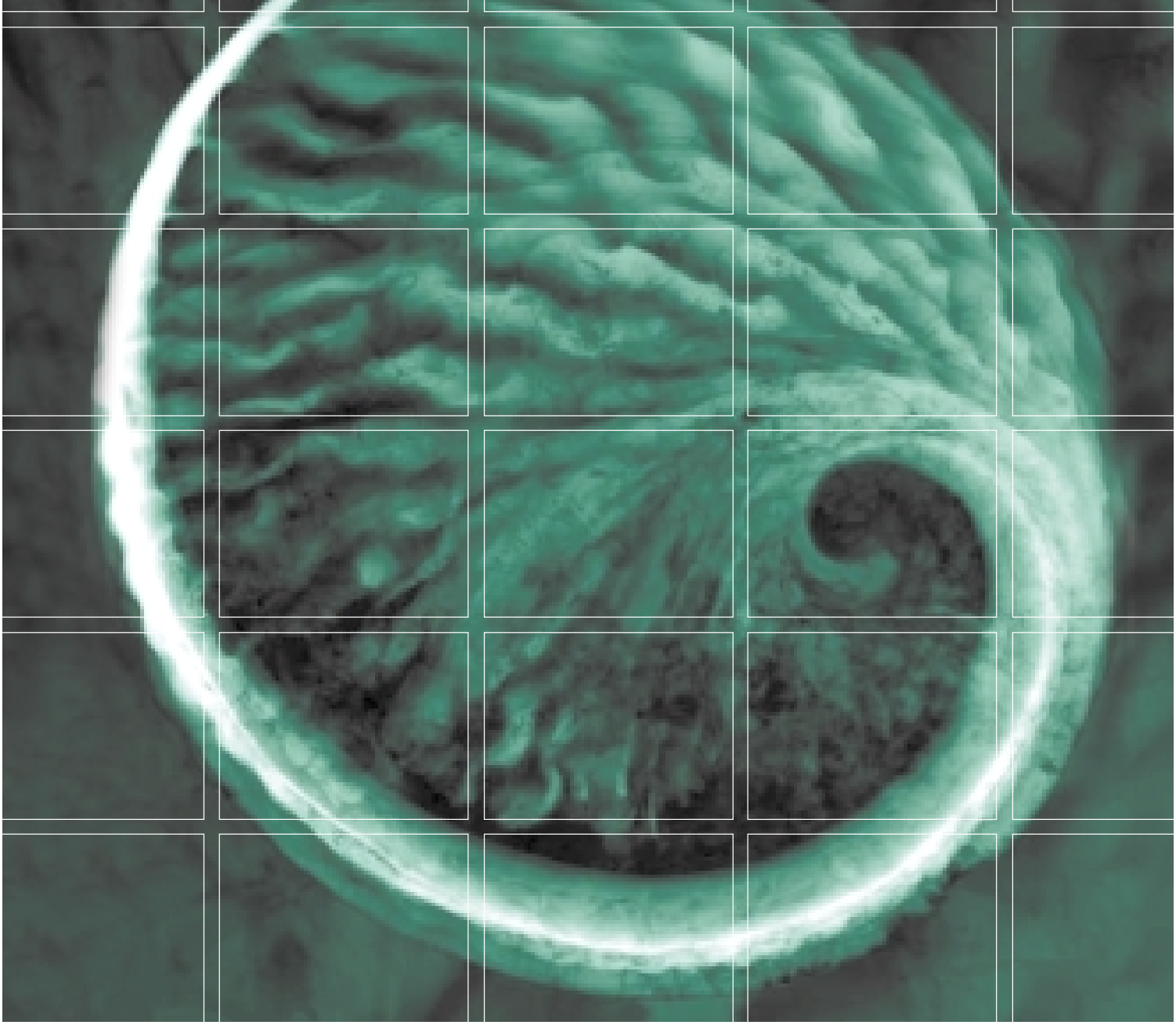

Risk Evaluation Report – Fort Smith, Arkansas Facility

Whirlpool Corporation
Fort Smith, Arkansas

June 14, 2007

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Fort Smith Arkansas Facility

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TABLE OF CONTENTS

APPENDICES

List of Tables

List of Figures

Glossary of Acronyms

ADEQ	Arkansas Department of Environmental Quality
ASTM	American Standard for Testing and Materials
CAS	Corrective Action Strategy
COPC	Constituent of Potential Concern
CSM	Conceptual Site Model
DAF	Dilution and Attenuation Factor
EPA	Environmental Protection Agency
GWP	Ground Water Protection
HQ	Hazard Quotient
J&E	Johnson and Ettinger
LOA	Letter of Agreement
MSSL	Medium-Specific Screening Level
NOD	Notice of Deficiency
QAPP	Quality Assurance Project Plan
RAGS	Risk Assessment Guidance for Superfund
RER	Risk Evaluation Report
RMR	Risk Management Report
SSL	Soil Screening Levels
USGS	United States Geological Survey
UST	Underground Fuel Storage Tank
VF	Volatilization Factor
VOCs	Volatile Organic Constituents

1.0 INTRODUCTION

This Risk Evaluation Report (RER) has been prepared pursuant to the requirements specified in Section II.F of the Letter of Agreement (LOA) between the Arkansas Department of Environmental Quality (ADEQ) and Whirlpool Corporation, dated July 19, 2002. The RER captures four elements necessary in guiding risk management decisions at the site: 1) the site characterization activities and results for the Whirlpool Corporation, Fort Smith Facility (hereafter referred to as the site), 2) the exposure scenario evaluation, 3) highlights of the revised conceptual site model (CSM), and 4) the findings of the risk assessment.

Initial information for the first three of the four elements listed above was previously provided in the Conceptual Site Model (CSM) report, dated August 2, 2002, and in the Corrective Action Strategy Work Plan Addendum (Work Plan), dated August 30, 2006. These elements have been updated as necessary and are provided in the RER.

Consistent with the path forward outlined in Work Plan, a risk assessment (the fourth element of the RER) was completed for the site. The technical approach used for the risk assessment generally followed the principles and guidelines described in EPA Region 6 Corrective Action Strategy (CAS) (EPA, 2000).

As an initial step in the risk assessment, High Priority Bright Line Screening Levels provided in the CAS were used as a priority screen. The results indicated that several constituents significantly exceeded the High Priority Bright Line Screening Levels. It was apparent from the results of the priority screen that it would be more effective to initiate remediation directly after conducting the priority screen, rather than perform a detailed site-specific risk assessment. Constituents of potential concern (COPCs) that required remediation were identified in a subsequent risk-based screening step.

1.1 REGULATORY BACKGROUND

Whirlpool entered into a LOA with ADEQ on July 19, 2002 to investigate and remediate affected ground water at the northern position of the site in accordance with the CAS. A chronology of significant events related to the site is presented below.

August 2001	Notice of Intent
June 2002	Letter of Agreement
August 2002	Conceptual Site Model

August 2002	Scoping Meeting – ADEQ indicated that Whirlpool should proceed with off-site delineation under CAS Work Plan Outline.
August 2002	CSM Addendum
June 2003	CAS Work Plan
July 2003	Off-site Delineation Phase A – included installation and sampling of three off-site wells
November 2003	Off-site Delineation Phase B – included ten Geoprobe borings and field screening using a membrane interface probe, and the installation and sampling of four off-site wells
June 2004	Interim Status Report and Revised CAS Work Plan
October 2004	E-mail from Linda Hanson, ADEQ – directed Whirlpool to continue with off-site delineation under the Revised CAS Work Plan and address specified deficiencies upon completion of delineation
November 2004	Off-site Delineation Phase C – included installation of seven Geoprobe borings and the installation and sampling of four off-site wells
March 2005	Interim Status Report for Off-Site Investigation
April 2005	Off-Site Delineation Phase D – included installation of five Geoprobe borings and the installation and sampling of four off-site wells
June 2005	Interim Status Report for Off-Site Investigation
June 2005	Notice of Deficiency (NOD) letter from ADEQ – identified several items to be addressed, requested a revised CAS Work Plan
July 2005	Response to June 2005 ADEQ NOD letter
April 2006	Off-site Delineation Phase E - including installation and sampling of two off-site monitoring wells
June 2006	NOD letter from ADEQ
June 2006	Meeting with ADEQ to review off-site delineation status and clarify path forward

August 2006 CAS Work Plan Addendum (approved by ADEQ January, 2007)

1.2 OBJECTIVES

As presented in the CAS Guidelines, the objectives of the RER include:

- Summarize the site characterization activities and results of those studies;
- Evaluate exposure scenarios that apply to the site;
- Assess the potential risk to human health considering site-specific conditions; and
- Identify aspects of the site that may warrant remediation or further risk evaluation.

1.3 REPORT ORGANIZATION

This report is organized into the following sections to present the information in a clear and concise framework.

- *Section 1* (Introduction) presents the site background and description, and outlines the scope and objectives of the report.
- *Section 2* (Conceptual Site Model) describes the site conditions based on the comprehensive site investigation activities, presents a discussion of the extent of affected media, exposure scenarios, results of the Ecological Exclusion Criteria Worksheet, and identifies areas that require evaluation in the risk assessment.
- *Section 3* (Risk-Based Priority Screening) presents a summary of the methods and results for prioritizing the site.
- *Section 4* (Identification of COPCs) describes the risk-based methods used to identify COPCs for remediation and the list of COPCs.
- *Section 5* (Summary of Risk-Screening Process and Conclusions) summarizes the significant findings of the risk assessment.
- *Section 6* (References) provides a listing of the references used in the report.

2.0 CONCEPTUAL SITE MODEL

The CSM characterizes the site conditions and provides the basis for the exposure scenario evaluation. Key components of the CSM are discussed below organized by facility profile, land use and exposure profile, physical profile, release profile, ecological profile, and risk management profile.

2.1 FACILITY PROFILE

2.1.1 Site Features

The Whirlpool Fort Smith facility is located at 6400 Jenny Lind Avenue on the south side of Fort Smith in Sebastian County, Arkansas (Figure 2-1). 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 2-2). 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. Historical records indicate that a small building located west of the boiler house was formerly used for degreasing operations. The former degreaser building has not been used since the mid 1980s.

2.1.2 Facility Operations

The facility manufactures side-by-side household refrigerators, trash compactors and icemakers, and has been operated by Whirlpool for over 30 years. Manufacturing processes include polyurethane foaming, metal fabrication, plastic thermoforming, and assembly operations. All storage of hazardous wastes is limited to 90 days or less in containers. No hazardous waste disposal activities are conducted on site.

2.2 LAND USE AND EXPOSURE PROFILE

2.2.1 Land Use

The facility property is developed for industrial use (i.e., manufacturing and warehousing). No other specific land use categories are present on the property. Land uses adjacent to the site include residential areas to the north and industrial/commercial areas to the south, west and east. A tract of undeveloped land is also present east of the site. 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. 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. Figure 2-3 illustrates the land uses immediately surrounding the facility.

2.2.2 Resource Use

Drinking water and sanitary sewer services for both commercial/industrial and residential properties in the vicinity of the site are supplied by the City of Fort Smith. Drinking water supplies include Lake Fort Smith, Lake Shepherd Springs and the Lee Creek Reservoir. None of these reservoirs are located near the facility.

Based on the EPA ground water classification guidelines, ground water in the vicinity of the site is classified as Class IIB ground water (a potential drinking water source). However, available literature indicates that the majority of shallow wells in the Fort Smith area are completed in the McAlester Shale. The thin alluvial deposits in the Fort Smith area (specifically those not associated with the Arkansas River) yield insufficient quantities of water to justify shallow wells. Most wells completed in the McAlester Shale are completed to depths up to 475 feet and produce poor quality water with yields of 25 to 75 gallons per minute. These potential drinking water resources are significantly separated from thin alluvial sands and gravels that immediately underlie the site.

A water well search was initially conducted for the facility in February 2001. In May 2006, a new water well search was performed and covered a one-mile radius around the site (Figure 2-4). No federal, state or public water supply wells were identified within the search radius. Based on the water well search reports and area reconnaissance, no water supply wells are present on the residential properties adjacent to the facility to the north. The database search also indicated the presence of 20 shallow (<30 ft bgs) environmental monitor wells within a one-mile radius of the site. All 20 of those wells are situated at least 2,000 feet away from the site, and none are impacted by site activities.

Future impacts to domestic or public water supply wells are unlikely based on the current location of the ground water plumes, inferred ground water flow directions, and the lack of drinking water use in the vicinity of the site.

The closest surface water body is approximately 1200 feet east of the site and is named Mill Creek. Mill Creek is a perennial freshwater stream that is classified as state segment 11110105002991 and has designated uses for contact recreation, fishery, and domestic, industrial, and agricultural water supply. Based on site reconnaissance and data from lithologic logs from borings along Jenny Lind Avenue, the transmissive zone containing site constituents is not hydraulically connected to and does not discharge to the creek.

Other than the features described above, there are no beneficial resources that are in the vicinity of the site that would be potentially impacted by the historical release from the site (described in more detail in Section 2.4, Release Profile).

2.2.3 *Exposure Profile*

The exposure profile integrates the information on land uses, receptors, resources, and releases to identify applicable exposure pathways. As defined by EPA, a pathway is potentially complete if all of the following conditions exist: (1) a source or chemical release from a source, (2) an exposure point where contact can occur, and (3) an exposure route by which contact can occur (EPA, 1989). The following subsections discuss each of the conditions stated above as necessary for identification of a potentially complete pathway.

2.2.3.1 *Source*

Additional aspects of the source component of the exposure profile are described in more detail in Section 2.4 (Release Profile). In summary, chlorinated solvents (reportedly tricholorethylene, or TCE) likely entered the environment from historical site activities that were potentially related to former degreasing operations at or near the former degreaser building. The known area of affected soils is wholly contained within the confines of the facility security fencing. Those historical releases appear to have traveled through surface soil, migrating vertically to ground water within alluvial sands and gravels constituting the uppermost aquifer underlying the site. Over time, the constituents were transported laterally within the uppermost aquifer to the south and to the north from the general vicinity of the former degreaser building, located outside the northeastern corner of the manufacturing building.

At this time, both soil and ground water may be considered as a source for the purposes of this exposure pathway analysis. Constituents present in deep soil above the water table may potentially act as a source for transfer to ground water. Similarly, the affected ground water may potentially serve as a source as constituents migrate to soils, soil vapor and then to air.

2.2.3.2 *Exposure Point*

The concept of an exposure point primarily refers to an exposure medium. However, another important component of the exposure pathway analysis is the exposure population. Both of these components, an exposure medium and an exposure population are discussed below.

Exposure Medium

The exposure media by which receptors may potentially come in contact with constituents from the site were considered to be soil (for the direct contact to soil pathway), ground water (for the direct contact to ground water pathway) and air (for the ground water to ambient air and ground water to indoor air pathways).

Exposure Population

Based on the available information concerning land uses both on and off site, the following potential exposure populations were identified:

- Site workers (potentially long-term exposure) that are involved in manufacturing activities, facility maintenance administration over many years;
- Site construction workers (potentially short-term exposure) that may be involved in limited duration activities construction, utility, or other related activities; and
- Off-site residents (potentially long-term exposure) that live in the area north of the site where the plume has migrated.

In this risk assessment, these exposure populations are represented by a *receptor*.

2.2.3.3 *Exposure Routes and Pathways*

Constituents may potentially enter the human body through ingestion, dermal contact, and inhalation. These modes of entry constitute exposure routes.

Based on the nature and distribution of the affected soil and ground water, the on- and off-site receptors may potentially be exposed to site constituents through several pathways. For purposes of discussion, the exposure pathways that were carried into the risk assessment are referred to as *Determined Exposure Pathways* while others that were generally considered, but not used in the risk assessment are referred to as *Undetermined Exposure Pathways*.

Determined Exposure Pathways

Considering the source, potential exposure points, potential exposure routes, and EPA's guidelines for a potentially complete pathway, two Determined Exposure Pathways were identified to be potentially complete at the site:

- 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 0-2 ft bgs (i.e., combined ingestion, dermal, and inhalation exposures) for future construction workers.

Additionally, three 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;

- 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; 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.

Undetermined Exposure Pathways

Several additional pathways were assessed, but not demonstrated to be complete based on analytical data in the exposure medium. Rather, they are acknowledged as theoretically possible based on site conditions (e.g., source concentrations, lack of engineering controls, potential receptors, etc). For the most part, these Undetermined Exposure Pathways rely on an indirect connection between the source and the potential receptor. For example, exposure via inhalation of vapors in outdoor air over an area of the plume requires transport from ground water to soil and through soil vapor, and then into ambient air where vapors might accumulate. Then, exposure would be required by a receptor to the accumulated vapors in the outdoor air space.

The lack of analytical data and accurate models for such indirect pathways make quantitative analysis less reliable, and therefore less useful for these pathways. The Undetermined Exposure Pathways considered for the site are listed below:

- Inhalation of volatile emissions in outdoor air from constituents in shallow ground water for current and future site workers, construction workers, and residents;
- Vapor intrusion into buildings from constituents in shallow ground water for current and future site workers, and residents;
- Incidental contact with off-site surface soils for the resident; and
- Incidental contact with ground water in off-site soils for the resident (short-term exposure).

The exposure pathways, both Determined and Undetermined, are summarized in the exposure pathway analysis diagram in Figure 2-5. A pictorial illustrating the conceptual exposure model is provided in Figure 2-6. Exposure scenarios were developed for both Determined and Undetermined Pathways (See Section 3.3). However, quantitative risk assessment was only performed for the Determined Pathways. Potential risk from the Undetermined Exposure Pathways will be managed as part of the overall remediation strategy.

2.2.3.4 *Description of On-Site Receptor Exposure Scenarios*

Ground Water Receptor Scenario

Current and Future Site Worker: Shallow ground water beneath the site is currently not used and it is anticipated that it will not be used in the future. No

water supply wells are located on site. The site and immediate surrounding area are provided with municipally supplied water, which is expected to continue in the future. Therefore, there is no risk to the current site worker from direct contact with on-site ground water as the pathway is incomplete.

There is no current restriction on ground water use at the facility. In the unlikely event that a drinking water well is installed in the future, a *hypothetical* scenario was evaluated for the future site worker. Direct contact with shallow ground water on site was hypothetically assumed for the future site worker only. In this hypothetical scenario, a future site worker may be exposed to ground water via a *hypothetical* water supply well completed in the shallow affected ground water zone on site. In this hypothetical scenario, the exposure route could occur via ingestion, dermal contact while showering, and inhalation of volatiles while showering.

Volatile COPCs are present in on-site ground water. Based on headspace analysis of site soils using an organic vapor meter, there is no indication that vapors from ground water have actually reached the surface and, if so, at what concentration. The ground water to ambient air pathway was not quantified for the current and future site worker in the absence of reported ambient air data. Quantification of this pathway would require use of screening level models that use a "box" assumption which limits the degree of circulation and exchange of air. Such models do not represent site conditions.

For the current and future site worker (indoor), the vapor intrusion into buildings pathway was not quantified. While volatile COPCs are detected in on-site ground water, the lack of analytical data in the exposure medium (air) and inaccuracies of screening quality models present a high level of uncertainty regarding the completeness of the pathway.

Current and Future Construction Worker: Construction/utility projects at the site do not typically involve work to a depth below five feet or more. Contact with shallow ground water at the site is not a likely scenario due to the depth to ground water (more than 10 to 15 feet below ground surface) and because dewatering would be required should water enter an excavation during construction activities. Accordingly, this pathway was considered incomplete and not evaluated.

It is unknown whether the ground water to ambient air pathway is complete for the construction worker. Screening-level models to assess ambient air typically use a "box" assumption which limits the degree of circulation and exchange of air. Such models are overly simplistic and do not represent site conditions. Accordingly, this pathway was not quantitatively evaluated for the construction worker.

2.2.3.5 *Description of Off-Site Receptor Exposure Scenarios*

Soil Receptor Scenarios

Residential Receptor (Short-Term Exposure) Scenario: Under current and future conditions, some residents may come into contact with saturated surface soil in their yards. Ground water elevation measurements in several off-site wells, suggest the ground water potentiometric surface is proximate to the ground surface in an area roughly demarcated by wells MW-50, MW-58, MW-56, and MW-62. The aquifer is confined in this area such that there is no direct discharge of ground water to the ground surface. In that limited area, a residential receptor involved in digging or related activities could experience short-term direct contact with saturated soils via incidental ingestion, dermal contact, and inhalation of volatiles and particulates. However, this pathway was not quantitatively evaluated since it has not been established that this pathway is, in fact, complete.

Ground Water Receptor Scenarios

Current and Future Resident: There are no domestic water supply wells located within limits of the plume in the residential area adjacent to the facility. Therefore, there is no current risk to a residential receptor from direct contact with ground water.

There are no current institutional or other controls restricting the use of ground water off site. For this risk assessment, a *hypothetical* scenario was evaluated for the future resident assuming access to ground water via a *hypothetical* supply well completed in the shallow aquifer. It was assumed that a water supply well is completed in the uppermost aquifer within the limits of the off-site plume and water was used for potable and non-potable uses. Based on these assumptions, exposure could occur via ingestion, dermal contact while showering, and inhalation of volatiles while showering.

For the current and future resident, it is unknown whether the vapor intrusion into buildings pathway is complete for ground water. Volatile COPCs were detected in off-site ground water samples and there are currently two slab-on-grade residential buildings overlying the off-site ground water plume. Quantitative evaluation of this pathway would require the use of screening-quality models using site ground water data. However, such models do not accurately represent the actual site conditions, and therefore would yield results with a high level of uncertainty. This pathway was not quantitatively evaluated. Note that most homes in the residential neighborhood are constructed with raised crawl spaces, which allow for venting to the ambient air and are not significantly affected by subsurface vapor intrusion.

Migration of volatiles from ground water to ambient air is an undetermined pathway off site. This pathway has not been quantified due to potential inaccuracies in screening level models and the lack of ambient air data.

Screening-level models to assess ambient air typically use a "box" assumption which limits the degree of circulation and exchange of air. Such models are overly simplistic and do not represent site conditions. Accordingly, this pathway was not quantitatively evaluated for the current and future resident.

Current and Future Resident (Short-Term Exposure) Scenario: Under current and future conditions, residents involved in digging activities could potentially be exposed to shallow ground water in some limited areas northwest of MW-50, MW-58, MW-56, and MW-62 where the ground water potentiometric surface is proximate to the ground surface. The aquifer is confined in this area such that there is no direct discharge of ground water to the ground surface. Such exposure would be short-term, and given the uncertainty associated with the pathway, it was not quantitatively evaluated.

2.3 PHYSICAL PROFILE

2.3.1 Topography

The site is situated near the crest of a low hill such that the topography gently slopes to the east-northeast along the northern portion of the site, and to the south-southeast along the southern portion of the site. The location of the site is identified on the USGS 7.5 min. topographic quadrangle for Fort Smith, Arkansas in Figure 2-1. The site is located outside the 100-year and 500-year floodplains.

The residential area north of the facility generally slopes to the northeast towards Mill Creek. The overall slope is gradual, but punctuated by minor slope breaks at what appear to be former terraces that are generally coincident with the mapped topographic contours (Figure 2-1). These topographic breaks are also evident on cross sections presented in Figure 2-7 (MW-23 and MW-55 areas).

Drainage ditches are located along Ingersoll Avenue on the north side of the facility and along Jenny Lind Road on the east side of the facility. Surface water along the eastern half of the facility generally flows toward the northeast corner of the facility to the facility outfall where it enters the city storm sewer system under Jenny Lind Road and flows toward Mill Creek. Surface water from the western part of the facility flows to ditches located adjacent to the railroad tracks where it drains to an unnamed tributary of the Poteau River approximately one mile to the west.

2.3.2 Geology

The geology of the Fort Smith area of Western Arkansas is generally characterized by Pennsylvanian age sediments. The site, situated on the Northwestern flank of the Massard Prairie Anticline, overlies Quaternary Alluvium and gently dipping Pennsylvanian McAlester Shale.

