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March 26, 2008

Mr. Mostafa Mehran
Arkansas Department of Environmental Quality
Hazardous Waste Division
8001 National Drive
Little Rock, Arkansas 72219-8913

Project No. 0079781

Subject: Risk Management Plan
Whirlpool Corporation, Fort Smith, Arkansas

Dear Mr. Mehran:

On behalf of Whirlpool, Environmental Resources Management (ERM) is pleased to submit this Risk Management Plan (RMP) for the Fort Smith Facility. This submittal has been prepared in accordance with Section I.E of the Letter of Agreement (LOA) between the Arkansas Department of Environmental Quality and Whirlpool Corporation.

In accordance with the reporting requirements in Section J of the LOA, four hard copies of the RMP are enclosed.

If you have any questions, please contact Mr. Scott Horton of Whirlpool at (479) 648-2698.

Sincerely,

Environmental Resources Management

Troy W. Meinen

TWM/skd
Enclosures

cc: Mr. Scott Horton, Whirlpool Corporation
Mr. Bob Karwowski, Whirlpool Corporation (letter only)
Mr. Doug Wilson, Whirlpool Corporation (letter only)
Mr. Paul Schultz, Whirlpool Corporation (letter only)
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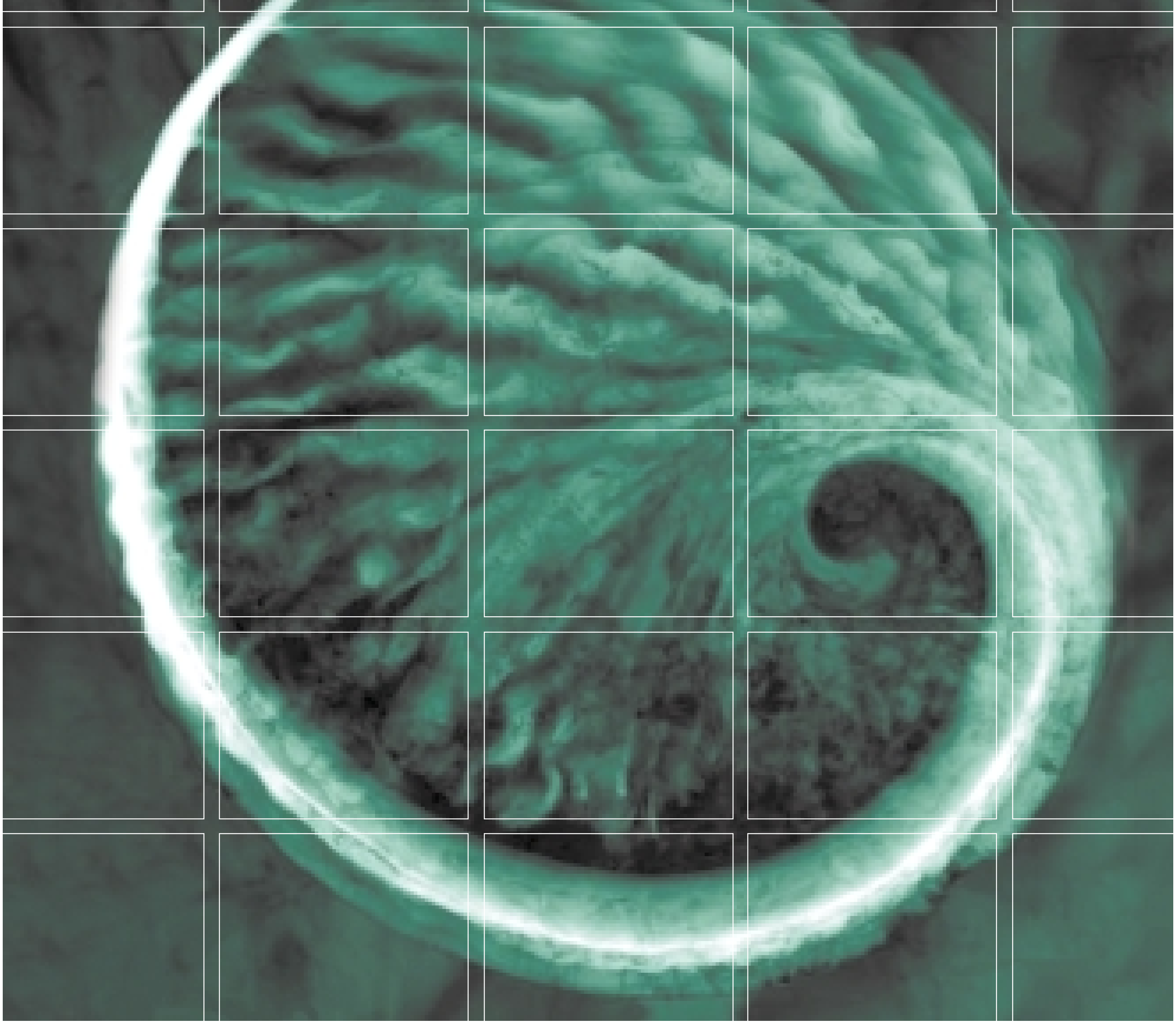

Risk Management Plan

Fort Smith, Arkansas
Whirlpool Corporation, Inc.

March 27, 2008

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Risk Management Plan

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1.0 INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

1.1.1 General Site Description

The Whirlpool Fort Smith facility is located at 6400 Jenny Lind Road on the south side of Fort Smith, Arkansas (Figure 1-1). The facility manufactures side-by-side household refrigerators and trash compactors. The facility has been operated by Whirlpool for over 40 years.

The facility is approximately 153 acres and includes the main manufacturing building (approximately 1.3 million square feet), adjoining warehouse and administrative offices, and approximately 21 acres of undeveloped land (Figure 1-2). Additional buildings located on the north side of the property include a water treatment plant and boiler house. The majority of the property surrounding the buildings is covered with concrete or asphalt for parking. Some gravel parking areas are also present. An outdoor waste storage area is located on the south side of the manufacturing facility. This paved area is enclosed with a chain-link fence topped with razor wire.

1.1.2 Facility Operations

The manufacturing processes at the Whirlpool-Fort Smith facility involve metal fabrication, plastic thermoforming and assembly operations. All storage of hazardous wastes is limited to 90 days or less in containers, no hazardous waste treatment activities are conducted on site. It is believed that constituents in the soils and ground water identified in the facility investigation are the result of historical practices prior to 1980.

Dating back to approximately 1967, equipment degreasing operations utilizing trichloroethylene (TCE) were performed in the former degreaser building located near the northwestern corner of the main manufacturing building, west of the boiler house. Based on verbal reports from former workers, the degreasing equipment consisted of a tank and a parts rack. The degreasing operations involved placing parts into the parts rack positioned over the tank. The TCE tank was then heated creating a TCE vapor in the area where the parts were placed. Following degreasing activities, the vapor was condensed and returned to the tank below the parts rack.

The use of TCE was discontinued in 1981 and the degreaser building is not currently used for any cleaning operations. There are no historical records that document any specific spills or other release incidents from the degreaser building. However, it is possible that historical leaks from the tank or surface spills in the vicinity of the degreaser building may have occurred, resulting in releases to the soil and ground water.

A series of soil and ground water studies were initiated at the site as part of a project to remove an underground fuel storage tank (UST). Although there was no evidence of releases of petroleum hydrocarbons from the UST, the analytical data showed the presence of TCE and other solvents in the shallow ground water. Subsequent investigations, including soil sampling to assess the potential source area have been conducted to delineate affected soil and ground water.

Based on historical process knowledge, and recent analytical data, the major constituent of concern (COC) is TCE. Tetrachloroethylene (PCE), and TCE daughter products (including cis-1,2-dichloroethylene (cis-1,2-DCE) and trans-1,2-dichloroethylene (trans-1,2-DCE), 1,1-dichloroethylene (1,1-DCE), and vinyl chloride) resulting from degradation have also been periodically detected in site monitoring wells.

1.1.3 Summary of Previous Site Assessments and Risk Evaluations

To address the impacts from the historical releases, Whirlpool entered into a letter of agreement (LOA) with the Arkansas Department of Environmental Quality (ADEQ), dated July 19, 2002. Under the LOA, Whirlpool is following the US EPA's Corrective Action Strategy (CAS) that includes the development of a site conceptual model and other documents describing environmental conditions at the site. Results of the various studies are included in a series of reports listed below:

- Supplemental Site Investigation, December 2000;
- Conceptual Site Model, August 2002;
- CAS Work Plan, June 2003;
- Interim Status Report and Revised CAS Work Plan, June 2004;
- Interim Status Report for Off-Site Investigations, March 2005;
- Interim Status Report for Off-Site Investigations, June 2005; and
- CAS Work Plan Addendum, August 2006.

In addition to the above reports, a series of Annual Ground Water Monitoring Reports have been produced since March 2000 documenting the results of semi-annual ground water sampling events. The last semi-annual ground water monitoring event was conducted during September 2007.

Data from the assessments described above were evaluated and summarized in the Risk Evaluation Report (RER), dated June 2007. The results of the RER indicate that two exposure pathways, soil leaching to ground water and direct contact with ground water, exceed acceptable risk standards. Corrective action will be required to address these pathways. Additional pathways, defined in the RER as Undetermined Exposure Pathways, may also be a concern. It is expected that the corrective action(s) to address the ground water exposure pathways will also control potential risks posed by the Undetermined Exposure Pathways.

1.2 OBJECTIVES AND TECHNICAL APPROACH

The next step in the CAS process is to prepare a Risk Management Plan (RMP) that identifies and selects a site remedy and to develop a plan for managing the risk at the site. As required by the LOA, the remedy selection process was conducted "*in general accordance with the remedy evaluation standards and general decision factors contained in Chapter IV of the EPA guidance document entitled RCRA Corrective Action Plan (Final), May 1994…*" (the CAP Guidance).

The objective of this RMP is to present the selected remedy and schedule for implementation, establish performance monitoring criteria, describe contingency plans for additional corrective measures, and describe the approach and schedule for performance reviews. The Conceptual Site Model (CSM) was finalized and presented in the RER. The only data that have been obtained since the submittal of the RER are the September 2007 ground water data which are generally consistent with historic data; therefore the CSM has not been modified.

The remedy selection process generally followed the approach specified in Section II (Corrective Measures Study Report), subsections A, B, C, and D in Chapter IV of the CAP Guidance. Based on the nature of the site conditions, Section I of Chapter IV (Corrective Measures Study Work Plan) is not needed.

Additionally, the RMP was prepared in accordance with the LOA and following Section II (Corrective Measures Study Report), subsections E, F, and G, and Sections III and IV in Chapter IV of the CAP Guidance.

