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Remedial Investigation of a VOC-Contaminated Aquifer

Wisconsin Department of Natural Resources

Webster, Wisconsin

Task 1

Investigation Report

Wisconsin DNR Project Number 91SW409

Prepared by

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Investigation Report

Remedial Investigation of a VOC-Contaminated Aquifer
Webster, Wisconsin

Certification

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly registered professional engineer under the laws of the State of Wisconsin.

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Investigation Report

Remedial Investigation of a VOC-Contaminated Aquifer
Webster, Wisconsin

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Investigation Report

EXECUTIVE SUMMARY

FINDINGS

1. The investigation was conducted in the Village of Webster, Wisconsin, which is located in Burnett County.

2. The site is located approximately halfway between the Yellow River (to the north) and the Clam River (to the south), within the St. Croix River drainage basin.

3. The topography of the area is dominated by an extensive, low relief outwash plain that contains scattered wetlands. The study area is flat, with a total variation in topography of less than five feet.

4. Nineteen soil borings, varying from 36 to 71 feet in depth, were drilled at various locations around the study area to determine the sedimentary stratigraphy, the depth to groundwater, and the lateral and vertical extent of soil contamination by volatile organic compounds (VOCs).

5. The sedimentary stratigraphy consists of silty to clayey sand, plus gravel fill, silty clay, and fine to coarse-grained, well rounded, well-sorted sand deposits that locally contain lenses of pebbly to gravelly sand and silt to silty sand.

6. Groundwater was encountered in all soil borings at depths ranging from 34 to 36 feet below the ground surface.

7. The groundwater is contained in an unconfined aquifer system. Mechanical analyses of soil samples from the saturated zone indicate that the aquifer varies from poorly graded sand (SP) to poorly graded sand with silt (SP-SM) to silty sand (SM).

Findings, continued

8. Thirty-eight soil samples were selected for chemical analysis. Twenty-eight samples were analyzed for VOCs, using EPA Method 8010/8020, total petroleum hydrocarbons (TPH) using the California Method, and lead via EPA Method 7421. Ten samples were analyzed only for VOC contamination via EPA Method 8010/8020. All analyses were performed by Enviroscan of Rothschild, Wisconsin.

9. Lead was detected in 17 of the 28 soil samples analyzed, with concentrations ranging from 1.82 to 9.47 μg/g. These are considered to be background concentrations.

10. Toluene was detected only in soil boring SB-13, where a soil sample collected from 34 to 36 feet in depth had a concentration of 4.2 μg/g.

11. Tetrachloroethylene (PCE) contaminated soil was detected at depths of 34 to 36 feet in soil borings SB-1 (34.9 μg/g), SB-6 (2.4 μg/g), and SB-18 (9.3 μg/g). Tetrachloroethylene contamination was also detected at 69 to 71 feet in depth in soil boring SB-4 (5.8 μg/g).

12. Methylene chloride contamination, detected in samples from soil borings SB-4, SB-7, SB-9, and SB-14, is believed to be the result of laboratory contamination during the analysis of the samples.

13. Ten monitoring wells were installed to evaluate the hydrogeological characteristics of the aquifer, as well as to allow groundwater sampling.

14. The aquifer was found to have a geometric mean hydraulic conductivity of 1.77×10^{-2} cm/sec and an arithmetic mean hydraulic conductivity of 1.82×10^{-2} cm/sec, based on analyses of data collected by a pressure transducer using the Hvorslev method.

15. Water table elevations were monitored from June through October, 1991, in the ten wells installed by RREM and in the nine wells installed during the previous study by Ayres (1987). Groundwater flows from east to west, with a gradient between 8×10^{-4} ft/ft and 9×10^{-4} ft/ft.

Findings, continued

16. The groundwater average linear velocity was calculated to be between 44 and 48 ft/year, assuming a porosity of 35 percent for the aquifer.

17. Groundwater samples were obtained during two rounds of sampling from the 19 wells discussed above and from a tap connected to Webster village well 2 (VW-2).

18. Low-level contamination of groundwater by the gasoline-related compounds benzene, toluene, and 1,2-dichloropropane was recognized during the first round of sampling. Benzene, ethylbenzene, 1,2-dichloropropane, toluene, and m- and p-xylene were detected in the second round of sampling.

19. Only the concentrations reported for benzene exceeded the preventive action limit (PAL). None of the concentrations reported for the gasoline-related contaminants exceeded its respective enforcement standard (ES).

20. Contamination by organic compounds used primarily as solvents was also recognized during the two rounds of groundwater sampling. During the first round of sampling, the halogenated compounds 1,2-dichlorobenzene, 1,2-dichloroethane, tetrachloroethylene (PCE) and trichloroethylene (TCE) were detected. The second round water samples contained the previous compounds as well as 1,2-dichloroethylene.

21. The concentrations of 1,2-dichlorobenzene and 1,2-dichloroethylene did not exceed the PAL or the ES.

22. Trichloroethylene was detected in wells 91-2B, 91-3,91-4, and 91-6. All concentrations detected exceeded the PAL of 0.18 ug/l, and the concentration in well 91-2B consistently exceeded the ES of 5.0 ug/l.

23. Two halogenated VOCs (1,2-dichloroethane and tetrachloroethylene) had a widespread distribution in the groundwater at Webster.

24. Dichloroethane concentrations that exceeded the PAL of 0.05 ug/l were detected in wells 91-4, 91-5B, OW-2, and VW-2. The enforcement standard for 1,2-dichloroethane (5.0 ug/l) was exceeded in both rounds of water sampling by groundwater from well 91-3.

Findings, continued

25. Tetrachloroethylene was detected in water from 11 wells during the first round of sampling, and 13 wells from the second round of sampling. In all locations where tetrachloroethylene was detected, the concentrations exceeded both the PAL and the ES.

26. Based on the mapped distribution of 1,2-dichloroethane and tetrachloroethylene, the contaminant concentration increases with depth as one moves away from the possible sources.

27. Contamination by 1,2-dichloroethane and tetrachloroethylene appears to have originated from separate sources.

CONCLUSIONS

1. The results of this investigation indicate that volatile organic compound contamination of both soil and water is present at the Webster, Wisconsin, study site.

2. Although petroleum-related contamination has been detected, for the most part, the concentrations of these compounds are below the preventive action limits (PAL) and do not appear to pose substantial threat to human health.

3. The most widespread contamination at the site is related to VOCs that are primarily associated with solvents. These include 1,2-dichlorobenzene, 1,2-dichloroethane, 1,2-dichloroethylene, tetrachloroethylene, and trichloroethylene.

4. Based on the groundwater quality standards enforced by the Wisconsin DNR, it appears that the most serious contamination is due to the presence of 1,2-dichloroethane and tetrachloroethylene.

5. The plume of 1,2-dichloroethane appears to be restricted to the southwestern region of the study area.

6. The plume related to tetrachloroethylene contamination appears to be concentrated in a northeast-southwest trending zone through the central region of the site in shallow portions of the aquifer. In deeper parts of the aquifer (down to 70 feet), this zone appears to be shifted northward relative to its position near the top of the aquifer.

Conclusions, continued

7. The plumes related to 1,2-dichloroethane and tetrachloroethylene contamination appear to have different sources. The source for 1,2-dichloroethane appears to be located along Main Street on the west side of the village, probably between Pike and Sturgeon avenues, whereas the source for tetrachloroethylene may exist west of Lakeland Avenue (Highway #35) and east of Muskey Avenue, between Main and Elm streets.

8. Continued monitoring of groundwater quality from existing monitoring wells is recommended.

9. Drilling of several soil borings at potential source locations, with geochemical analysis of soil and water, is recommended to better define the distribution of the contamination.

10. The drilling of soil borings and the installation of monitoring wells is recommended to better define the lateral and vertical limits of the 1,2-dichloroethane and tetrachloroethylene plumes.

11. The drilling of at least four soil borings to the base of the sand aquifer underlying Webster is recommended to better define the slope of the surface of the confining layer.

12. Sampling of water from residences with private wells located immediately downgradient of the contaminant plumes is recommended.

Investigation Report

INTRODUCTION

RREM, Inc., was retained by the Wisconsin Department of Natural Resources (DNR) to conduct a remedial investigation of a contaminated aquifer in the Village of Webster. The 1991 investigation was conducted to determine the scope, extent, source(s) and potential impacts of volatile organic compound (VOC) contamination in the aquifer underlying Webster. The contamination was first recognized in 1984 and 1985 in Webster Village Wells 1 and 2.

This Task 1 study examined background information about the site and previous investigations of the aquifer. In addition, the study area was expanded to evaluate possible sources of halogenated VOCs. Site work included soil boring completion, soil sample collection and analysis, monitoring well installation, groundwater sample collection and analysis, aquifer tests, and a site survey. Additional work is being conducted by RREM in a Task II investigation to evaluate the feasibility of various remedial options and future use of the aquifer.

PROJECT SCOPE

This remedial investigation encompassed:

- evaluation of the subsurface geological and hydrogeological characteristics of the study area;
- investigation of the vertical and horizontal distribution of VOC contamination in the soil and groundwater;
- evaluation of potential impacts related to the VOC contaminated soil and/or groundwater; and
- identification of several possible sources of VOC contamination in the study area.

SITE LOCATION

The Village of Webster is located in Section 8, Township 39 North, Range 16 West, Burnett County, Wisconsin (Figure 1). The study area (Figures 2 and 3) is bounded by Fir Street to the north, Cedar Street to the south, Wisconsin State Highway 35 to the east, and the less developed area immediately west of the abandoned Soo Line Railroad right-of-way to the west. The study area includes most of Webster's downtown business district.

SITE CHARACTERISTICS

TOPOGRAPHY

The topography in the Webster area (Figure 4) is dominated by an extensive, low relief outwash plain, containing scattered wetlands. The Yellow River to the north and the Clam River to the south occupy east-west trending river valleys and lowlands, which lie approximately 30-50 feet below the elevation of the outwash plain. The study area is flat, with a total variation in topography of less than 5 feet.

BEDROCK GEOLOGY

Bedrock in the vicinity of Webster (Figure 5) is composed of subaerially deposited amygdaloidal to massive basalt lava flows and associated sedimentary rocks (Mudrey, Brown, and Greenberg, 1982; Ojakangas and Matsch, 1982). These rocks comprise part of the Chengwatana Volcanic Group, a series of 1100-million-year-old volcanic and sedimentary rocks, which are up to 25,000 feet in thickness (Young and Hindall, 1973).

The Chengwatana Volcanic Group has been mapped, primarily by geophysical means, from east-central Minnesota through northeastern Wisconsin. This group of rocks comprises a portion of the larger Keweenawan Super Group, which is composed of Middle Proterozoic volcanic and sedimentary rocks, formed within a failed continental rift system that extends from eastern Lake Superior to Kansas.

No lithified strata of Paleozoic, Mesozoic, or Cenozoic age have been recognized in the immediate Webster area. However, Cambrian age rock, consisting dominantly of quartzose and glauconitic sandstone and siltstone with lesser amounts of carbonate rocks, are believed to underlie the unconsolidated Pleistocene glacial sediments two to three miles west of Webster (Morey, Sims, Cannon, Mudrey, and Southwick, 1982; Mudrey et al., 1982).

GLACIAL GEOLOGY

The quaternary geologic history of the Webster area includes a period of continental glaciation, which extended over a large region in Wisconsin. Sediments deposited during this glaciation range from 5,000 to 70,000 years in age (Paull and Paull, 1977).

Glacial sediments present in the Webster area (Figure 6) are believed to have been deposited during the Woodfordian Advance of the Wisconsinian glaciation. This advance occurred between 22,000 and 12,500 years ago. At its maximum limit, ice from the Woodfordian Advance covered regions of Minnesota, Wisconsin, Iowa, and central Illinois. Over northwestern Wisconsin, ice flowed out of the Lake Superior Basin in a southwesterly direction. During periods of glacial stagnation, sediment-laden streams, produced from glacial meltwaters, deposited stratified sand and gravel deposits. This resulted in the formation of an extensive, pitted outwash plain. In the vicinity of Webster, these sedimentary deposits are more than 150 feet thick (Young and Hindall, 1973).

PREVIOUS INVESTIGATIONS

WISCONSIN DNR (1984 AND 1985)

Wisconsin DNR Northwest Water Supply Staff first recognized the presence of volatile organic compound (VOC) contamination in water samples from the Webster village well 1 (VW-1) in December, 1984. The concentration of the contamination was not quantifiable at that time. Analysis of water samples taken from village well 1 (VW-1) in December 1984 indicated the presence of 1,2-dichloroethane and tetrachloroethylene (perchloroethylene [PCE]) in concentrations of 26 and 18 μg/l, respectively. A summary of the chemical analyses performed on village well 1 by the Wisconsin DNR is contained in Appendix A.

Water samples from village well 2 (VW-2) were also collected and analyzed. Although no contamination was detected initially, both 1,2-dichloroethane and tetrachloroethylene were recognized in samples from this well in November 1985. Again, the concentrations of these contaminants was not quantifiable at that time. Analyses of water from VW-2 in December 1985 detected 1,2-dichloroethane and tetrachloroethylene in concentrations of 14 and 6.9 μg/l, respectively. A summary of the chemical analyses performed on water samples from village well 2 is contained in Appendix A.

The locations of village well 1 and village well 2 are shown in Figure 7.

Tetrachloroethylene is considered an irritant to eyes and skin and a carcinogen; 1,2-dichloroethane is a strong eye irritant and a carcinogen (Sax & Lewis, 1987; U.S. Department of Health and Human Services, 1990).

Several attempts were made to locate the source of contamination. In May 1985, field work conducted by Wisconsin DNR Northwest District personnel included several shallow auger borings in an area just north and northeast of VW-1. Petroleum product odors and petroleum hydrocarbon contamination were detected at locations between VW-1 and the site of the former Hoffman's Corner Bulk Oil Facility.

AYRES ASSOCIATES (1986-87)

In May 1986, Ayres Associates of Eau Claire, Wisconsin, was retained by the Wisconsin DNR to:

- investigate the extent and degree of contamination in the groundwater and soil near the contaminated wells;
- determine the sources of the contamination;
- evaluate the contamination with respect to relevant environmental criteria;
- and summarize the data collected and formulate opinions for remedial action.

The Ayres investigation included drilling of nine soil borings and installation of nine groundwater monitoring wells, laboratory analysis of soil samples, two rounds of groundwater sampling and laboratory analysis for selected VOCs, a site survey, and a pump test of VW-2 to assess the hydraulic characteristics of the aquifer. A summary of the chemical analyses performed for this study is contained in Appendix A.

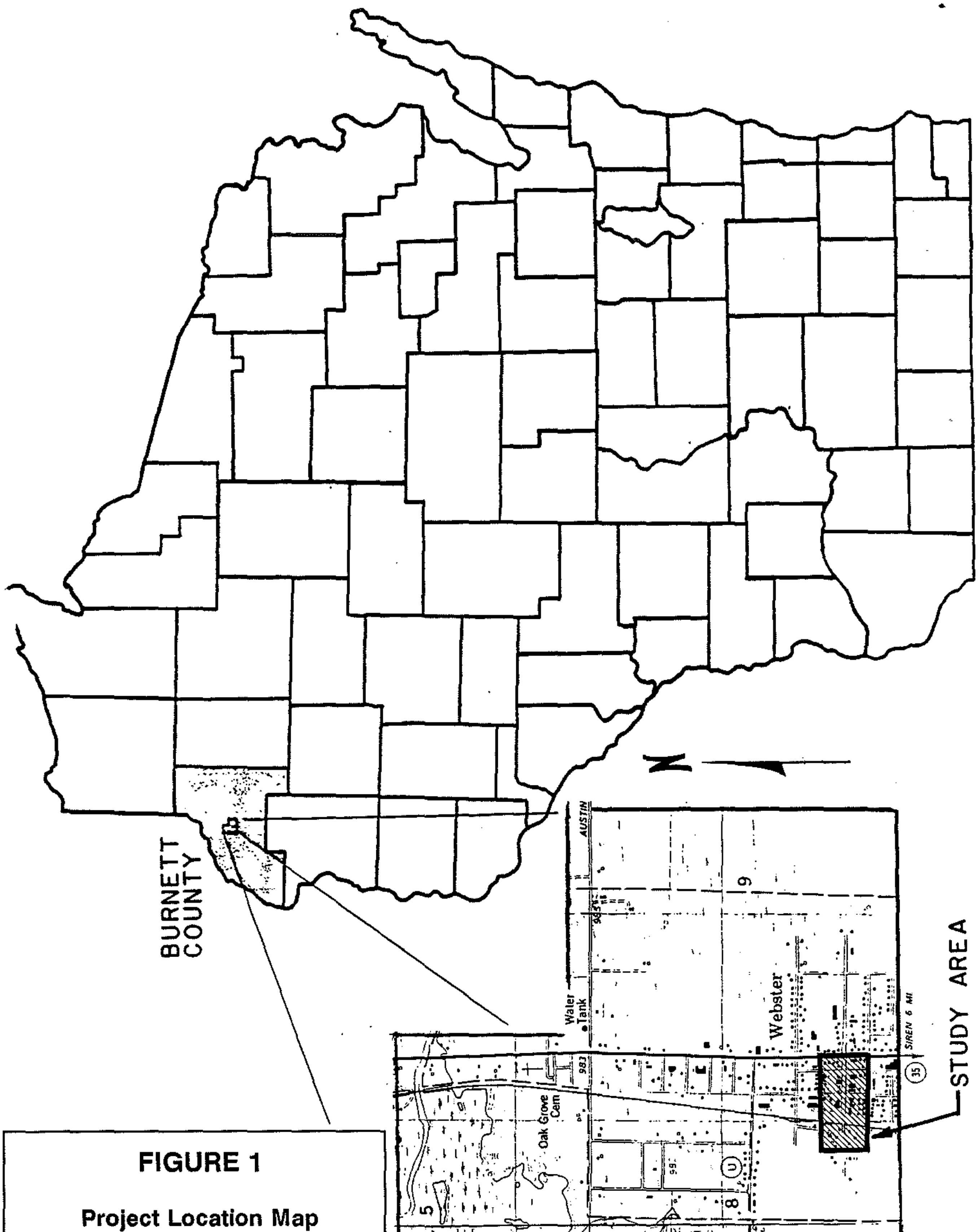


FIGURE 1

Project Location Map
Webster, Wisconsin

▪ Wisconsin DNR ▪
Remedial Investigation, Task 1

RREM, INC. Engineering and Environmental Consultants

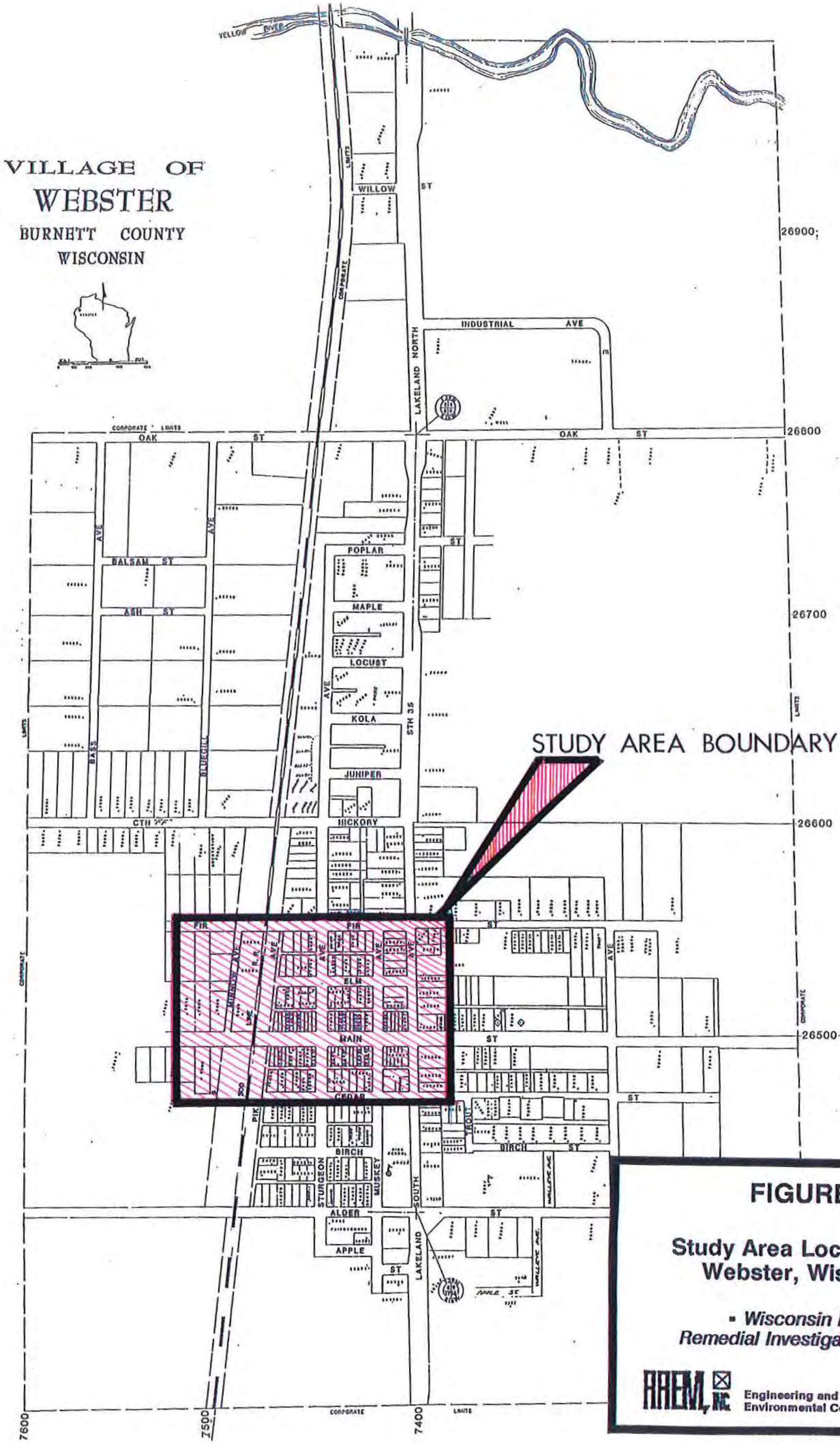


FIGURE 2

Study Area Location Map
Webster, Wisconsin

▪ Wisconsin DNR ▪
Remedial Investigation, Task 1

AAEM, INC. Engineering and Environmental Consultants

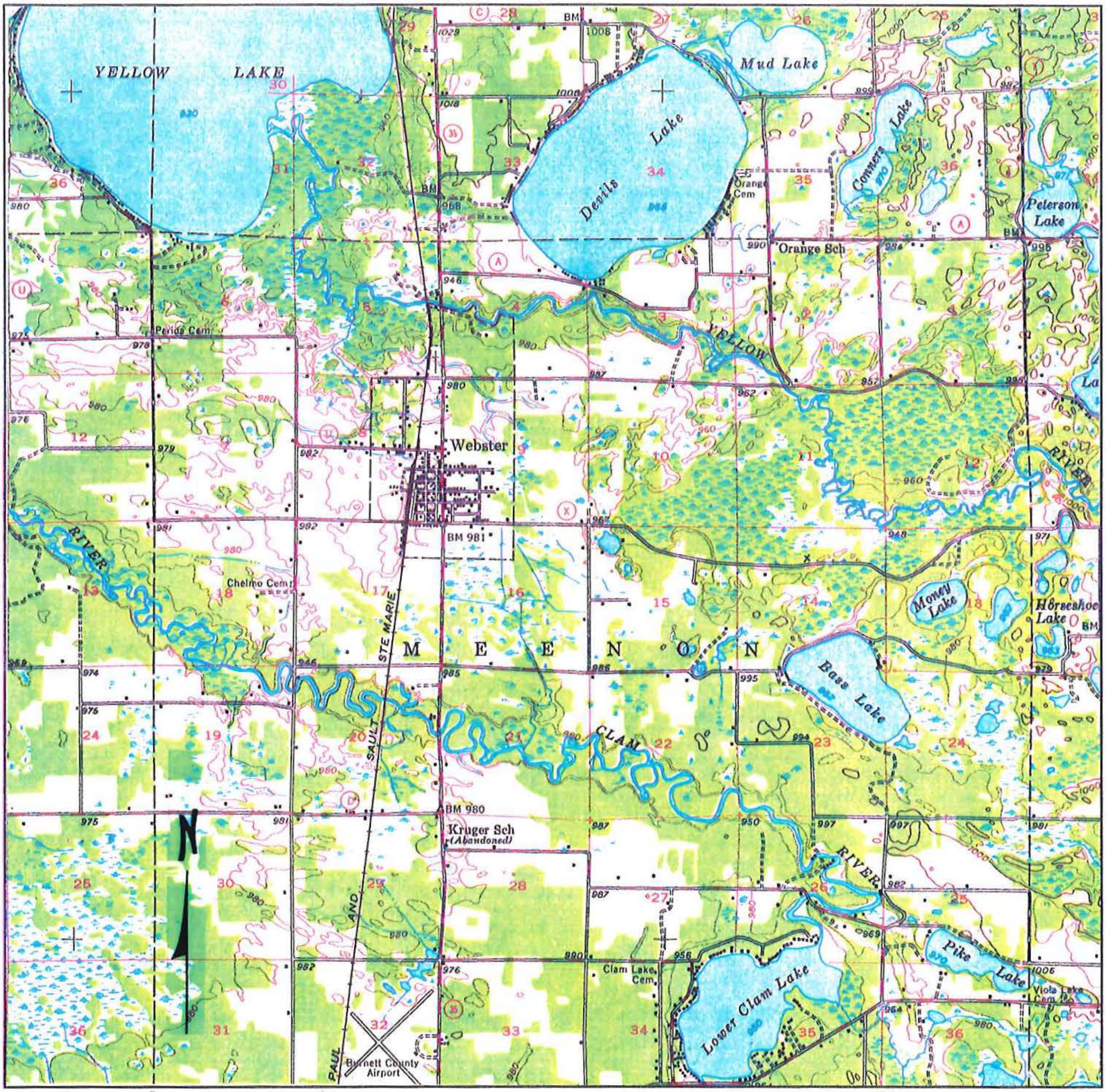
Scale: l" = 200'

FIGURE 3

Aerial Photograph of Study Area Webster, Wisconsin

▪ Wisconsin DNR ▪
Remedial Investigation, Task 1

RREM, INC. Engineering and Environmental Consultants



SCALE 1:62500

1 ½ 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

FROM:
UNITED STATES DEPARTMENT OF THE INTERIOR
STATE OF WISCONSIN – WEBSTER QUADRANGLE

1955 WEBSTER, WIS.–MINN.
N4545–W9215/15

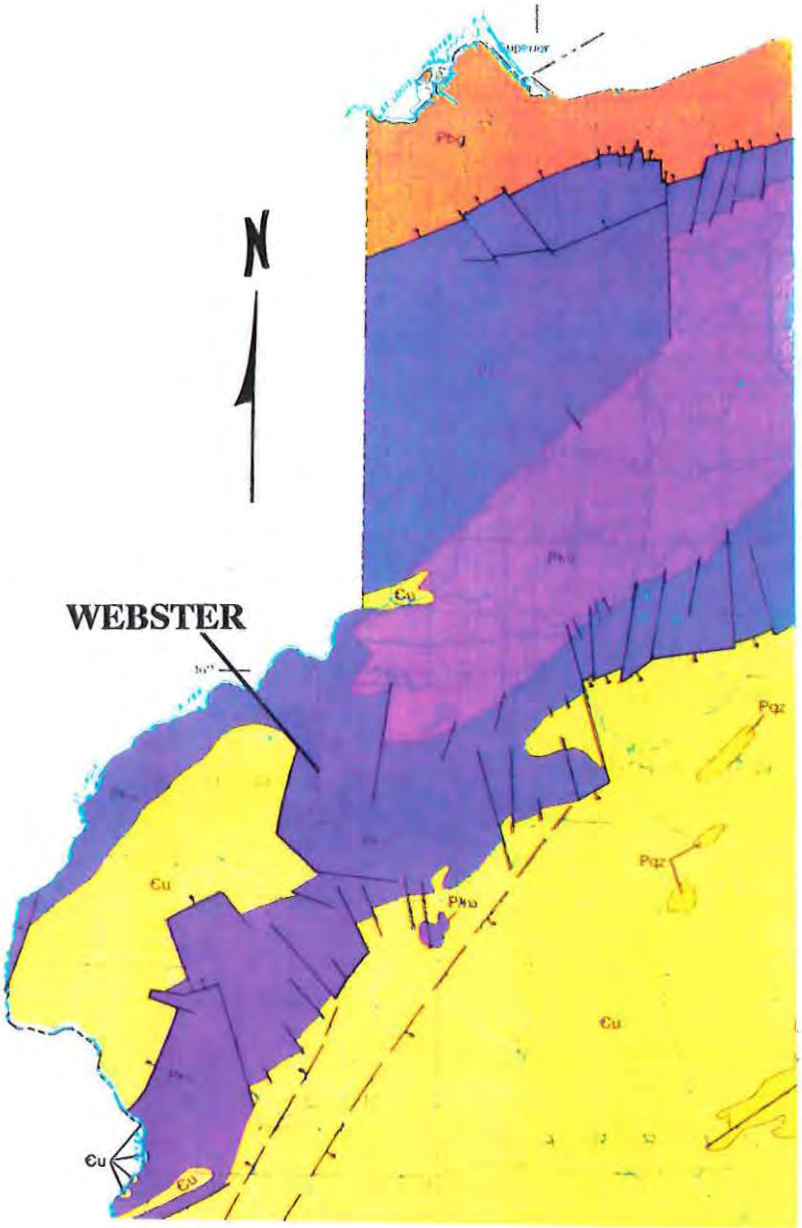
QUADRANGLE LOCATION

FIGURE 4

Area Topographic Map
Webster, Wisconsin

▪ *Wisconsin DNR* ▪
Remedial Investigation, Task 1

RRFM, INC.
Engineering and Environmental Consultants



EXPLANATION OF UNITS

Cambrian System

Ɛu Sandstone with some dolomite and shale, undivided; includes Trempealeau, Tunnel City and Elk Mound Groups.

Sedimentary Rocks of Paleozoic or Proterozoic Age

Cambrian (?) or Upper Proterozoic System

Pbg Bayfield Group—feldspathic quartzose sandstone with some orthoquartzitic sandstone; includes Chequamegon, Devils Island and Orienta Formations.

PRECAMBRIAN ROCKS

Sedimentary, Igneous and Metamorphic Rocks of Proterozoic Age

Middle Proterozoic System

KEWEENAWAN SUPERGROUP

Pko Oronto Group—feldspathic sandstone, siltstone, shale and conglomerate; includes Freda and Nonesuch Formations and Copper Harbor Conglomerate.

Pku Upper volcanic sequence—basalt flows and minor interbedded sedimentary rocks; includes Chengwatana Volcanic Group in west.

Lower Proterozoic System

Pqz Quartzite and associated slate, dolomite, ferruginous slate, conglomerate and chert; includes Barron Quartzite in northwest, metasedimentary inclusions in Wolf River rocks including Rib Mountain, Mosinee Hill and McCaslin Quartzites and other metasedimentary rocks of uncertain stratigraphic position which occur as inliers and outliers in central Wisconsin.

SCALE 1:1,000,000

FROM
BEDROCK GEOLOGIC MAP OF WISCONSIN
By M.G. Mudrey, B.A. Brown and J.K. Greenberg

(University of Wisconsin-Extension
Geological and Natural History Survey
Meredith E. Ostrom, Director and State Geologist)

1982

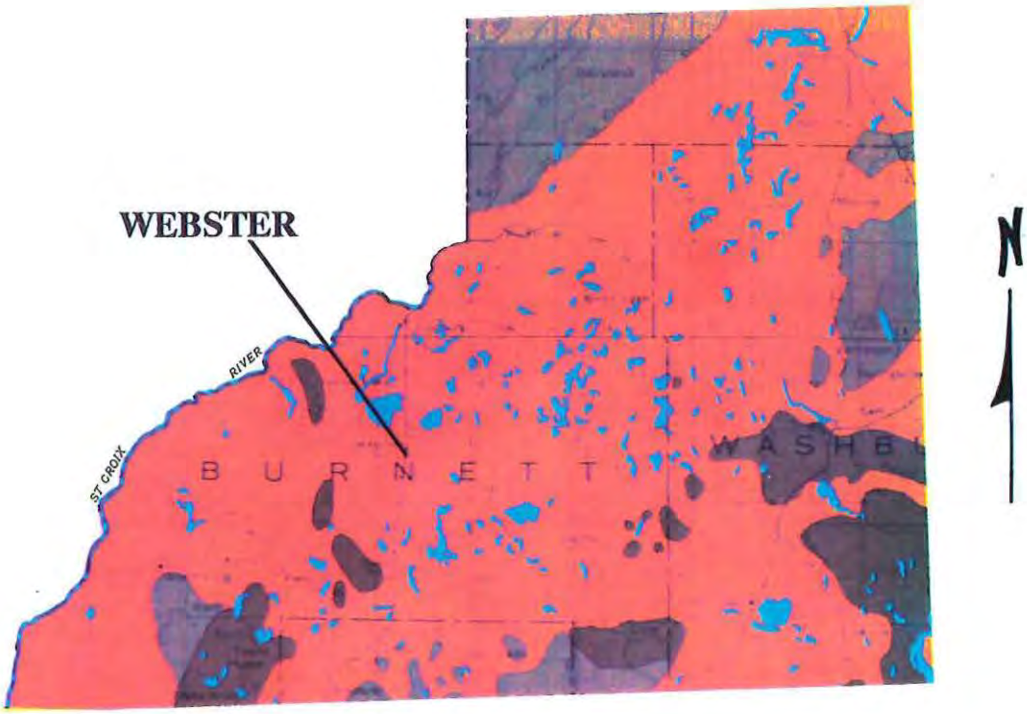
FIGURE 5

Bedrock Geologic Map Webster, Wisconsin

▪ Wisconsin DNR ▪
Remedial Investigation, Task 1

RMT, INC. Engineering and Environmental Consultants

SCALE
1:500,000



EXPLANATION

PITTED OUTWASH
AND OTHER ICE CONTACT DEPOSITS

Pitted outwash plains, kames, eskers, crevasse fillings and related features.
Mainly sand and gravel with sorting and stratification locally poor.

Pitted outwash and other ice contact deposits have a high potential for containing commercial sand and gravel. These deposits tend to be smaller and often less uniform than those found in outwash. However, as most ice contact deposits are steep-sided, the sand and gravel is often exposed by erosion and thus more readily found than are flat-lying outwash plains and alluvial fans. In addition, the sand and gravel is usually well-drained, making special mining methods necessary.

GROUND MORAINE

Till plains. Thin drift, mostly till of relatively uniform thickness
but discontinuous in some areas of older drift. Includes drumlins.

Till plains have a low potential for containing deposits of commercial sand and gravel. Production is limited to gravel-cored drumlins and to isolated kames, eskers and similar features which are often superimposed on the ground moraine.

END MORAINES

Terminal, recessional and interlobate moraines.
Mostly till and associated local ice contact deposits.

End moraines have a low potential for containing large deposits of commercial sand and gravel. Outwash plains as well as kames and other local ice contact deposits are often found in association with end moraines. These associated deposits have a high potential to contain moderate to small deposits of sand and gravel.

WATER

FROM
GLACIAL DEPOSITS OF WISCONSIN
SAND AND GRAVEL RESOURCE POTENTIAL

(Land Resources Analysis Program

Wisconsin Geological and Natural History Survey
University of Wisconsin-Extension
and State Planning Office
Wisconsin Department of Administration)

1976

FIGURE 6

Glacial Geologic Map
Webster, Wisconsin

▪ Wisconsin DNR ▪
Remedial Investigation, Task 1

AAEM, INC. Engineering and Environmental Consultants

The Ayres study made the following findings:

1) Soil samples from the borings completed for OW-1 and OW-2 (Figure 7) contained contamination by petroleum-related aromatic hydrocarbons. Samples from OW-1 were found to contain BTEX (benzene, toluene, ethylbenzene, xylene). Contamination occurred at several depths within the hole. Soil from OW-2, located approximately 75 feet southwest of OW-1, contained contamination only by toluene. This contamination was found in samples ranging from 15 to 35 feet in depth.

2) Soil samples from the borings completed for OW-3, OW-6, and OW-7 contained contamination by halogenated hydrocarbons. Dichloromethane was detected at a depth of 10 feet in a soil sample from OW-3. Trichlorofluoromethane was detected in samples from depths of 10 and 45 feet in OW-6, and in a sample from a depth of 45 feet in OW-7.

3) With the exception of monitoring well OW-3 and OW-4, water sample analyses during one or both of the sampling rounds indicated the presence of one or more halogenated compounds. At several locations, groundwater contamination occurred where the corresponding soil samples contained no contamination.

4) Water samples from OW-1 and OW-5 contained the aromatic hydrocarbon toluene.

5) Water samples obtained during two periods in a 20.5 hour long pump test of VW-2 were contaminated. The sample taken 0.88 hours into the pump test revealed the presence of 1,2-dichloroethane, tetrachloroethylene, benzene, and trichloroethylene. In the sample taken 20 hours into the test, only 1,2-dichloroethane and tetrachloroethylene were detected. These contaminants were present at significantly lower concentrations than those observed in the sample from 0.88 hours into the test. This trend was attributed to dilution of contaminants during the pump test.

Based on the above findings, Ayres Associates drew the following conclusions:

- The contaminants detected in soil samples are most likely derived from various surface spills of petroleum fuels (aromatic hydrocarbons) and degreasing solvents (halogenated compounds), which occurred over time within the 1986-87 study area. A possible source for this contamination is the former Hoffman's Corner bulk fuel storage facility.

- The data suggest that aromatic hydrocarbons are essentially limited to soil in the area just south of Main Street and west of the Soo Line Railroad right-of-way. An area 30-50 feet north of VW-1 contains soil and possibly groundwater contamination. The source of this contamination was not located.

- There may be more than one source of halogenated hydrocarbon contamination present in the region. The location of these sources may be east of the Ayres study area, upgradient of the village wells. Based on available information, the source of the halogenated compounds could not be determined, although the data suggest a source upgradient of VW-2.

- The principal contaminants in water samples from VW-2 are constituents of degreasing solvents, which may have originated from a source different from that responsible for the aromatic compounds.

WISCONSIN DNR (1990)

Chemical analyses of water samples taken by the Wisconsin DNR in March 1990 from village well 2 (VW-2) detected 1,2-dichloroethane and tetrachloroethylene. The concentrations detected exceeded the Preventive Action Limits (PAL) for these compounds (0.05 $\mu g/l$ and 0.1 $\mu g/l$, respectively) but remained below the Enforcement Standard (ES) of 5 $\mu g/l$ and 1 $\mu g/l$, respectively. A summary of these analyses is contained in Appendix A.

MID-STATE ASSOCIATES, INC. (1991)

As part of the construction of Webster village well 4, Mid-State Associates, Inc., Baraboo, Wisconsin, has performed several analyses of water obtained from VW-2. A summary of the results is contained in Appendix A (Table A5).

Samples obtained during February and early June detected 1,2-dichloroethane, tetrachloroethylene, and toluene. The concentrations of 1,2-dichloroethane and tetrachloroethylene exceeded their Preventive Action Limits (PALs) but were below the Enforcement Standards (ESs) established by the Wisconsin DNR for these compounds. The concentration of toluene detected in the water remained below both the PAL and the ES.

Village well 2 was pumped constantly from June 20, 1991, to July 23, 1991, at a rate of approximately 110 gallons per minute. Samples obtained June 27 and July 3 also detected 1,2-dichloroethane, tetrachloroethylene, and toluene. The concentrations of 1-2-dichloroethane and tetrachloroethylene in these samples were above both the PALs and the ESs. The concentration of toluene remained below both the PAL and the ES.

1991 SUBSURFACE EXPLORATION

The 1991 remedial investigation was conducted by RREM, Inc. The work included:

- drilling of soil borings, and collection of soil samples;
- field screening of soil samples;
- mechanical analysis of soil samples;
- geochemical analysis of soil samples;
- installation of groundwater monitoring wells in the study area, and collection of groundwater samples;
- laboratory geochemical analyses of groundwater samples;
- examination of subsurface characteristics related to groundwater flow direction and velocity;
- examination of vertical distribution of contamination.

SOIL

Nineteen soil borings, varying from 36 to 71 feet in depth, were completed between June 17 and August 7, 1991, by GME Consultants, Duluth, under the supervision of a RREM geologist. Soil boring locations are shown in Figure 8.

All soil borings were logged by a RREM geologist. Figure 9 summarizes the information gathered from the soil borings; detailed boring logs are contained in Appendix B.

Soil Boring Procedures

The soil borings were drilled with a CME 550 All-Terrain drill rig, using 4¼-inch inside diameter, hollow-stem augers. Because wet, heaving sands were encountered below the water table, mud-rotary drilling techniques were employed below a depth of 40 feet in deep borings.

A moderately thick, clay-water slurry (typically composed of 6-12 pounds of quick-gel bentonite mixed with 50 gallons of water), mixed within a jetting tank, was pumped through the center of a tri-cone bit during drilling. The excess slurry was then pumped up through the hollow-stem auger back into the jetting tank, where it was recirculated for further drilling. The boring progressed in 2-5 foot intervals, as determined by the sampling interval requirements.

Soil borings not converted to monitoring wells were abandoned in accordance with Wisconsin Administrative Code NR 141.25 with neat cement grout. The grout extended to grade in borings located on city streets. The remainder of the borings were filled to within 6 inches of grade with grout, then filled with native material.

Soil Sample Collection

A total of 218 soil samples were collected for field screening. Twelve samples were selected for mechanical tests, and 36 were selected for chemical analysis.

Soil samples were collected from each boring using a split-spoon sampler following ASTM Standards D1586 and D1587 at 5-foot intervals in all but two of the 71-foot deep borings, which were sampled continuously. As each split-spoon was retrieved from the boring and opened, a 4-ounce glass laboratory jar (supplied by Enviroscan, Rothschild, Wisconsin) was packed completely with soil (to prevent volatile loss into the headspace) and sealed. A second soil sample was collected in an 8-ounce glass jar, filled approximately two-thirds to three-quarters, for use in the soil vapor screening analysis.

The spatula used to transfer sediment from the split-spoon into the jars was cleaned prior to collecting each sample. Samples were packed into the jars manually. Single-use vinyl gloves were worn by the field crew at all times and were discarded and replaced with new gloves after each sample was obtained. Sample jars were sealed, labelled, and refrigerated immediately in a cooler chest.

Following collection of soil samples, each split-spoon sampler was cleaned with a solution of water and Red Devil phosphate-free TSP/90 heavy-duty cleaner. Split-spoon samplers were rinsed with fresh water prior to re-use. All water used in the drilling process was obtained from municipal taps located on the Webster Municipal building or at the Webster Sanitary Dumping station.

At the end of each day, soil samples were transferred from the cooler to a refrigerator in the Webster Municipal Building.

Soil Classification

Soil samples were classified in the field by a RREM geologist, in accordance with the Unified Soil Classification System (USCS) and ASTM 2487. Munsell Soil Color Charts (1988 edition) were used to classify the color of each sample. Samples were submitted for laboratory analyses to verify field classifications. These analyses are discussed in the following section.

Mechanical Analyses of Soil

During subsurface exploration, twelve soil samples were selected by a RREM geologist for mechanical analysis. Ten grain size distribution analyses (sieve analyses) were performed on representative samples of the native material around the screened interval of each well. The purpose of these analyses was to characterize the samples by grain size. In addition, one undisturbed hydraulic conductivity test and one recompacted hydraulic conductivity test were also performed.

The results of these analyses are contained in Table 1. The results confirm the field observations that the aquifer underlying the Webster study area is composed of poorly graded sand (SP) to poorly graded sand with silt (SP-SM) to silty sand (SM).

Table 1
Sieve Analysis Results
Village of Webster, Wisconsin

Soil Boring Number	Sample Depth (in feet)	Description	ASTM Classification(1)
SB-2	34 - 36	Poorly graded sand	SP
SB-4	34 - 36	Poorly graded sand	SP
SB-4	69 - 71	Poorly graded sand with silt	SP-SM
SB-7	34 - 36	Poorly graded sand	SP
SB-7	66 - 68	Poorly graded sand with silt	SP-SM
SB-8	34 - 36	Poorly graded sand	SP
SB-9	66 - 68	Silty sand	SM
SB-14	34 - 36	Poorly graded sand	SP
SB-16	64 - 66	Poorly graded sand	SP
SB-17	64 - 66	Poorly graded sand	SP

(1) Samples were classified by GME Consultants per Unified Soil Classification System (USCS) classifications, in accordance with American Society of Testing and Materials (ASTM) Standard D:2487

Site Stratigraphy

The stratigraphy in the Webster area, as indicated by the soil samples collected, is composed dominantly of flat-lying unconsolidated sediments, which were deposited primarily as glacial outwash. This stratigraphy can be divided into four laterally continuous, field-recognizable units. Presented in order of occurrence with increasing depth, these units are:

A) Blacktop, which composes the uppermost 0.5 feet of the stratigraphic succession in soil borings located on city streets.

B) Black-brown to red-brown sand plus gravel fill which contains silt and clay. This unit varies from 0.5 to 5.0 feet in thickness, and has an average thickness of 3.1 feet. This material is present in all soil borings, except SB-14. Locally, topsoil up to 0.25 feet in thickness is present above this fill layer.

C) Light, brownish grey to pale red, mottled clay is present in all borings, except SB-12. This unit typically has a massive appearance and varies from 0.5 to 5.0 feet thick. Locally, thin lenses ($\leq$ 1 mm thick) of very fine-grained to medium-grained, black sand are present. Decayed rootlets are also occasionally observed, and may comprise up to two percent of the unit. In some borings, this clay unit is underlaid by 0.25 feet to 1.5 feet of silty to clayey, fine- to medium-grained sand. This material appears to represent a mixture of the clay deposits described above and the underlying sand deposits.

D) Brown, very fine to coarse-grained, interbedded sand and pebbly to gravelly sand deposits. These deposits are typically massive in appearance, but the fine-grained sand deposits occasionally contain laminations (1-5 mm thick), interpreted to be bedding.

The sand present in these deposits is typically well-rounded and well-sorted and varies from very fine-grained to coarse-grained. Although quartz and feldspar are the predominant components of the sand, grains composed of calcite, biotite, basalt, rhyolite, and mudstone have also been observed. Pebbles are typically moderately to well-rounded and vary from 0.6 to 4.0 cm in diameter. They are composed of quartz, chert, basalt, rhyolite, and mudstone fragments. Gravel is similar in size and composition to the pebbles but is subangular to angular in shape.

Individual sandy deposits may reach up to 17 feet in thickness. Pebbly and gravelly sand deposits attain thicknesses up to 24 feet in the soil borings.

Deposits of brown silty sand (up to 8 feet thick) and silt (up to 6 feet thick) are interbedded with the sand and pebbly to gravelly sand deposits. These deposits cannot be correlated between adjacent soil borings, and appear to be lenses that are very limited in areal extent.

Detailed soil boring logs are contained in Appendix B. Geological cross-section are shown in Figures 10 through 12. The geology of the OW-series borings is based on the soil boring logs present in Ayres (1987). The locations of the cross-sections are shown in Figure 8.