Quaternary Alluvium is present from ground surface to depths ranging from 29 to 37 feet at the site. Site boring logs and previous site literature indicate that the

alluvium is generally composed of a shallow fine-grained unit, and a coarse-textured basal unit. Cross-sections of the site are provided as Figures 2-7 and 2-8.

The Upper Fine-Grained unit exhibits significant variations in lithologic texture throughout the site and with depth, generally varies from fine-grained silt to sandy clay. In general, the central portion of this unit (from 4 to 15 feet below ground surface consists of silty to sandy clay. In off-site areas, especially north of Jacobs and east of monitor well MW-46, this unit becomes characterized by thinly bedded silty clays and silts.

The lower unit of the alluvium at the site, referred to as the Basal Transmissive Zone, consists of sands and gravels. The upper portion of the Basal Transmissive Zone is typically composed of a fine-grained silty sand to sandy silt. This sandy silt grades to a sandy gravel with depth. Where present (generally observed on site), the silty sand portion of the unit is from 5 to 10 feet thick and forms a gradational transition between the Upper Fine-Grained unit and the Basal Transmissive Zone.

The sandy gravel at the base of the Basal Transmissive Zone is commonly 3 to 6 feet thick on site and has variable amounts of clay and silt. This sand and gravel layer is present in the majority of the borings on site and it rests unconformably on either weathered shale or clay associated with the weathered shale. North and northeast of the site this unit thins and pinches out. Additional detail on this gravel-rich portion of the transmissive zone is provided below.

The alluvial units are underlain by the McAlester Shale. This formation ranges up to 1000 feet thick in the Fort Smith region. In the vicinity of the Whirlpool facility the upper portion has been eroded leaving a thickness of 100 to 500 feet. The full thickness of the McAlester Shale immediately beneath the Whirlpool facility has not been determined.

Based on the site boring logs, the top of the shale is present at depths from 26 to 35 feet (Figure 2-9). The upper portion of the shale is typically silty, black to dark-gray, fissile, micaceous shale. Commonly, there is a thin veneer of friable red-orange to gray-brown clay between the base of the gravel zone and the weathered shale. This clay typically grades to the black or dark gray shale of the McAlester Formation.

Soil boring logs, cone penetrometer test logs and monitor well completion details were provided in the Work Plan.

Characteristics of the Gravel-Rich Portion of the Basal Transmissive Zone

As discussed above, the lower portion of the Basal Transmissive Zone within the limits of the facility is gravel-rich. This gravel-rich portion of the transmissive zone thins and pinches out to the north and northeast (Figures 2-7 and 2-8). The gravel-rich portion of the Basal Transmissive Zone is of interest because it appears to have a strong influence on the distribution of the plume north of the site.

As shown in Figure 2-10, the gravel-rich basal zone forms a hook-shaped area that extends north from Ingersoll across Jacobs and pinches out south of Brazil and west of Jenny Lind. North and northeast of this area, pockets of gravel are present but they have clay-rich matrices and appear to be discontinuous.

Additionally, as part of the field studies, an initial reconnaissance of Mill Creek was conducted. Gravel deposits observed in the side banks of Mill Creek also are in a clay-rich, low permeability matrix that is different from the gravel zone that extends from the plant. The different character indicates that the gravels in the far eastern part of the study area are in a different terrace formation and likely not hydraulically connected to the more transmissive gravel zone located west of Jenny Lind.

2.3.3 Hydrogeology

Evaluation of potentiometric surface maps from the past five years indicates that there are two distinct ground water flow regimes at the site (Figures 2-11 and 2-12). These flow regimes are separated by a ground water divide that is consistently present along a general line from MW-26 through MW-24, ITMW-3, and MW-22. The Northern Flow Regime extends from the ground water divide across Ingersoll to the north and northeast. The Southern Flow Regime extends south and southwestward from the ground water divide and covers the majority of the Whirlpool Facility.

In the Northern Flow Regime, ground water flows consistently toward the northeast without significant seasonal variations. The gradient is relatively flat near the ground water divide and in the immediate area north of Ingersoll Avenue, and then increases north of Jacobs Avenue. The gradient appears to experience minor seasonal fluctuations in magnitude. Ground water elevation measurements in several off-site wells, suggest the ground water potentiometric surface is proximate to the ground surface in an area roughly outlined by wells MW-50, MW-58, MW-56, and MW-62. This area corresponds to a minor topographic slope break. The aquifer is confined in this area such that there is no direct discharge of ground water to the ground surface.

In contrast, ground water flow in the Southern Flow Regime has a fairly uniform gradient throughout the year, but exhibits seasonal shifts in ground water flow direction of up to 90 degrees. Ground water appears to flow to the southeast during spring and to the south, southwest during fall.

Aquifer tests conducted in wells immediately to the north of Ingersoll Avenue in MW-35 indicate that the hydraulic conductivity of the gravel-rich portion of the Basal Transmissive Zone is quite variable. A review of the data collected at the pumping well and the observation well indicates the following:

	Transmissivity (T)	*Hydraulic Conductivity (K)*	*Storativity (S)*
Pumping	4.56e00 to 7.17e00 ft^2/day	5.00e-01 to 7.88e-01 ft/day	9.83e-02
Well MW-35R	4.24e03 to 6.66e03 cm^2/day	1.52e01 to 2.40e01 cm/day	
Observation	4.95e02 to 8.40e02 ft^2/day	5.44e01 to 9.23e01 ft/day	7.17e-03 to
Well MW-65	4.60e05 to 7.8e05 cm^2/day	1.66e03 to 2.81e03 cm/day	9.76e-03

A drawdown map illustrating the maximum observed drawdown in the wells after 24 hours of pumping in MW-35R is presented in Figure 2-11. The tightness and strong oval shape of the cone of depression indicate that the Basal Transmissive Zone is anisotropic and heterogeneous in nature. The anisotropic character is also evidenced by the variations in the aquifer characteristics calculated for MW-35R and MW-65. The main axis of the cone of depression generally follows the trend of the axis of the ground water plume within the zone.

Ground water flow velocity for the northern portion of the facility has been calculated at 24 feet per year. As is indicated by the stagnant nature of constituent concentrations, off-site ground water flow is likely much slower due to the pinch-out of the Basal Transmissive Zone. Ground water flow in the off-site area will be further characterized during corrective measure studies as part of risk management planning.

2.4 RELEASE PROFILE

From 1967 to mid-1980s, the former degreaser building housed equipment degreasing operations that utilized TCE as a cleaning solvent. The use of TCE was discontinued in the early 1980s. 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 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.

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.

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

In the late 1980s, 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) that was located near the northwest corner of the site. The initial work indicated the presence of TCE and other solvents not related to the UST in the shallow ground

water. Subsequent soil and ground water investigations were performed to characterize, assess, and delineate the potential source area and ground water plumes.

The following sections summarize the findings from the five phases of site investigation activities (Phases A through E). Phases A and B were described in Revised CAS Work Plan, dated June 2004. Phases C through E were presented in the CAS Work Plan Addendum, dated August 30, 2006.

Soil

Soil borings were advanced in 10 locations in a developed area near the former degreaser building and MW-25 northwest of the current factory building. Fifteen soil samples and one field duplicate were collected at depths ranging from 2 feet to 26 feet bgs. TCE and cis-1,2-dichloroethylene were reported at three on-site locations, with higher concentrations generally reported at deeper sample intervals (around 8 to 14 feet bgs). This increase in concentration with depth suggests that the release was historical with residual TCE remaining near the surface while most of the material migrated to depth. Low concentrations of methylene chloride were also reported in some soil samples, but were considered to be a laboratory artifact associated with laboratory procedures and not a site release.

Five of the borings were completed along the northern perimeter near the facility security fence. All constituents were reported Not Detected, indicating that the impacted soil does not extend off site. Figure 2-13 illustrates the extent of affected soil. Free phase TCE, which is a dense non-aqueous phase liquid (DNAPL), has not been observed at the site in shallow soils or in wells completed to screen across the base of the transmissive zone.

Ground Water

Thirty-four wells were installed within the facility property. Twenty-one wells have been installed in the residential area north of the facility. Ground water data have been collected at least on a semi-annual basis from 1989 to 2006.

Nineteen constituents have been detected in ground water associated with the Southern Flow Regime. Of these 19 constituents, 10 were detected sporadically (less than 5%) and are not thought to be associated with any potential site release. The remaining nine constituents are associated with chlorinated solvents. No constituents have been consistently reported in areas where TCE or cis-1,2-dichloroethylene are not also present. The highest historical TCE concentration of 157 mg/L was reported in MW-25 on September 2002. For 2006, the highest TCE concentration was 65 mg/L from the same well, MW-25, on October 12, 2006.

Wells in the Southern Flow Regime appear to have generally decreasing or stable trends, indicating that the ground water plume is stable or shrinking. Trend

graphs for wells in the Southern Flow Regime are provided as Appendix A. Concentrations of cis-1,2-dichloroethylene and TCE are generally stable but exhibit some seasonal variation.

A total of seven constituents plus TCE have been reported in ground water associated with the Northern Flow Regime. The highest historical TCE concentration of 2.4 mg/L was reported in MW-23 on May 1, 1997. The highest cis-1,2-dichloroethylene concentration of 0.205 mg/L was reported in MW-41 on November 14, 2003. For 2006, the highest trichloroethylene concentration was 2.0 mg/L from MW-42 on October 10, 2006 and the highest cis-1,2-dichloroethylene concentration was 0.0525 mg/L from MW-35R on April 6, 2006 and MW-41 on March 17, 2006.

The other constituents reported in off-site monitoring wells are generally reported at concentrations at a frequency of five percent or less. The exception to this is cis-1,2-dichloroethane which has been reported at a frequency of about 25 percent.

In general, wells in the Northern Flow Regime appear to have decreasing or stable constituent concentration trends indicating that the ground water plume is not migrating. Graphs of ground water concentration trends for the Northern Flow Regime are provided in Appendix A. Concentrations appear to fluctuate seasonally and have been generally stable or decreasing. Constituent concentrations in 2006 are lower than those recorded in the past; with the exception of MW-46R (replacement for damaged MW-46), which exhibited higher levels of TCE than in the past.

The Southern Flow Regime ground water plume is bounded to the south by ITMW-6, to the west by MW-29, and to the east by MW-22 and does not extend beyond the Whirlpool property. The Northern Flow Regime ground water plume extends from the Whirlpool facility to Brazil Avenue to the north, Ferguson Street to the west, Jenny Lind Avenue to the east. The northern and northeastern distribution of the plume appears to coincide with the area where a gravel-rich alluvial deposit is present.

Ground water samples from wells installed outside of the gravel-rich zone have been consistently reported as non-detect for TCE and cis-1,2-dichloroethylene. The only exception is that the samples from well MW-63, which is outside the area of the gravel zone, and is hydraulically upgradient or cross gradient from other portions of the plume, have reported very low, sporadic concentrations of TCE. Figure 2-14 illustrates the extent of the ground water plumes.

2.5 *ECOLOGICAL PROFILE*

As indicated previously, the majority of the 153-acre Whirlpool facility, is developed and consists of a warehouse, manufacturing facility, boiler house and water treatment plant. Concrete driveways and concrete and asphalt parking areas surround the structures. Approximately 21 acres of the site are

undeveloped and consist of open grassy areas in the southwestern portion of the property. Affected soil is limited to a small area in the northwestern portion of the facility, which is developed and subject to industrial activities. Residential areas are located to the north and south of the property, and commercial industrial properties are located to the east and west.

City of Fort Smith stormwater drainage ditches are located along the northern and eastern boundaries of the property along Ingersoll Avenue and Jenny Lind Road, respectively. An intermittent drainage channel is also located on the west side of the property and appears to drain to an unnamed tributary of the Poteau River approximately 1.0 mile to the west.

In accordance with the requirements of the CAS, an assessment to identify potential endangered and threatened species habitat in the vicinity of the facility has been requested from the U.S Fish and Wildlife Service.

There are no wetlands or gaining streams within the limits of the plume. Therefore, off-site migration of affected ground water to the north of the facility does not appear to impact any surface water features. Data collected during limited off-site investigation activities indicate that only off-site ground water is affected. Field observations from boring logs indicate there are no off-site soils that are impacted by the historical site releases.

The nearest major surface water body is Mill Creek, which is located approximately 1500 to 2000 feet east of the property, outside of the limits of affected ground water. The results of the delineation activities show that the downgradient limit of the plume is at least 1000 feet from Mill Creek and the gravel-rich zone where the core of the plume is observed is not connected to the creek. Based on this profile, it appears that there are no complete exposure pathways from the affected ground water to any ecological receptors in the vicinity of the facility.

The USEPA Region 6 *Ecological Exclusion Criteria Worksheet* was completed and provided in Appendix E of the Work Plan. The results of the worksheet indicate that the site meets the ecological exclusion criteria based on Subpart A (for surface water/sediment pathways), and Subpart C (for soil pathways). The affected soil is wholly contained within the developed portion of the facility which is characterized by pavement, buildings, landscaped areas, roadways, equipment storage area, manufacturing or process area, or other surface cover or structure, or otherwise disturbed ground.

Based on absence of complete exposure pathways, no further ecological evaluations are warranted at the site.

2.6 RISK MANAGEMENT PROFILE

As presented in more detail in Section 4, the screening of constituents of concern established TCE, chloroform, cis-1,2-dichloroethylene, tetrachloroethylene, and

vinyl chloride as the ground water COPCs that may require remediation. For off-site areas north of the facility, TCE is the only COPC. The risk assessment identified direct contact with on- and off-site ground water (the Determined Exposure Pathways) are a potential risk concern for the site. Although currently incomplete pathways, there is potential for excess risk if a water supply well were to be installed within the plume in the uppermost aquifer. Leaching of TCE from soil to on-site ground water was also identified as a potential risk concern for the site.

The primary risk management approach for the Whirlpool site will be to address the Determined Exposure Pathways. This strategy will focus on eliminating or reducing the exposure pathways so that remaining risks are below acceptable levels based on current and future land use. Potential remedial options may include source reduction or isolation for the ground water plumes and physical controls to minimize leaching potential. Institutional controls to prohibit future use of ground water within the uppermost aquifer will also be implemented as part of the remedial strategy.

Additionally, the effort to address the Determined Exposure Pathways will also take into account the Undetermined Exposure Pathways. For example, preference will be given to remedial actions that will both remove or reduce ground water concentrations to levels that are acceptable for direct contact, as well as reduce concentrations so that exposure via indirect means (such as TCE volatilization from ground water through soil, and soil vapor to outdoor air) will be below acceptable risk levels.

Final cleanup goals for the Determined Exposure Pathways will be based on current and future potential land use. Uncertainties associated with the Undetermined Exposure Pathways will be managed by developing an appropriate program for performance monitoring during and after implementation of the remedy. The proposed remedies and cleanup goals for ground water and on-site soil (leaching pathway) will be presented in the Risk Management Plan (RMP) following the ADEQ's approval of this Risk Evaluation Report. The RMP will also detail the performance standards and monitoring activities suggested for the site.

3.0 RISK-BASED PRIORITY SCREEN

A risk-based priority screen was performed for the site to identify and prioritize impacted areas which may pose a potential risk concern. This would allow the efforts and resources for corrective action to be focused on activities that would yield maximum risk reduction benefits in a time-efficient manner.

There are two stages to the risk-based priority screen:

1) Comparison with CAS High Priority Bright Line Screening Values; and
2) Comparison with CAS Low Priority Bright Line Screening Values, which correspond to EPA Region 6 Medium-Specific Screening Levels (MSSLs).

Constituent concentrations in an impacted area are first compared to the CAS High Priority Bright Line Screening Values, which are based on a target cancer risk level of 1.0E-04 and a hazard quotient of 1.0. Constituent exceedances of these screening values indicate that the impacted area is high priority and requires a site-specific risk assessment and/or remedial action.

If an impacted area has no constituents that exceed the CAS High Priority Bright Line Screening Values, then further evaluation is performed using the CAS Low Priority Bright Line Screening Values (i.e., EPA Region 6 MSSLs), which are based on a target cancer risk level of 1.0E-06 and a hazard quotient of 1.0. If a site has multiple constituents exceeding the Low, but not High Priority Bright Line Screening Values, further evaluation of cumulative risk may be warranted.

Two pathways were evaluated using this priority screen:

1) direct contact with soil for the site worker; and
2) direct contact with ground water for the site worker and resident.

For this priority screen, reported maximum historical concentrations for detected constituents were compared to the High Priority Bright Line Screening Values. Tables 3-1 and 3-2 present the comparisons for on-site and off-site ground water, respectively. The results of the comparisons indicate that TCE, 1,1-dichloroethylene, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, 1,2-dichloroethylene (total), chloroform, and vinyl chloride in on-site ground water and TCE in off-site ground water exceeded their High Priority Bright Line Screening Values. Thus, according to the CAS guidance, the site may be classified as high priority, requiring a site-specific risk assessment and/or remedial action.

TCE was the only constituent reported detected in on-site soils at depths from surface to two feet. The maximum reported concentration of 0.012 mg/kg did not exceed the High Priority Bright Line Screening Value of 760 mg/kg for an industrial outdoor worker. The reported maximum concentration of 0.012 mg/kg was further compared to the CAS Low Priority Bright Line Screening Value of 7.6 mg/kg for the industrial outdoor worker, and did not exceed the screening criteria.

4.0 IDENTIFICATION OF CONSTITUENTS OF POTENTIAL CONCERN

4.1 DATA EVALUATION AND SCREENING PROCESS

A data screening process was used to identify constituents that should be retained for quantitative risk assessment and/or remediation and those that may be excluded from further risk evaluation. This process is very similar to the site priority screen, but does not replicate it. The main point of difference is that the site priority screen is intended to provide a basis for a ranking a site (e.g., high priority), whereas the constituent screening process is used to identify COPCs that will be evaluated in site-specific exposure pathways.

The data screening process consisted of comparisons of soil and ground water concentrations with EPA Region 6 Medium-Specific Screening Levels (MSSLs), updated February 2007. This was a step-wise process that involved initial comparisons with historical maximum concentrations and where appropriate, a second comparison with recent maximum concentrations reported for 2006. All available data were included in this screening evaluation. The results of the data-screening step were used to identify COPCs for each medium of concern. A constituent was retained as a COPC if the reported 2006 maximum detected concentration exceeded the MSSL. Constituents that were reported as *Not Detected* at appropriate reporting limits that were above MSSLs (applicable to ground water only) were not identified as exceedances because the reporting limits were obtained using widely-accepted, standard analytical techniques, i.e., EPA Solid Waste 846 Method 8260B.

4.2 RISK-BASED SCREENING RESULTS

4.2.1 Soil

Residential risk-based screening levels were used to identify which of the constituents detected in the on-site soils required detailed evaluation under more site-appropriate exposure scenarios. The EPA Region 6 MSSLs for residential direct contact were used as the screening values for soils in the surficial (0 to 2-foot) and shallow subsurface (0 to 5-foot) depth intervals. The intent was to identify constituents for which risk calculations would be required for direct contact exposures (e.g., site worker and construction worker). The surficial soil interval is consistent with EPA guidance for evaluating soil exposure in site workers (EPA, 2002). A standard EPA default for soil depth for the construction worker was not available. The shallow subsurface interval was deemed to be appropriate for a construction worker receptor based on site-specific knowledge that the predominance of site construction or utility work at the facility is generally not greater than five feet.

This data-screening step only identifies COPCs for the direct contact exposure pathways for media of concern. Data screening results are provided in Tables 4-1 and 4-2 for the surficial and shallow subsurface soil intervals, respectively. No

constituents were retained for further evaluation of direct contact with soils 0-2 ft bgs (site worker) and 0-5 ft bgs (construction worker).

Since the direct contact MSSLs do not address migration of constituents from soil to ground water, all soil constituents reported for all depths were evaluated in the soil protection of ground water (GWP) evaluation. The results of the GWP evaluation are discussed following the ground water screening.

4.2.2 Ground Water

For ground water, a similar approach was used to identify COPCs. The ground water data were segregated into the Northern Flow Regime and Southern Flow Regime, roughly corresponding to off site and on site, respectively, and compared to the EPA Region 6 MSSLs for tap water. The tap water MSSLs are conservatively derived and assume a residential scenario. Tables 4-3 and 4-4 present the data screening results for on-site ground water. For the Southern Flow Regime (on-site ground water), seven constituents exceeded the screening criteria based on reported maximum historical concentrations:

- chloroform;
- cis-1,2-dichlorothylene;
- trans-1,2-dichloroethylene;
- 1,2-dichloroethylene (total);
- tetrachloroethylene;
- trichloroethylene; and
- vinyl chloride.

These seven constituents were further screened using reported maximum concentrations for 2006. Of the seven, only current concentrations of trans-1,2-dichloroethylene were less than the screening value.

Tables 4-5 and 4-6 present the data screening results for off-site ground water. For the Northern Flow Regime (off-site ground water), two constituents exceeded the screening criteria:

- cis-1,2-dichloroethylene; and
- trichloroethylene.

An additional evaluation was performed using current maximum ground water concentrations reported for 2006. Current maximum concentrations of trichloroethylene still exceeded the screening value. However, the maximum cis-1,2-dichloroethylene concentration for 2006 was less than the screening value.

4.2.3 *Ground Water Protection Demonstration*

Demonstrating ground water protection is a concept that involves assessing reported concentrations in soil to determine if constituents in soil have the potential to leach (as a result of precipitation) at concentrations that would cause an exceedance of acceptable levels in ground water. For this assessment, GWP was evaluated based on a comparison of the maximum reported concentration or limit for all soil depths to EPA Region 6 MSSLs for GWP. Table 4-7 presents the GWP data screening evaluation. For the screening evaluation, additional residential GWP screening levels were derived for constituents that were not listed in the EPA Region 6 MSSL table. The screening values were derived using the EPA's GWP model provided in the EPA's 1996 Soil Screening Guidance assuming a default dilution and attenuation factor (DAF) of 1 (Table 4-8).

Fourteen constituents exceeded the default GWP screening levels. Only one constituent, TCE, was detected. The remaining 13 Not Detected constituents had reporting limits that exceeded the GWP screening levels. Constituents that exceeded the default GWP screening levels were evaluated further using a site-specific DAF of 43. Derivation of the site-specific DAF is provided in Table 4-9. The screening results are provided as Table 4-7. The reporting limits for the 13 Not Detected constituents were less than the site-specific DAF screening levels. The one detected constituent, TCE, still had a reported maximum soil concentration that exceeded the site-specific DAF screening level. The results of the GWP screening suggest that TCE may leach from soil to the underlying ground water at concentrations above the acceptable ground water use limit.

4.2.4 *Identification of COPCs*

Based on the risk-based screening process described above, a list of site COPCs was identified for the site (Table 4-10). No COPCs were identified for direct contact soil exposure pathways. The primary COPCs for ground water on and off site are cis-1,2-dichloroethylene and TCE. Additional COPCs identified for on-site ground water include chloroform, tetrachloroethylene, and vinyl chloride. For the GWP pathway, the only soil COPC is trichloroethylene.

5.0 SUMMARY OF RISK SCREENING PROCESS AND CONCLUSIONS

This RER complies with Section II.F of the LOA between the ADEQ and Whirlpool Corporation, dated July 19, 2002. The results of the RER indicate that, soil leaching to ground water and, in the event that a water supply well were to be installed within the limits of the plume, direct contact with ground water are potential risk concerns. The areas where soil leaching to ground water is a concern (affected soil) is shown in Figure 2-13. The area where direct contact with ground water would be a concern (ground water plume) is shown in Figure 2-14.

The RER also identified some Undetermined Exposure Pathways that may be a concern. However, there is a high degree of uncertainty associated with the analysis of these Undetermined Exposure Pathways. Unacceptable current risk to human health has not been demonstrated for any of the identified receptors associated with the Undetermined Exposure Pathways. To determine if there are, in fact, risks associated with those pathways and to better understand uncertainties associated with the pathways, Whirlpool proposes to collect additional data during corrective measure studies as part of risk management planning. Alternately, the data may be obtained during performance monitoring that would be implemented as part of corrective action.