2.0 REMEDY SELECTION

2.1 INTRODUCTION AND PURPOSE

The purpose of the remedy selection process is to identify and screen remedial technologies for potential use at the site and to select the final remedy. As described in the CSM (Section 2 of the RER), affected soil and ground water are present within the fenced boundary of the Whirlpool Facility (on site) and affected ground water is present beneath a residential area north of the Facility (off site). Given the nature of the affected media and differences in land use on site versus off site, there are differences in potentially complete exposure pathways for on-site versus off-site areas. Thus, this Whirlpool RMP presents the results of the identification and screening of potential remedial technologies separately for on-site versus off-site areas.

2.2 DESCRIPTION OF CURRENT CONDITIONS

The CSM characterizes the site conditions and provides the basis for the exposure scenario evaluation. Key components of the CSM include a facility profile, a land use and exposure profile, a physical profile, a release profile, an ecological profile, and a risk management profile. A brief summary of the current site conditions is provided below. The current site conditions and the CSM are summarized more fully in Section 2.0 of the RER. No new information has been discovered since the site conditions were summarized in the RER.

On-Site Current Conditions

On-site land use is characterized by industrial activities involving the manufacture of refrigerators and trash compactors. The facility has been operated by Whirlpool for over 40 years.

The known area of affected on-site soils is wholly contained within the confines of the facility security fencing (Figure 2-1). The main area of impacts, the “source area,” is a fairly localized area of elevated TCE concentrations in soil and ground water near and immediately to the west of the former degreaser building. The general area of impacted soils is limited to a 50 by 250-foot area west of the former degreaser building (Figure 2-1). The on-site ground water plume extends about 1,000 feet to the south and southwest from the source area (Figure 2-2).

Based on the available information concerning on-site land use, the following potential exposure populations were identified:

- Site workers (potentially long-term exposure) that are involved in manufacturing activities and facility maintenance administration; and
- Site construction workers (potentially short-term exposure) that may be involved in limited duration activities, e.g., construction, utility, or other related activities.

Considering the source, potential exposure points, potential exposure routes, and EPA's guidelines for a potentially complete pathway, the RER identified two potentially complete, on-site Determined Exposure Pathways:

- Direct contact with soil 0-2 ft bgs (i.e., combined ingestion, dermal, and inhalation exposures) for current and future site workers; and
- Direct contact with soil 0-5 ft bgs (i.e., combined ingestion, dermal, and inhalation exposures) for future construction workers.

Two additional on-site Determined Exposure Pathways that are not currently complete, but without institutional controls could become potentially complete, were identified:

- Direct contact with on-site ground water (i.e., combined ingestion, dermal, and inhalation exposures) for site workers if a water supply well was installed in the uppermost aquifer in the future; and
- Direct contact with on-site ground water via leaching and infiltration of soil constituents to on-site ground water if a water supply well was installed in the uppermost aquifer in the future.

Off-Site Current Conditions

Off-site land use is generally residential. Residential properties to the north include single-family homes and two multi-family units. A recreational facility that includes three buildings, two basketball courts, and three baseball fields is located northeast of the site, adjacent to the residential area. The recreational facility lies beyond the area of the off-site ground water plume. No agricultural properties are located in the vicinity of the site. There are no sensitive areas, such as schools, hospitals, or day care centers located within 0.5 miles from the facility.

As indicated in the CSM, affected ground water extends to an area north of the Facility. At the facility boundary, current data indicate that the off-site ground water plume is relatively narrow (less than about 200 feet wide near well MW-23). North of Ingersol Avenue, the plume becomes broader and extends to the north and then northeast for a distance of about 1,000 feet (Figure 2-2). The higher TCE ground water concentrations (e.g. greater than 1 mg/L) are mostly constrained to the limits of a gravel-rich portion of the shallow aquifer (Figure 2-3). Lower TCE and cis-1,2-DCE concentrations extend beyond the known limits of the gravel-rich zone for approximately 200 feet. The gravel-rich zone is about 6 to 7 feet thick near the source area (on site) and is composed mostly of gravel and sandy gravel. Off site, the gravel-rich zone thins and increases in clay content such that north of Jacobs Avenue, it is composed mostly of clayey gravel to gravely clay.

Based on the available information concerning off site land use, the following potential exposure population was identified:

- Off-site residents (potentially long-term exposure) that live in the area north of the site where the plume has migrated.

Considering the source, potential exposure points, potential exposure routes, and EPA's guidelines for a potentially complete pathway, no Determined Exposure Pathways were identified to be potentially complete off-site currently. One off-site Determined Exposure Pathway that is not currently complete, but without institutional controls could become potentially complete, was identified:

- Direct contact with off-site ground water (i.e., combined ingestion, dermal, and inhalation exposures) for residents if a domestic water supply well was installed in the uppermost aquifer in the future.

In addition, one Undetermined Exposure Pathway that will be evaluated, and, if necessary, addressed during the Risk Management Corrective Action, was identified:

- Inhalation of vapors in indoor air due to volatilization from affected ground water.

2.3 CORRECTIVE ACTION OBJECTIVES/MEDIA CLEANUP STANDARDS

Based on the identified exposure pathways that require risk management, the corrective action objectives for the Site are summarized below:

- Reduce the risk of potential exposure to on-site workers from impacted surface or subsurface soils;
- Reduce, where technically feasible, the potential for the subsurface soils to act as a continuing source of chemicals to the on-site ground water;
- Control further migration and reduce concentrations within the off-site ground water plume, and reduce the potential for direct contact with the impacted ground water; and
- Reduce the potential for inhalation exposure to vapors from ground water in off-site areas.

2.3.1 Remedial Action Criteria

Ground Water

Drinking water standards, EPA Maximum Contaminant Levels, or MCLs will be used as the remedial action criteria for off-site ground water. Constituents present at the site include a number of chemicals for which MCLs exist or are proposed. Specifically, the RER identified TCE and cis-1,2-DCE as the COCs in off-site ground water. Each of these constituents have MCLs, as summarized in Table 2-1.

It is noted that MCLs are developed as standards for drinking water. As discussed in Section 3, Whirlpool intends to apply institutional controls on property it owns and will enforce its restriction that no on-site ground water will be used as a drinking water source. Accordingly, MCLs would only be applicable beyond the Whirlpool property boundary, unless similar institutional controls to restrict the use of ground water for drinking water supplies are applied to off-site property. Therefore, the primary remedial action criterion for on-site ground water will be to assure no further migration of COCs from the Whirlpool site at concentrations that exceed MCLs. . The RER identified TCE, cis-1,2-DCE, chloroform, PCE and vinyl chloride as the COCs in on-site ground water. Each of these constituents have MCLs, as summarized in Table 2-1.

While MCLs will be the primary criteria for off-site ground water, a secondary consideration will be potential exposure to vapors from affected ground water. As discussed in the RER, a screening-level assessment of the potential risks associated with vapor intrusion from ground water to indoor air as a pathway was initiated. Following EPA's and ADEQ's common practice, that initial assessment utilized the Johnson and Ettinger model for vapor intrusion (the J&E Model). The results of the screening suggest that the vapor intrusion pathway exceeded the acceptable risk level.

It was recognized, however, that the J&E Model incorporates a number of assumptions that tend to overestimate risk. Also, many of the model assumptions are not consistent with the actual conditions at the Ft. Smith site. Therefore, the model results do not provide an accurate estimate of the potential risk associated with the vapor pathway. For those reasons, the RER concluded that vapor intrusion was an "indeterminate" pathway that would be evaluated further as part of a performance monitoring program for the remediation program that would be presented in the RMP.

Soils

The ADEQ has not established default clean up standards for soils. Therefore, the RER utilized the EPA Region VI Medium-Specific Screening Levels (MSSLs) to define the soil COCs. MSSLs are typically used for comparison to preliminary investigation data to provide an initial evaluation for the relative environmental concern for a site or set of environmental data. MSSLs are not cleanup standards, but are intended to be used as a tool to identify areas for further evaluation.

The RER concluded that no reported soil COC concentrations exceed direct-contact MSSLs for soils. For the ground water protection pathway (soil leaching to ground water), the only soil COC identified in the RER that exceeds MSSLs is TCE. The RER then developed a site-specific ground water protection value for TCE in soil of 0.129 mg/kg that would be protective of ground water at the MCL. The ground water protection value of 0.129 mg/kg for TCE will be used as the remedial action criteria for soils.

2.4 *IDENTIFICATION AND SCREENING OF CORRECTIVE MEASURES*

As a first step in developing a plan to address the impacted soil and ground water, several candidate corrective measures were identified for the Whirlpool site. Each corrective measure was evaluated on a screening-level basis to assess whether the measure should be retained for more detailed consideration.

In general, the potential response measures can be grouped into five categories:

- No Action;
- Containment;
- Removal;
- Treatment; and
- Institutional Controls.

A description of each of the categories and the specific technologies within the categories are presented below along with the discussion of how the corrective measures were screened in or out. Based on the nature of the exposure pathways to be addressed, the screening process gives a preference to proven, presumptive measures rather than new or highly innovative measures. This approach was taken to facilitate the timely implementation of the ground water remedy in order to more quickly address off-site areas where there may be potential for risks associated with the Undetermined Exposure Pathways (e.g., vapor intrusion into buildings for residents from affected shallow ground water). Measures eliminated from further consideration are noted, along with the reasons for their elimination. In general, alternatives which:

- are not currently available commercially;
- have not been demonstrated on similar wastes; or
- are less effective than other technologies that could achieve the same results, were eliminated from further consideration.

It should be noted that some technologies must be combined with others to fully address the site conditions. Table 2-2 summarizes the technologies considered for each of the above general response measures.

2.4.1 No Action

The No Action alternative represents a base line approach against which other alternatives can be compared. This alternative would entail continuation of the current semi-annual ground water monitoring program but with no active remedial activities to address affected soils or ground water, either on site or off site.

The No Action alternative is screened out from further consideration because it will not address the potential risks associated with affected ground water if a drinking water well were to be installed, either on site or off site. As a separate remedial action, No Action will not reduce concentrations, control mobility, or reduce the extent of impacted media. However, semi-annual ground water monitoring will be retained as a technology for consideration to be combined with other active remedial measures.

2.4.2 *Containment*

Containment is the second corrective measure that is potentially applicable to the Whirlpool site. Containment involves the placement of a physical barrier that impedes movement of constituents, thereby providing a means to significantly reduce or eliminate an exposure pathway. Containment technologies can effectively isolate soils and/or ground water, and are generally separated into the following groups:

- Horizontal barriers; and
- Vertical barriers.

Horizontal barriers can be constructed using several technologies including:

- Topsoil/clay and vegetative covers;
- Cement-stabilized soil covers;
- Asphalt covers;
- Concrete covers; and
- Soil cover with synthetic/geotextile composite liner.

