Additional Site Investigation Report

N.W. Mauthe Site, System Evaluation

Prepared for

Wisconsin Department of Natural Resources
Bureau for Remediation & Redevelopment

April 24, 2007

WDNR BRRTS Number 02-45-000127
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Evaluation of the Collection and Treatment System, N.W. Mauthe Site Conducted For The Wisconsin Department of Natural Resources

Additional Investigation Report

N.W. Mauthe Site
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List of Acronyms and Abbreviations

ARARs	Applicable or Relevant and Appropriate Requirements
BRRTS	Bureau for Remediation and Redevelopment Tracking System
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
ch. Wis. Adm. Code	Chapter of the Wisconsin Administrative Code
EPA	United States Environmental Protection Agency
ES	Enforcement Standard
FBGS	Feet Below Ground Surface
GIS	Geographic Information System
GPM	Gallons Per Minute
Mauthe	N.W. Mauthe
meq/100g	Milli-equivalents per 100 grams
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MSL	Mean Sea Level
OMNNI	OMNNI Associates, Inc.
PAL	Preventive Action Limit
PID	Photoionization Detector
PLC	Programmable Logic Controller
PPM	Part Per Million
RA	Remedial Action
RI	Remedial Investigation
ROD	Record of Decision
ug/L	Micrograms per liter
USGS	United States Geological Survey
VOCs	Volatile Organic Compounds
WDNR	Wisconsin Department of Natural Resources
WTM	Wisconsin Transverse Mercater

EXECUTIVE SUMMARY

The following report outlines the additional investigation conducted by OMNNI Associates, Inc. (OMNNI) at the N.W. Mauthe (Mauthe) property located at 725 S. Outagamie Street, Appleton, Wisconsin 54914-5072. (See Figure 1 – Site Location Map, Appendix 1.)

Investigative activities prior to 1995 and the United States Environmental Protection Agency (EPA) soil removal encountered elevated levels of volatile organic compounds (VOCs) and metals in the soil and groundwater at the Mauthe site and surrounding properties. VOCs included trichloroethene, 1,1,1-trichloroethane, 1,1-dichloroethene, and toluene. Metals included cadmium, chromium (hexavalent and total), cyanide, and zinc.

The EPA installed a groundwater collection trench system in 1995 and a groundwater treatment facility in 1996. The purpose of the collection trench system was to contain and collect the groundwater contamination prior to piping it to the facility for treatment. After treatment, groundwater was discharged to the City of Appleton sanitation system for additional treatment at the City's wastewater treatment facility. The EPA's efforts were focused on mitigating the immediate risk. The EPA transferred project management of this site to the Wisconsin Department of Natural Resources (WDNR) for routine operation and maintenance in 1998.

In January 2005, the WDNR requested an evaluation of the groundwater collection and treatment system at the Mauthe site. The installation of four piezometers was part of the evaluation to understand the extent of contaminants in the soil and groundwater. At the request of the WDNR, OMNNI installed five additional monitoring wells on May 24, 2006, to further understand the extent of contaminants in the soil and groundwater in the former source area.

The results of the additional investigation conducted show contamination remains in the soil above ch. NR 720 Wis. Adm. Code levels, in the groundwater above ch. NR 140 Wis. Adm. Code enforcement standards, and in the groundwater above the applicable or relevant and appropriate requirements (ARARs) established for the Mauthe site. Groundwater does not appear to be impacted at depth based on the piezometer groundwater analysis.

The data collected from the additional areas investigated assisted in further delineating soil and groundwater contamination and with estimating the timeframe to achieve cleanup goals identified by EPA in the record of decision (ROD). Using both newly acquired data and historical data, OMNNI conducted a groundwater flow and transport model simulating contaminant movement at the Mauthe site. The model indicated that exceedances of the 5 μg/l closure standard for chromium

in the groundwater will continue to occur for many hundreds of years at the site, whether or not the present groundwater collection system continues to operate.

In preparation for the treatment system evaluation, OMNNI reviewed nine years of groundwater sampling data. Statistical analysis of the data indicated that it was unlikely that the influent into the treatment system would exceed the Appleton wastewater discharge permit requirements. The City agreed to an eight week direct discharge pilot study starting April 18, 2006. After successfully completing the pilot study, the City modified the permit to allow for direct discharge of the groundwater collected from the existing trench system. Since treatment of the collected groundwater is no longer required, additional treatment system evaluation was unnecessary. However, there are two manholes associated with the collection system. Hydrogen sulfide odors have been detected in both manholes. There is an ongoing effort to determine the concentrations of hydrogen sulfide and what modifications to the collection system may be necessary.

GENERAL INFORMATION

Project Title

Evaluation of the collection and treatment system, N.W. Mauthe Site

Project Identification Numbers

WDNR Bureau for Remediation and Redevelopment Tracking System (BRRTS) Number: 02-45-000127.

WDNR Contract Number: 05RRYU.

Facility Identification Number: 445014460.

EPA CERCLIS Identification Number: WID083290981.

OMNNI Associates, Inc. Project Number: N1866A05.

Purpose

The purpose of the project was to evaluate the existing collection and treatment system at the Mauthe site[1]. Four piezometers were to be installed to delineate the vertical extent of chromium contamination and evaluate the capture zone of the existing collection system. The existing treatment system was to be evaluated to

[1] Reference Scope of Work for Evaluation of the Collection and Treatment System and Proposal for Modifications at N.W. Mauthe, 725 South Outagamie Street, Appleton, Wisconsin, WDNR Proj: RRYU, dated August 31, 2004, for project purpose definition.

determine if modifications to the system could be made to increase the system's efficiency and/or reduce operations and maintenance costs.

During the treatment system review, it was decided that additional soil and groundwater information from the former source areas would be beneficial. Five monitoring wells were to be installed in the former source areas identified during the initial remedial investigation (RI) to delineate the vertical extent of contamination remaining in these areas[2]. Groundwater modeling of the site was also to be conducted to assist in the determination if the current remedial strategy was a cost-effective approach to obtaining site remedial goals identified in the ROD (1992 PALs).

The additional investigative activities were not intended to be a complete site investigation. The additional work was to supplement the previous site investigation and indicate site conditions after almost 10 years of groundwater capture and treatment. Only the newly installed piezometers and monitoring wells were sampled for this project. Data on existing monitoring points can be found in the quarterly progress reports and semi-annual operation and maintenance reports for the site.

Contact Information

Property Owner:	N.W. Mauthe, Contact: Carol Mauthe.
Regulatory Agency:	Wisconsin Department of Natural Resources, Bureau for Remediation and Redevelopment Ms. Jennifer Borski, Project Manager, 625 E. County Road Y, Suite 700, Oshkosh, WI 54901-9731, Tel.: 920/424-7887, Fax: 920/424-4404; jennifer.borski@wisconsin.gov.
Consultant:	OMNNI Associates, Inc. Mr. Brian Wayner, Project Manager, One Systems Drive, Appleton, WI 54914-1654, Tel.: 920/735-6900, Fax: 920/830-6100; bwayner@omnni.com.
Driller:	Environmental Drilling Services, Inc. Mr. Tom Vande Yacht, 3671 Monroe Road, De Pere, WI 54115; Tel.: 800-236-0337. Midwest Engineering Services, Inc. Mr. John D. McAfee, 1125 Tuckaway Lane, Suite B, Menasha, WI 54952; Tel.: (920) 735-1200.

[2] Reference N.W. Mauthe, System Evaluation (02-45-000127) Additional Monitoring Wells and Modeling Services, dated May 3, 2006.

Analytical Laboratory: Pace Analytical Services, Inc.
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Site Location

The additional investigation encompasses the Mauthe property and two off-site properties, which are located at 1428 W. Second Street and 1414 W. Second Street. The project is located in the NE¼, NW¼, Section 34, T21N, R17E, Outagamie County. (See Figure 1 – Site Location Map, Appendix 1.)


Photo 1 - Mauthe Treatment Facility

Geographic coordinates of the Mauthe site are 645411, 421476 and were obtained from the on-line GIS Registry of Closed Remediation Sites at a scale of 1:1,604 using the Wisconsin Transverse Mercater '91 (WTM) coordinate system. (See Figure 2 – Property Identification, Appendix 1.)

The Mauthe property's tax parcel identification number is 313011500. Outagamie County property record describes the property as "LENOX PARK ADDN 3 WD 141D227 LOT 12,13,14 &15 BLK 3 1501 W MELVIN ST & 725 S OUTAGAMIE ST 9086M22." The property is zoned manufacturing.

BACKGROUND INFORMATION

Site History

The Mauthe site was a former electroplating facility. The facility consisted of a zinc building and a chromium building. Zinc, cadmium, copper, and possibly silver were electroplated in the zinc building from 1978 to 1987. Hard chromium plating was conducted in the chromium building from 1960 to 1976. In 1982, the WDNR received a report that yellowish-green water was observed south of the chromium building. Apparently, for several years plating solutions and waste solvents had leaked from holding vats and tanks, and sump pumps allegedly discharged plating tank solutions onto the ground outside the facility.

The WDNR began an investigation of the site in April 1982. A shallow groundwater collection system was installed parallel to the railroad tracks in May 1982, where groundwater and surface water were collected for two years. The Mauthe site was added to the National Priorities List in 1989.

From November 1991 to May 1992, CH2M HILL performed a RI for the WDNR[3]. The RI showed the greatest concentrations of soil and groundwater contamination in the area around the zinc and chromium buildings. The chemicals most often detected above background levels or state standards included total chromium, hexavalent chromium, zinc, cadmium, cyanide, trichloroethene, 1,1,1-trichloroethane, 1,1-dichloroethene, and toluene. Subsurface soil contamination was detected up to 25 feet deep near the former buildings. Groundwater contamination extended over most of the block bordered by Melvin, Outagamie, and Second Streets.

CH2M HILL conducted a feasibility study for the WDNR[4]. A ROD was signed in March 1994.

Remedial design/remedial action activities took place at the Mauthe site in a phased approach. Phase I, which took place in 1995, involved the excavation of contaminated soils and the installation of groundwater containment trenches. Phase II, which took place in 1996, involved the construction of a groundwater treatment system, which began operation in June 1997. Active treatment of collected groundwater ended on April 18, 2006 with approval for direct discharge by the City. Collected groundwater is now discharged directly to the sanitary sewer system for treatment at the City of Appleton waste water treatment facility.

Site Description

The site is located within the City of Appleton limits in an area of mixed commercial, light industrial, and residential properties. The property is approximately one acre in size and triangular in shape. (See Figure 3 – Site Detail Map, Appendix 1.) Melvin Street borders the site to the north, a parking lot owned by Miller Electric and Manufacturing Company is on the west, and railroad tracks are on the southeast. Private residences are located north of Melvin Street and south of the railroad tracks. The former zinc building was located on the northeast portion of the property. The former chromium building was located on the southwest portion of the property. Approximately half of the land immediately surrounding the site contains impervious structures or paved roads and parking areas.

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[3] The remedial investigation is documented in the *Remedial Investigation Report, N.W. Mauthe Site, Appleton, Wisconsin*, dated February 1993.
[4] The feasibility study is documented in the *Feasibility Study Report, N.W. Mauthe Site, Appleton, Wisconsin*, dated May 1993.

