02-72-240751

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

WISCONSIN
DEPT. OF NATURAL RESOURCES

Scott McCallum, Governor
Darrell Bazzell, Secretary

101 S. Webster St.
Box 7921
Madison, Wisconsin 53707-7921
Telephone 608-266-2621
FAX 608-267-3579
TTY 608-267-6897

November 17, 2004

ref: DC-081

Paul Bohman
1414 S. Maple Ave.
Marshfield, WI 54449

Subject: Dry Cleaning Reimbursement Acknowledgment for 5 Corners Laundry & Cleaners

Dear Mr. Bohman:

This letter is just to acknowledge that we have received your claims for reimbursement under the dry cleaning program. I will audit your request in detail. There is currently money available and I am going to complete this audit as soon as possible.

I will likely have some questions when I get a chance to review the files. I will contact your consultant first to get answers to my questions. After the audit is complete you will receive another letter from me with the audit results. You should receive the check within ten days after receiving the audit letter. Thanks for your patience throughout this process.

Sincerely,

Jeffrey Soellner
Dry Cleaning Fund Manager
WI DNR , Madison

cc

Tom Hvizdak – WCR – Wisconsin Rapids

Hvizdak, Thomas

From: Soellner, Jeffrey K
Sent: Tuesday, November 16, 2004 4:52 PM
To: Hvizdak, Thomas
Subject: DC-081 Acknowledgement letter for 5 Corners payment request

5 Corners acknowl DC-081.doc

Hvizdak, Thomas

From: Kalnicky, Richard A
Sent: Tuesday, August 24, 2004 9:06 AM
To: Hvizdak, Thomas
Cc: Kalnicky, Richard A
Subject: 5 Corners Laundry and Dry Cleaners--Environmental Risk Score

Tom, I have reviewed the score sheets you submitted earlier this month for the above site. (I just returned from a two weeks + vacation yesterday. I am making a couple of changes on specifics which I'll explain below. These would change the overall environmental risk score to 80 (up from 76) but still place the site in the same DERF high priority classification you proposed.

1. For the Environmental Characteristics and Receptors Score, we are limited to 40 points total, even if the raw score calculates to 50 points total.

2. The Soil Exposure portion of the Contaminant Characteristics Score should be 24 rather than 2. The 12 should be divided by 0.5. This 24, plus the 24 points for the Groundwater Migration Pathway, adds up to 48 points. But, again we are limited to 40 points maximum for Contaminant Characteristics.

These two corrections give a total Environmental Risk Score of 80. Note that the automated system Joe Traynor is developing would have caught these type of "math errors" because it sets limits and does the calculations.

Hopefully, these comments make sense. If not, please call me at 608-267-7554. Thanks.

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

WISCONSIN
DEPT. OF NATURAL RESOURCES

Jim Doyle, Governor
Scott Hassett, Secretary
Scott Humrickhouse, Regional Director

Wisconsin Rapids Service Center
473 Griffith Avenue
Wisconsin Rapids, Wisconsin 54494
Telephone 715-421-7800
FAX 715-421-7830

FILE COPY

August 6, 2004

BRRTS #: 02-72-240751

Mr. Paul Bohman
5 Corners Laundry & Dry Cleaning
1414-B South Maple Avenue
Marshfield, WI 54449

RE: Site Investigation and Remedial Action Options Reports,
5 Corners Laundry & Dry Cleaning Site,
1414-B South Maple Avenue, Marshfield, Wisconsin.

Dear Mr. Bohman:

The Wisconsin Department of Natural Resources (DNR) has received the site investigation report (dated September 29, 2003), the Remedial Action Options Assessment Report (dated June 10, 2004) and the Addmendum to the remedial action options report (dtaed August 5, 2004) for the above-referenced site. I have reviewed this information and based on this review it appears that the site investigation is complete enough to proceed with the cleanup of this site. In addition, based on this information and DNR guidelines the recommendations included in the Remedial Action Options Assessment Report appear to be a reasonable approach in this situation.

This letter is your **notice to proceed** with submitting your reimbursement application for the site investigation and remedial action options report, and with obtaining bids from qualified consultants to conduct the cleanup at this site. Work should be performed and reported in accordance with Wisconsin Administrative Code. Particularly bidding and reimbursement requirements in NR 169, the NR 700 series on contamination cleanups, and applicable DNR groundwater sampling and remediation technical guidance publications.

The Department appreciates your cooperative approach to this investigation and looks forward to continued progress. If you have any questions about this letter or concerns about your investigation and cleanup, please feel free to call me at (715) 421-7850.

Sincerely,

Tom Hvizdak
Hydrogeologist

c: Scott McKittrick, Northern Environmental, 1203 Storbeck Dr., Waupun, WI 53963
Jeff Soellner - WDNR

Northern Environmental℠
Hydrologists • Engineers • Surveyors • Scientists

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Waupun, WI 53963
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www.northernenvironmental.com

August 5, 2004
(CLD08-0407-0429)

RECEIVED
WI DEPT OF NATURAL RESOURCES
AUG 6 2004
WI RAPIDS SERVICE CENTER
WI RAPIDS, WI

Mr. Tom Hvizdak
Wisconsin Department of Natural Resources
Wisconsin Rapids Service Center
473 Griffith Avenue
Wisconsin Rapids, Wisconsin 54494

RE: Addendum to Remedial Action Options Report, 5 Corners Laundry and Drycleaning, Marshfield, Wisconsin, BRRTS #02-72-240751

Dear Mr. Hvizdak:

This letter serves as an addendum to the Remedial Action Options Report (RAOR) dated June 10, 2004. As you requested in an email dated June 21, 2004, this letter contains an evaluation and comparison of remedial options that are the most technically and economically feasible for the 5 Corners Laundry and Drycleaning site (the "Site").

Air Sparging/Soil Vapor Extraction

The combination of air sparging and soil vapor extraction AS/SVE is a technically feasible option; however, this option was eliminated from further consideration due to cost, time, and property disruption issues, as discussed below.

Air sparging transfers VOCs from water to the vadose zone by injecting air into the aquifer and stripping the dissolved organics from the water column. Vapor extraction is then utilized to remove the stripped VOCs from the vadose zone. Also, air sparging tends to increase biodegradation of certain organic compounds.

This AS/SVE has limited applications and works well in certain circumstances however, the geology of this site increases the possibility of lateral migration of the chlorinated compounds thus potentially expanding the plume. Also, the area is heavily urbanized thus limiting vapor extraction well placement. These two factors present an increase risk to potential receptors such as basements and utility trenches. Also, dry chlorinated compounds tend to have low vapor pressure which decreases their strippability and degradation byproducts can be more toxic than the original compounds.

Northern Environmental estimated the system would need to operate for a minimum of 24 months. The assumption also assumes no treatment of emitted vapor would be required. Carbon treatment of emitted air would significantly increase costs. With this option there are also considerable time and expense involved with construction, maintenance and sampling. Also, there are low permeability (silty clay) soils on-site that contain residual contamination requiring remediation. Achieving sufficient air flow through silty clay soils is difficult. The estimated cost to, operate, and maintain an AS/SVE system for 24 months is approximately $784,000. It is likely additional operation time would be required.

Groundwater Pump and Treat/SVE

As with AS/SVE, groundwater pump and treat coupled with SVE is technically feasible but not practical at this site. Groundwater pump and treat consists of extracting, treating, and discharging groundwater. The water acts as a carrier for the contaminant. The low solubility of chlorinated solvents in water requires a significant quantity of water be removed to recover the solvents. Any waste generated must also be properly disposed of. The network of wells needed to achieve containment at this site would include a minimum of 11 extraction wells. The water would need to be routed to one of 4 treatment systems placed in the area and then disposed of via storm water discharge or reinjection. Groundwater pump and treat systems are expensive to operate, especially in winter months and are notoriously high maintenance. As discussed above, the system would be extremely difficult to install due to the development in the area. SVE, which would be needed to remediate the soil above the water table has been discussed previously. The estimated cost to install and operate this system for 24 months would be $922,000. Additional operation time would likely be required.

Enhanced Bioremediation

This process involves the injection of compounds that act to accelerate the natural degradation of the contaminant. It is very similar in execution to the selected option, chemical oxidation. The significant difference is that chemical oxidation uses a specific compound that targets the contaminant. Enhanced bioremediation attempts to encourage naturally occuring microorganism to consume the contaminant. Costs of execution are similar between the two options; however, enhanced bioremediation would require more treatments and time to reduce contaminant concentrations to acceptable levels. Based on treatment results at similar sites, it is estimated enhanced bioremediation would take several uses to lower VOCs concentrations to acceptable state standards. Since a municipal well has been impacted by solvents, the length of time required for remediation is a critical consideration.

Chemical Oxidation

Chemical oxidation using potassium permanganate is recommended as the most technically and economically feasible remedial method for the Site. Compared to the alternative methods above, chemical oxidation is the recommended remedial option for the following reasons:

- More effective remedial method
- Less overall project cost
- Faster remediation time
- Less property disruption
- Minimal generation of hazardous waste material

The use of potassium permanganate has been limited in Wisconsin; however, it has been successfully used to remediate similar releases in similar geologic and hydrogeologic conditions throughout the United States. The chemical will be injected within Geoprobe boreholes. When the oxidant contacts chlorinated solvents a nearly immediate reaction occurs that converts the solvent into carbon dioxide, water, and other innocuous byproducts. The majority of the time involved with chemical oxidation is the WDNR approval process, injection design, and setup. A given area can be effectively treated within a matter of days. The main advantages of chemical oxidation as compared to the other evaluated alternatives are less time, less costs, generation of fewer hazardous breakdown products, less chance of inducing contaminant migration, and less property disruption. As discussed above, the reduced remediation time is a critical factor due to the impacted municipal well. An overview of the proposed remedial approach and costs were included in the RAOR.

Please contact me if you have any questions or require additional information.

Sincerely,
Northern Environmental Technologies, Incorporated

Scott A. McKittrick
Project Manager

SAM:alw

c: Mr. Paul Bohman – 5 Corners Laundry & Drycleaning

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PROFESSIONAL CERTIFICATIONS

I, Marty L. Koopman, 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.

Marty L. Koopman, P.G.
District Director

8/5/04
Date

I, Joseph E. Mentzer, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the 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 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.

Joseph E. Mentzer, P.E.
Engineer/Client Manager

8-4-04
Date

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: August 6, 2004 FILE REF: 02-72-240751

TO: Jeff Soellner, Bob Strous

FROM: Tom Hvizdak TH

SUBJECT: Environmental Risk Score Sheets – 5 Corners Laundry & Dry Cleaners, Marshfield

Attached are the score sheets for the 5 Corners Laundry & Dry Cleaners site in Marshfield.

FILE COPY

Printed on Recycled Paper

A. Groundwater Pathway (**Pick only one item, even though several may apply**)

1. 40 pts. Contamination above an NR 140 ES exists in a well(s) serving a total of 25 or more people (10 or more occupied households).
2. 30 Contamination above an NR 140 ES exists in a well(s) serving a total of less than 25 people (less than 10 occupied households).
3. 26 Contamination above an NR 140 PAL exists in a well(s) serving a total of 25 or more people (10 or more occupied households).
4. 20 Contamination above an NR 140 PAL exists in a well(s) serving a total of less than 25 people (less than 10 occupied households).
5. 20 Contamination above an NR 140 ES exists less than 1000 feet from a public water supply well.
6. 20 Contamination above an NR 140 ES exists less than 100 feet from a private water supply well.
7. 10 Free product exists in groundwater.
8. 10 Contamination above an NR 140 ES exists farther than 1000 feet from a public water supply well and farther than 100 feet from a private water supply well.
9. 10 Contamination above an NR 140 PAL exists less than 1000 feet from a public water supply well.
10. 10 Contamination above an NR 140 PAL exists less than 100 feet from a private water supply well.
11. 4 Contamination above an NR 140 PAL exists farther than 1000 feet from a public water supply well and farther than 100 feet from a private water supply well.
12. Potentials for individual items 1 through 11 to occur receive 1/2 the points for that item (Scores can range from 2 to 20). Provide the score next to number 12. Indicate the basis for your determination.

_____

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13. 0 No potential that any of the individual items 1 through 11 will occur. Explain if needed.

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Notes:

1. Using DNR's Drinking and Groundwater program's web page and another easily accessible web site will allow staff to determine how far a site is from a municipal well. Step by step directions are on the next page. Thanks to Jennifer Tobias for providing these instructions.

Follow these instructions to determine how far a site is from a municipal well.

1. Access the Intranet
2. Select Go To Program -- DG and click "GO"
3. Click on "Drinking Water Systems -- Public Systems"
4. Enter City/Village name, Type, Region, County and click "FIND"
5. Click on appropriate name of system
6. Next page gives population and contact names
7. Scroll down to third bullet and click on "Entry Points and Water Sources"
8. Click on a specific water source id
9. Next page gives location street, latitude and longitude
10. Write down the complete latitude and longitude--degrees, minutes, seconds
11. Go to www.topozone.com
12. Under "Get a Map" click "Deg/Min/Sec"
13. Enter lat/lon from DG page and click on "MAP IT"
14. This will show you the location of the municipal system.

B. Surface Water/Sediments Pathway

1. 40 pts. Fish consumption advisory or fish kills.
2. 40 Surface drinking water quality standards for human threshold and human cancer criteria in NR 105 are exceeded in a public water supply source.
3. 30 Violations of surface water quality standards in an outstanding or exceptional resource water identified in NR 102.10 or NR 102.11.
4. 20 Violations of surface water quality standards in a fish and aquatic life water or in a wetland as given in NR 102 through NR 105.
5. 10 Violations of surface water quality standards in an intermittent stream or a dry run as given in NR 104.
6. 5 Potentials for individual items 1 through 5 to occur receive 1/2 the points for that item (Scores can range from 5 to 20). Provide the score next to number 6. Indicate the basis for your determination.

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7. 0 No potential that any of the items 1 through 5 will occur. Explain if needed.

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Notes:

1. Points are awarded only if the specific impact or standards violation(s) are associated with contaminants from the site under evaluation.
2. Outstanding or exceptional resource waters, listed in NR 102.10 and NR 102.11, include national and state wild and scenic rivers, class I and II trout waters, and selected inland lakes. Intermittent streams and dry runs include noncontinuous streams, diffused surface waters, and wastewater effluent channels as defined in NR 104. All other water bodies are fish and aquatic life or wetlands. For further assistance, contact the appropriate Watershed Expert in the Region.
3. There are no specific water quality standards for sediments. However, if the contaminant characteristics and amounts of the sediment to be remediated can be shown to cause item 1, 2, 3, 4 or 5 above through water quality, toxicity, or bioaccumulation analyses, or the potential (item 6), the associated points are awarded.
4. Lacking water quality data, sites can be awarded points for the potential for standards violations to occur (item 6 above), based on professional judgment. Potentials can also be based on migration of the contaminants from another location (soil, groundwater, etc.) into the water body, increase in concentration or amount, or other professional judgment.

C. Air Pathway

1. 40 pts. Indoor air quality toxic to human health, as determined by the Wisconsin Division of Health.
2. 26 Violation of any ambient air quality standard in NR 404.04 or an air emission standard, if there are 50 or more **residents** within 0.1 mile of the contaminant source.
3. 14 Violation of any ambient air quality standard in NR 404.04 or an air emission standard, if there are less than 50 **residents** within 0.1 mile of the contaminant source.
4. 13 Potential for explosive vapors, if there are 50 or more **residents** within 0.1 mile of the contaminant source.
5. 7 Potential for explosive vapors, if there are less than 50 **residents** within 0.1 mile of the contaminant source.
6. Potentials for individual items 1 through 3 to occur receive 1/2 the points for that item (Scores can range from 7 to 20). Provide the score next to number 6.