The results of the risk assessment, including the priority screen, indicate that it would be more effective to initiate remediation of the ground water plume now, rather than perform a detailed site-specific risk assessment. It is anticipated that the corrective actions that are being considered for the site will effectively manage both Determined and Undetermined Exposure Pathways. Therefore, rather than spend time collecting additional information now and delay the submittal of the RER, Whirlpool recommends that the appropriate data be collected in the process of corrective action/risk management.

The technical approach used for the risk assessment generally followed the principles and guidelines described in EPA Region 6 Corrective Action Strategy (CAS) (EPA, 2000). The technical work related to the risk evaluation portion of this report was conducted by Ms Hong Vu whose professional profile is included as Appendix B.

6.0 REFERENCES

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EPA, 2007. EPA Region 6 Medium-Specific Screening Levels, updated February 2007.

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Tables

June 14, 2007
Project No. 0048030

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TABLE 3-1

Comparison of Ground Water Data to High Priority Bright Line Screening Levels
Southern Flow Regime (On-Site)

Whirlpool Corporation
Fort Smith, Arkansas

Constituents [a]	Maximum Result [b] (mg/L)	High Priority Bright Line Screening Levels for Tap Water [c] (mg/L)		Maximum Result Greater Than Screening Value? Yes/No
1,1,1-Trichloroethane	9.70E-02	7.90E+00		No
1,1,2-Trichloroethane	3.00E-03	2.00E-02		No
1,1-Dichloroethane	7.40E-02	8.10E+00		No
1,1-Dichloroethylene	3.30E-01	4.60E-03		**Yes**
1,2-Dichloroethylene (total)	5.30E+00	6.10E-01	(d)	**Yes**
1,2-Dichloropropane	7.00E-03	1.60E-02		No
2-Hexanone	1.44E-02	NA		---
Acetone	2.85E-01	6.10E+00		No
Chlorobenzene	5.74E-03	1.10E+00		No
Chloroform	1.10E-02	6.20E-03		**Yes**
cis-1,2-Dichloroethylene	5.30E+00	6.10E-01		**Yes**
Ethylbenzene	1.00E-03	1.30E+01		No
Methylene Chloride	6.77E-02	4.30E-01		No
Tetrachloroethylene	3.60E-02	1.10E-01		No
Toluene	1.83E-02	7.20E+00		No
trans-1,2-Dichloroethylene	3.60E+00	1.20E+00		**Yes**
Trichloroethylene	1.57E+02	1.60E-01		**Yes**
Vinyl Chloride	2.15E+00	4.30E-03		**Yes**
Xylenes (total)	5.50E-02	1.40E+01	(e)	No

NOTES:

NA - No EPA Region 6 CAS High Priority Bright Line Screening Level was provided for 2-Hexanone.
(a) Only detected constituents are presented.
(b) Maximum results for all available on-site ground water data.
(c) Tap Water Screening Levels from EPA Region 6 CAS High Priority Bright Line Screening Levels Table with a Cancer Risk of 10^{-4} and Hazard Quotient of 10 (August 2000).
(d) A screening value for 1,2-Dichloroethylene (total) was not available. The conservative value for cis 1,2-Dichloroethylene was used as the screening value.
(e) A screening value for xylenes (total) was not available. The most conservative value for the various isomers (m-xylene) was used as the screening value.

TABLE 3-2

Comparison of Ground Water Data to High Priority Bright Line Screening Levels
Northern Flow Regime (Off-Site)

Whirlpool Corporation
Fort Smith, Arkansas

Constituents [a]	Maximum Result [b] (mg/L)	High Priority Bright Line Screening Levels for Tap Water [c] (mg/L)		Maximum Result Greater Than Screening Value? Yes/No
1,1-Dichloroethylene	3.00E-03	4.60E-03		No
1,2-Dichloroethylene (total)	5.80E-02	6.10E-01	(d)	No
Acetone	3.92E-02	6.10E+00		No
Carbon Disulfide	1.15E-01	1.00E+01		No
cis-1,2-Dichloroethylene	2.05E-01	6.10E-01		No
Tetrachloroethylene	1.00E-03	1.10E-01		No
Trichloroethylene	2.40E+00	1.60E-01		**Yes**
Vinyl Chloride	2.00E-03	4.30E-03		No

NOTES:

(a) Only detected constituents are presented.

(b) Maximum results for all available off-site ground water data.

(c) Tap Water Screening Levels from EPA Region 6 CAS High Priority Bright Line Screening Levels Table with a Cancer Risk of 10^{-4} and Hazard Quotient of 10 (August 2000).

(d) A screening value for 1,2-Dichloroethylene (total) was not available. The conservative value for cis 1,2-Dichloroethylene was used as the screening value.

TABLE 4-1

Soil Data Evaluation and Screening Results for Current and Future On-Site Industrial Worker (0-2 ft)

Whirlpool Corporation
Fort Smith, Arkansas

DATA SUMMARY								SCREENING RESULTS			
Constituents	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Result (mg/kg)	Maximum Result (mg/kg)	Location of Max. Result	Maximum Reporting Limit (mg/kg)	EPA Region 6 Residential[(a)] Soil Screening Levels (mg/kg)		Screened out? Yes/No	Screening Rationale
Acetone	2	0	0.0%	---	---	---	1.00E-02	1.42E+04		Yes	(e)
Benzene	2	0	0.0%	---	---	---	5.00E-03	6.56E-01		Yes	(e)
Bromodichloromethane	2	0	0.0%	---	---	---	5.00E-03	1.03E+00		Yes	(e)
Bromoform	2	0	0.0%	---	---	---	5.00E-03	6.16E+01		Yes	(e)
Bromomethane (Methyl bromide)	2	0	0.0%	---	---	---	1.00E-02	3.90E+00		Yes	(e)
Carbon disulfide	2	0	0.0%	---	---	---	5.00E-03	7.21E+02		Yes	(e)
Carbon tetrachloride	2	0	0.0%	---	---	---	5.00E-03	2.40E-01		Yes	(e)
Chlorobenzene	2	0	0.0%	---	---	---	5.00E-03	2.73E+02		Yes	(e)
Dichlorobromomethane	2	0	0.0%	---	---	---	5.00E-03	1.01E+00		Yes	(e)
Chloroethane (Ethyl chloride)	2	0	0.0%	---	---	---	1.00E-02	3.03E+00		Yes	(e)
Chloroform	2	0	0.0%	---	---	---	5.00E-03	2.45E-01		Yes	(e)
Chloromethane (Methyl chloride)	2	0	0.0%	---	---	---	1.00E-02	1.26E+00		Yes	(e)
1,1-Dichloroethane	2	0	0.0%	---	---	---	5.00E-03	8.46E+02		Yes	(e)
1,2-Dichloroethane	2	0	0.0%	---	---	---	5.00E-03	3.47E-01		Yes	(e)
1,1-Dichloroethene	2	0	0.0%	---	---	---	5.00E-03	2.85E+02		Yes	(e)
1,2-Dichloroethylene (total)	2	0	0.0%	---	---	---	1.00E-02	4.30E+01	(b)	Yes	(e)
cis-1,2-Dichloroethylene	2	0	0.0%	---	---	---	5.00E-03	4.30E+01		Yes	(e)
trans-1,2-Dichloroethylene	2	0	0.0%	---	---	---	5.00E-03	1.22E+02		Yes	(e)
1,2-Dichloropropane	2	0	0.0%	---	---	---	5.00E-03	3.51E-01		Yes	(e)
cis-1,3-Dichloropropene	2	0	0.0%	---	---	---	5.00E-03	6.97E-01	(c)	Yes	(e)
trans-1,3-Dichloropropene	2	0	0.0%	---	---	---	5.00E-03	6.97E-01	(c)	Yes	(e)
Ethylbenzene	2	0	0.0%	---	---	---	5.00E-03	2.34E+02		Yes	(e)
2-Hexanone	2	0	0.0%	---	---	---	1.00E-02	1.10E+02	(d)	Yes	(e)
Methylene Chloride	2	0	0.0%	---	---	---	5.00E-03	8.90E+00		Yes	(e)
Methyl Ethyl Ketone (2-Butanone)	2	0	0.0%	---	---	---	1.00E-02	3.21E+04		Yes	(e)
4-Methyl-2-pentanone (MIBK)	2	0	0.0%	---	---	---	1.00E-02	5.80E+03		Yes	(e)
Styrene	2	0	0.0%	---	---	---	5.00E-03	1.73E+03		Yes	(e)
1,1,1,2-Tetrachloroethane	2	0	0.0%	---	---	---	5.00E-03	3.01E+00		Yes	(e)
Tetrachloroethylene	2	0	0.0%	---	---	---	5.00E-03	5.54E-01		Yes	(e)
Toluene	2	0	0.0%	---	---	---	5.00E-03	5.21E+02		Yes	(e)
1,1,1-Trichloroethane	2	0	0.0%	---	---	---	5.00E-03	1.39E+03		Yes	(e)
1,1,2-Trichloroethane	2	0	0.0%	---	---	---	5.00E-03	8.44E-01		Yes	(e)
Trichloroethylene	2	2	100.0%	9.00E-03	1.20E-02	ERM-8 (2')	5.00E-03	4.26E-02		Yes	(e)
Vinyl chloride	2	0	0.0%	---	---	---	1.00E-02	4.30E-02		Yes	(e)
Xylene (total)	2	0	0.0%	---	---	---	2.00E-02	2.14E+02		Yes	(e)

NOTES:

(a) Residential Soil Screening Levels from EPA Region 6 Human Health Medium-Specific Screening Levels Table (February 2007).
(b) There was no value listed in the EPA Region 6 Screening Levels for 1,2-Dichloroethylene (total). The conservative value for cis-1,2-Dichloroethylene was used as the screening value.
(c) There was no value listed in the EPA Region 6 Screening Levels for cis-1,3-Dichloropropene and trans-1,3-Dichloropropene. The value for 1,3-Dichloropropene (total) was used as the screening value.
(d) No EPA Region 6 Screening Level was provided for 2-hexanone. The residential direct contact soil value ($^{Tot}Soil_{Comb}$ Protective Concentration Level (PCL) for 0.5 acre source) from Texas Risk Reductic
(TRRP) was used. The TRRP PCL was taken from Table 1, updated March 30, 2007.
(e) Maximum detected result and the maximum reporting limit are below EPA Region 6 Screening Levels.

TABLE 4-2

Soil Data Evaluation and Screening Results for Current and Future On-Site Construction Worker (0-5 ft)

Whirlpool Corporation
Fort Smith, Arkansas

DATA SUMMARY								SCREENING RESULTS			
Constituents	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Result (mg/kg)	Maximum Result (mg/kg)	Location of Max. Result	Maximum Reporting Limit (mg/kg)	EPA Region 6 Residential[a] Soil Screening Levels (mg/kg)		Screened out? Yes/No	Screening Rationale
Acetone	3	0	0.0%	---	---	---	1.00E-02	1.42E+04		Yes	(e)
Benzene	3	0	0.0%	---	---	---	5.00E-03	6.56E-01		Yes	(e)
Bromodichloromethane	3	0	0.0%	---	---	---	5.00E-03	1.03E+00		Yes	(e)
Bromoform	3	0	0.0%	---	---	---	5.00E-03	6.16E+01		Yes	(e)
Bromomethane (Methyl bromide)	3	0	0.0%	---	---	---	1.00E-02	3.90E+00		Yes	(e)
Carbon disulfide	3	0	0.0%	---	---	---	5.00E-03	7.21E+02		Yes	(e)
Carbon tetrachloride	3	0	0.0%	---	---	---	5.00E-03	2.40E-01		Yes	(e)
Chlorobenzene	3	0	0.0%	---	---	---	5.00E-03	2.73E+02		Yes	(e)
Dichlorobromomethane	3	0	0.0%	---	---	---	5.00E-03	1.01E+00		Yes	(e)
Chloroethane (Ethyl chloride)	3	0	0.0%	---	---	---	1.00E-02	3.03E+00		Yes	(e)
Chloroform	3	0	0.0%	---	---	---	5.00E-03	2.45E-01		Yes	(e)
Chloromethane (Methyl chloride)	3	0	0.0%	---	---	---	1.00E-02	1.26E+00		Yes	(e)
1,1-Dichloroethane	3	0	0.0%	---	---	---	5.00E-03	8.46E+02		Yes	(e)
1,2-Dichloroethane	3	0	0.0%	---	---	---	5.00E-03	3.47E-01		Yes	(e)
1,1-Dichloroethene	3	0	0.0%	---	---	---	5.00E-03	2.85E+02		Yes	(e)
1,2-Dichloroethylene (total)	3	0	0.0%	---	---	---	1.00E-02	4.30E+01	(b)	Yes	(e)
cis-1,2-Dichloroethylene	3	0	0.0%	---	---	---	5.00E-03	4.30E+01		Yes	(e)
trans-1,2-Dichloroethylene	3	0	0.0%	---	---	---	5.00E-03	1.22E+02		Yes	(e)
1,2-Dichloropropane	3	0	0.0%	---	---	---	5.00E-03	3.51E-01		Yes	(e)
cis-1,3-Dichloropropene	3	0	0.0%	---	---	---	5.00E-03	6.97E-01	(c)	Yes	(e)
trans-1,3-Dichloropropene	3	0	0.0%	---	---	---	5.00E-03	6.97E-01	(c)	Yes	(e)
Ethylbenzene	3	0	0.0%	---	---	---	5.00E-03	2.34E+02		Yes	(e)
2-Hexanone	3	0	0.0%	---	---	---	1.00E-02	1.10E+02	(d)	Yes	(e)
Methylene Chloride	3	0	0.0%	---	---	---	5.00E-03	8.90E+00		Yes	(e)
Methyl Ethyl Ketone (2-Butanone)	3	0	0.0%	---	---	---	1.00E-02	3.21E+04		Yes	(e)
4-Methyl-2-pentanone (MIBK)	3	0	0.0%	---	---	---	1.00E-02	5.80E+03		Yes	(e)
Styrene	3	0	0.0%	---	---	---	5.00E-03	1.73E+03		Yes	(e)
1,1,1,2-Tetrachloroethane	3	0	0.0%	---	---	---	5.00E-03	3.01E+00		Yes	(e)
Tetrachloroethylene	3	0	0.0%	---	---	---	5.00E-03	5.54E-01		Yes	(e)
Toluene	3	0	0.0%	---	---	---	5.00E-03	5.21E+02		Yes	(e)
1,1,1-Trichloroethane	3	0	0.0%	---	---	---	5.00E-03	1.39E+03		Yes	(e)
1,1,2-Trichloroethane	3	0	0.0%	---	---	---	5.00E-03	8.44E-01		Yes	(e)
Trichloroethylene	3	2	66.7%	9.00E-03	1.20E-02	ERM-8 (2')	5.00E-03	4.26E-02		Yes	(e)
Vinyl chloride	3	0	0.0%	---	---	---	1.00E-02	4.30E-02		Yes	(e)
Xylene (total)	3	0	0.0%	---	---	---	2.00E-02	2.14E+02		Yes	(e)

NOTES:

(a) Residential Soil Screening Levels from EPA Region 6 Human Health Medium-Specific Screening Levels Table (February 2007).
(b) There was no value listed in the EPA Region 6 Screening Levels for 1,2-Dichloroethylene (total). The conservative value for cis-1,2-Dichloroethylene was used as the screening value.
(c) There was no value listed in the EPA Region 6 Screening Levels for cis-1,3-Dichloropropene and trans-1,3-Dichloropropene. The value for 1,3-Dichloropropene (total) was used as the screening value.
(d) No EPA Region 6 Screening Level was provided for 2-hexanone. The residential direct contact soil value ($^{Tot}Soil_{Comb}$ Protective Concentration Level (PCL) for 0.5 acre source) from Texas Risk Reduction Rule Program (TRRP) was used. The TRRP PCL was taken from Table 1, updated March 30, 2007.
(e) Maximum detected result and the maximum reporting limit are below EPA Region 6 Screening Levels.

TABLE 4-3

Ground Water Data Evaluation and Screening Results
Southern Flow Regime (On-Site)

Whirlpool Corporation
Fort Smith, Arkansas

DATA SUMMARY								SCREEN RESULTS			
Constituents	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Result (mg/L)	Maximum Result (mg/L)	Location of Max. Result	Maximum Reporting Limit (mg/L)	EPA Region 6 Screening Levels for Tap Water [a] (mg/L)		Screened out? Yes/No	Screening Rationale
1,1,1-Trichloroethane	619	12	1.94%	7.00E-03	9.70E-02	MW-25	1.00E-01	8.40E-01		Yes	(e)
1,1,2,2-Tetrachloroethane	327	0	0.00%	---	---	---	1.00E-01	3.30E-04		Yes	(f)
1,1,2-Trichloroethane	327	2	0.61%	3.00E-03	3.00E-03	ITMW-17, ITMW-19	1.00E-01	1.20E-03		Yes	(k)
1,1-Dichloroethane	615	39	6.34%	1.60E-03	7.40E-02	MW-25	1.00E-01	1.20E+00		Yes	(e)
1,1-Dichloroethylene	327	69	21.10%	3.00E-03	3.30E-01	MW-25	2.00E-01	3.40E-01		Yes	(e)
1,2-Dichloroethane	327	0	0.00%	---	---	---	1.00E-01	7.30E-04		Yes	(f)
1,2-Dichloroethylene (total)	150	102	68.00%	4.00E-03	5.30E+00	MW-37	1.00E+00	6.10E-02	(b)	**No**	(g)
1,2-Dichloropropane	327	1	0.31%	7.00E-03	7.00E-03	ITMW-11	1.00E-01	9.70E-04		Yes	(l)
2-Hexanone	327	2	0.61%	1.00E-02	1.44E-02	MW-25	2.00E-01	1.50E+00	(c)	Yes	(e)
4-Methyl-2-pentanone (MIBK)	327	0	0.00%	---	---	---	2.00E-01	2.00E+00		Yes	(e)
Acetone	327	9	2.75%	6.00E-03	2.85E-01	MW-38	2.50E-01	5.50E+00		Yes	(e)
Benzene	327	0	0.00%	---	---	---	1.00E-01	1.20E-03		Yes	(f)
Bromodichloromethane	327	0	0.00%	---	---	---	1.00E-01	1.10E-03		Yes	(f)
Bromoform	327	0	0.00%	---	---	---	1.00E-01	8.50E-03		Yes	(f)
Bromomethane	327	0	0.00%	---	---	---	2.00E-01	8.70E-03		Yes	(f)
Carbon Disulfide	327	0	0.00%	---	---	---	1.00E-01	1.00E+00		Yes	(e)
Carbon Tetrachloride	327	0	0.00%	---	---	---	1.00E-01	5.10E-04		Yes	(f)
Chlorobenzene	327	2	0.61%	2.00E-03	5.74E-03	ITMW-4	1.00E-01	9.10E-02		Yes	(h)
Chloroethane	327	0	0.00%	---	---	---	2.00E-01	2.30E-02		Yes	(f)
Chloroform	327	20	6.12%	3.00E-03	1.10E-02	MW-25	1.00E-01	1.70E-04		**No**	(g)
Chloromethane (Methyl Chloride)	327	0	0.00%	---	---	---	2.00E-01	2.10E-03		Yes	(f)
cis-1,2-Dichloroethylene	463	300	64.79%	4.00E-03	5.30E+00	MW-37	5.00E-01	6.10E-02		**No**	(g)
cis-1,3-Dichloropropene	327	0	0.00%	---	---	---	1.00E-01	6.70E-04	(d)	Yes	(f)
Dibromochloromethane	327	0	0.00%	---	---	---	1.00E-01	7.90E-04		Yes	(f)
Ethylbenzene	327	1	0.31%	1.00E-03	1.00E-03	MW-37	1.00E-01	1.30E+00		Yes	(e)
Methyl Ethyl Ketone (2-Butanone)	327	0	0.00%	---	---	---	2.00E-01	7.10E+00		Yes	(e)
Methylene Chloride	327	11	3.36%	2.00E-03	6.77E-02	ITMW-4	2.00E-01	8.90E-03		Yes	(i)
Styrene	327	0	0.00%	---	---	---	1.00E-01	1.60E+00		Yes	(e)
Tetrachloroethylene	619	51	8.24%	1.00E-03	3.60E-02	MW-25	1.00E-01	1.20E-04		**No**	(g)
Toluene	619	8	1.29%	2.00E-03	1.83E-02	ITMW-11	1.00E-01	2.30E+00		Yes	(e)
trans-1,2-Dichloroethylene	613	52	8.48%	1.00E-03	3.60E+00	ITMW-11	1.00E-01	1.10E-01		**No**	(g)
trans-1,3-Dichloropropene	327	0	0.00%	---	---	---	1.00E-01	6.70E-04	(d)	Yes	(f)
Trichloroethylene	617	423	68.56%	1.70E-03	1.57E+02	MW-25	1.00E+01	1.70E-04		**No**	(g)
Vinyl Chloride	619	104	16.80%	1.00E-03	2.15E+00	MW-38	1.00E+00	1.50E-05		**No**	(g)
Xylenes (total)	327	2	0.61%	6.00E-03	5.50E-02	MW-37	3.00E-01	2.00E-01		Yes	(j)

NOTES:

(a) Screening Levels for Tap Water From EPA Region 6 Human Health Medium-Specific Screening Levels Table (February 2007).
(b) A screening value for 1,2-Dichloroethylene (total) was not available. The conservative value for cis 1,2-Dichloroethylene was used as the screening value.
(c) No EPA Region 6 Screening Level was provided for 2-hexanone. The Tier 1 Residential Ground Water value ($^{GW}GW_{Ing}$ PCL) from the Texas Risk Reduction Rule Program (TRRP) was utilized for screening purposes. The TRRP PCL value was taken from Table 3, updated March 30, 2007.
(d) There was no value listed in the EPA Region 6 Screening Levels for cis-1,3-Dichloropropene and trans-1,3-Dichloropropene. The value for 1,3-Dichloropropene (total) was used as the screening value.
(e) Maximum detected result and the maximum reporting limit are below the EPA Region 6 Screening Level.
(f) The maximum reporting limit exceeded the screening level. However, no detections were reported. The constituent was screened from further quantitative evaluation, and discussed in the uncertainty analysis.
(g) Maximum detected result exceeded the EPA Region 6 Screening Level.
(h) The maximum reporting limit (0.1 mg/l) was above the EPA Region 6 Screening Level in only two samples (3/15/06 and 10/13/06) at separate locations (MW-25 and MW-27). All other reporting limits as well as reported detections were below screening levels.
(i) Methylene chloride is a common laboratory artifact. It was detected in only 11 samples out of 327 (3% frequency), and detected at various sample locations not indicative of the source area.
(j) The maximum reporting limit (0.3 mg/l) was above EPA Region 6 Screening Levels one time (10/13/06) for a duplicate at sample location MW-37. All other reporting limits and reported detections were below screening levels.
(k) Detections were determined to be anomalous. 1,1,2-Trichloroethane was detected once at an estimated concentration at two different well locations (ITMW-17 and ITMW-19) in samples collected on 10/12/06 for a 0.6% detection frequency.
(l) Detection was determined to be anomalous. 1,2-Dichloropropane was detected only once (4/13/04) at one well location (ITMW-11), for a detection frequency of 0.3%. Since 2004, the constituent has been Not Detected for approximately 6 consecutive sampling events from 2005 to 2006.

TABLE 4-4

Ground Water Screening Results: 2006 Concentrations
Southern Flow Regime (On-Site)

Whirlpool Corporation
Fort Smith, Arkansas

Constituents	2006 Maximum Concentration (mg/L)	EPA Region 6 Screening Levels for Tap Water [(a)] (mg/L)		Site Concentration Less Than Screening Value? Yes/No
1,2-Dichloroethylene (total)	5.30E+00	6.10E-02	(b)	**No**
Chloroform	7.00E-03	1.70E-04		**No**
cis-1,2-Dichloroethylene	5.30E+00	6.10E-02		**No**
Tetrachloroethylene	2.10E-02	1.20E-04		**No**
trans-1,2-Dichloroethylene	9.00E-03	1.10E-01		Yes
Trichloroethylene	6.50E+01	1.70E-04		**No**
Vinyl Chloride	2.00E+00	1.50E-05		**No**

NOTES:

(a) Screening Levels for Tap Water From EPA Region 6 Human Health Medium-Specific Screening Levels Table (February 2007).
(b) A screening value for 1,2-Dichloroethylene (total) was not available. The conservative value for cis 1,2-Dichloroethylene was used as the screening value.