Soil Vapor Screening

Soil samples were screened in the field by a RREM geologist for volatile organic compounds, using a flame ionization detector and following the standard jar-headspace method described at right.

> ***Soil Vapor Screening Method***
> *Soil samples collected with the split-spoon sampler were placed in 8-ounce glass jars. When each jar was approximately 2/3 full, it was covered with aluminum foil and sealed with a screw-on lid. The jars were then agitated to aid in releasing volatile organic compounds from the soil. The samples were then allowed to stand for ten minutes to allow headspace development.*
>
> *At the end of this time period, the lid was removed and the foil seal penetrated with the probe of a flame ionization detector (FID). The highest reading shown on the instrument was then recorded.*
>
> *The FID used was a Foxboro OVA 128. This instrument was calibrated each day prior to use on the site, using ambient air as zero gas and either 50 ppm or 100 ppm isobutylene in air as the calibration gas. Instrument calibration was checked periodically during each day.*

Field vapor screening readings ranged from 0.0 ppm to 20.0 ppm organic vapors. No significant trends in the distribution of these readings were observed.

Table 2 contains the results of the soil vapor analyses. These results are also listed on the soil boring logs in Appendix B.

GROUND WATER

Ten monitoring wells were installed during the 1991 subsurface exploration *(91- series wells)*. The new wells were used in conjunction with wells installed during the previous investigation *(OW- series wells; Ayres, 1987)* and village well 2 *(VW-2)* to:

- evaluate groundwater quality and the hydrogeologic characteristics of the aquifer.
- further assess the distribution and extent of groundwater contamination.

Groundwater was encountered in all soil borings at depths ranging from 34 to 36 feet below the ground surface. The physical properties of the organic contaminants detected in previous studies were considered in establishing the new monitoring system. Two groups of contaminants were known to be present: those with densities less than water (benzene, toluene, etc.) and those

Table 2
Results of Soil Vapor Screening
Village of Webster, Wisconsin

Footage	Soil Boring Number																
	SB-1	SB-2	SB-3	SB-4	SB-5	SB-6	SB-8	SB-10	SB-11	SB-12	SB-13	SB-14	SB-15	SB-16	SB-17	SB-18	SB-19
0-2	0.0[1]	1.3	---	2.1	0.3	---	3.9	0.9	2.0	---	0.0	---	---		1.1	0.2	1.2
4-6	7.0	0.4	0.0	0.1	0.0	0.3	4.3	0.0	0.0	0.0	0.0	1.3	---	0.8	1.1	0.1	1.2
9-11	0.0	0.3	0.4	0.2	0.2	1.0	4.6	0.8	0.1	1.5	0.0	0.5	0.8	1.2	0.2	2.0	0.4
14-16	0.0	0.8	1.0	0.2	0.1	0.3	4.7	0.4	0.0	0.0	0.4	0.5	0.9	0.5	0.2	0.7	3.6
19-21	0.0	1.6	0.4	0.1	0.1	0.3	4.7	0.0	0.1	0.3	0.2	0.7	0.3	0.8	0.4	0.3	3.3
24-26	0.0	2.9	0.2	0.3	0.2	1.8	4.1	0.0	0.0	0.0	1.2	0.0	0.6	0.2	0.9	0.5	0.7
29-31	5.0	0.6	0.2	0.6	0.0	1.8	3.5	0.4	0.0	0.0	0.4	2.5	0.3	0.3	0.7	0.3	0.7
34-36	4.5	0.3	4.3	0.4	0.0	2.7	3.2	0.1	0.3	0.0	1.0	3.5		0.4	2.5	6.8	1.2
39-41				1.0								2.9		1.2	3.0	0.3	
44-46				3.2										3.2	9.2		
49-51				0.8										1.6	0.5		
54-56				0.6										4.5	4.2		
59-61				0.3										2.4	1.0		
64-66				0.3										4.0	1.0		
69-71				0.0										0.9	2.7		

[1] Concentrations in parts per million (instrument units as isobutylene).

Results of soil vapor screening at borings SB-7 and SB-9 are shown below:

Footage	SB-7	SB-9	Footage	SB-7	SB-9
0-2	0.5	1.0	36-38	1.4	0.1
2-4	0.0	0.3	38-40	2.6	0.4
4-6	0.0	1.7	40-42	7.0	9.6
6-8	0.4	8.5	42-44	1.0	1.6
8-10	0.2	2.0	44-46	1.7	0.3
10-12	0.2	0.7	46-48	6.5	5.0
12-14	0.3	1.1	48-50	8.4	1.6
14-16	0.2	0.2	50-52	4.1	8.8
16-18	0.3	0.3	52-54	1.6	1.2
18-20	0.1	0.1	54-56	5.6	11.0
20-22	0.3	0.3	56-58	3.2	4.0
22-24	0.4	0.2	58-60	9.7	2.8
24-26	0.0	0.1	60-62	10.5	2.2
26-28	0.1	0.4	62-64	15.0	1.2
28-30	0.2	0.0	64-66	20.0	0.2
30-32	0.3	0.2	66-68	19.0	1.6
32-34	0.1	0.0	68-70	5.0	0.8
34-36	0.9	0.0			

with densities greater than water (tetrachloroethylene, 1,2-dichloroethane). For this reason, wells were installed at several levels—near the top of the aquifer for lighter compounds and deep in the aquifer for heavier compounds.

Prior to initiating the subsurface exploration, several potential contaminant sources were identified through interviews with village officials and residents. These potential sources included:

- an existing laundromat/dry cleaner near Highway 35,
- the site of a former dry cleaner on Main Street, near the site of the present post office, and
- a former print shop site, approximately one block west of the post office.

Several other potential sources were mentioned during the interviews. These sites were located near the Hoffman's Corner site and along the abandoned railroad right-of-way. Since the area near Hoffman's Corner was investigated by Ayres and Associates, monitoring wells and borings were concentrated upgradient of that study area.

Monitoring well locations are shown in Figure 13.

Monitoring Well Installation

Five 40-foot-deep wells were installed. The wells were constructed of 2-inch, inside diameter, Schedule 80 PVC pipe flush threaded with No. 10 slot, 10-foot-long, Schedule 80 PVC well screens.

Five deep monitoring wells were installed: one at 60 feet and four at 71 feet. The monitoring wells were constructed of materials similar to those in the 40-foot wells, with the exception of the well screens, which were 5 feet long.

A filter pack, composed of a mixture of native fine- to medium-grained sand and red flint sand, filled the annulus around each well screen. In some wells, all of the filter pack consisted of red flint sand. The filter pack extended a minimum of 2 feet above the top of the well screen.

A bentonite seal, at least 2 feet thick, was placed directly on top of the filter pack. During construction of this seal, a thick slurry of bentonite and water was pumped down a tremie pipe into position in the deeper wells. Dry powdered bentonite was dropped slowly through the auger into position in the 40-foot-deep wells. The thickness of the bentonite filter pack seal was measured during installation with a fiberglass measuring tape. The annular space seal consisted of neat cement grout which, in turn, was covered by a surface seal consisting of concrete. Typical well construction diagrams are illustrated in Figure 14.

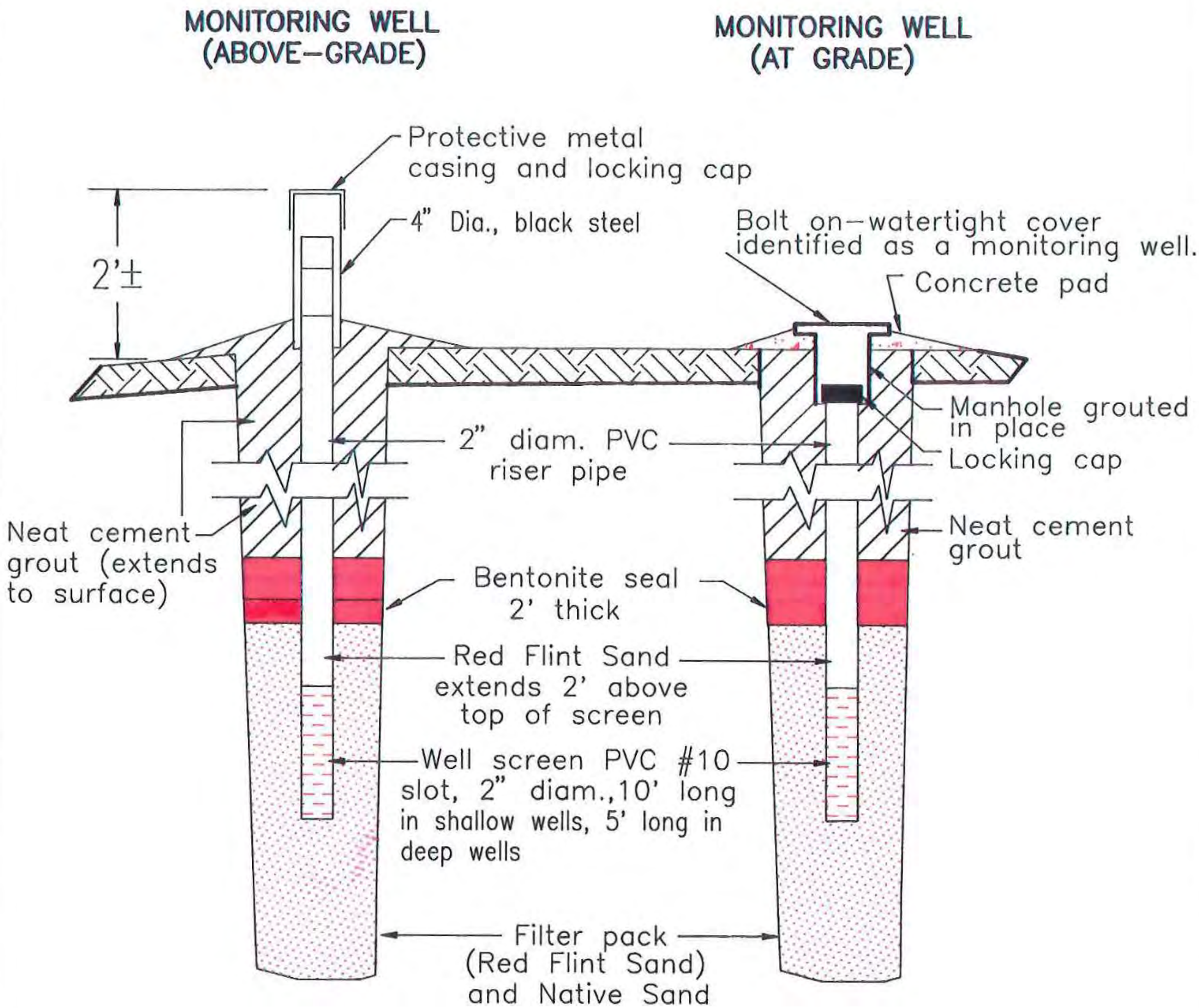
Monitoring wells 91-1, 91-2A, 91-2B, and 91-3 were completed by extending a 2-inch inside diameter PVC riser pipe to approximately two feet above grade. A lockable expanding well cap sealed the top of this pipe. A 4-inch diameter black steel protective casing, with locking cap, was placed around each PVC riser pipe and cemented into place. Three 4-inch diameter steel guard posts, filled with cement, were placed around each well to prevent damage to the well. Both the protective casing and the guard posts were painted orange for visibility.

Because of their location in high traffic areas, wells 91-4, 91-5A, 91-5B, 91-6, 91-7 and 91-8 were completed using at-grade well covers. The top of the PVC riser pipe was cut approximately 2-3 inches below grade and was sealed with a lockable, expanding well cap. The wells were covered with a water-tight manhole with a bolted O-ring cover, which was cemented into place. The manhole cover was clearly marked as a monitoring well.

Well construction diagrams (form 4400-113A) for each well are included in the subsurface exploration report (GME Consultants), contained in Appendix C of this report. All wells constructed for this study conform to Wisconsin Administrative Code NR-141.

Hydraulic Conductivity

In situ hydraulic conductivity tests of the aquifer underlying the Webster study area were conducted between October 28 and October 31, 1991, on 14 monitoring wells.



TYPICAL MONITORING WELL
CONSTRUCTION DETAILS

FIGURE 14

Typical Monitoring Well Construction Diagram

▪ Wisconsin DNR ▪
Remedial Investigation, Task 1

AAEM, INC. Engineering and Environmental Consultants

During these tests, a volume of water was pumped from each well, resulting in a drop in the water level. Because of the extremely fast rate at which the water returned to its original elevation, a pressure transducer was used to record water levels every second during the recovery period of the test.

The data generated by these tests were graphed and analyzed, using the Hvorslev Method of determining hydraulic conductivity.

***HYDRAULIC CONDUCTIVITY** is the measure of the ability of an aquifer or water-bearing formation to transmit fluids. The hydraulic conductivity of a geologic unit is dependent on the characteristics of both the fluid and the unit. As an example—in saturated, unconsolidated sediments—sand transmits water more easily than clay does; therefore, the hydraulic conductivity of sand is greater than that of clay.*

The Hvorslev Method

The Hvorslev Method plots H/H_0 on a logarithmic scale [H_0 = the height of the water level (head) above or below the static water level at time zero; H = the head at time t] versus time on a linear scale. Data plots in a straight or nearly straight line. The following equation is used to calculate the hydraulic conductivity (K):

$$K = \frac{r_c^2 \ln\left(\frac{L}{R}\right)}{2LT_o}$$

where
K = hydraulic conductivity (cm/sec)
r_c = radius of the well casing (cm)
ln = natural log
L = length of well screen of screened saturated interval (cm)
R = radius of the well screen (cm)
T_o = basic time lag (seconds)

The basic time lag, as defined by Hvorslev (1951) is the time required for the equalization of head at the original inflow rate. Basic time lag is determined from the plot at $H/H_o = 0.37$ ($\ln H/H_o = -1$).

Table 3 lists the hydraulic conductivity values calculated for the Webster study area, using the Hvorslev Method, based on the well recovery graphs contained in Appendix D. These values range from 1.23×10^{-2} cm/sec to 2.9×10^{-2} cm/sec. The arithmetic mean of the hydraulic conductivity values is 1.82×10^{-2} cm/sec; the geometric mean of these values is 1.77×10^{-2} cm/sec. These values are within the range for hydraulic conductivities of well-sorted sands and glacial outwash (Table 4), which vary from 10^{-3} cm/sec to 10^{-1} cm/sec (Fetter, 1988). The hydraulic conductivities determined in this study are of the same order of magnitude as the horizontal hydraulic conductivities determined by Ayres Associates (1987) for wells OW-5 and OW-6 (7.41×10^{-2} cm/sec and 2.12×10^{-2} cm/sec, respectively).

Laboratory permeability (hydraulic conductivity) analyses were performed on two samples by GME Consultants, Inc. A Shelby Tube sample of the silty clay, located from 3.5 to 6.5 feet in soil boring SB-15, was found to have a hydraulic conductivity of 1.5×10^{-6} cm/sec. A recompacted sample of fine- to medium-grained, well-rounded, well-sorted sand—from 34 to 36 feet in soil boring SB-7—had a hydraulic conductivity of 7.1×10^{-3} cm/sec.

Groundwater Flow Direction

During the summer and fall of 1991, the groundwater level elevations were measured on the ten new wells installed and on the nine Ayres observations wells in Webster. The data collected are shown in Table 5. Contour maps of the water table elevations for each sampling date were constructed from the data using the CONTOUR PLUS software package (CIVILSOFT, 1989). Because of the similarity of the geometry of the contour diagrams constructed between August 7 and October 28. Average groundwater elevations were calculated (Table 6), and an average groundwater elevation contour map was constructed (Figure 15). This figure indicates that over this time period, groundwater flowed generally from east to west in the study area.

Table 3
In Situ Hydraulic Conductivities
Calculated Using the Hvorslev Method
Village of Webster, Wisconsin

Monitoring Well No.	Hydraulic Conductivity (cm/sec)
91-1	1.35×10^{-2}
91-2A	1.70×10^{-2}
91-4	2.42×10^{-2}
91-5A	1.23×10^{-2}
91-6	1.57×10^{-2}
OW-1	2.25×10^{-2}
OW-2	1.63×10^{-2}
OW-3	1.65×10^{-2}
OW-4	1.83×10^{-2}
OW-5	1.93×10^{-2}
OW-6	1.74×10^{-2}
OW-7	2.90×10^{-2}
OW-8	1.33×10^{-2}
OW-9	1.97×10^{-2}
Arithmetic Mean	1.82×10^{-2}
Geometric Mean	1.77×10^{-2}

Table 4
Ranges of Hydraulic Conductivities
For Unconsolidated Sediments
(Fetter, 1988)

Material	Hydraulic Conductivity (cm/sec)
Clay	10^{-9} - 10^{-6}
Silt, sandy silt, clayey sand, till	10^{-6} - 10^{-4}
Silty sand, fine sand	10^{-5} - 10^{-3}
Well-sorted sand, glacial outwash	10^{-3} - 10^{-1}
Well-sorted gravel	10^{-2} - 1

Table 5
Water Table Elevations
Village of Webster, Wisconsin

(Wells Installed During RREM, Inc., Investigation)

RREM Well No.	Wisconsin Unique Well No.	Top of Riser Elevation	Date of Elevation Measurement (measured in feet)					
			7/24/91	8/7/91	8/26/91	9/10/91	10/16/91	10/28/91
91-1	DL-001	983.22	946.70	947.00	947.20	947.23	947.39	947.40
91-2A	DL-002	984.28	946.97	947.25	947.37	947.44	947.56	947.56
91-2B	DL-003	983.69	946.69	947.21	947.37	947.42	947.55	947.56
91-3	DL-004	982.27	946.77	947.25	947.35	947.43	947.52	947.63
91-4	DL-005	980.13	947.18	947.43	947.60	947.66	947.78	947.78
91-5A	DL-006	980.49	947.52	947.63	947.76	947.82	947.93	947.94
91-5B	DL-007	980.48	947.53	947.62	947.75	947.81	947.93	947.93
91-6	DL-008	982.01	947.85	947.94	948.04	948.09	948.20	948.24
91-7	DL-571	980.99	—[1]	947.89	947.96	948.05	948.08	948.24
91-8	DL-572	980.50	—	948.34	948.17	948.30	948.40	948.46

Table 5, continued
Water Table Elevations
Village of Webster, Wisconsin

(Wells Installed During Ayres Associates Investigation)									
Ayres Well No.	**Top of Riser Elevation[1]**	**Date of Elevation Measurement (measured in feet)**							
		6/20/91	**7/23/91**	**8/7/91**	**8/9/91**	**9/26/91**	**9/10/91**	**10/16/91**	**10/28/91**
OW-1	983.36	947.00	946.43	946.97	—	947.21	947.25	947.43	947.46
OW-2	983.48	946.99	946.30	946.97	—	947.21	947.25	947.40	947.43
OW-3	982.65	947.03	946.04	946.98	—	947.21	947.19	947.42	947.44
OW-4	981.80	946.81	945.03	946.72	—	946.97	946.92	947.19	947.24
OW-5	982.46	945.80	945.44	946.81	—	947.00	946.94	947.21	947.24
OW-6	982.59	946.87	945.92	946.84	—	947.05	947.06	947.29	947.31
OW-7	981.25	946.95	946.50	946.97	—	947.16	947.20	947.37	947.40
OW-8	983.11	947.14	946.78	947.18	—	947.38	947.45	947.57	947.57
OW-9	981.00	—	—	—	947.19	947.36	947.41	947.56	947.56

[1] Top of riser elevation figure taken from Ayres and Associates report (1987).

Table 6
Average Water Table Elevations
Village of Webster, Wisconsin
(Based on Data Collected August 7, 1991, through October 28, 1991)

Monitoring Well Number	Average Water Table Elevation
91-1	947.24
91-2A	947.44
91-2B	947.42
91-3	947.44
91-4	947.65
91-5A	947.82
91-5B	947.81
91-6	948.10
91-7	948.05
91-8	948.33
OW-1	947.26
OW-2	947.25
OW-3	947.25
OW-4	947.01
OW-5	947.04
OW-6	947.11
OW-7	947.22
OW-8	947.43
OW-9	947.42

Groundwater Gradient

As shown in Figure 15, groundwater surface is relatively flat. Groundwater gradients were determined between three pairs of wells at various locations in the study area. The groundwater gradient was calculated by measuring the difference in water table elevations between the two wells, and dividing by the horizontal distance between them. Between wells 91-8 and 91-1, the groundwater gradient was determined to be 0.0009 ft/ft. Between wells 91-6 and OW-7, the gradient was calculated to be 0.0008 ft/ft. Between wells 91-3 and OW-5, the gradient was determined to be 0.0009 ft/ft. These groundwater gradients are slightly higher than the 0.0006 and 0.0007 ft/ft calculated by Ayres (1987).

Seepage Velocity

The average linear seepage velocity can be calculated using the following formula:

$$V_s = \left(\frac{K}{n}\right)\left(\frac{dl}{dh}\right)$$

where

V_s	=	seepage velocity
K	=	hydraulic conductivity
dh/dl	=	groundwater gradient
n	=	porosity

The range of porosities determined for various sediment types is shown in Table 7. As illustrated in Figure 9, the wells used for the hydraulic conductivity tests are screened primarily in fine- to medium-grained, well-sorted, well-rounded sand deposits, which contain lenses of coarse sand and gravel.

Table 7
Porosity Ranges for Unconsolidated Sediments
(Fetter, 1988)

Material	Porosity
Clay	33% - 60%
Silt	35% - 50%
Glacial till	10% - 20%
Well-sorted sand or gravel	25% - 50%
Sand and gravel, mixed	20% - 35%

Using the geometric mean hydraulic conductivity of 1.77×10^{-2} cm/sec, and intermediate groundwater gradient of 8.5×10^{-4} cm/sec, and assuming a porosity of 35 percent for the deposits located in the screened intervals of the wells, the average linear velocity for the Webster study area is:

$$V_s = \frac{1.77 \times 10^{-2}\ cm/\sec\ (0.00085)}{0.35}$$

$$\begin{aligned} &= 4.3 \times 10^{-5} \text{ cm/sec} \\ &= 1.4 \times 10^{-6} \text{ ft/sec} \\ &= 1.2 \times 10^{-1} \text{ ft/day} \\ &= 43.8 \text{ ft/year.} \end{aligned}$$

In the area just west of village well VW-2, the hydraulic gradient is slightly higher:

$$V_s = \frac{1.77 \times 10^{-2}\ cm/\sec\ (0.0009)}{0.35}$$

$$\begin{aligned} &= 4.6 \times 10^{-5} \text{ cm/sec} \\ &= 1.5 \times 10^{-6} \text{ ft/sec} \\ &= 1.3 \times 10^{-1} \text{ ft/day} \\ &= 47.5 \text{ ft/year.} \end{aligned}$$

Assuming that the groundwater elevations, groundwater gradients, and sediment porosities used in the above calculations are representative, a water particle in the saturated zone is expected to travel horizontally between 44 and 48 feet per year. These values are much lower than those calculated by Ayres (1987), which imply seepage velocities ranging from 2070 to 2250 feet per year.

CHEMICAL ANALYSIS OF SOIL AND GROUNDWATER

In order to determine the composition and distribution of subsurface contamination in the Webster study area, both soil and groundwater samples collected during this investigation were chemically analyzed. Laboratory analyses of both soil and groundwater were performed by Enviroscan, Rothschild, Wisconsin (Wisconsin Lab Certification Number 737053130). Chain-of-custody documents and laboratory reports of the analyses are included in Appendix E (soil) and Appendix F (groundwater).

SOIL

Soil Sample Collection

During the drilling of the soil borings, 218 soil samples were collected by a RREM geologist for possible geochemical analyses. Thirty-eight of these samples were analyzed; the samples were selected from the intervals shown in Table 8. Soil samples were collected in 4-ounce glass laboratory jars, using procedures described on page 8. Following collection, the sample jars were immediately placed in insulated containers and kept cool with ice packs. At the end of each day, the samples were transferred to the Webster Municipal Building and stored overnight in a refrigerator. The following day, the jars containing samples chosen for chemical analysis were packed into insulated shipping containers with ice packs and shipped via overnight carrier to Enviroscan.

Laboratory Analysis

A total of 38 samples were analyzed, including a minimum of one sample per boring. Up to five samples per boring were analyzed where jar-headspace results suggested VOC contamination. Two duplicate samples were analyzed.

Twenty-eight samples from early in the drilling program were analyzed in accordance with the following methods:

- Volatile Organic Compounds: *EPA Method 8010/8020.*
- Total Petroleum Hydrocarbons (TPH): *California Method, with a capillary GC/FID.*
- Lead: *EPA Method 7421.*

Table 8
Depths of Soil Samples Collected for Chemical Analysis
Village of Webster, Wisconsin

Soil Boring Number	Collection Date	Depth of Sample (in feet below ground surface)
SB-1	6/17/91 6/17/91	9 - 11 34 - 36
SB-2	7/09/91 7/09/91	24 - 26 34 - 36
SB-3	6/18/91	34 - 36
SB-4	7/11/91 7/11/91 7/11/91	34 - 36 44 - 46 69 - 71
SB-5	6/26/91	34 - 36
SB-6	6/26/91	34 - 36
SB-7	7/16/91 7/17/91 7/17/91 7/17/91	8 - 10 38 - 40 60 - 62 64 - 66
SB-8	7/08/91	34 - 36
SB-9	7/22/91 7/23/91 7/23/91 7/23/91	8 - 10 40 - 42 60 - 62 68 - 70
SB-10	6/25/91	34 - 36
SB-11	6/25/91	34 - 36
SB-12	6/19/91 6/19/91	9 - 11 34 - 36
SB-13	6/24/91	34 - 36
SB-14	6/19/91	34 - 36
SB-15	6/18/91	34 - 36
SB-16	8/05/91 8/05/91 8/05/91	4 - 6 44 - 46 64 - 66
SB-17	8/06/91 8/06/91 8/06/91	4 - 6 44 - 46 69 - 71
SB-18	8/06/91 8/06/91	9 - 11 34 - 36
SB-19	8/06/91 8/06/91	14 - 16 34 - 36

Since the lead and TPH results suggested no contamination from these substances, the final ten samples were analyzed for VOCs only, by EPA Method 8010/8020.

Results of Chemical Analyses of Soil

The results of the chemical analyses of the soil samples from Webster are summarized in Table 9. Lead, tetrachloroethylene, toluene and methylene chloride were detected in these samples. Figure 16 illustrates the distribution and composition of soil contamination detected in soil borings completed by RREM (1991) and by Ayres (1987).

Lead was detected in 17 of the 28 samples analyzed. The values reported ranged from 1.82 to 9.47 μg/g. These are considered to be background concentrations.

Tetrachloroethylene (PCE) was detected in soil samples collected from depths of 34 to 36 feet in soil borings SB-1 *(34.9 μg/g)*, SB-6 *(2.4 μg/g)*, and SB-18 *(9.3 μg/g)*, and at 69 to 71 feet in boring SB-4 *(5.8 μg/g)*. These results appear to limit the PCE contamination to an area north of Main Street that is approximately 800 feet long and 200 feet wide.

Soil contaminated with toluene was found only at soil boring SB-13, at a depth of 34 to 36 feet, where a concentration of 4.2 μg/g was detected.

Methylene chloride (dichloromethane) contamination was detected in samples from soil borings SB-4, SB-7, SB-9 and SB-14. Enviroscan reported that the methylene chloride concentrations may be the result of laboratory contamination. According to an Enviroscan chemist, methylene chloride is used in the preparation of samples for semi-volatile compound analysis. Each day, Enviroscan runs a test blank through its analytical equipment; if methylene chloride concentrations are detected, each subsequent analysis that detects this compound is footnoted as containing possible lab contamination.

Table 9
Summary of Laboratory Analyses of Soil Samples
Samples Collected June 17, 1991 through August 6, 1991
Village of Webster, Wisconsin

Sample Location (Soil Boring / Depth)	Compound Concentration (all units ug/g)				
	Lead	Methylene Chloride[1]	Tetrachloroethylene	Toluene	TPH as Gas/Diesel
Detection Limit[2]	*1.8*	*9.8*	*2.0*	*2.0*	*6.3*
SB-1					
9-11 ft.	2.5	ND[3]	ND	ND	ND
34-36 ft.	ND	ND	34.9	ND	ND
SB-2					
24-26 ft.	ND	ND	ND	ND	ND
34-36 ft.	ND	ND	ND	ND	ND
SB-3					
34-36 ft.	2.0	ND	ND		
SB-4					
34-36 ft.	5.34	42.9	ND	ND	ND
34-36 ft.[4]	5.29	46.0	ND	ND	ND
44-46 ft.	9.47	49.2	ND	ND	ND
69-71 ft.	ND	43.1	5.8	ND	ND
SB-5					
34-36 ft.	3.49	ND	ND	ND	ND
SB-6					
34-36 ft.	ND	ND	2.4	ND	ND
SB-7					
8-11 ft.	2.06	ND	ND	ND	ND
38-40 ft.	2.31	ND	ND	ND	ND
60-62 ft.	3.9	13.7	ND	ND	ND
60-62 ft.[4]	3.52	35.7	ND	ND	ND
64-66 ft.	2.34	22.4	ND	ND	ND
SB-8					
34-36 ft.	2.27	ND	ND	ND	ND

Table 9, continued
Summary of Laboratory Analyses of Soil Samples
Samples Collected June 17, 1991 through August 6, 1991
Village of Webster, Wisconsin

Sample Location (Soil Boring / Depth)	Compound Concentration (all units ug/g)				
	Lead	Methylene Chloride[1]	Tetrachloroethylene	Toluene	TPH as Gas/Diesel
Detection Limit[2]	*1.8*	*9.8*	*2.0*	*2.0*	*6.3*
SB-9					
8-10 ft.	ND	ND	ND	ND	ND
40-42 ft.	4.62	ND	ND	ND	ND
60-62 ft.	ND	14.6	ND	ND	ND
68-70 ft.	1.82	ND	ND	ND	ND
SB-10					
34-36 ft.	2.26	ND	ND	ND	ND
SB-11					
34-36 ft.	3.34	ND	ND	ND	ND
SB-12					
9-11 ft.	ND	ND	ND	ND	ND
34-36 ft.	ND	ND	ND	ND	ND
SB-13					
34-36 ft.	ND	ND	ND	4.2	ND
SB-14					
34-36 ft.	3.7	13.5	ND	ND	ND
SB-15					
34-36 ft.	ND	ND	ND	ND	ND
SB-16					
4- 6 ft.	—[5]	ND	ND	ND	—
44-46 ft.	—	ND	ND	ND	—
64-66 ft.	—	ND	ND	ND	—

Table 9, continued
Summary of Laboratory Analyses of Soil Samples
Samples Collected June 17, 1991 through August 6, 1991
Village of Webster, Wisconsin

Sample Location (Soil Boring / Depth)	Compound Concentration (all units ug/g)				
	Lead	Methylene Chloride[1]	Tetrachloroethylene	Toluene	TPH as Gas/Diesel
Detection Limit[2]	*1.8*	*9.8*	*2.0*	*2.0*	*6.3*
SB-17					
4- 6 ft.	—	ND	ND	ND	—
44-46 ft.	—	ND	ND	ND	—
69-71 ft.	—	ND	ND	ND	—
SB-18					
9-11 ft.	—	ND	ND	ND	—
34-36 ft.	—	ND	9.3	ND	—
SB-19					
14-16 ft.	—	ND	ND	ND	—
34-36 ft.	—	ND	ND	ND	—

(1) May be a laboratory contaminant.
(2) Detection limits in accordance with methods discussed on page 25. Detection limits may vary slightly between analyses.
(3) ND — Not detected; compound concentration is below detection limit.
(4) Duplicate sample.
(5) — - Not analyzed.

GROUND WATER

Earlier studies by the Wisconsin DNR (1984), and Ayres Associates (1987), along with several rounds of water sampling by the Wisconsin DNR between 1984 and 1991 have indicated that groundwater in the Webster area is contaminated by volatile organic compounds.

As part of the 1991 subsurface investigation by RREM, Inc., chemical analysis of groundwater samples was conducted.

Groundwater Sample Collection

Groundwater samples were collected during two sampling periods: September 17-19, 1991, and October 14-16, 1991. Samples were collected from wells installed for this investigation (1991) and from wells installed by Ayres Associates in 1986. Groundwater sample collection was supervised by a RREM geologist.

Prior to sampling, each well was purged of at least four well volumes of water to ensure that representative samples of groundwater were obtained, as suggested in the Wisconsin DNR *Groundwater Sampling Procedures Guidelines* (1987). Groundwater samples were then collected from each well, using teflon bailers.

One field blank and two duplicate samples were collected during the first round of sampling. Two field blanks and two duplicate samples were collected during the second round of sampling.

Following collection, groundwater samples were placed in insulated containers with ice packs and/or ice and shipped via overnight carrier to Enviroscan Laboratories, Rothschild, Wisconsin. Samples were analyzed for volatile organic compounds (VOCs), by EPA Method 8010/8020.

Results of Chemical Analyses of Groundwater

The results of both rounds of 1991 groundwater sampling are summarized in Tables 10 and 11. Wisconsin DNR Enforcement Standards (ES) and Preventive Action Limits (PAL) are presented in Table 12.

Table 10
Summary of Laboratory Analysis of Groundwater Samples
Round One Sampling (samples collected September 17-19, 1991)
Village of Webster, Wisconsin

Monitoring Well	Compound Concentration (all units $\mu g/l$)						
	Benzene	1,2-Dichloro-benzene	1,2-Dichloro-ethane	1,2-Dichloro-propane	Tetrachloro-ethylene	Toluene	Trichloro-ethylene
Detection Limit[1]	*0.2*	*1.0*	*0.5*	*0.5*	*0.5*	*0.5*	*0.2*
91-1	ND[2]	ND	ND	ND	ND	ND	ND
91-2A	ND	ND	ND	ND	ND	ND	ND
91-2B	0.5	1.4	ND	0.7	112.0	ND	6.1
91-3	1.6	ND	83.6	ND	ND	ND	ND
91-4	ND	ND	2.9	ND	15.3	ND	0.2
91-5A	ND	ND	ND	ND	8.0	ND	ND
91-5A[3]	ND	ND	ND	ND	7.7	ND	ND
91-5B	0.3	ND	0.8	ND	ND	ND	ND
91-6	ND	ND	ND	ND	31.8	ND	0.4
91-7	ND	ND	ND	ND	ND	ND	ND
91-8	ND	ND	ND	ND	ND	0.6	ND
OW-1	ND	ND	ND	ND	13.8	ND	ND
OW-2	ND	ND	4.3	ND	2.3	ND	ND
OW-3	ND	ND	ND	ND	ND	ND	ND
OW-4	ND	ND	ND	ND	ND	ND	ND
OW-5	ND	ND	ND	ND	3.5	ND	ND
OW-6	ND	ND	ND	ND	1.3	ND	ND

Table 10, continued
Summary of Laboratory Analysis of Groundwater Samples
Round One Sampling (samples collected September 17-19, 1991)
Village of Webster, Wisconsin

Monitoring Well	Compound Concentration (all units $\mu g/l$)						
	Benzene	1,2-Dichloro-benzene	1,2-Dichloro-ethane	1,2-Dichloro-propane	Tetrachloro-ethylene	Toluene	Trichloro-ethylene
Detection Limit[1]	*0.2*	*1.0*	*0.5*	*0.5*	*0.5*	*0.5*	*0.2*
OW-7	ND	ND	ND	ND	1.3	ND	ND
OW-8	ND	ND	ND	ND	13.2	ND	ND
OW-9	ND	ND	ND	ND	ND	ND	ND
OW-9[3]	ND	ND	ND	ND	ND	ND	ND
VW-2	ND	ND	2.8	ND	ND	ND	ND

(1) Detection limits in accordance with methods discussed on page 31.
(2) ND — Not Detected.
(3) Duplicate sample.

Table 11
Summary of Laboratory Analysis of Groundwater Samples
Round Two Sampling (samples collected October 14-16, 1991)
Village of Webster, Wisconsin

Monitoring Well	Compound Concentration (all units μg/l)									
	Benzene	1,2-Dichloro-benzene	1,2-Dichloro-ethane	1,2-Dichloro-ethylene	1,2-Dichloro-propane	Ethyl-benzene	Tetra-chloro-ethylene	Toluene	Trichloro-ethylene	M and P Xylene
Detection Limit[1]	*0.2*	*1.0*	*0.5*	*1.0*	*0.5*	*1.0*	*0.5*	*0.5*	*0.2*	*1.0*
91-1	0.6	ND	ND	ND	ND	ND	ND	1.0	ND	ND
91-2A	0.5	ND	ND	ND	ND	ND	ND	0.9	ND	ND
91-2B	ND	1.4	ND	2.2	0.6	ND	105.0	ND	7.2	ND
91-3	0.7	ND	90.2	ND	ND	ND	ND	ND	0.3	ND
91-4	0.5	ND	1.5	ND	ND	ND	11.5	0.7	ND	ND
91-5A	0.4	ND	ND	ND	ND	ND	5.1	0.8	ND	ND
91-5B	0.4	ND	0.8	ND	ND	ND	ND	ND	ND	ND
91-6	0.3	ND	ND	ND	ND	ND	32.0	ND	0.7	ND
91-6[3]	0.2	ND	ND	ND	ND	ND	52.5	ND	0.6	ND
91-7	ND	ND	ND	ND	ND	ND	0.6	ND	ND	ND
91-8	0.4	ND	ND	ND	ND	ND	ND	5.6	ND	ND
OW-1	1.1	ND	ND	ND	ND	3.3	9.4	0.5	ND	1.1
OW-2	0.2	ND	2.5	ND	ND	ND	1.2	ND	ND	ND
OW-3	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND
OW-4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
OW-5	ND	ND	ND	ND	ND	ND	2.1	ND	ND	ND

Table 11, continued
Summary of Laboratory Analysis of Groundwater Samples
Round Two Sampling (samples collected October 14-16, 1991)
Village of Webster, Wisconsin

Monitoring Well	Compound Concentration (all units $\mu g/l$)									
	Benzene	1,2-Dichloro-benzene	1,2-Dichloro-ethane	1,2-Dichloro-ethylene	1,2-Dichloro-propane	Ethyl-benzene	Tetra-chloro-ethylene	Toluene	Trichloro-ethylene	M and P Xylene
Detection Limit[1]	*0.2*	*1.0*	*0.5*	*1.0*	*0.5*	*1.0*	*0.5*	*0.5*	*0.2*	*1.0*
OW-5[3]	ND	ND	ND	ND	ND	ND	2.1	ND	ND	ND
OW-6	ND	ND	ND	ND	ND	ND	0.9	ND	ND	ND
OW-7	0.3	ND	ND	ND	ND	ND	1.6	0.5	ND	ND
OW-8	0.2	ND	ND	ND	ND	ND	12.9	ND	ND	ND
OW-9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
VW-2	ND	ND	2.7	ND	ND	ND	ND	ND	ND	ND
Trip Blank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FB-1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FB-2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

(1) Detection limits in accordance with methods discussed on page 31.
(2) ND — Not Detected.
(3) Duplicate sample.

Table 12
Wisconsin Department of Natural Resources
Public Health Groundwater Quality Standards[1]
October 1990

Compound	Enforcement Standard (μg/l)	Preventive Action Limit (μg/l)
Benzene	5	0.067
1,2-Dichlorobenzene	1250	125
1,2-Dichloroethane	5	0.05
1,2-Dichloroethylene	100	10[2] or 20[3]
1,2-Dichloropropane	NA[4]	NA
Ethylbenzene	1360	272
Tetrachloroethylene	1	0.1
Toluene	343	68.6
Trichloroethylene	5	0.18
(M & P) Xylene	620	124

(1) Per Wisconsin Administrative Code NR 140.
(2) cis-1,2-dichloroethylene.
(3) trans-1,2-dichloroethylene.
(4) NA — Standards not established.

First Round Sampling

First-round results indicate the presence of gasoline-related contaminants:

- Benzene was detected in three of the wells samples (91-2B, 91-3 and 91-5B), with concentrations ranging from 0.3-1.6 μg/l. These concentrations exceed the PAL but do not exceed the ES.
- Toluene was detected only in well 91-8 at a concentration of 0.6 μg/l. This concentration does not exceed the PAL or the ES.
- 1,2-dichloropropane was detected only in well 91-2B (0.7 μg/l). No PAL or ES has been established for 1,2-dichloropropane.

The distribution of these contaminants is illustrated in Figure 17. Although present, contamination by these gasoline-related compounds is not the focus of this study.

Other contaminants detected during the first round of sampling were the following halogenated compounds:

- 1,2-dichlorobenzene was detected only in well 91-2B *(1.4 μg/l)*. This concentration does not exceed the PAL or the ES.
- 1,2-dichloroethane was detected in wells 91-3 *(83.6 μg/l)*, 91-4 *(2.9 μg/l)*, 91-5B *(0.8 μg/l)* OW-2 *(4.3 μg/l)* and village well VW-2 *(2.8 μg/l)*. These concentrations exceed the PAL established for this compound, but the ES is exceeded only in well 91-3.
- Tetrachloroethylene was detected in eleven of the wells tested, with concentrations ranging from 1.3 μg/l to 112 μg/l. These concentrations exceed both the PAL and the ES.
- Trichloroethylene was detected in wells 91-2B *(6.1 μg/l)*, 91-4 *(0.2 μg/l)*, and 91-6 *(0.4 μg/l)*. These concentrations exceed the PAL, but the ES is exceeded only in well 91-2B.

The distribution of these compounds is shown in Figure 18.

Second Round Sampling

Gasoline-related contaminants were again detected during the second-round chemical analyses of groundwater samples.

- Benzene concentrations ranging from 0.2 μg/l to 1.1 μg/l were detected in 14 of the wells sampled. These values again exceed the PAL but are below the ES.
- Ethylbenzene was detected only in well OW-1, where a concentration of 3.3 μg/l was found. This concentration is well below both the PAL and the ES.
- 1,2-dichloropropane was detected only in well 91-2B (0.6 μg/l). Again, no PAL or ES has been established for this compound.
- Toluene was detected in seven of the wells sampled, with concentrations ranging from 0.5 μg/l to 5.6 μg/l. These values are below both the PAL and the ES.
- M-xylene and p-xylene were detected only in well OW-1, where the concentration of 1.1 μg/l is not greater than either the PAL or the ES.

The distribution of these contaminants is illustrated in Figure 19.

Also detected during second round sampling were compounds primarily associated with solvents. These include:

- 1,2-dichlorobenzene was detected only in well 91-2B. The reported concentration of 1.4 μg/l at this location is well below the PAL and ES.
- 1,2-dichloroethane was detected in wells 91-3 *(90.2 μg/l)*, 91-4 *(1.5 μg/l)*, 91-5B *(0.8 μg/l)*, OW-2 *(2.5 μg/l)*, and VW-2 *(2.7 μg/l)*. As in the first round of sampling, these concentrations exceed the PAL, but the ES of 0.5 μg/l is exceeded only in well 91-3.
- 1,2-dichloroethylene was detected only in well 91-2B, at a concentration of 2.2 μg/l, is below the PAL and the ES.
- Tetrachloroethylene was again found to be the most widespread of the halogenated contaminants. This compound was detected in 13 of the wells tested, at concentrations ranging from 0.6 μg/l to 105 μg/l. These values exceed both the PAL and the ES.
- Trichloroethylene concentrations were detected in shallow well 91-6 *(0.6 and 0.7 μg/l)* in the eastern part of the study area, and in deep wells 91-2B *(7.2 μg/l)* and 91-3 *(0.3 μg/l)* in the western part of the study area. These values are above the PAL of 0.18 μg/l. Only the concentration reported in well 91-2B exceeds the ES of 5 μg/l.

The distribution of these compounds is shown in Figure 20.

DISCUSSION OF FINDINGS

Based on the results of laboratory analysis of groundwater, the halogenated compounds 1,2-dichloroethane and tetrachloroethylene appear to have a well-defined distribution in the groundwater in the Webster area.

Uses for 1,2-dichloroethane include degreaser, solvent, wetting and penetrating agent, and lead scavenger in anti-knock gasolines (Sax and Lewis, 1987). Uses for tetrachloroethylene include dry cleaning solvent, vapor degreasing solvent, drying agent for metals and certain other solids, vermifuge, heat transfer medium, and the manufacture of fluorocarbons (Sax and Lewis, 1987).

DNAPLs

Both 1,2-dichloroethane and tetrachloroethylene have densities greater than that of water (Table 13). These compounds have been classified as Dense Non-Aqueous Phase Liquids (DNAPLs) (Huling and Weaver, 1991). Chlorinated solvents are the most frequently encountered contaminants within this classification.

Within the vadose zone, the DNAPL contamination may exist in up to four simultaneous phases. These include:

1. The air phase, where the contaminants are present as vapor;
2. The solid phase, where the contaminants may adsorb or partition onto the soil or aquifer material;
3. The water phase, in which the contaminants dissolve into the water according to their relative solubility;
4. The immiscible phase, where the contaminants are present as dense non-aqueous phase liquids (Huling and Weaver, 1991).

Table 13
Densities of Contaminants Detected in Webster (Sax and Lewis, 1987)

Contaminant	Density(1)	Reference Temperature
Benzene	0.8790	20° C
Dichloromethane (methylene chloride)	1.335	15° C
1,2-Dichlorobenzene	1.284	20° C
1,2-Dichloroethane	1.2554	20° C
1,2-Dichloroethylene	1.27(2)	25° C
Ethylbenzene	0.867	20° C
Tetrachloroethylene	1.160(3)	20° C
Toluene	0.866	20° C
Trichloroethylene	1.452 - 1.458(3)	25° C
Trichlorofluoromethane	1.494	17.2° C
M-xylene	0.8684	15° C
P-xylene	0.8611	20° C

(1) Measured in grams/cubic centimeter (g/cm^3).
(2) According to Weiss (1986).
(3) Calculated using reference water densities from Perry et al. (1969).

Potential Migration of DNAPLs

DNAPLs are considered mobile in three of the four phases. Under saturated, subsurface conditions, DNAPLs can migrate in water according to their solubility, and in the gas phase, according to their DNAPL-air partition coefficients. DNAPLs as a continuous immiscible phase also have potential to be mobile. The relative distribution of DNAPLs within these three phases is complex and is poorly understood at this time.

In the solid phase, DNAPLs which have adsorbed onto the soil are considered immobile.

Often, pore spaces within permeable sediments—such as sands or fracture networks within low permeability units such as clays—provide the most efficient locations for movement of the contaminant. Soil capillarity is also important when considering the lateral movement of DNAPLs. Because of the surface tension within the pores within the sediment, a fraction of the DNAPLs will be retained within the porous media. This fraction is referred to as residual saturation.

DNAPL contaminants tend to sink within the saturated zone, rather than float on top of the water table as many petroleum-related contaminants do. According to Cherry (1991), when DNAPLs sink in the groundwater zone, their movements (i.e., their immiscible phase) are influenced more by gravity than by natural groundwater movement. The contaminants will continue to sink until a stratigraphic unit of lower permeability is encountered. At this point, the transport of the DNAPLS will depend greatly on the gradient of the lower permeability stratigraphic unit. If the directional gradient of the stratigraphic unit is different than the groundwater gradient, the continuous (immiscible) phase DNAPL contamination may migrate in a different direction than the flow of groundwater, while the dissolved (water, gas) phase contaminants will continue to migrate in the direction of groundwater flow (Huling and Weaver, 1991). Eventually, continuous-phase DNAPLS are expected to pool within topographic depressions on the relatively impermeable stratigraphic unit. Several possible scenarios for DNAPL migration are illustrated in Figure 21.

