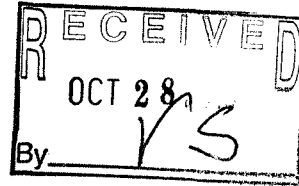


Vicki Stovall
HQ

October 22, 2010

Mr. John Feeney
Hydrogeologist
Wisconsin Department of Natural Resources
1155 Pilgrim Road
P.O. Box 408
Plymouth, WI 53703



Subject: Response to Closure Requirements and Work Plan for Additional Groundwater Remediation
in TCA Filling/Parking Lot Area
Tecumseh Products Company, Grafton, Wisconsin

Dear John:

Thank you again for providing detailed comments to the Tecumseh Products Company's (TPC) presentations to the Case Closure Committee on the groundwater portion at the Grafton site. The specificity of the comments is much appreciated.

Please recall that TPC's main objective is to achieve a level of certainty regarding the closure of the groundwater portion at the Grafton site. To that end TPC has spoken with Jim Delwiche and arrived at an agreement to submit a work plan (enclosed) that specifies additional remedial action, quantitative goals, and a schedule. We are formally requesting a review of this work plan (the \$500 fee is forthcoming) in order to reach agreement on the endpoint at this site.

Please know that TPC takes their environmental obligations seriously, and have historically satisfied every environmental obligation at this site. However, the groundwater has appeared to be a moving target. This work plan is intended to achieve acceptable clean up limits, and to provide certainty for TPC.

Thank you for your help on this.

Sincerely,

RMT, Inc.

Thomas R. Stolzenburg
Thomas R. Stolzenburg
Project Manager

cc: Jim Delwiche – WDNR
Jason Smith – Tecumseh Products Company
Lynn Dennison – Tecumseh Products Company
John Rice – RMT
Alyssa Sellwood – RMT

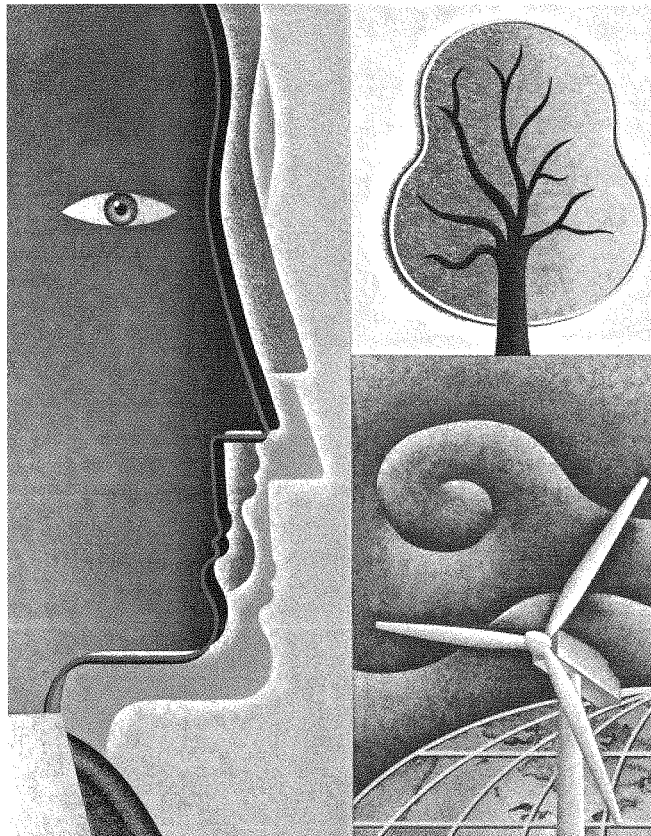
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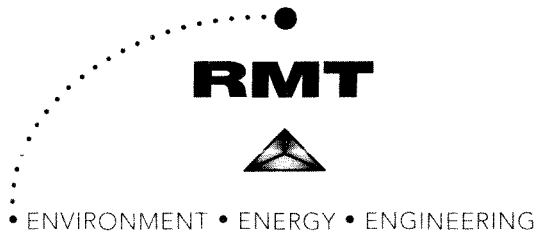
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Response to Closure Requirements and Work Plan for Additional Groundwater Remediation in TCA Filling/Parking Lot Area

October 2010





Response to Closure Requirements and Work Plan for Additional Groundwater Remediation in TCA Filling/Parking Lot Area

October 2010

*Prepared For
Tecumseh Products Company
Grafton, Wisconsin*

RMT, Inc. | Tecumseh Products Company
Final
I:\WPMSN\PJ\T1\02268\07\001\R0226807001-001.DOCX

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Section 1

Introduction

1.1 Background

The Tecumseh Products Company (TPC) has operated a manufacturing facility located at 900 North Street in Grafton, Wisconsin, since the mid-1950s (Figure 1). During the late 1980s and early 1990s, eight underground storage tanks (USTs) were removed from the site. During the course of the tank investigations, chlorinated volatile organic compounds (CVOCs) were detected in soil and groundwater at the facility.

Since that time, TPC has performed on-site and off-site investigations to define the extent of the CVOC impacts in soil and groundwater, as part of TPC's voluntary response action under Wisconsin Administrative Code (WAC) NR 700. The on-site investigations identified three main source areas of CVOCs: the West Dock Area, the Recycling Dock/Southeast Degreaser Area, and the TCA Filling/East Parking Lot Area (Figure 2). In 1996, the off-site investigations identified a CVOC plume in the bedrock aquifer.

TPC has remediated the source areas: enhanced bioremediation was completed in the West Dock Area and the Recycling Dock/Southeast Degreaser Area, and unsaturated soil was excavated and treated using an *ex situ* process in the TCA Filling/East Parking Lot Area. A "Source Area Remediation Completion Report" was submitted to the Wisconsin Department of Natural Resources (WDNR) on October 24, 2007 (RMT, 2007a). The report summarized the success of the source area remediation, showed that the NR 700 remedial objectives had been met in the source areas, and provided data showing that the CVOC plume is decreasing in both concentration and areal extent.

In 2008, following WDNR approval, 2 years of Monitored Natural Attenuation (MNA) was initiated for the groundwater contaminant plume (RMT, 2007b). TPC completed the 2 years of MNA monitoring in October 2009. Based on the results presented in the Source Area Completion Report, and MNA monitoring, TPC submitted a formal request for closure for the site in March 2010 (RMT, 2010).

The WDNR responded in a letter to TPC dated September 27, 2010 (Appendix A), listing a set of concerns to be addressed by TPC.

1.2 Purpose Scope

As agreed to with Jim Delwiche, TPC is taking the opportunity address each of the concerns listed in the letter, and to propose a specific set of tasks, goals and schedule to reach groundwater closure at this site.

The three core areas of concerns to the Department, which will be addressed in this report include:

- Fluctuating Concentrations in MW-25 – West Dock source area.
- Elevated concentrations of TCE in MW-9/9D, and the residual impacts to soil in the TCA Filling source area
- Increasing concentrations of TCE in the MW-18BR/MW-19BR well nest

Other requirements listed in the letter, which will be addressed in the report include:

- Plan to continue MNA monitoring program
- Flux of contaminants to the Milwaukee River for all substances over PAL
- Municipal Well Map for Grafton, Wisconsin

TPC is requesting formal approval from the WDNR of the response and goals established in this report.

Section 2

Response to Closure Concerns/Requirements

2.1 West Dock Area - MW-25

The West Dock source area around MW-25 has already been addressed to the satisfaction of the WDNR, as documented in the Source Area Completion Report, dated October, 2007. The remedial goal approved by the WDNR for the West Dock area was to reduce the groundwater and soil concentrations by 50 percent compared to the 2002 sampling round (see WDNR letters in Appendix A).

7
①
not in my approval letter specifically

②

MW-25 is directly below the infiltration trenches used to remediate the West Dock (2002 and 2007). The location of MW-25 makes it suited to evaluate the removal of mass from the unsaturated zone, but it is not representative of the groundwater conditions for the broader West Dock source area. Mass removal from the unsaturated zone was achieved as a result of the remediation, as demonstrated by the 85 percent reduction in the concentration of TCE in the unsaturated soil near MW-25. The groundwater conditions for the West Dock source area

③

should be evaluated based on the groundwater quality at MW-26, which is within the West Dock source area, but 60 feet downgradient from the infiltration trenches. MW-26 has seen steadily declining concentrations of TCE and a 98 percent reduction in the concentration of TCE since 2002. This reduction in concentration is significantly greater than the 50 percent goal, so the statement in the Department's letter "...a significant and consistent reduction has not been demonstrated" is contrary to the data and contrary to the remedial action goal approved for this source area. TPC reiterates the conclusions of the Source Area Completion Report that the remedial action goal for the West Dock source area has been achieved.

not sure if we agreed with that don't think so

I think we disagreed

④

Similarly, the facts argue against the allegation by the Department in the September 27th letter regarding the treatment effectiveness around MW-25: "...it is difficult to clearly establish how successful the treatment has been". Referring again back to the Source Area Completion Report of October, 2007, MW-26 was installed directly downgradient of MW-25, within 60 feet, and at approximately the same depth. MW-26 clearly showed the effects of treatment in the MW-25 area. In the first sampling event following the first injections the initial breakdown product of TCE (cis-1,2-DCE) increased by 3.5 times, from 2,400 to 8,800 µg/L, while TCE decreased by over 7 times, from 950 to 130 µg/L. As 130 µg/L of TCE can break down to form at most 96 µg/L of cis-1,2-DCE, the 8,800 µg/L DCE that was measured at MW-26 must have originated from upgradient reactions. Besides the obvious hydraulic connection between MW-25 and MW-26, this chemical data is hard evidence that MW-26 is positioned to document the dechlorination reactions initiated in the MW-25 area. As of the most recent sampling event,

→ I think our point was lack of wells ...?

May, 2010, the TCE concentration at MW-26 has declined to 18 µg/L, down from a beginning concentration of 950 µg/L before injections began. Furthermore, in the 60 feet from MW-25 to MW-26 the concentration declined from 284 µg/L to the aforementioned 18 µg/L, which demonstrates that reductive dechlorination is continuing. These data argue that MW-26 provides clear evidence of effective treatment in the MW-25 area.