For scores under items 4, 5, or 6, indicate the basis for your determination.

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7. 0 No potential that any of the items 1 through 5 will occur. Explain if needed.

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Notes:

1. If the explosivity threat is imminent, emergency response should occur before the site is scored. The site should not be scored based on the imminent threat. It should be scored based on the longer-term threat for the generation of explosive vapors.
2. Residents include the residential population, not worker population.
3. Violations of ambient air quality standards or air emission standards, or the potential for these violations to occur, are expected to occur very infrequently. The Regional Air Team Supervisor can assist RR staff in making these determinations.
4. For items 4 and 5 above, methane is normally the substance of concern. If available, use data on methane concentrations and pressures from gas monitoring wells or bar hole probes. A Regional Solid Waste Hydrogeologist or Engineer can assist RR staff in making a determination.

D. Soil/Direct Contact Pathway

1. 40 pts Residual contaminant levels (RCLs) for protection of human health from direct contact with contaminated soil in NR 720 are exceeded, there is access to the site, the site is in a residential setting.
2. 30 Same as 1 above, without the access, and with 50 or more **residents** within 0.1 mile of the contaminated soil.
3. 20 Same as 2 above, except less than 50 **residents** within 0.1 mile of the contaminated soil.
4. 20 Residual contaminant levels for protection of human health from direct contact with contaminated soil in NR 720 are exceeded, there is access to the site, the site is in a commercial, industrial, rural, or other non-residential setting.
5. 14 Same as 4 above, without the access, and with 50 or more **residents** within 0.1 mile of the contaminated soil.
6 8 Same as 5 above, except less than 50 **residents** within 0.1 mile of the contaminated soil.
7. 10 Potentials for individual items 1 through 6 to occur receive 1/2 the points for that item (Scores can range from 4 to 20). Provide the score next to number 7. Indicate the basis for your determination.

~~Source area~~ 2 Soil samples collected from the 0-4' depth in the source area had a maximum PERC concentration of 2.7 ug/kg. Since the source area is by the back door of the facility there's a degree of uncertainty whether the samples were collected in the hottest zone

8. 0 No potential that any of the items 1 through 6 will occur. Explain if needed.

Notes:

1. Provide a score other than 0 **only if** contaminants are detected in or suspected to be present in the top 4 feet of soil with no impermeable cover or partial/ineffective covering.
2. For calculation of RCLs, go the Remediation and Redevelopment web site, What's New page, for an item posted on January 14, 2002. The item is Determining RCLs Using the EPA Soil Screening Level Website, Publication RR-682.
3. Residents include residential population, not worker population.

E. Summary of Pathway Scores/Calculate Environmental Characteristics and Receptors Score

1. Groundwater Pathway Score 40
2. Surface Water/Sediments Pathway Score 0
3. Air Pathway Score 0
4. Soil/Direct Contact Pathway Score 10
5. Environmental Characteristics and Receptors Score (Sum of 1 through 4) 50
   (Limited to 40 points maximum)
6. Explain how/why complex site was split into several sites for priority setting purposes (only if applicable).

CONTAMINANT CHARACTERISTICS

Source Summary

Describe waste sources and containment and estimate area or volume. Include all known waste sources, contaminated soil. Do not include contaminated groundwater, surface water or sediments.

Source Description	Containment (from Table 3)	Area/volume
Dry Cleaner - Spent filters were stored on a utility trailer near the back door	~~All Sources~~ None	~~10,000 ft²~~ ? 27,000 ft³

GROUNDWATER MIGRATION PATHWAY

Evaluate only if a potential for a hazardous substance to release or migrate is identified in Environmental Characteristics scoring.

Using Tables 1-3, enter site-specific information into the table below.

If release to groundwater is documented, Mobility = 4
If a drinking water supply is contaminated > ES, Quantity >= 3

Hazardous Substance	Toxicity (Table1)	Mobility (Table 1)	Waste Quantity (Table 2)	Containment (Table 3)	T x M x WQ x C
Perc	3	4	~~3~~ 4	4	~~144~~ 192

Using the highest scoring hazardous substance, calculate pathway score:

$\frac{T \times M \times WQ \times C}{8}$ = Contaminant Characteristics Score (1-40, round decimals up)

Groundwater Migration Pathway Score (enter on page 6 also) ~~18~~ 24

Surface Water Migration Pathway

Evaluate only if a potential for a hazardous substance to release or migrate is identified in Environmental Characteristics scoring.

Using Tables 1-3, enter site-specific information into the table below.

If release to surface water/sediment is documented, use Quantity >= 3.

Hazardous Substance	EcoToxicity (Table1)	Persistence (Table 1)	Bioaccumulation (Table 1)	Waste Quantity (Table 2)	Containment (Table 3)	ET x P x B x WC x C

Persistence - Identify water body type, River (pers_riv in table 1), Lake (pers_lak in table 1).
Bioaccumulation - Use the highest scoring contaminant detected or suspected in a site, specify either food chain (bcff) or ecological (bcfef) bioaccumulation (or the highest scoring if both sensitive environment and fishery are present).

When there is no value in the table for toxicity or bioaccumulation, use 1.

Using the highest scoring hazardous substance, calculate pathway score:

$$\frac{ET \times P \times B \times WQ \times C}{10} = \text{Contaminant Characteristics Score (1-40,round decimals up)}$$

Surface Water Migration Pathway Score (enter on page 6 also) 0

Air Migration Pathway

Evaluate if contaminants are detected in off-site air samples or are suspected to have migrated off the site via gas or particulate migration.

Hazardous Substance	Toxicity (Table1)	Waste Quantity (Table 2)	T x WQ

Using the highest scoring hazardous substance, calculate pathway score:

$\frac{T \times WQ}{0.5}$ = Contaminant Characteristics Score (1-40, round decimals up)

Air Migration Pathway Score (enter on page 6 also) 0

Soil Exposure

Evaluate if contaminants are detected in or suspected to be present in the top four feet of soil with no impermeable cover, or partial/ineffective covering.

Hazardous Substance	Toxicity (Table1)	Waste Quantity (Table 2)	T x WQ
PERC	3	4	12

Using the highest scoring hazardous substance, calculate pathway score:

$\frac{T \times WQ}{0.5}$ = Contaminant Characteristics Score (1-40, round decimals up)

Soil Exposure Score (enter on page 6 also) 2

CONTAMINANT CHARACTERISTICS

Score Summary

Groundwater Migration Pathway	~~18~~ 24
Surface Water Migration Pathway	0
Air Migration Pathway	0
Soil Exposure	2
Total Contaminant Characteristics Score (Max. 40) (Add pathways and Soil exposure)	~~20~~ 26

Environmental Risk Priority

ECR Score 50

CC Score 26

Total Score 76 **Classification (H, M. or L)** H

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: June 21, 2004

FILE REF: 02-72-240751

TO: Paul Bohman

FROM: Tom Hvizdak TH

FILE COPY

SUBJECT: Remedial Action Options Report – 5 Corners Dry Cleaners

Paul,

Attached is a copy of an e-mail I sent to Scott regarding the remedial action options report he submitted for your site. Basically, he needs to supply me with more information as to how he came to his decision that the most cost-effective method to remediate your site is permanganate injection.

Call me if you have any questions (715/421-7850).

Tom

Printed on Recycled Paper

Hvizdak, Thomas

From: Hvizdak, Thomas
Sent: Monday, June 21, 2004 10:59 AM
To: 'Scott A McKittrick'
Subject: 5 Corners Dry Cleaners RAOR

FILE COPY

I started to look at your RAOR for this site and noticed a couple things that need to be addressed regarding the various options you looked at:

- Why wouldn't air sparging coupled with SVE be feasible? The water table is below the clay layer, therefore this is not a confined aquifer situation. Is there another reason why it's not feasible (please note that I do realize SVE will not be very effective on the soil contamination in the clay zone)? You also mention that this option was not selected due to costs; what are the costs?
- The only reason you give for not selecting enhanced bioremediation is because of time considerations. What exactly do you mean by that, and what about feasibility and cost considerations [as required in NR722..07(4)]?

While I like the table format you used in Table 3 (it makes a nice summary of the remedial options considered at for this site), the table in this report is filled with general information/criteria (characteristics, effectiveness, advantages, etc) about the various methods and does not provide the site-specific evaluation or comparison of these methods as required in NR722.13(2)(d)(5). Therefore, please submit an addendum to this report that evaluates and compares at least three methods that are the most technically and economically feasible for this site.

cc: Paul Bohman, 5 Corners Dry Cleaners.

02-72-240751

Hvizdak, Thomas

From: Scott A McKittrick [smckittrick@northern-env.com]
Sent: Wednesday, March 24, 2004 9:41 AM
To: Hvizdak, Thomas
Cc: Marty Koopman
Subject: 5 Corners Laundry

I talked to Scott on 3/31/04 at 11:05 and told him that RNA is not an option at this site at this time. This site warrents a more aggressive action, so, he should send a RAOR that addressed the entire plume.
T — 7/5 M

Tom,

After continuing to review data and consider all options for this site we have come up with some options I would like to discuss with you.

I feel we need more groundwater monitoring data (at least one year) to help define contaminant and geochemical concentrations and variation with seasonal fluctuations.
The DNR guidance for investigating solvents recommends two to three years of monitoring in the investigation phase. We also need additional well nests as we discussed, prior to continuing monitoring. The monitoring could be completed in conjunction with or prior to the remedial phase. I feel it is best completed under the investigation phase. We do have an impacted City Well, but they are continuing to aerate and blend water, therefore, mitigating the human health risk and actually remediating groundwater contamination. I have listed three possible approaches for continuing site activities. You may have additional ideas.

1. Continue under the investigation phase
   -install additional well nests and monitor quarterly for one year
   -request variance to submit reimbursement request to DERP for site investigation costs to date. It seems reasonable that Paul Bohman should be able to submit a claim considering the expenses incurred and magnitude of the site investigation.

2. Initiate Remedial Phase and also continue Investigation Phase
   -Our Green Bay office used this approach for the Donaldson's Cleaners site in Green Bay
   -Submit Remedial Options Report (ROR). Address on-site source soils through excavation and/or SVE and/or impermeable capping.
   - In the ROR state additional well nests and monitoring are required under the investigation phase.
   - DNR grant variance to submit a reimbursement request, stating soils aspect of investigation is complete, but groundwater aspect requires additional definition and monitoring

3. Assume Site Investigation Phase complete, Enter Remedial Phase

   -Submit ROR for source control measures, as listed above,
   -Include in ROR, proposed additional wells and year of monitoring for RNA
   -If RNA does not appear to be a viable option, then submit revised ROR
   -submit reimbursement request following ROR approval

I believe option 1 is the most preferable at this point since we need more data to make a better determination of the most cost-effective and technically feasible remedial option. Groundwater PCE concentrations have decreased significantly in most wells with multiple sampling events. Addressing the source area is potentially very expensive and maybe the source is no longer contributing much solvent to the groundwater.

Please contact me to discuss. Thanks.

C: faxed to Paul Bohman

Scott McKittrick
Project Manager
Northern Environmental
920 324 8600
920 324 3023 fax

Hvizdak, Thomas

From: Scott A McKittrick [smckittrick@northern-env.com]
Sent: Wednesday, March 24, 2004 9:41 AM
To: Hvizdak, Thomas
Cc: Marty Koopman
Subject: 5 Corners Laundry

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   - DNR grant variance to submit a reimbursement request, stating soils aspect of investigation is complete, but groundwater aspect requires additional definition and monitoring

3. Assume Site Investigation Phase complete, Enter Remedial Phase

   -Submit ROR for source control measures, as listed above,
   -Include in ROR, proposed additional wells and year of monitoring for RNA
   -If RNA does not appear to be a viable option, then submit revised ROR
   -submit reimbursement request following ROR approval

I believe option 1 is the most preferable at this point since we need more data to make a better determination of the most cost-effective and technically feasible remedial option. Groundwater PCE concentrations have decreased significantly in most wells with multiple sampling events. Addressing the source area is potentially very expensive and maybe the source is no longer contributing much solvent to the groundwater.

Please contact me to discuss. Thanks.

C: faxed to Paul Bohman

Here are my thoughts:

Your argument regarding a possible downgradient source was weak, you've been told in the past that RNA is not a viable/acceptable option in this situation, you've been told that you cannot rely on the treatment system at the municipal well as part of the remedial action, you've had over 3 years to collect all of the data necessary to develop a RAOR, and prolonging the SI any longer is only going to reduce the total amount of money spent on eliminating the impact to the municipal well. If there's additional data that you failed to collect when you were at the site I suggest you go back and collect it at your own expense because I don't know how I can justify spending DERP funds for you to go back a second time to collect it. In addition, prolonging the site investigation will result in Paul paying additional interest costs and the City having to treat the water for an additional year or so. Regarding DNR guidance recommending

Wisconsin Statutes make it very clear that the <u>only</u> time money can be reimbursed for the site investigation is after the RAOR is approved. The Statute does not allow us to give variances to this schedule. In the Donaldson case the investigation regarding the soil contamination was completed, it was obvious as to what needed to be done regarding the soil contamination, and it was obvious that investigation regarding the groundwater plume was not complete enough to develop a RAOR to address the groundwater contamination and that it was going to take quite a bit of time before it was complete enough to do so. I'm not convinced that that's the case here. The degree and extent of the groundwater plume has been defined enough to develop a RAOR and it was your job to ensure that all sample data necessary to developing the RAOR be collected while you were at the site collecting the samples (in other words you should've been thinking about what information you needed to develop your RAOR when you were developing your site investigation workplan). In addition, if this division in the investigation was approved, at this time Paul would only be eligible for the costs associated with the soils portion of the investigation.

I expect to receive a RAOR that addresses the <u>entire</u> plume (soil and groundwater) within 45 days so Paul can submit his claim and so he can start the cleanup process. Please note that this report must be detailed enough so that this bid process is fair and that the bids are complete. You're firm has had experience with developing RAORs in other parts of the State and I suggest you learn from their experience as to how much detail (costs and technical information) is needed to achieve this goal.

Remember, I expect the RAOR within 45 days.

Hvizdak, Thomas

02-50-240751

From: Hvizdak, Thomas
Sent: Wednesday, March 03, 2004 10:31 AM
To: 'smckittrick@northern-env.com'
Subject: RE: Operation of Aeration system on City well 10, remedial costs

Scott,

It looks like you'll have no control of the muni well. Which means you'll have no control of the pumping rates, or whether or not the well is pumped at all, therefore it appears that relying on the muni well as part of the remedial action is not an option. I guess you'll have to figure out something else.

Getting back to you on you questions regarding how much cost detail is needed in the RAOR; I'll have to apologize that I haven't gotten to it yet. My Dad's health is failing fast and I've spent the last 2 weeks in Milw. helping my Mother take care of him.

-----Original Message-----
From: Scott A McKittrick [mailto:smckittrick@northern-env.com]
Sent: Wednesday, February 25, 2004 11:03 AM
To: Hvizdak, Thomas
Cc: Marty Koopman
Subject: FW: Operation of Aeration system on City well 10, remedial costs

Tom,
Below is a response from the City regarding our proposal to try to reimburse them from the DERF fund for operation of Well 10 and/or its aeration system. They don't want to be directly involved. Obviously the City is going to have to continue to operate the aeration system, however, it doesn't look like we can directly incorporate that into our remedial proposal.

Any thoughts yet on how to handle costs in the remedial options report (see my previous email)? Will you need costs to approve our plan or would it be possible to submit our costs following the bidding process?