TABLE 4-5

Ground Water Data Evaluation and Screening Results
Northern Flow Regime (Off-Site)

Whirlpool Corporation
Fort Smith, Arkansas

	DATA SUMMARY							SCREEN RESULTS			
Constituents	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Result (mg/L)	Maximum Result (mg/L)	Location of Max. Result	Maximum Reporting Limit (mg/L)	EPA Region 6 Screening Levels for Tap water[(a)] (mg/L)		Screened out? Yes/No	Screening Rationale
1,1,1-Trichloroethane	218	0	0.00%	---	---	---	5.00E-03	8.40E-01		Yes	(e)
1,1,2,2-Tetrachloroethane	200	0	0.00%	---	---	---	5.00E-03	3.30E-04		Yes	(f)
1,1,2-Trichloroethane	200	0	0.00%	---	---	---	5.00E-03	1.20E-03		Yes	(f)
1,1-Dichloroethane	218	0	0.00%	---	---	---	5.00E-03	1.20E+00		Yes	(e)
1,1-Dichloroethylene	200	6	3.00%	1.00E-03	3.00E-03	MW-42	5.00E-03	3.40E-01		Yes	(e)
1,2-Dichloroethane	200	0	0.00%	---	---	---	5.00E-03	7.30E-04		Yes	(f)
1,2-Dichloroethylene (total)	117	25	21.37%	4.00E-03	5.80E-02	MW-41	1.00E-02	6.10E-02	(b)	Yes	(e)
1,2-Dichloropropane	200	0	0.00%	---	---	---	5.00E-03	9.70E-04		Yes	(f)
2-Hexanone	200	0	0.00%	---	---	---	1.00E-02	1.50E+00	(c)	Yes	(e)
4-Methyl-2-pentanone (MIBK)	200	0	0.00%	---	---	---	1.00E-02	2.00E+00		Yes	(e)
Acetone	200	8	4.00%	1.14E-02	3.92E-02	MW-39	2.00E-02	5.50E+00		Yes	(e)
Benzene	200	0	0.00%	---	---	---	5.00E-03	1.20E-03		Yes	(f)
Bromodichloromethane	200	0	0.00%	---	---	---	5.00E-03	1.10E-03		Yes	(f)
Bromoform	200	0	0.00%	---	---	---	5.00E-03	8.50E-03		Yes	(e)
Bromomethane	200	0	0.00%	---	---	---	1.00E-02	8.70E-03		Yes	(f)
Carbon Disulfide	200	6	3.00%	8.00E-02	1.15E-01	MW-33	5.00E-03	1.00E+00		Yes	(e)
Carbon Tetrachloride	201	0	0.00%	---	---	---	5.00E-03	5.10E-04		Yes	(f)
Chlorobenzene	200	0	0.00%	---	---	---	5.00E-03	9.10E-02		Yes	(e)
Chloroethane	200	0	0.00%	---	---	---	1.00E-02	2.30E-02		Yes	(e)
Chloroform	200	0	0.00%	---	---	---	5.00E-03	1.70E-04		Yes	(f)
Chloromethane (Methyl Chloride)	200	0	0.00%	---	---	---	1.00E-02	2.10E-03		Yes	(f)
cis-1,2-Dichloroethylene	214	54	25.23%	2.00E-03	2.05E-01	MW-41	5.00E-02	6.10E-02		**No**	(g)
cis-1,3-Dichloropropene	200	0	0.00%	---	---	---	5.00E-03	6.70E-04	(d)	Yes	(f)
Dibromochloromethane	200	0	0.00%	---	---	---	5.00E-03	7.90E-04		Yes	(f)
Ethylbenzene	200	0	0.00%	---	---	---	5.00E-03	1.30E+00		Yes	(e)
Methyl Ethyl Ketone (2-Butanone)	200	0	0.00%	---	---	---	1.00E-02	7.10E+00		Yes	(e)
Methylene Chloride	200	0	0.00%	---	---	---	1.00E-02	8.90E-03		Yes	(f)
Styrene	200	0	0.00%	---	---	---	5.00E-03	1.60E+00		Yes	(e)
Tetrachloroethylene	218	1	0.46%	1.00E-03	1.00E-03	MW-43	5.00E-03	1.20E-04		Yes	(h)
Toluene	218	0	0.00%	---	---	---	5.00E-03	2.30E+00		Yes	(e)
trans-1,2-Dichloroethylene	218	0	0.00%	---	---	---	5.00E-03	1.10E-01		Yes	(e)
trans-1,3-Dichloropropene	200	0	0.00%	---	---	---	5.00E-03	6.70E-04	(d)	Yes	(f)
Trichloroethylene	218	115	52.75%	1.00E-03	2.40E+00	MW-23	2.50E-01	1.70E-04		**No**	(g)
Vinyl Chloride	218	1	0.46%	2.00E-03	2.00E-03	MW-42	1.00E-02	1.50E-05		Yes	(h)
Xylenes (total)	200	0	0.00%	---	---	---	2.00E-02	2.00E-01		Yes	(e)

NOTES:

(a) Screening Levels for Tap Water From EPA Region 6 Human Health Medium-Specific Screening Levels Table (February 2007).
(b) A screening value for 1,2-Dichloroethylene (total) was not available. The conservative value for cis 1,2-Dichloroethylene was used as the screening value.
(c) No EPA Region 6 Screening Level was provided for 2-hexanone. The Tier 1 Residential Ground Water value ($^{GW}GW_{Ing}$ PCL) from the Texas Risk Reduction Rule Program (TRRP) was utilized for screening purposes. The TRRP PCL value was taken from Table 3, updated March 30, 2007.
(d) There was no value listed in the EPA Region 6 Screening Levels for cis-1,3-Dichloropropene and trans-1,3-Dichloropropene. The value for 1,3-Dichloropropene (total) was used as the screening value.
(e) Maximum detected result and the maximum reporting limit are below the EPA Region 6 Screening Level.
(f) The maximum reporting limit exceeded the screening level. However, no detections were reported. The constituent was screened from further quantitative evaluation, and discussed in the uncertainty analysis.
(g) Maximum detected result exceeded the EPA Region 6 Screening Level.
(h) Detection was determined to be anomalous. Vinyl chloride was detected only once (10/10/2006) at one well location (MW-42), for a detection frequency of 0.46%.

TABLE 4-6

Ground Water Screening Results: 2006 Maximum Concentrations
Northern Flow Regime (Off-Site)

Whirlpool Corporation
Fort Smith, Arkansas

Constituents	2006 Maximum Concentration (mg/L)	EPA Region 6 Screening Levels for Tap Water [(a)] (mg/L)	Site Concentration Less Than Screening Value? Yes/No
cis-1,2-Dichloroethylene	5.25E-02	6.10E-02	Yes
Trichloroethylene	2.00E+00	1.70E-04	**No**

NOTES:

(a) Screening Levels for Tap Water From EPA Region 6 Human Health Medium-Specific Screening Levels Table (February 2007).
(b) A screening value for 1,2-Dichloroethylene (total) was not available. The conservative value for cis 1,2-Dichloroethylene was used as the screening value.

TABLE 4-7

Soil Data Evaluation and Screening Results for Ground Water Protection: Southern Flow Regime (On-Site)

Whirlpool Corporation
Fort Smith, Arkansas

DATA SUMMARY								SCREENING RESULTS						
Constituent	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Result (mg/kg)	Maximum Result (mg/kg)	Location of Max. Result	Maximum Reporting Limit (mg/kg)	EPA Region 6 DAF 1 [(a)] Screening Levels (mg/kg)		Screened out? Yes/No	Screening Rationale	Site-Specific DAF [(i)] Screening Level (mg/kg)	Screened out? Yes/No	Screening Rationale
Acetone	16	0	0.0%	---	---	---	1.00E-02	8.00E-01		Yes	(h)	---	---	---
Benzene	16	0	0.0%	---	---	---	5.00E-03	2.00E-03		No	(g)	8.60E-02	Yes	(j)
Bromodichloromethane	16	0	0.0%	---	---	---	5.00E-03	3.00E-02		Yes	(h)	---	---	---
Bromoform	16	0	0.0%	---	---	---	5.00E-03	4.00E-02		Yes	(h)	---	---	---
Bromomethane (Methyl bromide)	16	0	0.0%	---	---	---	1.00E-02	1.00E-02		Yes	(h)	---	---	---
Carbon disulfide	16	0	0.0%	---	---	---	5.00E-03	2.00E+00		Yes	(h)	---	---	---
Carbon tetrachloride	16	0	0.0%	---	---	---	5.00E-03	3.00E-03		No	(g)	1.29E-01	Yes	(j)
Chlorobenzene	16	0	0.0%	---	---	---	5.00E-03	7.00E-02		Yes	(h)	---	---	---
Dichlorobromomethane	16	0	0.0%	---	---	---	5.00E-03	2.00E-02		Yes	(h)	---	---	---
Chloroethane (Ethyl chloride)	16	0	0.0%	---	---	---	1.00E-02	6.20E-03	(d)	No	(g)	2.67E-01	Yes	(j)
Chloroform	16	0	0.0%	---	---	---	5.00E-03	3.00E-02		Yes	(h)	---	---	---
Chloromethane (Methyl chloride)	16	0	0.0%	---	---	---	1.00E-02	4.29E-04	(d)	No	(g)	1.85E-02	Yes	(j)
1,1-Dichloroethane	16	0	0.0%	---	---	---	5.00E-03	1.00E+00		Yes	(h)	---	---	---
1,2-Dichloroethane	16	0	0.0%	---	---	---	5.00E-03	1.00E-03		No	(g)	4.30E-02	Yes	(j)
1,1-Dichloroethylene	16	0	0.0%	---	---	---	5.00E-03	3.00E-03		No	(g)	1.29E-01	Yes	(j)
1,2-Dichloroethylene (total)	16	1	6.3%	1.20E-02	1.20E-02	ERM-8 (14')	1.00E-02	2.00E-02	(b)	Yes	(h)	---	---	---
cis-1,2-Dichloroethylene	16	2	12.5%	6.00E-03	1.20E-02	ERM-8 (14')	5.00E-03	2.00E-02		Yes	(h)	---	---	---
trans-1,2-Dichloroethylene	16	0	0.0%	---	---	---	5.00E-03	3.00E-02		Yes	(h)	---	---	---
1,2-Dichloropropane	16	0	0.0%	---	---	---	5.00E-03	1.00E-03		No	(g)	4.30E-02	Yes	(j)
cis-1,3-Dichloropropene	16	0	0.0%	---	---	---	5.00E-03	2.00E-04	(c)	No	(g)	8.60E-03	Yes	(j)
trans-1,3-Dichloropropene	16	0	0.0%	---	---	---	5.00E-03	2.00E-04	(c)	No	(g)	8.60E-03	Yes	(j)
Ethylbenzene	16	0	0.0%	---	---	---	5.00E-03	7.00E-01		Yes	(h)	---	---	---
2-Hexanone	16	0	0.0%	---	---	---	1.00E-02	3.54E-01	(d)	Yes	(h)	---	---	---
Methylene Chloride	16	4	25.0%	5.00E-03	7.00E-03	ERM-5 (9')	5.00E-03	1.00E-03		Yes	(e)	---	---	---
Methyl Ethyl Ketone (2-Butanone)	16	0	0.0%	---	---	---	1.00E-02	1.48E+00	(d)	Yes	(h)	---	---	---
4-Methyl-2-pentanone (MIBK)	16	0	0.0%	---	---	---	1.00E-02	9.37E-01	(d)	Yes	(h)	---	---	---
Styrene	16	0	0.0%	---	---	---	5.00E-03	2.00E-01		Yes	(h)	---	---	---
1,1,1,2-Tetrachloroethane	16	0	0.0%	---	---	---	5.00E-03	8.98E-04	(d)	No	(g)	3.86E-02	Yes	(j)
Tetrachloroethylene	16	0	0.0%	---	---	---	5.00E-03	3.00E-03		No	(g)	1.29E-01	Yes	(j)
Toluene	16	0	0.0%	---	---	---	5.00E-03	6.00E-01		Yes	(h)	---	---	---
1,1,1-Trichloroethane	16	0	0.0%	---	---	---	5.00E-03	1.00E-01		Yes	(h)	---	---	---
1,1,2-Trichloroethane	16	0	0.0%	---	---	---	5.00E-03	9.00E-04		No	(g)	3.87E-02	Yes	(j)
Trichloroethylene	16	4	25.0%	9.00E-03	1.86E-01	ERM-8 (14')	5.00E-03	3.00E-03		No	(f)	1.29E-01	No	(k)
Vinyl chloride	16	0	0.0%	---	---	---	1.00E-02	7.00E-04		No	(g)	3.01E-02	Yes	(j)
Xylene (total)	16	0	0.0%	---	---	---	2.00E-02	1.00E+01		Yes	(h)	---	---	---

NOTES:

(a) Ground Water Protection (GWP) Screening Levels assuming a DAF 1 from EPA Region 6 Human Health Medium-Specific Screening Levels Table (February 2007).
(b) There was no value listed in the EPA Region 6 Screening Levels for 1,2-Dichloroethylene (total). The conservative value for cis-1,2-Dichloroethylene was used as the screening value.
(c) There was no value listed in the EPA Region 6 Screening Levels for cis-1,3-Dichloropropene and trans-1,3-Dichloropropene.The value for 1,3-Dichloropropene (total) was used as the screening value.
(d) A screening value was not provided on the EPA Region 6 Human Health Medium-Specific Screening Levels Table. A Soil Screening Value was calculated using Equation 4-10 of the EPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (December 2002). See Table 4-8.
(e) Methylene chloride is a common laboratory artifact and is not anticipated to be associated with site operations. The constituent was screened out.
(f) The maximum detected result exceeded the EPA Region 6 Screening Level.
(g) The maximum reporting limit exceeded the EPA Region 6 Screening Level. However, there were no reported detections. The constituent was evaluated further using a screening level based on a site-specific DAF.
(h) The maximum detected result is less than the EPA Region 6 Screening Level.
(i) The calculated site-specific DAF was 43. Calculations for the DAF are presented in Table 4-9. MSSL (assuming DAF 1) was multiplied by the calculated DAF of 43 to obtain the site-specific screening levels.
(j) The maximum reporting limit is below the calculated site-specific DAF screening level.
(k) The maximum detected result exceeds the calculated site-specific DAF screening level.

TABLE 4-8

Calculation of Soil Ground Water Protection Screening Values

Whirlpool Corporation
Fort Smith, Arkansas

Parameter	Definition	Value	Units	Notes
C_w	Concentration in ground water	chemical-specific	mg/L	
Kd	Soil-water partition coefficient	chemical-specific	L/kg	
K_{OC}	Soil organic carbon/water partition coefficient	chemical-specific	L/kg	
f_{oc}	Fraction organic carbon in soil	0.002	g/g	
θ_w	Water-filled soil porosity	0.3	L_{water}/L_{soil}	
θ_a	Air-filled soil porosity	0.134	L_{air}/L_{soil}	$\theta_a = n - \theta_w$
n	Soil porosity	0.43	L_{pore}/L_{soil}	$n = 1 - (\rho_b/\rho_s)$
ρ_b	Dry soil bulk density	1.5	kg/L	
ρ_s	Soil particle density	2.65	kg/L	
H'	Dimensionless Henry's law constant	chemical-specific	unitless	
SSL	Screening level in soil	chemical-specific	mg/kg	

Constituent		C_w [(a)] mg/L	H' [(b)] unitless	K_{oc} [(b)] L/kg	K_d [(c)] L/kg	SSL [(d)] mg/kg
Methyl Ethyl Ketone (2-Butanone)		7.10E+00	1.12E-03	4.50E+00	9.00E-03	1.48E+00
Chloroethane (Ethyl chloride)		2.30E-02	4.51E-01	1.47E+01	2.94E-02	6.20E-03
Chloromethane (Methyl chloride)		1.20E-03	9.84E-01	3.50E+01	7.00E-02	4.29E-04
2-Hexanone	(c)	1.50E+00	3.38E-03	1.78E+01	3.56E-02	3.54E-01
4-Methyl-2-pentanone (MIBK)		2.00E+00	5.74E-03	1.34E+02	2.68E-01	9.37E-01
1,1,1,2-Tetrachloroethane		2.50E-03	1.41E-02	7.90E+01	1.58E-01	8.98E-04

NOTES:

(a) EPA's Region 6 Human Health Medium-Specific Screening Levels for Tap Water (February 2007).
(b) Values from EPA's Region 6 Human Health Medium-Specific Screening Levels Table (February 2007).
(c) $K_d = K_{oc} \times f_{oc}$
(d) $SSL = C_w \times (K_d + ((\theta_w + \theta_a \times H')/\rho b))$
(e) No EPA Region 6 Screening Level for Tap Water was provided for 2-Hexanone. The Tier 1 Residential Ground Water value from the Texas Risk Reduction Rule Program (TRRP) was utilized for C_w. The TRRP PCL value is from Table 3, updated March 30, 2007. TRRP values were also utilized for H' and Koc for 2-Hexanone from TRRP chemical and physical properties table, updated March 30, 2007.
Equations from Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (EPA, 2002).

TABLE 4-9

Site Specific DAF and Soil Ground Water Protection Calculation

Whirlpool Corporation
Fort Smith, Arkansas

Parameter	Definition	Value	Units	Comments
K	Hydraulic conductivity	8.70E+02	m/yr	
i	Hydraulic gradient	2.70E-03	unitless	
P	Annual precipitation	1.05E+00	m/yr	(a)
I	Infiltration	1.99E-04	m/yr	(b)
d	Mixing zone depth	1.36E+00	m	(c), (d)
L	Source length parallel to ground water flow	3.79E+02	m	
d_a	Aquifer thickness	1.36E+00	m	
DAF	Dilution Attenuation Factor	4.33E+01	unitless	(e)

Constituent	EPA Region 6 MSSL [(f)] (mg/kg)	Site-Specific MSSL [(g)] (mg/kg)
Benzene	2.00E-03	8.60E-02
Carbon tetrachloride	3.00E-03	1.29E-01
Chloroethane (Ethyl chloride)	6.20E-03	2.67E-01
Chloromethane (Methyl chloride)	4.29E-04	1.85E-02
1,2-Dichloroethane	1.00E-03	4.30E-02
1,1-Dichloroethylene	3.00E-03	1.29E-01
1,2-Dichloropropane	1.00E-03	4.30E-02
cis-1,3-Dichloropropene	2.00E-04	8.60E-03
trans-1,3-Dichloropropene	2.00E-04	8.60E-03
1,1,1,2-Tetrachloroethane	8.98E-04	3.86E-02
Tetrachloroethylene	3.00E-03	1.29E-01
1,1,2-Trichloroethane	9.00E-04	3.87E-02
Trichloroethylene	3.00E-03	1.29E-01
Vinyl chloride	7.00E-04	3.01E-02

NOTES:

(a) Annual precipitation from worldclimate.com

(b) $I = 0.00018 \times (P^2)$. Infiltration calculation from Texas Risk Reduction Rule Program, 1999.

(c) $d = (0.0112(L^2))^{0.5} + da(1 - \exp((-L \times I)/(K \times i \times da)))$. Mixing zone depth calculated using Equation 4-12 from the Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (December 2002).

(d) The calculated mixing zone depth of 40.1 m was greater than the aquifer thickness of 1.36 m. The mixing zone depth was set equal to the aquifer thickness.

(e) $DAF = 1 + ((K \times i \times d)/(I \times L))$. DAF calculated using Equation 4-11 from the Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (December 2002).

(f) Values taken from EPA Region 6 Human Health Medium-Specific Screening Levels (MSSL) Table for DAF 1 (February 2007).

(g) Site-specific MSSL = DAF 1 MSSL x Site-specific DAF (43.3).

TABLE 4-10

Constituents of Potential Concern

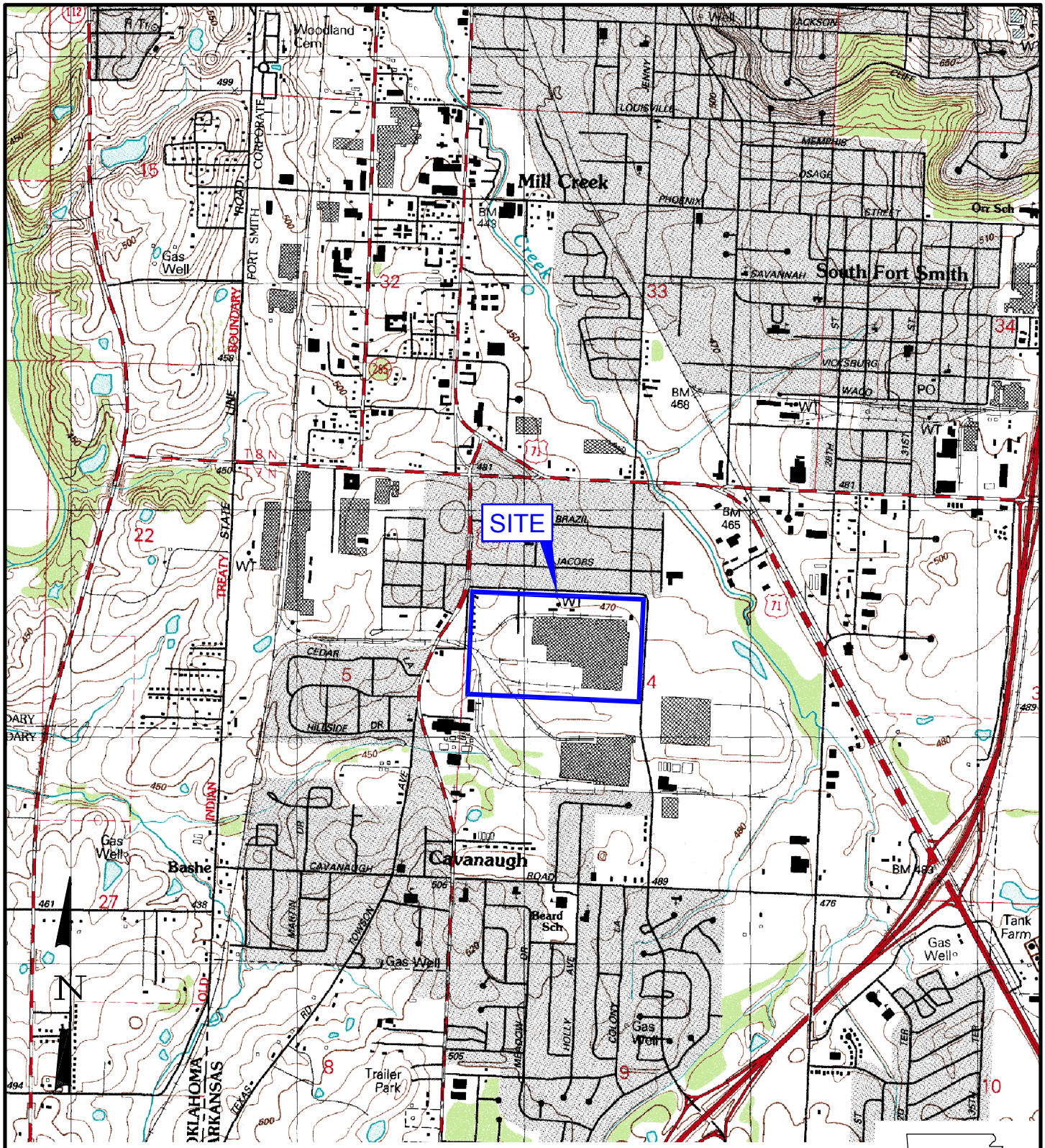
Whirlpool Corporation
Fort Smith, Arkansas

