# Remedial Alternatives Technical Memorandum

# Marion Pressure Treating Company Superfund Site
# Union Parish, Louisiana
# EPA Identification No. LAD008473142

**Remedial Action Contract 2 Full Service**
**Contract: EP-W-06-004**
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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ARAR | Applicable or Relevant and Appropriate Requirement |
| bgs | Below ground surface |
| B(a)P | Benzo(a)pyrene |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| COPC | Contaminant of potential concern |
| DNAPL | Dense non-aqueous phase liquid |
| EA | EA Engineering, Science, and Technology, Inc. |
| EC | Engineering control |
| E&E | Ecology and Environment, Inc. |
| EPA | U.S. Environmental Protection Agency |
| FS | Feasibility Study |
| FSR | Feasibility Study Reassessment |
| GRA | General response action |
| HHRA | Human Health Risk Assessment |
| IASD | Inactive and Abandoned Sites Division |
| IC | Institutional control |
| ISCO | *In situ* chemical oxidation |
| LDEQ | Louisiana Department of Environmental Quality |
| LDR | Land Disposal Restrictions |
| LTM | Long-term monitoring |
| MCL | Maximum Contaminant Level |
| mg/kg | Milligram(s) per kilogram |
| MNA | Monitored natural attenuation |
| MPTC | Marion Pressure Treating Company |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NFA | No Further Action |
| NPL | National Priorities List |
| OSWER | Office of Solid Waste and Emergency Response |
| PAH | Polynuclear aromatic hydrocarbon |
| PRG | Preliminary remediation goal |
| RAO | Remedial action objective |
| RAETM | Remedial Alternatives Evaluation Technical Memorandum |
| RATM | Remedial Alternatives Technical Memorandum |
| RCRA | Resource Conservation and Recovery Act |
| RD | Remedial Design |
| RECAP | Risk Evaluation/Corrective Action Plan |
| RI | Remedial Investigation |
| ROD | Record of Decision |
| RSL | Regional Screening Level |
| SFI | Supplemental field investigation |
| site | Marion Pressure Treating Company Superfund Site |
| SVOC | Semi-volatile organic compound |
| TBC | To be considered |

| | |
|---|---|
| TCLP | Toxicity Characteristic Leaching Procedure |
| TT | Tetra Tech EM, Inc. |
| μg/L | Microgram(s) per liter |
| USACE | U.S. Army Corps of Engineers |
| WBZ | Water-bearing zone |

# 1. INTRODUCTION

This document presents the Remedial Alternatives Technical Memorandum (RATM) produced by EA Engineering, Science, and Technology, Inc. (EA) for the Marion Pressure Treating Company (MPTC) Superfund Site (site) in Union Parish, Louisiana. EA produced this RATM for the U.S. Environmental Protection Agency (EPA) Region 6 under Remedial Action Contract Number EP-W-06-004 and Task Order 0062-RICO-067Z. The framework and requirements are documented in the EPA Statement of Work Revision 01 (EPA 2010a) and the EA Work Plan and Cost Estimate (EA 2010a).

The Remedial Investigation (RI) Report (Tetra Tech EM, Inc. [TT] 2001c), the Human Health Risk Assessment (HHRA) and Ecological Risk Evaluation (TT 2001a), the Feasibility Study (FS) Remedial Alternatives Memorandum (TT 2001b), the Feasibility Study (TT 2001d), and the Supplemental Field Investigation Report (EA 2011) provide the basis for this RATM. The regulation and guidance documents that were utilized in this evaluation included, but were not limited to, the following:

- National Oil and Hazardous Substance Pollution Contingency Plan (NCP), Title 40 Code of Federal Regulations (CFR) Part 300

- *Guidance for Conducting Remedial Investigation and Feasibility Studies* under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Office of Solid Waste and Emergency Response [OSWER] Directive 9355.3-01) (EPA 1988).

## 1.1 PURPOSE OF REPORT

This RATM will support the preparation of the FS Reassessment (FSR) Report and remedy selection to be included as an Amendment to the original Record of Decision (ROD) completed in June 2002. In this document, potential remedial alternatives are qualitatively developed and assessed against preliminary screening criteria to determine which remedial alternatives will be considered in the Remedial Alternatives Evaluation Technical Memorandum (RAETM) and FSR; remedial alternatives will be more fully evaluated against seven evaluation criteria in the RAETM and FSR. EPA will make the determination regarding final selection of the remedial alternatives to be further developed.

The three preliminary screening criteria to be employed in this RATM are:

- Effectiveness
- Implementability
- Cost.

The seven criteria to be employed in the evaluation of remedial alternatives in the RAETM and FSR are:

- Overall protection of human health and the environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARAR)
- Long-term effectiveness and permanence
- Reduction in toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability (technical and administrative)
- Cost.

Prior to the completion of any potential ROD Amendment, two additional criteria will be considered. These include:

- State acceptance; and
- Community acceptance.

Fully developed cost estimates were not prepared for this RATM, but will be prepared for remedial alternatives that are evaluated in the FSR.

## 1.2 SITE LOCATION AND DESCRIPTION

The MPTC site covers approximately 22 acres and is located in a rural area northwest of Marion, Union Parish, Louisiana (Figure 1). The site is located about 14 miles northeast of Farmersville and 35 miles north-northwest of Monroe, Louisiana.

The site is located on the east side of State Highway 551 about 0.5 mile north of the intersection of State Highway 551 and State Highway 33. It is located in the northwest quarter of the northeast quarter of the southwest quarter of Section 10, Township 22 North, Range 2 East, Union Parish, Louisiana. The geographical coordinates of the site are latitude 32°54' 29" north and longitude 92°15'14" west.

The property is surrounded by forest to the north, east, and south. Wetlands are located to the east and southeast. Residential properties are located west and south of the site along State Highway 551. Big Creek is located east of the property, and an unnamed tributary to Big Creek is west of the property. The former wood-treating operational area drains (1) to the east towards Big Creek through drainage gullies collectively called the East Drainage Ditch, and (2) to the west towards the gullies collectively called the West Drainage Ditch.

An abandoned building, tanker trailer, and small wastewater treatment sump are the only known structures remaining from past wood-treating operations (Figure 2). During an EPA removal action, polynuclear aromatic hydrocarbon (PAH)-contaminated soil was consolidated in an onsite area (Consolidation Area) and capped. The Consolidation Area measures about 280 feet by 210 feet and is surrounded by a fence (Ecology and Environment, Inc. [E&E] 1999). Additionally, two small PAH-contaminated spoil piles are located 200 to 300 feet south of the original (10-acre) property boundary (Louisiana Department of Environmental Quality [LDEQ] 1999). These features, in addition to a shed located near the spoil piles, are shown on Figure 2, which presents the current site layout. During the RI, a fence was constructed around the perimeter of the site to restrict access to the site.

## 1.3 SITE OWNERSHIP

The MPTC site originally consisted of a 10-acre tract of land owned by Mr. Bobby L. Green. MPTC was owned and operated by Mr. Bobby L. Green from 1 November 1964 to 8 May 1990. Mr. Green also served as MPTC's president. Between 1964 and 1984, partial ownership of the original 10-acre tract had been divided between H.D. Green, Daniel Green, Bobby L. Green, and Brooks Jones. The original 10-acre tract was sold to MPTC on 17 August 1984. Through property tax forfeiture and sales, the original 10-acre tract has passed through various owners. The current owners of the property are Otis Riley, Daniel B. Green, Mary Virginia Green-Jones, and Bobby L. Green. The MPTC site has also expanded beyond the original 10-acre tract to currently encompass about 22 acres (Figure 2).

## 1.4 SITE HISTORY

MPTC began operations on 1 November 1964. MPTC produced pressure-treated wood products, including poles, bridge pilings, fence posts, and other lumber. Creosote was reported to be the only wood preservative used during the wood treatment process (E&E 1995a and 1995b). From 1964 to 1985, a 15,000 square-foot, unlined surface impoundment (the former impoundment) was used to dispose of process wastewater. The former impoundment was regulated under the Resource Conservation and Recovery Act (RCRA) after 1976 and was described as a two-celled, hourglass-shaped unit, approximately 80 feet wide by 240 feet long. The depth of the former impoundment is not known, but is estimated to have been between 2.5 to 10 feet deep. During closure of the unit in 1985, (1) water in the former impoundment was pumped to the onsite wastewater treatment system, (2) sediments were excavated and transported offsite for disposal, and (3) the former impoundment was backfilled with approximately 1,450 cubic yards of loamy sand and graded to conform to the general topography of the area (E&E 1995c). Closure of the impoundment resulted in several unresolved LDEQ enforcement actions against MPTC for lack of post-closure plans, ground water sampling plans, and invalid certification of clean closure.

After MPTC failed to submit a post-closure permit in July 1989, LDEQ conducted a RCRA compliance inspection at MPTC in September 1990 and found that the facility was abandoned with no sign of recent activity. The facility gates were open, the retorts and associated equipment were still in place, and ground surface around the tanks was covered with a "creosote-like material." The LDEQ referred the site to the Inactive and Abandoned Sites Division (IASD), since MPTC had filed for bankruptcy on 10 October 1989. IASD requested a removal action by the EPA Response and Prevention Branch.

Between September 1996 and March 1997, EPA performed a removal action at the MPTC site. These activities included the offsite disposal of fluids and sludge stored in the tanks, decontamination, dismantling and offsite disposal of the tanks and retort vessels at the site, excavation of contaminated soil, and placement of the contaminated soil in a capped Consolidation Area (E&E 1997). Approximately 10,000 cubic yards of contaminated soil were excavated and placed into the Consolidation Area. The contaminated soil was capped with a 2-foot thick clay cover and an 18-inch thick topsoil layer, limiting risk of exposure.

The MPTC site was proposed to the National Priorities List (NPL) on 22 October 1999 and added to the NPL on 4 February 2000. An RI and FS were completed at MPTC in 2001. The ROD (EPA 2002), identified two operational units: (1) contaminated onsite soil; and (2) contaminated ground water. The selected remedy included a combination of the following: (1) excavating wastes, (2) onsite thermal desorption, (3) offsite stabilization and disposal of residual wastes, and (4) backfill of excavated areas and re-vegetation. The Remedial Design (RD) was completed in September 2003. An independent technical review of the RD was performed by the U.S. Army Corps of Engineers (USACE) in 2006 (USACE 2006). Implementation of the designed remedy and Remedial Action was prioritized and queued subject to availability of funding. In the meantime, unsuccessful implementation of the selected thermal desorption technology at another Superfund site demonstrated that the technology was more difficult to implement than anticipated. This prompted the current reassessment to evaluate if other technologies would be more appropriate.

## 1.5 REMEDIAL INVESTIGATION RESULTS

During the RI in 2000, samples were collected from surface soil/sediment, subsurface soil, ground water, surface water, public water supply, and ecological samples at the MPTC site to determine the nature and extent of contamination (TT 2001c). The analytical results for these samples indicated the presence of creosote-related contaminants in concentrations above residential human health risk screening levels and ecological risk levels across a large area of the site.

A field investigation was performed as part of the RD in 2002, where additional soil borings were collected to aid in dense non-aqueous phase liquid (DNAPL) delineation and to determine the physical properties and the extent of the confining unit underlying the Cockfield Aquifer. Additionally, seven monitoring wells were installed and 14 previously existing monitoring wells were sampled (TT 2002).

A supplemental field investigation (SFI) in 2010–2011 employed the use of a cone-penetrometer testing rig in conjunction with the Tar-specific Green Optical Screening Technology® to delineate the extent of creosote at the site. Testing was performed in the Consolidation Area and former impoundment in an attempt to more accurately determine the extent of the DNAPL (Figure 3). Additionally, monitoring wells were purged and sampled using low-flow (micropurge) sampling techniques in accordance with the EPA-approved Field Sampling Plan (EA 2010b) and standard operating procedures.

The following sections summarize the findings of the three investigative field efforts introduced above. The elements included are: (1) contaminants of potential concern (COPCs); (2) conceptual site model; and (3) risk assessment.

### 1.5.1 Contaminants of Potential Concern

COPCs detected in soil, sediment, surface water, and ground water include metals, semi-volatile organic compounds (SVOCs), and volatile organic compounds. Creosote DNAPL was observed in measurable quantities in three monitoring wells (MW-2, MW-3, and MW-14) during each of the investigative field events.

### 1.5.2 Conceptual Site Model

The conceptual site model is comprised of the following components: (1) hydrogeology; (2) nature and extent of contamination; (3) source areas; (4) migration pathways; and (5) exposure pathways.

#### *1.5.2.1 Hydrogeology*

The Cockfield Formation (0–100 feet below ground surface [bgs]), the Cook Mountain Formation (100–300 feet bgs), and the Sparta Sand (300–900 feet bgs) are the geologic formations (in descending order) beneath the site. The site monitoring wells are screened in the Cockfield Formation. A 50- to 110-foot thick massive silty clay bed at the base of the Cook Mountain Formation (200–300 feet bgs) creates a confining unit for the Cockfield Aquifer, because it retards movement of water through the Cook Mountain Formation into the Sparta Sand.

The geology of the Cockfield Formation at the MPTC site generally consists of clay with silt and sand stringers (soil unit C1) from the ground surface to a depth varying from approximately 13 feet bgs to 25 feet bgs, underlain by sand and fine sand with silt clay and lignite (soil unit S1) to a depth varying from approximately 40 feet bgs to 50 feet bgs. The C1 clay layer on top reduces infiltration of water to underlying layers. S1 is the shallow water-bearing zone (WBZ) of the Cockfield Aquifer. This sand layer is underlain by another shallow clay and silty clay layer (soil unit C2), followed by a fine sand and sand with silt clay and lignite layer (soil unit S2). S2 is the deeper WBZ. Both S1 and S2 are potential drinking water sources. The deepest layer of the Cockfield Formation is silty clay (soil unit C3), which confines the S2 sand on the bottom. Soil unit C3 is the deepest interval assessed during the RI. Figure 4 identifies the locations of the cross sections detailed in Figures 5 and 6, which provide visual representations of the Cockfield Formation.

Based on a review of the potentiometric data from the SFI, the horizontal hydraulic gradients in both WBZs of the Cockfield Aquifer appear to be relatively low. Shallow ground water flow was to the southwest in December 2010. In March 2011, the shallow ground water flow was to the south and west. The S1 WBZ water elevation ranged from 159.32 to 160.98 feet above mean sea level across the site in December 2010, and from 160.01 to 161.59 feet above mean sea level in March 2011.

The S2 WBZ water elevations ranged from 162.66 to 162.85 feet above mean sea level in December 2010, and from 162.98 to 163.16 feet above mean sea level in March 2011. The S2 ground water flow was to the south and southeast in December 2010 and March 2011. Because of the very flat gradient at the site, ground water is not expected to migrate offsite. The S2 WBZ water elevations are about 2 to 3 feet higher than those in the S1 WBZ, indicating an upward head gradient.

*1.5.2.2 Nature and Extent of Contamination*

An analysis of the data collected during the RI, FI, and SFI was performed to describe the nature and extent of contamination in sediment, soil, surface water, and ground water. Chemical concentrations were incorporated with physical characteristics, historical information regarding site activities, and other evidence to evaluate the nature and magnitude of contamination. Similar evidence was used to delineate the extent of contamination both horizontally and vertically. Spatial and temporal trends were evaluated as they may be important in the migration pathway analysis. Such delineation of trends contributed to the identification of areas that need to be remediated at MPTC, as further discussed in Section 2.3.

The horizontal limits of the DNAPL plume appear stable. Review of available data suggests that only the three monitoring wells (MW-2, MW-3, and MW-14), where DNAPL was observed in 2000, still contain DNAPL in 2010, or traces thereof. The DNAPL occurrence appears to be limited to the area of the Consolidation Area and former impoundment. There is no evidence that vertical migration of DNAPL has continued. Furthermore, vertical migration of DNAPL is hindered by an aquitard (C2). As a result, future significant vertical DNAPL plume migration is unlikely. However, there are minor dissolved-phase ground water impacts to S2, which is below the C2 aquitard (Figures 7 and 8).

Creosote-impregnated soils have been found down to a depth of 45.6 feet bgs, which is an elevation of 123.76 feet above mean sea level underneath and around the Consolidation Area and former impoundment. The vertical extent of the DNAPL-contaminated soils is not defined, as depths reached during investigative activities were limited. The lateral extent of contaminated soil spans the Consolidation Area and the outermost borings where DNAPL-impacted soils were identified in Figure 3.

The water wells for the Marion public supply water system are screened in the Sparta Sand. No other nearby water wells were identified during the RI. Ground water samples were collected from the City of Marion public supply water wells as part of the RI. The laboratory testing results indicate that the drinking water from the Marion public supply water wells meet Maximum Contaminant Levels (MCLs; EPA 2011) and the water quality criteria established for primary drinking water systems by the Louisiana Department of Health and Hospitals, Office of Public Health. No site-related contaminants have been detected in the City of Marion public supply water wells.

