

July 9, 2010

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

Project No. 0097932

Subject: Interim Measure Status Report for January to June 2010;  
Whirlpool Corporation, Fort Smith, Arkansas

Dear Mr. Mehran:

On behalf of Whirlpool Corporation, Environmental Resources Management Southwest, Inc. (ERM) is pleased to provide this status report on the interim measure (IM) activities as conducted in accordance with the approved Interim Measure Work Plan dated March 17, 2008.

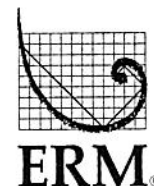
### *Introduction*

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 (the Site) located at 6400 Jenny Lind Avenue, Fort Smith, Arkansas (Figure 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 Site, submitted June 13, 2007, characterized the approximate extent of the off-site ground water plume as having two general components: the "core" and the "fringe" (Figure 2). The RER concluded that there were two exposure pathways that 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 appears to be complete.

### *Objectives*

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 in April 2009 initiated the ADEQ approved Interim Measures (IM) as an early response to target the "core" of the off-site plume.



### *Interim Measures Tasks Completed to Date*

As discussed in the initial IM Status Report, dated January 12, 2010, the IM is being conducted as a two-phased program. The initial phase included two ISCO treatment events (conducted in April 2009 and July 2009) along with a ground water pumping test. The purpose of the initial phase was to evaluate 1) the effectiveness of ISCO at treating the core of the off-site plume and 2) the feasibility of ground water pumping to induce gradients and subsequent flow through the aquifer. The second phase (tentatively scheduled for 3Q 2010) will involve ground water pumping from at least one well to induce gradients and pull permanganate through the plume to effect treatment of the entire core of the plume.

The January 2010 IM Status Report concluded that ISCO treatments are very effective at the site where treatment is applied. The area over which the treatment is effective, however, appears to be highly dependent on local lithology and static ground water flow gradients. Based on the evaluation of ISCO performance data, permanganate had not migrated a measurable distance away from treatment wells over the then three-month evaluation period. Evaluation of aquifer test data indicated that ground water pumping at the well RW-69 could be a viable option for inducing a gradient at the site to help move ISCO reagents through the formation to reach untreated portions of the aquifer.

Tasks completed since the January 2010 IM Status Report include the following:

- ISCO Performance Monitoring was conducted in combination with the May 2010 semi-annual sampling event and included water level gauging, sampling of monitor wells for volatile organic compounds, and field screening for water quality parameters.
- Installation of support equipment at an offsite location for the purpose of ground water pumping using well RW-69 as part of the second phase of the IM.

### *ISCO Performance Evaluation*

Following each ISCO treatment, performance monitoring was conducted in accordance with the Work Plan including:

- 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., oxidation-reduction potential (ORP), dissolved oxygen (DO), temperature, pH, specific conductivity (SC) and chloride (Cl)) to assess the level of impact on the ground water chemistry from the ISCO treatment.

Continuing ISCO performance monitoring was conducted on May 10 through May 13, 2010 in conjunction with the semi-annual sampling event. Wells with visible permanganate in the ground water (IW-72, IW-73, IW-74, IW-75, IW-76, IW-78, IW-79, IW-80, MW-35R and MW-65) were not sampled during sampling event. With two exceptions, all of the treatment area wells

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with no visible permanganate in the ground water were sampled and analyzed during the May 2010 sampling event.

Two wells located along Jacobs street immediately downgradient of the treatment area (MW-42B and MW-43) were damaged between the April and October, 2009 sampling events. To prevent further damage and potential unauthorized access, each well was temporarily capped and sealed. The wells could not be sampled during performance monitoring activities or during the May 2010 sampling event.

#### *Ground Water Sampling Results*

Figures 3 and 4 illustrate TCE concentrations in ground water from the October 2009 and the May 2010 sampling events. Wells with unreacted permanganate were not sampled, since the presence of unreacted permanganate generally implies complete destruction of the TCE. Additionally, purging those wells would remove a small volume of the treatment solution.

In the previous status report, a slight decrease in TCE concentrations was observed in monitoring points adjacent to the ISCO treatment wells (i.e., wells MW-32, MW-33, MW-41, MW-46R, and IW-77). Based on May 2010 data, TCE concentrations were stable or continued to decline in wells IW-77 and MW-71 (Table 1). TCE concentrations appeared to have increased in wells MW-41 and RW-69.

ORP performance monitoring between the treatments in 2009, suggests the radius of influence for ISCO treatment ranges from 5 to 45 feet. The variation is generally consistent with lithological characterizations of the aquifer: wells in gravel-rich areas have larger radius of influence than wells in clay-rich areas.

