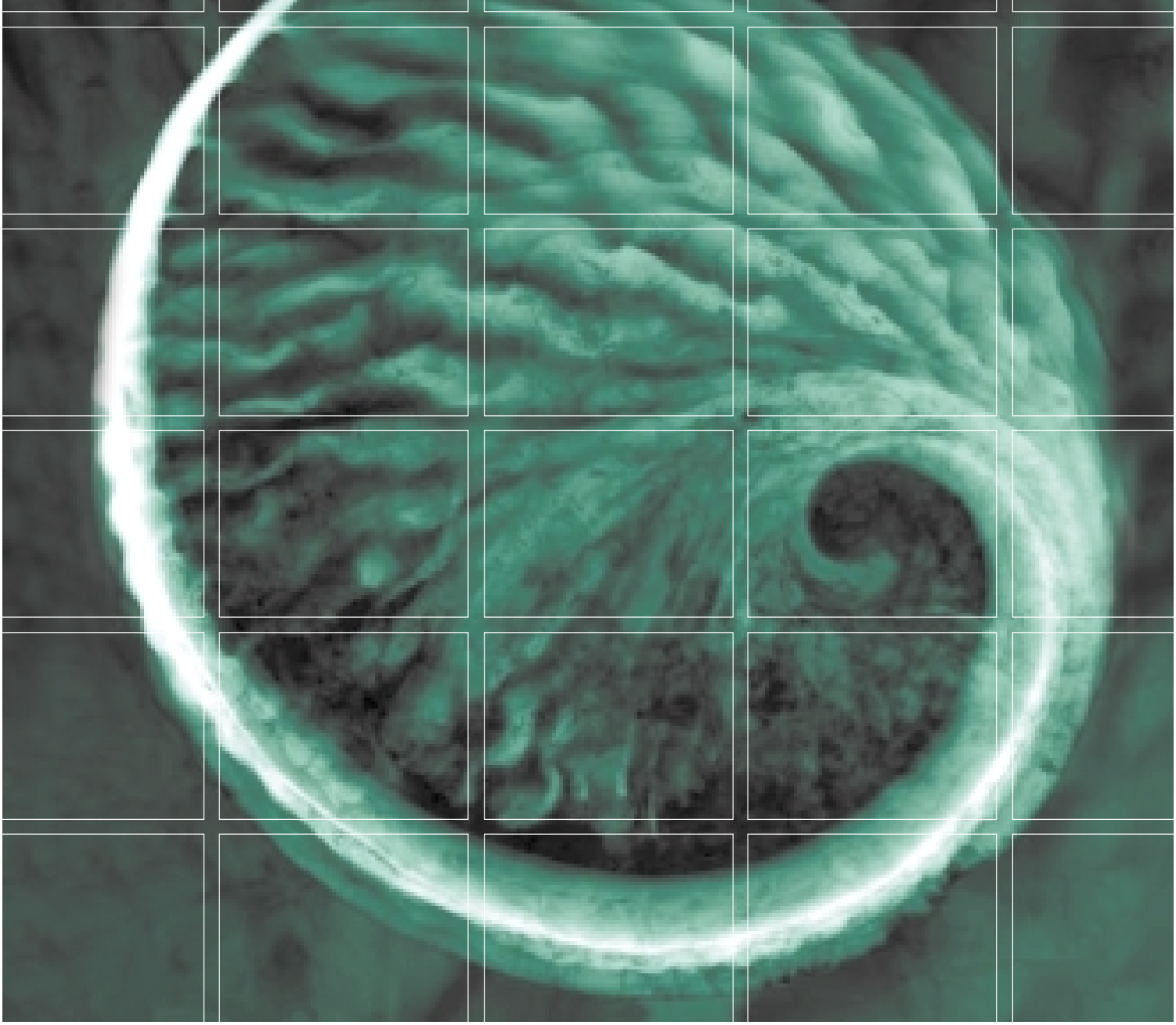

Interim Measures Work Plan – Fort Smith, Arkansas Facility

Whirlpool Corporation
Fort Smith, Arkansas

March 17, 2008

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Interim Measures Work Plan:
Fort Smith Arkansas Facility

March 17, 2008

Project No. 0079781
Fort Smith, Arkansas

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1.0 INTRODUCTION

1.1 BACKGROUND

Whirlpool Corporation (Whirlpool) has been working with The Arkansas Department of Environmental Quality (ADEQ) to address potential risks to human health and the environment associated with a historical release of trichloroethylene (TCE) at the Whirlpool Fort Smith facility located at 6400 Jenny Lind Ave., Fort Smith, Arkansas (Figure 1-1). Based on site investigations conducted between 1999 and 2006, TCE and associated degradation products (primarily cis-1,2-dichloroethene) are present in shallow ground water at the site and have migrated off-site into a residential area north of the facility.

Whirlpool's Risk Evaluation Report (RER) for the Fort Smith Site, submitted June 13, 2007, summarized area land use, site geology and hydrogeology, and evaluated exposure scenarios and assessed potential risks to human health. The RER characterized the approximate extent of the off-site ground water plume. The plume has two general components; the "core" and the "fringe" (Figure 1-2). The "core" is roughly identified as the area where TCE concentrations exceed 0.8 mg/L.

The RER concluded that there were two exposure pathways that, depending on site conditions could pose potential risk to human health and the environment near the "core" of the off-site plume: 1) ground water ingestion via use of a hypothetical future well, and 2) inhalation of vapors via volatilization of affected ground water. Based on current conditions, neither of these pathways is expected to be complete. The ground water ingestion pathway is not complete since shallow wells are not present within the footprint of the plume and the homes in the area are on municipal water service. Additionally, potential exposure by vapor intrusion into homes is also not likely. For example, the clayey soils that are present at the surface would serve as a significant barrier to vapor transport to the ground surface and all but two of the residences near the core are raised, pier and beam-type homes having crawl spaces that would vent vapors to ambient air and interrupt the intrusion pathway.