Concentrations of SVOCs in ground water collected from the monitoring wells appear to be decreasing over time, with the exception of MW-14, where higher concentrations of several phenol compounds were detected. Phenols and creosols are components of creosote, the main wood-preserving compound used at the site. Additionally, the most significant ground water contamination appears to be localized around the Consolidation Area and former surface impoundment, proximal to observed (explicit and implicit) DNAPL in the subsurface. The monitoring wells outside of this localized area did not have SVOC detections during the SFI, providing little evidence of widespread dissolved-phase contamination. Because of the low ground water seepage rates at the site and general immobility of creosote compounds, ground water contamination is not expected to migrate appreciably. Additionally, monitoring wells screened in the S2 formation had concentrations that were orders of magnitude less than the concentrations found in wells screened in the S1 formation, indicating remedial alternatives should focus on the shallow WBZ (S1).

Wells MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-12, and MW-13 are screened through both WBZs, which allows for contaminant migration between S1 and S2. Because they may serve as conduits for contamination migration, they fail to provide useful ground water contamination data with respect to each individual WBZ, and render confused water levels for the purpose of calculating seepage velocity.

In addition to SVOCs, metals were detected in several wells during the RI (Figure 8). The arsenic concentration detected in MW-6 was 20.5 micrograms per liter (µg/L) and was the only exceedance of the MCL (10 µg/L). Because copper-chromated-arsenic was not utilized for wood treatment at the site, and the only well with arsenic above the MCL is located over 150 feet upgradient of the source area, arsenic in the ground water is not considered to be attributable to historic site activities.

Lead exceeded the MCL (15 µg/L) in one ground water sample that was collected from monitoring well MW-2 (42 µg/L). This monitoring well also had an exceedance of the zinc secondary MCL of 5,000 µg/L, with a concentration of 9,520 µg/L. Although lead and zinc exceeded their MCLs, they are not likely related to site activities because of their isolated occurrences outside of the source area.

Thallium ground water concentrations exceeded the MCL of 2 µg/L in MW-5, MW-7, and MW-4, with concentrations of 13, 10, and 8 µg/L, respectively. Iron was detected above its secondary MCL of 300 µg/L in all but two wells (MW-1 and MW-2) during the RI. Manganese was detected above its secondary MCL of 50 µg/L in all but two wells (MW-1 and MW-3). The thallium, iron, and manganese concentrations are not likely related to the wood treatment activities at MPTC. However, there exists a possibility that reducing conditions, which could contribute to elevated levels of these metals in the ground water, can be a secondary effect of the contamination emanating from previous site activities. Metals should be monitored as part of any future ground water monitoring programs implemented.

#### *1.5.2.3 Sources Areas*

Source material is a media that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration to other media or for direct exposure (EPA 1991). The EPA identifies source material as either a principal threat waste or a low-level threat waste.

- **Principal Threat Wastes** – Source materials that are considered highly toxic or highly mobile and that generally cannot be reliably contained or would present a significant risk to human health or the environment if exposure were to occur.

- **Low-level Threat Wastes** – Source materials that exhibit low toxicity and low mobility and can be reliably contained or would present only a low risk to human health or the environment if exposure were to occur.

The source material identified at MPTC is considered a principal threat waste. The Consolidation Area and Former Impoundment Area (Figure 3) both contain DNAPL-impacted soils. The presence of DNAPL indicates high toxicity.

#### *1.5.2.4 Migration Pathways*

The nature and extent of contamination is combined with source identification and physical characteristic information to evaluate migration pathways. Free-phase DNAPL flow is not likely to be a prominent migration pathway because it has been found to be localized to three wells (MW-2, MW-3, and MW-14), and DNAPL appears trapped in capillary tension. Percolation of precipitation is a potential migration route for the contaminants present in the surface and subsurface soils. Surface water transport of contaminated sediments and erosion of Consolidation Area waste and Former Impoundment Area are likely routes of migration to nearby surface water.

#### *1.5.2.5 Exposure Pathways*

Current and future exposure pathways evaluated in the HHRA include the following:

- Ingestion of surface soil
- Dermal contact with surface soil
- Inhalation of particulates or vapors generated from surface soil
- Ingestion of ground water
- Dermal contact with ground water during showering or bathing
- Inhalation of vapors from ground water during showering or bathing
- Ingestion of surface water/sediment
- Dermal contact with surface water/sediment
- Ingestion of biota.

### 1.5.3 Risk Assessment

The HHRA Report (TT 2001a) results indicate that the major noncarcinogenic risks (Table 1-1) are due to (1) ingestion of arsenic, barium, and manganese in crayfish tissue and (2) ingestion and dermal absorption of arsenic, thallium, dibenzofuran, and naphthalene in ground water. The majority of the carcinogenic risks (Table 1-2) are due to (1) incidental ingestion and dermal contact with PAHs in Big Creek sediments, and (2) ingestion and dermal absorption of arsenic in ground water.

In addition to the noncarcinogenic and carcinogenic risks associated with direct contact with site-related COPCs in surface soil (0–2 feet bgs) and surface sediment (0– 0.5 feet bgs), PAHs have been detected at depth in several soil and sediment locations at MPTC. DNAPL has been detected in only three monitoring wells. Therefore, the potential for continued leaching of COPCs from contaminated soils and sediments to ground water was also evaluated in the HHRA in order to determine site-specific preliminary remediation goals (PRGs; identified in 2.3.4).

The Ecological Risk Assessment evaluated a comprehensive suite of upland and aquatic receptors to identify adverse impacts from COPCs identified for the site. For terrestrial plants, the residual risk should be evaluated in conjunction with the implementation of PRGs for the site. If topsoil and reseeding are not placed during the Remedial Action, then risk to this community should be reassessed. No further action is needed to protect the soil invertebrate community, mammals, and birds at MPTC.

For aquatic receptors, such as benthic invertebrates, sediments in low-lying areas of Big Creek should be remediated. These areas overlap with the areas identified in the HHRA as posing a significant threat to human health, if exposure were to occur. No further action is needed to protect the fish community and amphibians at MPTC.

# 2. REMEDIAL ACTION OBJECTIVES

This section discusses remedial action objectives (RAOs), Applicable or Relevant and Appropriate Requirements (ARARs), and identifying areas subject to a remedial alternative evaluation. This last step includes the development of PRGs.

## 2.1 PRESENTATION OF 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, preliminary RAOs were developed to aid in the development and screening of remedial alternatives. Final RAOs will be documented in the ROD Amendment, if appropriate.

### 2.1.1 Remedial Action Objectives

The preliminary RAOs for the site are:

- Prevent exposure to contaminants associated with the site in soils and sediment above remediation goals.
- Prevent exposure to contaminants associated with the site ground water above remediation goals.

- Prevent offsite migration of ground water above remediation goals (based on drinking water standards or health-based levels).

- Return ground water to its expected beneficial uses wherever practicable (aquifer restoration).

## 2.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ARARs are substantive federal and state environmental laws and regulations that specify clean-up levels or performance standards for CERCLA sites.

Section 121(d) of CERCLA, as amended by Superfund Amendments and Reauthorization Act, states that onsite Remedial Actions must attain ARARs. ARARs may include regulations, standards, criteria, or limitations promulgated under federal or state laws. An ARAR may be either "applicable" or "relevant and appropriate," but not both. The NCP in 40 CFR §300 defines ARARs.

Three categories of ARARs exist: chemical-, location-, and action-specific requirements. Chemical-specific ARARs are health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical clean-up values. These values establish the acceptable amount or concentration of a chemical that may be detected in or discharged to the ambient environment. Location-specific ARARs are restrictions on the concentrations of hazardous substances or on activities conducted at the site that result from site characteristics or its immediate environment. For example, location of the site or proposed RA in a flood plain, wetland, historic place, or sensitive ecosystem may trigger location-specific ARARs. Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken. These requirements are triggered by the specific remedial activities selected. Action-specific ARARs do not in themselves determine the remedial alternative; rather, they indicate how an alternative must be conducted.

In addition to the legally binding requirements established as ARARs, many federal and state programs have developed criteria, advisories, guidelines, or proposed "To Be Considered" (TBC) standards. TBC material may provide useful information or recommend procedures if no ARAR addresses a particular situation or if existing ARARs do not provide protection. In such situations, TBC criteria or guidelines will be used to set remedial action levels. Chemical-, location-, and action-specific ARARs for each of the remedial alternatives are presented in Table 2-1.

## 2.3 IDENTIFYING AREAS SUBJECT TO A REMEDIAL ALTERNATIVE EVALUATION

Areas that require remedial alternative evaluation were identified if they satisfied the following criteria:

- Area is identified as a principle threat waste.

- Area exceeds remediation goals for COPCs calculated in the HHRA.

- Area where ground water exceeds MCLs (EPA 2011), Regional Screening Levels (RSLs; EPA 2010b), or LDEQ Risk Evaluation/Corrective Action Plan (RECAP) values (LDEQ 2003).

### 2.3.1 Identification of Areas Based on Human Health Risk Assessment

The HHRA (TT 2001a) evaluated potential current and future exposures at MPTC within 10 exposure areas. This evaluation was completed using benzo(a)pyrene (B[a]P) equivalent concentrations in surface soil. B(a)P equivalents are calculated values based on the concentrations of seven carcinogenic PAHs (benzo[a]anthracene, B[a]P, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, and indeno[1,2,3-c,d]pyrene) present in each sample. Table 2-2 presents the $10^{-4}$, $10^{-5}$, and $10^{-6}$ excess cancer risk direct exposure limits for two exposure scenarios: the current/future trespasser/recreational visitor and the potential future industrial worker that were developed in the HHRA (TT 2001a). While a future hypothetical residential scenario was evaluated in the HHRA, future residential land use is unlikely. Therefore, the future trespasser/recreational visitor and future industrial worker scenarios formed the basis of the remediation level development.

A remediation level of 42 milligrams per kilogram (mg/kg) B[a]P equivalent was calculated for the trespasser/recreational visitor at the $1x10^{-4}$ excess cancer risk level (upper end of the acceptable risk range). The remediation level for an onsite industrial worker would be 26 mg/kg B(a)P equivalent for the upper range of the acceptable risk range. The toxicity equivalent and toxicity values used to determine exposure limits in the 2001 HHRA were verified during the development of this report with the current values for PAHs. Based on the comparison, the PRGs determined in the HHRA are considered appropriate.

Samples in the Big Creek Exposure Area (Figure 9) have locations that exceed the $10^{-4}$ remediation goals. Therefore, these surface soil and sediment locations were considered for remediation to address direct contact at MPTC. The industrial worker exposure scenario was used for the remedial alternative evaluation to allow potential industrial and/or recreational reuse.

Table 2-3 identifies the five soil and sediment sample locations that exceeded the risk-based B(a)P equivalent industrial worker remediation goal. The length of the area subject to remediation spans the length of Big Creek between the midpoint of O16 and N15 and the midpoint of SD01 and SD25 (see Figure 9). A length of 1,400 feet and an average width of 4 feet for Big Creek were used to calculate volumes subject to remediation (approximately 415 cubic yards).

Although sample location JS04 has surface soil concentrations above the risk-based industrial worker remediation level from the 0 to 0.5 feet bgs, it is an isolated hot-spot and, therefore, is not grouped together with the sample locations along Big Creek. Additionally, the surface soil from 0.5 to 2 feet bgs at this location is less than the B(a)P equivalent industrial worker remediation goal. Because it is an isolated hot-spot, the likelihood of a worker spending 25 years at the exact JS04 location is improbable. Before designating this hot-spot for remediation, additional sampling and characterization at and around this location should be performed to obtain a current and realistic requirement for remediation.

Additional assessment and characterization should be performed during the Remedial Action for sediment sample locations that comprise the Big Creek Exposure Area to verify the presence of affected media greater than remediation goals, as well as the depth of contamination. This characterization can determine whether the contamination is continuous or comprised of isolated pools of residual DNAPL. The current volume of soil and sediment requiring remediation in the Big Creek Exposure Area may vary significantly from the volume estimated using data from sampling performed in 2000.

Although the Consolidation Area and Former Impoundment Area do not pose a current direct contact risk, erosion of the existing clay and soil cap may lead to future exposure above the remediation goals determined in the HHRA. These areas also contain principal threat wastes, which are considered highly toxic and/or highly mobile. To prevent such a scenario, the Consolidation Area and Former Impoundment Area were considered in the remedial alternatives evaluation.

### 2.3.2 Identification of Areas Based on Prevention of Future Ground Water Exceedances at the Site Property Boundary

According to the ground water monitoring results of the sampling performed in December 2010 as part of the SFI, the SVOC exceedances were evident within the extents of the DNAPL-contaminated soil, but not near the site boundary. The MCL, RSL, and LDEQ RECAP values (LDEQ 2003) were compared to analytical ground water data for SVOCs in Table 2-4. The LDEQ RECAP screening values are not ARARs, but rather, they are TBCs. Figure 7 presents the locations where specific SVOC concentrations were above screening levels in December 2010. In addition to SVOCs, primary and secondary MCL exceedances were detected for arsenic, thallium, lead, zinc, iron, and manganese during the RI (Figure 8). The arsenic and thallium in ground water were also determined to be risk drivers for human health risk (Table 1-1 and 1-2). Areas where contaminated ground water is present above acceptable levels are subject to a remedial alternatives evaluation.

### 2.3.3 Summary of Areas Subject to a Remedial Alternatives Evaluation

Based on the results of the HHRA (TT 2001a), the Big Creek Exposure area is subject to a remedial alternative evaluation in order to prevent direct exposure above remediation goals calculated as safe for human health. The Consolidation Area and Former Impoundment Area are subject to a remedial alternatives evaluation because they contain principal threat wastes that may cause direct exposure above remediation goals if eroded. Areas where ground water contamination exceeds screening criteria (e.g., MCLs) are subject to a remedial alternative evaluation.

### 2.3.4 Preliminary Remediation Goals

After considering past operations at MPTC, the analytical results for soil, sediment, and ground water samples collected during the RI, and the results of the HHRA, the following remediation goals were identified:

1) B(a)P equivalent of 26 mg/kg (industrial worker scenario) in surface soils and sediment subject to remediation

2) Prevention of exposure to and offsite migration of ground water that exceeds MCLs, RSLs, or RECAP values.

## 3. DEVELOPMENT AND SCREENING OF TECHNOLOGIES

Remedial technologies were developed in accordance with EPA Guidance (EPA 1988). The development process starts by identifying general response actions (GRAs) and associated technologies for each medium of interest that will satisfy the RAOs. GRAs are generic, medium-specific remedial actions and may include no action, institutional controls (ICs), containment, removal, treatment, disposal, monitoring, or a combination thereof (EPA 1988). At this site, the media of interest within specific areas are:

- **Surface and Subsurface Soil Former Impoundment Area** – Applies to the unsaturated soil (C1) over the Former Impoundment and the area located east of the Consolidation Area (Area B on Figure 10).

- **Surface and Subsurface Soil Source Area** – Applies to an area measuring approximately 130 feet by 80 feet surrounding monitoring well MW-14 to a depth of approximately 45 feet through the first (S1) sand layer (Area C on Figure 10).

- **Sediment and Surface Soil Big Creek Exposure Area** – Applies to the sediment and surface soil hotspots in the Big Creek area near the southern end of the site (Figure 9).

- **S1 Ground Water** – Applies to the contaminated ground water in the shallow WBZ (Figure 7).

- **S2 Ground Water** – Applies to the contaminated ground water in the deep WBZ (Figure 7).

The GRAs and remedial technologies for each of the media of interest are identified and presented in Section 3.1. The GRAs and remedial technologies are then screened for effectiveness, implementability, and cost in Section 3.2 before being developed into remedial alternatives in Section 4.

## 3.1 GENERAL RESPONSE ACTION AND REMEDIAL TECHNOLOGIES

### 3.1.1 All Media Types

The following GRAs will be considered for all media types:

- No further action (NFA)
- Limited action.

As required by the NCP (40 CFR § 300.430 [e][6]), the selected remedial alternatives must include the NFA alternative to be used as the baseline alternative against which the effectiveness of all other remedial alternatives are judged.

The limited action GRA utilizes ICs, engineering controls (ECs), and long-term monitoring (LTM) to achieve RAOs. ICs are non-engineered instruments, such as administrative and legal controls, that help minimize the potential for human exposure to contamination and protect the integrity of a remedy by limiting land or resource use. ECs are measures that involve design and/or construction in order to prevent human exposure to contamination. LTM involves sampling and analysis of contaminated media to verify that the remedy remains protective. ICs and ECs can be used in all stages of the remedial process to accomplish various remedial objectives, and can be implemented in a series to provide overlapping assurances of protection against contamination.

### 3.1.2 Surface and Subsurface Soil Former Impoundment Area

The subsurface soil alternatives in the Former Impoundment Area apply to the unsaturated clay soil (C1). The depth to water varies from an average of 0.5 to 23 feet bgs. The GRAs evaluated for contaminated subsurface soil include the following:

- NFA
- Limited action
- Containment
- Removal.

These GRAs and the individual technologies considered for each GRA are presented in Table 3-1.

Containment is an engineered remedy designed to prevent migration of the contaminants and eliminate exposure pathways to potential receptors. Physical removal may include removal of contaminated soil or the removal of contamination from soil. Removing contaminated soil entails excavation using standard construction equipment to remove material for disposal or treatment. The removal of contamination from the soil entails thermally, biologically, physically, or chemically removing contaminants from the soil. Removal may also be supplemented with other response actions (e.g., treatment) to achieve RAOs.