The WDNR also expressed some concern about the potential deeper migration of CVOCs downgradient from the infiltration trenches. There are two lines of evidence that indicate that a deeper monitoring well is not necessary to evaluate the effectiveness of the source area treatment and the extent of the CVOC plume in the West Dock area. Firstly, as described above, MW-26 is directly downgradient from the infiltration trenches and has shown a clear and convincing effect from infiltration of lactate solution from the infiltration trenches. Secondly, because of the short distance between MW-25 and MW-26 and the presence of the building that acts as a cap for groundwater recharge, there is little likelihood for the CVOCs to migrate deeper into the bedrock between MW-25 and MW-26. Furthermore, the existing network of downgradient bedrock wells adequately characterizes the vertical and horizontal extent of the CVOC plume. Additional bedrock monitoring wells in the West Dock area would not significantly add to that characterization.

2.2 TCA Filling/Parking Lot Area - MW-9/MW-9D

In the September 27th letter the Department indicates an opinion: "...not shown enough reduction in TCE concentration..." The May, 2010 sampling results showed MW-9 at 687 µg/L and MW-9D at 837 µg/L. The source of the TCE at this location is from more localized sources that were previously excavated and treated ex-situ as part of the East Parking Lot source area remediation. The excavation of impacted soil was necessarily limited by the presence of underground utilities. So, although an estimated 86 percent reduction in mass was achieved as a result of the remediation, residuals were necessarily left (see Residual Soil Impacts in Appendix B).

TPC agrees that additional remedial efforts are warranted to address the elevated TCE concentrations near MW-9 and MW-9D. Specific details on the proposed remediation are presented in Section 3; however, in general TPC plans to stimulate biodegradation of TCE in the groundwater by injecting zero valent iron [ZVI] and lactate upgradient of MW-9 and MW-9D, with the goal of achieving at least a 50 percent reduction in the groundwater concentration of TCE at both MW-9 and MW-9D between October 2010 and October 2012.

MW-12 is a few hundred feet north of MW-9/9D, and it too exhibits residual TCE levels. Similarly to MW-9/9D, TCE-impacted soil near MW-12 was previously excavated and treated ex-situ, but residual TCE impacts were necessarily left due to the presence of utilities (see

Should we recommend injections @ MW-25 - source area (West Dock?) recycle in dock area too?

Residual Soil Impacts in Appendix B). Therefore, TPC proposes to complete groundwater injections near the residual impacts surrounding MW-12 in conjunction with the remediation associated with MW-9/9D. ★

2.3 Downgradient Bedrock Plume - MW-18BR/MW-19BR Well Nests

In the September 27th letter the Department expressed concern about concentration trends in MW-19BR1, MW-19BR2, MW-18BR1 and MW-18BR-2. As implied by the labels for these monitoring wells, all are bedrock wells. It is not practical to treat a bedrock aquifer. As for the concentration trends in these wells, the Department should refer back to Figure 1 of the March 25, 2010 Case Closure Report submitted by RMT (also included in Attachment C). There is a very strong upward gradient at the Milwaukee River, such that bedrock aquifer groundwater at MW-19BR1 is discharging to the river. In addition to the hydraulic evidence that the plume does not migrate past the river to the southeast, the MW-20 well nest (BR-1 and BR-2) exists at a sentinel location to verify that the river acts as a hydraulic barrier to migration. This well nest has historically exhibited non-detects, up through May, 2010, and it will continued to be monitored through October, 2012.

2.4 Other Closure Requirements

The WDNR has listed four specific requirements in their September 27th letter. These requirements, and TPC's responses are listed below:

2.4.1 Additional Soil Investigations

TPC understands that if the concrete slab on the property is removed additional soil investigations and remediation will be necessary.

2.4.2 Continued Groundwater Monitoring

Since the March 2010 closure request, TPC has continued the semi-annual monitoring program for the site (May 2010 and October 2010). TPC plans to continue with the semi-annual monitoring program through October 2012. At that time, TPC assumes that the goals presented in Section 4 will be achieved, and no additional monitoring or remediation will be required by the Department.

★ they don't plan on monitoring past 10/2012

2.4.3 Mass Flux to Milwaukee River

In the September 27th letter the Department asked for the flux to the Milwaukee River of all contaminants that exceed their respective PAL. The calculation for TCE was previously provided in the receptor analysis of the closure request, dated March 25, 2010. Those calculations showed an estimated 0.022 grams per day (234 µg/sec)

discharge to the Milwaukee River. The other constituents that exceed their respective PALs in the downgradient plume include cis-1,2-DCE, vinyl chloride, 1,1-DCA, and 1,1-DCE. The mass flux calculations for these contaminants are included in Appendix C. The average flux calculated for each contaminant with a PAL exceedence is as follows:

- TCE = 234 $\mu\text{g}/\text{sec}$
- cis-1,2-DCE = 75 $\mu\text{g}/\text{sec}$
- Vinyl chloride = 3.7 $\mu\text{g}/\text{sec}$
- 1,1-DCE = 12 $\mu\text{g}/\text{sec}$
- 1,1-DCA = 89 $\mu\text{g}/\text{sec}$

2.4.4 Municipal Well Map

The current municipal water supply well map was obtained from the Village of Grafton and is included in Appendix D. ☆

includes service area?

Section 3

Remedial Action Workplan

Since 1998 the TCE groundwater plume has steadily decreased in size. Most of the remaining TCE mass in the plume is in an area around MW-9 and MW-12. To reduce the residual TCE mass in this area, we propose to enhance reductive dechlorination (a process successfully used previously at the site). Specifically, TPC plans to stimulate biodegradation of TCE in the groundwater upgradient of MW-9/9D and MW-12 through *in situ* treatment, near the areas documented to have residual impacts.

3.1 Approach

TPC will subcontract with Redox Tech, LLC (Redox), to inject Redox's Aneroxic BioChem Plus (ABC®+) into the unconsolidated aquifer. ABC® is a patented mixture of ethyl lactate and glycerin, with small amounts of dipotassium phosphate (buffer and micronutrients) and fatty acids. The ABC® provides a carbon source for bacteria which facilitate the reductive dechlorination of TCE and other chlorinated VOCs. The "Plus" component in Redox's injectate is Zero Valent Iron (ZVI). ZVI provides a reducing environment to facilitate biotic reductive dechlorination of TCE, and can also facilitate abiotic reductive dechlorination processes directly.

To ensure that TCE is not "masked" (temporarily solubilized in injectate), neither vegetable oil nor a similar product will be used in the injection mixture. This will allow for an unbiased observation of the enhanced remedial effects.

3.2 Injection Details

Redox will inject the ABC®+ solution using a Geoprobe into a total of 40 temporary injection points. The location of the treatment areas and injection points are included on Figure 2. The details for the proposed injection include the following:

- A total of 33 injection points will be completed near MW-9, and a total of 7 injection points will be completed near MW-12.
- Injections will be completed at approximately 5 to 6 depths between 10 and 30 feet bgs. This range of depth covers the full extent of the unconsolidated aquifer near MW-9/9D and MW-12. The aquifer is primarily sand between 10 and 30 feet bgs (See cross-sections in Appendix B).
- A total of 19,800 gallons of solution containing 17,500 lbs of ZVI and 5,000 lbs of ABC® will be injected throughout the target treatment zone. This equates to approximately 485 gallons of solution with 437 lb ZVI and 125 lb of ABC® per injection point.
- The injection rate will be between 2 and 15 gpm per well, using pressures between 5 and 100 psi.

Section 4

Schedule and Groundwater Closure Targets

4.1 Schedule and Monitoring

Assuming timely approval of this workplan, TPC plans to complete the proposed injection of ABC®+ in the fall/winter 2010. TPC will then complete four semi-annual monitoring events (spring and fall) after the injection in accordance with the approved MNA program for the site. The monitoring will be completed by October 2012.

4.2 Groundwater Closure Targets

As of the final October 2012 sampling round, groundwater closure targets will be:

- A 50 percent reduction in groundwater concentrations of TCE at MW-9, MW-9D, and MW-12, as compared to the October 2010 monitoring round results.
- A calculated TCE plume mass that is stable to declining, as compared to the October 2010 monitoring results. (TPC is intending that the closure targets are focused on the Department's own guidance – to achieve a stable to decreasing plume. Therefore, besides MW-9, MW-9D and MW-12, no targets for individual wells will be required to achieve closure.)

If these targets are achieved, then the groundwater closure requirements at this site will be met and additional monitoring and remediation will not be required for the site.

? MW 25, 26 etc.

Section 5 References

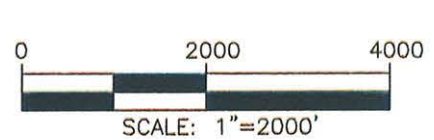
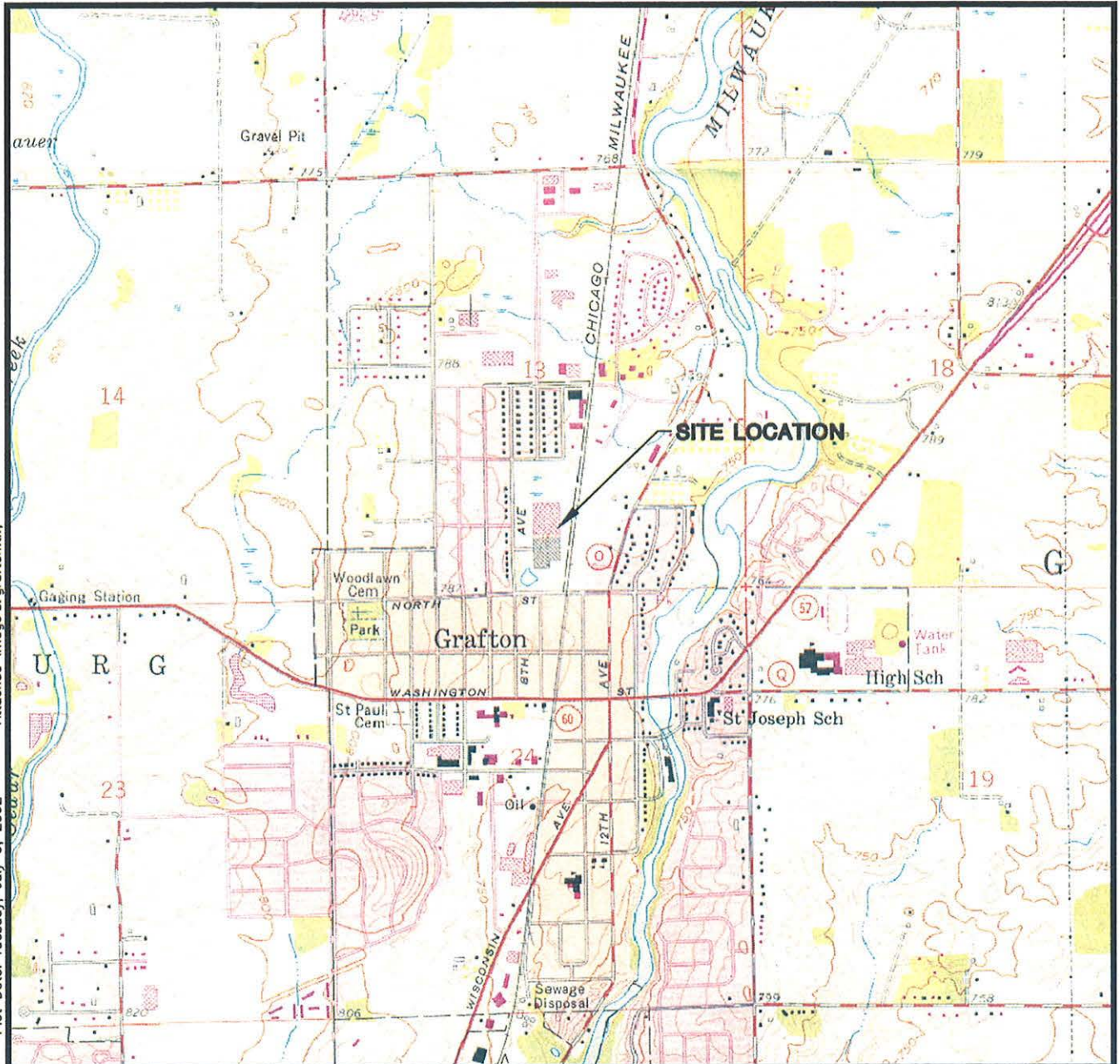
RMT, Inc. 2007a. Source area remediation completion report. Prepared for Tecumseh Products Company, Grafton, Wisconsin. October 2007.