1.2 INTERIM MEASURES OBJECTIVES AND GOALS

Although the ground water ingestion pathway is not currently complete, and the potential for risk via ground water-to-indoor air pathway has not been quantified, Whirlpool's goal is to reduce any potential risk to human health. Therefore, Whirlpool is proposing to conduct an Interim Measure (IM) as an early response.

In addition to serving as an early response targeting the "core" of the off-site plume, the IM will serve as a pilot test to assess if these technologies (either separately or in combination) are appropriate for full scale implementation and provide data for use in designing a full scale system. In order to address the area with the greatest concentration of COC mass offsite and the area that may be a

concern for potential vapor intrusion, the IM will target the core of the off-site plume (Figure 1-2). Technologies that are considered most likely to provide a cost effective and shorter term reduction in constituent concentrations are ground water pump-and-treat and in-situ chemical oxidation (ISCO).

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

2.0 INTERIM MEASURES TECHNICAL APPROACH

This section describes the technical approach for the IM which will consist of: 1) ground water recovery to extract TCE from the subsurface and induce hydraulic capture of the plume to limit potential for additional plume migration, and 2) a series of ISCO injection points using sodium permanganate to aggressively oxidize the TCE and related constituents in the core of the plume.

2.1 GROUND WATER RECOVERY AND TREATMENT

The ground water recovery component of the IM will be comprised of up to two 2-inch diameter recovery wells with pneumatic pumps with a bottom inlet. The pump(s) will periodically discharge to a ground water treatment system each time the pump float senses the pump is full.

Granular Activated Carbon (GAC) will be used to treat recovered ground water. GAC is a proven technology in removal of TCE from water and its low operator labor requirements, low operations and maintenance (O&M) costs, and relatively low capital costs compared with other technologies make it a preferred treatment method for this application.

Two GAC vessels will be placed in series with a sampling port after the first unit to collect monthly samples of treated water to determine when that unit has reached its chemical loading capacity. Any TCE that passes through the first vessel after its capacity has been reached will be adsorbed by the second vessel. The first vessel will then be changed out and the vessel configuration changed so that the second (backup) becomes the primary treatment unit. A preliminary conceptual schematic process and instrumentation diagram (PID) of a similar recovery and treatment system is provided in Figure 2-1.

The treatment system equipment and ancillary instrumentation will be housed in an enclosed temporary building located on an off-site property. The building style will be consistent with the residential structures and will be designed with internal secondary containment of fluids.

Treated water management approaches that may be employed include discharge to the local storm sewers, re-injection into the shallow transmissive zone, or discharge via the Whirlpool facility's waste water treatment system. Final disposition of the treated water will be determined based on results of permitting activities and evaluation of actual quantities produced.

2.2 IN-SITU CHEMICAL OXIDATION

The ISCO component of the IM will be comprised of up to eight injection wells located through the core of the off-site plume as shown in Figure 1-2. It is anticipated that two 70-gallon (approximate volume) injections of a 12% sodium permanganate solution will occur at each of eight injection well locations for a total injected volume of approximately 1100 gallons. Injection pressure will be

no greater than 12 psi. Based on pilot studies, ISCO injections are anticipated to treat the core of the plume to a radial distance of 30 feet from the injection wells.

Sodium permanganate (RemOx® L ISCO Reagent – Carus Chemicals), (Appendix A – Sodium Permanganate Fact Sheet) has been selected for the in-situ chemical treatments, because of its low toxicity and quick degradation of TCE. The reagent is specifically designed for environmental remediation applications.

Injection of the sodium permanganate into the subsurface requires registration in the ADEQ Underground Injection Control (UIC) Section Class V well program. The UIC is regulated under Regulation 17 (Arkansas Underground Injection Control Code) and the Code of Federal Regulations (CFR) Title 40, Parts 144, 145, 146, and 124. The ISCO injection wells will be registered with the State of Arkansas after installation. Information required by the UIC Section for authorization of injection wells will be submitted prior to initiating injection activities.

Upon completion of ISCO activities, the injection wells will either be converted for use as monitor wells or plugged and abandoned in accordance with abandonment procedures {40 CFR 144.28 and 146.10(c)}.

2.3 WELL INSTALLATION

Twelve wells and one piezometer will initially be installed for the IM -- one ground water recovery well, three monitor wells and eight ISCO injection wells. The proposed arrangement of the wells is shown in Figure 1-2. The recovery well will be installed in the vicinity of monitor well MW-42B. As a contingency, depending on access and permitting, an additional recovery well may be installed near MW-46 but is not currently planned for this phase of the IM. The ISCO injection wells will be installed up-gradient of the recovery well. Two monitor wells will be installed north of the recovery well and one installed east of the easternmost injection wells. The piezometer will be installed approximately 5 feet from the recovery well to facilitate measuring water levels without recovery well pump interference.

Wells will be installed to a depth of approximately 30 feet below ground surface (bgs) and constructed of 2-inch diameter PVC casing with 0.01-inch slotted screen. The surface completions for the injection and monitor wells are anticipated to be 4-foot by 4-foot concrete pads with a steel manway and a manhole cover. Figure 2-2 shows the typical well construction. The surface completion for the recovery well will be a below-grade concrete vault. The piezometer will be a 1-inch diameter "pre-pack" design. Wells will be developed upon completion and all purge water contained for proper disposal. Well installation will be in accordance with prevailing well construction standards for the State of Arkansas.