### 3.1.3 Surface and Subsurface Soil Source Area

The surface and subsurface soil alternatives apply to an area within the Former Impoundment Area identified as the Source Area and to a depth of 45 feet bgs. It includes the unsaturated clay soil (C1) and the saturated sand layer (S1). The depth to water varies from an average of 0.5 to 23 feet bgs. The GRAs evaluated for contaminated surface and subsurface soil include the following:

- NFA
- Limited action
- Containment
- Removal
- Treatment.

These GRAs and the individual technologies considered for each GRA are presented in Table 3-1.

Containment and removal are as discussed in the previous section. Treatment subjects contaminants to processes that alter their state, transform them to innocuous forms, or immobilize them. This GRA is usually preferred unless site- or contaminant-specific characteristics make it impracticable. Treatment may be physical or chemical and can be performed *in situ*. *In situ* treatment systems treat the contaminated medium in place; consequently, the need for aboveground waste management is minimal.

### 3.1.4 Sediment and Surface Soil Big Creek Exposure Area

The sediment and surface soil alternatives apply to the sediment 0 to 2 feet bgs along the Big Creek. The surface soil applies to hotspots near the Big Creek. The GRAs evaluated for contaminated sediment and surface soil include the following:

- NFA
- Limited action
- Containment
- Removal.

These GRAs and the individual technologies considered for each GRA are presented in Table 3-1.

### 3.1.5 Ground Water

The ground water evaluation applies to the two WBZs in the Cockfield Aquifer. The GRAs evaluated for contaminated ground water include the following:

- NFA

- Limited action
- Containment
- Treatment
- Removal.

These GRAs and the individual technologies considered for each GRA are presented in detail in Table 3-2.

Containment is an engineered remedy designed to prevent migration of the contaminants and eliminate exposure pathways to potential receptors. Physical removal may include removal of contaminated ground water or the removal of contamination from the ground water. Removing contaminated ground water entails collection via extraction wells. The removal of contamination from the ground water entails vaporizing PAHs and collecting contaminants from the water without having to extract the water. Removal may also be supplemented with other response actions (e.g., treatment) to achieve RAOs.

Treatment subjects contaminants to processes that alter their state, transform them to innocuous forms, or immobilize them. This GRA is usually preferred unless site- or contaminant-specific characteristics make it impracticable. Treatment may be chemical or biological and can be performed *in situ*. *In situ* treatment systems treat the contaminated medium in place; consequently, the need for aboveground waste management is minimal.

## 3.2 REMEDIAL TECHNOLOGY SCREENING

This section presents and screens the remedial technologies presented in Tables 3-1 and 3-2.

### 3.2.1 Preliminary Screening Criteria

Three preliminary screening criteria (i.e., effectiveness, implementability, and cost) were used to screen these remedial technologies. Definitions for these criteria are presented below, and the technology screening is presented in Tables 3-3 and 3-4.

#### *3.2.1.1 Effectiveness*

This criterion is a measure of the ability of an option to: (1) reduce toxicity, mobility, or volume; (2) minimize residual risks; (3) afford long-term protection; (4) comply with ARARs; (5) minimize short-term impacts; and (6) achieve protectiveness in a limited duration. Technologies that offer significantly less effectiveness than other proposed technologies may be eliminated from the alternative development process. Options that do not provide adequate protection of human health and the environment likewise are eliminated from further consideration.

#### *3.2.1.2 Implementability*

Implementability is a measure of the technical feasibility and availability of the option and the administrative feasibility of implementing it (e.g., obtaining permits for offsite activities, rights-of-way, or construction). Options that are technically or administratively infeasible or that would require equipment, specialists, or facilities that are not available within a reasonable period may be eliminated from further consideration.

#### *3.2.1.3 Cost*

Qualitative relative costs for implementing the remedy are considered. Costs were obtained from published sources. Technologies that cost more to implement, but that offer no benefit in effectiveness or implementability over other technologies, may be excluded from the alternative development process.

### 3.2.2 Screening Summary

The results of the technology screening are summarized in the following section, and the screening is presented in greater detail, including the explanation of whether technologies were retained or not, in Tables 3-3 and 3-4. From the list of technologies potentially applicable for remediation of the chemicals and media of concern, the following technologies were retained for development of alternatives, because they were considered effective, implementable, and cost-effective relative to the other alternatives under consideration.

#### *3.2.2.1 Soil and Sediment*

Technologies retained for treatment of soil and sediment are:

- No Action
- ECs
- ICs
- Erosion Controls
- Consolidation and Capping
- Excavation and Disposal
- *In Situ* Chemical Oxidation (ISCO)
- *In Situ* Solidification/Stabilization.

#### *3.2.2.2 Ground Water*

Technologies retained for treatment of ground water are:

- No Action
- ICs
- LTM

- Monitored natural attenuation (MNA)
- ISCO.

# 4. DEVELOPMENT OF REMEDIAL ALTERNATIVES

This section combines the technologies that were retained after screening to develop alternatives for the different exposure areas. Table 4-1 provides the remedial alternatives for the site. Alternatives were developed generally based on the media they are designed to treat: soil, sediment, and ground water.

The developed alternatives are described below. These alternatives will be further developed during the RAETM and FSR.

## 4.1 GENERAL REMEDIAL ALTERNATIVES

### 4.1.1 Plugging, Abandonment, and Replacement of Monitoring Wells

The free-phase DNAPL found in MW-2, MW-3, and MW-14 provides a continuing source of contamination to ground water. The amount of DNAPL measured in MW-2 and MW-3 has decreased significantly from 2000 to 2010. However, as discussed in the SFI (EA 2011), it appears that DNAPL drains to MW-14 from the upper formations all the way to the C2 contact. MW-14 had 0.4 foot of DNAPL in 2000, 19.5 feet in 2002, and 20.7 feet in 2010. EA recommends the plugging, abandoning, and replacement of these three wells after DNAPL removal.

EA also recommends the plugging and abandoning of any monitoring wells that are screened through both the S1 and S2 WBZs. These wells include MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-12, and MW-13. Monitoring wells that are screened through both WBZs allow for contaminant migration between S1 and S2, fail to provide useful ground water contamination data, and render confused water levels.

### 4.1.2 Erosion Control

Unimpacted areas to the west, north, and south of the Consolidation Area, including the perimeter slopes (Area A on Figure 10), are presently devoid of vegetation and showing signs of erosion from runoff originating from the Consolidation Area. Topsoil will be placed in these areas, graded, and covered with vegetation to prevent erosion of surface soils and potential damage to the engineered cap, thereby, possibly exposing consolidated waste materials. The erosion control of the areas around the Consolidation Area will be included for each remedial alternative where contaminated material is left onsite.

## 4.2 SURFACE AND SUBSURFACE SOIL FORMER IMPOUNDMENT AREA REMEDIAL ALTERNATIVES

The following remedial alternatives were identified as potential alternatives for the remediation of the Former Impoundment Area (Area B on Figure 10) at the MPTC Site:

- Alternative F-1: NFA
- Alternative F-2: Limited Action
- Alternative F-3: Erosion Control
- Alternative F-4: Capping
- Alternative F-5: Excavation and Offsite Disposal/Offsite Incineration

Table 4-2 describes how each of the alternatives meets the RAO.

### 4.2.1 Alternative F-1: No Further Action

As required by the NCP (40 CFR § 300.430 [e][6]), the alternatives must include the NFA alternative. This is to be used as the baseline alternative against which the effectiveness of all other remedial alternatives are judged. Under NFA, no RAs will be conducted at the site. All contaminants will remain in place and will be subject to environmental influences. Furthermore, no action will be taken to prevent unauthorized access or development at the site. No deed notices to inform interested parties regarding the site conditions will be implemented.

### 4.2.2 Alternative F-2: Limited Action

Limited action utilizes ICs, ECs, and/or LTM to achieve RAOs. IC instruments used include building/construction restriction, excavation restriction, ground water use restriction, or a combination thereof. ECs are instruments such as fencing or signage that are used to minimize access to contaminated areas or areas that may pose a physical hazard. Because limited action will not restore the ground water to beneficial use, it may require a demonstration of MNA or a Technical Impracticability Waiver to be a stand-alone remedial alternative for ground water.

Because some alternatives may include leaving material above the PRGs, ICs, and ECs will need to be included to isolate these materials from contact or completing a pathway. In the FSR, ICs and ECs will be evaluated in greater depth for effectiveness, implementability, and cost.

### 4.2.3 Alternative F-3: Erosion Control

Erosion control measures of Alternative F-3 over the Former Impoundment Area include placing top soil, grading, and seeding this area. This will prevent the further erosion of soil from the adjacent Consolidation Area cap, which could possibly lead to exposure to contaminated soil above human health risk levels. ECs and ICs will be implemented because contaminated material will remain onsite.

### 4.2.4 Alternative F-4: Capping

Alternative F-4 addresses the soil media contamination in the Former Impoundment Area by extending the existing cap over the Consolidation Area to the east to resolve erosion issues that may lead to receptor exposure above acceptable risk levels.

The purpose of capping in Alternative F-4 is to prevent infiltration of surface water. Preventing surface water infiltration will limit the ability for water to transport COPCs (i.e., SVOCs) through the vadose zone into the underlying ground water. The cap may include a clay layer and a layer of top soil, possibly separated by a geosynthetic liner. A vegetative cover will be placed on the soil or clay cap to reduce erosion, degradation of the cover material, and for aesthetics. ECs and ICs will be implemented because contaminated material remains onsite.

### 4.2.5 Alternative F-5: Excavation and Offsite Disposal/Offsite Incineration

The purpose of Alternative F-5 is to remove the contaminated surface and subsurface soils. The removed soil can either be transported for offsite disposal or offsite incineration.

Disposal requirements will depend on whether the excavated material is classified as a hazardous waste, in which case, Land Disposal Restrictions (LDRs) may apply. Classification of the excavated material as a hazardous waste will depend on two factors: its toxicity characteristics, as determined by the Toxic Characteristic Leaching Procedure (TCLP) analytical test, and whether it qualifies as a listed waste. Hazardous wastes are land disposal restricted and require treatment prior to disposal.

## 4.3 SURFACE AND SUBSURFACE SOIL SOURCE AREA REMEDIAL ALTERNATIVES

The following remedial alternatives were identified as potential alternatives for the remediation of the Source Area (Area C on Figure 10):

- Alternative S-1: NFA
- Alternative S-2: Limited Action
- Alternative S-3: Select Capping
- Alternative S-4: ISCO
- Alternative S-5: Deep Soil Mixing with Stabilization and Solidification.

Alternatives S-1 and S-2 are as described previously in Sections 4.2.1 and 4.2.2, respectively. Table 4-2 describes how each of the alternatives meets the RAO.

### 4.3.1 Alternative S-3: Select Capping

The purpose of Alternative S-3 is to cap the area identified as the Source Area. The cap may include a clay layer and top soil layer, possibly separated by a geosynthetic liner. Additional investigation activities (i.e., soil borings) will be required during the design phase to delineate the Source Area. ECs and ICs will be implemented because contaminated material remains onsite.

#### 4.3.2 Alternative S-4: *In Situ* Chemical Oxidation

Alternative S-4 requires the injection of a chemical oxidant, such as potassium permanganate, in the areas of DNAPL, to chemically oxidize the contaminants of concern. Pilot study testing will be conducted and the results of the testing will be used to fully develop this alternative.

To implement this alternative at the site, a chemical oxidizer will be injected into and around the Source Area via direct push or injection wells. The depth and location intervals of the injection points will be determined during the pilot test and will focus on areas of dissolved phase and DNAPL contamination. Additional monitoring wells will be installed to monitor potential downgradient migration of the permanganate and to monitor the progress of the remediation.

#### 4.3.3 Alternative S-5: Solidification/Stabilization

Alternative S-5 utilizes stabilization/solidification for the surface and subsurface soils in the Source Area (Area C on Figure 10). The stabilization/solidification alternative will be used to bind the DNAPL in the soil/ground water matrix such that it can no longer act as a continuing source of contamination to ground water. Treatability tests (i.e., pilot study tests) will be required to determine the applicability of solidification/stabilization at the site. The mixture of determined reagents and contaminated materials will need to meet the requirements of both the TCLP and Synthetic Precipitation Leaching Procedure. Common additives may include, but are not limited to, Portland cement, fly ash, and activated carbon.

### 4.4 SEDIMENT AND SURFACE SOIL BIG CREEK EXPOSURE AREA REMEDIAL ALTERNATIVES

The following remedial alternatives were identified as potential alternatives for the remediation of the Big Creek Exposure Area:

- Alternative B-1: NFA
- Alternative B-2: Limited Action
- Alternative B-3: Consolidation and Capping
- Alternative B-4: Excavation and Offsite Disposal/Offsite Incineration

Alternatives B-1 and B-2 are as described previously in Sections 4.2.1 and 4.2.2, respectively. Table 4-2 describes how each of the alternatives meets the RAO.

#### 4.4.1 Alternative B-3: Consolidation and Capping

Alternative B-3 addresses the soil media contamination in the Big Creek Exposure Area by consolidating the material over the Former Impoundment Area and capping the impacted material, as described previously. Sediment (0 to 2 feet bgs) along the Big Creek and identified hot spots would be included in the material to be moved (Figure 9).

### 4.4.2 Alternative B-4: Excavation and Offsite Disposal/Offsite Incineration

Alternative B-4 addresses the soil media contamination in the Big Creek Exposure Area by excavating and offsite disposal or offsite incineration. Disposal requirements will depend on whether the excavated material is classified as a hazardous waste, in which case LDR would apply.

## 4.5 SHALLOW (S1) GROUND WATER REMEDIAL ALTERNATIVES

The following remedial alternatives were identified as potential alternatives for the remediation of the shallow WBZ (S1) ground water:

- Alternative GW-1: NFA
- Alternative GW-2: Limited Action
- Alternative GW-3: LTM
- Alternative GW-4: MNA
- Alternative GW-5: ISCO

Alternative GW-1 is as described previously in Section 4.2.1. Table 4-3 describes how each of the alternatives meets the RAOs.

### 4.5.1 Alternative GW-2: Limited Action

Limited action for ground water consists of ground water monitoring and implementing a ground water restriction or other IC to prevent future ground water use at MPTC that presents an unacceptable risk to human health or may mobilize contaminants hydraulically. The ICs will limit future use of ground water or prevent drilling wells that may cause unacceptable risk from exposure. Because limited action will not restore the ground water to beneficial use, it may require a demonstration of MNA or a Technical Impracticability Waiver to be a stand-alone remedy.

### 4.5.2 Alternative GW-3: Long-term Monitoring

LTM, Alternative GW-2, would be performed to verify that the plume is not moving and that concentrations are not increasing. ICs will be implemented to minimize human exposure to contaminated ground water until the remedy is complete. Ground water monitoring will be conducted biannually to evaluate migration of contaminants offsite that would pose an unacceptable risk. A contingency measure such as alternative GW-5 may be evaluated if movement or concentration increases are observed.

### 4.5.3 Alternative GW-4: Monitored Natural Attenuation

Alternative GW-4, MNA, allows natural processes to achieve site-specific remedial objectives without enhancement or aggressive treatment. The "natural attenuation processes" that are at work in such a remediation approach include physical, chemical, or biological processes that, under favorable conditions, reduce the mass, toxicity, mobility, volume, or concentration of contaminants in the ground water. Natural processes that occur under MNA may include biodegradation (aerobic or anaerobic), dispersion, or dilution.

It is assumed MNA ground water sampling will be performed quarterly for the first 2 years to demonstrate the natural attenuation of the ground water, and bi-annually thereafter. ICs will be implemented to minimize human exposure to contaminated ground water until the remedy is complete. Ground water samples will be analyzed for contaminants of concern and MNA parameters, including chloride, nitrate, nitrite, sulfate, ferrous, ferric iron, and/or others. Indicator parameters measured during well purging will include dissolved oxygen, oxidation-reduction potential, pH, conductivity, and alkalinity.

The effectiveness of MNA will need to be demonstrated. A contingency measure such as Alternative GW-5 may be evaluated if MNA is not effective.

### 4.5.4 Alternative GW-5: ISCO

Alternative GW-5, ISCO, utilizes chemical oxidants such as permanganate, persulfate, peroxide, and ozone to oxidize contaminants in the ground water. Oxidants can be injected into WBZs of the Cockfield Aquifer via direct push technology or installation of injection wells. This technology will treat the ground water contamination, precluding any future human exposure in areas of treatment and offsite migration. The ISCO will likely be applied to the outer boundary of observed ground water contamination. The ground water contamination at the source area will still remain. Therefore, ICs restricting ground water use will still be required to prevent human exposure above acceptable risk levels in the source area. Ground water monitoring will be conducted bi-annually to evaluate migration of contaminants offsite that would pose an unacceptable risk.

## 4.6 DEEP (S2) GROUND WATER REMEDIAL ALTERNATIVES

The following remedial alternatives were identified as potential alternatives for the remediation of the deep WBZ (S2) ground water:

- Alternative DW-1: NFA
- Alternative DW-2: Limited Action
- Alternative DW-3: LTM.

Alternatives DW-1, DW-2, and DW-3 are as described previously in Sections 4.2.1, 4.5.1, and 4.5.2, respectively. Table 4-3 describes how each of the alternatives meets the RAOs.