Distribution and Concentration of DNAPLs in Webster Study Area

In an attempt to determine the distribution and concentration gradients of 1,2-dichloroethane and tetrachloroethylene, contour diagrams of the first and second round groundwater chemistry for these contaminants have been constructed.

1,2-Dichloroethane

Figures 22 and 23 are contour diagrams, presenting the results of 1,2-dichloroethane concentrations detected in the first and second rounds of groundwater analysis, respectively. These two-dimensional diagrams present a simplistic view of the contaminant distribution, since the groundwater quality data has a three-dimensional component. Based on these diagrams, 1,2-dichloroethane appears to be restricted to the south-central and southwestern portions of the study area.

The vertical distribution of 1,2-dichloroethane can be approximated based on the groundwater quality data available from the two rounds of analyses. Two of the five wells (91-4 and OW-2) in which 1,2-dichloroethane is present are screened at the top of the aquifer, whereas the remaining wells (91-5B, 91-3, and VW-2) are screened deeper in the formation. Conceptual drawings of the vertical distribution of 1,2-dichloroethane are shown in Figure 24. These conceptual cross-sections were constructed by projecting the concentrations of 1,2-dichloroethane from the first round of groundwater sampling onto the cross-section planes X-X' and Y-Y'.

The highest concentration of this contaminant was found at well 91-3, during both rounds of groundwater analysis (83.6 μg/l in round 1, and 90.2 μg/l in round 2). The concentration of 1,2-dichloroethane appears to decrease upgradient and downgradient (northeast and southwest, respectively) of well 91-3. The concentration also decreases in directions perpendicular to groundwater flow (northwest and southeast) but appears to increase with depth.

The contaminant distribution is well-constrained near the top of the aquifer, with nearby wells OW-4, OW-5, OW-6, OW-1, 91-5A, OW-9, and OW-3 showing no impact from this contaminant.

Information is limited at depth, with well 91-2B to the north being the nearest available deep aquifer sampling point. Well 91-2B constrains the northernmost possible margin of 1,2-dichloroethane contamination. However, no wells exist south-southeast of well 91-3, nor further west than VW-2. Therefore, the extent of contamination in these directions cannot be adequately determined.

The source for 1,2-dichloroethane appears to occur along Main Street on the west side of town, probably between Pike and Sturgeon avenues. Information collected prior to the start of this investigation indicated a printing shop had once operated in the vicinity of the current Community Center; the former printing shop may represent a source for the 1,2-dichloroethane contamination.

Although the source of the 1,2-dichloroethane is not known with certainty, RREM believes the majority of the original compound has passed through the unsaturated zone. The apparent lack of widespread soil contamination by 1,2-dichloroethane lends support to this theory, although it should be noted that direct encounters of DNAPLs in boreholes are rare (Cherry, 1991). Once in the saturated zone, 1,2-dichloroethane may have travelled to the bottom of the aquifer, pooled on top of a relatively impermeable stratigraphic layer, or migrated according to the slope of an impermeable surface encountered at depth.

Tetrachloroethylene

Contour drawings of the concentrations of tetrachloroethylene (PCE) from the first and second rounds of groundwater sampling are illustrated in Figures 25 and 26.

These drawings were constructed based on tetrachloroethylene concentrations detected in wells screened in the shallow sections of the aquifer, between depths of 34 and 45 feet. The locations of contaminated soil samples at depths of 34 to 36 feet were also considered in constructing the contours, but no contaminant concentrations other than those detected in the groundwater have been implied. Therefore, the maps shown in Figures 25 and 26 represent the concentrations of PCE that might be expected to occur in groundwater present only in the upper sections of the aquifer.

Based on comparison of the chemical analyses of soil and groundwater, it appears that contaminated groundwater occurs where there is contaminated soil, but contaminated soil is not always present where groundwater contamination exists. It is likely that soil contamination will be found only near the source of contamination, and only where high levels of water contamination exist away from the source.

In the upper sections of the aquifer, tetrachloroethylene-contaminated groundwater occurs within a northeast-southwest trending plume, approximately 1600 feet in length and up to 450 feet in width, which occurs west of Lakeland Avenue (Highway 35) between Elm and Cedar streets (Figures 25 and 26). The highest concentration of tetrachloroethylene in groundwater within this portion of the aquifer was found at well 91-6 (31.8 μg/l, 32 μg/l, and 52.5 μg/l), while the highest concentration of soil contamination was detected at SB-1 (34.9 μg/g). The concentration of PCE appears to decrease upgradient and downgradient of these two locations. Concentrations also appear to decrease perpendicular to groundwater flow.

The lateral distribution of the tetrachloroethylene contamination is well-defined in the southwestern region of the study area by wells 91-3, OW-9, OW-3, and OW-4. In the northwestern portion of the area, the extent of the plume is delimited by data from wells 91-1 and 91-2A. In the east, the extent of contamination is restricted by data from well 91-8. It is difficult to ascertain the lateral extent of contamination in the eastern portion of the study area and the longitudinal extent of contamination in the western portion of the area, because of a lack of sampling points.

In addition to lateral and longitudinal concentration gradients, it also appears that vertical concentration gradients of PCE contamination are present in Webster. The highest concentrations of tetrachloroethylene detected in both rounds of groundwater sampling occurred in well 91-2B (112 and 105 μg/l), which is screened between a depth of 65 and 70 feet near the intersection of Elm Street and Pike Avenue. Chemical analyses of groundwater samples taken from well 91-7, which is also screened between 65 and 70 feet deep, failed to detect tetrachloroethylene during round 1 sampling and detected only 0.6 μg/l PCE during round 2 sampling.

It appears, therefore, that the tetrachloroethylene plume is sinking as it moves from east to west. At depth, the plume also appears to be centered more northward than it is near the top of the aquifer. This apparent northward shift in the location of the plume may be a result of the plume encountering a relatively impermeable soil unit, such as the silt horizon that was encountered at depths of 60 to 66 feet in soil boring SB-9.

Conceptual illustrations of the possible geometry of the tetrachloroethylene-contaminated groundwater plume, based solely on the results of the first round groundwater analyses, are illustrated in Figure 27. These conceptual cross-sections were constructed by projecting the concentrations of tetrachloroethylene from the first round of groundwater sampling onto the cross-section planes X-X' and Y-Y'. These diagrams illustrate the sinking nature of the plume as it moves from its source in the east-central region of the study area to the west, via transportation by flowing groundwater.

Based on current data, it is not possible to determine the nature of the plume below a depth of 70 feet. However, based on the relative differences in density between water and tetrachloroethylene, it is likely that the plume will continue to sink until it encounters an impermeable boundary, where it is likely to pool within topographic depressions.

Based on information collection to date, it appears that a source of tetrachloroethylene contamination may exist west of Lakeland Avenue and east of Muskey Avenue, between Main and Elm streets. It is RREM's interpretation that this source is separate from the source of 1,2-dichloroethane. Research early in this investigation indicated that dry cleaning businesses were operating at the location of the present laundromat, as well as in the vicinity of the post office. These two locations may represent possible sources of the tetrachloroethylene contamination.

IMPACT TO RECEPTORS

The distribution of soil and groundwater contamination by halogenated volatile organic compounds in the Webster study area has been examined within this report. The potential impacts to receptors are discussed below.

SOIL CONTAMINATION

Based on the analyses performed for this study, tetrachloroethylene-contaminated soil appears to be confined to depths between 34 and 71 feet in the Webster area. Although this soil does not have any direct contact with humans, the contaminated soil may represent, in part, a source for tetrachloroethylene to further contaminate the groundwater. Groundwater quality will continue to be affected, as long as this contaminated soil is present. Well 91-8, which is located upgradient of the potential source of PCE contamination, contains groundwater that does not appear to be affected by the PCE contamination. Therefore, it appears that PCE-contaminated groundwater is restricted to receptors downgradient of well 91-8.

GROUND WATER CONTAMINATION

Contaminated groundwater appears to have the potential to affect a widespread area within and to the west of the Village of Webster. The following receptors have been or may be affected by contaminated groundwater:

1. Village well 2 (VW-2) continues to be impacted by contamination from 1,2-dichloroethane and, periodically, by tetrachloroethylene. During the course of this study, concentrations of 2.8 and 2.7 μg/l of 1,2-dichloroethane were detected in water samples from this well. Tetrachloroethylene has periodically been detected in water samples analyzed by the Wisconsin DNR and Mid-State Associates from this well since 1984. The concentrations detected for this study are relatively low and do not exceed the Enforcement Standard of the Wisconsin DNR. However, a potential for impacts to human health does exist.

2. Potential exists for contamination of private wells located downgradient (to the west) of the study area. The residence of Vernon and Connie Bushey, which is located approximately 500 feet west of the boundary of the study area, is supplied by a private well. Attempts were made during the course of this

study to contact the Busheys and to sample water from their well. These attempts were unsuccessful. During the next phase of this investigation (Task II), samples will be collected and analyzed from this site. No further wells have been identified immediately downgradient of the study area.

3. The Yellow River, located approximately 1.25 miles north of Village Well 2, and the Clam River, located approximately 1.25 miles south of Village Well 2, represent potential downgradient receptors of contamination from the groundwater passing beneath Webster. A small stream located approximately one-quarter to one-half mile north of Village Well 2 represents the closest surface water to the presently defined plumes. It is speculated that, due to dilution from uncontaminated groundwater, levels of contamination will be greatly reduced by the time groundwater has reached these receptors. In addition, since the contaminants appear to be sinking with increasing distances from their probable sources, it is unlikely that surface water will be greatly impacted by the contamination.

4. It appears that until the source(s) of contamination are eliminated, either by remedial action or dilution of the contamination via solution by groundwater, the potential exists for the continuation of widespread contamination.

SUMMARY AND CONCLUSIONS

Volatile organic compound (VOC) contamination has been documented in the Village of Webster, Wisconsin municipal water wells 1 and 2 since 1984 and 1985, respectively. RREM, Inc., was retained by the Wisconsin Department of Natural Resources (DNR) to conduct a remedial investigation of the contaminated aquifer in the Village of Webster. The purpose of this investigation was to determine the scope, extent, source(s), and potential impacts of VOC contamination in the Village.

As part of the investigation, a subsurface exploration program was conducted. Nineteen soil borings, varying from 36 to 71 feet in depth, were drilled at various locations within the site to evaluate the subsurface stratigraphy and to determine the lateral and vertical extent of the contamination. Based on these borings, the generalized stratigraphy in the Webster area, as logged with increasing depth, consists of:

- blacktop (on city streets only),
- silty to clayey sand plus gravel fill,
- silty clay,
- fine to coarse, well rounded, well sorted sand deposits, which locally contain lenses of pebbly to gravelly sand and silt to silty sand.

Ten soil samples from the aquifer beneath Webster that were selected by RREM geologists were subjected to sieve analysis tests by GME Consultants, Duluth, Minnesota. The results of these analyses indicate that the aquifer varies from poorly graded sand (SP) to poorly graded sand with silt (SP-SM) to silty sand (SM).

A Foxboro OVA-128 Flame Ionization Detector (FID) was used to screen soil samples in the field for volatile organic compound contamination using the standard jar-headspace method. Based on the chemical analyses of the soil from Webster (see below), there appears to be little correlation between the magnitude of the readings on the FID and actual soil contamination. This may suggest:

- the concentration of VOC contamination in the soil was not high enough to cause a significant FID reading;
- the vapor phase of contamination was not migrating into the headspace of the apparatus because of its relatively high

density with respect to air. It is speculated that the vapor phase of contamination remained in the pore space of the soil sample during these tests.

Thirty-eight soil samples were selected for chemical analysis. The samples were analyzed by Enviroscan in Rothschild, Wisconsin. The first 28 samples were analyzed for volatile organic compounds (VOCs), using EPA Method 8010/8020, total petroleum hydrocarbons (TPH) using the California Method, and lead via EPA Method 7421. The final ten samples were analyzed only for VOC contamination by EPA Method 8010/8020.

Lead was detected in 17 of the 28 samples analyzed, with concentrations ranging from 1.82 to 9.47 μg/g.

Toluene was detected only in soil boring SB-13, where a sample from 34 to 36 feet had a concentration of 4.2 μg/g.

Tetrachloroethylene (PCE) contaminated soil was detected at depths of 34 to 36 feet in soil borings SB-1 (34.9 μg/g), SB-6 (2.4 μg/g), and SB-18 (9.3 μg/g). Tetrachloroethylene contamination was also detected at 69 to 71 feet in soil boring SB-4 (5.8 μg/g).

Methylene chloride was detected in soil samples from borings SB-4, SB-7, SB-9, and SB-14. However, it is believed that the methylene chloride detects resulted from lab contamination during the analysis of the samples.

Ten monitoring wells were installed to evaluate the hydrogeological characteristics of the aquifer, as well as to allow groundwater sampling. Based on data collected from a pressure transducer during in situ hydraulic conductivity tests, the sediments beneath the study site were found to have a geometric mean hydraulic conductivity of 1.77×10^{-2} cm/sec and an arithmetic mean hydraulic conductivity of 1.82×10^{-2} cm/sec. This compares favorably with the hydraulic conductivity determined by GME Consultants on a recompacted sample of fine to medium sand (7.1×10^{-3} cm/sec). A Shelby tube sample of silty clay was determined to have a hydraulic conductivity of 1.5×10^{-6} cm/sec.

Water table elevations were monitored from June through October in the ten wells installed by RREM and in the nine wells from the previous study by Ayres (1987). Groundwater flows from east to west, with a gradient between 8×10^{-4} ft/ft and 9×10^{-4} ft/ft.

The groundwater flow velocity was calculated to be between 44 and 48 ft/year, assuming a porosity of 35 percent for the fine- to medium-grained, well-sorted, well-rounded sand aquifer.

Groundwater samples were obtained during two rounds of sampling from the 19 wells discussed above and from a tap connected to Webster village well 2. Contamination of groundwater by the gasoline-related compounds benzene, toluene, and 1,2-dichloropropane was recognized during the first round of sampling. Benzene, ethylbenzene, 1,2-dichloropropane, toluene, and m- and p-xylene were also detected in the second round of sampling. However, only the concentrations reported for benzene exceed the Preventive Action Limits (PAL). None of the concentrations reported for these contaminants exceeded its respective Enforcement Standard (ES).

Contamination by organic compounds used primarily as solvents was also recognized during the two rounds of groundwater sampling. During the first round of sampling, the halogenated compounds 1,2-dichlorobenzene, 1,2-dichloroethane, tetrachloroethylene (PCE) and trichloroethylene (TCE) were detected. Second-round water samples detected the previous compounds, as well as 1,2-dichloroethylene. Neither the PAL nor ES was exceeded by the concentrations of 1,2-dichlorobenzene, or 1,2-dichloroethylene.

Dichloroethane concentrations that exceeded the PAL of 0.05 µg/l were detected in wells 91-4, 91-5B, OW-2, and VW-2. The Enforcement Standard for 1,2-dichloroethane was exceeded in both rounds of sampling by groundwater from well 91-3.

Tetrachloroethylene was detected in water from 11 wells during the first round of sampling, and 13 wells from the second round of sampling. In all locations where tetrachloroethylene was detected, the concentrations exceeded both the PAL and the ES established by the Wisconsin DNR.

Trichloroethylene was detected in wells 91-2B, 91-3, 91-4, and 91-6. All concentrations detected exceeded the PAL of 0.18 µg/l, and the concentration in well 91-2B consistently exceeded the Enforcement Standard of 5.0 μg/l.

The potential for high concentrations of contamination deep in the groundwater downgradient from the source appears to exist. Based on the distribution of 1,2-dichloroethane and tetrachloroethylene, the contamination by these substances appears to increase with depth as one moves further from the possible sources. The contaminants are expected to eventually pool within topographic depressions in the surface of a relatively impermeable unit. The likelihood of detecting these pools by conventional drilling is small, and any breaching of the confining layer may only lead to increasing the area contaminated by the substances.

Based on this evaluation, it appears that a source of tetrachloroethylene contamination may exist west of Lakeland Avenue and east of Muskey Avenue between Main and Elm streets. It is RREM's interpretation that this source is separate from the source of 1,2-dichloroethane, which appears to be located along Main Street on the west side of the Village, probably between Pike and Sturgeon avenues.

Based on the information collected to date, it appears that the most likely locations to be impacted by the contamination are located in the western portion of the study area and to the immediate west of the study area. Village well 2 (VW-2) continues to be impacted by the presence of 1,2-dichloroethane and tetrachloroethylene contamination, at levels that exceed the PAL. Because VW-2 is no longer being used as a municipal water supply, this contamination is presently not affecting the village water supply. However, such contamination will continue to preclude the use of VW-2 as a municipal water source. The Vernon Bushey residence, located approximately 500 feet west of the study area, is supplied by a private water well. At the present time, this well is the most likely downgradient receptor to be affected by the contamination.

The Yellow and Clam rivers also are potential downgradient receptors of the contamination. However, due to their distances from the presently outlined contamination plumes, and due to the apparent sinking nature of the plumes, these rivers are not likely to be greatly affected by the contamination.

RECOMMENDATIONS

Based upon the findings of this report, RREM recommends the following:

1. The drilling of several soil borings at potential source locations, with soil sampling and geochemical analysis. This will better define the distribution of contamination. Groundwater samples should be collected from each soil boring to define the distribution of contaminants.

2. The installation of monitoring wells and soil borings to better define the lateral and vertical limits of the 1,2-dichloroethane and tetrachloroethylene plumes. At the present time, the western and southeastern margins of the 1,2-dichloroethane plume is poorly defined, and the western, northern, and southeastern margins of the tetrachloroethylene plume, especially at depth, are not well defined.

3. The drilling of at least four soil borings to the base of the sand aquifer underlying Webster. This will serve to better define the slope of the surface of the confining layer, which may be influencing the direction of migration of immiscible DNAPL phases at depth. It should also help to refine the present interpretations about the vertical distribution of the contamination.

4. Continuation of groundwater sampling in the present wells and from Village Well 2 (VW-2). This will monitor the migration as well as the concentrations of any contaminants present in the groundwater.

5. Sampling of water from residences with private wells located downgradient of the contaminant plumes should be undertaken. The Vernon Bushey residence, which has a private well approximately 500 feet west of Village Well 2, is the most likely location for future impacts from the present contamination.

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Appendix A

Results of Chemical Analyses of Soil and Groundwater from Previous Studies

- **Summary of Soil Geochemistry, Ayres Associates**
- **Summary of Groundwater Geochemistry, Ayres Associates, September 1986 (Round One Sampling)**
- **Summary of Groundwater Chemistry, Ayres Associates, October 1986 (Round Two Sampling)**
- **Summary of Water Chemistry, Webster Village Wells 1 and 2**

Table A1
Summary of Soil Chemistry
Ayres Associates (July 1986)
Village of Webster, Wisconsin

Soil Boring / Sample Depth	Compound Concentration (all units µg/g)						
	Benzene	Dichloromethane	Ethylbenzene	Toluene	Trichloro-fluoromethane	M-xylene	P-xylene
Detection Limit	*0.4*	*0.4*	*0.4*	*0.2*	*0.4*	*0.1*	*1.0*
OW-1							
5 ft.	ND	ND	29.6	45.7	ND	51.0	60.7
15 ft.	ND	ND	ND	ND	ND	ND	ND
25 ft.	ND	ND	ND	0.3	ND	ND	ND
30 ft.	ND	ND	ND	0.3	ND	ND	ND
35 ft.	ND	ND	ND	0.8	ND	ND	ND
45 ft.	0.6	ND	ND	1.2	ND	3.8	5.1
OW-2							
5 ft.	ND	ND	ND	ND	ND	ND	ND
15 ft.	ND	ND	ND	0.2	ND	ND	ND
25 ft.	ND	ND	ND	0.4	ND	ND	ND
30 ft.	ND	ND	ND	0.5	ND	ND	ND
35 ft.	ND	ND	ND	0.3	ND	ND	ND
45 ft.	ND	ND	ND	ND	ND	ND	ND
OW-3							
5 ft.	ND	ND	ND	ND	ND	ND	ND
10 ft.	ND	2.0	ND	ND	ND	ND	ND
40 ft.	ND	ND	ND	ND	ND	ND	ND
OW-4							
5 ft.	ND	ND	ND	ND	ND	ND	ND
45 ft.	ND	ND	ND	ND	ND	ND	ND

Table A1, continued
Summary of Soil Chemistry
Ayres Associates (July 1986)
Village of Webster, Wisconsin

Soil Boring / Sample Depth	Compound Concentration (all units $\mu g/g$)						
	Benzene	Dichloromethane	Ethylbenzene	Toluene	Trichloro-fluoromethane	M-xylene	P-xylene
Detection Limit	*0.4*	*0.4*	*0.4*	*0.2*	*0.4*	*0.1*	*1.0*
OW-5							
5 ft.	ND	ND	ND	ND	ND	ND	ND
45 ft.	ND	ND	ND	ND	ND	ND	ND
OW-6							
5 ft.	ND	ND	ND	ND	ND	ND	ND
10 ft.	ND	ND	ND	ND	9.8	ND	ND
45 ft.	ND	ND	ND	ND	3.3	ND	ND
OW-7							
5 ft.	ND	ND	ND	ND	ND	ND	ND
10 ft.	ND	ND	ND	ND	ND	ND	ND
45 ft.	ND	ND	ND	ND	11.3	ND	ND
OW-8							
5 ft.	ND	ND	ND	ND	ND	ND	ND
10 ft.	ND	ND	ND	ND	ND	ND	ND
45 ft.	ND	ND	ND	ND	ND	ND	ND
OW-9							
5 ft.	ND	ND	ND	ND	ND	ND	ND
40 ft.	ND	ND	ND	ND	ND	ND	ND

Table A2
Summary of Groundwater Chemistry
Ayres Associates, Sept. 1986 (Round One Sampling)
Village of Webster, Wisconsin

Monitoring Well	Compound Concentration (all units ug/l)				
	Chloroform	Dichloromethane	Tetrachloroethylene	Toluene	1,1,2-Trichloroethane
Detection Limit[1]	*0.1*	*0.2*	*0.1*	*0.1*	*0.1*
OW-1	ND[2]	ND	0.6	0.5	ND
OW-2	ND	ND	ND	ND	ND
OW-3	ND	ND	ND	ND	ND
OW-4	ND	ND	ND	ND	ND
OW-5	0.4	0.2	0.1	0.1	ND
OW-6	0.5	ND	ND	ND	ND
OW-7	ND	0.9	ND	ND	1.2
OW-8	ND	0.9	0.9	ND	ND
OW-9	ND	0.2	ND	ND	ND

(1) Analyzed using EPA Method 601, with photoionization detector (10.2 eV).
(2) ND - Not Detected.

Table A3
Summary of Groundwater Chemistry
Ayres Associates, October 1986 (Round Two Sampling)
Village of Webster, Wisconsin

Monitoring Well	Benzene	Chloroform	1,2-Dichloro-ethane	Tetrachloro-ethylene	1,1,1-Trichloro-ethane	Trichloro-ethylene
Detection Limit[1]	*0.2*	*0.1*	*0.3*	*0.1*	*0.1*	*0.1*
OW-1	ND	ND	ND	3.3	ND	ND
OW-2	ND	ND	ND	0.7	ND	ND
OW-3	ND	ND	ND	ND	ND	ND
OW-4	ND	ND	ND	ND	ND	ND
OW-5	ND	ND	ND	3.3	ND	ND
OW-6	ND	0.3	ND	0.1	ND	ND
OW-7	ND	ND	ND	ND	0.4	ND
OW-8	ND	ND	ND	3.0	ND	ND
OW-9	ND	ND	ND	0.2	ND	ND
VW-2[3] (0.88 hours into pump test)	0.3	ND	69.3	12.5	ND	0.2
VW-2[3] (20 hours into pump test)	ND	ND	9.9	5.5	ND	ND

(1) Analyzed using EPA Method 601, with photoionization detector (10.2 eV).
(2) ND - Not Detected.
(3) Samples collected during a 20.5-hour pump test of Village Well 2 (October 1986).

Table A4
Summary of Water Chemistry
Village Well 1 □ Webster, Wisconsin

Sampling Date	Compound Concentration (all units ug/l)			
	1,2-Dichloroethane	Tetrachloroethylene	Trichloroethylene	Source
November 1984	D(1)	D	ND(2)	A
December 1984	26	18	ND	A
January 1985	22	17	ND	A
May 1985	16	11	ND	A
October 1986	4	58	2.3	A
February 1987	100	18	ND	A
February 1988	16	23	1.2	A
May 1988	24	18	ND	A
October 1988	18	19	ND	A
August 1989	27	9	0.34	A

(1) D — Compound detected but not quantified.
(2) ND — Not Detected.

Sources:
A — Wisconsin Department of Natural Resources

Table A5
Summary of Water Chemistry
Village Well 2 □ Webster, Wisconsin

Sampling Date	Compound Concentration (all units ug/l)					
	Benzene	1,2-Dichloroethane	Tetrachloroethylene	Trichloroethylene	Toluene	Source
November 1984	ND[1]	ND	ND	ND	ND	A
November 1985	ND	D[2]	D	ND	ND	A
December 1985	ND	14	6.9	ND	ND	A
February 1987	ND	D	D	D	ND	A
February 1988	2.3	120	2.2	ND	ND	A
May 1988	ND	6.7	5	ND	ND	A
October 1988	ND	2.8	2.6	ND	ND	A
August 1989	0.36	5.8	4.1	ND	ND	A
March 1990	ND	3.2	0.37	ND	ND	A
September 1986	ND	9.9	5.5	ND	ND	B
September 1986	0.3	69.3	12.5	0.2	ND	B
February 1991	ND	4.4	0.65	ND	2.3	C
June 1991	ND	3.5	0.9	ND	1.2	C
June 1991	ND	7.2	1.4	ND	<0.5	C
July 1991	ND	7.6	2.0	ND	<0.5	C
September 1991	ND	2.8	ND	ND	ND	D
October 1991	ND	2.7	ND	ND	ND	D

(1) ND — Not Detected.
(2) D — Compound detected but not quantified.

Sources:
A — Wisconsin DNR Public Water Sample Results
B — Ayres (1987)
C — Mid-State Associates (1991)
D — RREM (1991)

Appendix B

Soil Boring Logs

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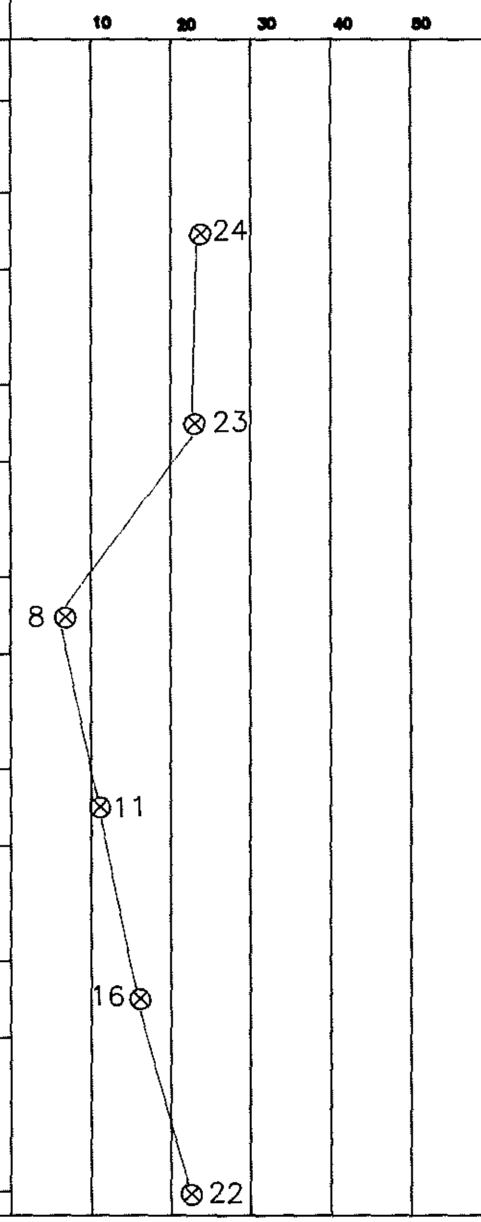
FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 1 of 2
BORING NUMBER–LOCATION: SB–1: MUSKEY AVE & ELM		DATE: 6–16–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT)
					CL	0.2" BLACK TOP, 0.6" SAND FILL 1.2" OLIVE (5YR5/2) SILTY CLAY	
5	1	2	2	0.0	SP	BROWN (7.5YR4/4) MED TO FINE GRAINED WELL SORTED AND WELL ROUNDED SAND DAMP	24
10	2	2	2	7.0	SP	BROWN (7.5YR4/4) MED TO FINE GRAINED WELL SORTED AND WELL ROUNDED SAND DAMP LAB SAMPLE	23
15	3	2	2	0.0	SP	BROWN (7.5YR4/4) MED TO FINE GRAINED WELL SORTED AND WELL ROUNDED SAND DAMP	8
20	4	2	2	0.0	SP	BROWN (7.5YR4/4) MEDIUM GRAINED WELL SORTED AND WELL ROUNDED SAND DAMP	11
25	5	2	2	0.0	SP	BROWN (7.5YR4/4) MED TO FINE GRAINED WELL SORTED AND WELL ROUNDED SAND DAMP	16
30							22



WATER LEVEL:	BORING STARTED: 6–16–91	BORING COMPLETED: 6–16–91	REMARKS:
	LOGGED BY: Brian Hayden/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 2 of 2
BORING NUMBER–LOCATION: SB-1		**DATE:** 6-16-91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	⊗ STANDARD PENETRATION (BLOWS/FT)
	6	2	2	0.0	SP	BROWN (7.5YR4/4) MEDIUM TO FINE GRAINED WELL SORTED WELL ROUNDED SAND DAMP	22
					SP	BROWN (7.5YR4/4) MED TO FINE GRAINED WELL SORTED AND WELL ROUNDED SAND DAMP LAB SAMPLE	
35	7	2	2	5.0	GW	6" LAYER COARSE GRAINED ROUNDED SAND–FINE GRAVEL	46
					SP	6" LAYER FINE GRAINED SAND	
40	8	2	2	4.5	SP	BROWN (7.5YR4/4) MED–FINE GRAINED WELL SORTED AND WELL ROUNDED QUARTZ SAND SATURATED	22
						END OF BORING	
45							
50							
55							
60							

WATER LEVEL:	**BORING STARTED:** 6-16-91	6-16-91	**REMARKS:**
	LOGGED BY: Brian Hayden/RREM,Inc.		
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura		**SIGNED:**

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 1 of 2
BORING NUMBER–LOCATION: SB-2: WELL 91-6, 20' SE OF FIRE HYDRANT ON WEST SIDE OF ALLEY BETWEEN H-35 & MUSKEY (TAP LOT)		DATE: 7-09-91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT)
				1.3		BLACK BROWN SANDY CLAY AND SILT FILL, GRAVEL AT SURFACE	
					SP	RED BROWN FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND, TRACE SILT, FILL	
5	1	2	2	0.4	CL	LIGHT BROWNISH GREY (10YR6/2) CLAY WITH 5-10% WEAK RED (10YR4/4) MOTTLING & ROOTLETS	11
					SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND WITH 5-10% CLAY (TRANSITION-LIKE MATERIAL)	
10	2	2	2	0.3	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND W/ TRACE 0.25-0.5MM ROUNDED PEBBLES	13
15	3	2	1.8	0.8	SP	BROWN (7.5YR4/4) FINE TO MEDIUM WELL ROUNDED WELL SORTED SAND	13
20	4	2	1.8	1.6	SP	BROWN (7.5YR4/4) FINE TO MEDIUM WELL ROUNDED WELL SORTED SAND BROWN (7.5YR4/4) COARSE TO MEDIUM WELL ROUNDED WELL SORTED SAND	8
25	5	2	1.8	2.9	SP	BROWN (7.5YR4/4)COARSE TO MED WELL ROUNDED WELL SORTED SAND 5-10% ORANGE MOTTLING 3-5% COARSE SAND PRESENT LAB SAMPLE	7
30	6	2	1.8	0.6	SP	BROWN (7.5YR4/4) MED TO COARSE WELL ROUNDED WELL SORTED SAND	29

WATER LEVEL:	BORING STARTED: 7-09-91	BORING COMPLETED: 7-10-91	REMARKS: SCREEN @ 30-40'
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 2 of 2
BORING NUMBER–LOCATION: SB–2		DATE: 7–10–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	⊗ STANDARD PENETRATION (BLOWS/FT)
35	7	2	2	0.3	SP	BROWN (7.5YR4/4) MEDIUM TO COARSE GRAINED WELL ROUNDED WELL SORTED SAND BROWN (7.5YR4.4) FINE TO MED GRAINED WELL SORTED WELL ROUNDED SAND LAB SAMPLE SATURATED	35
40	8	2	RECOVERED FROM AUGER		SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND SATURATED	67
						END OF BORING	

Depth scale: 35, 40, 45, 50, 55, 60

Standard penetration scale: 10, 20, 30, 40, 50

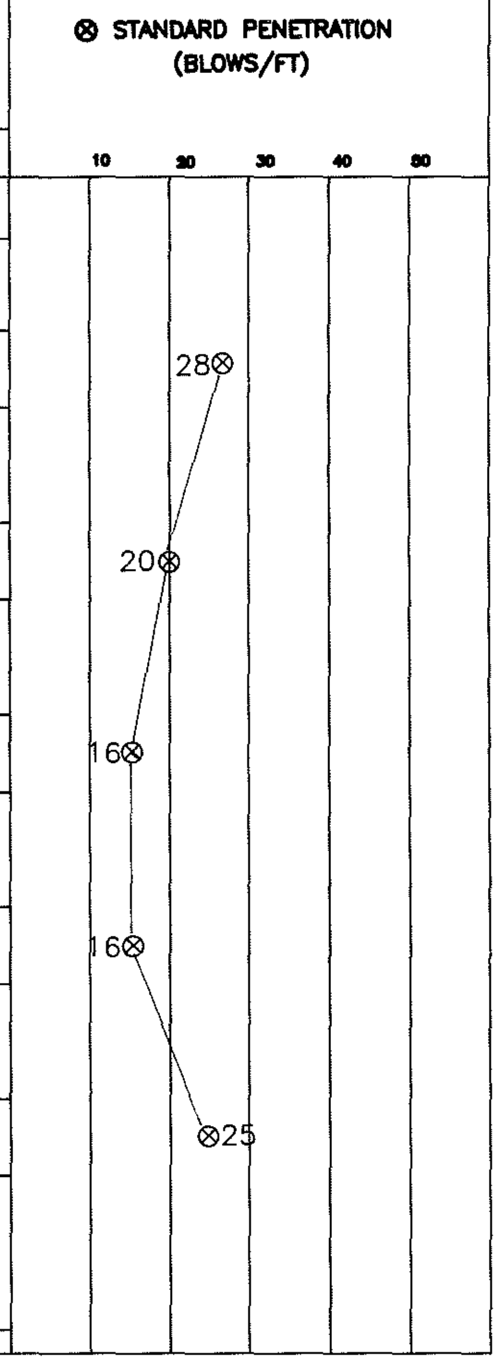
WATER LEVEL:	BORING STARTED: 7–09–91	BORING COMPLETED: 7–10–91	REMARKS: SCREEN AT 30–40'
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: **HOLE DIAMETER:** 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 1 of 2
BORING NUMBER–LOCATION: SB–3: SE CORNER OF STURGEON & ELM		**DATE:** 6–18–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION
					CL	.2" BLACK TOP .6" SAND FILL SILTY CLAY
5	1	2	2	0.0	SP	BROWN (7.5YR4/4) MED–FINE GRAINED WELL ROUNDED WELL SORTED SAND
10	2	2	2	0.4	SP	BROWN (7.5YR4/4) MED–FINE GRAINED WELL ROUNDED WELL SORTED SAND
15	3	2	2	1.0	SP	BROWN (7.5YR4/4) MED–FINE GRAINED WELL ROUNDED WELL SORTED SAND
20	4	2	2	0.4	SP	BROWN (7.5YR4/4) MED–FINE GRAINED WELL ROUNDED WELL SORTED SAND WITH 2CM META–VOLCANIC ROUNDED PEBBLE
25	5	2	2	0.2	SP	BROWN (7.5YR4/4) MED–FINE GRAINED WELL ROUNDED WELL SORTED SAND, LOWER 1 FT FINER GRAINED
30						



WATER LEVEL:	**BORING STARTED:** 6–18–91	**BORING COMPLETED:** 6–18–91	**REMARKS:**
	LOGGED BY: Brian Hayden/RREM,Inc.		
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura		**SIGNED:**

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FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 2 of 2
BORING NUMBER–LOCATION: SB–3		DATE: 6–18–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT) 10 20 30 40 50
	6	2	2	0.2	SP	BROWN (7.5YR4/4) FINE GRAINED WELL ROUNDED WELL SORTED SAND	17
35	7	2	2	4.3	SP	BROWN (7.5YR4/4) FINE GRAINED WELL ROUNDED WELL SORTED SAND SATURATED LAB SAMPLE	39
						END OF BORING	
40							
45							
50							
55							
60							

WATER LEVEL:	BORING STARTED: 6–18–91	BORING COMPLETED: 6–18–91	REMARKS:
	LOGGED BY: Brian Hayden/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

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consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 1 of 3
BORING NUMBER–LOCATION: SB–4: NESTED WELLS 91–2A & 91–2B CORNER OF PIKE & ELM		DATE: 7–11–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	⊗ STANDARD PENETRATION (BLOWS/FT)
				2.1		BLACK–BROWN SANDY SILT & CLAY FILL ROOTLETS THROUGHOUT, GRASSY VEGETATION AT SURFACE	
					CL	LIGHT BROWNISH GREY (10YR6/2) CLAY–SILT WITH 5% WEAK RED (10YR5/4) MOTTLING	
5	1	2	2.0	0.1	SP	BROWN (7.5YR4/4) CLAYEY–SAND TRANSITION ZONE, FINE TO MED GRAINED WELL ROUNDED WELL SORTED SAND	29
						BROWN (7.5YR4/4) WELL ROUNDED WELL SORTED FINE TO MEDIUM GRAINED SAND	
10	2	2	2.0	0.2	SP	BROWN (7.5YR4/4) WELL SORTED WELL ROUNDED FINE TO MEDIUM GRAINED SAND WITH LOCAL 1–2" LENSES OF 10–20% COARSE AND MEDIUM SAND TRACE PEBBLES, UP TO 1CM DIA.	30
15	3	2	1.8	0.2	SP	BROWN (7.5YR4/4) WELL SORTED WELL ROUNDED FINE TO MEDIUM GRAINED SAND NO PEBBLES	42
20	4	2	1.8	0.1	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND. FINE GRAINED SAND, WELL ROUNDED WELL SORTED FROM 20'8"–21'0"	27
25	5	2	2.0	0.3	SP	BROWN (7.5YR4/4) FINE TO MED GRAINED WELL SORTED WELL ROUNDED SAND ORANGE–RED MOTTLING 5% AT 25' GRADES DOWN INTO SLIGHT ORANGE–RED STAINING FROM 25'–26' NO ODOR	24
						BROWN (7.5YR4/4) FINE TO MED GRAINED WELL SORTED WELL ROUNDED SAND; ORANGE–RED MOTTLING 5% GRADES DOWN INTO INTO SLIGHT ORANGE–RED STAINING NO ODOR	
30	6	2	1.9	0.6	SP	BROWN (7.5YR4/4) COARSE SAND & GRAVEL; PEBBLES 0.25–1.0CMOF NORTH SHORE VOLCANICS 15–20%; SAND POORLY SORTED MODERATELY ROUNDED	32

WATER LEVEL:	BORING STARTED: 7–11–91	BORING COMPLETED: 7–11–91	REMARKS: 91–2A SCREEN @ 30–40' 91–2B SCREEN @ 65–70'
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 2 of 3
BORING NUMBER–LOCATION: SB–4		DATE: 7–11–91

SURFACE ELEVATION

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL	⊗ STANDARD PENETRATION (BLOWS/FT)
35	7/8	2	1.8	0.4	SP	BROWN (7.5YR4/4) WELL ROUNDED WELL SORTED MED GRAINED SAND WITH 5–10% COARSE SAND BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND LAB SAMPLES SATURATED	19
40	9	2	2	1.0	SP	BROWN (7.5YR4/4) VERY FINE TO MED GRAINED WELL SORTED WELL ROUNDED SAND, SOMEWHAT FINER GRAINED THAN OTHER FINE TO MEDIUM GRAINED SANDS EXCAVATED	24
45	10	2	2	3.2	SP	BROWN (7.5YR4/4) SILTY FINE TO MEDIUM GRAINED WELL SORTED SAND SATURATED WITH WATER BROWN, WATER SATURATED SILT LAB SAMPLE SATURATED	5
50	11	2	1.8	0.8	SP	BROWN (7.5YR4/4) SILTY VERY FINE TO FINE GRAINED WELL SORTED SAND WITH 1–2CM THICK SILT LENSES SILT 20–30% WHEN WITH SANDS 80–90% IN LENSES WATER SATURATED	9
55	12	2	1.0	0.6	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND 1–2% 0.25–0.5 BLACK TO GREY BASALT PEBBLES, ANGULAR TO SUB-ROUND	10
60	13	2	1.4	0.3	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND	52

WATER LEVEL:	BORING STARTED: 7–11–91	BORING COMPLETED: 7–11–91	REMARKS: MUD ROTARY DRILLING FROM 50'–70'
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

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FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 3 of 3
BORING NUMBER–LOCATION: SB–4		DATE: 10–11–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT) 10 20 30 40 50
65	14	2	1.8	0.3	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND SATURATED WITH WATER	59
70	15	2	1.8	0.0	SP	BROWN (7.5YR4/4) VERY FINE TO FINE GRAINED WELL ROUNDED, WELL SORTED SAND LAB SAMPLE SATURATED WITH WATER	54
						END OF BORING AT 71'	
75							
80							
85							
90							

WATER LEVEL:	BORING STARTED: 7–11–91	BORING COMPLETED: 7–11–91	REMARKS:
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

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FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: **HOLE DIAMETER:** 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 1 of 2
BORING NUMBER–LOCATION: SB–5: 15' NORTH SIDE OF ALLEY BEHIND HORTON MFG. GARAGE BETWEEN PIKE & STURGEON AVE		**DATE:** 6–16–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT)
				0.3		BROWN SANDY SILT AND CLAY TOPSOIL WITH ROOTLETS AND ORGANIC MATERIAL GRASS AT SURFACE	
5	1	2	1.5	0.0	CL	LIGHT BROWNISH-GREY (10YR6/2) TO BROWN (7.5YR5/4) MOTTLED CLAY WITH 1-2% LOCAL FINE TO MEDIUM GRAINED BLACK SAND. LOCAL WEAK RED (10YR5/4) STREAKS PRESENT. ROOTLETS, 1-2% DECAYED	6
					SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED AND WELL ROUNDED SAND. SANDY CLAY TRANSITION ZONE FROM 5'6" TO 5'9"	
10	2	2	1.5	0.2	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED, WELL ROUNDED SAND: 2-3% COARSE SAND GRAINS PRESENT	27
15	3	2	1.7	0.1	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED, WELL ROUNDED SAND	36
20	4	2	1.7	0.1	SP	BROWN (7.5YR4/4) FINE TO MED GRAINED WELL SORTED SAND BROWN (7.5YR4/4) MEDIUM TO COARSE GRAINED WELL SORTED MODERATELY TO WELL ROUNDED SAND	14
25	5	2	1.8	0.2	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND.	46

Standard penetration scale: 10, 20, 30, 40, 50

WATER LEVEL:	**BORING STARTED:** 6–26–91	**BORING COMPLETED:** 6–26–91	**REMARKS:**
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura		**SIGNED:**

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FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: **HOLE DIAMETER:** 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 2 of 2
BORING NUMBER-LOCATION: SB-5		**DATE:** 6-16-91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT)
	6	2	1.8	0.0	SP	BROWN (7.5YR4/4) MEDIUM TO COARSE GRAINED SAND	16
						BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND; TRACE <0.5CM PEBBLES	
35	7	2	1.8	0.0	SP	BROWN (7.5YR4/4) FINE TO MED GRAINED WELL SORTED, WELL ROUNDED SAND; TRACE 0.3-0.5CM PEBBLES WATER AT 34' LAB SAMPLE WET	9
						END OF BORING	
40							
45							
50							
55							
60							

Standard penetration scale: 10, 20, 30, 40, 50

WATER LEVEL:	**BORING STARTED:** 6-26-91	**BORING COMPLETED:** 6-26-91	**REMARKS:**
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura		**SIGNED:**

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: **HOLE DIAMETER:** 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 1 of 2
BORING NUMBER–LOCATION: SB–6: BEHIND POST OFFICE ON SOUTH SIDE OF ALLEY		**DATE:** 6–26–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT)
					MH	RED BROWN SILTY-CLAY-SAND WITH GRAVEL BLACK SANDY SILT AND CLAY FILL	
5	1	2	1.3	0.3	CL	RED-BROWN SANDY SILT AND CLAY FILL LIGHT BROWNISH GREY (10YR6/2) TO DARK GREYISH BROWN (10YR4/2) MOTTLED CLAY WITH 1-2% LOCAL FINE GRAINED BLACK SAND, WEAK RED STREAKS PRESENT	13
10	2	2	1.5	1.0	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND	28
15	3	2	1.5	0.3	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND	26
20	4	2	1.6	0.3	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND; 1% 0.5-1.0CM ROUNDED PEBBLES	17
25	5	2	1.8	1.8	SP	BROWN(7.5YR4/4) MED-COARSE GRAINED WELL ROUNDED WELL SORTED SAND WITH 2% 1-2CM PEBBLES AT BASE BROWN (7.5YR4/4) FINE-MED GRAINED WELL SORTED WELL ROUNDED SAND	16
30					SP	BROWN(7.5YR4/4) MED-COARSE GRAINED WELL ROUNDED WELL SORTED SAND WITH 3-5% 0.5-1.0CM PEBBLES AT BASE	17

WATER LEVEL:	**BORING STARTED:** 6–26–91	**BORING COMPLETED:** 6–26–91	**REMARKS:**
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura		**SIGNED:**

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FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 2 of 2
BORING NUMBER–LOCATION: SB–6		DATE: 6–26–91

SURFACE ELEVATION

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL	⊗ STANDARD PENETRATION (BLOWS/FT)
	6	2	1.8	0.1	SP	BROWN (7.5YR4/4) MED-COARSE GRAINED WELL SORTED WELL ROUNDED SAND WITH 3-5% 0.5-1.0CM WELL ROUNDED PEBBLES	17
35	7	2	1.8	2.7	SP	BROWN (7.5YR4/4) FINE TO MED GRAINED WELL SORTED WELL ROUNDED SAND WITH TRACE 0.5-1.0 CM PEBBLES SATURATED LAB SAMPLE	32
						END OF BORING	
40							
45							
50							
55							
60							

Standard penetration scale: 10, 20, 30, 40, 50

WATER LEVEL:	BORING STARTED: 6–26–91	BORING COMPLETED: 6–26–91	REMARKS:
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