Horizontal barriers can prevent contact between affected surface soils and surface water runoff, thereby reducing the potential for constituent migration via infiltration into the ground water. In addition, installation of a cover can also be engineered to prevent human exposure to affected soils, and to limit air emissions.

Much of the on-site area where affected soils are present is already covered by asphalt or concrete which serves as a horizontal barrier. Regular maintenance of the existing cover will act to reduce the potential for future leaching of constituents from the affected soils to ground water. The limited areas where affected on-site soils are not currently paved (in the northwestern portion of the facility) could also be paved to increase the effectiveness of the cover.

There are no documented affected off-site soils; therefore, applying a horizontal barrier as a corrective measure in the off-site areas would provide little if any benefit. In addition, considering the residential nature of the off-site ground water plume area, implementation of capping is not practicable.

Vertical barriers are typically used to limit or redirect the lateral flow of ground water from or around an affected area, to isolate affected soils, or to contain an affected ground water plume. Such barriers are usually keyed into an existing confining clay layer. Vertical barriers can include:

- Slurry wall;
- Cement-bentonite cutoff wall;
- Grout curtain;

- Sheet pile wall; and
- Interceptor trenches and recovery well systems.

Construction of these types of barriers require a significant working area, typically at least a 50-ft wide, area along the entire length of the barrier. A material mixing area would also be needed.

For the Whirlpool site, vertical barriers would be keyed into the lower McAllester Shale at a depth of about 35 ft. Prior to final design, a series of geotechnical soil borings would need to be drilled on 20 to 50-ft intervals along the proposed trench centerline to obtain detailed stratigraphic information and other design data. Depth to water, depth to the "key" layer, soil types, and the potential presence of gravels or flowing sands are important data items for barrier design. Compatibility testing may be required to evaluate the impact of COCs on the permeability of the barrier material.

Screening of the Containment Alternative

A containment-based response action would not remove the chemicals from the site but would provide protection of human health and the environment by reducing migration of or exposure to constituents in soils and/or ground water. Containment technologies are highly proven, commercially available, and readily implemented. Due to the highly intrusive nature of the construction method, residential areas with homes and underground utilities are generally not good candidates for these types of controls. Therefore, containment could be applied on-site and used to control both on-site exposure and the off-site migration of constituents.

Accordingly, capping of affected on-site soils was retained as a viable alternative to be used in conjunction with other technologies. With respect to a vertical barrier, considering the nature of the current ground water flow patterns, a barrier wall may not be necessary to control the off-site migration of affected ground water away from the on-site source area. However, a vertical barrier would be effective if, in the future, ground water flow conditions were to change; therefore, the option of a vertical barrier was retained for further analysis.

2.4.3 Removal

Removal is the third remedial alternative that is potentially applicable to the Whirlpool site. Removal of affected soils or ground water involves excavation or collection of the media for treatment or disposal. Removal technologies must be combined with a treatment or disposal technology to form a complete response action. Treatment technologies will be addressed as part of the design specification and will not be discussed as part of this report.

Two common removal technologies were considered as potentially applicable for the Whirlpool site:

Excavation – Soils

Excavation is a proven technology for direct mass removal and, for small to moderate soil volumes, technically feasible. Excavation achieves a very direct means of reducing the amount of constituent mass in the environment that could pose a risk to human health. Where high concentrations are present in relatively small areas (i.e., hot spots), excavation can be cost effective as long as the cost for off-site transportation and disposal is acceptable.

Ground Water Extraction

Ground water extraction is a removal technology that is also applied as a hydraulic barrier/control technology. The process entails removing ground water to prevent down gradient migration, which results in removal of dissolved and residual mass from the affected transmissive zone. It is rarely effective in fully restoring ground water concentrations to cleanup standards, but can provide adequate protection from potential exposure pathways as an independent remedial measure or when coupled with other remedial options.

Ground water can be extracted using either extraction trenches or extraction wells.

An extraction trench is an open trench that is designed to collect and convey liquid discharges by gravity flow in a manner similar to a French drain. The trench could be installed in any of three basic configurations:

1. To intercept a plume downgradient of the leading edge;
2. In conjunction with a ground water cutoff barrier to prevent buildup of ground water upgradient of the barrier; or
3. As a more active withdrawal system where the drain(s) are installed within the ground water plume perpendicular to the direction of ground water flow.

Similar to vertical barriers, extraction trenches are commonly “keyed” into a confining clay layer. Extraction trenches are more effective than a line of wells when used to contain and/or recover affected liquids in low transmissivity hydrogeological environments. Extraction trenches are considered a feasible technology except where access is a problem.

Affected ground water can also be extracted from the ground by a system of recovery wells that is designed to both control ground water flow in a specific area and to remove dissolved and residual mass from the affected transmissive zone. In addition, recovery wells may be used in conjunction with a physical vertical barrier to prevent hydraulic mounding behind the barrier.

Ground water extraction can reduce the dissolved phase concentrations in ground water. While the rate of mass removal is typically small compared to the residual mass of constituents in soil, ground water extraction can lower the dissolved phase concentrations to a level where the ground water to vapor phase pathway is eliminated.

The pumping test conducted at well MW-35R indicated that the radius of influence of a recovery well and its ability to remove constituent mass in areas outside of the more transmissive, gravel portions aquifer would likely be low. Thus, long term pumping may be required, or additional technologies may be needed to be effective.

Screening of the Removal Alternative

The removal alternative for both soil and ground water is a highly proven remedial approach and readily implemented at other similar sites. With respect to soils, there is only one documented exceedance of the soil remedial action criteria in on-site soils (boring ERM-8 at 14 feet) and none off-site. However, excavation to 14 feet is not likely to be technically practicable. Accordingly, this option is not retained as a remedial alternative for on-site soils as a means to reduce the potential leaching via soil-to-ground water pathway.

Ground water pumping and treatment is the EPA's presumptive remedy for VOC affected ground water. Furthermore, removal has the technical ability to reduce COC concentrations within the more transmissive portions of the gravel aquifer, providing near term protection to off-site residents. However, off-site access in the residential area may limit the ability to install a trench and may also limit the number of recovery wells that could be installed. In addition, the presence of buried utility lines in the residential area may make installation of a trench unfeasible. Therefore, only the use of ground water extraction by recovery wells is retained for further evaluation and use in the development of the final on-site and off-site remedial alternatives.

2.4.4 In Situ Treatment

In situ treatment technologies rely on the application of treatment methods in the subsurface to reduce constituent mass and concentrations without removing the affected media. The technologies and options considered for this alternative include:

- Biological
  - Natural Attenuation
  - Enhanced Aerobic/Anaerobic Biodegradation
- Physical/Chemical
  - Vapor Extraction or Sparging
  - Permeable Treatment Beds
  - Chemical Oxidation

The technologies are described in the following paragraphs.

2.4.4.1 *Biological*

Natural Attenuation

The term "natural attenuation" refers to the reliance on natural attenuation processes to control or prevent migration and/or over time achieve site-specific remediation objectives (EPA, 1989). Natural attenuation processes include a variety of physical, chemical, and biological processes that, under favorable conditions, reduce the mass, toxicity, mobility, volume, or constituent concentrations in soil and/or ground water.

The primary constituents in the off-site plume are TCE and cis-1,2-DCE, and the constituents of concern in on-site plume are TCE, cis-1,2-DCE, PCE, vinyl chloride, and chloroform. These chemicals can be degraded both anaerobically (via reductive dechlorination) or aerobically. However, reductive dechlorination of cis-1,2-DCE risks the formation of vinyl chloride. Currently, little to no reductive dechlorination of TCE or cis-1,2-DCE appears to be occurring in the off-site plume given the generally stable concentrations and the lack of vinyl chloride in the off-site plume. However, some reductive dechlorination appears to be occurring in the source area of the on-site plume.

While both the on-site and off-site ground water plumes appear to be stable, ground water concentrations are not dropping significantly with time. The rate of natural attenuation does not appear to be sufficient to meet the remedial objectives in a timely fashion.

Enhanced Aerobic/Anaerobic Biodegradation

In situ biological treatment includes the addition of nutrients, oxygen and/or acclimated microbes to enhance the natural degradation processes. Biodegradation in the saturated zone can be used for the remediation of both affected soils and ground water. To implement biodegradation in the saturated zone, a series of wells or trenches is used to inject water containing nutrients, microbes and/or oxygen. The treatment occurs as the water flows with the natural or induced gradient and is collected in downgradient wells or trenches. Additional nutrients, microbes, or oxygen are added to the water and it is recirculated through the soils. Use of this technology may be limited in areas with clayey soils due to the limited flow and reduced contact.

2.4.4.2 *Physical/Chemical Treatment*

Vapor Extraction or Sparging

Vapor extraction includes application of a vacuum on the subsurface soils to induce volatilization of organic constituents. This is accomplished by pulling a vacuum on a series of vertical or horizontal wells screened in the unsaturated soil zone. Sparging (stripping) of VOCs in ground water via wells can also be performed to remove vapors. A low permeability cover may be installed above the treatment area to reduce air bypass. This technology works most efficiently in highly permeable, granular soils.

Permeable Treatment Beds

Implementation of permeable treatment beds would include construction of a downgradient trench filled with a material which would either adsorb or chemically react with constituents in the ground water. As ground water passes through the bed, the COCs would be treated or removed. Treatment beds can include granular zero valent iron to treat dissolved chlorinated hydrocarbons (chlorinated solvents) to nontoxic end products. This abiotic process involves corrosion (oxidation) of zero valent iron (ZVI) and reduction of dissolved chlorinated hydrocarbons. This technology could potentially be used alone or together with other technologies to control the migration of affected ground water.

Chemical Oxidation

In situ chemical oxidation (ISCO) involves the decomposition and in situ destruction using chemical oxidation technologies. In contrast to other remedial technologies, reduction in constituent concentrations can be seen in short time frames (e.g., weeks or months). Chemical oxidation technologies are predominantly used to address in situ ground water and soil in the source area saturated zone and capillary fringe.

Understanding the site hydrogeologic conditions is important when considering the use of chemical oxidation or reduction technologies because these conditions often determine the extent to which the chemical oxidants or reducing agents may come into contact with the COCs. Soil reactivity with chemical oxidants or reducing agents is also important when considering the costs of chemical oxidation. Excessive loss of a chemical oxidant or reducing agent that is reacting with organics in soil, instead of reacting with the COCs, may preclude the use of the technology as an economically viable approach to site remediation. Consequently, if chemical oxidation is to be considered, it is recommended that treatability studies be completed prior to field implementation.

