017 | 77 | mg/kg | 21/23 | 77 | mg/kg | MAX |
| Subsurface Soil | Maintenance Pits Area | Methylene chloride | 0.026 | 63 | mg/kg | 11/23 | 63 | mg/kg | MAX |
| Subsurface Soil | Maintenance Pits Area | Total Xylenes | 0.00367 | 2390 | mg/kg | 15/23 | 2390 | mg/kg | MAX |
| Subsurface Soil | Maintenance Pits Area | Tetrachloroethene | 0.053 | 58 | mg/kg | 8/23 | 58 | mg/kg | MAX |

**Table 5. Summary of Contaminants of Concern and Medium-Specific Exposure Point Concentrations**
**Baseline Human Health Risk Assessment**

| | Scenario Timeframe: Current<br>Medium: Soil<br>Exposure Medium: Soil | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Concentration Detected | | | | | | |
| Exposure Point | Exposure Area | Contaminant of Concern | Min | Max | Units | Frequency of Detection | Exposure Point Concentration | Exposure Point Concentration Units | Statistical Measure |
| Subsurface Soil | Maintenance Pits Area | Trichloroethene | 0.076 | 320 | mg/kg | 7/23 | 320 | mg/kg | MAX |
| Subsurface Soil | Maintenance Pits Area | Hexachlorobenzene | 21 | 64 | mg/kg | 2/23 | 64 | mg/kg | MAX |
| Subsurface Soil | Maintenance Pits Area | Hexachlorobutadiene | 0.28 | 600 | mg/kg | 4/23 | 600 | mg/kg | MAX |
| Subsurface Soil | Maintenance Pits Area | Naphthalene | 0.011 | 610 | mg/kg | 14/23 | 610 | mg/kg | MAX |
| Subsurface Soil | Tank 800 | 2,3,7,8-TCDD TEQ (Mammal) | 0.003409 | 0.003409 | mg/kg | 1/1 | 0.003409 | mg/kg | MAX |
| Subsurface Soil | Tank 800 | Aldrin | 7.8 | 7.8 | mg/kg | 1/1 | 7.8 | mg/kg | MAX |
| Subsurface Soil | Tank 800 | Total PCBs | 121.89 | 121.89 | mg/kg | 1/1 | 121.89 | mg/kg | MAX |
| Subsurface Soil | Tank 800 | 1,2-Dichloroethane | 0.0013 | 55 | mg/kg | 8/23 | 55 | mg/kg | MAX |
| Subsurface Soil | Tank 800 | Benzene | 0.0014 | 190 | mg/kg | 17/23 | 190 | mg/kg | MAX |
| Subsurface Soil | Tank 800 | Methylene chloride | 0.07 | 61 | mg/kg | 8/23 | 61 | mg/kg | MAX |
| Subsurface Soil | Tank 800 | Total Xylenes | 0.026 | 1850 | mg/kg | 10/23 | 1850 | mg/kg | MAX |
| Subsurface Soil | Tank 800 | Tetrachloroethene | 0.00061 | 170 | mg/kg | 6/23 | 170 | mg/kg | MAX |
| Subsurface Soil | Tank 800 | Trichloroethene | 0.0019 | 510 | mg/kg | 11/23 | 510 | mg/kg | MAX |
| Subsurface Soil | Tank 800 | Hexachlorobenzene | 0.0046 | 230 | mg/kg | 8/23 | 230 | mg/kg | MAX |
| Subsurface Soil | Tank 800 | Hexachlorobutadiene | 0.0082 | 2200 | mg/kg | 9/23 | 2200 | mg/kg | MAX |
| Subsurface Soil | Tank 800 | Naphthalene | 0.02 | 2700 | mg/kg | 10/23 | 2700 | mg/kg | MAX |
| Subsurface Soil | Tank 800 | Benzo(a)pyrene | 0.0025 | 27 | mg/kg | 8/23 | 27 | mg/kg | MAX |

**Table 6.A Values Used for Intake Calculations, Reasonable Maximum Exposure**
**Baseline Human Health Risk Assessment**

| | Scenario Timeframe: Current/Future<br>Medium: Surface Soil<br>Exposure Medium: Surface Soil, Vapors and Particulates | | | | | | |
|---|---|---|---|---|---|---|---|
| **Exposure Route** | **Receptor Population** | **Receptor Age** | **Exposure Point** | **Parameter Code** | **Parameter Definition** | **Value** | **Units** |
| Ingestion | Industrial Worker | Adult | Surface soil at the site | IRsoil | Ingestion rate of soil | 50 | mg/day |
| | | | | FIsoil | Fraction ingested, soil | 1 | unitless |
| | | | | EF | Exposure frequency | 250 | days/year |
| | | | | ED | Exposure duration | 25 | years |
| | | | | BW | Body weight | 70 | kg |
| | | | | ATnc | Averaging time for non-carcinogenics | 9125 | days |
| | | | | ATc | Averaging time for carcinogenics | 25550 | days |
| Dermal Contact | Industrial Worker | Adult | Surface soil at the site | AF | Adherence factor of soil to skin | 0.2 | mg/cm2-event |
| | | | | EF | Exposure frequency | 250 | days/year |
| | | | | ED | Exposure duration | 25 | years |
| | | | | EV | Event frequency | 1 | events/day |
| | | | | SA | Skin surface area available for contact | 3300 | cm2 |
| | | | | BW | Body weight | 70 | kg |
| | | | | ATnc | Averaging time for non-carcinogenics | 9125 | days |
| | | | | ATc | Averaging time for carcinogenics | 25550 | days |
| Inhalation | Industrial Worker | Adult | Ambient air above the site vapors and particulates | InhR | Inhalation rate, hourly | 1 | m3/hr |
| | | | | ET | Exposure time | 8 | hr/day |
| | | | | EF | Exposure frequency | 250 | days/year |
| | | | | ED | Exposure duration | 25 | years |
| | | | | BW | Body weight | 70 | kg |
| | | | | ATnc | Averaging time for non-carcinogenics | 9125 | days |
| | | | | ATc | Averaging time for carcinogenics | 25550 | days |
| | | | | T | Exposure interval | 9.50E+08 | s |

Notes:
mg/day = milligrams per day
kg = kilogram
mg/cm2-event = milligrams per square centimeter per event
cm2 = square centimeter
m3/hr = cubic meters per hour
hr/day = hours per day
s = second

**Table 6.B Values Used for Intake Calculations, Reasonable Maximum Exposure**
**Baseline Human Health Risk Assessment**

| | **Scenario Timeframe:** | **Current/Future** | | | | | |
|---|---|---|---|---|---|---|---|
| | **Medium:** | **Surface and Subsurface Soil** | | | | | |
| | **Exposure Medium:** | **Surface Soil, Subsurface Soil, Vapors and Particulates** | | | | | |
| **Exposure Route** | **Receptor Population** | **Receptor Age** | **Exposure Point** | **Parameter Code** | **Parameter Definition** | **Value** | **Units** |
| Ingestion | Construction Worker | Adult | Surface and Subsurface soil at the site | IRsoil | Ingestion rate of soil | 330 | mg/day |
| | | | | FIsoil | Fraction ingested, soil | 1 | unitless |
| | | | | EF | Exposure frequency | 30 | days/year |
| | | | | ED | Exposure duration | 1 | years |
| | | | | BW | Body weight | 70 | kg |
| | | | | ATnc | Averaging time for non-carcinogenics | 365 | days |
| | | | | ATc | Averaging time for carcinogenics | 25550 | days |
| Dermal Contact | Construction Worker | Adult | Surface and subsurface soil at the site | AF | Adherence factor of soil to skin | 0.3 | mg/cm2-event |
| | | | | EF | Exposure frequency | 30 | days/year |
| | | | | ED | Exposure duration | 1 | years |
| | | | | EV | Event frequency | 1 | events/day |
| | | | | SA | Skin surface area available for contact | 3300 | cm2 |
| | | | | BW | Body weight | 70 | kg |
| | | | | ATnc | Averaging time for non-carcinogenics | 365 | days |
| | | | | ATc | Averaging time for carcinogenics | 25550 | days |
| Inhalation | Construction Worker | Adult | Ambient air above the site vapors and particulates | InhR | Inhalation rate, hourly | 1.5 | m3/hr |
| | | | | ET | Exposure time | 8 | hr/day |
| | | | | EF | Exposure frequency | 30 | days/year |
| | | | | ED | Exposure duration | 1 | years |
| | | | | BW | Body weight | 70 | kg |
| | | | | ATnc | Averaging time for non-carcinogenics | 365 | days |
| | | | | ATc | Averaging time for carcinogenics | 25550 | days |
| | | | | T | Exposure interval | 9.50E+08 | s |

Notes:
mg/day = milligrams per day
kg = kilogram
mg/cm2-event = milligrams per square centimeter per event
cm2 = square centimeter
m3/hr = cubic meters per hour
hr/day = hours per day
s = second

**Table 6.C Values Used for Intake Calculations, Reasonable Maximum Exposure**
**Baseline Human Health Risk Assessment**

| Scenario Timeframe: Current/Future<br>Medium: Surface Soil<br>Exposure Medium: Surface Soil, Vapors and Particulates | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Exposure Route** | **Receptor Population** | **Receptor Age** | **Exposure Point** | **Parameter Code** | **Parameter Definition** | **Value** | **Units** |
| Ingestion | Recreational Birdwatcher | Adult | Surface soil at the site | IRsoil | Ingestion rate of soil | 20 | mg/day |
| | | | | FIsoil | Fraction ingested, soil | 1 | unitless |
| | | | | EF | Exposure frequency | 15 | days/year |
| | | | | ED | Exposure duration | 25 | years |
| | | | | BW | Body weight | 70 | kg |
| | | | | ATnc | Averaging time for non-carcinogenics | 9125 | days |
| | | | | ATc | Averaging time for carcinogenics | 25550 | days |
| Dermal Contact | Recreational Birdwatcher | Adult | Surface soil at the site | AF | Adherence factor of soil to skin | 0.3 | mg/cm2-event |
| | | | | EF | Exposure frequency | 15 | days/year |
| | | | | ED | Exposure duration | 25 | years |
| | | | | EV | Event frequency | 1 | events/day |
| | | | | SA | Skin surface area available for contact | 3300 | cm2 |
| | | | | BW | Body weight | 70 | kg |
| | | | | ATnc | Averaging time for non-carcinogenics | 9125 | days |
| | | | | ATc | Averaging time for carcinogenics | 25550 | days |
| Inhalation | Recreational Birdwatcher | Adult | Ambient air above the site vapors and particulates | InhR | Inhalation rate, hourly | 1.5 | m3/hr |
| | | | | ET | Exposure time | 8 | hr/day |
| | | | | EF | Exposure frequency | 15 | days/year |
| | | | | ED | Exposure duration | 25 | years |
| | | | | BW | Body weight | 70 | kg |
| | | | | ATnc | Averaging time for non-carcinogenics | 9125 | days |
| | | | | ATc | Averaging time for carcinogenics | 25550 | days |
| | | | | T | Exposure interval | 9.50E+08 | s |

Notes:
mg/day = milligrams per day
kg = kilogram
mg/cm2-event = milligrams per square centimeter per event
cm2 = square centimeter
m3/hr = cubic meters per hour
hr/day = hours per day
s = second

**Table 6.D Values Used for Intake Calculations, Reasonable Maximum Exposure**
**Baseline Human Health Risk Assessment**

| | **Scenario Timeframe: Current/Future**<br>**Medium: Surface Soil**<br>**Exposure Medium: Surface Soil, Vapors and Particulates** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Exposure Route** | **Receptor Population** | **Receptor Age** | **Exposure Point** | **Parameter Code** | **Parameter Definition** | **Value** | **Units** |
| Dermal Contact | Recreational Wader | Adult | Surface water at Earthen Impoundment | t-event | Event duration | 3 | hours/event |
| | | | | EF | Exposure frequency | 39 | days/year |
| | | | | ED | Exposure duration | 25 | years |
| | | | | EV | Event frequency | 1 | events/day |
| | | | | SA | Skin surface area available for contact | 6310 | cm2 |
| | | | | BW | Body weight | 70 | kg |
| | | | | ATnc | Averaging time for non-carcinogenics | 9125 | days |
| | | | | ATc | Averaging time for carcinogenics | 25550 | days |

Notes:
kg = kilogram
cm2 = square centimeter

**Table 6.E Values Used for Intake Calculations, Reasonable Maximum Exposure**
**Baseline Human Health Risk Assessment**

| VALUES USED FOR INTAKE CALCULATIONS, REASONABLE MAXIMUM EXPOSURE | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Scenario Timeframe:** Current/Future<br>**Medium:** Surface Soil<br>**Exposure Medium:** Surface Soil, Vapors and Particulates | | | | | | |
| **Exposure Route** | **Receptor Population** | **Receptor Age** | **Exposure Point** | **Parameter Code** | **Parameter Definition** | **Value** | **Units** |
| Ingestion | Conservancy Worker | Adult | Surface soil at the site | IRsoil | Ingestion rate of soil | 20 | mg/day |
| | | | | FIsoil | Fraction ingested, soil | 1 | unitless |
| | | | | EF | Exposure frequency | 150 | days/year |
| | | | | ED | Exposure duration | 25 | years |
| | | | | BW | Body weight | 70 | kg |
| | | | | ATnc | Averaging time for non-carcinogenics | 9125 | days |
| | | | | ATc | Averaging time for carcinogenics | 25550 | days |
| Dermal Contact | Conservancy Worker | Adult | Surface soil at the site | AF | Adherence factor of soil to skin | 0.3 | mg/cm2-event |
| | | | | EF | Exposure frequency | 150 | days/year |
| | | | | ED | Exposure duration | 25 | years |
| | | | | EV | Event frequency | 1 | events/day |
| | | | | SA | Skin surface area available for contact | 3300 | cm2 |
| | | | | BW | Body weight | 70 | kg |
| | | | | ATnc | Averaging time for non-carcinogenics | 9125 | days |
| | | | | ATc | Averaging time for carcinogenics | 25550 | days |
| Inhalation | Conservancy Worker | Adult | Ambient air above the site vapors and particulates | InhR | Inhalation rate, hourly | 1.5 | m3/hr |
| | | | | ET | Exposure time | 8 | hr/day |
| | | | | EF | Exposure frequency | 150 | days/year |
| | | | | ED | Exposure duration | 25 | years |
| | | | | BW | Body weight | 70 | kg |
| | | | | ATnc | Averaging time for non-carcinogenics | 9125 | days |
| | | | | ATc | Averaging time for carcinogenics | 25550 | days |
| | | | | T | Exposure interval | 9.50E+08 | s |

Notes:
mg/day = milligrams per day
kg = kilogram
mg/cm2-event = milligrams per square centimeter per event
cm2 = square centimeter
m3/hr = cubic meters per hour
hr/day = hours per day
s = second

**Table 7.A Cancer Toxicity Data Summary**
**Baseline Human Health Risk Assessment**

| Pathway: | Ingestion, Dermal | | | | | |
|---|---|---|---|---|---|---|
| **Chemical of Concern** | **Oral Cancer Slope Factor** | **Dermal Cancer Slope Factor** | **Slope Factor Units** | **Weight of Eveidence** | **Source** | **Date** |
| 1,1,2,2-Tetrachloroethane | 2.00E-01 | 2.00E-01 | kg-day/mg | C | I | 3/7/2006 |
| 1,1,2-Trichloroethane | 5.70E-02 | 5.70E-02 | kg-day/mg | C | I | 3/7/2006 |
| 1,2-Dibromoethane | 2.00E+00 | 2.00E+00 | kg-day/mg | Likely | I | 3/7/2006 |
| 1,2-Dichloroethane | 9.10E-02 | 9.10E-02 | kg-day/mg | B2 | I | 3/7/2006 |
| 2,3,7,8-TCDD TEQ (Mammal) | 1.50E+05 | 1.50E+05 | kg-day/mg | B2 | H | 7/31/1997 |
| 2-Methylnaphthalene | -- | -- | kg-day/mg | Cannot be determined | | |
| Aldrin | 1.70E+01 | 1.70E+01 | kg-day/mg | B2 | I | 3/7/2006 |
| Arsenic | 1.50E+00 | 1.50E+00 | kg-day/mg | A | I | 3/7/2006 |
| Benzene | 5.50E-02 | 5.50E-02 | kg-day/mg | A | I | 3/7/2006 |
| Benzo(a)anthracene | 7.30E-01 | 7.30E-01 | kg-day/mg | B2 | EPA-93 | 3/7/2006 |
| Benzo(a)pyrene | 7.30E+00 | 7.30E+00 | kg-day/mg | B2 | I | 3/7/2006 |
| Benzo(b)fluoranthene | 7.30E-01 | 7.30E-01 | kg-day/mg | B2 | EPA-93 | 3/7/2006 |
| bis(2-Chloroethyl)ether | 1.10E+00 | 1.10E+00 | kg-day/mg | B2 | I | 3/7/2006 |
| bis(2-Ethylhexyl)phthalate | 1.40E-02 | 7.37E-02 | kg-day/mg | B2 | I | 3/7/2006 |
| Chloroform | -- | -- | kg-day/mg | B2 | -- | |
| Dibenz(a,h)anthracene | 7.30E+00 | 7.30E+00 | kg-day/mg | B2 | EPA-93 | 3/7/2006 |
| Hexachlorobenzene | 1.60E+00 | 1.60E+00 | kg-day/mg | B2 | I | 3/7/2006 |
| Hexachlorobutadiene | 7.80E-02 | 7.80E-02 | kg-day/mg | C | I | 3/7/2006 |
| Indeno(1,2,3-cd)pyrene | 7.30E-01 | 7.30E-01 | kg-day/mg | B2 | EPA-93 | 3/7/2006 |
| Methylene chloride | 7.50E-03 | 9.50E-01 | kg-day/mg | B2 | I | 3/7/2006 |
| Naphthalene | -- | -- | kg-day/mg | C | -- | |
| Pentachlorophenol | 1.20E-01 | 1.20E-01 | kg-day/mg | B2 | I | 3/7/2006 |
| Tetrachloroethene | 5.20E-02 | 5.20E-02 | kg-day/mg | Likely | N | 3/7/2006 |
| Total PCBs | 2.00E+00 | 2.00E+00 | kg-day/mg | A | I | 3/7/2006 |
| Total Xylenes | -- | -- | kg-day/mg | Cannot be determined | | |
| Trichloroethene | 1.10E-02 | 1.10E-02 | kg-day/mg | B1 | N | 3/7/2006 |
| Vinyl chloride | 1.50E+00 | 1.50E+00 | kg-day/mg | A | I | 3/7/2006 |

**Table 7.A Cancer Toxicity Data Summary**
**Baseline Human Health Risk Assessment**

| Pathway: | Inhalation | | | | | | |
|---|---|---|---|---|---|---|---|
| **Chemical of Concern** | **Unit Risk** | **Units** | **Inhalation Cancer Slope Factor** | **Units** | **Weight of Evidence/ Cancer Guideline Description** | **Source** | **Date** |
| 1,1,2,2-Tetrachloroethane | 5.80E-05 | m3/ug | 0.203 | kg-day/mg | C | I | 3/7/2006 |
| 1,1,2-Trichloroethane | 1.60E-05 | m3/ug | 0.056 | kg-day/mg | C | I | 3/7/2006 |
| 1,2-Dibromoethane | 8.80E-05 | m3/ug | 0.308 | kg-day/mg | Likely | 0 | 3/7/2006 |
| 1,2-Dichloroethane | 2.60E-05 | m3/ug | 0.091 | kg-day/mg | B2 | I | 3/7/2006 |
| 2,3,7,8-TCDD TEQ (Mammal) | 4.29E+01 | m3/ug | 150000 | kg-day/mg | B2 | H | 7/31/1997 |
| 2-Methylnaphthalene | -- | m3/ug | -- | kg-day/mg | Cannot be determined | | |
| Aldrin | 4.90E-03 | m3/ug | 17.2 | kg-day/mg | B2 | I | 3/7/2006 |
| Arsenic | 4.30E-03 | m3/ug | 15.1 | kg-day/mg | A | I | 3/7/2006 |
| Benzene | 7.80E-06 | m3/ug | 0.0273 | kg-day/mg | A | I | 3/7/2006 |
| Benzo(a)anthracene | 8.80E-05 | m3/ug | 0.308 | kg-day/mg | B2 | EPA-93 | 3/7/2006 |
| Benzo(a)pyrene | 8.80E-04 | m3/ug | 3.08 | kg-day/mg | B2 | N | 3/7/2006 |
| Benzo(b)fluoranthene | 8.80E-05 | m3/ug | 0.308 | kg-day/mg | B2 | EPA-93 | 3/7/2006 |
| bis(2-Chloroethyl)ether | 3.30E-04 | m3/ug | 1.16 | kg-day/mg | B2 | I | 3/7/2006 |
| bis(2-Ethylhexyl)phthalate | -- | m3/ug | -- | kg-day/mg | B2 | | |
| Chloroform | 0.000023 | m3/ug | 0.0805 | kg-day/mg | B2 | I | 3/7/2006 |
| Dibenz(a,h)anthracene | 8.80E-04 | m3/ug | 3.08 | kg-day/mg | B2 | EPA-93 | 3/7/2006 |
| Hexachlorobenzene | 4.60E-04 | m3/ug | 1.61 | kg-day/mg | B2 | I | 3/7/2006 |
| Hexachlorobutadiene | 2.20E-05 | m3/ug | 0.077 | kg-day/mg | C | I | 3/7/2006 |
| Indeno(1,2,3-cd)pyrene | 8.80E-05 | m3/ug | 0.308 | kg-day/mg | B2 | EPA-93 | 3/7/2006 |
| Methylene chloride | 4.70E-07 | m3/ug | 0.00165 | kg-day/mg | B2 | I | 3/7/2006 |
| Naphthalene | -- | m3/ug | -- | kg-day/mg | B2 | | |
| Pentachlorophenol | -- | m3/ug | -- | kg-day/mg | B2 | | |
| Tetrachloroethene | 5.80E-07 | m3/ug | 0.00203 | kg-day/mg | Likely | N | 3/7/2006 |
| Total PCBs | 5.70E-04 | m3/ug | 2 | kg-day/mg | A | I | 3/7/2006 |
| Total Xylenes | -- | m3/ug | -- | kg-day/mg | Cannot be determined | | |
| Trichloroethene | 1.70E-06 | m3/ug | 0.00595 | kg-day/mg | B1 | N | 3/7/2006 |
| Vinyl chloride | 8.80E-06 | m3/ug | 0.0308 | kg-day/mg | A | I | 3/7/2006 |

**Table 7.B Non-Cancer Toxicity Data Summary**
**Baseline Human Health Risk Assessment**

| Chemical of Concern | Chronic/ Subchronic | Oral RfD Value | Oral RfD Units | Dermal RfD | Dermal RfD Units | Primary Target Organ | Combined Uncertainty/ Modifying Factors | Sources of RfD: Target Organ | Dates of RfD: Target Organ |
|---|---|---|---|---|---|---|---|---|---|
| Pathway: | Ingestion, Dermal | | | | | | | | |
| 1,1,2,2-Tetrachloroethane | Chronic | 4.00E-02 | mg/kg-day | 4.00E-02 | mg/kg-day | Respiratory | 1000 | A | 3/7/2006 |
| 1,1,2-Trichloroethane | Subchronic | 4.00E-03 | mg/kg-day | 4.00E-03 | mg/kg-day | Blood | 1000 | I | 3/7/2006 |
| 1,2-Dibromoethane | Chronic | 9.00E-03 | mg/kg-day | 9.00E-03 | mg/kg-day | Testes/Liver/Kidneys | 3000 | I | 3/7/2006 |
| 1,2-Dichloroethane | -- | -- | mg/kg-day | -- | mg/kg-day | -- | -- | -- | -- |
| 2,3,7,8-TCDD TEQ (Mammal) | -- | -- | mg/kg-day | -- | mg/kg-day | -- | -- | -- | -- |
| 2-Methylnaphthalene | Chronic | 4.00E-03 | mg/kg-day | 4.00E-03 | mg/kg-day | Heart | 1000 | I | 3/7/2006 |
| Aldrin | Chronic | 3.00E-05 | mg/kg-day | 3.00E-05 | mg/kg-day | Liver | 1000 | I | 3/7/2006 |
| Arsenic | Chronic | 3.00E-04 | mg/kg-day | 3.00E-04 | mg/kg-day | Vascular System | 3 | I | 3/7/2006 |
| Benzene | Chronic | 4.00E-03 | mg/kg-day | 4.00E-03 | mg/kg-day | Bone Marrow | 300 | I | 3/7/2006 |
| Benzo(a)anthracene | -- | -- | mg/kg-day | -- | mg/kg-day | -- | -- | -- | -- |
| Benzo(a)pyrene | -- | -- | mg/kg-day | -- | mg/kg-day | -- | -- | -- | -- |
| Benzo(b)fluoranthene | -- | -- | mg/kg-day | -- | mg/kg-day | -- | -- | -- | -- |
| bis(2-Chloroethyl)ether | -- | -- | mg/kg-day | -- | mg/kg-day | -- | -- | -- | -- |
| bis(2-Ethylhexyl)phthalate | Chronic | 2.00E-02 | mg/kg-day | 3.80E-03 | mg/kg-day | Liver | 1000 | I | 3/7/2006 |
| Chloroform | Chronic | 1.00E-02 | mg/kg-day | 2.00E-03 | mg/kg-day | Liver | 1000 | I | 3/7/2006 |
| Dibenz(a,h)anthracene | -- | -- | mg/kg-day | -- | mg/kg-day | -- | -- | -- | -- |
| Hexachlorobenzene | Chronic | 8.00E-04 | mg/kg-day | 8.00E-04 | mg/kg-day | Liver | 100 | I | 3/7/2006 |
| Hexachlorobutadiene | Chronic | 2.00E-04 | mg/kg-day | 2.00E-04 | mg/kg-day | Kidney | 1000 | H | 3/7/2006 |
| Indeno(1,2,3-cd)pyrene | -- | -- | mg/kg-day | -- | mg/kg-day | -- | -- | -- | -- |
| Methylene chloride | Chronic | 6.00E-02 | mg/kg-day | 6.00E-02 | mg/kg-day | Liver | 100 | I | 3/7/2006 |
| Naphthalene | Subchronic | 2.00E-02 | mg/kg-day | 2.00E-02 | mg/kg-day | Weight | 3000 | I | 3/7/2006 |
| Pentachlorophenol | Chronic | 3.00E-02 | mg/kg-day | 3.00E-02 | mg/kg-day | Liver/Kidney | 100 | I | 3/7/2006 |
| Tetrachloroethene | Subchronic | 1.00E-02 | mg/kg-day | 1.00E-02 | mg/kg-day | Liver | 1000 | I | 3/7/2006 |
| Total PCBs | Chronic | 4.00E-02 | mg/kg-day | 4.00E-02 | mg/kg-day | Respiratory | 1000 | A | 3/7/2006 |
| Total Xylenes | Chronic | 2.00E-01 | mg/kg-day | 2.00E-01 | mg/kg-day | Weight | 1000 | I | 3/7/2006 |
| Trichloroethene | Subchronic | 3.00E-04 | mg/kg-day | 3.00E-04 | mg/kg-day | Liver/Kidney | 3000 | N | 3/7/2006 |
| Vinyl chloride | Chronic | 3.00E-03 | mg/kg-day | 3.00E-03 | mg/kg-day | Liver | 30 | I | 3/7/2006 |
| | | | | | | | | | |
| **Chemical of Concern** | **Chronic/ Subchronic** | **Inhalation RfC** | **Inhalation RfC Units** | **Inhalation RfD** | **Inhalation RfD Units** | **Primary Target Organ** | **Combined Uncertainty/ Modifying Factors** | **Sources of RfC:RfD: Target Organ** | **Dates** |
| Pathway: | Inhalation | | | | | | | | |
| 1,1,2,2-Tetrachloroethane | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |
| 1,1,2-Trichloroethane | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |
| 1,2-Dibromoethane | Chronic | 9.00E-03 | mg/m3 | 2.57E-03 | mg/kg-day | Nasal | 300 | I | 3/7/2006 |
| 1,2-Dichloroethane | | 2.42E+00 | mg/m3 | 6.92E-01 | mg/kg-day | | | A | 3/7/2006 |
| 2,3,7,8-TCDD TEQ (Mammal) | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |

**Table 7.B Non-Cancer Toxicity Data Summary**
**Baseline Human Health Risk Assessment**

| Chemical of Concern | Chronic/ Subchronic | Oral RfD Value | Oral RfD Units | Dermal RfD | Dermal RfD Units | Primary Target Organ | Combined Uncertainty/ Modifying Factors | Sources of RfD: Target Organ | Dates of RfD: Target Organ |
|---|---|---|---|---|---|---|---|---|---|
| 2-Methylnaphthalene | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |
| Aldrin | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |
| Arsenic | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |
| Benzene | Chronic | 3.00E-02 | mg/m3 | 8.57E-03 | mg/kg-day | Bone Marrow | 300 | I | 3/7/2006 |
| Benzo(a)anthracene | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |
| Benzo(a)pyrene | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |
| Benzo(b)fluoranthene | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |
| bis(2-Chloroethyl)ether | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |
| bis(2-Ethylhexyl)phthalate | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |
| Chloroform | Chronic | 9.75E-02 | mg/m3 | 2.78E-02 | mg/kg-day | Liver/Kidney/CNS/GI tract/Reproduction | NA | PPRTV | 3/7/2006 |
| Dibenz(a,h)anthracene | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |
| Hexachlorobenzene | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |
| Hexachlorobutadiene | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |
| Indeno(1,2,3-cd)pyrene | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |
| Methylene chloride | | 3.00E+00 | mg/m3 | 8.57E-01 | mg/kg-day | | | H | 3/7/2006 |
| Naphthalene | | 3.00E-03 | mg/m3 | 8.57E-04 | mg/kg-day | Nasal | 3000 | I | 3/7/2006 |
| Pentachlorophenol | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |
| Tetrachloroethene | Chronic | 2.71E-01 | mg/m3 | 7.74E-02 | mg/kg-day | Neurological | NA | A | 3/7/2006 |
| Total PCBs | -- | -- | mg/m3 | -- | mg/kg-day | -- | -- | -- | -- |
| Total Xylenes | Subchronic | 1.00E-01 | mg/m3 | 2.86E-02 | mg/kg-day | Neurological | 300 | I | 3/7/2006 |
| Trichloroethene | Subchronic | -- | mg/m3 | -- | mg/kg-day | CNS | 1000 | N | 3/7/2006 |
| Vinyl chloride | Chronic | 1.00E-01 | mg/m3 | 2.86E-02 | mg/kg-day | Liver | 30 | I | 3/7/2006 |

# Table 8. Carcinogenic Exposure Routes
# Baseline Human Health Risk Assessment

| Exposure Point | Exposure Area | Exposure Point Concentration (mg/kg) | Receptor | Chemical of Concern | Carcinogenic Risk | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Surface Soil | Earthen Impoundment - Oil Pits | 20.8 | Industrial Worker | Arsenic | 5.50E-06 | 1.30E-08 | 2.20E-06 | 7.60E-06 |
| Surface Soil | Earthen Impoundment - Oil Pits | 960 | Industrial Worker | 1,1,2,2-Tetrachloroethane | 3.40E-05 | 8.40E-09 | --- | 3.40E-05 |
| Surface Soil | Earthen Impoundment - Oil Pits | 1200 | Industrial Worker | 1,1,2-Trichloroethane | 1.20E-05 | 2.90E-09 | --- | 1.20E-05 |
| Surface Soil | Earthen Impoundment - Oil Pits | 45 | Industrial Worker | 1,2-Dibromoethane | 1.60E-05 | 5.90E-10 | --- | 1.60E-05 |
| Surface Soil | Earthen Impoundment - Oil Pits | 4300 | Industrial Worker | 1,2-Dichloroethane | 6.80E-05 | 1.70E-08 | --- | 6.80E-05 |
| Surface Soil | Earthen Impoundment - Oil Pits | 1600 | Industrial Worker | Benzene | 1.50E-05 | 1.90E-09 | --- | 1.50E-05 |
| Surface Soil | Earthen Impoundment - Oil Pits | 52 | Industrial Worker | Chloroform | --- | 1.80E-10 | --- | 1.80E-10 |
| Surface Soil | Earthen Impoundment - Oil Pits | 3100 | Industrial Worker | Methylene chloride | 4.10E-06 | 2.20E-10 | --- | 4.10E-06 |
| Surface Soil | Earthen Impoundment - Oil Pits | 2700 | Industrial Worker | Tetrachloroethene | 2.50E-05 | 2.30E-10 | --- | 2.50E-05 |
| Surface Soil | Earthen Impoundment - Oil Pits | 4300 | Industrial Worker | Trichloroethene | 8.30E-06 | 1.10E-09 | --- | 8.30E-06 |
| Surface Soil | Earthen Impoundment - Oil Pits | 16 | Industrial Worker | Vinyl chloride | 4.20E-06 | 2.10E-11 | --- | 4.20E-06 |
| Surface Soil | Earthen Impoundment - Oil Pits | 15 | Industrial Worker | Benzo(a)anthracene | 1.90E-06 | 2.00E-10 | 3.30E-06 | 5.20E-06 |
| Surface Soil | Earthen Impoundment - Oil Pits | 5.4 | Industrial Worker | Benzo(a)pyrene | 6.90E-06 | 7.00E-10 | 1.20E-05 | 1.90E-05 |
| Surface Soil | Earthen Impoundment - Oil Pits | 11 | Industrial Worker | Benzo(b)fluoranthene | 1.40E-06 | 1.40E-10 | 2.40E-06 | 3.80E-06 |
| Surface Soil | Earthen Impoundment - Oil Pits | 11 | Industrial Worker | bis(2-Chloroethyl)ether | 2.10E-06 | 5.40E-10 | --- | 2.10E-06 |
| Surface Soil | Earthen Impoundment - Oil Pits | 66 | Industrial Worker | Hexachlorobenzene | 1.80E-05 | 4.60E-09 | 2.40E-05 | 4.30E-05 |
| Surface Soil | Earthen Impoundment - Oil Pits | 390 | Industrial Worker | Hexachlorobutadiene | 5.30E-06 | 1.30E-09 | 7.00E-06 | 1.20E-05 |
| | | | | | | | **Surface Soil Risk Total =** | **2.79E-04** |
| Surface Soil | Earthen Impoundment - Oil Pits | 960 | Construction Worker | 1,1,2,2-Tetrachloroethane | 1.10E-06 | 6.00E-11 | --- | 1.10E-06 |
| Surface Soil | Earthen Impoundment - Oil Pits | 4300 | Construction Worker | 1,2-Dichloroethane | 2.20E-06 | 1.20E-10 | --- | 2.20E-06 |
| Surface Soil | Earthen Impoundment - Oil Pits | 4300 | Construction Worker | Trichloroethene | 2.60E-07 | 7.90E-12 | --- | 2.60E-07 |
| | | | | | | | **Surface Soil Risk Total =** | **3.56E-06** |
| Surface Soil | Earthen Impoundment - Oil Pits | 4300 | Recreational Person | 1,2-Dichloroethane | 1.60E-06 | 1.50E-09 | --- | 1.60E-06 |
| Surface Soil | Earthen Impoundment - Oil Pits | 5.4 | Recreational Person | Benzo(a)pyrene | 1.70E-07 | 6.30E-11 | 1.10E-06 | 1.20E-06 |
| Surface Soil | Earthen Impoundment - Oil Pits | 66 | Recreational Person | Hexachlorobenzene | 4.40E-07 | 4.10E-10 | 2.20E-06 | 2.60E-06 |
| | | | | | | | **Surface Soil Risk Total =** | **5.40E-06** |
| Surface Water | Earthen impoundment - Sludge Pit | 0.587 | Recreational Person | Arsenic | --- | --- | 9.10E-06 | 9.10E-06 |
| Surface Water | Earthen impoundment - Sludge Pit | 0.015 | Recreational Person | Vinyl chloride | --- | --- | 2.20E-06 | 2.20E-06 |
| Surface Water | Earthen impoundment - Sludge Pit | 0.0018 | Recreational Person | Benzo(a)anthracene | --- | --- | 1.10E-05 | 1.10E-05 |
| Surface Water | Earthen impoundment - Sludge Pit | 0.094 | Recreational Person | bis(2-Ethylhexyl)phthalate | --- | --- | 1.30E-03 | 1.30E-03 |
| Surface Water | Earthen impoundment - Sludge Pit | 0.0022 | Recreational Person | Hexachlorobenzene | --- | --- | 3.10E-05 | 3.10E-05 |
| Surface Water | Earthen impoundment - Sludge Pit | 0.0049 | Recreational Person | Pentachlorophenol | --- | --- | 1.10E-06 | 1.10E-06 |
| | | | | | | | **Surface Water Risk Total =** | **1.35E-03** |
| Surface Soil | Laydown Area | 0.000189 | Industrial Worker | 2,3,7,8-TCDD TEQ (Mammal) | 5.00E-06 | 1.30E-09 | 2.00E-06 | 6.90E-06 |
| Surface Soil | Laydown Area | 49 | Industrial Worker | Arsenic | 1.30E-05 | 3.30E-08 | 5.10E-06 | 1.80E-05 |
| Surface Soil | Laydown Area | 219 | Industrial Worker | Total PCBs | 7.70E-05 | 2.00E-08 | 1.40E-04 | 2.20E-04 |
| Surface Soil | Laydown Area | 11 | Industrial Worker | Benzo(a)anthracene | 1.40E-06 | 1.50E-10 | 2.40E-06 | 3.80E-06 |
| Surface Soil | Laydown Area | 9.5 | Industrial Worker | Benzo(a)pyrene | 1.20E-05 | 1.30E-09 | 2.10E-05 | 3.30E-05 |
| Surface Soil | Laydown Area | 14 | Industrial Worker | Benzo(b)fluoranthene | 1.80E-06 | 1.90E-10 | 3.10E-06 | 4.90E-06 |
| Surface Soil | Laydown Area | 1.5 | Industrial Worker | Dibenz(a,h)anthracene | 1.90E-06 | 1.90E-10 | 3.30E-06 | 5.20E-06 |
| Surface Soil | Laydown Area | 94 | Industrial Worker | Hexachlorobenzene | 2.60E-05 | 6.90E-09 | 3.50E-05 | 6.10E-05 |
| Surface Soil | Laydown Area | 310 | Industrial Worker | Hexachlorobutadiene | 4.20E-06 | 1.10E-09 | 5.60E-06 | 9.80E-06 |