RMT, Inc. 2007b. Workplan for monitored natural attenuation demonstration. Prepared for Tecumseh Products Company, Grafton, Wisconsin. December 2007.

RMT, Inc. 2010. Case Closure Request. Prepared for Tecumseh Products Company, Grafton, Wisconsin. March 25, 2010.

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Scale: 1"=1'
 Dwg Size: 42009 Bytes
 Plot Date: Tuesday, July 9, 2002



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 7.5 MIN. USGS QUADRANGLE.

LOCATION: SW1/4, SE1/4 SEC 13, T10N, R21E

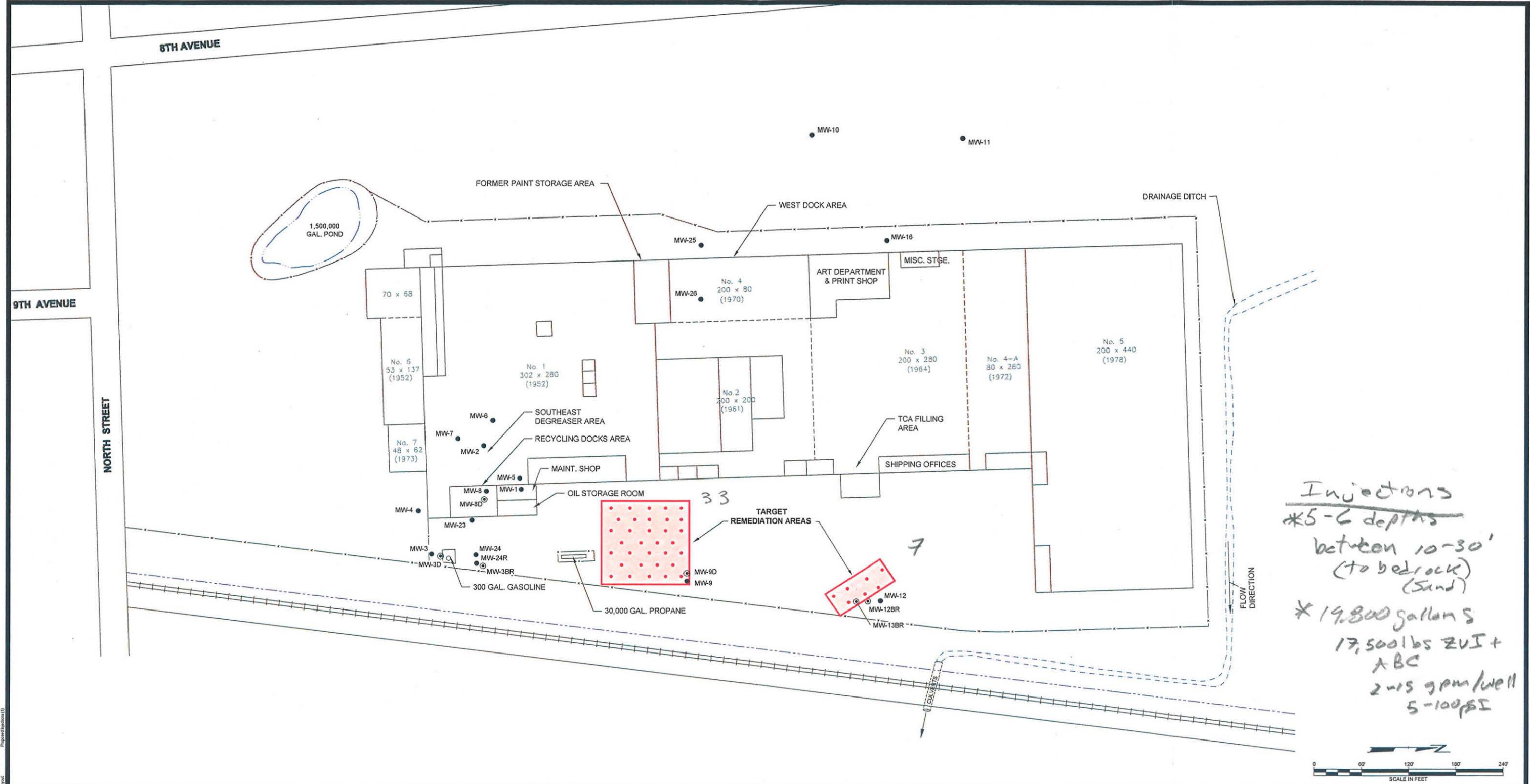
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 Operator Name: siewertd

**TECUMSEH PRODUCTS COMPANY
 GRAFTON, WISCONSIN**

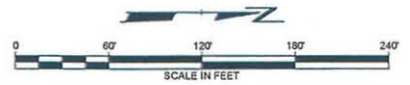
SITE LOCATOR MAP

DRAWN BY:	SIEWERTD
APPROVED BY:	
PROJECT NO.	03084.27
FILE NO.	02268.10.01
DATE:	October 2010

FIGURE 1



Handwritten notes:
 Injections
 *5-6 depths
 between 10-30'
 (to bedrock)
 (sand)
 *19,800 gallons
 17,500 lbs ZVI +
 ABC
 2-1/2 gpm/well
 5-100 PSI



LEGEND

---	PROPERTY LINE
- - - -	AISLEWAY
---	FENCE LINE
	RAILROAD
MW-24R ●	WATER TABLE WELL
MW-3BR ⊙	PIEZOMETER
●	TEMPORARY PROPOSED INJECTION POINT

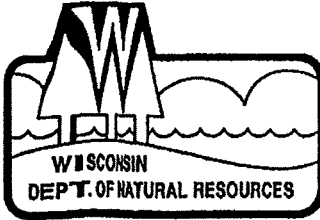
- NOTES**
1. FACILITY LAYOUT ADAPTED FROM DRAWINGS PROVIDED BY TECUMSEH PRODUCTS COMPANY.
 2. MONITORING WELL LOCATIONS AND ELEVATIONS WERE SURVEYED BY RMT INC. ON 12/5/94.
 3. LOCATION OF INJECTION POINTS IS APPROXIMATE. FINAL LOCATION OF POINTS MAY DIFFER FROM THOSE SHOWN HERE DUE TO PRESENCE OF UTILITIES OR OTHER OBSTRUCTIONS.
 4. ALL INJECTION POINTS WILL BE TEMPORARY AND ABANDONED FOLLOWING THE INJECTION.

5.				
4.				
3.				
2.				
1.				
NO.	BY	DATE	REVISION	APP'D.
TECUMSEH PRODUCTS COMPANY GRAFTON, WISCONSIN				
PROPOSED INJECTION LAYOUT				
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CHECKED BY:	AAS	AS INDICATED	FILE NO.:	02268.07.01.dwg
APPROVED BY:	TS	DATE PRINTED:		
DATE:	October 2010			
RMT		3754 Ranchero Drive Ann Arbor, MI 48108-2237 Phone: 734-971-7080 • Fax: 734-971-9022		

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 PLOT BY: JLS
 PLOT TIME: 3:11 PM
 PROJECT: 10226407
 DRAWING: 02268.07.01.dwg
 SCALE: AS SHOWN
 SHEET: 1 OF 1
 RMT INC. 3754 RANCHERO DRIVE ANN ARBOR, MI 48108-2237

Appendix A

WDNR Correspondence



State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Jim Doyle, Governor
Matthew J. Frank, Secretary
Gloria L. McCutcheon, Regional Director

Plymouth Service Center
1155 Pilgrim Rd.
P.O. Box 408
Plymouth, Wisconsin 53073-0408
Telephone 920-892-8756
FAX 920-892-6638

September 27, 2010

Jason Smith
Tecumseh Products Company
1604 Michigan Avenue
New Holstein, WI 53061-1175

Dear Mr. Smith:

Subject: Closure request for groundwater, Tecumseh Power Co, 900 North Street, Grafton, file reference FID #246009170, BRRTS #0246000751.

Thank you for submitting a closure request regarding the status of groundwater remediation at the site. The Wisconsin Department of Natural Resources appreciates all your efforts and work that you have put into restoring the environment at your property and beyond. The department has reviewed your submittals and is not able to close the groundwater portion of your case at this time:

Concerns

- Concentrations in source area wells have not decreased sufficiently to demonstrate effectiveness of the remedial actions taken. Contaminant concentrations must decrease significantly from where they are at present, including concentrations in the source area wells.
- Although TCE concentrations in MW-25 have shown fluctuations, a significant and consistent reduction has not been demonstrated. The soil sampling results within the treatment zone have indicated some reduction of TCE in the soil samples, but high levels remain (10,000 ug/kg) which could still contribute to groundwater contamination. Also, as no piezometers were ever placed in this area, and only one nearby monitor well is being used to evaluate affects in the estimated downgradient direction, it is difficult to clearly establish how successful the treatment has been.
- Monitoring well MW9 and MW-9D have not shown enough reduction in TCE concentration to reflect the success of the remedy there (excavation and thermal treatment). Extremely high concentrations of TCE were measured in some of the soil samples collected from the remedial excavations conducted in this area (1,000 to 22,000 mg/kg), which indicate that a significant soil source for groundwater contamination may remain in this area. There are no other monitor wells, besides MW-9 and MW-9D in this area to help define the plume from this source, and so it is difficult to judge whether the soil excavation has had a significant impact on groundwater quality.
- Overall, the limited number of monitoring wells makes a detailed analysis of the contaminant plume difficult.