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# Tables

**TABLE 1-1**
**NON-CANCER HAZARD INDEX SUMMARY**
**MARION PRESSURE TREATING COMPANY SITE**

| Receptor | Media | Noncancer HQ[1] | Risk Driver(s)[2] (media) |
|---|---|---|---|
| Trespasser/Recreational Visitor (Adolescent) | Surface water (Big Creek)<br>Surface water (Unnamed Tributary)<br>Surface soil (grid system)<br>Surface soil (Consolidation Area)<br>Airborne particulate and vapors<br>Sediment (Big Creek)<br>Sediment (Unnamed Tributary)<br>Crayfish<br>**Total (all media, all routes)**<br>Sediment (Big Creek hot spots)<br>**Total (all media, all routes, hot spot scenario)** | 0.036<br>0.031<br>0.0043<br>0.000056<br>0.00032<br>0.005<br>0.0033<br>10<br>**10**<br>3.7<br>**13.7** | Arsenic (crayfish)<br>Barium (crayfish)<br>Manganese (crayfish) |
| Offsite Resident (Adult) | Airborne particulates and vapors<br>**Total** | 0.0011<br>**0.0011** | N/A |
| Offsite Resident (Child) | Airborne particulates and vapors<br>**Total** | 0.0017<br>**0.0017** | N/A |
| Industrial Worker | Surface soil (grid system)<br>Surface soil (Consolidation Area)<br>Airborne particulates and vapors<br>Ground water<br>**Total (all media, all routes)** | 0.0075<br>0.0001<br>0.001<br>3.2<br>**3.2** | Thallium (ground water) |
| Onsite Resident (Adult) | Surface soil (grid system)<br>Surface soil (Consolidation Area)<br>Airborne particulates and vapors<br>Ground water<br>**Total (all media, all routes)** | 0.02<br>0.00017<br>0.0011<br>11<br>**11** | Arsenic (ground water)<br>Dibenzofuran (ground water)<br>Naphthalene (ground water)<br>Thallium (ground water) |
| Onsite Resident (Child) | Surface soil (grid system)<br>Surface soil (Consolidation Area)<br>Airborne particulates and vapors<br>Ground water<br>**Total (all media, all routes)** | 0.14<br>0.0014<br>0.0017<br>24<br>**24** | Arsenic (ground water)<br>Dibenzofuran (ground water)<br>Naphthalene (ground water)<br>Thallium (ground water) |

Notes:
1. A hazard index (HI) greater than 1.0 is considered an excess risk for non-carcinogenic health effects.
2. Constituents with a combined exposure route HI greater than 1.0.
N/A - As the HI for this receptor was less than 1.0, no constituents were identified as risk drivers.
Source: Tetra Tech EM Inc. 2001. Marion Pressure Treating Company Human Health Risk Assessment. 25 May.

**TABLE 1-2**
**CARCINOGENIC RISK SUMMARY**
**MARION PRESSURE TREATING COMPANY SITE**

| Receptor | Media | Carcinogenic Risk[1] | Risk Driver(s)[2] (media) |
|---|---|---|---|
| Trespasser/ Recreational Visitor (Adolescent) | Surface water (Big Creek) | 2.9E-08 | Benzo(a)pyrene (Big Creek sediment) |
| | Surface water (Unnamed Tributary) | --- | |
| | Surface soil (grid system) | 5.4E-07 | |
| | Surface soil (Consolidation Area) | 4.2E-07 | |
| | Air | 4.0E-10 | |
| | Sediment (Big Creek) | 3.9E-04 | |
| | Sediment (Unnamed Tributary) | 2.5E-06 | |
| | Crayfish | 8.2E-05 | |
| | **Total (all media, all routes)** | **4.7E-04** | |
| | Sediment (Big Creek hot spots) | 5.1E-04 | |
| | **Total (all media, all routes, hot spot scenario)** | **6.0E-04** | |
| Offsite Resident (Adult) | Airborne particulates and vapors | 4.0E-09 | N/A |
| | **Total** | **4.0E-09** | |
| Offsite Resident (Child) | Airborne particulates and vapors | 1.2E-09 | N/A |
| | **Total** | **1.2E-09** | |
| Industrial Worker | Surface soil (grid system) | 2.5E-06 | Arsenic (ground water) |
| | Surface soil (Consolidation Area) | 2.0E-06 | |
| | Airborne particulates and vapors | 2.5E-09 | |
| | Ground water | 1.1E-04 | |
| | **Total (all media, all routes)** | **1.1E-04** | |
| Onsite Resident (Adult) | Surface soil (grid system) | 5.3E-06 | Arsenic (ground water) |
| | Surface soil (Consolidation Area) | 3.7E-06 | |
| | Airborne particulates and vapors | 4.0E-09 | |
| | Ground water | 3.7E-04 | |
| | **Total (all media, all routes)** | **3.8E-04** | |
| Onsite Resident (Child) | Surface soil (grid system) | 9.1E-06 | Arsenic (ground water) |
| | Surface soil (Consolidation Area) | 6.3E-06 | |
| | Airborne particulates and vapors | 1.2E-09 | |
| | Ground water | 1.7E-04 | |
| | **Total (all media, all routes)** | **1.9E-04** | |

Notes:

1. Cancer risks above $1x10^{-4}$ are generally considered unacceptable.

2. Constituents with a combined exposure route cancer risk greater than $1x10^{-4}$.

--- = Carcinogenic risk not reported in Human Health Risk Assessment

N/A - As the carcinogenic risk for this receptor was less than $10^{-6}$, no constituents were identified as risk drivers.

Source: Tetra Tech EM Inc. 2001. Marion Pressure Treating Company Human Health Risk Assessment. 25 May.

**TABLE 2-1**
**APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)**
**MARION PRESSURE TREATING COMPANY SITE**

| ARAR | Citation (If Available) | Description | Applicability |
|---|---|---|---|
| **Chemical-Specific** | | | |
| Federal Safe Drinking Water Act, Primary Drinking Water Standard (MCLs) | 40 CFR 141,143 | Establishes health-based standards for public water systems. It is applicable where contaminated ground water is or may be used for drinking water. | CERCLA requires that MCL for inorganics and organics be considered "relevant and appropriate" for ground water remediation. |
| Clean Water Act | 40 CFR 131 | Water Quality Criteria. These criteria set in-stream contaminant concentration levels for the protection of human health and wildlife. | ARAR applies because the ground water at the site is contaminated above levels that pose a threat to human health and wildlife. |
| EPA's Regional Screening Levels (RSLs) | "Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites" (EPA 2011) | Establishes risk-based screening levels for chemical contaminants in soil, water, and air. | TBC applies because many of the COPCs found at MPTC have RSLs (even if they do not have MCLs). |
| LDEQ RECAP Screening Values | "Risk Evaluation/Corrective Action Program" (RECAP; LDEQ 2003) | Establishes screening standards for chemical contaminants in soil and water. | TBC applies because many of the COPCs found at MPTC have RECAP screening values (even if they do not have MCLs). |
| **Location-Specific** | | | |
| Location Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities | 40 CFR 264.18 | These regulations prohibit new treatment, storage, or disposal of hazardous waste within 200 feet of a fault displaced in Holocene time, and require that a facility must be designed and maintained to avoid washout if located within a 100-year floodplain. | ARAR would apply if the Quaternary (Holocene) fresh water-bearing unit contains a fault and/or parts of the site are within a 100-year floodplain. A flood zone location map is not available for MPTC. |
| Floodplain Management | Executive Order 11988; 40 CFR 6 and Appendix A | Requires federal agencies to evaluate the potential affects of actions they may take in a floodplain to avoid adverse impacts in a floodplain. | ARAR may apply if parts of the site are within a 100-year floodplain. A flood zone location map is not available for MPTC. |
| Protection of Wetlands Order | Executive Order 11990; 40 CFR 6 and Appendix A | Mandates that federal agencies and potentially responsible parties avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and avoid support of new construction on wetlands if a practicable alternative exists. | ARAR applies because parts of the site may be considered wetlands. |
| Fish and Wildlife Coordination Act | 16 USC § 661 et seq., 16 USC § 742 a, 16 USC § 2901 | Requires adequate provisions for protection of fish and wildlife resources | ARAR applies because treatment or construction activities will be performed near a creek and wildlife refuge. |
| **Action-Specific** | | | |
| **Air** | | | |
| 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 for sulfur dioxide, nitrogen dioxide, and carbon monoxide apply to incineration. | ARAR may apply if desorption is used during remedial action. |
| Clean Air Act | 42 USC § 7475; 40 CFR 50.21 | Prevention of significant deterioration of air quality. These provisions impose various requirements on any new major stationary source of a federally regulated air pollutant in an area that has been designated attainment or unclassifiable for that pollutant. | ARAR may apply because even though activities at MPTC are not expected to constitute a major stationary source of any federally regulated air pollutant, remediation activities performed may change air quality. |

**TABLE 2-1**
**APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)**
**MARION PRESSURE TREATING COMPANY SITE**

| ARAR | Citation (If Available) | Description | Applicability |
|---|---|---|---|
| **Action-Specific (continued)** | | | |
| Emission Standards For Particulate Matter | LAC 33: III Chapter 13 | Remedial cleanup actions resulting in the generation of airborne particulate matter from the excavation of contaminated soils, earth moving, and regrading must be evaluated. | ARAR may apply because excavation of contaminated soils, earth moving, and regrading are activities that are a part of the excavation and disposal/treatment remedial alternative. |
| General Regulations on Control of Emissions and Emission Standards | LAC 33: III Section 905 | States air pollution control facilities should be installed whenever practically, economically, and technically feasible even though the ambient air quality standards in the affected area are not exceeded. | ARAR may apply for the excavation and desorption or *in situ* thermal treatment remedial alternatives, where air pollutants may be emitted. |
| Air Emission Standards for Tanks, Surface Impoundments, and Containers | LAC 33: III Chapter 17 Subchapter C | Regulates waste determination procedures, inspection and monitoring requirements, and recording and reporting requirements with respect to air emissions from tanks, surface impoundments, and containers. | ARAR may apply if the excavation and desorption remedial alternative require use of tanks, containers, or surface impoundments. |
| **Waste** | | | |
| Criteria for Identifying the Characteristics of Hazardous Waste and for Listing Hazardous Waste | 40 CFR 261; LAC 33: V Chapter 11 | Provides the criteria for identifying a characteristic or listed waste. Solid waste is a hazardous waste if it exhibits any of the characteristics of ignitability, corrosivity, reactivity, and toxicity or if it is a listed waste. Applicable to off site waste disposal. | ARAR applies for excavated soil or waste produced during treatment or construction activities. |
| Standards Applicable to Generators of Hazardous Waste | 40 CFR 262; LAC 33: V Chapter 11 | Provides requirements for preparation of waste manifests, waste packaging, labeling and handling. | ARAR applies for possible offsite disposal of excavated soil or waste produced during treatment or construction activities. |
| Standards Applicable to Transporters of Hazardous Waste | 40 CFR Part 263 | These regulations establish standards which apply to persons transporting hazardous waste within the United States if the transportation requires a manifest under 40 CFR part 262. | ARAR applies for possible offsite disposal of excavated soil or waste produced during treatment or construction activities. |
| Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities | 40 CFR Part 264; LAC 33: V Chapters 1, 3, and 5 | Establishes minimum national standards which define the acceptable management of hazardous waste. | ARAR applies for excavated soil or waste produced during treatment or construction activities that may be hazardous. |
| Hazardous Waste Burned in Boilers and Industrial Furnaces | 40 CFR 266 Subpart H | Regulates the burning of hazardous waste in boilers and industrial furnaces (BIF). BIFs are subject to essentially the same general facility standards as are other RCRA treatment, storage, and disposal facilities. Regulation covers management prior to burning, permit standards and interim status standards, emission control, exemptions, and regulation of residues. | ARAR would apply for the thermal desorption remedial alternative. |
| Land Disposal Restrictions | 40 CFR 268; LAC 33: V Chapter 22 | Restricts the land disposal of most hazardous wastes, and specified specific treatment standards that must be met before these wastes can be land disposed. | ARAR applies for possible offsite disposal of excavated soil or waste produced during treatment or construction activities. |
| Procedures of Planning and Implementing Offsite Response Actions | 40 CFR 300.400 | Hazardous waste 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. | ARAR would apply if hazardous waste is sent excavated and disposed offsite because this site is a CERCLA cleanup. |
| Transportation of Hazardous Materials | 49 CFR Part 171 | Hazardous materials that may be transported cannot be transported in interstate and intrastate commerce, except in accordance with the requirements of 49 CFR Part 171, Subpart C. | ARAR applies because hazardous materials may be transported during treatment or construction. |

**TABLE 2-1**
**APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)**
**MARION PRESSURE TREATING COMPANY SITE**

| ARAR | Citation (If Available) | Description | Applicability |
|---|---|---|---|
| **Action-Specific (continued)** | | | |
| Solid Waste Regulation | LAC 33: VII Subpart 1 | Establishes standards that govern the storage, collection, processing, recovery and reuse, and disposal of solid waste. It also implements a management program that will protect the air, ground water, surface water, and the environment from pollution from solid wastes and, thus, eliminate the potential threat to human health from such pollution. | ARAR applies because treatment or construction activity at the MPTC site may produce solid waste. |
| Waste Piles | LAC 33: V Chapter 23 | Apply to owners and operators of facilities that store or treat hazardous waste in piles. Regulations include design and operating requirement, action leakage rates, inspection of synthetic liners, and monitoring and inspection. | ARAR applies if treatment or removal of contaminated soils requires formation of waste piles. |
| **Remediation Activities** | | | |
| RAPs | LAC 33: V Chapter 5 Subchapter G | This is a special form of a RCRA permit that an owner or operator may obtain instead of a permit issued under LAC 33: V Section 303-329 and 501-537, to authorize you to treat, store, and dispose of hazardous waste at a remediation waste management site. | ARAR applies if remediation activities require treatment, storage, or disposal of hazardous waste at a remediation waste management site. |
| Inactive and Abandoned Hazardous Waste Substance Site Remediation | LAC 33: IV Chapter 5 | Regulates remedial actions, role of PRP in remedial actions, minimum remediation standards and risk evaluation, corrective action, selection of final remedy, and inspections by the department. | ARAR applies because remediation activities will be performed at an inactive and abandoned hazardous waste site. |
| **Water Discharge** | | | |
| National Pollutant Discharge Elimination System | 40 CFR 122-125 | Provides conditions that must be incorporated into NPDES permits. Applicable to discharge of storm water from the Site. | ARAR applies because water may be discharged from the site during remedial activities. |
| Underground Injection Control Program | 40 CFR 144 | Provides minimum requirements for Class 5 injection wells. Applicable to alternative where reagents will be injected below the water table. | ARAR would apply to the remedial alternatives which includes injecting amendments. |
| LPDES | LAC 33: IX Subpart 2 | Regulates permit applications, permitting conditions, criteria and standards for technology-based treatment requirement, toxic pollutant effluent standards and prohibitions, and sampling procedures. | ARAR applies because water may be discharged from the site during remedial activities. |

Notes:
ARAR - Applicable or relevant and appropriate requirements
BIF - Boiler and industrial furnaces
CERCLA - Comprehensive Environmental Response, Compensation & Liabilities Act
CFR - Code of Federal Regulations
COPC - Contaminant of potential concern
LAC - Louisiana Administrative Code
LDEQ - Louisiana Department of Environmental Quality
LPDES - Louisiana Pollutant Discharge Elimination System
MCL - Maximum Contaminant Level
MPTC - Marion Pressure Treating Company
NAAQS - National Primary and Secondary Ambient Air Quality Standards
NPDES - National Pollutant Discharge Elimination System
RAP - Remedial action plan
RCRA - Resource Conservation and Recovery Act
RECAP - Risk Evaluation/Corrective Action Program
RSL - Regional Screening Level
TBC - To be considered
USC - United States Code

## TABLE 2-2
## DIRECT EXPOSURE LIMITS
## MARION PRESSURE TREATING COMPANY SITE

| Exposure Scenario | Excess Cancer Risk B(a)P Equivalent Concentrations | | |
|---|---|---|---|
| | **1 X 10$^{-6}$** | **1 X 10$^{-5}$** | **1 X 10$^{-4}$** |
| Current Trespasser/Recreational Visitor<br>Future Trespasser/Recreational Visitor | 0.42 mg/kg | 4.2 mg/kg | 42 mg/kg |
| Future Industrial Worker | 0.26 mg/kg | 2.6 mg/kg | 26 mg/kg |

Notes:
B(a)P = Benzo(a)pyrene
mg/kg = Milligram(s) per kilogram

**TABLE 2-3**
**AREAS EXCEEDING HUMAN HEALTH RISK EXPOSURE LIMITS - BIG CREEK EXPOSURE AREA**
**MARION PRESSURE TREATING COMPANY SITE**

| Sample Location | B(a)P Equivalent (mg/kg) | Remedial Depth (feet bgs) | Notes |
|---|---|---|---|
| JS04 | 171.72 | 0.5 | Soil hotspot is located near waste pile. Further analysis is required to determine if JS04 is still above exposure limits before designating it as subject to remediation. Additionally, surrounding areas should be further characterized to determine the localization of the contamination exceeding exposure limits. |
| O16 | 115.68 | 0.5 | Soil hotspot is located near Big Creek. Further analysis is required to determine if O16 is still above exposure limits before designating it as subject to remediation. |
| | 103.46 | 2 | |
| SD03 | 669.4 | 0.5 | Sediment contamination is located in Big Creek. Analysis of this location is required before designating area as subject to remediation due to the transient nature of sediment contamination. |
| SD02 | 347.21 | 0.5 | |
| SD01 | 148.61 | 0.5 | |