# Table 8. Carcinogenic Exposure Routes
# Baseline Human Health Risk Assessment

| Exposure Point | Exposure Area | Exposure Point Concentration (mg/kg) | Receptor | Chemical of Concern | Carcinogenic Risk | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Surface Soil | Laydown Area | 5.3 | Industrial Worker | Indeno(1,2,3-cd)pyrene | 6.80E-07 | 6.60E-11 | 1.20E-06 | 1.80E-06 |
| | | | | | | | **Surface Soil Risk Total =** | **3.64E-04** |
| Surface Soil | Laydown Area | 219 | Construction Worker | Total PCBs | 2.40E-06 | 1.40E-10 | 1.00E-06 | 3.40E-06 |
| Surface Soil | Laydown Area | 94 | Construction Worker | Hexachlorobenzene | 8.30E-07 | 4.90E-11 | 2.50E-07 | 1.10E-06 |
| | | | | | | | **Surface Soil Risk Total =** | **4.50E-06** |
| Surface Soil | Laydown Area | 219 | Recreational Person | Total PCBs | 1.80E-06 | 1.80E-09 | 1.30E-05 | 1.50E-05 |
| Surface Soil | Laydown Area | 9.5 | Recreational Person | Benzo(a)pyrene | 2.90E-07 | 1.20E-10 | 1.90E-06 | 2.20E-06 |
| Surface Soil | Laydown Area | 94 | Recreational Person | Hexachlorobenzene | 6.30E-07 | 6.20E-10 | 3.10E-06 | 3.80E-06 |
| | | | | | | | **Surface Soil Risk Total =** | **2.10E-05** |
| Surface Soil | Cemetery | 0.0047 | Industrial Worker | 2,3,7,8-TCDD TEQ (Mammal) | 1.20E-04 | 2.60E-08 | 4.90E-05 | 1.70E-04 |
| Surface Soil | Cemetery | 7.6 | Industrial Worker | Arsenic | 2.00E-06 | 4.30E-09 | 7.90E-07 | 2.80E-06 |
| Surface Soil | Cemetery | 131 | Industrial Worker | Total PCBs | 4.60E-05 | 9.80E-09 | 8.50E-05 | 1.30E-04 |
| Surface Soil | Cemetery | 68 | Industrial Worker | 1,2-Dichloroethane | 1.10E-06 | 2.30E-10 | --- | 1.10E-06 |
| Surface Soil | Cemetery | 800 | Industrial Worker | Benzene | 7.70E-06 | 8.20E-10 | --- | 7.70E-06 |
| Surface Soil | Cemetery | 39 | Industrial Worker | Vinyl chloride | 1.00E-05 | 4.50E-11 | --- | 1.00E-05 |
| Surface Soil | Cemetery | 16 | Industrial Worker | Benzo(a)anthracene | 2.00E-06 | 1.80E-10 | 3.50E-06 | 5.50E-06 |
| Surface Soil | Cemetery | 7.5 | Industrial Worker | Benzo(a)pyrene | 9.60E-06 | 8.40E-10 | 1.60E-05 | 2.60E-05 |
| Surface Soil | Cemetery | 6 | Industrial Worker | Benzo(b)fluoranthene | 7.70E-07 | 6.80E-11 | 1.30E-06 | 2.10E-06 |
| Surface Soil | Cemetery | 2 | Industrial Worker | Hexachlorobenzene | 5.60E-07 | 1.20E-10 | 7.40E-07 | 1.30E-06 |
| Surface Soil | Cemetery | 2.9 | Industrial Worker | Indeno(1,2,3-cd)pyrene | 3.70E-07 | 3.00E-11 | 6.30E-07 | 1.00E-06 |
| Surface Soil | Cemetery | 600 | Industrial Worker | Naphthalene | --- | --- | --- | --- |
| | | | | | | | **Surface Soil Risk Total =** | **3.58E-04** |
| Surface Soil | Cemetery | 0.0047 | Construction Worker | 2,3,7,8-TCDD TEQ (Mammal) | 3.90E-06 | 1.90E-10 | 3.50E-07 | 4.30E-06 |
| Surface Soil | Cemetery | 131 | Construction Worker | Total PCBs | 1.50E-06 | 7.00E-11 | 6.10E-07 | 2.10E-06 |
| | | | | | | | **Surface Soil Risk Total =** | **6.40E-06** |
| Surface Soil | Cemetery | 0.0047 | Recreational Person | 2,3,7,8-TCDD TEQ (Mammal) | 3.00E-06 | 2.30E-09 | 4.40E-06 | 7.30E-06 |
| Surface Soil | Cemetery | 131 | Recreational Person | Total PCBs | 1.10E-06 | 8.80E-10 | 7.60E-06 | 8.70E-06 |
| Surface Soil | Cemetery | 7.5 | Recreational Person | Benzo(a)pyrene | 2.30E-07 | 7.60E-11 | 1.50E-06 | 1.70E-06 |
| | | | | | | | **Surface Soil Risk Total =** | **1.77E-05** |
| Subsurface Soil | Cemetery | 370 | Industrial Worker | 1,2-Dichloroethane | --- | 3.90E-04 | --- | 3.90E-04 |
| Subsurface Soil | Cemetery | 1000 | Industrial Worker | Benzene | --- | 3.60E-04 | --- | 3.60E-04 |
| Subsurface Soil | Cemetery | 2.3 | Industrial Worker | Chloroform | --- | 2.50E-06 | --- | 2.50E-06 |
| Subsurface Soil | Cemetery | 150 | Industrial Worker | Methylene chloride | --- | 3.90E-06 | --- | 3.90E-06 |
| Subsurface Soil | Cemetery | 2480 | Industrial Worker | Total Xylenes | --- | --- | --- | --- |
| Subsurface Soil | Cemetery | 79 | Industrial Worker | Tetrachloroethene | --- | 2.40E-06 | --- | 2.40E-06 |
| Subsurface Soil | Cemetery | 350 | Industrial Worker | Trichloroethene | --- | 3.10E-05 | --- | 3.10E-05 |
| Subsurface Soil | Cemetery | 39 | Industrial Worker | Vinyl chloride | --- | 5.70E-05 | --- | 5.70E-05 |
| Subsurface Soil | Cemetery | 9700 | Industrial Worker | Naphthalene | --- | --- | --- | --- |
| | | | | | | | **Subsurface Soil Risk Total =** | **8.47E-04** |
| Subsurface Soil | Cemetery | 7600 | Construction Worker | 2-Methylnaphthalene | --- | --- | --- | --- |
| Subsurface Soil | Cemetery | 190 | Construction Worker | Benzo(a)anthracene | 7.70E-07 | 1.60E-11 | 3.00E-07 | 1.10E-06 |
| Subsurface Soil | Cemetery | 62 | Construction Worker | Benzo(a)pyrene | 2.50E-06 | 5.00E-11 | 9.80E-07 | 3.50E-06 |

# Table 8. Carcinogenic Exposure Routes
# Baseline Human Health Risk Assessment

| Exposure Point | Exposure Area | Exposure Point Concentration (mg/kg) | Receptor | Chemical of Concern | Carcinogenic Risk | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| | | | | | | | **Subsurface Soil Risk Total =** | **4.60E-06** |
| Subsurface Soil | Cemetery | 370 | Recreational Person | 1,2-Dichloroethane | --- | 3.50E-05 | --- | 3.50E-05 |
| Subsurface Soil | Cemetery | 1000 | Recreational Person | Benzene | --- | 3.30E-05 | --- | 3.30E-05 |
| Subsurface Soil | Cemetery | 350 | Recreational Person | Trichloroethene | --- | 2.80E-06 | --- | 2.80E-06 |
| Subsurface Soil | Cemetery | 39 | Recreational Person | Vinyl chloride | --- | 5.10E-06 | --- | 5.10E-06 |
| Subsurface Soil | Cemetery | 9700 | Recreational Person | Naphthalene | --- | --- | --- | --- |
| | | | | | | | **Subsurface Soil Risk Total =** | **7.59E-05** |
| Surface Soil | Maintenance Pits Area | 0.00094587 | Industrial Worker | 2,3,7,8-TCDD TEQ (Mammal) | 2.50E-05 | 4.80E-09 | 9.80E-06 | 3.50E-05 |
| Surface Soil | Maintenance Pits Area | 6.86 | Industrial Worker | Arsenic | 1.80E-06 | 3.60E-09 | 7.10E-07 | 2.50E-06 |
| Surface Soil | Maintenance Pits Area | 0.91 | Industrial Worker | Aldrin | 2.70E-06 | 5.40E-10 | 3.60E-06 | 6.30E-06 |
| Surface Soil | Maintenance Pits Area | 54.39 | Industrial Worker | Total PCBs | 1.90E-05 | 3.70E-09 | 3.50E-05 | 5.40E-05 |
| Surface Soil | Maintenance Pits Area | 26 | Industrial Worker | Benzo(a)anthracene | 3.30E-06 | 2.70E-10 | 5.70E-06 | 9.00E-06 |
| Surface Soil | Maintenance Pits Area | 12 | Industrial Worker | Benzo(a)pyrene | 1.50E-05 | 1.20E-09 | 2.60E-05 | 4.20E-05 |
| Surface Soil | Maintenance Pits Area | 13 | Industrial Worker | Benzo(b)fluoranthene | 1.70E-06 | 1.40E-10 | 2.80E-06 | 4.50E-06 |
| Surface Soil | Maintenance Pits Area | 1.4 | Industrial Worker | Dibenz(a,h)anthracene | 1.80E-06 | 1.40E-10 | 3.10E-06 | 4.90E-06 |
| Surface Soil | Maintenance Pits Area | 1.9 | Industrial Worker | Hexachlorobenzene | 5.30E-07 | 1.10E-10 | 7.00E-07 | 1.20E-06 |
| Surface Soil | Maintenance Pits Area | 3.8 | Industrial Worker | Indeno(1,2,3-cd)pyrene | 4.80E-07 | 3.60E-11 | 8.30E-07 | 1.30E-06 |
| | | | | | | | **Surface Soil Risk Total =** | **1.61E-04** |
| Surface Soil | Maintenance Pits Area | 54.39 | Construction Worker | Total PCBs | 6.00E-07 | 2.70E-11 | 2.50E-07 | 8.60E-07 |
| | | | | | | | **Surface Soil Risk Total =** | **8.60E-07** |
| Surface Soil | Maintenance Pits Area | 0.00094587 | Recreational Person | 2,3,7,8-TCDD TEQ (Mammal) | 5.90E-07 | 4.30E-10 | 8.80E-07 | 1.50E-06 |
| Surface Soil | Maintenance Pits Area | 54.39 | Recreational Person | Total PCBs | 4.60E-07 | 3.40E-10 | 3.20E-06 | 3.60E-06 |
| Surface Soil | Maintenance Pits Area | 12 | Recreational Person | Benzo(a)pyrene | 3.70E-07 | 1.10E-10 | 2.40E-06 | 2.70E-06 |
| | | | | | | | **Surface Soil Risk Total =** | **7.80E-06** |
| Subsurface Soil | Maintenance Pits Area | 7.7 | Industrial Worker | 1,2-Dichloroethane | --- | 7.40E-06 | --- | 7.40E-06 |
| Subsurface Soil | Maintenance Pits Area | 77 | Industrial Worker | Benzene | --- | 2.60E-05 | --- | 2.60E-05 |
| Subsurface Soil | Maintenance Pits Area | 63 | Industrial Worker | Methylene chloride | --- | 1.50E-06 | --- | 1.50E-06 |
| Subsurface Soil | Maintenance Pits Area | 2390 | Industrial Worker | Total Xylenes | --- | --- | --- | --- |
| Subsurface Soil | Maintenance Pits Area | 58 | Industrial Worker | Tetrachloroethene | --- | 1.60E-06 | --- | 1.60E-06 |
| Subsurface Soil | Maintenance Pits Area | 320 | Industrial Worker | Trichloroethene | --- | 2.60E-05 | --- | 2.60E-05 |
| Subsurface Soil | Maintenance Pits Area | 64 | Industrial Worker | Hexachlorobenzene | --- | 1.70E-05 | --- | 1.70E-05 |
| Subsurface Soil | Maintenance Pits Area | 600 | Industrial Worker | Hexachlorobutadiene | --- | 1.10E-04 | --- | 1.10E-04 |
| Subsurface Soil | Maintenance Pits Area | 610 | Industrial Worker | Naphthalene | --- | --- | --- | --- |
| | | | | | | | **Subsurface Soil Risk Total =** | **1.90E-04** |
| Subsurface Soil | Maintenance Pits Area | 600 | Construction Worker | Hexachlorobutadiene | 2.60E-07 | 1.10E-11 | 7.80E-08 | 3.40E-07 |
| | | | | | | | **Subsurface Soil Risk Total =** | **3.40E-07** |
| Subsurface Soil | Maintenance Pits Area | 77 | Recreational Person | Benzene | --- | 2.30E-06 | --- | 2.30E-06 |
| Subsurface Soil | Maintenance Pits Area | 320 | Recreational Person | Trichloroethene | --- | 2.30E-06 | --- | 2.30E-06 |
| Subsurface Soil | Maintenance Pits Area | 64 | Recreational Person | Hexachlorobenzene | --- | 1.50E-06 | --- | 1.50E-06 |
| Subsurface Soil | Maintenance Pits Area | 600 | Recreational Person | Hexachlorobutadiene | --- | 9.50E-06 | --- | 9.50E-06 |
| | | | | | | | **Subsurface Soil Risk Total =** | **1.56E-05** |
| Subsurface Soil | Tank 800 | 0.003409 | Industrial Worker | 2,3,7,8-TCDD TEQ (Mammal) | --- | 1.00E-06 | --- | 1.00E-06 |

## Table 8. Carcinogenic Exposure Routes
## Baseline Human Health Risk Assessment

| Exposure Point | Exposure Area | Exposure Point Concentration (mg/kg) | Receptor | Chemical of Concern | Carcinogenic Risk | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Subsurface Soil | Tank 800 | 7.8 | Industrial Worker | Aldrin | --- | 5.40E-06 | --- | 5.40E-06 |
| Subsurface Soil | Tank 800 | 121.89 | Industrial Worker | Total PCBs | --- | 1.30E-05 | --- | 1.30E-05 |
| Subsurface Soil | Tank 800 | 55 | Industrial Worker | 1,2-Dichloroethane | --- | 6.00E-05 | --- | 6.00E-05 |
| Subsurface Soil | Tank 800 | 190 | Industrial Worker | Benzene | --- | 7.30E-05 | --- | 7.30E-05 |
| Subsurface Soil | Tank 800 | 61 | Industrial Worker | Methylene chloride | --- | 1.70E-06 | --- | 1.70E-06 |
| Subsurface Soil | Tank 800 | 1850 | Industrial Worker | Total Xylenes | --- | --- | --- | --- |
| Subsurface Soil | Tank 800 | 170 | Industrial Worker | Tetrachloroethene | --- | 5.40E-06 | --- | 5.40E-06 |
| Subsurface Soil | Tank 800 | 510 | Industrial Worker | Trichloroethene | --- | 4.70E-05 | --- | 4.70E-05 |
| Subsurface Soil | Tank 800 | 230 | Industrial Worker | Hexachlorobenzene | --- | 7.10E-05 | --- | 7.10E-05 |
| Subsurface Soil | Tank 800 | 2200 | Industrial Worker | Hexachlorobutadiene | --- | 4.40E-04 | --- | 4.40E-04 |
| Subsurface Soil | Tank 800 | 2700 | Industrial Worker | Naphthalene | --- | --- | --- | --- |
| | | | | | | | **Subsurface Soil Risk Total =** | **7.18E-04** |
| Subsurface Soil | Tank 800 | 0.003409 | Construction Worker | 2,3,7,8-TCDD TEQ (Mammal) | 2.80E-06 | 1.40E-10 | 2.50E-07 | 3.10E-06 |
| Subsurface Soil | Tank 800 | 121.89 | Construction Worker | Total PCBs | 1.30E-06 | 6.90E-11 | 5.70E-07 | 1.90E-06 |
| Subsurface Soil | Tank 800 | 27 | Construction Worker | Benzo(a)pyrene | 1.10E-06 | 2.30E-11 | 4.30E-07 | 1.50E-06 |
| Subsurface Soil | Tank 800 | 230 | Construction Worker | Hexachlorobenzene | 2.00E-06 | 1.00E-10 | 6.10E-07 | 2.60E-06 |
| Subsurface Soil | Tank 800 | 2200 | Construction Worker | Hexachlorobutadiene | 9.50E-07 | 4.80E-11 | 2.80E-07 | 1.20E-06 |
| | | | | | | | **Subsurface Soil Risk Total =** | **1.03E-05** |
| Subsurface Soil | Tank 800 | 121.89 | Recreational Person | Total PCBs | --- | 1.20E-06 | --- | 1.20E-06 |
| Subsurface Soil | Tank 800 | 55 | Recreational Person | 1,2-Dichloroethane | --- | 5.40E-06 | --- | 5.40E-06 |
| Subsurface Soil | Tank 800 | 190 | Recreational Person | Benzene | --- | 6.60E-06 | --- | 6.60E-06 |
| Subsurface Soil | Tank 800 | 510 | Recreational Person | Trichloroethene | --- | 4.20E-06 | --- | 4.20E-06 |
| Subsurface Soil | Tank 800 | 230 | Recreational Person | Hexachlorobenzene | --- | 6.30E-06 | --- | 6.30E-06 |
| Subsurface Soil | Tank 800 | 2200 | Recreational Person | Hexachlorobutadiene | --- | 4.00E-05 | --- | 4.00E-05 |
| Subsurface Soil | Tank 800 | 2700 | Recreational Person | Naphthalene | --- | --- | --- | --- |
| | | | | | | | **Subsurface Soil Risk Total =** | **6.37E-05** |

Notes:
See Appendix A for Human Health PRG Calculations
mg/kg = Milligrams per kilogram

## Table 9. Non-Carcinogenic Exposure Routes
## Baseline Human Health Risk Assessment

| Exposure Point | Exposure Area | Exposure Point Concentration (mg/kg) | Receptor | Chemical of Potential Concern | Primary Target Organs | Non-Cancer Hazard | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Surface Soil | Earthen Impoundment - Oil Pits | 20.8 | Industrial Worker | Arsenic | Vascular syst. | 3.40E-02 | --- | 1.30E-02 | 4.70E-02 |
| Surface Soil | Earthen Impoundment - Oil Pits | 960 | Industrial Worker | 1,1,2,2-Tetrachloroethane | Respiratory | 1.20E-02 | --- | --- | 1.20E-02 |
| Surface Soil | Earthen Impoundment - Oil Pits | 1200 | Industrial Worker | 1,1,2-Trichloroethane | Blood | 1.50E-01 | --- | --- | 1.50E-01 |
| Surface Soil | Earthen Impoundment - Oil Pits | 45 | Industrial Worker | 1,2-Dibromoethane | Liver/Kidney/Nasal/Testes | 2.40E-03 | 2.10E-06 | --- | 2.40E-03 |
| Surface Soil | Earthen Impoundment - Oil Pits | 4300 | Industrial Worker | 1,2-Dichloroethane | --- | --- | 7.50E-07 | --- | 7.50E-07 |
| Surface Soil | Earthen Impoundment - Oil Pits | 1600 | Industrial Worker | Benzene | Bone Marrow | 2.00E-01 | 2.20E-05 | --- | 2.00E-01 |
| Surface Soil | Earthen Impoundment - Oil Pits | 52 | Industrial Worker | Chloroform | Liver/Kidney/CNS/GI tract/Reprod | 2.50E-03 | 2.20E-07 | --- | 2.50E-03 |
| Surface Soil | Earthen Impoundment - Oil Pits | 3100 | Industrial Worker | Methylene chloride | Liver | 2.50E-02 | 4.30E-07 | --- | 2.50E-02 |
| Surface Soil | Earthen Impoundment - Oil Pits | 2700 | Industrial Worker | Tetrachloroethene | Liver/Neurological | 1.30E-01 | 4.20E-06 | --- | 1.30E-01 |
| Surface Soil | Earthen Impoundment - Oil Pits | 4300 | Industrial Worker | Trichloroethene | Liver/Kidney/CNS | 7.00E+00 | --- | --- | 7.00E+00 |
| Surface Soil | Earthen Impoundment - Oil Pits | 16 | Industrial Worker | Vinyl chloride | Liver | 2.60E-03 | 6.70E-08 | --- | 2.60E-03 |
| Surface Soil | Earthen Impoundment - Oil Pits | 15 | Industrial Worker | Benzo(a)anthracene | --- | --- | --- | --- | --- |
| Surface Soil | Earthen Impoundment - Oil Pits | 5.4 | Industrial Worker | Benzo(a)pyrene | --- | --- | --- | --- | --- |
| Surface Soil | Earthen Impoundment - Oil Pits | 11 | Industrial Worker | Benzo(b)fluoranthene | --- | --- | --- | --- | --- |
| Surface Soil | Earthen Impoundment - Oil Pits | 11 | Industrial Worker | bis(2-Chloroethyl)ether | --- | --- | --- | --- | --- |
| Surface Soil | Earthen Impoundment - Oil Pits | 66 | Industrial Worker | Hexachlorobenzene | Liver | 4.00E-02 | --- | 5.30E-02 | 9.40E-02 |
| Surface Soil | Earthen Impoundment - Oil Pits | 390 | Industrial Worker | Hexachlorobutadiene | Kidney | 9.50E-01 | --- | 1.30E+00 | 2.20E+00 |
| | | | | | | | | **Surface Soil Risk Total =** | **9.87E+00** |
| Surface Soil | Earthen Impoundment - Oil Pits | 960 | Construction Worker | 1,1,2,2-Tetrachloroethane | Respiratory | 9.30E-03 | --- | --- | 9.30E-03 |
| Surface Soil | Earthen Impoundment - Oil Pits | 4300 | Construction Worker | 1,2-Dichloroethane | --- | --- | 1.30E-07 | --- | 1.30E-07 |
| Surface Soil | Earthen Impoundment - Oil Pits | 4300 | Construction Worker | Trichloroethene | Liver/Kidney/CNS | 5.60E+00 | --- | --- | 5.60E+00 |
| | | | | | | | | **Surface Soil Risk Total =** | **5.61E+00** |
| Surface Soil | Earthen Impoundment - Oil Pits | 4300 | Recreational Person | 1,2-Dichloroethane | --- | --- | 6.70E-08 | --- | 6.70E-08 |
| Surface Soil | Earthen Impoundment - Oil Pits | 5.4 | Recreational Person | Benzo(a)pyrene | --- | --- | --- | --- | --- |
| Surface Soil | Earthen Impoundment - Oil Pits | 66 | Recreational Person | Hexachlorobenzene | Liver | 9.70E-04 | --- | 4.80E-03 | 5.80E-03 |
| Surface Water | Earthen impoundment - Sludge Pit | 0.587 | Recreational Person | Arsenic | Vascular syst. | --- | --- | 5.70E-02 | 5.70E-02 |
| Surface Water | Earthen impoundment - Sludge Pit | 0.015 | Recreational Person | Vinyl chloride | Liver | --- | --- | 1.40E-03 | 1.40E-03 |
| Surface Water | Earthen impoundment - Sludge Pit | 0.0018 | Recreational Person | Benzo(a)anthracene | --- | --- | --- | --- | --- |
| Surface Water | Earthen impoundment - Sludge Pit | 0.094 | Recreational Person | bis(2-Ethylhexyl)phthalate | Liver | --- | --- | 1.30E+01 | 1.30E+01 |
| Surface Water | Earthen impoundment - Sludge Pit | 0.0022 | Recreational Person | Hexachlorobenzene | Liver | --- | --- | 6.90E-02 | 6.90E-02 |
| Surface Water | Earthen impoundment - Sludge Pit | 0.0049 | Recreational Person | Pentachlorophenol | Liver/Kidney | --- | --- | 8.30E-04 | 8.30E-04 |
| | | | | | | | | **Surface Water Risk Total =** | **1.31E+01** |
| Surface Soil | Laydown Area | 0.000189 | Industrial Worker | 2,3,7,8-TCDD TEQ (Mammal) | --- | --- | --- | --- | --- |
| Surface Soil | Laydown Area | 49 | Industrial Worker | Arsenic | Vascular syst. | 8.00E-02 | --- | 3.20E-02 | 1.10E-01 |
| Surface Soil | Laydown Area | 219 | Industrial Worker | Total PCBs | Eyes | 5.40E+00 | --- | 9.90E+00 | 1.50E+01 |
| Surface Soil | Laydown Area | 11 | Industrial Worker | Benzo(a)anthracene | --- | --- | --- | --- | --- |
| Surface Soil | Laydown Area | 9.5 | Industrial Worker | Benzo(a)pyrene | --- | --- | --- | --- | --- |
| Surface Soil | Laydown Area | 14 | Industrial Worker | Benzo(b)fluoranthene | --- | --- | --- | --- | --- |
| Surface Soil | Laydown Area | 1.5 | Industrial Worker | Dibenz(a,h)anthracene | --- | --- | --- | --- | --- |
| Surface Soil | Laydown Area | 94 | Industrial Worker | Hexachlorobenzene | Liver | 5.70E-02 | --- | 7.60E-02 | 1.30E-01 |
| Surface Soil | Laydown Area | 310 | Industrial Worker | Hexachlorobutadiene | Kidney | 7.60E-01 | --- | 1.00E+00 | 1.80E+00 |
| Surface Soil | Laydown Area | 5.3 | Industrial Worker | Indeno(1,2,3-cd)pyrene | --- | --- | --- | --- | --- |
| | | | | | | | | **Surface Soil Risk Total =** | **17.04** |
| Surface Soil | Laydown Area | 219 | Construction Worker | Total PCBs | Eyes | 4.20E+00 | --- | 1.80E+00 | 6.00E+00 |
| Surface Soil | Laydown Area | 94 | Construction Worker | Hexachlorobenzene | Liver | 4.60E-02 | --- | 1.40E-02 | 5.90E-02 |
| | | | | | | | | **Surface Soil Risk Total =** | **6.06E+00** |
| Surface Soil | Laydown Area | 219 | Recreational Person | Total PCBs | Eyes | 1.30E-01 | --- | 8.90E-01 | 1.00E+00 |
| Surface Soil | Laydown Area | 9.5 | Recreational Person | Benzo(a)pyrene | --- | --- | --- | --- | --- |
| Surface Soil | Laydown Area | 94 | Recreational Person | Hexachlorobenzene | Liver | 1.40E-03 | --- | 6.80E-03 | 8.20E-03 |

## Table 9. Non-Carcinogenic Exposure Routes
## Baseline Human Health Risk Assessment

| Exposure Point | Exposure Area | Exposure Point Concentration (mg/kg) | Receptor | Chemical of Potential Concern | Primary Target Organs | Non-Cancer Hazard | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| | | | | | | | | **Surface Soil Risk Total =** | **1.01E+00** |
| Surface Soil | Cemetery | 0.0047 | Industrial Worker | 2,3,7,8-TCDD TEQ (Mammal) | --- | --- | --- | --- | --- |
| Surface Soil | Cemetery | 7.6 | Industrial Worker | Arsenic | Vascular syst. | 1.20E-02 | --- | 4.90E-03 | 1.70E-02 |
| Surface Soil | Cemetery | 131 | Industrial Worker | Total PCBs | Eyes | 3.20E+00 | --- | 5.90E+00 | 9.10E+00 |
| Surface Soil | Cemetery | 68 | Industrial Worker | 1,2-Dichloroethane | --- | --- | 1.00E-08 | --- | 1.00E-08 |
| Surface Soil | Cemetery | 800 | Industrial Worker | Benzene | Bone Marrow | 9.80E-02 | 9.80E-06 | --- | 9.80E-02 |
| Surface Soil | Cemetery | 39 | Industrial Worker | Vinyl chloride | Liver | 6.40E-03 | 1.40E-07 | --- | 6.40E-03 |
| Surface Soil | Cemetery | 16 | Industrial Worker | Benzo(a)anthracene | --- | --- | --- | --- | --- |
| Surface Soil | Cemetery | 7.5 | Industrial Worker | Benzo(a)pyrene | --- | --- | --- | --- | --- |
| Surface Soil | Cemetery | 6 | Industrial Worker | Benzo(b)fluoranthene | --- | --- | --- | --- | --- |
| Surface Soil | Cemetery | 2 | Industrial Worker | Hexachlorobenzene | Liver | 1.20E-03 | --- | 1.60E-03 | 2.80E-03 |
| Surface Soil | Cemetery | 2.9 | Industrial Worker | Indeno(1,2,3-cd)pyrene | --- | --- | --- | --- | --- |
| Surface Soil | Cemetery | 600 | Industrial Worker | Naphthalene | Nasal/Weight | 1.50E-02 | 7.30E-05 | 2.50E-02 | 4.00E+00 |
| | | | | | | | | **Surface Soil Risk Total =** | **1.32E+01** |
| Surface Soil | Cemctery | 0.0047 | Construction Worker | 2,3,7,8-TCDD TEQ (Mammal) | --- | --- | --- | --- | --- |
| Surface Soil | Cemetery | 131 | Construction Worker | Total PCBs | Eyes | 2.50E+00 | --- | 1.10E+00 | 3.60E+00 |
| | | | | | | | | | |
| Surface Soil | Cemetery | 0.0047 | Recreational Person | 2,3,7,8-TCDD TEQ (Mammal) | --- | --- | --- | --- | --- |
| Surface Soil | Cemetery | 131 | Recreational Person | Total PCBs | Eyes | 7.70E-02 | --- | 5.30E-01 | 6.10E-01 |
| Surface Soil | Cemetery | 7.5 | Recreational Person | Benzo(a)pyrene | --- | --- | --- | --- | --- |
| | | | | | | | | **Surface Soil Risk Total =** | **4.21E+00** |
| Subsurface Soil | Cemetery | 370 | Industrial Worker | 1,2-Dichloroethane | --- | --- | 1.70E-02 | --- | 1.70E-02 |
| Subsurface Soil | Cemetery | 1000 | Industrial Worker | Benzene | Bone Marrow | --- | 4.40E+00 | --- | 4.40E+00 |
| Subsurface Soil | Cemetery | 2.3 | Industrial Worker | Chloroform | Liver/Kidney/CNS/GI tract/Reprod | --- | 3.20E-03 | --- | 3.20E-03 |
| Subsurface Soil | Cemetery | 150 | Industrial Worker | Methylene chloride | Liver | --- | 7.80E-03 | --- | 7.80E-03 |
| Subsurface Soil | Cemetery | 2480 | Industrial Worker | Total Xylenes | Neurological/Weight | --- | 1.90E+00 | --- | 1.90E+00 |
| Subsurface Soil | Cemetery | 79 | Industrial Worker | Tetrachloroethene | Liver/Neurological | --- | 4.20E-02 | --- | 4.20E-02 |
| Subsurface Soil | Cemetery | 350 | Industrial Worker | Trichloroethene | --- | --- | --- | --- | --- |
| Subsurface Soil | Cemetery | 39 | Industrial Worker | Vinyl chloride | Liver | --- | 1.80E-01 | --- | 1.80E-01 |
| Subsurface Soil | Cemetery | 9700 | Industrial Worker | Naphthalene | Nasal/Weight | --- | 2.40E+01 | --- | 2.40E+01 |
| | | | | | | | | **Subsurface Soil Risk Total =** | **3.06E+01** |
| Subsurface Soil | Cemetery | 7600 | Construction Worker | 2-Methylnaphthalene | Heart | 7.40E-01 | --- | 2.90E-01 | 1.00E+00 |
| Subsurface Soil | Cemetery | 190 | Construction Worker | Benzo(a)anthracene | --- | --- | --- | --- | --- |
| Subsurface Soil | Cemetery | 62 | Construction Worker | Benzo(a)pyrene | --- | --- | --- | --- | --- |
| | | | | | | | | **Subsurface Soil Risk Total =** | **1.00E+00** |
| Subsurface Soil | Cemetery | 370 | Recreational Person | 1,2-Dichloroethane | --- | --- | 1.50E-03 | --- | 1.50E-03 |
| Subsurface Soil | Cemetery | 1000 | Recreational Person | Benzene | Bone Marrow | --- | 3.90E-01 | --- | 3.90E-01 |
| Subsurface Soil | Cemetery | 350 | Recreational Person | Trichloroethene | --- | --- | --- | --- | --- |
| Subsurface Soil | Cemetery | 39 | Recreational Person | Vinyl chloride | Liver | --- | 1.60E-02 | --- | 1.60E-02 |
| Subsurface Soil | Cemetery | 9700 | Recreational Person | Naphthalene | Nasal/Weight | --- | 2.20E+00 | --- | 2.20E+00 |
| | | | | | | | | **Subsurface Soil Risk Total =** | **2.61E+00** |
| Surface Soil | Maintenance Pits Area | 0.00094587 | Industrial Worker | 2,3,7,8-TCDD TEQ (Mammal) | --- | --- | --- | --- | --- |
| Surface Soil | Maintenance Pits Area | 6.86 | Industrial Worker | Arsenic | Vascular syst. | 1.10E-02 | --- | 4.40E-03 | 1.60E-02 |
| Surface Soil | Maintenance Pits Area | 0.91 | Industrial Worker | Aldrin | Liver | 1.50E-02 | --- | 2.00E-02 | 3.40E-02 |
| Surface Soil | Maintenance Pits Area | 54.39 | Industrial Worker | Total PCBs | Eyes | 1.30E+00 | --- | 2.50E+00 | 3.80E+00 |
| Surface Soil | Maintenance Pits Area | 26 | Industrial Worker | Benzo(a)anthracene | --- | --- | --- | --- | --- |
| Surface Soil | Maintenance Pits Area | 12 | Industrial Worker | Benzo(a)pyrene | --- | --- | --- | --- | --- |
| Surface Soil | Maintenance Pits Area | 13 | Industrial Worker | Benzo(b)fluoranthene | --- | --- | --- | --- | --- |
| Surface Soil | Maintenance Pits Area | 1.4 | Industrial Worker | Dibenz(a,h)anthracene | --- | --- | --- | --- | --- |

## Table 9. Non-Carcinogenic Exposure Routes
## Baseline Human Health Risk Assessment

| Exposure Point | Exposure Area | Exposure Point Concentration (mg/kg) | Receptor | Chemical of Potential Concern | Primary Target Organs | Non-Cancer Hazard | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Surface Soil | Maintenance Pits Area | 1.9 | Industrial Worker | Hexachlorobenzene | Liver | 1.20E-03 | --- | 1.50E-03 | 2.70E-03 |
| Surface Soil | Maintenance Pits Area | 3.8 | Industrial Worker | Indeno(1,2,3-cd)pyrene | --- | --- | --- | --- | --- |
| | | | | | | | | **Surface Soil Risk Total =** | **3.8527** |
| Surface Soil | Maintenance Pits Area | 54.39 | Construction Worker | Total PCBs | Eyes | 1.10E+00 | --- | 4.40E-01 | 1.50E+00 |
| | | | | | | | | **Surface Soil Risk Total =** | **1.50E+00** |
| Surface Soil | Maintenance Pits Area | 0.00094587 | Recreational Person | 2,3,7,8-TCDD TEQ (Mammal) | --- | --- | --- | --- | --- |
| Surface Soil | Maintenance Pits Area | 54.39 | Recreational Person | Total PCBs | Eyes | 3.20E-02 | --- | 2.20E-01 | 2.50E-01 |
| Surface Soil | Maintenance Pits Area | 12 | Recreational Person | Benzo(a)pyrene | --- | --- | --- | --- | --- |
| | | | | | | | | **Surface Soil Risk Total =** | **2.50E-01** |
| Subsurface Soil | Maintenance Pits Area | 7.7 | Industrial Worker | 1,2-Dichloroethane | --- | --- | 3.30E-04 | --- | 3.30E-04 |
| Subsurface Soil | Maintenance Pits Area | 77 | Industrial Worker | Benzene | Bone Marrow | --- | 3.10E-01 | --- | 3.10E-01 |
| Subsurface Soil | Maintenance Pits Area | 63 | Industrial Worker | Methylene chloride | Liver | --- | 3.00E-03 | --- | 3.00E-03 |
| Subsurface Soil | Maintenance Pits Area | 2390 | Industrial Worker | Total Xylenes | Neurological/Weight | --- | 1.70E+00 | --- | 1.70E+00 |
| Subsurface Soil | Maintenance Pits Area | 58 | Industrial Worker | Tetrachloroethene | Liver/Neurological | --- | 2.90E-02 | --- | 2.90E-02 |
| Subsurface Soil | Maintenance Pits Area | 320 | Industrial Worker | Trichloroethene | --- | --- | --- | --- | --- |
| Subsurface Soil | Maintenance Pits Area | 64 | Industrial Worker | Hexachlorobenzene | --- | --- | --- | --- | --- |
| Subsurface Soil | Maintenance Pits Area | 600 | Industrial Worker | Hexachlorobutadiene | --- | --- | --- | --- | --- |
| Subsurface Soil | Maintenance Pits Area | 610 | Industrial Worker | Naphthalene | Nasal/Weight | --- | 1.40E+00 | --- | 1.40E+00 |
| | | | | | | | | **Subsurface Soil Risk Total =** | **3.44E+00** |
| Subsurface Soil | Maintenance Pits Area | 600 | Construction Worker | Hexachlorobutadiene | Kidney | 1.20E+00 | --- | 3.50E-01 | 1.50E+00 |
| | | | | | | | | **Subsurface Soil Risk Total =** | **1.50E+00** |
| Subsurface Soil | Maintenance Pits Area | 77 | Recreational Person | Benzene | Bone Marrow | --- | 2.80E-02 | --- | 2.80E-02 |
| Subsurface Soil | Maintenance Pits Area | 320 | Recreational Person | Trichloroethene | --- | --- | --- | --- | --- |
| Subsurface Soil | Maintenance Pits Area | 64 | Recreational Person | Hexachlorobenzene | --- | --- | --- | --- | --- |
| Subsurface Soil | Maintenance Pits Area | 600 | Recreational Person | Hexachlorobutadiene | --- | --- | --- | --- | --- |
| | | | | | | | | **Subsurface Soil Risk Total =** | **2.80E-02** |
| Subsurface Soil | Tank 800 | 0.003409 | Industrial Worker | 2,3,7,8-TCDD TEQ (Mammal) | --- | --- | --- | --- | --- |
| Subsurface Soil | Tank 800 | 7.8 | Industrial Worker | Aldrin | --- | --- | --- | --- | --- |
| Subsurface Soil | Tank 800 | 121.89 | Industrial Worker | Total PCBs | --- | --- | --- | --- | --- |
| Subsurface Soil | Tank 800 | 55 | Industrial Worker | 1,2-Dichloroethane | --- | --- | 2.70E-03 | --- | 2.70E-03 |
| Subsurface Soil | Tank 800 | 190 | Industrial Worker | Benzene | Bone Marrow | --- | 8.70E-01 | --- | 8.70E-01 |
| Subsurface Soil | Tank 800 | 61 | Industrial Worker | Methylene chloride | Liver | --- | 3.30E-03 | --- | 3.30E-03 |
| Subsurface Soil | Tank 800 | 1850 | Industrial Worker | Total Xylenes | Neurological/Weight | --- | 1.50E+00 | --- | 1.50E+00 |
| Subsurface Soil | Tank 800 | 170 | Industrial Worker | Tetrachloroethene | Liver/Neurological | --- | 9.60E-02 | --- | 9.60E-02 |
| Subsurface Soil | Tank 800 | 510 | Industrial Worker | Trichloroethene | --- | --- | --- | --- | --- |
| Subsurface Soil | Tank 800 | 230 | Industrial Worker | Hexachlorobenzene | --- | --- | --- | --- | --- |
| Subsurface Soil | Tank 800 | 2200 | Industrial Worker | Hexachlorobutadiene | --- | --- | --- | --- | --- |
| Subsurface Soil | Tank 800 | 2700 | Industrial Worker | Naphthalene | Nasal/Weight | --- | 7.10E+00 | --- | 7.10E+00 |
| | | | | | | | | **Subsurface Soil Risk Total =** | **9.57E+00** |
| Subsurface Soil | Tank 800 | 0.003409 | Construction Worker | 2,3,7,8-TCDD TEQ (Mammal) | --- | --- | --- | --- | --- |
| Subsurface Soil | Tank 800 | 121.89 | Construction Worker | Total PCBs | Eyes | 2.40E+00 | --- | 9.90E-01 | 3.40E+00 |
| Subsurface Soil | Tank 800 | 27 | Construction Worker | Benzo(a)pyrene | --- | --- | --- | --- | --- |
| Subsurface Soil | Tank 800 | 230 | Construction Worker | Hexachlorobenzene | Liver | 1.10E-01 | --- | 3.30E-02 | 1.40E-01 |
| Subsurface Soil | Tank 800 | 2200 | Construction Worker | Hexachlorobutadiene | Kidney | 4.30E+00 | --- | 1.30E+00 | 5.50E+00 |
| | | | | | | | | **Subsurface Soil Risk Total =** | **9.04E+00** |
| Subsurface Soil | Tank 800 | 121.89 | Recreational Person | Total PCBs | --- | --- | --- | --- | --- |
| Subsurface Soil | Tank 800 | 55 | Recreational Person | 1,2-Dichloroethane | --- | --- | 2.40E-04 | --- | 2.40E-04 |
| Subsurface Soil | Tank 800 | 190 | Recreational Person | Benzene | Bone Marrow | --- | 7.90E-02 | --- | 7.90E-02 |
| Subsurface Soil | Tank 800 | 510 | Recreational Person | Trichloroethene | --- | --- | --- | --- | --- |