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FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 1 of 3
BORING NUMBER–LOCATION: SB-7: NESTED WELLS 91-5A & 91-5B ON NORTH SIDE MAIN ST, CORNER OF MAIN & STURGEON IN FRONT OF ANTIQUE STORE		DATE: 7-16-91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	⊗ STANDARD PENETRATION (BLOWS/FT)
						6" BLACKTOP	
	1	2	1.8	0.5	SP	DARK REDDISH BROWN (5YR3/4) FINE TO MED GRAINED SAND WITH GRAVEL FILL GRAVEL 5-15%, 0.5-2CM DIA	
		2	1.9	0.0	SP	LIGHT BROWN (7.5YR6/4) FINE TO MED GRAINED SAND FILL WITH TRACE CLAY	11
5	2	2	2.0	0.0	CL SP	GREYISH BROWN (2.5YR5/2) CLAY REDDISH BROWN (5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND TRACE 2% CLAY	26
		2	1.8	0.4			28
10	3	2	1.8	0.2		BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND LAB SAMPLE	18
		2	1.7	0.2			16
		2	1.8	0.3			19
15	4	2	1.7	0.2	SP		18
		2	1.8	0.3			19
20	5	2	2	0.1		BROWN (7.5YR4/4) FINE TO MED GRAINED WELL ROUNDED WELL SORTED SAND WITH TRACE 1% 0.2-0.4 CM PEBBLES	24
		2	1.8	0.3	SP	BROWN (7.5YR4/4) FINE TO COARSE GRAINED WELL ROUNDED SAND GRADATIONAL CONTACT WITH ABOVE COARSE SAND GRAINS 5-10%	22
		2	1.7	0.4	SP	BROWN (7.5YR4/4) FINE TO MED GRAINED WELL ROUNDED WELL SORTED SAND	20
25	6	2	1.8	0.0	SP	BROWN (7.5YR4/4) FINE GRAINED WELL ROUNDED WELL SORTED SAND	13
		2	1.8	0.1	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND	10
30	7	2	1.8	0.2	SP	BROWN (7.5YR4/4) INTERBEDDED FINE TO MED GRAINED WELL ROUNDED WELL SORTED SAND WITH MED TO COARSE GRAINED MODERATELY WELL ROUNDED SAND AND GRAVEL, BEDS 6" THICK	7

WATER LEVEL:	BORING STARTED: 7-16-91	BORING COMPLETED: 7-18-91	REMARKS: 91-5A SCREEN @ 30-40' 91-5B SCREEN @ 65-70'
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: **HOLE DIAMETER:** 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 2 of 3
BORING NUMBER–LOCATION: SB-7		**DATE:** 7-16-91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT)
		2	2	0.3	SP	BROWN (7.5YR4/4) INTERBEDDED FINE TO MED GRAINED WELL ROUNDED WELL SORTED SAND WITH MED TO COARSE GRAINED MODERATELY WELL ROUNDED SAND AND GRAVEL INDIVIDUAL BEDS 6" THICK	6
	8	2	1.8	0.1		BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND LAB SAMPLE 38'-40'	5
35		2	1.4	0.9			3
		2	1.8	1.4			8
	9	2	2	2.6			17
40		2	1.3	7.0			38
	10	2	1.0	1.0	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND WITH TRACE 1% DARK BROWN TO BLACK SAND PATCHES 0.2-0.5CM DIAMETER	49
45	11	2	1.8	1.7			25
	12	2	1.9	6.5		BROWN (7.5YR4/4) FINE TO MED GRAINED WELL ROUNDED WELL SORTED SAND WITH TRACE -1% BLACK TO WHITE COARSE SAND / SM PEBBLES 0.1-0.2CM DIA	49
		2	1.5	8.4		BROWN (7.5YR4/4) FINE-MED GRAINED WELL ROUNDED WELL SORTED SAND WITH TRACE TO 2% 0.1-0.3CM PEBBLES; 1-2% COARSE SAND	33
50	13	2	1.6	4.1		BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND WITH TRACE COARSE SAND. NO PEBBLES	28
	14	2	1.5	1.6			21
55		2	1.2	5.6		BROWN (7.5YR4/4) FINE-MED GRAINED WELL ROUNDED WELL SORTED SAND WITH 1-3% COARSE SAND	34
	15	2	1.8	3.2	SP	BROWN (7.5YR4/4) FINE TO MEDIUM SAND WITH 3-5% 0.5-0.7CM ROUNDED PEBBLES	45
60		2	1.6	9.7	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED ROUNDED ROUNDED WELL SORTED SAND	65

WATER LEVEL:	**BORING STARTED:** 7-16-91	**BORING COMPLETED:** 7-18-91	**REMARKS:** MUD ROTARY DRILLING BELOW 40'0"
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura		**SIGNED:**

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: **HOLE DIAMETER:** 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 3 of 3
BORING NUMBER–LOCATION: SB–7		**DATE:** 7–16–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT) 10 20 30 40 50
	16,17	2	1.9	10.5		BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND LAB SAMPLE 60'–62'	66
	17	2	1.7	15.0			69
65	18	2	1.7	20.0	SP	LAB SAMPLE 64'–66'	76
		2	1.6	19.0			69
	19	2	1.8	5.0			34
70						END OF BORING	
75							
80							
85							
90							

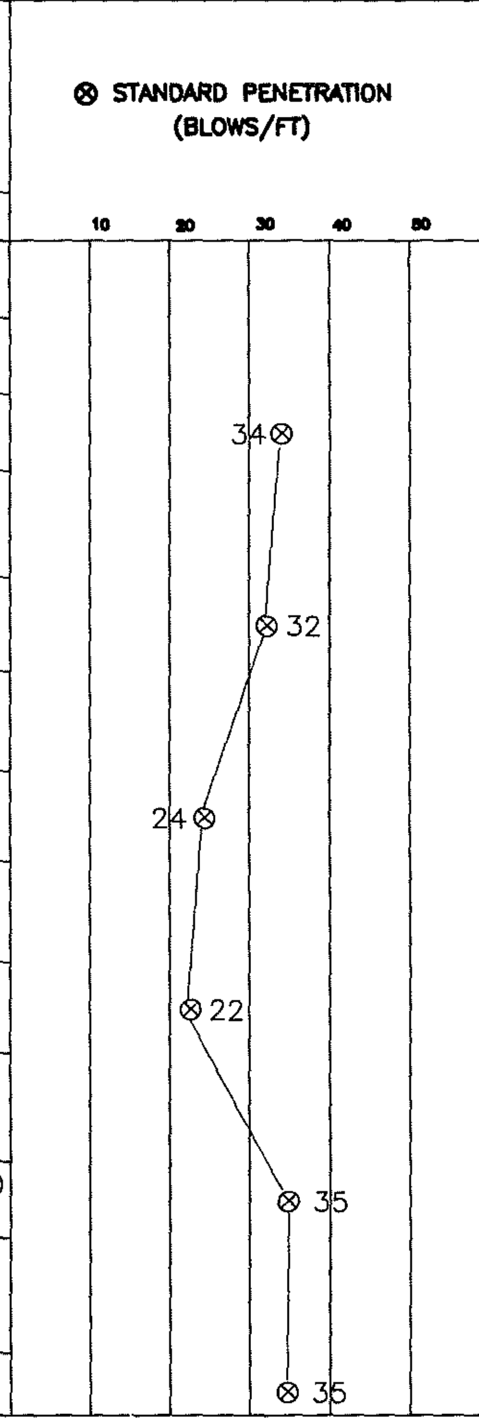
WATER LEVEL:	**BORING STARTED:** 7–16–91	**BORING COMPLETED:** 7–18–91	**REMARKS:**
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura		**SIGNED:**

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: **HOLE DIAMETER:** 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 1 of 2
BORING NUMBER–LOCATION: SB–8: WELL 91–4 ON SOUTH SIDE OF MAIN ST BETWEEN PIKE & STURGEON IN FRONT OF BIKE SHOP		**DATE:** 7–08–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL SURFACE ELEVATION
				3.9	SP	6" BLACKTOP BROWN COARSE SAND AND GRAVEL FILL TRACE SILT
					CL	LIGHT BROWNISH GREY (10YR6/2) TO WEAK RED (10YR5/4) MOTTLED CLAY & SILT
5	1	2	1.8	4.3	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND
10	2	2	1.8	4.6	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND, TRACE COARSE SAND ODD 0.5–1.0CM PEBBLES
15	3	2	1.8	4.7	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND, TRACE COARSE SAND ODD 0.5–1.0CM PEBBLES
20	4	2	1.7	4.7	SP	BROWN (7.5YR4/4) MEDIUM TO COARSE GRAINED WELL ROUNDED WELL SORTED SAND WITH 5–10% GRAVEL 0.5–1.5CM DIA.
25	5	2	1.8	4.1	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND
30	6	2	1.8	3.5	SP	BROWN (7.5YR4/4) MEDIUM TO COARSE GRAINED WELL ROUNDED WELL SORTED SAND



WATER LEVEL:	**BORING STARTED:** 7–08–91 **BORING COMPLETED:** 7–09–91	**REMARKS:** MICROTIP PID USED TO MONITOR SAMPLES INSTEAD OF OVA– OVA WOULD NOT CALIBRATE WELL 91–4: SCREEN AT 30'–40'
	LOGGED BY: George Hudak/RREM,Inc.	
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura	**SIGNED:**

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: **HOLE DIAMETER:** 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 2 of 2
BORING NUMBER–LOCATION: SB–8		**DATE:** 7–08–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT) 10 20 30 40 50
35	7	2	0.9	3.2	SP	BROWN (7.5YR4/4) MEDIUM TO COARSE GRAINED WELL ROUNDED WELL SORTED SAND LAB SAMPLE SATURATED	⊗ 16
	8				SP	BROWN (7.5YR4/4) FINE–MED GRAINED WELL ROUNDED WELL SORTED SAND TRACE 1% COARSE GRAINED SAND	
40						END OF BORING	
45							
50							
55							
60							

WATER LEVEL:	**BORING STARTED:** 7–08–91	**BORING COMPLETED:** 7–09–91	**REMARKS:** WELL 91–4: SCREENED 30'–40'
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura		**SIGNED:**

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 1 of 3
BORING NUMBER–LOCATION: SB-9: WELL 91-3 APPROXIMATELY 300' SOUTH OF MAIN ST ON PIKE AVE		**DATE:** 7-22-91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	⊗ STANDARD PENETRATION (BLOWS/FT)
				1.0	SM	BLACK SANDY SILT TOPSOIL, TRACE CLAY; 3-5% ROOTLETS; DAMP	
	1	2	1.8	0.3	SM	YELLOWISH RED (5YR5/8) SILTY SAND WITH TRACE CLAY	6
5	2	2	1.8	1.7	CL	LIGHT BROWNISH GREY (10YR6/2) SILT & CLAY WITH YELLOWISH RED (5YR5/6) MOTTLING	25
					SM	YELLOWISH RED (5YR5/6) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND WITH LOCAL CONCENTRATIONS OF CLAY; CLAY 2-5%	
		2	1.8	8.5	SP	REDDISH BROWN (5YR4/4) FINE TO MEDIUM GRAINED SAND W/ 1% CLAY; MOIST; GRADATIONAL LOWER CONTACT	57
10	3	2	1.7	2.0	SP	REDDISH BROWN (5YR4/4) FINE TO MEDIUM GRAINED SAND WITH TRACE CLAY 1-2%; 0.2-0.4CM PEBBLES; MOIST; LAB SAMPLE	36
		2	1.8	0.7			34
	4	2	1.8	1.1	SP	REDDISH BROWN (5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND NO CLAY; DRY	24
15	5	2	1.9	0.2			27
		2	1.8	0.3	SP	REDDISH BROWN (5YR4/4) FINE GRAINED WELL SORTED WELL ROUNDED SAND	33
						DUSKY RED (10YR3/3) HARD SILTSTONE FRAGMENTS	
20	6	2	2.0	0.1	SP	REDDISH BROWN (5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND; 18'-21' MAINLY MG SAND, 1-3% FG SAND, TRACE PEBBLES 0.2-0.4CM	17
		2	1.8	0.3	SP	REDDISH BROWN (5YR4/4) MEDIUM TO COARSE GRAINED WELL ROUNDED MODERATELY SORTED SAND; 3-5% COARSE SAND WITH 1% 0.2-0.3CM WELL ROUNDED WHITE TO BLACK PEBBLES	19
		2	2.0	0.2			24
25	7	2	1.9	0.1	SP	REDDISH BROWN (5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND; TRACE COARSE SAND	25
		2	1.8	0.4			30
30	8	2	1.9	0.0			17

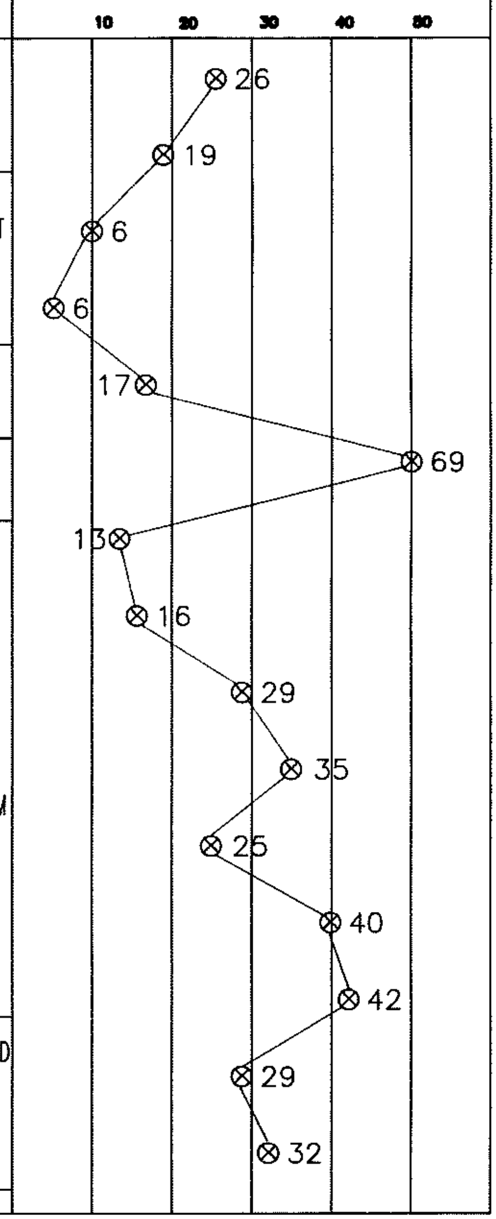
WATER LEVEL:	**BORING STARTED:** 6-26-91	**BORING COMPLETED:** 6-26-91	**REMARKS:** WELL 91-3 SCREEN @ 35-60'
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura		**SIGNED:**

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: **HOLE DIAMETER:** 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 2 of 3
BORING NUMBER-LOCATION: SB-9		**DATE:** 7-22-91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	STANDARD PENETRATION (BLOWS/FT)
		2	1.8	0.2	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND; TRACE COARSE SAND LAB SAMPLE SATURATED	26
▼	9	2	1.8	0.0			19
35		2	0.6	0.0	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED SAND WITH 1-2% COARSE SAND. WET, GRADATIONAL CONTACT WITH ABOVE. SAND WELL ROUNDED, WELL SORTED	6
	10	2	1.0	0.1			6
40		2	1.3	0.4	SP	BROWN (7.5YR4/4) WELL ROUNDED WELL SORTED FINE TO COARSE GRAINED SAND (5-10%); WET	17
	11	2	1.8	9.6	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND MAINLY FINE GRAINED SAND WITH 5% MEDIUM GRAINED SAND; LAB SAMPLE	69
		2	1.2	1.6	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED SAND, 0.1-1CM REDDISH BROWN SILTSTONE PEBBLE PRESENT MORE MEDIUM GRAINED SAND THAN ABOVE	13
45	12	2	1.6	0.3			16
		2	1.2	5.0		46'-48' TRACE COARSE SAND	29
	13	2	1.2	1.6		48'-52' 1-2% COARSE SAND; MATRIX MAINLY MEDIUM GRAINED SAND TRACE 0.1-0.2CM PEBBLES, ROUNDED	35
50		2	1.4	8.8			25
	14	2	1.8	1.2		53'-53'6" 5% 0.1-0.2CM FLATTENED PEBBLES	40
55		2	1.6	11.0			42
	15	2	1.7	4.0	SP	BROWN (7.5YR4/4) VERY FINE GRAINED TO FINE GRAINED WELL ROUNDED WELL SORTED SAND SATURATED	29
60		2	1.8	2.8		59'-59'3" 3% 0.2-0.3MM OVAL TO ROUNDED BLACK PEBBLES	32



WATER LEVEL:	**BORING STARTED:** 7-22-91	**BORING COMPLETED:** 7-24-91	**REMARKS:** MUD ROTARY DRILLING BELOW 38'
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura		**SIGNED:**

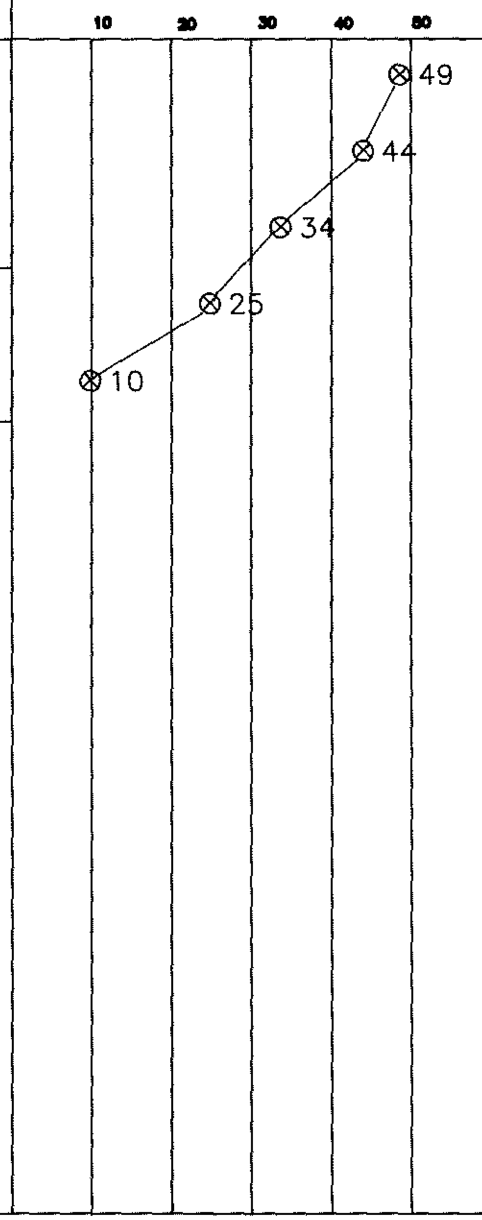
RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 3 of 3
BORING NUMBER–LOCATION: SB–9		DATE: 7–22–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION
	16	2	2.0	2.2	MH	BROWN (7.5YR5/2) SILT WITH TRACE VERY FINE SAND SATURATED 63'0"–63'3" TRACE REDDISH BROWN CLAY IN LENSES LAB SAMPLE 60–'62'
		2	1.9	1.2		
65	17	2	2.0	0.2		
		2	1.0	1.6	SP	(7.5YR5/2) VERY FINE TO FINE SAND WITH TRACE 2% SILT: SILT CONTENT DECREASES WITH DEPTH WET SAME COLOR AS SILT UNIT; LAB SAMPLE 68'–70'
	18	2	2.0	0.8		
70						END OF BORING
75						
80						
85						
90						

⊗ STANDARD PENETRATION (BLOWS/FT)



WATER LEVEL:	BORING STARTED: 7–22–91	BORING COMPLETED: 7–24–91	REMARKS:
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 1 of 2
BORING NUMBER–LOCATION: SB–10: ON RAILROAD GRADE APPROX 300' EAST OF MUNICIPAL BLDG		DATE: 6–25–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT)
	1			0.9	SM	BROWNISH-BLACK MOTTLED FINE SANDY SILT AND CLAY FILL	
					CL	DARK GREYISH BROWN (10YR4/2) MOTTLED CLAY WITH 2-3% BLACK SAND LOCAL WEAK RED (10YR5/4) STREAKS PRESENT	
5	2	2	2	0.0	SP	BROWN (7.5YR4/4) FINE TO MED GRAINED WELL SORTED WELL ROUNDED SAND	12
10	3	2	2	0.8	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED AND WELL ROUNDED SAND; MOIST	18
15	4	2	1.9	0.4	SP	BROWN (7.5YR4.4) FINE TO MED GRAINED WELL SORTED WELL ROUNDED SAND SLIGHTLY COARSER GRAINED 14'0"-14'6"	12
20	5	2	1.5	0.0	SP	BROWN (7.5YR4/4) FINE TO MED GRAINED WELL SORTED WELL ROUNDED SAND; MED TO COARSE GRAINED SAND LENS @ 19'6"-20'6" TRACE 0.5-1.0CM ROUNDED PEBBLES	18
25	6	2	1.5	0.0	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND TRACE 0.5-1.0CM WELL ROUNDED NORTH SHORE VOLCANIC PEBBLES (PORPHYRITIC RHYOLITE)	20
30	7	2	1.6	0.4	SP	BROWN (7.5YR4/4) FINE GRAINED TO MED GRAINED WELL SORTED WELL ROUNDED SAND	46

WATER LEVEL:	BORING STARTED: 6–25–91	BORING COMPLETED: 6–25–91	REMARKS:
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: **HOLE DIAMETER:** 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 2 of 2
BORING NUMBER–LOCATION: SB–10		**DATE:** 6–25–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT) 10 20 30 40 50
	7	2	1.6	0.4	SP	BROWN (7.5YR4/4) FINE GRAINED TO MED GRAINED WELL SORTED WELL ROUNDED SAND	46
35	8	2	1.5	0.1	SP	BROWN (7.5YR4/4) FINE–MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND; 1–2% MEDIUM–COARSE GRAINED SAND-SIZED BLACK BASALT FRAGMENTS. LAB SAMPLE	29
						END OF BORING	
40							
45							
50							
55							
60							

WATER LEVEL:	**BORING STARTED:** 6–25–91 / **BORING COMPLETED:** 6–25–91	**REMARKS:**
	LOGGED BY: George Hudak/RREM,Inc.	
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura	**SIGNED:**

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 1 of 2
BORING NUMBER–LOCATION: SB-11: 100' EAST OF LARGE STORAGE TANK ON RAILROAD GRADE		DATE: 6-25-91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT)
	1			2.0	SM	VERY DARK GREY (10YR3/1) TO LIGHT BROWNISH GREY (10YR6/2) SANDY SILT AND CLAY FILL WITH GRAVEL. SURFACE MATERIAL IS GRAVEL WITH 0.5-5.0CM WELL ROUNDED PEBBLES	
5	2	2	1.4	0.0	CL	DARK GREYISH BROWN (10YR4/2) TO LIGHT BROWNISH GREY (10YR6/2) MOTTLED CLAY WITH 1-2% FINE GRAINED BLACK SAND	13
					SP	5'10"-6'0" BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND	
10	3	2	1.5	0.1	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND	31
15	4	2	1.3	0.0	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND	29
20	5	2	1.5	0.1	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND LOCAL MEDIUM TO COARSE GRAINED SAND LENSES	22
25	6	2	1.5	0.0	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND	23
30							

Standard penetration scale: 10 20 30 40 50

WATER LEVEL:	BORING STARTED: 6-25-91	BORING COMPLETED: 6-25-91	REMARKS:
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 2 of 2
BORING NUMBER–LOCATION: SB–11		DATE: 6–25–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT) 10 20 30 40 50
	7	2	1.8	0.0	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND COARSE SAND WITH GRAVEL CONSISTING OF 0.5–2.0CM ROUNDED NORTH SHORE VOLCANIC PEBBLES (RHYOLITE)	15
36	8	2	1.5	0.3	SP	BROWN (7.5YR4/4) FINE TO MED GRAINED WELL SORTED WELL ROUNDED SAND SATURATED FROM 35'–36' LAB SAMPLE	13
						END OF BORING	
40							
45							
50							
55							
60							

WATER LEVEL:	BORING STARTED: 6–25–91	BORING COMPLETED: 6–25–91	REMARKS:
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GMF/Jamie Tuura		SIGNED:

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 1 of 2
BORING NUMBER–LOCATION: SB–12: NW CORNER MAIN & MINNOW		DATE: 6–19–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT)
						SAND (FILL)	
5	1	2	2	0.0	SP	BROWN (7.5YR4/4) MED–FINE GRAINED WELL ROUNDED AND WELL SORTED SAND	5
10	2	2	2	1.5	SP	BROWN (7.5YR4/4) MED–FINE GRAINED WELL ROUNDED WELL SORTED SAND, TRACE FINE GRAVEL LAB SAMPLE	30
15	3	2	2	0.0	SP	BROWN (7.5YR4/4) MED–FINE GRAINED WELL ROUNDED AND WELL SORTED SAND	11
20	4	2	2	0.3	SP	BROWN (7.5YR5/5) FINE GRAINED WELL ROUNDED WELL SORTED SAND WITH PARALLEL BEDDING. THIN 2" COARSE GRAINED WELL ROUNDED WELL SORTED SAND LENS	34
25	5	2	2	0.0	SP	BROWN (7.5YR4/4) MED–FINE GRAINED WELL ROUNDED AND WELL SORTED SAND	14
30							

WATER LEVEL:	BORING STARTED: 6–19–91	BORING COMPLETED: 6–19–91	REMARKS:
	LOGGED BY: Brian Hayden/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 2 of 2
BORING NUMBER–LOCATION: SB–12		DATE: 6–19–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	⊗ STANDARD PENETRATION (BLOWS/FT)
	6	2	2	0.0	SP	BROWN (7.5YR4/4) MEDIUM GRAINED SAND WELL ROUNDED AND SORTED WITH 2" COARSE GRAINED LENS	16
35	7	2	2	0.0	SP	BROWN (7.5YR4/4) MED GRAINED WELL ROUNDED WELL SORTED SAND SATURATED LAB SAMPLE	10
						END OF BORING	
40							
45							
50							
55							
60							

WATER LEVEL:	BORING STARTED: 6–19–91	BORING COMPLETED: 6–19–91	REMARKS:
	LOGGED BY: Brian Hayden/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

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FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 1 of 2
BORING NUMBER-LOCATION: SB-13: MUNICIPAL BUILDING DRIVEWAY APPROX. HALFWAY BETWEEN MUNICIPAL WELLS 1 & 3		DATE: 6-24-91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL	⊗ STANDARD PENETRATION (BLOWS/FT)
						SURFACE ELEVATION	
				0.0	MH	2" LOOSE GRAVEL DRIVEWAY FILL, RED-BROWN FINE TO MEDIUM GRAINED SANDY-SILTY CLAY FILL	
					CL	LIGHT BROWNISH GREY (10YR6/2) TO DARK GREYISH BROWN (10YR4/2) MOTTLED SILT & CLAY	
5	1	2	1.5	0.0	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND	18
10	2	2	1.5	0.0	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND	25
15	3	2	2	0.4	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND	12
20	4	2	1.3	0.2	SP	BROWN(7.5YR4/4)MED TO COARSE GRAINED WELL SORTED WELL ROUNDED SAND COARSE GRAINED SAND LENS @ 20'-20'2"	12
25	5	2	1.6	1.2	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND	10
30							

WATER LEVEL:	BORING STARTED: 6-24-91	BORING COMPLETED: 6-24-91	REMARKS:
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

RREM Inc. consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 2 of 2
BORING NUMBER–LOCATION: SB–13		DATE: 6–24–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT) 10 20 30 40 50
	6	2	1.6	0.4	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND WITH 1-2% 1-3CM WELL ROUNDED PEBBLES	17
35	7	2	1.6	1.0	SP	BROWN (7.5YR4/4) FINE TO MED GRAINED WELL SORTED WELL ROUNDED SAND; SATURATED; LAB SAMPLE	10
						END OF BORING	
40							
45							
50							
55							
60							

WATER LEVEL:	BORING STARTED: 6–24–91	BORING COMPLETED: 6–24–91	REMARKS:
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

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FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 1 of 2
BORING NUMBER–LOCATION: SB–14: WELL 91–1 WEST OF FERRELLGAS ON MINNOW		DATE: 6–19–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	⊗ STANDARD PENETRATION (BLOWS/FT)
					CL	DARK YELLOWISH BROWN (10YR4/4) SILTY CLAY	
5	1	2	2	1.3	SP	BROWN (7.5YR4/4) MED GRAINED WELL SORTED WELL ROUNDED SAND	27
10	2	2	2	0.5	SP	BROWN (7.5YR4/4) MED GRAINED WELL SORTED WELL ROUNDED SAND	29
15	3	2	2	0.5	SP	BROWN (7.5YR4/4) COARSE GRAINED ROUNDED SORTED SAND	27
20	4	2	2	0.7	SP	BROWN (7.4YR4/4) COARSE GRAINED ROUNDED SORTED SAND WITH TRACE (2CM) FINE GRAVEL CLAST SANDSTONE & SILTSTONE	16
25	5	2	2	0.0	SP	BROWN (7.5YR4/4) COARSE GRAINED ROUNDED & SORTED SAND	26
30							

WATER LEVEL:	BORING STARTED: 6–19–91	BORING COMPLETED: 6–19–91	REMARKS: Well 91–1 Screen @ 30–40'
	LOGGED BY: Brian Hayden/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

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FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 2 of 2
BORING NUMBER–LOCATION: SB–14		DATE: 6–19–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	STANDARD PENETRATION (BLOWS/FT)
	6	2	2	2.5	SP	BROWN (7.5YR4/4) COARSE GRAINED ROUNDED AND SORTED SAND WITH 2" LENS OF FINE SAND WITH THIN PARALLEL BEDDING	20
35	7	2	2	3.5	SP	BROWN (7.5YR4/4) FINE GRAINED WELL ROUNDED WELL SORTED SAND SATURATED LAB SAMPLE	20
40	8	2	2	2.9	SP	BROWN (7.5YR4/4) MED GRAINED WELL ROUNDED WELL SORTED SAND SATURATED	49
						END OF BORING	
45							
50							
55							
60							

WATER LEVEL:	BORING STARTED: 6–19–91	BORING COMPLETED: 6–19–91	REMARKS:
	LOGGED BY: Brian Hayden/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

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FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 1 of 2
BORING NUMBER—LOCATION: SB—15: MINNOW & ELM		DATE: 6—18—91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	⊗ STANDARD PENETRATION (BLOWS/FT)
	1				SP	DARK REDDISH BROWN (5YR3/3) MED GRAINED WELL SORTED WELL ROUNDED SAND DAMP WITH TRACE SILT	
5	2	2	1.5		CL	PUSHED SHELBY TUBE CUTTINGS SILTY CLAY	
10	3	2	2	0.8	SP	BROWN (7.5YR4/4) MEDIUM TO FINE GRAINED WELL ROUNDED WELL SORTED SAND	15
15	4	2	2	0.9	SP	BROWN (7.5YR4/4) MEDIUM TO FINE GRAINED WELL ROUNDED WELL SORTED SAND	13
20	5	2	2	0.3	SP	BROWN (7.5YR4/4) MEDIUM TO FINE GRAINED WELL ROUNDED WELL SORTED SAND	5
25	6	2	2	0.6	SP	BROWN (7.5YR4/4) COARSE GRAINED WELL ROUNDED WELL SORTED SAND	12
30							

WATER LEVEL:	BORING STARTED: 6—18—91	BORING COMPLETED: 6—18—91	REMARKS:
	LOGGED BY: Brian Hayden/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

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FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 2 of 2
BORING NUMBER–LOCATION: SB–15		DATE: 6–18–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	⊗ STANDARD PENETRATION (BLOWS/FT)
	7	2	2	0.3	SP	BROWN (7.5YR4/4) MEDIUM TO FINE GRAINED WELL ROUNDED WELL SORTED SAND	⊗14
35	8	2	2		SP	BROWN (7.5YR4/4) COARSE GRAINED SUB ROUNDED-SORTED SAND SATURATED LAB SAMPLE	⊗16
						END OF BORING	
40							
45							
50							
55							
60							

WATER LEVEL:	BORING STARTED: 6–18–91	BORING COMPLETED: 6–18–91	REMARKS:
	LOGGED BY: Brian Hayden/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

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FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: **HOLE DIAMETER:** 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 1 of 3
BORING NUMBER–LOCATION: SB–16: WELL 91–7 ON MUSKEY AVE 20' SOUTH OF ALLEY (BETWEEN ALLEY & FIRE STATION DRIVEWAY)		**DATE:** 6–16–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT)
		2	2.0	0.8		6" BLACKTOP BROWN (7.5YR4/2) SILTY SAND AND GRAVEL FILL	
					CL	LIGHT BROWNISH GREY (10YR6/2) SILT & CLAY, 5% WEAK RED (10YR4/4) MOTTLING, TRACE BLACK DECAYED ORGANICS	
5	1	2	2.0	1.2	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND, TRACE COARSE SAND LAB SAMPLE	33
					SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL SORTED WELL ROUNDED SAND, TRACE GRAVEL PRIMARILY MEDIUM GRAINED SAND	
10	2	2	1.7	0.5			24
					SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND, PRIMARILY FINE SAND WITH 5–10% MEDIUM GRAINED SAND	
15	3	2	2.0	0.8	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND; TRACE COARSE SAND	15
					SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND	
20	4	2	1.9	0.2			16
					SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED SAND; TRACE GRAVEL (9.3–1.0CM DIA) 2–3% COARSE SAND	
					SP	BROWN (7.5YR4/4) FINE TO MED GRAINED SAND WITH 1–3% COARSE SAND AND FINE PEBBLES(0.2–0.3CM DIA)	
25	5	2	1.9	0.3			55
					SP	BROWN (7.5YR4/4) FINE BEDDED SAND BLACK SUB–1MM WIDE LAMINATIONS DEFINE BEDDING	
30	6	2	1.8	0.4	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND	35

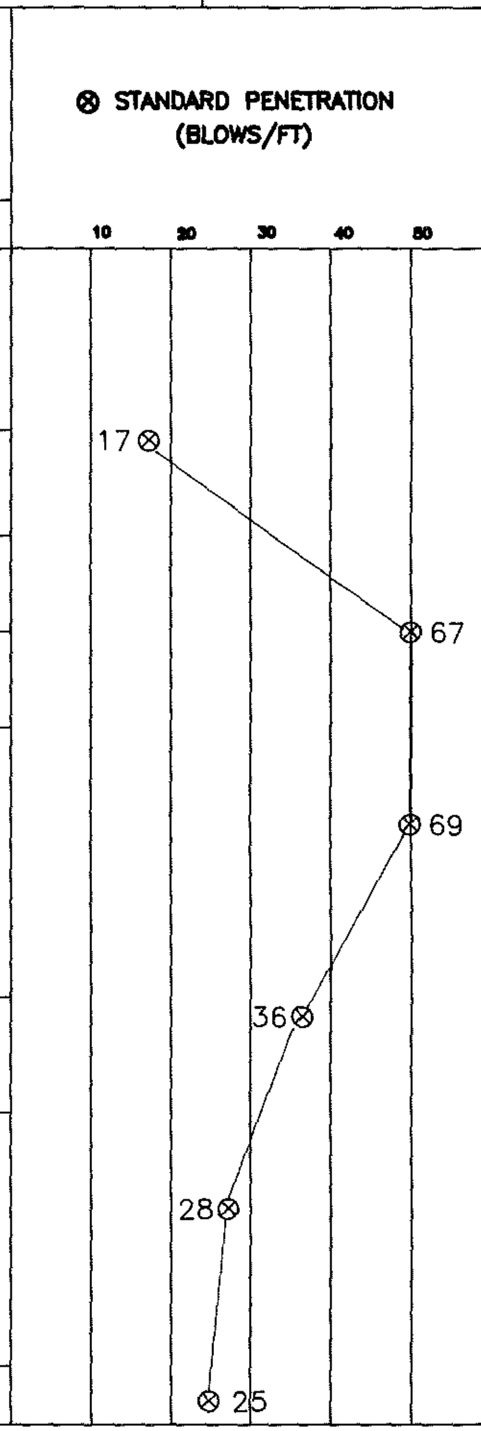
WATER LEVEL:	**BORING STARTED:** 8–05–91	**BORING COMPLETED:** 8–05–91	**REMARKS:** MUD ROTARY DRILLING BELOW 41' WELL 91–7 SCREEN @ 65'–70'
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura		**SIGNED:**

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: **HOLE DIAMETER:** 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 2 of 3
BORING NUMBER–LOCATION: SB–16		**DATE:** 8–05–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION
					SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND
35	7	2	1.9	1.2	SP	BROWN (7.5YR4/4) FINE GRAINED BEDDED WELL ROUNDED WELL SORTED SAND WITH TRACE 3% MED SAND. BLACK SUB 1-MM LAMINAE DEFINE BEDDING
					SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND: PRIMARILY FINE SAND
40	8	2	1.9	3.2	SP	BROWN (7.5YR4/4) FINE GRAINED WELL ROUNDED WELL SORTED SAND WITH TRACE COARSE SAND AND FINE GRAVEL (0.2-0.3CM DIA)
45	9	2	1.4	1.6	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND LAB SAMPLE 44'-46'
50	10	2	1.2	4.5	SP	BROWN (7.5YR4/4) COARSE GRAINED WELL ROUNDED WELL SORTED SAND, 6" DIA BOULDER
55	11	2	1.1	2.4	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND
60	12	2	1.2	0.4	SP	BROWN (7.5YR4/4) VERY FINE TO FINE WELL ROUNDED WELL SORTED SAND WITH UP TO 5% SILT LENSES



WATER LEVEL:	**BORING STARTED:** 8–05–91	**BORING COMPLETED:** 8–05–91
	LOGGED BY: George Hudak/RREM,Inc.	**REMARKS:** MUD ROTARY DRILLING BELOW 41'
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura	**SIGNED:**

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 3 of 3
BORING NUMBER–LOCATION: SB-16		DATE: 8-05-91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT) 10 20 30 40 50
					SP	SEE DESCRIPTION ABOVE	
65	13	2	1.3	4.0	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND WITH TRACE SILT	45
					SP	BROWN (7.5YR4/4) VERY FINE TO FINE GRAINED SAND WITH 2-3% SILTY LENSES AND TRACE MEDIUM SAND LAB SAMPLE	
70	14	2	1.6	0.9	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND	32
75						END OF BORING	
80							
85							
90							

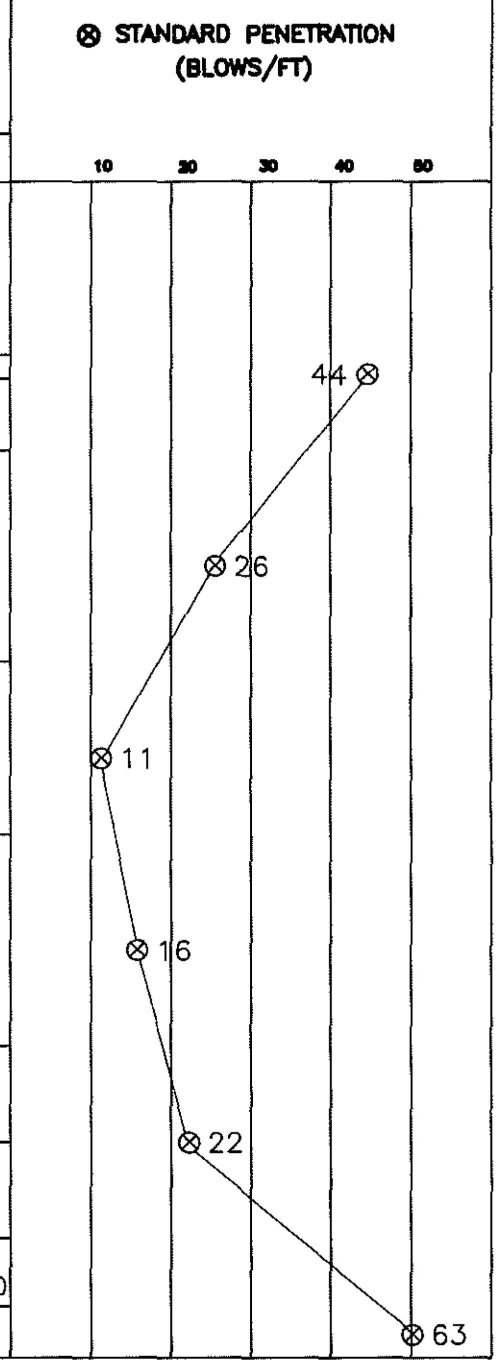
WATER LEVEL:	BORING STARTED: 8-05-91	BORING COMPLETED: 8-05-91	REMARKS: MUD ROTARY DRILLING BELOW 41'
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: **HOLE DIAMETER:** 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 1 of 3
BORING NUMBER–LOCATION: SB-17: WELL 91-8 ON EAST END OF SHARED DRIVEWAY BETWEEN LAWLESS & CHRISTIANSON PROPERTIES		**DATE:** 8-06-91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	STANDARD PENETRATION (BLOWS/FT)
		2	2.0	1.1	SM	2" TOPSOIL DARK BROWN (7.5YR3/2) SILTY SAND WITH 2-3% CLAY LAB SAMPLE 4'-6'	
5	1	2	1.8	1.1	CL	LIGHT BROWNISH GREY(10YR6/2)MOTTLED SANDY SILT & CLAY	44
					SP	STRONG BROWN (7.5YR5/8) SILTY FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND	
10	2	2	1.6	0.2	SP	BROWN (7.5YR5/5) FINE-MED GRAINED WELL ROUNDED WELL SORTED SAND WITH UP TO 1% COARSE SAND	26
15	3	2	1.9	0.2	SP	BROWN (7.5YR4/4) COARSE SAND WITH 2% 0.4-0.5CM PEBBLES; LOCALLY PEBBLES UP TO 1.0CM	11
20	4	2	1.8	0.4	SP	BROWN (7.5YR4/4) MEDIUM TO COARSE GRAINED WELL ROUNDED WELL SORTED SAND, TRACE PEBBLES UP TO 0.75CM IN DIA	16
					SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND	
25	5	2	1.8	0.9			22
					SP	BROWN (7.5YR4/4) VERY FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND	
					SP	BROWN (7.5YR4/4) MEDIUM TO COARSE GRAINED WELL ROUNDED WELL SORTED SAND WITH LOCAL FINE GRAINED SAND	
30	6	2	1.7	0.7	SP	BROWN (7.5YR4/4) VERY FINE TO FINE GRAINED WELL ROUNDED WELL SORTED SAND	63



WATER LEVEL:	**BORING STARTED:** 8-06-91	**BORING COMPLETED:** 8-06-91	**REMARKS:** WELL 91-8 SCREEN @ 65'-70'
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura		**SIGNED:**

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: **HOLE DIAMETER:** 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 2 of 3
BORING NUMBER–LOCATION: SB–17		**DATE:** 8–06–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT)
					SP	BROWN (7.5YR4/4) VERY FINE TO FINE GRAINED WELL ROUNDED WELL SORTED SAND	
35	7	2	1.6	2.5	SP	BROWN (7.5YR4/4) VERY FINE TO FINE GRAINED WELL ROUNDED WELL SORTED SAND WITH 2–5% MEDIUM SAND	67
40	8	2	1.8	3.0			66
					SP	BROWN (7.5YR4/4) VERY FINE TO FINE GRAINED BEDDED WELL ROUNDED WELL SORTED SAND: BEDDING DEFINED BY 1MM WIDE BLACK LAMINATIONS	
					SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND	
45	9	2	1.8	9.2	SP	BROWN (7.5YR4/4) VERY FINE TO FINE GRIANED WELL ROUNDED WELL SORTED SAND INTERBEDDED WITH BLACK 1–4MM WIDE WELL ROUNDED WELL SORTED SAND 2–3% LAB SAMPLE	85
50	10	2	1.9	0.5	SP	BROWN (7.5YR4/4) FINE–MED GRAINED WELL ROUNDED WELL SORTED SAND WITH TRACES OF COARSE SAND	75
55	11	2	1.8	4.2	SP	BROWN (7.5YR4/4) MEDIUM–COARSE GRAINED WELL ROUNDED WELL SORTED SAND WITH 3–5% 0.3–0.4CM GRAVEL, TRACE–1% ROUNDED PEBBLES (RHYOLITE) UP TO 1.5CM ACROSS	9
60	12	2	1.2	1.0	SP	BROWN (7.5YR4/4) FINE TO COARSE GRAINED WELL ROUNDED WELL SORTED SAND WITH 1–2% 0.5–3.0CM PEBBLES	8

WATER LEVEL:	**BORING STARTED:** 8–06–91	**BORING COMPLETED:** 8–06–91
	LOGGED BY: George Hudak/RREM,Inc.	**REMARKS:**
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura	**SIGNED:**

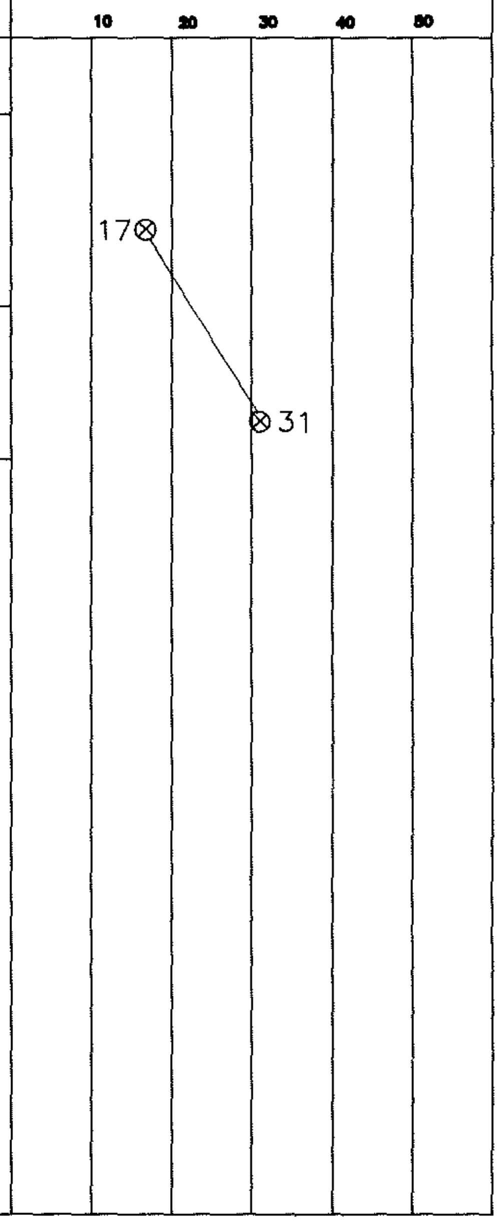
RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 3 of 3
BORING NUMBER–LOCATION: SB-17		DATE: 8-06-91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION
65	13	2	1.3	1.0	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND WITH TRACE-2% COARSE SAND; TRACE-1% PEBBLES UP TO 1.0CM DIA
70	14	2	1.3	2.7	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND WITH TRACE-1% COARSE SAND LAB SAMPLE
75						END OF BORING
80						
85						
90						

⊗ STANDARD PENETRATION (BLOWS/FT)