Scott McKittrick
Project Manager
Northern Environmental
920 324 8600

-----Original Message-----
From: David Wasserburger [mailto:wasser@tznet.com]
Sent: Wednesday, February 18, 2004 10:06 AM
To: smckittrick@northern-env.com
Subject: Re: Operation of Aeration system on City well 10

Scott,

I have talked to our lawyers on this matter. We can find no benefit to the utility to go through with this idea. Any $ we would get would have to be reported as income and would be incorporated into our rate structure. For this reason we really would get no net financial gain. Also, if we would go along with using our well to help with remediation, our lawyer is afraid that we could set ourselves up for future litigation. After all, our pumping the well for the removal of PERC and receiving payment for the pumping, we are possibly causing the contamination to move and therefore we may be made liable to help with the clean-up or pay for a portion of the clean-up.

So, to close this matter out I have to say we are not interested.

Thanks,

Dave Wasserburger
----- Original Message -----
From: Scott A McKittrick

To: David Wasserburger
Sent: Wednesday, February 11, 2004 10:16 AM
Subject: RE: Operation of Aeration system on City well 10

Thanks for your response. Even though you don't operate the wells continuously we still likely want to try to incorporate operation of well 10 and its aeration system into our cleanup plan for 5 Corners Laundry, based on the City's operation plan. During initial discussions with Tom Hvizdak from the DNR, it sounds like at least costs to operate the aeration system would be reimbursable to the City through the State DERF fund.

Could you please provide me with an estimate of overall costs to operate well 10? Also, please breakout the costs for the aeration system operation. Thanks.

Scott McKittrick
Project Manager
Northern Environmental
920 324 8600

-----Original Message-----
From: David Wasserburger [mailto:wasser@tznet.com]
Sent: Tuesday, February 10, 2004 11:14 AM
To: smckittrick@northern-env.com
Subject: Re: Operation of Aeration system on City well 10

Scott,

We currently use wells 10 and 8 as peaking wells. Well 10 is fairly high in manganese and causes problems in our distribution system if continuously pumped. Currently we pump about 100,000 gallons per week out of the 2 wells combined just to keep the water in the reservoir fresh. I would not be interested in pumping the wells continuously because of the problems it would cause in the distribution system. We do not have any type of filtration system for these wells and the cost to install one would probably not justify the use of the wells.

Dave Wasserburger
----- Original Message -----
From: Scott A McKittrick

To: wasser@tznet.com
Sent: Monday, February 09, 2004 4:26 PM
Subject: Operation of Aeration system on City well 10

Mr. Wasserburger,

As part of a possible remedial action for the chlorinated solvent (PCE) release associated with 5 Corners Laundry, we are considering incorporating operation of the aeration system currently used on City well 10. I have a couple questions:

- is water pumped from well 10 on a regular basis, and if so, do you plan to continue using it?

- This might be difficult to estimate, but could you give me an estimate of the operating costs associated with the aeration system on well 10, and overall operating costs for well 10?

If the DNR would accept our proposal, costs for operating the aeration system (and possibly the overall pumping costs for well 10) could be reimbursed to the City, either directly or indirectly, through the State's DERF fund. The DERF fund is utilized for investigating and remediating solvent-impacted soil and groundwater resulting from dry cleaning operations.

Thanks.

Scott McKittrick
Project Manager
Northern Environmental
920 324 8600
920 324 3023 fax

Hvizdak, Thomas

From: Evanson, Theresa A.
Sent: Wednesday, January 07, 2004 8:29 AM
To: Hvizdak, Thomas
Subject: FW: 5 Corners Laundry remediation

-----Original Message-----
From: Evanson, Theresa A.
Sent: Wednesday, January 07, 2004 8:28 AM
To: 'hvisdak'; 'smckittrick@northern-env.com'
Subject: FW: 5 Corners Laundry remediation

Scott,

Give me a call & I'll be happy to discuss the regulatory requirements for injection approvals. Permanganate is being used or considered at other PCE (I'm assuming PCE is the contaminanant of concern) releases in the State.

FYI, I'm including an e-mail I sent to DNR staff earlier in the year regarding issues that need to be considered before approving permanganate injection.

You can call me at (608)266-0941 or e-mail me. I'm in my office Tues, Wed & Thurs, 8 am - 3 p.m.

Terry
-----Original Message-----
From: Hvizdak, Tom J
Sent: Tuesday, December 30, 2003 10:18 AM
To: ; Evanson, Theresa A
Subject: RE: 5 Corners Laundry remediation

Scott:

Sodium permanganate injection is feasible in Wisconsin providing you get the required variance to NR 140. Since I've never had a site in my area use aquifer injection as a remedial option, you're probably better off contacting Terry Evanson (608/266-0941) to discuss what hoops you would need to jump through to have this or other injection method approved.

There is one thing that concerns me with using sodium permanganate at this site and that is that it turns the groundwater purple. Since the plume from this site reaches a municipal well, I'm not sure that sodium permanganate is the best substance to be injecting into the aquifer at this location unless you can provide some assurance that it will not affect the municipal well.

Regarding your proposal to only address the on-site source area and a portion of the plume, I'm assuming you're referring to addressing this area with an active method (i.e. injection) and rely on RNA for the downgradient plume. Off the top of my head I see 2 major problems that would have to be overcome using this approach:

1. It's been my understanding that the aquifer has high DO and therefore RNA, alone, will not do the job here. Will remediation of the source area be sufficient enough that the downgradient plume will not be of concern?
2. The main goal is to eliminate the risk and/or significantly reduce the impact to Muni Well #10. Will this approach achieve this goal?

Now keep in mind that I no idea what area you have in mind when you state "and a portion of the plume", nor do I

have any idea what affect a source area remedial action would have on the downgradient plume. You are the expert. You tell me how attacking a portion of the plume will benefit the entire plume and how it will address all receptors of concern.

Terry:

Could you please help Scott if he calls. I'm having rotator cuff surgery on my right shoulder next week and since I live an hour from the office and my car has a standard transmission, I'm probably not going to be in the office much for a good month or so after surgery. So I'm a little too busy right now tying up loose ends before my surgery to spend the research-time needed to address his question or proposed method completely.

Thanks

-----Original Message-----
From: Scott A McKittrick [mailto:smckittrick@northern-env.com]
Sent: Monday, December 29, 2003 2:35 PM
To: Hvizdak, Tom J
Cc: Marty Koopman
Subject: 5 Corners Laundry remediation

Tom,
As a possible remedial option we are considering injecting sodium permanganate to oxidize the chlorinated compounds. Our Illinois office has used this process with success. Is this permissible in Wisconsin?

Since it may not be economically feasible to remediate the entire plume, our thinking at this time is to address the on-site source area and a portion of the plume.
Any comments? Thanks.

Scott McKittrick
Project Manager
Northern Environmental
920 324 8600

Hvizdak, Thomas

From: Evanson, Theresa A
Sent: Tuesday, March 25, 2003 1:14 PM
To: DNR_RR_STATE
Cc: Phelps, William L; Roth, Richard T
Subject: Permanganate Injection into Groundwater

There have been recent requests to inject permanganate (MnO4 - in either the potassium or sodium form) into groundwater to treat contaminants in-situ. Some issues have come up that we'd like all project managers to be aware of.

1. MnO4 is used to oxidize & destroy chlorinated ethenes, primarily. It does not oxidize petroleum compounds, however MnO4 does provide oxygen to the subsurface and will support biological activity which can degrade petroleum (however, this is a very costly method for adding oxygen).

2. MnO4 is created from manganese ores, which contain a variety of trace metals. Trace metals that may be present include: antimony, arsenic, chromium, mercury, beryllium, cadmium, lead, and thallium. The metal of most concern is chromium which will be in the Cr (VI) form (the most oxidized & mobile form). In general, concentrations of the trace metals injected with the MnO4 should not exceed ES standards. However, there are various grades of MnO4, containing different concentrations of trace metals. The manufacturer should be able to provide an analysis of the MnO4 proposed for injection at a remediation site, including the amounts of trace metals to be expected.

3. MnO4 (and other strong oxidizers) can oxidize and mobilize chromium that is native to soils/bedrock. Other metals may also be mobilized through oxidation. The background concentration of the trace metals, the availability of the trace metals to the oxidant, the soil type, etc., will determine the final concentrations in groundwater. It is possible to exceed ES levels of chromium (& perhaps other metals) through of mobilization of native trace metals.

4. It's recommended that the following issues be addressed before proceeding with an approval of MnO4 injection:

   a. Obtain the chemical analysis of the MnO4 proposed for injection.
   b. The consultant should provide a mass balance of the MnO4 vs. the natural oxidant demand and contaminant demand (i.e., to limit addition of excess MnO4).
   c. Concentrations of MnO4 in groundwater necessary to oxidize the contaminant.
   d. Expected persistence of MnO4 in the groundwater (i.e., how long it will be effective).
   e. A monitoring system should be in place that can determine the extent of the area affected by the MnO4 injection.
   f. Analyze groundwater for:
      - total Cr before treatment & then periodically during treatment & after treatment until Cr has declined to background levels.
      - other trace metals that could exceed PALs. This includes an assessment of metals contained in the MnO4 as well as native trace metals.
      - MnO4 concentrations
   g. Sentinel wells should be part of the monitoring program. Use these wells to determine that MnO4 doesn't extend beyond the area intended to be treated.
   h. Monitor MnO4 and trace metals until those compounds have returned to background levels.

5. **All injection requests require approval under NR 812 before injection. Depending on levels, an exemption from NR 140 may also be necessary. All injection approvals must be copied to Rich Roth - UIC, DW&GW/2 and Bill Phelps - DW&GW/2.**

If you have any questions, please call or e-mail myself or Bill Phelps.

Terry

Theresa Evanson, Hydrogeologist
Wisconsin Department of Natural Resources
Bureau for Remediation & Redevelopment
P.O. Box 7921
Madison, WI 53707
phone: (608)266-0941
fax: (608) 267-7646

e-mail: theresa.evanson@dnr.state.wi.us

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June 10, 2004
(CLD08-0407-0429)

RECEIVED
WI DEPT OF NATURAL RESOURCES
JUN 14 2004
WI RAPIDS SERVICE CENTER
WI RAPIDS, WI

Mr. Tom Hvizdak
Wisconsin Department of
Natural Resources
Wisconsin Rapids Service Center
473 Griffith Avenue
Wisconsin Rapids, Wisconsin 54494

RE: Remedial Action Options Report, 5 Corners Laundry and Drycleaning, Marshfield, Wisconsin
BRRTS #02-72-240751

Dear Mr. Hvizdak:

Enclosed for your review is the Remedial Action Options Report for the above-referenced site.

Please contact me if you have any questions or require additional information.

Sincerely,
Northern Environmental
Technologies, Incorporated

Scott A. McKittrick
Project Manager

SAM:alw

c: Mr. Paul Bohman – 5 Corners Laundry & Drycleaning

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REMEDIAL ACTION OPTIONS REPORT

5 CORNERS LAUNDRY & DRYCLEANING
MARSHFIELD, WISCONSIN

WDNR BRRTS ID# 02-72-240751

June 10, 2004

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REMEDIAL ACTION OPTIONS REPORT

5 CORNERS LAUNDRY & DRYCLEANING
1414-B SOUTH MAPLE AVENUE
MARSHFIELD, WISCONSIN

June 10, 2004

Prepared For:

Mr. Paul Bohman
5 Corners Laundry & Drycleaning
1414-B South Maple Avenue
Marshfield, Wisconsin 54494

Prepared By:

Northern Environmental Technologies, Incorporated
1203 Storbeck Drive
Waupun, Wisconsin 53963

Project Number: CLD08-0407-0429

Scott A McKittrick, P.S.S
Soil Scientist/Project Manager

Marty L. Koopman, P.G.
District Director

SAM:alw

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1.0 EXECUTIVE SUMMARY

Northern Environmental Technologies, Incorporated (Northern Environmental) has completed a remedial options evaluation for the 5 Corners Laundry and Drycleaning Facility, 1414-B South Maple Avenue, Marshfield, Wisconsin (the Site). The purpose of the evaluation was to select the most technically effective and cost effective remedial option to address soil and groundwater impacted by chlorinated solvents that have originated from the site. Information about the contaminant plume and local and regional hydrogeology and geology are presented in Northern Environmental's Site Investigation Report dated September 29, 2003. Based on a review of feasible alternatives, Northern Environmental recommends chemical oxidation of chlorinated solvents within the soil and groundwater using potassium permanganate.

The Site has been a laundry and drycleaning facility since 1961. Prior to that time, the property was used for agricultural purposes. In the past, up to eight drycleaning machines were utilized at the Site and were located inside the west end of the building. Tetrachloroethene ("perc" or PCE) was delivered to the machines from a transport truck that would park along the west side of the building. The investigation indicates primary PCE source area is located adjacent to the northwest corner of the site building. The groundwater contaminant plume extends approximately 3,000 feet to the south of the site. Municipal well #10, located at the downgradient edge of the plume, has been historically impacted by PCE.

Due to the size of the groundwater contaminant plume Northern Environmental contends that the remediation should be completed in a phased approach. A phased approach will help to ensure each remedial step is necessary and if so, is completed in the most cost-effective and technically effective manner. Prior to completing each remedial phase of work, a proposed design and cost estimate will be submitted to the client and WDNR for approval.

Phase one of the remediation will consist of the following: installation of supplemental well nests, collection of one round of samples from all wells and piezometers, an on-site chemical oxidation pilot test, and confirmatory soil and groundwater sampling following the pilot test. The remedial design and cost estimate for subsequent remediation phases will be based on results obtained from phase one. The pilot test is necessary to determine the most cost effective treatment design to address residual on-site soil contamination and the majority of the groundwater contaminant plume.

Following receipt of all post-pilot test soil and groundwater results, a design proposal for phase two of the remedial process will be submitted to the client and WDNR. Phase two will likely consist of chemical injection on-site and off-site. On-site injection would address remaining soil and groundwater contamination. Off-site injection would likely occur on the V and H property to address groundwater contamination.

Following phase two, groundwater samples will again be collected from the majority of on-site and off-site wells and piezometers. Samples will be submitted for laboratory analysis of VOCs and various natural attenuation parameters. Based on results from phase two remediation and groundwater monitoring, phase three of remediation will be designed. Phase three may consist of additional chemical injection on the V and H property and properties to the south. Remediation of the contaminant plume will proceed south toward City Well 10 as deemed necessary, based on results of groundwater monitoring between remediation phases and consultations with the client and WDNR.

2.0 INTRODUCTION AND BACKGROUND

2.1 Site Location

Northern Environmental Technologies, Incorporated (Northern Environmental) has completed a site investigation at the 5 Corners Laundry and Drycleaning Facility, 1414-B South Maple Avenue, Marshfield, Wisconsin (the Site). The Site is in the northeast quarter of the northeast quarter of Section 18, Township 25 North, Range 3 East in the city of Marshfield, Wood County, Wisconsin. The site location is shown on Figure 1 (United States Geological Survey [USGS], 1979).

2.2 Background Information

The Site has been a laundry and drycleaning facility since 1961. Prior to that time, the property was used for agricultural purposes. In the past, up to eight coin-operated drycleaning machines were utilized at the Site and were located inside the west end of the building. Tetrachloroethene ("perc" or PCE) was delivered to the machines from a transport truck that would park along the west side of the building.

Northern Environmental completed investigation activities at the Site in September 2003. Please refer to Northern Environmental's Site Investigation Report (Northern Environmental, 2003) for more information.