## Table 9. Non-Carcinogenic Exposure Routes
## Baseline Human Health Risk Assessment

| Exposure Point | Exposure Area | Exposure Point Concentration (mg/kg) | Receptor | Chemical of Potential Concern | Primary Target Organs | Non-Cancer Hazard | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Subsurface Soil | Tank 800 | 230 | Recreational Person | Hexachlorobenzene | --- | --- | --- | --- | --- |
| Subsurface Soil | Tank 800 | 2200 | Recreational Person | Hexachlorobutadiene | --- | --- | --- | --- | --- |
| Subsurface Soil | Tank 800 | 2700 | Recreational Person | Naphthalene | Nasal/Weight | --- | 0.64 | --- | 0.64 |
| | | | | | | | | **Subsurface Soil Risk Total =** | **7.19E-01** |

Notes:
See Appendix A for Human Health PRG Calculations
mg/kg = Milligrams per kilogram

**Table 10. Ecological Summary**
**Baseline Ecological Risk Assessment**

| Exposure Point | Contaminant of Concern | NOAEL Based HQ | LOAEL Based HQ | Average HQ | Midpoint LOAEL/NOAEL PRGs (all receptors) | NOAEL Based HQ | LOAEL Based HQ | Average HQ | Midpoint LOAEL/NOAEL PRGs (mobile receptors) |
|---|---|---|---|---|---|---|---|---|---|
| Laydown Area | 2,3,7,8-TCDD TEQ (Mammal) | --- | --- | --- | 3.19E-05 [6] | 1.60E+02 | 1.60E+01 | 8.80E+01 | ***2.80E-04*** [4] |
| Laydown Area | 2,3,7,8-TCDD TEQ (Avian) | --- | --- | --- | 5.20E-05 [6] | --- | --- | --- | ***5.20E-05*** [6] |
| Laydown Area | 2-Methylnaphthalene | 1.20E+02 | 2.40E+01 | 7.20E+01 | 8.0 [1] | 1.20E+02 | 2.40E+01 | 7.20E+01 | ***8.1*** [1] |
| Laydown Area | Hexachlorobenzene | 5.90E+00 | 2.60E+00 | 4.25E+00 | 8.0 [2] | 2.00E+01 | 1.00E+01 | 1.50E+01 | ***9.5*** [1] |
| Laydown Area | Hexachlorobutadiene | 2.20E+02 | 2.20E+01 | 1.21E+02 | 2.5 [3] | 2.10E+01 | --- | --- | ***60*** [1] |
| Laydown Area | High Molecular Weight PAHs | 5.60E+01 | 1.10E+01 | 3.35E+01 | 5 [3] | 2.40E+02 | 9.60E+00 | 1.25E+02 | ***5.6*** [1] |
| Laydown Area | Phenanthrene | 9.90E+01 | 2.00E+01 | 5.95E+01 | 10.5 [1] | 9.90E+01 | 2.00E+01 | 5.95E+01 | ***10.5*** [1] |
| Laydown Area | Total PCBs | 4.40E+04 | 9.80E+03 | 2.69E+04 | 0.055 [3] | 9.00E+03 | 1.80E+03 | 5.40E+03 | ***1.35*** [1] |
| Oil Pit Area | Hexachlorobutadiene | 7.10E+01 | 7.10E+00 | 3.91E+01 | 2.5 [3] | 6.80E+00 | --- | --- | ***725*** [1] |
| Oil Pit Area | High Molecular Weight PAHs | 9.30E+00 | 1.90E+00 | 5.60E+00 | 5.0 [3] | 4.00E+01 | 1.60E+00 | 2.08E+01 | ***70*** [1] |
| Cemetery Area | High Molecular Weight PAHs | 6.30E+00 | 1.30E+00 | 3.80E+00 | 5.0 [3] | 2.70E+01 | 1.10E+00 | 1.41E+01 | ***19.2*** [1] |
| Tank 800 Area | bis(2-Ethylhexyl)phthalate | 2.90E+02 | 1.20E+01 | 1.51E+02 | ***33*** [1] | 2.90E+02 | 1.20E+01 | 1.51E+02 | 33 [1] |
| Tank 800 Area | Cadmium | 6.50E+01 | 6.50E+00 | 3.58E+01 | ***1.3*** [3] | 8.90E+01 | 6.40E+00 | 4.77E+01 | 9.5 [1] |
| Tank 800 Area | Chromium | --- | --- | --- | ***30*** [5] | 2.70E+02 | 5.40E+01 | 1.62E+02 | 90 [1] |
| Tank 800 Area | Copper | 1.00E+01 | 7.90E+00 | 8.95E+00 | ***115*** [3] | 1.60E+00 | 1.20E+00 | 1.40E+00 | 4,100 [1] |
| Tank 800 Area | High Molecular Weight PAHs | 1.10E+01 | 2.20E+00 | 6.60E+00 | ***5*** [3] | 4.80E+01 | 1.90E+00 | 2.50E+01 | 14 [1] |
| Tank 800 Area | Nickel | 2.00E+01 | 4.10E+00 | 1.21E+01 | ***10.5*** [3] | 7.30E-01 | 5.30E-01 | 6.30E-01 | 2,700 [1] |
| Tank 800 Area | Zinc | --- | --- | --- | ***30*** [5] | --- | --- | --- | 30 [5] |

***Bold-italicized values are considered the default PRGs for to surface soils from 0 - 6 inches below ground surface. Portions of the Tank 800 Area that will not be covered by either the Subtitle C Landfill or by a minimum of 6 inches of soil will be subject to ecological PRGs for all receptors. Otherwise, ecological PRGs for mobile receptors apply.***

[1] Red-winged Blackbird
[2] Deer Mouse
[3] Least Shrew
[4] Raccoon
[5] State Background
[6] Borrow Pit Background

## Table 11. Occurrence, Distribution, and Selection of Chemicals of Concern
## Baseline Ecological Risk Assessment

| Exposure Medium: Soil | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Chemical of Potential Concern** | **Area of Concern** | **Minimum Concentration (mg/kg)** | **Maximum Concentration (mg/kg)** | **95% UCL of the Mean (mg/kg)** | **Background Concentration (mg/kg)** | **Screening Toxicity Value (mg/kg) Invertebrate/ Plant** | **Screening Toxicity Value Source Invertebrate/Plant** | **HQ Value Invertebrate/Plant** | **COC Flag (Y or N)** |
| 2,3,7,8-TCDD TEQ (Mammal) | Laydown Area | 1.89E-04 | 1.89E-04 | 1.89E-04 | NV | NA | NA | NA | NA |
| 2,3,7,8-TCDD TEQ (Avian) | Laydown Area | 1.77E-04 | 1.77E-04 | 1.77E-04 | NV | NA | NA | NA | NA |
| 2-Methylnaphthalene | Laydown Area | 7.20E-03 | 1.30E+02 | 3.59E+03 | NV | 3.24 / NV | EPA Region 5 / NA | 4.01E+01 / NA | Y |
| Hexachlorobenzene | Laydown Area | 3.10E-03 | 9.40E+01 | 3.25E+01 | NV | 0.199 / NV | EPA Region 5 / NA | 4.72E+02 / NA | Y |
| Hexachlorobutadiene | Laydown Area | 2.00E-03 | 2.90E+02 | 1.44E+07 | NV | 0.0398 / NV | EPA Region 5 / NA | 7.29E+03 / NA | Y |
| High Molecular Weight PAHs | Laydown Area | 1.26E-02 | 1.60E+02 | 1.57E+03 | NV | 25 / 1.2 | EPA Region 6 / EPA Region 6 | 6.40E+00 / 1.33E+02 | Y |
| Phenanthrene | Laydown Area | 3.40E-03 | 1.40E+02 | 3.14E+03 | NV | 45.7 / NV | EPA Region 5 / NA | 3.06E+00 / NA | Y |
| Total PCBs | Laydown Area | 6.00E-03 | 2.19E+02 | 5.92E+01 | NV | NV / 40 | NA / TCEQ 2005 | NA / 5.48E+00 | Y |
| Hexachlorobutadiene | Oil Pit Area | 9.30E+01 | 9.30E+01 | 9.30E+01 | NV | 0.0398 / NV | EPA Region 5 / NA | 2.34E+03 / NA | Y |
| High Molecular Weight PAHs | Oil Pit Area | 2.65E+01 | 2.65E+01 | 2.65E+01 | NV | 25 /1.2 | EPA Region 6 / EPA Region 6 | 1.06E+00 / 2.21E+01 | Y |
| High Molecular Weight PAHs | Cemetery Area | 2.25E-01 | 1.79E+01 | 2.09E+01 | NV | 25 /1.2 | EPA Region 6 / EPA Region 6 | 7.16E-01 / 1.49E+01 | Y |
| bis(2-Ethylhexyl)phthalate | Tank 800 Area | 2.40E-01 | 4.40E+02 | 1.13E+05 | NV | 0.925 / NV | EPA Region 5 / NA | 4.76E+02 / NA | Y |
| Cadmium | Tank 800 Area | 1.40E-01 | 2.78E+01 | 2.60E+02 | NV | 140 / 32 | TCEQ 2005 / TCEQ 2005 | 1.99E-01 / 8.69E-01 | N |
| Chromium | Tank 800 Area | 1.16E+01 | 1.34E+03 | 2.14E+03 | 30 | 0.4 / 1 | TCEQ 2005 / TCEQ 2005 | 3.35E+93 / 1.34E+03 | Y |
| Copper | Tank 800 Area | 5.80E+00 | 5.42E+02 | 5.92E+02 | 15 | 61 /100 | TCEQ 2005 / TCEQ 2005 | 8.89E+00 / 5.42E+00 | Y |
| High Molecular Weight PAHs | Tank 800 Area | 1.63E-01 | 3.17E+01 | 1.03E+02 | NV | 25 / 1.2 | EPA Region 6 / EPA Region 6 | 1.27E+00 / 2.64E+01 | Y |
| Nickel | Tank 800 Area | 6.00E+00 | 1.37E+02 | 1.27E+02 | 10 | 200 / 30 | TCEQ 2005 / TCEQ 2005 | 6.85E-01 / 4.57E+00 | Y |
| Zinc | Tank 800 Area | 2.78E+01 | 1.54E+03 | 2.75E+03 | 30 | 120 /190 | TCEQ 2005 / TCEQ 2005 | 1.28E+01 / 8.11E+00 | Y |

Notes:

mg/kg = milligrams per kilogram

Hazard Quotient (HQ) = Maximum Concentration/Screening Toxicity Value.

## Table 12. Summary of Remedial Investigation and Risk Assessment Results

| Site Area/Media | RI Conclusions | BHHRA Conclusions | BERA Conclusions | Remedial Action Objectives | Remedial Alternative Component |
|---|---|---|---|---|---|
| Sludge | Primary sources of contamination are Earthen Impoundment (Sludge Pit and Oil Pit), Unit 100 API Separator, sludge and oils in Unit 1200 API Separator, and aboveground tanks. | Source material not evaluated; overlying surface water in Sludge Pit and soil in Oil Pit estimated to present risk to human health. | Source material not evaluated; overlying soil in Oil Pit estimated to present risk to ecological receptors. | 1. Prevent potential direct contact/inhalation by nature conservancy workers<br>2. Prevent release to surface soils and sediments above human and ecological risk values<br>3. Prevent migration to ground water<br>4. Prevent release to surface water | Solidification and consolidation in engineered containment area |
| Ground water | Ground water does not meet TCEQ criteria for potable water. Impacted ground water is localized in few areas within the Site boundaries | Estimated not to present unacceptable risk to human health | Not evaluated; incomplete pathway | 1. Prevent migration to Site boundaries in concentrations exceeding Texas Class 3 ground water Protective Concentration Levels. | No action with monitoring |
| Surface soils | Impacted soil limited to Laydown Area, Cemetery Area, Tank 800 Area, and Oil Pit | Laydown Area, Cemetery Area, and Oil Pit estimated to present a risk to human health | Laydown Area, Cemetery Area, Tank 800, and Oil Pit estimated to present risk to ecological receptors | 1. Prevent ingestion/direct contact/inhalation by nature conservancy workers<br>2. Prevent migration to ground water and surface water<br>3. Prevent potential ingestion by ecological receptors<br>4. Prevent potential ingestion by avian and mammalian receptors of soil invertebrates, terrestrial plants, and/or other prey that have accumulated COPCs from soil. | Consolidation in engineered containment area |
| Subsurface soils | Impacted subsurface soils limited to Cemetery Area, Maintenance Area-Pits, Maintenance Area-900, and Tank 800 Area | Cemetery Area and Tank 800 estimated to present risk to human health | Not evaluated; incomplete pathway | 1. Prevent inhalation by nature conservancy workers | Consolidation in engineered containment area |
| Freshwater Pond sediments and surface water | | Estimated not to present unacceptable risk to human health | Estimated not to present unacceptable risk to ecological receptors | None | None |
| Drainage Ditch sediments and surface water | | Not evaluated since contact recreation not a complete exposure pathway for recreational user | Estimated not to present unacceptable risk to ecological receptors | None | None |
| Marsh Area sediments and surface water | | Estimated not to present unacceptable risk to human health | Estimated not to present unacceptable risk to ecological receptors | None | None |

## Table 13. Comparative Evaluation of Alternatives

| Criteria | Alternative 1<br>No Action | Alternative 2<br>Engineered Containment of Unsolidified Sludges and RCRA Subtitle C Containment of Soils | Alternative 3<br>Engineered Containment of Solidified Sludges and RCRA Subtitle C Containment of Soils | Alternative 4<br>RCRA Subtitle C Containment of Solidified Sludges and Untreated Soils | Alternative 5<br>Slurry-Phase Bioremediation of Sludges and RCRA Subtitle C Containment of Treated Sludges and Untreated Soils |
|---|---|---|---|---|---|
| **Remedy Description** | No direct action would be taken; required by NCP | 1. Injection well disposal of water contained in tanks, separators, and Sludge Pit<br>2. Construct Sludge Pit improvements to include subsurface barrier wall, ground water gradient recovery system, and enlarged perimeter berms<br>3. Consolidate sludges in Sludge Pit and construct RCRA Subtitle C cap supported by solidified bridge cap<br>4. Consolidate affected soils/debris in aboveground RCRA Subtitle C equivalent cell<br>5. No action (with monitoring) for ground water<br>6. Institutional controls | 1. Injection well disposal of water contained in tanks, separators, and Sludge Pit<br>2. Construct Sludge Pit improvements to include subsurface barrier wall, ground water gradient recovery system, and enlarged perimeter berms<br>3. Consolidate/solidify sludges in Sludge Pit and construct RCRA Subtitle C cap<br>4. Consolidate excess solidified sludge/affected soils/debris in aboveground RCRA Subtitle C equivalent cell<br>5. No action (with monitoring) for ground water<br>6. Institutional controls | 1. Injection well disposal of water contained in tanks, separators, and Sludge Pit<br>2. Construct Sludge Pit improvements to include subsurface barrier wall and enlarged perimeter berms<br>3. Solidify sludges and consolidate solidified sludges/affected soils/ debris in aboveground RCRA Subtitle C equivalent cell<br>4. No action (with monitoring) for ground water<br>5. Institutional controls | 1. Injection well disposal of water contained in tanks, separators, and Sludge Pit<br>2. Construct Sludge Pit improvements to include subsurface barrier wall and enlarged perimeter berms<br>3. Slurry-phase bioremediation of consolidated sludges within Sludge Pit<br>4. Consolidate solidified sludge residuals and affected soils in aboveground RCRA Subtitle C equivalent cell<br>5. No action (with monitoring) for ground water<br>6. Institutional controls |
| **Overall Protection of Human Health and the Environment** | Provides no additional short- or long-term protection of human health and the environment. No risk above that currently existing at site is associated with implementation of this alternative. | Alternative reduces mobility of COPCs from sludge and impacted soils; removes potential for direct contact, ingestion, or inhalation from affected media; and removes potential for runoff to sediments, unimpacted soils, and surface water. Alternative is estimated to take 36 months to implement; technology and personnel are readily available. | Alternative reduces mobility of COPCs from sludge and impacted soils; removes potential for direct contact, ingestion, or inhalation from affected media; and removes potential for runoff to sediments, unimpacted soils, and surface water. Alternative is estimated to take 42 months to implement; technology and personnel are readily available. | Alternative reduces mobility of COPCs from sludge and impacted soils; removes potential for direct contact, ingestion, or inhalation from affected media; and removes potential for runoff to sediments, unimpacted soils, and surface water. Alternative is estimated to take 48 months to implement; technology and personnel are readily available. | Alternative reduces toxicity, mobility, and volume of COPCs from sludge, and reduces mobility of COPCs from impacted soils. Alternative is estimated to take 72 months to implement. Treatability study to evaluate the effectiveness and implementability of alternative has not been conducted. |
| **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)** | Not compliant with floodplain protection ARAR since sludge is exposed. | Alternative 2 does not meet requirements of 40 CFR 264.228 since free liquids will not be eliminated by solidifying sludges through entire depth of Sludge Pit. Compliance with other ARARs is similar for alternatives. | Compliance with ARARs listed in Table 3 through Table 5 is similar for alternatives. | Compliance with ARARs listed in Table 3 through Table 5 is similar for alternatives. | Compliance with ARARs listed in Table 3 through Table 5 is similar for alternatives. |

**Table 13. Comparative Evaluation of Alternatives**

| Criteria | Alternative 1<br>No Action | Alternative 2<br>Engineered Containment of Unsolidified Sludges and RCRA Subtitle C Containment of Soils | Alternative 3<br>Engineered Containment of Solidified Sludges and RCRA Subtitle C Containment of Soils | Alternative 4<br>RCRA Subtitle C Containment of Solidified Sludges and Untreated Soils | Alternative 5<br>Slurry-Phase Bioremediation of Sludges and RCRA Subtitle C Containment of Treated Sludges and Untreated Soils |
|---|---|---|---|---|---|
| **Long-Term Effectiveness and Permanence** | Long-term effectiveness and permanence cannot be evaluated. Remedy relies on maintenance of *status quo* that could be altered with change in site conditions. | Adequacy and reliability of RCRA Subtitle C equivalent cell for soils is equivalent in Alternatives 2 and 3. Potential risk to long-term effectiveness is settlement/collapse of bridge cap with subsequent failure of RCRA Subtitle C cap and release of sludge. | Adequacy and reliability of RCRA Subtitle C equivalent cell for soils is equivalent in Alternatives 2 and 3. Solidified sludge remains in Sludge Pit potentially reducing permanence of remedy. | Adequacy and reliability of RCRA Subtitle C equivalent cell for soils and solidified sludge is well documented. | Adequacy and reliability of RCRA Subtitle C equivalent cell for soils and treated sludge residuals is well documented. |
| **Reduction of Contaminant Toxicity, Mobility, or Volume** | Does not provide for reduction in contaminant toxicity, mobility, or volume. Tank contents, sludge, and affected soils would remain on site without containment or treatment. | Alternative relies primarily on engineered containment to reduce mobility of COPCs in sludge. Layer of solidified sludge provides a bridge cap to support RCRA Subtitle C cap; unsolidified sludge remains in paleochannel. Alternative relies primarily on RCRA Subtitle C equivalent cell to reduce mobility of COPCs in soil. | Alternative relies primarily on engineered containment and solidification of sludges to reduce mobility of COPCs in sludge. Sludge is solidified through depth of the Sludge Pit; solidified sludge remains in paleochannel. Alternative relies primarily on aboveground engineered containment area to reduce mobility of COPCs in soil. | Alternative relies primarily on RCRA Subtitle C equivalent cell to reduce mobility of COPCs in sludge and soils. Mobility is also reduced by solidification of sludges. | Toxicity, mobility, and volume of sludge are reduced by bioremediation. Alternative relies primarily on RCRA Subtitle C equivalent cell to reduce mobility of COPCs in soils and treated sludge residuals. |
| **Short-Term Effectiveness** | Has minimal short-term impact since no direct remedial construction activities would occur and no incremental risk to workers, community, and environment would accrue. | Estimated that alternative can be implemented and completed within 36 months. In situ solidification presents minimal exposure to community unless uncontrolled temperature reactions increase volatile emissions. Additional exposures are minimized since sludge is not removed from Sludge Pit during implementation. | Estimated that alternative can be implemented and completed within 42 months. In situ solidification presents minimal exposure to community unless uncontrolled temperature reactions increase volatile emissions. Additional exposures are minimized since sludge is not removed from Sludge Pit during implementation. | Estimated that alternative can be implemented and completed within 48 months. Removal of sludge after solidification may present a slightly greater potential for exposure to remediation workers and community during implementation, but can be managed through engineering controls. | Estimated that alternative can be implemented and completed within 72 months. Properly operated slurry phase bioremediation process has minimal risks to community and environment. However, due to length of time to implement remedy, exposed sludge remains at Site for a longer period. |
| **Implementability** | Easily implementable as it involves no direct construction activity. | Barrier walls, ground water recovery systems, solidification, and RCRA Subtitle C caps and cells are readily available technologies. Contractors and pozzolanic reagents are readily available. | Barrier walls, ground water recovery systems, solidification, and RCRA Subtitle C caps and cells are readily available technologies. Contractors and pozzolanic reagents are readily available. | Solidification and RCRA Subtitle C equivalent cells are readily available technologies. Contractors and pozzolanic reagents are readily available. | Requires construction and operation of a slurry-phase bioremediation system. System would require additional treatability and pilot studies prior to implementation as well as additional design effort. |

**Table 14. Alternatives for Each Medium**

| Medium | Treatment Technology | Comments | Alternative 1 No Action | Alternative 2 Engineered Containment of Unsolidified Sludges and RCRA Subtitle C Containment Soils | Alternative 3 Engineered Containment of Solidified Sluges and RCRA Subtitle C Containment of Soils | Alternative 4 RCRA Subtitle C Containment of Solidified Sludges and Untreated Soils | Alternative 5 Slurry-Phase Bioremediation of Sludges and RCRA Subtitle C Containment of Treated Sludges and Untreated Soils |
|---|---|---|---|---|---|---|---|
| **Sludge** | Excatvation | Visible sludges underlying soil to PRGs | | X (Outside Sludge Pit) | X (Outside Sludge Pit) | X | X |
| | Disposal/RCRA Subtitle C Cap | On-site in ground | | X | X | | |
| | RCRA Subtitle C equivalent cell | On-site above ground | | | | X | X (Residuals) |
| | Disposal | Off-site | | | | | |
| | Containment | Solidification | | X (Bridge only) | X | X | X (Residuals) |
| | Treatment | Bioremediation | | | | | X |
| **Soil** | Excatvation | Soil above $10^{-4}$ Risk or with potential to leach | | X | X | X | X |
| | RCRA Subtitle C equivalent cell | On-site above ground | | X | X | X | X |
| **Ground Water** | No Action with Monitoring | All monitoring wells per schedule | | X | X | X | X |
| | Barrier Wall | Groundwater infiltration | | | | X | X |
| | Barrier Wall | All water above $10^{-5}$ Risk | | X | X | | X |
| | Collection with deep well injection | All water above $10^{-4}$ Risk | | X | X | | X |

**Table 15. Contaminants of Concern - Ground Water**

| Contaminants of Concern | Remediation Levels[1] (mg/L) |
|---|---|
| **Metals[2]** | |
| Aluminum | 7.3E+03 |
| Arsenic | 1.0E+00 |
| Cadmium | 5.0E-01 |
| Mercury | 2.0E-01 |
| Selenium | 5.0E+00 |
| Silver | 3.7E+01 |
| Zinc | 2.2E+03 |
| **Volatile Organic Compounds** | |
| 1,1,2-Trichloroethane | 5.0E-01 |
| 1,2-Dichloroethane | 5.0E-01 |
| cis-1,2-Dichloroethylene | 7.0E+00 |
| trans-1,2-Dichloroethylene | 1.0E+01 |
| Benzene | 5.0E-01 |
| Methylene chloride (Chloromethane) | 1.6E+01 |
| Trichloroethene | 5.0E-01 |
| Vinyl chloride | 2.0E-01 |
| **Semivolatile Organic Compounds** | |
| Naphthalene | 1.5E+02 |

[1] Based on Texas Commission on Environmental Quality Class 3 Groundwater Protective Concentration Levels (PCLs), Commercial/Industrial, March 25, 2009

[2] Metals concentrations should also consider background levels

mg/L - milligram(s) per liter

## Table 16.A ARARs and TBCs (Location-Specific)

| ARAR / TBC | Regulatory Citation | Description |
|---|---|---|
| **Floodplain and Wetlands Protection** | | |
| Section 404(b)(1) Guidelines for the Specification of Disposal Sites for Dredged or Fill Material | 40 CFR 230 | Designates procedures for the protection of wetlands including the evaluation of sites and the issuance of General Permits. Portions of the MSC Superfund Site and the Marsh Area adjacent to the Site contain wetlands. |
| Location Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities | 40 CFR 264.18 | A facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood. Standard would serve as an ARAR for treatment units. Surface water run on/run off control would be maintained for the Site but non-treatment areas would not be protected from 100-year flood. The MSC Superfund Site is located within a floodplain |
| **Protected Species** | | |
| Endangered and Threatened Wildlife and Plants | 50 CFR 17 | Identifies those species of wildlife and plants determined to be endangered or threatened with extinction and also carry over the species and subspecies of wildlife designated as endangered under the Endangered Species Conservation Act of 1969. Statute requires that proposed actions minimize effects on endangered species. One protected bird species potentially exists on-site. |
| Threatened and Endangered Nongame Species | 31 TAC 65.175 and 65.176 | Provides lists of threatened and endangered species. |
| **Surface Water** | | |
| Texas Surface Water Quality Standards (Site-Specific Uses and Criteria) | 30 TAC 307.7 and Appendix A | Sets surface water quality standards for Segment 2439 (Lower Galveston Bay). |
| **Cemeteries** | | |
| Cemeteries and Crematories | Texas Health and Safety Code Chapter 711 | Describes requirements for removal of remains, for an unknown or abandoned cemetery, rights for access to cemetery, and historic cemeteries. The Campbell Bayou Cemetery is located within the boundaries of the MSC Superfund Site. |

## Table 16.A ARARs and TBCs (Location-Specific)

| ARAR / TBC | Regulatory Citation | Description |
|---|---|---|
| Historic Preservation Act (HPA) | 40 CFR Part 800 | Requires Federal agencies to take into account the effects of their undertakings on historic properties. |

Notes:

ARAR – Applicable or relevant and appropriate requirements
CFR – Code of Federal Regulations
HPA – Historic Preservation Act
MSC – Malone Service Company
TAC – Texas Administrative Code
State regulations are not included in this table if they are referencing Federal regulations.

## Table 16.B ARARs and TBCs (Chemical-Specific)

| ARAR / TBC | Regulatory Citation | Description |
|---|---|---|
| **Waste** | | |
| Identification and Listing of Hazardous Waste | 40 CFR 261.1 to 40 CFR 261.38 | Defines a hazardous waste as exhibiting the characteristics of hazardous wastes, is a mixture of a solid waste and hazardous waste, or is a listed hazardous waste. |
| **Air** | | |
| National Primary and Secondary Ambient Air Quality Standards (NAAQS) | 40 CFR 50.4, 50.6, 50.8, 50.9, 50.11, 50.12 | NAAQS define levels of air quality to protect the public health or the public welfare from any known or anticipated adverse effects of a federally regulated pollutant. NAAQS are promulgated for sulfur dioxide, particulate matter ($PM_{10}$ and $PM_{2.5}$), nitrogen dioxide, carbon monoxide, ozone, and lead. Sulfur dioxide, nitrogen dioxide, and carbon monoxide apply only to incineration and not to other process options. |
| General Air Quality | 30 TAC 101.4 | Prohibits discharge from any source air contaminants in such concentration and of such duration that may be injurious to or to adversely affect human health or welfare, animal life, vegetation, or property, or as to interfere with the normal use and enjoyment of animal life, vegetation, or property. |
| **Risk-based Criteria** | | |
| Texas Surface Water Quality Standards (Site-Specific Uses and Criteria) | 30 TAC 307.6, Table 1 and Table 3 | Serves as an ARAR to the extent that surface water remains on-site within the Sludge Pit. |
| PCDD/PCDF PCL | 30 TAC 350.76(e) (3) | Sets critical soil PCL for 2,3,7,8-TCDD of 0.001 mg/kg for residential use and 0.005 mg/kg for commercial/industrial use. |
| PCDD/PDCF | 2007 EPA Region 6 Human Health Medium Specific Screening Level | The 2,3,7,8-TCDD Human Health Medium Specific Screening Level for an outdoor industrial worker is 0.0000177 mg/kg. |

Notes:

ARAR – Applicable or relevant and appropriate requirements
CFR – Code of Federal Regulations
TAC – Texas Administrative Code
State regulations are not included in this table if they are referencing Federal regulations.

## Table 16.C ARARs and TBCs (Action-Specific)

| ARAR / TBC | Regulatory Citation | Description |
|---|---|---|
| **General Remediation** | | |
| Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities: Applicability | 40 CFR 264.1(j) | Describes general facility requirements, preparedness and contingency requirements for remediation waste management sites that can be used in lieu of 40 CFR 261 Subparts B, C, and D and 40 CFR 265.101. |
| Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities: Subpart F: Releases from Solid Waste Management Units | 40 CFR 264.92 - 264.95 | Provides requirements for monitoring and responding to releases from Solid Waste Management Units. |
| Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities: Subpart F: Releases from Solid Waste Management Units | 40 CFR 264.97 | Provides general ground water monitoring requirements for releases from Solid Waste Management Units. |
| Worker Health and Safety for Remedial Action | 40 CFR 300.150 | Response actions under the NCP would comply with the provisions for response action worker safety and health in 29 CFR 1910.120. |
| Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution, in Commerce and Use Prohibitions | 40 CFR 761.61 | Provides cleanup and disposal options for PCB remediation waste. |
| Facilities (Emissions and Distance Limitations) | 30 TAC 106.262 | Specifies distance limitations for emission points from off-plant receptors. |
| Permits by Rule (Remediation) | 30 TAC 106.533 | Provides conditions permitting by rule for equipment used to extract, handle, process, condition, reclaim, or destroy contaminants for the purpose of remediation. |
| Texas Surface Water Quality Standards (General Criteria) | 30 TAC 307.4 | Lists general criteria applicable to surface waters of the State for aesthetics, toxicity, nutrients, salinity, aquatic life uses and habitat. |
| Texas Surface Water Quality Standards (Toxic Materials) | 30 TAC 307.6 | Designates that waters of the State shall not be acutely toxic, chronically toxic to aquatic life, or be toxic to humans. Lists numerical criteria for aquatic life protection and human health |

**Table 16.C ARARs and TBCs (Action-Specific)**

| ARAR / TBC | Regulatory Citation | Description |
|---|---|---|
| | | protection Designates that concentrations of toxic materials for which no numerical criteria have been established must not exceed $LC_{50}$ values. |
| Spill Prevention and Control | 30 TAC Chapter 327 | Defines reportable quantities in the event of a spill or release to environment, notification requirements, and actions required. |
| **Thermal Treatment** | | |
| National Emissions Standards for Hazardous Air Pollutants (NESHAPs) | 40 CFR 61 | Lists requirements for emission of hazardous air pollutants during incineration (stationary sources). |
| NESHAPS for Hazardous Waste Combustors | 40 CFR 63 Subpart EEE | Provides standards for emissions for PCDDs/PCDFs, mercury, lead, cadmium, arsenic, beryllium, chromium, carbon monoxide, hydrocarbons, hydrochloric acid, chlorine gas, particulate matter and requirements for destruction and removal efficiency for incinerators. |
| Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities: Subpart O: Incinerators | 40 CFR 264.340 to 40 CFR 264.343 | References 40 CFR 63 Subpart EEE and provides requirements for waste analysis and performance standards for treatment. |
| Land Disposal Restrictions (LDRs) | 40 CFR 268, 40 CFR 268.4 and Subpart D (Treatment Standards) | Off-site shipments of hazardous wastes are restricted from land disposal without meeting treatment standards. Off-site shipments must contain a notice that wastes are restricted from land disposal without treatment. Treatment on-site within a thermal desorption unit and subsequent placement in a cell are restricted from land disposal without meeting treatment standards. |
| Incineration | 30 TAC 111.121 - 111.129 | Provides standards for the emissions from single-, dual-, and multiple chamber incinerators. |
| Control of Sulfur Dioxide – Net Ground Level Concentrations | 30 TAC 112.3(b) | Specifically limits sulfur dioxide emissions from any source in Galveston County downwind at the property boundary (minus upwind concentrations) to 0.28 ppmw averaged over any 30-minute period. |

## Table 16.C ARARs and TBCs (Action-Specific)

| ARAR / TBC | Regulatory Citation | Description |
|---|---|---|
| Vent Gas Control | 30 TAC 115.121(a)(1) and 30 TAC 115.122(a) | Establishes the requirements for vent gas control and control requirements. |
| Industrial, Commercial, and Institutional Combustion Sources in Ozone Nonattainment Areas | 30 TAC 117.201 - 117.223 | Applies to combustion units located within Galveston County. |
| **Bioremediation** | | |
| Industrial Wastewater | 30 TAC 115.142 | Establishes control requirements for VOCs in industrial wastewater treatment units. Exempts properly operated biotreatment units from requirements to reduce VOC content of wastewater by 90%. |
| **Underground Injection** | | |
| Underground Injection Control Program | 40 CFR 144 | Provides minimum requirements for Class 1 injection wells. |
| Underground Injection Control Program: Criteria and Standards | 40 CFR 146, Subparts A and B | Provides operating, monitoring, and reporting requirements for Class I injection wells. Includes requirements for plugging and abandoning Class 1 injection wells. |
| Hazardous Waste Injection Restrictions | 40 CFR 148 | Identifies wastes that are restricted from disposal into Class I wells and defines those circumstances under which a waste, otherwise prohibited from injection, may be injected. |
| Underground Injection Control; Standards for Class I Wells Other than Salt Cavern Solid Waste Disposal Wells | 30 TAC 331.64(d) | Requires mechanical integrity testing of Class I injection wells. |
| **Landfills** | | |
| Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities: Subpart K: Surface Impoundments | 40 CFR 264.228 | States requirements for closure of surface impoundments including the elimination of free liquids by removing liquid wastes or solidifying the remaining wastes and waste residues and stabilizing the remaining wastes to a bearing capacity sufficient to support final cover. Final cover requirements are also outlined. |
| Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities: Subpart N: Landfills | 40 CFR 264.300 through 40 CFR 264.310 | States requirements for liner system and exemptions for liner requirements; States requirements for surveying location, and monitoring and inspection of hazardous waste landfills. Only applies to alternatives that trigger LDRs (or placement). |

## Table 16.C ARARs and TBCs (Action-Specific)

| ARAR / TBC | Regulatory Citation | Description |
|---|---|---|
| Deed Recordation of Waste Disposal | 30 TAC 335.5 | Requires deed recordation of portion or portions of the tract of land on which disposal of industrial solid waste or municipal hazardous waste occurs. |
| **Off-site Disposal** | | |
| Criteria for Identifying the Characteristics of Hazardous Waste and for Listing Hazardous Waste | 40 CFR 261.10 to 40 CFR 261.11 | Provides the criteria for identifying a characteristic or listed waste. |
| Characteristics of Hazardous Waste | 40 CFR 261.20 to 40 CFR 261.24 | Solid waste is a hazardous waste if it exhibits any of the characteristics of ignitability, corrosivity, reactivity, and toxicity. |
| Waste Classification | 30 TAC 335.505 to 30 TAC 335.508 | Provides a procedure for implementation of Texas waste notification system and establishes standards for classification of industrial solid waste managed in Texas, including Class 1, Class 2 and Class 3 wastes. |
| Procedures for Planning and Implementing Off-Site Response Actions | 40 CFR 300.440 | Hazardous wastes generated from CERCLA cleanups must go to RCRA-permitted treatment, storage and disposal facilities that are in compliance with RCRA and State rules and that do not have releases to the environment. |
| Standards Applicable to Generators of Hazardous Waste: The Manifest | 40 CFR 262 Subpart B | Provides requirements for the use of the manifest system. |
| Standards Applicable to Generators of Hazardous Waste: Pre-Transport Requirements | 40 CFR 262 Subpart C | Provides requirements for pre-transport packaging, labeling, marking, placarding, and accumulation time limits. |
| Department of Transportation (DOT); Hazardous Materials Regulations | 49 CFR 171 - 177 | Packaging and pre-transport regulations that apply to persons that cause hazardous materials to be transported. |
| **Ground Water Management** | | |
| Technical Requirements--Standards for Capping and Plugging of Wells and Plugging Wells that Penetrate Undesirable Water or Constituent Zones | Texas Administrative Code 76.1004 | Describes standards for capping and plugging of wells and plugging wells that penetrate undesirable water or constituent zones. |
| **Water Discharge** | | |
| National Pollutant Discharge Elimination System Conditions Applicable to All Permits | 40 CFR 122.41 | Provides conditions that must be incorporated into NPDES permits. Relevant and appropriate to discharge of water from the Site. |

## Table 16.C ARARs and TBCs (Action-Specific)

| ARAR / TBC | Regulatory Citation | Description |
|---|---|---|
| National Pollutant Discharge Elimination System Establishing Limitations, Standards and Permit Conditions | 40 CFR 122.44 | Provides conditions that must be incorporated into NPDES permits. Relevant and appropriate to discharge of water from the Site. |
| Effluent Guidelines and Standards – Landfills Point Source Category | 40 CFR 445 | Provides for discharge of wastewater from landfills subject to provisions of 40 CFR 264 Subpart N and 40 CFR 265 Subpart N. |
| Texas Hazardous Metals Discharge Limits | 30 TAC 319.22 | Sets numerical limitations on discharge of hazardous metals to inland or tidal waters. |
| General Permit to Discharge Wastes | TXR050000 | Describes effluent limitations for industrial facilities that discharge storm water associated with industrial activity. |

Notes:

ARAR – Applicable or relevant and appropriate requirements
CFR – Code of Federal Regulations
TAC – Texas Administrative Code
State regulations are not included in this table if they are referencing Federal regulations.