WATER LEVEL:	BORING STARTED: 8-06-91	BORING COMPLETED: 8-06-91	REMARKS:
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 1 of 2
BORING NUMBER–LOCATION: SB–18: IN VACANT CHURCH PARKING LOT NORTH OF LAUNDROMAT		**DATE:** 8–06–91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT)
		2		0.2		GRASS AT SURFACE LIGHT BROWN SAND AND GRAVEL FILL WITH LOCAL SILT AND CLAY PODS UP TO 1CM IN DIA	
5	1	2	1.8	0.1	CL	LIGHT BROWNISH GREY (10YR6/2) SILT AND CLAY WITH 10–15% LIGHT GREY FINE TO MEDIUM GRAINED SAND	13
10	2	2	1.8	2.0	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND LAB SAMPLE 9'–11'	36
15	3	2	1.8	0.7			12
20	4	2	1.7	0.3	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND WITH TRACE 0.2–0.5CM PEBBLES, TRACE COARSE SAND	16
					SP	BROWN (7.5YR4/4) MEDIUM TO COARSE GRAINED WELL ROUNDED WELL SORTED SAND WITH UP TO 10% FINE GRAINED SAND	
25	5	2	2.0	0.5			17
					SP	BROWN (7.5YR4/4) VERY FINE TO FINE GRAINED WELL ROUNDED WELL SORTED SAND	
30	6	2	1.8	0.3	SP	BROWN (7.5YR4/4) MED TO COARSE GRAINED WELL ROUNDED WELL SORTED SAND WITH 5–10% 0.2–1.0CM PEBBLES. ONE 3.5CM PEBBLE IS GABBRO	29

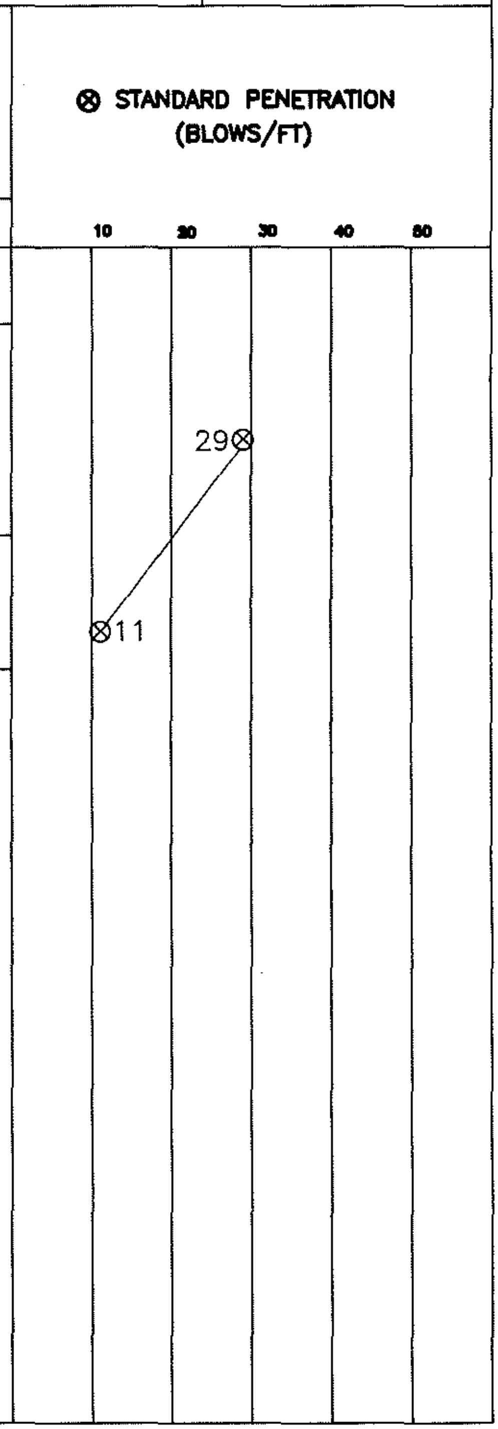
WATER LEVEL:	**BORING STARTED:** 8–06–91	**BORING COMPLETED:** 8–06–91	**REMARKS:**
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura		**SIGNED:**

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 2 of 2
BORING NUMBER—LOCATION: SB-18		DATE: 8-06-91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	STANDARD PENETRATION (BLOWS/FT)
					SP	SEE DESCRIPTION ABOVE	
35	7	2	2.0	6.8	SP	BROWN (7.5YR4/4) VERY FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND SATURATED LAB SAMPLE 34'-36'	29
40	8	2	1.6	0.3	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND WITH TRACES OF COARSE SAND	11
						END OF BORING	



WATER LEVEL:	BORING STARTED: 8-06-91	BORING COMPLETED: 8-06-91	REMARKS:
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	**CLIENT:** WISCONSIN DNR	**PROJECT No.** 9114
DRILLING METHOD: **HOLE DIAMETER:** 4 1/4" HSA	**SITE LOCATION:** Webster Wisconsin	**SHEET No.** 1 of 2
BORING NUMBER-LOCATION: SB-19: ON MAIN ST IN FRONT OF CALICO KITCHEN		**DATE:** 8-06-91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT)
		2		1.2		6" BLACKTOP BROWN (7.5YR4/2) SILTY SAND AND GRAVEL FILL	
					CL	LIGHT BROWNISH GREY (10YR6/2) MOTTLED SILT & CLAY	
5	1	2	1.9	1.2	SP	BROWN (7.5YR4/4) FINE-MED GRAINED WELL ROUNDED WELL SORTED SAND WITH TRACE-1% BLACK ORGANICS	32
10	2	2	1.9	0.4	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND WITH TRACE-1% COARSE SAND AND LOCAL 0.2-0.3CM PEBBLES	35
15	3	2	1.9	3.6	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND LAB SAMPLE 14'-16'	43
					SP	BROWN (7.5YR4/4) MEDIUM TO COARSE GRAINED SAND WITH 1% 0.5-1.0CM ROUNDED PEBBLES	
20	4	2	1.9	3.3			28
					SP	BROWN (7.5YR4/4) FINE TO MED GRAINED SAND WITH TRACE COARSE SAND AND TRACE 0.2-0.5CM PEBBLES	
					SP	BROWN (7.5YR4/4) MEDIUM TO COARSE GRAINED WELL ROUNDED WELL SORTED SAND	
25	5	2	1.9	0.7			24
					SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND	
30	6	2	2.0	0.7	SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND WITH 1-2% COARSE SAND AND 1-2% 0.2-0.7MM ROUNDED PEBBLES	17

WATER LEVEL:	**BORING STARTED:** 8-06-91	**BORING COMPLETED:** 8-06-91	**REMARKS:**
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	**DRILLING COMPANY/DRILLER:** GME/Jamie Tuura		**SIGNED:**

RREM Inc.
consulting engineers

FIELD EXPLORATORY BORING LOG

PROJECT: Wisconsin DNR Remedial Investigation	CLIENT: WISCONSIN DNR	PROJECT No. 9114
DRILLING METHOD: HOLE DIAMETER: 4 1/4" HSA	SITE LOCATION: Webster Wisconsin	SHEET No. 2 of 2
BORING NUMBER-LOCATION: SB-19		DATE: 8-06-91

DEPTH (FT)	SAMPLE No.	SAMPLE DISTANCE	SAMPLE RECOVERED	F I D READING (PPM)	SOIL GROUPS SYMBOL (USCS)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	⊗ STANDARD PENETRATION (BLOWS/FT) 10 20 30 40 50
					SP	BROWN (7.5YR4/4) FINE TO MEDIUM GRAINED WELL ROUNDED WELL SORTED SAND WITH 1-2% COARSE SAND AND 1-2% 0.2-0.7MM ROUNDED PEBBLES	
35	7	2	1.9	1.2	SP	BROWN (7.5YR4/4) FINE-MED GRAINED WELL ROUNDED WELL SORTED SAND WITH TRACE-1% COARSE SAND LAB SAMPLE 34'-36'	⊗21
						END OF BORING	
40							
45							
50							
55							
60							

WATER LEVEL:	BORING STARTED: 8-06-91	BORING COMPLETED: 8-06-91	REMARKS:
	LOGGED BY: George Hudak/RREM,Inc.		
WATER LEVEL:	DRILLING COMPANY/DRILLER: GME/Jamie Tuura		SIGNED:

Appendix C

Subsurface Exploration and Monitoring Well Installation Program,
Village of Webster Water Supply
(Prepared by GME Consultants, October 1991)

GME CONSULTANTS, INC.
CONSULTING ENGINEERS
314 Garfield Avenue / Duluth, MN 55802
(218) 722-4323 / Fax (218) 722-9722

November 13, 1991

Mr. Colin Reichhoff
RRem Engineers & Architects
408 Board of Trade Building
301 West First Street
Duluth, Minnesota 55802

Report of: Recompacted Permeability Test

GME Project No. 30-232-01

Project: Subsurface Exploration & Monitoring Well Installation

Location: Village of Webster
Webster, Wisconsin
Soil Boring No. B-7, 34 to 36 Feet

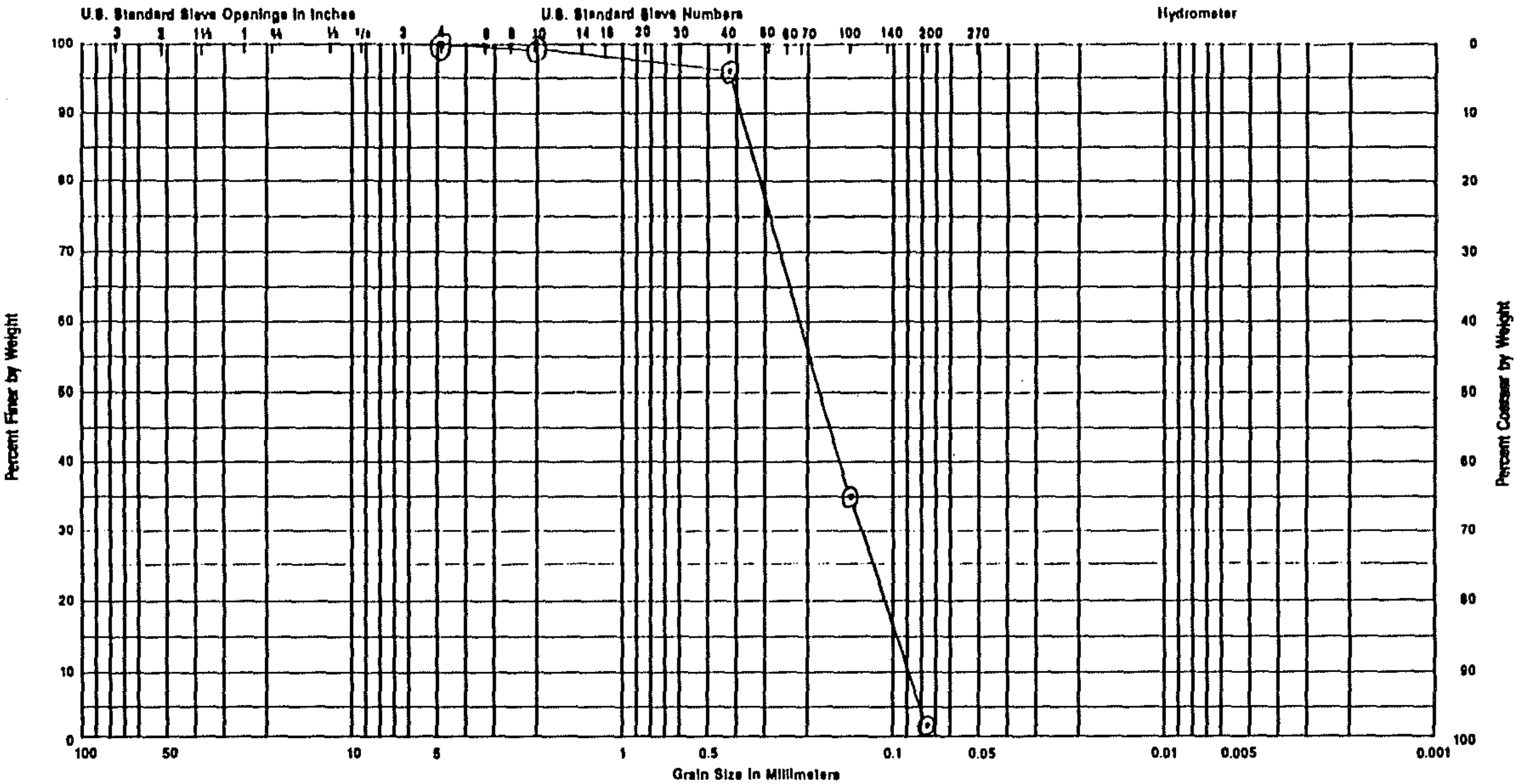
Date of Test: 8-22-91

Moisture Content (air dried)	16.7%
Dry Unit Weight (lbs/FT)	101.7
Void Ratio (e)	0.393

HYDRAULIC CONDUCTIVITY 7.086×10^{-3} cm/sec

GME Consultants, Inc.

Village of Webster - Water Supply
Webster, Wisconsin



	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

KEY SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH FEET	PLASTICITY DATA: LIQUID LIMIT (%)	PLASTICITY DATA: PLASTIC LIMIT (%)	PLASTICITY DATA: PLASTICITY INDEX (%)	NATURAL WATER CONTENT (%)	UNIFIED SOIL CLASSIFICATION	
	91-04	15	69-71					SP	Poorly graded sand

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Geotechnical • Materials • Environmental
14000 21st Avenue No.
Minneapolis, MN 55447

DF | KL | 8-9-91 | 30-232-01

Village of Webster - Water Supply
Webster, Wisconson

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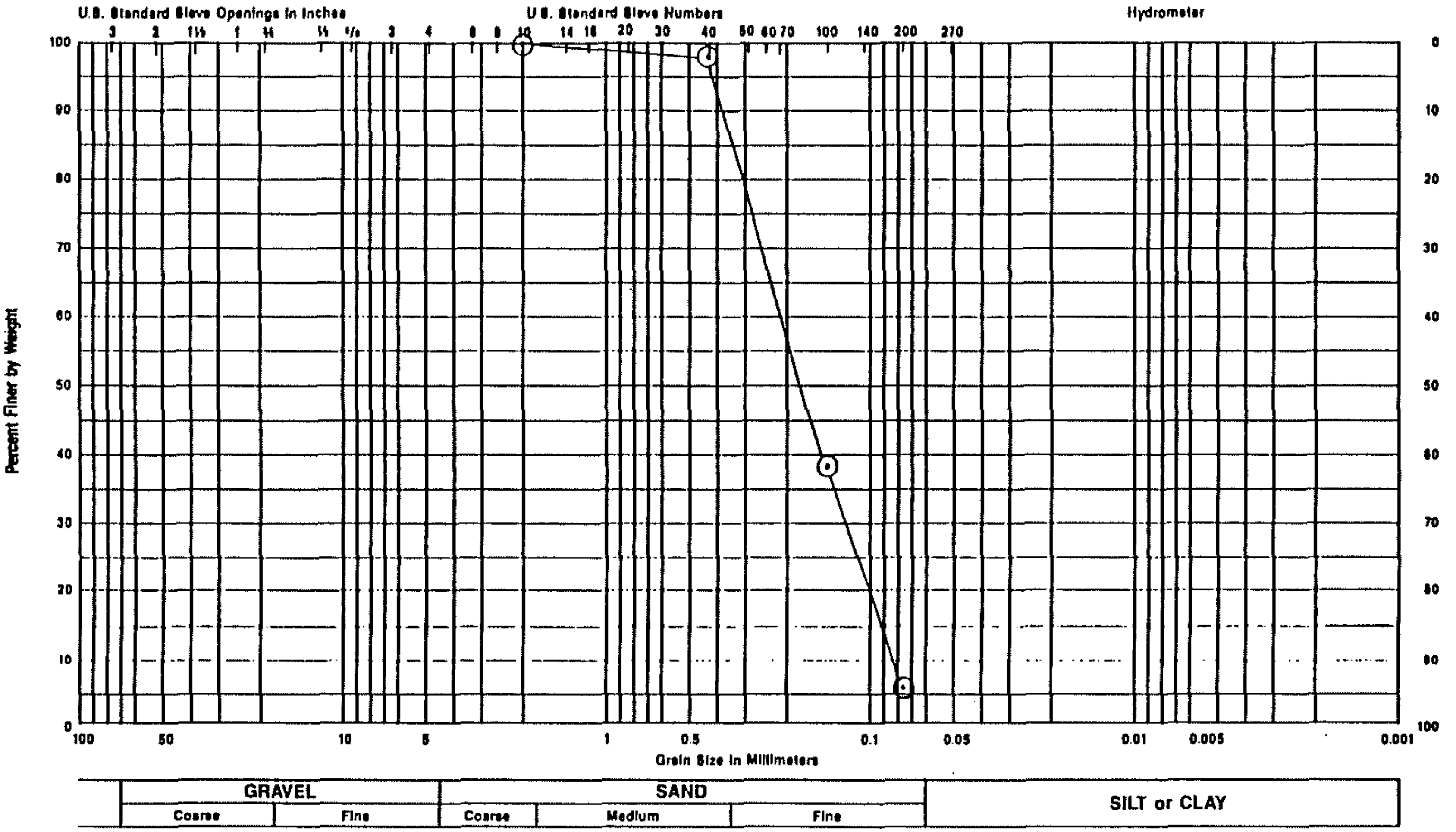
Geotechnical • Materials • Environmental
14000 21st Avenue No.
Minneapolis, MN 55447

DF	KL	3-9-91	30-232-01



KEY SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH FEET	PLASTICITY DATA: LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	NATURAL WATER CONTENT (%)	UNIFIED SOIL CLASSIFICATION	
	91-16	14	64-66						SP - Poorly graded sand

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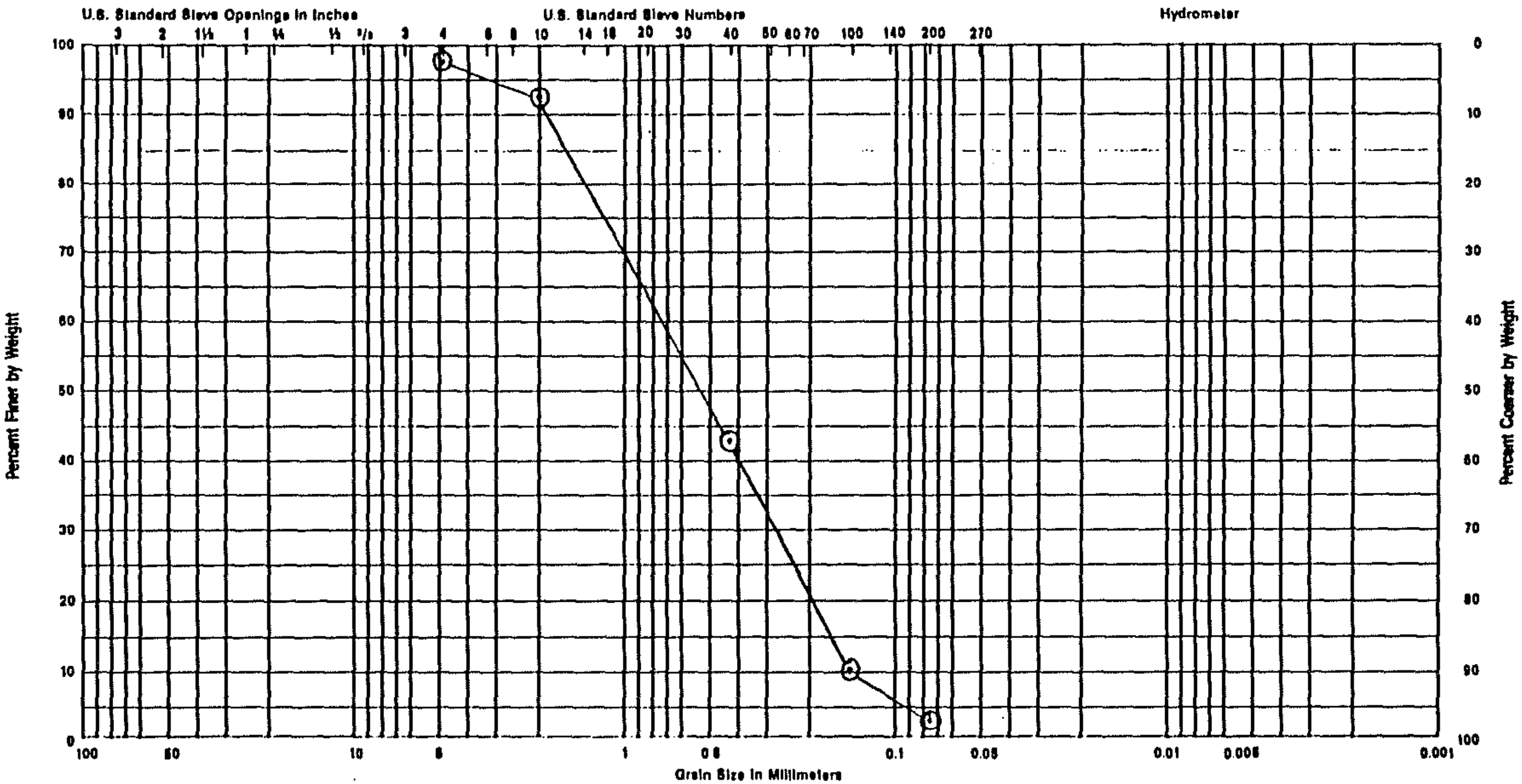
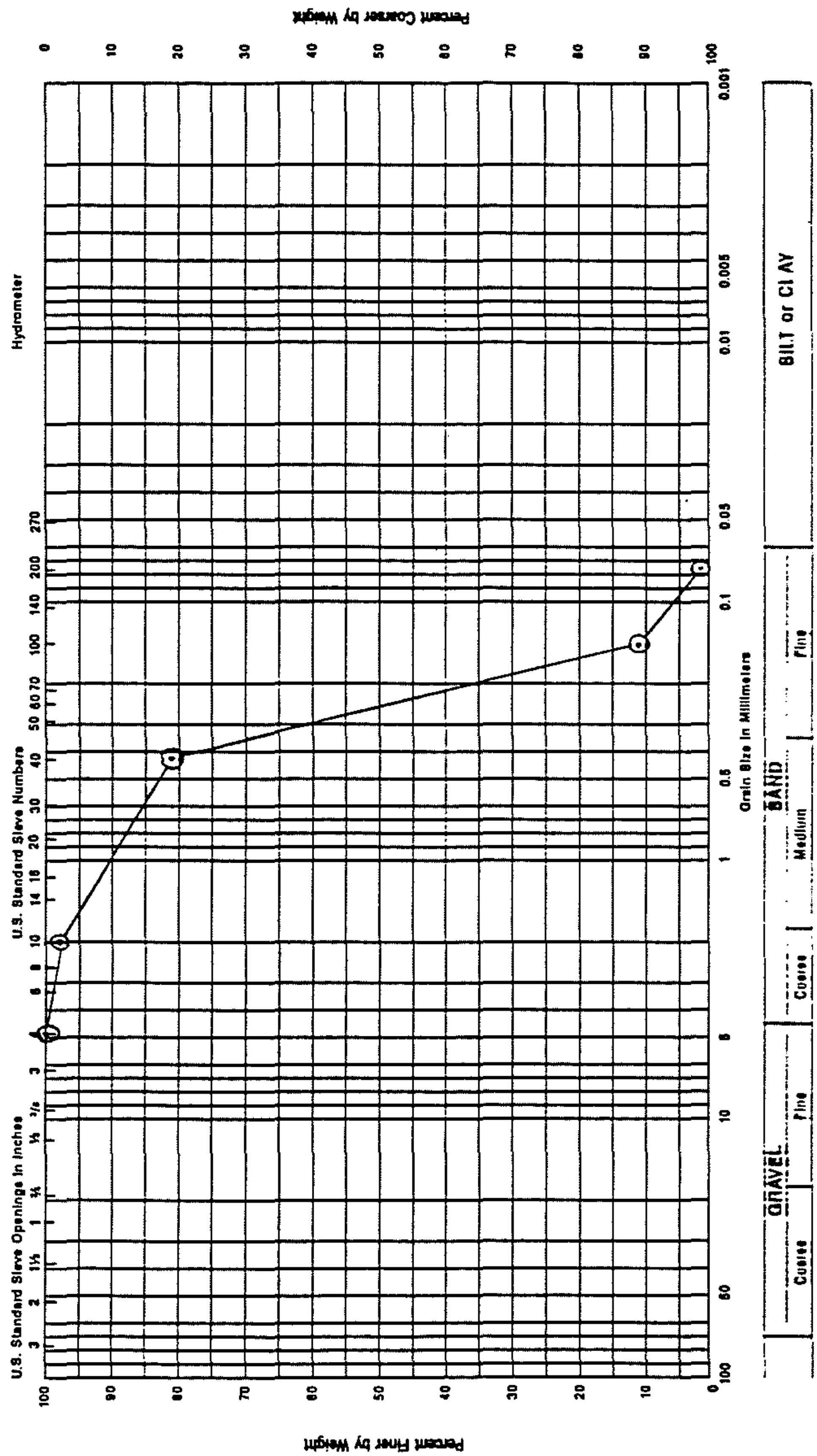


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

KEY SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH FEET	PLASTICITY DATA: LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	NATURAL WATER CONTENT (%)	UNIFIED SOIL CLASSIFICATION	
	91-04	8	34-36					SP	Poorly graded Sand



KEY SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH FEET	PLASTICITY DATA: LIQUID LIMIT (%)	PLASTICITY DATA: PLASTIC LIMIT (%)	PLASTICITY DATA: PLASTICITY INDEX (%)	NATURAL WATER CONTENT (%)	UNIFIED SOIL CLASSIFICATION	
	91-02	8	34-36					SP	Poorly graded sand

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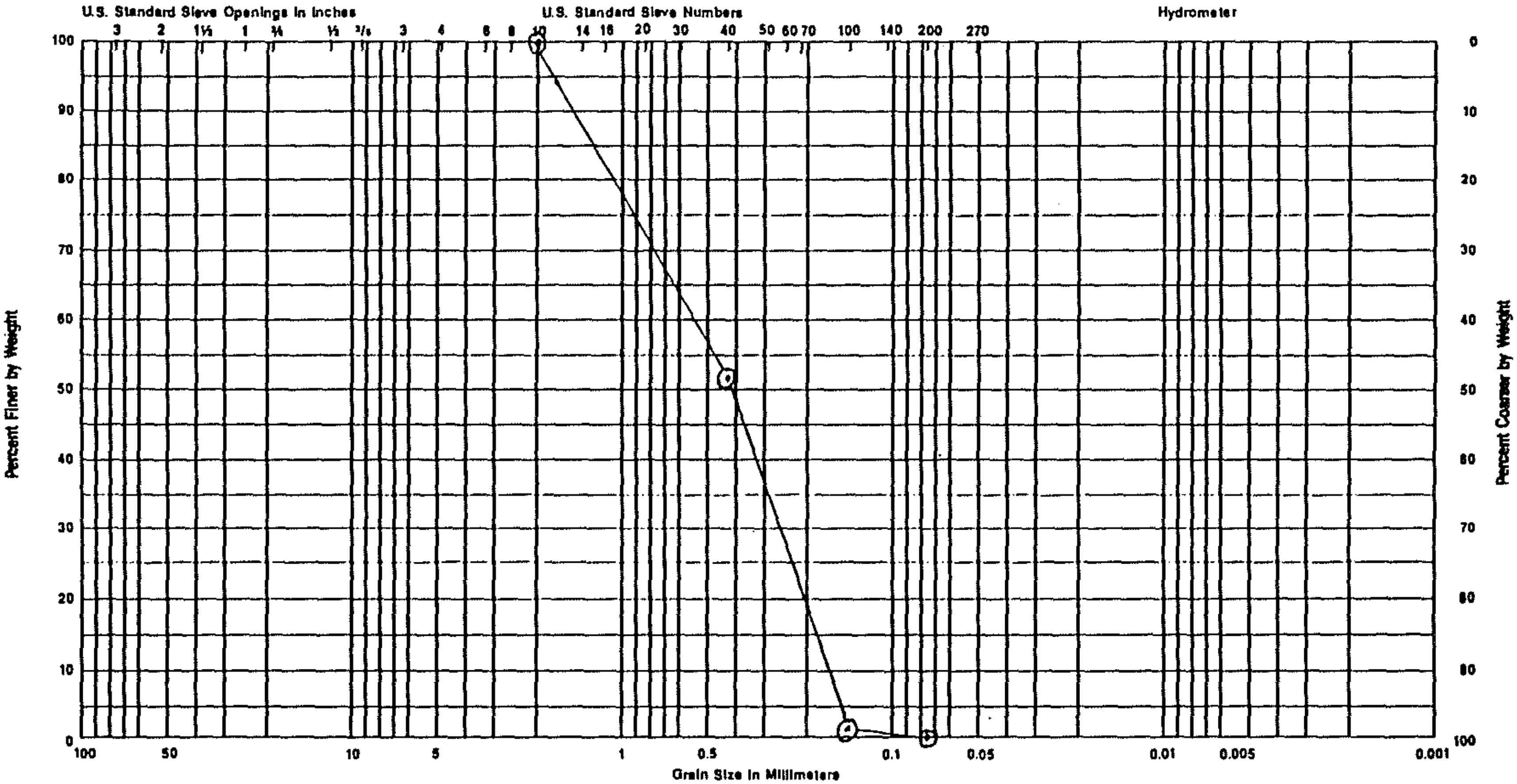

GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

KEY SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH FEET	PLASTICITY DATA: LIQUID LIMIT (%)	PLASTICITY DATA: PLASTIC LIMIT (%)	PLASTICITY DATA: PLASTICITY INDEX (%)	NATURAL WATER CONTENT (%)	UNIFIED SOIL CLASSIFICATION	
	91-14	8	34-36					SP	Poorly graded sand

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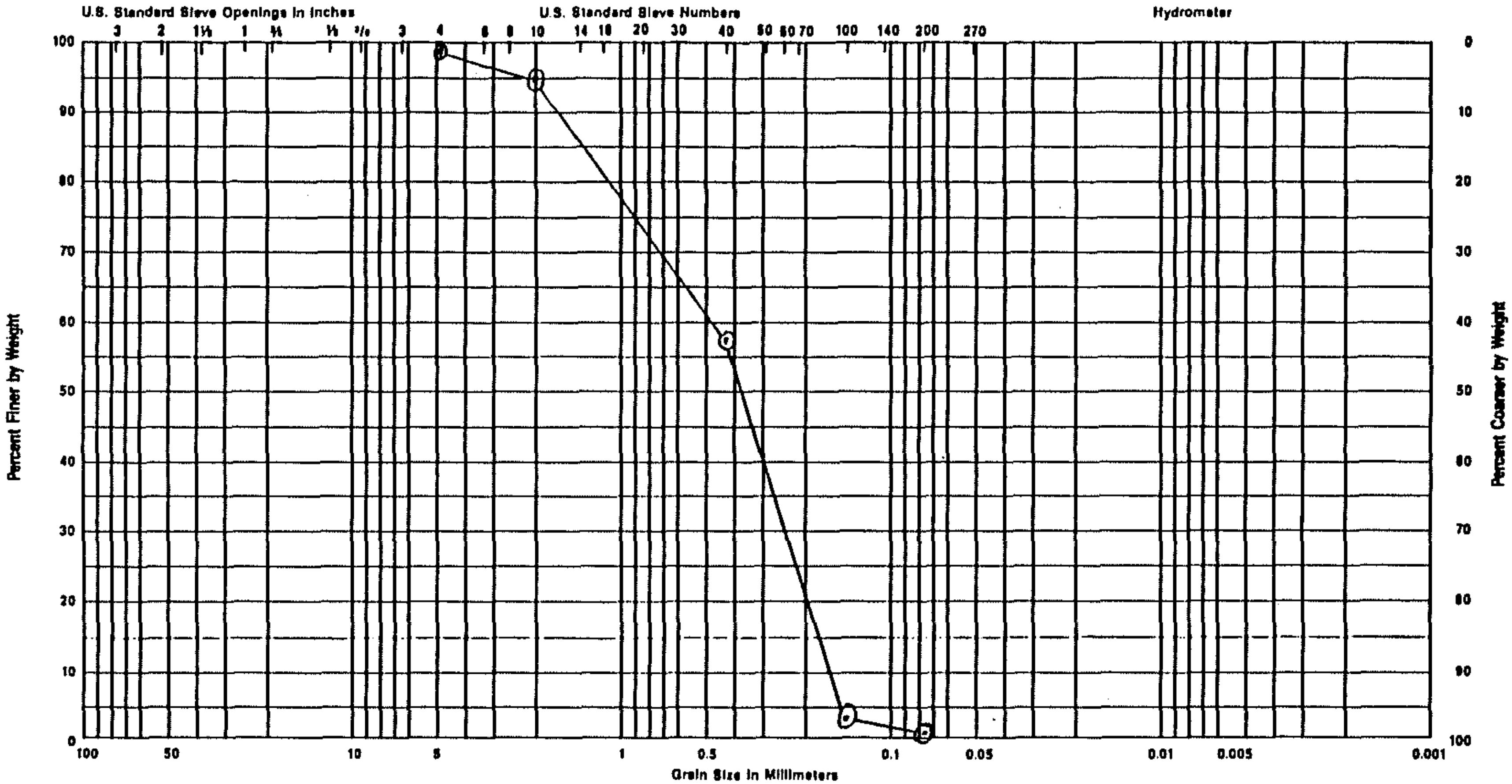

GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

KEY SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH FEET	PLASTICITY DATA: LIQUID LIMIT (%)	PLASTICITY DATA: PLASTIC LIMIT (%)	PLASTICITY DATA: PLASTICITY INDEX (%)	NATURAL WATER CONTENT (%)	UNIFIED SOIL CLASSIFICATION	
	91-08	8	34-36					SP	Poorly graded sand

Village of Webster - Water Supply
Webster, Wisconson

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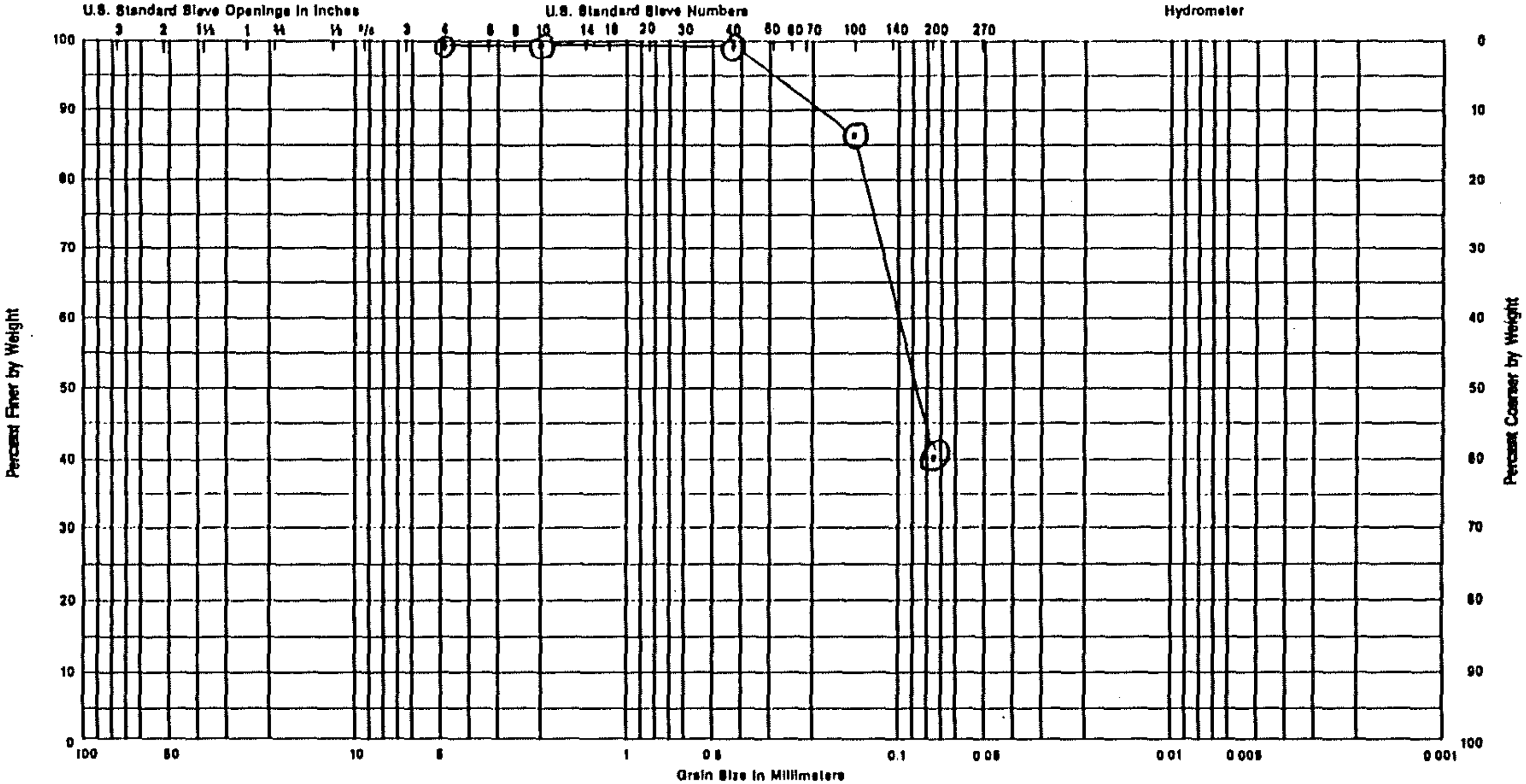
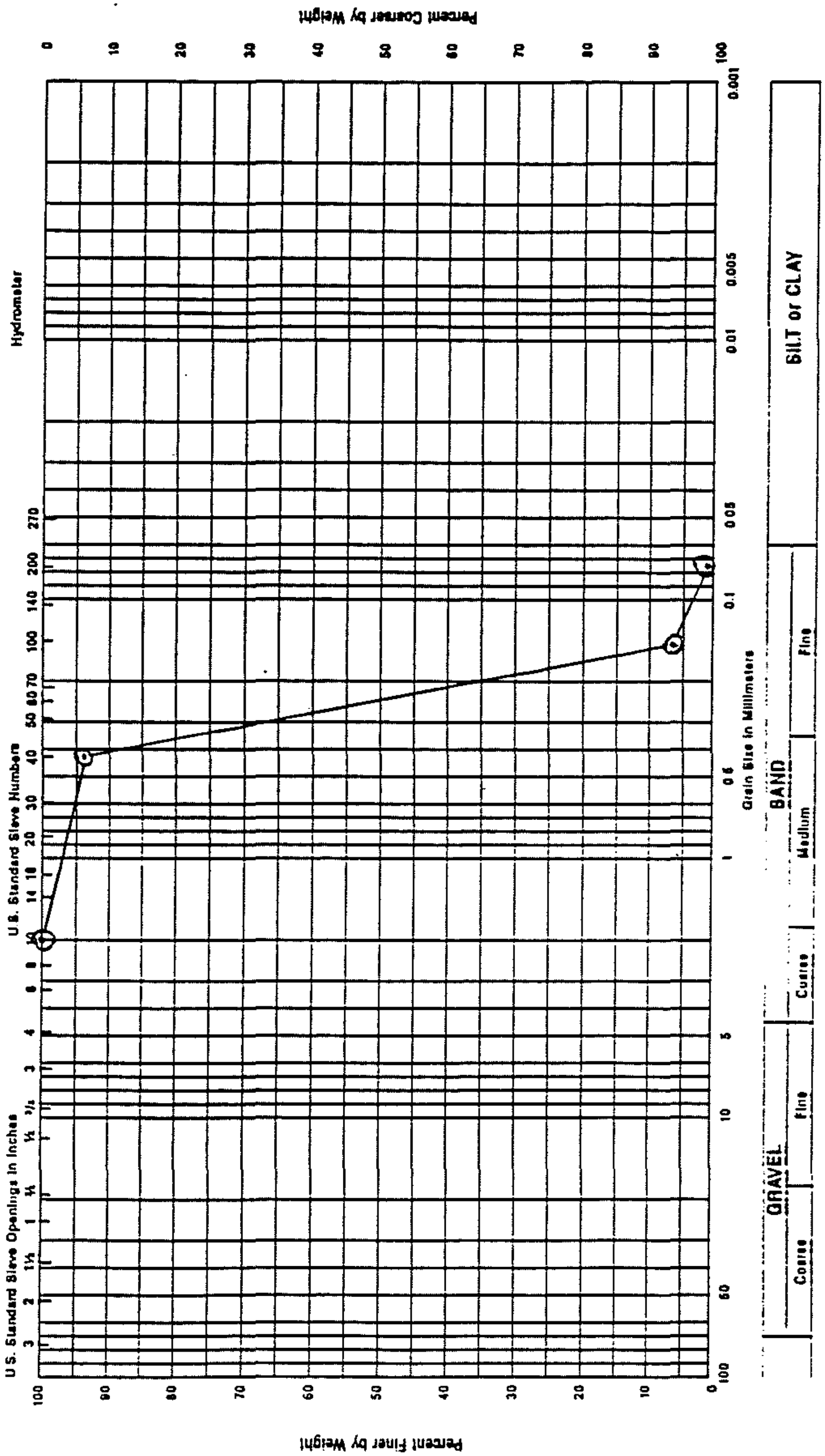
8-9-91

30-232-01



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

KEY SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH FEET	PLASTICITY DATA: LIQUID LIMIT (%)	PLASTICITY DATA: PLASTIC LIMIT (%)	PLASTICITY DATA: PLASTICITY INDEX (%)	NATURAL WATER CONTENT (%)	UNIFIED SOIL CLASSIFICATION	
	91-09	34	66-68					SM	Silty Sand



KEY SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH FEET	PLASTICITY DATA: LIQUID LIMIT (%)	PLASTICITY DATA: PLASTIC LIMIT (%)	PLASTICITY DATA: PLASTICITY INDEX (%)	NATURAL WATER CONTENT (%)	UNIFIED SOIL CLASSIFICATION	
	91-07	8	34-36					SP	Poorly graded sand

Village of Webster - Water Supply
Webster, Wisconson

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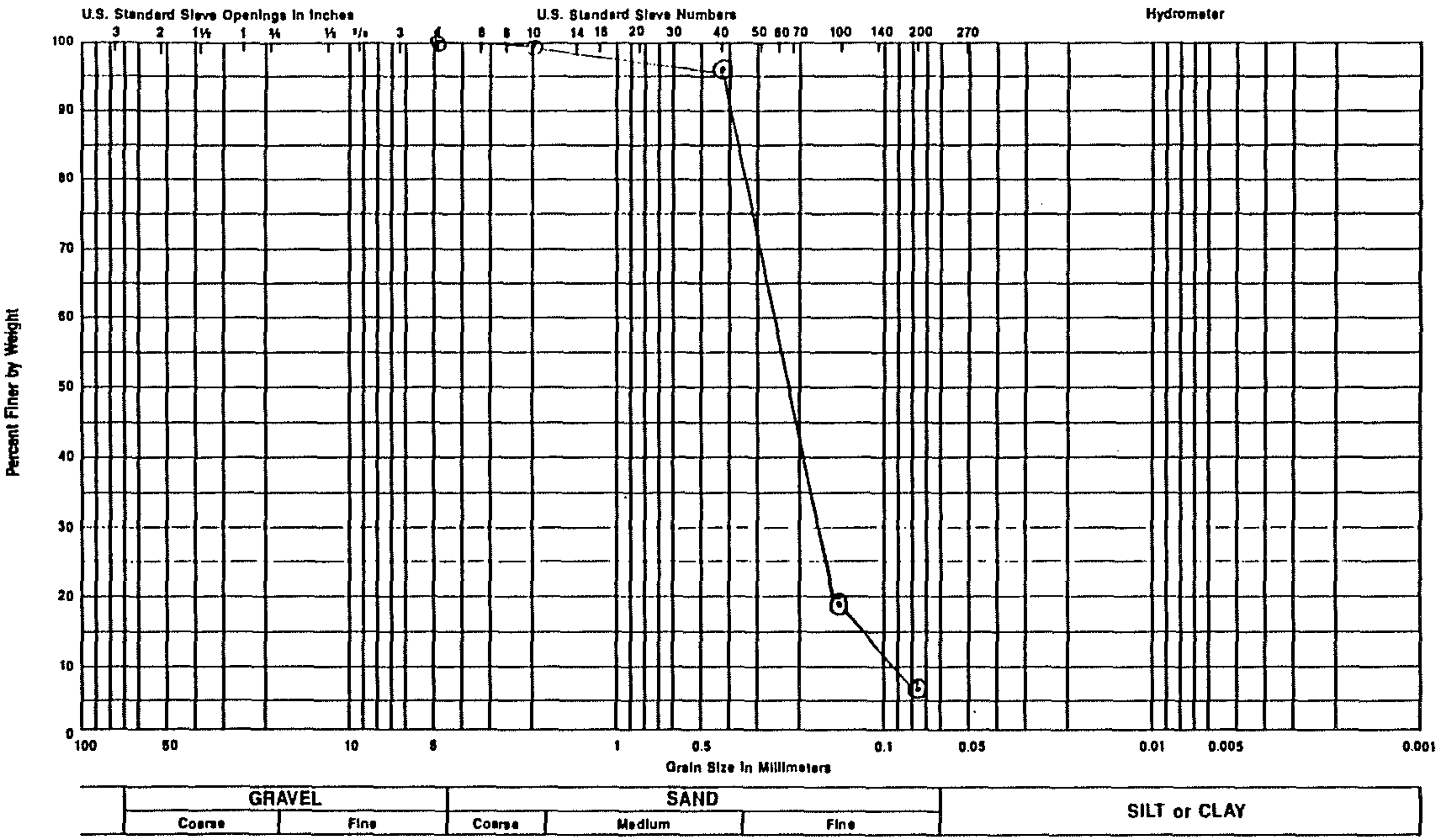
14000 21st Avenue No.
Minneapolis, MN 55447

DF	KL	8-9-91	30-232-01

Village of Webster
Water Supply
Webster, Wisconsin



KEY SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH FEET	PLASTICITY DATA LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	NATURAL WATER CONTENT (%)	UNIFIED SOIL CLASSIFICATION	
	91-17	14	64-66						SP - Poorly Graded Sand

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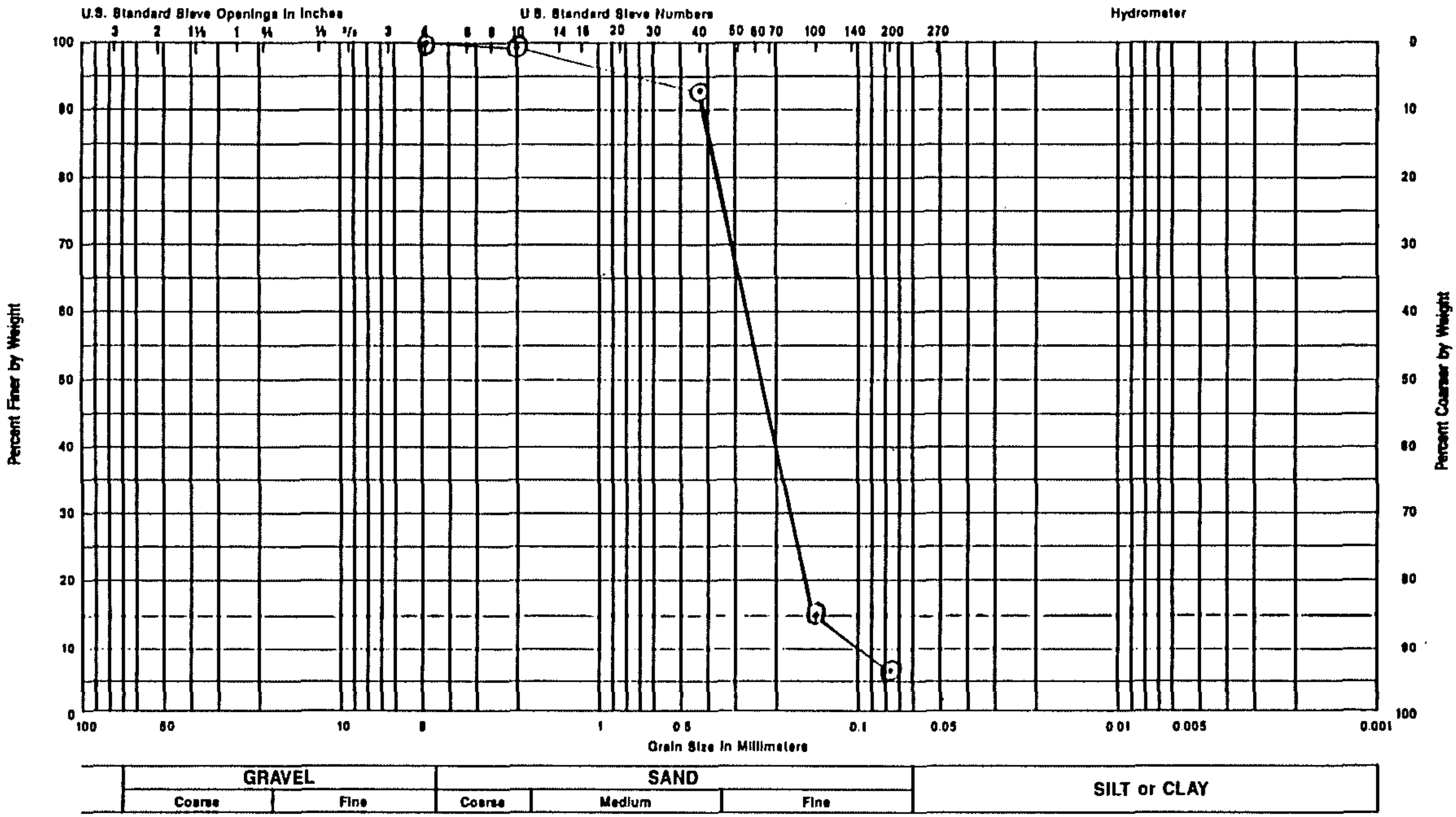
Village of Webster
Water Supply
Webster, Wisconsin



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	91-07	34	66-68					SP-SM Poorly Graded Sand with Silt

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Minneapolis, MN 55447

DF | KL | 8-9-91 | 30-232-01

SUBSURFACE EXPLORATION
AND MONITORING WELL
INSTALLATION PROGRAM
VILLAGE OF WEBSTER-WATER SUPPLY
WEBSTER, WISCONSIN
GME PROJECT NUMBER D1368
OCTOBER 8, 1991

GME CONSULTANTS, INC.
CONSULTING ENGINEERS
14000 21st Ave. No. / Minneapolis, MN 55447
Phone (612) 559-1859 / Fax (612) 559-0720

October 8, 1991

Mr. Colin L. Reichhoff
RREM, Inc.
408 Board of Trade Building
301 West First Street
Duluth, Minnesota 55802

GME Project No. D1368

RE: Report of subsurface exploration an monitoring well installation program for the Village of Webster water supply in Webster, Wisconsin.