Constituent	On Site	Off Site
Soil		
Trichloroethylene	X	
Ground Water		
Chloroform	X	
cis-1,2-Dichloroethylene	X	
Tetrachloroethylene	X	
Trichloroethylene	X	X
Vinyl Chloride	X	

Figures

June 14, 2007
Project No. 0048030

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



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

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W.O.NO.: H:\dwg\E07\0048030_Site_Loc.dwg, 5/18/2007 10:55:56 AM		

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

ERM

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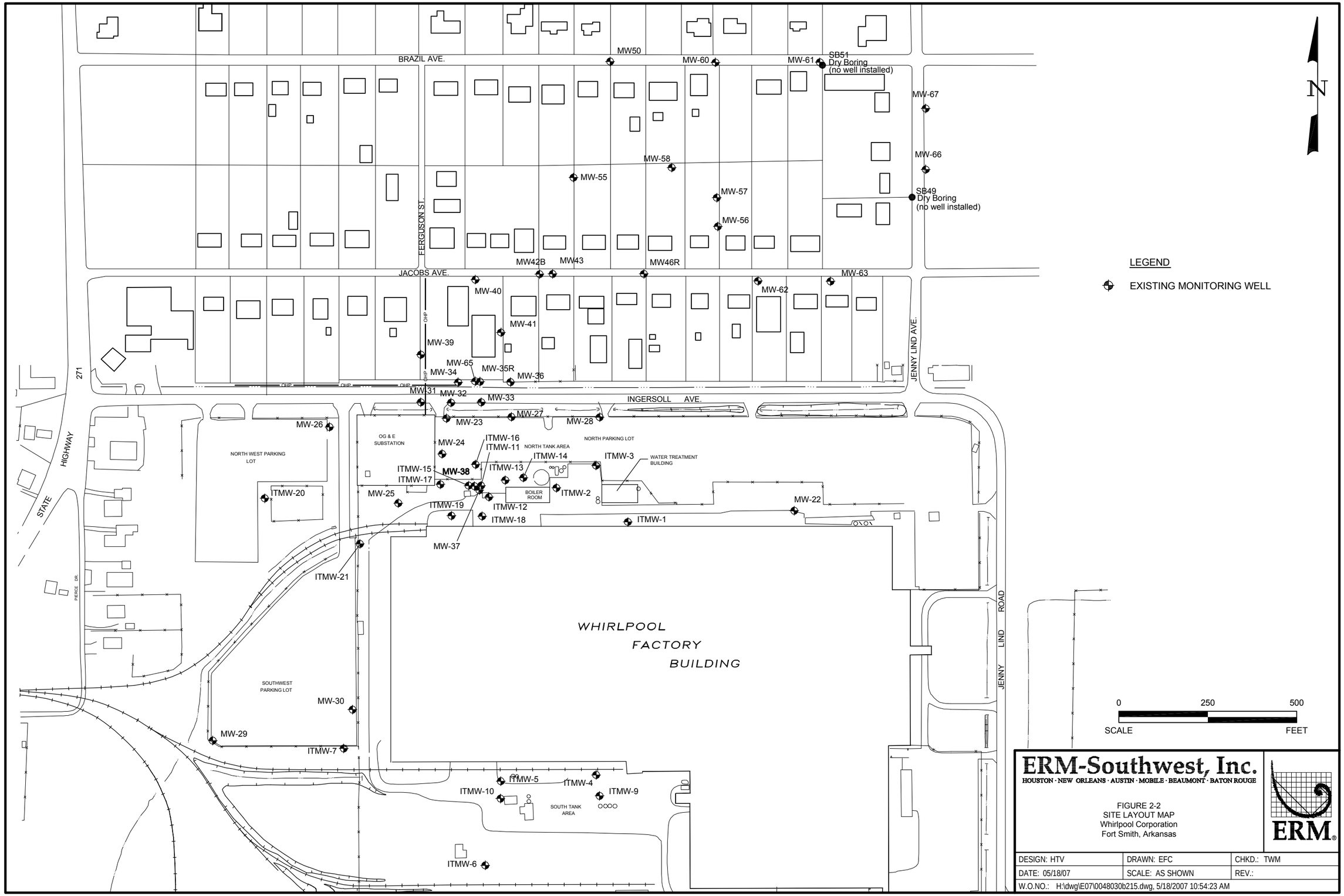

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FIGURE 2-2
SITE LAYOUT MAP
Whirlpool Corporation
Fort Smith, Arkansas

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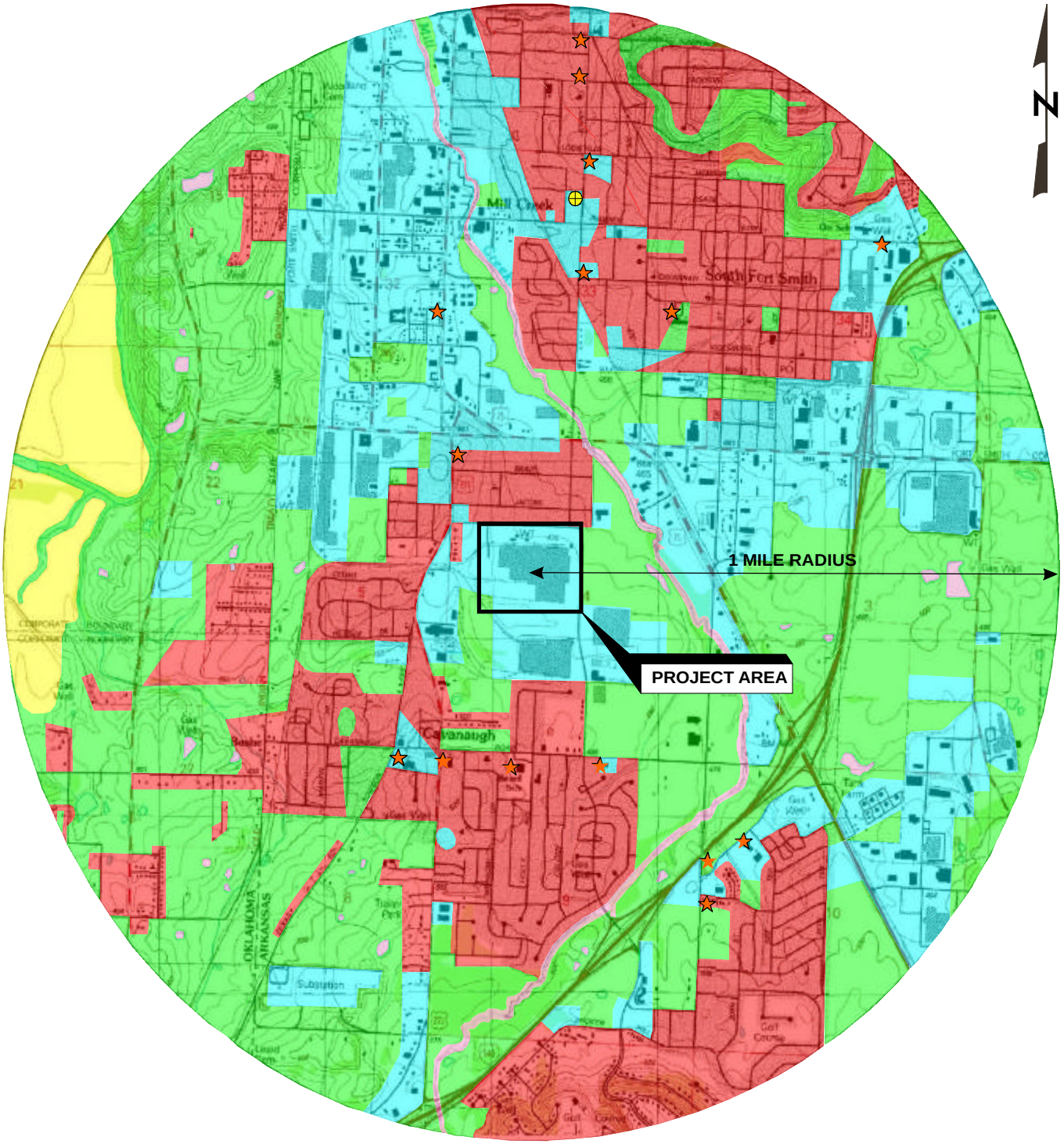

SOURCE: U.S.G.S. 7.5' QUADRANGLE, SOUTH FORT SMITH, ARK.-OKLA., (o35094C4) 1987.

LEGEND:

- RESIDENTIAL
- UNDERDEVELOPED
- AGRICULTURAL
- COMMERCIAL / INDUSTRIAL
- SURFACE WATER
- HOSPITAL
- SCHOOL / DAYCARE

0 1500 3000

SCALE FEET

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FIGURE 2-3
LAND USE MAP
Whirlpool Corporation
Fort Smith, Arkansas

DESIGN: HTV	CHKD.: TWM	DATE: 05/18/07	REV.: 0
DRAWN: EFC	SCALE: AS SHOWN	W.O.NO.: \E07\581007a208.cdr	

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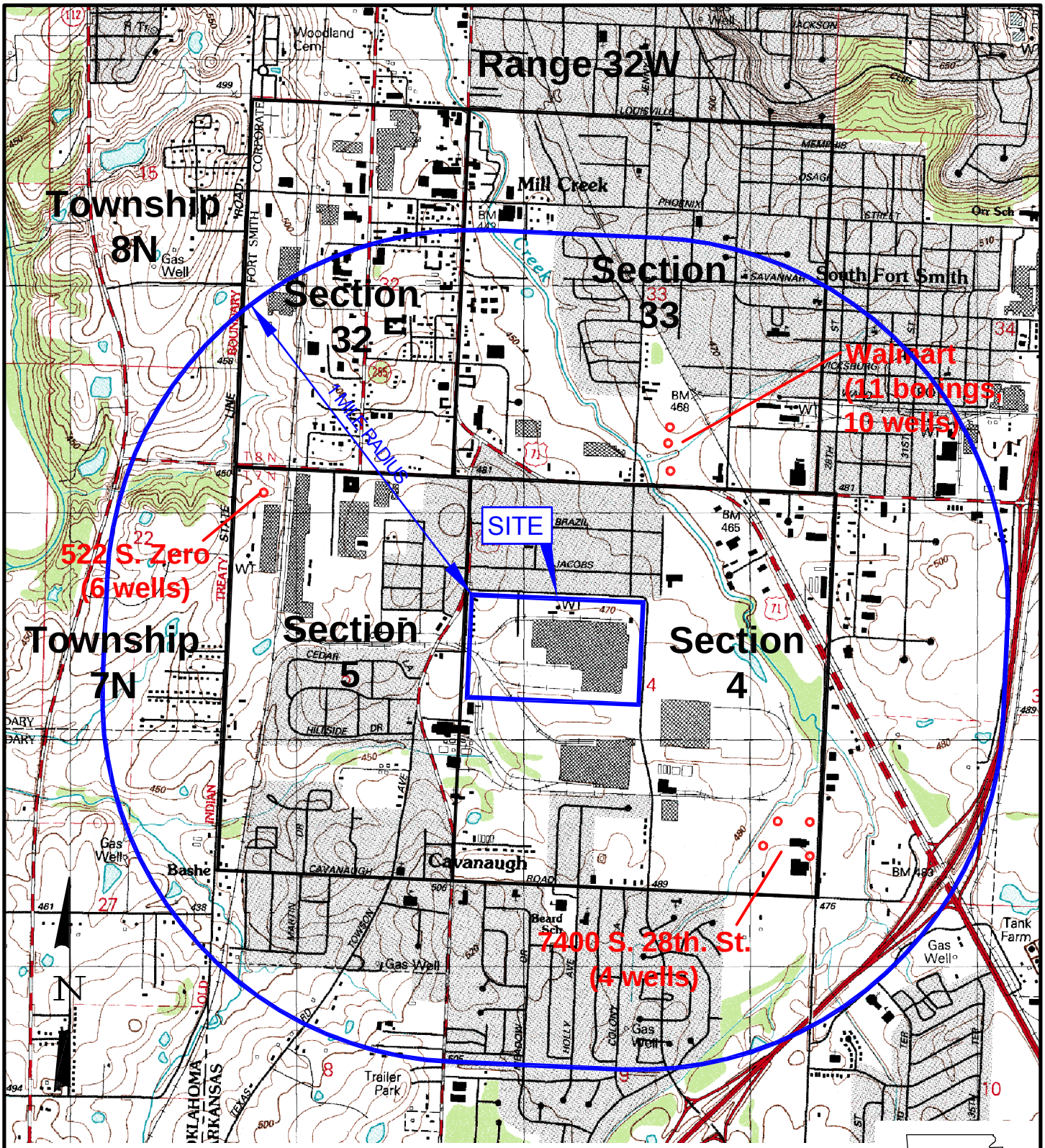

SOURCE: U.S.G.S. 7.5' QUADRANGLE, SOUTH FORT SMITH, ARK.-OKLA., 1987 (o35094C4).

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FIGURE 2-4
WELL SURVEY SUMMARY MAP
Whirlpool Corporation
Fort Smith, Arkansas

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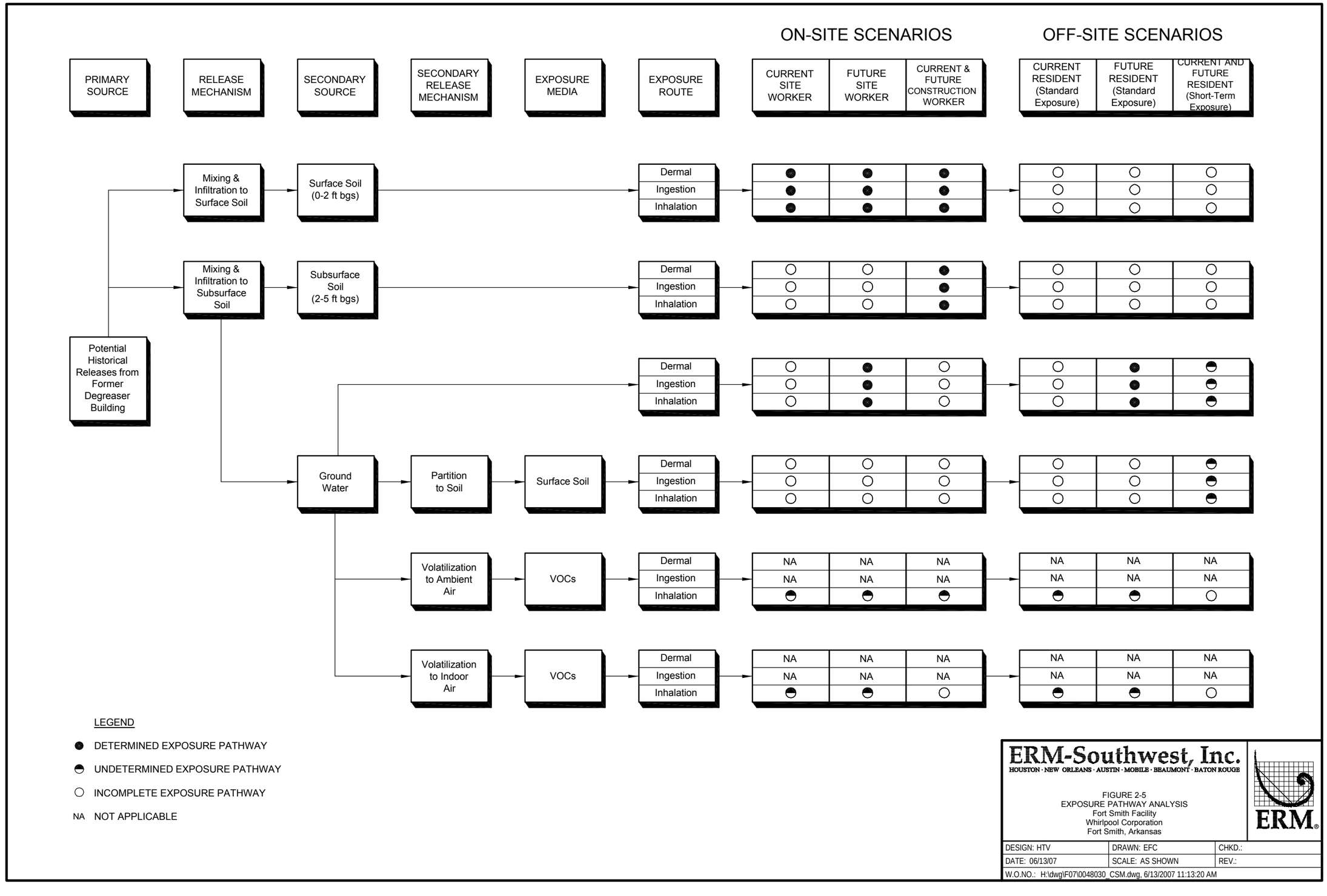

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FIGURE 2-5
EXPOSURE PATHWAY ANALYSIS
Fort Smith Facility
Whirlpool Corporation
Fort Smith, Arkansas

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DATE: 06/13/07	SCALE: AS SHOWN	REV.:
W.O.NO.: H:\dwg\F07\0048030_CSM.dwg, 6/13/2007 11:13:20 AM		

OFF-SITE

ON-SITE

Ingestion, dermal contact, inhalation - soil & water

Saturated soil

Dermal Contact

Inhalation

Ingestion

Inhalation

Inhalation

VAPOR

VAPOR

VAPOR

VAPOR

Hypothetical water supply well

Hypothetical water supply well

FENCE

Ingersoll Avenue

Ingestion, dermal contact and inhalation - soil

Chlorinated solvents

Transport Medium (Soil)

Leaching

Ground water flow

Transport Medium (Ground water)

0048030B F07

Environmental Resources Management

FIGURE 2-6
CONCEPTUAL EXPOSURE MODEL
Whirlpool Corporation
Fort Smith, Arkansas

DESIGN: HV	DRAWN: RLM	CHKD.: HV
DATE: 06/07/07	SCALE: N.T.S.	REV.:
W.O.NO.: 0048030B201 F07		

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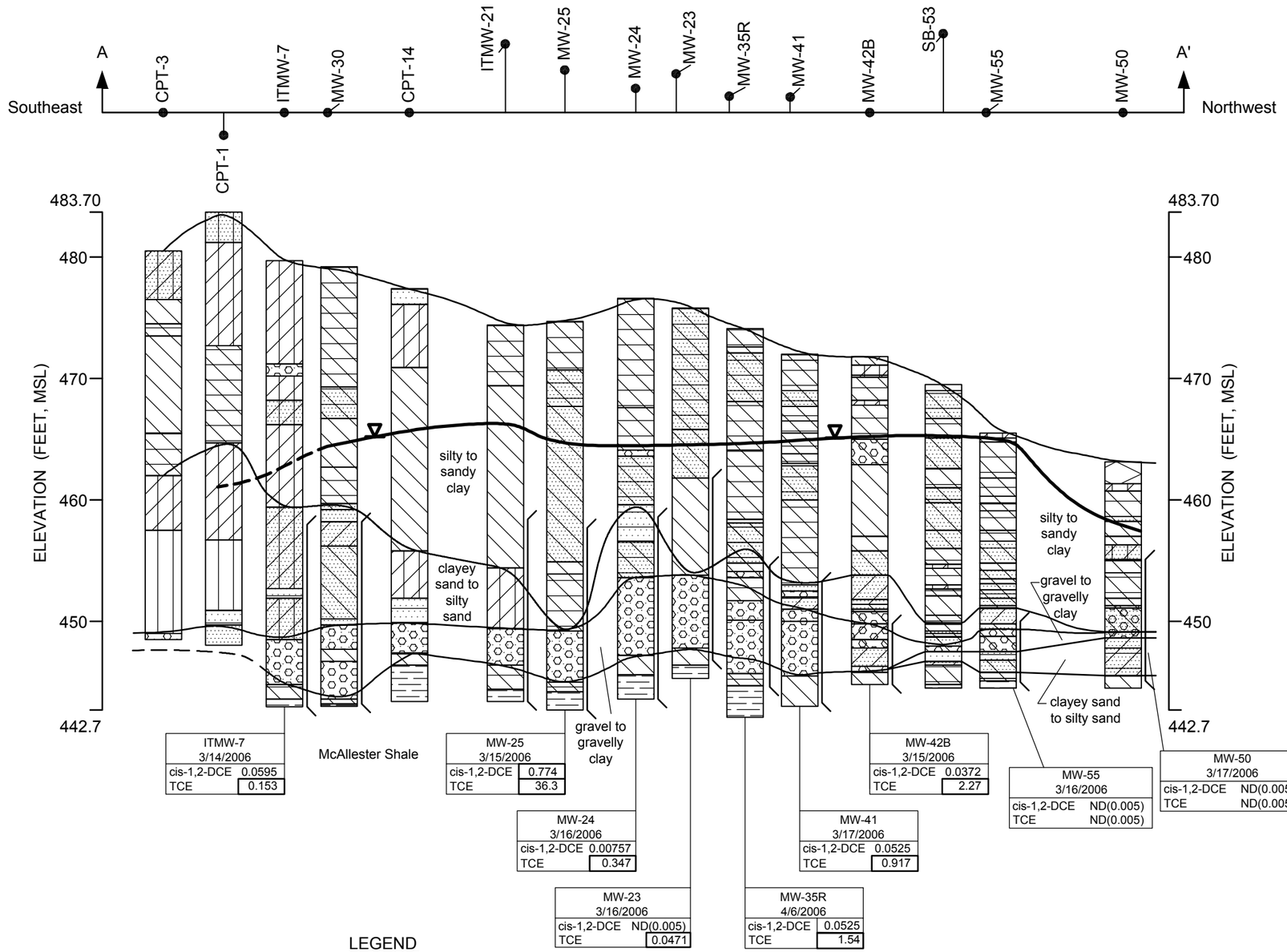
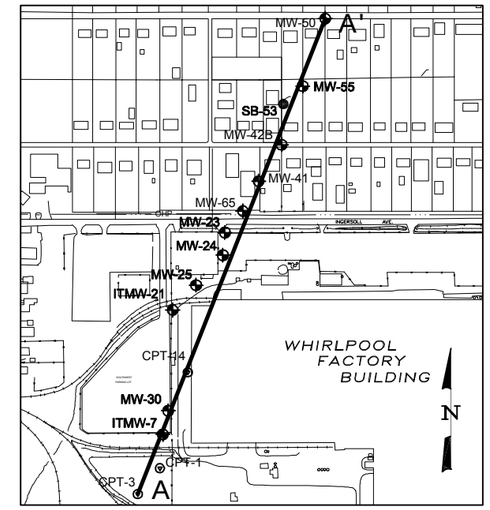




CROSS-SECTION LOCATION MAP
SCALE: 1" = 700'

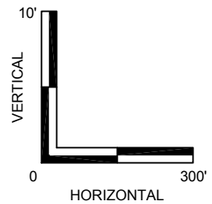
NOTES:

ALL DATA ARE mg/L IN MARCH/APRIL 2006

cis-1,2-DCE = cis-1,2-DICHLOROETHENE

TCE = TRICHLOROETHENE

EXCEEDS EPA REGION 6 HUMAN HEALTH MEDIUM SPECIFIC SCREEN LEVEL FOR TAPWATER



LEGEND

- CLAY
- CLAYEY SAND
- CLAYEY SILT
- FILL
- GRAVELY SAND
- SAND
- SHALE
- SILTY CLAY
- SILTY SAND
- SILT
- SANDY CLAY
- SANDY CLAYEY SILT
- GRAVELLY CLAY
- SCREENED INTERVAL
- FEBRUARY 2005 POTENTIOMETRIC SURFACE

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FIGURE 2-7
CROSS-SECTION A-A'
Whirlpool Corporation
Fort Smith, Arkansas