3.0 SUMMARY OF FINDINGS

3.1 Geology and Hydrogeology

Geology encountered during the site investigation consisted of crystalline bedrock overlain by glacial till. Generally, silty clay was observed from the ground surface to approximately 6 to 12 fbg. The silty clay unit extended deeper (12 fbg +) south of the Site. Medium to coarse-grained sand was present under the silty clay. The sand unit was intermixed with some clay and extended to depths of approximately 30 to 64 fbg across the area investigated. A dense gray, silty clay was observed underlying the sand unit at most borehole locations. Weathered bedrock/saprolite was encountered at depths of 58 to 80 fbg. Competent bedrock was encountered in one off-site borehole (PZ100) at a depth of approximately 87 fbg.

Ground water at the Site is present within the sand at depths ranging between 13 and 26 fbg. The groundwater flow direction is generally to the south and is consistent over each sampling event.

The horizontal hydraulic gradients vary significantly across the area. From monitoring well MW400 to MW500 and from MW600 to MW800 the hydraulic gradient is much flatter than the hydraulic gradient from MW500 to MW600. Between MW500 and MW600 the hydraulic gradient was calculated to be 0.012 ft/ft. The gradient from MW-400 to MW-800 was calculated to be 0.005 ft/ft. Pumping from City Wells 8 and 10 has likely depressed the water table and is influencing ground water levels. Based on a contaminant assessment study and wellhead protection plan completed by Northern Environmental in 1994 (Northern Environmental 1993 and 1994), the estimated capture zone induced by City Well 10 extends north of the 5 Corners site.

Vertical hydraulic gradients were calculated using the groundwater elevation data from each nested monitoring well and piezometer. Data from MW500/ PZ300 and MW600/PZ400 yielded upward vertical gradients of 0.004 ft/ft and 0.007 ft/ft, respectively. Downward vertical gradients of 0.03 ft/ft and 0.07 ft/ft were calculated for MW800/PZ500 and MW100/PZ1, respectively.

3.2 Extent of Soil Impact

Concentrations of PCE were detected in excess of EPA soil screening levels for the groundwater migration pathway (60 ug/kg) in soil samples collected from on-site borings B100, B300, GP46, GP47, GP48, GP49, GP50, and off-site boring SB-1. No PCE concentrations in the soil were detected at concentrations exceeding the EPA's soil screening levels for the ingestion or inhalation pathway (EPA, 2001). The highest PID responses observed from on-site soil samples were collected from borings GP47 (92 iui) and GP48 (109 iui), completed adjacent to the northwest corner of the 5 Corners building, the apparent primary PCE source area.

The highest concentrations of PCE were detected in the soil samples collected from on-site borings GP-47 and B100. Soil samples from these borings contained PCE at 2,700 and 1,300 µg/kg respectively, which are below the EPA soil screening ingestion and inhalation levels. Soil laboratory analytical results are summarized in Table 1. The distribution of PCE in the soil is illustrated in Figure 2.

The extent of PCE-contaminated soil at the Site is defined. Based on soil analytical results, the on-site source area appears to be located adjacent to the north and west sides of the 5 corners building.

Based on field screening and laboratory analytical results of soil samples, PCE in soil was found to exist primarily adjacent to the west and north of the 5 Corners building. The apparent source of contamination in these areas is likely from the former storage of drycleaning filters, possible spills during delivery of bulk PCE, and/or operation of drycleaning machines. The released solvent appears to have migrated from the gravel or grass-covered surface through the native soil, to the ground water. The solvents have also migrated vertically through the water table aquifer into the underlying silty clay and upper limits of the weathered bedrock/saprolite.

3.3 Extent of Groundwater Impact

Based on laboratory results of groundwater sampling PCE, TCE, and cis-1,2-Dichloroethene (cis-1,2-DCE) were the most widely detected chlorinated compounds at the Site. PCE was detected in ground water samples collected from 18 of the 19 monitoring wells or piezometers at the Site at concentrations ranging from 1 ug/l (PZ-100) to 1,530 ug/l (MW-2). TCE was detected at concentrations ranging from 1.4 ug/l (PZ-300) to 35 ug/l (MW-200). Concentrations of cis-1,2-DCE were all below NR 140 PALs during the most recent sampling event. The highest concentrations of cis-1,2-DCE were present in samples collected from MW-200 (2.5 ug/l) and PZ-1 (4.9 ug/l). The contaminant plume extends approximately 2,600 feet to the south of the site. Groundwater analytical results are summarized in Table 2. The distribution of PCE in groundwater is illustrated in Figure 3.

The presence of PCE breakdown products (TCE and cis-1,2-DCE) in the ground water and results of geochemical analyses indicate that reductive dechlorination is likely occurring at the Site. The detection of ethane in the sample collected from source-area piezometer PZ1 indicates complete dechlorination of PCE. The presence of methane in samples collected from PZ1 and PZ300 indicate strong reducing (anaerobic) conditions that will support dechlorination of solvents. Relatively low levels of oxygen and nitrates in the source area also indicate favorable conditions for dechlorination of PCE.

Based on results of the groundwater sampling from monitoring wells and Geoprobe borings, the extent of chlorinated compounds is essentially defined. The dense, silty clay and weathered bedrock/saprolite appear to have prevented significant vertical migration to the competent crystalline bedrock, based on

results from bedrock piezometer PZ100. The screen for PZ100 was set on the competent bedrock surface at a depth of approximately 87 fbg. However, to provide sentinel wells for future monitoring, Northern Environmental recommends the installation of two additional well/piezometer nests, as shown on Figure 4. Each proposed nest would consist of one monitoring well, one shallow piezometer screened at the sand/silty clay interface, and one deeper piezometer screened at the surface of the crystalline bedrock interface. However, the actual location and number of wells will be determined in consultation with the WDNR. Installation of additional wells and piezometers will be completed in coordination with proposed remedial activities.

Based on groundwater results of samples collected from off-site monitoring well MW2, located on the V and H property, and other available information it is Northern Environmental's contention that there appears to be a secondary source of PCE contamination on the V and H property which exists to directly south of the Site. However, in a letter dated December 5, 2003, Tom Hvizdak of the WDNR provided information supporting the WDNR's opinion that the V and H Property does not appear to be a secondary source of PCE contamination. For further information, please refer to Northern Environmental's Site Investigation Report (Northern Environmental, 2003).

City of Marshfield municipal well #10 located approximately 3,000 feet to the south of the site, has been historically impacted by PCE. An aeration system was installed in 1998 on City Well 10 due to historic detections of PCE. The aeration system continues to be operated. Immediately following construction of the aeration system on municipal well #10 water samples were collected before and after aeration. Laboratory results indicated PCE was present at a concentration of 10 ug/l prior to aeration and at 2.7 ug/l post-aeration (Wasserburger, 2003).

4.0 DETERMINATION OF APPLICABLE CLEANUP CRITERIA

4.1 Soil Criteria

In accordance with NR720.99 and NR720.11, Wis. Adm. Code, three separate RCLs have been evaluated for the Site: an RCL protective of human health from direct contact with the soil, an RCL protective of human health from inhalation, and an RCL protective of ground water. Northern Environmental recommends the generic soil screening levels for a residential scenario, as listed in Appendix A of the *United States Environmental Protection Agency (EPA) Soil Screening Guidance: Technical Background Document* (EPA, 2001), be used as RCLs for the Site. The generic soil screening levels were calculated by the EPA using default values in standard equations presented in the document. The default values are conservative and are likely protective for the majority of site conditions across the nation.

Based on soil results obtained during the site investigation, the only pathway of concern at the Site is the migration to groundwater. Concentrations of chlorinated compounds protective of groundwater quality were obtained from Appendix A of the *EPA Soil Screening Guidance: Technical Background Document.* The soil criteria protective of groundwater quality for various chlorinated compounds are as follows:

PCE:	60 µg/kg
TCE:	60 µg/kg
Cis-1,2 DCE:	400 µg/kg
Trans-1,2-DCE:	700 µg/kg
Vinyl Chloride:	10 µg/kg

4.2 Groundwater Criteria

Public health related groundwater quality standards are set forth in Chapter NR 140, Wisconsin Administrative Code (WAC). Standards are listed for substances of public health concern (defined as substances having carcinogenic, mutogenic, or teratogenic properties or interactive effects), and substances of public welfare concern (roughly defined as having a negative aesthetic value, but with little threat to human health). Two levels of standards are listed, the ES and the Preventive Action Limit (PAL). The ES represents a concentration above which action generally must be taken to improve the quality of ground water. Remedial actions are to be designed to prevent or minimize the further discharge or release of substances to ground water and to renovate or restore groundwater quality. The PAL represents a lower concentration (usually 10 to 20 percent of the ES), above which the groundwater quality should generally be monitored. The ES and PAL, in micrograms per liter (µg/L), for various chlorinated compounds typically associated with releases from dry cleaners sites are as follows:

	PAL	ES
PCE:	0.5 µg/L	5 µg/L
TCE:	0.5 µg/L	5 µg/L
Cis-1,2-DCE:	7 µg/L	70 µg/L
Trans-1,2-DCE:	20 µg/L	100 µg/L
Vinyl Chloride:	0.02 µg/L	0.2 µg/L

4.3 Remedial Action Options

The primary purposes of the remedial action are as follows: 1.) to reduce the concentration of the majority of on-site PCE-contaminated soil to levels below the EPA's groundwater protection pathway screening level, and 2.) to reduce chlorinated solvent concentrations throughout the majority of the groundwater plume to concentrations below NR 140 ESs within a reasonable time period.

5.0 SELECTED REMEDIAL ACTION

An initial screening was conducted in accordance with s. NR 722.07(2), Wis. Adm. Code to identify feasible remedial action options for further evaluation. A list with general descriptions of the remedial action options that were screened is provided in Table 3. Justification is provided for elimination of the remedial action options that were not further evaluated.

5.1 Evaluation of Alternatives

Both soil and groundwater require remediation, therefore, the evaluated alternatives address both media. The primary focus of remediation is to reduce on-site soil and groundwater contamination and off-site groundwater contamination. This approach should help reduce chlorinated-solvent impacts to municipal well #10 within a reasonable time period. Based on a review of feasible alternatives, Northern Environmental recommends chemical oxidation of chlorinated solvents within the soil and groundwater using potassium permanganate.

Chemical oxidation using potassium permanganate is recommended as the most appropriate remedial method for the Site. Compared to the alternative methods (i.e., SVE, soil excavation, air sparging, and/or groundwater pump and treat), chemical oxidation is the recommended remedial option for the following reasons:

- More effective remedial method
- Less overall project cost
- Faster remediation time
- Less property disruption for neighboring properties
- Minimal generation of hazardous waste material

The use of potassium permanganate has been limited in Wisconsin; however, it has been successfully used to remediate similar releases in similar geologic and hydrogeologic conditions throughout the United States.

5.2 Description of Remedial Action Plan

Due to the size of the groundwater contaminant plume Northern Environmental contends that the remediation should be completed in a phased approach. A phased approach will help to ensure each remedial step is necessary and if so, is completed in the most cost-effective and technically effective manner. Prior to completing each remedial phase of work, a proposed design and cost estimate will be submitted to the client and WDNR for approval. No work would be completed without prior approval from the client and WDNR.

Phase one of the remediation will consist of the following: installation of supplemental well nests, collection of one round of samples from all wells and piezometers, an on-site chemical oxidation pilot test, and confirmatory soil and groundwater sampling following the pilot test. The remedial design and cost estimate for subsequent remediation phases will be based on results obtained from phase one. The pilot test is necessary to determine the most cost effective treatment design to address residual on-site soil contamination and the majority of the groundwater contaminant plume.

The pilot test will consist of injecting potassium permanganate solution into approximately 5 to 10 geoprobe boreholes in an area of approximately 450 square feet. Approximately 200 to 300 gallons of potassium permanganate solution will be injected into each borehole. During the pilot test, the number of injection points and/or the injection rate may be modified to determine the best application rates and methods. Potassium permanganate will be injected between depths of 2 fbg to 40 fbg in order to evaluate treatment of saturated and unsaturated areas.

As required under NR 812 and NR 140, it will be necessary to obtain a variance/approval from various WDNR personnel prior to chemical injection. Therefore, implementation of the proposed remedial option is dependent upon WDNR approval. Groundwater monitoring will commence prior to the chemical injection pilot test to establish a contaminant baseline and to acquire data necessary to request WDNR approval. In an e-mail received by Scott McKittrick of Northern Environmental from Theresa Evanson of the WDNR regarding WDNR approval of chemical injection, Ms. Evanson recommended analyzing groundwater samples for RCRA metals pre and post-chemical injection and analyzing a soil sample for natural oxidant demand (NOD). Following receipt of the pre-injection data, a request will be submitted to the appropriate WDNR personnel for chemical injection approval.

Soil sampling to help determine the overall effectiveness of the chemical oxidation pilot test will be completed approximately 2 months following the chemical injection. We recommend waiting two months prior to sampling to allow sufficient time for the permanganate to react with the solvents in the soil. Sampling will be completed by advancing up to four Geoprobe soil borings in the source area. The borings will be sampled continuously. A photoionization detector will be used to help measure the level of VOCs in a sample. One soil sample from each boring will be submitted for laboratory analysis of VOCs.

In conjunction with confirmation soil sampling, groundwater samples will be collected from select monitoring wells and piezometers. It is anticipated all on-site wells and piezometers and the nearest off-site, downgradient wells and piezometers would be sampled. Samples will be submitted for laboratory analysis of VOCs.

Following receipt of all post-pilot test soil and groundwater results, a design proposal for phase two of the remedial process will be submitted to the client and WDNR. Phase two will likely consist of chemical injection on-site and off-site. On-site injection would address remaining soil and groundwater contamination. Off-site injection would likely occur on the V and H property to address groundwater contamination.

Following phase two, groundwater samples will again be collected from the majority of on-site and off-site wells and piezometers. Samples will be submitted for laboratory analysis of VOCs and various natural attenuation parameters. Based on results from phase two remediation and groundwater monitoring, phase three of remediation will be designed. Phase three may consist of additional chemical injection on the V and H property and properties to the south. Remediation of the contaminant plume will proceed south toward City Well 10 as deemed necessary, based on results of groundwater monitoring between remediation phases and consultations with the client and WDNR.

At this time, it is not anticipated chemical injection will occur in proximity to the City Well. If permanganate is present in any monitoring well or piezometer near City Well 10 during regular monitoring, the permanganate can easily be neutralized with the addition of an innocuous solution. How? Cost?

5.3 Project Schedule and Costs

An estimate of the project schedule is included in Table 4.

A detailed cost estimate for phase one will be provided to the client and WDNR following the client's receipt of other consultant bids for the remedial work.

Since design and costs for subsequent remediation phases are dependent upon phase one results, it is not possible at this time to accurately estimate total remedial costs, however, total costs may range between $250,000.00 to $450,000.00. Based on our calculation estimates, total costs for the selected remedial option should be less than other evaluation options.

Recommendations provided in this report are based on interpretation of the information available to Northern Environmental. Northern Environmental does not warrant that this submittal represents an exhaustive study of all possible environmental concerns potentially associated with the Site. However, we believe this report, conclusions, and recommendations are consistent with existing state guidance and regulations and adequately address the responsible party's needs at this time.

6.0 REFERENCES

Northern Environmental, "Site Investigation Report, 5 Corners Laundry and Drycleaning, WDNR BRRTS ID #02-72-240751," September 29, 2003.

Dames and Moore Group, "Supplemental Site Investigation Report, V and H Automotive Group, Marshfield, Wisconsin," August, 2000.

Dames and Moore Group, "Phase II Site Investigation Report, V and H Automotive Group, 1505 Central Avenue, Marshfield, Wisconsin," August 13, 1999.

United States Environmental Protection Agency (EPA), "Soil Screening Guidance, Technical Background Document, Appendix A," March, 2001.

7.0 PROFESSIONAL CERTIFICATIONS

I, Marty L. Koopman, 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.