## Table 17. Costs of Alternatives

| | Alternative 1<br>No Action | Alternative 2<br>Engineered Containment of Unsolidified Sludges and RCRA Subtitle C Containment of Soils | Alternative 3<br>Engineered Containment of Solidified Sludges and RCRA Subtitle C Containment of Soils | Alternative 4<br>RCRA Subtitle C Containment of Solidified Sludges and Untreated Soils | Alternative 5<br>Slurry-Phase Bioremediation of Sludges and RCRA Subtitle C Containment of Treated Sludges and Untreated Soils |
|---|---|---|---|---|---|
| **Capital Cost** | No capital costs associated with this alternative. | $24,900,000 | $35,400,000 | $52,900,000 | $82,600,000 |
| **O&M Cost (Present Worth)** | No O&M costs associated with this alternative. | $6,300,000 | $6,400,000 | $3,500,000 | $3,200,000 |
| **Total Cost** | Not Applicable | $31,200,000 | $41,800,000 | $56,400,000 | $85,800,000 |

**Table 18 – Remedial Alternative 4 Cost Summary (4.5% Discount Factor)**

| | |
|---|---|
| **CONSTRUCTION CAPITAL COSTS** | |
| ***Phase 1: Pre-Construction/Tank Demolition/Tank Contents Management*** | |
| Plan Preparation and Submittals | $90,900 |
| Mobilization/Demobilization and Construct Project Facilities/Utilities | $427,600 |
| Transfer Tank Water to Deep Well | $43,850 |
| Transfer Tanks Sludges to Sludge Pit | $97,000 |
| Tank/Piping Demolition | $160,000 |
| Hauling Scrap Metal to Precessor | $40,000 |
| Asbestos Abatement for Tank/Piping | $297,167 |
| Lead Paint Abatement Surcharge | $10,000 |
| Temporarily Relocate Cemetery Monuments | $51,970 |
| Road Improvement | $147,360 |
| ***Phase 2: Excavate and Consolidate Soils and Sludges*** | |
| Mobilization/Demobilization | $46,920 |
| Construct Slurry Wall around Sludge Pit | $705,312 |
| Construction RCRA Subtitle C Cell | $11,523,280 |
| Improve Perimeter Berm System for the Sludge Pit | $233,902 |
| Excavate and Transfer Sludges to Solidification Area | $2,497,400 |
| Solidify Sludges | $15,090,038 |
| Excavate, Transfer and Place Treated Sludges | $1,991,526 |
| Rework Sludges to Meet Performance Standards | $690,975 |
| Excavate, Transfer, and Place Affected Soil, Concrete Rubble | $834,820 |
| Backfill Excavated Areas with Clean Backfill to Ground Surface | $1,744,200 |
| ***Phase 3: General Site Improvements*** | |
| Mobilization/Demobilization | $50,000 |
| Construct Perimeter Drainage ditch | $246,400 |
| Shoreline Protection | $1,083,700 |
| Abandon Deep Wells (2) | $400,000 |
| Abandon Water/Monitoring Wells | $150,000 |
| Develop and Implement Ground Water Monitoring Program | $236,988 |
| Institutional Controls Plans and Measures | $200,000 |
| ***General Construction Costs*** | |
| Contingency - 10% | $3,909,131 |
| Project Management - 3% | $1,290,013 |
| Pre-Design Investigation, Remedial Design, Engineering Support - 10% | $4,300,044 |
| Construction Management - 5% | $2,150,022 |
| Health and Safety/Fence Line Air Monitoring - 4% | $1,720,018 |
| Third Party Quality Assurance/Quality Control - 1% | $430,004 |
| ***CONSTRUCTION CAPITAL COSTS*** | ***$52,890,540*** |
| **ANNUAL OPERATION AND MAINTENANCE (O&M) COSTS** | |
| General Site Maintenance | $36,000 |
| Leachate Management/Gas Monitoring | $41,400 |
| Ground Water Monitoring Year 1 (Quarterly) | $166,287 |
| Ground Water Monitoring Years 2-10 (Semiannually) | $83,144 |
| Ground Water Monitoring Years 11-30 (Annually) | $41,572 |
| **CUMULATIVE NET PRESENT VALUE (NPV) O&M COST (4.5% DF)** | |
| Annual O&M NPV (Year 1) | $348,625 |
| Annual O&M NPV (Years 2-10) | $1,669,476 |
| Annual O&M NPV (Years 11-30) | $1,489,809 |
| ***TOTAL NPV O&M COST (YEARS 1-30)*** | ***$3,507,910*** |
| **TOTAL COST: CONSTRUCTION CAPITAL AND O&M (NPV)** | **$56,398,450** |
| FEASIBILITY STUDY RANGE (-30%) | $39,478,915 |
| FEASIBILITY STUDY RANGE (+50%) | $84,597,674 |

**Table 19 – Remedial Alternative 4 Cost Summary (7.0% Discount Factor)**

| | |
|---|---|
| **CONSTRUCTION CAPITAL COSTS** | |
| ***Phase 1: Pre-Construction/Tank Demolition/Tank Contents Management*** | |
| Plan Preparation and Submittals | $90,900 |
| Mobilization/Demobilization and Construct Project Facilities/Utilities | $427,600 |
| Transfer Tank Water to Deep Well | $43,850 |
| Transfer Tanks Sludges to Sludge Pit | $97,000 |
| Tank/Piping Demolition | $160,000 |
| Hauling Scrap Metal to Precessor | $40,000 |
| Asbestos Abatement for Tank/Piping | $297,167 |
| Lead Paint Abatement Surcharge | $10,000 |
| Temporarily Relocate Cemetery Monuments | $51,970 |
| Road Improvement | $147,360 |
| ***Phase 2: Excavate and Consolidate Soils and Sludges*** | |
| Mobilization/Demobilization | $46,920 |
| Construct Slurry Wall around Sludge Pit | $705,312 |
| Construction RCRA Subtitle C Cell | $11,523,280 |
| Improve Perimeter Berm System for the Sludge Pit | $233,902 |
| Excavate and Transfer Sludges to Solidification Area | $2,497,400 |
| Solidify Sludges | $15,090,038 |
| Excavate, Transfer and Place Treated Sludges | $1,991,526 |
| Rework Sludges to Meet Performance Standards | $690,975 |
| Excavate, Transfer, and Place Affected Soil, Concrete Rubble | $834,820 |
| Backfill Excavated Areas with Clean Backfill to Ground Surface | $1,744,200 |
| ***Phase 3: General Site Improvements*** | |
| Mobilization/Demobilization | $50,000 |
| Construct Perimeter Drainage ditch | $246,400 |
| Shoreline Protection | $1,083,700 |
| Abandon Deep Wells (2) | $400,000 |
| Abandon Water/Monitoring Wells | $150,000 |
| Develop and Implement Ground Water Monitoring Program | $236,988 |
| Institutional Controls Plans and Measures | $200,000 |
| ***General Construction Costs*** | |
| Contingency - 10% | $3,909,131 |
| Project Management - 3% | $1,290,013 |
| Pre-Design Investigation, Remedial Design, Engineering Support - 10% | $4,300,044 |
| Construction Management - 5% | $2,150,022 |
| Health and Safety/Fence Line Air Monitoring - 4% | $1,720,018 |
| Third Party Quality Assurance/Quality Control - 1% | $430,004 |
| ***CONSTRUCTION CAPITAL COSTS*** | ***$52,890,540*** |
| **ANNUAL OPERATION AND MAINTENANCE (O&M) COSTS** | |
| General Site Maintenance | $36,000 |
| Leachate Management/Gas Monitoring | $41,400 |
| Ground Water Monitoring Year 1 (Quarterly) | $166,287 |
| Ground Water Monitoring Years 2-10 (Semiannually) | $83,144 |
| Ground Water Monitoring Years 11-30 (Annually) | $41,572 |
| **CUMULATIVE NET PRESENT VALUE (NPV) O&M COST (7.0% DF)** | |
| Annual O&M NPV (Year 1) | $340,479 |
| Annual O&M NPV (Years 2-10) | $1,461,438 |
| Annual O&M NPV (Years 11-30) | $957,873 |
| ***TOTAL NPV O&M COST (YEARS 1-30)*** | ***$2,759,790*** |
| **TOTAL COST: CONSTRUCTION CAPITAL AND O&M (NPV)** | **$55,650,330** |
| FEASIBILITY STUDY RANGE (-30%) | $38,955,231 |
| FEASIBILITY STUDY RANGE (+50%) | $83,475,495 |

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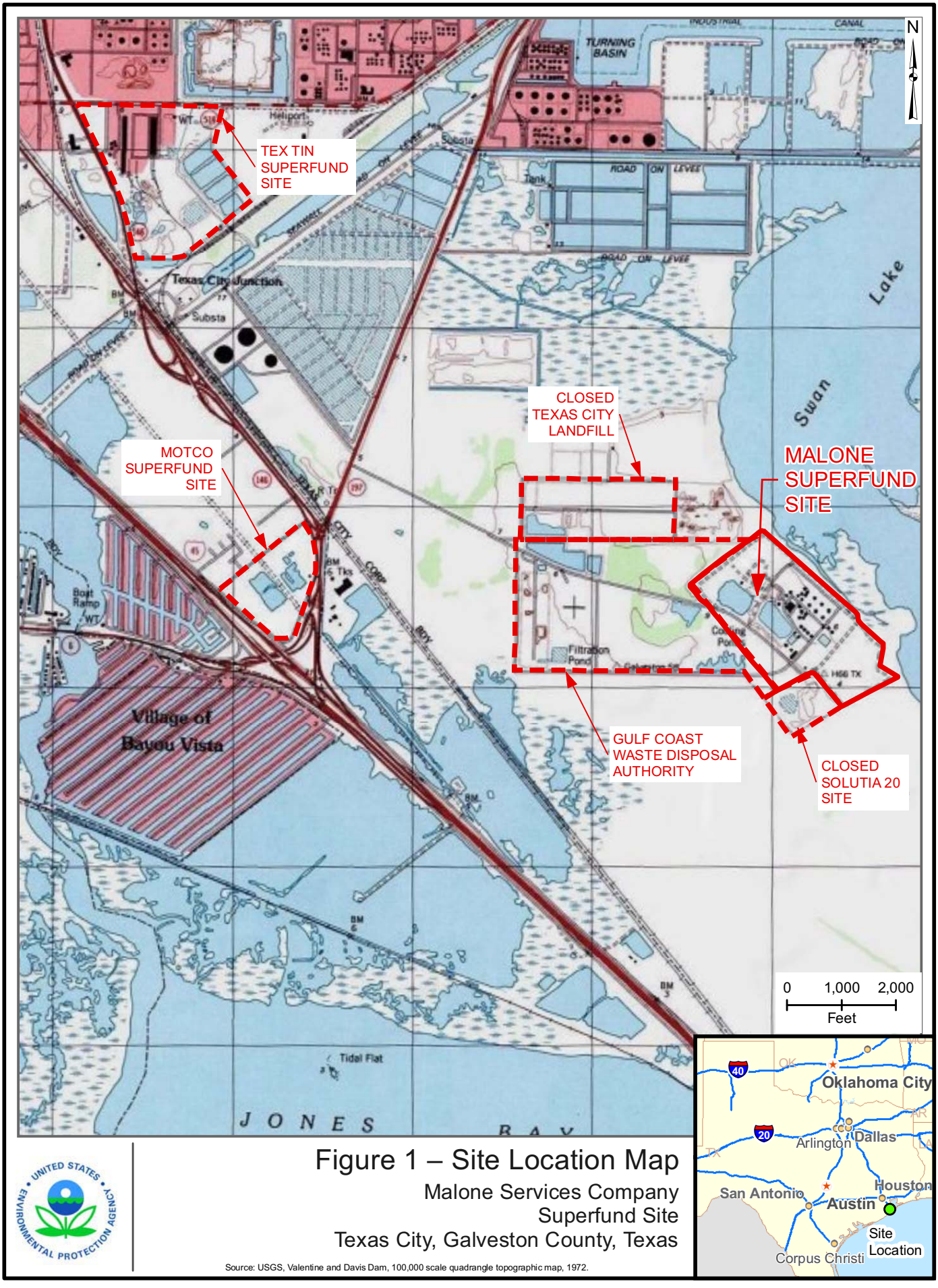
# Figures




# Figure 1 – Site Location Map

Malone Services Company Superfund Site
Texas City, Galveston County, Texas

Source: USGS, Valentine and Davis Dam, 100,000 scale quadrangle topographic map, 1972.

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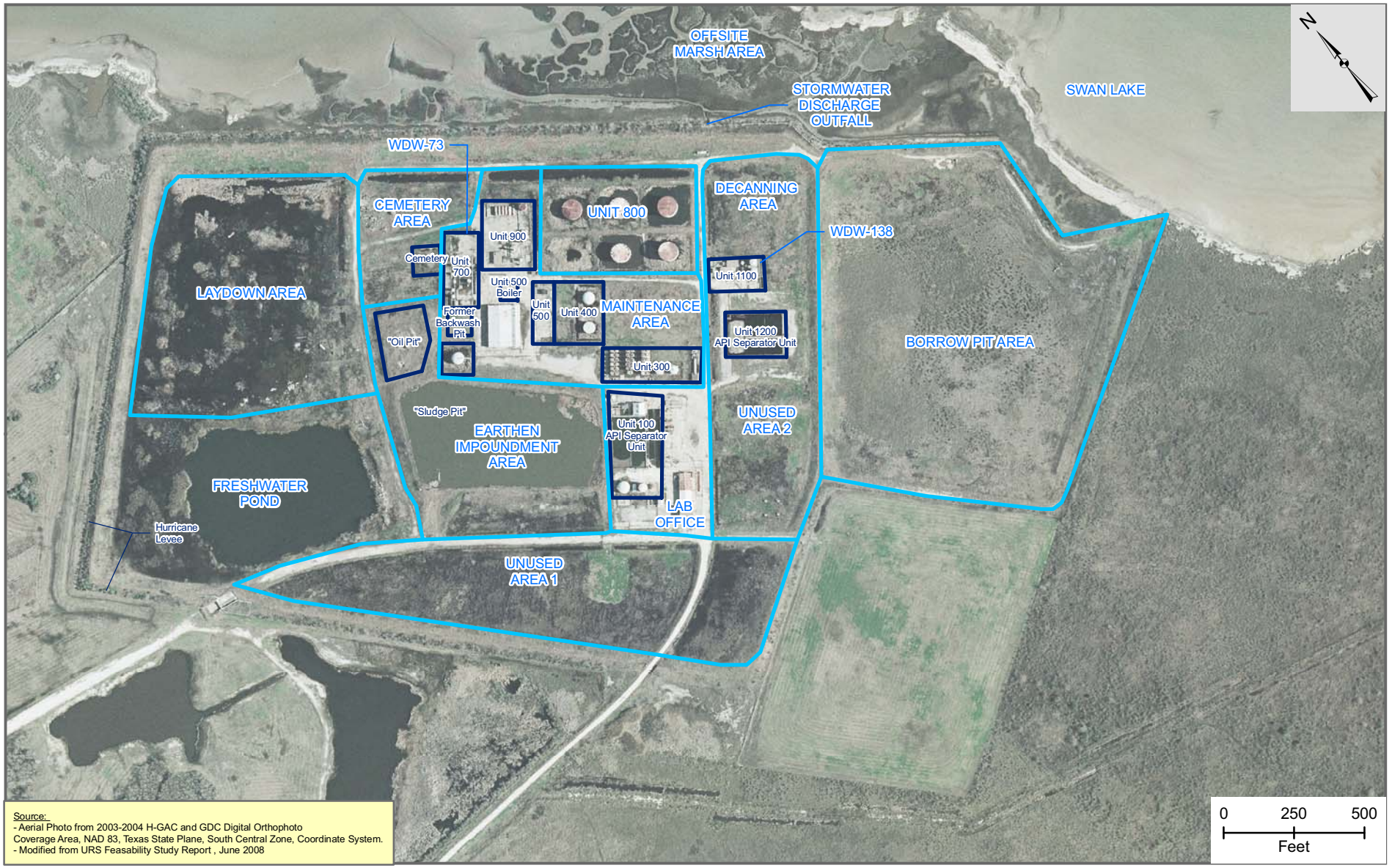



Source:
- Aerial Photo from 2003-2004 H-GAC and GDC Digital Orthophoto Coverage Area, NAD 83, Texas State Plane, South Central Zone, Coordinate System.
- Modified from URS Feasability Study Report , June 2008

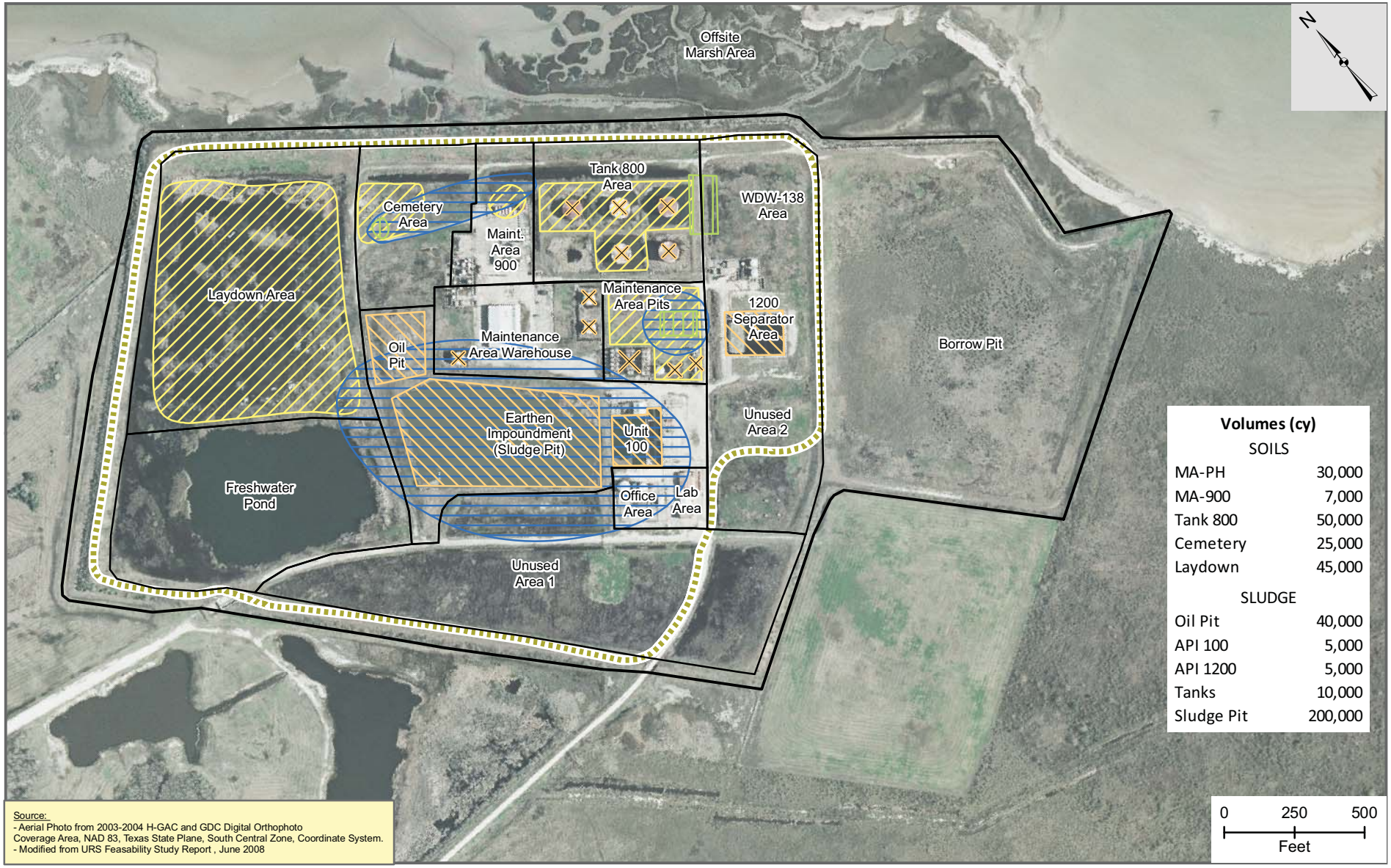
**Legend:**

- SiteFeatures_Line
- SiteFeatures

# Figure 2 – Investigative Areas

Malone Service Company
Superfund Site
Texas City, Galveston County, Texas

002359



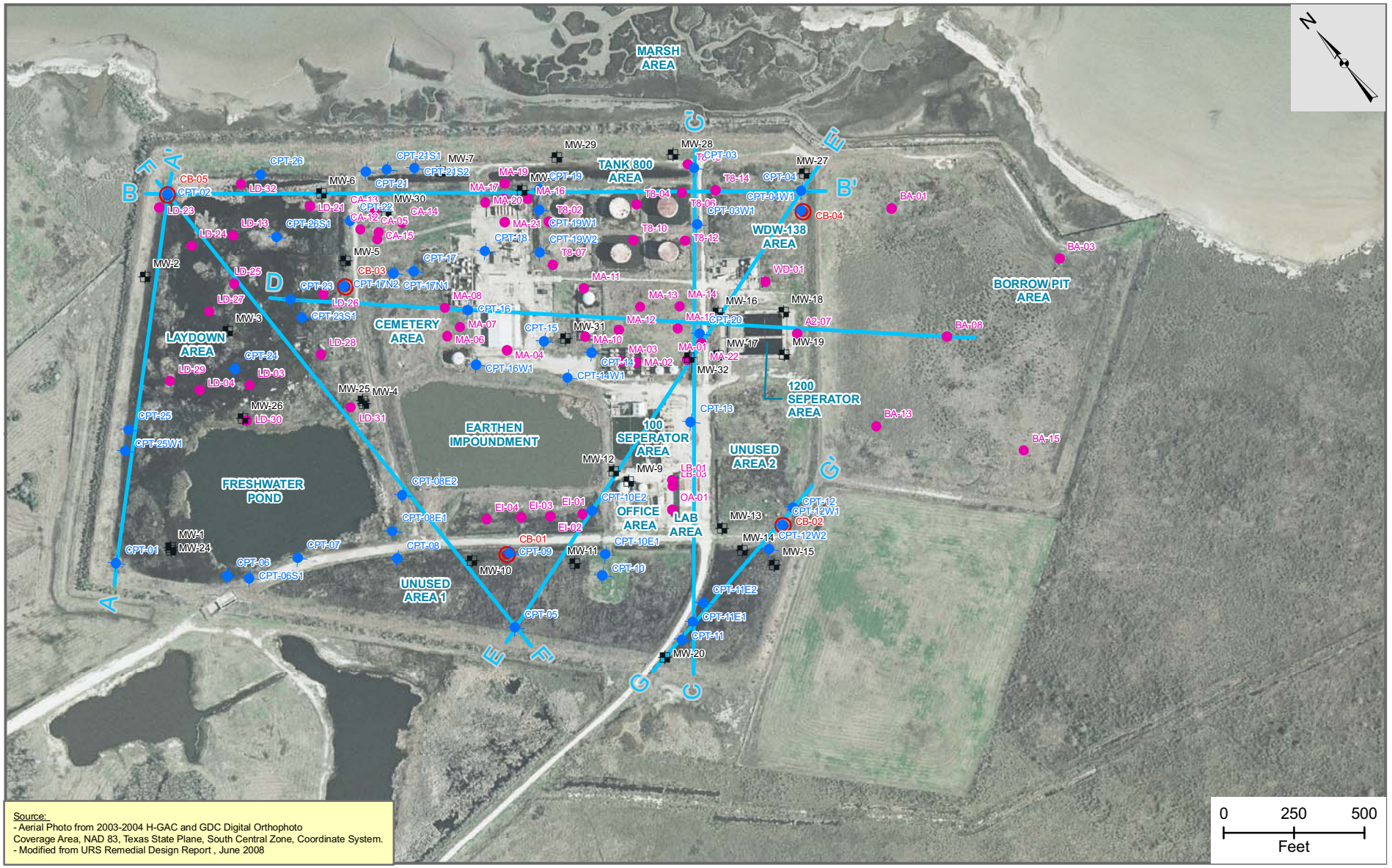

**Legend:**

- Area of Contamination
- Sludge Area
- Soil Remediation Area
- Probable Area of Subsurface Source
- Probable Class 3 Ground Water Plume Outline
- Site Boundary
- Remediation Areas
- Tank Sludge

# Figure 3 – Primary and Potential Sources of Contamination

Malone Service Company
Superfund Site
Texas City, Galveston County, Texas

002360




Source:
- Aerial Photo from 2003-2004 H-GAC and GDC Digital Orthophoto Coverage Area, NAD 83, Texas State Plane, South Central Zone, Coordinate System.
- Modified from URS Remedial Design Report , June 2008

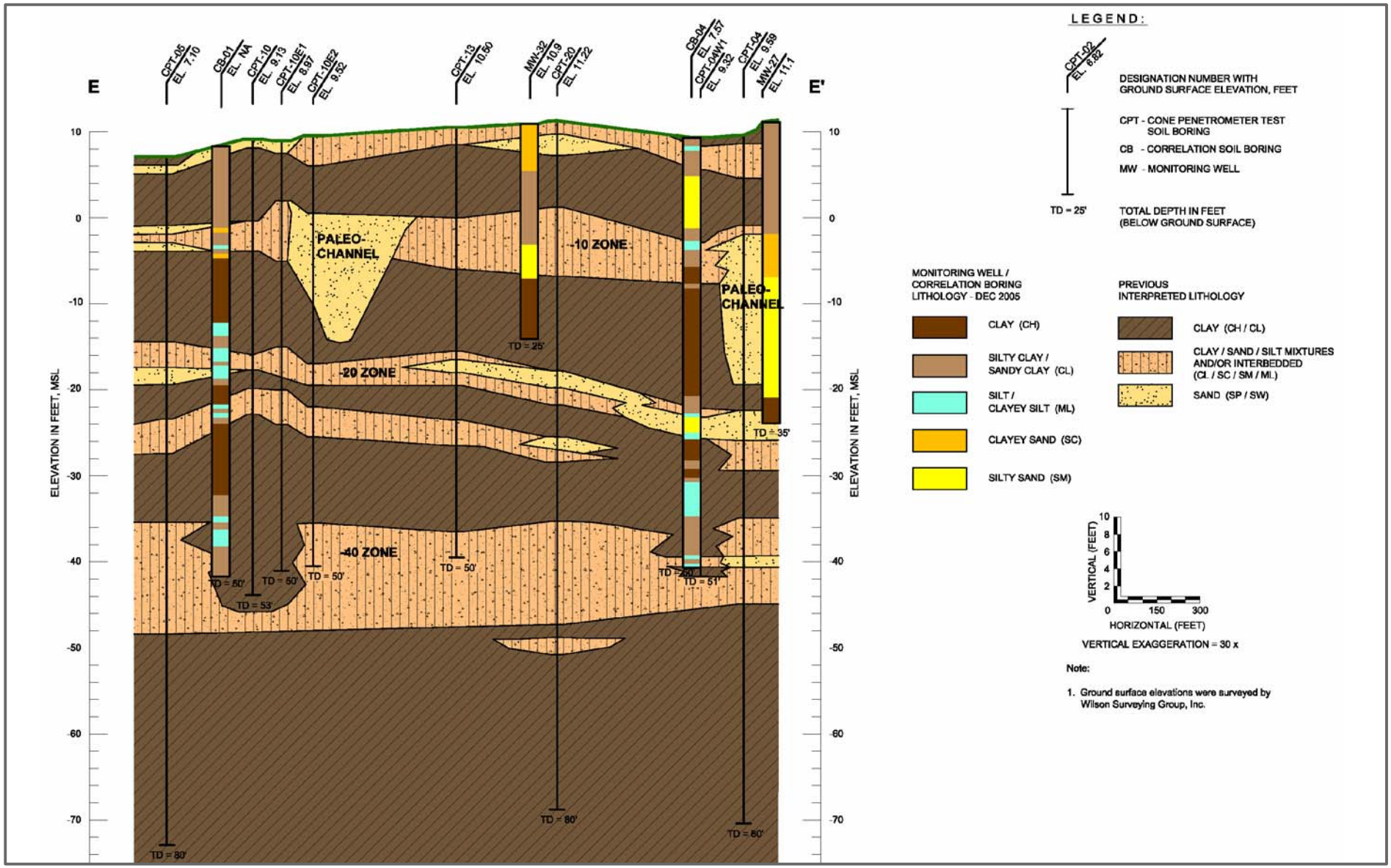
**Legend:**

- Monitor Well Location
- CPT Location
- Soil Bore Location
- Correlation Soil Bore Location
- Cross-Section Location

# Figure 4 – Cross-Section Locations

Malone Service Company
Superfund Site
Texas City, Galveston County, Texas

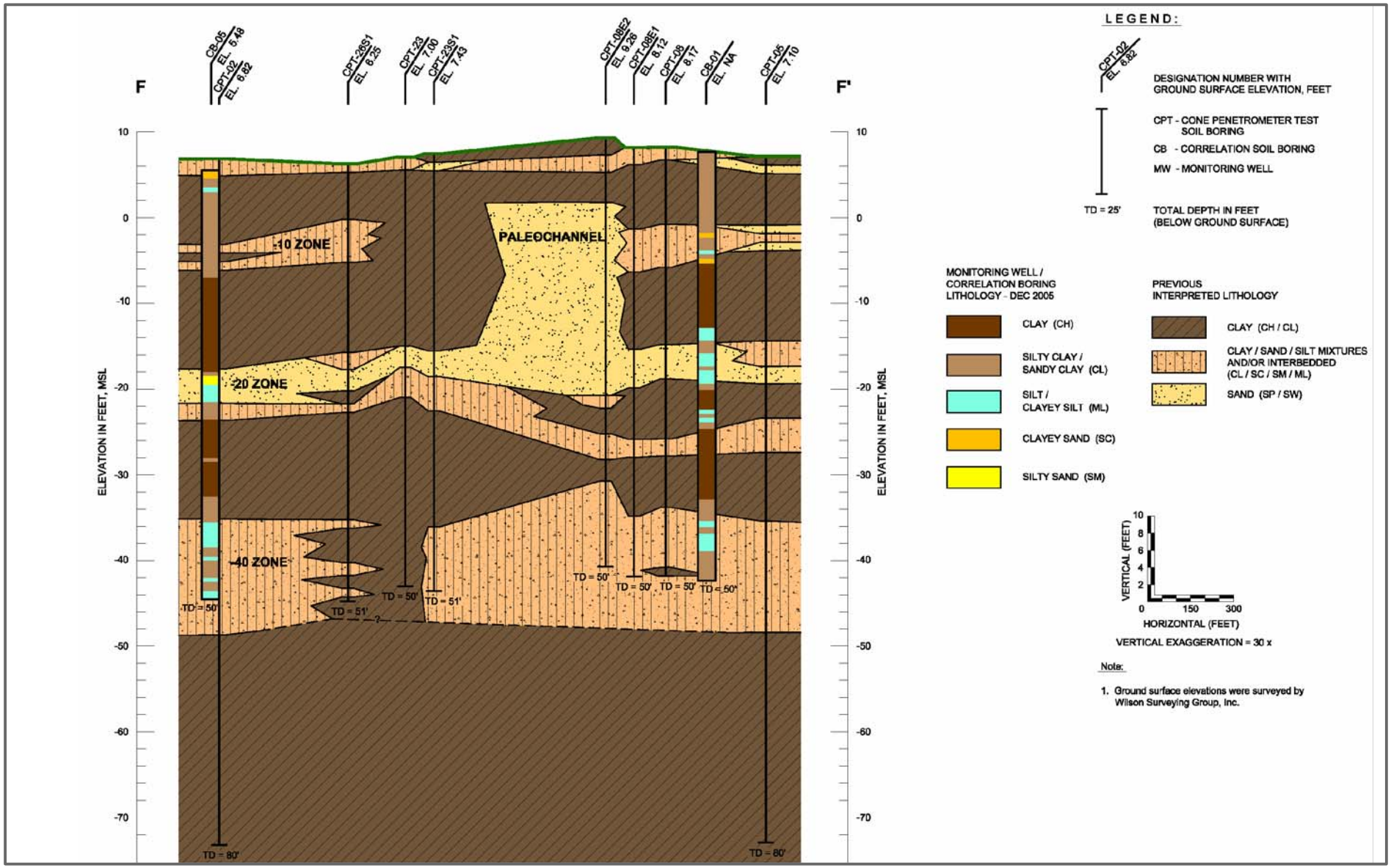
002361




Source:
Modified from URS Remedial Investigation Report, February 2006.

# Figure 5 – Cross-Section E-E'

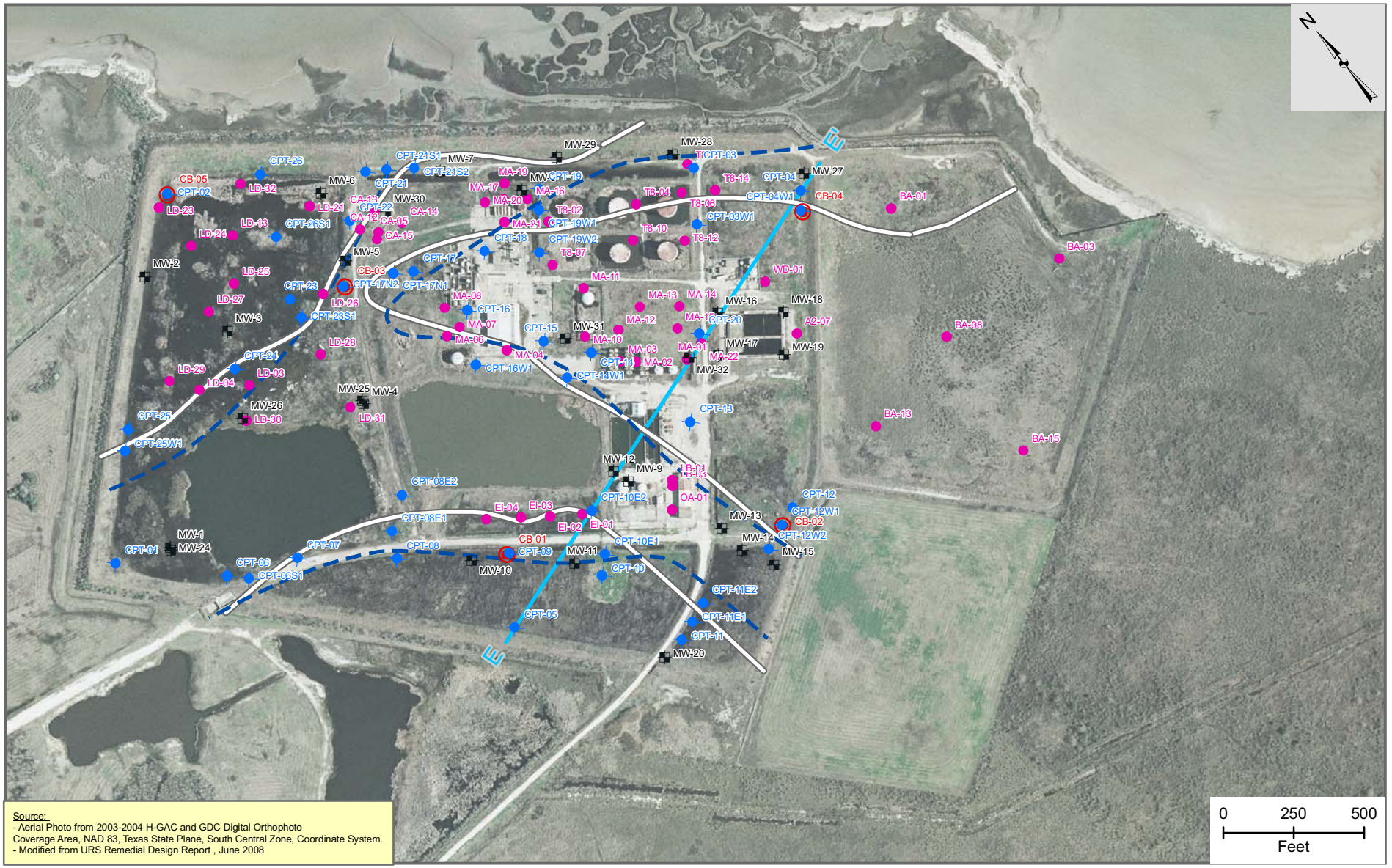
Malone Service Company
Superfund Site
Texas City, Galveston County, Texas




Source:
Modified from URS Remedial Investigation Report, February 2006.