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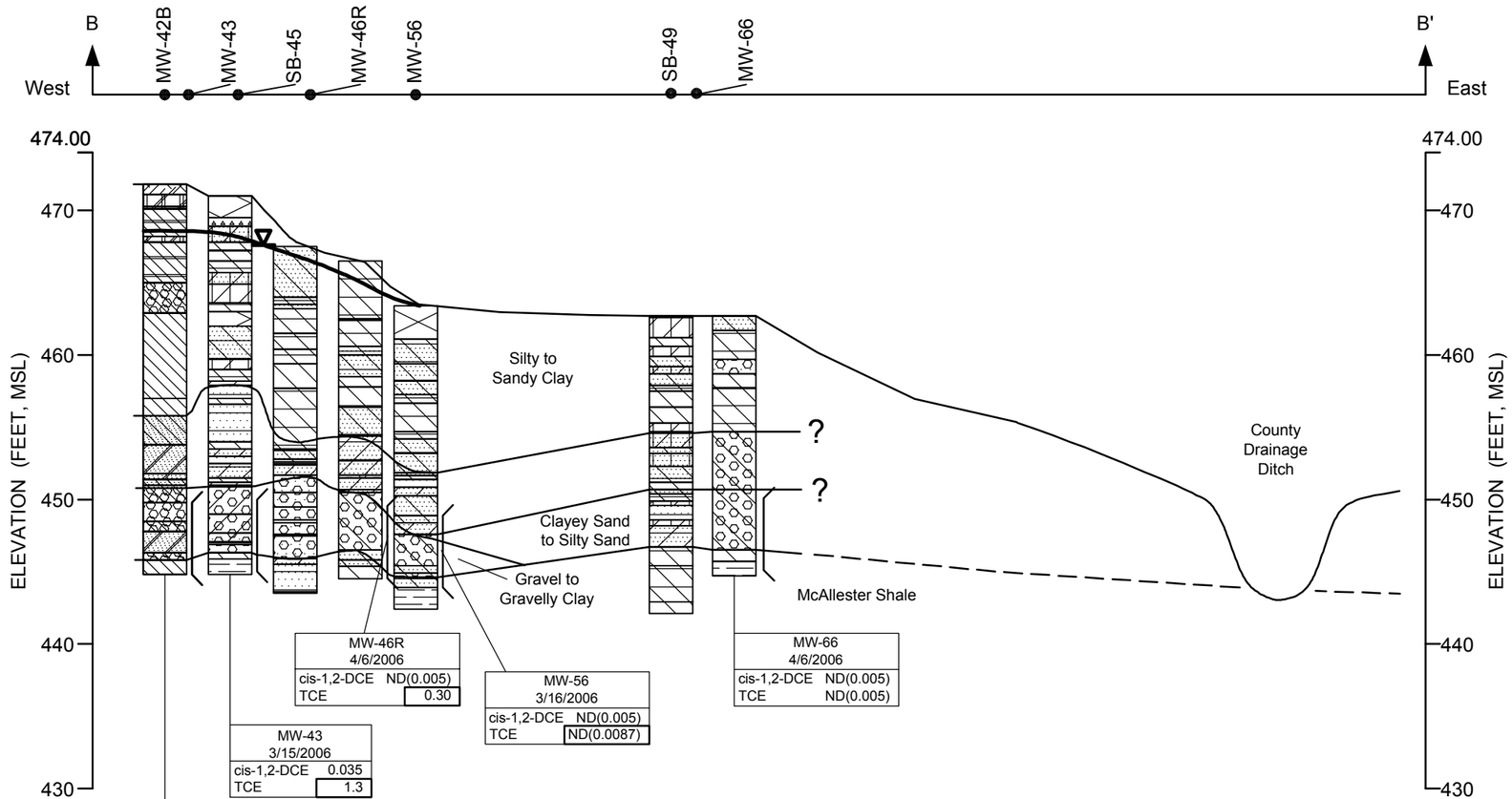
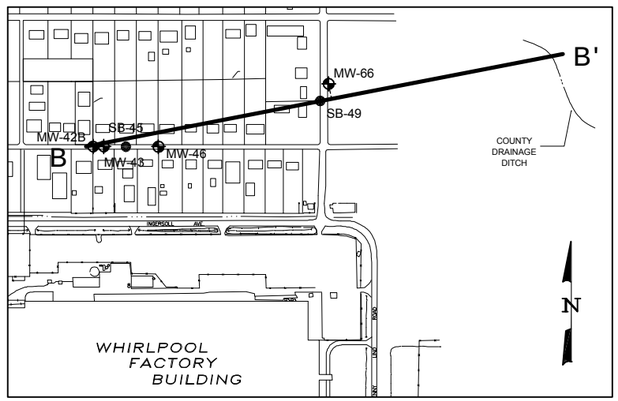




CROSS-SECTION LOCATION MAP
SCALE: 1" = 700'

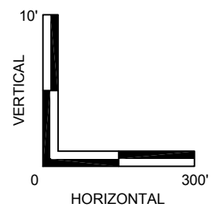
NOTES:

ALL DATA ARE mg/L IN MARCH/APRIL 2006.

cis-1,2-DCE = cis-1,2-DICHLOROETHENE

TCE = TRICHLOROETHENE

EXCEEDS EPA REGION 6 HUMAN HEALTH MEDIUM SPECIFIC SCREEN LEVEL FOR TAPWATER



LEGEND

- CLAY
- CLAYEY SAND
- CLAYEY SILT
- CONCRETE
- COARSE SAND
- FILL
- GRAVEL
- GRAVELLY SAND
- NO RECOVERY
- SHALE
- SILTY CLAY
- SILTY CLAYEY SAND
- SILTY SAND
- SANDY CLAY
- SANDY CLAYEY SILT
- SANDY SILTY CLAY
- GRAVELLY CLAY
- SCREENED INTERVAL
- FEBRUARY 2005 POTENTIOMETRIC SURFACE

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FIGURE 2-8
CROSS-SECTION B-B'
Whirlpool Corporation
Fort Smith, Arkansas

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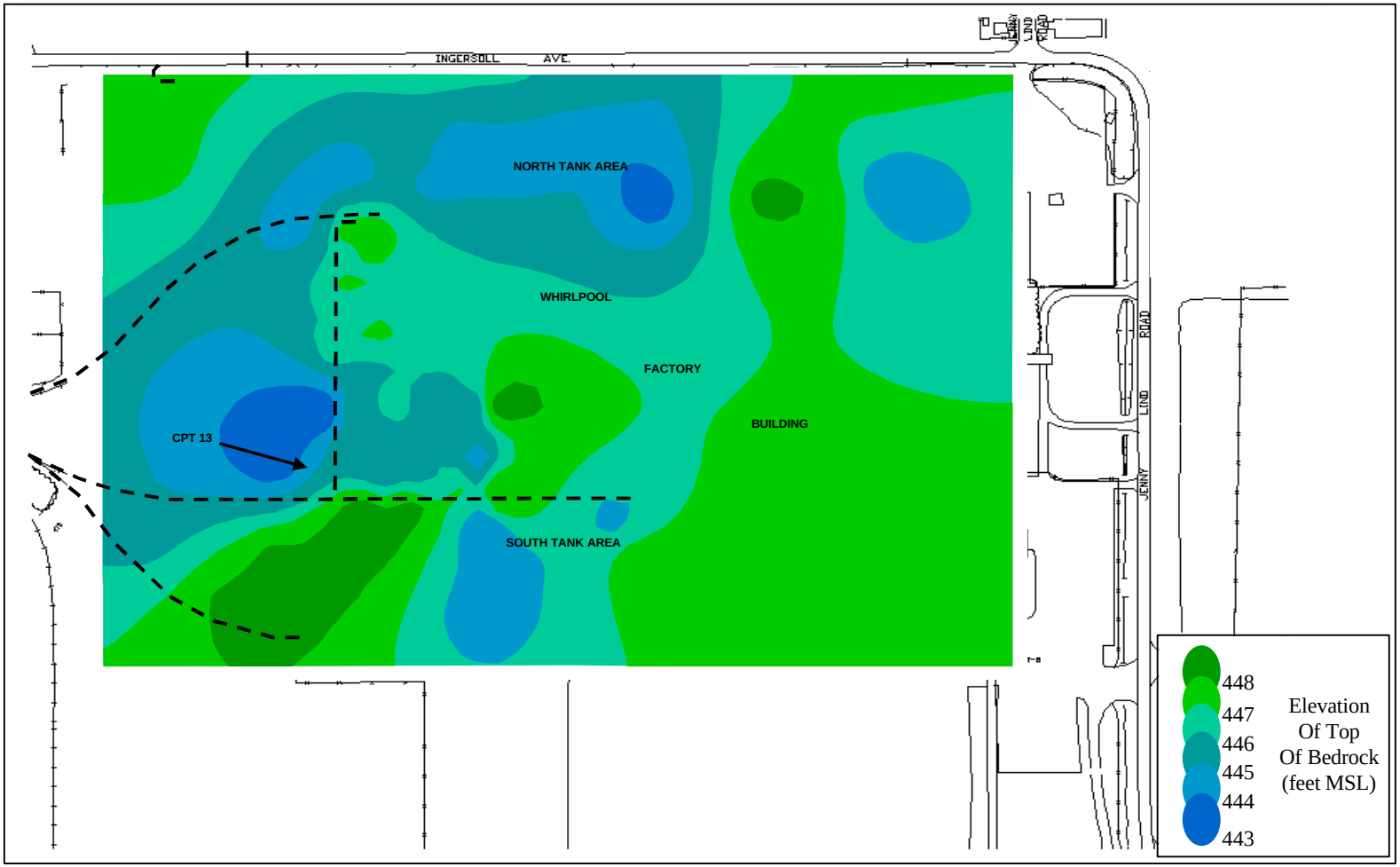

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FIGURE 2-9
CONTOUR MAP OF McALESTER SHALE SURFACE
Whirlpool corporation
Fort Smith, Arkansas

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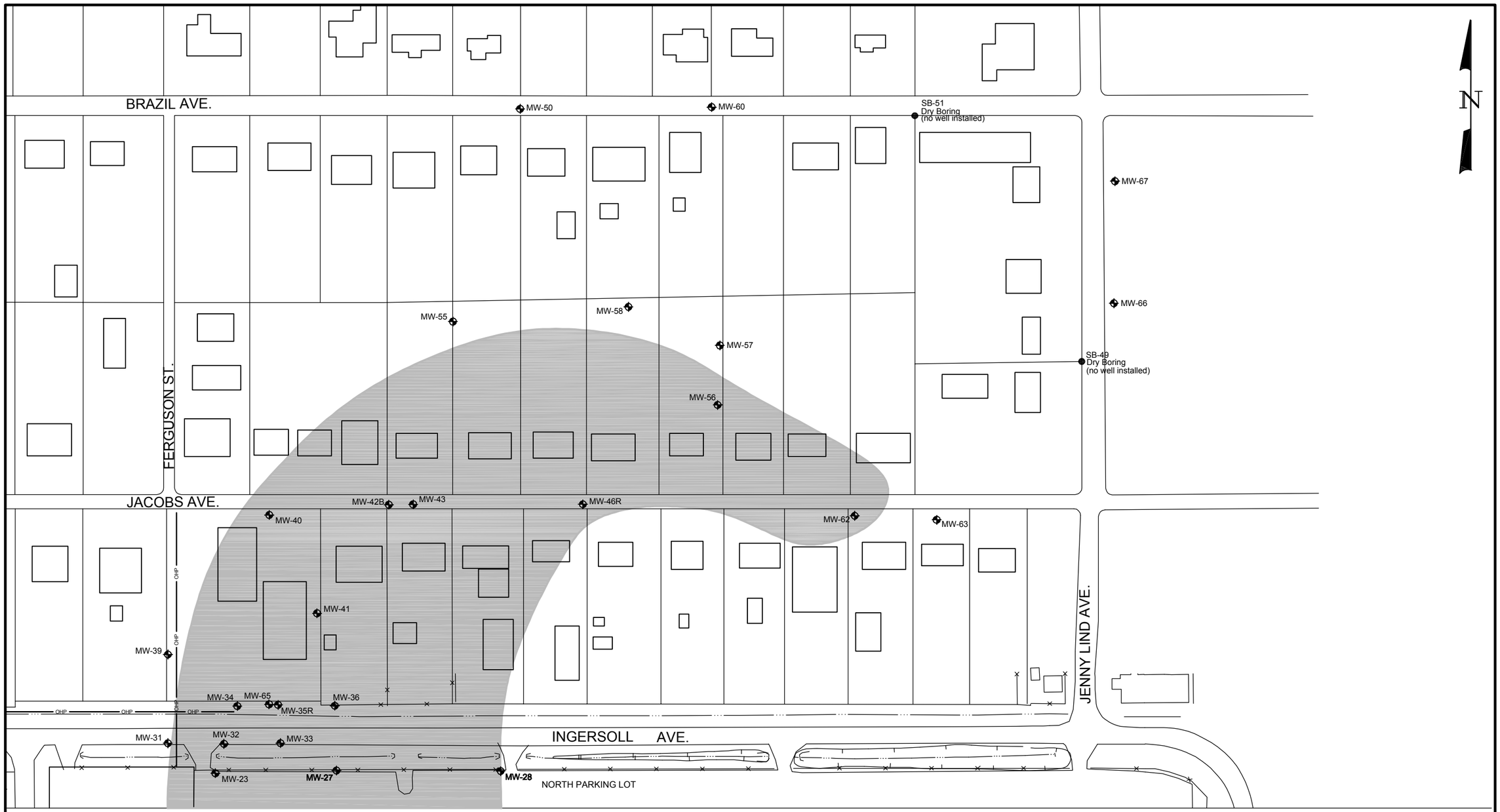

LEGEND

EXISTING MONITORING WELL

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

0 150 300

SCALE FEET

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HOUSTON · NEW ORLEANS · AUSTIN · MOBILE · BEAUMONT · BATON ROUGE · CORPUS CHRISTI

FIGURE 2-10
DISTRIBUTION OF GRAVEL ZONE
Whirlpool Corporation
Fort Smith, Arkansas

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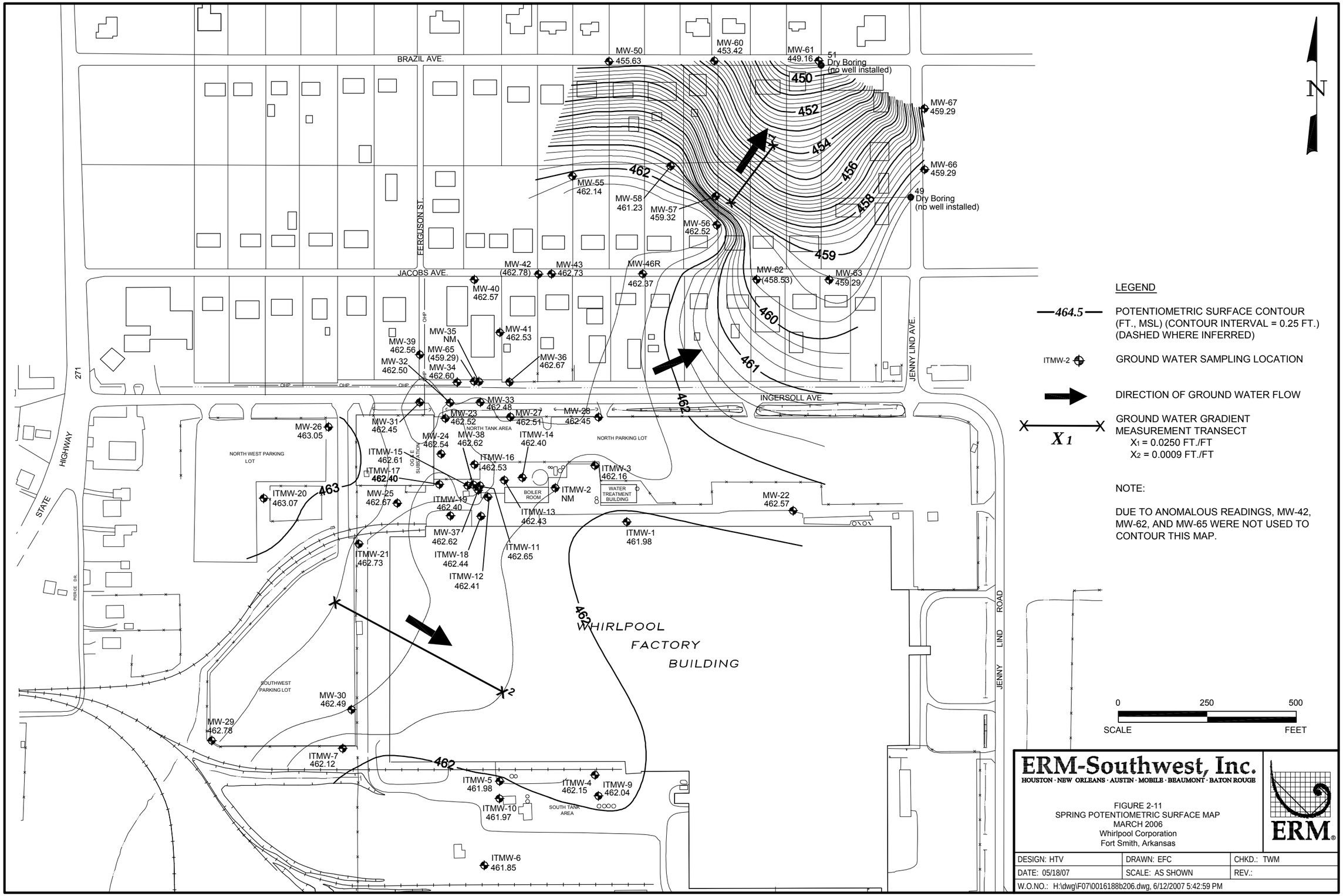

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FIGURE 2-11
SPRING POTENTIOMETRIC SURFACE MAP
MARCH 2006
Whirlpool Corporation
Fort Smith, Arkansas

DESIGN: HTV	DRAWN: EFC	CHKD.: TWM
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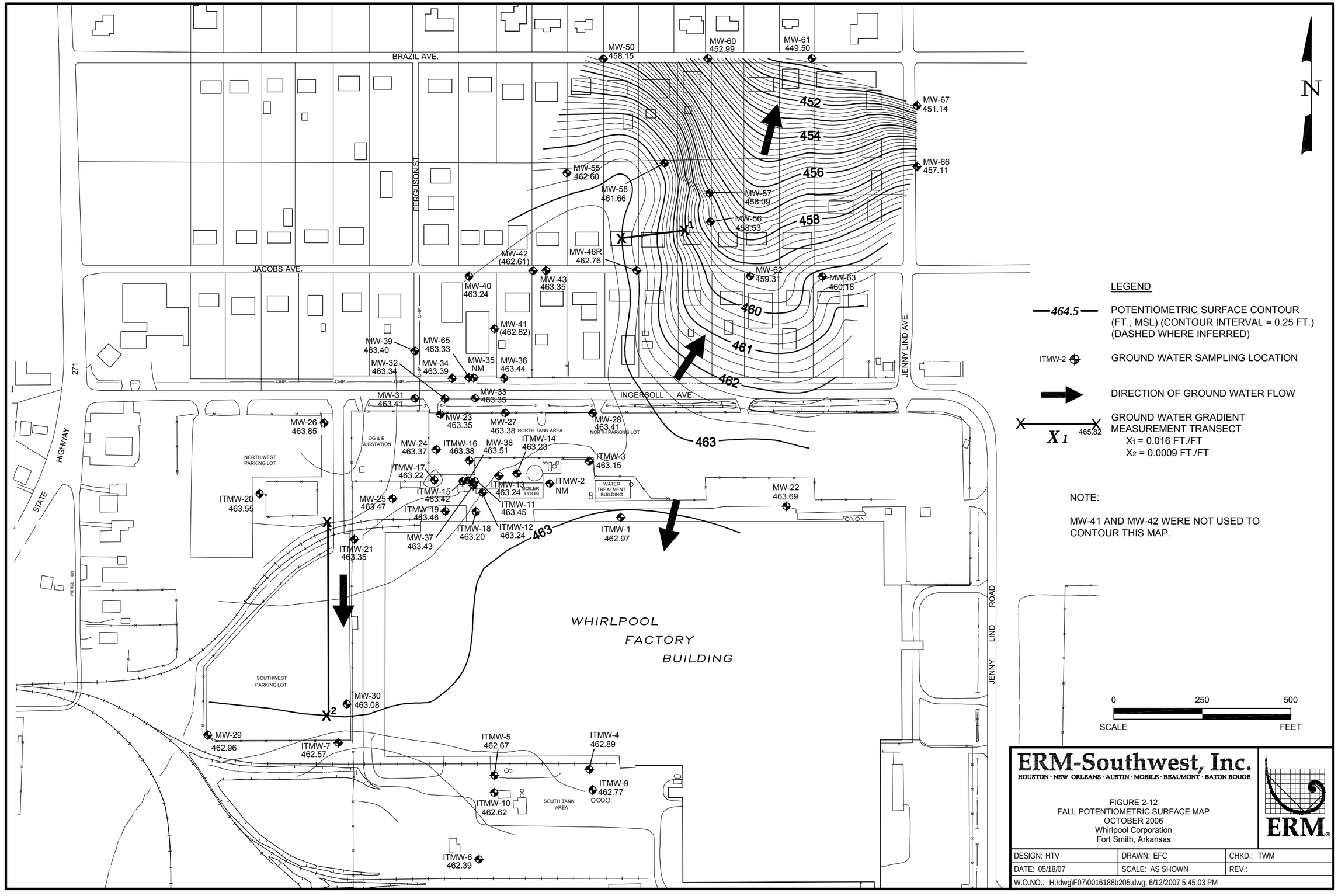

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FIGURE 2-12
FALL POTENTIOMETRIC SURFACE MAP
OCTOBER 2006
Whirlpool Corporation
Fort Smith, Arkansas

DESIGN: HTV	DRAWN: EFC	CHKD.: TWM
DATE: 05/18/07	SCALE: AS SHOWN	REV.:
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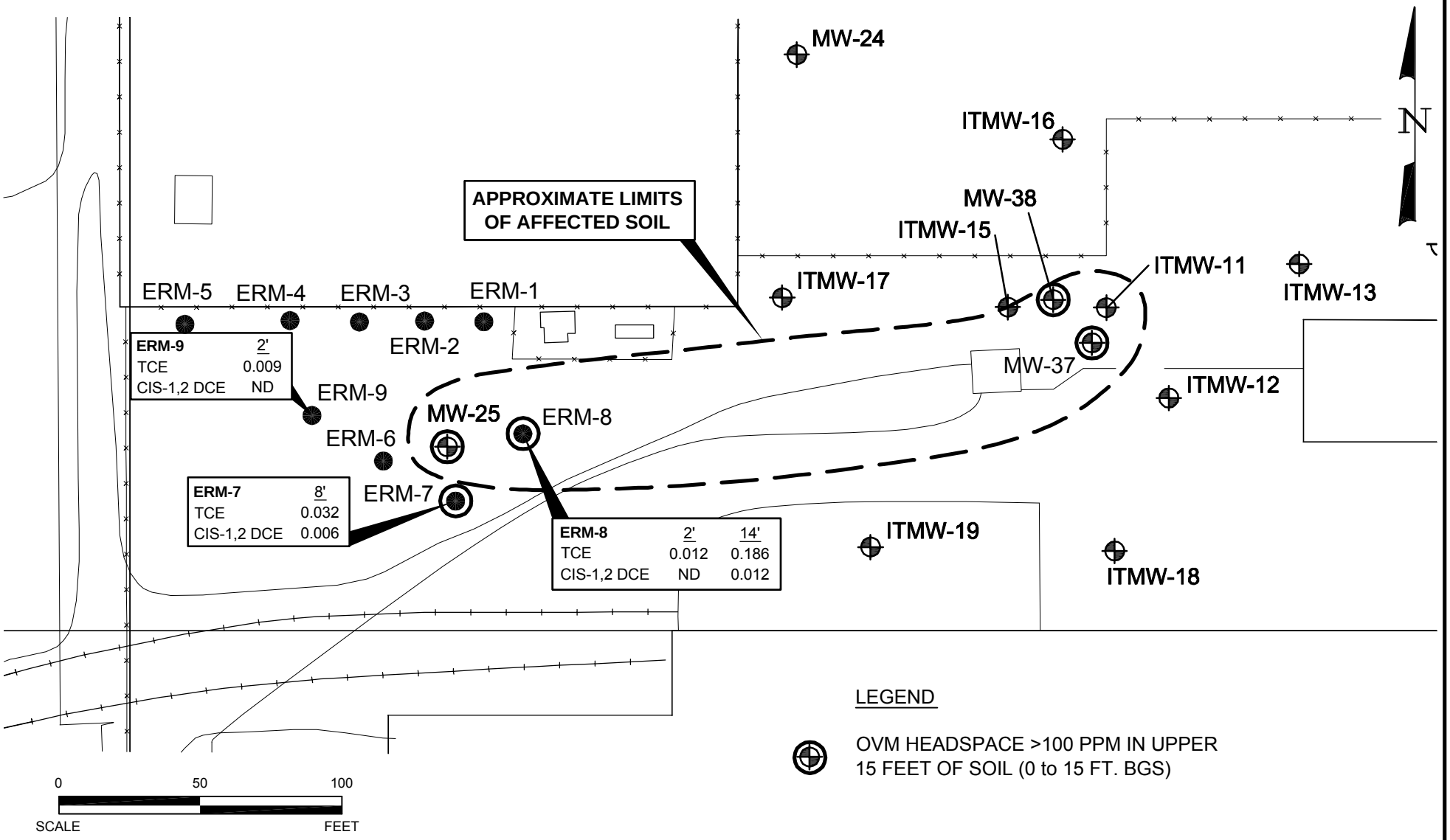