Groundwater Collection System

The groundwater collection system consists of three trenches. The west trench crosses the Miller Electric property to the west of the site and is approximately 200 linear feet in length. The central trench runs south of the site parallel to the railroad and is approximately 280 linear feet in length. The southeast trench runs along Second Street and Outagamie Street and is approximately 600 linear feet in length. (See Figure 3 – Site Detail Map, Appendix 1.)

The groundwater treatment system was designed to capture groundwater containing contaminates at concentrations greater than 1992 ch. NR 140, Wis. Adm. Code preventative action limits (PALs) as approved in the ROD. The west trench and southeast trench were located outside the estimated extent of the groundwater contamination and are designed to prevent further migration of groundwater contamination. The central trench was designed to collect contaminated groundwater and prevent further migration of the groundwater contamination off-site.

Groundwater enters the trenches based on the head differential between the local water table and the level maintained in the trench. The trenches are backfilled with course sand. A 6-inch perforated high-density polyethylene collection pipe in the bottom of the trench drains water from the trench to manholes where the water is collected and pumped to the groundwater treatment facility (Photo 1, pg 3).

In normal operation, the water level in the trenches is maintained at or near the bottom of the trench. The trenches can provide storage and continue to act as a hydraulic barrier until the water in the trench rises to the level of the water table. This storage capacity can be taken advantage of if the collection/treatment system needs to be shut down for repair or maintenance for a short period of time.

Three properties south and southeast of the facility have foundation drain systems that are connected to the groundwater collection system via gravity piping (801 S. Outagamie Street, 1410 W. Second Street, and 1414 W. Second Street). Additionally, the sump pump discharge at 1428 W. Second Street is connected to the collection system.

Groundwater collected in the west trench flows by gravity to manhole 1 where the maximum depth of the trench extends approximately 32 feet below ground surface (fbgs). Groundwater in the central and southeast trenches flows by gravity to manhole 2, where the maximum depth of the trench extends approximately 31 fbgs. Groundwater from the manholes is hard piped to the treatment facility (See Figure 3 – Site Detail Map, Appendix 1).

Hydrogen sulfide odors from manhole 2 and to a lesser degree manhole 1 have been detected. Hydrogen sulfide gas has a foul odor (rotten egg smell) and is slightly heavier than air. Hydrogen sulfide is a naturally occurring byproduct of the anaerobic decomposition of organic matter by sulfate-reducing bacteria.

Dissolved hydrogen sulfide can build up to levels exceeding the saturation point in water. Once agitated (by dropping into the bottom of the manhole or being pumped), the hydrogen sulfide can come out of solution and enter the atmosphere of the manhole. Hydrogen sulfide gas reacts with oxygen in the air to form sulfuric acid. Sulfuric acid has a very low vapor pressure, and as a result it condenses on available surfaces, such as the water, the manhole liner, and the manhole components. The sulfuric acid that condenses on the water slightly lowers the pH of the water. However, the sulfuric acid that condenses on the solid surfaces is concentrated relative to the amount of water on those surfaces. This thin layer of concentrated sulfuric acid reacts with the concrete and metal components of the manholes. Hydrogen sulfide will continue to be produced, which in turn will be converted to sulfuric acid as long as conditions are favorable for the sulfate-reducing bacteria.

The collection trenches may provide the anaerobic conditions necessary for the sulfate-reducing bacteria; however, the bacteria also produce a slime layer that can create anaerobic conditions even though oxygen is available. The organic matter necessary for the hydrogen sulfide reaction could be coming from peat lenses that were identified during the initial investigation activities. According to City of Appleton personnel, the adjacent buildings to the Mauthe site never had septic systems/fields and there are no other reports of hydrogen sulfide odors in the area.

In order to evaluate the impact the hydrogen sulfide is having on the manhole liners, the manhole components, and the nuisance created, hydrogen sulfide meters and data loggers are being evaluated to monitor conditions. Once the varying concentrations of the hydrogen sulfide has been evaluated, corrective actions can be considered.

Groundwater Treatment System

From February 1997 through April 18, 2006, the treatment system operated in a manual batch system mode. The groundwater treatment system was designed to be a fully automated batch treatment process designed for control of total chromium. Each batch operation was capable of treating 2,700 gallons of influent groundwater and took approximately six hours to complete a cycle (i.e., from the start of filing the reaction tank to finishing the discharge to the City of Appleton sanitary system). The system was capable of treating 10,800 gallons in a 24-hour period.

Pumps located in the two manholes convey groundwater from the collection trenches into the storage tank. Float switches control water levels in the manholes. The pumps have a pumping capacity of 43 gallons per minute (gpm) each.

A storage tank stores water from the collection system to provide equalization of the groundwater. The storage tank has a 9,000 gallon capacity. A top-mounted, turbine type, constant speed mixer, for mixing the tank contents and keeping solids in suspension, is located on the tank. An ultrasonic level indicator monitors the water level in the tank. The water level of the storage tank is monitored by the programmable logic controller (PLC).

Prior to the start of direct discharge on April 18, 2006, the reaction tank feed pump transferred groundwater from the storage tank to the reaction tank. The reaction tank feed pump is an air operated, double diaphragm pump with an 86 gpm capacity. The reaction tank feed pump is sized to fill the reaction tank working volume (2,700 gallons) in approximately 30 minutes.

The reaction tank has a capacity of 6,100 gallons. The conical bottom of the tank allows for the collection and transfer of sludge. The volume of water treated during a batch process is approximately 2,700 gallons. Chemical and physical processes for the groundwater treatment occurred in the reaction tank. The water was treated by batch process in the reaction tank as follows: decant, fill, ferrous sulfate addition, caustic addition, aeration, flocculation, settling, and sludge withdrawal.

The above systems are the primary parts in the treatment process. However, there are several other components necessary for the successful treatment of contaminated groundwater. They include: reaction tank mixer, reaction tank level detector, reaction tank air diffuser, reaction tank pH monitor, air compressor, ferrous sulfate feed system, caustic feed system, sludge transfer pump, sludge tank, and tanker truck feed pump. These components were monitored and/or controlled by the PLC in the master control panel. Only the tanker transfer pump and the air compressor are locally controlled. The system was designed to provide continuous batch process treatment if required.

The master control panel includes: failure annunciators, pH strip chart recorder, data access module, autodialer, PLC system, and uninterruptible power supply. The master control panel will also sound an audible alarm if an upset in the process or a failure is detected.

Although the system was designed to be a fully automated batch treatment process, the City of Appleton industrial user permit formerly required treated groundwater to be tested for hexavalent chromium using a Hach hexavalent chromium test kit before discharge to the sanitary sewer system. The existing treatment system (batch treatment and manual discharge) met discharge permit conditions but was labor intensive.

Groundwater brought into the treatment facility has contaminant concentrations below discharge limits. WDNR received approval from the City of Appleton to perform direct discharge of untreated, collected groundwater beginning April 18, 2006, when influent meets discharge limits listed in the Appleton Industrial User

(Wastewater Discharge) Permit No. 06-21. Since April 18, 2006, collected groundwater has been directly discharged without treatment to the City of Appleton sanitary sewer system.

Groundwater Monitoring Network

The groundwater monitoring wells and piezometers were designed to provide information on containment of the groundwater plume and on water quality at the site and adjacent residential properties. The monitoring network is comprised of eleven wells constructed during the RI and the remedial action (RA) activities (W-2, W-8, W-15, MW-101 through MW-108), five monitoring wells (MW-109 through MW-113) installed in May 2006 and four piezometers (PZ5 through PZ8) installed in May 2005, to evaluate the remaining source area. (See Figure 3 – Site Detail Map, Appendix 1.)

Monitoring wells W-2 and MW-108 are located up-gradient of the site to monitor background conditions.

Monitoring well MW-101, which is located west of the site, is used to monitor the effectiveness of the west trench.

Three down-gradient wells, MW-102, MW-103 and MW-104, are used to monitor changes in groundwater quality down-gradient of the central trench and to monitor hydraulic gradient control.

Four wells, W-8, W-15, MW-105 and MW-106, are used to monitor changes in groundwater quality outside of the southeast trench. Monitoring wells MW-106 and W-15 are also used to monitor hydraulic gradient control of the southeast trench.

Monitoring well MW-107 is used to provide source area groundwater quality data and hydraulic gradient information up-gradient of the central trench.

Five wells (MW-109 through MW-113) installed in May 2006 are located at former source areas identified during the RI:

> MW-109 is located at the west edge of the former chromium building between two historic monitoring points (MW25R and MW26R) installed during the RI with significant concentrations of VOCs and chromium in groundwater.
>
> MW-110 is located on the north edge of the former chromium building adjacent to a nest of three historic monitoring points (MW17, MW18 and MW19) installed during the RI with significant concentrations of VOCs and chromium in groundwater.
>
> MW-111 is located near a historic monitoring point (MW13R) installed during the RI with significant concentrations of chromium in groundwater.

MW-112 is located within the former zinc building at the edge of the former trough adjacent to a historic soil sample (SB3A) installed during the RI with significant concentrations of metals (cadmium, chromium, zinc and cyanide) in soil.

MW-113 is located on the southeast edge of the former chromium building adjacent to a nest of three historic monitoring points (MW14, MW15 and MW16) installed during the RI with significant concentrations of VOCs (MW14 only) and chromium in groundwater.

PZ5 and PZ6 are located on the north side of the central collection trench and PZ7 and PZ8 are located on the south side of the central collection trench to evaluate the vertical extent of groundwater contamination and verify vertical capture of the groundwater plume.

Other Potential Sources Of Contamination

The Christensen & Wisnet Bulk Oil Plant site (BRRTS #02-45-000382) (Bulk Oil site) was located at 702 S. Outagamie Street, approximately 380 feet east of the Mauthe site. Although the Bulk Oil site received closure from the Department of Commerce, petroleum soil and groundwater contamination remains on and off the source property. Based on data collected from monitoring wells for the Bulk Oil site, contaminant impact to the Mauthe site is not anticipated.

The Midwest Plating Corporation site (BRRTS #02-45-191769) (MPC site) was located at 1315 W. Fourth Street, approximately 700 feet east of the Mauthe site. The MPC site was also a former electroplating facility that engaged in hard chrome plating. Soil and groundwater results observed to date reveal that the MPC site is contaminated with cadmium, chromium, lead, and nickel. Based on data collected from downgradient monitoring wells for the Mauthe site and the groundwater flow direction observed at both projects, contaminants from the MPC site do not appear to impact the Mauthe site.