Based on ORP measurements and qualitative field observations in May 2010, unreacted permanganate remains within 40 to 50 feet of ISCO treatment wells; even ten months after treatment. Additionally, it appears that the influence of the ISCO treatments evidenced by increasing ORP values or changes in TCE concentrations have been observed at distances of up to 400 feet from the ISCO treatment wells. ORP values have increased in wells IW-77, MW-28, MW-36, MW-39, and MW-68. In addition, there also appear to be some areas where permanganate has begun to be depleted or its influence has decreased. For example, ORP values have dropped in wells MW-71, MW-34, MW-41, MW-65, and RW-69 (although the ground water in well MW-65 is still pink from the permanganate). ORP values from the October 2009 and May 2010 sampling events are presented in Figures 3 and 4. The changes in ORP concentration in wells adjacent to ISCO treatment wells are shown in Table 2. The inferred area of unreacted permanganate is indicated on Figure 4.

The analytical data suggest permanganate treatment continues to be very effective within the radius of influence of the injection well. The fact that permanganate has not migrated further away from the treatment wells supports conclusions from earlier site data that the aquifer is characterized by highly permeable soils within the gravel-rich zone but given the limited amount of saturated thickness, has low transmissivity. Therefore, ground water in the areas where treatment was applied is fairly stagnant. It is expected that migration of unreacted

permanganate into the plume will be slow due to the very low gradients in the area between Ingersoll and Jacobs.

The exception to this conclusion (potentially evidenced by data from MW-46R from October 2009 and wells MW-28, MW-39, and MW-68 in May 2010) may be the presence of some flow along interconnected gravel rich zones or channels<sup>1</sup>. While such interconnectedness has not been observed directly, it may be responsible for the current configuration of the plume and the fact that impact of ISCO was apparent at MW-46R.

#### *Phase II IM Activities Completed January to June 2010*

During April and May 2010 support equipment has been installed near well RW-69 for the purpose of initiating ground water pumping. The purpose of the ground water pumping portion of the IM is to induce a gradient at RW-69 and pull permanganate through the plume to effect treatment of the entire core of the plume. During May 2010 the following equipment and infrastructure was installed at an offsite property owned by Whirlpool located at 1501 Jacob Avenue:

- Concrete and gravel driveway and culvert to provide access to the property;
- Small shed (5 by 7 feet) to house a low noise compressor to power the ground water pump in well RW-69;
- 8-foot wooded privacy fence around the shed;
- Underground piping from well RW-69 to the shed; and
- Electrical power box.

In addition to the construction activities listed above, a 120-day temporary use permit application was filed with the City of Fort Smith to operate the ground water pumping system. Ground water pumping will start following final approval of the temporary use permit and approval of an amendment to the Whirlpool industrial user water discharge permit by the City. It is currently anticipated that ground water pumping will start in July 2010. IM performance monitoring will continue during Phase II of the IM activities to assess the effectiveness of ground water pumping to pull permanganate through the plume to effect treatment of the entire core of the plume.

#### *Conclusion and Path Forward*

ORP data, visual observations, and analytical data collected during Phase 1 of the IM suggest that ISCO treatments are very effective at the site where treatment is applied. The area over which the treatment is effective, however, appears to be highly dependent on local lithology and static ground water flow gradients. Based on the evaluation of ISCO performance data,

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<sup>1</sup> While the concentration of TCE in well MW-46R decreased and the ORP concentration increased in October 2009 as compared to April 2009; both the TCE concentration and the ORP value increased in May 2010 as compared to October 2009.

permanganate has not migrated a measurable distance away from treatment wells over the ten-month evaluation period.

IM performance monitoring is ongoing. The aquifer has remained stagnant and permanganate has not moved adequately through the core of the plume; therefore, the second phase of the IM will be initiated. The January 2010 IM Status Report indicated that ground water pumping at the well RW-69 could be a viable option for inducing a gradient at the site to help move ISCO reagents through the formation to reach untreated portions of the aquifer. A schedule for further IM implementation is included in Table 3.

Should you have any questions, please contact us.

Sincerely,

Environmental Resources Management Southwest, Inc.



Reed Miner, P.G. (Arkansas)

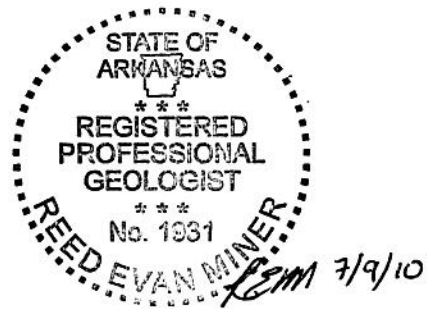


Troy W. Meinen

TWM/skd

Attachments

cc: Robert J. Karwowski, Whirlpool Corporation  
Jerry Scott Horton, Whirlpool Corporation  
H. Reiffert Hedgcoxe, Environmental Resources Management Southwest, Inc.