3.0 PERFORMANCE MONITORING

Performance monitoring will be conducted to assess:

- the rate of TCE concentration reduction in ground water;
- the mass removed by the ground water recovery system; and
- the rate of oxidation and effectiveness of ISCO injections in oxidizing TCE in ground water.

3.1 PERFORMANCE MONITORING

The performance monitoring program for the IM will consist of the following activities:

For the ground water recovery component:

- Periodic water level gauging of selected wells to assess the change in ground water flow resulting from the extraction of ground water; and
- Periodic sampling of selected monitor wells to assess the changes in TCE concentrations resulting from the recovery operation.

For the ISCO treatment component:

- Periodic water level gauging of selected wells to assess potential changes in ground water flow resulting from injection activities;
- Periodic sampling of selected monitor wells to assess the changes in TCE concentration from the ISCO injections; and
- Periodic field screening of selected wells for water quality parameters (e.g., ORP, DO, temp, pH, SC and Cl) to assess the level of impact on the ground water chemistry from the ISCO treatment.

Ground water gauging and monitoring will be conducted in accordance with the approved CAS Work Plan utilizing wells shown in Figure 1-2.

The anticipated frequencies of the monitoring activities are summarized below:

Performance Monitoring Activity		
Water Level Gauging (1)	***Sampling for TCE***	***Water Quality Parameters (2)***
Ground Water Recovery		
Baseline prior to system startup; daily for first 5 days; weekly through first month; and monthly thru month 6	Baseline prior to system startup; day 10; end month 1, and; end month 3. (May include additional interim sampling pending review of initial data.)	

Performance Monitoring Activity		
Water Level Gauging (1)	***Sampling for TCE***	***Water Quality Parameters (2)***
ISCO Injection		
Baseline prior to ISCO injection; end of weeks 1 & 2; monthly thru month 6.	Baseline prior to injections; day 10; end month 1, and; end month 3. (May include additional interim sampling pending review of initial data.)	Baseline prior to injection; weekly thru month 1.
(1) Additional water level gauging may be recorded in the event of significant rainfall events to assess transient impacts on local flow conditions. (2) Water quality parameters include ORP, DO, temp, pH, SC and Cl.		

4.0 OPERATIONS AND MAINTENANCE

Operations and maintenance of the ground water recovery system and ground water treatment system will consist of the following activities:

For the ground water recovery system component:

- Periodic check of air supply and pressure to recovery well pump(s);
- Periodic check of power supply to air compressor;
- Period readings of recovery well pump cycle counter; and
- Periodic check for leakage of hoses and fittings.

For the ground water treatment system component:

- Periodic check of power supply to system;
- Periodic check for leakage of hoses and fittings;
- Periodic collection of water sample for TCE analysis from sampling port between GAC vessel 1 and GAC vessel 2 to check for break-through;
- Periodic collection of water sample for TCE analysis from discharge line sampling port; and
- Periodic check of discharge rate.

The anticipated frequency of O&M activities is summarized below:

Operations and Maintenance Activities			
Hoses & Fittings	***Air & Power Supply***	***Cycle Counter / Discharge Gauging***	***TCE Analysis***
Ground Water Recovery System			
Check for leakage prior to system startup; daily week 1, and; weekly thereafter.	Check daily first week, and; weekly thereafter.	Discharge manually gauged from pump discharge at startup; Discharge manually gauged from pump quarterly, and; weekly cycle counter readings.	Pump discharge sampled at system startup, and; monthly thru month 6,
Ground Water Treatment System			
Check for leakage at system startup; daily week 1, and; weekly thereafter.	Check weekly.	Discharge manually gauged at startup; weekly month 1; quarterly thereafter, and; weekly flow meter readings.	GAC vessel-to-vessel sampling port and discharge sampling port at system startup, and; monthly thereafter.

5.0 IM REPORTING AND IMPLEMENTATION SCHEDULE

Status reports documenting IM operations will be submitted at least quarterly to the ADEQ. The IM implementation schedule is described below. Implementation of ISCO injections and installation and startup of the pump and treat system may not occur concurrently due to access and permitting requirements. Construction of a building to house the GAC treatment system is dependent on closure of a pending real estate transaction to purchase the property and subsequent review and approval by the City of Fort Smith Planning and Zoning Board to allow the construction of the GAC pump and treat system on the property. Utilization of injection wells is subject to authorization by the UIC Section. A general timeline of activities to prepare and implement the IM is shown below.

Task	*Timeline*	*Duration*
Submit Work Plan to ADEQ	March 12, 2008	
Obtain applicable permits and access agreements.	Concurrent with Work Plan preparation.	Undetermined
Submit ADEQ Notice of Field Activities.	Within 4 weeks of ADEQ approval of Work Plan and receipt of signed access agreements.	
Conduct well installation and development.	Within 2 weeks of ADEQ Notice of Field Activities submittal.	2 to 3 weeks.
Conduct baseline sampling/monitoring	Upon completion of well installation.	1 to 2 weeks.
Conduct ISCO injection.	Within two weeks of receipt of baseline analytical data (assuming authorization by ADEQ UIC Section).	1 week.
Construct ground water treatment facilities.	Within 4 weeks of approval of city Conditional Use Permit.	2 to 3 weeks.
Conduct ground water recovery system operational testing.	Upon completion of treatment system construction.	1 week.
Commence ground water system operation.	Upon completion of system testing.	