WISCONSIN MARTY L. KOOPMAN G-1121 WAUPUN, WI PROFESSIONAL GEOLOGIST

6-15-2004

Marty L. Koopman, P.G.
District Director

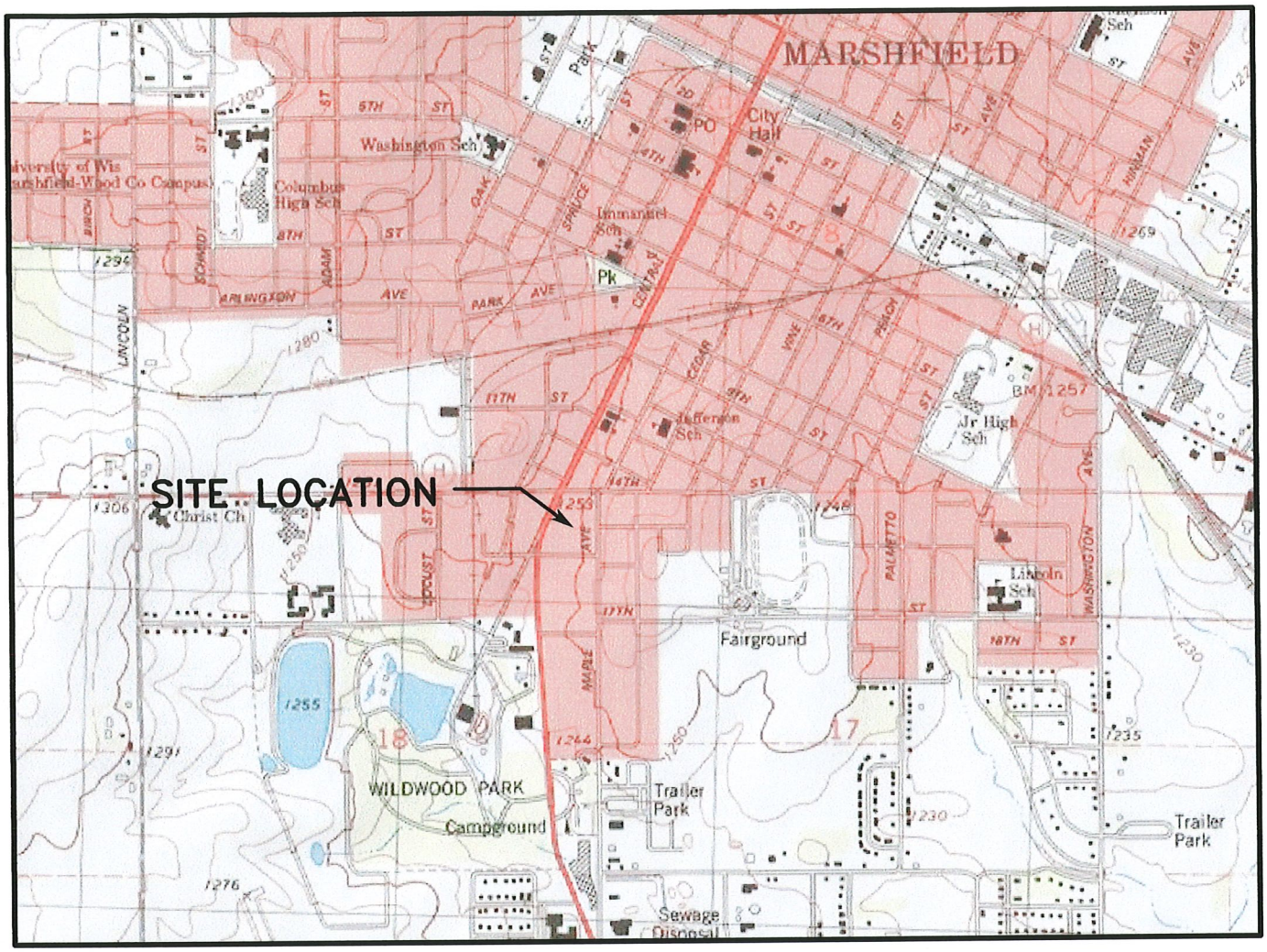
Date

I, Joseph E. Mentzer, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the 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 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.

Joseph E. Mentzer, P.E.
Engineer/Client Manager

WISCONSIN JOSEPH E. MENTZER E-24480 SUSSEX, WI PROFESSIONAL ENGINEER

FIGURES



SCALE IN FEET

1" = 2000'

0 1000 2000 3000 4000 5000 6000 7000 8000

N

CONTOUR INTERVAL 10 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

BASE MAP SOURCE: USGS 7.5 MINUTE QUADRANGLE, MARSHFIELD, WISCONSIN, 1977 (NATIONAL GEOGRAPHIC TOPO! 2001)

Northern Environmental SM

Hydrologists · Engineers · Geologists

1203 Storbeck Drive, Waupun, Wisconsin

Phone: 800-498-3921 Fax 920-324-3023

WISCONSIN ▲ MICHIGAN ▲ ILLINOIS ▲ IOWA

CREATION DATE:	09/03/03
DRAWN BY:	DDP
REVISION DATE:	00/00/00

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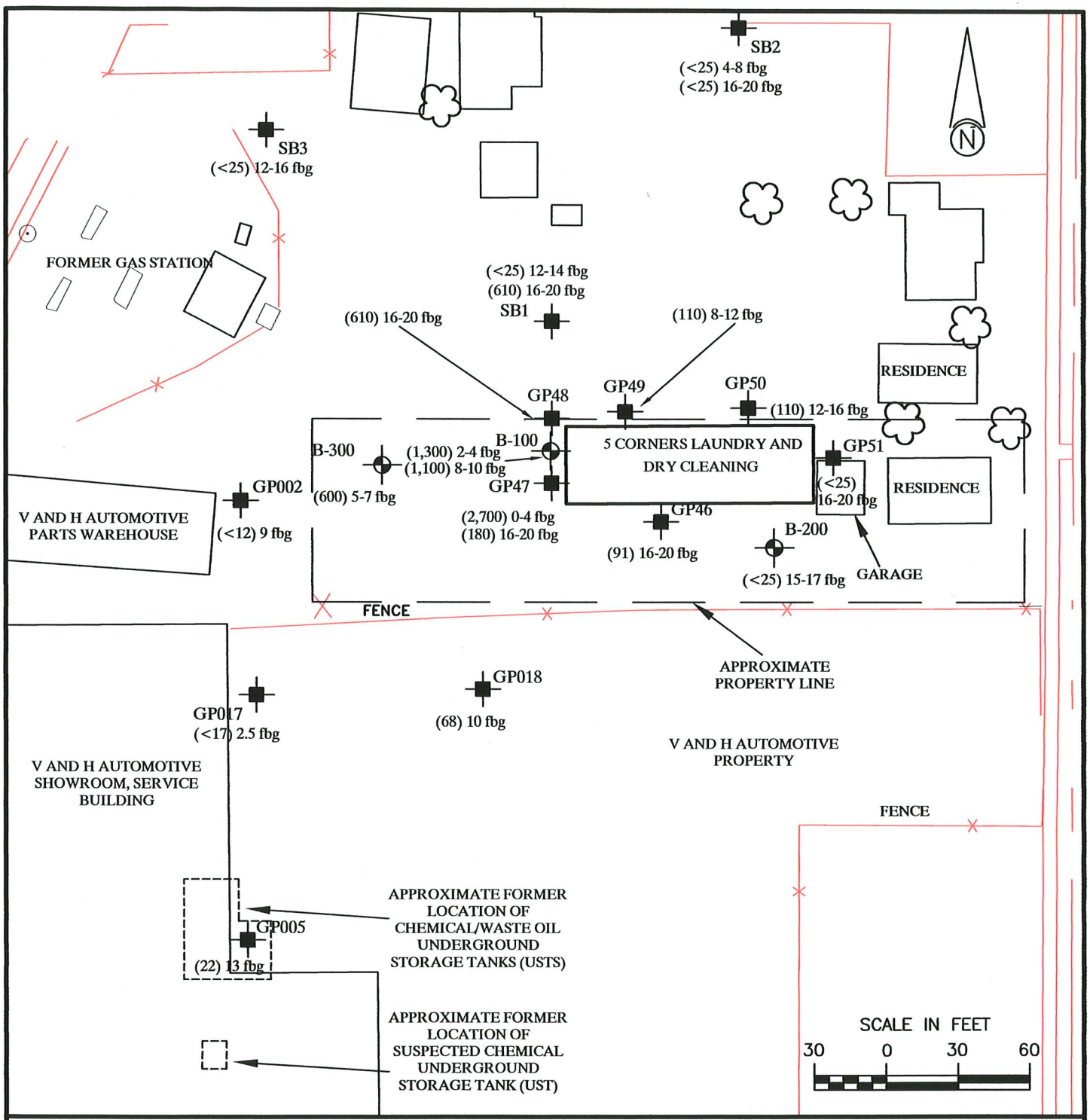
SITE LOCATION AND LOCAL TOPOGRAPHY

5 CORNERS LAUNDRY AND DRY CLEANING
MARSHFIELD, WISCONSIN

PROJECT NUMBER: CLD08-0407-0429

FIGURE 1

K:\WAUPUN\PROJECTS\CLD-0429\dwg\082803.dwg, Layout1, 6/7/2004 1:20:38 PM



LEGEND

UST	UNDERGROUND STORAGE TANK	B-##	HOLLOW-STEM AUGER BORING LOCATION
XX##	GEOPROBE LOCATION	fbg =	FEET BELOW GRADE
(###)	PCE CONCENTRATION IN SOIL (ug/kg)		

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WISCONSIN ▲ MICHIGAN ▲ ILLINOIS ▲ MINNESOTA ▲ IOWA

DISTRIBUTION OF PCE IN SOIL

5 CORNERS LAUNDRY AND DRY CLEANING MARSHFIELD, WISCONSIN

CREATION DATE: 02/11/03
DRAWN BY: DDP
REVISION DATE: 00/00/00

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PROJECT NUMBER: CLD08-0407-0429 | FIGURE 2

K:\WAUPUN\PROJECTS\CLD-0429\dwg\081103.dwg, FIG 11, 6/7/2004 1:47:17 PM

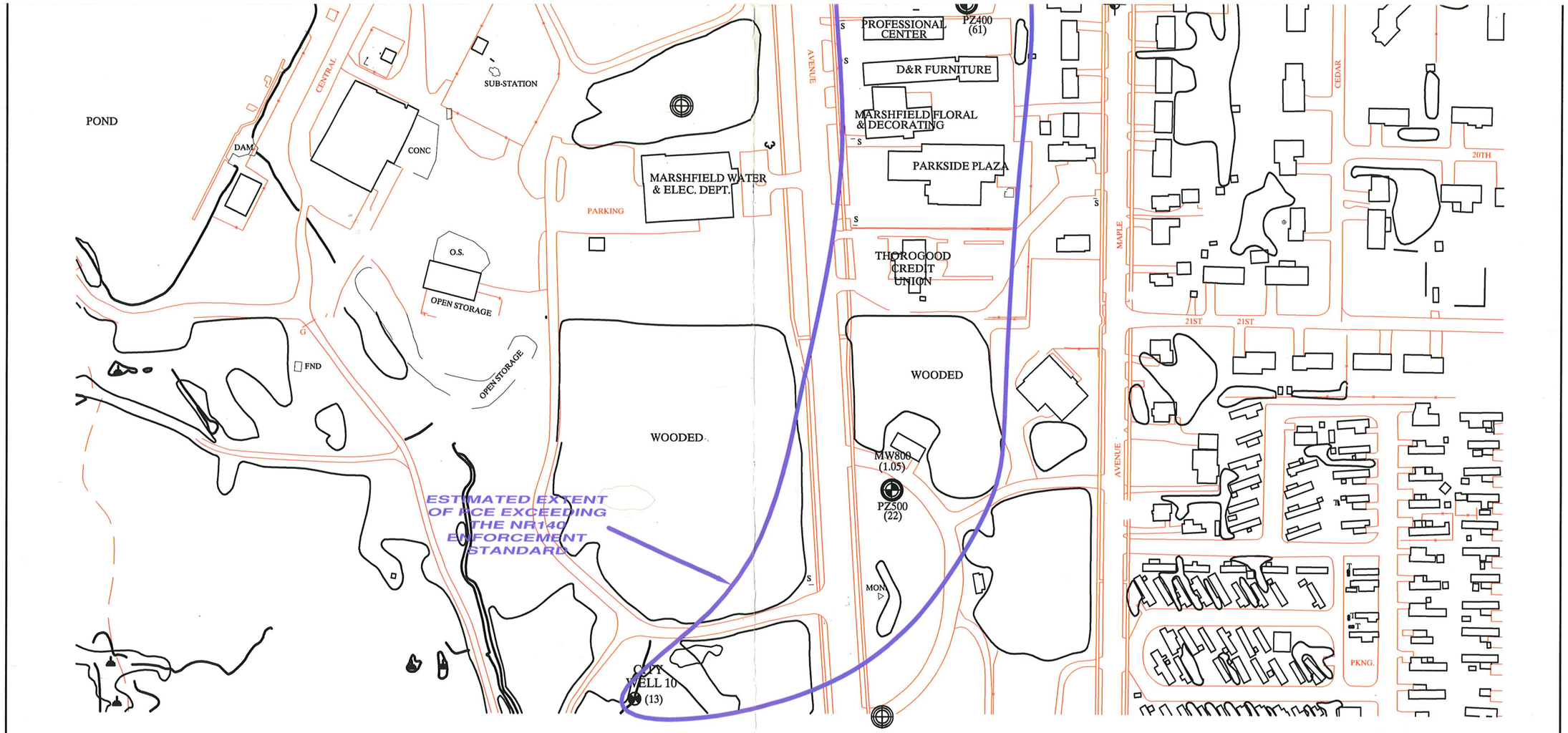
~~2002~~ MAPS

Insert Map

Fig 3 Dist of PCE

in GW

3-26-02



NOTE: BASE MAP PROVIDED BY THE CITY OF MARSHFIELD

NOTE:

1. MONITORING WELLS MW1–MW5 AND GEOPROBES GP003 AND GP026 WERE INSTALLED BY DAMES AND MOORE FOR V AND H AUTOMOTIVE INVESTIGATION
2. SAMPLES WERE COLLECTED ON THE FOLLOWING DATES: MONITORING WELLS AND PIEZOMETERS 5/03, CITY WELL 10 9/98.