Potassium permanganate has demonstrated success in applications involving the destruction of chlorinated organics and was evaluated in an on-site field scale test in 2002 near well MW-11. This test was conducted in an area where the shallow aquifer is predominately gravel. The results indicated that ISCO was effective in treating the COCs within the treatment zone and over 20 feet outside the treatment zone. However, given the limited area of the test, COC concentrations eventually rebounded to pre-test levels – likely due to flow of affected ground water back into the treated zone.

Additional field scale testing would be needed to further evaluate the effectiveness and design parameters for application of ISCO in the off-site plume in areas where the shallow aquifer has higher clay content.

In general, the advantages of using chemical oxidation or reduction as an in situ treatment option for both ground water and soils are:

- COC mass can be destroyed in situ;
- Produces no significant wastes;
- Reduced operation and monitoring costs;
- Compatible with post treatment natural attenuation if limited to the most affected areas; and
- Causes only minimal disturbance to nearby human activities.

2.4.4.3 *Screening of the In Situ Treatment Alternative*

In situ treatment technologies are proven remediation methods, readily implemented, and have been used at other similar sites. Furthermore, in situ treatment has the technical ability to rapidly reduce ground water concentrations, providing near term protection to off-site residents. In situ Treatment is retained as a remedial alternative for further consideration. In particular, the following in situ treatment technologies were considered further in identifying remedial alternatives and are discussed further in subsequent sections:

- Enhanced Aerobic/Anaerobic Biodegradation;
- Permeable Treatment Beds; and
- In situ Chemical Oxidation.

The following-in situ treatment technologies were screened out from further consideration:

- Natural Attenuation was screened out as an independent remedial measure because it does not appear to be currently effective in reducing the mass of COCs in the on-site and off-site ground water plume in a timely fashion. Enhanced Biodegradation was also screened out as a remedial measure because it is less effective in clayey or silty soils like those found in offsite areas. However, natural attenuation or enhanced biodegradation may be used in combination with other remedial measures and as a contingent remedial measure.
- Vapor extraction and sparging were screened out because they are generally less effective in clayey or silty soil types.

2.4.5 *Institutional Controls*

Applying institutional controls as a remedial measure entails the implementation of legally enforceable restrictions on land use in order to prevent exposure to affected media. Institutional controls would not directly remediate the site (reduce concentrations and/or limit migration). However, by preventing exposure (ingestion, direct contact, etc.), institutional controls can effectively protect human health on a long-term basis. Institutional controls can be applied to both soil and ground water, depending on the nature of the impacted media.

Institutional controls are usually deed recorded wherein a metes and bounds description of impacted media, a description of the impacts (e.g., constituent concentrations and distribution), and all land-use restrictions are entered into the deed for the affected property. Institutional controls can be applied via property acquisition, easement or through the use of a legal covenant.

Other institutional controls include measures such as Municipal Setting Designations (MSDs) where a city or other municipal entity establishes a prohibition on the use of ground water in an area that is impacted. MSDs are often instituted in areas that are fully serviced by municipal water supplies and private water wells are not needed or used.

Screening of Institutional Control Alternative

The use of institutional controls have been approved by ADEQ as an element of remedial measures on other sites and can readily be applied to impacted areas within the limits of Whirlpool's property. Applying institutional controls such as MSDs and/or deed recordation in the off-site area would require the cooperation and approval of residents, property owners, and the City of Fort Smith.

As a separate remedial action, institutional controls will not reduce concentrations, control mobility, or reduce the extent of impacted media. Additionally, application of institutional controls in off-site areas necessarily involves other property owners. For these reasons, the Institutional Control alternative is eliminated as a primary option and is not acceptable for use as an independent corrective measure. However, it is retained as a secondary or contingency action that may be applied in combination with one or more other corrective measures.

2.5 SUMMARY OF REMEDIAL MEASURES RETAINED FOR FURTHER ANALYSIS

Four of the five general remedial measures discussed above were retained, in whole or in part, for potential inclusion in the Whirlpool Risk Management Plan. No Action was completely screened out as a candidate approach. In some cases, a given remedial measure should not be implemented as a "stand alone" remedy or could be applied on a contingency basis (e.g., institutional controls), while others could be applied on a broader basis (e.g., removal by ground water extraction).

To help focus the selection of final corrective measures (presented in Section 3), the retained remedial measures were subjected to a second screening and a "short list" of surviving approaches was identified as summarized in the table below.

Remedial Measures Retained For Further Analysis			
General Remedial Measure	Media	Exposure Pathway Applicability	Retained for Potential Inclusion in the RMP?
Containment - Horizontal Barrier	On-Site Soil	Interrupt the soil-to-ground water pathway by incorporating with existing asphalt and concrete to reduce infiltration and limit potential leaching from affected on-site soils.	Yes
Containment – Vertical Barrier	Ground Water	Interrupt the residential ground water exposure pathway by limiting migration from on-site "source area".	No, may be considered as a contingency action if performance monitoring indicates a need for secondary measures to protect off-site ground water.
Removal – Excavation	On-Site Soil	Interrupt the soil-to-ground water exposure pathway by removing constituents from soil.	No, current data indicates higher soil concentrations within the ground water zone and are below practical excavation depths. May be considered as a contingency action if performance monitoring indicates a need for secondary measures to protect off-site ground water.
Removal – Extraction	Ground Water	Interrupt the ground water exposure pathway by removing constituents from ground water. Interrupt potential vapor intrusion to indoor air exposure pathway by decreasing concentrations to levels below concern for volatilization.	Yes, for on-site and off-site plume. May also be considered as a contingency action if performance monitoring indicates a need for secondary measures to protect off-site ground water.
In Situ Treatment	Ground Water	Interrupt the ground water exposure pathway by removing constituents from ground water. Interrupt potential vapor intrusion to indoor air by decreasing concentrations to levels below concern for volatilization.	Yes, for on-site and off-site plume. May need to combine with other measures to adequately cover plume area. May also be considered as a contingency action if performance monitoring indicates a need for secondary measures to protect off-site ground water.

Remedial Measures Retained For Further Analysis			
Institutional Controls	On-Site Soil	Interrupt potential for worker direct contact to subsurface soil by restricting access.	Yes, if combined with other measures.
Institutional Controls	Ground Water	Eliminate ground water exposure pathway by restricting access.	Yes, for on-site if combined with other measures. Not currently available for off-site. May be applied if allowed in future.

Based on the second level of screening, the remedial measures retained for potential inclusion in the RMP are:

- On-Site Soils – Containment via a horizontal barrier and institutional controls;
- On-Site Ground Water – In situ treatment (ISCO) or ground water extraction, and institutional controls; with vertical containment as a contingency measure; and
- Off-Site Ground Water – In situ treatment (ISCO) or ground water extraction; with institutional controls if allowed in the future.

This analysis indicates that combining remedial measures can provide an effective means of addressing the exposure pathways for the Whirlpool site. It also suggests that using in situ treatment or ground water extraction are equally acceptable methods for addressing the ground water pathway. Therefore, the next step in developing the Risk Management Plan was to combine two or more remedial measures to create corrective measure alternatives recommended for the Whirlpool site. That approach is described in Section 3, below.

3.0 *RISK MANAGEMENT PLAN*

Grouping different remedial measures into an alternative allows the remedial plan to focus on the specific exposure pathways that pose an unacceptable risk, or potential risk. Based on the environmental setting at the Whirlpool site, two corrective measure alternatives were identified as having a high potential to address the exposure pathways of concern:

Alternative 1 –

- *On-Site: Soil Containment, In Situ Ground Water Treatment and Institutional Controls; and*
- *Off-Site: In Situ Ground Water Treatment*

Alternative 2 –

On-Site: Soil Containment, Ground Water Extraction and Institutional Controls; and

Off-Site: Ground Water Extraction

For both of these alternatives, the soil leaching to ground water pathway would be addressed by adding additional cover to the existing asphalt and concrete in the area where affected soils are present on site. Further protection is provided with the first alternative by reducing ground water concentrations using in situ treatment (ISCO). Decreasing ground water concentrations reduces the potential for future off-site migration. Additionally, applying institutional controls limits on-site access to the affected soil and ground water.

The second alternative is essentially equivalent to Alternative 1, except that ground water concentrations (both on and off-site) are reduced via removal (recovery wells) rather than by in situ treatment. Ground water extraction has the added benefit of providing hydraulic control of the plume migration. However, compared to in situ treatment, contaminant mass removal by ground water recovery is a slower process. Conversely, in situ treatment may not cover the entire plume.

3.1 *EVALUATION OF FINAL CORRECTIVE MEASURE ALTERNATIVES*

As specified in the CAP guidance, and in accordance with the LOA, the components of the two corrective measures alternatives described above were evaluated against the following performance criteria:

- Protection of Human Health and the Environment;
- Attainment of remedial action criteria;
- Control of the source of releases;
- Compliance with applicable standards for management of waste;
- Short and long-term reliability and effectiveness;
- Reduction in toxicity, mobility, or volume of impacted media;

- Implementability; and
- Costs.

The results of the evaluation are summarized as follows:

On-Site Soil Containment -

Protection of Human Health and the Environment	Containment effectively reduces or eliminates the potential for exposure to affected soils and limits potential for infiltration through affected soils and into ground water
Attainment of remedial action criteria	Containment will not modify concentrations in soil or ground water
Control of the source of releases	Containment creates a physical barrier to isolate the source from the environment
Compliance with applicable standards for management of waste	Containment is not applicable to this criteria since the remediation does not involve management of wastes
Short and long-term reliability and effectiveness	Containment can be applied in a reasonably short time frame and can be designed to provided long-term effectiveness
Reduction in toxicity, mobility, or volume of impacted media	Containment will help reduce mobility, but will not affect reductions in toxicity or volume
Implementability	Containment is readily implemented
Cost	Containment is cost effective as compared to other soil corrective measures

In Situ Ground Water Treatment -

Protection of Human Health and the Environment	Treatment effectively reduces or eliminates the potential for exposure to affected ground water by reducing concentrations
Attainment of remedial action criteria	Treatment can potentially attain MCLs if applied over a sufficient area
Control of the source of releases	Treatment effectively controls the source of releases by reducing constituent mass
Compliance with applicable standards for management of waste	Treatment can be conducted in a manner consistent with applicable standards
Short and long-term reliability and effectiveness	Treatment can be applied in a reasonably short time frame and can be designed to provided long-term effectiveness
Reduction in toxicity, mobility, or volume of impacted media	Treatment will reduce toxicity, mobility, and volume by reducing constituent mass
Implementability	Treatment is readily implemented but may be limited by off-site access issues
Cost	Treatment has higher initial cost and low long term cost, but is cost effective as compared to other ground water corrective measures