Figures

March 17, 2008
Project No. 0079781

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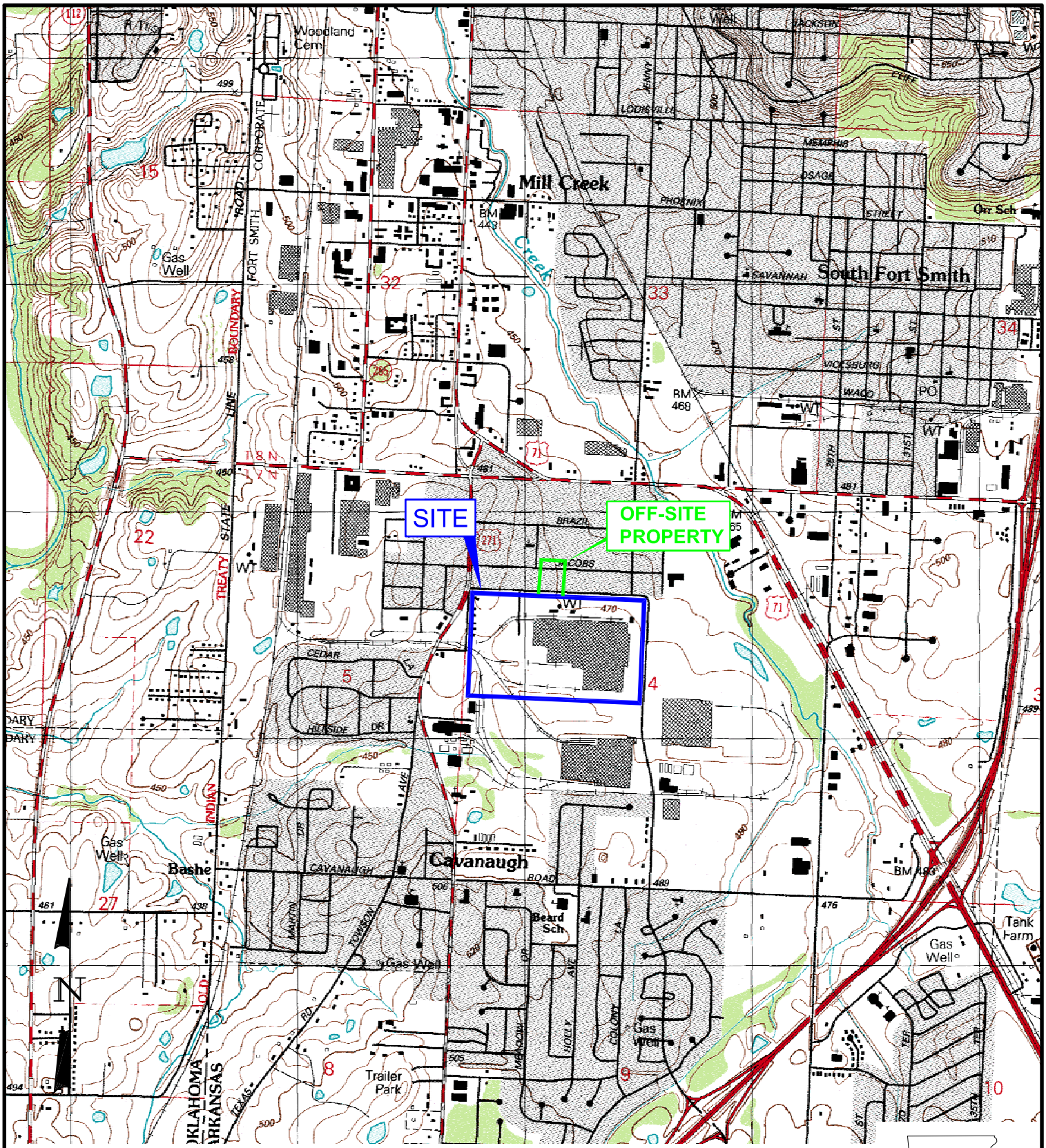

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FIGURE 1-1
SITE LOCATION MAP
Whirlpool Corporation
Fort Smith, Arkansas