LEGEND

⊕	MONITORING WELL LOCATIONS
⊕	PIEZOMETER AND MONITORING WELL NEST LOCATIONS
GP38	GEOPROBE LOCATION
PZ	PIEZOMETER
(<0.49)	TETRACHLOROETHENE (PCE) CONCENTRATION IN ug/l
⊕	PROPOSED PIEZOMETER AND MONITORING WELL NEST LOCATIONS

N

SCALE IN FEET

100 0 100 200

Northern Environmental SM
Hydrologists • Engineers • Geologists
1203 Storbeck Drive, Waupun, Wisconsin Phone: 800-498-3921 Fax 920-324-3023

CREATION DATE: 03/26/02	
DRAWN BY:	DDP
CHECKED BY:	
APPROVED BY:	

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FIGURE 3
DISTRIBUTION OF PCE IN GROUNDWATER
(MONITORING WELLS AND PIEZOMETERS ONLY)
5 CORNERS LAUNDRY & DRY CLEANING
MARSHFIELD, WISCONSIN

REVISIONS

PROJECT NUMBER: CLD08-0407-0429

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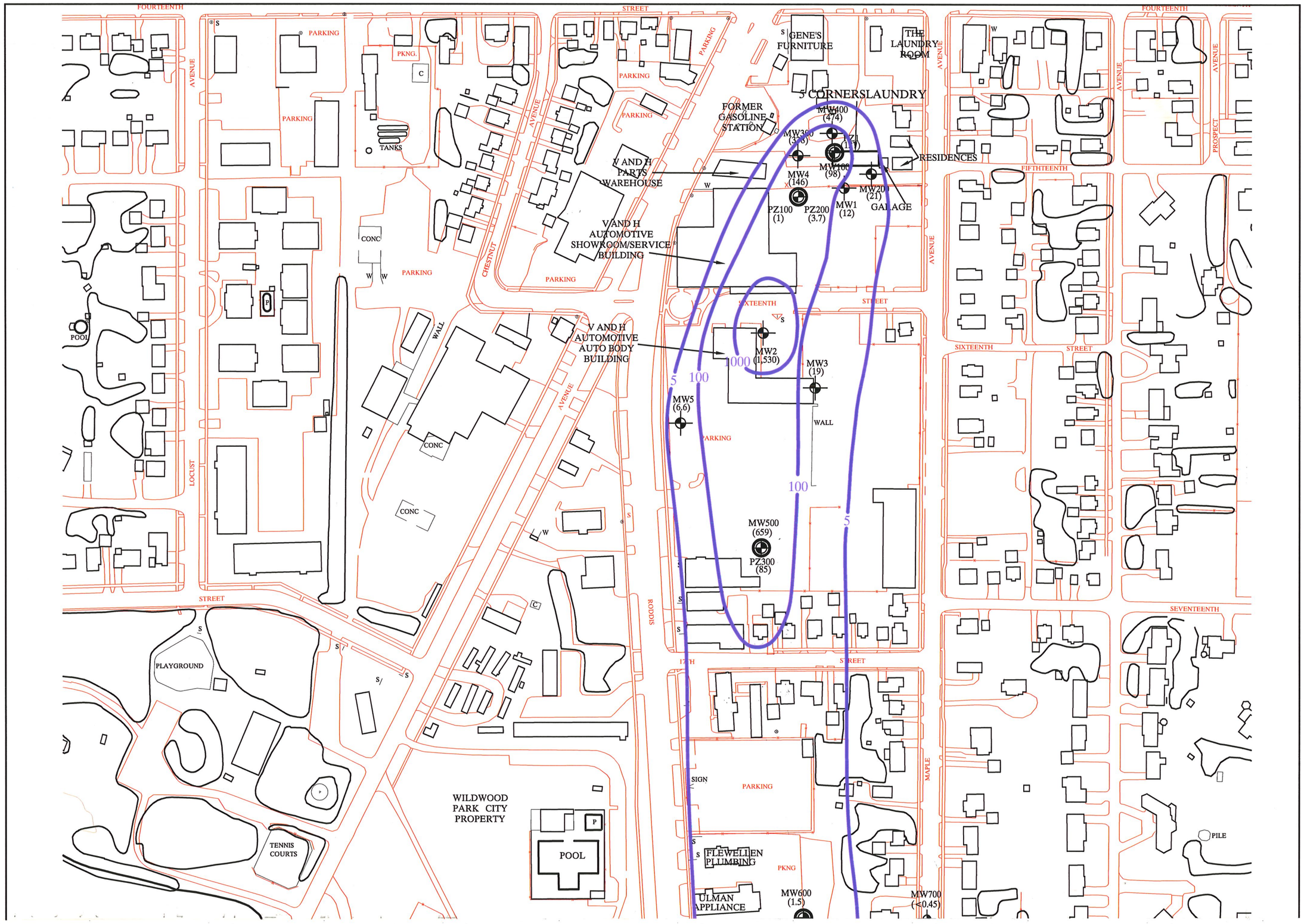
FOURTEENTH
STREET
AVENUE
PARKING
PKNG.
C
TANKS
GENE'S FURNITURE
THE LAUNDRY ROOM
5 CORNERSLAUNDRY
FORMER GASOLINE STATION
MW400 (474)
MW300 (3.8)
PZ (1.1)
MW100 (98)
RESIDENCES
V AND H PARTS WAREHOUSE
MW4 (146)
MW20 (21)
PZ100 (1)
PZ200 (3.7)
MW1 (12)
GARAGE
V AND H AUTOMOTIVE SHOWROOM/SERVICE BUILDING
CONC
W
CHESTNUT
FIFTHTEENTH
PROSPECT
POOL
WALL
V AND H AUTOMOTIVE AUTO BODY BUILDING
MW2 (1,530)
MW3 (19)
1000
100
5
MW5 (6,6)
LOCUST
MW500 (659)
PZ300 (85)
ROBBIS
SIXTEENTH
SEVENTEENTH
PLAYGROUND
SIGN
MAPLE
WILDWOOD PARK CITY PROPERTY
TENNIS COURTS
P
FLEWELLEN PLUMBING
ULMAN APPLIANCE
MW600 (1.5)
MW700 (<0.45)
PILE

TABLES

Table 1: Soil Field Screening and Analytical Results, 5 Corners Laundry & Dry Cleaning, Marshfield, Wisconsin

Location	Sample Label	Depth (feet)	Date Collected	PID Headspace Analysis	Sample Description	VOC Results (ug/kg) (Detected Compounds Only)	
				PID Response (iui)		Tetrachloroethene	Vinyl chloride
B100	B101	0-2	8/29/2000	1	Silty sand	---	---
	B102	2-4	8/29/2000	3	Silty clay	1300	<25
	B103	4-6	8/29/2000	3	Silty sand	---	---
	B104	6-8	8/29/2000	12	Silty sand	---	---
	B105	8-10.	8/29/2000	28	Sand	1100	<25
	B106	10-12	8/29/2000	NR	NR	---	---
	B107	12-14	8/29/2000	17	Sand	---	---
	B108	14-16	8/29/2000	NR	NR	---	---
	B109	16-18	8/29/2000	NR	NR	---	---
	B110	18-20	8/29/2000	3	Sand	---	---
	B111	20-22	8/29/2000	7	Sand	---	---
	B112	22-24	8/29/2000	0	Sand	---	---
	B113	24-26	8/29/2000	1	Sand	---	---
	B114	30-32	8/29/2000	0	Sand	---	---
	B115	35-37	8/29/2000	0	Silty Clay	---	---
B200	B201	0-2	8/30/2000	NS	NS	---	---
	B202	2.5-4.5	8/30/2000	0	Sandy silt	---	---
	B203	5-7	8/30/2000	0	Sandy silt	---	---
	B204	7.5-9.5	8/30/2000	0	Medium sand	---	---
	B205	10-12	8/30/2000	1	Medium sand	---	---

Table 1: Soil Field Screening and Analytical Results, 5 Corners Laundry & Dry Cleaning, Marshfield, Wisconsin

Location	Sample Label	Depth (feet)	Date Collected	PID Headspace Analysis	Sample Description	VOC Results (ug/kg) (Detected Compounds Only)	
				PID Response (iui)		Tetrachloroethene	Vinyl chloride
B200	B206	12.5-14.5	8/30/2000	2	Medium sand	---	---
	B207	15-17	8/30/2000	2	Medium sand	<25	<25
	B208	17.5-19.5	8/30/2000	NR	NR	---	---
	B209	20-22	8/30/2000	NR	NR	---	---
	B210	22.5-24.5	8/30/2000	NR	NS	---	---
	B211	25-27	8/30/2000	1	Coarse to medium sands & gravel	---	---
B300	B301	0-2	8/30/2000	0	Silty clay	---	---
	B302	2.5-4.5	8/30/2000	0	Silty clay	---	---
	B303	5-7	8/30/2000	10	Sandy silt	600	<25
	B304	7.5-9.5	8/30/2000	NR	NR	---	---
	B305	10-12	8/30/2000	0	Medium sand	---	---
	B306	12.5-14.5	8/30/2000	NR	NR	---	---
	B307	15-17	8/30/2000	NR	NR	---	---
B300	B308	17.5-19.5	8/30/2000	NR	NR	---	---
	B309	20-22	8/30/2000	NRN	NR	---	---
B400	B401	0-2	8/30/2000	0	Silts with clay and sand	---	---
	B402	2.5-4.5	8/30/2000	0	Silty clay	<25	<25
	B403	5-7	8/30/2000	0	Silty clay	---	---
	B404	7.5-9.5	8/30/2000	0	Medium sand	---	---
	B405	10-12	8/30/2000	NS	NS	---	---

Table 1: Soil Field Screening and Analytical Results, 5 Corners Laundry & Dry Cleaning, Marshfield, Wisconsin

Location	Sample Label	Depth (feet)	Date Collected	PID Headspace Analysis PID Response (iui)	Sample Description	VOC Results (ug/kg) (Detected Compounds Only)	
						Tetrachloroethene	Vinyl chloride
B400	B406	12.5-14.5	8/30/2000	0	coarse sand	<25	<25
	B407	15-17	8/30/2000	0	Medium to coarse sand	---	---
	B408	17.5-19.5	8/30/2000	0	Sands	---	---
	B409	20-22	8/30/2000	0	Sands	---	---
	B410	22.5-24.5	8/30/2000	0	Sand & gravel	---	---
SB1	101	16-20	12/11/2001	12	coarse sand	610	<25
	102	20-24	12/11/2001	37	coarse sand	---	---
	103	24-28	12/11/2001	9	coarse sand	---	---
	104	28-32	12/11/2001	5	coarse sand, clay	---	---
	105	32-36	12/11/2001	25	Clay	---	---
	106	36-38	12/11/2001	27	Fine Sand	---	---
SB2	201	0-4	12/11/2001	0	Silty clay	<25	<25
	202	4-8	12/11/2001	0	Silty clay	---	---
	203	8-12	12/11/2001	0	Sandy silt	---	---
	204	12-16	12/11/2001	0	Sandy silt	---	---
	205	16-20	12/11/2001	2	coarse sand	<25	<25
	206	20-24	12/11/2001	4	coarse sand	---	---
SB3	301	0-4	12/11/2001	0	Silty clay	---	---
	302	4-8	12/11/2001	0	Silty clay	---	---
	303	8-12	12/11/2001	48	Weathered cobbles	---	---

Table 1: Soil Field Screening and Analytical Results, 5 Corners Laundry & Dry Cleaning, Marshfield, Wisconsin

Location	Sample Label	Depth (feet)	Date Collected	PID Headspace Analysis	Sample Description	VOC Results (ug/kg) (Detected Compounds Only)	
				PID Response (iui)		Tetrachloroethene	Vinyl chloride
SB3	304	12-16	12/11/2001	53	coarse sand	<25	38*
SB4	401	0-4	12/11/2001	0	Silty clay	---	---
	402	4-8	12/11/2001	0	Silty clay	---	---
	403	8-12	12/11/2001	0	Silty clay	<25	39*
SB5	501	0-4	12/12/2001	0	Silty clay	---	---
	502	4-8	12/12/2001	117	Silty clay	---	---
	503	8-12	12/12/2001	13	coarse sand, silty clay	<25	<25
	504	12-16	12/12/2001	18	coarse sand	---	---
	505	16-20	12/12/2001	99	coarse sand	---	---
	506	20-24	12/12/2001	47	coarse sand	---	---
	507	24-28	12/12/2001	34	coarse sand	---	---
	508	28-32	12/12/2001	---	coarse sand & gravel, silty clay	---	---
SB6	601	0-4	12/12/2001	0	Silty clay	---	---
	602	4-8	12/12/2001	0	Silty clay	---	---
	603	8-12	12/12/2001	0	Silty clay	---	---
	604	12-16	12/12/2001	0	Silty clay, coarse sand	---	---
	605	16-20	12/12/2001	0	coarse sand	<25	<25
SB7	701	0-4	12/12/2001	0	Silty clay	---	---
	702	4-8	12/12/2001	0	Silty clay	---	---
	703	8-12	12/12/2001	0	Silty clay	---	---

Table 1: Soil Field Screening and Analytical Results, 5 Corners Laundry & Dry Cleaning, Marshfield, Wisconsin

Location	Sample Label	Depth (feet)	Date Collected	PID Headspace Analysis	Sample Description	VOC Results (ug/kg) (Detected Compounds Only)	
				PID Response (iui)		Tetrachloroethene	Vinyl chloride
SB7	704	12-16	12/12/2001	0	Silty clay	---	---
	705	16-18	12/12/2001	0	Silty clay, coarse sand	---	---
	706	18-22	12/12/2001	0	Sand & cobbles	<25	33*
SB8	801	0-4	12/12/2001	0	Silty clay	---	---
	802	4-8	12/12/2001	0	Silty clay	---	---
	803	8-12	12/12/2001	83	Sands	---	---
	804	12-16	12/12/2001	174	Sands	<25	<25
SB9	901	0-4	12/12/2001	0	Silty clay	---	---
	902	4-8	12/12/2001	0	Silty clay	---	---
	903	8-12	12/12/2001	4	Silty clay	<25	26*
	904	12-16	12/12/2001	0	coarse sand	---	---
	905	16-20	12/12/2001	0	coarse sand	---	---
SB10	1001	0-4	12/12/2001	0	Fine Sand	---	---
	1002	4-8	12/12/2001	0	Silty Clay	---	---
	1003	8-12	12/12/2001	0	Silty Clay	---	---
	1004	12-16	12/12/2001	0	Silty Clay	---	---
	1005	16-20	12/12/2001	0	Silty clay, coarse sand	---	---
	1006	20-24	12/12/2001	0	Silty clay, coarse sand	---	---
	1007	24-28	12/12/2001	0	Silty clay, coarse sand	<25	<25
GP46	SS5	16-20	1/8/2003	21	Clayey sand	91	<25

Table 1: Soil Field Screening and Analytical Results, 5 Corners Laundry & Dry Cleaning, Marshfield, Wisconsin

Location	Sample Label	Depth (feet)	Date Collected	PID Headspace Analysis	Sample Description	VOC Results (ug/kg) (Detected Compounds Only)	
				PID Response (iui)		Tetrachloroethene	Vinyl chloride
GP47	SS1	0-4	1/8/2003	92	Silty clay	2700	<25
GP47	SS5	16-20	1/8/2003	70	Clayey sand	180	<25
GP48	SS5	16-20	1/8/2003	109	Sand	610	<25
GP49	SS3	8-12	1/8/2003	49	Clayey sand	110	<25
GP50	SS4	12-16	1/8/2003	6	Sand	110	<25
GP51	SS5	16-20	1/8/2003	22	Clayey sand	<25	<25
PZ100	SS1	16-20	4/23/2003	1	Coarse sand with trace gravel	<25	<25
PZ200	8260B	Below water level	5/2/2003			<25	<25
PZ300	8260B	Below water level	5/2/2003			<25	<25

NOTE: = Indicates value is between the limit of detection and limit of quantification

* = not submitted for laboratory analysis

--- = No Recovery

NR = No Sample

NS = Volatile Organic compounds

VOCs = micrograms per kilogram

ug/kg

Table 2: Groundwater Analytical Results (Detected Compounds Only), 5 Corners Laundry & Drycleaning, Marshfield, Wisconsin