Ground Water Extraction -

Protection of Human Health and the Environment	Extraction effectively reduces or eliminates the potential for exposure to affected ground water by reducing concentrations
Attainment of remedial action criteria	Extraction can potentially attain MCLs if implemented over a sufficient area and operated long-term
Control of the source of releases	Extraction effectively controls the source of releases by reducing concentrations and isolating the source using hydraulic control
Compliance with applicable standards for management of waste	Extraction can be conducted in a manner consistent with applicable standards
Short and long-term reliability and effectiveness	Extraction can be applied in a reasonably short time frame and can be designed to provided long-term effectiveness
Reduction in toxicity, mobility, or volume of impacted media	Extraction will help reduce toxicity and volume by direct removal and will reduce mobility by hydraulic control
Implementability	Extraction is readily implemented but may be limited by off-site access issues
Cost	Extraction has low initial and moderate to high long term cost, but can be cost effective as compared to other ground water corrective measures in the short term

Institutional Controls-

Protection of Human Health and the Environment	Institutional Controls effectively reduce or eliminate the potential for exposure to affected soils and ground water
Attainment of remedial action criteria	Institutional Controls will not modify concentrations in soil or ground water
Control of the source of releases	Institutional Controls will not physically isolate the source of releases from the environment
Compliance with applicable standards for management of waste	Institutional Controls are not applicable to this criteria since it does not involve management of wastes
Short and long-term reliability and effectiveness	Institutional Controls can be applied in a reasonably short time frame and can be designed to provided long-term effectiveness
Reduction in toxicity, mobility, or volume of impacted media	Institutional Controls will not help reduce toxicity, mobility, or volume of impacted media
Implementability	Institutional Controls are readily implemented on-site but would require the cooperation of multiple parties to be implemented off-site
Cost	Institutional Controls are cost effective as compared to other soil and ground water corrective measures

3.2 *PROPOSED INTERIM MEASURES*

As discussed above, the evaluation of alternatives indicates that both ground water recovery and in situ treatment using ISCO are potentially viable alternatives for off-site ground water corrective measures. In order to provide a basis for selecting a final corrective measure, it is often necessary to conduct one or more design studies and/or pilot tests. Pilot testing also provides operational data that are needed for a full-scale design of a remediation system.

In the case of the off-site portion of the Whirlpool ground water plume, it would be beneficial to conduct a design study/pilot test program to support the final selection of a corrective measure for the off-site area. Unfortunately, the time required to plan, implement, and evaluate data from pilot testing and related design studies may take a year or more to complete. Although the off-site ground water ingestion pathway is not currently complete, and the potential for residential risk via ground water-to-indoor air pathway has not been quantified, Whirlpool believes it is prudent to move forward with an "early response" in the residential area. Whirlpool's goal is to reduce any potential risk to human health.

On that basis, Whirlpool has proposed to conduct an Interim Measure (IM) focusing on the off-site plume as an early response. The IM Work Plan was submitted to ADEQ for review on March 17, 2008.

In addition to serving as an early response, the IM will serve as a pilot test to assess whether ground water recovery or ISCO (either separately or in combination) are more appropriate for expanded implementation. This IM will provide data for use in designing an expaned system. In order to address the area with the greatest concentration of COC mass off site and the area that may be a concern for potential vapor intrusion, the IM will target the "core" of the off-site plume (Figure 3-1).

If performance monitoring of the IM indicates that the initial system is effective in reducing concentrations of TCE and daughter compounds in ground water and controlling the potential for exposure in the off-site area, it is envisioned the IM will be incorporated into the RMP as Phase 1 of the remediation plan for the site. A Process Flowchart illustrating the projected IM pilot program activities and relationship to the RMP is provided as Figure 3-2.

3.3 *RECOMMENDATION OF FINAL CORRECTIVE MEASURE*

In order to take maximum advantage of the information that will be obtained during the IM, Whirlpool has developed a recommended plan for final corrective measures that will be implemented in phases.

Phase 1 – Interim Measure

The IM will serve as a first phase of remediation. As illustrated in Figure 3-1, the IM will consist of two components: 1) in situ treatment using a series of injection wells installed in the core of the plume that will be used to deliver an oxidizing agent in the ground water, and 2) a ground water recovery well installed downgradient of the ISCO injection wells. Additional details of the IM design and implementation are provided in the IM Work Plan. It is anticipated that the IM will be operated over a 6-month period, with performance monitoring being performed throughout the operation.

Operational data from the IM will be used in the detail design of an expanded system for the off-site and on-site ground water plumes in Phase 2. Specifically, the IM data will help assess whether ISCO treatment, ground water recovery, or both should be implemented as the Expanded Remedy for off-site and on-site ground water. In addition, the IM will guide refinement of the system to more effectively treat the more clay-rich portions of the shallow aquifer off site. If the IM has not been implemented by the time this RMP has been approved and public notice given, the IM will be implemented as Phase 1, and Phase 2 will not start until sufficient operational data has been collected for design purposes.

Phase 2 – Expanded Remedy

As discussed above, the IM will provide operational data that are needed for assessing whether treatment or removal, or both, are appropriate for expanded application for on-site and/or off-site ground water.

Off-Site Ground Water

Following evaluation of the data collected during the IM, it is expected that either the ISCO treatment system or the ground water recovery system, or both, will be modified and/or expanded to more fully address the off-site plume.

On-Site Ground Water

The Expanded Remedy for on-site ground water will include establishing Institutional Controls to preclude use of shallow ground water. Data from the IM will be used to design the on-site ground water remedial system using either ISCO treatment, ground water recovery, or both to reduce ground water concentrations and control potential for off-site migration.

On-Site Soil

The Expanded Remedy for on-site soils will include establishing Institutional Controls to preclude access to affected shallow soils. Also, the existing asphalt/concrete cover in the source area will be upgraded and/or maintained to serve as a physical barrier (containment) to infiltration through the affected soils. Additional cover may be added to provide a more extensive cover system. The detail design for the soil containment system will proceed during Phase 1 activities.

The Expanded Remedy will also include semi-annual ground water monitoring of both on-site and off-site areas, as discussed below, to monitor remedy effectiveness and to provide the data necessary to assess the need for contingency measures, if any.

Phase 3 - Contingency Measures

If ground water monitoring results indicate remedial action criteria may not be met within three years, Whirlpool will, in consultation with the ADEQ, evaluate the need for modification of the existing remedial measures or the application of other measures that may be required to improve the performance of the selected remedies at the Fort Smith site. Such contingent measures may include one or more of the following technologies:

- Additional ground water extraction to control migration and remove mass;
- Soil excavation to remove residual constituents in the source area;
- The injection of nutrients to enhance natural attenuation;
- Additional ISCO treatment to reduce constituent mass;
- Installation of a permeable treatment bed;
- Installation of a vertical barrier or other containment structures; or
- Filing of deed recordation, restricting off-site ground water use.

3.4 PUBLIC INVOLVEMENT PLAN

As specified in the LOA, Whirlpool will work with the ADEQ to seek public comment on the Administrative Record (AR) and the proposed corrective measures for the remedial actions to be implemented for the Fort Smith facility. The public involvement plan will consist of three parts:

- Establishing a local repository for project documents;
- Compiling a copy of the AR for public access at the repository; and
- Providing public notice of the availability of the AR and a request for comments on the AR and the proposed corrective measures.

Whirlpool will establish a local document repository where the public will have access to the AR (i.e., the collection of documents forming the basis for the final corrective measure). The location of the document repository, typically a local library, will be determined in cooperation with the ADEQ.

Whirlpool will provide a copy of relevant site documents to the repository that will provide the public the basis to understand the selection of the final corrective measure. Whirlpool will then work with the ADEQ to place a pubic notice in a local newspaper advertising the availability of the AR and asking for public comments on the selection of the final corrective measure. The public will be directed to provide comments to the ADEQ. The public comment period will be for a minimum of 30 calendar days. Following receipt of comments and direction from ADEQ, Whirlpool will update the AR, as necessary. Once the AR is complete and fully approved, the RMP will be implemented.

3.5 PROGRESS REPORTS

Performance Monitoring

Starting with the initiation of the IM activities, Whirlpool proposes to implement a program of semiannual ground water monitoring for at least a three-year period to evaluate the effectiveness of the remedies. The monitoring will involve analysis of the key constituents of concern: PCE, TCE, cis-1,2-DCE, vinyl chloride and chloroform. Specific wells to be incorporated into the monitoring system will be specified in the final design.

If analytical results indicate that remediation activities are not making reasonable progress toward reducing the constituent concentrations in the off-site area to MCLs within three years, or that concentrations are rebounding above their respective MCLs, then Whirlpool will notify the ADEQ and discuss the need to implement one or more contingent remedial measures (triggering Phase 3 of the remedial plan as indicated in Figure 3-2). Similarly, if analytical results show changes in concentrations that would indicate an increase in off-site migration during the remedy implementation, Whirlpool will notify the ADEQ and discuss the need to implement one or more contingent remedial measures (again triggering Phase 3).

The condition of the existing asphalt/concrete cover in the source area and any additional cover will be monitored semiannually for general wear and the existence of significant cracks. Cover will be repaired as necessary to maintain effectiveness.

Performance Reviews

Whirlpool will prepare quarterly Remedial Action and Operation and Maintenance Status Reports as required in the LOA and annual ground water monitoring reports that summarize the results of the semiannual ground water monitoring and any performance data from continuing corrective actions.

The quarterly status reports will contain the following:

- Summaries of findings in the reporting period, including the result of any pilot studies;
- Summaries of any changes made in the RMP during the reporting period;
- Summaries of problems encountered during the reporting period; and
- Actions taken to address problems.

The annual monitoring report will contain the following:

- Summaries of the semiannual ground water monitoring results with comparisons to remedial action criteria;
- Summaries of ground water level elevation data; and
- Copies of the laboratory analytical reports.

Consistent with the 2005 Arkansas Ground Water Remediation Level Interim Policy, five years after initiating the Expanded Remedy (Phase 2) Whirlpool will prepare a five-year technical review of the status of the Fort Smith facility corrective actions and assess the need for implementation of contingency response actions (Phase 3). In the event that the three-year monitoring program indicates that the performance criteria have been met, Whirlpool will propose that performance monitoring cease.

3.6 PROPOSED SCHEDULE AND COMPLETION OF CAS PROGRAM

The RMP implementation schedule is presented in Figure 3-3 and represents Whirlpools current estimate of the timing for completion of each of the outlined tasks. The schedule has been developed to provide for the expeditious implementation of corrective measures following notification to proceed from the ADEQ. It should be noted that the schedule includes assumptions for duration of tasks outside of Whirlpool's control (e.g., ADEQ review of IM Work Plan).

Since off-site corrective action is being initiated as an IM, the implementation schedule for the on-site and off-site corrective measures will follow separate but parallel schedules (Figure 3-3). As illustrated in the flowchart in Figure 3-2, the IM will be initiated while the review and approval process (including the public review/comment period) for the RMP proceeds. The on-site remedy will begin following approval of this RMP, likely after the start of the IM.