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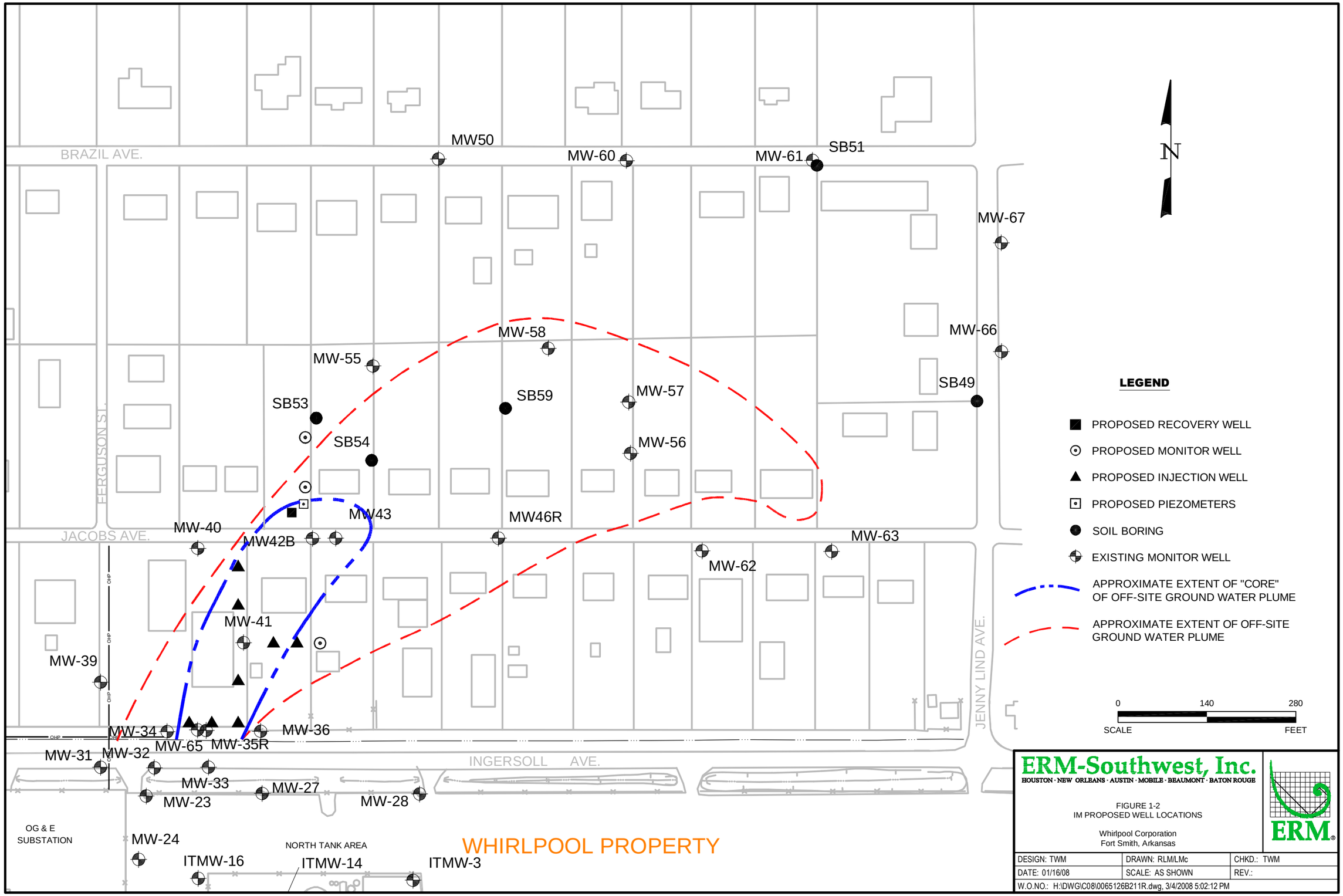

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FIGURE 1-2
IM PROPOSED WELL LOCATIONS

Whirlpool Corporation
Fort Smith, Arkansas

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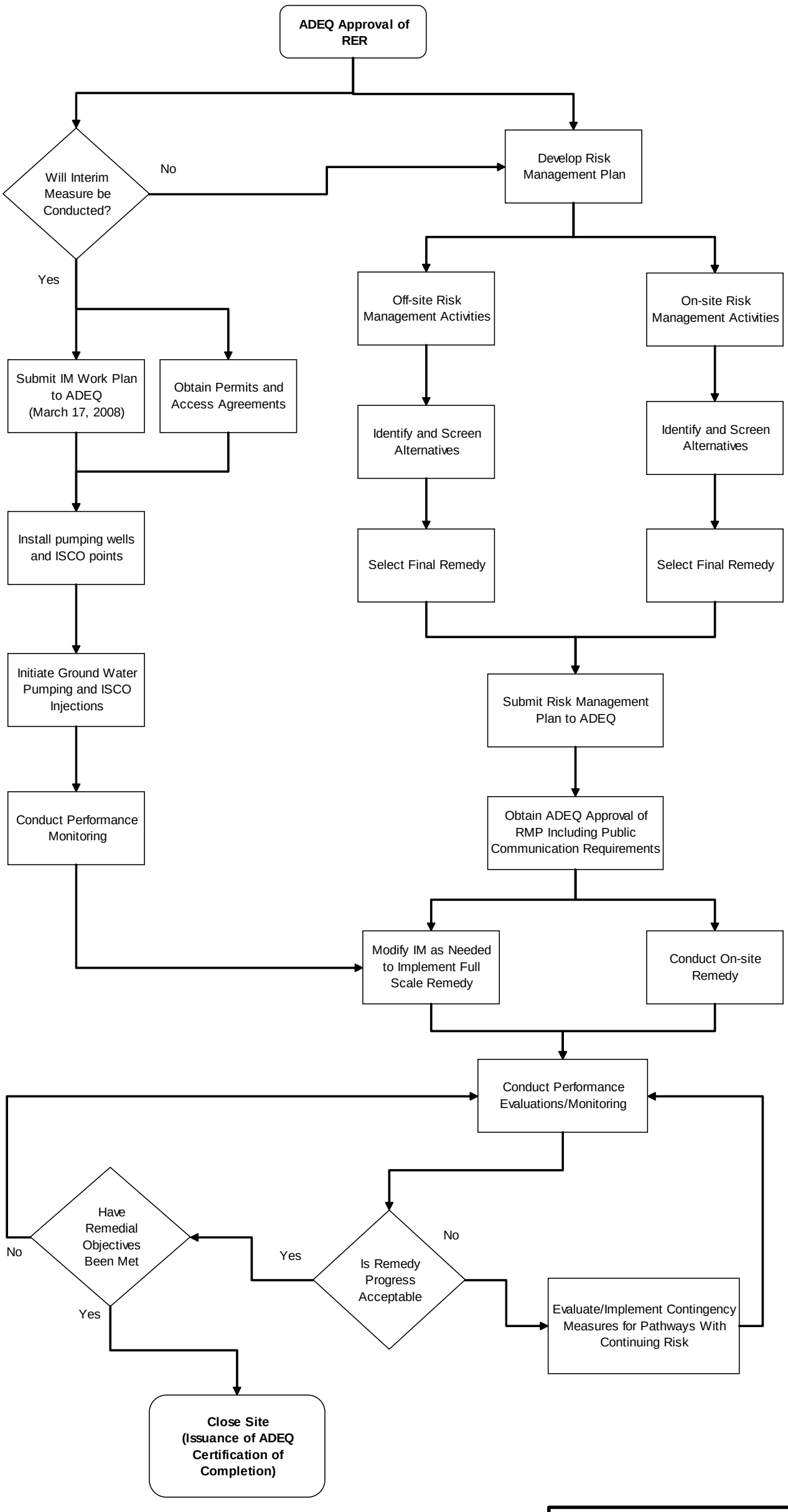