Well ID	Date Sampled	cis-1,2-Dichloroethene	Chlorobenzene	Chloroform	Tetrachloroethene	Toluene	Trichloroethene	Benzene	n-Butylbenzene	sec-Butylbenzene	tert-Butylbenzene	Isopropylbenzene	Methyl Tert Butyl Ether	Total Trimethylbenzenes	Chloromethane	Ethylbenzene	Naphthalene	n-Propylbenzene	Total Xylenes	diisopropyl Ether
WDNR PAL (µg/l)		*7*	*NE*	*0.6*	*0.5*	*200*	*0.5*	*0.5*	*NE*	*NE*	*NE*	*NE*	*12*	*96*	*0.3*	*140*	*8*	*NE*	*1000*	*NE*
WDNR ES (µg/l)		**70**	**NE**	**6**	**5**	**1000**	**5**	**5**	**NE**	**NE**	**NE**	**NE**	**60**	**480**	**3**	**700**	**40**	**NE**	**10,000**	**NE**
MW100	08/31/00	**110**	<30	<50	**2700**	<10	<30	<10	<40	<30	<10	<10	<110	<20	<30	<10	<70	<30	<20	<10
	01/21/01	*11*	<3.0	<5.0	**4800**	<1.0	<3.0	<1.0	<4.0	<3.0	<1.0	<1.0	<11	<2.0	<3.0	<1.0	<7.0	<3.0	<2.0	<1.0
	05/29/03	1.1	<0.26	<0.69	**98**	<0.15	*1.4*	<0.17	<0.22	<0.43	<0.31	<0.11	<0.22	<0.26	<0.22	<0.16	<0.26	<0.19	<0.46	<0.17
MW200	08/31/00	<4.0	<3.0	<5.0	**250**	<1.0	**12**	<1.0	<4.0	<3.0	<1.0	<1.0	<11	<2.0	<3.0	<1.0	<7.0	<3.0	<2.0	<1.0
	01/21/01	0.89	<0.30	<5.0	**200**	<0.10	**7.5**	<0.10	<0.40	<0.30	<0.10	<0.10	<1.1	<0.20	<3.0	<0.10	<0.70	<0.30	<0.20	<0.10
	05/29/03	2.5	<0.26	<0.69	**21**	<0.15	**35**	<0.17	<0.22	<0.43	<0.31	<0.11	<0.22	<0.26	<0.22	<0.16	<0.26	<0.19	<0.46	<0.17
MW300	08/31/00	<0.40	<0.30	<0.50	**1300**	<0.10	*1*	0.4	0.66*	<0.30	<0.10	<0.10	<1.1	1.8	0.81*	1.2	5.4	0.36*	7.4	<0.10
	01/21/01	<4.0	<3.0	<5.0	**480**	21	<3.0	<1.0	<4.0	<3.0	<1.0	<1.0	<11	<2.0	<3.0	<1.0	<7.0	<3.0	<2.0	<1.0
	05/29/03	<6.25	<6.5	<17.25	**338**	<3.75	<2.5	<4.25	<5.5	<10.75	<7.75	<2.75	<5.5	<6.5	<5.5	<4	<6.5	<4.75	<11.5	<4.25
MW400	08/31/00	<0.40	<0.30	<0.50	**450**	<0.10	*1.4*	<0.10	<0.40	<0.30	<0.10	<0.10	<1.1	0.49*	<0.30	0.20*	0.87*	<0.30	1.9	<0.10
	01/21/01	<0.4	1.8	<0.50	**310**	<0.10	0.85	<0.10	<0.40	<0.30	<0.10	<0.10	<1.1	<0.20	<0.30	<0.10	<0.70	<0.30	<0.20	<0.10
	05/29/03	<6.25	<6.5	<17.25	**474**	<3.75	<2.5	<4.25	<5.5	<10.75	<7.75	<2.75	<5.5	<6.5	<5.5	<4	<6.5	<4.75	<11.5	<4.25
MW500	05/29/03	<6.25	<6.5	<17.25	**659**	<3.75	*<2.5*	<4.25	<5.5	<10.75	<7.75	<2.75	<5.5	<6.5	<5.5	<4	<6.5	<4.75	<11.5	<4.25
PZ1	08/31/00	1.5	<0.30	<0.50	**130**	<0.10	*3.1*	0.24*	<0.40	<0.30	<0.10	<0.10	<1.1	0.21*	<0.30	<0.10	<0.70	<0.30	0.91*	0.79
	01/21/01	1.4	<0.30	*1.5*	**570**	1.4	*1.9*	<0.10	<0.40	<0.30	<0.10	<0.10	<1.1	<0.20	<0.30	<0.10	<0.70	<0.30	<0.20	<0.10
	05/29/03	4.9"J"	<2.6	*<6.9*	**127**	<1.5	**13**	<1.7	<2.2	<4.3	<3.1	<1.1	<2.2	<2.6	<2.2	<1.6	<2.6	<1.9	<4.6	<1.7
PZ100	05/29/03	<0.25	<0.26	<0.69	*1"J"*	0.45"J"	<0.1	0.43"J"	<0.22	<0.43	<0.31	<0.11	<0.22	<0.26	<0.22	0.24"J"	<0.26	<0.19	1.55"J"	<0.17
PZ200	05/29/03	<0.25	<0.26	<0.69	*3.7*	<0.15	<0.1	<0.17	<0.22	<0.43	<0.31	<0.11	<0.22	<0.26	<0.22	<0.16	<0.26	<0.19	<0.46	<0.17
PZ300	05/29/03	0.69"J"	<0.26	<0.69	**85**	0.31"J"	*1.4*	<0.17	<0.22	<0.43	<0.31	<0.11	<0.22	<0.26	<0.22	<0.16	<0.26	<0.19	<0.46	<0.17
PZ400	05/29/03	<0.25	<0.26	<0.69	**61**	0.52	*4.6*	<0.17	<0.22	<0.43	<0.31	<0.11	<0.22	<0.26	<0.22	<0.16	<0.26	<0.19	<0.46	<0.17
PZ500	05/29/03	<0.25	<0.26	<0.69	**22**	<0.15	**24**	<0.17	<0.22	<0.43	<0.31	<0.11	<0.22	<0.26	<0.22	<0.16	<0.26	<0.19	<0.46	<0.17
MW600	05/29/03	<0.25	<0.26	<0.69	*1.5*	<0.15	*0.72*	<0.17	<0.22	<0.43	<0.31	<0.11	<0.22	<0.26	<0.22	<0.16	<0.26	<0.19	<0.46	<0.17
MW700	05/29/03	<0.25	<0.26	<0.69	<0.45	<0.15	<0.1	<0.17	<0.22	<0.43	<0.31	<0.11	<0.22	<0.26	<0.22	<0.16	<0.26	<0.19	<0.46	<0.17
MW800	05/29/03	<0.25	<0.26	<0.69	*1.05"J"*	<0.15	<0.1	<0.17	<0.22	<0.43	<0.31	<0.11	<0.22	<0.26	<0.22	<0.16	<0.26	<0.19	<0.46	<0.17

Table 2: Groundwater Analytical Results (Detected Compounds Only), 5 Corners Laundry & Drycleaning, Marshfield, Wisconsin

Well ID	Date Sampled	cis-1,2-Dichloroethene	Chlorobenzene	Chloroform	Tetrachloroethene	Toluene	Trichloroethene	Benzene	n-Butylbenzene	sec-Butylbenzene	tert-Butylbenzene	Isopropylbenzene	Methyl Tert Butyl Ether	Total Trimethylbenzenes	Chloromethane	Ethylbenzene	Naphthalene	n-Propylbenzene	Total Xylenes	diisopropyl Ether
WDNR PAL (µg/l)		*7*	*NE*	*0.6*	*0.5*	*200*	*0.5*	*0.5*	*NE*	*NE*	*NE*	*NE*	*12*	*96*	*0.3*	*140*	*8*	*NE*	*1000*	*NE*
WDNR ES (µg/l)		**70**	**NE**	**6**	**5**	**1000**	**5**	**5**	**NE**	**NE**	**NE**	**NE**	**60**	**480**	**3**	**700**	**40**	**NE**	**10,000**	**NE**
MW1(V&H)	01/26/01	<8.0	<6.0	<10	**260**	<2.0	<6.0	<2.0	<8.0	<6.0	<2.0	<2.0	<22	<4.0	<6.0	<2.0	<14	<6.0	<4.0	<2.0
	05/29/03	3.6	<0.26	<0.69	**12**	<0.15	**12**	<0.17	<0.22	<0.43	<0.31	<0.11	<0.22	<0.26	<0.22	<0.16	<0.26	<0.19	<0.46	<0.17
MW2(V&H)	01/26/01	<40	<30	<50	**2800**	<10	<30	<10	<40	<30	<10	<10	<110	<20	<30	<10	<70	<30	<20	<10
	05/29/03	<12.5	<13	<34.5	**1530**	<7.5	<5	<8.5	<11	<21.5	<15.5	<5.5	<11	<13	<11	<8	<13	<9.5	<23	<8.5
MW3(V&H)	01/26/01	<0.80	<0.60	<1.0	**42**	<0.20	**26**	<0.20	<0.80	<0.60	<0.20	<0.20	<2.2	<0.40	<0.60	<0.20	<1.4	<0.60	<0.40	<0.20
	05/29/03	1.4	<0.26	<0.69	**19**	<0.15	**31**	<0.17	<0.22	<0.43	<0.31	<0.11	<0.22	<0.26	<0.22	<0.16	<0.26	<0.19	<0.46	<0.17
MW4(V&H)	01/26/01	<4.0	<0.30	<5.0	**270**	<0.10	<0.30	<0.10	<0.40	<0.30	<0.10	<0.10	<1.1	<0.20	<3.0	<0.10	<0.70	<0.30	<0.20	<1.0
	05/29/03	<5	<5.2	<13.8	**146**	<3	<2	<3.4	<4.4	<8.6	<6.2	<2.2	<4.4	<5.2	<4.4	<3.2	<5.2	<3.8	<9.2	<3.4
MW5(V&H)	01/26/01	*17*	<0.30	<0.50	**76**	3.1	**45**	**8.2**	5.9	6.2	0.68	3.3	3.0*	<0.20	<0.30	<0.10	<0.70	<0.30	<0.20	<0.10
	05/29/03	0.57"J"	<0.26	<0.69	**6.6**	<0.15	*2.8*	<0.17	<0.22	0.5"J"	<0.31	0.42	<0.22	<0.26	<0.22	<0.16	<0.26	<0.19	<0.46	<0.17
SB1-GW-D	12/11/01	<0.40	<0.30	<0.50	**13**	0.81	<0.30	<0.10	<0.40	<0.30	<0.10	<0.10	<1.1	3	**15**	<0.10	<0.70	<0.30	1.92	<0.10
SB2-GW-S	12/11/01	<0.40	<0.30	<0.50	<0.40	0.60	<0.30	<0.10	<0.40	<0.30	<0.10	<0.10	<1.1	0.68	<0.30	<0.10	<0.70	<0.30	0.98	<0.10
SB2-GW-D	12/11/01	<0.40	<0.30	<0.50	<0.40	0.81	<0.30	<0.10	<0.40	<0.30	<0.10	<0.10	<1.1	0.41	<0.30	0.53	<0.70	<0.30	0.57	<0.10
SB3-GW-S	12/11/01	<20	<15	<25	<20	*520*	<15	**150**	250	<15	<5.0	60	<55	**890**	<15	*420*	**95**	120	*1570*	<5.0
SB4-GW-S	12/11/01	<0.40	<0.30	<0.50	<0.40	0.75	<0.30	<0.10	<0.40	<0.30	<0.10	<0.10	<1.1	<0.30	<0.30	<0.10	<0.70	<0.30	1.07	<0.10
SB4-GW-D	12/11/01	<0.40	<0.30	<0.50	*4.7*	<0.10	<0.30	<0.10	<0.40	<0.30	<0.10	<0.10	<1.1	<0.30	<0.30	<0.10	<0.70	<0.30	<0.20	<0.10
SB5-GW-S	12/12/01	<0.40	<0.30	<0.50	**320**	0.89	*1.5*	0.46	<0.40	<0.30	<0.10	<0.10	<1.1	0.62	<0.30	<0.10	<0.70	<0.30	1.38	<0.10
SB5-GW-D	12/12/01	<0.40	<0.30	<.050	**33**	0.55	*0.86*	<0.10	<0.40	<0.30	<0.10	<0.10	<1.1	0.50	<0.30	<0.10	<0.70	<0.30	0.54	<0.10
SB6-GW-S	12/12/01	0.79	<0.30	<0.50	**110**	0.74	**5.8**	0.45	<0.40	<0.30	<0.10	<0.10	<1.1	<0.30	<0.30	<0.10	<0.70	<0.30	0.48	<0.10
SB7-GW-S	12/12/01	<0.40	<0.30	<0.50	*2.9*	<0.10	<0.30	<0.10	<0.40	<0.30	<0.10	<0.10	<1.1	<0.30	<0.30	<0.10	<0.70	<0.30	<0.20	<0.10
SB8-GW-S	12/12/01	<0.40	<0.30	<0.50	**10**	<0.10	*1.8*	<0.10	<0.40	<0.30	<0.10	<0.10	<1.1	<0.30	<0.30	<0.10	<0.70	<0.30	<0.20	<0.10
SB9-GW-S	12/12/01	<0.40	<0.30	<0.50	*1.1*	<0.10	<0.30	<0.10	<0.40	<0.30	<0.10	<0.10	<1.1	<0.30	<0.30	<0.10	<0.70	<0.30	<0.20	<0.10
SB10-GW-S	12/12/01	<0.40	<0.30	<0.50	**6.1**	<0.10	*1.3*	<0.10	<0.40	<0.30	<0.10	<0.10	<1.1	<0.30	<0.30	<0.10	<0.70	<0.30	<0.20	<0.10

Table 2: Groundwater Analytical Results (Detected Compounds Only), 5 Corners Laundry & Drycleaning, Marshfield, Wisconsin

Well ID	Date Sampled	cis-1,2-Dichloroethene	Chlorobenzene	Chloroform	Tetrachloroethene	Toluene	Trichloroethene	Benzene	n-Butylbenzene	sec-Butylbenzene	tert-Butylbenzene	Isopropylbenzene	Methyl Tert Butyl Ether	Total Trimethylbenzenes	Chloromethane	Ethylbenzene	Naphthalene	n-Propylbenzene	Total Xylenes	diisopropyl Ether
WDNR PAL (µg/l)		*7*	*NE*	*0.6*	*0.5*	*200*	*0.5*	*0.5*	*NE*	*NE*	*NE*	*NE*	*12*	*96*	*0.3*	*140*	*8*	*NE*	*1000*	*NE*
WDNR ES (µg/l)		**70**	**NE**	**6**	**5**	**1000**	**5**	**5**	**NE**	**NE**	**NE**	**NE**	**60**	**480**	**3**	**700**	**40**	**NE**	**10,000**	**NE**
GP 36 S-1	08/27/02	<0.53	<0.43	<0.56	<0.49	<0.63	<0.73	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	*1"J"*	<0.49	<1.4	<0.34	<1.45	<0.51
GP 36 S-2	08/27/02	<0.53	<0.43	<0.56	*0.56"J"*	1"J"	<0.73	*0.62"J"*	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	<0.69	<0.49	<1.4	<0.34	<1.45	<0.51
GP 37 S-1	08/27/02	<0.53	<0.43	<0.56	<0.49	<0.63	<0.73	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	<0.69	<0.49	<1.4	<0.34	<1.45	<0.51
GP 37 S-2	08/27/02	<2.7	<2.2	<2.8	<2.5	<3.2	<3.7	<2.2	<1.7	<2.3	<2.1	<2.3	<2.5	<5.7	<3.5	<2.5	<7	<1.7	<7.1	<2.6
GP 38 S-1	08/27/02	<0.53	<0.43	<0.56	<0.49	<0.63	<0.73	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	<0.69	<0.49	<1.4	<0.34	<1.45	<0.51
GP 38 S-2	08/27/02	<0.53	<0.43	<0.56	*0.65"J"*	<0.63	<0.73	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	<0.69	<0.49	<1.4	<0.34	<1.45	<0.51
GP 39 S-1	08/27/02	<0.53	<0.43	<0.56	**130**	<0.63	<0.73	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	*1.8"J"*	<0.49	<1.4	<1.34	<1.45	<0.51
GP 39 S-2	08/27/02	0.83"J"	<0.43	*1.5"J"*	**92**	<0.63	*3.8*	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	*0.85"J"*	<0.49	<1.4	<0.34	<1.45	<0.51
GP 40 S-1	08/27/02	<5.3	<4.3	<5.6	**230**	<6.3	<7.3	<4.3	<3.4	<4.6	<4.2	<4.6	<4.9	<1.14	<6.9	<4.9	<14	<3.4	<14.5	<5.1
GP 40 S-2	08/27/02	1.1"J"	<0.43	<0.56	**190**	<0.63	*3.8*	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	*1"J"*	<0.49	<1.4	<0.34	<1.45	<0.51
GP 41 S-1	08/28/02	<0.53	<0.43	<0.56	<0.49	1.6"J"	<0.73	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	<0.69	<0.49	<1.4	<0.34	<1.45	<0.51
GP 41 S-2	08/28/02	<0.53	<0.43	<0.56	<0.49	1.2"J"	<0.73	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	<0.69	0.5"J"	<1.4	<0.34	<1.45	<0.51
GP 42 S-1	08/28/02	<0.53	<0.43	<0.56	<0.49	0.67"J"	<0.73	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	<0.69	<0.49	<1.4	<0.34	<1.45	<0.51
GP 42 S-2	08/28/02	<0.53	<0.43	<0.56	<0.49	1.2"J"	<0.73	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	<0.69	<0.49	<1.4	<0.34	<1.45	<0.51
GP 43 S-1	08/28/02	<0.53	<0.43	<0.56	**20**	<0.63	*2.7*	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	<0.69	<0.49	<1.4	<0.34	<1.45	<0.51
GP 43 S-2	08/28/02	<0.53	<0.43	<0.56	**11**	0.7"J"	**18**	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	<0.69	<0.49	<1.4	<0.34	<1.45	<0.51
GP 44 S-1	08/28/02	<0.53	<0.43	<0.56	**65**	<0.63	*2"J"*	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	<0.69	<0.49	<1.4	<0.34	<1.45	<0.51
GP 44 S-2	08/28/02	<0.53	<0.43	<0.56	**38**	<0.63	*2.6*	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	<0.69	<0.49	<1.4	<0.34	<1.45	<0.51