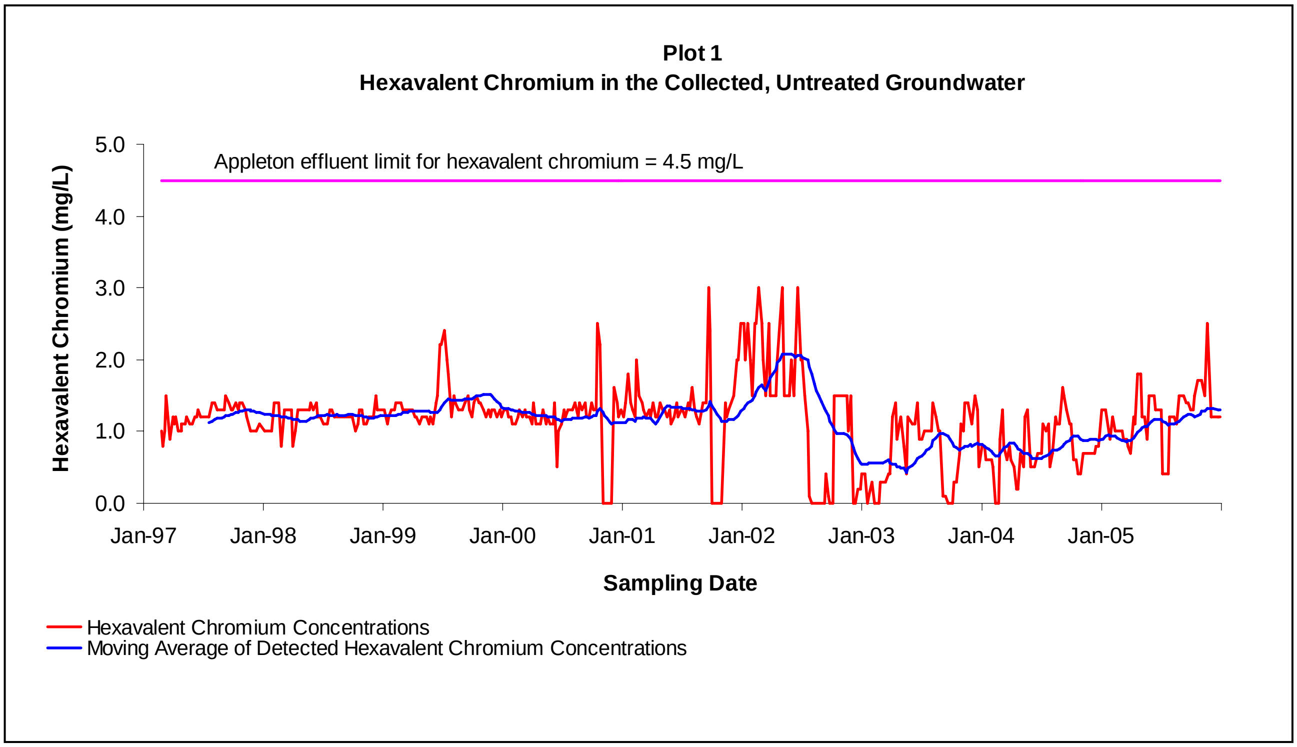
There are several other leaking underground storage tank sites, spill sites, and sites in the environmental repair program located around the Mauthe site. However, these sites have either had a minimum amount of reported contamination, or are located at a distance, which make them unlikely to have impacted the Mauthe site.

Proposed End Use

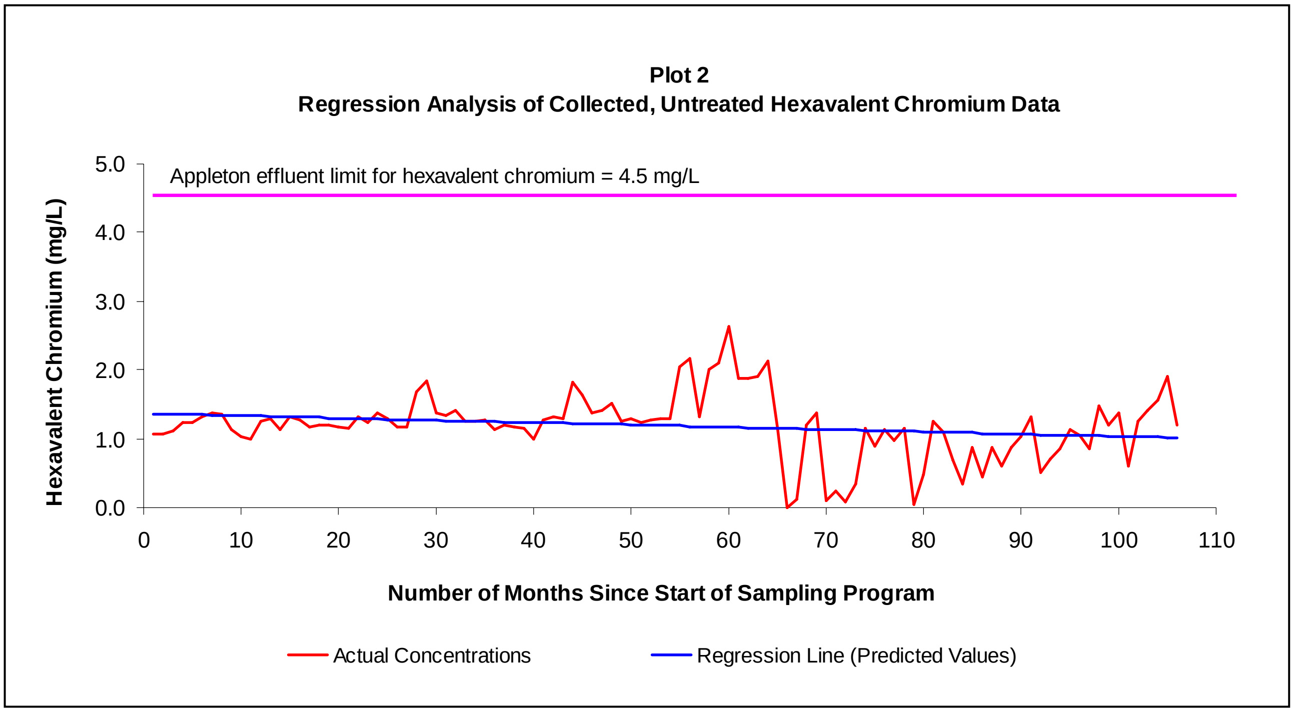
Because of the severity of the contamination and the timeframe required to complete a remedial action at the Mauthe site, future use of the property has not been addressed.

TREATMENT SYSTEM MODIFICATIONS

OMNNI reviewed nine years of groundwater sampling data. In observing the contaminant concentrations in the groundwater within the Mauthe site's collection trenches over that time period, no parameters have exceeded the City of Appleton pretreatment program's discharge limits. The primary contaminant of concern was hexavalent chromium. Over the last nine years, the concentration of hexavalent chromium has averaged 1.2 milligrams per liter (mg/L), has never exceeded 3.0 mg/L, and is trending downward at a rate of 0.0033 mg/L annually. The City of Appleton pretreatment standard is 4.5 mg/L.



Plot 1 shows the hexavalent chromium concentrations found in groundwater collected at the Mauthe site prior to the groundwater being treated by the existing on-site treatment system. The highest concentration found over that time period was 3.0 mg/L, which is less than the City of Appleton pretreatment standard.



OMNNI performed a regression analysis on the data in an attempt to determine whether hexavalent chromium levels in the groundwater at the collection trench were trending downward. (See Plot 2.) The weekly test results were averaged into monthly averages, and a downward slope was evident in the regression line, indicating a downward trend.

A meeting was held with Jessica Garratt, former City of Appleton Deputy Director of Utilities; Jennifer Borski, WDNR project manager; Brian Wayner, OMNNI project manager; and Don Brittnacher, OMNNI engineer on April 5, 2006 to discuss the statistical analysis performed on the groundwater and treatment system data.

Based on discussions from the meeting, the WDNR received approval from the City of Appleton to perform direct discharge of untreated, collected groundwater during an eight week direct discharge pilot study. The pilot study began on April 18, 2006. No exceedances of the Appleton Industrial User (Wastewater Discharge) Permit requirements were identified during the pilot study.

On May 26, 2006, the City issued an Appleton Industrial User (Wastewater Discharge) Permit[5] to the WDNR, which allowed for the continuation of direct discharge of the collected groundwater. Laboratory hexavalent chromium testing must be performed to insure compliance with the discharge permit during direct discharge. Testing is performed weekly from April through October and monthly from November through March. Collected groundwater has been directly

[5] Permit number 06-21.

discharged without treatment to the City of Appleton sanitary sewer system since April 18, 2006.

Since treatment of the collected groundwater is no longer required, additional treatment system evaluation was not performed. The August 31, 2004 scope of work also requested that the existing Mauthe treatment system, and any recommended modifications, be evaluated for the acceptance and treatment of chromium-contaminated groundwater from the Midwest Plating Corporation site (BRRTS # 02-45-191769) (MPC site). Since the Mauthe treatment system was modified for direct discharge of collected water, acceptance and treatment of chromium-contaminated groundwater from the MPC site was not evaluated.

METHODS OF INVESTIGATION

The methods of investigation were performed in general accordance with the methods described in the work plans[6].

INVESTIGATION

Geology and Hydrogeology

The Mauthe site is located in the Fox-Wolf River basin of Wisconsin. Surficial deposits in this basin consist of glacial sediment deposited during the Wisconsin glaciation. The glaciers were present during the Pleistocene period. United States Geological Survey maps *Water Resources of Wisconsin – Fox-Wolf River Basin*, by Perry G. Alcott, 1968, indicate that the materials in the vicinity of the site are composed of glacial lake deposits consisting of silt and clay. The site overlies bedrock formed during the Ordovician Period and dolomite bedrock.

The Phase I remedial action performed by EPA in 1995 involved excavating soils with chromium concentrations in excess of 500 mg/kg. The depth of the excavation varied across the site from four to 20 fbgs. The excavation was filled with excavated material having chromium concentrations less than 50 mg/kg, a two foot clay cap, and topsoil.

Prior to the excavation, previous work completed at the site identified fill ranging in thickness from one to seven feet. Underlying the fill is a till unit that can be divided into two layers. The upper till unit varies in thickness from five to 10 feet. The bottom of the upper till is at an elevation of 792 to 795 feet above mean sea level (MSL) and was noted to be fairly uniform across the site. The soils in the upper till were generally classified as silty clay with sand (CL).

[6] Reference *Work Plan, N.W. Mauthe Site, System Evaluation*, dated May 25, 2005 and *Work Plan, N.W. Mauthe Site, System Evaluation*, dated May 19, 2006.

The lower till was observed to be approximately 60 feet thick and extends down to bedrock. The lower till was described as soft to firm, light brown-gray clay with trace gravel and sand. Some of the deep borings showed peat lenses several inches thick. The soils in the lower till were generally classified as silty clay with sand (CL).

Bedrock was encountered in one boring at an elevation of 72 fbgs. The bedrock was thought to be dolomitic.

Topography across most of the site is generally flat. Regionally, the topography is also generally flat with an approximate elevation of 805 feet above MSL.

During the groundwater sampling events in 2005 and 2006, groundwater elevations at the newly installed monitoring wells (MW-109 – MW-113) ranged from 792.44 to 801.62 feet above MSL. Groundwater elevation at the piezometers (PZ5 – PZ8) ranged from 772.28 to 782.32 feet above MSL. Groundwater depth and flow direction were influenced by the collection system. (See Figures 4 through 7, Groundwater Elevation Contour Map, Appendix 1.)

In 2005 and 2006, the median depth to groundwater from the newly established monitoring wells varied from 5.83 to 10.60 fbgs. The median depth to groundwater from the piezometers varied from 28.44 to 30.25 fbgs. (See Table 3 – Groundwater Elevations for Select Wells, Appendix 2.) Regional groundwater flow is expected to be to the south-southeast toward the Fox River. The Fox River is located approximately ½ mile to the south-southeast of the site. The Fox River flows to the northeast.