Dear Mr. Reichhoff:

We are pleased to submit the results of our environmental exploration program for the above referenced project. Submittal of this report concludes the scope of work for this project as discussed in our May 29, 1991 proposal.

We appreciate having had the opportunity to work with you on this project. If you have any questions regarding this material, please feel free to contact us at your convenience.

Sincerely,

GME Consultants, Inc.

Kristopher A. Lyytinen, EIT
Geotechnical Engineer

William C. Kwasny, P.E.
Principal Engineer/President

KAL/WCK:ljn

SUBSURFACE EXPLORATION
AND MONITORING WELL
INSTALLATION PROGRAM
VILLAGE OF WEBSTER-WATER SUPPLY
WEBSTER, WISCONSIN
GME PROJECT NUMBER D1368
OCTOBER 8, 1991

TABLE OF CONTENTS

INTRODUCTION

The subsurface exploration and monitoring well installation program performed in Webster, Wisconsin, was performed to evaluate the potential for contamination of the Village's water supply. The program explored the area to obtain subsurface information relative to the soil and groundwater conditions and potential contamination and to install permanent wells to allow groundwater sampling and monitoring.

In accordance with your acceptance of our May 29, 1991 proposal for the project, we have conducted a subsurface exploration and monitoring well installation program. The purpose of this report is to present the results of our field exploration program.

EXPLORATION PROGRAM RESULTS

Scope of Exploration

The field exploration consisted of drilling 19 soil borings around the City of Webster. The soil borings ranged in depth from 36 to 71 feet, and monitoring wells were installed in 10 of the borings.

The borings were drilled with our CME 550 rig all-terrain. The borings were drilled at locations and to depths specified by the RREM site representative. The elevations of the ground surface and the top of monitoring well casings were also determined by RREM.

Surface Conditions

The explored area is located on the southern end of the Village of Webster, bordered on the east by Lakeland South Avenue, on the south by Cedar Avenue, on the north by Elm Street, to the west of Minnow Avenue and the Soo Line Railroad. The area is relatively flat, consisting of developed areas. The borings were drilled on streets and avenues.

Subsurface Conditions

The subsurface conditions encountered in each boring are illustrated on logs included in the Appendix. We wish to point out that the subsurface conditions at other times and locations at this site may differ from those found at our test locations.

The logs show that the soil conditions are relatively uniform. The borings encountered 3 to 5 feet of brown sand or sand with silt, fill overlying the naturally occurring soils, which consisted of a thin layer of gray silty lean clay extending to depths of 5 to 6 feet. Below this silty lean clay, we encountered brown fine to medium sand which extended to the termination depths in all of the borings. The N-values indicate that the sand is medium dense.

Monitoring Wells

Ten monitoring wells were installed within the project area, as directed by RREM. The wells were installed in accordance with the current State of Wisconsin Well Regulations. Five of the wells were installed to an approximate depth of 40 feet, one was installed to an approximate depth of 60 feet, and four of the monitoring wells were installed to an approximate depth of 70 feet below existing grade.

The holes for the wells were drilled using 4-1/4 inch hollow stem auger (HSA). The screens consisted of 2 inch by 5 feet, and 2 inch by 10 feet, No. 10 slot, Johnson SCH 80 PVC. The screens were attached to SCH 80 PVC riser which extended approximately 2 feet above the ground surface for the wells with protective casings and to the ground surface for wells installed in at grade gateboxes. The screens were then backfilled with Red Flint sand to a level approximately 2 feet above the top of the screen. The annulus was sealed with a approximately 2 feet of bentonite, and the remainder of the boreholes were grouted to the surface with neat cement grout. Four foot long, 4 inch diameter locking low carbon steel protective casing surrounded by three, 4 inch steel guard posts or at grade gateboxes were then installed to protect the wells.

Groundwater Levels

Groundwater level measurements were made in the borings and monitoring wells. The data obtained from these measurements are included on the boring and well logs. A study of these readings indicates that water was encountered in all of the borings and wells at an approximated depth of 33 to 34 feet below the ground surface. The consistency of the depths of the readings and the relatively permeable soils found in the borings lead us to believe that this is the static groundwater table. The groundwater levels can be expected to vary seasonally and annually, and with variations in precipitation and infiltration.

Laboratory Testing

A laboratory testing program to determine the grain size and permeability of the various soil strata was completed. The results of the testing program are included on the appended data sheets. Ten mechanical analysis tests and two permeability tests were performed on recovered samples.

FIELD EXPLORATION PROCEDURES

Soil Sampling

Soil sampling was performed in accordance with ASTM:D1586. Using this procedure, a 2 inch O.D., split-barrel sampler is driven into the soil by a 140 pound weight falling 30 inches. After an initial set of 6 inches, the number of blows required to drive the sampler an additional 12 inches is known as the Standard Penetration resistance or N-value. The N-value is an index of the relative density of cohesionless soils and the consistency of cohesive soils. The recovered samples were screened in the field by a representative of RREM using a Hnu meter.

Soil Classification

As the samples were obtained in the field, they were preliminarily classified by our driller. Representative portions of all samples were then sealed in moisture tight jars and returned to our laboratory for final examination and classification by a Geotechnical Engineer. The samples obtained during the soil boring program will be held for a period of one month at which time they will be discarded unless we are notified further as to their disposition.

The boring logs in the Appendix indicate the depth and identification of various soil strata, the N-value, groundwater level information, and pertinent information regarding the method of maintaining and advancing the drill holes. Charts illustrating the soil classification and the descriptive terminology and symbols used on the boring logs are also attached.

STANDARD OF CARE

The factual data contained in this report are based on our interpretation of the subsurface conditions and represent our professional opinions. These opinions were arrived at in accordance with currently accepted geotechnical practices at this time and location. Other than this, no warranty is implied or intended.

Prepared by:

Kristopher A. Lyytinen, EIT
Geotechnical Engineer

Reviewed by:

William C. Kwasny, P.E.
Principal Engineer/President
Registered Profession Engineer, Wisconsin

KAL/WCK:ljn

APPENDIX

IMPORTANT INFORMATION
ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, thanks to the Association of Soil and Foundation Engineers (ASFE).

When ASFE was founded in 1969, subsurface problems were frequently being resolved through lawsuits. In fact, the situation had grown to such alarming proportions that consulting geotechnical engineers had the worst professional liability record of all design professionals. By 1980, ASFE-*member consulting soil and foundation engineers had the best professional liability record.* This dramatic turn-about can be attributed directly to client acceptance of problem-solving programs and materials developed by ASFE for its members' application. *This acceptance was gained because clients perceived the ASFE approach to be in their own best interests.* Disputes benefit only those who earn their living from others' disagreements.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of the structure involved, its size and configuration; the location of the structure on the site and its orientation; physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of his report may affect his recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should not be used*:

- When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to an adjacent site.

A geotechnical engineer cannot accept responsibility for problems which may develop if he is not consulted after factors considered in his report's development have changed.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by the geotechnical engineer who then renders an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those opined to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. For example, the actual interface between materials may be far more gradual or abrupt than the report indicates, and actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced owners retain their geotechnical consultant through the construction stage*, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly-changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SL : SS with Liner
SS : Split Spoon — 1⅜" I.D., 2" O.D., unless otherwise noted
ST : Shelby Tube — 2" O.D., unless otherwise noted
PA : Power Auger
DB : Diamond Bit — NX: BX: AX
AS : Auger Sample
JS : Jar Sample
VS : Vane Shear
OS : Osterberg Sampler — 3" Shelby Tube
HS : Hollow Stem Auger
WS : Wash Sample
FT : Fish Trail
RB : Rock Bit
BS : Bulk Sample
PM : Pressuremeter test — in situ

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch OD split spoon, except where noted.

WATER LEVEL MEASUREMENT SYMBOLS:

WL : Water Level
WCI : Wet Cave In
DCI : Dry Cave In
WS : While Sampling
WD : While Drilling
BCR : Before Casing Remvoal
ACR : After Casing Removal
AB : After Boring

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In previous soils, the indicated elevations are considered reliable ground water levels. In impervious soils, the accurate determination of ground water elevations is not possible in even several days observation, and additional evidence of ground water elevations must be sought.

GRADATION DESCRIPTION & TERMINOLOGY

Coarse Grained or Granular Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays or clayey silts if they are cohesive, and silts if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency, and their plasticity.

Major Component Of Sample	Size Range	Descriptive Term(s) (Of Components Also Present in Sample)	Percent of Dry Weight
Boulders	Over 8 in. (200mm)	Trace	1 — 9
Cobbles	8 in. to 3 in. (200mm to 75mm)	Little	10 — 19
Gravel	3 in. to #4 sieve (75mm to 2mm)	Some	20 — 34
Sand	#4 to #200 sieve (2mm to .074mm)	And	35 — 50
Silt	Passing #200 sieve (0.074mm to 0.005mm)		
Clay	Smaller than 0.005mm		

CONSISTENCY OF COHESIVE SOILS:

Unconfined Comp. Strength, Qu, tsf	Consistency
< 0.25	Very Soft
0.25 — 0.49	Soft
0.50 — 0.99	Medium (Firm)
1.00 — 1.99	Stiff
2.00 — 3.99	Very Stiff
4.00 — 8.00	Hard
> 8.00	Very Hard

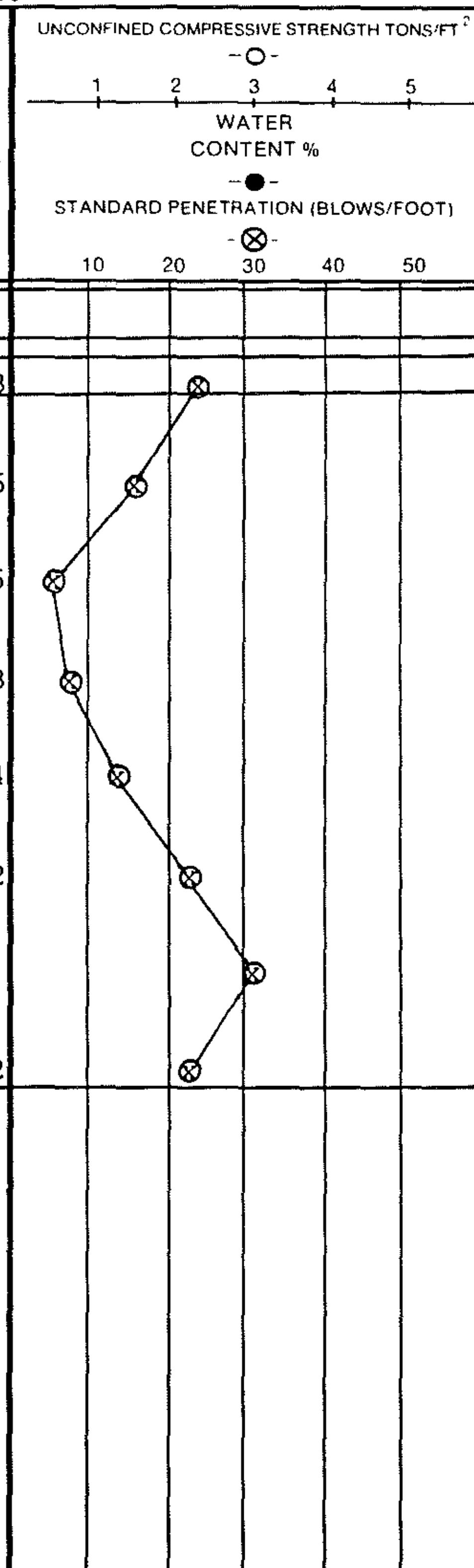
RELATIVE DENSITY OF GRANULAR SOILS:

N — Blows/ft.	Relative Density
0 — 3	Very Loose
4 — 9	Loose
10 — 29	Medium Dense
30 — 49	Dense
50 — 80	Very Dense
80 +	Extremely Dense

LOG OF BORING SB-1

PROJECT Subsurface Exploration and Monitoring Well Installation Program -	SITE Musky Street Webster, Wisconsin
OWNER Water Supply Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL SURFACE ELEVATION	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
			0.2	Bituminous Pavement		
	1AS		3	Brown SAND with SILT, fill, moist (SP-SM)		
			4	Black PEAT, organic (PT)		
	2SS		6	Gray SILTY LEAN CLAY, organic, moist, stiff (CL)		23
10	3SS			Brown fine to medium SAND, moist to waterbearing at 34 feet, medium dense		16
	4SS			(SP)		6
20	5SS					8
	6SS					14
30	7SS					22
		▼				
	8SS					31
40 / 41	9SS					22
				End of boring at 41 feet $4\frac{1}{4}$ inch hollow stem auger used full depth Borehole backfilled with sand/ cement grout		
50						
60						



WATER LEVEL OBSERVATIONS	
W.L.	34 feet while sampling
W.L.	
W.L.	

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BORING STARTED	6-17-91		
BORING COMPLETED	6-17-91		
RIG	CME 550	DRILLER	J.Tuura
DRAWN	KAL	APPROVED	WCK
JOB#	30-232-01	SHEET	1 of 26

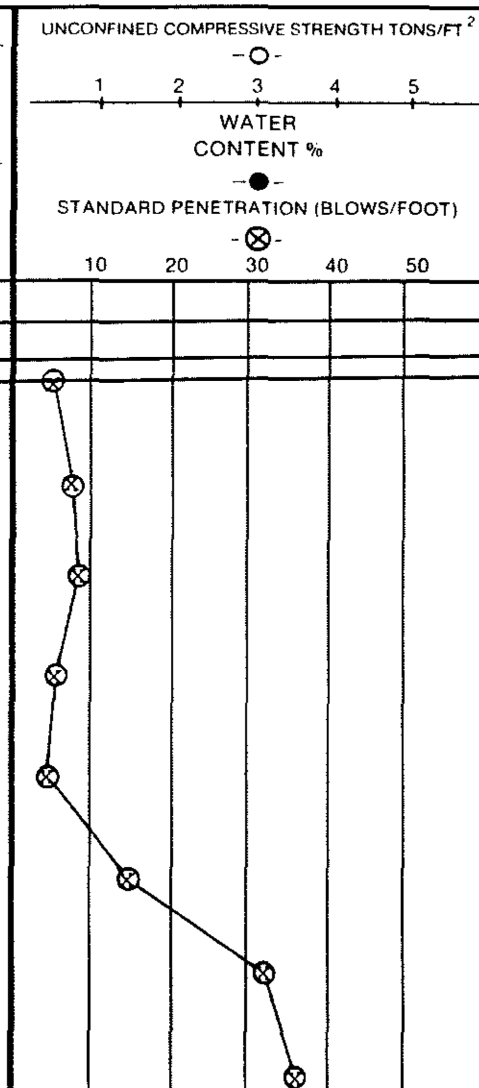
The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-2

PROJECT Subsurface Exploration and Monitoring Well Installation Program - Water Supply	SITE Musky Street and Alley behind the Tap Bar, Webster, Wisconsin
OWNER Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

SURFACE ELEVATION

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS		2.5	Brown fine to medium SAND with SILT, fill, moist (SP-SM)		
			4.5	Brown fine to medium SAND, fill, moist (SP)		
	2SS		5.5	Grey-brown SILTY LEAN CLAY, moist (CL)		5
10	3SS			Brown fine to medium SAND, moist to waterbearing at 34 feet, loose to dense (SP)		8
	4SS					9
20	5SS					5
	6SS					4
30	7SS					15
		▼				
	8SS				MA	32
40						
41	9SS					36
50				End of boring at 41 feet 4¼" hollow stem auger used full depth Monitoring well MW91-6 was installed in this boring		
60						



WATER LEVEL OBSERVATIONS	
W.L.	34 feet while sampling
W.L.	
W.L.	

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BORING STARTED 7-9-91	
BORING COMPLETED 7-9-91	
RIG CME 550	DRILLER J. Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 2 of 26

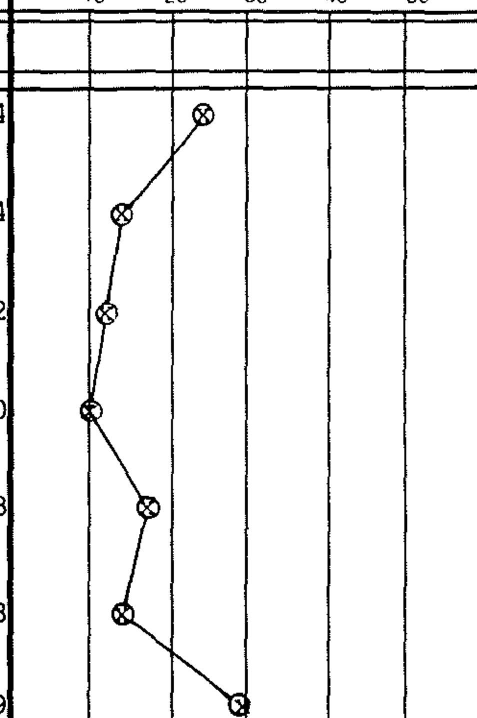
The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-3

PROJECT Subsurface Exploration and Monitoring Well INstallation Program -	SITE Elm Street and Sturgeon Avenue Webster, Wisconsin
OWNER Water Supply Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
			0.2	Bituminous Pavement		
	1AS		3	Brown SAND with gravel, fill, moist (SP)		
			4	Black to gray organic SILT, moist (OL)		
	2SS			Brown fine to medium SAND, moist to waterbearing at 34 feet, medium dense (SP)		24
10	3SS					14
	4SS					12
20	5SS					10
	6SS					18
30	7SS					13
		▼				
36	8SS					29

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² -O- 1 2 3 4 5
WATER CONTENT % -●-
STANDARD PENETRATION (BLOWS/FOOT) -⊗- 10 20 30 40 50



End of boring at 36 feet

$4\frac{1}{4}$ inch hollow stem auger used full depth

Borehole backfilled with sand/ cement grout

40

50

60

WATER LEVEL OBSERVATIONS	
W.L.	34 feet while sampling
W.L.	
W.L.	

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BORING STARTED 6-18-91	
BORING COMPLETED 6-18-91	
RIG CME 550	DRILLER J.Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 3 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-4A

PROJECT Subsurface Exploration and Monitoring Well Installation Program -	SITE Corner of Pike Avenue and Elm Street Webster, Wisconsin
OWNER Water Supply Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)	UNCONFINED COMPRESSIVE STRENGTH TONS/FT² -O- 1 2 3 4 5; WATER CONTENT % -●-; STANDARD PENETRATION (BLOWS/FOOT) -⊗- 10 20 30 40 50
			4	Brown, fine to medium SAND with SILT, fill, moist (SP-SM)			
			5	Black to Gray SILTY LEAN CLAY, moist (CL)			
10				Brown fine to medium SAND, moist to waterbearing at 34 feet (SP)			
20							
30		▼					
40				End of boring at 40 feet			
				4¼ inch hollow stem auger was used full depth			
50				No split barrel sampling was performed			
				Monitoring well MW-91-2A was installed in this boring			
60							

WATER LEVEL OBSERVATIONS	
W.L.	34 feet while drilling
W.L.	
W.L.	

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BORING STARTED 6-20-91	
BORING COMPLETED 6-20-91	
RIG CME 550	DRILLER J. Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 4 of 26

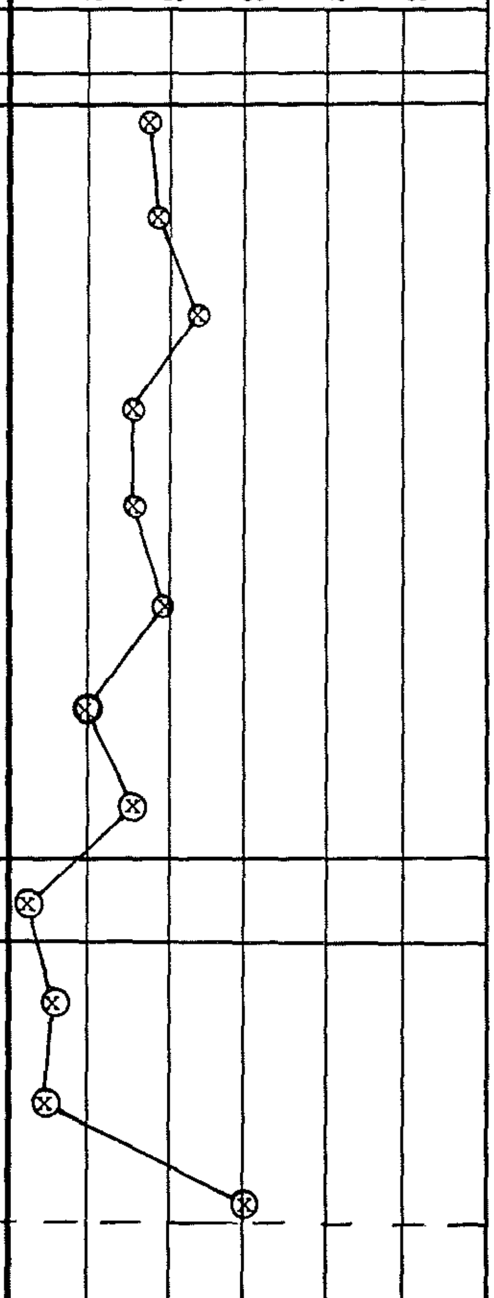
The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-4B

PROJECT Subsurface Exploration and Monitoring Well Installation Program - Water Supply	SITE Corner of Pike Avenue and Elm Street Webster, Wisconsin
OWNER Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS		3.5	Brown fine to medium SAND with SILT and gravel, fill, moist (SP-SM)		
			5	Gray SILTY LEAN CLAY, moist (CL)		
	2SS			Brown fine to medium SAND, moist to waterbearing, medium dense (SP)		17
10	3SS					18
	4SS					23
20	5SS					15
	6SS					15
30	7SS					19
		▼				
	8SS				MA	10
40	9SS		43			15
	10SS		47	Brown SANDY SILT, waterbearing, loose (ML)		2
50	11SS			Brown fine to medium SAND with lenses of silt, waterbearing, loose to dense (SP)		6
	12SS					5
60	13SS					30

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² -○- 1 2 3 4 5
WATER CONTENT % -●-
STANDARD PENETRATION (BLOWS/FOOT) -⊗- 10 20 30 40 50



Boring continued on next page

WATER LEVEL OBSERVATIONS	
W.L.	34 feet while sampling
W.L.	
W.L.	

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BORING STARTED 7-11-91	
BORING COMPLETED 7-11-91	
RIG CME 550	DRILLER J. Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 5 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual

LOG OF BORING SB-4B Cont'd

PROJECT Subsurface Exploration and Monitoring Well Installation Program - Water Supply.

SITE Corner of Pine Avenue and Elm Street Webster, Wisconsin

OWNER Village of Webster

ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL / SURFACE ELEVATION → Depth 60'	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
				Brown fine to medium SAND with lenses of silt, waterbearing, dense (SP)		
	14SS					38
70 / 71	15SS				MA	35
				End of boring at 71 feet		
				$4\frac{1}{4}$" hollow stem auger used full depth		
80				Monitoring well MW-91-2B installed in this boring		
90						
100						
110						
120						

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² -○- 1 2 3 4 5

WATER CONTENT % -●-

STANDARD PENETRATION (BLOWS/FOOT) -⊗- 10 20 30 40 50

WATER LEVEL OBSERVATIONS

W.L.	34 feet while sampling
W.L.	
W.L.	

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BORING STARTED 7-11-91	
BORING COMPLETED 7-11-91	
RIG CME 550	DRILLER JTuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 6 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-5

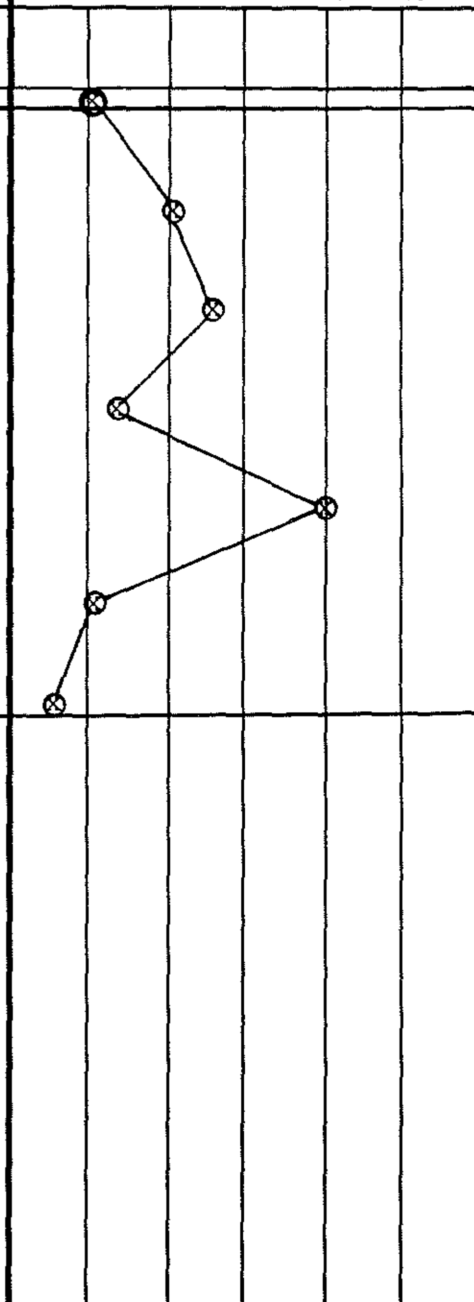
PROJECT Subsurface Exploration and Monitoring Well Installation Program-Water Supply	SITE Alley near Pike Avenue, Webster, Wisconsin
OWNER Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS			Reddish-brown fine to medium SAND, fill, moist (SP)		
			4			
	2SS		5.5	Gray SILTY LEAN CLAY, moist, stiff (CL)		10
				Brown fine to medium SAND, moist to waterbearing, medium dense to loose		
10	3SS					20
				(SP)		
	4SS					26
20	5SS					13
	6SS					40
30	7SS					11
		▼				
36	8SS					7
				End of boring at 36 feet		
40				$4\frac{1}{4}$ inch hollow stem auger used full depth		
				Borehole backfilled with sand/ cement grout		
50						
60						

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² -O- 1 2 3 4 5

WATER CONTENT % -●-

STANDARD PENETRATION (BLOWS/FOOT) -⊗- 10 20 30 40 50



WATER LEVEL OBSERVATIONS	
W.L.	34 feet while sampling
W.L.	
W.L.	

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BORING STARTED 6-26-91	
BORING COMPLETED 6-26-91	
RIG CME 550	DRILLER J. Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 7 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB - 6

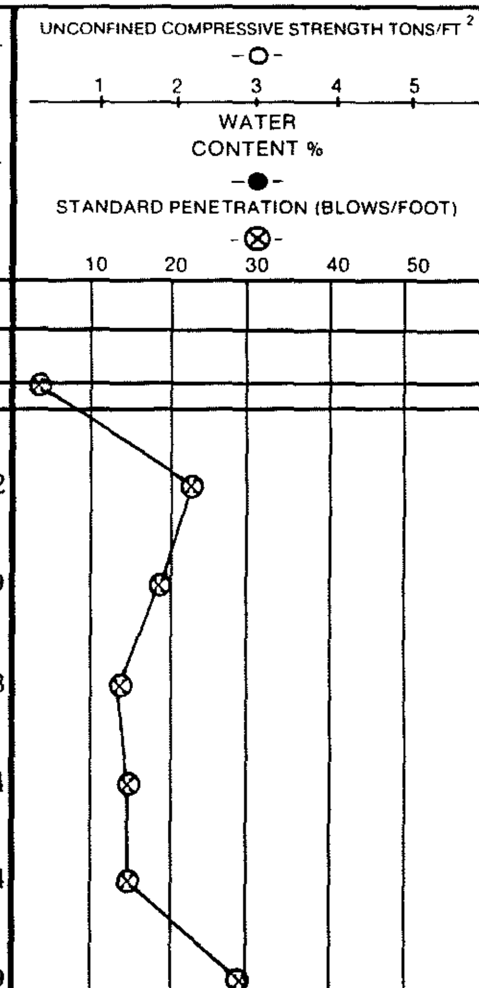
PROJECT Subsurface Exploration and MOnitoring Well Installation Program

SITE Alley Near Muskie Avenue, Webster, Wisconsin

OWNER Village of Webster Water Supply

ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL SURFACE ELEVATION	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS		2	Dark brown fine to medium SAND with silt, fill, moist (SP-SM)		
	2SS		5	Brown fine to medium SAND, fill, moist (SP)		3
			6.5	Gray SILTY LEAN CLAY, moist, soft (CL)		
10	3SS			Brown fine to medium SAND, moist to waterbearing at 34 feet, medium dense (SP)		22
	4SS					19
20	5SS					13
	6SS					14
30	7SS					14
		▼				
36	8SS					29
40				End of boring at 36 feet $4\frac{1}{4}$" hollow stem auger used full depth Borehole backfilled with sand/ cement grout		
50						
60						



WATER LEVEL OBSERVATIONS

W.L.	34.5 feet while sampling
W.L.	
W.L.	

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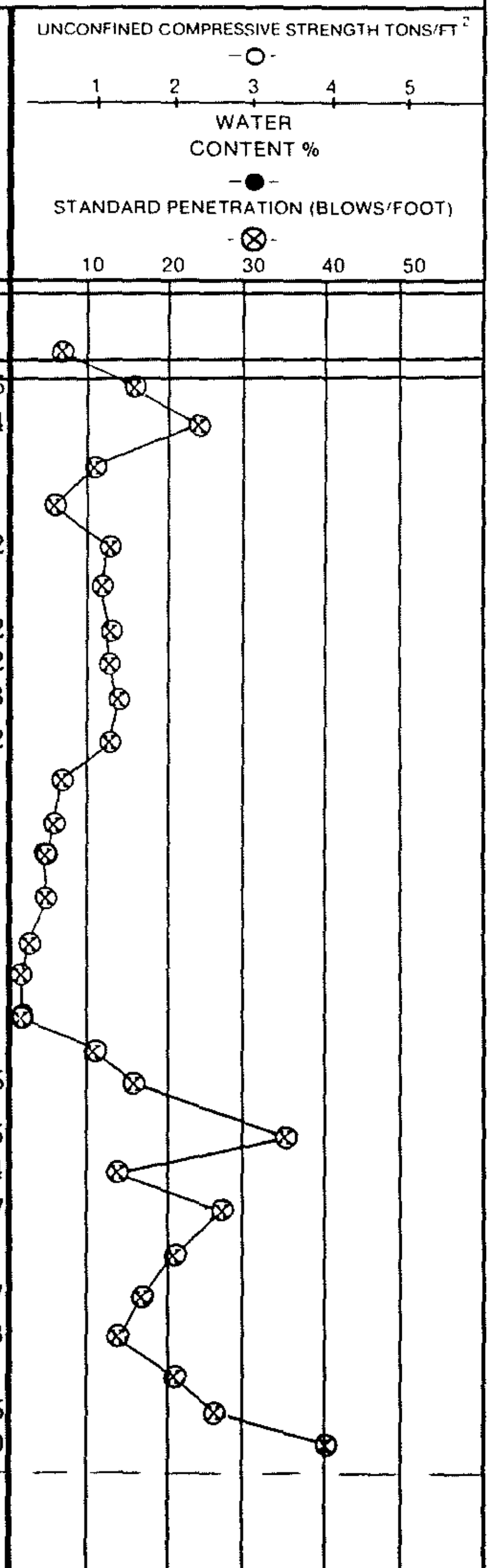
BORING STARTED 6-26-91	
BORING COMPLETED 6-26-91	
RIG CME 550	DRILLER J. Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 8 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-7

PROJECT Subsurface Exploration and Monitoring Well Installation Program	SITE Webster, Wisconsin
OWNER Water Supply Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS		0.5	Bituminous Pavement		
	2SS		4	Brown fine to medium SAND, fill, moist, medium dense (SP)		8
	3SS		5	Gray SILTY LEAN CLAY, moist, stiff (CL)		16
	4SS					24
10	5SS			Brown fine to medium SAND, moist to waterbearing at 38 feet, loose to dense (SP)		11
	6SS					7
	7SS					12
	8SS					11
	9SS					12
20	10SS					12
	11SS					13
	12SS					12
	13SS					8
	14SS					6
30	15SS					4
	16SS					5
	17SS	▼			MA	3
	18SS				Perm	2
	19SS					2
40	20SS					11
	21SS					16
	22SS					36
	23SS					14
	24SS					27
50	25SS					21
	26SS					17
	27SS					13
	28SS					21
	29SS					26
60	30SS					40



Boring log continued on next page.

WATER LEVEL OBSERVATIONS	
W.L.	33 feet while sampling
W.L.	
W.L.	

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(218) 722-4323

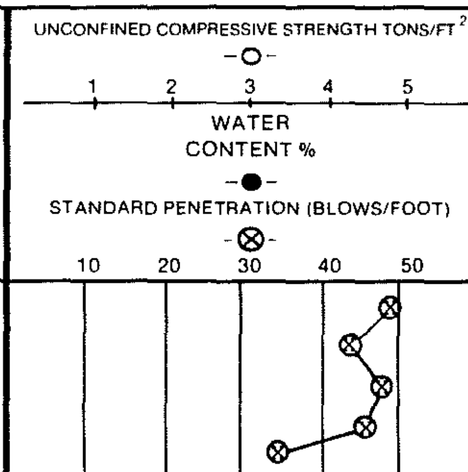
BORING STARTED 7-16-91	
BORING COMPLETED 7-16-91	
RIG CME 550	DRILLER J. Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 9 of 26

The stratification lines represent approximate boundaries between soil types: insitu the transition may be gradual.

LOG OF BORING SB-7 Cont'd

PROJECT	SITE
Subsurface Exploration and Monitoring Well Installation Program - Water Supply	Webster, Wisconsin
OWNER	ARCHITECT-ENGINEER
Village of Webster	RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	31SS			Brown fine to medium SAND, waterbearing, dense		49
	32SS					43
	33SS			(SP)	MA	48
	34SS					46
70	35SS					34
				End of boring at 70 feet		
				$4\frac{1}{4}$ inch hollow stem auger used full depth		
80				Monitoring well MW-91-5B was installed in this boring		
90						
100						
110						
120						



WATER LEVEL OBSERVATIONS	
W.L.	33 feet while sampling
W.L.	
W.L.	

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BORING STARTED 7-16-91	
BORING COMPLETED 7-16-91	
RIG CME 550	DRILLER J.Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 10 of 26

The stratification lines represent approximate boundaries between soil types: insitu the transition may be gradual.

LOG OF BORING SB-7A

PROJECT Subsurface Exploration and Monitoring Well Installation Program - Water Supply	SITE Webster, Wisconsin
OWNER Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² -O- 1 2 3 4 5

WATER CONTENT % -●-

STANDARD PENETRATION (BLOWS/FOOT) -⊗- 10 20 30 40 50

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
			0.5	Bituminous Pavement		
			2.5	Brown SAND with gravel, fill (SP)		
			3.5	Black organic clay (OH)		
			6.5	Grayish-brown SILTY LEAN CLAY, moist (CL)		
10				Brown fine to medium SAND, moist to waterbearing at 33 feet (SP)		
20						
30		▼				
40						

0 feet

m auger used

split barrel

-MW-5A was

is boring

No sampling was performed

WATER LEVEL OBSERVATIONS	
W.L.	33 feet while sampling
W.L.	
W.L.	

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BORING STARTED	7-16-91		
BORING COMPLETED	7-16-91		
RIG	CME 550	DRILLER	J.Tuura
DRAWN	KAL	APPROVED	WCK
JOB#	30-232-01	SHEET	11 of 26

The stratification lines represent approximate boundaries

LOG OF BORING SB-8

PROJECT Subsurface Exploration and Monitoring Well Installation Program - Water Supply

SITE Webster, Wisconsin

OWNER Village of Webster

ARCHITECT-ENGINEER RREM, Inc.

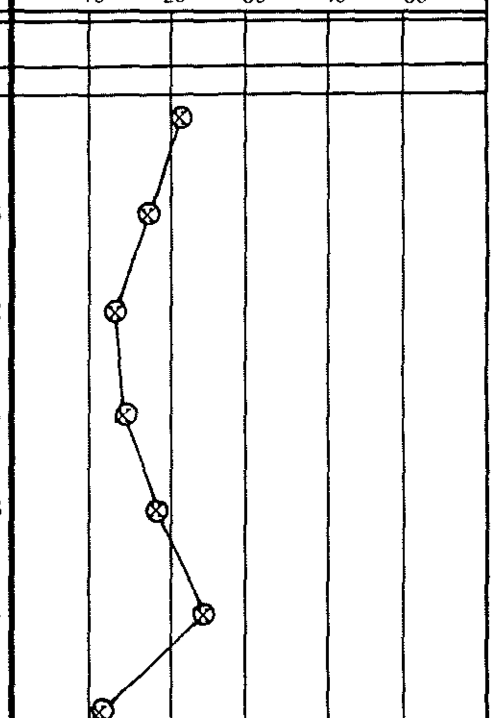
SURFACE ELEVATION

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS		0.5	Bituminous Pavement		
			3	Brown fine to medium SAND with gravel, fill, moist (SP)		
			4.5	Gray SILTY LEAN CLAY, moist, stiff (CL)		
	2SS			Brown fine to medium SAND, moist to waterbearing at 33 feet, medium dense (SP)		21
10	3SS					18
	4SS					12
20	5SS					13
	6SS					18
30	7SS					24
		▼				
36	8SS				MA	11
40				End of boring at 36 feet 4¼ inch hollow stem auger used full depth Monitoring well MW-91-4 was installed in this boring with an at grade well cover		
50						
60						

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² -○- 1 2 3 4 5

WATER CONTENT % -●-

STANDARD PENETRATION (BLOWS/FOOT) -⊗- 10 20 30 40 50



WATER LEVEL OBSERVATIONS

W.L.	33 feet while sampling
W.L.	
W.L.	

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BORING STARTED 7-8-91	
BORING COMPLETED 7-8-91	
RIG CME 550	DRILLER J.Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 12 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-9

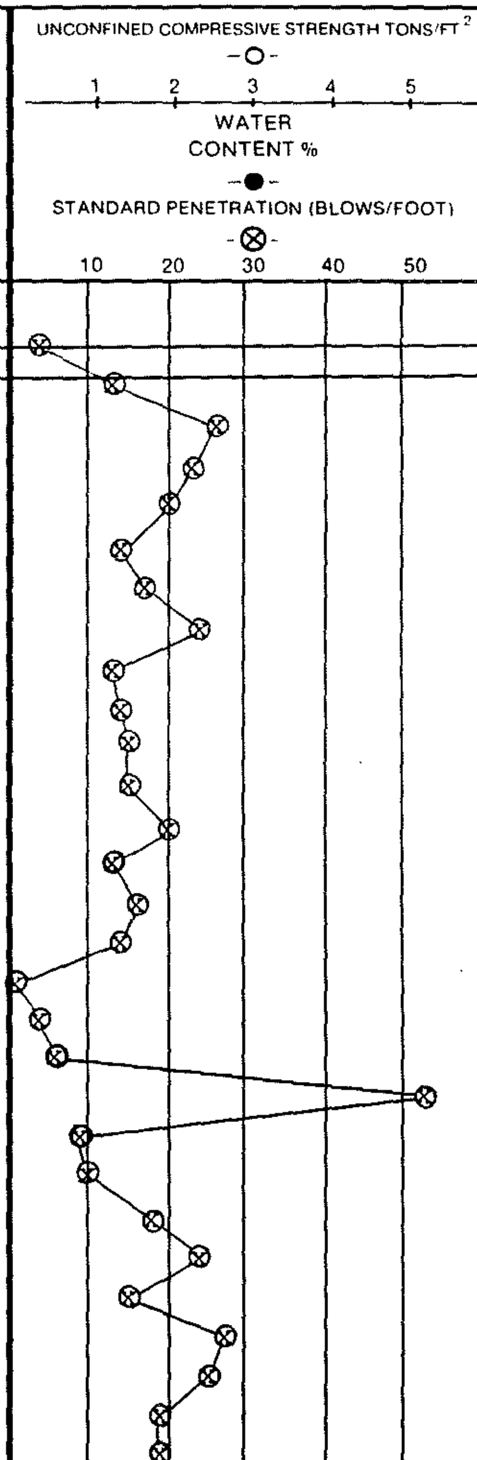
PROJECT Subsurface Exploration and Monitoring Well Installation Program - Water Supply

SITE Webster, Wisconsin

OWNER Village of Webster

ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS			Brown SILTY SAND, moist, loose		
	2SS		3.5	(SM)		4
			5	Gray SILTY LEAN CLAY, moist, stiff (CL)		
	3SS					12
	4SS					27
10	5SS			Brown fine to medium SAND, moist to waterbearing at 33.5 feet, loose to medium dense		22
	6SS					20
	7SS			(SP)		14
	8SS					17
	9SS					23
20	10SS					12
	11SS					13
	12SS					14
	13SS					14
	14SS					20
30	15SS					12
	16SS					16
	17SS	▼				13
	18SS					ROD
	19SS					4
40	20SS					6
	21SS					52
	22SS					9
	23SS					10
	24SS					18
50	25SS					24
	26SS					15
	27SS					28
	28SS					26
	29SS					19
60	30SS					19



Boring log continued on next page.

WATER LEVEL OBSERVATIONS

W.L.	33.5 feet while sampling
W.L.	
W.L.	

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BORING STARTED	7-22-91		
BORING COMPLETED	7-23-91		
RIG	CME 550	DRILLER	J. Tuura
DRAWN	KAL	APPROVED	WCK
JOB#	30-232-01	SHEET	13 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

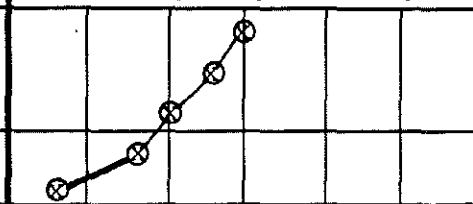
LOG OF BORING SB-9 Cont'd

PROJECT Subsurface Exploration and Monitoring Well Installation Program - Water Supply	SITE Webster, Wisconsin
OWNER Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

SURFACE ELEVATION → Depth = 60'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	31SS			Brown SILT, waterbearing, medium dense		30
	32SS					26
	33SS		66	(ML)		20
	34SS			Brown fine grained SAND, water-bearing, medium dense to loose	MA	16
70	35SS			(SP)		7
				End of boring at 70 feet		
				4¼ inch hollow stem auger used full depth		
80				Monitoring Well MW-91-3 was installed in this boring		
90						
100						
110						
120						

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² -O- 1 2 3 4 5
WATER CONTENT % -●-
STANDARD PENETRATION (BLOWS/FOOT) -⊗- 10 20 30 40 50



WATER LEVEL OBSERVATIONS	
W.L.	33.5 feet while sampling
W.L.	
W.L.	