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FIGURE 1-3
IM AND RMP PROCESS FLOW CHART
Whirlpool Corporation
Fort Smith, Arkansas

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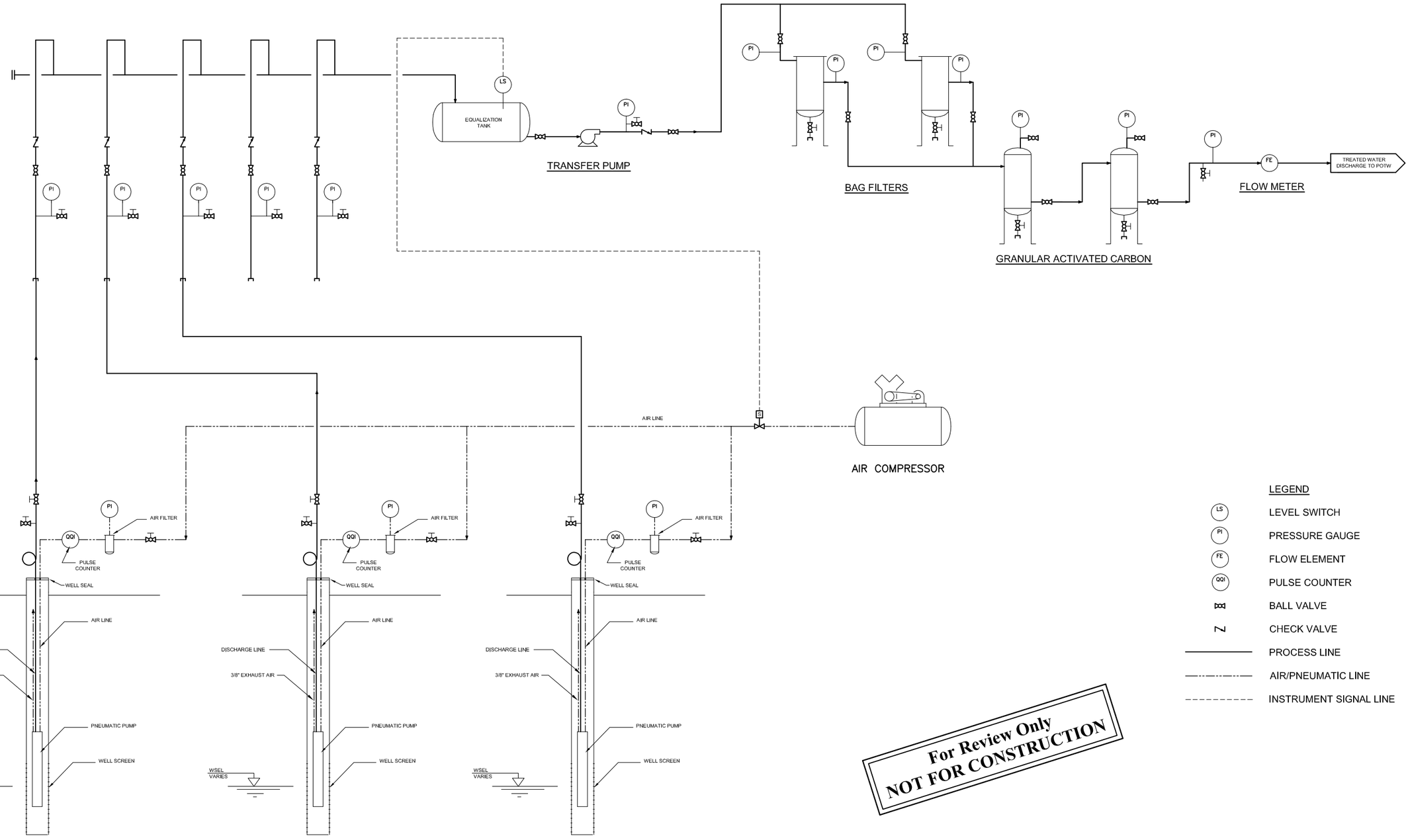

LEGEND

- LS — LEVEL SWITCH
- PI — PRESSURE GAUGE
- FE — FLOW ELEMENT
- QQI — PULSE COUNTER
- BALL VALVE
- CHECK VALVE
- PROCESS LINE
- AIR/PNEUMATIC LINE
- INSTRUMENT SIGNAL LINE

For Review Only
NOT FOR CONSTRUCTION

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FIGURE 2-1
GROUND WATER TREATMENT SYSTEM
PRELIMINARY CONCEPTUAL
PIPING AND INSTRUMENTATION DIAGRAM
WHIRLPOOL CORPORATION
FORT SMITH, ARKANSAS