Soil classifications were determined on nine sample locations during 2005 and 2006. Sample 110-4 was taken from soil boring OB9 (MW-110) from 6-8 fbgs, and classified as LEAN CLAY W/SAND, reddish brown (CL). Sample 110-7 was taken from soil boring OB-9 from 12-14 fbgs, and classified as SANDY LEAN CLAY, reddish brown (CL).

Sample 111-4 was taken from soil boring OB7 (MW-111) from 6-8 feet, and classified as SANDY LEAN CLAY, reddish brown (CL). Sample 111-7 was taken from soil boring OB7 from 12-14 fbgs, and classified as LEAN CLAY W/SAND, reddish brown (CL).

Sample 112-4 was taken from soil boring OB8 (MW-112) from 6-8 feet, and classified as LEAN CLAY W/SAND, reddish brown (CL). Sample 112-7 was taken from soil boring OB8 from 12-14 fbgs, and classified as SANDY LEAN CLAY, reddish brown (CL).

Sample 113-4 was taken from soil boring OB6 (MW-113) from 6-8 feet, and classified as LEAN CLAY W/SAND, reddish brown (CL). Sample 113-7 was taken from soil boring OB6 from 12-14 fbgs, and classified as LEAN CLAY W/SAND, reddish brown (CL).

Sample OB-5-7 was taken from soil boring OB5 (MW-109) from 12-14 fbgs, and classified as LEAN CLAY W/SAND, reddish brown (CL).

Moisture density of the samples ranged from 14.4% to 21.3%. Porosity of the samples ranged from 26.6% to 36.2%. (See Laboratory Tests of Soils, Appendix 4.)

Field Activities

Field activities included the installation of piezometers PZ5 through PZ8 in May 2005 and monitoring wells MW-109 through MW-113 in May 2006.

Soil Borings

Soil boring activities were performed on May 25 and 26, 2005 and May 24 and 25, 2006. Prior to the 2005 soil boring activities, a portion of the fence between 801 S. Outagamie Street and 1414 W. Second Street was temporarily removed to allow access for the drill rig to install soil boring OB1 (PZ8). A gate was also installed in the chain link fence on the Mauthe site to allow access by a drill rig within the fenced area.

A total of nine additional soil borings were performed to determine the extent of contamination. Soil borings OB1 – OB9 were performed to collect general site characterization data, although they were placed near areas of concern. Piezometers were constructed in four of the borings to determine the vertical extent of the groundwater contamination and verify vertical capture of the groundwater plume. Monitoring wells were constructed in five of the borings to determine the impact of any contamination on the groundwater from the former source area.

Borings OB1 – OB4 were drilled to depths between approximately 36 and 40 fbgs. (See Soil Boring Log Information, Form 4400-122, Appendix 3.) Soil samples were obtained continuously at two-foot intervals for field screening with a photoionization detector (PID). At each sampling interval, a representative portion of the soil was also collected for possible laboratory analysis. Soil samples were chosen from each boring for laboratory analysis based on PID screening data, the location of the water table, previous site information, and visual and olfactory observations.

Borings OB5 – OB9 were drilled to depths of approximately 20 fbgs. Soil samples were obtained continuously at two-foot intervals for field screening with a PID. At each sampling interval, a representative portion of the soil was also collected for possible laboratory analysis in the same

Photo 2 - Soil Core

manner as was soil from soil borings OB1 – OB4.

Piezometers

Piezometers were constructed in soil borings OB1 – OB4 to identify the vertical extent of the groundwater contamination and verify vertical capture of the groundwater plume. The piezometers were installed and developed according to ch. NR 141 Wis. Adm. Code groundwater monitoring well requirements. Five-foot screens were used in the piezometer construction. (See Monitoring Well Construction, Form 4400-113A, Appendix 3.) An initial attempt at developing the piezometers took place on June 8, 2005. Piezometers PZ7 and PZ8 were both dry. Piezometer PZ5 bailed dry after approximately 1/8 of a gallon of groundwater was removed. Piezometer PZ6 bailed dry after approximately two gallons of groundwater were removed. A second attempt on developing the piezometers took place on June 29, 2005. There was sufficient groundwater in all the piezometers for development. (See Monitoring Well Development, Form 4400-113B, Appendix 3.)

Photo 3 - Piezometer Installation at PZ5

Monitoring Wells

Permanent monitoring wells were constructed in soil borings OB5 – OB9 to identify groundwater contamination in the former source area. The monitoring wells were installed and developed according to ch. NR 141 Wis. Adm. Code groundwater monitoring well requirements. Fifteen-foot screens were used in the monitoring well construction to intersect the shallow water table at the site. (See Monitoring Well Construction, Form 4400-113A, Appendix 3.) The monitoring wells were developed on June 9, 2006. (See Monitoring Well Development, Form 4400-113B, Appendix 3.)

Photo 4 - Monitoring Well Installation at MW-111

OMNNI surveyed the piezometers on June 6, 2005 and the monitoring wells on June 14, 2006. Elevations were based on the USGS datum. Ground elevation was surveyed to the nearest 0.1 foot, and the top of the well casing to the nearest 0.01

foot. (See Groundwater Monitoring Well Information Form, Form 4400-89, Appendix 3.)

Field and Analytical Results

Headspace screening results from soil borings OB1 – OB9 ranged from 0.0 parts per million (ppm) to 3.0 ppm (isobutylene equivalents). (See soil boring logs for headspace data, Appendix 3.)

Soil samples collected from borings OB1 – OB4 were analyzed for total chromium. Soil samples collected from borings OB3 and OB4 were also analyzed for VOCs.

Total chromium concentrations in the soil samples analyzed from borings OB1 – OB4 ranged from 14 mg/kg to 190 mg/kg. VOCs were not detected above method detection limits in the soil analyzed from boring OB3. VOC analysis from soil collected from boring OB4 (PZ5) detected 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene,1,1,1-trichloroethane, and trichloroethene. (See Table 1 – Soil Sample Summary, Appendix 2, and Laboratory Analysis Results and Chain of Custody Documentation, Appendix 4.)

Soil samples collected from borings OB5 – OB9 were analyzed for chromium (total and hexavalent), total manganese, total organic carbon, total Cr(VI) reducing capacity, pH, and cation exchange capacity. Soil samples collected from borings OB6 and OB8 were also analyzed for VOCs. Soil samples collected from boring OB8 were also analyzed for total cadmium, total zinc, and total cyanide.

Total chromium concentrations in the soil samples analyzed from borings OB5 – OB9 ranged from 18 mg/kg to 370 mg/kg. Hexavalent chromium concentrations in soil samples analyzed from borings OB6, OB8, and OB9 were detected above ch. NR 720.11 residual contaminant levels based on human health risk from direct contact (non-industrial land use). Total manganese concentrations in the soil samples analyzed from borings OB5 – OB9 ranged from 250 mg/kg to 410 mg/kg. Total zinc concentrations in the soil samples analyzed from boring OB8 ranged from 26 mg/kg to 35 mg/kg. Total organic carbon concentrations in the soil samples analyzed from borings OB5 – OB9 ranged from 1,100 mg/kg to 5,800 mg/kg. Cation exchange capacity in the soil samples analyzed from borings OB5 – OB9 ranged from 7.3 milli-equivalents per 100 grams (meq/100g) to 22 meq/100g. Soil pH in the soil samples analyzed from borings OB5 – OB9 ranged from 7.9 to 8.9 standard units. Average total organic carbon as non-purgeable organic carbon in the soil samples analyzed from borings OB5 – OB9 ranged from 860 mg/kg to 17,000 mg/kg. (See Table 1 – Soil Sample Summary, Appendix 2 and Laboratory Analysis Results and Chain of Custody Documentation, Appendix 4.)

Groundwater from piezometers PZ5 – PZ8 was sampled on July 19, 2005 and September 21, 2005. Piezometers PZ5 – PZ8 were sampled for (filtered) total chromium and (unfiltered) hexavalent chromium. Piezometer PZ5 and PZ6 were also sampled for VOCs. Analytical test results showed no groundwater PAL exceedances for chromium or VOCs. (See Table 2 – Groundwater Sample Summary, Appendix 2 and Laboratory Analysis Results and Chain of Custody Documentation, Appendix 4.)

Groundwater from monitoring wells MW-109 through MW-113 was sampled on June 21, 2006 and September 20, 2006. Monitoring wells MW-109 through MW-113 were sampled for (filtered) total chromium, (unfiltered) hexavalent chromium, VOCs, cadmium, copper, cyanide, manganese, mercury, zinc, total organic carbon, dissolved organic carbon, pH, temperature, and conductivity. Analytical test results showed groundwater enforcement standard (ES) exceedances at all five monitoring wells. Groundwater ES exceedances for chromium and trichloroethene were observed at all the monitoring wells. Manganese, zinc, 1,2-dichloroethane, 1,1-dichloroethene, and 1,1,1-trichloroethane were also observed above groundwater ES exceedances at some of the monitoring wells. Analytical test results also showed groundwater PAL exceedances for cyanide, 1,1-dichloroethane, cis-1,2-dichloroethene, trans-1,2-dichloroethene, and 1,1,2-trichloroethane. (See Table 2 – Groundwater Sample Summary, Appendix 2 and Laboratory Analysis Results and Chain of Custody Documentation, Appendix 4.)

Groundwater elevations were taken at the piezometers and monitoring wells during the groundwater sampling events. (See Table 3 – Groundwater Elevations for Select Wells, Appendix 2.) In 2005 and 2006, the median depth to groundwater ranged from 28.44 to 30.25 fbgs in the new piezometers. Median depth to groundwater ranged from 5.83 to 10.60 fbgs in the new monitoring wells.

The July 19, 2005 and September 21, 2005 elevation data from the piezometers were used to develop piezometric groundwater contour maps. (See Figure 4 – Piezometric Groundwater Elevation Contour Map (7/19/2005) and Figure 5 - Piezometric Groundwater Elevation Contour Map (9/21/2005), Appendix 1.) Groundwater flow direction, based on the piezometer groundwater elevations, appeared to be flowing in a southerly direction.

The June 21, 2006 and September 20, 2006 elevation data from the monitoring wells were used to develop groundwater contour maps. (See Figure 6 – Groundwater Elevation Contour Map (6/21/2006) and Figure 7 - Groundwater Elevation Contour Map (9/20/2006), Appendix 1.) Groundwater flow direction was in the general direction of the collection trenches. Since two of the three collection trenches are near monitoring well MW-102, groundwater elevation at monitoring well MW-102 is likely near the pumping level in manhole 2. If the elevations along the collection trenches were know, the groundwater contours could be portrayed more accurately.

Analysis of Degree and Extent of Contamination

The contamination detected during the additional investigation activities is consistent with the contamination previously detected across the site. Although over 10,000 tons of contaminated soils and materials were removed from the site by EPA during the Phase I remedial action[7], chlorinated solvent and chromium contamination remain in the soil and groundwater.

Soil impacts were identified at the sampled locations during the piezometer installation. VOC contamination in the soil above the screened interval of piezometer PZ5 (OB4) was identified. Chromium was detected in the soil above the screened interval of all four piezometers.