# Figure 6 – Cross-Section F-F'

Malone Service Company
Superfund Site
Texas City, Galveston County, Texas




Source:
- Aerial Photo from 2003-2004 H-GAC and GDC Digital Orthophoto Coverage Area, NAD 83, Texas State Plane, South Central Zone, Coordinate System.
- Modified from URS Remedial Design Report , June 2008

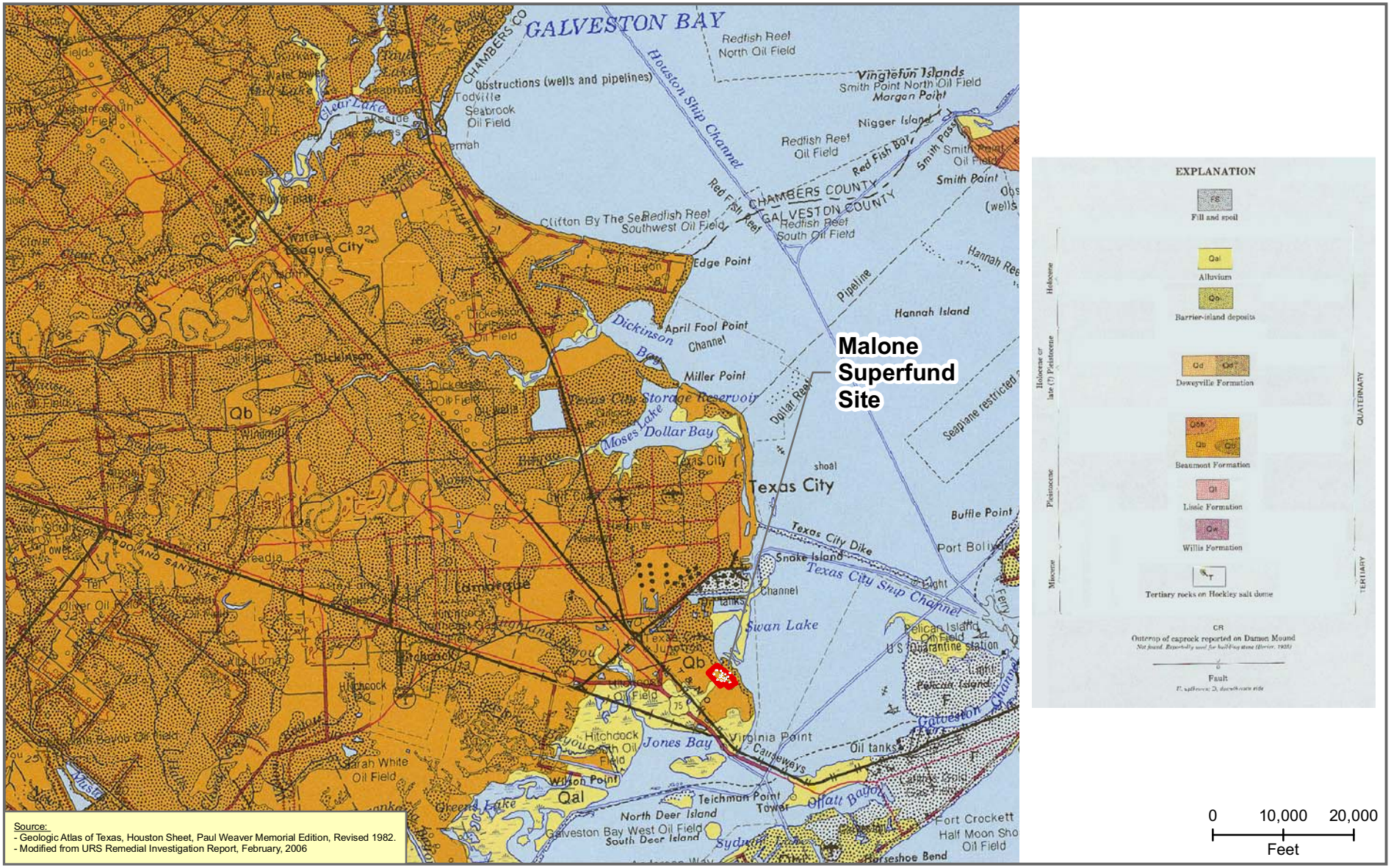
**Legend:**

- Monitor Well Location
- CPT Location
- Soil Bore Location
- Correlation Soil Bore Location
- Paleochannel (URS 2006)
- Paleochannel (ECA 1986)
- Cross-Section Location

# Figure 7 – Paleochannel Location

Malone Service Company
Superfund Site
Texas City, Galveston County, Texas

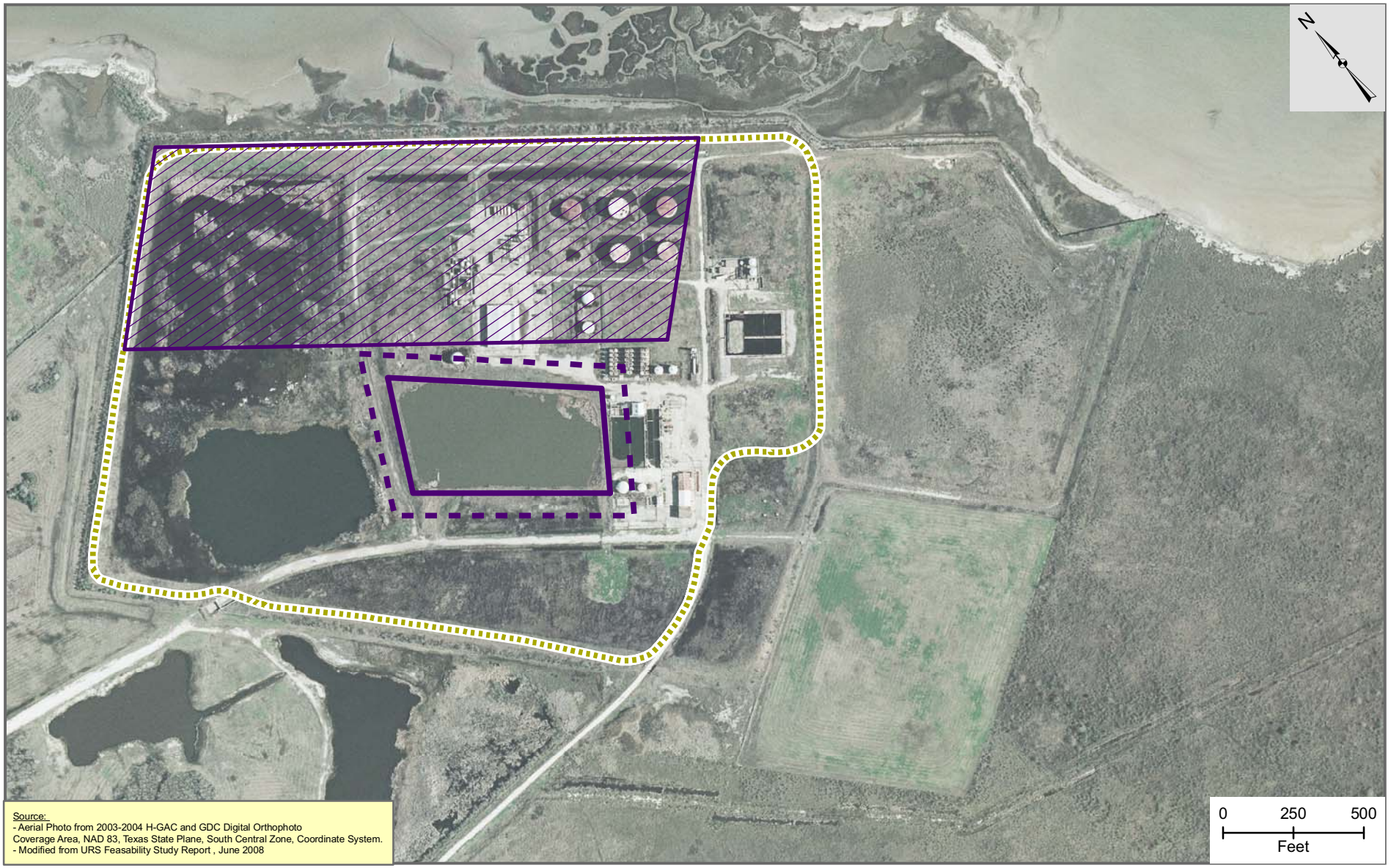
002364




# Figure 8 – Geologic Map

Malone Service Company
Superfund Site
Texas City, Galveston County, Texas

002365




Source:
- Aerial Photo from 2003-2004 H-GAC and GDC Digital Orthophoto
Coverage Area, NAD 83, Texas State Plane, South Central Zone, Coordinate System.
- Modified from URS Feasability Study Report , June 2008

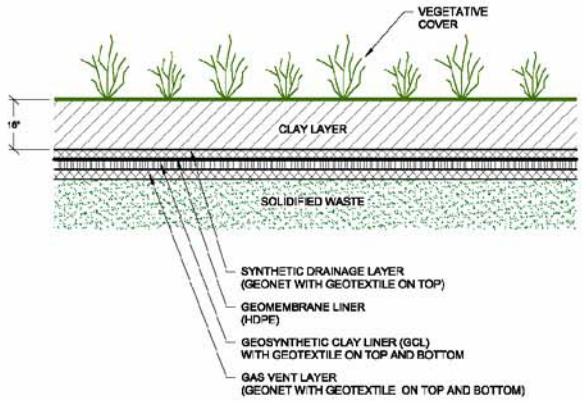
**Legend:**

- Barrier Wall
- Excavated Sludge Pit
- RCRA Subtitle C Cell
- Area of Contamination

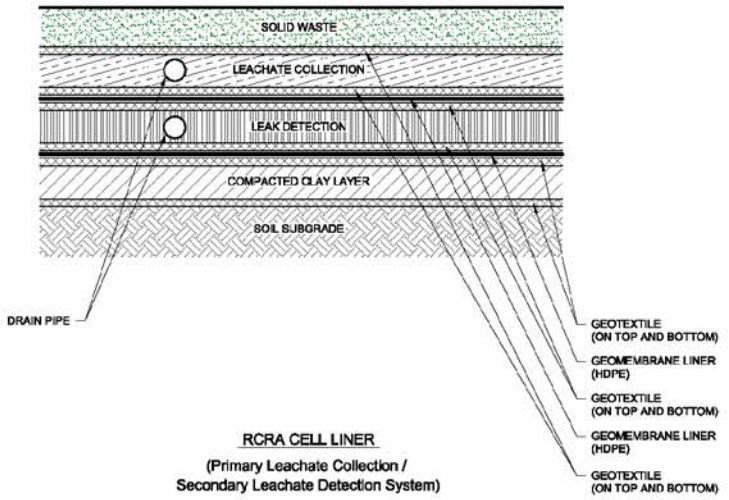
# Figure 9 – Containment Design Layout

Malone Service Company
Superfund Site
Texas City, Galveston County, Texas

002366

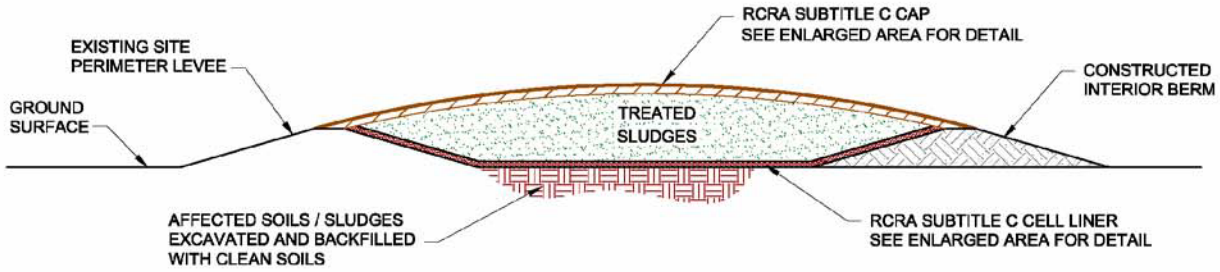



RCRA CELL COVER DETAIL




RCRA CELL LINER

(Primary Leachate Collection / Secondary Leachate Detection System)




**CONSTRUCTED RCRA SUBTITLE C CELL**

NOT TO SCALE

# Figure 10 – RCRA Subtitle C Cell

Malone Service Company
Superfund Site
Texas City, Galveston County, Texas

Source:
Modified from URS Remedial Investigation Report, February 2006.

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# Appendix A – Administrative Record File Index

The following documents are contained in the Administrative Record:

1. Site Specific Plans (URS, 2004)
2. Data Evaluation Report (URS, 2004)
3. Final RI Report (URS, 2006)
4. Baseline Human Health Risk Assessment (URS, 2006)
5. Baseline Ecological Risk Assessment (URS, 2007)
6. Treatability Study (Shaw, 2008)
7. Final FS Report (URS, 2008)
8. Final Proposed Plan (EPA, 2009)
9. Selected EPA Guidance (Varies)

**Prepared for**

**United States Environmental Protection Agency**

**Region 6**

# RECORD OF DECISION ADMINISTRATIVE RECORD

**for**

# MALONE SERVICE COMPANY SUPERFUND SITE

**EPA ID No. TXD980864789**
**SSID: GZ**

**GS09K99BHD0010**
**Task Order No. T0703BG1026**

**David Abshire**
**Remedial Project Manager**
**U.S. EPA Region 6**

**Prepared by**

**Science Applications International Corporation**
**555 Republic Drive, Suite 300**
**Plano, TX 75074**

**October 1, 2009**

## PREAMBLE

The purpose of this document is to provide the public with an index to the Administrative Record File (AR File) for the U.S. Environmental Protection Agency's (EPA) selected remedial action to respond to conditions at the Malone Service Company Superfund Site (the "Site"). EPA's action is authorized by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. Section 9601 et seq.

Section 113 (j)(1) of CERCLA, 42 U.S.C. Section 9613 (j)(1), provides that judicial review of the adequacy of a CERCLA response action shall be limited to the Administrative Record (AR). Section 113 (k)(1) of CERCLA, 42 U.S.C. Section 9613 (k)(1), requires the EPA to establish an AR upon which it shall base the selection of its remedial actions. As the EPA decides what to do at the site of a release of hazardous substances, it compiles documents concerning the site and it's decision into an "AR File." This means that documents may be added to the AR File from time to time. After the EPA Regional Administrator or the Administrator's delegate signs the Action Memorandum or the Record of Decision memorializing the selection of the action, the documents which form the basis for the selection of the response action are then known as the Administrative Record "AR."

Section 113(k)(1) of CERCLA requires the EPA to make the AR File available to the public at or near the site of the response action. Accordingly, the EPA has established a repository where the AR File may be reviewed near the Site at:

Moore Memorial Public Library
1701 9th Avenue North
Texas City, Texas 77590
Contact: Beth Steiner
Telephone: (409) 643-5979

and

Texas Commission on Environmental Quality
Records Management Center
12100 Park 35 Circle
Building E
Austin, Texas 78753
Contact: Joe Shields
Telephone: (512) 239-2463 or 1- (800) 633-9363

The public also may review the AR File at the EPA Region 6 office in Dallas, Texas, by contacting the Remedial Project Manager at the address listed below. The AR File is available for public review during normal business hours. The AR File is treated as a non-circulating reference document. Any document in the AR File may be photocopied according to the procedures used at the repository or at the EPA Region 6 office. This index and the AR File were compiled in accordance with the EPA's Final Guidance on Administrative Records for Selecting CERCLA Response Actions, Office of Solid Waste and Emergency Response (OSWER) Directive Number 9833.3A1 (December 3, 1990).

Documents listed as bibliographic sources for other documents in the AR File might not be listed separately in the index. Where a document is listed in the index but not located among the documents which the EPA has made available in the repository, the EPA may, upon request, include the document in the repository or make the document available for review at an alternate location. This applies to documents such as verified sampling data, chain of custody forms, guidance and policy documents, as well as voluminous site-specific reports. It does not apply to documents in EPA's confidential file. (Copies of guidance documents also can be obtained by calling the RCRA/Superfund/Title 3 Hotline at (800) 424-9346.)

These requests should be addressed to:

David Abshire
Remedial Project Manager
U.S. EPA Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733
(214) 665-7188

The EPA response selection guidance compendium index has not been updated since March 22, 1991 (see CERCLA Administrative Records: First Update of the Compendium of Documents Used for Selecting CERCLA Response Actions [March 22, 1991]); accordingly, it is not included here. Moreover, based on resource considerations, the Region 6 Superfund Division Director has decided not to maintain a Region 6 compendium of response selection guidance. Instead, consistent with 40 CFR Section 300.805(a)(2) and 300.810(a)(2) and OSWER Directive No. 9833.3A-1 (page 37), the AR File Index includes listings of all guidance documents which may form a basis for the selection of the response action in question.

The documents included in the AR File index are arranged predominantly in chronological order. The AR File index helps locate and retrieve documents in the file. It also provides an overview of the response action history. The index includes the following information for each document:

- **Doc ID**- The document identifier number.
- **Date** - The date the document was published and/or released. "01/01/2525" means no date was recorded.
- **Pages** - Total number of printed pages in the document, including attachments.
- **Title -** Descriptive heading of the document.
- **Document Type** - General identification, (e.g. correspondence, Remedial Investigation Report, Record of Decision.)
- **Author** - Name of originator, and the name of the organization that the author is affiliated with. If either the originator name or the organization name is not identified, then the field is captured with the letters "N/A".
- **Addressee**- Name and affiliation of the addressee. If either the originator name or the organization name is not identified, then the field is captured with the letters "N/A".

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 945905
**Bates:** 000001 **To:** 000042
**Date:** 04/28/1986
**Pages:** 42
**Title:** [INORGANIC ANALYSES DATA PACKAGE FOR CASE NO. 5424]
**Doc Type:** QA / QC
SAMPLING / ANALYSIS

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | NONE |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

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**Region Id:** 06
**Docid:** 217301
**Bates:** 000043 **To:** 000228
**Date:** 10/01/1988
**Pages:** 186
**Title:** GUIDANCE FOR CONDUCTING REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES UNDER CERLCA - EPA/540/G-89/004 - OSWER DIRECTIVE 9355.3-01
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 217311
**Bates:** 000229 **To:** 000515
**Date:** 12/01/1989
**Pages:** 287
**Title:** RISK ASSESSMENT GUIDANCE FOR SUPERFUND VOLUME I - HUMAN HEALTH EVALUATION MANUAL (PART A) - EPA/540/1-89/002
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | NONE |

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**Region Id:** 06
**Docid:** 133794
**Bates:** 000516 **To:** 000522
**Date:** 09/15/1994
**Pages:** 7
**Title:** REMOVAL ASSESSMENT REPORT FOR MALONE SERVICE COMPANY - RUNOFF CHARACTERIZATION
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | ECOLOGY & ENVIRONMENT INCORPORATED |

| | Name | Organization |
|---|---|---|
| **Addressee:** | THOMPSON, HENRY | EPA REGION 6, PROGRAM MANAGEMENT BRANCH |

---

**Region Id:** 06
**Docid:** 217320
**Bates:** 000523 **To:** 000752
**Date:** 06/01/1997
**Pages:** 230
**Title:** ECOLOGICAL RISK ASSESSMENT GUIDANCE FOR SUPERFUND: PROCESS FOR DESIGNING AND CONDUCTING ECOLOGICAL RISK ASSESSMENTS - EPA 540-R-97-006
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | NONE |

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# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 141429
**Bates:** 000753 **To:** 000807
**Date:** 01/29/1998
**Pages:** 55
**Title:** REMOVAL ASSESSMENT REPORT FOR MALONE SERVICES COMPANY SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | NONE , | ECOLOGY & ENVIRONMENT INCORPORATED |

| | Name | Organization |
|---|---|---|
| **Addressee:** | HAMMACK, PATRICK L | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | REESE, SHARON M | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | QUINA, CHRISTOPHER | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | THOMPSON JR., HENRY | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 908401
**Bates:** 000808 **To:** 003084
**Date:** 10/01/1998
**Pages:** 2277
**Title:** [SCREENING SITE INSPECTION REPORT VOLUMES I, II, AND III OF THE FOR MALONE SERVICE COMPANY SUPERFUND SITE]
**Doc Type:** REPORT / STUDY
SAMPLING / ANALYSIS

| | Name | Organization |
|---|---|---|
| **Author:** | NEWBERRY, WESLEY G | TEXAS NATURAL RESOURCE CONSERVATION COMMISSION |
| | SMITH, CATRIONA V | TEXAS NATURAL RESOURCE CONSERVATI0N COMMISSION |
| | KENNEDY, JOHNNY | TEXAS NATURAL RESOURCE CONSERVATION COMMISSION |
| | SEILS, ALLEN | TEXAS NATURAL RESOURCES CONSERVATION COMMISSION |

| | Name | Organization |
|---|---|---|
| **Addressee:** | RHOTENBERRY, WILLIAM | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 138325
**Bates:** 003085 **To:** 003086
**Date:** 06/07/1999
**Pages:** 2
**Title:** [REQUEST FROM TNRCC FOR AN EPA LEAD EMERGENCY RESPONSE ACTION AND FOR EPA TO PERFORM A HAZARD RANKING SYSTEM PACKAGE (HRS) AT MALONE SERVICE COMPANY SITE]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | PEDDE, RONALD R | TEXAS NATURAL RESOURCE CONSERVATION COMMISSION |
| | **Name** | **Organization** |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138326
**Bates:** 003087 **To:** 003087
**Date:** 07/28/1999
**Pages:** 1
**Title:** [MAYOR CHARLES T. DOYLE OF TEXAS CITY REQUEST TO GOVERNOR OF TEXAS GEORGE W. BUSH FOR ASSISTANCE IN URGING THE USEPA TO PLACE THE MALONE PROPERTY ON THEIR NATIONAL PRIORITIES LIST]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | DOYLE, CHARLES T | CITY OF TEXAS CITY TEXAS |
| | **Name** | **Organization** |
| **Addressee:** | BUSH, GEORGE W | TEXAS STATE OF |

---

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 138327
**Bates:** 003088 **To:** 003088
**Date:** 08/10/1999
**Pages:** 1
**Title:** [ATTORNEY GENERAL OF TEXAS, JOHN CORNYN'S RESPONSE TO MAYOR DOYLE'S REQUEST FOR ASSISTANCE IN GETTING THE MALONE SERVICE COMPANY SITE ON THE EPA NATIONAL PRIORITIES LIST]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | CORNYN, JOHN | TEXAS STATE OF |
| | **Name** | **Organization** |
| **Addressee:** | DOYLE, CHARLES T | CITY OF TEXAS CITY TEXAS |

---

**Region Id:** 06
**Docid:** 922348
**Bates:** 003089 **To:** 004359
**Date:** 10/20/1999
**Pages:** 1271
**Title:** [HAZARDOUS RANKING SYSTEM DOCUMENTATION RECORD FOR THE MALONE SERVICE COMPANY INCORPORATED SITE]
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 138329
**Bates:** 004359.001 **To:** 004359.029
**Date:** 10/26/1999
**Pages:** 29
**Title:** [REQUEST FOR APPROVAL OF AN EMERGENCY EXEMPTION TO THE STATUTORY TWO MILLION DOLLAR LIMIT]
**Doc Type:** ACTION MEMORANDUM

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | KNUDSON, MYRON O | U.S. ENVIRONMENTAL PROTECTION AGENCY |

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 138330
**Bates:** 004360 **To:** 004361
**Date:** 11/06/1999
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 1 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138331
**Bates:** 004362 **To:** 004363
**Date:** 11/13/1999
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 2 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138333
**Bates:** 004364 **To:** 004365
**Date:** 11/20/1999
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 3 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 138334
**Bates:** 004366 **To:** 004367
**Date:** 12/04/1999
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 4 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138335
**Bates:** 004368 **To:** 004369
**Date:** 12/11/1999
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 5 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138336
**Bates:** 004370 **To:** 004371
**Date:** 12/17/1999
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 6 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 138337
**Bates:** 004372 **To:** 004373
**Date:** 01/01/2000
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 7 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138338
**Bates:** 004374 **To:** 004375
**Date:** 01/08/2000
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 8 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138339
**Bates:** 004376 **To:** 004377
**Date:** 01/15/2000
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 9 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

---

**Region Id:** 06
**Docid:** 138340
**Bates:** 004378 **To:** 004379
**Date:** 01/22/2000
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 10 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138341
**Bates:** 004380 **To:** 004381
**Date:** 02/12/2000
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 11 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138342
**Bates:** 004382 **To:** 004383
**Date:** 02/19/2000
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 12 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138343
**Bates:** 004384 **To:** 004385
**Date:** 02/26/2000
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 13 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138344
**Bates:** 004386 **To:** 004387
**Date:** 03/11/2000
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 14 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138345
**Bates:** 004388 **To:** 004389
**Date:** 03/18/2000
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 15 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 138346
**Bates:** 004390 **To:** 004391
**Date:** 03/25/2000
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 16 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138347
**Bates:** 004392 **To:** 004393
**Date:** 04/08/2000
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 17 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138348
**Bates:** 004394 **To:** 004395
**Date:** 04/15/2000
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 18 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138349
**Bates:** 004396 **To:** 004397
**Date:** 04/22/2000
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 19 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 901640
**Bates:** 004398 **To:** 004399
**Date:** 04/28/2000
**Pages:** 2
**Title:** [MALONE SERVICE COMPANY SITE FACT SHEET: U.S. EPA COMPLETES STABILIZATION EFFORTS AT FORMER RECLAMATION PLANT]
**Doc Type:** FACTSHEET

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 138350
**Bates:** 004400 **To:** 004401
**Date:** 05/06/2000
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 20 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 138351
**Bates:** 004402 **To:** 004403
**Date:** 05/13/2000
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 21 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138352
**Bates:** 004404 **To:** 004405
**Date:** 05/18/2000
**Pages:** 2
**Title:** [POLLUTION REPORT (POLREP) NO. 22 FOR MALONE SERVICE COMPANY SUPERFUND SITE]
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 138353
**Bates:** 004406 **To:** 004407
**Date:** 05/27/2000
**Pages:** 2
**Title:** POLLUTION REPORT (POLREP) NO. 23 FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| **Addressee:** | GAZDA, CHARLES A | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**10/01/2009** **Region Id: 06**

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**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 138323
**Bates:** 004408 **To:** 004429
**Date:** 06/07/2000
**Pages:** 22
**Title:** [REMOVAL ACTION ADMINISTRATIVE RECORD FOR THE MALONE SERVICE COMPANY]
**Doc Type:** INDEX

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | TECHLAW INCORPORATED |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 911139
**Bates:** 004430 **To:** 004431
**Date:** 11/20/2000
**Pages:** 2
**Title:** [REGARDING U.S. DEPARTMENT OF THE INTERIOR RECEIVING AND REVIEWING PRELIMINARY INFORMATION PROVIDED FROM EPA]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | SEKAVEC, GLENN B | UNITED STATES DEPARTMENT OF INTERIOR |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, CHARLES | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 902992
**Bates:** 004432 **To:** 004432
**Date:** 06/01/2001
**Pages:** 1
**Title:** [U.S. EPA PUBLIC NOTICES JUNE 2001 - MALONE SERVICE COMPANY SITE PLACED ON NATIONAL PRIORITIES LIST]
**Doc Type:** NOTICE

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

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**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 914518
**Bates:** 004433 **To:** 004434
**Date:** 06/14/2001
**Pages:** 2
**Title:** [MALONE SERVICES SITE IN TEXAS CITY ADDED TO SUPERFUIND PRIORITIES LIST]
**Doc Type:** PRESS RELEASE

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 914519
**Bates:** 004435 **To:** 004438
**Date:** 06/26/2001
**Pages:** 4
**Title:** [FOLLOW-UP REGARDING THE ADDITION OF MALONE SERVICES COMPANY ADDITION TO NATIONAL PRIORITIES LISTING]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | NONE |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 926209
**Bates:** 004439 **To:** 004440
**Date:** 09/10/2001
**Pages:** 2
**Title:** ACCESS ORDER / AGREEMENT FOR TRACY HOLLISTER OF SOUTHEAST TEXAS ENVIRONMENTAL
**Doc Type:** ACCESS AGREEMENT

| | Name | Organization |
|---|---|---|
| **Author:** | HOLLISTER, TRACY L | SOUTHEAST TEXAS ENVIRONMENTAL |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 861507
**Bates:** 004441 **To:** 004825
**Date:** 12/01/2001
**Pages:** 385
**Title:** RISK ASSESSMENT GUIDANCE FOR SUPERFUND: VOLUME III - PART A, PROCESS FOR CONDUCTING PROBABILISTIC RISK ASSESSMENT - EPA 540-R-02-002 / OSWER 9285.7-45
**Doc Type:** ELECTRONIC RECORD
REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 928444
**Bates:** 004826 **To:** 004862
**Date:** 01/30/2002
**Pages:** 37
**Title:** [PUBLIC HEALTH ASSESSMENT FOR THE MALONE SERVICE COMPANY - SWAN LAKE PLANT SUPERFUND SITE]
**Doc Type:** HEALTH ASSESSMENT

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | TEXAS DEPARTMENT OF HEALTH |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 917600
**Bates:** 004862.001 **To:** 004862.003
**Date:** 09/26/2002
**Pages:** 3
**Title:** REQUEST FOR APPROVAL OF A CEILING INCREASE AND EMERGENCY AND CONSISTENCY EXEMPTIONS TO THE STATUTORY 12 MONTH TIME LIMIT TO CONDUCT A TIME-CRITICAL REMOVAL ACTION AT THE MALONE SERVICE COMPANY SITE
**Doc Type:** ACTION MEMORANDUM

| | Name | Organization |
|---|---|---|
| **Author:** | ZEHNER, WARREN | U.S. ENVIRONMENTAL PROTECTION AGENCY |

| | Name | Organization |
|---|---|---|
| **Addressee:** | KNUDSON, MYRON O | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 922711
**Bates:** 004863 **To:** 004863
**Date:** 05/01/2003
**Pages:** 1
**Title:** [U.S. EPA REGION 6 PUBLIC NOTICE: U.S. EPA REGION 6 RECEIVES LETTER OF INTENT TO APPLY FOR THE SITE TECHNICAL ASSISTANCE GRANT]
**Doc Type:** FACTSHEET
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | U. S. ENVIRONMENTAL PROTECTION AGENCY<br>ENVIRONMENTAL RESEARCH LABORATORY |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | NONE |

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## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 190543
**Bates:** 004864 **To:** 004974
**Date:** 09/29/2003
**Pages:** 111
**Title:** ADMINISTRATIVE ORDER ON CONSENT FOR THE REMEDIAL INVESTIGATION / FEASIBILITY STUDY AND SPECIFIED REMOVAL ACTIONS FOR THE MALONE SERVICE COMPANY SUPERFUND SITE [U.S. EPA VS MALONE SERVICE COMPANY, ET AL - DOCKET NO. CERCLA 06-18-03]
**Doc Type:** ADMINISTRATIVE ORDER (AOC)

| | Name | Organization |
|---|---|---|
| **Author:** | BERNARDO, NAN | BASF CORPORATION |
| | CARAVELLO, HALINA E | BAKER PETROLITE |
| | FINLEY, G S | BAKER HUGHES OILFIELD OPERATIONS INCORPORATED |
| | KNUDSON, MYRON O | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | LINDLEY, STEVEN J | CHAMPION TECHNOLOGIES INCORPORATED |
| | WALES, JOAN L | ATLANTIC RICHFIELD COMPANY |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 184881
**Bates:** 004975 **To:** 005021
**Date:** 03/01/2004
**Pages:** 47
**Title:** FINAL STORMWATER MANAGEMENT PLAN FOR STORM WATER MANAGEMENT AT THE MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** WORK PLAN / AMENDMENT
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | URS CORPORATION |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | NONE |

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**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 166441
**Bates:** 005022 **To:** 005247
**Date:** 04/01/2004
**Pages:** 226
**Title:** [PRELIMINARY SITE CHARACTERIZATION REPORT FOR THE MALONE SERVICE COMPANY SUPERFUND SITE]
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | URS CONSULTANTS INCORPORATED |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**Region Id:** 06
**Docid:** 181439
**Bates:** 005248 **To:** 005841
**Date:** 04/21/2004
**Pages:** 594
**Title:** REMOVAL REPORT FOR THE MALONE SERVICES SITE
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | URS CORPORATION |
| | NONE, | SANDIA TECHNOLOGIES LLC |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 181436
**Bates:** 005842 **To:** 005986
**Date:** 07/01/2004
**Pages:** 145
**Title:** PRELIMINARY REMEDIAL ALTERNATIVES EVALUATION REPORT FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** WORK PLAN / AMENDMENT
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | URS CORPORATION |

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**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, NONE | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 190545
**Bates:** 005987 **To:** 006022
**Date:** 07/19/2004
**Pages:** 36
**Title:** FIRST AMENDMENT TO THE ADMINISTRATIVE ORDER ON CONSENT FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY US EPA DOCKET NO. CERCLA 06-18-03
**Doc Type:** ADMINISTRATIVE ORDER (AOC)

| | Name | Organization |
|---|---|---|
| **Author:** | BERNARDO, NAN | BASF CORPORATION |
| | BOLEN, ZANE K | EXXONMOBIL REFINING AND SUPPLY COMPANY |
| | COLEMAN, SAMUEL | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | CARAVELLO, HALINA E | BAKER PETROLITE |
| | GORDON, TURL | CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY |
| | KELLER, A L | ATLANTIC RICHFIELD CO. |
| | MCLEMORE, PAULA | DIXIE CHEMICAL COMPANY, INCORPORATED |
| | MARTIN, MARCUS | NL INDUSTRIES INC |
| | SAVNER, DAVID A | GENERAL DYNAMICS CORPORATION |
| | ROSS, LOREN | CHAMPION TECHNOLOGIES INCORPORATED |
| | STANLEY, DON | GOODYEAR TIRE & RUBBER COMPANY |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 173956
**Bates:** 006023 **To:** 006454
**Date:** 08/16/2004
**Pages:** 432
**Title:** REMOVAL REPORT FOR THE MALONE SERVICES SITE
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | WESTON SOLUTIONS INCORPORATED |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
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**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 825369
**Bates:** 006455 **To:** 006455
**Date:** 09/20/2004
**Pages:** 1
**Title:** [OFFER TO DISCUSS EPA'S OVERSIGHT EXPECTATIONS FOR UPCOMING ACTIVITIES]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |

| | Name | Organization |
|---|---|---|
| **Addressee:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

---

**Region Id:** 06
**Docid:** 9093903
**Bates:** 006456 **To:** 006487
**Date:** 11/19/2004
**Pages:** 32
**Title:** QUALITY ASSURANCE PROJECT PLAN FOR STORMWATER AT THE MALONE SERVICE COMPANY
**Doc Type:** ELECTRONIC RECORD
WORK PLAN / AMENDMENT

| | Name | Organization |
|---|---|---|
| **Author:** | RAMSDEN, DAVID K | URS CORPORATION |
| | BASILE, BRENDA P | URS CORPORATION |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 9093914
**Bates:** 006488 **To:** 006488
**Date:** 11/22/2004
**Pages:** 1
**Title:** [URS NOTIFICATION OF CHANGES TO VARIOUS STORMWATER PLANS AFTER CONVERSATION WITH TCEQ REGARDING THE MALONE SERVICE COMPANY]
**Doc Type:** ELECTRONIC RECORD
MEMORANDUM

| | Name | Organization |
|---|---|---|
| **Author:** | BASILE, BRENDA P | URS CORPORATION |

| | Name | Organization |
|---|---|---|
| **Addressee:** | ETHEREDGE, ALAN | URS CORPORATION |

---

**Region Id:** 06
**Docid:** 825340
**Bates:** 006489 **To:** 006492
**Date:** 12/23/2004
**Pages:** 4
**Title:** [STORMWATER MANAGEMENT ANALYTICAL DATA DECEMBER 2004 AT THE MALONE SERVICE COMPANY]
**Doc Type:** ELECTRONIC RECORD
CORRESPONDENCE
SAMPLING / ANALYSIS

| | Name | Organization |
|---|---|---|
| **Author:** | RAMSDEN, DAVID K | URS CORPORATION |
| | BASILE, BRENDA P | URS CORPORATION |

| | Name | Organization |
|---|---|---|
| **Addressee:** | ABSHIRE, DAVID C | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

---

**Region Id:** 06
**Docid:** 184882
**Bates:** 006493 **To:** 006547
**Date:** 03/01/2005
**Pages:** 55
**Title:** FINAL SAMPLING AND ANALYSIS PLAN QUALITY ASSURANCE PROJECT PLAN FOR STORMWATER MANAGEMENT AT THE MALONE SERVICES COMPANY SUPERFUND SITE
**Doc Type:** WORK PLAN / AMENDMENT
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | URS CORPORATION |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 184883
**Bates:** 006548 **To:** 006811
**Date:** 03/01/2005
**Pages:** 264
**Title:** FINAL HEALTH AND SAFETY PLAN FOR STORMWATER MANAGEMENT AT THE MALONE SERVICES COMPANY SUPERFUND SITE
**Doc Type:** WORK PLAN / AMENDMENT
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | URS CORPORATION |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 213874
**Bates:** 006812 **To:** 006878
**Date:** 03/01/2005
**Pages:** 67
**Title:** FINAL OPERATIONS AND MAINTENANCE PLAN FOR STORMWATER MANAGEMENT AT THE MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** WORK PLAN / AMENDMENT
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | URS CORPORATION |

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**Region Id:** 06
**Docid:** 9093913
**Bates:** 006879 **To:** 006879
**Date:** 03/01/2005
**Pages:** 1
**Title:** EQUIPMENT MAINTENANCE RECOMMENDATION SHEET FORM MDWF-6 (FOR OPERATIONS) AT THE MALONE SERVICE COMPANY
**Doc Type:** ELECTRONIC RECORD
FORM

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | NONE |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 9093912
**Bates:** 006880 **To:** 006880
**Date:** 03/01/2005
**Pages:** 1
**Title:** DISCHARGE/INJECTION DECISION FORM MDWF-5 FOR DEEP WELL OPERATIONS AT THE MALONE SERVICE COMPANY
**Doc Type:** ELECTRONIC RECORD
FORM

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | NONE |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | NONE |

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# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 9093911
**Bates:** 006881 **To:** 006881
**Date:** 03/01/2005
**Pages:** 1
**Title:** DAILY INJECTION MONITORING LOG MDWF-4 FOR DEEP WELL OPERATIONS AT THE MALONE SERVICE COMPANY
**Doc Type:** ELECTRONIC RECORD
LOG / LOG BOOK

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | NONE |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 9093910
**Bates:** 006882 **To:** 006882
**Date:** 03/01/2005
**Pages:** 1
**Title:** [MALONE SERVICE COMPANY SUPERFUND SITE DEEP WELL OPERATIONS SHUTDOWN CHECKLIST MDWF-3 (BLANK FORM)]
**Doc Type:** ELECTRONIC RECORD
FORM

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | NONE |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 9093907
**Bates:** 006883 **To:** 006949
**Date:** 03/01/2005
**Pages:** 67
**Title:** FINAL OPERATIONS AND MAINTENANCE PLAN FOR STORMWATER MANAGEMENT AT THE MALONE SERVICE COMPANY
**Doc Type:** ELECTRONIC RECORD
WORK PLAN / AMENDMENT

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | URS CORPORATION |

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**Region Id:** 06
**Docid:** 9093901
**Bates:** 006950 **To:** 006997
**Date:** 03/01/2005
**Pages:** 48
**Title:** FINAL STORMWATER MANAGEMENT PLAN FOR STORMWATER MANAGEMENT AT THE MALONE SERVICE COMPANY
**Doc Type:** ELECTRONIC RECORD
WORK PLAN / AMENDMENT

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | URS CORPORATION |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 825338
**Bates:** 006998 **To:** 006998
**Date:** 03/15/2005
**Pages:** 1
**Title:** [TRANSMITTAL OF FINAL STORM WATER MANAGEMENT PLAN, DEEP WELL OPERATIONS AND MAINTENANCE PLAN, AND DEEP WELL OPERATIONS HEALTH AND SAFETY PLAN FOR MALONE SERVICE COMPANY]
**Doc Type:** ELECTRONIC RECORD
CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

| | Name | Organization |
|---|---|---|
| **Addressee:** | ABSHIRE, DAVID C | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 217240
**Bates:** 006999 **To:** 007050
**Date:** 03/16/2005
**Pages:** 52
**Title:** MALONE SERVICES CORPORATION INJECTION WELL WDW-138 2005 MECHANICAL INTEGRITY TEST & BOTTOMHOLE PRESSURE SURVEY REPORT
**Doc Type:** ELECTRONIC RECORD
REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | SANDIA TECHNOLOGIES LLC |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | URS CORPORATION |

---

**Region Id:** 06
**Docid:** 825339
**Bates:** 007051 **To:** 007051
**Date:** 03/22/2005
**Pages:** 1
**Title:** [EPA ACKNOWLEDGEMENT OF RECEIPT OF TCEQ'S AND EPA'S APPROVAL OF FINAL STORMWATER MANAGEMENT PLAN]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