Notes:
B(a)P = Benzo(a)pyrene
bgs = Below ground surface
mg/kg = Milligram(s) per kilogram

**TABLE 2-4**
**SUMMARY OF ANALYTICAL DETECTIONS - 2000, 2002, 2010**
**MARION PRESSURE TREATING COMPANY SITE**

| Well ID | Analyte | MCL Standards (µg/L) | RSL November 2010 Tap Water (µg/L) | LDEQ RECAP Screening Standards 2003 (µg/L) | August 2000 Concentration (µg/L) | Qualifiers | July 2002 Concentration (µg/L) | Qualifiers | December 2010 Concentration (µg/L) | Qualifiers |
|---|---|---|---|---|---|---|---|---|---|---|
| MW-1 | Bis(2-ethylhexyl)phthalate | 6 | 4.80 | 6.00 | 1 | LJ | NS | | <5.0 | U |
| MW-2 | 2,4-Dimethylphenol | | 730 | 73 | **3,450** | | NS | | <4.8 | U |
| | 2-Methylnaphthalene | | 150 | 0.62 | <5.0 | U | NS | | **420** | |
| | Acenaphthene | | 2200 | 37 | 1,880 | | NS | | 550 | |
| | Acetophenone | | 3730 | | 57 | | NS | | <4.8 | U |
| | Benzo(a)anthracene | | 0.020 | 7.80 | **114** | | NS | | <4.8 | U |
| | Benzo(a)pyrene | 0.2 | 0.0029 | 0.20 | **47.5** | | NS | | <4.8 | U |
| | Benzo(b)fluoranthene | | 0.0290 | 4.80 | **47.8** | | NS | | <9.5 | U |
| | Benzo(k)fluoranthene | | 0.29 | 2.50 | **49.1** | | NS | | <9.5 | U |
| | Biphenyl | | 1800 | 30 | 299 | | NS | | 77 | LJ |
| | Carbazole | | 1500[1] | | 382 | | NS | | 320 | |
| | Chrysene | | 2.90 | 1.60 | **132** | | NS | | <0.095 | U |
| | Dibenzo(a,h)anthracene | | 0.0029 | 2.50 | **5.6** | | NS | | <0.095 | U |
| | Dibenzofuran | | 37 | 10 | **1,150** | | NS | | **290** | |
| | Fluoranthene | | 1500 | 150 | 1,220 | | NS | | <5.0 | U |
| | Fluorene | | 1500 | 24 | 1,100 | | NS | | 210 | LJ |
| | Indeno(1,2,3-cd)pyrene | | 0.029 | 3.70 | **14.5** | | NS | | <5.0 | U |
| | Naphthalene | | 0.14 | 10 | **15,600** | | NS | | **7,700** | |
| | Phenanthrene | | 11000[2] | 180 | <5.0 | U | NS | | 220 | LJ |
| | Phenol | | 11000 | 180 | <5.0 | U | NS | | 92 | LJ |
| | Pyrene | | 1100 | 18 | 764 | | NS | | <0.10 | U |
| MW-3 | 2-Methylnaphthalene | | 150 | 0.62 | <5.0 | U | NS | | 2.7 | LJ |
| | Acenaphthene | | 2200 | 37 | 238 | | NS | | 8.4 | |
| | Biphenyl | | 1800 | 30 | 50.1 | | NS | | <5.0 | U |
| | Dibenzofuran | | 37 | 10 | **149** | | NS | | <5.0 | U |
| | Fluorene | | 1500 | 24 | 152 | | NS | | 4.5 | LJ |
| | Naphthalene | | 0.14 | 10 | **258** | | NS | | **18** | |
| | Phenanthrene | | 11000[2] | 180 | <5.0 | U | NS | | 5.6 | |
| | Pyrene | | 1100 | 18 | 39.9 | | NS | | <0.10 | U |
| MW-3D | 2-Methylnaphthalene | | 150 | 0.62 | NS | | NS | | 3.2 | LJ |
| | Acenaphthene | | 2200 | 37 | NS | | NS | | 9.2 | |
| | Bis(2-ethylhexyl)phthalate | 6 | 4.80 | 6.00 | NS | | NS | | **5.4** | |
| | Dibenzofuran | | 37 | 10 | NS | | NS | | 5.6 | |
| | Fluoranthene | | 1500 | 150 | NS | | NS | | 1.3 | LJ |
| | Fluorene | | 1500 | 24 | NS | | NS | | 5.0 | LJ |
| | Naphthalene | | 0.14 | 10 | NS | | NS | | **20** | |
| | Phenanthrene | | 11000[2] | 180 | NS | | NS | | 6.0 | |

**TABLE 2-4**
**SUMMARY OF ANALYTICAL DETECTIONS - 2000, 2002, 2010**
**MARION PRESSURE TREATING COMPANY SITE**

| Well ID | Analyte | MCL Standards (µg/L) | RSL November 2010 Tap Water (µg/L) | LDEQ RECAP Screening Standards 2003 (µg/L) | August 2000 Concentration (µg/L) | Qualifiers | July 2002 Concentration (µg/L) | Qualifiers | December 2010 Concentration (µg/L) | Qualifiers |
|---|---|---|---|---|---|---|---|---|---|---|
| MW-4 | Bis(2-ethylhexyl)phthalate | 6 | 4.80 | 6.00 | 2 | LJ | NS | | <5.0 | U |
| | Diethylphthalate | | 29000 | 2900 | 1 | LJ | NS | | <5.0 | U |
| MW-4D | Bis(2-ethylhexyl)phthalate | 6 | 4.80 | 6.00 | 2 | LJ | NS | | <5.0 | U |
| | Diethylphthalate | | 29000 | 2900 | 1 | LJ | NS | | <5.0 | U |
| MW-5 | Bis(2-ethylhexyl)phthalate | 6 | 4.80 | 6.00 | 1 | LJ | NS | | <5.0 | U |
| MW-7 | Bis(2-ethylhexyl)phthalate | 6 | 4.80 | 6.00 | **7** | | NS | | <5.0 | U |
| MW-14 | 2,4-Dimethylphenol | | 730 | 73 | <180 | U | NS | | **9,200** | LJ |
| | 2-Methylnaphthalene | | 150 | 0.62 | 110 | LJ | NS | | **590** | |
| | 2-Methylphenol | | 1800 | | <180 | U | NS | | **34,000** | |
| | 4-Methylphenol | | 180 | | <180 | U | NS | | **90,000** | |
| | Acenaphthene | | 2200 | 37 | 140 | | NS | | 540 | |
| | Biphenyl | | 1800 | 30 | 21 | LJ | NS | | 54 | LJ |
| | Dibenzofuran | | 37 | 10 | **84** | LJ | NS | | **270** | |
| | Fluorene | | 1500 | 24 | 78 | LJ | NS | | 200 | LJ |
| | Naphthalene | | 0.14 | 10 | **570** | | NS | | **6,500** | LJ |
| | Phenanthrene | | 11000[2] | 180 | 150 | LJ | NS | | 210 | LJ |
| | Phenol | | 11000 | 180 | <180 | U | NS | | **120,000** | |
| MW-15 | 2,4-Dimethylphenol | | 730 | 73 | NS | | 2.8 | J | <4.8 | U |
| | 2-Methylnaphthalene | | 150 | 0.62 | NS | | 17 | | 4.7 | |
| | 2-Methylphenol | | 1800 | | NS | | 3.1 | J | <240 | U |
| | 3 and 4-Methylphenol | | 180 | | NS | | 5.6 | J | <4.8 | U |
| | Acenaphthene | | 2200 | 37 | NS | | 19 | | 8.5 | |
| | Acetophenone | | 3730 | | NS | | 11 | | <4.8 | U |
| | Anthracene | | 11000 | 43 | NS | | 2.01 | | <4.8 | U |
| | Biphenyl | | 1800 | 30 | NS | | <10 | U | 1.1 | LJ |
| | Bis(2-ethylhexyl)phthalate | 6 | 4.80 | 6.00 | NS | | **118** | | <5.0 | U |
| | Caprolactam | | 18000 | | NS | | 18 | | <9.5 | U |
| | Carbazole | | 1500[1] | | NS | | 7.3 | J | 6.3 | |
| | Chrysene | | 2.90 | 1.60 | NS | | <10 | U | 0.070 | LJ |
| | Dibenzofuran | | 37 | 10 | NS | | 6.6 | J | 5.6 | |
| | Fluoranthene | | 1500 | 150 | NS | | 1.53 | | 2.8 | LJ |
| | Fluorene | | 1500 | 24 | NS | | 7.5 | J | 6.8 | |
| | Naphthalene | | 0.14 | 10 | NS | | **112** | | **6.2** | |
| | Phenanthrene | | 11000[2] | 180 | NS | | 11.1 | | 15 | |
| | Phenol | | 11000 | 180 | NS | | 4.3 | J | <5.0 | U |
| | Pyrene | | 1100 | 18 | NS | | 1.84 | | 2.2 | LJ |
| MW-16 | 2-Methylnaphthalene | | 150 | 0.62 | NS | | <10 | U | 0.087 | LJ |
| | Acetophenone | | 3730 | | NS | | 23 | | <4.8 | U |
| | Naphthalene | | 0.14 | 10 | NS | | **2.65** | | <9.5 | U |

**TABLE 2-4**
**SUMMARY OF ANALYTICAL DETECTIONS - 2000, 2002, 2010**
**MARION PRESSURE TREATING COMPANY SITE**

| Well ID | Analyte | MCL Standards (µg/L) | RSL November 2010 Tap Water (µg/L) | LDEQ RECAP Screening Standards 2003 (µg/L) | August 2000 Concentration (µg/L) | Qualifiers | July 2002 Concentration (µg/L) | Qualifiers | December 2010 Concentration (µg/L) | Qualifiers |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2,4-Dimethylphenol | | 730 | 73 | NS | | 8.9 | J | <4.8 | U |
| | 2-Methylnaphthalene | | 150 | 0.62 | NS | | 7.7 | J | 0.26 | |
| | 2-Methylphenol | | 1800 | | NS | | 8.5 | J | <240 | U |
| | 3 and 4-Methylphenol | | 180 | | NS | | 8.6 | J | <4.8 | U |
| | Acenaphthene | | 2200 | 37 | NS | | 14.7 | | 10 | |
| | Acetophenone | | 3730 | | NS | | 21 | | <4.8 | U |
| | Anthracene | | 11000 | 43 | NS | | 8.85 | | 8.2 | |
| | Benzo(a)anthracene | | 0.020 | 7.80 | NS | | **3.3** | | <4.8 | U |
| | Benzo(a)pyrene | 0.2 | 0.0029 | 0.20 | NS | | **1** | | **0.042** | LJ |
| | Benzo(b)fluoranthene | | 0.029 | 4.80 | NS | | 1.15 | | <9.5 | U |
| | Benzo(k)fluoranthene | | 0.29 | 2.50 | NS | | <10 | U | 0.092 | LJ |
| MW-17 | Biphenyl | | 1800 | 30 | NS | | 2.1 | J | 1.5 | LJ |
| | Bis(2-ethylhexyl)phthalate | 6 | 4.80 | 6.00 | NS | | **250** | | <5.0 | U |
| | Caprolactam | | 18000 | | NS | | 188 | | <9.5 | U |
| | Carbazole | | 1500[1] | | NS | | 4.9 | J | <9.5 | U |
| | Chrysene | | 2.90 | 1.60 | NS | | **3.55** | | 0.37 | |
| | Dibenzofuran | | 37 | 10 | NS | | 6.3 | J | 16 | |
| | Fluoranthene | | 1500 | 150 | NS | | 24.2 | | 27 | |
| | Fluorene | | 1500 | 24 | NS | | 10.7 | | 23 | |
| | Naphthalene | | 0.14 | 10 | NS | | **90.5** | | <9.5 | U |
| | Phenanthrene | | 11000[2] | 180 | NS | | 36.6 | | 96 | |
| | Phenol | | 11000 | 180 | NS | | 3.4 | J | <5.0 | U |
| | Pyrene | | 1100 | 18 | NS | | 19.7 | | 14 | |
| | 2-Methylnaphthalene | | 150 | 0.62 | NS | | 70 | | 2.2 | |
| | Acenaphthene | | 2200 | 37 | NS | | 111 | | 4.9 | LJ |
| | Benzo(a)anthracene | | 0.020 | 7.80 | NS | | **1.84** | | <4.8 | U |
| | Benzo(a)pyrene | 0.2 | 0.0029 | 0.20 | NS | | **0.41** | | **0.052** | LJ |
| | Benzo(b)fluoranthene | | 0.029 | 4.80 | NS | | **0.43** | | **0.14** | |
| | Benzo(k)fluoranthene | | 0.29 | 2.50 | NS | | 0.24 | | 0.21 | |
| | Biphenyl | | 1800 | 30 | NS | | 22.9 | | <5.0 | U |
| | Bis(2-ethylhexyl)phthalate | 6 | 4.80 | 6.00 | NS | | **229** | | <5.0 | U |
| MW-18 | Carbazole | | 1500[1] | | NS | | 31.4 | | <9.5 | U |
| | Chrysene | | 2.90 | 1.60 | NS | | 2.12 | | 0.46 | |
| | Dibenzofuran | | 37 | 10 | NS | | **60** | | <5.0 | U |
| | Fluoranthene | | 1500 | 150 | NS | | 31.4 | | 21 | |
| | Fluorene | | 1500 | 24 | NS | | 61.4 | | 4.6 | LJ |
| | Indeno(1,2,3-cd)pyrene | | 0.029 | 3.70 | NS | | <14.3 | U | **0.031** | LJ |
| | Naphthalene | | 0.14 | 10 | NS | | **299** | | **4.6** | LJ |
| | Phenanthrene | | 11000[2] | 180 | NS | | 113 | | 29 | |
| | Pyrene | | 1100 | 18 | NS | | 18.6 | | 12 | |

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**TABLE 2-4**
**SUMMARY OF ANALYTICAL DETECTIONS - 2000, 2002, 2010**
**MARION PRESSURE TREATING COMPANY SITE**

| Well ID | Analyte | MCL Standards (µg/L) | RSL November 2010 Tap Water (µg/L) | LDEQ RECAP Screening Standards 2003 (µg/L) | August 2000 Concentration (µg/L) | Qualifiers | July 2002 Concentration (µg/L) | Qualifiers | December 2010 Concentration (µg/L) | Qualifiers |
|---|---|---|---|---|---|---|---|---|---|---|
| MW-19 | Bis(2-ethylhexyl)phthalate | 6 | 4.80 | 6.00 | NS | | **169** | | <5.0 | U |
| MW-19DUP | Bis(2-ethylhexyl)phthalate | 6 | 4.80 | 6.00 | NS | | **205** | | <5.0 | U |
| MW-20 | Acenaphthene | | 2200 | 37 | NS | | 6.7 | | <0.095 | U |
| | Anthracene | | 11000 | 43 | NS | | 1.51 | | <4.8 | U |
| | Benzo(a)anthracene | | 0.020 | 7.80 | NS | | **0.59** | | <4.8 | U |
| | Benzo(a)pyrene | 0.2 | 0.0029 | 0.20 | NS | | **0.15** | | <4.8 | U |
| | Benzo(b)fluoranthene | | 0.0290 | 4.80 | NS | | **0.16** | | <9.5 | U |
| | Bis(2-ethylhexyl)phthalate | 6 | 4.80 | 6.00 | NS | | **22.9** | | <5.0 | U |
| | Chrysene | | 2.90 | 1.60 | NS | | 0.62 | | 0.073 | LJ |
| | Fluoranthene | | 1500 | 150 | NS | | 8.81 | | <5.0 | U |
| | Fluorene | | 1500 | 24 | NS | | 4.38 | | <0.095 | U |
| | Naphthalene | | 0.14 | 10 | NS | | **12.1** | | <9.5 | U |
| | Phenanthrene | | 11000[2] | 180 | NS | | 18.6 | | <1.0 | U |
| | Pyrene | | 1100 | 18 | NS | | 5.73 | | <0.10 | U |
| MW-21 | Acenaphthene | | 2200 | 37 | NS | | 8.69 | | <0.095 | U |
| | Anthracene | | 11000 | 43 | NS | | 1.02 | | <4.8 | U |
| | Benzo(a)anthracene | | 0.02 | 7.80 | NS | | **0.26** | | <4.8 | U |
| | Chrysene | | 2.90 | 1.60 | NS | | 0.28 | | 0.053 | LJ |
| | Fluoranthene | | 1500 | 150 | NS | | 3.44 | | <5.0 | U |
| | Fluorene | | 1500 | 24 | NS | | 4.7 | | <0.095 | U |
| | Naphthalene | | 0.14 | 10 | NS | | **17.8** | | <9.5 | U |
| | Phenanthrene | | 11000[2] | 180 | NS | | 11.7 | | <1.0 | U |
| | Pyrene | | 1100 | 18 | NS | | 2.79 | | <0.10 | U |

Notes:

[1] Carbazole does not have an MCL, RSL, or LDEQ RECAP screening value. The RSL for fluorene was used for carbazole because of structural similarities.