- TCA concentrations in MW-12BR, MW-13BR1 and MW-13BR2 have decreased since the soil excavations were conducted, and TCE concentrations in MW-12BR and MW-13BR1 have also declined somewhat, but TCE concentrations in MW-13BR2 and MW-13BR3 have shown increases since 2007 and approach pre-remedial levels.
- Bedrock well MW-18BR1 and 18BR2 had a increase in TCE contaminant concentration for the past two years, such that TCE levels in 18BR2 are actually higher now than they were prior to remediation efforts. Similarly, TCE levels in bedrock well MW-19BR1 appear to have rebounded, approaching pre-remedial levels, although TCE concentrations in MW-19BR2 remain low.

Recommendations

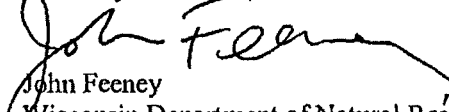
- Continue to monitor until relevant wells show significant reductions in concentrations.
- Consider additional wells close to and downgradient from the three major source areas on site to better show the effects of the remedial actions. Including a bedrock well close to and downgradient from MW-25 may also help to show the effectiveness of the remedial action in that location.
- Consider additional remedial actions

Requirements

- If the building and especially the floor slab are removed, additional investigation and remedial action should be done. You may want to consider whether to conduct investigation prior to building removal to better define the residual contamination and identify any other source areas that could be continuing to contribute to groundwater quality degradation.
- Continue with the groundwater sampling program. The department can't make a guarantee on how long this could take or if additional remedy is needed.
- Calculate flux of contaminants into the river for all substances over PAL concentrations.
- Please contact the local water utility to provide a service area map for the municipal wells closest to your contaminant plume.

If you have any questions about this letter, please call me at 920-892-8756 extension 3023.

Sincerely


John Feeney
Wisconsin Department of Natural Resources

Cc: RMT
SER File



Integrated
Environmental
Solutions

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www.rmtinc.com

November 8, 2002

Mr. John Feeney
Wisconsin Department of Natural Resources
Plymouth Service Center
115 Pilgrim Road
Plymouth, WI 53073-0408

Subject: Response to Conditional Remedial Action Plan Approval
West Dock and Recycling Dock Areas
Tecumseh Products Company
Grafton, Wisconsin (WDNR FID #246009170, BRRTS #02-46-000751)

Dear Mr. Feeney:

This letter is in response to the Wisconsin Department of Natural Resource's (WDNR's) Conditional Remedial Action Plan Approval letter dated June 6, 2002. RMT, Inc. (RMT), on behalf of Tecumseh Products Company (Tecumseh), is submitting this response. The information summarized below includes the WDNR's individual approval conditions, followed by Tecumseh's response.

WDNR Comment

Develop a contingency plan for quick groundwater extraction and hydraulic control if the concentrations of biodegradation daughter products below and downgradient from the treatment areas accumulate and do not degrade. Submit that to me before you start the systems.

Response

It is possible that, during enhanced reductive dechlorination in the West Dock and Recycling Dock source areas, the concentrations of biodegradation daughter products such as cis-1,2 dichloroethene (cis-DCE) or vinyl chloride (VC) could accumulate and not degrade. This phenomenon has been found at some sites, as is documented in the literature. It is not fully understood why this happens at some sites, but it is likely due to varying geochemical and microbiological conditions in the subsurface.

At the City of Sun Prairie site, RMT saw an initial accumulation of cis-DCE in the source area, but it was subsequently degraded. VC was never observed. In the case of the Sun Prairie site, the plume surrounding the source area was aerobic. It is likely that VC was degraded aerobically downgradient from the anaerobic treatment zone, and therefore never accumulated.

The contingency plan for the Tecumseh site, should daughter products accumulate, will be based on site conditions monitored during the enhanced remediation work. Therefore, it is difficult to develop a detailed *a priori* contingency plan. Performance monitoring and

Mr. John Feeney
Plymouth Service Center
November 8, 2002
Page 2

reporting is already included in the remediation plan. Once it is clear that degradation of daughter products is sufficient to achieve site goals, we will notify the WDNR and assess remediation alternatives. Several options could be used to remedy the situation, as follows:

- Revised anaerobic processes
- Chemical oxidation downgradient of the source areas
- Enhanced aerobic bioremediation downgradient of the source areas
- Installation of groundwater recovery wells for hydraulic containment downgradient of the source areas

These options will be evaluated against soil and groundwater conditions, should cis-DCE or VC be found to accumulate. A plan for additional action consistent with future conditions will be submitted to the WDNR for approval within 45 days of the initial notification.

WDNR Comment

Submit a brief yearly system performance/evaluation report. After five years of system operation or 50 percent of the groundwater contaminant concentration is reached in the source area a performance evaluation of the remedial system must be made to determine the appropriateness of shutting down the system, and if natural attenuation is appropriate at that time.

Response

An annual system performance/evaluation report will be submitted to the WDNR for the remediation systems installed at the West Dock and Recycling Docks Areas. This report will include a summary of the injections performed each year, a presentation of the monitoring data collected, an assessment of daughter product accumulation, and an evaluation of the system performance relative to the treatment performance goals.

After 5 years of operation, or a 50 percent reduction in groundwater contaminant concentrations in the source area, an evaluation will be made regarding the appropriateness of shutting down the remediation systems. At that time, site data will be evaluated to determine if natural attenuation is the appropriate remedial action for the site.

Mr. John Feeney
Plymouth Service Center
November 8, 2002
Page 3

Please contact me, at (608) 662-5108, if you have any questions regarding these responses to your approval letter.

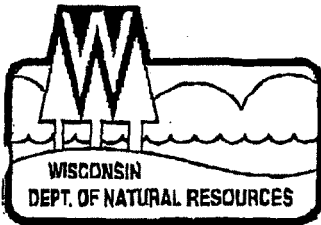
Sincerely,

RMT, Inc.



Bernd W. Rehm, P.G.
Project Manager

cc: Tecumseh Products Company – Bharat Shah, Kerry DeKeyser, Glenn Elmer
RMT – Randi Williams, Stacey Koch
Wisconsin Department of Natural Resources - Corey Heckel



State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Scott McCallum, Governor
Darrell Bazzell, Secretary
Gloria L. McCutcheon, Regional Director

Plymouth Service Center
1155 Pilgrim Road
P.O. Box 408
Plymouth, Wisconsin 53073-0408
Telephone 414-892-8756
FAX 414-892-8638

June 6, 2002

Kerry Dekeyser
Tecumseh Products Company
1604 Michigan Avenue
New Holstien, WI 53061-1175

Post-It® Fax Note	7671	Date	# of pages 1
To	Stacey Koch	From	John Feeney
Co./Dept.		Co.	
Phone #		Phone #	
Fax #		Fax #	

West Dock + Recycling

Subject: Conditional remedial action plan approval, east parking lot area, Tecumseh, 900 North Street, Grafton, file reference FID #246009170, BRRTS #246009170

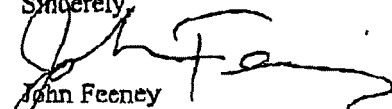
Dear Mr. Dekeyser:

Thank you for having your consultant submit a remedial action plan for the West Dock and Recycling Dock/Southeast Degreaser areas. I approve your plan contingent on the following:

- Develop a contingency plan for quick groundwater extraction and hydraulic control if the concentrations of biodegradation daughter products below and downgradient from the treatment areas accumulate and do not degrade. Submit that to me before you start the system.
- Submit a brief yearly system performance/evaluation report. After five years of system operation or 50% of the groundwater contaminant concentration is reached in the source area a performance evaluation of the remedial system must be made to determine the appropriateness of shutting down the system, and if natural attenuation is appropriate at that time.

The department will require additional remedial work if the system does not show itself to be effective. If you have any questions about this letter, please call me at 920-892-8756 extension 3023.

Sincerely,


John Feeney
Wisconsin Department of Natural Resources

Cc: RMT, Inc.
SER File



April 15, 2002

Mr. John Feeney
Wisconsin Department of Natural Resources
4041 North Richards Street
P.O. Box 12436
Milwaukee, WI 53212-0436

Subject: Remedial Action Workplan
Tecumseh Products Company
Grafton, Wisconsin (WDNR FID# 24009170, BRRTS# 02-46000751)

Dear Mr. Feeney:

The purpose of this letter is to provide the Wisconsin Department of Natural Resources (WDNR) with a workplan for enhanced bioremediation of soil and groundwater impacted with trichloroethene (TCE) and 1,1,1-trichloroethane (TCA), at the Tecumseh Products Company facility in Grafton, Wisconsin. Based on the findings reported in the Subsurface Investigation Report for Tecumseh Products Company (RMT, Inc., 1997) and the Bioremediation Treatability Study Results (RMT, Inc., 1999), the selected remedial action approach is *in situ* enhanced bioremediation at both the West Dock and the Southeast Degreaser and Recycling Dock Areas. In addition, approximately 200 cy of soil will be excavated from within the West Dock Area, and will be characterized for disposal. This workplan has been prepared by RMT, Inc. (RMT), on behalf of Tecumseh Products Company (Tecumseh).

Executive Summary

RMT, Inc. (RMT), on behalf of Tecumseh Products Company (Tecumseh) in Grafton, Wisconsin, has prepared this remedial action workplan. The workplan is for *in situ* enhanced bioremediation of soil and groundwater impacted with trichloroethene (TCE) and 1,1,1-trichloroethane (TCA) within the West Dock and Southeast Degreaser and Recycling Dock Areas at the Tecumseh site. Findings reported in the Subsurface Investigation Report (RMT, 1997) and the Bioremediation Treatability Study Results (RMT, 1999) indicate that anaerobic biodegradation of groundwater impacted with TCE, TCA, and their breakdown products is occurring within both areas, and will be accelerated using lactate enhancements. Lactate infiltration trenches will be constructed in the West Dock Area, and injection wells will be installed in the Southeast Degreaser and Recycling Dock Area. In addition, as part of the trench construction in the West Dock Area, petroleum and/or polycyclic aromatic hydrocarbon (PAH)-impacted soil will be excavated and characterized for proper disposal.