The piezometers were located on either side of the central collection trench to evaluate the vertical extent of groundwater contamination and verify vertical capture of the groundwater plume. Each piezometer was installed with a five-foot screen to monitor groundwater conditions at depth. Piezometer PZ5 (40 fbgs) and piezometer PZ6 (40 fbgs) were located on the north side of the central collection trench. There were some minor detections of analyzed parameters between the laboratory limits of detection and limit of quantitation from the first sampling event. The second sampling event only detected chromium between the laboratory limit of detection and limit of quantitation in piezometer PZ5. The groundwater at these locations and depths does not appear to be impacted.

Piezometer PZ7 (35 fbgs) and piezometer PZ8 (36 fbgs) were located on the south side of the central collection trench. There were some minor detections of chromium during the two sampling events between the laboratory limits of detection and limit of quantitation. The groundwater at these locations and depths does not appear to be impacted.

The monitoring wells were located in areas previously identified as being impacted. Based on field and laboratory analysis, soil and near-surface groundwater contamination remains across the site.

Soil analysis from the samples collected during the monitoring well installation indicates that VOC and chromium (hexavalent and total) remain across the site. However, the total chromium concentrations were generally less than 100 mg/kg.

Groundwater ES and PAL exceedances have been observed at all five monitoring wells, which indicates that groundwater contamination remains across the site. (See Figure 8 – Groundwater VOC Data and Figure 9 – Groundwater Chromium and Cyanide Data, Appendix 1.) Groundwater observed during both sampling events from monitoring wells MW-110, MW-112, and MW-113 ranged in color

[7] The Phase I Remedial Action Closure Report, dated July 31, 1996 contains quantities and descriptions of the contaminated materials removed.

from a light yellow hue to a yellow hue. (See Well Specific Field Sheets, Appendix 3.)

Potential For Impacts

Photo 5 - Groundwater From Monitoring Well MW-112 on June 9, 2006

At this time the remaining contamination from the Mauthe site does not appear to be impacting: species, habitat, or ecosystems sensitive to the contamination; wetlands; outstanding resource waters; or sites or facilities of historic or archaeological significance.

The containment system appears to be capturing the groundwater plume. However, there are buildings downgradient of the Mauthe site that could be considered potential receptors of the contamination. The buildings have basements and basement sumps, and have water and sanitary lateral connections. In areas of tight clays, such as the present case, any granular material, such as found in utility trenches or in basement wall backfill, acts as a preferential pathway for groundwater flow.

As part of the Phase I remedial efforts by EPA, the foundation drain systems or sump pumps in these buildings were piped to the groundwater collection system, so that any contaminated groundwater that might enter the foundation drain systems or sump pumps would be drawn away from the buildings. In the existing arrangement, as long as the groundwater in the collection trenches is being pumped, the system of piping to the foundation drain systems or sump pumps will reduce the potential environmental impact to the downgradient buildings. However, if the groundwater collection system is turned off in the future, the trenches holding the piping to the foundation drain systems could act as preferential pathways for contaminant movement. The construction of the piping trenches is unknown.

No private water supply wells are located on the Mauthe property. Municipal sewer and water service the area businesses and residences surrounding the property.

Utilities

Utility locations are indicated in the Phase I remedial action closure report[8] and the Phase II remedial action construction documentation report[9]. (Note: The as-built drawings contained in Appendix B of the Phase II remedial action construction documentation report are the drawings that were used for construction. As-built drawings were not completed.)

Utilities and utility trenches can assist in the migration of contaminants. Vapor intrusion and the spread of groundwater contamination are the primary concerns with contaminant migration within utilities and utility trenches. Vapor intrusion is discussed below.

The ROD[10] discusses utility investigations that took place during the initial investigation. The initial utility investigations found that the sanitary sewer and/or the storm sewer in Melvin Street maybe acting as conduits for the transport of contaminated groundwater.

The scope of the additional investigation activities did not include an investigation of the utilities; however, based on information collected during the investigation, contaminated groundwater appears to be moving toward the collection trenches and away from the utilities. Contaminated groundwater may remain near the utilities, so any future utility work should be prepared to encounter contamination.

Vapor Intrusion

Vapor intrusion occurs when volatile contaminants migrate from contaminated soil, groundwater, or fill material and enter the indoor air of a building. No vapors were detected while in the on-site building, or in the surrounding buildings; however, a specific vapor intrusion investigation was not conducted. No known reports of vapor issues from the contamination were identified.

Photo 6 - Organics From Manhole 2 on September 21, 2005

The residents located at 801 S. Outagamie Street have complained of a "rotten egg" odor coming from manhole 2. The odor is from the creation of hydrogen sulfide.

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[8] *Phase I Remedial Action Closure Report*, N.W. Mauthe Site, Appleton, Wisconsin, dated July 31, 1996.
[9] *Phase II Remedial Action Construction Documentation Report*, N.W. Mauthe Site, Appleton, Wisconsin, dated July 29, 1997.
[10] *Record of Decision Summary*, N.W. Mauthe Site, City of Appleton, Outagamie County, Wisconsin, dated March 1994.

Meters that will be placed in the manholes to monitor and record the levels of hydrogen sulfide are being evaluated. (Reference the *Groundwater Collection System* section for additional discusion on hydrogen sulfide.)

Waste Management

The investigative waste from the additional investigation activities consisted of: excess sample materials and soil cuttings from the drilling; development and purge water; disposable sampling supplies; disposable personal protective equipment; and equipment decontamination.

Excess sample materials, soil cuttings, and equipment decontamination waste from the soil boring installation were placed in 55-gallon drums. The drums are stored inside in the truck bay of the building. Waste generated by equipment decontamination activities was placed in two 55-gallon drums and allowed to settle. The liquid waste generated by equipment decontamination activities was removed and disposed of in manhole 1. The solid waste was allowed to dry and combined into one 55-gallon drum.

Environmental Services Plus[11] is currently coordinating the disposal of the excess sample materials, soil cuttings, and equipment decontamination waste, which are contained in 14 55-gallon drums. The drums will be transported to Veolia Hickory Meadows Landfill[12] (formerly ONYX) for disposal.

Development and purge water were placed in manhole 1 as directed by the WDNR.

Disposable sampling supplies and disposable personal protective equipment were removed from the site and disposed of as solid waste.

CONCLUSIONS AND RECOMMENDATIONS

The results of the additional investigation conducted showed contamination remains on-site in the soil above ch. NR 720 Wis. Adm. Code levels, in the groundwater above ch. NR 140 Wis. Adm. Code enforcement standards, and in the groundwater above the ARARs established for the Mauthe site. Groundwater does not appear to be impacted at depth based on the piezometer groundwater analysis.

The excavation and soil removal, installation of containment trenches, and construction of the groundwater treatment system were overseen by the EPA, which was focused on mitigating the immediate risk. The EPA transferred project

[11] Environmental Services Plus, 4450 Fieldcrest Drive, Kaukauna, WI 54130-4539, Jesse Rose (920) 766-6756.
[12] Hickory Meadows Landfill, W3105 Schneider Road, Hilbert, WI 54129-9451, Kari Rabideau, (920) 853-8553.

management of this site to the WDNR for routine operation and maintenance. Although the containment trenches appear to be operating as designed, the existing containment and treatment systems were identified in the ROD[13] to take over 1,012 years to meet the ARAR of 5 μg/L for chromium (1992 PAL). OMNNI conducted a groundwater flow and transport model[14] simulating contaminant movement at the Mauthe site. The model indicated that exceedances of the 5 μg/l closure standard for chromium in the groundwater will continue to occur for many hundreds of years at the site, whether or not the present groundwater collection system continues to operate.

Statistical analysis of the treatment system influent and monitoring well data indicated that, even though the contamination will persist for a long time, it was unlikely that the influent into the treatment system would exceed the Appleton wastewater discharge permit requirements. After successfully completing the pilot study in April 2006, the permit was modified in May 2006 to allow for direct discharge of the collected groundwater. OMNNI does not recommend additional evaluation of the existing treatment system. OMNNI also does not recommend evaluating acceptance and treatment of chromium-contaminated groundwater from the Midwest Plating site at this time.

The remedial work performed to date at the Mauthe site, in particular the excavation of contaminated soils, has significantly reduced the mass of contamination at the site. The potential to encounter chlorinated solvents or chromium-contaminated soil through contact with surface soils has been minimized by the removal of soils containing chromium concentrations in excess of 500 mg/kg and the addition of a clay cap across the site.

Soil contamination does remain in soils below the cap based on the analytical data from soil samples collected during the piezometer and monitoring well installation. If the current containment and treatment approach remains unchanged, the existing soil data should be sufficient. However, if remedial actions are evaluated to shorten the timeframe to achieving site goals, additional soil characterization maybe necessary to further define the degree and extent of soil contamination. Also, more soil investigation beyond the Mauthe site is needed to clearly define the limits of soil exceeding direct contact standards in the top four feet of soil and the horizontal and vertical limits of residual soil contamination.

Groundwater contaminant concentrations remain above the ARARs established for the site (5 μg/L for chromium) and above ch. NR 140 Wis. Adm. Code enforcement standards. Recent analysis of the groundwater sampled from the newly installed piezometers and monitoring wells has revealed the continued presence of elevated levels of chromium and chlorinated solvent contamination across the site.

[13] *Record of Decision Summary*, N.W. Mauthe Site, City of Appleton, Outagamie County, Wisconsin, dated March 1994.
[14] Reference *Simulation of Solute Movement At a Chromium-Contaminated Site*, dated March 16, 2007.

However, when compared to the maximum detected levels[15], the groundwater contamination has been significantly reduced. Based on the groundwater flow and transport model, the reduction of groundwater contamination is likely due to the soil removal. Similar to the soil discussion above, if the current containment and treatment approach remains unchanged, the existing groundwater monitoring network should be sufficient. If remedial actions are evaluated to shorten the timeframe to achieving site goals, additional groundwater characterization maybe necessary to further define the degree and extent of contamination.

The clay soils at the site are relatively impermeable. The tightness of the clay soils found in the primary discharge area has positive and negative impacts on remediation. The soils, in combination with the site's clay cap, are in essence "entombing" the remaining contamination, limiting the extent of migration in horizontal and vertical directions. However, the impermeability of the soils also impedes active extraction efforts. The present groundwater collection system, in particular, while capable of minimizing downgradient migration of chromium contamination, will nevertheless operate poorly as an extraction system.

In order to more effectively reduce contaminant mass at the site, OMNNI recommends that other remedial options be evaluated. The original remedial choices – a limited excavation and groundwater collection system – were made at a time when experience with soil and groundwater treatment options was limited and the goal under the Superfund Program was to mitigate immediate risk. The performance of reactive permeable barriers, for instance, was largely unproven. That technology has now developed a successful track record of altering chromium-contaminated groundwater flowing through the barrier, changing chromium from its mobile hexavalent mode to the largely benign trivalent mode. Other remedial options, such as phytoremediation, are also proving effective in removing or rendering benign metal and chlorinated solvent contamination.

The costs and benefits of further excavation at the site should also be re-evaluated. The area of significant mass of chromium contamination is relatively limited at present. Physical removal of contaminated materials may achieve significant cost savings and reduction in the cleanup timeframe, as opposed to centuries of active system operation.