Table 2: Groundwater Analytical Results (Detected Compounds Only), 5 Corners Laundry & Drycleaning, Marshfield, Wisconsin

Well ID	Date Sampled	cis-1,2-Dichloroethene	Chlorobenzene	Chloroform	Tetrachloroethene	Toluene	Trichloroethene	Benzene	n-Butylbenzene	sec-Butylbenzene	tert-Butylbenzene	Isopropylbenzene	Methyl Tert Butyl Ether	Total Trimethylbenzenes	Chloromethane	Ethylbenzene	Naphthalene	n-Propylbenzene	Total Xylenes	diisopropyl Ether
WDNR PAL (µg/l)		*7*	*NE*	*0.6*	*0.5*	*200*	*0.5*	*0.5*	*NE*	*NE*	*NE*	*NE*	*12*	*96*	*0.3*	*140*	*8*	*NE*	*1000*	*NE*
WDNR ES (µg/l)		**70**	**NE**	**6**	**5**	**1000**	**5**	**5**	**NE**	**NE**	**NE**	**NE**	**60**	**480**	**3**	**700**	**40**	**NE**	**10,000**	**NE**
GP 45 S-1	08/28/02	<0.53	<0.43	<0.56	**24**	<0.63	*4.8*	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	*0.71"J"*	<0.49	<1.4	<0.34	<1.45	<0.51
GP 45 S-2	08/28/02	<0.53	<0.43	*0.77"J"*	**27**	<0.63	*1.2"J"*	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	<0.69	<0.49	<1.4	<0.34	<1.45	<0.51

NOTE:

µg/l = micrograms per liter
WDNR = Wisconsin Department of Natrual Resources
PAL = Preventive Action Limit
ES = Enforcement Standard
"J" = concentration detected between Limit of Detection and Limit of Quantification
NE = Not established by WDNR
32 = WDNR Preventive Action Limit Exceeded
32 = WDNR Enforcement Standard Exceeded

Ground-water grab samples (collected 12/2001) with an "S" designation are collected at the water table. Ground-water grab samples with a "D" designation were collected at or near the bottom of the boring.

Table 2: Groundwater Analytical Results (Detected Compounds Only), 5 Corners Laundry & Drycleaning, Marshfield, Wisconsin

Well ID	Date Sampled	cis-1,2-Dichloroethene	Chlorobenzene	Chloroform	Tetrachloroethene	Toluene	Trichloroethene	Benzene	n-Butylbenzene	sec-Butylbenzene	tert-Butylbenzene	Isopropylbenzene	Methyl Tert Butyl Ether	Total Trimethylbenzenes	Chloromethane	Ethylbenzene	Naphthalene	n-Propylbenzene	Total Xylenes	diisopropyl Ether
WDNR PAL (µg/l)		*7*	*NE*	*0.6*	*0.5*	*200*	*0.5*	*0.5*	*NE*	*NE*	*NE*	*NE*	*12*	*96*	*0.3*	*140*	*8*	*NE*	*1000*	*NE*
WDNR ES (µg/l)		**70**	**NE**	**6**	**5**	**1000**	**5**	**5**	**NE**	**NE**	**NE**	**NE**	**60**	**480**	**3**	**700**	**40**	**NE**	**10,000**	**NE**
GP 45 S-1	08/28/02	<0.53	<0.43	<0.56	**24**	<0.63	*4.8*	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	*0.71"J"*	<0.49	<1.4	<0.34	<1.45	<0.51
GP 45 S-2	08/28/02	<0.53	<0.43	*0.77"J"*	**27**	<0.63	*1.2"J"*	<0.43	<0.34	<0.46	<0.42	<0.46	<0.49	<1.14	<0.69	<0.49	<1.4	<0.34	<1.45	<0.51

NOTE:

µg/l = micrograms per liter
WDNR = Wisconsin Department of Natrual Resources
PAL = Preventive Action Limit
ES = Enforcement Standard
"J" = concentration detected between Limit of Detection and Limit of Quantification
NE = Not established by WDNR
32 = WDNR Preventive Action Limit Exceeded
32 = WDNR Enforcement Standard Exceeded

Ground-water grab samples (collected 12/2001) with an "S" designation are collected at the water table. Ground-water grab samples with a "D" designation were collected at or near the bottom of the boring.

Table 3: Evaluated Remedial Action Options – 5 Corners Laundry & Drycleaning, Marshfield, Wisconsin, BRRTS #02-72-240751

REMEDIAL ACTION OPTION	ZONES AND MEDIA TREATED	OPTIMAL CONTAMINANT CHARACTERISTICS	OPTIMUM MEDIA CHARACTERISTICS	LENGTH OF TREATMENT	EFFECTIVENESS	ADVANTAGES	DISADVANTAGES	COMBINED WITH OTHER REMEDIAL ACTION OPTIONS	RATIONALE FOR ELIMINATION
Air Sparging (AS)	In-situ ground water	- Generally more applicable to lighter gasoline constituents (e.g., BTEX) - Chlorinated solvents - Henry's Law constant>100 atm - Boiling point<300°C - Vapor pressure>0.5 mm Hg - Depth to ground water>10 ft	- Intrinsic permeability>10^{-9} cm^2 - Initial dissolved iron (Fe^{+2}) concentration at the site<10 mg/l - Free of impermeable layers or other conditions that would disrupt/reduce air flow	1 to 3 years under optimal conditions	Achievable clean-up level will vary greatly depending upon the soil and contaminant types	- Requires no removal, treatment, storage, or discharge considerations for groundwater - Enhances biodegradation by increased oxygen transfer to the ground water	- Air channeling often hinders overall effectiveness - Can induce migration of contaminants - Cannot be used to treat confined aquifers - Requires detailed pilot testing and monitoring - Should not be used if basements or sewers are present at or near the site - Cannot remove non-aqueous phase liquids (NAPLs) - Permits generally required for air injection wells	Commonly combined with soil vapor extraction (SVE) or pump-and-treat options	Evaluated and not selected due to cost, feasibility, time, and property disruption considerations.
Excavation and Landfilling	Ex-situ, unsaturated soil	- Heavy metals - Chlorinated compounds - All petroleum fuels and lubricants including gasoline, jet fuels, kerosene, diesel fuel, heating oils, and lubricating oils	- Fine-grained soils (e.g., silts and clays) - Maximum moisture content <85% (may require dewatering)	Excavation usually requires less than 2 weeks	Very effective for source-area removal if extent is defined. Minimizes contaminant migration and maximizes contaminant	- Easily implemented - High technical feasibility if soils are fine grained and excavation is less than 17 ft deep	- High cost for disposal - Removed soils must be staged/stored and treated ex-situ - Cannot be used under buildings - Highly disruptive to site use - High capital cost and reduced technical feasibility if soils are coarse grained and excavation is greater than 17 ft deep - Fill must be carefully recompacted to prevent differential settlement - Transportation and disposal/ characterization costs can be high - Requires large area for storage	Easily combined with AS or pump-and-treat options	Evaluated and not selected due to high cost for transportation and disposal.
Enhanced Groundwater Bioremediation (i.e. HRC or molasses injection)	In-situ ground water	- Short-chain, low molecular weight, more water-soluble constituents - Constituents should be biodegradable - TPH<50,000 ppm - Total heavy metals<2500 ppm - Organic solvent concentrations<7000 ppm	- Hydraulic conductivity>10^{-4} cm/sec - Dissolved iron concentrations <10 mg/l - Groundwater pH between 6-8 - Groundwater temperature between 10-45°C - Total heterotrophic bacteria >1000 CFU/gram in dry soil - C:N:P ratio in the range of 100:10:1 to 100:1:0.5	May be shorter than pump-and-treat options	Difficult to achieve a constituent concentration<0.1 ppm or TPH reduction >95%	- Remediates contaminants that are adsorbed to, or trapped within, the geologic materials of which the aquifer is composed along with dissolved groundwater contaminants - In many cases, does not produce waste products that need to be disposed	- Injection wells and/or infiltration galleries may become plugged by microbial growth or mineral precipitates - Requires continuous monitoring and maintenance - Remediation may only occur in more permeable layers or channels within the aquifer - LNAPLs should be removed prior to operation	Can be combined with AS, and SVE or bioventing	Evaluated and not selected because of time considerations.
Natural Attenuation (NA) using reductive dechlorination.	In-situ, ground water and unsaturated soil	-Product constituents should be at most slightly soluble in water (generally>0.1 mg/l) -Low volatility -K_{oc} and K_d values should be high enough to adequately retard migration -Biodegradable constituents -High concentration of heavy metals and other toxic compounds could inhibit microbial activity -Shrinking or stable plume	- Intrinsic permeability>10^{-8} cm^2 - Hydraulic conductivity<10^{-7} cm/sec - Groundwater dissolved oxygen less than or equal to 0.5 mg/l - Temperature greater than 20 C - ORP less then –100 mV - Iron II greater than 1mg/l - Nitrate less than 1 mg/l - Sulfate less than 20 mg/l - Sulfide greater than 1mg/l - Total Organic Carbon greater than 20 mg/l - Groundwater pH between 5 – 9	Longer period of time may be required to mitigate contamination than active remedial measures	May not always achieve the desired cleanup levels within a reasonable amount of time.	- Low cost - Minimal disturbance to the site operations - Increasing regulatory support - Increasing public support - Potential use below buildings and other areas that cannot be excavated	- Some migration of constituents may occur - Not suitable if potential receptors may be exposed to contaminated soil, ground water, or vapors - Rainfall > 60 inches/year could be a problem - Climate should be moderate to warm, 5-45 °C (microbial activity typically doubles for every 10°C rise in temperature) - May not be suitable if potable water wells are in the contaminant plume	NA is usually completed alone for low level contaminant concentrations or following other remedial action options	Evaluated and not selected. Not WDNR-approvable due to impacted City Well.

Table 3: Evaluated Remedial Action Options – 5 Corners Laundry & Drycleaning, Marshfield, Wisconsin, BRRTS #02-72-240751

REMEDIAL ACTION OPTION	ZONES AND MEDIA TREATED	OPTIMAL CONTAMINANT CHARACTERISTICS	OPTIMUM MEDIA CHARACTERISTICS	LENGTH OF TREATMENT	EFFECTIVENESS	ADVANTAGES	DISADVANTAGES	COMBINED WITH OTHER REMEDIAL ACTION OPTIONS	RATIONALE FOR ELIMINATION
Groundwater Pumping and Tray-Type Air Stripping	Ex-situ ground water	- Is not effective for diesel fuel, heating oils, kerosene, or lubricating oils - Generally more applicable to lighter VOC (e.g., gasoline constituents, chlorinated solvents)	- Hydraulic conductivity > 10^{-4} cm/sec - Initial dissolved iron (Fe^{+2}) concentration at the site < 10 mg/l - Free of impermeable layers or other conditions that would disrupt/reduce water flow	- All groundwater treatment occurs during operation of the air stripper - Total remediation time usually exceeds 2 yrs	- Air stripping can consistently achieve constituent concentration reductions to 99% - Achievable cleanup level will vary greatly depending upon the soil and contaminant type	- Proven to be very effective in treating/ remediating aqueous-phase VOC - Low-profile shape makes it unobtrusive and easy to house in standard building - Hydraulically controls groundwater migration	- Requires continuous monitoring and maintenance - Requires pump testing - Off gas from the air stripper may require treatment - Extracted ground water may require additional treatment - LNAPL VOC should be removed prior to treatment - Local groundwater pumping can make plume capture difficult	Can be combined with SVE or bioventing and groundwater natural attenuation	Evaluated and not selected due to technical feasibility and cost considerations, and property disruption.
Soil Vapor Extraction (SVE)	In-situ, unsaturated soil	- VOCs and certain SVOCs (e.g., lighter products such as gasoline) - Vapor pressure>0.5 mm Hg - Boiling points<300°C - Henry's Law constant>100 atm - Is not effective against diesel fuel, heating oils, kerosene, and lubricating oils	- Intrinsic permeability>10^{-9} cm^2 (e.g., gravel, clean sand, silty sand) - ADry≡ soil (Awet≡ soil decreases permeability) - Depth to ground water>3 ft (preferably>10 ft)	6 months to 2 years under optimal conditions	Difficult to achieve constituent concentration reductions >90%	- Can be used under buildings and other locations that cannot be excavated	- Off gas often requires treatment during early phases of remediation (expensive)	Easily combined with AS, groundwater bioremediation or dual-phase extraction	Evaluated and not selected due to low permeability of shallow, silty clay at the site. Relatively high capital, operation, maintenance costs.

BTEX =Benzene, Toluene, Ethylbenzene, and Xylenes (total)
C:N:P =Carbon:Nitrogen:Phosphorus ratio
K_d =Soil-water partition coefficient
K_{ow} =Octanal-water partition coefficient
SVOC =Semi-Volatile Organic Compounds
VOC =Volatile Organic Compounds
NAPLs =non-aqueous phase liquids
f_{oc} =Fractional content of soil organic carbon
K_{oc} =Organic carbon-water partition coefficient
ppm =parts per million
TPH =Total Petroleum Hydrocarbons

Table 4: Estimated Remediation Schedule - 5 Corners Laundry & Drycleaning, Marshfield, Wisconsin, BRRTS #02-72-240751

Remediation Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Phase One																														
Phase Two																														
Phase Three																														
Phase Four																														
Additional Injection/Monitoring/Closure Activities																														

Notes:

The actual project schedule may differ significantly. Completing the chemical injection during each phase is dependent upon WDNR approval and other variables that are difficult to ascertain at this time.