The remediation goal for the West Dock and the Southeast Degreaser and Recycling Dock Areas is to reduce the TCE and its daughter product concentrations in the source area groundwater to 50 percent of the concentrations measured during the sampling round that will take place in 2002, prior to the first lactate enhancement. Enhancements will occur until the remediation goal is met within each area, or for up to 5 years, whichever comes first. TCA and its daughter products will also be degraded, although the potential decrease is unknown at this time.

Mr. John Feeney
Wisconsin Department of Natural Resources
April 15, 2002
Page 2

On behalf of Tecumseh, RMT requests the comments and approval of the Wisconsin Department of Natural Resources for the remedial action workplan by 22 April 2002, so that planning for construction and remedial action startup, which is to take place during the summer of 2002, may begin shortly thereafter.

Bioremediation Background

The anaerobic biodegradation of TCE, and similar compounds, can occur by a process known as reductive dehalogenation. This process is a redox reaction consisting of the reduction of an electron acceptor, TCE, by the replacement of a chlorine atom with a hydrogen atom, and the oxidation of an electron donor (organic substrate). This process is mediated by microorganisms that are able to obtain energy from reductive dehalogenation, making the process favorable. The electron donor that will be used at this site is lactate, a buffered form of lactic acid. When lactate is anaerobically degraded, other volatile fatty acids, such as acetic acid, and hydrogen are generated. Hydrogen is believed to be the actual electron donor in reductive dechlorination. Lactate is an innocuous food grade material that has been used successfully at other sites. Specifically, this process was used by RMT in Sun Prairie, Wisconsin, and Steve Ales was the WDNR Remediation Project Manager. The results of that project were recently presented at the Batelle *In Situ* and On-site Bioremediation Symposium held in 2001 (Rice et al., 2001) (see attachment).

During the Bioremediation Treatability Study at the Tecumseh Grafton facility, laboratory studies were conducted to determine whether dehalogenation is occurring in the Southeast Degreaser and Recycling Dock and West Dock Areas. Soil and groundwater samples were collected beneath the Recycling Dock Area, also representative of the West Dock Area, and bench-scale microcosms were set up using these samples under unspiked (natural), spiked, and abiotic conditions. Anaerobic conditions were maintained throughout the 83 days of observation in the natural and spiked samples. The volatile fatty acid (VFA) results in the natural and spiked condition bottles showed decreases in acetic acid (acetate), butyric acid (butyrate), and some propionic acid (propionate), demonstrating that they are being utilized. Under these conditions, anaerobic fermentation by methanogens and likely reductive dehalogenation is occurring in the Southeast Degreaser and Recycling Dock and West Dock Areas. TCE and its breakdown products were fully degraded in the natural and spiked bottles of the extended study (+3 months). The chlorinated ethanes (TCA and its breakdown products) were not observed to significantly degrade in the laboratory studies. However, field observations do indicate that degradation of chloroethanes is occurring in both areas, and this is supported by other studies in the literature.

Treatment Performance Goals

The enhanced bioremediation system is intended to accelerate the process of biodegradation of TCE, TCA, and their respective breakdown products at the West Dock Area and the Southeast Degreaser and Recycling Dock Areas. The performance goals have been set based, in part, on the results of the Biotreatability Study performed in 1999 (RMT, 1999). In that study, intrinsic bioremediation rates were estimated for TCE and cis-dichloroethene (cis-DCE). While enhancements with lactate were not

Mr. John Feeney
Wisconsin Department of Natural Resources
April 15, 2002
Page 3

performed in the study, our experience at the Sun Prairie site and the published experience of others, indicates that degradation rates will increase with the addition of lactate. It is estimated that, with increased biodegradation rates, groundwater concentrations in the source areas can be decreased by 50 percent over a 5-year period.

West Dock Area

Background

Plant maintenance operations were conducted at the West Dock Area, as depicted on Figures 1 through 3, from 1952 until approximately 1966. The primary solvent used for machine maintenance and cleaning during that time was TCE. The extent of the TCE impacts is shown on Figures 2 and 3. The TCE impacts in the soil extend both underneath the building and outside the building wall. The vertical extent of the TCE is limited to a relatively narrow interval, located immediately above the water table surface. The water table is located at a depth of approximately 15 feet. PAH and petroleum-related contaminants were found to a limited horizontal extent within the upper 5 feet in the West Dock Area (see Figures 2 and 3). The PAH and petroleum impacts appear to be a result of activities within the area that took place post-1966, because these materials were not reported to have been used in the area prior to that time (RMT, 1997).

Remedial Action

The remedial action will consist of constructing four lactate infiltration trenches (see Figures 2 and 3) throughout the area of highest TCE soil impacts, which will allow the lactate solution to infiltrate the unsaturated soil, and impact an estimated 47,000 cubic feet of soil, as well as the underlying groundwater. Initial groundwater concentrations will be established by sampling prior to the first infiltration in 2002. Two new 2-inch monitoring wells, MW-25 and MW-26, will be installed between trenches 1 and 2 and within the Tecumseh facility (Figures 1-3), respectively, in order to monitor the progress of the remediation system. The wells will be screened within the sandy soil that forms the shallowest aquifer beneath the site. The goal of the bioremediation is to reduce the TCE concentrations in the source area groundwater to 50 percent of the initial concentrations.

A lactate solution tank will be located within the Tecumseh Plant, and will supply the four trenches located west of the plant with the solution by means of gravity infiltration. Other additives in the lactate solution include yeast extract, used to provide micronutrients to the microorganisms, and sodium sulfide, used as an oxygen scavenger to ensure that an anaerobic environment is maintained. The system will operate continuously for 3 months, at an estimated flow rate of 0.5 gpm, after which time the soil is expected to be saturated. An estimated 70,000 gallons of solution will be injected over the 3 months. The system will then be shut off for 3 months to allow for biodegradation. The 6-month infiltration/biodegradation cycle will be repeated for up to 5 years, or until the remediation goal is met within the area.

Soil samples will be collected after each 6-month interval for the first year of operation to evaluate soil concentrations. Subsequent sampling will take place once per year. Two soil samples will be

collected during each sampling round, from locations in close proximity to previous soil borings SB5WD and SB7WD (see Figure 2). Monitoring wells MW-25 and MW-26 will also be sampled quarterly for the first year of operation. Subsequent sampling will take place at six-month intervals. Soil and groundwater collection and analysis are described below.

Infiltration Trench Construction

The infiltration trenches will be 5 feet deep and 5 feet wide. Gravel bedding and 3-inch PVC perforated pipe will be placed in the lower 2 feet of the trenches. The remaining 3 feet of trench will be backfilled and compacted with clean clay-rich soil brought to the site, to better seal the trenches. Filter fabric will be placed between the soil and gravel to keep small particles out of the gravel. Approximately 200 cubic yards of soil contaminated with PAH and petroleum-related constituents will be excavated in the vicinity of trenches 1 and 2, and will be characterized for disposal (see Figures 2 and 3). The lactate solution will be routed to each trench from the lactate solution tank(s) through a buried PVC pipe. The lactate solution tank(s) will be made of heavy-duty polyethylene. The tank will be refilled approximately once every 2 weeks during the injection periods by a maintenance technician.

Southeast Degreaser and Recycling Dock Area

Background

Parts degreasing was performed in the Southeast Degreaser and Recycling Dock Area, as depicted on Figures 1, 4, and 5, from the early 1960s to 1986. TCE, TCA, and dichloroethenes are the primary chlorinated compounds detected in the groundwater. The water table is at a depth of approximately 12 feet bgs in this area. The highest levels of TCE and TCA concentrations are located just above the water table. In general, TCE and TCA impacts extend from the ground surface to the water table. The groundwater flows to the east at a rate of 330 feet per year at this location.

Remedial Action

The remedial action will consist of constructing three 4-inch-diameter injection wells, LI-1, LI-2, and LI-3, just east of the dock (see Figures 4 and 5). Lactate solution will be injected at each well at an approximate rate of 3 gpm over a two day period (7,050 gallons per well), every 6 months for up to 5 years, or until the remediation goal is met within the area. The primary goal of the aquifer enhancement injections is to reduce the TCE concentrations in the source area groundwater to 50 percent of the concentrations measured during the sampling round that is to take place prior to startup in 2002. A temporary lactate solution tank made of polyethylene will be used during each injection, and the material will be metered into a pipe pressurized by on-site tap water downstream of a newly installed backflow prevention device, to dilute the solution to the desired concentration. The solution will be injected under pressure to the injection wells via temporary tubing set up prior to each injection. The wells will be constructed to an approximate depth of 20 feet, and will be screened from 10 to 20 feet below ground surface.

Mr. John Feeney
Wisconsin Department of Natural Resources
April 15, 2002
Page 5

The wells will be constructed just east of the recycling dock in order to maximize the downgradient migration of the lactate solution through the impacted groundwater. Two new 2-inch-diameter monitoring wells, MW-23 and MW-24, will be constructed 40 feet and 80 feet downgradient from the injection wells, respectively, in order to monitor the progress of the system.

Depending on need and accessibility, less frequent injections may be performed upgradient of the recycling dock, utilizing existing monitoring wells MW-2 and MW-6. These injections will allow for increased biodegradation in this area of lower concentration.

Injection and Monitoring Well Construction

The wells will be constructed in accordance with NR 141. Figures 6 and 7 show the well details for the injection wells (LI-1, LI-2, and LI-3) and monitoring wells (MW-23, MW-24, MW-25, and MW-26) respectively. Waste cuttings generated during well drilling will be characterized and handled as either solid waste or characteristic hazardous waste in accordance with NR 141.

Permitting

Prior to remediation startup, the WPDES Permit for Contaminated Groundwater from Remedial Action Operations, WI-0046566-4, will be obtained. The permit will address injecting enhanced bioremediation additives into the groundwater (i.e., lactate, yeast extract, sodium sulfide).