The schedule will be revisited on an annual basis and updates provided to the ADEQ, as warranted based on current conditions and remedial progress.

Tables

March 27, 2008
Project No. 0048030

Environmental Resources Management
15810 Park Ten Place, Suite 300
Houston, Texas 77084-5140
(281) 600-1000

TABLE 2-1

Summary of Remedial Action Criteria

Whirlpool Corporation
Fort Smith, Arkansas

On-Site Soil - Soil to Ground Water Pathway

	RAC	Units	RAC Source
TCE	0.129	mg/kg	Table 4-9 RER

On-Site Ground Water - No Migration Off-Site Above MCLs

	RAC	Units	RAC Source
Trichloroethene (TCE)	0.005	mg/l	MCL
cis-1,2-DCE	0.070	mg/l	MCL
Chloroform	0.080	mg/l	MCL[1]
Tetrachlorethene (PCE)	0.005	mg/l	MCL
Vinyl Chloride	0.002	mg/l	MCL

Off-Site Ground Water - Direct Contact and Vapor Intrusion Pathways

	RAC	Units	RAC Source
Trichloroethene (TCE)	0.005	mg/l	MCL

NOTES:

1) MCL for Total Trihalomethanes, which includes chloroform.
RAC - Remedial Action Criteria
RER - Risk Evaluation Report

TABLE 2-2

Corrective Action Measures Summaries

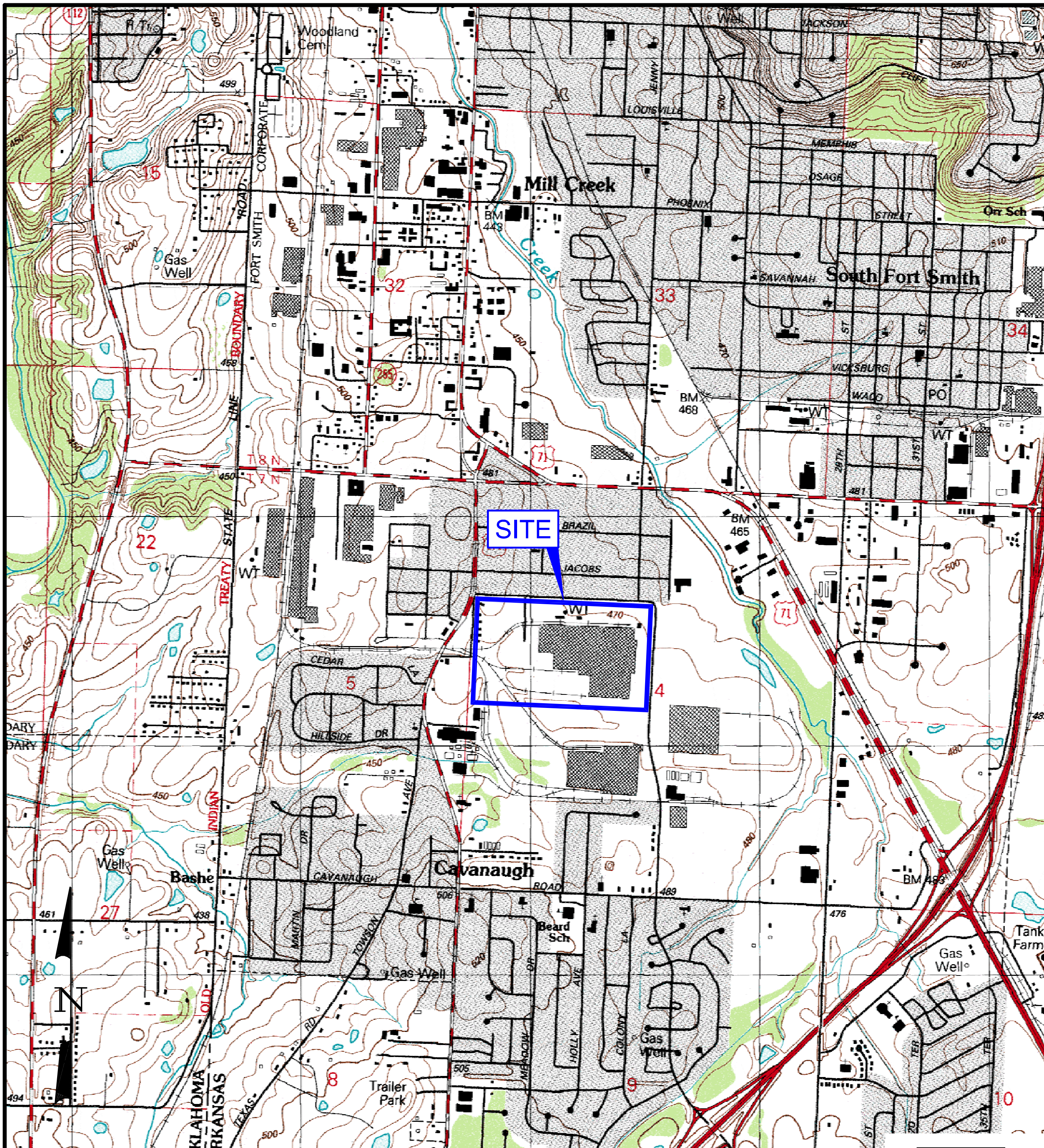
Whirlpool Corporation
Fort Smith, Arkansas

General Corrective Action	Remedial Technology	Process Option	Description
NO ACTION	None	No Action	No action, represents base line conditions. Includes semi-annual ground water monitoring.
CONTAINMENT	Horizontal Barriers	Topsoil/Clay and Vegetation	Placement of topsoil/clay and seeding to vegetate
		Cement Stabilized Soil	Mixing of soil with cement and compacting
		Asphalt	Placement of asphalt over affected soil
		Concrete	Mixing and placement of concrete over affected soil
		Soil Cover w/Synthetic Liner	Construction of combination soil cover and synthetic liner
	Vertical Barriers	Slurry Wall	Installation of trench filled with soil/bentonite slurry
		Cement-Bentonite Wall	Installation of trench filled with cement/bentonite slurry
		Grout Curtain	Injection of clay-cement grout into voids where piles were driven and extracted
		Sheet Pile Wall	Construct of containment wall by driving sheet piling
		Interceptor Trenches	Installation of gravel filled trench used to isolate affected area
REMOVAL	Soil Excavation	Excavation	Excavation - Removing media for treatment or disposal by backhoe
	Ground Water Extraction	Extraction Trenches	Trench, either open or backfilled with porous media, to allow seepage and collection of ground water and oils
		Extraction Wells	Series of wells to extract affected ground water
TREATMENT - In situ	Biological	Enhanced Aerobic/Anaerobic Biodegradation	Addition of bacteria, oxygen and nutrients to promote biodegradation of chemicals
		Natural Attenuation	Long-term monitoring physical, chemical and biological processes that reduce chemicals of concern naturally
	Physical/Chemical	Vapor Extraction	Application of a vacuum on the soil
		Permeable Treatment Beds	Affected ground water is intercepted in a downgradient trench filled with materials to treat or absorb the chemicals
		Chemical Oxidation	Saturated soils and ground water are oxidized by injection of oxidants such as sodium persulfate
INSTITUTIONAL ACTIONS	Access Restrictions	Deed Recordation	Surveying and filing of deed recordation, restricting ground water use

Figures

March 27, 2008
Project No. 0048030

Environmental Resources Management
15810 Park Ten Place, Suite 300
Houston, Texas 77084-5140
(281) 600-1000



0 2000 4000

SCALE FEET

QUADRANGLE LOCATION

SOURCE: U.S.G.S. 7.5' QUADRANGLE, SOUTH FORT SMITH, ARK.-OKLA., (o35094C4) 1987.

Environmental Resources Management

DESIGN: HTV	DRAWN: EFC	CHKD.: TWM
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FIGURE 1-1
SITE LOCATION MAP
Whirlpool Corporation
Fort Smith, Arkansas

ERM

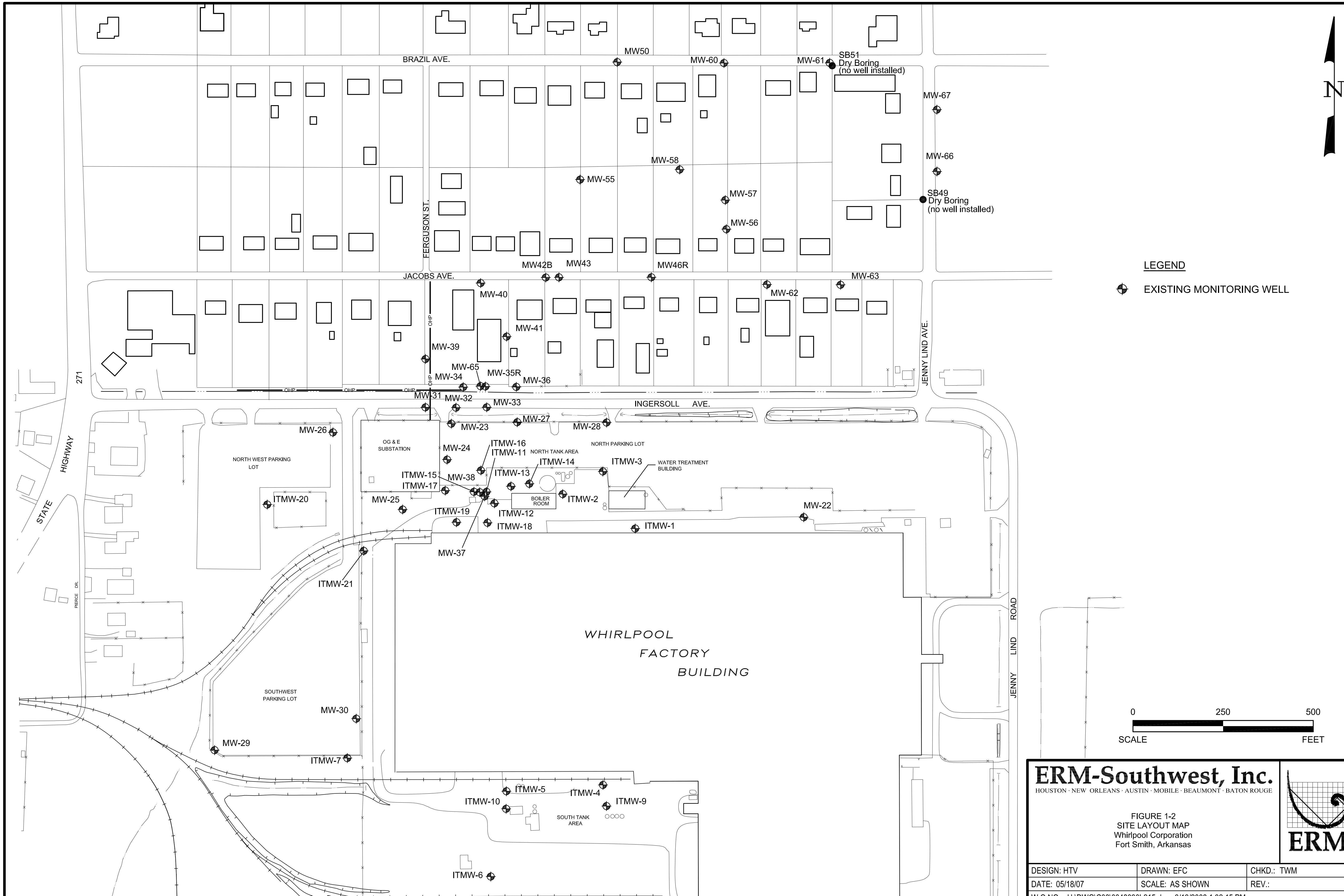

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FIGURE 1-2
SITE LAYOUT MAP
Whirlpool Corporation
Fort Smith, Arkansas