The purchase of the properties within the triangle to the southeast of the subject property should be evaluated. Modeling indicates that the users of those properties will remain at some risk to exposure from the remaining contaminant plume, under either scenario of continued system operation or system shutdown. The purchase of those properties would significantly minimize the risk of the remaining contamination reaching any potential receptors under any remedial scenario.

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[15] Reference Table 2-2, Determination of Preliminary Remedial Goals for Groundwater, *Feasibility Study Report*, dated May 1993, for maximum detected levels of contaminants of concern.

The ARAR closure level for chromium at the site, 5 μg/L, should be reviewed. A risk-based approach should be taken at the site to determine whether alternative closure criteria are available that are still protective of potential receptors in the area, yet do not require the significant level of effort and cost presently necessitated by the site's closure criteria. Any risk-based approach must be protective of users of the triangular property to the southeast of the subject property, and would therefore probably require the purchase and vacating of that area.

STANDARD OF CARE

The conclusions presented in this report were arrived at using generally accepted hydrogeologic and engineering practices. The conclusions presented herein represent our professional opinions, based on data collected at the time of the investigation, at the specific boring and sampling locations discussed in this report. Conditions at other locations on the property may be different than described in this investigation. The scope of this report is limited to the specific project and location described herein.

Prepared By: ______________________________

Brian D. Wayner, P.E.
Project Manager

Reviewed By: ______________________________

Don Brittnacher, P.G.
Hydrogeologist

"I, Brian D. Wayner, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with requirements of ch. A-E 4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code; and that, to the best of my knowledge, all the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."

______________________________ , ______________

(Professional Engineer) (P.E. Stamp)

"I, Don Brittnacher, hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03 (1), Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."

____ , ____________________

(Professional Geologist) (P.G. Stamp)

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Table 1 Soil Sample Summary

Boring & Sample	Sample Date	Depth (fbg)	PID (ppm eq)	Soil Condi-tions	Detected VOCs over LOD (µg/kg)					
					1,1-Dichloro ethane	1,1-Dichloro ethene	cis-1,2,-Dichloro ethene	Trans-1,2-dichloro ethene	1,1,1-Trichloro ethane	Trichloro ethene (TCE)
NR 720.09 RCLs based on protection of groundwater										
OB1-1	5/25/05 (PZ8)	0-2	0.2							
OB1-2		2-4	0.2							
OB1-3		4-6	0.1							
OB1-4		6-8	0.2							
OB1-5		8-10	0.2		—	—	—	—	—	—
OB1-6		10-12	0.2							
OB1-7		12-14	0.2							
OB1-8		14-16	0.2							
OB1-9		16-18	0.1							
OB1-10		18-20	0.3		—	—	—	—	—	—
OB1-11		20-22	0.3							
OB1-12		22-24	0.1							
OB1-13		24-26	0.2							
OB1-14		26-28	0.1							
OB1-15		28-30	0.0							
OB1-16		30-32	0.2							
OB1-17		32-34	0.2	S						
OB1-18		34-36	0.2	S						
OB2-1	5/26/05 (PZ7)	0-2	0.1							
OB2-2		2-4	0.0							
OB2-3		4-6	0.0							
OB2-4		6-8	0.0							
OB2-5		8-10	0.1							
OB2-6		10-12	0.1		—	—	—	—	—	—
OB2-7		12-14	0.1							
OB2-8		14-16	0.1							
OB2-9		16-18	0.1							
OB2-10		18-20	0.1							
OB2-11		20-22	0.1		—	—	—	—	—	—
OB2-12		22-24	0.4							
OB2-13		24-26	0.2							
OB2-14		26-28	0.3							
OB2-15		28-30	0.3							
OB2-16		30-32	0.1							
OB2-17		32-34	0.2	S						
OB2-18		34-36	0.2	S						

Table 1 Soil Sample Summary

Boring & Sample	Sample Date	Depth (fbg)	PID (ppm eq)	Soil Condi-tions	Detected VOCs over LOD (µg/kg)					
					1,1-Dichloro ethane	1,1-Dichloro ethene	cis-1,2,-Dichloro ethene	Trans-1,2-dichloro ethene	1,1,1-Trichloro ethane	Trichloro ethene (TCE)
NR 720.09 RCLs based on protection of groundwater										
OB3-1	5/26/05 (PZ6)	0-2	2.0							
OB3-2		2-4	2.1							
OB3-3		4-6	2.2		<26	<26	<26	<26	<26	<26
OB3-4		6-8	0.2							
OB3-5		8-10	—							
OB3-6		10-12	0.3							
OB3-7		12-14	0.1		<25	<25	<25	<25	<25	<25
OB3-8		14-16	0.1							
OB3-9		16-18	0.0							
OB3-10		18-20	0.1							
OB3-11		20-22	0.1							
OB3-12		22-24	0.2							
OB3-13		24-26	0.1							
OB3-14		26-28	0.2							
OB3-15		28-30	0.2							
OB3-16		30-32	0.2							
OB3-17		32-34	0.4							
OB3-18		34-36	0.3	S						
OB3-19		36-38	0.4	S						
OB3-20		38-40	0.3	S						
OB4-1	5/26/05 (PZ5)	0-2	0.8							
OB4-2		2-4	2.0		<26	<26	<26	<26	76	330
OB4-3		4-6	1.1							
OB4-4		6-8	0.5							
OB4-5		8-10	0.6							
OB4-6		10-12	0.3							
OB4-7		12-14	3.0		160	140	340	34 Q	4,200	3,000
OB4-8		14-16	0.5							
OB4-9		16-18	0.6							
OB4-10		18-20	0.3							
OB4-11		20-22	—							
OB4-12		22-24	0.4							
OB4-13		24-26	0.4							
OB4-14		26-28	0.7							
OB4-15		28-30	0.4							
OB4-16		30-32	0.3							
OB4-17		32-34	0.8							
OB4-18		34-36	0.7	S						
OB4-19		36-38	0.2	S						
OB4-20		38-40	1.0	S						

Table 1 Soil Sample Summary

Boring & Sample	Sample Date	Depth (fbg)	PID (ppm eq)	Soil Condi-tions	Detected VOCs over LOD (µg/kg)					
					1,1-Dichloro ethane	1,1-Dichloro ethene	cis-1,2,-Dichloro ethene	Trans-1,2-dichloro ethene	1,1,1-Trichloro ethane	Trichloro ethene (TCE)
NR 720.09 RCLs based on protection of groundwater										
OB5-1	5/24/06 (MW-109)	0-2	0.1	U						
OB5-2		2-4	0.1	U						
OB5-3		4-6	0.0	SZ						
OB5-4		6-8	—	S						
OB5-5		8-10	0.1	S						
OB5-6		10-12	0.1	S						
OB5-7		12-14	—	S						
OB5-8		14-16	0.1	S						
OB5-9		16-18	0.0	S						
OB5-10		18-20	0.0	S						
OB6-1	5/24/06 (MW-113)	0-2	0.0	U						
OB6-2		2-4	0.1	U						
OB6-3		4-6	0.0	U	<25	<25	<25	<25	34 Q	56 Q
OB6-4		6-8	—	SZ						
OB6-5		8-10	0.0	S	<25	<25	<25	<25	94	86
OB6-6		10-12	0.3	S						
OB6-7		12-14	—	S						
OB6-8		14-16	0.0	S						
OB6-9		16-18	0.0	S						
OB6-10		18-20	0.0	S	<25	<25	<25	<25	66 Q	<25
OB7-1	5/24/06 (MW-111)	0-2	0.0	U						
OB7-2		2-4	0.0	U						
OB7-3		4-6	0.1	U						
OB7-4		6-8	—	SZ						
OB7-5		8-10	0.4	SZ						
OB7-6		10-12	0.1	SZ						
OB7-7		12-14	—	S						
OB7-8		14-16	0.0	S						
OB7-9		16-18	0.0	S						
OB7-10		18-20	0.0	S						
OB8-1	5/24/06 (MW-112)	0-2	0.0	U						
OB8-2		2-4	0.0	U						
OB8-3		4-6	0.0	U	<25	<25	<25	<25	<25	1100
OB8-4		6-8	—	U						
OB8-5		8-10	2.2	SZ	<25	<25	<25	<25	42 Q	3100
OB8-6		10-12	0.1	SZ						
OB8-7		12-14	—	SZ						
OB8-8		14-16	0.1	S						
OB8-9		16-18	0.0	S						
OB8-10		18-20	0.1	S	<25	<25	<25	<25	<25	66 Q

Table 1 Soil Sample Summary

Boring & Sample	Sample Date	Depth (fbg)	PID (ppm eq)	Soil Condi-tions	Detected VOCs over LOD (µg/kg)					
					1,1-Dichloro ethane	1,1-Dichloro ethene	cis-1,2,-Dichloro ethene	Trans-1,2-dichloro ethene	1,1,1-Trichloro ethane	Trichloro ethene (TCE)
NR 720.09 RCLs based on protection of groundwater										
OB9-1	5/25/06 (MW-110)	0-2	0.0	U						
OB9-2		2-4	0.1	U						
OB9-3		4-6	0.2	U						
OB9-4		6-8	—	SZ						
OB9-5		8-10	0.3	SZ						
OB9-6		10-12	0.1	S						
OB9-7		12-14	—	S						
OB9-8		14-16	0.0	S						
OB9-9		16-18	0.0	S						
OB9-10		18-20	0.1	S						

Table 1 - Soil Sample Summary

Boring & Sample	Sample Date	Depth (fbg)	PID (ppm eq)	Soil Condi-tions	Cadmium (mg/kg)	Chromium Hex (mg/kg)	Total Chromium (mg/kg)	Cyanide (mg/kg)	Manganese (mg/kg)	Zinc (mg/kg)	Organic Carbon (mg/kg)	Cation Exchange Capacity (meq/100g)	pH	Average TOC as NPOC (mg/kg)
NR 720.11 RCLs Direct Contact Non-industrial					8	14								
OB1-1		0-2	0.2											
OB1-2		2-4	0.2											
OB1-3		4-6	0.1											
OB1-4		6-8	0.2											
OB1-5		8-10	0.2		—	—	21	—	—	—	—	—	—	—
OB1-6		10-12	0.2											
OB1-7		12-14	0.2											
OB1-8		14-16	0.2											
OB1-9	5/25/05	16-18	0.1											
OB1-10	(PZ8)	18-20	0.3		—	—	14	—	—	—	—	—	—	—
OB1-11		20-22	0.3											
OB1-12		22-24	0.1											
OB1-13		24-26	0.2											
OB1-14		26-28	0.1											
OB1-15		28-30	0.0											
OB1-16		30-32	0.2											
OB1-17		32-34	0.2	S										
OB1-18		34-36	0.2	S										
OB2-1		0-2	0.1											
OB2-2		2-4	0.0											
OB2-3		4-6	0.0											
OB2-4		6-8	0.0											
OB2-5		8-10	0.1											
OB2-6		10-12	0.1		—	—	15	—	—	—	—	—	—	—
OB2-7		12-14	0.1											
OB2-8		14-16	0.1											
OB2-9	5/26/05	16-18	0.1											
OB2-10	(PZ7)	18-20	0.1											
OB2-11		20-22	0.1		—	—	17	—	—	—	—	—	—	—
OB2-12		22-24	0.4											
OB2-13		24-26	0.2											
OB2-14		26-28	0.3											
OB2-15		28-30	0.3											
OB2-16		30-32	0.1											
OB2-17		32-34	0.2	S										
OB2-18		34-36	0.2	S										
OB3-1		0-2	2.0											
OB3-2		2-4	2.1											
OB3-3		4-6	2.2											
OB3-4		6-8	0.2											
OB3-5		8-10	—											
OB3-6		10-12	0.3											
OB3-7		12-14	0.1											
OB3-8		14-16	0.1		—	—	15	—	—	—	—	—	—	—
OB3-9		16-18	0.0											
OB3-10	5/26/05	18-20	0.1											
OB3-11	(PZ6)	20-22	0.1											
OB3-12		22-24	0.2											
OB3-13		24-26	0.1											
OB3-14		26-28	0.2											
OB3-15		28-30	0.2		—	—	16	—	—	—	—	—	—	—
OB3-16		30-32	0.2											
OB3-17		32-34	0.4											
OB3-18		34-36	0.3	S										
OB3-19		36-38	0.4	S										
OB3-20		38-40	0.3	S										