Sampling Plan

The following protocol will be implemented to monitor the performance and confirm the effectiveness of the soil and groundwater treatment process:

- Prior to startup, water from MW-8, MW-8D, MW-3, MW-3D, MW-3BR, and the newly constructed wells MW-23, MW-24, MW-25, and MW-26 will be sampled for the following parameters:
 - Field parameters (water table elevations, dissolved oxygen, pH, oxidation-reduction potential, temperature, and specific conductivity)
 - Chlorinated VOCs (TCE, dichloroethenes, vinyl chloride, TCA, dichloroethane, and chloroethane)
 - Chloride
- After the initial injection, MW-8, MW-8D, MW-23, MW-24, MW-25, and MW-26 will be sampled quarterly for the first year of operation for the following parameters (subsequent monitoring will be performed at the 6-month interval):
 - Field parameters (same as above)
 - Chlorinated VOCs (same as above)
 - Chloride
 - Volatile fatty acids (to evaluate lactate metabolism)

Mr. John Feeney
Wisconsin Department of Natural Resources
April 15, 2002
Page 6

- After each 6 month interval for the first year of operation, two soil samples will be collected in the West Dock Area and analyzed for chlorinated VOCs, to be compared to historical data. Subsequent sampling will take place once per year.

Remedial Action Schedule

The remediation system construction and well installations are scheduled to begin in July 2002. The initial lactate injections are targeted for August 2002. Initially, monitoring may be more frequent; but after the system parameters are established, monitoring will occur 6 months after each injection. The second injection to the system is estimated to begin in mid-February 2003, and then every 6 months thereafter.

I will contact you to discuss any questions you may have and to obtain the Department's approval of this plan.

Sincerely,

RMT, Inc.



Stacey A. Koch, P.E.
Project Engineer



Bernd W. Rehm, P.G.
Senior Consulting Hydrogeologist
Project Manager

Attachments: Figure 1 - Site Layout
Figure 2 - Lactate Infiltration Trench Layout
Figure 3 - Cross Section A-A' - Lactate Infiltration Trench Details
Figure 4 - Lactate Injection Well Layout
Figure 5 - Cross Section B-B' - Injection Well Details
Figure 6 - Injection Well Detail
Figure 7 - Monitoring Well Detail
"Enhanced Reductive Dechlorination of PCE" (Rice, et al., 2001)

cc: Tecumseh Products Company - Glenn Elmer, Kerry DeKeyser, Bharat Shah
RMT - Randi Williams

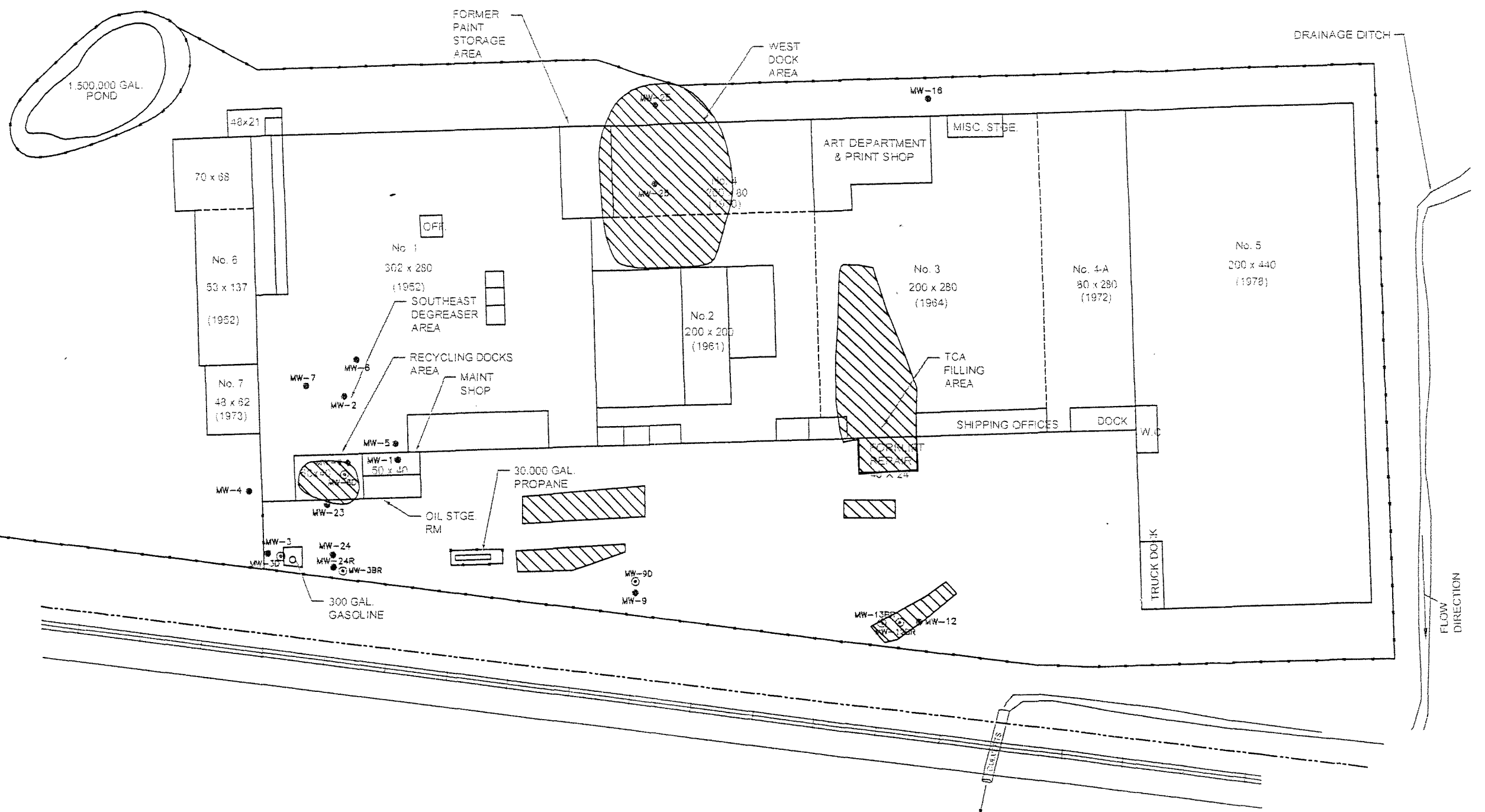
12/12

Appendix B

Historical Reference Figures

9TH AVENUE
NORTH STREET

MW-10 MW-11



LEGEND

- MW-10 WATER TABLE WELL
- ⊙ MW-3BR PIEZOMETER
- ▬ RAILROAD
- - - PROPERTY LINE
- - - PIPES BELOW GROUND
- - - AISLEWAY
- FD FLOOR DRAIN
- CO CLEAN OUT
- ▨ APPROXIMATE EXTENT OF RESIDUAL TCE OR TCA IMPACTS TO SOIL

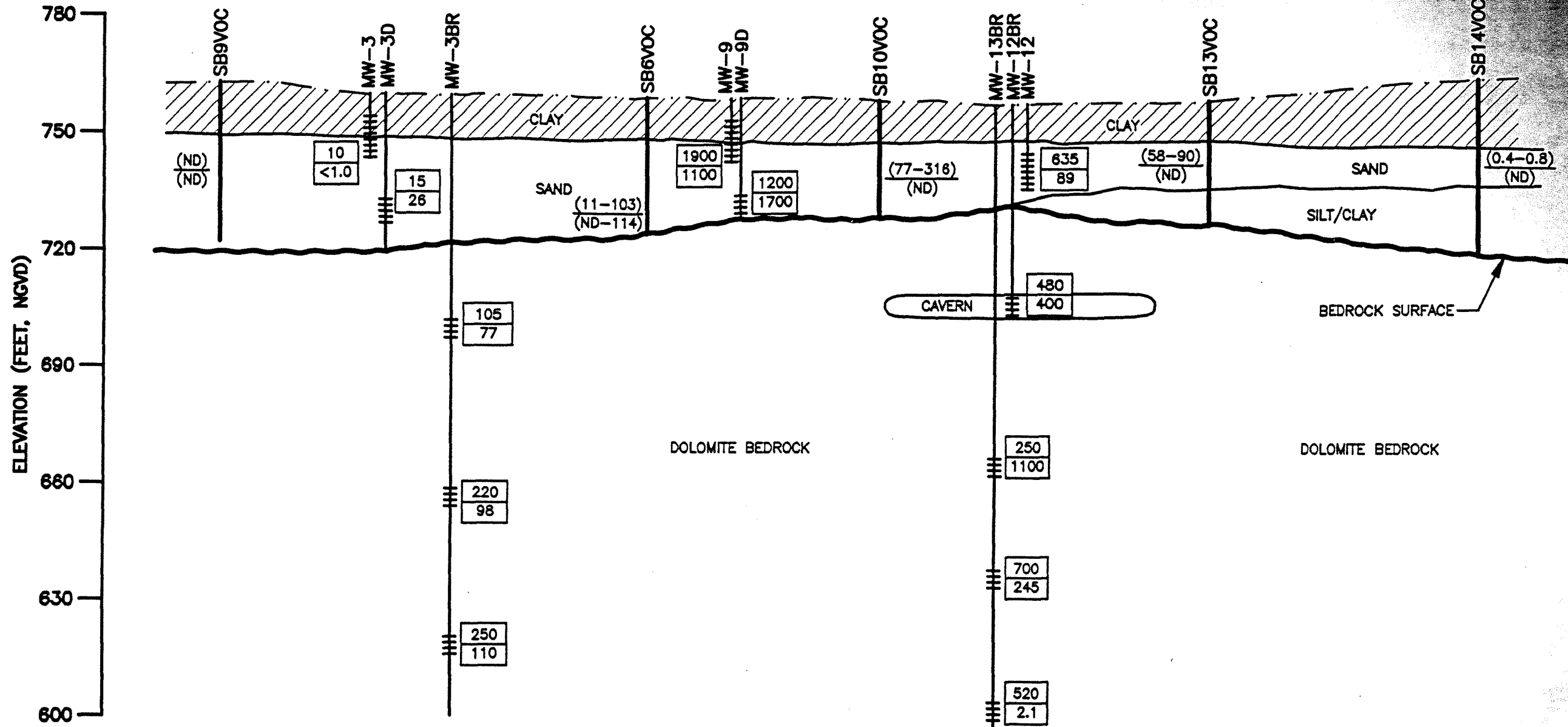
NOTES

1. FACILITY LAYOUT ADAPTED FROM DRAWINGS PROVIDED BY TECUMSEH PRODUCTS COMPANY.
2. MONITORING WELL LOCATIONS AND ELEVATIONS WERE SURVEYED BY RMT INC. ON 12/5/94.
3. RESIDUAL SOIL IMPACTS TO THE EAST OF THE FACILITY WERE LEFT IN PLACE DUE TO UTILITIES OR PROXIMITY TO BUILDING.