## **Tables**

*July 9, 2010*  
*Project No. 0097932*

**Environmental Resources Management Southwest, Inc.**  
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Houston, Texas 77084-5140  
(281) 600-1000

TABLE 1

Trichloroethene (TCE) Concentrations in the Vicinity of Treatment Wells  
Pre- and Post- ISCO

Fort Smith Interim Measure  
Whirlpool

Well ID	Pre-ISCO April 2009	Post ISCO October 2009	Post ISCO May 2010
IW-77	0.570	0.380	0.260
MW-32	0.047	0.068	0.058
MW-33	1.20	1.20	1.10
MW-41	0.660	0.180	0.610
MW-46R	0.460	0.390	0.610
RW-69	0.062	0.200 (12/09)	0.170
MW-71	---	0.190	0.160

## NOTES:

1. TCE concentrations reported in mg/L.
2. NS - Not Sampled due to presence of unreacted permanganate.



TABLE 2

ORP Concentrations in the Vicinity of Treatment Wells  
Pre- and Post- ISCO

Fort Smith Interim Measure  
Whirlpool

Well	Pre-Treatment	Post Treatment	
	April 2009	October 2009	May 2010
MW-23	-77	334	377
MW-24	-109	313	349
MW-28	--	104	246
MW-32	-248	321	347
MW-33	-173	333	366
MW-34	-257	613	416
MW-35R	-98	743	697.3
MW-36	-308	183	392
MW-39	-329	274	404
MW-40	-313	269	396
MW-41	-339	144	-127.6
MW-43	-104	35 (5/8/09)	Damaged
MW-46R	-115	274	411
MW-65	-320	773	21.4
MW-68	-318	-33	260
RW-69	-90	184 (8/26/09)	-65.2
MW-71	--	79	-129.2
IW-72	-73	796	714
IW-74	-283	795	697
IW-76	-301	774	774
IW-77	-192	238	461.3
IW-78	--	767	649.9
IW-80	-205	784	707