Table 1 - Soil Sample Summary

Boring & Sample	Sample Date	Depth (fbg)	PID (ppm eq)	Soil Condi-tions	Cadmium (mg/kg)	Chromium Hex (mg/kg)	Total Chromium (mg/kg)	Cyanide (mg/kg)	Manganese (mg/kg)	Zinc (mg/kg)	Organic Carbon (mg/kg)	Cation Exchange Capacity (meq/100g)	pH	Average TOC as NPOC (mg/kg)
NR 720.11 RCLs Direct Contact Non-industrial					8	14								
OB4-1		0-2	0.8											
OB4-2		2-4	2.0											
OB4-3		4-6	1.1											
OB4-4		6-8	0.5											
OB4-5		8-10	0.6											
OB4-6		10-12	0.3											
OB4-7		12-14	3.0		—	—	190	—	—	—	—	—	—	—
OB4-8		14-16	0.5		—	—	130	—	—	—	—	—	—	—
OB4-9		16-18	0.6		—	—	170	—	—	—	—	—	—	—
OB4-10	5/26/05	18-20	0.3											
OB4-11	(PZ5)	20-22	—											
OB4-12		22-24	0.4											
OB4-13		24-26	0.4											
OB4-14		26-28	0.7											
OB4-15		28-30	0.4		—	—	15	—	—	—	—	—	—	—
OB4-16		30-32	0.3											
OB4-17		32-34	0.8											
OB4-18		34-36	0.7	S										
OB4-19		36-38	0.2	S										
OB4-20		38-40	1.0	S										
OB5-1		0-2	0.1	U										
OB5-2		2-4	0.1	U	—	—	79	—	—	—	—	—	—	—
OB5-3		4-6	0.0	SZ	—	<1.2	34	—	250	—	1,400	22	8.2	1,100
OB5-4		6-8	—	S										
OB5-5	5/24/06	8-10	0.1	S	—	<1.2	37	—	320	—	1,100	11	8.0	860
OB5-6	(MW-109)	10-12	0.1	S	—	—	18	—	—	—	—	—	—	—
OB5-7		12-14	—	S										
OB5-8		14-16	0.1	S	—	—	24	—	—	—	—	—	—	—
OB5-9		16-18	0.0	S										
OB5-10		18-20	0.0	S	—	<1.2	22	—	330	—	3,800	10	8.5	3,000
OB6-1		0-2	0.0	U										
OB6-2		2-4	0.1	U	—	—	41	—	—	—	—	—	—	—
OB6-3		4-6	0.0	U	—	<1.1	46	—	360	—	5,800	20	7.9	17,000
OB6-4		6-8	—	SZ										
OB6-5	5/24/06	8-10	0.0	S	—	**27**	54	—	340	—	2,500	20	8.2	11,000
OB6-6	(MW-113)	10-12	0.3	S	—	—	130	—	—	—	—	—	—	—
OB6-7		12-14	—	S										
OB6-8		14-16	0.0	S	—	—	22	—	—	—	—	—	—	—
OB6-9		16-18	0.0	S										
OB6-10		18-20	0.0	S	—	<1.2	20	—	300	—	3,100	16	8.2	8,300
OB7-1		0-2	0.0	U										
OB7-2		2-4	0.0	U	—	—	29	—	—	—	—	—	—	—
OB7-3		4-6	0.1	U	—	<1.1	20	—	290	—	1,200	14	8.2	920
OB7-4		6-8	—	SZ										
OB7-5	5/24/06	8-10	0.4	SZ	—	<1.1	25	—	270	—	1,600	20	8.8	1,400
OB7-6	(MW-111)	10-12	0.1	SZ	—	—	31	—	—	—	—	—	—	—
OB7-7		12-14	—	S										
OB7-8		14-16	0.0	S	—	—	20	—	—	—	—	—	—	—
OB7-9		16-18	0.0	S										
OB7-10		18-20	0.0	S	—	<1.2	20	—	300	—	4,100	14	8.9	3,600
OB8-1		0-2	0.0	U										
OB8-2		2-4	0.0	U	1.0	—	110	0.76 Q	—	35	—	—	—	—
OB8-3		4-6	0.0	U	—	<1.1	190	—	310	—	1,400	18	8.9	1,200
OB8-4		6-8	—	U										
OB8-5	5/24/06	8-10	2.2	SZ	0.16 Q	**26**	210	<0.27	270	30	2,400	8.6	8.4	1,700
OB8-6	(MW-112)	10-12	0.1	SZ	0.18 Q	—	370	<0.32	—	29	—	—	—	—
OB8-7		12-14	—	SZ										
OB8-8		14-16	0.1	S	0.16 Q	—	21	<0.38	—	26	—	—	—	—
OB8-9		16-18	0.0	S										
OB8-10		18-20	0.1	S	0.15 Q	<1.2	21	<0.35	300	27	3,600	19	8.1	3,900
OB9-1		0-2	0.0	U										
OB9-2		2-4	0.1	U	—	—	22	—	—	—	—	—	—	—
OB9-3		4-6	0.2	U	—	<1.1	28	—	290	—	1,600	19	8.3	1,200
OB9-4		6-8	—	SZ										
OB9-5	5/25/06	8-10	0.3	SZ	—	**17**	56	—	410	—	1,500	7.3	8.3	1,700
OB9-6	(MW-110)	10-12	0.1	S	—	—	46	—	—	—	—	—	—	—
OB9-7		12-14	—	S										
OB9-8		14-16	0.0	S	—	—	45	—	—	—	—	—	—	—
OB9-9		16-18	0.0	S										
OB9-10		18-20	0.1	S	—	<1.2	39	—	290	—	2,900	9.2	8.3	4,000

Table 1 Soil Sample Summary

Note: fbg = feet below grade
--- = not analyzed

BOLD entries indicate that concentration detected above standard or guidance.
Q = Analyte detected between the limit of detection and limit of quantitation.

Soil Conditions (Based on observed groundwater elevations; Reference Table 3):
U =Unsaturated
SZ = Smear zone
S = Saturated

Table 2 - Groundwater Sample Summary

		Detected VOCs (µg/L)								
		Chloroform	1,1-Dichloro ethane	1,2-Dichloro ethane	1,1-Dichloro ethene	cis-1,2-dichloro ethene	Trans-1,2-Dichloro ethene	1,1,1-Trichloro ethane	1,1,2-Trichloro ethane	Trichloro ethene (TCE)
NR 140 ES		6	850	5	7	70	100	200	5	5
NR 140 PAL		0.6	85	0.5	0.7	7	20	40	0.5	0.5
MW-109	7/19/05	—	—	—	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—	—	—	—
Surface:	6/21/06	0.40 Q	1.3 Q	<0.36	*1.9*	<0.83	<0.89	37	0.45 Q	**46**
807.41	9/20/06	0.39 Q	1.7 Q	<0.36	*2.2*	<0.83	<0.89	37	0.48 Q	**51**
Top Casing:										
810.52										
Top Screen:										
802.74										
Bottom Screen:										
787.74										
MW-110	7/19/05	—	—	—	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—	—	—	—
Surface:	6/21/06	<3.7	*310*	**5.0**	**340**	*56*	19	**1,500**	<4.2	**27**
807.03	9/20/06	<3.7	*260*	<3.6	**300**	*57*	*28 Q*	**1,100**	<4.2	**30**
Top Casing:										
809.81										
Top Screen:										
802.33										
Bottom Screen:										
787.33										
MW-111	7/19/05	—	—	—	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—	—	—	—
Surface:	6/21/06	0.59 Q	2.7	<0.36	**11**	<0.83	<0.89	*78*	*0.71*	**180**
805.05	9/20/06	<0.37	3.2	<0.36	**7.7**	<0.83	<0.89	36	<0.42	**97**
Top Casing:										
807.59										
Top Screen:										
799.99										
Bottom Screen:										
784.99										
MW-112	7/19/05	—	—	—	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—	—	—	—
Surface:	6/21/06	<1.8	<3.8	<1.8	<3.8	<4.1	<4.4	7.9 Q	<2.1	**450**
805.51	9/20/06	<0.37	<7.5	<3.6	<5.7	<8.3	<8.9	<9.0	<4.2	**540**
Top Casing:										
808.14										
Top Screen:										
800.38										
Bottom Screen:										
785.38										
MW-113	7/19/05	—	—	—	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—	—	—	—
Surface:	6/21/06	<0.74	37	<0.72	**44**	4.4 Q	<1.8	**240**	<0.84	**92**
805.62	9/20/06	<0.37	22	<0.36	**19**	3.6	1.3 Q	*120*	*0.82 Q*	**81**
Top Casing:										
808.24										
Top Screen:										
800.67										
Bottom Screen:										
785.67										

Table 2 - Groundwater Sample Summary

		Detected VOCs (µg/L)								
		Chloroform	1,1-Dichloro ethane	1,2-Dichloro ethane	1,1-Dichloro ethene	cis-1,2-dichloro ethene	Trans-1,2-Dichloro ethene	1,1,1-Trichloro ethane	1,1,2-Trichloro ethane	Trichloro ethene (TCE)
NR 140 ES		6	850	5	7	70	100	200	5	5
NR 140 PAL		0.6	85	0.5	0.7	7	20	40	0.5	0.5
PZ5	7/19/05	<0.37	<0.75	<0.36	<0.57	<0.83	<0.89	1.7 Q	<0.42	<0.48
Elevations msl:	9/21/05	<0.37	<0.75	<0.36	<0.57	<0.83	<0.89	<0.90	<0.42	<0.48
Surface:	6/21/06	—	—	—	—	—	—	—	—	—
807.83	9/20/06	—	—	—	—	—	—	—	—	—
Top Casing:										
810.88										
Top Screen:										
772.88										
Bottom Screen:										
767.88										
PZ6	7/19/05	<0.37	<0.75	<0.36	<0.57	<0.83	<0.89	<0.90	<0.42	<0.48
Elevations msl:	9/21/05	<0.37	<0.75	<0.36	<0.57	<0.83	<0.89	<0.90	<0.42	<0.48
Surface:	6/21/06	—	—	—	—	—	—	—	—	—
806.97	9/20/06	—	—	—	—	—	—	—	—	—
Top Casing:										
809.77										
Top Screen:										
771.69										
Bottom Screen:										
766.69										
PZ7	7/19/05	—	—	—	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—	—	—	—
Surface:	6/21/06	—	—	—	—	—	—	—	—	—
804.60	9/20/06	—	—	—	—	—	—	—	—	—
Top Casing:										
804.48										
Top Screen:										
774.20										
Bottom Screen:										
769.2										
PZ8	7/19/05	—	—	—	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—	—	—	—
Surface:	6/21/06	—	—	—	—	—	—	—	—	—
804.52	9/20/06	—	—	—	—	—	—	—	—	—
Top Casing:										
804.35										
Top Screen:										
773.04										
Bottom Screen:										
768.04										