---

**Region Id:** 06
**Docid:** 194893
**Bates:** 007052 **To:** 007512
**Date:** 05/01/2005
**Pages:** 461
**Title:** FINAL REMEDIAL INVESTIGATION / FEASIBILITY STUDY WORK PLAN FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** WORK PLAN / AMENDMENT
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | URS CORPORATION |
| | **Name** | **Organization** |

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**Region Id:** 06
**Docid:** 194896
**Bates:** 007513 **To:** 007924
**Date:** 05/01/2005
**Pages:** 412
**Title:** FINAL HEALTH AND SAFETY PLAN FOR REMEDIAL INVESTIGATION AT MALONE SERVICES COMPANY SUPERFUND SITE
**Doc Type:** WORK PLAN / AMENDMENT
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | URS CORPORATION |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 865363
**Bates:** 007925 **To:** 007950
**Date:** 05/01/2005
**Pages:** 26
**Title:** COMMUNITY INVOLVEMENT PLAN - MALONE SERVICES CONPANY SITE
**Doc Type:** ELECTRONIC RECORD
COMMUNITY RELATIONS PLAN

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | NONE |

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**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 825360
**Bates:** 007951 **To:** 007951
**Date:** 05/10/2005
**Pages:** 1
**Title:** [RECEIPT OF TCEQ AND THE EPA'S APPROVAL OF WDW-138 2005 MECHANICAL INTEGRITY TEST AND BOTTOMHOLE PRESSURE SURVEY REPORT]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

---

**Region Id:** 06
**Docid:** 194901
**Bates:** 007952 **To:** 007956
**Date:** 05/13/2005
**Pages:** 5
**Title:** [MARCH 2005 AND APRIL 2005 MONTHLY PROGRESS REPORTS FOR MALONE SERVICE COMPANY SITE]
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, CHARLES | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**Region Id:** 06
**Docid:** 194903
**Bates:** 007957 **To:** 007959
**Date:** 06/15/2005
**Pages:** 3
**Title:** [MAY 2005 MONTHLY PROGRESS REPORT FOR MALONE SERVICE COMPANY SITE]
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, CHARLES | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 825346
**Bates:** 007960 **To:** 007967
**Date:** 06/29/2005
**Pages:** 8
**Title:** [EPA COMMENTS ON THE FINAL WORK PLAN FOR THE REMEDIAL INVESTIGATION / FEASIBILITY STUDY AT THE MALONE SERVICE COMPANY]
**Doc Type:** ELECTRONIC RECORD
CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | ABSHIRE, DAVID C | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

---

**Region Id:** 06
**Docid:** 194904
**Bates:** 007968 **To:** 007970
**Date:** 07/15/2005
**Pages:** 3
**Title:** [JUNE 2005 MONTHLY PROGRESS REPORT MALONE SERVICE COMPANY SITE]
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, CHARLES | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**Region Id:** 06
**Docid:** 194906
**Bates:** 007971 **To:** 007973
**Date:** 08/15/2005
**Pages:** 3
**Title:** [JULY 2005 MONTHLY PROGRESS REPORT MALONE SERVICE COMPANY SITE]
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, CHARLES | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 194907
**Bates:** 007974 **To:** 007976
**Date:** 09/15/2005
**Pages:** 3
**Title:** [AUGUST 2005 MONTHLY PROGRESS REPORT MALONE SERVICE COMPANY SITE]
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, CHARLES | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**Region Id:** 06
**Docid:** 194909
**Bates:** 007977 **To:** 007981
**Date:** 10/17/2005
**Pages:** 5
**Title:** [SEPTEMBER 2005 MONTHLY PROGRESS REPORT MALONE SERVICE COMPANY SITE]
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, CHARLES | U.S. ENVIRONMENTAL PROTECTION AGENCY |

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 194910
**Bates:** 007982 **To:** 007984
**Date:** 11/15/2005
**Pages:** 3
**Title:** [OCTOBER 2005 MONTHLY PROGRESS REPORT MALONE SERVICE COMPANY SITE]
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, CHARLES | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**Region Id:** 06
**Docid:** 865250
**Bates:** 007985 **To:** 008030
**Date:** 03/29/2006
**Pages:** 46
**Title:** [MALONE SERVICE CORPORATION INJECTION WELL WDW-138 2006 MECHANICAL INTEGRITY TEST AND BOTTOMHOLE PRESSURE SURVEY REPORT]
**Doc Type:** ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | GRANT, MICHAEL | SANDIA TECHNOLOGIES LLC |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 202779
**Bates:** 008031 **To:** 009197
**Date:** 04/01/2006
**Pages:** 1167
**Title:** FINAL REMEDIAL INVESTIGATION REPORT FOR THE MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | URS CONSULTANTS INCORPORATED |
| | **Name** | **Organization** |

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**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | NONE |

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**Region Id:** 06
**Docid:** 830623
**Bates:** 009198 **To:** 010868
**Date:** 06/01/2006
**Pages:** 1671
**Title:** FINAL BASELINE HUMAN HEALTH RISK ASSESSMENT AT MALONE SERVICE COMPANY SITE
**Doc Type:** ELECTRONIC RECORD
REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | URS CORPORATION |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | MALONE COOPERATING PARTIES |
| | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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**Region Id:** 06
**Docid:** 217244
**Bates:** 010869 **To:** 010870
**Date:** 06/13/2006
**Pages:** 2
**Title:** [EPA APPROVAL FOR FINAL REMEDIAL INVESTIGATION REPORT FOR MALONE SERVICE COMPANY]
**Doc Type:** ELECTRONIC RECORD
CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |

| | Name | Organization |
|---|---|---|
| **Addressee:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

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**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 825345
**Bates:** 010871 **To:** 010871
**Date:** 06/14/2006
**Pages:** 1
**Title:** [EPA ACKNOWLEDGEMENT OF RECEIPT OF TCEQ'S AND EPA'S APPROVAL OF FINAL REMEDIAL INVESTIGATION REPORT DOCUMENT]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |

| | Name | Organization |
|---|---|---|
| **Addressee:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

---

**Region Id:** 06
**Docid:** 830617
**Bates:** 010872 **To:** 011561
**Date:** 07/01/2006
**Pages:** 690
**Title:** FINAL SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT - BASELINE ECOLOGICAL RISK ASSESSMENT PROBLEM FORMULATION - BASELINE ECOLOGICAL RISK ASSESSMENT WORKPLAN AT THE MALONE SERVICE COMPANY SUPERFUND SITE]

**Doc Type:** ELECTRONIC RECORD
HEALTH ASSESSMENT

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | URS CORPORATION |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | NONE, | MALONE COOPERATING PARTIES |

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**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 825370
**Bates:** 011562 **To:** 011565
**Date:** 08/03/2006
**Pages:** 4
**Title:** [PROJECT NAVIGATOR, LIMITED REGARDING THE PROPOSED ACTIONS TO MANAGE THE LIQUID CONTENTS OF SELECTED ABOVE-GROUND TANKS AT THE MALONE SERVICES SUPERFUND SITE IN TEXAS CITY, TEXAS]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 825361
**Bates:** 011566 **To:** 011567
**Date:** 08/09/2006
**Pages:** 2
**Title:** [EPA APPROVED THE MCP'S REQUEST TO CHARACTERIZE THE TANK CONTENTS AS OUTLINED IN ITS AUGUST 3, 2006 LETTER]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

---

**Region Id:** 06
**Docid:** 210035
**Bates:** 011568 **To:** 011569
**Date:** 10/16/2006
**Pages:** 2
**Title:** [FINDINGS AND PAST DISCUSSIONS BETWEEN EPA AND MALONE COOPERATING PARTIES ON FINAL TREATABILITY STUDY REPORT]
**Doc Type:** REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | ABSHIRE, CHARLES | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

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**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 825330
**Bates:** 011570 **To:** 011583
**Date:** 11/01/2006
**Pages:** 14
**Title:** TECHNICAL MEMORANDUM - EVALUATION: ARE LAND DISPOSAL RESTRICTIONS AN APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENT FOR MALONE SERVICE COMPANY
**Doc Type:** ELECTRONIC RECORD
MEMORANDUM

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | MALONE COOPERATING PARTIES |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 825373
**Bates:** 011584 **To:** 011584
**Date:** 01/08/2007
**Pages:** 1
**Title:** [LAND DISPOSAL RESTRICTIONS DO NOT APPLY AT THE MALONE SERVICE COMPANY SUPERFUND SITE LOCATED IN TEXAS CITY, TEXAS]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

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**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 826723
**Bates:** 011585 **To:** 011585
**Date:** 03/07/2007
**Pages:** 1
**Title:** [TCEQ REVIEW OF SOLIDIFICATION/STABILIZATION TREATABILITY STUDY MALONE SERVICE COMPANY SUPERFUND SITE]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | DUKE, FAY | TEXAS COMMISSION ON ENVIRONMENTAL QUALITY |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, DAVID C | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 217251
**Bates:** 011586 **To:** 011691
**Date:** 03/15/2007
**Pages:** 106
**Title:** MALONE SERVICE CORPORATION INJECTION WELL WDW-138 2007 MECHANICAL INTEGRITY TEST & BOTTOMHOLE PRESSURE SURVEY REPORT
**Doc Type:** ELECTRONIC RECORD
REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | NONE |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 9079073
**Bates:** 011692 **To:** 011693
**Date:** 05/01/2001
**Pages:** 2
**Title:** [TCEQ TRANSMITTAL AND APPROVAL OF MALONE SERVICE CORPORATION INJECTION WELL WDW-138 2007 MECHANICAL INTEGRITY TEST & BOTTOMHOLE PRESSURE SURVEY REPORT]
**Doc Type:** ELECTRONIC RECORD
CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | DUKE, FAY | TEXAS COMMISSION ON ENVIRONMENTAL QUALITY |

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

| | Name | Organization |
|---|---|---|
| **Addressee:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 825344
**Bates:** 011694 **To:** 011694
**Date:** 05/21/2007
**Pages:** 1
**Title:** [EPA HAS APPROVED THE FINAL BASELINE HUMAN HEALTH RISK ASSESSMENT REPORT FOR THE MALONE SERVICE COMPANY SUPERFUND SITE]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |

| | Name | Organization |
|---|---|---|
| **Addressee:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

---

**Region Id:** 06
**Docid:** 830616
**Bates:** 011695 **To:** 012562
**Date:** 07/01/2007
**Pages:** 868
**Title:** FINAL BASELINE ECOLOGICAL RISK ASSESSMENT - MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** ELECTRONIC RECORD
HEALTH ASSESSMENT

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | URS CORPORATION |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | MALONE COOPERATING PARTIES |
| | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 951052
**Bates:** 012563 **To:** 012585
**Date:** 01/02/2007
**Pages:** 23
**Title:** [RESPONSE TO EPA, TRUSTEE, EA ENGINEERING AND TCEQ COMMENTS ON DRAFT BASELINE ECOLOGICAL RISK ASSESSMENT REPORT FOR MALONE SERVICE COMPANY SUPERFUND SITE]
**Doc Type:** ELECTRONIC RECORD
CORRESPONDENCE
HEALTH ASSESSMENT

| | Name | Organization |
|---|---|---|
| **Author:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 217249
**Bates:** 012586 **To:** 012586
**Date:** 07/02/2007
**Pages:** 1
**Title:** [TCEQ APPROVAL OF FINAL BASELINE ECOLOGICAL RISK ASSESSMENT REPORT FOR MALONE SERVICE COMPANY]
**Doc Type:** ELECTRONIC RECORD
CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | DUKE, FAY | TEXAS COMMISSION ON ENVIRONMENTAL QUALITY |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 825290
**Bates:** 012587 **To:** 012588
**Date:** 07/02/2007
**Pages:** 2
**Title:** [TCEQ REVIEW OF DRAFT SUPPLEMENTAL TREATABILITY STUDY REPORT MALONE SERVICE COMPANY SUPERFUND SITE]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | DUKE, FAY | TEXAS COMMISSION ON ENVIRONMENTAL QUALITY |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 991247
**Bates:** 012589 **To:** 012591
**Date:** 08/02/2007
**Pages:** 3
**Title:** EPA COMMENTS ON: DRAFT WORK PLAN - ADDITIONAL STABILIZATION /SOLIDIFICATION TREATABILITY STUDY FOR THE MALONE SERVICE COMPANY SUPERFUND SITE, TEXAS CITY, TEXAS
**Doc Type:** OTHER

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | NONE |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

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**Region Id:** 06
**Docid:** 825362
**Bates:** 012592 **To:** 012592
**Date:** 09/17/2007
**Pages:** 1
**Title:** [TCEQ REVIEW OF ADDENDUM NO. 1 TO STORM WATER MANAGEMENT PLAN TO CONDUCT REMOVAL OF LIQUIDS FROM ON-SITE TANKS AT MALONE SERVICE COMPANY]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | DUKE, FAY | TEXAS COMMISSION ON ENVIRONMENTAL QUALITY |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 825343
**Bates:** 012593 **To:** 012593
**Date:** 09/25/2007
**Pages:** 1
**Title:** [EPA APPROVED THE REVISED FINAL BASELINE ECOLOGICAL RISK ASSESSMENT DOCUMENT FOR THE MALONE SERVICE SITE]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

---

**Region Id:** 06
**Docid:** 826399
**Bates:** 012594 **To:** 014137
**Date:** 02/01/2008
**Pages:** 1544
**Title:** STABILIZATION/SOLIDIFICATION TREATABILITY STUDY REPORT FOR MALONE SERVICE COMPANY
**Doc Type:** ELECTRONIC RECORD
REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | SHAW TECHNOLOGY APPLICATIONS LABORATORY |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 826722
**Bates:** 014138 **To:** 014138
**Date:** 03/11/2008
**Pages:** 1
**Title:** [EPA REVIEW OF THE STABILIZATION/SOLIDIFICATION TREATABILITY STUDY REPORT FOR THE MALONE SERVICE COMPANY SUPERFUND SITE IN TEXAS CITY, TEXAS]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

---

**Region Id:** 06
**Docid:** 865251
**Bates:** 014139 **To:** 014189
**Date:** 03/25/2008
**Pages:** 51
**Title:** MALONE SERVICE CORPORATION INJECTION WELL WDW-138 2008 MECHANICAL INTEGRITY TEST & BOTTOMHOLE PRESSURE SURVEY REPORT

**Doc Type:** ELECTRONIC RECORD
REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | SANDIA TECHNOLOGIES LLC |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 9050758
**Bates:** 014190 **To:** 014208
**Date:** 06/13/2008
**Pages:** 19
**Title:** [TRANSMITTAL OF FINAL FEASIBILITY STUDY WITH RESPONSE TO COMMENTS]
**Doc Type:** ELECTRONIC RECORD
CORRESPONDENCE
TABLE

| | Name | Organization |
|---|---|---|
| **Author:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

| | Name | Organization |
|---|---|---|
| **Addressee:** | ABSHIRE, DAVID C | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 830615
**Bates:** 014209 **To:** 014575
**Date:** 06/13/2008
**Pages:** 367
**Title:** FINAL FEASIBILITY STUDY FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

| | Name | Organization |
|---|---|---|
| **Addressee:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 951054
**Bates:** 014576 **To:** 014594
**Date:** 06/13/2008
**Pages:** 19
**Title:** [MALONE SERVICE COMPANY TABLE ONE: RESPONSE TO EPA COMMENTS]
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | NONE, | MALONE COOPERATING PARTIES |

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# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 9059306
**Bates:** 014595 **To:** 014657
**Date:** 07/01/2008
**Pages:** 63
**Title:** [TANK LIQUID CONSOLIDATION AND REMOVAL TECHNICAL MEMORANDUM STORM WATER MANAGEMENT - MALONE SERVICES COMPANY SUPERFUND SITE]
**Doc Type:** ELECTRONIC RECORD
REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

| | Name | Organization |
|---|---|---|
| **Addressee:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 860961
**Bates:** 014658 **To:** 014658
**Date:** 09/24/2008
**Pages:** 1
**Title:** [TEXAS HISTORICAL COMMISSION PROJECT REVIEW UNDER SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT OF 1966 CAMPBELL BAYOU CEMETERY AT THE MALONE SERVICES SUPERFUND SITE]
**Doc Type:** ELECTRONIC RECORD
CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | OAKS, F. LAWRENCE | TEXAS HISTORICAL COMMISSION |

| | Name | Organization |
|---|---|---|
| **Addressee:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |

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# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 9059307
**Bates:** 014659 **To:** 014659
**Date:** 12/16/2008
**Pages:** 1
**Title:** [TRANSMITTAL OF THE TANK LIQUID CONSOLIDATION AND REMOVAL REPORT FOR MALONE SERVICE COMPANY SUPERFUND SITE]
**Doc Type:** ELECTRONIC RECORD
CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 860123
**Bates:** 014660 **To:** 014660
**Date:** 12/22/2008
**Pages:** 1
**Title:** [EPA APPROVAL LETTER FOR MALONE SERVICE COMPANY FEASIBILITY STUDY DOCUMENT]
**Doc Type:** CORRESPONDENCE
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | PUGA, ROBERTO | PROJECT NAVIGATOR LTD |

---

**Region Id:** 06
**Docid:** 865252
**Bates:** 014661 **To:** 014723
**Date:** 03/24/2009
**Pages:** 63
**Title:** [MALONE SERVICE CORPORATION INJECTION WELL WDW-138 2009 MECHANICAL INTEGRITY TEST AND BOTTOMHOLE PRESSURE SURVEY REPORT]
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | SANDIA TECHNOLOGIES LLC |

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | NONE |

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**Region Id:** 06
**Docid:** 864247
**Bates:** 014724 **To:** 014728
**Date:** 04/14/2009
**Pages:** 5
**Title:** [MEMORANDUM: WELL LOG FOR MALONE WATER SUPPLY WELL (IN REFERENCE TO NO DEEP GROUND WATER MONITORING)]
**Doc Type:** ELECTRONIC RECORD
INDEX

| | Name | Organization |
|---|---|---|
| **Author:** | BASILE, BRENDA P | URS CORPORATION |
| | **Name** | **Organization** |
| **Addressee:** | PUGA, ROBERTO | URS CORPORATION |

---

**Region Id:** 06
**Docid:** 864991
**Bates:** 014729 **To:** 014730
**Date:** 04/17/2009
**Pages:** 2
**Title:** [MALONE COOPERATING PARTIES TO TEXAS HISTORIC COMMISSION - CONFIRMATION OF PLAN TO MOVE CEMETERY]
**Doc Type:** ELECTRONIC RECORD
CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | JAWETZ, STEVEN | BEVERIDGE AND DIAMOND |
| | **Name** | **Organization** |
| **Addressee:** | MARTIN, WILLIAM | TEXAS HISTORICAL COMMISSION |

---

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 865366
**Bates:** 014731 **To:** 014736
**Date:** 05/01/2009
**Pages:** 6
**Title:** [SITE STATUS SUMMARY APRIL 30, 2009 - MALONE SERVICE COMPANY SUPERFUND SITE]
**Doc Type:** FACTSHEET
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | ABSHIRE, DAVID C | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 874031
**Bates:** 014736.001 **To:** 014736.001
**Date:** 05/01/2009
**Pages:** 1
**Title:** MALONE SERVICE PROPOSED PLAN - TCEQ SUPPORT LETTER
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | DUKE, FAY | TEXAS COMMISSION ON ENVIRONMENTAL QUALITY |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 865402
**Bates:** 014737 **To:** 014737
**Date:** 05/01/2009
**Pages:** 1
**Title:** [TCEQ SUPPORT FOR THE PREFERRED REMEDY FOR THE MALONE SERVICE COMPANY SITE]
**Doc Type:** ELECTRONIC RECORD
CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | DUKE, FAY | TEXAS COMMISSION ON ENVIRONMENTAL QUALITY |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, DAVID C | U.S. ENVIRONMENTAL PROTECTION AGENCY |

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 866572
**Bates:** 014738 **To:** 014741
**Date:** 05/01/2009
**Pages:** 4
**Title:** [FACT SHEET: EPA ANNOUNCES PROPOSED PLAN MALONE SERVICE COMPANY SUPERFUND SITE]
**Doc Type:** ELECTRONIC RECORD
FACTSHEET

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 865742
**Bates:** 014742 **To:** 014770
**Date:** 05/11/2009
**Pages:** 29
**Title:** [PROPOSED PLAN - MALONE SERVICE COMPANY (SWAN LAKE) SUPERFUND SITE TEXAS CITY, GALVESTON COUNTY, TEXAS]
**Doc Type:** REPORT / STUDY
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

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# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 9094020
**Bates:** 014771 **To:** 014822
**Date:** 05/12/2009
**Pages:** 52
**Title:** [PROPOSED PLAN ADMINISTRATIVE RECORD INDEX FOR THE MALONE SERVICE COMPANY SUPERFUND SITE]
**Doc Type:** INDEX

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 866569
**Bates:** 014823 **To:** 014823
**Date:** 05/22/2009
**Pages:** 1
**Title:** [PUBLIC NOTICE: U.S. EPA REGION 6 PUBLIC NOTICE ANNOUNCES THE PROPOSED PLAN FOR REMEDIATION OF THE MALONE SERVICE COMPANY SUPERFUND SITE]
**Doc Type:** ELECTRONIC RECORD
NOTICE

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 870381
**Bates:** 014824 **To:** 014829
**Date:** 06/08/2009
**Pages:** 6
**Title:** [RESPONSE FROM FRANK DICK REGARDING PROPOSED PLAN]
**Doc Type:** CORRESPONDENCE

| | Name | Organization |
|---|---|---|
| **Author:** | DICK, FRANK | NONE |
| | **Name** | **Organization** |
| **Addressee:** | ABSHIRE, DAVID C | U.S. ENVIRONMENTAL PROTECTION AGENCY |

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 874033
**Bates:** 014830 **To:** 014850
**Date:** 06/09/2009
**Pages:** 21
**Title:** [PUBLIC MEETING TRANSCRIPT - MALONE SERVICE COMPANY SUPERFUND SITE PROPOSED PLAN PUBLIC MEETING]
**Doc Type:** PUBLIC MEETING TRANSCRIPT
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | ROCHELLE, JOHN G | ESQUIRE DEPOSITION SOLUTIONS |

| | Name | Organization |
|---|---|---|
| **Addressee:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

**Region Id:** 06
**Docid:** 874032
**Bates:** 014851 **To:** 014852
**Date:** 06/22/2009
**Pages:** 2
**Title:** [SCENIC GALVESTON - COMMENTS ON MALONE SERVICE PROPOSED PLAN]
**Doc Type:** ELECTRONIC RECORD
REPORT / STUDY

| | Name | Organization |
|---|---|---|
| **Author:** | MASON, LALISE | SCENIC GALVESTON INCORPORATED |

| | Name | Organization |
|---|---|---|
| **Addressee:** | ABSHIRE, CHARLES D | U.S. ENVIRONMENTAL PROTECTION AGENCY |

---

# ADMINISTRATIVE RECORD INDEX

**10/01/2009** **Region Id: 06**

## ADMINISTRATIVE RECORD

**Site Name:** MALONE SERVICE CO - SWAN LAKE PLANT
**CERCLIS:** TXD980864789
**OUID:** 00
**SSID:** GZ
**Action:** RECORD OF DECISION

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**Region Id:** 06
**Docid:** 9100519
**Bates:** 014853 **To:** 014858
**Date:** 09/01/2009
**Pages:** 6
**Title:** SITE STATUS SUMMARY FOR MALONE SERVICE COMPANY
**Doc Type:** FACTSHEET

| | Name | Organization |
|---|---|---|
| **Author:** | NONE, | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

---

**Region Id:** 06
**Docid:** 9109310
**Bates:** 014859 **To:** 015100
**Date:** 09/30/2009
**Pages:** 243
**Title:** RECORD OF DECISION FOR MALONE SERVICE COMPANY SUPERFUND SITE
**Doc Type:** RECORD OF DECISION / AMENDMENT
ELECTRONIC RECORD

| | Name | Organization |
|---|---|---|
| **Author:** | ABSHIRE, CHARLES | U.S. ENVIRONMENTAL PROTECTION AGENCY |
| | **Name** | **Organization** |
| **Addressee:** | NONE, | NONE |

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# Appendix B – State of Texas Concurrence Letter

# TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

*Protecting Texas by Reducing and Preventing Pollution*

September 29, 2009

Mr. Samuel Coleman, P.E., Director
Superfund Division
U.S. Environmental Protection Agency, Region 6
1445 Ross Avenue
Dallas, Texas 75202

Re: Record of Decision
Malone Service Company (Swan Lake) Superfund Site
Texas City, Galveston County, Texas

Dear Mr. Coleman:

The Texas Commission on Environmental Quality (TCEQ) received the final Superfund Record of Decision (ROD) for the above-referenced site on September 19, 2009. We have completed our review and concur that the response action described in the ROD is the most appropriate remedy for this site.

Sincerely,

Mark R. Vickery, P.G.
Executive Director

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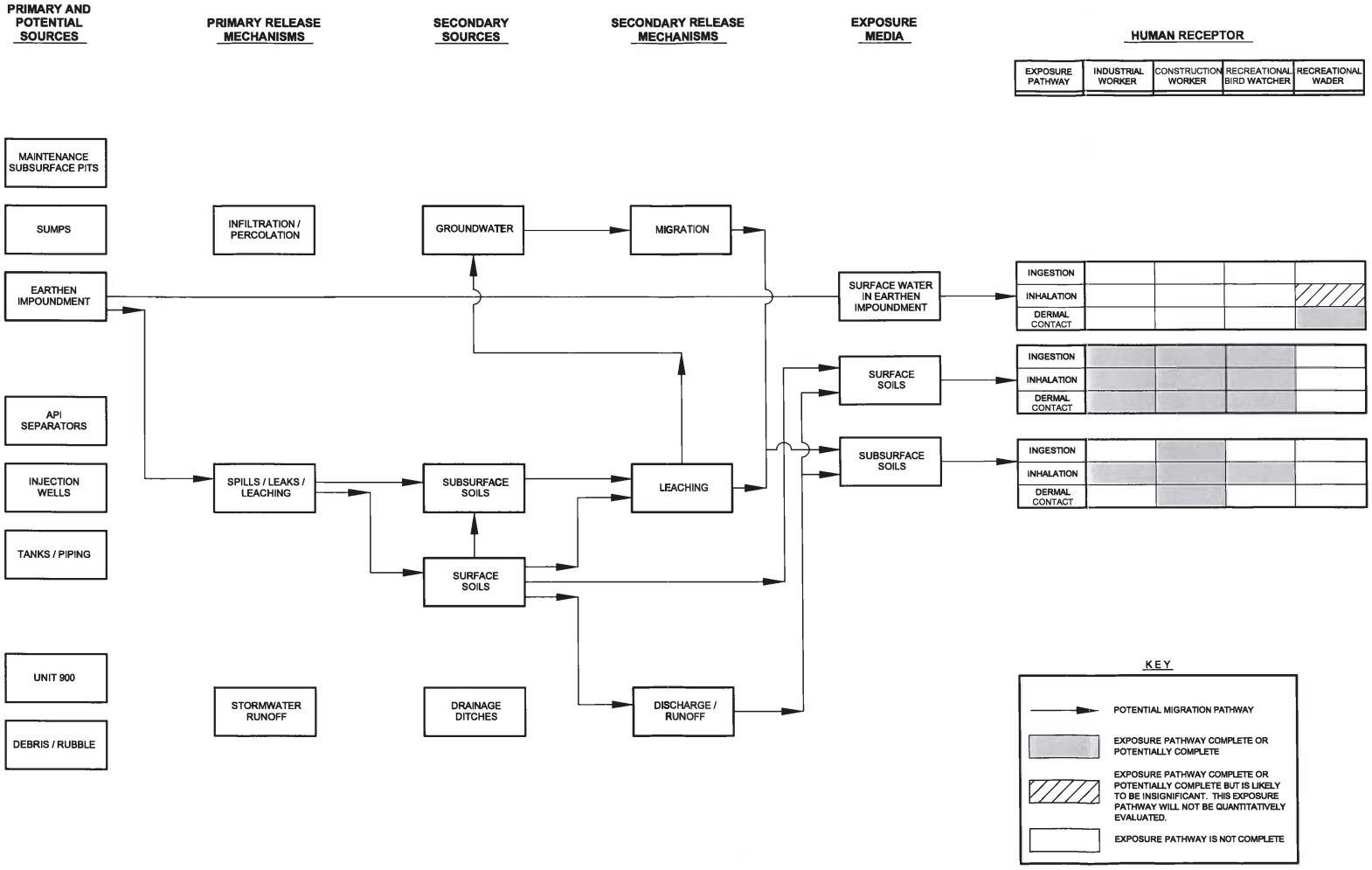
# Attachment 1 – Baseline Human Health Risk Assessment Figures




MALONE SERVICE CO.
SUPERFUND SITE

URS
9801 Westheimer
Suite 500
Houston, Texas 77042
PH: (713) 914-6699
FAX: (713) 914-8404

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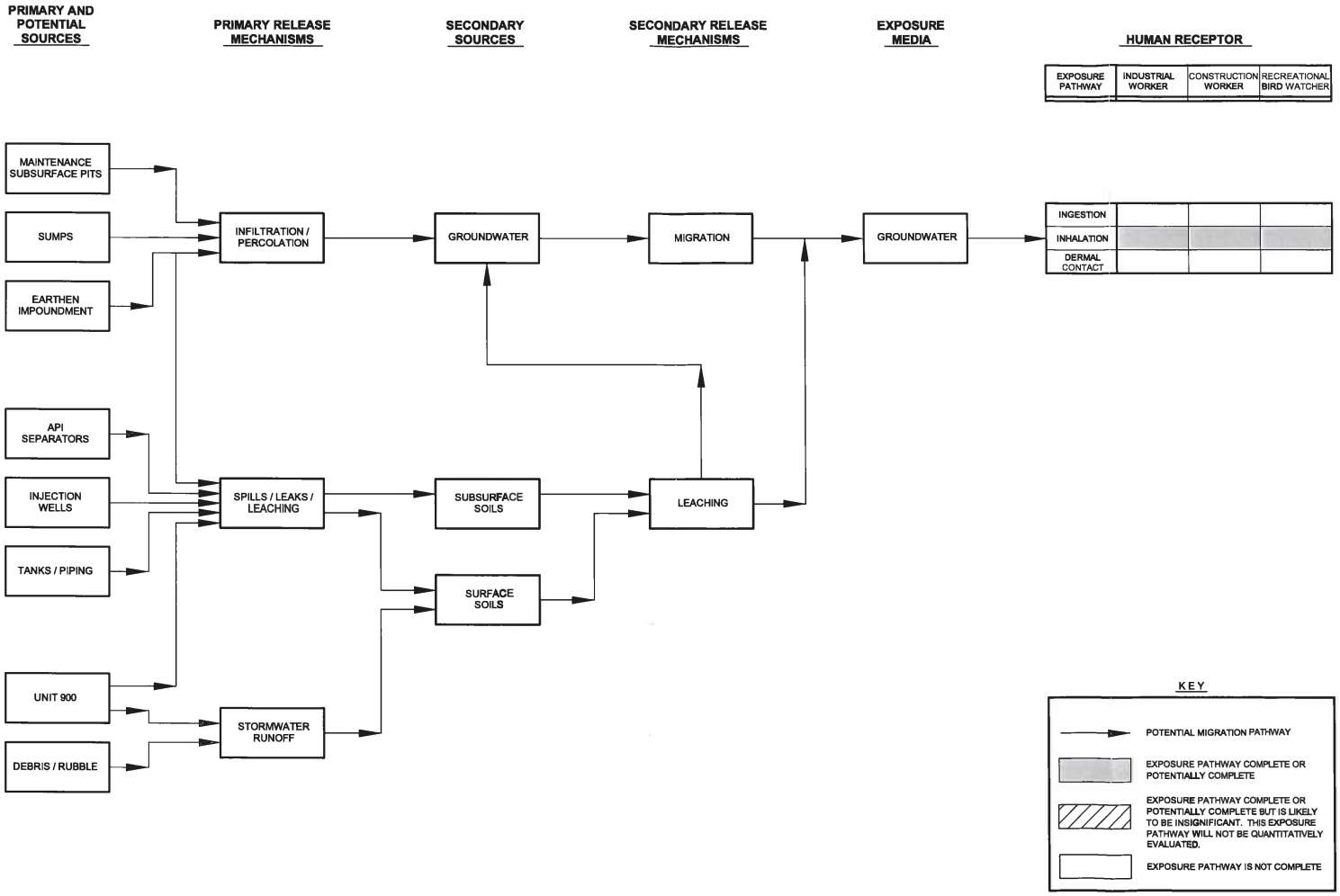
CONCEPTUAL MODEL
EARTHEN IMPOUNDMENT AREA

FILE NO.
Conceptual Model Earthen Impound Area.dwg

FIGURE NO.
5

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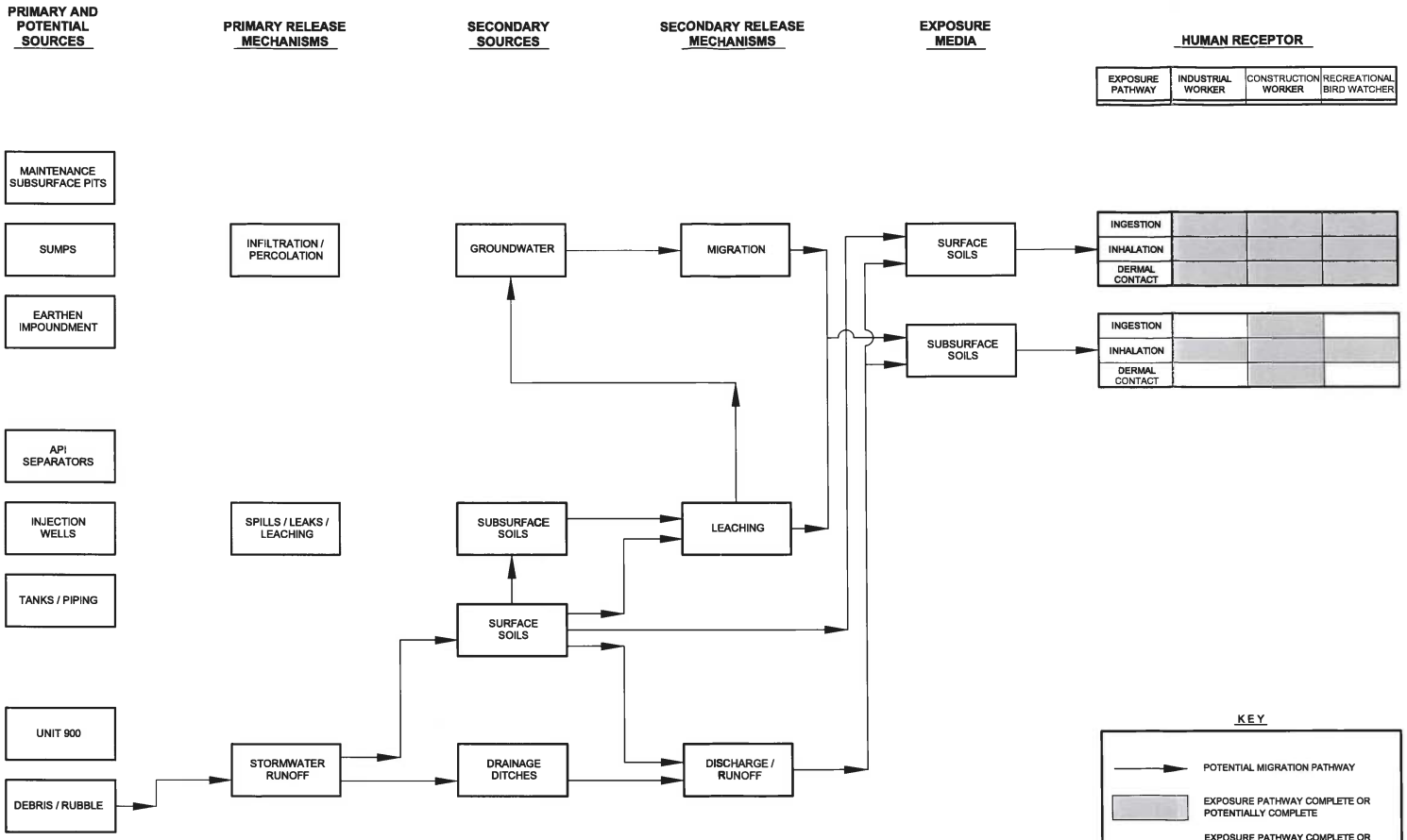
CONCEPTUAL MODEL
GROUNDWATER

FILE NO.
Conceptual Model Groundwater.dwg

FIGURE NO.
7

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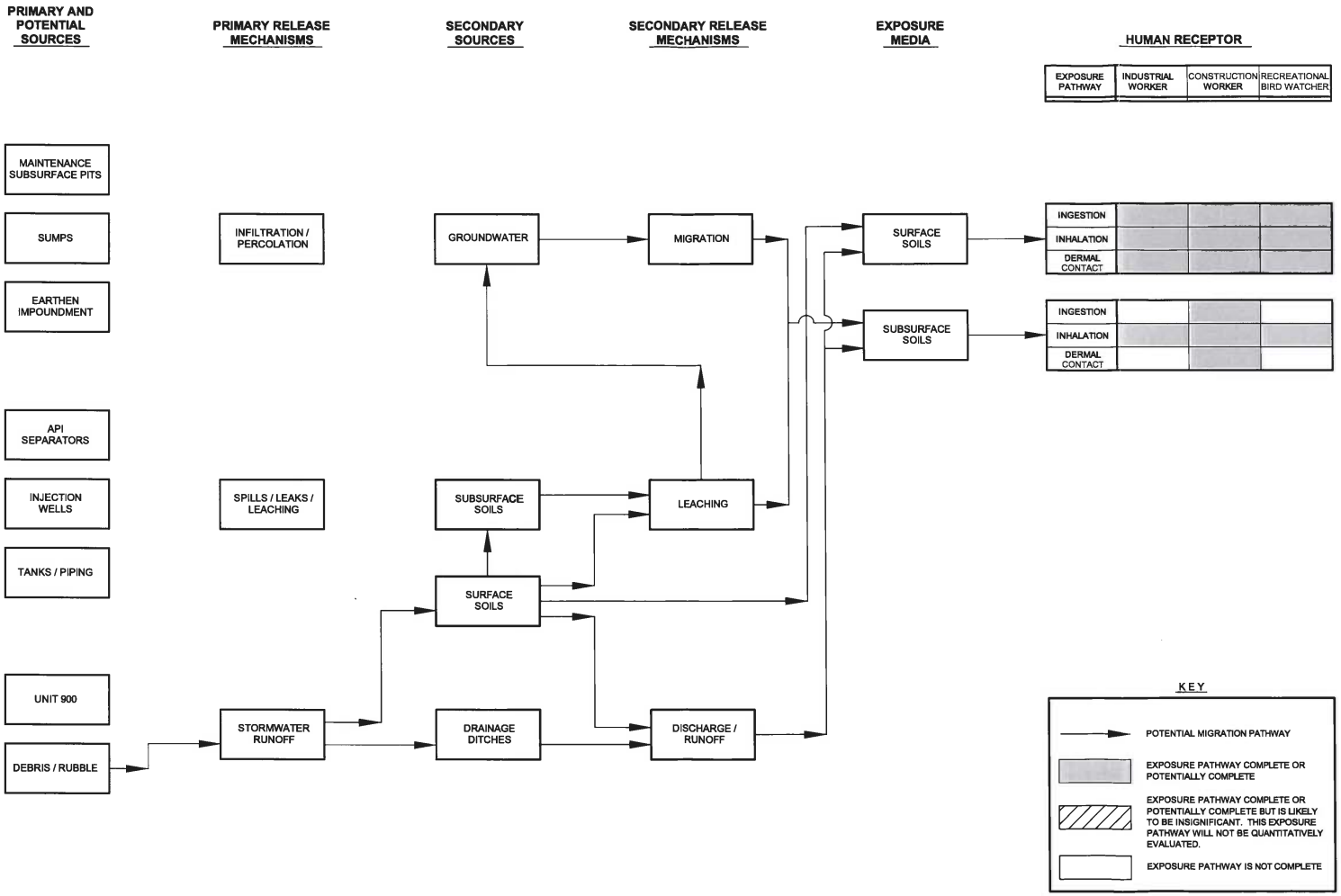
CONCEPTUAL MODEL
LAYDOWN AREA