Concentrations in mV



TABLE 3

IM Phase 2 Implementation Schedule

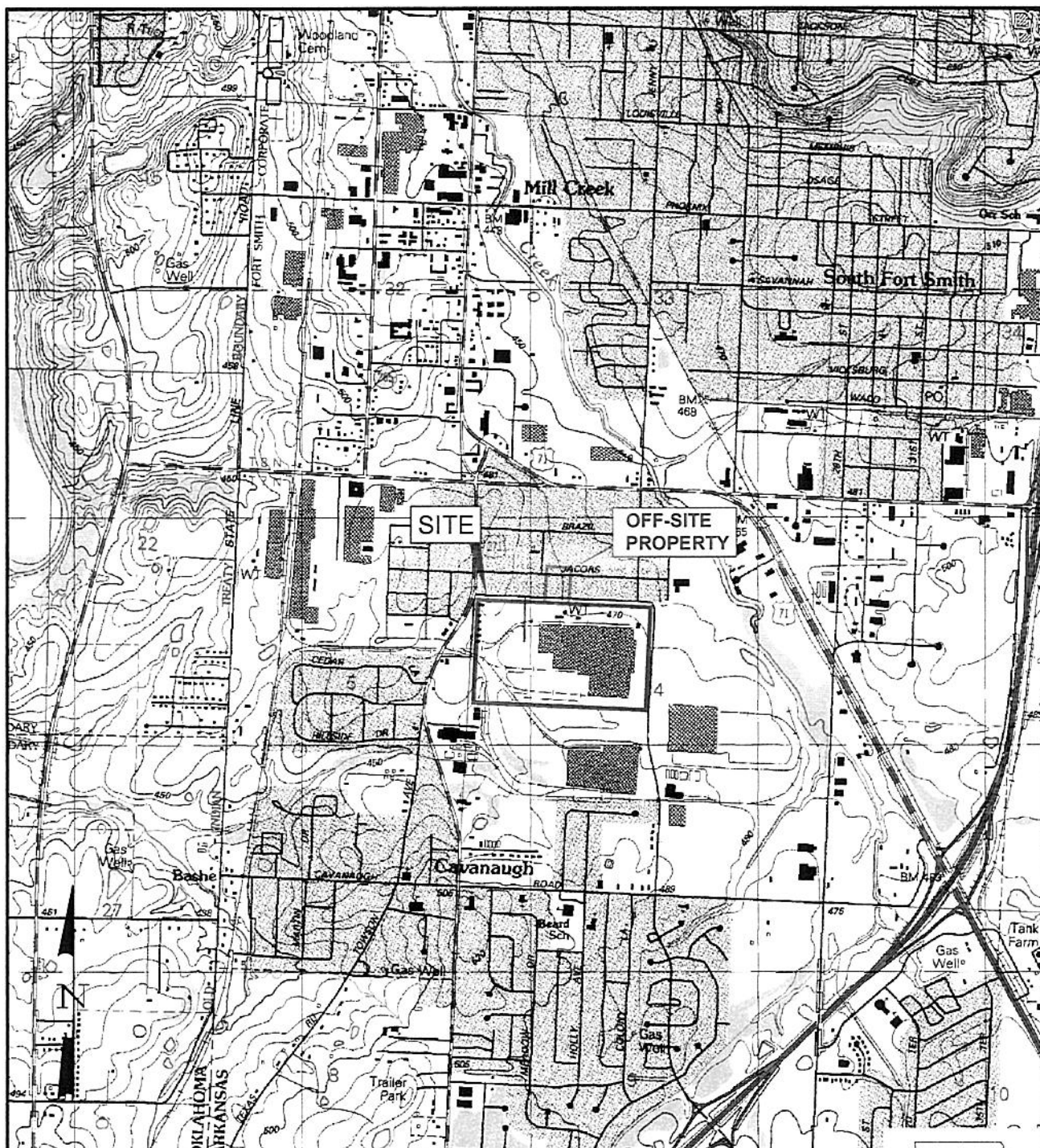
Fort Smith Interim Measure  
Whirlpool

Activity	Time Period
IM Pumping Well Design	Done
IM Pumping Well Installation	Done
IM Ground Water Recovery	Third Quarter 2010/Fourth Quarter 2010
IM Evaluation	First Quarter 2011

## **Figures**

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SOURCE: U.S.G.S. 7.5' QUADRANGLE, SOUTH FORT SMITH, ARK.-OKLA., (p35094C4) 1987.