ERM

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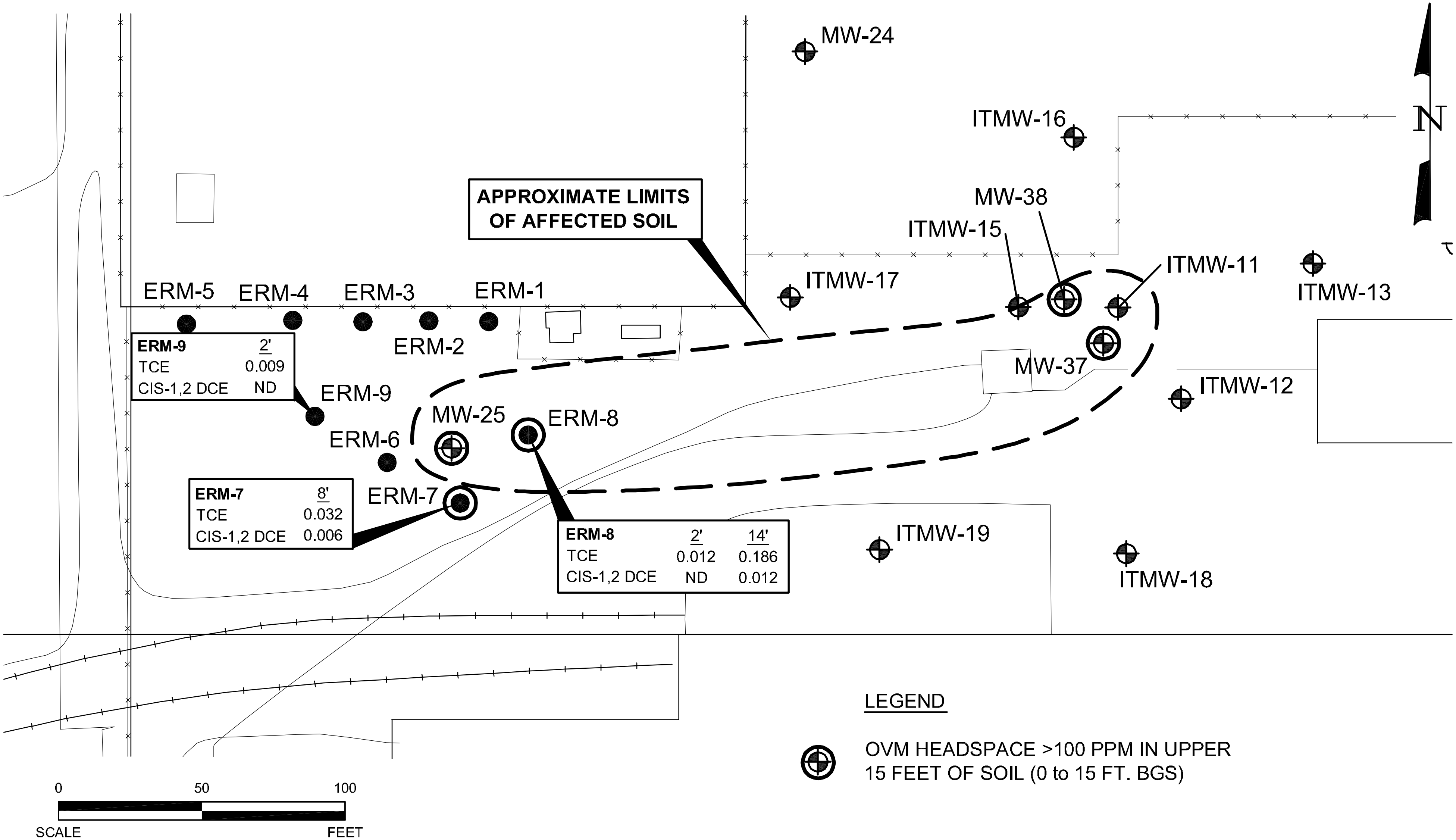

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FIGURE 2-1
APPROXIMATE EXTENT OF AFFECTED SOIL
Whirlpool Corporation
Fort Smith, Arkansas

ERM

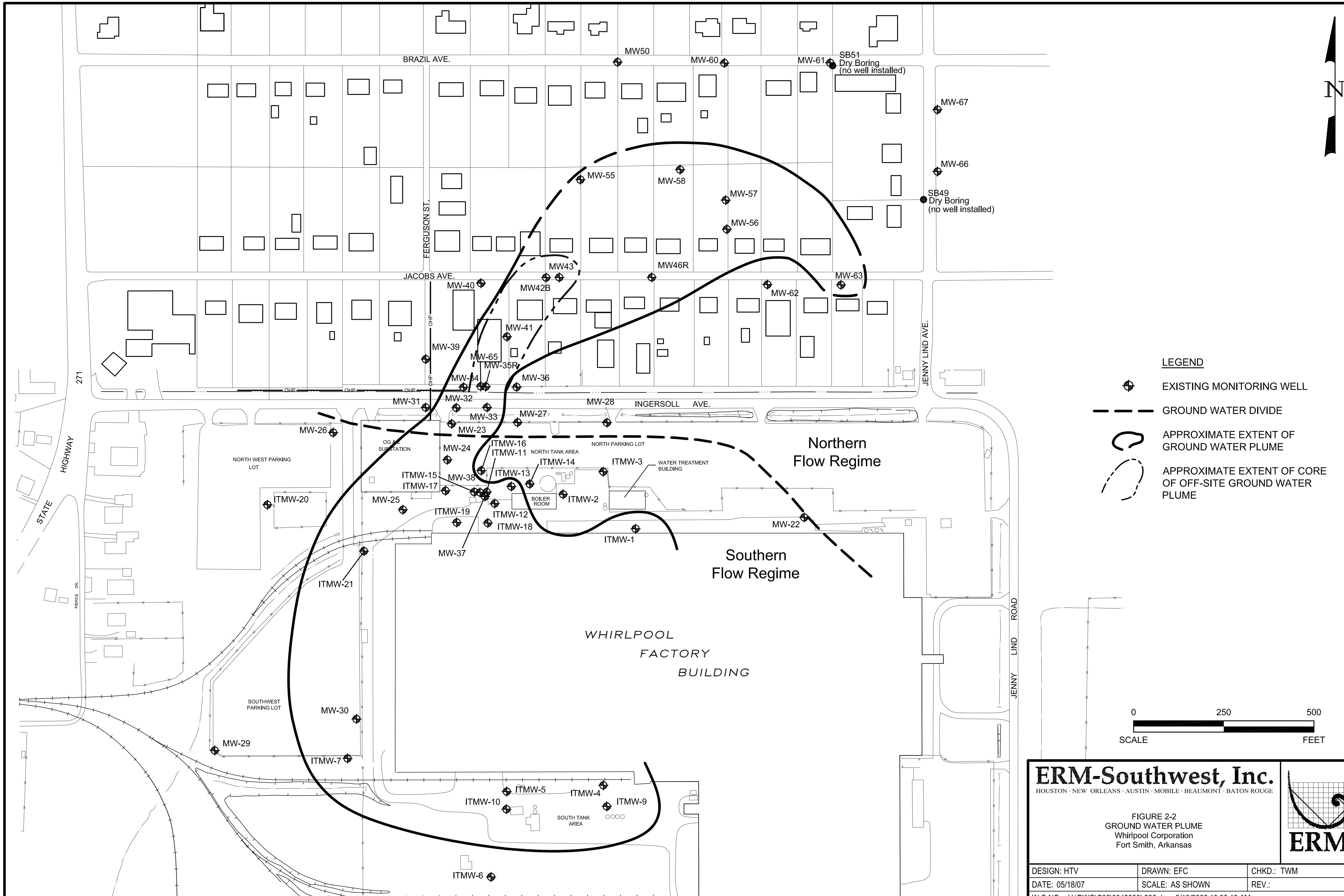

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FIGURE 2-2
GROUND WATER PLUME
Whirlpool Corporation
Fort Smith, Arkansas

ERM

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LEGEND

EXISTING MONITORING WELL

APPROXIMATE AREA OF GRAVEL ZONE
(MINIMUM THICKNESS OF 1 FOOT)

0 150 300

SCALE FEET

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FIGURE 2-3
DISTRIBUTION OF GRAVEL ZONE
Whirlpool Corporation
Fort Smith, Arkansas