[2] Phenanthrene does not have an MCL or RSL. The RSL for anthracene was used for phenanthrene because of structural similarities.

Values in bold exceed MCLs and/or RSLs.

Values in a colored cell exceed LDEQ RECAP Screening Values.

-- = Not detected

µg/L = Microgram(s) per liter

D or DUP = Duplicate

J = Estimated value

L = Reported concentration is below the Contract-required Quantitation Limit.

LDEQ = Louisiana Department of Environmental Quality

MCL = Maximum Contaminant Level

NS = Not sampled

RECAP = Risk Evaluation/Corrective Action Program

RSL = EPA Regional Screening Levels

U = Not detected above reporting limit.

**TABLE 3-1**
**DESCRIPTION OF TECHNOLOGIES POTENTIALLY APPLICABLE FOR SOIL/SEDIMENT**
**MARION PRESSURE TREATING COMPANY SITE**

| General Response Action | Technology | Process Option | Description |
|---|---|---|---|
| No Further Action | No Action | None | No action. |
| Limited Action | Engineering Controls | Fencing/Signs | Fencing and signs around the site will be used to keep trespassers out. |
| | Institutional Controls | Building/Construction Restriction and/or Excavation Restriction | Locations or buildings are restricted to prevent exposures or type/method of construction is limited to prevent exposures, or construction worker notification is required. Digging in areas where exposures might occur is prohibited or guidelines for how and where to perform excavations are used. |
| Containment | Capping | Consolidation Under a Clay Cap | A clay cap and top soil are placed over contaminated soil to prevent exposure above human health risk levels. |
| Removal | Excavation and Disposal | Landfill (Offsite) | Contaminated material is collected and transported to an approved offsite disposal facility. May be subject to Land Disposal Restrictions. |
| | Excavation and Treatment | Incineration (Onsite) | Contaminants are thermally decomposed via oxidation at temperatures usually greater than 900°C to destroy the organic fraction of the excavated soil. The contaminated soil would be incinerated onsite. |
| | | Incineration (Offsite) | Contaminants are thermally decomposed via oxidation at temperatures usually greater than 900°C to destroy the organic fraction of the excavated soil. The contaminated soil would be incinerated offsite. |
| | | Desorption | Contaminants are removed from excavated soil and sediment via direct or indirect heat exchange that vaporizes the semi-volatile organic compounds. The vapors are then condensed, collected, or oxidized. |
| | | Soil Washing | Contaminants sorbed onto fine soil and sediment particles are separated from bulk soil in aqueous solution by particle size. |
| | | Chemical Extraction | Contaminated soil and extractant are mixed in an extractor, thereby dissolving the contaminants. The extracted solution is placed in a separator, where the contaminants and extractant are then separated for treatment and further use. |
| | *In Situ* Thermal | *In Situ* Thermal Remediation | Contaminants are removed from soil in place via direct or indirect heat exchange that vaporizes the semi-volatile organic compounds. The vapors are then condensed or otherwise collected for further treatment. |
| | *In Situ* Biological | Phytoremediation | Contaminants are removed by plants/trees that are planted in the contaminated soil. |

**TABLE 3-1**
**DESCRIPTION OF TECHNOLOGIES POTENTIALLY APPLICABLE FOR SOIL/SEDIMENT**
**MARION PRESSURE TREATING COMPANY SITE**

| General Response Action | Technology | Process Option | Description |
|---|---|---|---|
| Removal (continued) | *In Situ* Physical | Soil Vapor Extraction | Contaminants are removed from soil using air extracted via soil vapor extraction wells. Volatile compounds in air are treated in a centralized unit. The air flow is induced by a vacuum. This alternative may be enhanced by executing pneumatic or hydraulic fracturing to expedite contaminant collection. |
| | | Soil Flushing | A fluid, having properties specific to the DNAPL and geosystem under consideration, is injected into the vadose zone and thoroughly swept through the DNAPL zone. The injected solution reacts with the contaminants by lowering interfacial tension between the DNAPL and aqueous phase, and alters other physical properties that enhance DNAPL solubility and mobility before being extracted for treatment. |
| Treatment | *In Situ* Chemical | Chemical Oxidation | Contaminants are oxidized into innocuous compounds by injecting oxidants such as permanganate, persulfate, peroxide, or ozone into the formation. |
| | *In Situ* Biological | Bioremediation | Contaminants are converted into innocuous end products by indigenous or inoculated micro-organisms. |
| | Solidification/Stabilization | Cement | Portland cement, often augmented with other materials, such as fly ash, lime kiln dust, cement kiln dust, and lime, is used as a binding reagent in solidification/stabilization because of its ability to both solidify (change the physical properties) and stabilize (change the chemical properties). |

Note:
DNAPL = Dense non-aqueous phase liquid

**TABLE 3-2**
**DESCRIPTION OF TECHNOLOGIES POTENTIALLY APPLICABLE FOR GROUND WATER**
**MARION PRESSURE TREATING COMPANY SITE**

| General Response Action | Technology | Process Option | Description |
|---|---|---|---|
| No Further Action | No Action | None | No action |
| Limited Action | Institutional Controls | Ground Water Use Restriction | Use of ground water is prohibited or its use (i.e., nonpotable uses) is limited to applications that would not cause exposure to humans. |
| | Long Term Monitoring | Sampling and Analysis | Periodic sampling and analysis of the ground water will determine plume migration offsite, which could pose a human exposure risk since access to ground water is not restricted offsite. |
| Containment | Vertical Barriers | Slurry Wall | Walls of bentonite and clay mixed with native soil are built in areas of soft earth via trenching, blocking off lateral ground water migration. |
| | | Grout Curtain | A row of vertical holes are drilled and filled with grout under pressure, so that each pillar of grout overlaps, forming a continuous wall or curtain that blocks off lateral ground water migration. |
| | | Sheet Piling | Sheet piling consists of thin interlocking sheets of steel driven into the ground with impact or vibratory hammers to obtain a continuous barrier in the ground, blocking off lateral ground water migration. |
| Treatment | *In Situ* Chemical | Chemical Oxidation | Contaminants are oxidized into innocuous compounds by injecting oxidants such as permanganate, persulfate, peroxide, or ozone into the aquifer. |
| | *In Situ* Biological | Bioremediation | Contaminants are converted into innocuous end products by indigenous or inoculated micro-organisms. |
| | | Phytoremediation | Contaminant are removed by plants/trees that are planted in soil overlying contaminated ground water. |
| Removal | *In Situ* Thermal | *In Situ* Thermal Remediation | Contaminants are removed from ground water in place via direct or indirect heat exchange that vaporizes the semi-volatile organic compounds. The vapors are then condensed or otherwise collected for further treatment or burned. |
| | *Ex Situ* Physical | Pump and Treat | A series of extraction wells are placed to remove contaminated ground water before it reaches residences. Extracted water is then treated and may be reinjected, released, or discharged. |

**TABLE 3-3**
**TECHNOLOGY SCREENING: SOIL/SEDIMENT**
**MARION PRESSURE TREATING COMPANY SITE**

| General Response Action | Technology | Process Option | Effectiveness | Implementability | Cost | Status |
|---|---|---|---|---|---|---|
| No Further Action | No Action | None | Will not address relevant RAO | Implementable as no remedial action will be conducted. | Low | **Retained as required under the National Oil and Hazardous Substances Pollution Contingency Plan** |
| Limited Action | Engineering Controls | Fencing/Signs | Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil. | Implementable | Low | **Retained** |
| Limited Action | Institutional Controls | Building/Construction Restriction and/or Excavation Restriction | Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil. | Implementable | Low | **Retained** |
| Limited Action | Erosion Controls | Consolidation Under Vegetative Cover | Will address relevant RAO because engineering and institutional controls will be used to prevent receptor contact with contaminated surface soil. | Implementable | Low | **Retained** |
| Containment | Consolidation and Capping | Consolidation Under a Clay or Soil Cap | Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil. | Implementable | Low | **Retained** |
| Removal | Excavation and Disposal | Landfill (Offsite) | Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil. | Implementable for surface soils | High | **Retained** |
| Removal | Excavation and Disposal | Disposal Cell (Onsite) | Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil. However, the protective lining underneath the disposal cell will provide no additional protection than capping because contaminated soil will still exist below the lining. | Implementable for surface soils | Medium | Not retained because of effectiveness. |
| Removal | Excavation and Treatment | Incineration (Onsite) | Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil. | Difficult to implement due to site location and terrain and insufficient utilities (i.e., limited water and energy resources). Incineration can be hazardous and will require control of noxious emissions. | High | Not retained because of implementability. |
| Removal | Excavation and Treatment | Incineration (Offsite) | Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil. | Difficult to implement due remote site location. Travel distance to incineration facility that would accept contaminated waste would drive up costs significantly. | High | **Retained** |
| Removal | Excavation and Treatment | Desorption | Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil. | Difficult to implement due to site location and terrain and insufficient utilities (i.e., limited water and energy resources). | High | Not retained because of implementability. |
| Removal | Excavation and Treatment | Soil Washing | Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil. | Difficult to implement - produces a large quantity of waste that requires treatment or disposal. C1 is largely fine soil. Removing organics that are adsorbed onto fine clay particles is difficult. | Medium | Not retained because of implementability. |
| Removal | Excavation and Treatment | Chemical Extraction | Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil. | Difficult to implement - produces a large quantity of waste that requires treatment or proper disposal. Hard to distribute in fine soils. | Medium | Not retained because of implementability. |

**TABLE 3-3**
**TECHNOLOGY SCREENING: SOIL/SEDIMENT**
**MARION PRESSURE TREATING COMPANY SITE**

| General Response Action | Technology | Process Option | Effectiveness | Implementability | Cost | Status |
|---|---|---|---|---|---|---|
| Removal (continued) | *In Situ* Thermal | *In Situ* Thermal Remediation | Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil by removing contaminants from the soil matrix. | Difficult to implement because of limited energy and water resources. | High | Not retained because of implementability. |
| | *In Situ* Biological | Phytoremediation | Will not address relevant RAO because phytoremediation relies on contaminants solubilizing to be metabolized during water uptake. Semi-volatile organic compounds have limited solubility. | Implementable | Low | Not retained because of effectiveness. |
| | *In Situ* Physical | SVE | Can be used to prevent receptor contact with contaminated surface soil by removing contaminants from the soil matrix. However, SVE of SVOCs from clay soil is difficult. | Not implementable - SVE is generally not appropriate for sites with ground water located less than 3 feet bgs and difficult for sites with ground water located less than 10 feet bgs. The ground water table at the site is as shallow as 0.5 foot bgs at some locations. | Medium | Not retained because of effectiveness and implementability. |
| | | Soil Flushing | Can be used to prevent receptor contact with contaminated surface soil by removing contaminants from the soil matrix. However, removing organics adsorbed onto fine clay particles is difficult. | Not implementable - distribution in fine soils is difficult. | Medium | Not retained because of implementability. |
| Treatment | *In Situ* Chemical | Chemical Oxidation | Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil by removing contaminants from the soil matrix. | Implementable via *in situ* mixing | High | **Retained** |
| | *In Situ* Biological | Bioremediation | Will not address relevant RAO because high SVOC concentrations (high toxicity) may hinder microbial degradation. | Implementable | Medium | Not retained because of effectiveness. |
| | *In Situ* Solidification/Stabilization | Cement | Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil by removing contaminants from the soil matrix. | Implementable | Medium | **Retained** |

Notes:
Cost estimates are relative within each General Response Action
bgs = Below ground surface
RAO = Remedial action objectives
SVE = Soil vapor extraction
SVOC = Semi-volatile organic compound

**TABLE 3-4**
**TECHNOLOGY SCREENING: GROUND WATER**
**MARION PRESSURE TREATING COMPANY SITE**

| General | Technology | Process Option | Effectiveness | Implementability | Cost | Status |
|---|---|---|---|---|---|---|
| No Further Action | No Action | None | Will not address relevant RAOs | Implementable as no remedial action will be conducted. | Low | **Retained as required under the National Oil and Hazardous Substances Pollution Contingency Plan** |
| Limited Action | Institutional Controls | Ground Water Use Restriction | Can prevent human exposure to contaminated ground water onsite. Must be coupled with another technology to address prevention of offsite migration and aquifer restoration. | Implementable | Low | **Retained** |
| | Long-term Monitoring | Sampling and Analysis | Will be able to indicate offsite migration. | Implementable | Low | **Retained** |
| | Monitored Natural Attenuation (MNA) | Sampling and Analysis Including MNA Parameters | Will be able to determine if natural attenuation and aquifer restoration is occurring. | Implementable | Low | **Retained** |
| Containment | Vertical Barriers | Slurry Wall | Will not address relevant RAOs because the ground water flow direction varies, preventing effective installation of the barrier. | Implementable | Medium | Not retained because of effectiveness. |
| | | Grout Curtain | Will not address relevant RAOs because the ground water flow direction varies, preventing effective installation of the barrier. | Implementable | Medium | Not retained because of effectiveness. |
| | | Sheet Piling | Will not address relevant RAOs because the ground water flow direction varies, preventing effective installation of the barrier. | Implementable | Medium | Not retained because of effectiveness. |
| Treatment | *In Situ* Chemical | Chemical Oxidation | Will address relevant RAOs because chemical oxidation can convert the SVOCs detected in the ground water into innocuous substances, preventing ground water contaminant migration to site boundary and offsite. | Implementable | Medium | **Retained** |
| | *In Situ* Biological | Bioremediation | Will not address relevant RAOs because microbial degradation of SVOCs is limited. | Implementable | Medium | Not retained because of effectiveness. |
| | | Phytoremediation | Will not address relevant RAOs because phytoremediation relies on contaminants solubilizing to be metabolized during water uptake. SVOCs have limited solubility. | Implementable | Low | Not retained because of effectiveness. |
| Removal | *In Situ* Thermal | *In Situ* Thermal Remediation | Will address relevant RAOs by removing contaminants from ground water, eliminating human exposure risks. Will address soil matrix contamination as well. | Difficult to implement because of limited water and energy resources | High | Not retained because of implementability. |
| | *Ex situ* physical | Pump and Treat | Will not address relevant RAOs. SVOCs are largely insoluble. Pumping ground water is an ineffective means of removing them. | Implementable | High | Not retained because of effectiveness. |

Notes:
Cost estimates are relative within each General Response Action
RAO = Remedial action objectives
SVOC = Semi-volatile organic compound

**TABLE 4-1**
**REMEDIAL ALTERNATIVES**
**MARION PRESSURE TREATING COMPANY SITE**

| **SOIL ALTERNATIVES** | | | | |
|---|---|---|---|---|
| **Former Impoundment Area** | | | | |
| Alternative F-1: NFA | Alternative F-2: Limited Action | Alternative F-3: Erosion Control | Alternative F-4: Capping | Alternative F-5: Excavation and Offsite Disposal/Offsite Incineration |
| **Source Area** | | | | |
| Alternative S-1: NFA | Alternative S-2: Limited Action | Alternative S-3: Select Capping | Alternative S-4: ISCO | Alternative S-5: Deep Soil Mixing with Stabilization/Solidification |
| **Big Creek Exposure Area** | | | | |
| Alternative B-1: NFA | Alternative B-2: Limited Action | Alternative B-3: Consolidation and Capping | Alternative B-4: Excavation and Offsite Disposal/Offsite Incineration | --- |
| **GROUND WATER ALTERNATIVES** | | | | |
| **Shallow (S1) Ground Water** | | | | |
| Alternative GW-1: NFA | Alternative GW-2: Limited Action | Alternative GW-3: LTM | Alternative GW-4: Monitored Natural Attenuation | Alternative GW-5: ISCO |
| **Deep (S2) Ground Water** | | | | |
| Alternative DW-1: NFA | Alternative DW-2: Limited Action | Alternative DW-3: LTM | --- | --- |

Notes:

*Capping - capping may consist of placing an impervious geosynthetic liner, clay, and top soil over area.
EC - Engineering Control
IC - Institutional Control
ISCO - *In Situ* Chemical Oxidation
LTM - Long-term Monitoring
NFA - No Further Action

**Former Impoundment Area (F alternatives)** - includes former impoundments and surrounding area, located to the east of the Consolidation Area.
**Source Area (S alternatives)** - are within the Former Impoundment Area of approximately 130 feet by 80 feet and surrounding MW-14, to a depth of 45 feet through the first (S1) sand layer.
**Big Creek Exposure Area (B alternatives)** - the sediment and surface soil hotspots in Big Creek, near the southern end of the site.
**Shallow Ground Water (GW alternatives)** - the contaminated ground water in the (S1) shallow water-bearing zone
**Deep Ground Water (DW alternatives)** - the contaminated ground water in the (S2) deep water-bearing zone

**General Remedial Alternatives**

**Plugging, Abandonment, and Replacement of Monitoring Wells** - plugging and abandoning wells with dense non-aqueous phase liquid in them (MW-2, MW-3, and MW-14) and wells that are screened through both the S1 and S2 water-bearing zones (MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-12, and MW-13).
**Erosion Control Area** - erosion control measures will be implemented around the slope/perimeter of the Consolidation Area with the majority of the area subject to such measures being located to the west and south. Erosion control measures will consist of, but are not limited to, placement of top soil, grading, and seeding.