FILE NO.
Conceptual Model Laydown Area.dwg

FIGURE NO.
9

K:\ELM\811102_Mol...rmedial Investigation & Feasibility Study_GA\Drawings\Acad\Drawings\BHHRA Report\Fig 9 - Concept...dal-Laydown Area.dwg\Layout1 Jun 01, 2006 - 5:26pm

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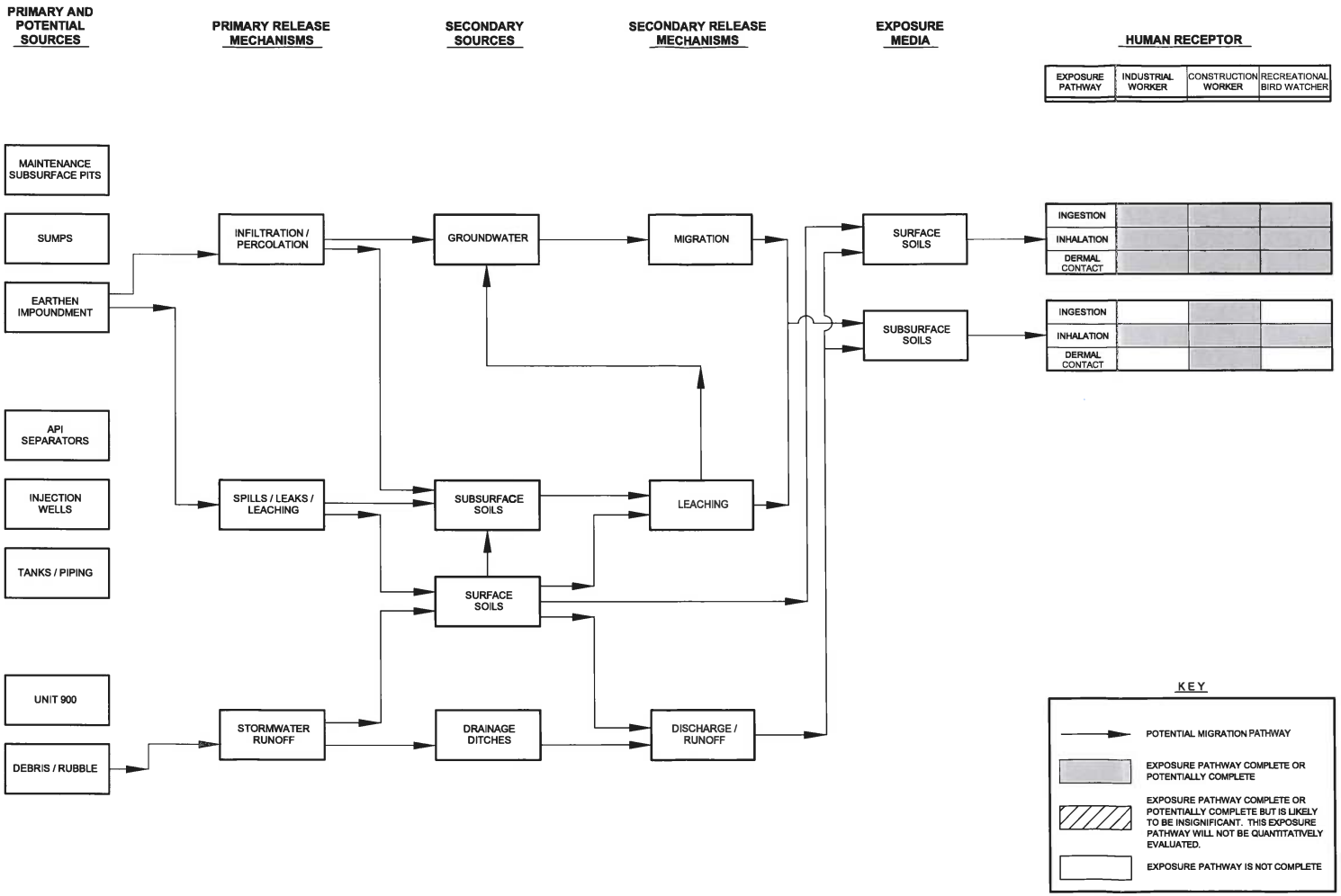
| AS SHOWN | CHKD. BY: | BPB | DATE: | 3-7-06 |

CONCEPTUAL MODEL
CEMETERY AREA

FILE NO.
Conceptual Model Cemetery Area.dwg

FIGURE NO.
11

K:\ELM\811102.Mul...rmedial Investigation & Feasibility Study...03\Drawings\Acad\Drawings\BHHRA Report\Fig 11 - Concep...todel - Cemetery Area.dwg Layout1 Jun 01, 2006 - 5:27pm

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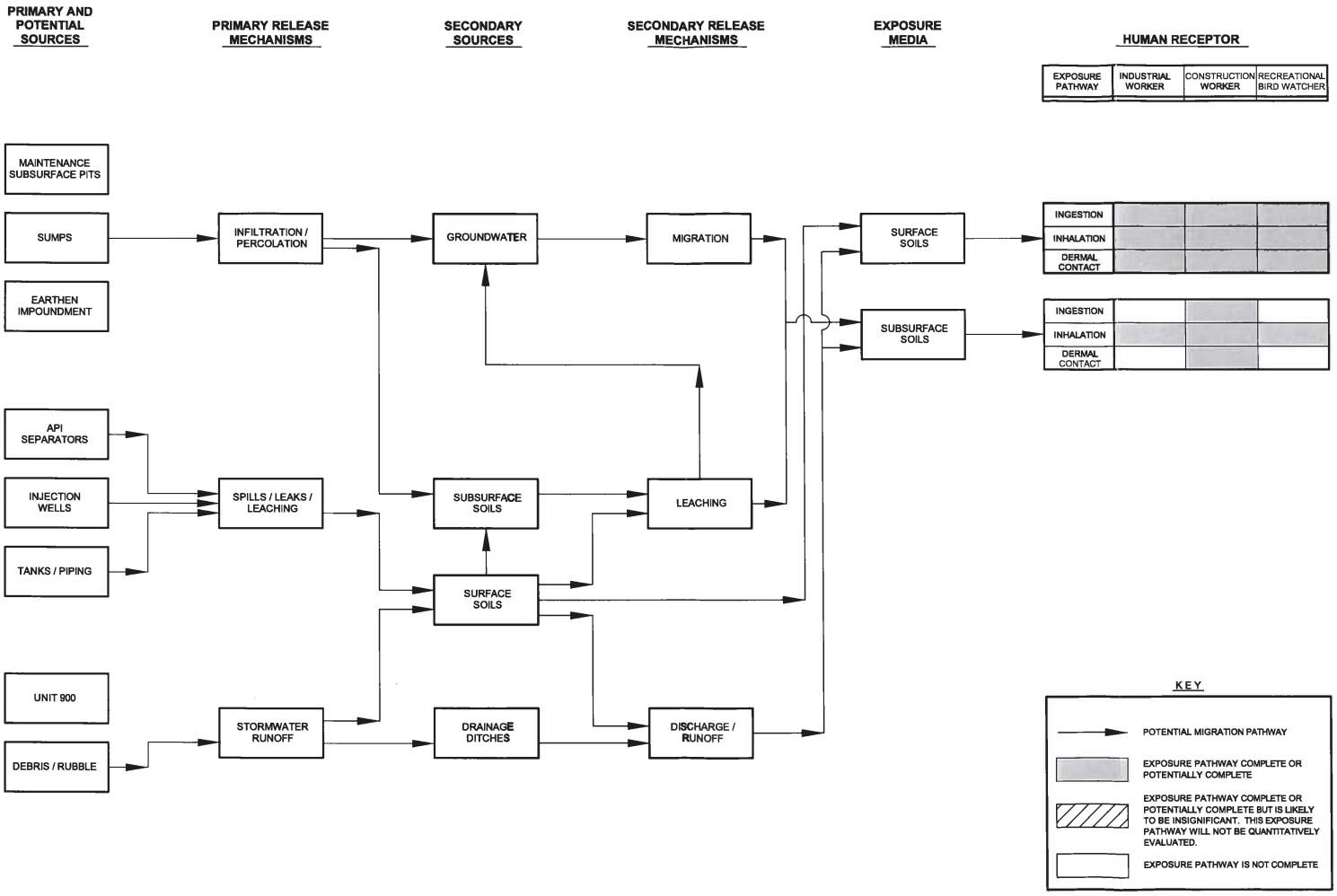
CHKD. BY: BPB DATE: 3-7-06

CONCEPTUAL MODEL
UNUSED AREA 1 /
EARTHEN IMPOUNDMENT
SOIL

FILE NO.
Conceptual Model Unused Area 1.dwg

FIGURE NO.
13

K:\ELM\B11102_Mali...rmedial Investigation & Feasibility Study_03\Drawings\Acad\Drawings\BHHRA Report\Fig 13 - Concep...odel- Unused Area 1.dwgLayout1 Jun 01, 2006 - 5:33pm

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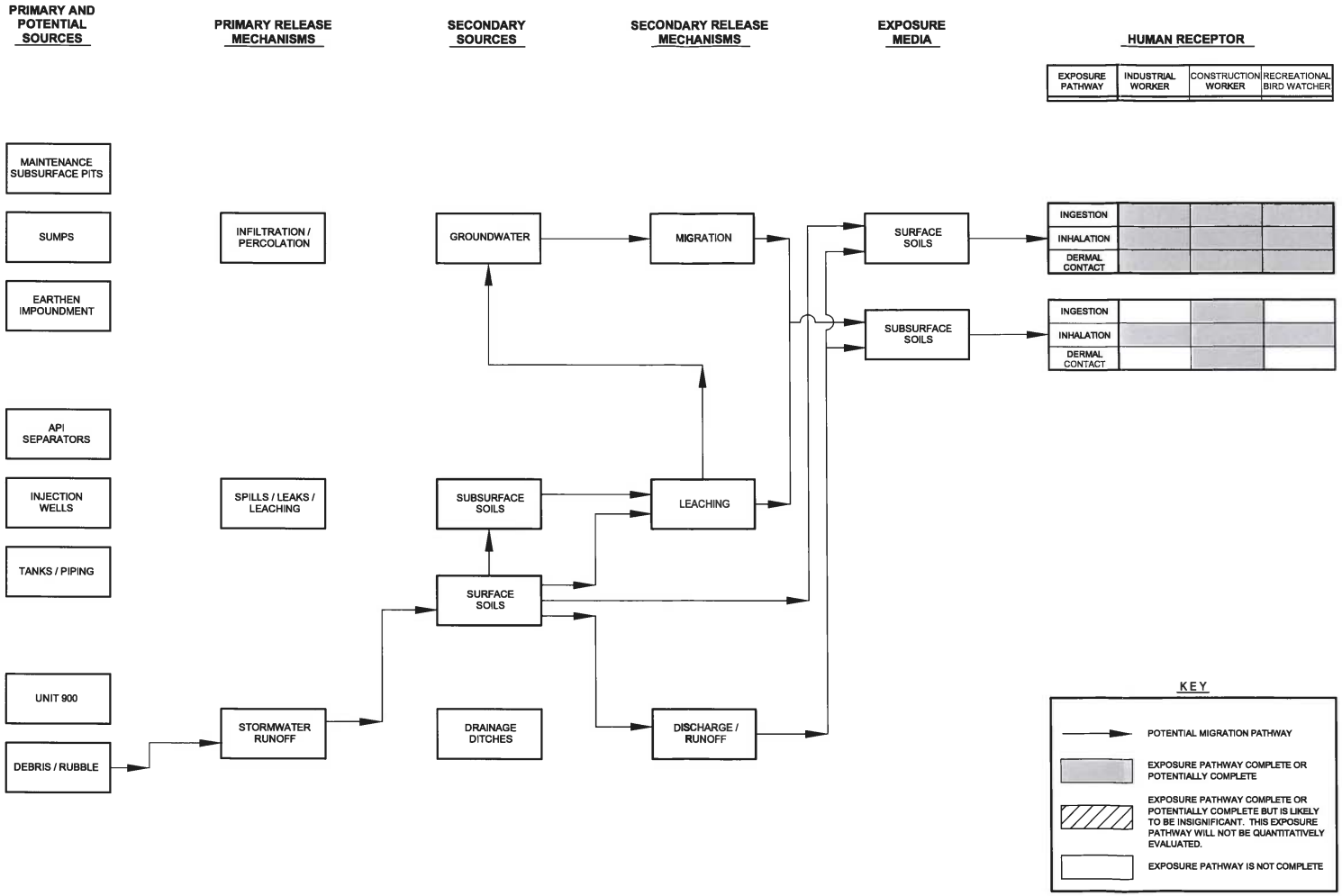
CHKD. BY: BPB | DATE: 3-7-06

CONCEPTUAL MODEL
UNUSED AREA 2 /
WDW-138

FILE NO.
Conceptual Model Unused Area 2.dwg

FIGURE NO.
15

K:\ELM\811102_Malc_...rmediat Investigation & Feasibility Study_03\Drawings\Acad\Drawings\BHHRA Report\Fig 15 - Concep...odel-Unused Area 2.dwg Layout1 Jun 01, 2006 - 5:34pm

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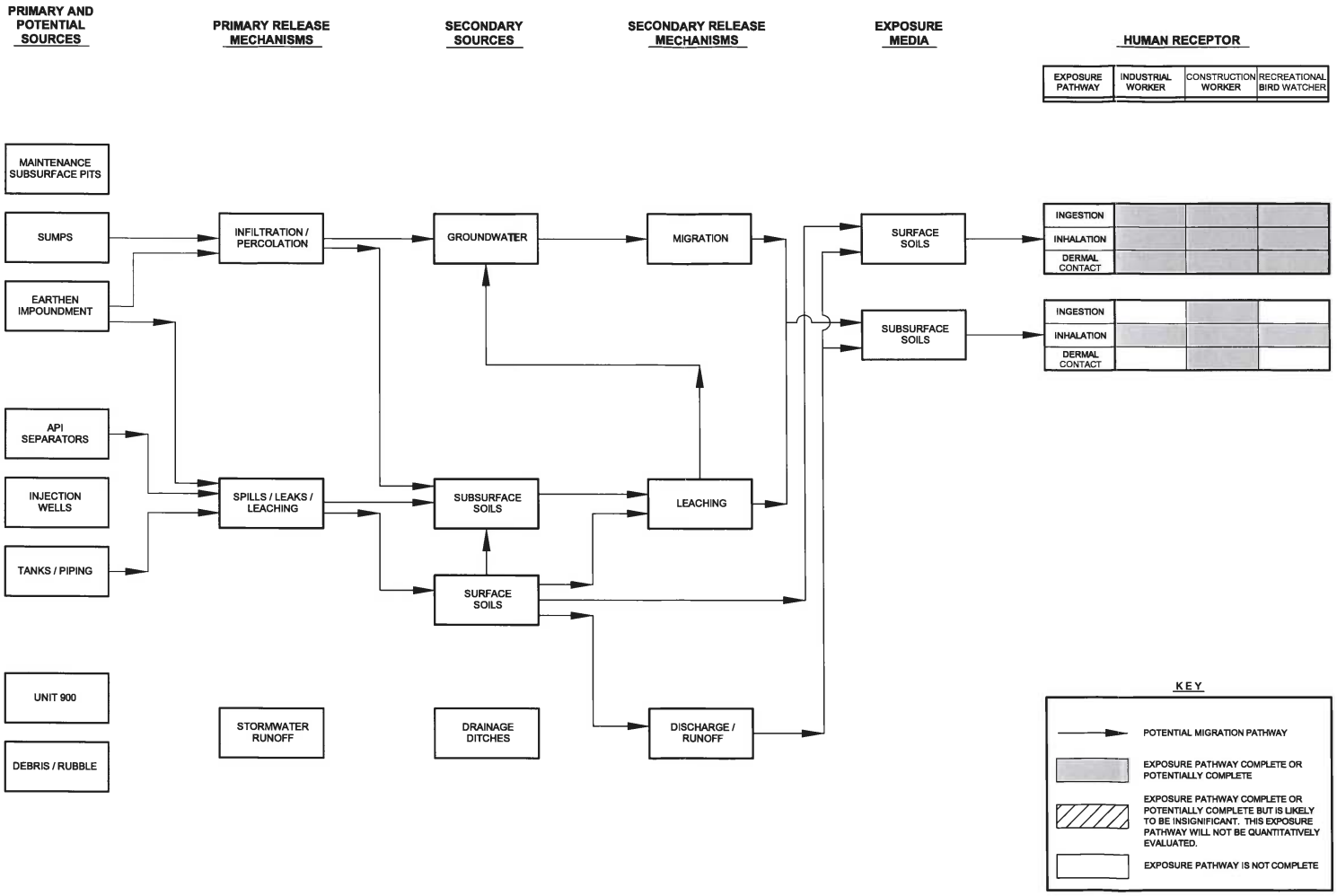
CONCEPTUAL MODEL
BORROW PIT

FILE NO.
Conceptual Model Borrow Pit.dwg

FIGURE NO.
17

K:\ELM\611102_Mal... emediol Investigation & Feasibility Study_03\Drawings\Acad\Drawings\BHHRA Report\Fig 17 - Concep... todel-Borrow Pit.dwgLayout1 Jun 01, 2006 - 5:35pm

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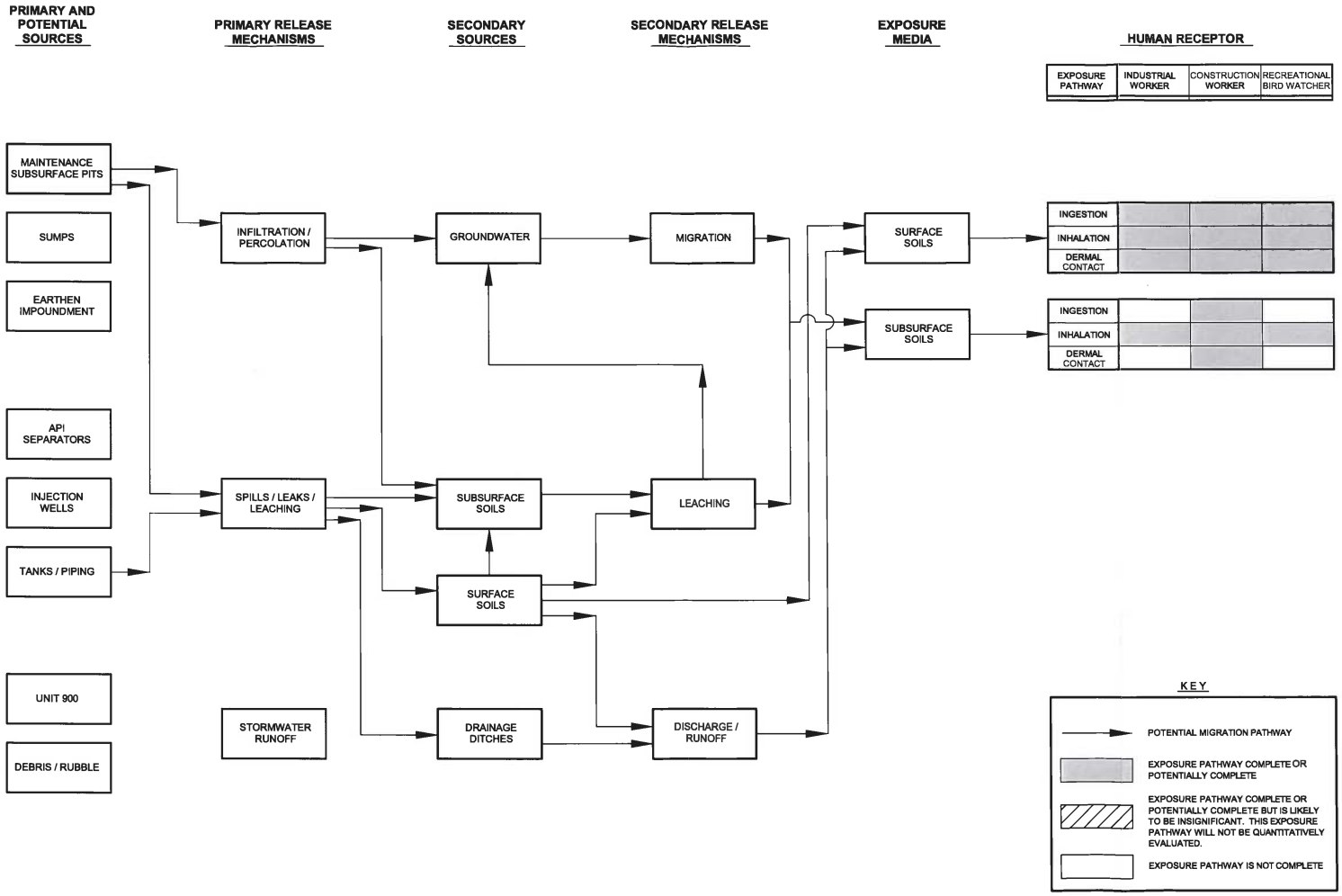
CONCEPTUAL MODEL
OFFICE AND LAB AREA

FILE NO.
Conceptual Model Office-Lab Area.dwg

FIGURE NO.
18

K:\ELM\611102_Mal...rmedial Investigation & Feasibility Study_03\Drawings\Acad\Drawings\BHHRA Report\Fig 18 - Concep...ndal-Office Lab Area.dwgLayout1 Jun 01, 2006 - 5:36pm

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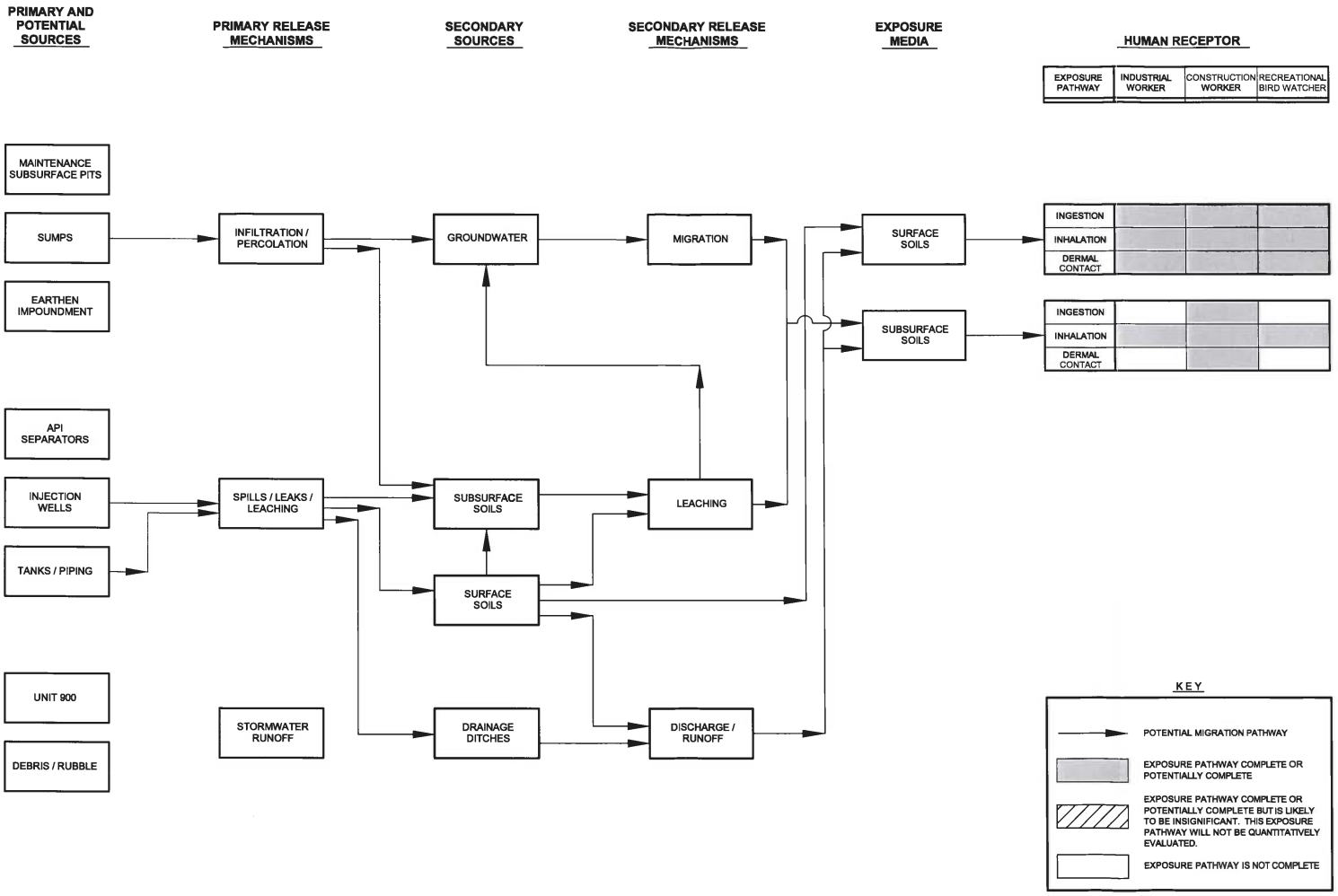
| AS SHOWN | CHKD. BY: | BPB | DATE: | 3-7-06 |

CONCEPTUAL MODEL
MAINTENANCE AREA
PITS

FILE NO.
Conceptual Model Maintenance Area Pits.dwg

FIGURE NO.
20

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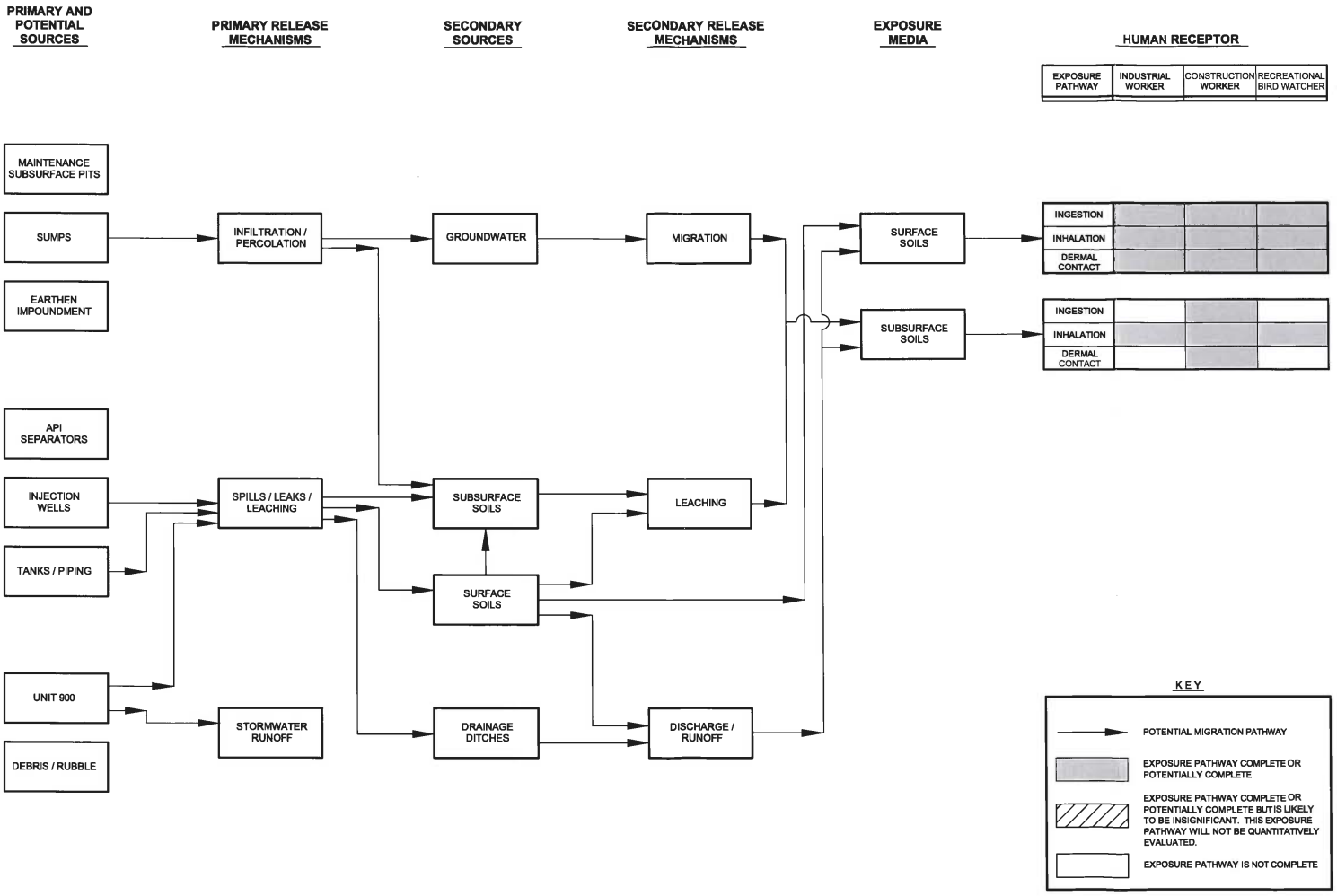
CONCEPTUAL MODEL
MAINTENANCE AREA
WAREHOUSE

FILE NO.
Conceptual Model Maintenance Area Warehouse.dwg

FIGURE NO.
21

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CONCEPTUAL MODEL
MAINTENANCE AREA
UNIT 900

FILE NO.
Conceptual Model Maintenance Area 900.dwg

FIGURE NO.
22

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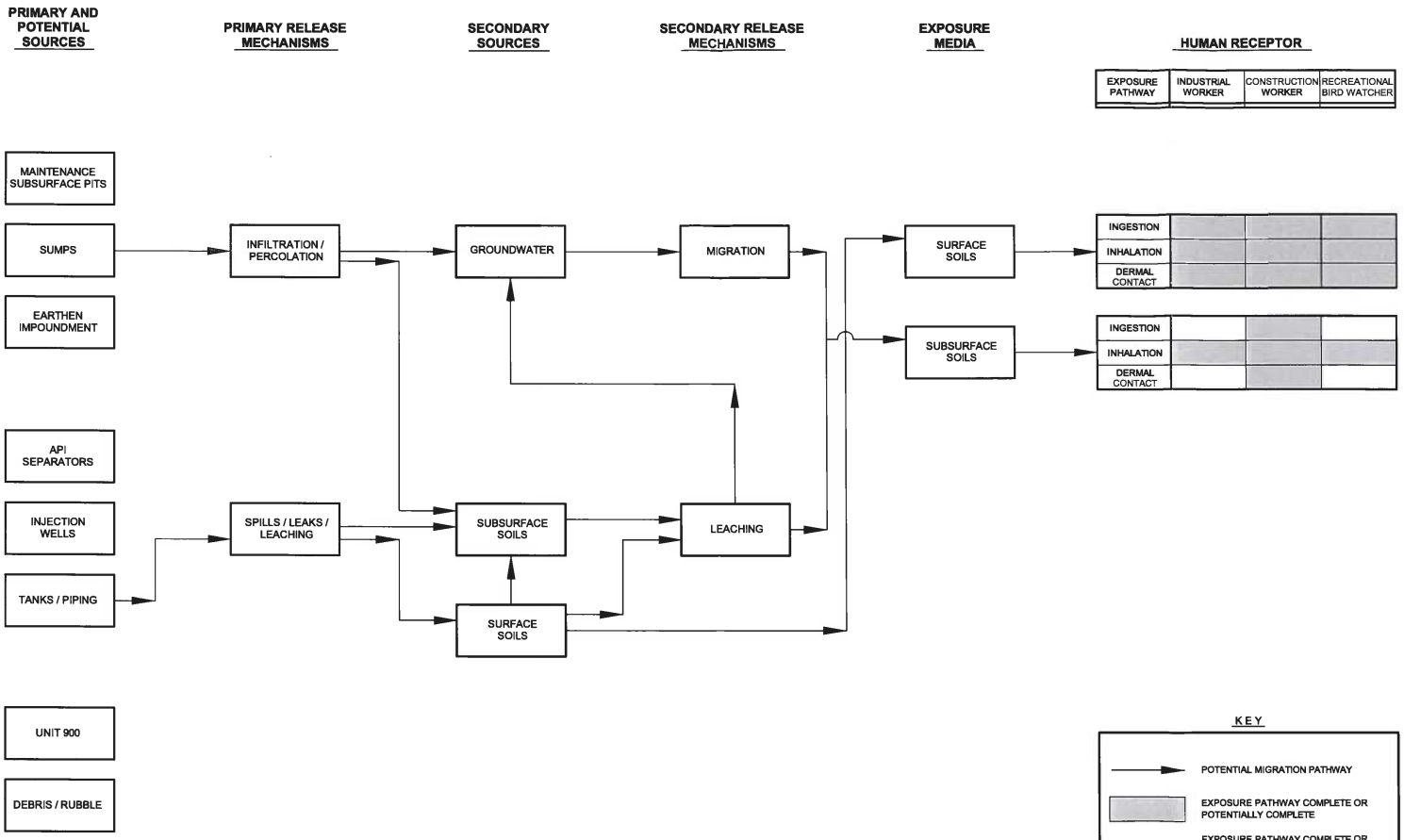


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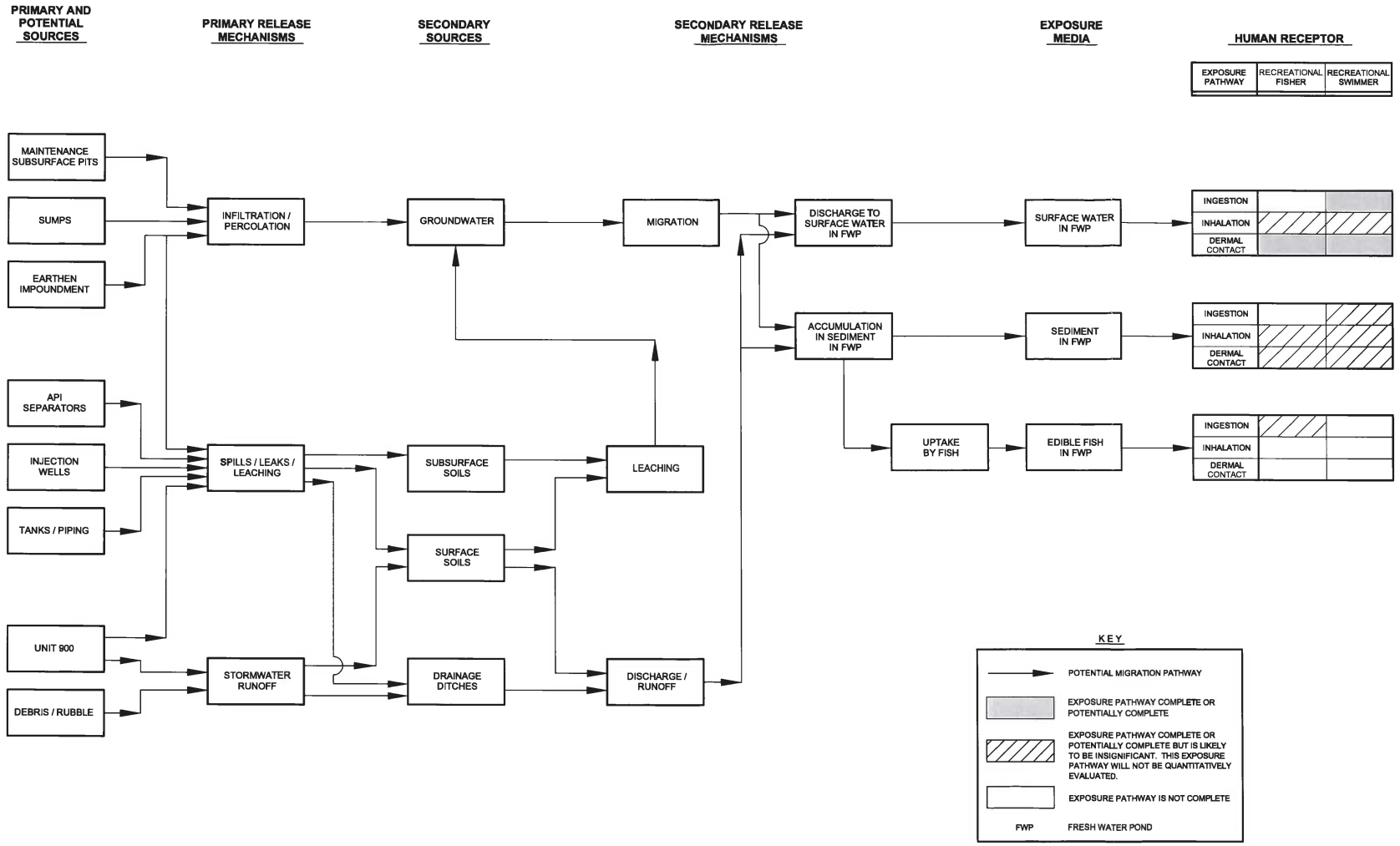
| AS SHOWN | CHKD. BY: | BPB | DATE: | 3-7-06 |

CONCEPTUAL MODEL
TANK 800 AREA

FILE NO.
Conceptual Model Tank 800 Area.dwg

FIGURE NO.
23

K:\ELM\811102_Mal... medial Investigation & Feasibility Study_03\Drawings\Acad\Drawings\BHHRA Report\Fig 23 - Concep... odel-Tank 800 Area.dwgLayout1 Jun 01, 2006 - 5:41pm