PROJECT: TECUMSEH PRODUCTS COMPANY GRAFTON, WISCONSIN			
SHEET TITLE: RESIDUAL SOIL IMPACTS			
DRAWN BY: FITZGERE	SCALE: 1"=100'	PROJ. NO. 07397.07	
CHECKED BY: AAS		FILE NO. 73970701.DWG	
APPROVED BY: TS	DATE PRINTED:	FIGURE 1	
DATE: MARCH 2010			
RMT <small>744 Heartland Trail Madison, WI 53717-1834 P.O. Box 8923 53708-8923 Phone: 608-831-4444 Fax: 608-831-3334</small>			

SOUTH

NORTH



LEGEND

- | |
|-------|
| (TCE) |
| (TCA) |

 PORTABLE GC RESULTS FOR TCE/TCA IN GROUNDWATER (µg/L)
- | |
|-----|
| TCE |
| TCA |

 LABORATORY RESULTS FOR TCE/TCA IN GROUNDWATER (µg/L)
- MONITORING WELL INTAKES

NOTES

1. THE PORTABLE GC SAMPLES WERE COLLECTED AUGUST THROUGH DECEMBER 1994. SEE TABLE F-2 FOR DETAILS OF CONCENTRATION CHANGES WITH DEPTH.
2. THE LABORATORY SAMPLES WERE COLLECTED IN JUNE 1998. WHERE DUPLICATE SAMPLES WERE COLLECTED, THE AVERAGE VOC CONCENTRATIONS ARE REPORTED.
3. GEOLOGIC CROSS SECTION LOCATION SHOWN ON FIGURE 2 (SAME AS CROSS SECTION A-A').

SCALE
 HORIZONTAL: 1" = 100'
 VERTICAL: 1" = 30'

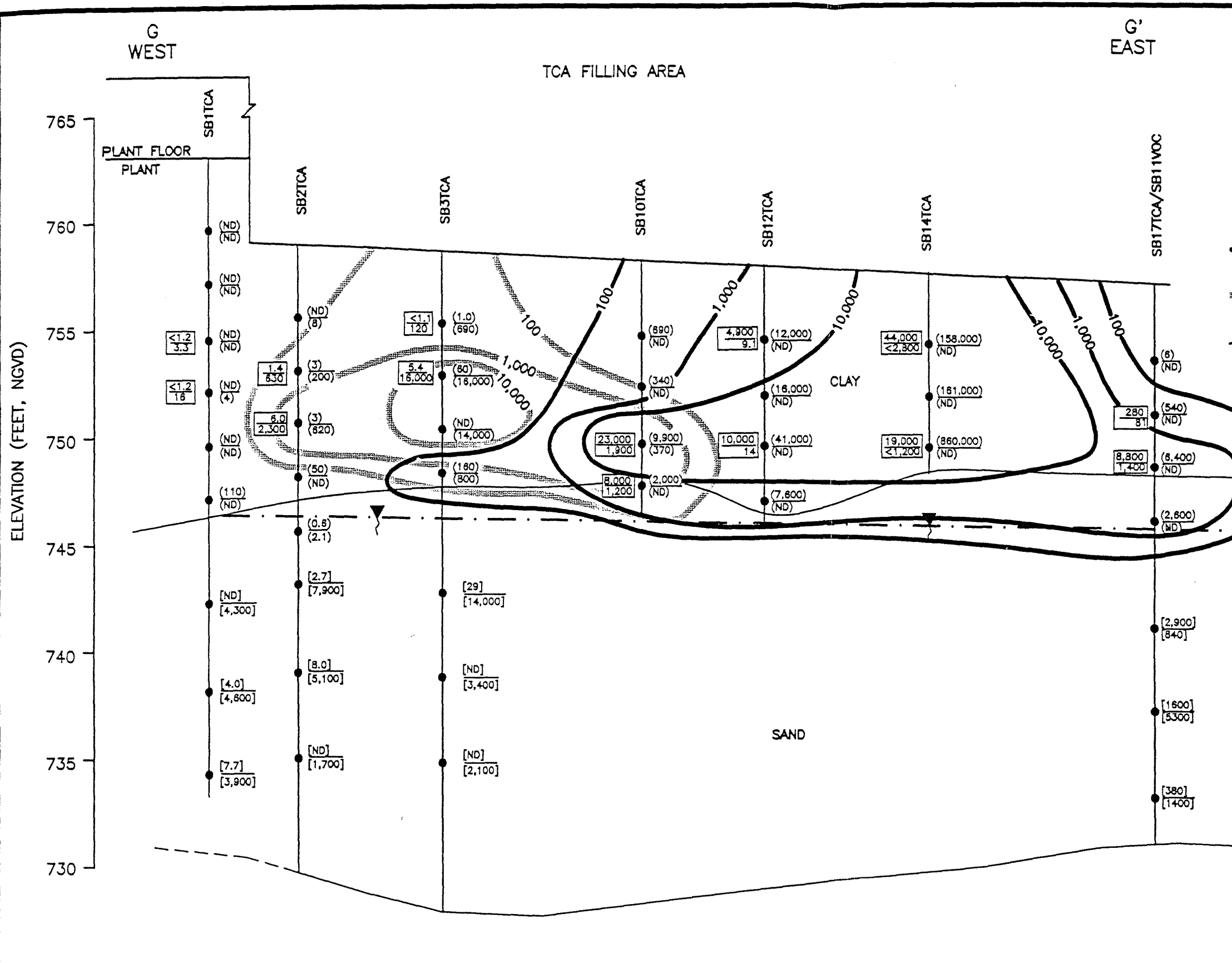
**ON-SITE CROSS SECTION WITH
 GROUNDWATER CHEMISTRY RESULTS
 TECUMSEH PRODUCTS COMPANY
 GRAFTON, WI**

	DWN. BY: RBN
	APPROVED BY: <i>BWR</i>
	DATE: APRIL 1997
	PROJ. # 3084.18
	FILE # 30841816.DWG

FIGURE 19

Operator Name: RBN
 Scale: 1" = 100'
 Plot Date: Thursday, March 20, 1997
 Plot Time: 10:01:2231 AM
 Attached Xrefs: No xrefs Attached.

Drawing Name: 0308... 30841
 Of: ...
 Scale: 1" = 20'
 Dwg Size: 83762 Rvles
 P: ursda
 Plot Time: 09:59:4278 AM
 Attached Xref's: No xref's Attached.



LEGEND

$\frac{(TCE)}{(TCA)}$	EQUIVALENT SOIL CONCENTRATION FOR TCE/TCA (ug/kg) (CALCULATED FROM PORTABLE GC DATA - SEE NOTE 1)
$\frac{[TCE]}{[TCA]}$	LABORATORY RESULTS FOR TCE/TCA IN SOIL (ug/kg)
$\frac{(TCE)}{(TCA)}$	PORTABLE GC RESULTS FOR TCE/TCA IN GROUNDWATER (ug/L)
—	ESTIMATED EXTENT OF TCE, ISOCONCENTRATION IN SOIL (ug/kg)
—	ESTIMATED EXTENT OF TCA, ISOCONCENTRATION IN SOIL (ug/kg)
—	APPROXIMATE WATER TABLE SURFACE

- NOTES**
1. THE REGRESSION EQUATIONS FOR TCE AND TCA (SEE FIGURES 8 AND 9) WERE USED TO COMPUTE THE "EQUIVALENT SOIL CONCENTRATIONS" (ug/kg) FROM GC SCREENING DATA (ug/L).
 2. GEOLOGIC CROSS SECTION LOCATION SHOWN ON FIGURE 16.

**CROSS SECTION G-G' WITH
 TCE AND TCA CONCENTRATIONS
 TCA FILLING AREA
 TECUMSEH PRODUCTS COMPANY**

SCALE
 HORIZ.: 1" = 20'
 VERT.: 1" = 5'

	DWN. BY: RBN
	APPROVED BY: BWR
	DATE: APRIL 1997
	PROJ. # 3084.18
	FILE # 30841811.DWG

FIGURE 17

33

Appendix C

Groundwater Flux to Milwaukee River

PROJECT/PROPOSAL NAME/LOCATION: <u>Tecumseh -</u>		PROJECT/PROPOSAL NO.
SUBJECT: <u>Response to WDNR comments</u>		<u>02268-07.001</u>
PREPARED BY: <u>JMR</u>	DATE: <u>10-21-10</u>	FINAL <input type="checkbox"/>
CHECKED BY:	DATE:	REVISION <input type="checkbox"/>

Flux cis 1,2 DCE to the Milwaukee River

Assume the same relative distribution of cis 1,2 DCE in groundwater. The flux of cis 1,2 DCE should be proportional to the peak down gradient concentration of TCE at MW-19BR1

Typical recent concentration:

TCE MW-19BR1 - 250 $\mu\text{g/L}$
 cis 1,2 DCE MW-19BR1 - 80 $\mu\text{g/L}$

Flux of cis 1,2 DCE as a proportion of Flux_{TCE}

(From Closure Request, Appendix B, March 2010)

$$\text{Flux}_{\text{TCE}} = 234 \text{ } \mu\text{g/sec}$$

$$\text{Flux}_{\text{cis 1,2 DCE}} = \frac{80 \text{ } \mu\text{g/L}}{250 \text{ } \mu\text{g/L}} \cdot 234 \text{ } \mu\text{g/sec} = \underline{\underline{75 \text{ } \mu\text{g/sec}}}$$

PROJECT/PROPOSAL NAME/LOCATION:		PROJECT/PROPOSAL NO.
SUBJECT:		
PREPARED BY:	DATE:	FINAL <input type="checkbox"/>
CHECKED BY:	DATE:	REVISION <input type="checkbox"/>

Flux of Vinyl Chloride (VC) to the Milwaukee River

Typical recent peak VC concentration in downgradient BR:

MW-19BR1 - 4 $\mu\text{g}/\text{L}$

$$\text{Flux}_{\text{VC}} = \frac{4 \mu\text{g}/\text{L}}{250 \mu\text{g}/\text{L}} \cdot 234 \mu\text{g}/\text{s} = \underline{\underline{3.7 \mu\text{g}/\text{sec}}}$$

Flux of 1,1 DCE to the Milwaukee River

Typical recent peak 1,1 DCE:

MW-19BR1 - 13 $\mu\text{g}/\text{L}$

$$\text{Flux}_{1,1\text{DCE}} = \frac{13 \mu\text{g}/\text{L}}{250 \mu\text{g}/\text{L}} \cdot 234 \mu\text{g}/\text{s} = \underline{\underline{12 \mu\text{g}/\text{sec}}}$$