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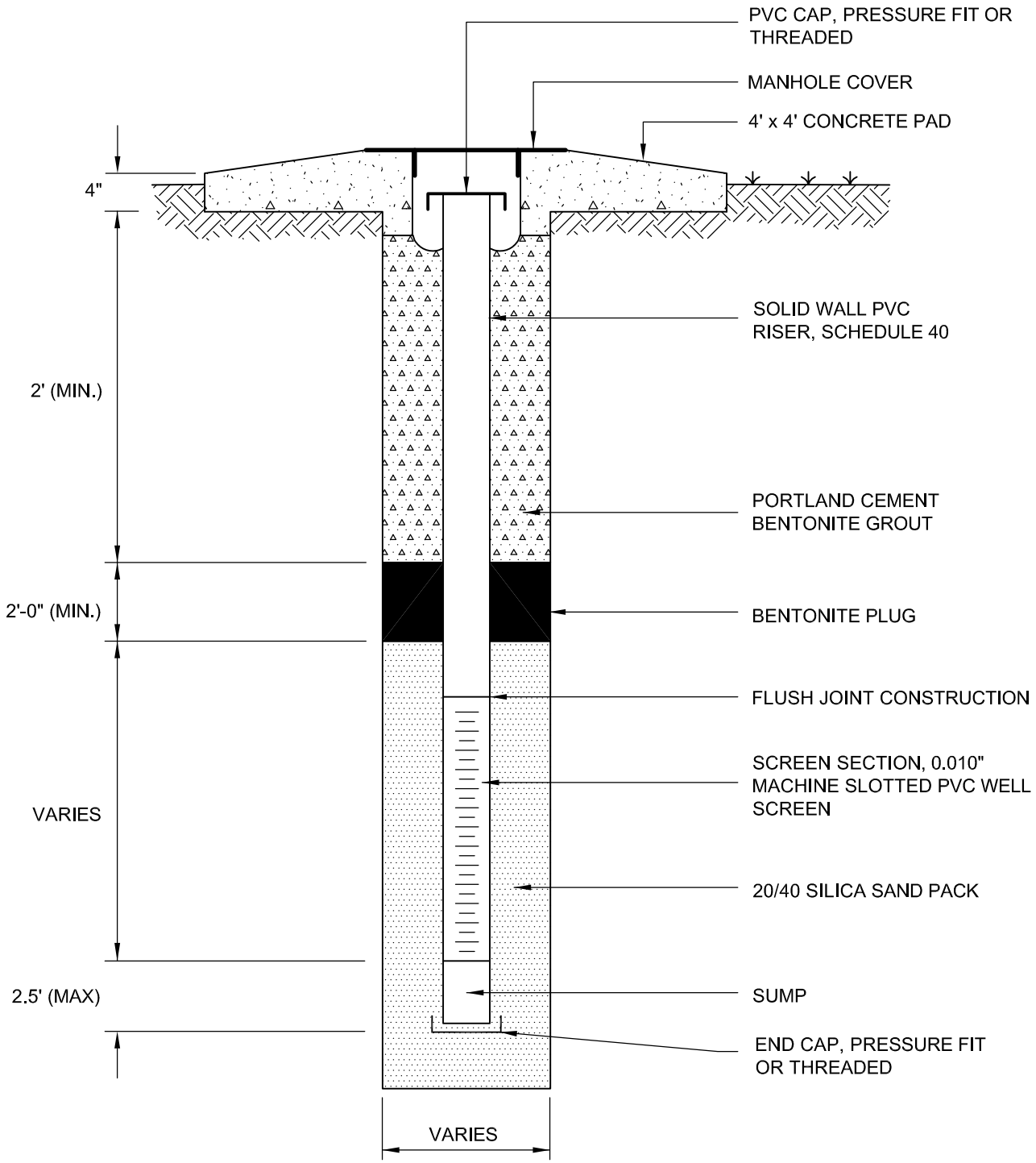

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FIGURE 2-2
TYPICAL CONSTRUCTION WELL
COMPLETED BELOW GRADE
Whirlpool Corporation
Fort Smith, Arkansas

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Sodium Permanganate Fact Sheet

Appendix A

March 17, 2008
Project No. 0079781

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RemOx® L
ISCO Reagent

CAS Registry No. 10101-50-5
EINECS No. 233-251-1

Fact Sheet

RemOx® L ISCO Reagent has been specifically manufactured for environmental applications such as remediation of soils and associated groundwater. This product can be used to degrade a variety of contaminants such as chlorinated solvents, polyaromatic hydrocarbons, phenolics, organo-pesticides and substituted aromatics. RemOx® L ISCO Reagent is shipped with a Certificate of Analysis (COA).

Product Specifications

Assay, %	39.5 - 41.0 as $NaMnO_4$
pH	5.0 - 8.0
Trace Metals	(See Table 1)

Chemical/Physical Data

Formula	$NaMnO_4$
Appearance	Dark Purple Solution
Specific Gravity	1.365-1.385
Shelf Life	18 months
Freezing Point	4° F
Solubility in Water	Miscible with water in all proportions.

Material will pass through a 10 micron filter

Applications

RemOx® L ISCO Reagent is used for soil and groundwater remediation by in-situ or ex-situ chemical oxidation and as active agent in subsurface reactive barriers for treatment of:

- Chlorinated Ethenes-PCE, TCE, Vinyl Chloride, etc.
- Phenolics-PCP, p-Cresol, 2,3 Dichlorophenol, etc.
- Polyaromatic Hydrocarbons-Naphthalene, Phenanthrene, Benzo(a)Pyrene, etc.
- TNT, RDX, HMX, etc.
- Various Pesticides

Benefits

- Concentrated liquid form
- More precise dosing of chemical
- Feed equipment is simplified
- Consistent concentration
- High stability

Shipping Containers

5-gallon (20-L) HDPE Jerrican
(UN Specification: UN3H1/Y1.8/100) Made of high-density polyethylene (HDPE). Weighs 3.5 lb (1.6 kg). The net weight is 57 lbs (25.7 kg). The jerrican stands approximately 13.4 in. tall, 9.4 in. wide, and 13.0 in. deep (33.9 cm high, 23.8 cm wide, and 33.0 cm deep).