**TABLE 4-2**
**SOIL REMEDIAL ALTERNATIVES EVALUATED AGAINST REMEDIAL ACTION OBJECTIVE**
**MARION PRESSURE TREATING COMPANY SITE**

| **Alternatives** | **Remedial Action Objective**<br>**Prevent receptor contact with contaminated soils that are above acceptable risk levels.** |
|---|---|
| **Alternatives F-1, S-1, and B-1: No Further Action** | Does not address remedial action objective. |
| **Alternatives F-2, S-2, and B-2: Limited Action** | Institutional and engineering controls will prevent receptor contact with contaminated soil. |
| **Alternative F-3: Erosion Control** | Erosion control will prevent receptor contact with contaminated soils. |
| **Alternatives F-4, S-3, and B-3: Capping** | Capping will prevent receptor contact with contaminated soils. |
| **Alternatives F-5 and B-4:**<br>**Excavation and Offsite Disposal/Offsite Incineration** | Removing contaminated soil will prevent receptor contact with contaminated soil. |
| **Alternative S-4 :**<br>***In Situ* Chemical Oxidation (ISCO)** | Treatment of the contaminated soils ISCO will prevent receptor contact with contaminated soil. |
| **Alternative S-5: Solidification/Stabilization** | In place solidification/stabilization of soils in the source area will prevent receptor contact with contaminated soils. |

Notes:

ISCO = *In situ* chemical oxidation
RAO = Remedial action objective

**Former Impoundment Area (F alternatives)** - includes former impoundments and surrounding area, located to the east of the Consolidation Area.
**Source Area (S alternatives)** - are within the Former Impoundment Area of approximately 130-feet by 80-feet and surrounding MW-14, to a depth of 45 feet through the first (S1) sand layer.
**Big Creek Exposure Area (B alternatives)** - the sediment and surface soil hotspots in Big Creek, near the southern end of the site.

**TABLE 4-3**
**GROUND WATER REMEDIAL ALTERNATIVES EVALUATED AGAINST REMEDIAL ACTION OBJECTIVES**
**MARION PRESSURE TREATING COMPANY SITE**

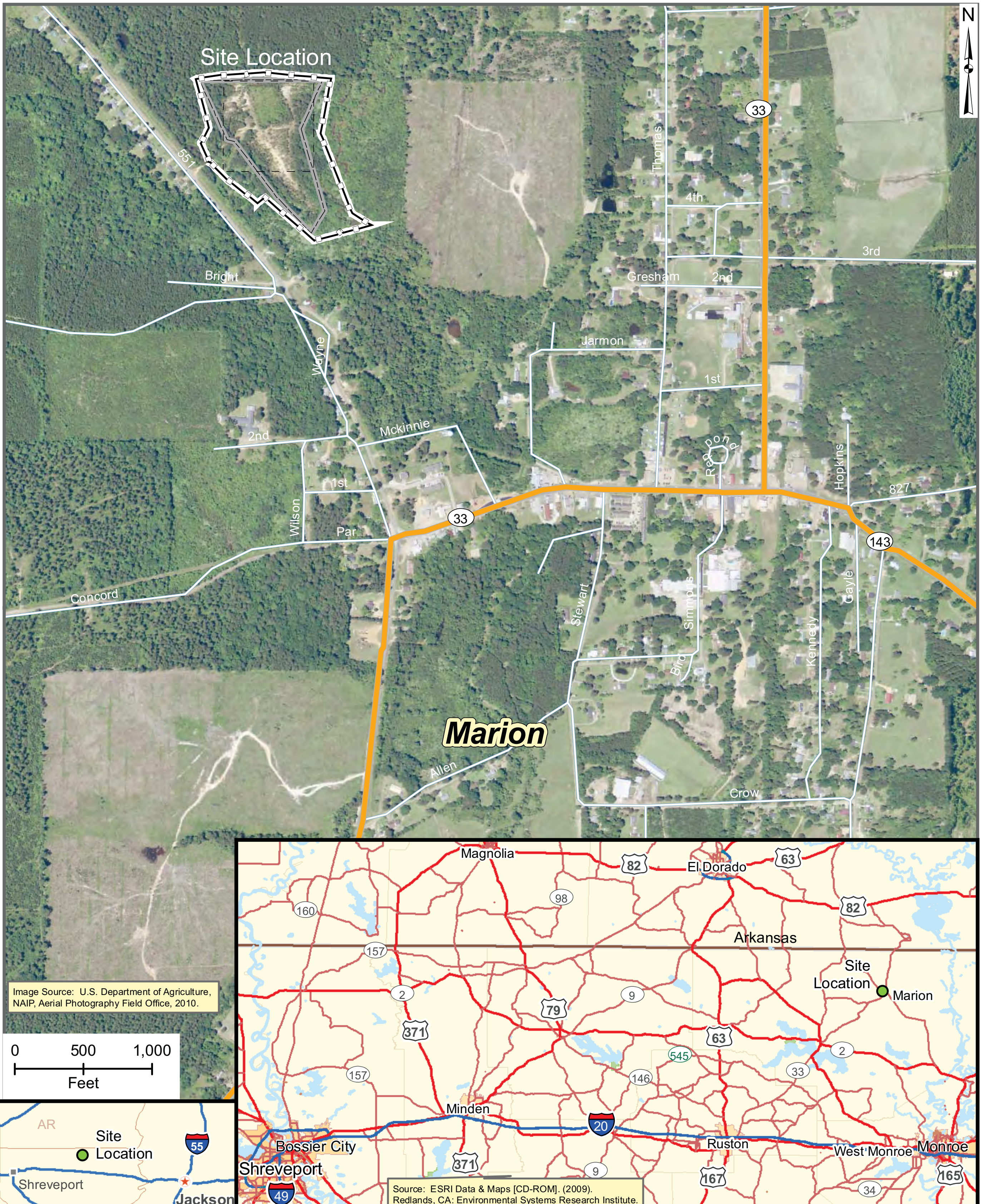
| Alternatives | Remedial Action Objectives | | |
|---|---|---|---|
| | **Prevent future human exposure to contaminated ground water above acceptable risk levels.** | **Prevent the contaminated ground water from migrating to the site property boundary and offsite.** | **Return ground water to its expected beneficial uses wherever practicable (aquifer restoration).** |
| **Alternatives GW-1 and DW-1: No Further Action** | Does not address RAO. | Does not address RAO. | Does not address RAO. Will require demonstration of monitored natural attenuation (MNA) or Technical Impracticability Waiver. |
| **Alternatives GW-2, and DW-2: Limited Action** | Institutional and engineering controls will prevent human exposure to contaminated ground water. | Does not address RAO. | Does not address RAO. Will require demonstration of MNA or Technical Impracticability Waiver. |
| **Alternative GW-3 and DW-3: Long Term Monitoring** | Institutional and engineering controls will prevent human exposure to contaminated ground water. | Will indicate offsite migration of ground water. | Does not address RAO. Will require demonstration of MNA or Technical Impracticability Waiver. |
| **Alternative GW-4: Monitored Natural Attenuation** | Institutional and engineering controls will prevent human exposure to contaminated ground water. | Will indicate offsite migration of ground water. | MNA may demonstrate a return of ground water to its expected beneficial. Aquifer restoration through natural attenuation may occur downgradient of Source Area but Technical Impracticability Waiver or other alternative may be required for the area with dense non-aqueous phase liquid (Source Area). |
| **Alternative GW-5: *In Situ* Chemical Oxidation (ISCO)** | Treatment of the contaminants at the outer boundary of the ground water contamination with ISCO will prevent exposure in those areas. | Treatment of the contaminants at the outer boundary of the ground water contamination with ISCO will prevent offsite migration of contaminated ground water. | Treatment of the contaminants in the ground water with ISCO will restore the aquifer. |

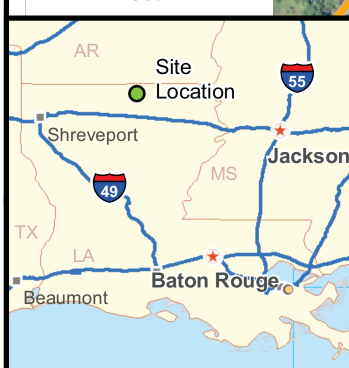
Notes:

ISCO = *In situ* chemical oxidation
MNA = Monitored natural attenuation
RAO = Remedial action objective

**Shallow Ground Water (GW alternatives) -** the contaminated ground water in the (S1) shallow water bearing zone
**Deep Ground Water (DW alternatives) -** the contaminated ground water in the (S2) deep water bearing zone

# Figures




# Figure 1
## Site Location Map

Remedial Investigation/Feasibility Study Reassessment
Marion Pressure Treating Company
Union Parish, Louisiana

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004593


Image Source: U.S. Department of Agriculture, NAIP, Aerial Photography Field Office, 2010.

# Figure 2
# Site Layout Map

Remedial Investigation/Feasibility Study Reassessment
Marion Pressure Treating Company
Union Parish, Louisiana

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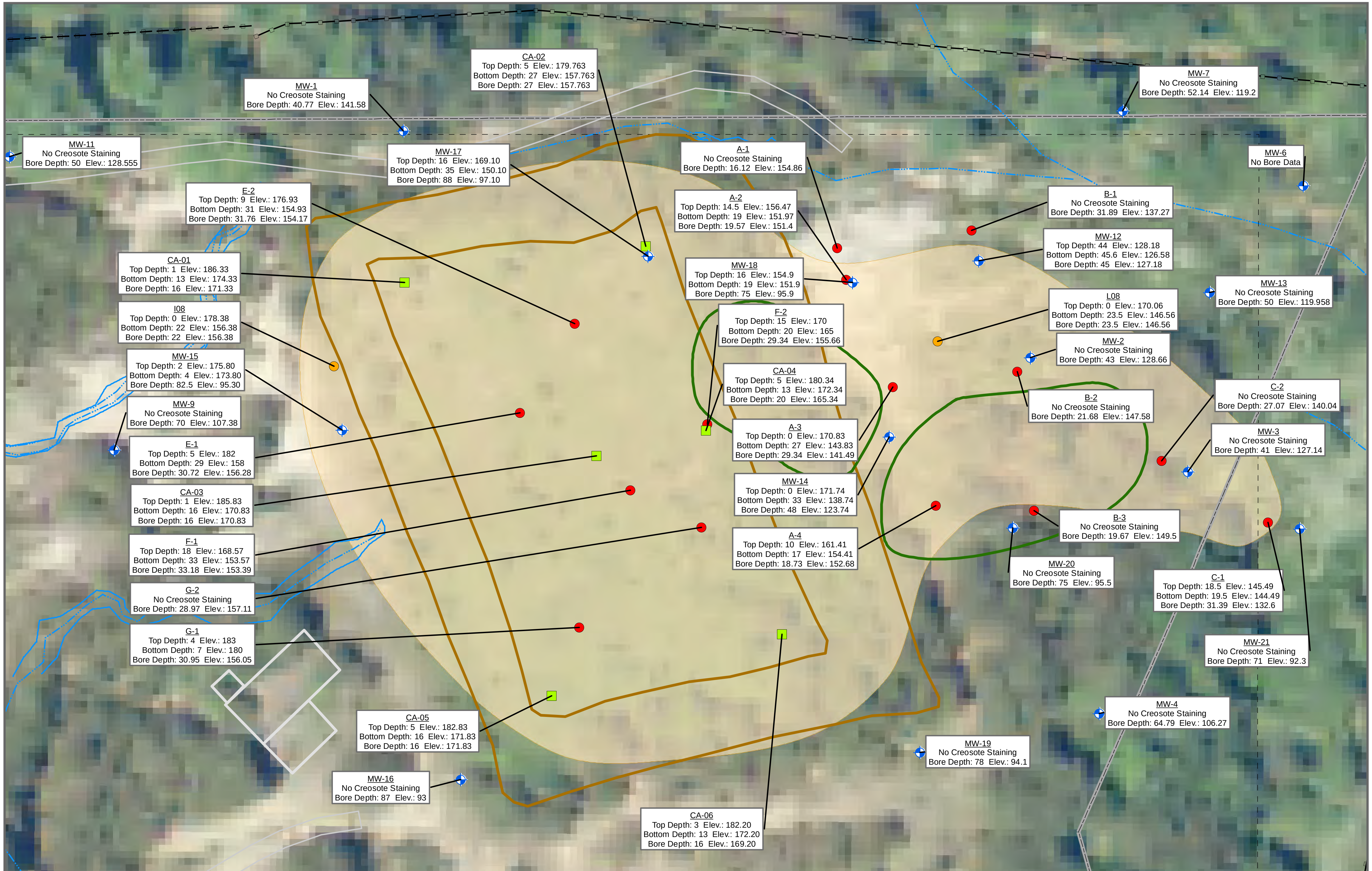


N

0 25 50
Feet

**Legend:**

- Bore Locations (2010)
- Bore Locations (2002)
- Bore Locations (2000)
- Monitor Well Locations
- Operational Boundary
- 10-acre Tract
- Fence
- Dirt Road
- Building
- Stream, Intermittent
- Pond, Intermittent
- Consolidation Area
- Former Impoundment
- Areal Extent of DNAPL

NOTES:

Location Designation
Top Depth: "Top of Observed Creosote"
Bottom Depth: "Bottom of Observed Creosote"
Bore Depth: "Total Depth of Boring"

Elevations are above Mean Sea Level, and are associated with referenced depth.

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Remedial Investigation/Feasibility Study Reassessment
Marion Pressure Treating Company
Union Parish, Louisiana

Image Source: USDA-FSA-APFO NAIP MrSID Mosaic, USDA/FSA - Aerial Photography Field Office, 2010

# Figure 3
# Observed and Calculated Area of Creosote/DNAPL Soil Contamination

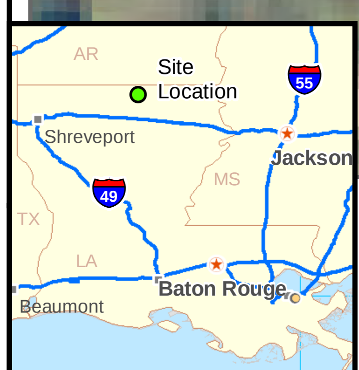
004595


N

0 25 50
Feet

**Legend:**

- Bore Locations (2010)
- Bore Locations (2002)
- Bore Locations (2000)
- Monitor Well Locations
- Operational Boundary
- Fence
- Dirt Road
- Building
- Culvert
- Stream, Intermittent
- Pond, Intermittent
- Consolidation Area
- Former Impoundment
- Tanks




Remedial Investigation/ Feasability Study Reassessment
Marion Pressure Treating Company
Union Parish, Louisiana

Image Source: 2008-2009 Texas Orthoimagery Program, Texas Strategic Mapping Program, TNRIS, 2009.

Figure 4
Cross Section Location Map

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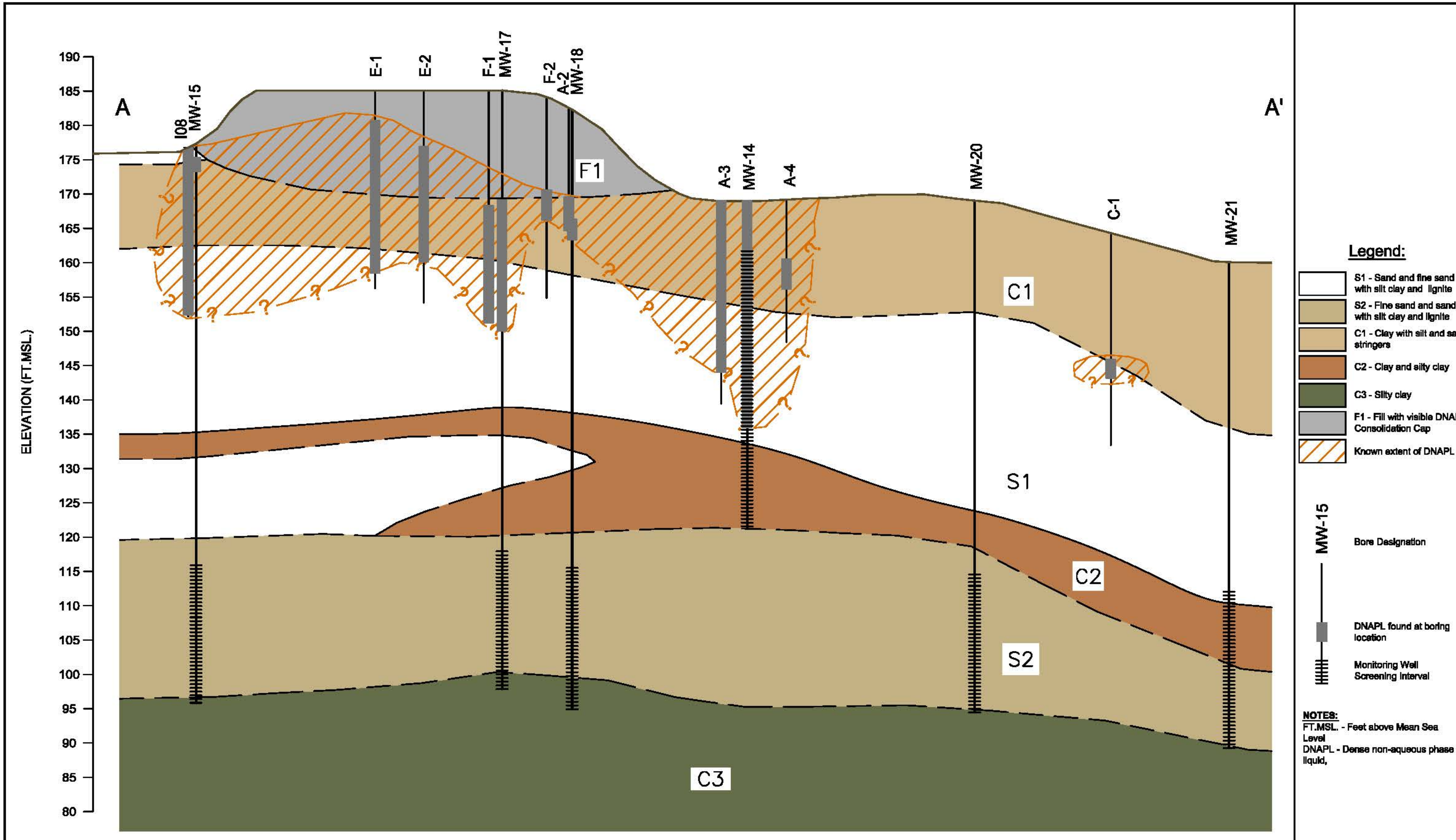
004596