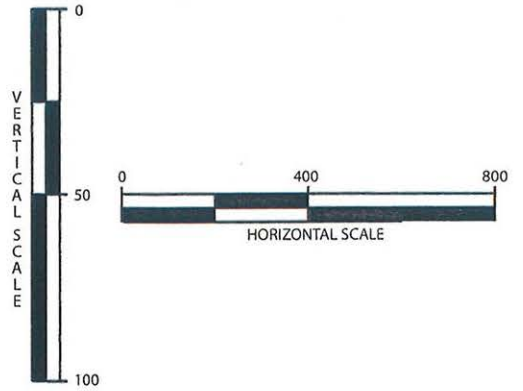
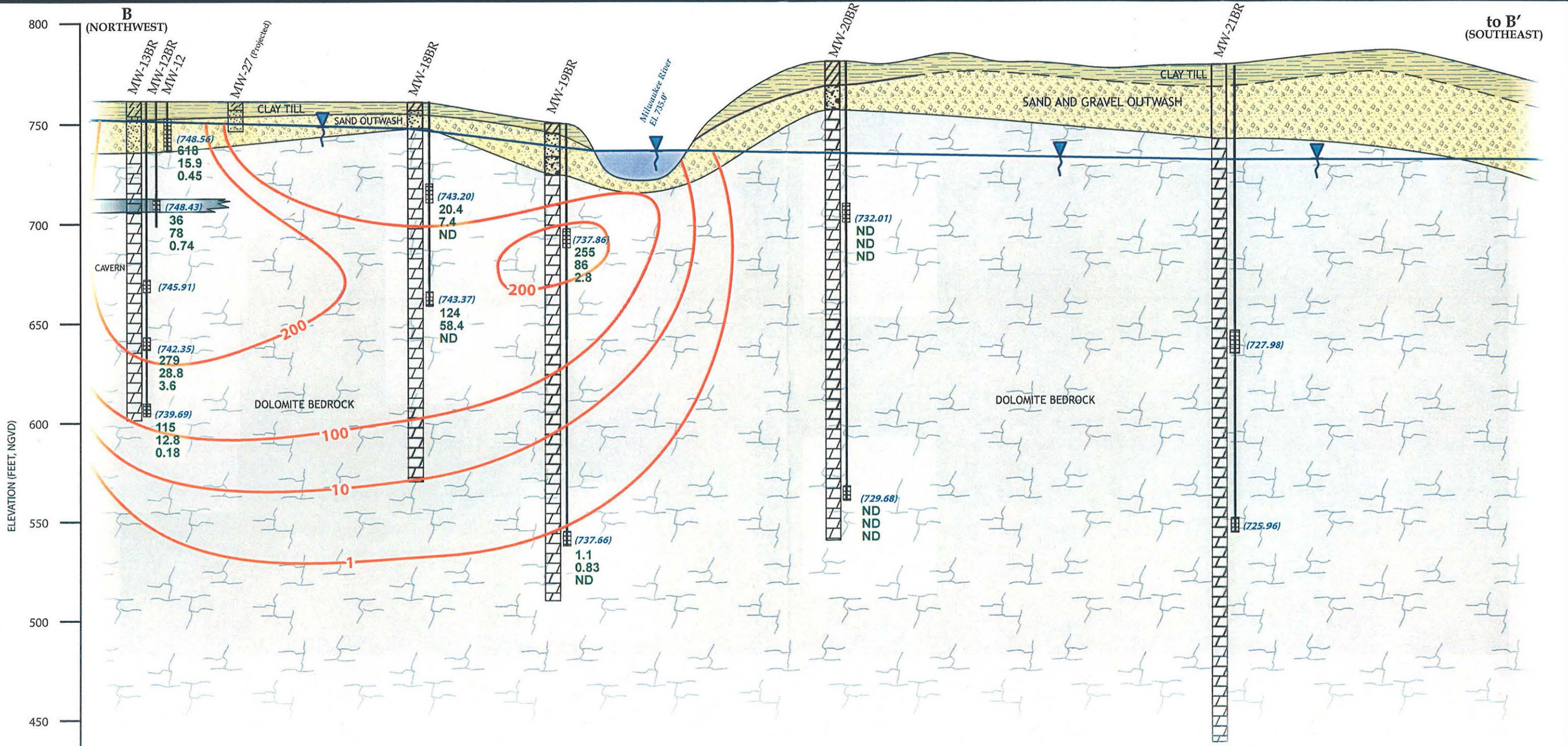
PROJECT/PROPOSAL NAME/LOCATION:		PROJECT/PROPOSAL NO.
SUBJECT:		
PREPARED BY:	DATE:	FINAL <input type="checkbox"/>
CHECKED BY:	DATE:	REVISION <input type="checkbox"/>

Flux of 1,1 DCA to the Milwaukee River

Typical recent peak for 1,1 DCA

MW-19 BR1 · 95 mg/L

$$Flux_{1,2DCA} = \frac{95 \text{ mg/L}}{250 \text{ m/s}} \cdot 234 \text{ m/s} = \underline{\underline{89 \text{ mg/sec}}}$$



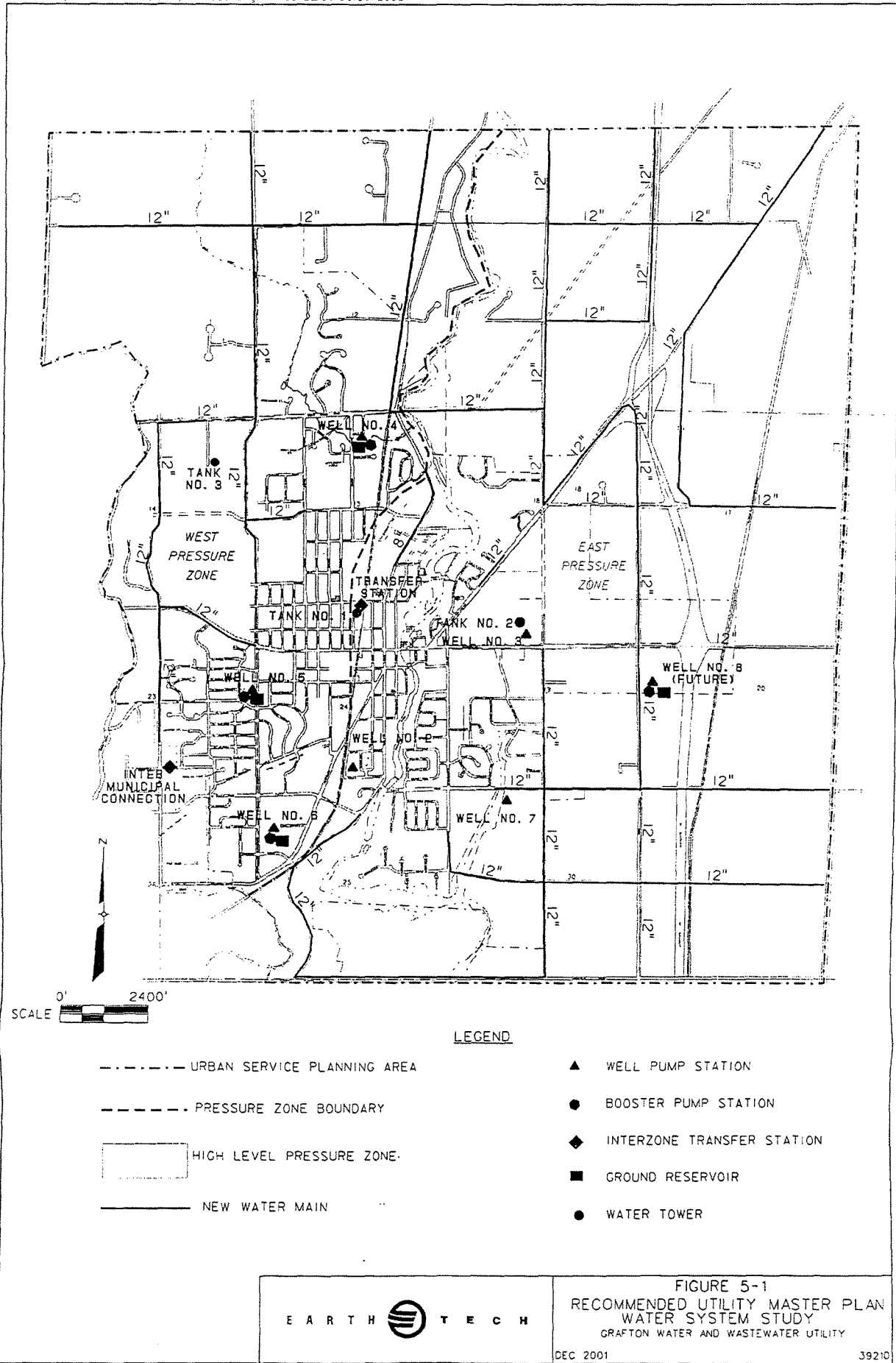
PROJECT: TECUMSEH PRODUCTS COMPANY GRAFTON, WISCONSIN			
SHEET TITLE: CONCEPTUAL GEOLOGIC CROSS SECTION WITH TCE CONCENTRATION CONTOURS			
DRAWN BY: PAPEZ J	SCALE: AS NOTED	PROJ. NO. 00-007397.07	
CHECKED BY: KELLER N		FILE NO. 739707XSEC01a.ai	
APPROVED BY: STOLZENBURG T	DATE PRINTED:	FIGURE 1	
DATE: MARCH 2010			
RMT		744 Heartland Trail Madison, WI 53717-1934 P.O. Box 8923 53708-8923 Phone: 608-831-4444 Fax: 608-831-3334	

D:\107397\107\doc\secl\739707XSEC01.AI

4/4

Appendix D

Municipal Well Map



LEGEND

- URBAN SERVICE PLANNING AREA
- PRESSURE ZONE BOUNDARY
- HIGH LEVEL PRESSURE ZONE
- NEW WATER MAIN
- ▲ WELL PUMP STATION
- BOOSTER PUMP STATION
- ◆ INTERZONE TRANSFER STATION
- GROUND RESERVOIR
- WATER TOWER



FIGURE 5-1
 RECOMMENDED UTILITY MASTER PLAN
 WATER SYSTEM STUDY
 GRAFTON WATER AND WASTEWATER UTILITY
 DEC 2001 39210

1/1