55-gallon (208.2L) HDPE TightHead Drum
(UN Specification: UN1H1/Y1.9/150) Made of high-density polyethylene (HDPE). Weighs 22 lbs (10 kg). The net weight is 550 lbs (249.5 kg). The drum stands approximately 34.5 in. tall, has an outside diameter of 23.4 in. (89.1 cm tall, OD 59.4 cm).

275-gallon (1041L) IBC (Intermediate Bulk Container)
(UN Specification: UN31HA1/Y1.9/100) They are also marked "MX" for multi-trip IBC Weighs 139 lbs (65 kg). The net weight is 3000 lb (1161 kg). The IBC contains 263 gallons or 995 liters of product. The IBC dimensions are 45.4 in. high, 48 in. long, and 40 in. wide. The IBC has a 2" butterfly valve with NPT threads in bottom sump. (Domestic)

Bulk Shipping - Quantities up to 4000 gallons are available.

Handling and Storage

Like any strong oxidant RemOx® L ISCO Reagent should be handled with care. Protective equipment during handling should include face shields and/or goggles, rubber or plastic loves, and rubber or plastic apron. If clothing becomes spotted, wash off immediately; spontaneous ignition can occur with cloth or paper. In cases where significant exposure exists use the appropriate NIOSH-MSHA dust or mist respirator is recommended.

Store in accordance with NFPA (National Fire Protection Association) Code 430 requirements for Class II Oxidizers. The product should be stored in a cool, dry area in closed containers. Concrete floors are preferred. Avoid wooden decks. Spillage should be collected and disposed of properly. Contain and dilute spillage to approximately 6% with water, and then reduce with sodium thiosulfate, a bisulfite, or ferrous salt solution. The bisulfite or ferrous salt may require some dilute sulfuric acid (10% w/w) to promote reduction. Neutralize with sodium carbonate to neutral pH, if acid was used. Deposit sludge in an approved landfill or, where permitted, drain into sewer with large quantities of water.

As an oxidant, the product itself is non-combustible, but will accelerate the burning of combustible materials. Therefore, contact with all combustible materials and/or chemicals must be avoided. These include but are not limited to: wood, cloth, organic chemicals, and charcoal. Fires may be controlled and extinguished by using large quantities of water. Refer to the *MSDS* for more information. Avoid contact with acids, peroxides, sulfites, oxalates, and all other oxidizable inorganic chemicals. During contact with hydrochloric acid, chlorine is liberated.

CARUS CHEMICAL COMPANY

Shipping

RemOx® L ISCO Reagent is classified as an oxidizer for both domestic and international transportation. Liquid permanganate is shipped domestically as Freight Class 70.

Harmonized Code for export: 2841.69.0010

Proper Shipping Name: Permanganates, inorganic, aqueous solution n.o.s (contains permanganate).
Hazard Class: 5.1
Identification Number: UN 3214
Packaging Group: II
Label Requirements: Oxidizer, 5.1

Packaging Requirements: 49 CFR Parts 171 to 180
Sections: 173.152, 173.202, 173.242.

Quantity Limitations: 1 liter net for passenger aircraft or railcar;
5 liters net for cargo aircraft.

Vessel Stowage: D-material must be stowed "on-deck" on a cargo vessel, but is prohibited on a passenger vessel. Other provisions: stow separately from ammonium compounds, hydrogen peroxide, peroxides, super-oxides, cyanide compounds and powdered metal.

Compatibility Information

RemOx® L ISCO Reagent is compatible with many metals and synthetic materials. Natural rubbers and fibers are often incompatible. Solution pH and temperature are also important factors. The material selected for use with liquid permanganate must also be compatible with any kind of acid or alkali being used.

In neutral and alkaline solutions, sodium permanganate is not corrosive to carbon steel and 316 stainless steel. However, chloride corrosion of metals may be accelerated when an oxidant such as liquid permanganate is present in solution. Plastics such as Teflon, polypropylene, HDPE and EPDM are also compatible with liquid permanganate.

Aluminum, zinc, copper, lead, and alloys containing these metals maybe be slightly affected by sodium permanganate. Actual corrosion or compatibility studies should be made under the conditions in which RemOx® L ISCO Reagent will be used prior to use.

Table 1: Trace Metal Content and Specifications

	Typical Analysis (mg/kg)	Specification (mg/kg)	DL* (mg/kg)	Element	Typical Analysis (mg/kg)	Specification (mg/kg)	DL* (mg/kg)
Ag	0.036	0.15	0.034	Fe	BDL	2.00	0.053
Al	0.33	2.00	0.24	Hg	BDL	0.03	0.003
As	0.005	4.00	0.006	Ni	BDL	0.10	0.030
Ba	2.26	5.00	0.016	Pb	BDL	0.70	0.16
Be	BDL	0.50	0.08	Sb	BDL	0.70	0.16
Cd	BDL	0.10	0.016	Se	0.0066	0.50	0.0003
Cr	1.99	5.00	0.031	Tl	BDL	3.50	0.8
Cu	0.024	0.10	0.022	Zn	0.024	0.40	0.011

*DL=Detection Limit

Carus Chemical Company

During its 90-year history, Carus' ongoing emphasis on research and development, technical support, and customer service has enabled the company to become the world leader in permanganate, manganese, oxidation, and base-metal catalyst technologies.

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