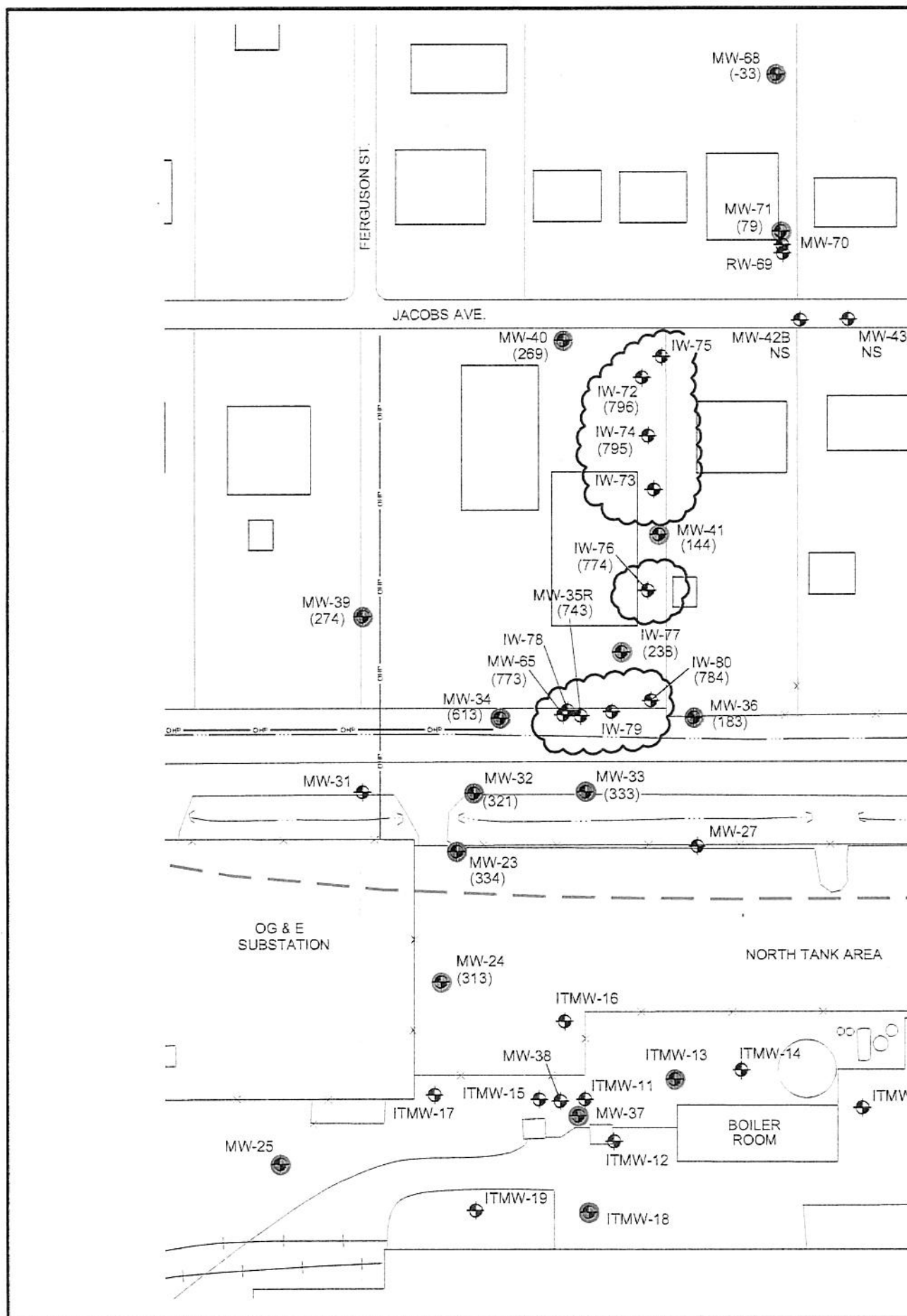
QUADRANGLE LOCATION

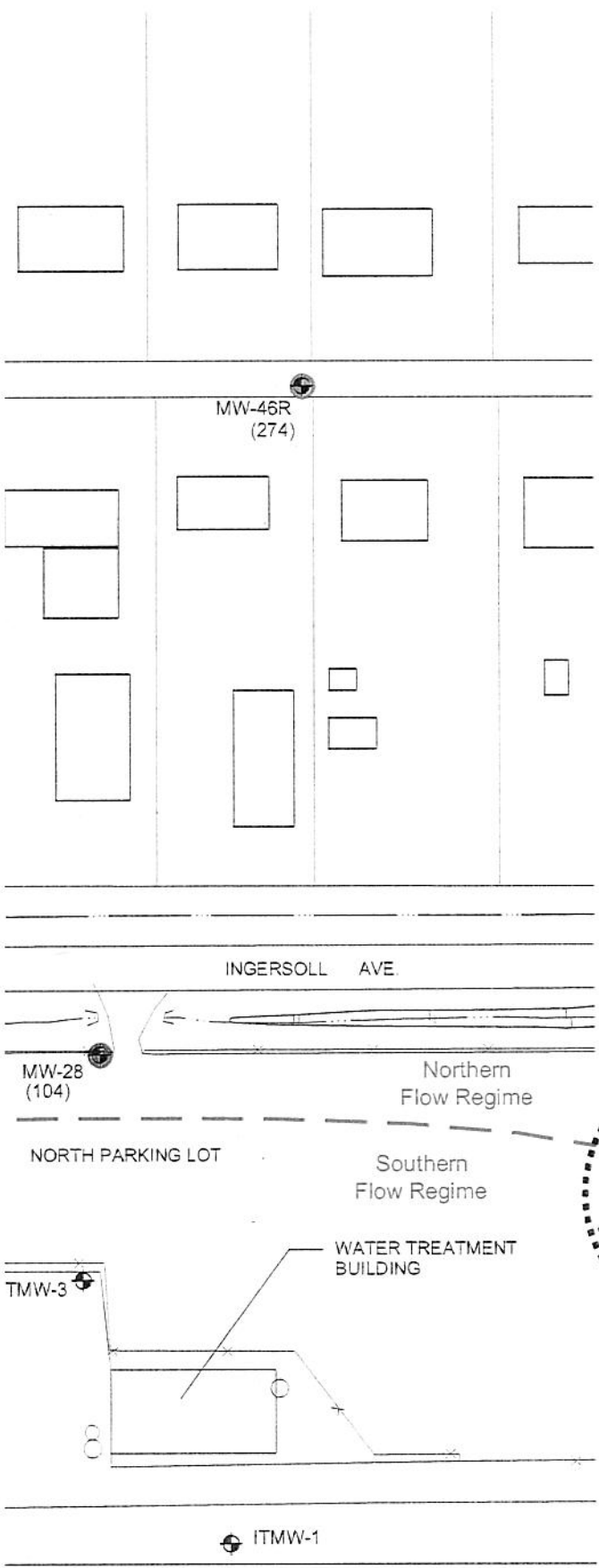
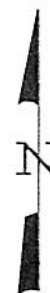
## Environmental Resources Management

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FIGURE 1  
SITE LOCATION MAP  
Whirlpool Corporation  
Fort Smith, Arkansas







**LEGEND**

EXISTING MONITORING WELL

NS NOT SAMPLED

(743) ORP READING (mV)

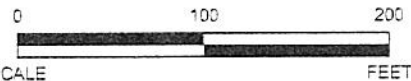
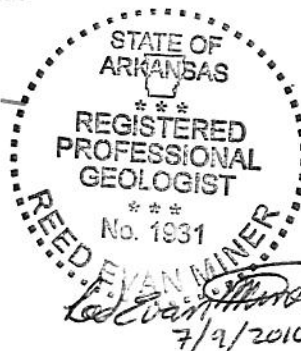
TCE CONCENTRATION (mg/l)  
OCTOBER 2009

- < 0.005
- 0.005 to 0.10
- 0.10 to 1.00
- 1.00 to 10.0
- ≥ 10.0

PERMANGANATE  
PRESENT IN WELL

**NOTE:**

WELLS WITHOUT ANY COLOR WERE  
NOT SAMPLED DURING THE OCTOBER  
SAMPLING EVENT.