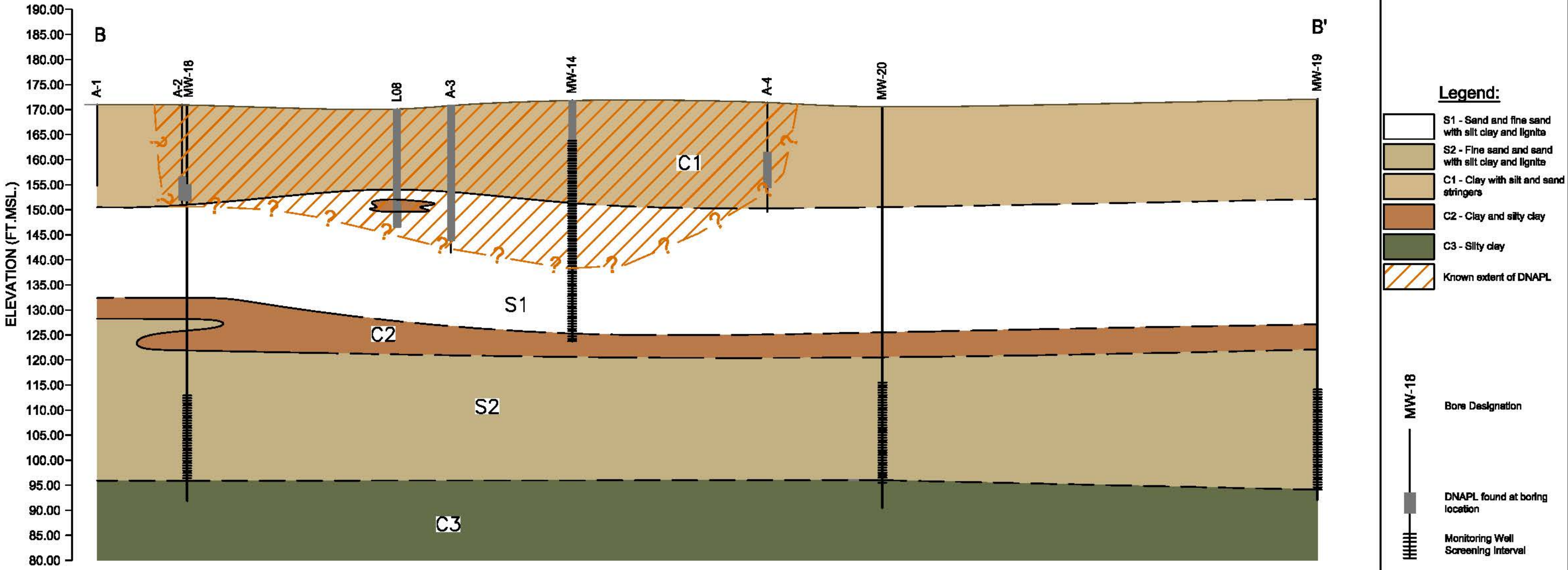



Remedial Investigation/Feasibility Study Reassessment
Marion Pressure Treating Company
Union Parish, Louisiana

Horizontal scale in feet
0 25 50

Figure 5
A-A' Cross Section

004597




**NOTES:**
FT.MSL. - Feet above Mean Sea Level
DNAPL - Dense non-aqueous phase liquid,

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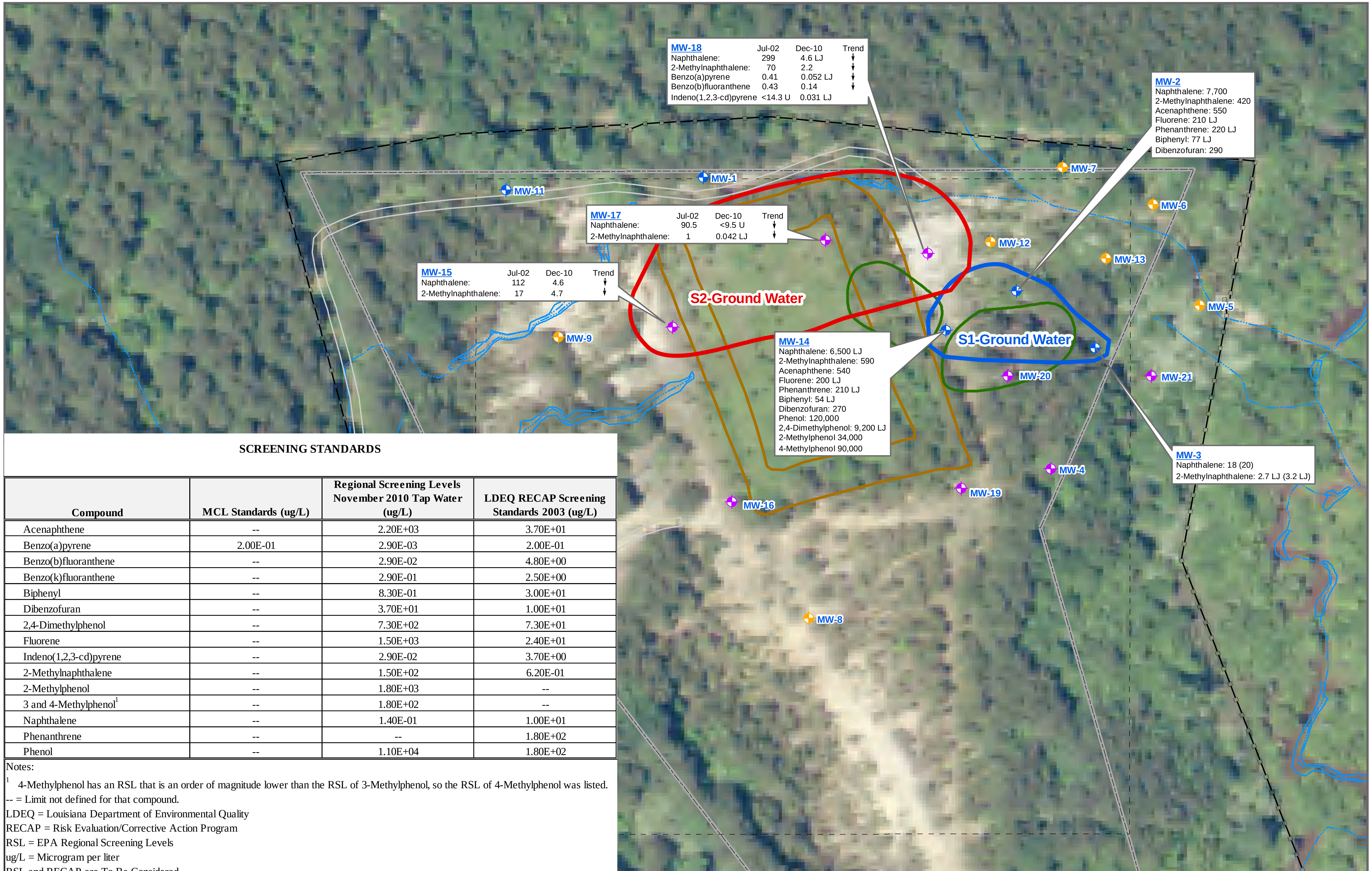
Figure 6
B-B' Cross Section

004598




**SCREENING STANDARDS**

| Compound | MCL Standards (ug/L) | Regional Screening Levels November 2010 Tap Water (ug/L) | LDEQ RECAP Screening Standards 2003 (ug/L) |
|---|---|---|---|
| Acenaphthene | -- | 2.20E+03 | 3.70E+01 |
| Benzo(a)pyrene | 2.00E-01 | 2.90E-03 | 2.00E-01 |
| Benzo(b)fluoranthene | -- | 2.90E-02 | 4.80E+00 |
| Benzo(k)fluoranthene | -- | 2.90E-01 | 2.50E+00 |
| Biphenyl | -- | 8.30E-01 | 3.00E+01 |
| Dibenzofuran | -- | 3.70E+01 | 1.00E+01 |
| 2,4-Dimethylphenol | -- | 7.30E+02 | 7.30E+01 |
| Fluorene | -- | 1.50E+03 | 2.40E+01 |
| Indeno(1,2,3-cd)pyrene | -- | 2.90E-02 | 3.70E+00 |
| 2-Methylnaphthalene | -- | 1.50E+02 | 6.20E-01 |
| 2-Methylphenol | -- | 1.80E+03 | -- |
| 3 and 4-Methylphenol[1] | -- | 1.80E+02 | -- |
| Naphthalene | -- | 1.40E-01 | 1.00E+01 |
| Phenanthrene | -- | -- | 1.80E+02 |
| Phenol | -- | 1.10E+04 | 1.80E+02 |

Notes:

[1] 4-Methylphenol has an RSL that is an order of magnitude lower than the RSL of 3-Methylphenol, so the RSL of 4-Methylphenol was listed.

-- = Limit not defined for that compound.

LDEQ = Louisiana Department of Environmental Quality

RECAP = Risk Evaluation/Corrective Action Program

RSL = EPA Regional Screening Levels

ug/L = Microgram per liter

RSL and RECAP are To Be Considered

N

0 50 100

Feet

**Legend:**

**Monitoring Well**

- S1 Formation
- S1,S2 Formation
- S2 Formation
- S1 - Ground Water
- S2 - Ground Water
- Operational Boundary
- 10-acre Tract
- Fence
- Dirt Road
- Stream, Intermittent
- Pond, Intermittent
- Consolidation Area
- Former Impoundment

NOTES:

Well Designation
"Chemical" "Concentration" "Qualifier"

"Concentration"
units = µg/L - microgram(s) per Liter
() - indicates duplicate sample results

"Qualifier"
J = Estimated value
L = Reported concentration is below the Contract-required Quantitation Limit

MCL = Maximum Contaminant Level
RSL = Regional Screening Level (US EPA)
LDEQ = Louisiana Department of Environmental Quality

Wells without analytical data shown did not exceed screening standards.

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Image Source: USDA-FSA-APFO NAIP MrSID Mosaic, USDA/FSA - Aerial Photography Field Office, 2010

# Figure 7
## Monitoring Wells Exceeding MCL/RSL/LDEQ Screening Standards
## December 2010

2011-09-12 r:\federal\epa\rac ii\0062-marion fs\gis\mxds\fig\x_wellocanalyt.mxd EA-Dallas jschwertz


N

0 50 100
Feet

**Legend:**

**Monitoring Well**
- S1 Formation
- S1,S2 Formation
- S2 Formation
- Operational Boundary
- 10-acre Tract
- Fence
- Dirt Road
- Stream, Intermittent
- Pond, Intermittent
- Consolidation Area
- Former Impoundment

NOTES:

Well Designation
"Chemical": "Concentration"

"Concentration"
units = µg/L - microgram(s) per liter

Primary MCL:
Arsenic: 10 µg/L
Lead: 15 µg/L
Thallium: 2 µg/L

Secondary MCL:
Iron: 300 µg/L
Manganese: 50 µg/L
Zinc: 5000 µg/L

MCL = Maximum Contaminant Level

Wells without analytical data shown did not exceed screening standards.

Wells MW-15 through MW-21 did not exist in 2000.

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Image Source: USDA-FSA-APFO NAIP MrSID Mosaic, USDA/FSA - Aerial Photography Field Office, 2010

# Figure 8
## Monitoring Wells Exceeding Metal MCLs During 2000 Remedial Investigation

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004600


N

0 30 60
Feet

**Legend:**

- Soil Sample Location
- Sediment Sample Location
- Operational Boundary
- 10-acre Tract
- Fence
- Dirt Road
- Stream, Intermittent
- Pond, Intermittent
- Consolidation Area
- Former Impoundment
- Spoil Pile
- Remediation Area

Notes:

"**Sample Identification - Sample depth**"
Results

Sample depth in inches
B(a)p eq.- Benzo(a)pyrene equivalent

Remediation Limits:
Industrial Worker: 26 mg/kg
Trespasser/
Recreational Visitor: 42 mg/kg

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Image Source: USDA-FSA-APFO NAIP MrSID Mosaic,
USDA/FSA - Aerial Photography Field Office, 2010

Figure 9
Big Creek Exposure Area

004601

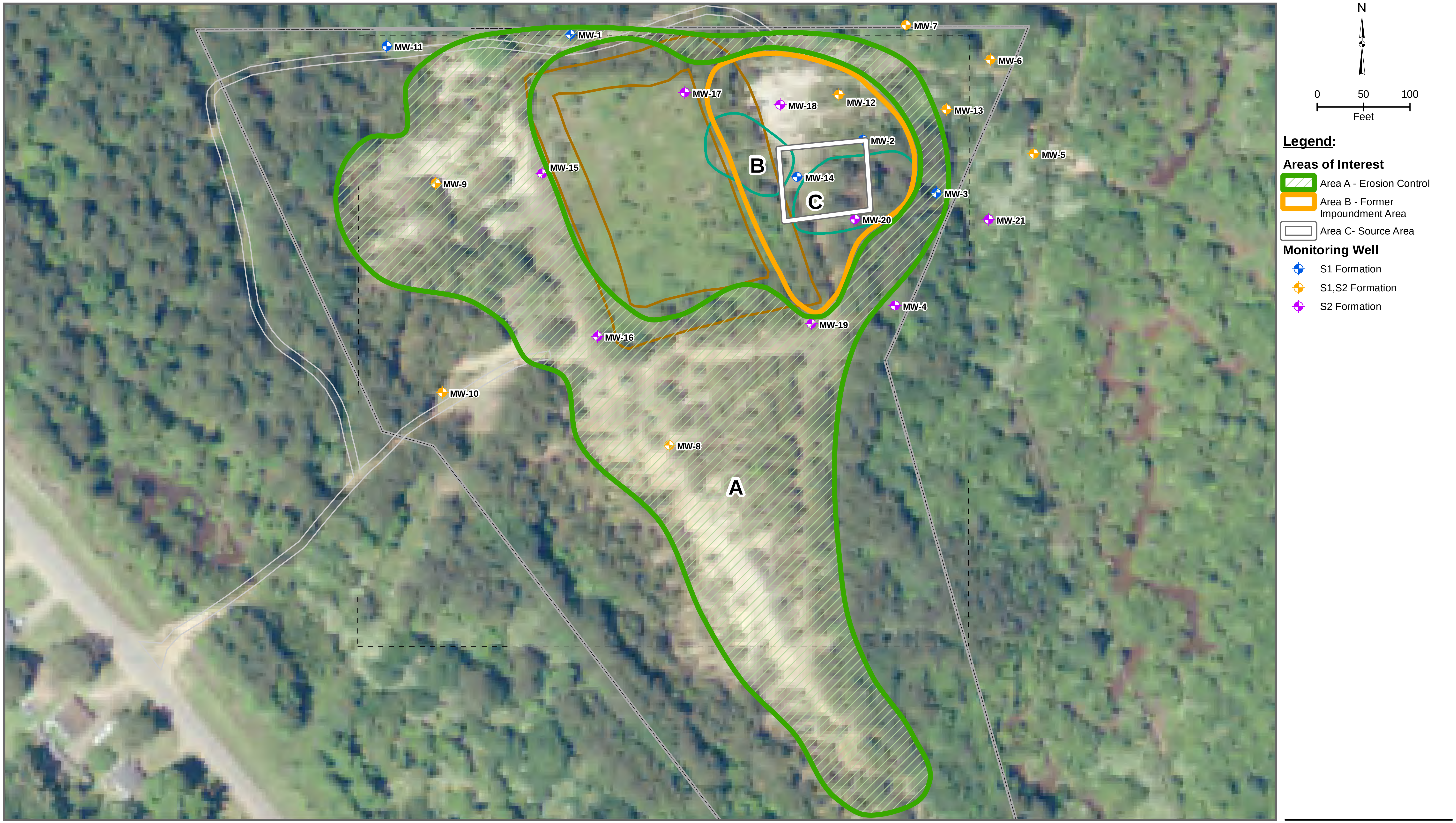


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Image Source: USDA-FSA-APFO NAIP MrSID Mosaic, USDA/FSA - Aerial Photography Field Office, 2010

Figure 10
Areas of Interest Map

2011-09-08 r:\federal\epa\vrac iii\0062-marion fsr\gis\mxds\figxx_welllocareadefsoil.mxd EA-Dallas jschwertz

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