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FIGURE 2-13
APPROXIMATE EXTENT OF AFFECTED SOIL
Whirlpool Corporation
Fort Smith, Arkansas

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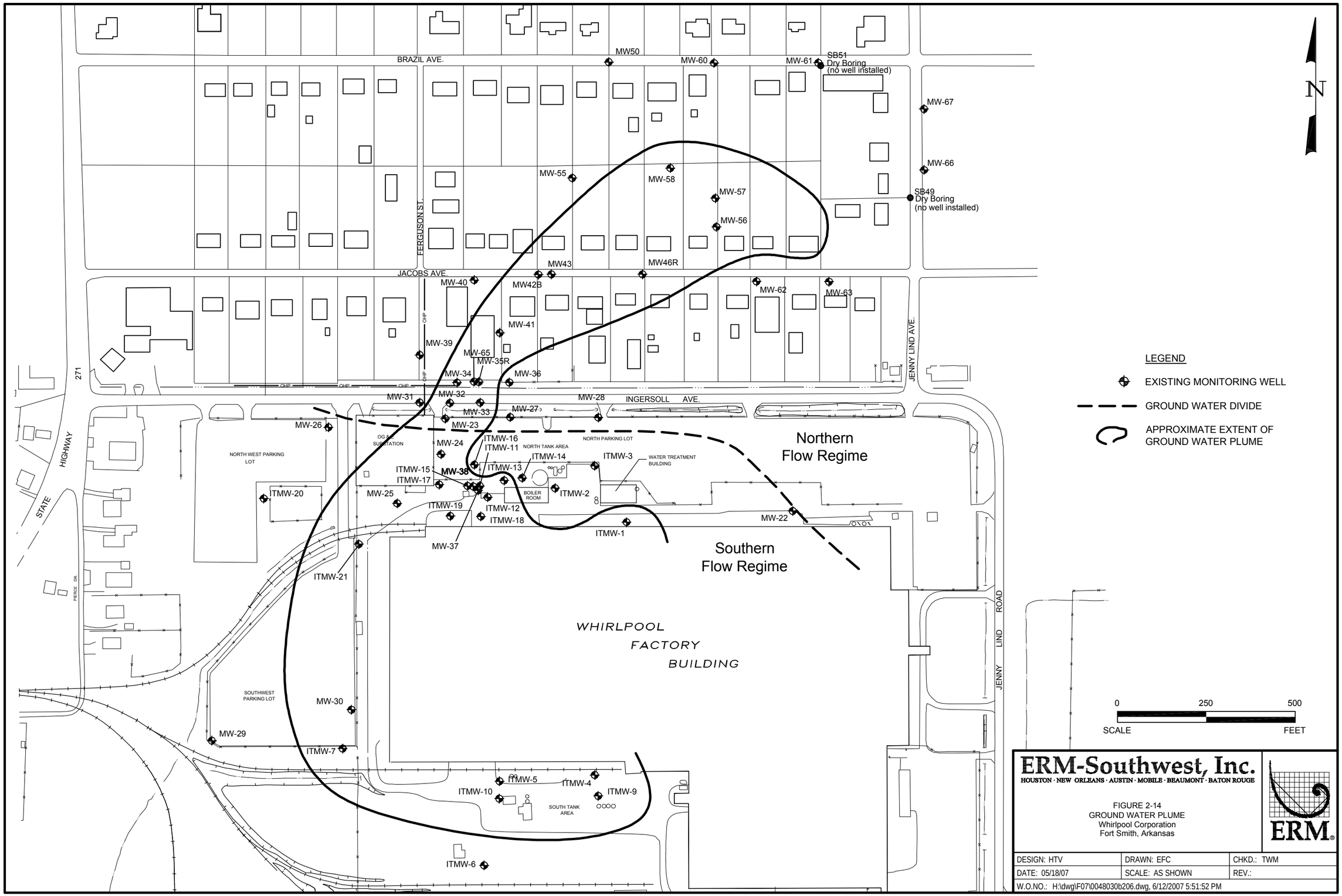

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FIGURE 2-14
GROUND WATER PLUME
Whirlpool Corporation
Fort Smith, Arkansas

DESIGN: HTV	DRAWN: EFC	CHKD.: TWM
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Ground Water Concentration Trend Charts

Appendix A

June 14, 2007
Project No. 0048030

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

BRAZIL AVE.

JACOBS AVE

INGERSOLL AVE.

FERGUSON ST.

JENNY LIND AVE.

JENNY LIND ROAD

HIGHWAY 271

STATE

PIERCE DR.

OHP

MW-50 MW-60 MW-61

51
Dry Boring
(no well installed)

49
Dry Boring
(no well installed)

MW-67 MW-66 MW-58 MW-55 MW-57 MW-56

MW-42 MW-43 MW-46R MW-62 MW-63 MW-40 MW-41 MW-39 MW-65 MW-36 MW-35 MW-34 MW-32 MW-33 MW-31 MW-23 MW-27 MW-28 MW-26

OFF-SITE AREA WELLS

NORTHERN BOUNDARY AREA WELLS

NORTHERN FLOW REGIME

APPROXIMATE LOCATION OF GROUND WATER DIVIDE

FRINGE AREA WELLS

PILOT STUDY AREA WELLS

SOURCE AREA WELLS

SOUTHERN FLOW REGIME

NORTH WEST PARKING LOT

OG & E SUBSTATION

NORTH TANK AREA

NORTH PARKING LOT

SOUTHWEST PARKING LOT

SOUTH TANK AREA

BOILER ROOM

WATER TREATMENT BUILDING

MW-24 ITMW-16 MW-38 ITMW-14 ITMW-17 ITMW-3 ITMW-20 MW-25 ITMW-15 ITMW-13 ITMW-2 ITMW-19 ITMW-11 MW-22 MW-37 ITMW-18 ITMW-12 ITMW-1 ITMW-21

MW-30 MW-29 ITMW-7 ITMW-5 ITMW-4 ITMW-9 ITMW-10 ITMW-6

WHIRLPOOL FACTORY BUILDING

N

LEGEND

MW-26 EXISTING MONITORING WELL

0 250 500
SCALE FEET

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FIGURE A-1
WELL GROUPINGS FOR ANALYSIS OF ANALYTICAL DATA
Whirlpool Corporation
Fort Smith, Arkansas

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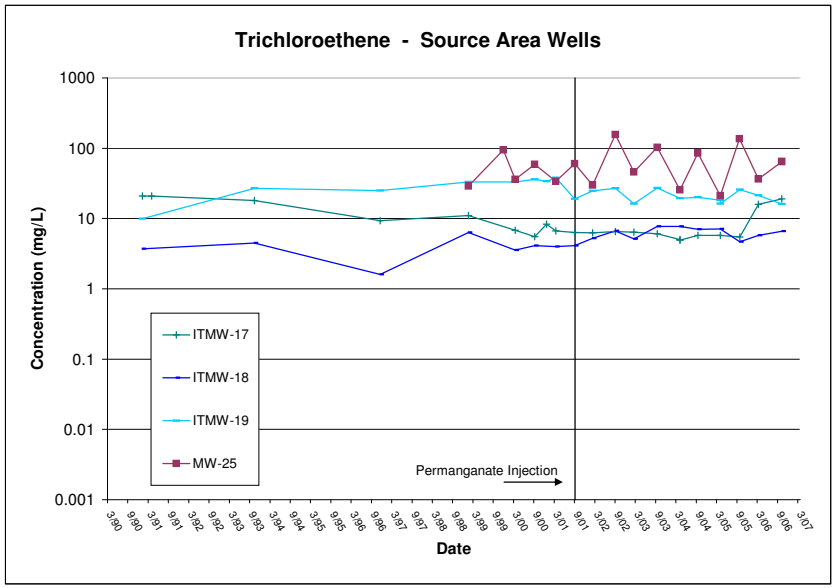

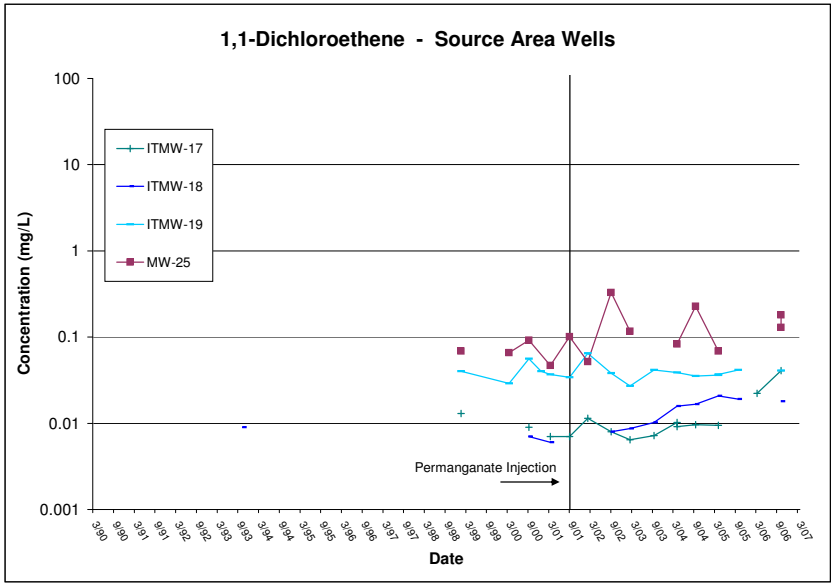

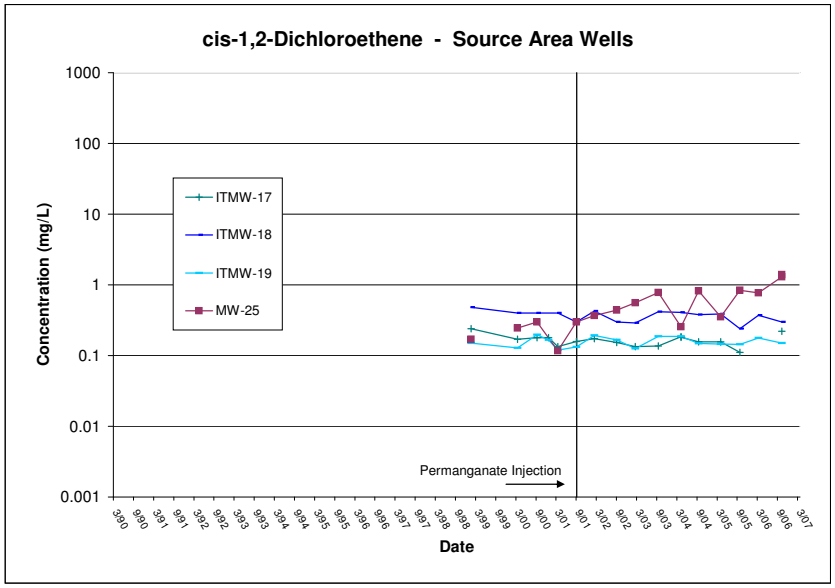

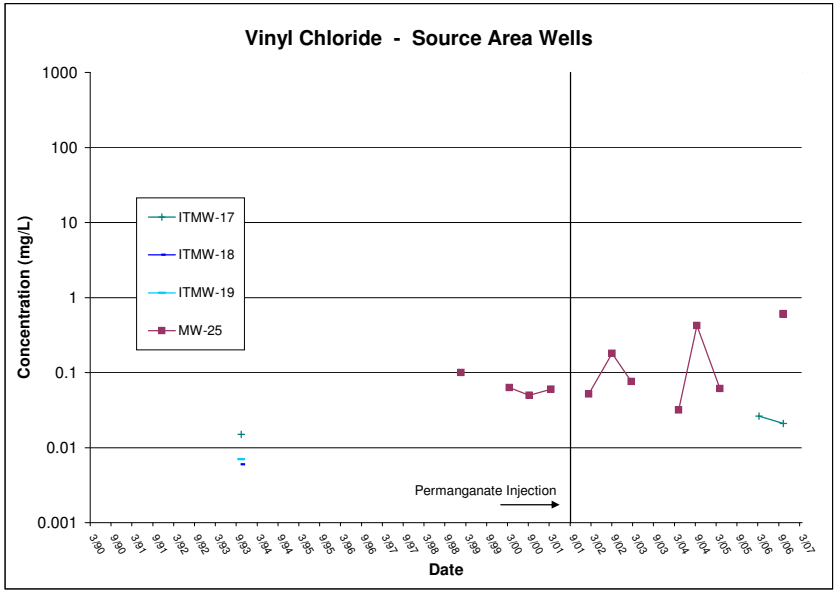

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FIGURE A-2
Source Area Wells Concentration Trends

Whirlpool Corporation
Fort Smith, Arkansas

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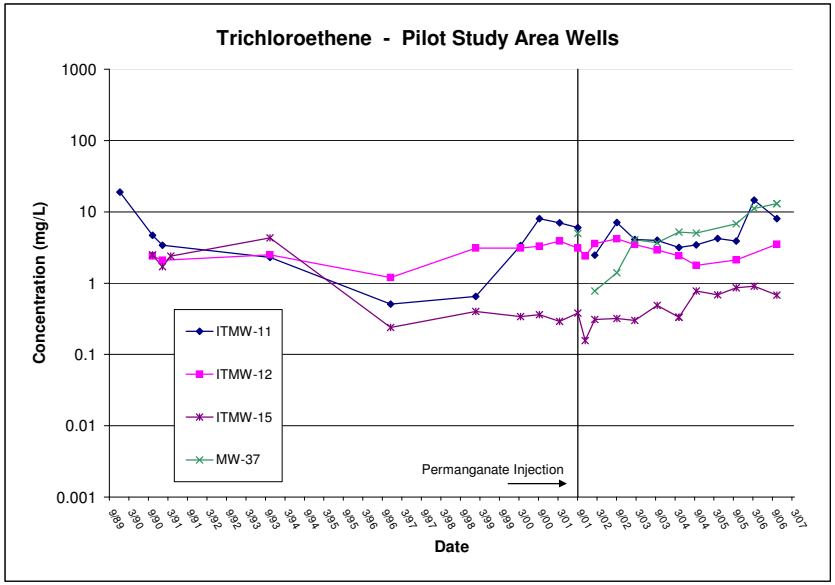

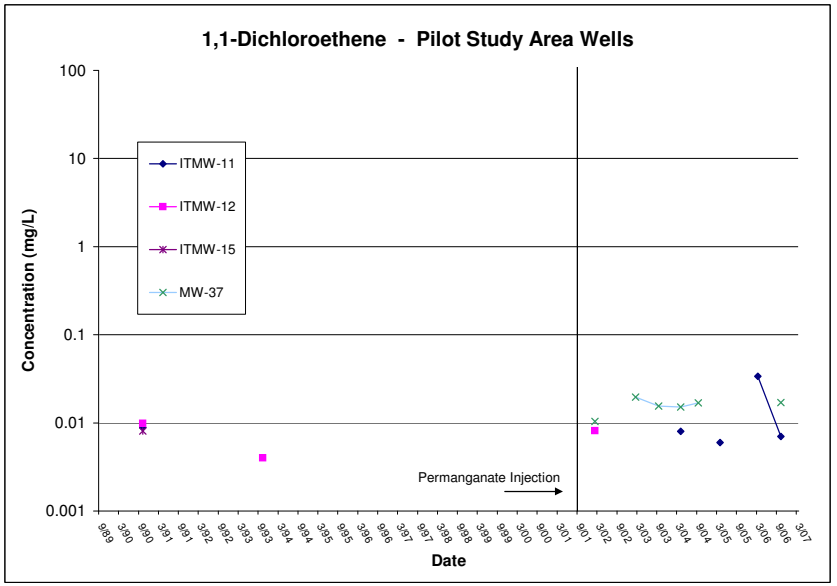

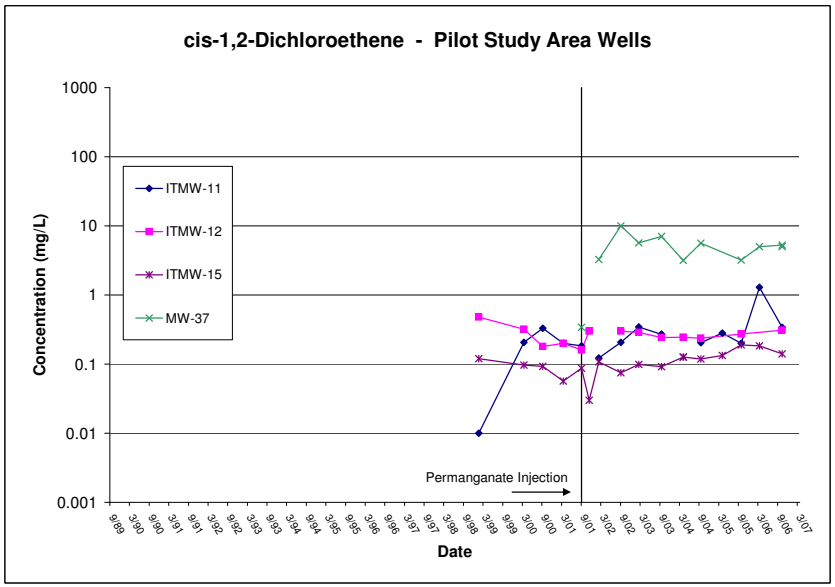

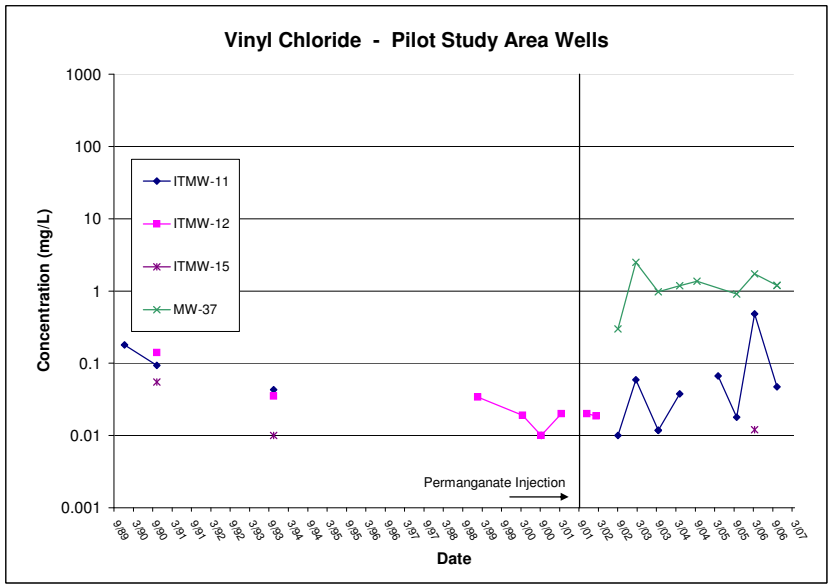

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FIGURE A-3
Pilot Study Area Concentration Trends

Whirlpool Corporation
Fort Smith, Arkansas

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DRAWN: ESB	SCALE: AS SHOWN	W.O.NO: 0046495	

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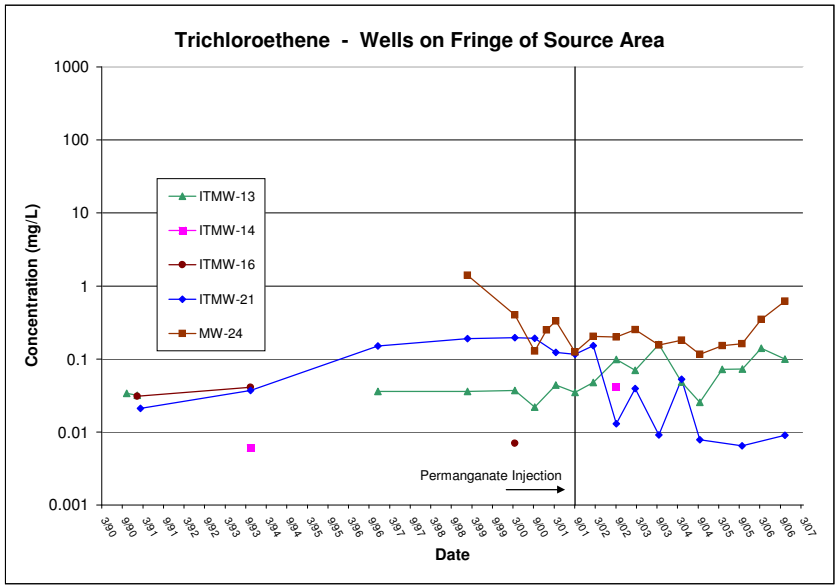