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BORING STARTED 7-22-91	
BORING COMPLETED 7-23-91	
RIG CME 550	DRILLER J.Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 14 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-10

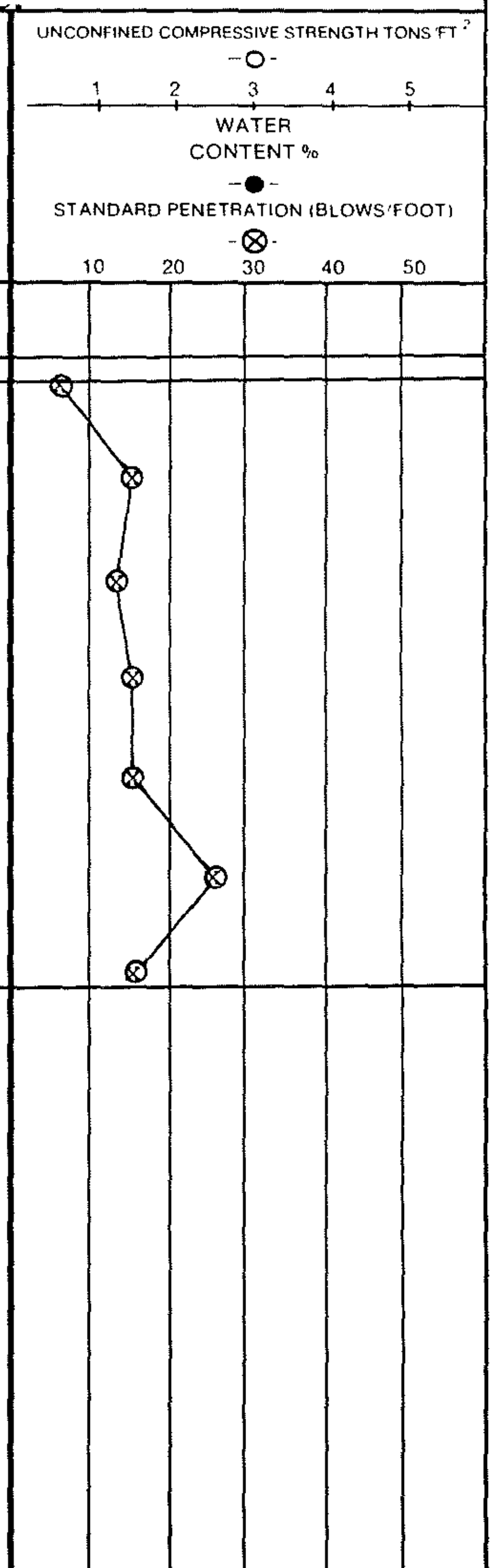
PROJECT Subsurface Exploration and Monitoring Well Installation Program - Water Supply

SITE Railroad Grade South of Main Street Webster, Wisconsin

OWNER Village of Webster

ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS		4	Black to brown SAND with SILT, fill, moist (SP-SM)		
	2SS		5.5	Gray SILTY LEAN CLAY, moist, medium (CL)		7
10	3SS			Brown fine to medium SAND, moist to waterbearing at 34 feet, medium dense (SP)		15
	4SS					12
20	5SS					15
	6SS					15
30	7SS					26
		▼				
36	8SS					16
40				End of boring at 36 feet 4¼ inch hollow stem auger used full depth Borehole backfilled with sand/cement grout		
50						
60						



WATER LEVEL OBSERVATIONS

W.L.	34 feet while sampling
W.L.	
W.L.	

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BORING STARTED 6-25-91	
BORING COMPLETED 6-25-91	
RIG CME 550	DRILLER J. Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 15 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-11

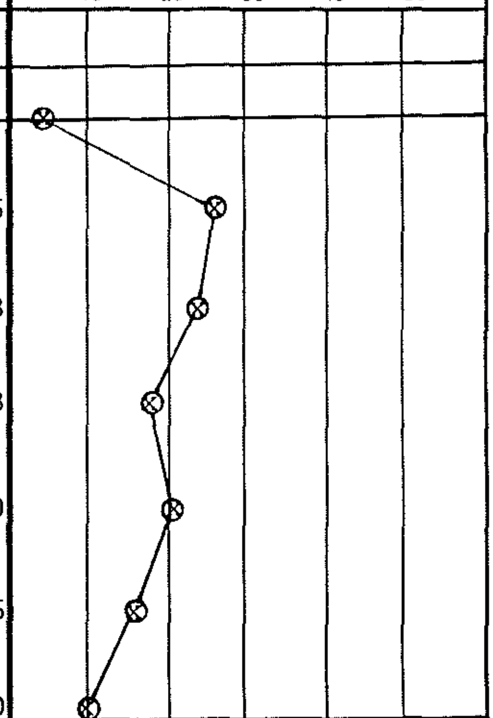
PROJECT Subsurface Exploration and Monitoring Well Installation Program - Water Supply	SITE Railroad Grade North of Main Street Webster, Wisconsin
OWNER Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS		3.5	Black to brown SAND with SILT, fill, with organics, moist (SP-SM)		
	2SS		6	Gray SILTY LEAN CLAY, moist, medium (CL)		4
10	3SS			Brown fine to medium SAND, moist to waterbearing, medium dense (SP)		26
	4SS					23
20	5SS					18
	6SS					20
30	7SS	▼				16
36	8SS					10
40				End of boring at 36 feet $4\frac{1}{4}$ inch hollow stem auger used full depth Borehole was backfilled with sand/ cement grout		
50						
60						

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² -O- 1 2 3 4 5

WATER CONTENT % -●-

STANDARD PENETRATION (BLOWS/FOOT) -⊗- 10 20 30 40 50



WATER LEVEL OBSERVATIONS	
W.L.	34 feet while sampling
W.L.	
W.L.	

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BORING STARTED 6-25-91	
BORING COMPLETED 6-25-91	
RIG CME 550	DRILLER J.Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 16 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-12

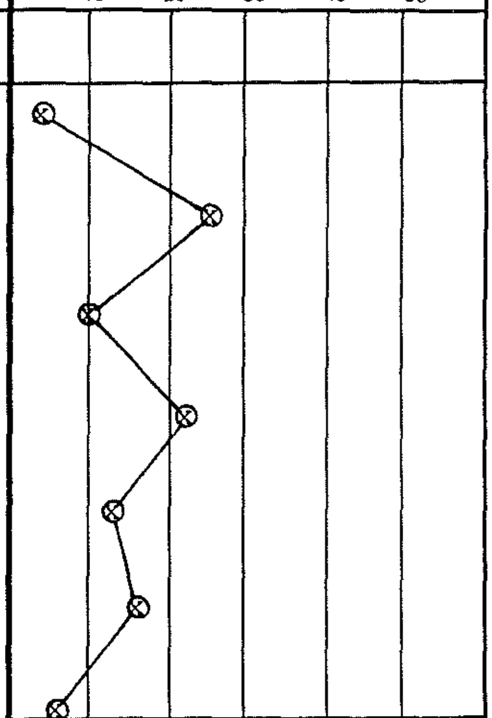
PROJECT Subsurface Exploration and Monitoring Well Installation Program - Water Supply	SITE Minnow Avenue and Main Street Webster, Wisconsin
OWNER Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS		4	Brown SAND with SILT, fill, with organics at 3 feet, moist (SP-SM)		
	2SS			Brown fine to medium SAND, moist to waterbearing at 34 feet, loose to medium dense (SP)		4
10	3SS					25
	4SS					10
20	5SS					22
	6SS					13
30	7SS					17
36	8SS	▼				7
40				End of boring at 36 feet 4¼ inch hollow stem auger used full depth Borehole backfilled with sand/ cement grout		
50						
60						

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² -O- 1 2 3 4 5

WATER CONTENT % -●-

STANDARD PENETRATION (BLOWS/FOOT) -⊗- 10 20 30 40 50



WATER LEVEL OBSERVATIONS	
W.L.	34 feet while sampling
W.L.	
W.L.	

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BORING STARTED 6-19-91	
BORING COMPLETED 6-19-91	
RIG CME 550	DRILLER J.Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 17 of 26

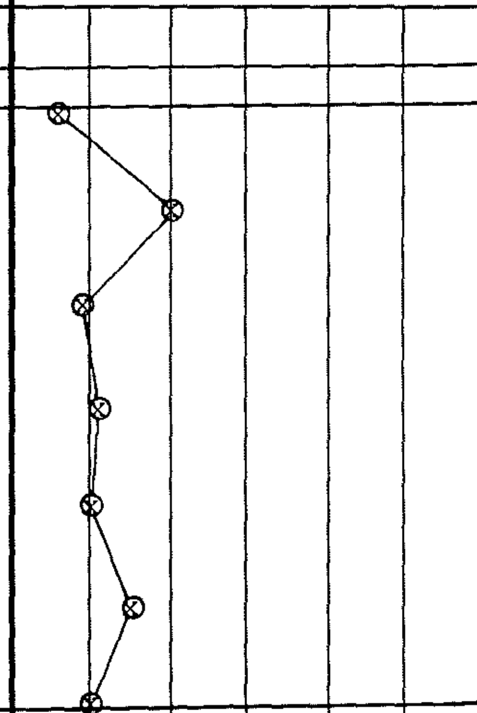
The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-13

PROJECT Subsurface Exploration and Monitoring Well Installation Program - Water Supply	SITE Webster, Wisconsin
OWNER Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS		3.5	Brown fine to medium SAND with SILT, fill, moist (SP-SM)		
	2SS		5.5	Gray SILTY LEAN CLAY, moist, medium (CL)		6
10	3SS			Brown fine to medium SAND, moist to waterbearing at 34 feet, medium dense (SP)		20
	4SS					9
20	5SS					11
	6SS					10
30	7SS	▼				16
36	8SS					10
40				End of boring at 36 feet		
				$4\frac{1}{4}$ inch hollow stem auger used full depth		
				Borehole backfilled with sand/ cement grout		
50						
60						

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² -O- (1, 2, 3, 4, 5)
WATER CONTENT % -●-
STANDARD PENETRATION (BLOWS/FOOT) -⊗- (10, 20, 30, 40, 50)



WATER LEVEL OBSERVATIONS	
W.L.	34 feet while sampling
W.L.	
W.L.	

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BORING STARTED 6-24-91	
BORING COMPLETED 6-24-91	
RIG CME 550	DRILLER J.Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 18 of 26

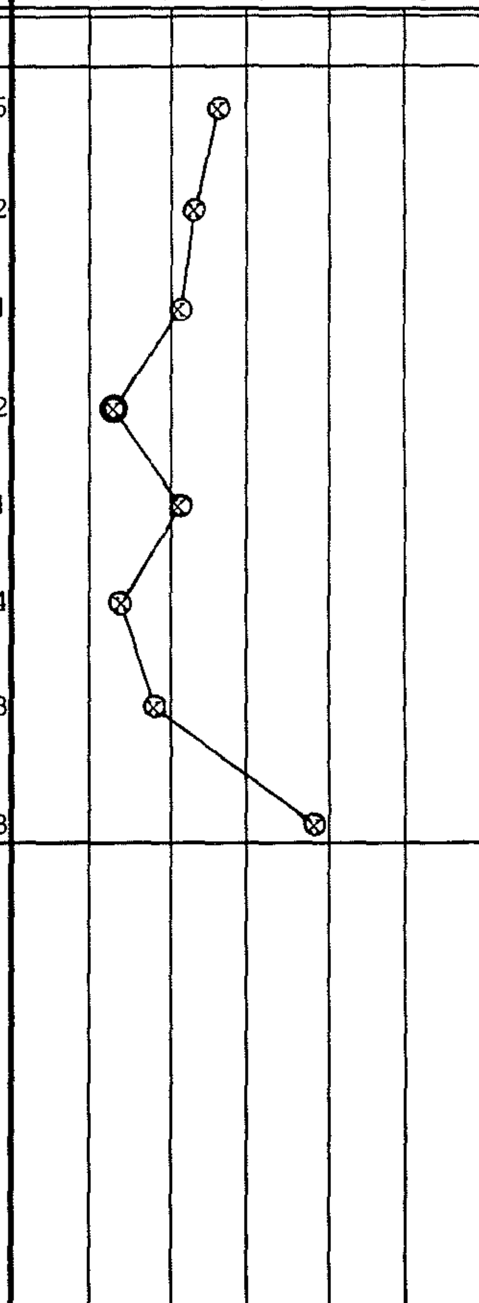
The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-14

PROJECT Subsurface Exploration and Monitoring Well Installation Program - water supply	SITE Minnow Avenue Webster, Wisconsin
OWNER Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS		0.5	Black sandy SILT, topsoil, organic (ML)		
			3	Gray SILTY LEAN CLAY, moist (CL)		
	2SS			Brown fine to medium SAND, moist to waterbearing at 33 feet, medium dense to dense (SP)		26
10	3SS					22
	4SS					21
20	5SS					12
	6SS					21
30	7SS					14
		▼				
	8SS				MA	18
40						
42	9SS					38
				End of boring at 42 feet		
				$4\frac{1}{4}$ inch hollow stem auger used full depth		
50				Monitoring well MW-91-1 was installed in this boring		
60						

UNCONFINED COMPRESSIVE STRENGTH TONS/FT^2 -O- 1 2 3 4 5
WATER CONTENT % -●-
STANDARD PENETRATION (BLOWS/FOOT) -⊗- 10 20 30 40 50



WATER LEVEL OBSERVATIONS	
W.L.	33 feet while sampling
W.L.	
W.L.	

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BORING STARTED 6-19-91	
BORING COMPLETED 6-19-91	
RIG CME 550	DRILLER J.Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 19 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-15

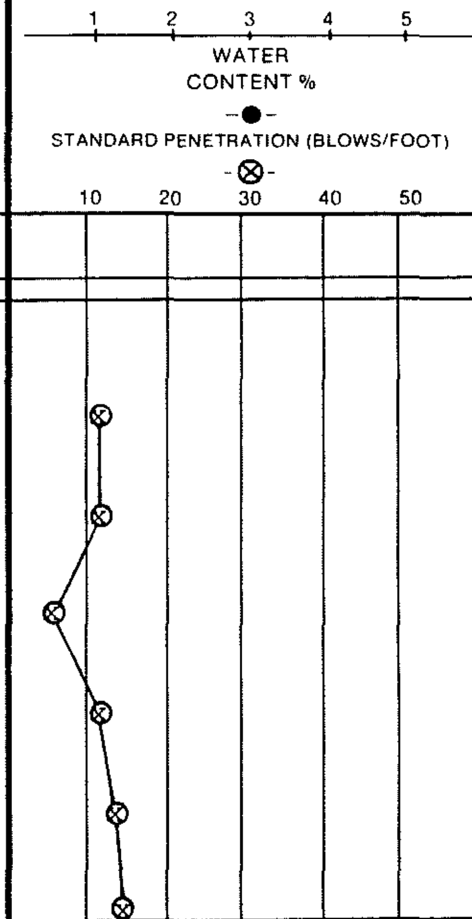
PROJECT Subsurface Exploration and Monitoring Installation Program - water supply	SITE Minnow Avenue and Elm Street Webster, Wisconsin
OWNER Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS		3.5	Brown SAND with gravel, fill, moist (SP)		
	2SS		4.5	Gray SILTY LEAN CLAY with organics (CL)	Perm	3T
10	3SS			Brown fine to medium SAND, moist, medium dense (SP)		11
	4SS					11
20	5SS					6
	6SS					11
30	7SS	▼				13
36	8SS					14
40				End of boring at 36 feet 4¼ inch hollow stem auger used full depth Borehole backfilled with sand/ cement grout		
50						
60						

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² -O-

WATER CONTENT % -●-

STANDARD PENETRATION (BLOWS/FOOT) -⊗-



WATER LEVEL OBSERVATIONS	
W.L.	33.5 while sampling
W.L.	
W.L.	

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BORING STARTED 6-18-91	
BORING COMPLETED 6-18-91	
RIG CME 550	DRILLER J.Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 20 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-16

PROJECT Subsurface Exploration and Monitoring Well Installation Program - Water Supply

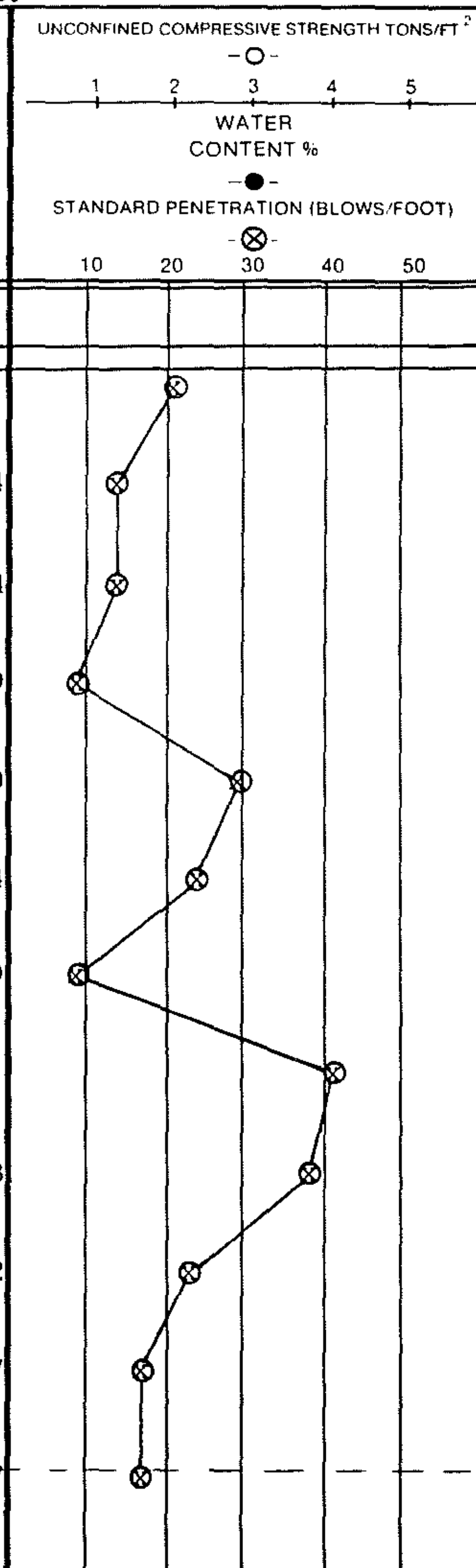
SITE Webster, Wisconsin

OWNER Village of Webster

ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS		0.5	Bituminous pavement		
			3.5	Brown fine to medium SAND with gravel fill, moist (SP)		
	2SS		4.8	Gray SILTY LEAN CLAY, moist, medium		21
10	3SS			Brown fine to medium SAND, moist to waterbearing at 33.5 feet, medium dense (SP)		14
	4SS					14
20	5SS					9
	6SS					30
30	7SS					24
	8SS					9
40	9SS					41
	10SS					38
50	11SS					22
	12SS					17
60	13SS					17

Boring log continued on next page.



WATER LEVEL OBSERVATIONS	
W.L.	33.5 feet while sampling
W.L.	
W.L.	

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BORING STARTED	8-6-91		
BORING COMPLETED	8-6-91		
RIG	CME 550	DRILLER	J.Tuura
DRAWN	KAL	APPROVED	WCK
JOB#	30-232-01	SHEET	21 of 26

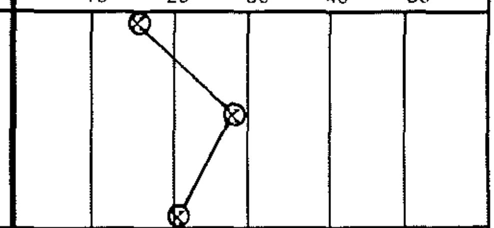
The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-16 cont'd

PROJECT Subsurface Exploration and Monitoring Well Installation Program - Water Supply	SITE Webster, Wisconsin
OWNER Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

SURFACE ELEVATION ↓ Depth = 60'

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	13SS			Brown fine to medium SAND, waterbearing, medium dense (SP)		17
	14SS				MA	28
70						
71	15SS					20
				End of boring at 71 feet		
				$4\frac{1}{4}$ inch hollow stem auger used full depth		
80				Monitoring well MW-91-7 was installed in this boring		
90						
100						
110						
120						



WATER LEVEL OBSERVATIONS

W.L.	33.5 feet while sampling
W.L.	
W.L.	

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BORING STARTED 8-6-91	
BORING COMPLETED 8-6-91	
RIG CME 550	DRILLER J.Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 22 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-17

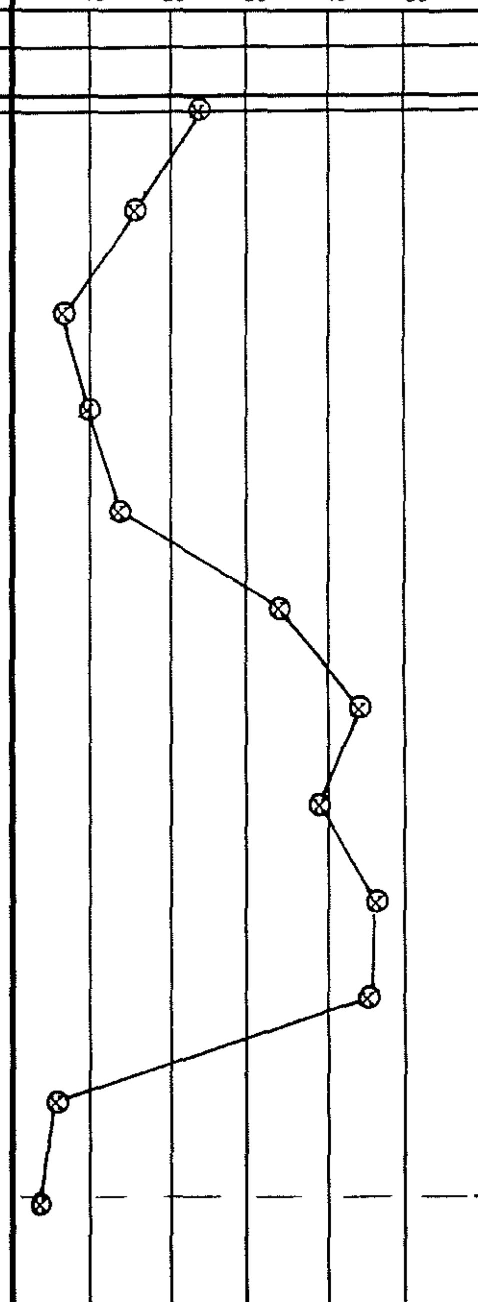
PROJECT Subsurface Exploration and Monitoring Well Installation Program - Water Supply	SITE Webster, Wisconsin
OWNER Village of Webster	ARCHITECT-ENGINEER RREM, inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS		2	Black to brown SANDY SILT with organics, topsoil, moist (ML)		
			4.5	Dark brown SILTY SAND, fill, moist (SM)		
	2SS		5.5	Gray SILTY LEAN CLAY, moist, stiff		23
10	3SS			Light brown fine to medium SAND, moist to waterbearing at 33.5 feet, medium dense to loose		15
	4SS			(SP)		7
20	5SS					10
	6SS					13
30	7SS					33
		▼				
	8SS					43
40	9SS					39
	10SS					46
50	11SS					45
	12SS					6
60	13SS			Boring log continued on next page.		3

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² -O- 1 2 3 4 5

WATER CONTENT % -●-

STANDARD PENETRATION (BLOWS/FOOT) -⊗- 10 20 30 40 50



WATER LEVEL OBSERVATIONS	
W.L.	33.5 feet while sampling
W.L.	
W.L.	

GME CONSULTANTS, INC.
Geotechnical • Materials • Environmental
P.O. Box 16070
Duluth, Minnesota 55816
(218) 722-4323

BORING STARTED 8-6-91	
BORING COMPLETED 8-6-91	
RIG CME 550	DRILLER J. Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 23 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-17 Cont'd

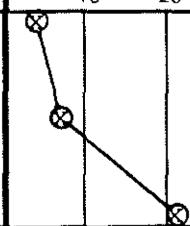
PROJECT Subsurface Exploration and Monitoring Well Installation Program - Water Supply	SITE Webster, Wisconsin
OWNER Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL SURFACE ELEVATION Depth = 60'	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	13SS			Brown fine to medium SAND, water-bearing, loose to medium dense		4
	14SS			(SP)	MA	7
70 71	15SS					21
				End of boring at 71 feet $4\frac{1}{4}$" hollow stem auger used full depth Monitoring well MW-91-8 was installed in this boring		
80						
90						
100						
110						
120						

UNCONFINED COMPRESSIVE STRENGTH TONS/FT² -O- 1 2 3 4 5

WATER CONTENT % -●-

STANDARD PENETRATION (BLOWS/FOOT) -⊗- 10 20 30 40 50



WATER LEVEL OBSERVATIONS	
W.L.	33.5 feet while sampling
W.L.	
W.L.	

GME CONSULTANTS, INC.
Geotechnical • Materials • Environmental
P.O. Box 16070
Duluth, Minnesota 55816
(218) 722-4323

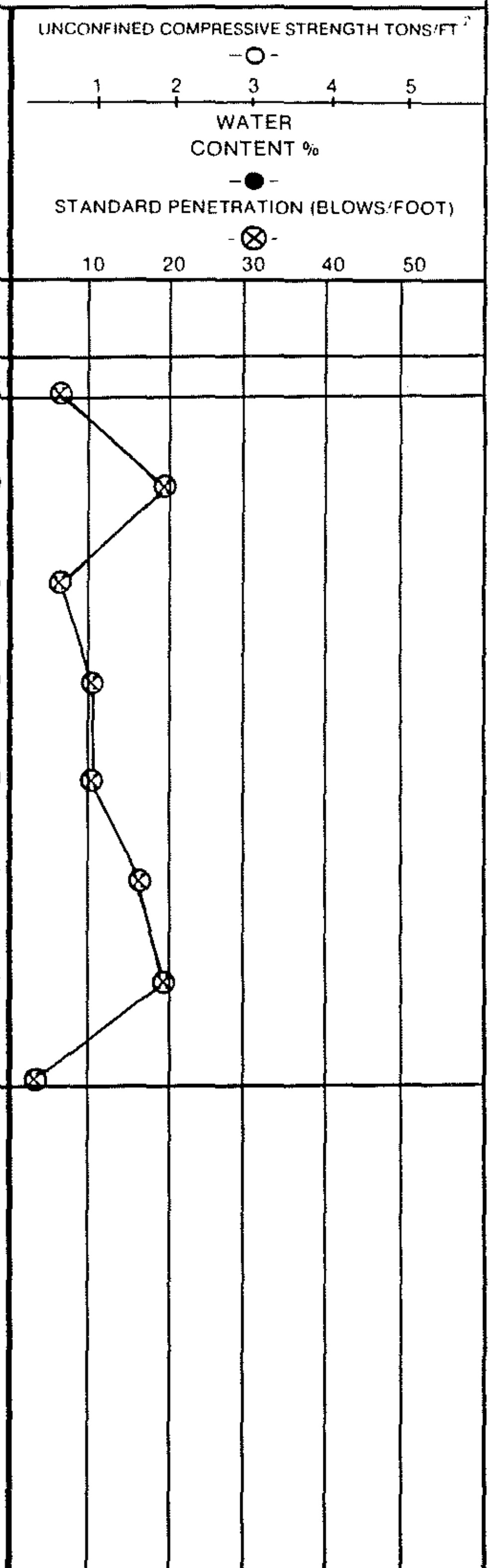
BORING STARTED 8-6-91	
BORING COMPLETED 8-6-91	
RIG CME 550	DRILLER J. Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 24 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB - 18

PROJECT Subsurface Exploration and Monitoring Installation Program - Water Supply	SITE Webster, Wisconsin
OWNER Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS		4	Brown SAND with gravel, fill, moist (SP)		
	2SS		6	Gray SILTY LEAN CLAY, moist, medium (CL)		6
10	3SS			Brown fine to medium SAND, moist to waterbearing at 33.5 feet, medium dense to loose (SP)		19
	4SS					6
20	5SS					10
	6SS					10
30	7SS					17
		▼				
	8SS					19
40 / 41	9SS					3
				End of boring at 41 feet		
				$4\frac{1}{4}$ inch hollow stem auger used full depth		
50				Borehole backfilled with sand/ cement grout		
60						



WATER LEVEL OBSERVATIONS	
W.L.	33.5 feet while sampling
W.L.	
W.L.	

GME CONSULTANTS, INC.
Geotechnical • Materials • Environmental
P.O. Box 16070
Duluth, Minnesota 55816
(218) 722-4323

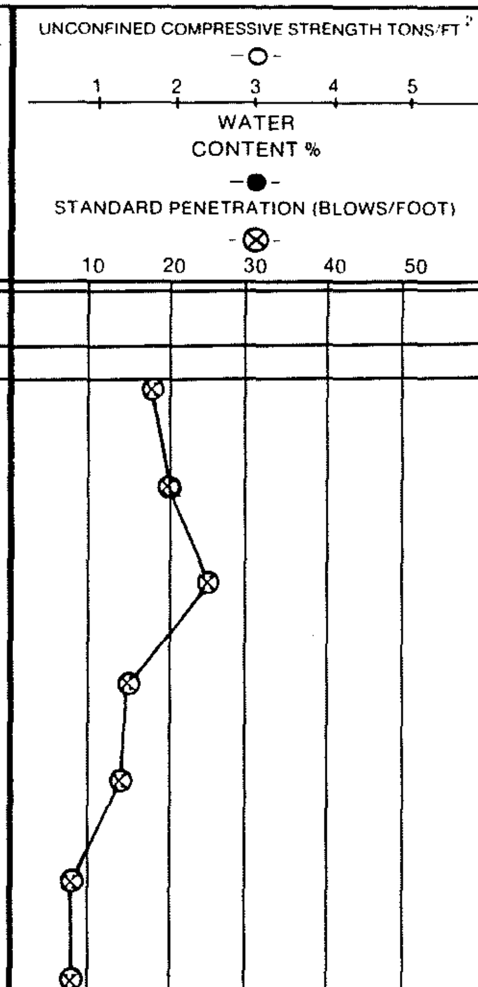
BORING STARTED	8-7-91		
BORING COMPLETED	8-7-91		
RIG	CME 550	DRILLER	J.Tuura
DRAWN	KAL	APPROVED	WCK
JOB#	30-232-01	SHEET	25 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

LOG OF BORING SB-19

PROJECT Subsurface Exploration and Monitoring Well Installation Program – Water Supply	SITE Webster, Wisconsin
OWNER Village of Webster	ARCHITECT-ENGINEER RREM, Inc.

DEPTH, FEET	SAMPLE NUMBER AND TYPE	WATER LEVEL	STRATA CHANGE, FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	SPECIAL TEST RESULTS	N-VALUE (BLOWS/FT.)
	1AS		0.5	Bituminous Pavement		
			3.5	Brown SAND with gravel, fill, moist (SP)		
	2SS		5	Gray SILTY LEAN CLAY, moist (CL)		18
10	3SS			Light brown fine to medium SAND, moist to waterbearing at 33 feet, medium dense (SP)		20
	4SS					25
20	5SS					15
	6SS					13
30	7SS	▼				8
36	8SS					8
40				End of boring at 36 feet		
				$4\frac{1}{4}$ inch hollow stem auger used full depth		
				Borehole backfilled with sand/cement grout		
50						
60						



WATER LEVEL OBSERVATIONS	
W.L.	33 feet while sampling
W.L.	
W.L.	

GME CONSULTANTS, INC.
Geotechnical • Materials • Environmental
P.O. Box 16070
Duluth, Minnesota 55816
(218) 722-4323

BORING STARTED 8-6-91	
BORING COMPLETED 8-6-91	
RIG CME 550	DRILLER J.Tuura
DRAWN KAL	APPROVED WCK
JOB# 30-232-01	SHEET 26 of 26

The stratification lines represent approximate boundaries between soil types; insitu the transition may be gradual.

SIEVE ANALYSIS TESTS

PROJECT Village of Webster-Water Supply DATE 8-9-91
Webster, Wisconsin

REPORTED TO RREM, Inc. JOB NO. 30-232-01

BORING NO.	91-02	91-04	91-04	91-07
SAMPLE NO.	8	8	15	8
DEPTH (ft)	34-36	34-36	69-71	34-36
TYPE OF SAMPLE	SS	SS	SS	SS
CLASSIFICATION (ASTM:D2487) Symbol	SP	SP	SP-SM	SP
Description	Poorly graded sand	Poorly graded sand	Poorly graded sand with silt	Poorly graded sand
MECHANICAL ANALYSIS: Dry Weight of Total Sample (grams)	168.6	168.4	108.2	135.7
Based on Total Sample Gravel-% (on #4)	-0-	2.6	-0-	-0-
Based on Total Sample Sand-% (#4-#10)	2.2	4.9	0.1	-0-
(#10-#40)	16.6	48.8	3.8	5.5
(#40-#100)	70.9	33.6	61.1	87.8
(#100-#200)	9.0	7.5	33.1	6.1
Fines-% (#200 Down)	1.3	2.6	9.3	0.6

SIEVE ANALYSIS TESTS

PROJECT Village of Webster - Water Supply DATE 8-9-91

Webster, Wisconsin

REPORTED TO RREM, Inc. JOB NO. 30-232-01

BORING NO.	91-07	91-08	91-09	91-14
SAMPLE NO.	34	8	34	8
DEPTH (ft)	66-68	34-36	66-68	34-36
TYPE OF SAMPLE	SS	SS	SS	SS
CLASSIFICATION (ASTM:D2487) Symbol	SP-SM	SP	SM	SP
Description	Poorly graded sand with silt	Poorly graded sand	Silty sand	Poorly graded sand
MECHANICAL ANALYSIS: Dry Weight of Total Sample (grams)	143.6	103.6	165.5	104.8
Based on Total Sample Gravel-% (on #4)	-0-	1.9	0.1	-0-
Based on Total Sample Sand-% (#4-#10)	0.1	3.3	-0-	-0-
(#10-#40)	6.9	37.5	0.5	48.7
(#40-#100)	78.1	53.5	12.7	50.3
(#100-#200)	8.3	2.9	47.0	1.0
Fines-% (#200 Down)	6.6	0.8	39.6	0.1

GME CONSULTANTS, INC.
GEOTECHNICAL * MATERIAL * ENVIRONMENTAL

SIEVE ANALYSIS TESTS

PROJECT Village of Webster - Water Supply DATE 8-9-91

Webster, Wisconsin

REPORTED TO RREM, Inc. JOB NO. 30-232-01

BORING NO.	91-16	91-17		
SAMPLE NO.	14	14		
DEPTH (ft)	64-66	64-66		
TYPE OF SAMPLE	SS	SS		
CLASSIFICATION (ASTM:D2487) Symbol	SP	SP		
Description	Poorly graded sand	Poorly graded sand		
MECHANICAL ANALYSIS: Dry Weight of Total Sample (grams)	115.2	161.6		
Based on Total Sample Gravel-% (on #4)	-0-	-0-		
Based on Total Sample Sand-% (#4-#10)	-0-	0.1		
(#10-#40)	1.8	3.2		
(#40-#100)	60.0	78.2		
(#100-#200)	31.9	11.8		
Fines-% (#200 Down)	6.4	6.7		

SPECIAL NOTES ON PLACEMENT OF COMPACTED FILL SOIL

GENERAL

The placement of compacted fill for support of foundations, floor slabs, pavements, or earth structures should be carried out by an experienced excavator with the proper equipment. The excavator must be prepared to adapt his procedures, equipment, and materials to the type of project, to weather conditions, and the structural requirements of the architect and engineer. Methods and materials used in summer may not be applicable in winter; fill used in dry excavations may not be suitable in wet excavations or during periods of precipitation; proposed fill soil may require wetting or drying for proper placement and compaction. Conditions may also vary during the course of a project or in different areas of the site. These needs should be addressed in the project drawings and specifications.

EXCAVATION/BACKFILL BELOW THE WATER TABLE

It is common to have to excavate and replace unsuitable soils below the water table for site correction. As a general rule of prudent construction technique, we recommend that excavation/backfill below the water table not be permitted, unless the excavation is dewatered. Numerous problems can develop when this procedure is attempted without dewatering.

- Inability of the equipment operators and soil technicians to observe that all unsuitable soil/materials have been removed from the base of the excavation.
- Inability to observe and measure that proper lateral oversizing is provided.
- Inability to prevent or correct sloughing of excavation sidewalls, which can result in unsuitable soils trapped within the select backfill.
- Inability of the contractor to adequately and uniformly compact the backfill.
- Possibility of disturbance of the suitable soils at the base of the excavation.

The dewatering methods, normally chosen at the contractor's option, should follow prudent construction practice. Excavations in clay can often be dewatered with sump pits and pumps; this technique would not be applicable for excavation extending into permeable granular soil, especially for depths significantly below the water table. Dewatering granular soils should normally be done with well points or wells. When dewatering is needed, we strongly recommend that the procedures be discussed at pre-bid or pre-construction meetings. The dewatering technique chosen by the contractor should be reviewed by the architect and engineer **before** construction starts; it should not be left until excavation is under way.

The selection of proper backfill materials is important when working in dewatered excavations. Even with dewatering, the base is usually wet and the contractor must be careful not to disturb the base. We recommend that the first lifts of backfill be a clean medium to course grain sand with less than 5% passing the #200 sieve. The use of silty sand, clayey sand, or cohesive/semi-cohesive soils is not recommended for such situations. The excavator should be required to submit samples of the proposed material(s) he plans to use as backfill **before** the fill is hauled to the site, so that it can be tested for suitability.

WINTER EARTHWORK CONSTRUCTION

Winter earthwork presents its own range of problems which must be overcome; the situation may be complicated by the need for dewatering discussed above.

During freezing conditions, the fill used must **not** be frozen when delivered to the site. It also must not be allowed to freeze during or after compaction. Since the ability to work the soil while keeping it from freezing depends in part on the soil type, the specifications should require the contractor to submit a sample of his proposed fill before construction starts, for laboratory testing. If the soil engineer and structural engineer determine that it is not suitable, it should be rejected. In general, silty sand, clayey sand, and cohesive/semi-cohesive soils should not be used as fill under freezing conditions. All frozen soil of any type should be rejected for use as compacted fill.

It is important that compacted fill be protected from freezing after it is placed. The excavator should be required to submit a plan for protecting the soil. The plan should include details on the type and amount of material (straw, blankets, extra loose fill, topsoil, etc.) proposed for use as frost protection. The need to protect the soil from freezing is ongoing throughout construction and applies both before **and** after concrete is placed, until backfilling for final frost protection is completed. Foundations placed on frozen soil can experience heaving and significant settlement, rotation, or other movement as the soil thaws. Such movement can also occur if the soil is allowed to freeze **after** the concrete is placed and then allowed to thaw. The higher the percentage of fines (clay and silt, P-200 material) in the fill, the more critical is the need for protection from freezing.

MOISTURE CONTROL OF FILL

The contractor should be required to adjust the moisture content of the soil to within a narrow range near the optimum moisture content (as defined by the applicable Proctor or AASHTO Test). In general, fill should be placed within about 2% of optimum. The need for moisture control is more critical as the percentage of fines increases. Naturally-occurring clayey sand or cohesive/semi-cohesive soil are often much wetter than the optimum. Placing and attempting to compact such soils to the specified density may be difficult, or not possible. Even if compacted to the specified density, excessively wet soils may not be suitable as floor slab or pavement subgrades due to pumping under applied load. This is especially true when wet cohesive/semi-cohesive soil is used as backfill in utility trenches under streets. Excessively wet soil in thick fill sections may cause post-construction settlement beyond that estimated for fill placed at or near (±2%) the optimum moisture content.

An exception to this would be low permeability soil placed as a pond liner or for a dam. Such soil should usually be placed at 2% to 4% above the optimum moisture content, to provide for a lower insitu permeability. Also, shrinking/swelling soils (expansive clay) should be placed at about 2% to 4% above optimum moisture to reduce the possibility of soil expansion. Clayey silt, silt, or very silty fine sand should be placed excessively dry. Such soils can undergo post-construction consolidation upon being wetted, even if the specified density had been achieved. This is caused by the collapse of flocculant soil particle arrangement, and can result in settlement of buildings or slabs constructed over the soil.

Proper control of fill soil moisture is the responsibility of the excavator. The excavator should evaluate the need for wetting or drying the soils, based either on the data in the soil report, or his own site testing. If the excavator is bringing in off-site fill, it is also his responsibility to evaluate the moisture content of the soil, and the need for wetting or drying. We recommend that this matter be addressed in the project specifications.

CONSTRUCTION ON COMPACTED SOIL

After the select fill has been placed, compacted, and tested, it must be maintained and protected in order to properly support structures. The suitability of compacted fill soil can be greatly diminished if it is allowed to freeze, become saturated while unconfined (such as in footing excavations or at the surface of slab/placement subgrade), or disturbed by construction equipment

The responsibility for protecting the soil, or for correcting any disturbance, should be clearly defined in the specifications. Soils which become wet and soft after compaction testing do not necessarily reflect inaccurate field density tests. Especially with non-expansive cohesive/semi-cohesive soils, saturation when unconfined can severely reduce the **shear strength** while the density remains adequate. The reduced shear strength can cause footings, floor slabs, or pavements to settle or fail under load. We strongly recommend that all pavement subgrade be test rolled (MN/DOT Specification 2111) immediately before paving to determine if the subgrade has not been protected and soft spots have developed.

FLOOR SLAB SUBGRADE AND UTILITY TRENCHES

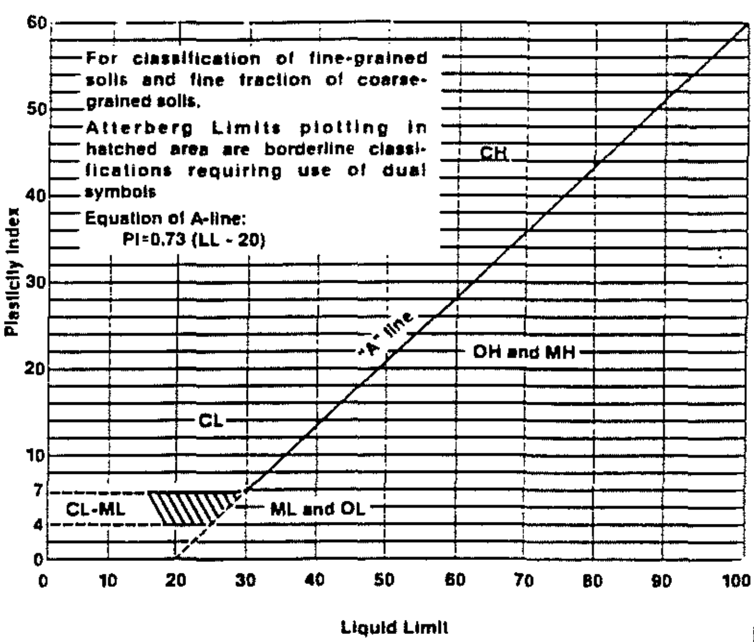
This facet of construction presents special problems, especially if the slab subgrade is allowed to freeze. When the soil thaws, it undergoes a period of temporarily lower shear strength. Floor slabs should **not** be cast over soil in such a weakened or frozen condition (reference pertinent PCA and ACI publications). To do so can result in cracked and failing slabs. The time period to heat and thaw a building may place the construction schedule and/or costs in jeopardy. We strongly recommend that this matter be reviewed in pre-bid and pre-construction meetings.

Backfilling of utility trenches in the floor slab subgrade can be difficult. If the soil is wet, compaction to the specified density may be difficult, or not possible. The narrowly cut trenches may preclude the use of proper compaction equipment. With the use of small equipment in confined areas, the contractor must place the soil in thin lifts (4 to 6 inches), with the soil at the proper moisture content. This work is typically carried out by contractors other than the mass grading or earthwork contractor. We strongly recommend that the responsibility to carry out the compaction be clearly detailed in the applicable section of the specifications, and reviewed with the appropriate contractor and subcontractor.

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

(ASTM: D 2487 and 2488)

Major divisions			Group symbols	Typical names	Laboratory classification criteria		
Coarse-grained soils (More than half of material is *larger* than No. 200 sieve size)	Gravels (More than half of corase fraction larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 per cent ..... GW, GP, SW, SP; More than 12 per cent ..... GM, GC, SM, SC; 5 to 12 per cent ..... *Borderline* cases requiring dual symbols	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} X D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM d / u	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 *are border-line* cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits below "A" line or P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} X D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM d / u	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 *are borderline* cases requiring use of dual symbols.
			SC	Clayey sands, sand-clay mixtures		Atterberg limits below "A" line or P.I. greater than 7	
Fine-grained soils More than half of material is *smaller* than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity			
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL	Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		Pt	Peat and other highly organic soil			



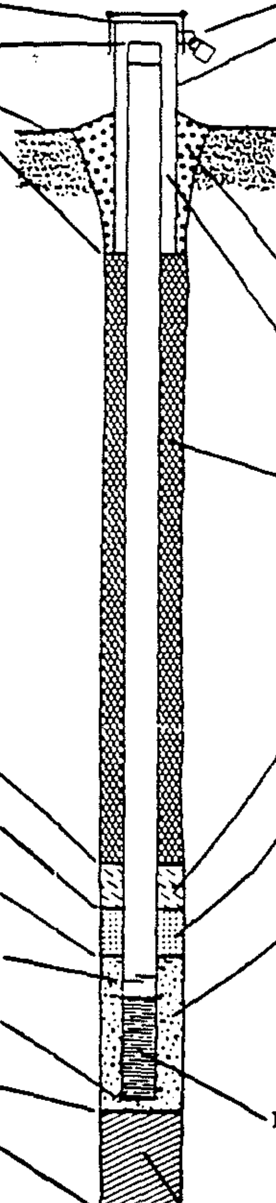
Plasticity Chart

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☒ Underground Tanks ☐ Other ☐ ______

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name: VILLAGE OF WEBSTER - WATER SUPPLY	Local Grid Location of Well: ______ ft. ☐N. ☐S. ______ ft. ☐E. ☐W.	Well Name: MW-91-1
Facility License, Permit or Monitoring Number: ________	~~[illegible]~~ WELL LOCATION Lat. ______ Long. ______ or	Wis. Unique Well Number: DL-001 DNR Well Number: ____
Type of Well: Water Table Observation Well ☒ 11 Piezometer ☐ 12	St. Plane 268547.797 ft. N, 1396684.11 ft. E.	Date Well Installed: 06/19/91 (m m / d d / y y)
Distance Well Is From Waste/Source Boundary ______ ft.	Section Location of Waste/Source: ___1/4 of ___ 1/4 of Sec. ___, T. ___ N, R. ___ ☐E. ☐W.	Well Installed By: (Person's Name and Firm) Jamie Tuura
Is Well A Point of Enforcement Std. Application? ☒ Yes ☐ No	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	GME Consultants, Inc.



A. Protective pipe, top elevation __983.42 ft. MSL

B. Well casing, top elevation __983.22 ft. MSL

C. Land surface elevation __980.2 ft. MSL

D. Surface seal, bottom ______ ft. MSL or 27.5 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☒ Yes ☐ No

14. Drilling method used: Rotary ☐ 50
Hollow Stem Auger ☒ 41
______ Other ☐ __

15. Drilling fluid used: Water ☐ 02 Air ☐ 01
Drilling Mud ☐ 03 None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis):
WEBSTER CITY GARAGE or County Fairgrounds

E. Bentonite seal, top __25.5 ft. MSL or ____ ft.

F. Fine sand, top __27.5 ft. MSL or ____ ft.

G. Filter pack, top __27.5 ft. MSL or ____ ft.

H. Screen joint, top __30.0 ft. MSL or ____ ft.

I. Well bottom __40.0 ft. MSL or ____ ft.

J. Filter pack, bottom __42.0 ft. MSL or ____ ft.

K. Borehole, bottom __42.0 ft. MSL or ____ ft.

L. Borehole, diameter 8.0 in.

M. O.D. well casing 2.39 in.

N. I.D. well casing 2.09 in.

1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 4.0 ft.
c. Material: Steel ☒ 04
Other ☐ __
d. Additional protection? ☒ Yes ☐ No
If yes, describe: 3- 4"x7' STEEL GUARD POSTS

3. Surface seal: Bentonite ☐ 30
Concrete ☒ 01
Other ☐ __

4. Material between well casing and protective pipe:
Bentonite ☐ 30
Annular space seal ☐ __
CONCRETE Other ☒ __

5. Annular space seal: a. Granular Bentonite ☐ 33
b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
c. ____Lbs/gal mud weight . . . . . Bentonite slurry ☐ 31
d. ____ % Bentonite . . . . . . Bentonite-cement grout ☒ 50
e. ______ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 01
Tremie pumped ☐ 02
Gravity ☒ 08

6. Bentonite seal: a. Bentonite granules ☒ 33
b. ☐1/4 in. ☐3/8 in. ☐1/2 in. Bentonite pellets ☐ 32
c. ______ Other ☐ __

7. Fine sand material: Manufacturer, product name & mesh size
a. None Used __
b. Volume added ______ ft^3

8. Filter pack material: Manufacturer, product name and mesh size
a. RED FLINT SAND 45-55 __
b. Volume added 5 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☐ 23
Flush threaded PVC schedule 80 ☒ 24
Other ☐ __

10. Screen material: ~~[illegible]~~ Schedule 80 PVC __
a. Screen type: Factory cut ☒ 11
Continuous slot ☐ 01
______ Other ☐ __
b. Manufacturer Johnson
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☒ 14
Other ☐ __

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
[signature], PE	GME CONSULTANTS INC.