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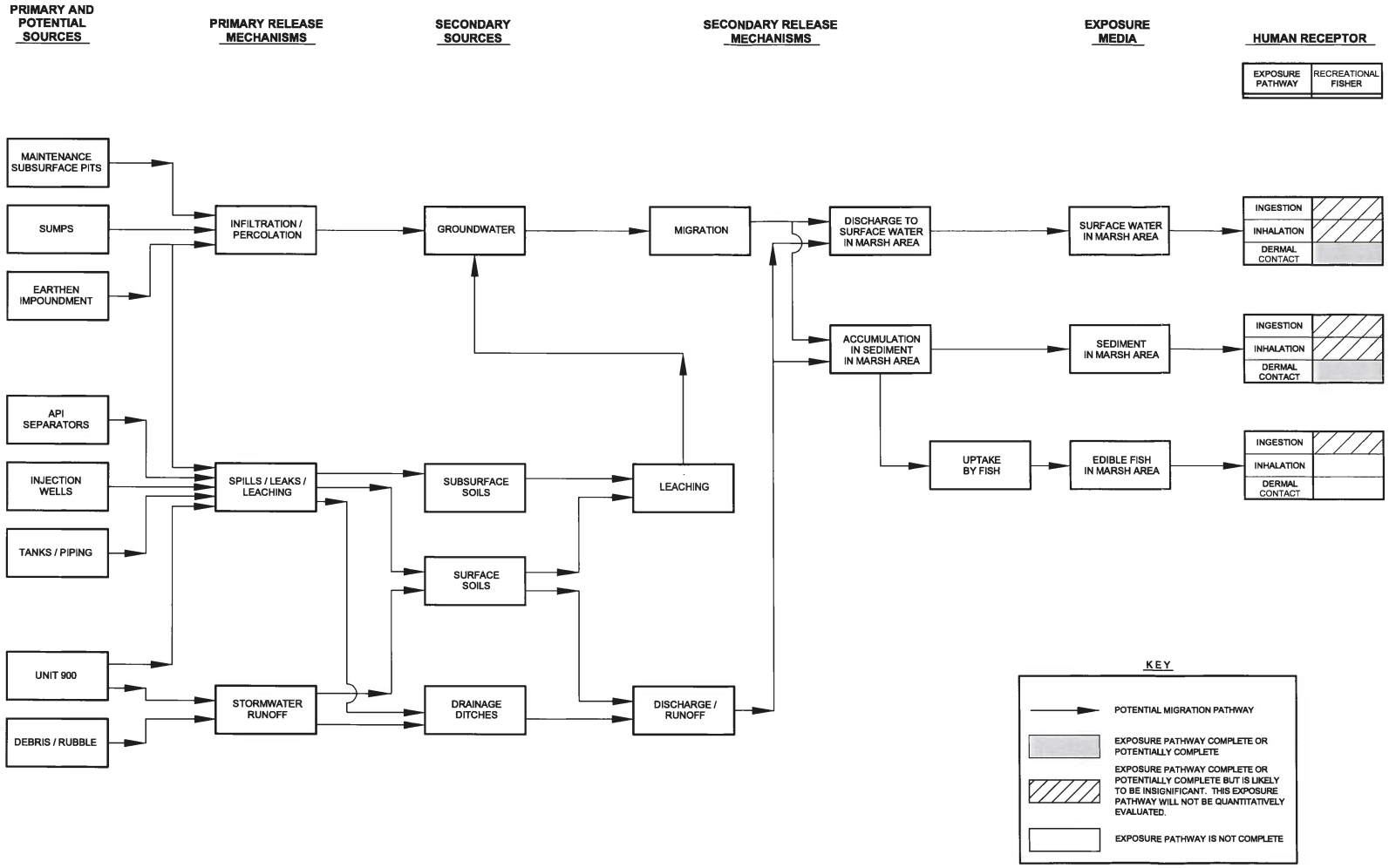
| AS SHOWN | CHKD. BY: | BPB | DATE: | 3-7-06 |

CONCEPTUAL MODEL
FRESHWATER POND

FILE NO.
Conceptual Model Freshwater Pond.dwg

FIGURE NO.
25

K:\ELM\611102_Malone\Remedial Investigation & Feasibility Study_03\Drawings\Acad\Drawings\BHHRA Report\Fig 25 - Conceptual Model - Freshwater Pond.dwg Layout1 Jun 07, 2006 - 9:18am

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| AS SHOWN | CHKD. BY: | BPB | DATE: | 5-30-06 |

CONCEPTUAL MODEL
MARSH AREA

FILE NO.
Conceptual Model Marsh Area.dwg

FIGURE NO.
27

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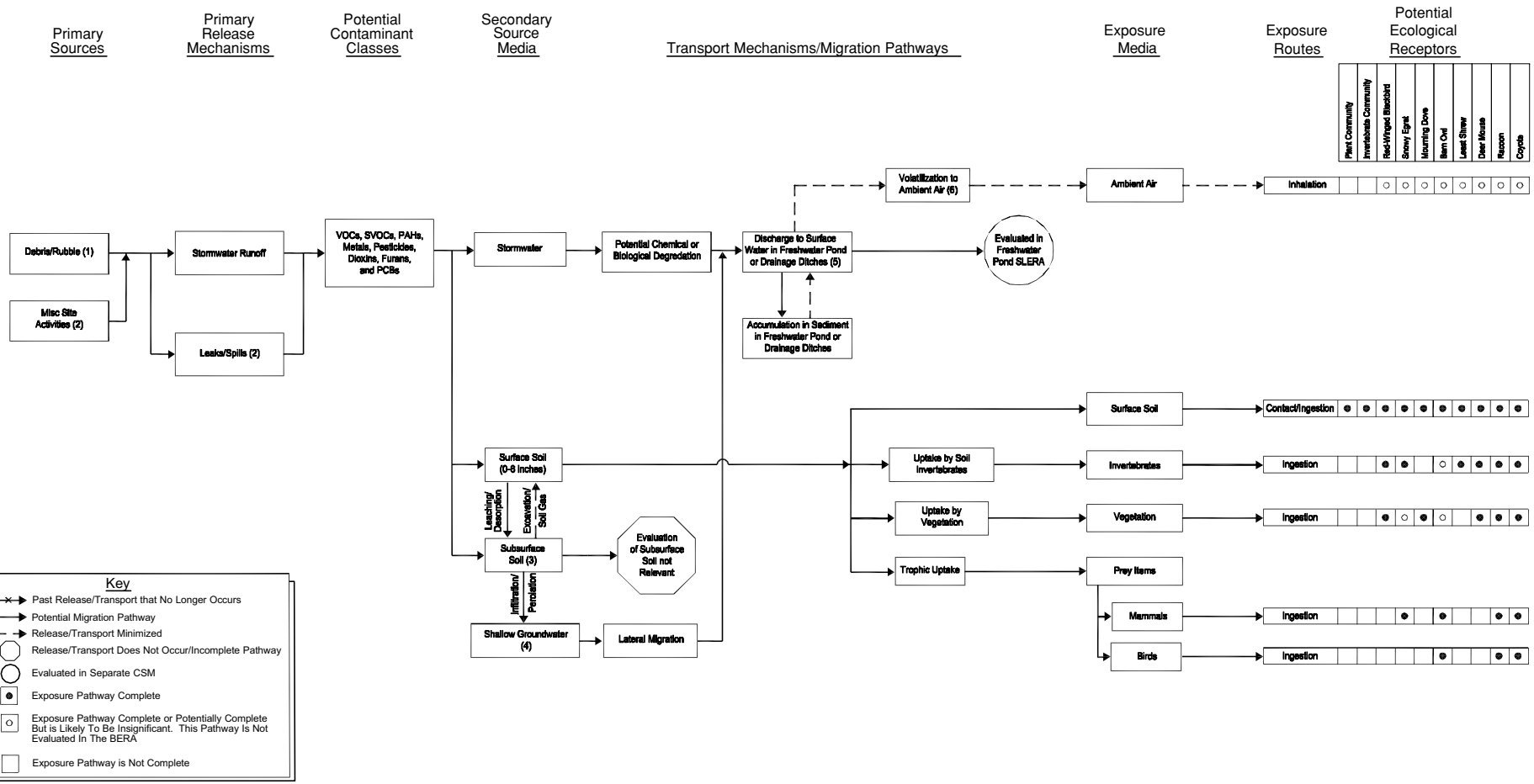
# Attachment 2 – Baseline Ecological Risk Assessment Figures




NOTES:

(1) The Laydown Area was used for storage of miscellaneous equipment, debris and concrete rubble. Several areas, such as the Borrow Pit, have no history of site activities.

(2) Equipment may have contained waste materials.

(3) Subsurface soil (below 6 inches) is not evaluated for ecological exposure.

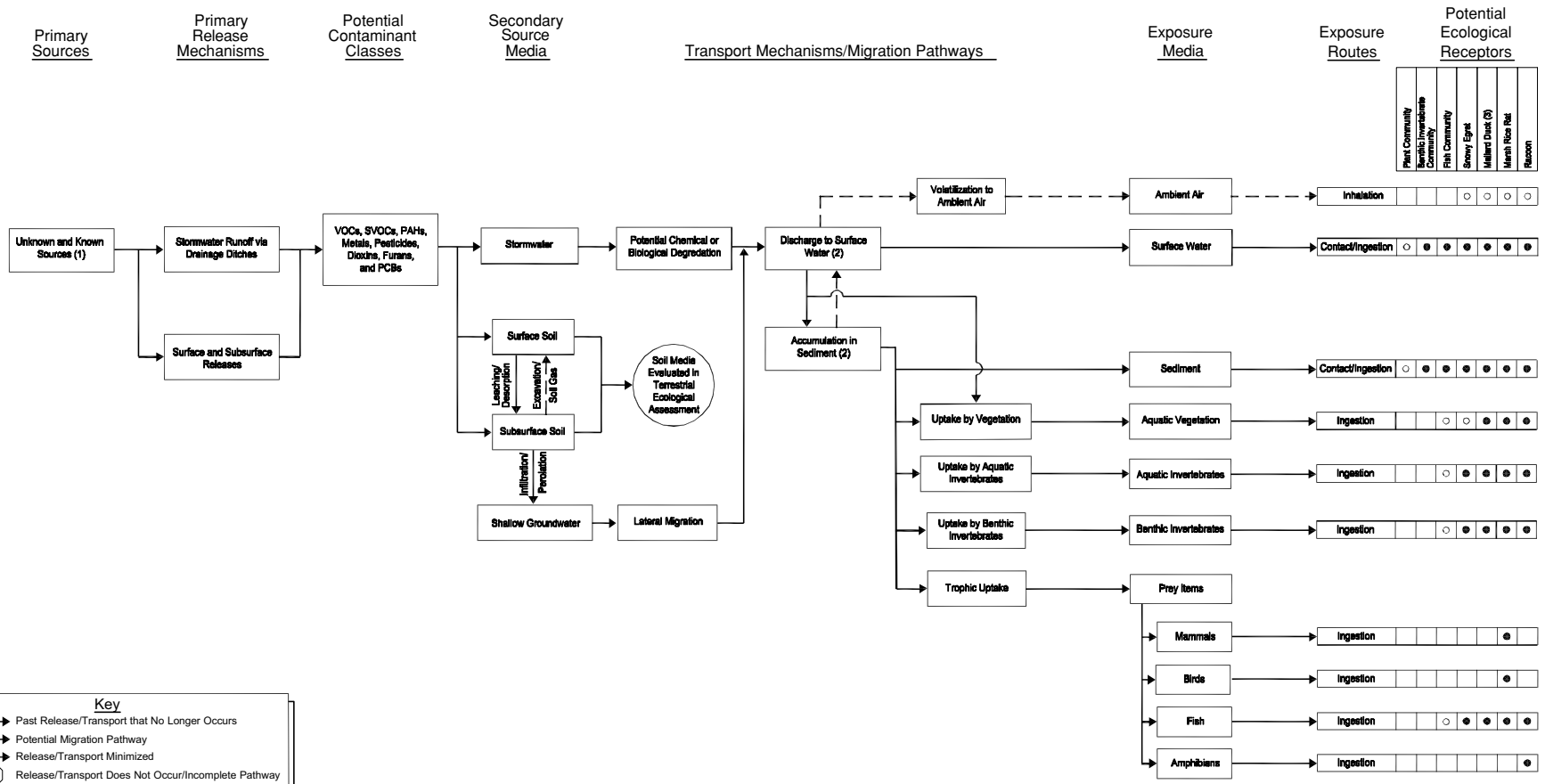
(4) Shallow groundwater is not available to ecological receptors.

(5) Runoff is channeled to the Freshwater Pond or drainage ditches, where it is collected and disposed of.

(6) Exposure of VOC via inhalation is not addressed in the ecological risk assessment, although pathway may be complete, it is likely insignificant.

| | | | |
|---|---|---|---|
| MALONE SERVICE CO. SUPERFUND SITE | URS 9801 Westheimer Suite 500 Houston, Texas 77042 PH: (713) 914-6699 FAX: (713) 914-8404 | CONCEPTUAL SITE MODEL TERRESTRIAL | FILE NO. Conceptual Site Model Terrestrial.dwg |
| | SCALE: AS SHOWN; DRAWN BY: DAL DATE: 12-19-06; CHKD. BY: BPB DATE: 12-19-06 | | FIGURE NO. 9 |

K:\EIM\811102_Malone_Remedial Investigation & Feasibility Study_03\Drawings\Acad\Drawings\BERA\Fig 9 - Conceptual Site Model-Terrestrial.dwg Fig 15 Dec 19, 2006 - 10:55am




NOTES:

(1) The Freshwater Pond receives storm water runoff/discharge from the undeveloped areas routed through the Drainage Area ditches. The Drainage Area consists of three drainage ditches surrounding the operating areas.
(2) The Freshwater Pond and Drainage Area provide aquatic habitat.
(3) Mallard duck only applicable to Freshwater Pond.

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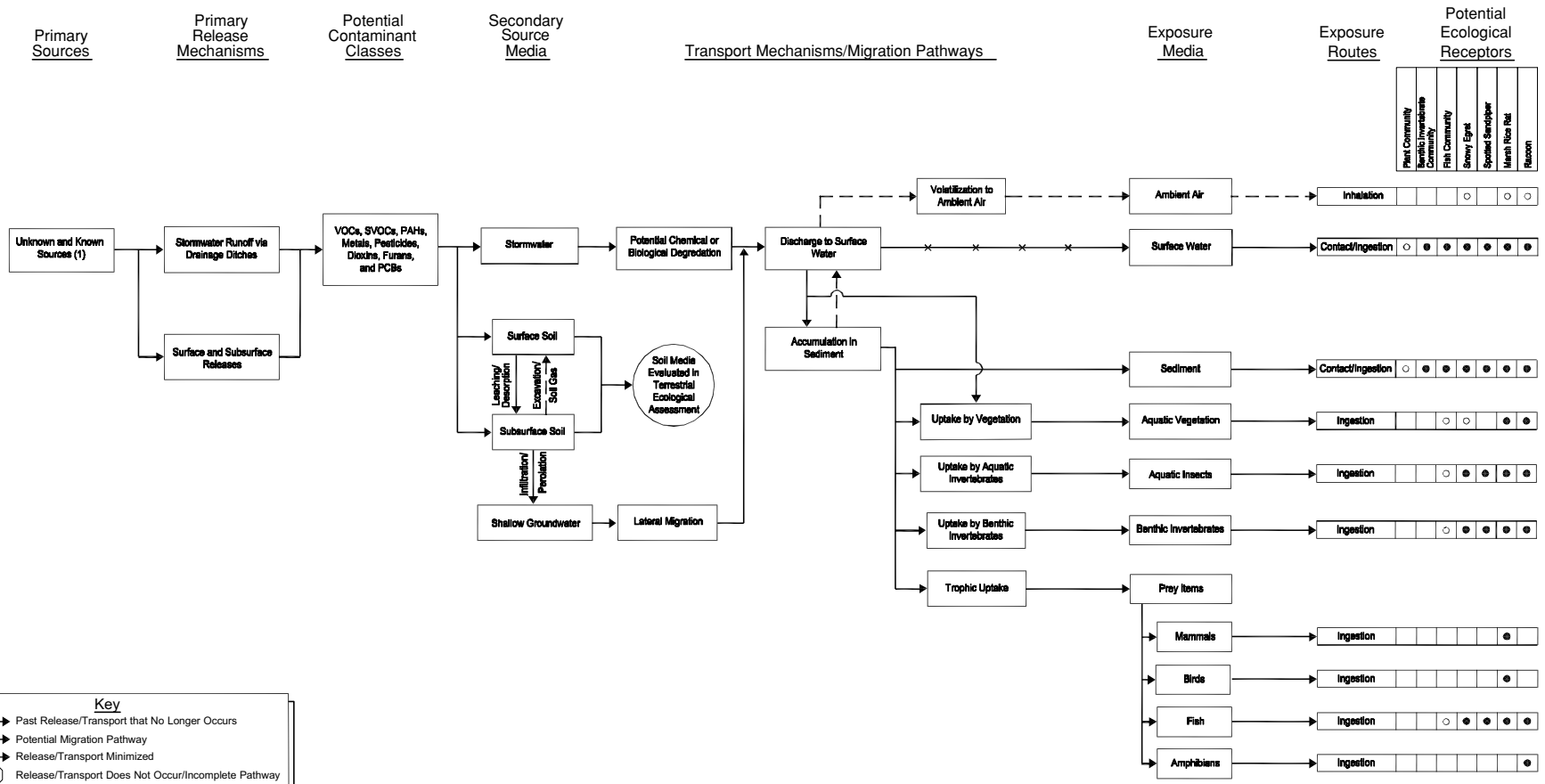
FRESHWATER POND AND DRAINAGE AREA CONCEPTUAL SITE MODEL AQUATIC

FILE NO.
Conceptual Site Model Aquatic-Freshwater Pond.dwg

FIGURE NO.
10

K:\EVM\811102_Malone_Remedial Investigation & Feasibility Study_03\Drawings\Acad\Drawings\BERA\Fig 10 - Conceptual Site Model - Aquatic - Freshwater Pond.dwg Fig 13 Dec 19, 2006 - 10:39am




**NOTES:**

**(1) The Marsh Area is located outside the MSC Superfund Site hurricane levee. Shallow drainage channels have incised into the Marsh Area from storm water discharge.**

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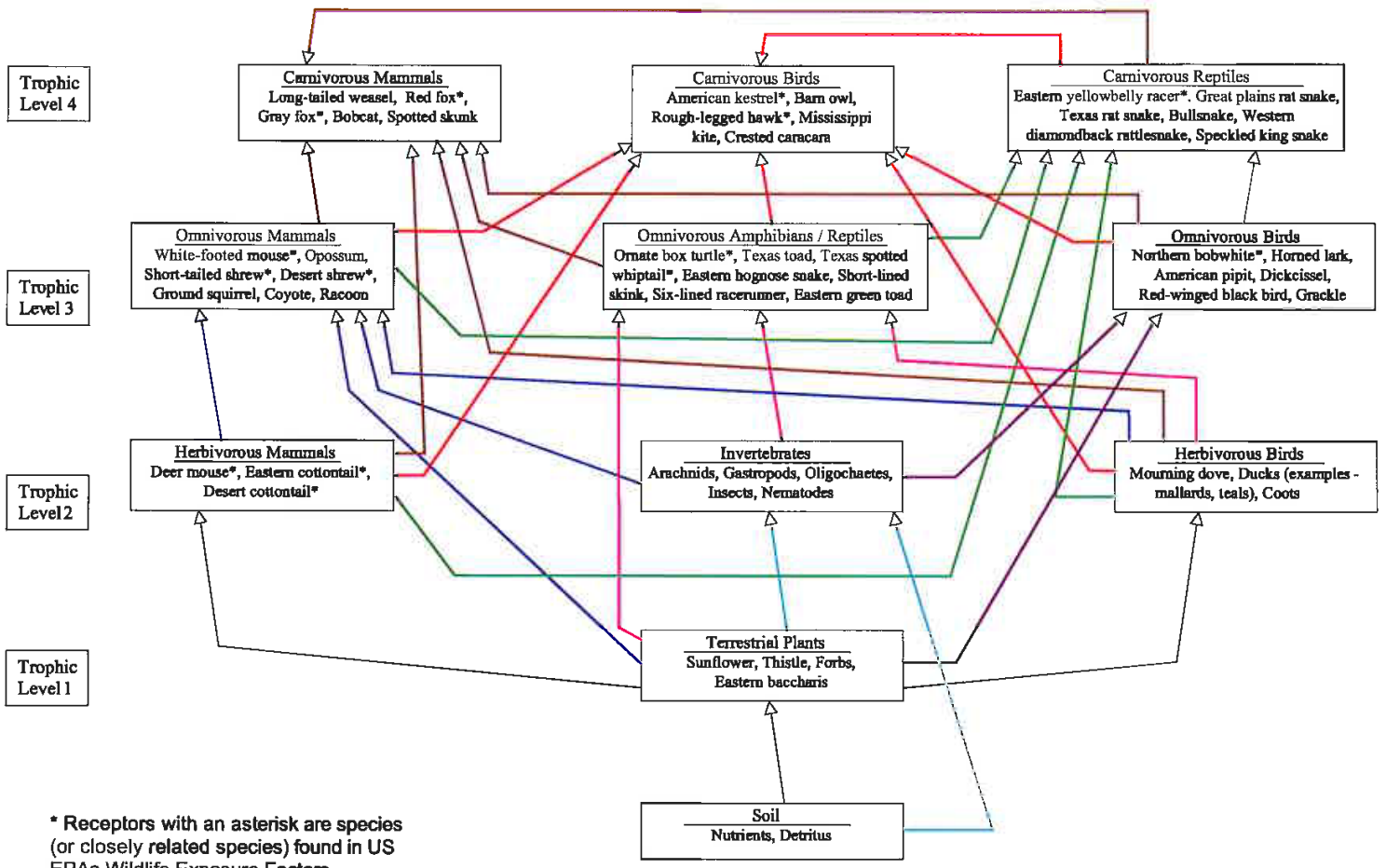
MARSH AREA
CONCEPTUAL SITE MODEL
AQUATIC

FILE NO.
Conceptual Site Model Aquatic-MarshArea.dwg

FIGURE NO.
11




* Receptors with an asterisk are species (or closely related species) found in US EPAs Wildlife Exposure Factors Handbook (1993).

Reference: Modified from Guidance For Conducting Ecological Risk Assessments at Remediation Sites in Texas, RG-263 (revised), December 2001, Figure 3-8.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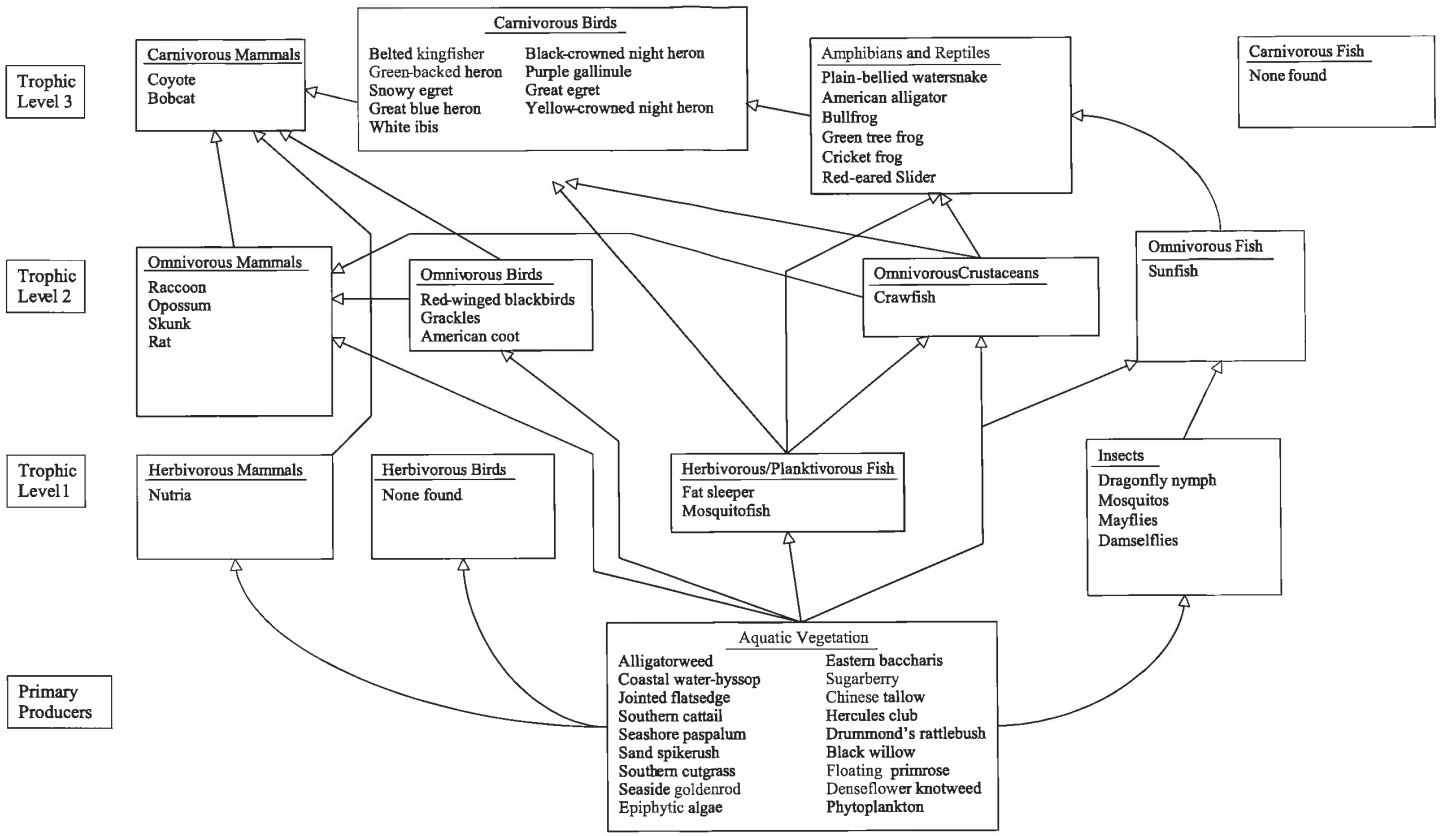
| | Chk'd by: BPB | Date: 12-21-06 |

Title: **TERRESTRIAL FOOD WEB**

Project: MALONE SERVICE CO. SUPERFUND SITE

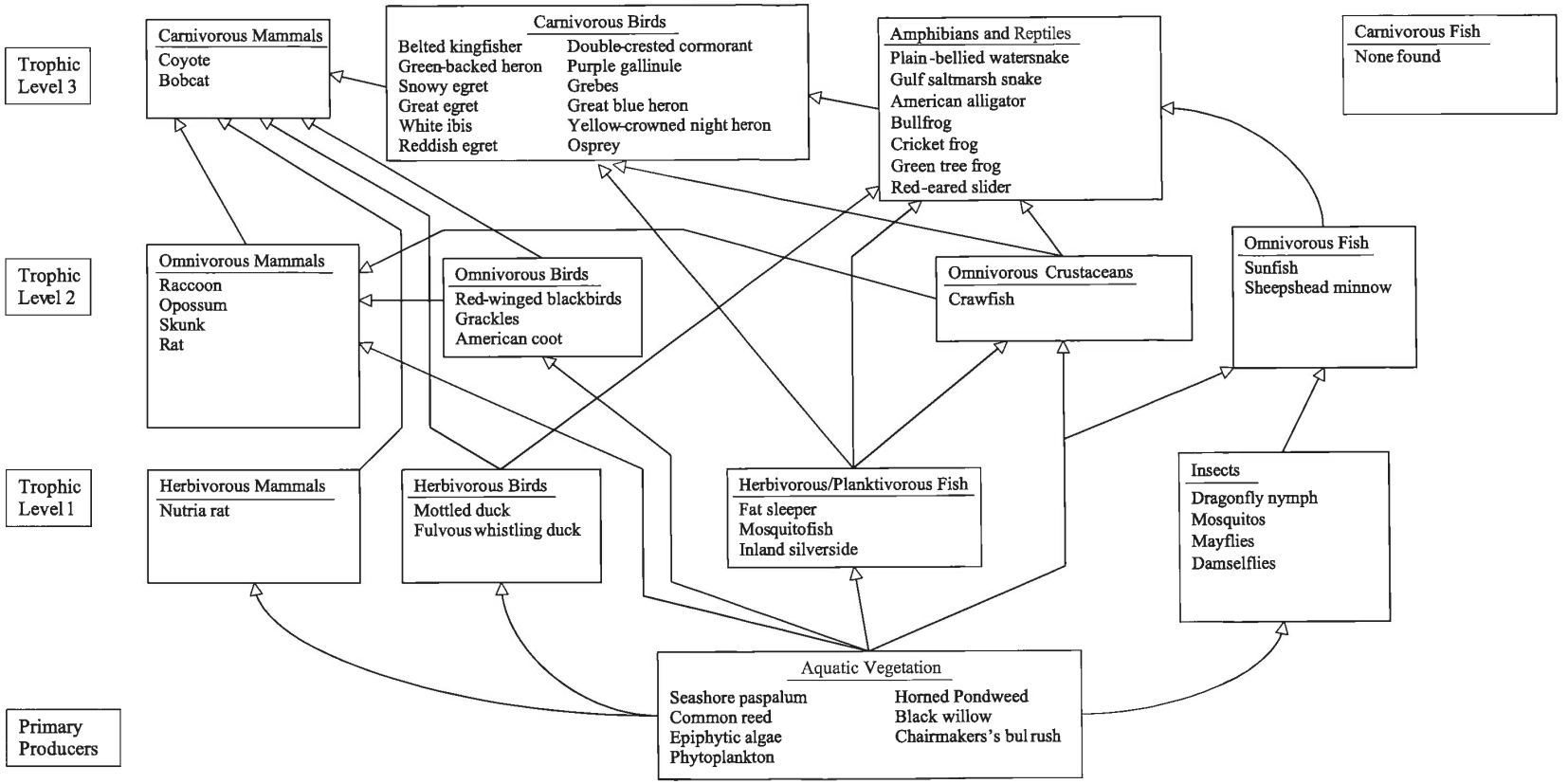
Client: MALONE COOPERATING PARTIES

| Project No.: | File Name: | Figure No.: |
|---|---|---|
| 25008093 | Terrestrial Food Web.dwg | 4 |




SOURCE:
Benchmark Ecological Services
Katy, Texas. October 10, 2006.

| | | | |
|---|---|---|---|
| MALONE SERVICE CO. SUPERFUND SITE | URS 9801 Westheimer Suite 500 Houston, Texas 77042 PH: (713) 914-8699 FAX: (713) 914-8404 | DRAINAGE DITCHES FOOD WEB | FILE No. Drainage Ditches Food Web.dwg |
| | SCALE: AS SHOWN; DRAWN BY: SJF DATE: 12-19-06; CHKD BY: BB DATE: 12-19-06 | | FIGURE No. 5 |




SOURCE:
Benchmark Ecological Services
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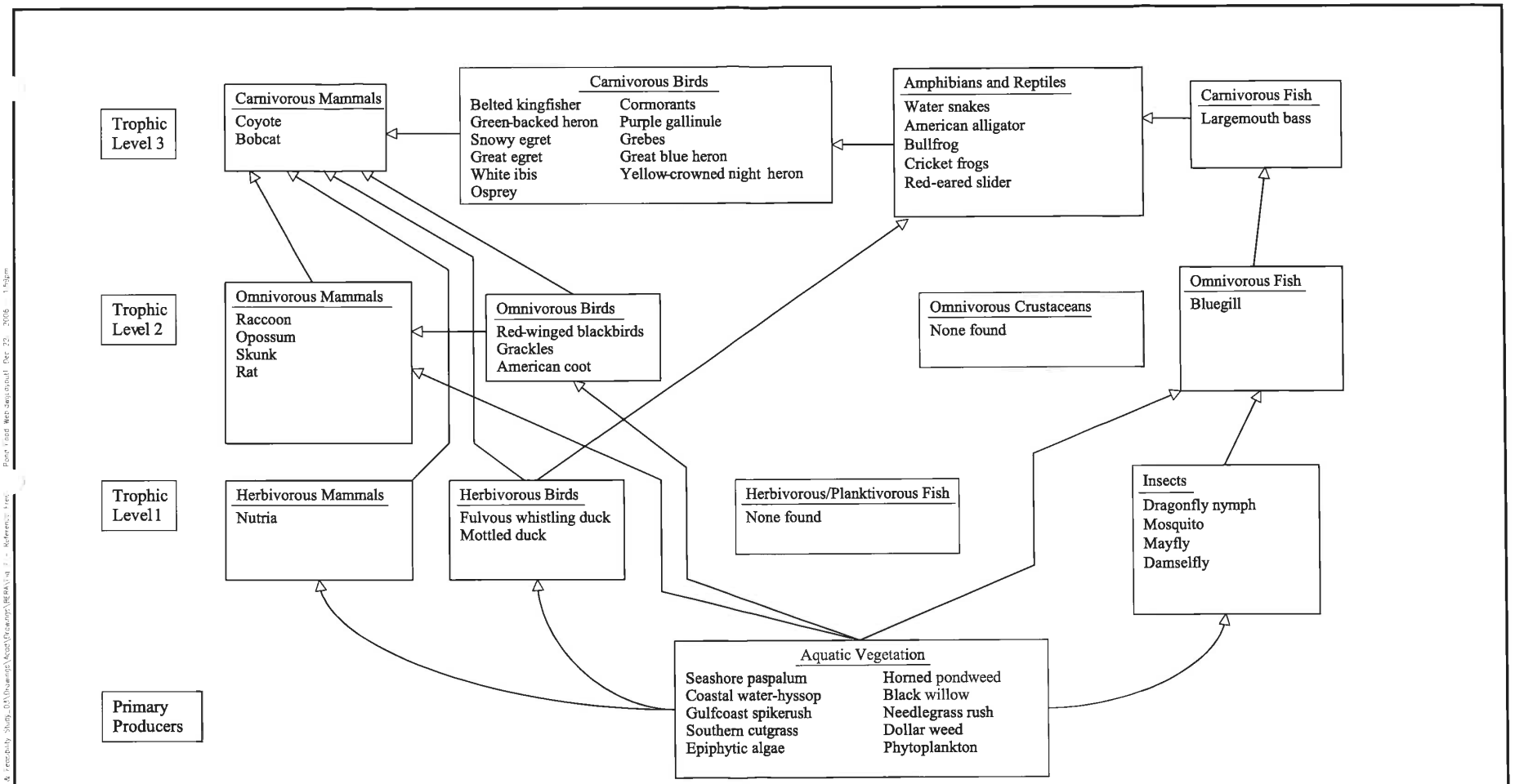
| | | | |
|---|---|---|---|
| MALONE SERVICE CO. SUPERFUND SITE | URS 9801 Westheimer Suite 500 Houston, Texas 77042 PH: (713) 914-6699 FAX: (713) 914-8404 | FRESHWATER POND FOOD WEB | FILE No. Freshwater Pond Food Web.dwg |
| | SCALE: AS SHOWN; DRAWN BY: SJF DATE: 12-19-06; CHKD BY: BB DATE: 12-19-06 | | FIGURE No. 6 |

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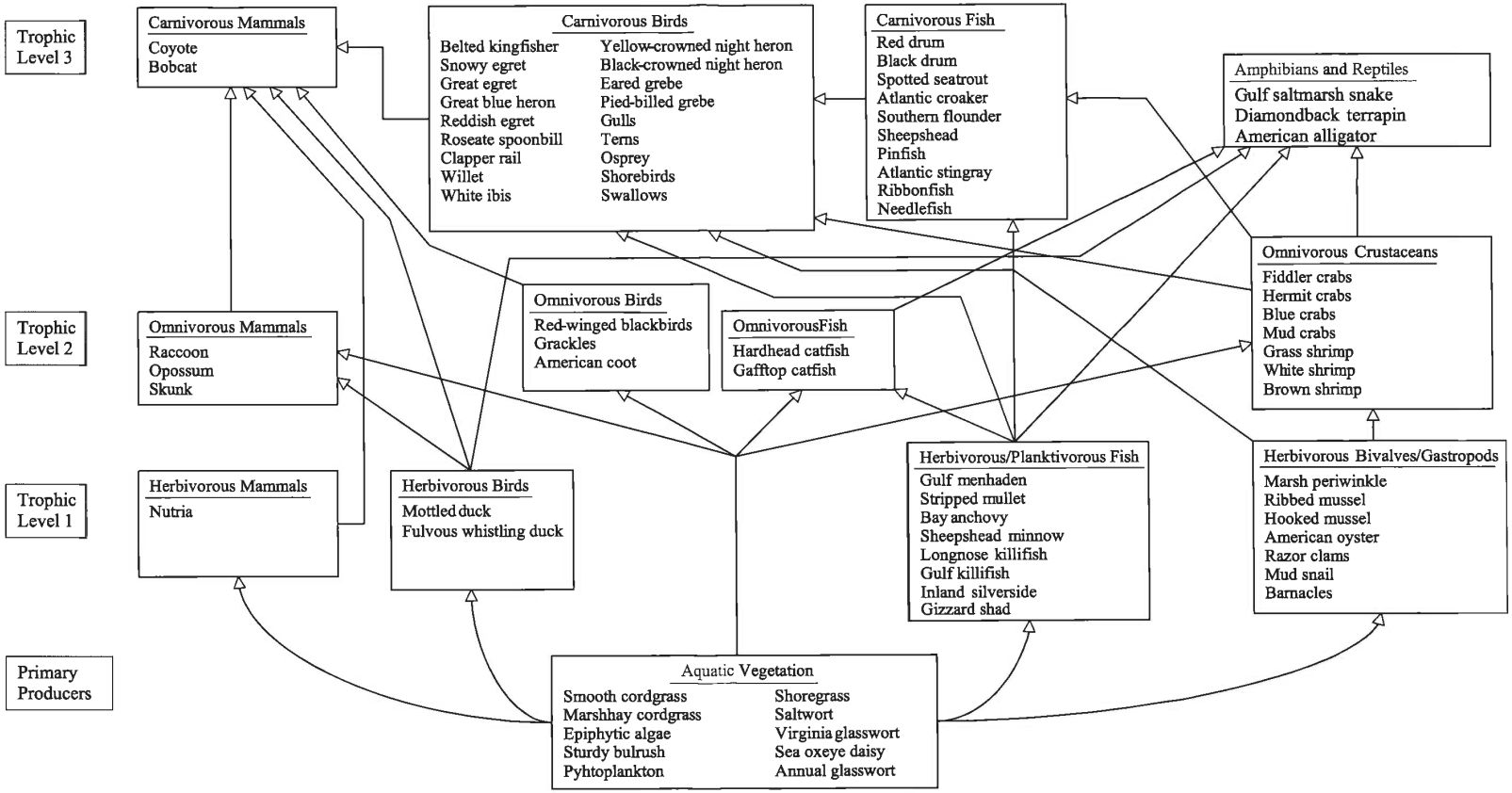
REFERENCE
FRESHWATER POND
FOOD WEB

FILE No.
Reference
Freshwater Pond
Food Web.dwg

FIGURE No.
7




SOURCE:
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ESTUARINE MARSH
FOOD WEB

FILE No.
Estuarine Marsh Food Web.dwg

FIGURE No.
8

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