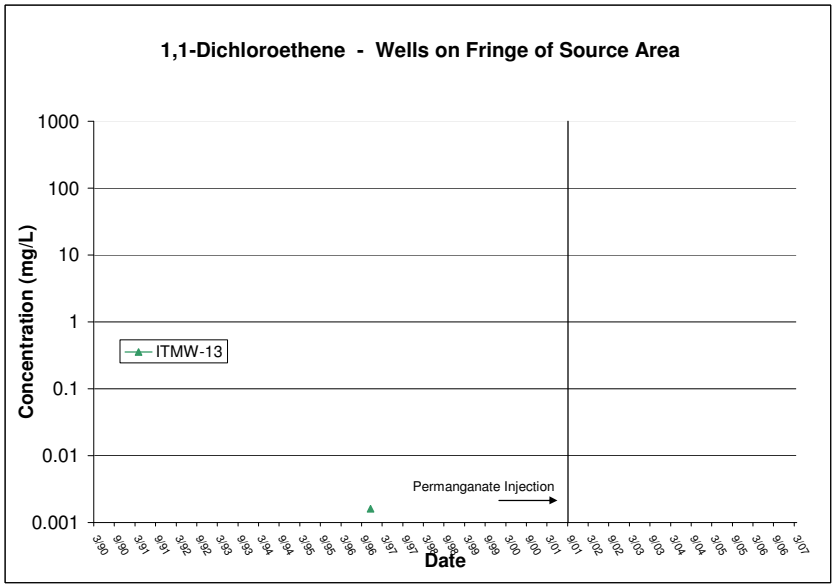

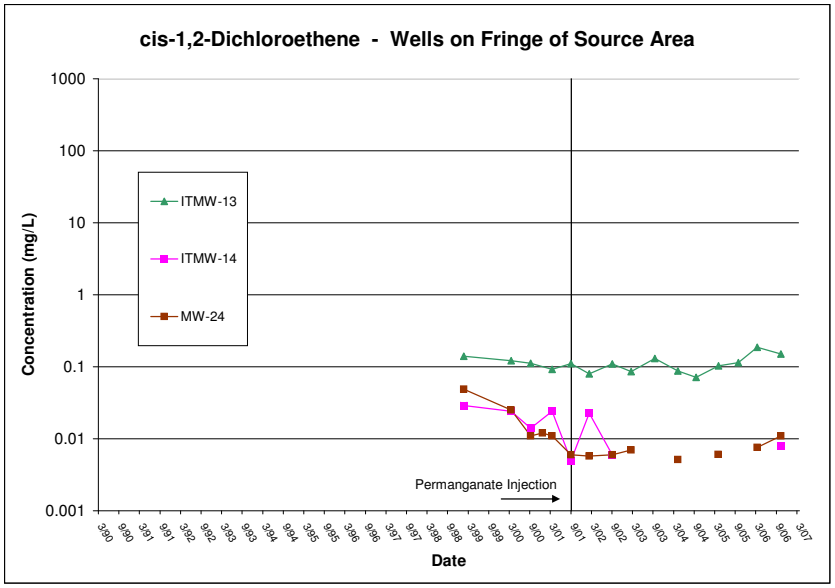

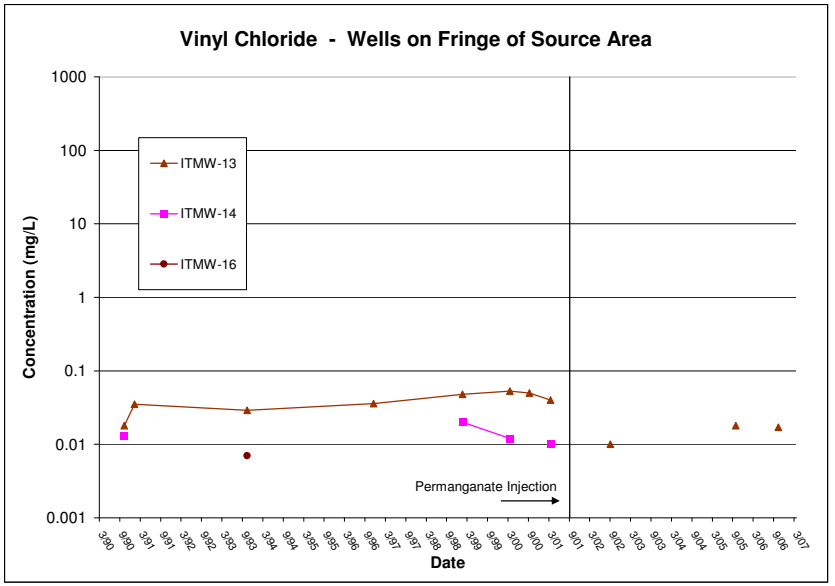

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HOUSTON-NEW ORLEANS-AUSTIN-DALLAS-BEAUMONT-BATON ROUGE

FIGURE A-4
Concentration Trends from Wells on Fringe of Source Area

Whirlpool Corporation
Fort Smith, Arkansas

DESIGN: TWM	CHKD:	DATE: 1/2/07	REV:
DRAWN: ESB	SCALE: AS SHOWN	W.O.NO: 0046495	

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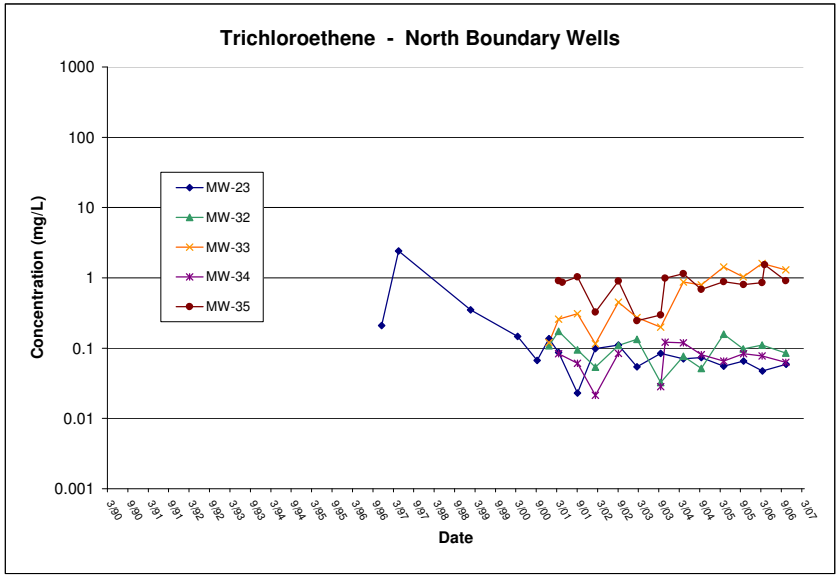

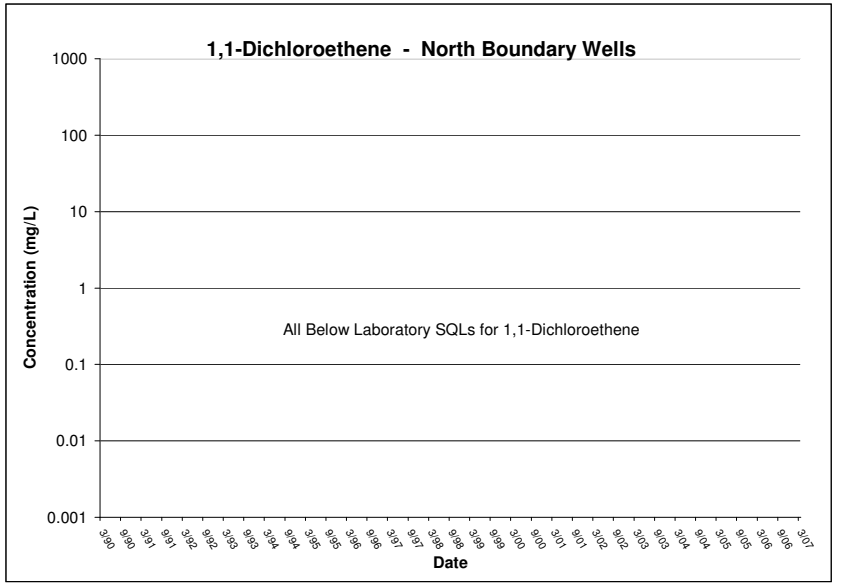

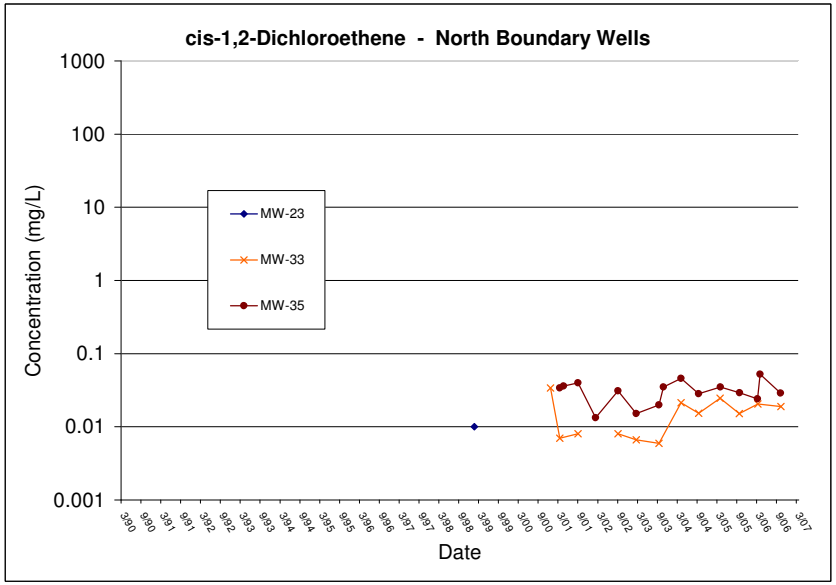

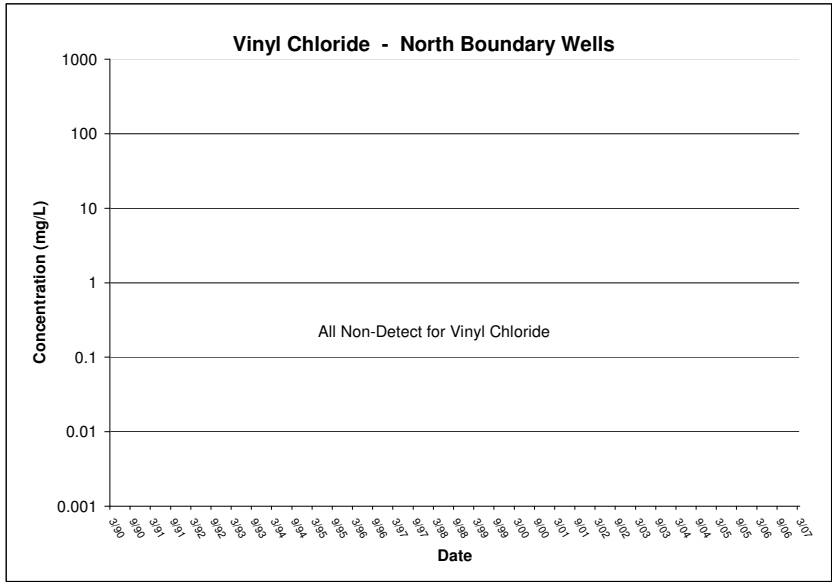

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FIGURE A-5
North Boundary Wells Concentration Trends

Whirlpool Corporation
Fort Smith, Arkansas

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DRAWN: ESB	SCALE: AS SHOWN	W.O.NO: 0046495	

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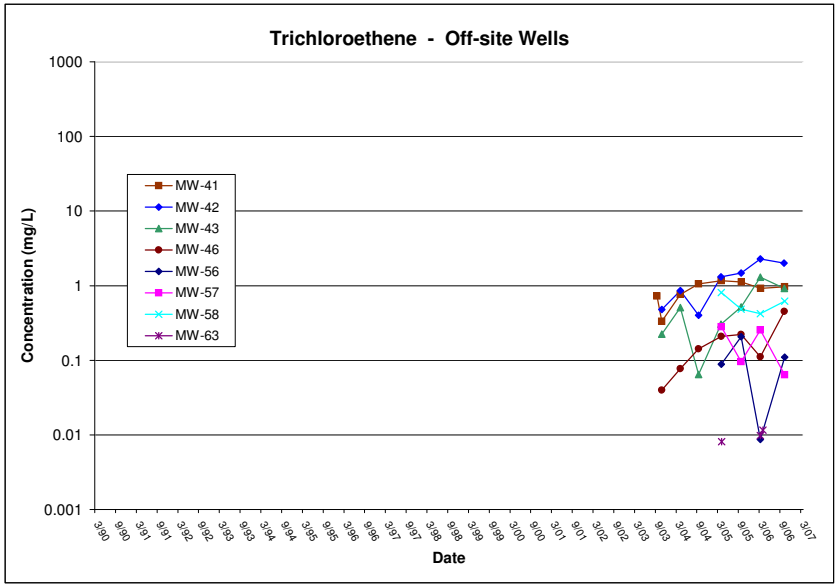

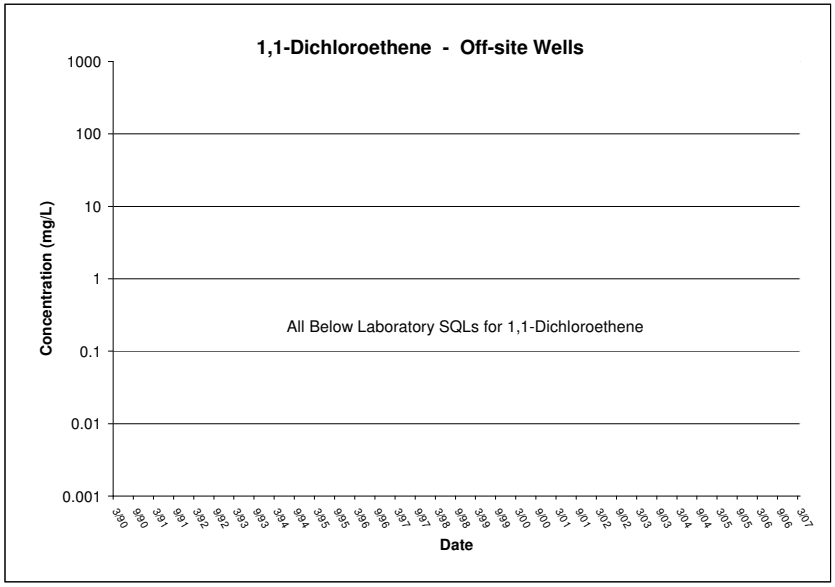

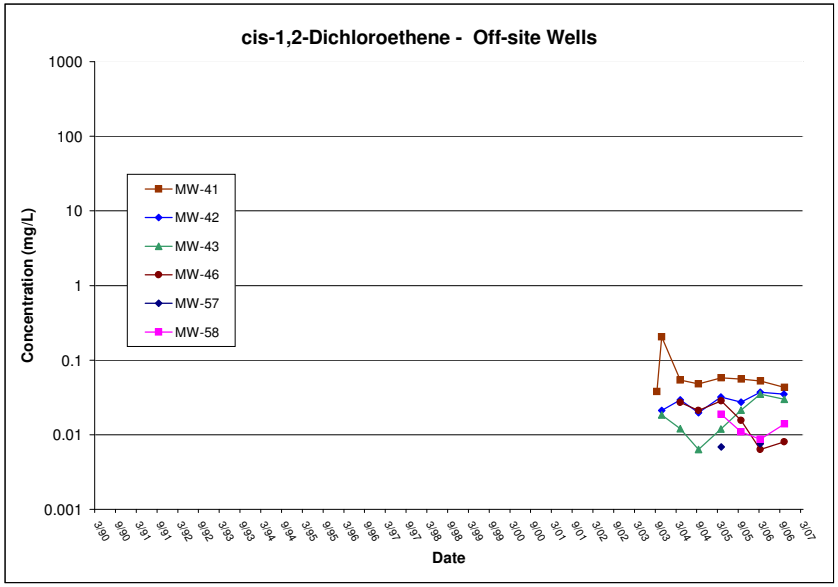

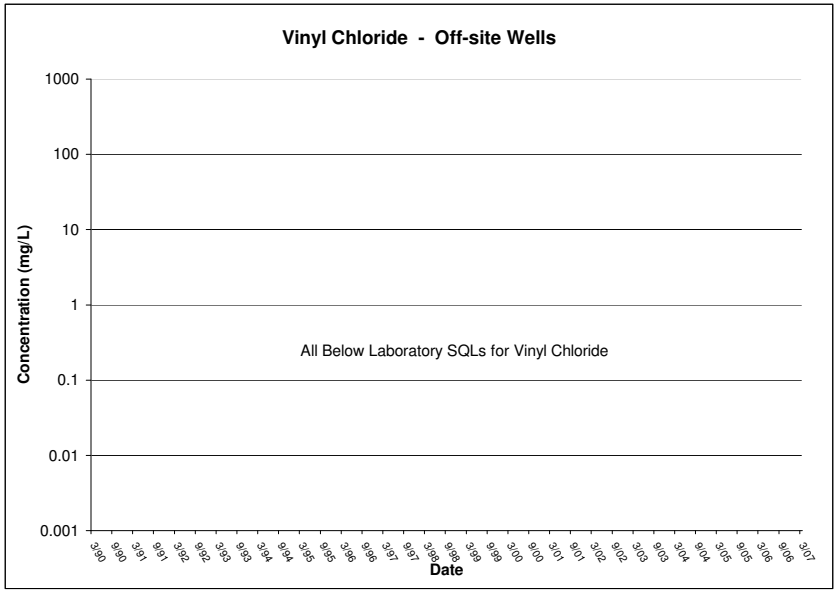

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HOUSTON-NEW ORLEANS-AUSTIN-DALLAS-BEAUMONT-BATON ROUGE

FIGURE A-6
Off-Site Wells Concentration Trends

Whirlpool Corporation
Fort Smith, Arkansas

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DRAWN: ESB	SCALE: AS SHOWN	W.O.NO: 0046495	

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Professional Profile

Appendix B

June 14, 2007
Project No. 0048030

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

Hong Thi Vu

Experience in human health and ecological risk assessment, litigation support, and epidemiological/public health research. Four years experience as an environmental consultant working on human health and ecological risk assessment, fate and transport mechanism, data quality assessment/data validation (QA/QC), and litigation support. Knowledge of federal and various state risk guidelines. Experience in risk assessment with U.S. and Mexico sites. Over four years experience with designing and analyzing epidemiological studies, including cross-sectional, case-control, prospective cohort and intervention clinical trial studies. Expertise in statistical programming and analysis, particularly with SAS, Stata and SPSS software. Statistical methods include chi-square, analysis of variance, analysis of covariance, t-tests and various non-parametric tests for small samples. More sophisticated methods include multivariate regressions (linear, logistic, proportional odds), generalized linear models and generalized estimating equations. Projects have included research in depression, psychiatric disorders, substance use, health services and sudden infant death syndrome. Extensive experience in survey data management. Some experience in cancer epidemiology and conducting field surveys.

Fields of Competence

- Risk Assessment (Human Health and Ecological)
- Data Quality Assessment/Data Validation (QA/QC)
- Fate and Transport Mechanisms
- Litigation Support
- Epidemiology
- Statistics

Education

- Master of Health Science, Epidemiology, Johns Hopkins University (1998)
- Certificate, Health Finance and Management, Johns Hopkins University (1998)
- Bachelor of Arts, Biology, Women's Studies, Wesleyan University (1996)

Honors and Awards

- Ronald E. McNair Scholar, Wesleyan University (1993-1994)
- Ronald E. McNair Fellow, Wesleyan University (1995-1996)
- Departmental Honors in Women's Studies, Wesleyan University (1996)

Key Projects

- Performed numerous risk assessments (including human health and ecological evaluations) for a wide variety of chemicals including total petroleum hydrocarbons, volatile organic compounds, semivolatile organics, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and inorganic compounds.
- Performed baseline risk assessments for an acrylics manufacturing facility in Mexico in support of developing a remedial strategy for chlorinated solvents at the site.
- Calculated risk-based cleanup value for a zinc-contaminated site in Mexico to reduce cleanup costs associated with a property transaction.
- Achieved risk-based closure for two separate sites for a utility company in Texas, United States.
- Performed risk-based closure for a coal combustion byproduct facility in Texas, United States which included human health and ecological risk evaluations. Site closure was approved by governing state agency.
- Prepared baseline risk assessments for Superfund site in Texas, United States. Assessments were reviewed and approved by governing state agency.
- Prepared and provided technical support for human health and ecological risk assessments for a multi-national oil supply company with sites in Texas, United States.
- Prepared a ground water risk-based assessment of a Louisiana, United States site for a transportation company.
- Prepared human health and ecological risk assessments for a refinery facility in Montana, United States.
- Prepared a risk-based evaluation for a chemical company in Mississippi.
- Conducted numerous data quality assessment/data validation assessments of laboratory analytical data for various clients, including Spanish-language laboratory reports for an industrial facility in Mexico.
- Created databases of analytical results for a manufacturing facility in Mexico.
- Calculated alternate risk-based values using fate and transport models for several risk assessment projects.
- Provided litigation support for toxic tort case involving wood preserving waste facility.
- Written critique of an epidemiological study used in a litigation case.
- Evaluated comparative health risks from indoor air exposure to LNAPL and DNAPL plumes.
- Summarized epidemiological findings on the relationship between mercury and neurological disorders in support of an expert witness testimony for toxic tort case involving an electric generator.
- Compiled/reviewed toxicity data and occupational standards for a toxic tort case involving a manufacturing facility.
- Performed data validation (QA/QC) for a litigation case. Chemicals of concern included polycyclic aromatic hydrocarbons, volatile organic compounds, pesticides, polychlorinated biphenyls, dioxins, and metals.
- Researched methods for fingerprinting chlorinated solvents in a property liability case.
- Performed statistics for site assessments and litigation cases.
- Collaborated on design and report writing for multiple epidemiological and health services research studies.
- Statistical data programming and analysis for numerous epidemiological and health services research projects.
- Database management for a variety of health research projects, including studies for head and neck cancer, treatment of major depression, physician-patient communication, health services, and sudden infant death syndrome.
- Performed power and sample size analyses for health research study proposals.

Publications

Cooper-Patrick, L., Gallo, J.J., Gonzales, J.J., Vu, H.T., Powe, N.R., Nelson, C. and Ford, D.E. (1999). "Race, Gender, and Partnership in the Patient-Physician Relationship." JAMA 282(6), 583-589.

Cooper, L.A., Brown, C., Vu, H.T., Palenchar, D.R., Gonzales, J.J., Ford, D.E. and Powe, N.R. (2000). "Primary Care Patients' Opinions Regarding the Importance of Various Aspects of Care for Depression." General Hospital Psychiatry 22(3), 163-173.

Primm, A.B., Gomez, M.B., Tzolova-Iontchev, I., Perry, W., Vu, H.T. and Crum, R.M. (2000). "Severely Mentally Ill Patients with and without Substance Use Disorders: Characteristics Associated with Treatment Attrition." Community Mental Health Journal 36(3), 235-246.

Gomez, M.B., Primm, A.B., Tzolova-Iontchev, I., Perry, W., Vu, H.T. and Crum, R.M. (2000). "A Description of Precipitants of Drug Use among Dually Diagnosed Patients with Chronic Mental Illness." Community Mental Health Journal 36(4), 351-362.

Primm, A.B., Gomez, M.B., Tzolova-Iontchev, I., Perry, W., Vu, H.T. and Crum, R.M. (2000). "Mental Health Versus Substance Abuse Treatment Programs for Dually Diagnosed Patients." Journal of Substance Abuse Treatment 19(3), 285-290.

Houston, T.K., Cooper, L.A., Vu, H.T., Kahn, J., Toser, J. and Ford, D.E. (2001). "Screening the Public for Depression through the Internet." Psychiatric Services 52(3), 362-367.

Cooper, L.A., Brown, C., Vu, H.T., Ford, D.E. and Powe, N.R. (2001). "How Important Is Intrinsic Spirituality in Depression Care? A Comparison of the Views of White and African-American Primary Care Patients." Journal of General Internal Medicine 16(9), 634-638.

Ford, D.E., Vu, H.T., and Anthony, J.C. (2002). "Marijuana use and cessation of tobacco smoking in adult from community sample." Drug and Alcohol Dependence 67(3), 243-248.

Primm, A.B., Cabot, D., Pettis, J., Vu, H.T., and Cooper, L.A. (2002). "The acceptability of a culturally-tailored depression education videotape to African Americans." Journal of the National Medical Association 94(11), 1007-1016.

Li, D.K., Petitti, D.B., Willinger, M., McMahon, R., Odouli, R., Vu, H., and Hoffman, H.J. (2003). "Infant Sleeping Position and the Risk of Sudden Infant Death Syndrome in California, 1997-2000. American Journal of Epidemiology, 157(5), 446-455.

Abstracts

Ford, D., Rost, K., Meredith, L., Duan, N., Rubenstein, L., Sherbourne, C., Smith, J., Vu, H., Nutting, P., and Wells, K. "Variation in the Quality of Primary Care Treatment Provided for Major Depression." National Institute of Mental Health. Thirteenth International Conference on Mental Health Problems in the General Health Care Sector. Washington, DC. July 12-13, 1999.

Alberg, A.J., Landrigan, J.A., Vu, H., Helzlsouer, K.J., and Ford, D.E. "A case-control study of *NAT2*, *GSTM1*, and *GSTT1* genotypes in relation to head and neck cancer." Society for Epidemiologic Research. 2000.

Crum, R.M., and Vu, H.T. "Risk of Problem Drinking Among Adolescents: The Role of Educational Aspirations and Other Characteristics." 23rd Annual Research Society on Alcoholism Scientific Meeting. 2000.

Theses

Vu, H.T. "HIV/AIDS and Women of Color in the United States." Senior honors thesis. Wesleyan University. 1996.

Vu, H.T. "Lifetime Depression and All-Cause Mortality: A 13-Year Follow-Up of the Baltimore ECA Study." Master's thesis. Johns Hopkins University. 1998.