Table 2 - Groundwater Sample Summary

		Detected Dissolved Metals (µg/L)							
		Cadmium	Chromium	Hexivalent Chromium	Copper	Cyanide	Manganese (mg/L)	Mercury	Zinc (mg/L)
NR 140 ES		5	100		1,300	200	0.05	2	5
NR 140 PAL		0.5	10		130	40	0.025	0.2	2.5
MW-109	7/19/05	—	—	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—	—	—
Surface:	6/21/06	<0.92	**1,300**	1,400	2.4 Q	<9.4	**0.480**	<0.072	<0.02
807.41	9/20/06	—	**450**	—	—	<9.4	**0.430**	—	<0.02
Top Casing:									
810.52									
Top Screen:									
802.74									
Bottom Screen:									
787.74									
MW-110	7/19/05	—	—	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—	—	—
Surface:	6/21/06	<0.92	**24,000**	26,000	2.9 Q	*40*	**0.290**	<0.072	<0.02
807.03	9/20/06	—	**15,000**	—	—	*41*	**0.260**	—	<0.02
Top Casing:									
809.81									
Top Screen:									
802.33									
Bottom Screen:									
787.33									
MW-111	7/19/05	—	—	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—	—	—
Surface:	6/21/06	<0.92	**1,400**	1,400	3.3 Q	27	**0.190**	<0.072	<0.02
805.05	9/20/06	—	*22*	—	—	20 Q	**0.210**	—	<0.02
Top Casing:									
807.59									
Top Screen:									
799.99									
Bottom Screen:									
784.99									
MW-112	7/19/05	—	—	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—	—	—
Surface:	6/21/06	<0.92	**130,000**	140,000	5.3	*140*	**0.180**	<0.072	**34**
805.51	9/20/06	—	**69,000**	—	—	*84*	**0.130**	—	<0.02
Top Casing:									
808.14									
Top Screen:									
800.38									
Bottom Screen:									
785.38									
MW-113	7/19/05	—	—	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—	—	—
Surface:	6/21/06	<0.92	**25,000**	26,000	3.4 Q	11	**0.170**	<0.072	<0.02
805.62	9/20/06	—	**31,000**	—	—	12 Q	**0.085**	—	<0.02
Top Casing:									
808.24									
Top Screen:									
800.67									
Bottom Screen:									
785.67									

Table 2 - Groundwater Sample Summary

		Detected Dissolved Metals (µg/L)							
		Cadmium	Chromium	Hexivalent Chromium	Copper	Cyanide	Manganese (mg/L)	Mercury	Zinc (mg/L)
NR 140 ES		5	100		1,300	200	0.05	2	5
NR 140 PAL		0.5	10		130	40	0.025	0.2	2.5
PZ5	7/19/05	—	1.3 Q	<5.0	—	—	—	—	—
Elevations msl:	9/21/05	—	0.41 Q	<5.0	—	—	—	—	—
Surface:	6/21/06	—	—	—	—	—	—	—	—
807.83	9/20/06	—	—	—	—	—	—	—	—
Top Casing:									
810.88									
Top Screen:									
772.88									
Bottom Screen:									
767.88									
PZ6	7/19/05	—	1.2 Q	12 Q	—	—	—	—	—
Elevations msl:	9/21/05	—	<0.40	<5.0	—	—	—	—	—
Surface:	6/21/06	—	—	—	—	—	—	—	—
806.97	9/20/06	—	—	—	—	—	—	—	—
Top Casing:									
809.77									
Top Screen:									
771.69									
Bottom Screen:									
766.69									
PZ7	7/19/05	—	<0.52	<5.0	—	—	—	—	—
Elevations msl:	9/21/05	—	0.55 Q	<5.0	—	—	—	—	—
Surface:	6/21/06	—	—	—	—	—	—	—	—
804.60	9/20/06	—	—	—	—	—	—	—	—
Top Casing:									
804.48									
Top Screen:									
774.20									
Bottom Screen:									
769.2									
PZ8	7/19/05	—	1.1 Q	<5.0	—	—	—	—	—
Elevations msl:	9/21/05	—	<0.40	<5.0	—	—	—	—	—
Surface:	6/21/06	—	—	—	—	—	—	—	—
804.52	9/20/06	—	—	—	—	—	—	—	—
Top Casing:									
804.35									
Top Screen:									
773.04									
Bottom Screen:									
768.04									

Table 2 - Groundwater Sample Summary

		Natural Attenuation and Field Parameters					
		Total Organic Carbon (mg/L)	Dissolved Organic Carbon (mg/L)	pH (std. units)	Temp °C	Field Conductivity (µS)	Water Elevation (ft MSL)
MW-109	7/19/05	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—
Surface:	6/21/06	4.2	4.4	6.42	14.8	1497	801.54
807.41	9/20/06	5.6	4.2	6.66	14.6	1429	801.62
Top Casing:							
810.52							
Top Screen:							
802.74							
Bottom Screen:							
787.74							
MW-110	7/19/05	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—
Surface:	6/21/06	6.0	5.6	6.91	12.7	1178	799.42
807.03	9/20/06	7.3	6.4	7.00	14.4	1248	798.72
Top Casing:							
809.81							
Top Screen:							
802.33							
Bottom Screen:							
787.33							
MW-111	7/19/05	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—
Surface:	6/21/06	4.2	5.0	7.01	12.4	1311	796.90
805.05	9/20/06	3.4	4.4	6.99	14.0	1164	794.14
Top Casing:							
807.59							
Top Screen:							
799.99							
Bottom Screen:							
784.99							
MW-112	7/19/05	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—
Surface:	6/21/06	11	10	7.21	12.4	1338	792.44
805.51	9/20/06	4.2	10	7.28	14.6	1238	797.39
Top Casing:							
808.14							
Top Screen:							
800.38							
Bottom Screen:							
785.38							
MW-113	7/19/05	—	—	—	—	—	—
Elevations msl:	9/21/05	—	—	—	—	—	—
Surface:	6/21/06	4.1	4.5	6.91	12.9	1020	798.55
805.62	9/20/06	4.3	4.2	7.11	14.6	900	797.97
Top Casing:							
808.24							
Top Screen:							
800.67							
Bottom Screen:							
785.67							

Table 2 - Groundwater Sample Summary

		Natural Attenuation and Field Parameters					
		Total Organic Carbon (mg/L)	Dissolved Organic Carbon (mg/L)	pH (std. units)	Temp °C	Field Conductivity (µS)	Water Elevation (ft MSL)
PZ5	7/19/05	—	—	7.55	18.9	643	773.49
Elevations msl:	9/21/05	—	—	7.13	17.9	619	782.32
Surface:	6/21/06	—	—	—	—	—	—
807.83	9/20/06	—	—	—	—	—	—
Top Casing:							
810.88							
Top Screen:							
772.88							
Bottom Screen:							
767.88							
PZ6	7/19/05	—	—	7.49	20.4	568	773.46
Elevations msl:	9/21/05	—	—	7.45	15.0	601	779.98
Surface:	6/21/06	—	—	—	—	—	—
806.97	9/20/06	—	—	—	—	—	—
Top Casing:							
809.77							
Top Screen:							
771.69							
Bottom Screen:							
766.69							
PZ7	7/19/05	—	—	7.37	21.7	572	772.45
Elevations msl:	9/21/05	—	—	7.40	18.5	581	777.14
Surface:	6/21/06	—	—	—	—	—	—
804.60	9/20/06	—	—	—	—	—	—
Top Casing:							
804.48							
Top Screen:							
774.20							
Bottom Screen:							
769.2							
PZ8	7/19/05	—	—	7.27	21.5	575	772.28
Elevations msl:	9/21/05	—	—	7.16	17.9	433	779.88
Surface:	6/21/06	—	—	—	—	—	—
804.52	9/20/06	—	—	—	—	—	—
Top Casing:							
804.35							
Top Screen:							
773.04							
Bottom Screen:							
768.04							

Notes:

— = not analyzed
msl = mean sea level

BOLD entries indicate that concentration detected is above ch. NR 140, Wis. Adm. Code Enforcement Standards (ES)
ITALIC entries indicate that concentration detected is above ch. NR 140, Wis. Adm. Code Preventive Action Limit (PAL)

Data Qualifiers:
Q = Analyte detected between the limit of detection and limit of quantitation.

Table 3 - Groundwater Elevations at Select Wells

Well I.D. *WI Unique Well No.*	Top of PVC Casing Elevation (MSL)	Ground Surface Elevation (MSL)	Depth to Bottom of Well from PVC (ft)	Screen Length (ft)	Screen Elevation (MSL)		Depth to Water				Historical Depth to Water Below Ground Surface (ft)			
					Top	Bottom	Date	Below Casing (ft)	Below Ground Surface (ft)	Elevation (MSL)	Min.	Max.	Avg.	Median
MW-109	810.52	807.41	22.78	15	802.74	787.74	06/21/06	8.98	5.87	801.54	5.79	5.87	5.83	5.83
PI420							09/20/06	8.90	5.79	801.62				
MW-110	809.81	807.03	22.48	15	802.33	787.33	06/21/06	10.39	7.61	799.42	7.61	8.31	7.96	7.96
PI424							09/20/06	11.09	8.31	798.72				
MW-111	807.59	805.05	22.60	15	799.99	784.99	06/21/06	10.69	8.15	796.90	8.15	10.91	9.53	9.53
PI422							09/20/06	13.45	10.91	794.14				
MW-112	808.14	805.51	22.76	15	800.38	785.38	06/21/06	15.70	13.07	792.44	8.12	13.07	10.60	10.60
PI423							09/20/06	10.75	8.12	797.39				
MW-113	808.24	805.62	22.57	15	800.67	785.67	06/21/06	9.69	7.07	798.55	7.07	7.65	7.36	7.36
PI421							09/20/06	10.27	7.65	797.97				
PZ5	810.88	807.83	43.00	5	772.88	767.88	07/19/05	37.39	34.34	773.49	25.51	34.34	29.93	29.93
PI412							09/21/05	28.56	25.51	782.32				
PZ6	809.77	806.97	43.08	5	771.69	766.69	07/19/05	36.31	33.51	773.46	26.99	33.51	30.25	30.25
PI411							09/21/05	29.79	26.99	779.98				
PZ7	804.48	804.60	35.28	5	774.20	769.20	07/19/05	32.03	32.15	772.45	27.46	32.15	29.80	29.80
PI410							09/21/05	27.34	27.46	777.14				
PZ8	804.35	804.52	36.31	5	773.04	768.04	07/19/05	32.07	32.24	772.28	24.64	32.24	28.44	28.44
PI409							09/21/05	24.47	24.64	779.88				