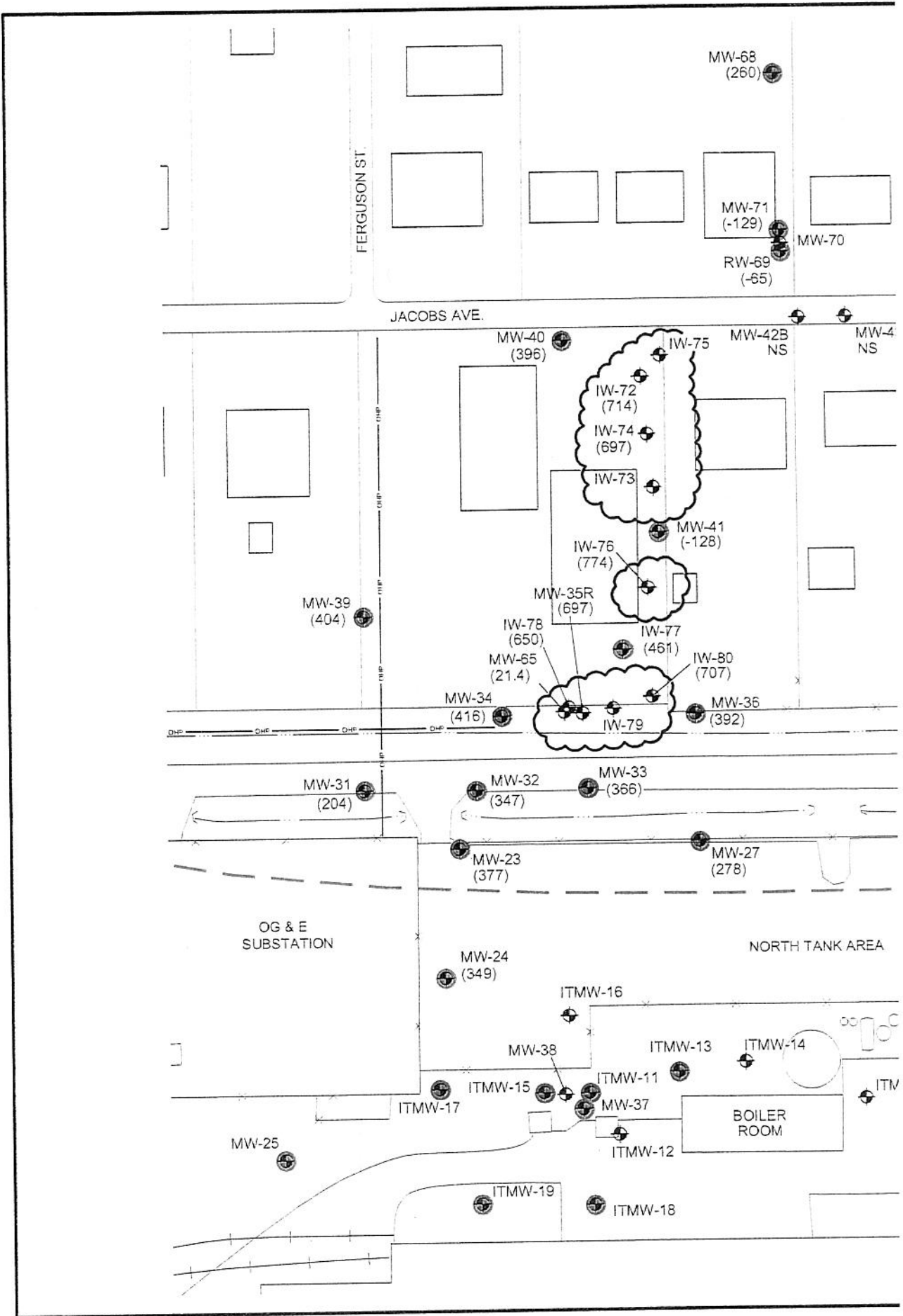


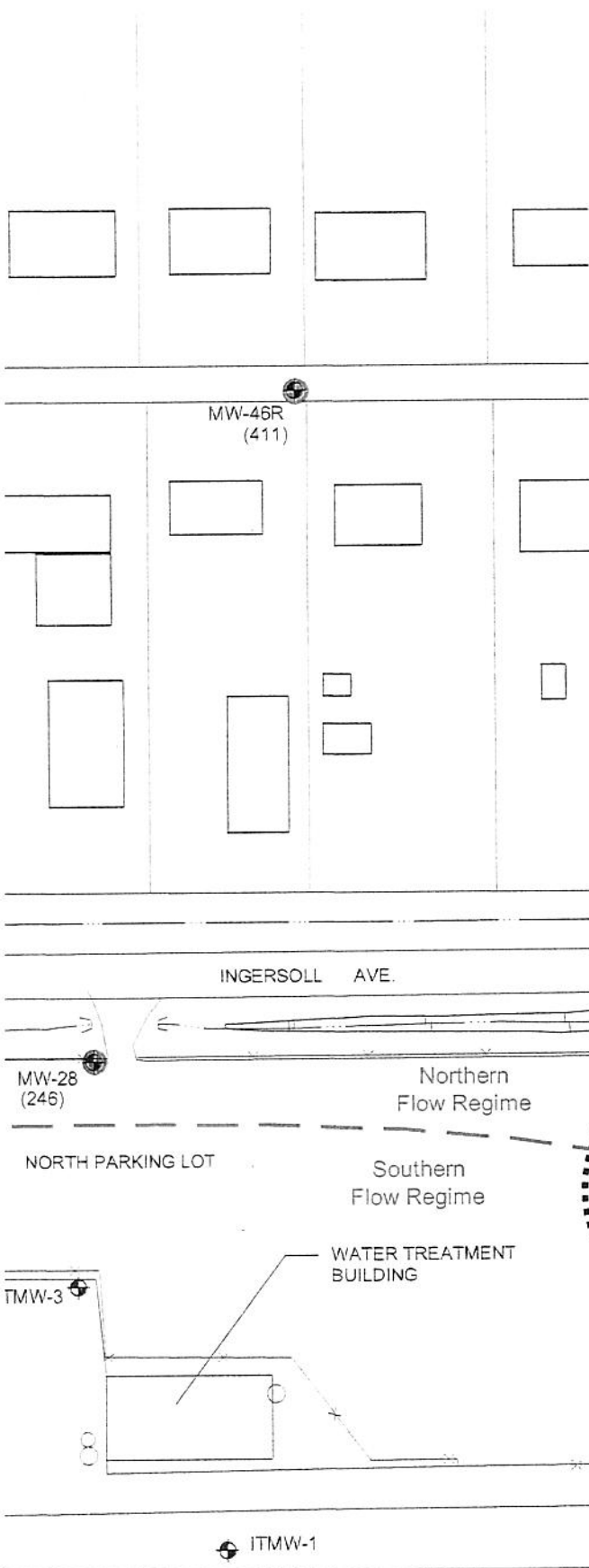
**Environmental Resources Management**

FIGURE 3  
FALL TCE ISOCONCENTRATION MAP  
OCTOBER 2009  
Whirlpool Corporation  
Fort Smith, Arkansas



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#### LEGEND

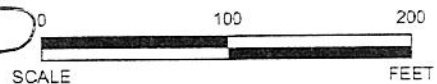
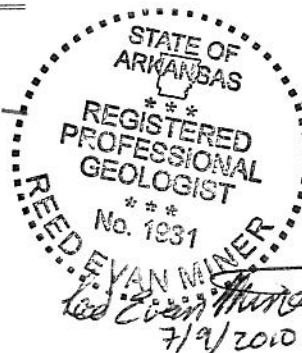
- EXISTING MONITORING WELL
- NS NOT SAMPLED
- (743) ORP READING (mV)

#### TCE CONCENTRATION (mg/l) OCTOBER 2009

- < 0.005
- 0.005 to 0.10
- 0.10 to 1.00
- 1.00 to 10.0
- ≥ 10.0
- PERMANGANATE PRESENT IN WELL

#### NOTE:

WELLS WITHOUT ANY COLOR WERE NOT SAMPLED DURING THE OCTOBER SAMPLING EVENT.