ERM

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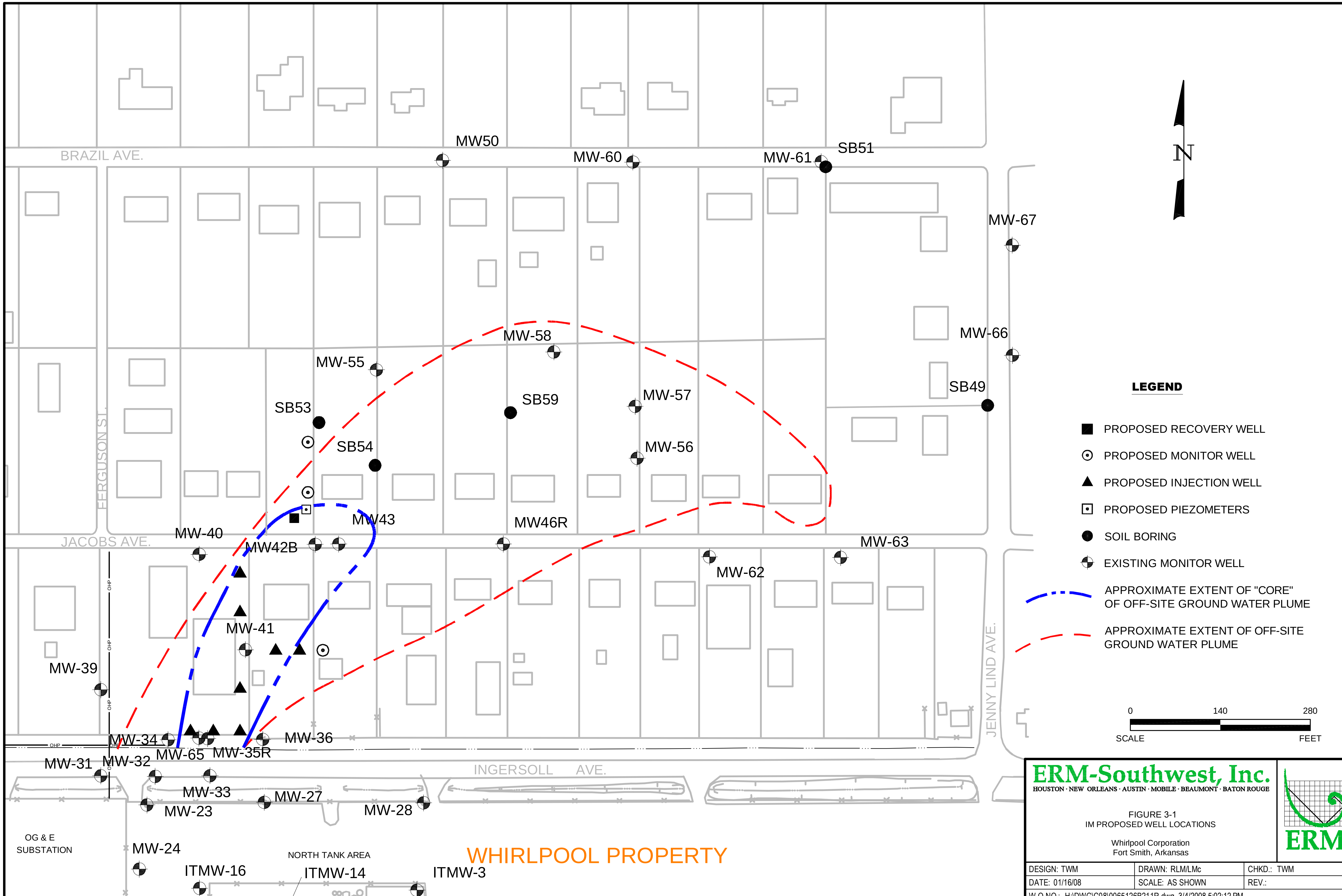
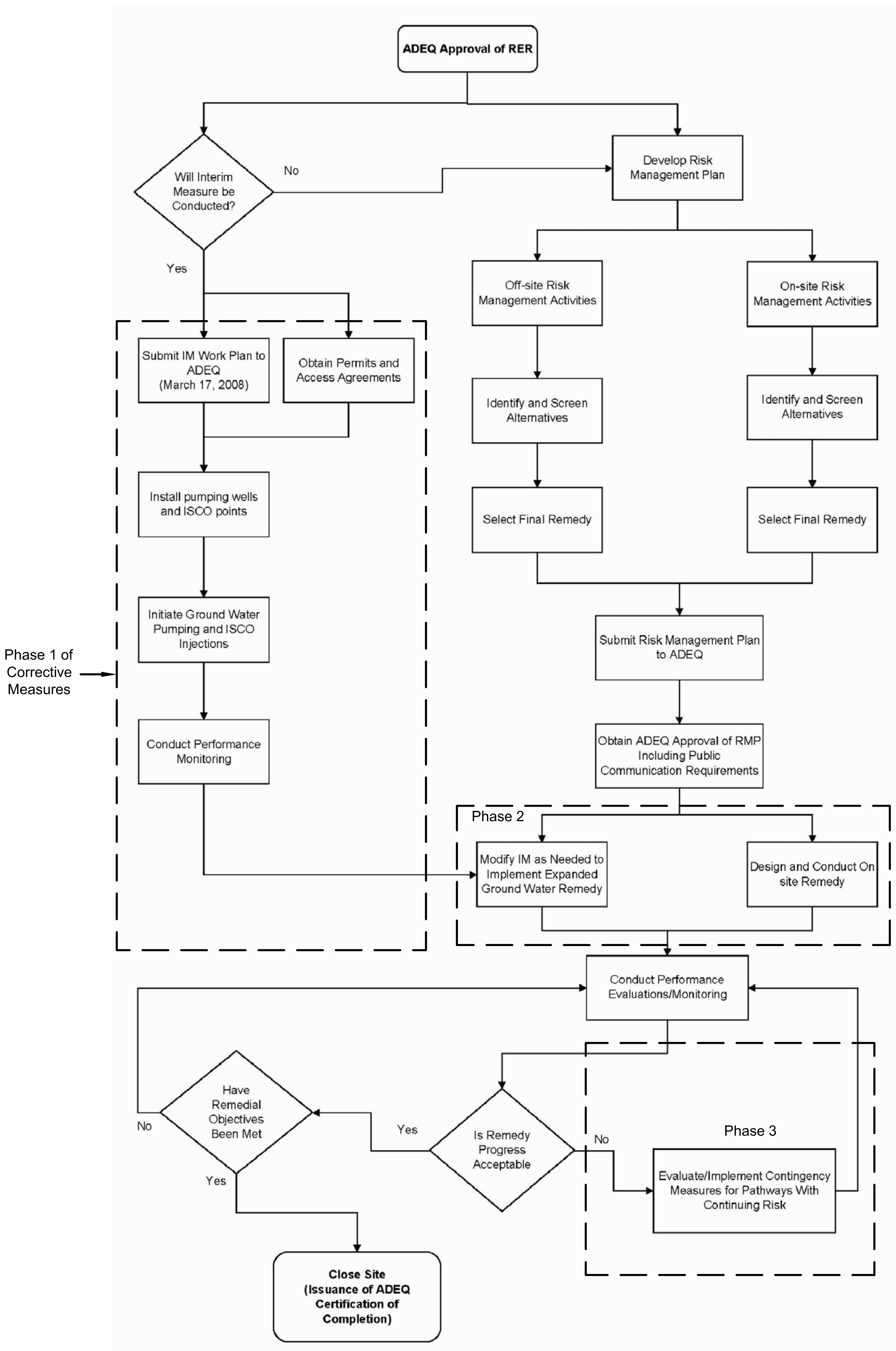


BRAZIL AVE.
JACOBS AVE.
INGERSOLL AVE.
FERGUSON ST.
JENNY LIND AVE.
MW50
MW-60
MW-61
SB51
MW-67
MW-66
SB49
MW-58
MW-55
SB53
SB59
MW-57
SB54
MW-56
MW43
MW46R
MW-40
MW42B
MW-63
MW-62
MW-41
MW-39
MW-34
MW-36
MW-31
MW-32
MW-65
MW-35R
MW-33
MW-27
MW-23
MW-28
OG & E
SUBSTATION
MW-24
ITMW-16
NORTH TANK AREA
ITMW-14
ITMW-3
WHIRLPOOL PROPERTY
N
LEGEND
PROPOSED RECOVERY WELL
PROPOSED MONITOR WELL
PROPOSED INJECTION WELL
PROPOSED PIEZOMETERS
SOIL BORING
EXISTING MONITOR WELL
APPROXIMATE EXTENT OF "CORE" OF OFF-SITE GROUND WATER PLUME
APPROXIMATE EXTENT OF OFF-SITE GROUND WATER PLUME
0
140
280
SCALE
FEET
ERM-Southwest, Inc.
HOUSTON · NEW ORLEANS · AUSTIN · MOBILE · BEAUMONT · BATON ROUGE
FIGURE 3-1
IM PROPOSED WELL LOCATIONS
Whirlpool Corporation
Fort Smith, Arkansas
ERM
DESIGN: TWM
DRAWN: RLM/LMc
CHKD.: TWM
DATE: 01/16/08
SCALE: AS SHOWN
REV.:
W.O.NO.: H:\DWG\C08\0065126B211R.dwg, 3/4/2008 5:02:12 PM



Environmental Resources Management

FIGURE 3-2

IM AND RMP PROCESS FLOW CHART
Whirlpool Corporation
Fort Smith, Arkansas

DESIGN: GJ	DRAWN: LMc	CHKD.:
DATE: 3/20/2008	SCALE: AS SHOWN	REV.:

W.O.NO.: H:\DWG\C08\0079781b203.dwg, 3/25/2008 1:54:50 PM

FIGURE 3-3

Schedule of Tasks
For RMP Implementation

Whirlpool Corporation
Fort Smith, Arkansas

Task/Activity	Timeframe	Expected Duration
Phase 1 – Interim Measure for Off-Site Ground Water		
Submit IM Work Plan	March 17, 2008	Completed
ADEQ IM Work Plan review and approval		30 days
Implement IM and conduct Performance Monitoring	Final planning and mobilization within two weeks of ADEQ approval	180 days
Evaluate IM data and initiate Phase 2 design activities	Results of IM evaluation to be included in a final quarterly status report IM operation may continue pending results of evaluation	90 days
ADEQ RMP review and approval	Concurrent with Phase 1 activities	
Establish Public Repository for Administrative Record (AR)	Begin upon approval of RMP	10 days
Issue Public Notice on availability of AR and begin 30-day comment period		30 days
ADEQ review of public comments		30 days
Revise / finalize RMP based on public and ADEQ comments	Level of effort to be determined based on nature and extent of comments	30 to 60 days
ADEQ issue Final Remedial Action Decision Document		30 days
Phase 2 – Expanded Remedy		
Design modified/expanded off-site ground water remedy	May be combined with on-site design activity and may parallel IM evaluation activity	60 days
Design on-site ground water remedy	May be combined with off-site design activity and may parallel IM evaluation activity	60 days
Design on-site soil containment	May parallel Phase 1 activities	60 days
ADEQ review of design document(s)	Expanded designs may be combined into one document	30 to 60 days
Revise / finalize designs based on ADEQ comments	Level of effort to be determined based on nature and extent of comments	30 to 60 days
Conduct on-site and off-site remedies	On-site and off-site implementation may begin independently based on timing of ADEQ approval of remedy designs	Duration of construction and system startup dependent upon final design
Begin performance monitoring and system operational evaluation	Following system startup and trouble shooting.	Milestone
Submit Quarterly Remedial Action and Operation and Maintenance Status Reports		Milestone
Conduct semiannual ground water monitoring	Following system startup and trouble shooting	
Submit annual ground water monitoring report		Milestone
Conduct 5-Year Technical Review		Milestone
Phase 3 – Contingency Measures		
Tasks and schedule to be determined		