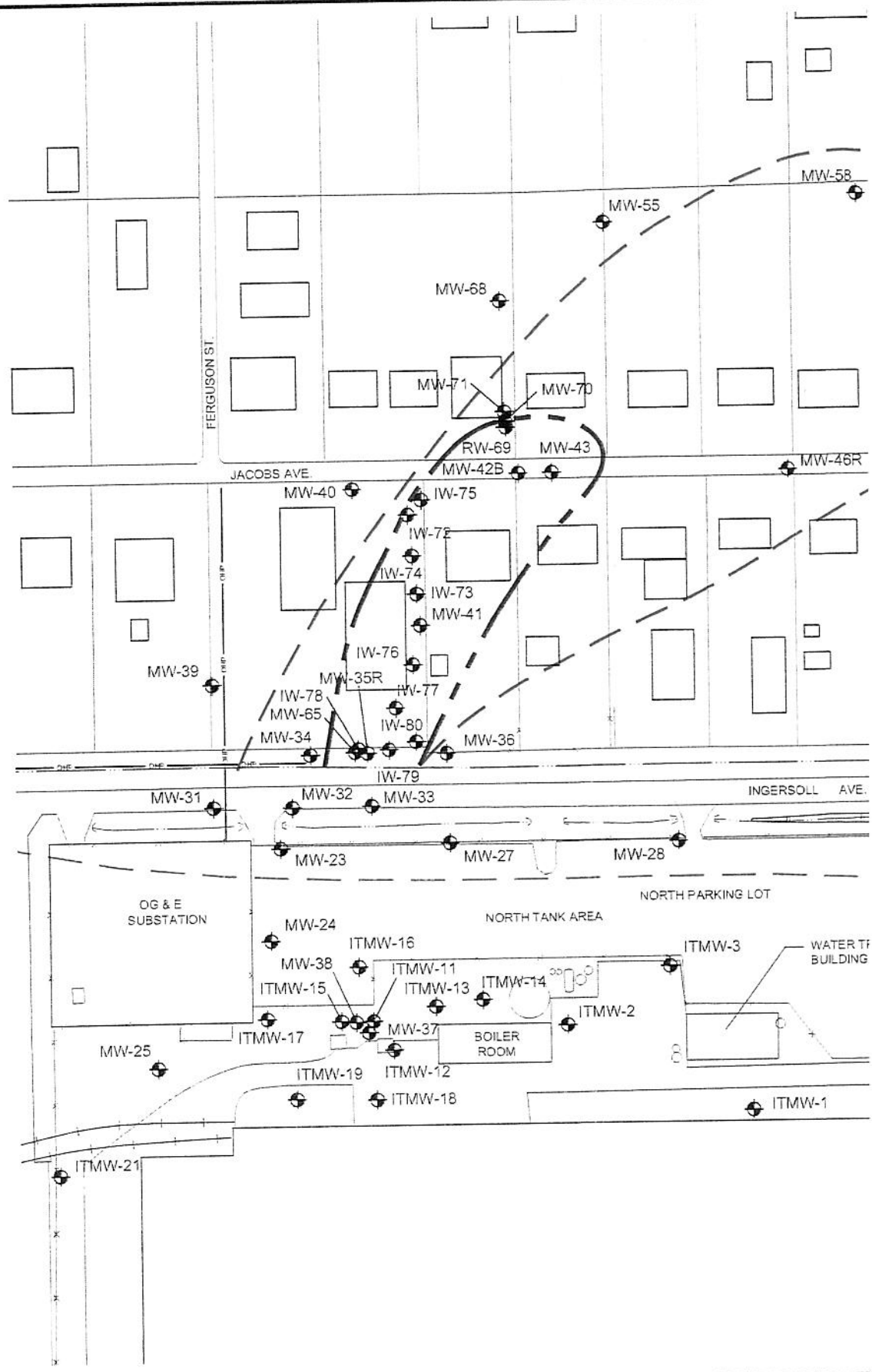
### Environmental Resources Management

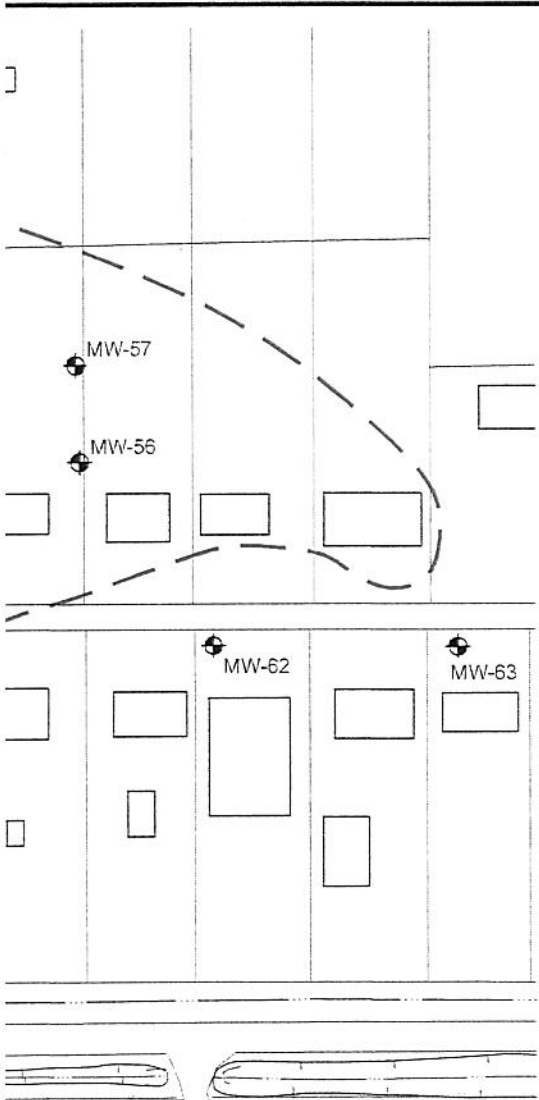
FIGURE 4  
TCE ISOCONCENTRATION MAP  
MAY 2010  
Whirlpool Corporation  
Fort Smith, Arkansas



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**LEGEND**



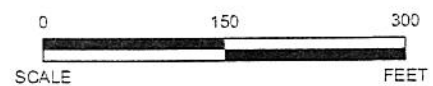
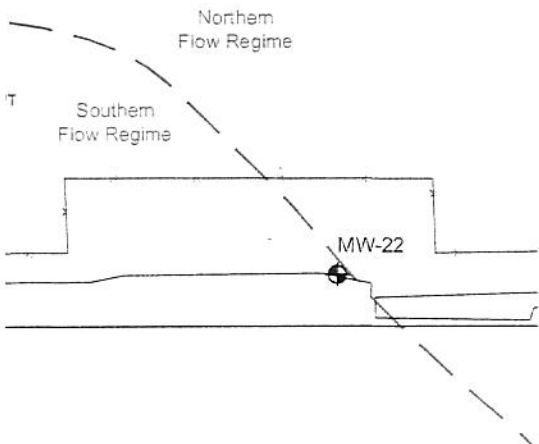
EXISTING MONITORING WELL



APPROXIMATE EXTENT OF "CORE"  
OF OFF-SITE GROUND WATER  
PLUME



APPROXIMATE EXTENT OF  
OFF-SITE GROUND WATER PLUME



**Environmental Resources Management**

FIGURE 2  
IM WELL LOCATIONS

Whirlpool Corporation  
Fort Smith, Arkansas



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