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Ad. Code. In accordance with ch. 144, Wis Stats., failure to file this form may result in a forfeiture of not less than $10, nor more than $5000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than $10,000 for each

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☒ Underground Tanks ☐ Other ☐ ________

Facility/Project Name	County Name	Well Name	
WEBSTER	BURNETT	MW-91-1	
Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
________	07		

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method
   - surged with bailer and bailed ☐ 41
   - surged with bailer and pumped ☒ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - Other ________ ☐

3. Time spent developing well 45 min.

4. Depth of well (from top of well casisng) 43.0 ft.

5. Inside diameter of well 2.00 in.

6. Volume of water in filter pack and well casing 6.5 gal.

7. Volume of water removed from well 20.0 gal.

8. Volume of water added (if any) 0.0 gal.

9. Source of water added ________

10. Analysis performed on water added? ☐ Yes ☒ No (If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 36.02 ft.	36.03 ft.
Date	b. 09/05/91 (m m d d y y)	09/05/91 (m m d d y y)
Time	c. 7:50 ☒ a.m. ☐ p.m.	9:20 ☒ a.m. ☐ p.m.
12. Sediment in well bottom	0.4 inches	0.1 inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☒ 20 Turbid ☐ 25
(Describe)	LIGHT BROWN DUE TO SUSPENDED FINE TO VERY FINE SILT	CLEAR WATER AFTER 3 MINUTES OF PUMPING

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: GEORGE J. HUDAK

Firm: RREM, INC.

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: [signature], PE

Print Initials: WCK

Firm: GME CONSULTANTS, INC.

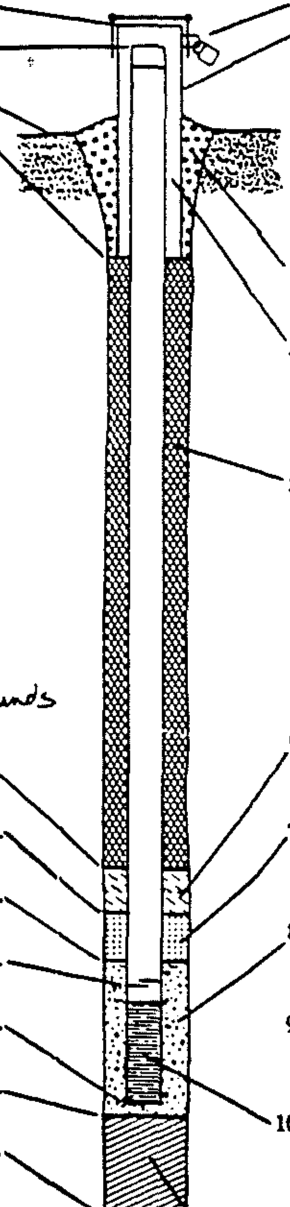
NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☒ Underground Tanks ☐ Other ☐ ______

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name Village of Webster - Water Supply	Local Grid Location of Well ______ ft. ☐N. ☐S. ______ ft. ☐E. ☐W.	Well Name MW-91-2A
Facility License, Permit or Monitoring Number ________	~~Grid Origin Location~~ WELL LOCATION Lat. ______ Long. ______ or	Wis. Unique Well Number DI-001 DNR Well Number ___
Type of Well Water Table Observation Well ☒ 11 Piezometer ☐ 12	St. Plane 268538.63 ft. N, 1396897.47 ft. E.	Date Well Installed 06/20/91 (m m d d y y)
Distance Well Is From Waste/Source Boundary ______ ft.	Section Location of Waste/Source ___1/4 of ___ 1/4 of Sec. ___, T. ___ N, R. ___ ☐E. ☐W.	Well Installed By: (Person's Name and Firm) Jamie Tuura
Is Well A Point of Enforcement Std. Application? ☒ Yes ☐ No	Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	GME Consultants, Inc.



A. Protective pipe, top elevation 983.79 ft. MSL

B. Well casing, top elevation 983.69 ft. MSL

C. Land surface elevation 980.7 ft. MSL

D. Surface seal, bottom ______ ft. MSL or 27.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☒ Yes ☐ No

14. Drilling method used: Rotary ☐ 50
Hollow Stem Auger ☒ 41
Other ☐ __

15. Drilling fluid used: Water ☐ 02 Air ☐ 01
Drilling Mud ☐ 03 None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis):
Webster City Garage or County Fairgrounds

E. Bentonite seal, top 24.0 ft. MSL or ______ ft.

F. Fine sand, top 27.0 ft. MSL or ______ ft.

G. Filter pack, top 27.0 ft. MSL or ______ ft.

H. Screen joint, top 29.5 ft. MSL or ______ ft.

I. Well bottom 39.5 ft. MSL or ______ ft.

J. Filter pack, bottom 40.0 ft. MSL or ______ ft.

K. Borehole, bottom 40.0 ft. MSL or ______ ft.

L. Borehole, diameter 8.0 in.

M. O.D. well casing 2.39 in.

N. I.D. well casing 2.09 in.

1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 4.0 ft.
c. Material: Steel ☒ 04
Other ☐ __
d. Additional protection? ☒ Yes ☐ No
If yes, describe: 3 - 4" steel guard posts

3. Surface seal: Bentonite ☐ 30
Concrete ☒ 01
Other ☐ __

4. Material between well casing and protective pipe:
Bentonite ☐ 30
Annular space seal ☐ __
Concrete Other ☒ __

5. Annular space seal: a. Granular Bentonite ☐ 33
b. ______ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
c. ______ Lbs/gal mud weight . . . . . Bentonite slurry ☐ 31
d. ______ % Bentonite . . . . . Bentonite-cement grout ☒ 50
e. ______ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 01
Tremie pumped ☐ 02
Gravity ☒ 08

6. Bentonite seal: a. Bentonite granules ☒ 33
b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
c. ______ Other ☐ __

7. Fine sand material: Manufacturer, product name & mesh size
a. None Used __
b. Volume added ______ ft^3

8. Filter pack material: Manufacturer, product name and mesh size
a. Red Flint Sand 45-55 __
b. Volume added 5 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☐ 23
Flush threaded PVC schedule 80 ☒ 24
Other ☐ __

10. Screen material: Schedule 80 PVC __
a. Screen type: Factory cut ☒ 11
Continuous slot ☐ 01
Other ☐ __
b. Manufacturer Johnson
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☒ 14
Other ☐ __

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
[signature] PE	GME Consultants, Inc.

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Ad. Code. In accordance with ch.144, Wis Stats., failure to file this form may result in a forfeiture of not less than $10, nor more than $5000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than $10,000 for each day of violation. NOTE: Shaded areas are for DNR use only. See instructions for more information including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☒ Underground Tanks ☐ Other ☐ ________

Facility/Project Name	County Name	Well Name	
WEBSTER	BURNETT	91-2A	
Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
________	07	DL-002	___

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method

Method		Code
surged with bailer and bailed	☐	41
surged with bailer and pumped	☒	61
surged with block and bailed	☐	42
surged with block and pumped	☐	62
surged with block, bailed and pumped	☐	70
compressed air	☐	20
bailed only	☐	10
pumped only	☐	51
pumped slowly	☐	50
Other ________	☐	

3. Time spent developing well: 45 min.
4. Depth of well (from top of well casisng): 42.9 ft.
5. Inside diameter of well: 2.00 in.
6. Volume of water in filter pack and well casing: 6.3 gal.
7. Volume of water removed from well: 20.0 gal.
8. Volume of water added (if any): 0.0 gal.
9. Source of water added ________
10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 36.94 ft.	36.93 ft.
Date (mm/dd/yy)	b. 09/05/91	09/05/91
Time	c. 10:27 ☒ a.m. ☐ p.m.	11:45 ☒ a.m. ☐ p.m.
12. Sediment in well bottom	0.2 inches	0.1 inches
13. Water clarity	Clear ☒ 10 Turbid ☐ 15	Clear ☒ 20 Turbid ☐ 25
(Describe)	CLEAR W/ MINOR FINE GRAINED SAND	CLEAR-SEDIMENT FREE AFTER 2 MINUTES OF PUMPING

Fill in if drilling fluids were used and well is at solid waste facility:

	Before	After
14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: GEORGE J. HUDAK

Firm: KREM, INC.

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: [signature], PE

Print Initials: WCK

Firm: GME CONSULTANTS, INC

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☒ Underground Tanks ☐ Other ☐ ______

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name Village of Webster - Water Supply	Local Grid Location of Well ______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	Well Name MW-91-2B
Facility License, Permit or Monitoring Number ________	Grid Origin Location WELL LOCATION Lat. ______ Long. ______ or	Wis. Unique Well Number DNR Well Number DL-003
Type of Well Water Table Observation Well ☐ 11 Piezometer ☒ 12	St. Plane 268539.35 ft. N, 1396893.78 ft. E.	Date Well Installed 07/12/91 (m m / d d / y y)
Distance Well Is From Waste/Source Boundary ft.	Section Location of Waste/Source ___1/4 of ___ 1/4 of Sec. ___, T. ___ N, R. ___ ☐ E. ☐ W.	Well Installed By: (Person's Name and Firm) Jamie Tuura
Is Well A Point of Enforcement Std. Application? ☒ Yes ☐ No	Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	GME Consultants, Inc.

A. Protective pipe, top elevation 984.48 ft. MSL
B. Well casing, top elevation 984.28 ft. MSL
C. Land surface elevation 982.0 ft. MSL
D. Surface seal, bottom ______ ft. MSL or 59.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☒ Yes ☐ No

14. Drilling method used: Rotary ☐ 50
Hollow Stem Auger ☒ 41
Other ☐ __

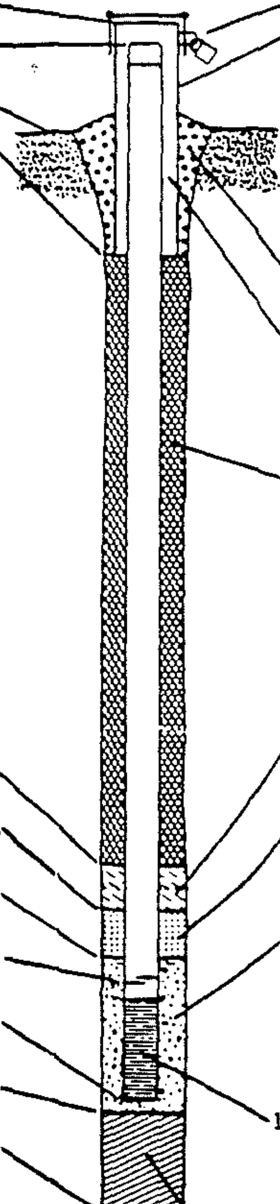
15. Drilling fluid used: Water ☐ 02 Air ☐ 01
Drilling Mud ☐ 03 None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis):
Webster City Garage or County Fairgrounds

E. Bentonite seal, top 49.0 ft. MSL or ______ ft.
F. Fine sand, top 59.0 ft. MSL or ______ ft.
G. Filter pack, top 59.0 ft. MSL or ______ ft.
H. Screen joint, top 64.0 ft. MSL or ______ ft.
I. Well bottom 69.0 ft. MSL or ______ ft.
J. Filter pack, bottom 71.0 ft. MSL or ______ ft.
K. Borehole, bottom 71.0 ft. MSL or ______ ft.
L. Borehole, diameter 8.0 in.
M. O.D. well casing 2.39 in.
N. I.D. well casing 2.09 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 4.0 ft.
c. Material: Steel ☒ 04
Other ☐ __
d. Additional protection? ☐ Yes ☐ No
If yes, describe: ______
3. Surface seal: Bentonite ☐ 30
Concrete ☒ 01
Other ☐ __
4. Material between well casing and protective pipe:
Bentonite ☐ 30
Annular space seal ☐ __
Concrete Other ☒ __
5. Annular space seal: a. Granular Bentonite ☐ 33
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
c. ____ Lbs/gal mud weight . . . . . Bentonite slurry ☐ 31
d. ____ % Bentonite . . . . . Bentonite-cement grout ☒ 50
e. ______ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 01
Tremie pumped ☐ 02
Gravity ☒ 08
6. Bentonite seal: a. Bentonite granules ☒ 33
b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
c. ______ Other ☐ __
7. Fine sand material: Manufacturer, product name & mesh size
a. None Used __
b. Volume added ______ ft^3
8. Filter pack material: Manufacturer, product name and mesh size
a. Red Flint Sand - 45-55 __
b. Volume added 5 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☐ 23
Flush threaded PVC schedule 80 ☒ 24
Other ☐ __
10. Screen material: Schedule 80 PVC
a. Screen type: Factory cut ☒ 11
Continuous slot ☐ 01
Other ☐ __
b. Manufacturer Johnson
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☒ 14
Other ☐ __

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature] PE | Firm: GME CONSULTANT INC.

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Ad. Code. In accordance with ch.144, Wis Stats., failure to file this form may result in a forfeiture of not less than $10, nor more than $5000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than $10,000 for each ... for DNR use only. See instructions for more information including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☒ Underground Tanks ☐ Other ☐ ________

Facility/Project Name	County Name	Well Name	
WEBSTER	BURNETT	91-2B	
Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
________	07	DL-003	

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method
   - surged with bailer and bailed ☐ 41
   - surged with bailer and pumped ☒ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - Other ________ ☐

3. Time spent developing well 62 min.

4. Depth of well (from top of well casisng) 71.8 ft.

5. Inside diameter of well 2.00 in.

6. Volume of water in filter pack and well casing 10.7 gal.

7. Volume of water removed from well 60.0 gal.

8. Volume of water added (if any) 0.0 gal.

9. Source of water added ________

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 36.33 ft.	36.31 ft.
Date	b. 09/05/91 (mm/dd/yy)	09/05/91 (mm/dd/yy)
Time	c. 11:57 ☒ a.m. ☐ p.m.	1:40 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	0.5 inches	0.2 inches
13. Water clarity	Clear ☒ 10 Turbid ☐ 15 (Describe) CLEAR WATER BUT 0.5-1.0 INCHES OF SAND CONSISTENTLY ON BOTTOM OF BAILER	Clear ☒ 20 Turbid ☐ 25 (Describe) CLEAR - LITTLE OR NO SAND OBSERVED

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____._ mg/l	____._ mg/l
15. COD	____._ mg/l	____._ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: GEORGE J. HUDAK

Firm: RREM, INC

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: [signature] PG

Print Initials: WCL

Firm: GME CONSULTANTS, INC

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☒ Underground Tanks ☐ Other ☐ ______

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name: VILLAGE OF WEBSTER - WATER SUPPLY	Local Grid Location of Well: ______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	Well Name: MW-91-3
Facility License, Permit or Monitoring Number: _ _ _ _ _ _ _ _	~~Grid Origin Location~~ WELL LOCATION Lat. ______ Long. ______ or	Wis. Unique Well Number: DL-004 DNR Well Number: ___
Type of Well: Water Table Observation Well ☐ 11; Piezometer ☒ 12	St. Plane 267988.90 ft. N. 1396804.61 ft. E.	Date Well Installed: 07/23/91 (m m / d d / y y)
Distance Well Is From Waste/Source Boundary: ______ ft.	Section Location of Waste/Source: ___1/4 of ___ 1/4 of Sec. ___, T. ___ N. R. ___ ☐ E. ☐ W.	Well Installed By: (Person's Name and Firm) Jamie Tuura, GME Consultants, Inc
Is Well A Point of Enforcement Std. Application? ☒ Yes ☐ No	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☐ Downgradient; n ☐ Not Known	

A. Protective pipe, top elevation _982.57 ft. MSL

B. Well casing, top elevation _982.27 ft. MSL

C. Land surface elevation _980.3 ft. MSL

D. Surface seal, bottom _ _ _ _ _ ft. MSL or 51.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☒ Yes ☐ No

14. Drilling method used: Rotary ☐ 50; Hollow Stem Auger ☒ 41; Other ☐ __

15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☐ 03; None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis):
WEBSTER CITY GARAGE or County Fairgrounds

E. Bentonite seal, top _ _ 47.0 ft. MSL or _ _ _ _ _ ft.

F. Fine sand, top _ _ 51.0 ft. MSL or _ _ _ _ _ ft.

G. Filter pack, top _ _ 51.0 ft. MSL or _ _ _ _ _ ft.

H. Screen joint, top _ _ 55.0 ft. MSL or _ _ _ _ _ ft.

I. Well bottom _ _ 60.0 ft. MSL or _ _ _ _ _ ft.

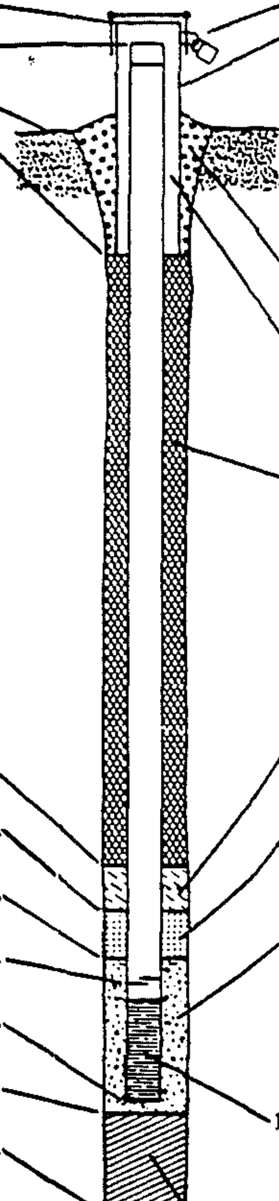
J. Filter pack, bottom _ _ 70.0 ft. MSL or _ _ _ _ _ ft.

K. Borehole, bottom _ _ 70.0 ft. MSL or _ _ _ _ _ ft.

L. Borehole, diameter _8.0 in.

M. O.D. well casing _2.39 in.

N. I.D. well casing _2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: _4.0 in.
b. Length: _4.0 ft.
c. Material: Steel ☒ 04; Other ☐ __
d. Additional protection? ☒ Yes ☐ No
If yes, describe: 3 - 4"x7' STEEL POSTS

3. Surface seal: Bentonite ☐ 30; Concrete ☒ 01; Other ☐ __

4. Material between well casing and protective pipe: Bentonite ☐ 30; Annular space seal ☐ __; Concrete Other ☒ __

5. Annular space seal:
a. Granular Bentonite ☐ 33
b. ______ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
c. ______ Lbs/gal mud weight . . . . . Bentonite slurry ☐ 31
d. ______ % Bentonite . . . . . . Bentonite-cement grout ☒ 50
e. ______ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08

6. Bentonite seal: a. Bentonite granules ☒ 33
b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
c. ______ Other ☐ __

7. Fine sand material: Manufacturer, product name & mesh size
a. None Used __
b. Volume added ______ ft^3

8. Filter pack material: Manufacturer, product name and mesh size
a. NATIVE SAND __
b. Volume added ______ ft^3

9. Well casing: Flush threaded PVC schedule 40 ☐ 23; Flush threaded PVC schedule 80 ☒ 24; Other ☐ __

10. Screen material: schedule 80 PVC
a. Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐ __
b. Manufacturer Johnson
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☒ 14; Other ☐ __

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
[signature] PE	GME CONSULTANTS, INC.

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Ad. Code. In accordance with ch.144, Wis Stats., failure to file this form may result in a forfeiture of not less than $10, nor more than $5000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than $10,000 for each

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☒ Underground Tanks ☐ Other ☐ ________

Facility/Project Name	County Name	Well Name	
WEBSTER	BURNETT	MW-91-3	
Facility License, Permit or Monitoring Number	**County Code**	**Wis. Unique Well Number**	**DNR Well Number**
________	07	DL-004	____

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method
   - surged with bailer and bailed ☐ 41
   - surged with bailer and pumped ☒ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - Other ________ ☐

3. Time spent developing well 65 min.

4. Depth of well (from top of well casisng) 62.1 ft.

5. Inside diameter of well 2.00 in.

6. Volume of water in filter pack and well casing 8.5 gal.

7. Volume of water removed from well 50.0 gal.

8. Volume of water added (if any) ___.__ gal.

9. Source of water added ________

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 34.82 ft.	34.90 ft.
Date (mm dd yy)	b. 09/04/91	09/04/91
Time	c. 3:05 ☐ a.m. ☒ p.m.	4:50 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	0.3 inches	0.1 inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe) PALE TAN DUE TO MIX OF SUSPENDED BENTONITE & FINE SAND	Clear ☒ 20 Turbid ☐ 25 (Describe) CLEAR WATER AFTER APPROXIMATELY 5 MINUTES OF PUMPING

Fill in if drilling fluids were used and well is at solid waste facility:

	Before Development	After Development
14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: GEORGE J. HUDAK

Firm: KREM, INC.

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: [signature] PE

Print Initials: WCK

Firm: GME CONSULTANTS INC

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐ Env. Response & Repair ☐ Underground Tanks ☐ Other ☐

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name: VILLAGE OF WEBSTER - WATER SUPPLY	Local Grid Location of Well: ____ ft. ☐N. ☐S. ____ ft. ☐E. ☐W.	Well Name: MW-91-4
Facility License, Permit or Monitoring Number: ________	Grid Origin Location: WELL LOCATION Lat. ____ Long. ____ or	Wis. Unique Well Number: DL-005 DNR Well Number: ____
Type of Well: Water Table Observation Well ☒ 11 Piezometer ☐ 12	St. Plane 268154.02 ft. N, 1397066.69 ft. E.	Date Well Installed: 07/09/91 (mm/dd/yy)
Distance Well Is From Waste/Source Boundary ____ ft.	Section Location of Waste/Source: ___1/4 of ___1/4 of Sec. ___, T. ___ N, R. ___ ☐E. ☐W.	Well Installed By: (Person's Name and Firm) Jamie Tuura, GME Consultants, Inc.
Is Well A Point of Enforcement Std. Application? ☒ Yes ☐ No	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	

A. Protective pipe, top elevation AT GRADE ft. MSL
B. Well casing, top elevation 980.13 ft. MSL
C. Land surface elevation 980.1 ft. MSL
D. Surface seal, bottom ____ ft. MSL or 27.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☒ Yes ☐ No

14. Drilling method used: Rotary ☐ 50; Hollow Stem Auger ☒ 41; Other ☐ __

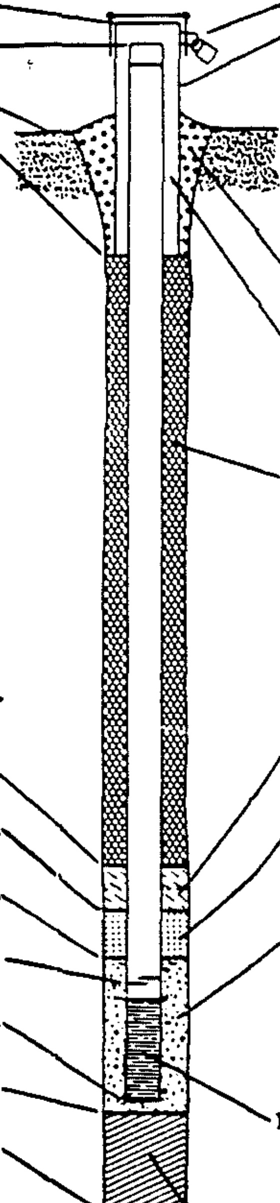
15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☐ 03; None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No

Describe ________

17. Source of water (attach analysis):
WEBSTER CITY GARAGE or County Fairgrounds

E. Bentonite seal, top 25.0 ft. MSL or ____ ft.
F. Fine sand, top 27.0 ft. MSL or ____ ft.
G. Filter pack, top 27.0 ft. MSL or ____ ft.
H. Screen joint, top 30.0 ft. MSL or ____ ft.
I. Well bottom 40.0 ft. MSL or ____ ft.
J. Filter pack, bottom 41.0 ft. MSL or ____ ft.
K. Borehole, bottom 41.0 ft. MSL or ____ ft.
L. Borehole, diameter 8.0 in.
M. O.D. well casing 2.39 in.
N. I.D. well casing 2.09 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 10.0 in.
   b. Length: 0.5 ft.
   c. Material: Steel ☒ 04; Other ☐ STEEL @ Grade Manhole
   d. Additional protection? ☐ Yes ☒ No
   If yes, describe: ________
3. Surface seal: Bentonite ☐ 30; Concrete ☒ 01; Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ 30; Annular space seal ☐; Concrete Other ☒
5. Annular space seal: a. Granular Bentonite ☐ 33
   b. ____ Lbs/gal mud weight ... Bentonite-sand slurry ☐ 35
   c. ____ Lbs/gal mud weight ..... Bentonite slurry ☐ 31
   d. ____ % Bentonite ...... Bentonite-cement grout ☒ 50
   e. ____ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08
6. Bentonite seal: a. Bentonite granules ☒ 33
   b. ☐1/4 in. ☐3/8 in. ☐1/2 in. Bentonite pellets ☐ 32
   c. ________ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. None used
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name and mesh size
   a. RED FLINT SAND - 45-55
   b. Volume added 5 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☐ 23; Flush threaded PVC schedule 80 ☒ 24; Other ☐
10. Screen material: Schedule 80 PVC
   a. Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐
   b. Manufacturer Johnson
   c. Slot size: 0.010 in.
   d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ 14; Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature] PE Firm: GME CONSULTANTS INC.

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Ad. Code. In accordance with ch.144, Wis Stats., failure to file this form may result in a forfeiture of not less than $10, nor more than $5000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than $10,000 for each

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☒ Underground Tanks ☐ Other ☐ ________

Facility/Project Name	County Name	Well Name	
WEBSTER	BURNETT	MW 91-4	
Facility License, Permit or Monitoring Number	**County Code**	**Wis. Unique Well Number**	**DNR Well Number**
_ _ _ _ _ _ _	07	DL-005	

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method
   - surged with bailer and bailed ☐ 41
   - surged with bailer and pumped ☒ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - Other ________ ☐

3. Time spent developing well: 50 min.

4. Depth of well (from top of well casisng): 40.2 ft.

5. Inside diameter of well: 2.00 in.

6. Volume of water in filter pack and well casing: 7.1 gal.

7. Volume of water removed from well: 20.0 gal.

8. Volume of water added (if any): ___ . _ gal.

9. Source of water added ________

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 32.48 ft.	32.48 ft.
Date	b. 09/06/91 (mm dd yy)	09/06/91 (mm dd yy)
Time	c. 1:55 ☐ a.m. ☒ p.m.	3:20 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	0.3 inches	0.1 inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☒ 20 Turbid ☐ 25
(Describe)	LIGHT BROWN W/ABUNDANT VERY FINE TO FINE GRAINED SUSPENDED SAND	CLEAR, SEDIMENT-FREE WATER AFTER APPROXIMATELY 3 MINUTES

Fill in if drilling fluids were used and well is at solid waste facility:

	Before Development	After Development
14. Total suspended solids	_ _ _ _ . _ mg/l	_ _ _ _ . _ mg/l
15. COD	_ _ _ _ . _ mg/l	_ _ _ _ . _ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: GEORGE J. HUDAK

Firm: RREM, INC.

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: [signature] PE

Print Initials: WCL

Firm: GME CONSULTANTS, INC

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☒ Underground Tanks ☐ Other ☐

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name: VILLAGE OF WEBSTER - WATER SUPPLY	Local Grid Location of Well: ____ ft. ☐N. ☐S. ____ ft. ☐E. ☐W.	Well Name: MW-91-5A
Facility License, Permit or Monitoring Number: ________	~~Grid Origin Location~~ WELL LOCATION Lat. ____ Long. ____ or St. Plane 268186.51 ft. N. 1397276.52 ft. E.	Wis. Unique Well Number: DL-006 DNR Well Number: ____
Type of Well: Water Table Observation Well ☒ 11 Piezometer ☐ 12	Section Location of Waste/Source: ___ 1/4 of ___ 1/4 of Sec. ___, T. ___ N, R. ___ ☐E. ☐W.	Date Well Installed: 07/16/91 (mm/dd/yy)
Distance Well Is From Waste/Source Boundary: ____ ft.	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Well Installed By: (Person's Name and Firm) JAMIE TUURA, GME Consultants, Inc.
Is Well A Point of Enforcement Std. Application? ☒ Yes ☐ No		

A. Protective pipe, top elevation AT GRADE ft. MSL
B. Well casing, top elevation 980.49 ft. MSL
C. Land surface elevation 980.5 ft. MSL
D. Surface seal, bottom ____ ft. MSL or 26.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☒ Yes ☐ No

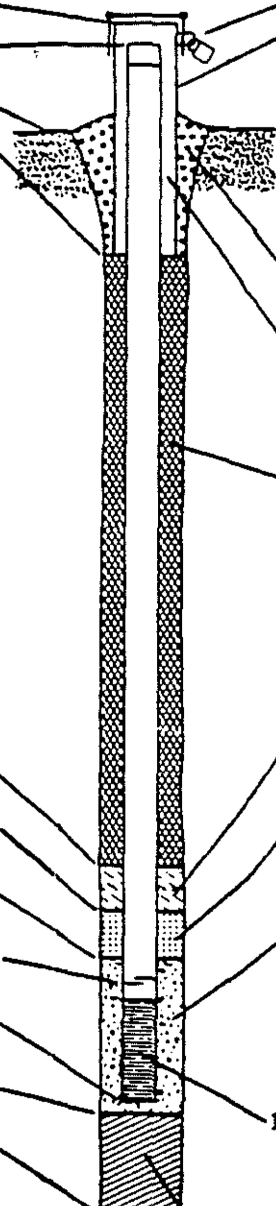
14. Drilling method used: Rotary ☐ 50
Hollow Stem Auger ☒ 41
Other ☐ __

15. Drilling fluid used: Water ☐ 02 Air ☐ 01
Drilling Mud ☐ 03 None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No
Describe ____

17. Source of water (attach analysis):
WEBSTER CITY HALL or County Fairgrounds

E. Bentonite seal, top 24.0 ft. MSL or ____ ft.
F. Fine sand, top 26.0 ft. MSL or ____ ft.
G. Filter pack, top 26.0 ft. MSL or ____ ft.
H. Screen joint, top 30.0 ft. MSL or ____ ft.
I. Well bottom 40.0 ft. MSL or ____ ft.
J. Filter pack, bottom 40.0 ft. MSL or ____ ft.
K. Borehole, bottom 40.0 ft. MSL or ____ ft.
L. Borehole, diameter 8.0 in.
M. O.D. well casing 2.39 in.
N. I.D. well casing 2.09 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 10.0 in.
b. Length: 0.5 ft.
c. Material: Steel ☒ 04
STEEL @ Grade Manhole Other ☒ __
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ____
3. Surface seal: Bentonite ☐ 30
Concrete ☒ 01
____ Other ☐ __
4. Material between well casing and protective pipe:
Bentonite ☐ 30
Annular space seal ☐ __
Concrete Other ☒ __
5. Annular space seal: a. Granular Bentonite ☐ 33
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
c. ____ Lbs/gal mud weight . . . . . Bentonite slurry ☐ 31
d. ____ % Bentonite . . . . . Bentonite-cement grout ☒ 50
e. ____ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 01
Tremie pumped ☐ 02
Gravity ☒ 08
6. Bentonite seal: a. Bentonite granules ☒ 33
b. ☐1/4 in. ☐3/8 in. ☐1/2 in. Bentonite pellets ☐ 32
c. ____ Other ☐ __
7. Fine sand material: Manufacturer, product name & mesh size
a. None Used __
b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name and mesh size
a. RED FLINT SAND 45-55 __
b. Volume added 5 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☐ 23
Flush threaded PVC schedule 80 ☒ 24
____ Other ☐ __
10. Screen material: Schedule 80 PVC
a. Screen type: Factory cut ☒ 11
Continuous slot ☐ 01
____ Other ☐ __
b. Manufacturer Johnson
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ 14
Other ☐ __

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
[signature] PE	GME CONSULTANTS, INC.

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Ad. Code. In accordance with ch.144, Wis Stats., failure to file this form may result in a forfeiture of not less than $10, nor more than $5000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than $10,000 for each

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ ________

Facility/Project Name	County Name	Well Name	
WEBSTER	BURNETT	MW-91-5A	
Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
________	07	DL-006	

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method
- surged with bailer and bailed ☐ 41
- surged with bailer and pumped ☒ 61
- surged with block and bailed ☐ 42
- surged with block and pumped ☐ 62
- surged with block, bailed and pumped ☐ 70
- compressed air ☐ 20
- bailed only ☐ 10
- pumped only ☐ 51
- pumped slowly ☐ 50
- Other ________ ☐

3. Time spent developing well __49 min.

4. Depth of well (from top of well casisng) 40.5 ft.

5. Inside diameter of well 2.00 in.

6. Volume of water in filter pack and well casing 7.3 gal.

7. Volume of water removed from well 20.0 gal.

8. Volume of water added (if any) ___.__ gal.

9. Source of water added ________

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 32.70 ft.	32.71 ft.
Date	b. 09/06/91 (m m d d y y)	09/06/91 (m m d d y y)
Time	c. 8:32 ☒ a.m. ☐ p.m.	10:09 ☒ a.m. ☐ p.m.
12. Sediment in well bottom	0.3 inches	0.1 inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe) INITIALLY PALE BROWN W/SILT AND FINE SAND CLEAR AFTER 5-10 MINUTES OF BAILING	Clear ☒ 20 Turbid ☐ 25 (Describe) CLEAR SEDIMENT-FREE WATER

Fill in if drilling fluids were used and well is at solid waste facility:

	Before	After
14. Total suspended solids	_____.__ mg/l	_____.__ mg/l
15. COD	_____.__ mg/l	_____.__ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: GEORGE J HUDAK

Firm: KREM, INC.

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: [signature] P.E.

Print Initials: WCL

Firm: GME CONSULTANTS, LLC

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☑ Underground Tanks ☐ Other ☐ ______

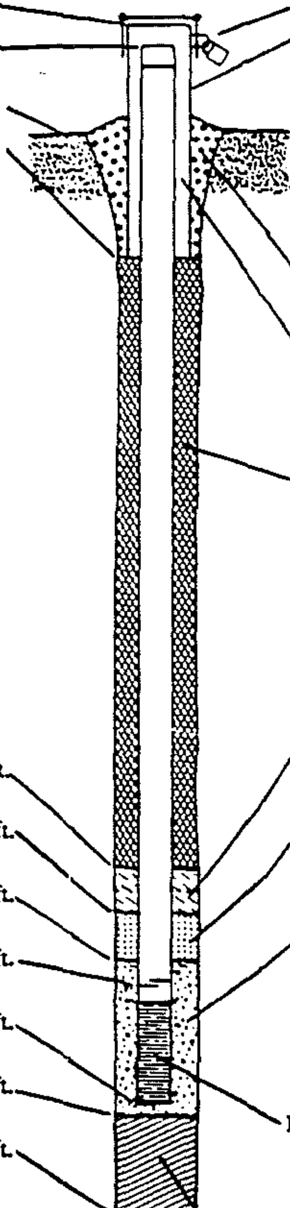
MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name: VILLAGE OF WEBSTER - WATER SUPPLY	Local Grid Location of Well: ______ ft. ☐N. ☐S. ______ ft. ☐E. ☐W.	Well Name: MW - 91 - 5B
Facility License, Permit or Monitoring Number: ________	~~Grid Origin Location~~ WELL LOCATION: Lat. ______ Long. ______ or	Wis. Unique Well Number: DL-007 DNR Well Number: ___
Type of Well: Water Table Observation Well ☐ 11; Piezometer ☑ 12	St. Plane 268186.63 ft. N, 1397273.27 ft. E.	Date Well Installed: 07/19/91 (mm/dd/yy)
Distance Well Is From Waste/Source Boundary: ______ ft.	Section Location of Waste/Source: ___1/4 of ___ 1/4 of Sec. ___, T. ___ N, R. ___ ☐E. ☐W.	Well Installed By: (Person's Name and Firm) Jamie Tuura, GME Consultants, Inc.
Is Well A Point of Enforcement Std. Application? ☑ Yes ☐ No	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☐ Downgradient; n ☐ Not Known	

A. Protective pipe, top elevation AT GRADE ft. MSL
B. Well casing, top elevation 980.48 ft. MSL
C. Land surface elevation 980.5 ft. MSL
D. Surface seal, bottom ____ ft. MSL or 58.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☑
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐
13. Sieve analysis attached? ☑ Yes ☐ No
14. Drilling method used: Rotary ☐ 50; Hollow Stem Auger ☑ 41; Other ☐ __
15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☐ 03; None ☑ 99
16. Drilling additives used? ☐ Yes ☑ No
Describe ______
17. Source of water (attach analysis):
WEBSTER CITY GARAGE or County Fairgrounds

E. Bentonite seal, top 50.0 ft. MSL or ____ ft.
F. Fine sand, top 58.0 ft. MSL or ____ ft.
G. Filter pack, top 58.0 ft. MSL or ____ ft.
H. Screen joint, top 65.0 ft. MSL or ____ ft.
I. Well bottom 70.0 ft. MSL or ____ ft.
J. Filter pack, bottom 71.0 ft. MSL or ____ ft.
K. Borehole, bottom 71.0 ft. MSL or ____ ft.
L. Borehole, diameter 8.0 in.
M. O.D. well casing 2.39 in.
N. I.D. well casing 2.09 in.



1. Cap and lock? ☑ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 10.0 in.
b. Length: 0.5 ft.
c. Material: Steel ☑ 04; Other ☑ STEEL @ Grade Manhole
d. Additional protection? ☐ Yes ☑ No
If yes, describe: ______
3. Surface seal: Bentonite ☐ 30; Concrete ☑ 01; Other ☐ __
4. Material between well casing and protective pipe: Bentonite ☐ 30; Annular space seal ☐ __; concrete Other ☑ __
5. Annular space seal: a. Granular Bentonite ☐ 33
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
c. ____ Lbs/gal mud weight . . . . . Bentonite slurry ☐ 31
d. ____ % Bentonite . . . . . Bentonite-cement grout ☑ 50
e. ______ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☑ 08
6. Bentonite seal: a. Bentonite granules ☑ 33
b. ☐1/4 in. ☐3/8 in. ☐1/2 in. Bentonite pellets ☐ 32
c. ______ Other ☐ __
7. Fine sand material: Manufacturer, product name & mesh size
a. NONE USED __
b. Volume added ______ ft^3
8. Filter pack material: Manufacturer, product name and mesh size
a. RED FLINT SAND 45-55 __
b. Volume added 5 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☐ 23; Flush threaded PVC schedule 80 ☑ 24; Other ☐ __
10. Screen material: Schedule 80 PVC __
a. Screen type: Factory cut ☑ 11; Continuous slot ☐ 01; Other ☐ __
b. Manufacturer Johnson
c. Slot size: 0.010 in.
d. Slotted length: 15.0 ft.
11. Backfill material (below filter pack): None ☑ 14; Other ☐ __

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
[signature] PE	GME CONSULTANTS, INC.

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Ad. Code. In accordance with ch.144, Wis Stats., failure to file this form may result in a forfeiture of not less than $10, nor more than $5000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than $10,000 for each ... DNR use only. See instructions for more information including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ ________

Facility/Project Name	County Name	Well Name	
WEBSTER	BURNETT	MW-91-5B	
Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
________	07	DL-007	____

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method
   - surged with bailer and bailed ☐ 41
   - surged with bailer and pumped ☒ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - Other ________ ☐

3. Time spent developing well 62 min.

4. Depth of well (from top of well casisng) 69.6 ft.

5. Inside diameter of well 2.00 in.

6. Volume of water in filter pack and well casing 11.8 gal.

7. Volume of water removed from well 60.0 gal.

8. Volume of water added (if any) ___.__ gal.

9. Source of water added ________

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 32.71 ft.	32.71 ft.
Date (mm dd yy)	b. 09/06/91	09/06/91
Time	c. 10:19 ☒ a.m. ☐ p.m.	12:00 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	0.4 inches	0.2 inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☒ 20 Turbid ☐ 25
(Describe)	PALE BROWN - LITTLE VERY FINE SAND W/ BENTONITE SUSPENSION	CLEAR WATER AFTER 5 MINUTES OF PUMPING

Fill in if drilling fluids were used and well is at solid waste facility:

	Before Development	After Development
14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: GEORGE J. HUDAK

Firm: RREM, INC.

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: [signature] PE

Print Initials: WCL

Firm: GME CONSULTANTS INC

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☒ Underground Tanks ☐ Other ☐ ______

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name Village of Webster - Water Supply	Local Grid Location of Well ______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	Well Name MW-91-6
Facility License, Permit or Monitoring Number __ __ __ __ __ __ __	Grid Origin Location WELL LOCATION Lat. ______ Long. ______ or	Wis. Unique Well Number DNR Well Number DL-008
Type of Well Water Table Observation Well ☒ 11 Piezometer ☐ 12	St. Plane 268311.75 ft. N. 1397668.05 ft. E.	Date Well Installed 07/10/91 (m m / d d / y y)
Distance Well Is From Waste/Source Boundary ft.	Section Location of Waste/Source ___1/4 of ___ 1/4 of Sec. ___, T. ___ N, R. ___ ☐ E. ☐ W.	Well Installed By: (Person's Name and Firm) JAMIE Tuura GME Consultants, Inc.
Is Well A Point of Enforcement Std. Application? ☒ Yes ☐ No	Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	

A. Protective pipe, top elevation AT GRADE ft. MSL

B. Well casing, top elevation 982.01 ft. MSL

C. Land surface elevation 982.0 ft. MSL

D. Surface seal, bottom __ __ __ __ ft. MSL or 27.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☒ Yes ☐ No

14. Drilling method used: Rotary ☐ 50
Hollow Stem Auger ☒ 41
Other ☐ __

15. Drilling fluid used: Water ☐ 02 Air ☐ 01
Drilling Mud ☐ 03 None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis):
WEBSTER CITY GARAGE or County Fairgrounds

E. Bentonite seal, top __24.0 ft. MSL or __ __ __ ft.

F. Fine sand, top __27.0 ft. MSL or __ __ __ ft.

G. Filter pack, top __27.0 ft. MSL or __ __ __ ft.

H. Screen joint, top __30.0 ft. MSL or __ __ __ ft.

I. Well bottom __40.0 ft. MSL or __ __ __ ft.

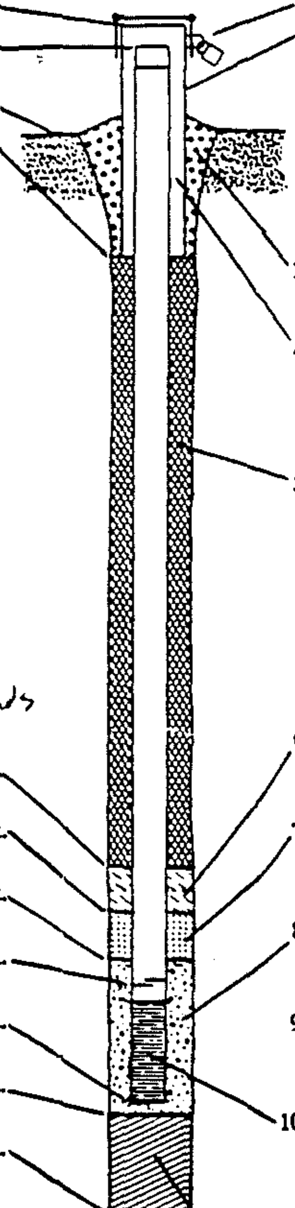
J. Filter pack, bottom __41.0 ft. MSL or __ __ __ ft.

K. Borehole, bottom __41.0 ft. MSL or __ __ __ ft.

L. Borehole, diameter 8.0 in.

M. O.D. well casing 2.39 in.

N. I.D. well casing 2.09 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 10.0 in.
b. Length: 0.5 ft.
c. Material: Steel ☐ 04
STEEL @ Grade Manhole Other ☒ __
d. Additional protection? ☐ Yes ☐ No
If yes, describe: ______

3. Surface seal: Bentonite ☐ 30
Concrete ☒ 01
Other ☐ __

4. Material between well casing and protective pipe:
Bentonite ☐ 30
Annular space seal ☐ __
Concrete Other ☒ __

5. Annular space seal: a. Granular Bentonite ☐ 33
b. ______ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
c. ______ Lbs/gal mud weight . . . . . Bentonite slurry ☐ 31
d. ______ % Bentonite . . . . . . Bentonite-cement grout ☒ 50
e. ______ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 01
Tremie pumped ☐ 02
Gravity ☒ 08

6. Bentonite seal: a. Bentonite granules ☒ 33
b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
c. ______ Other ☐ __

7. Fine sand material: Manufacturer, product name & mesh size
a. None used __
b. Volume added ______ ft^3

8. Filter pack material: Manufacturer, product name and mesh size
a. RED Flint SAND - 45-55 __
b. Volume added 5 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☐ 23
Flush threaded PVC schedule 80 ☒ 24
Other ☐ __

10. Screen material: Sch 80 PVC __
a. Screen type: Factory cut ☒ 11
Continuous slot ☐ 01
Other ☐ __
b. Manufacturer Johnson
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☒ 14
Other ☐ __

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
[signature] PE	GME CONSULTANTS INC.

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Ad. Code. In accordance with ch.144, Wis Stats., failure to file this form may result in a forfeiture of not less than $10, nor more than $5000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than $10,000 for each

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☒ Underground Tanks ☐ Other ☐ ________

Facility/Project Name	County Name	Well Name	
WEBSTER	BURNETT	MW-91-6	
Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
_ _ _ _ _ _ _	07	DL-008	

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method
   - surged with bailer and bailed ☐ 41
   - surged with bailer and pumped ☒ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - Other ________ ☐

3. Time spent developing well: 55 min.

4. Depth of well (from top of well casisng): 39.7 ft.

5. Inside diameter of well: 2.00 in.

6. Volume of water in filter pack and well casing: 6.7 gal.

7. Volume of water removed from well: 20.0 gal.

8. Volume of water added (if any): 0.0 gal.

9. Source of water added ________

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 33.92 ft.	33.92 ft.
Date	b. 09/10/91 (mm dd yy)	09/10/91 (mm dd yy)
Time	c. 10:40 ☒ a.m. ☐ p.m.	12:00 ☒ a.m. ☐ p.m.
12. Sediment in well bottom	0.3 inches	0.1 inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☒ 20 Turbid ☐ 25
(Describe)	LIGHT BROWN, TURBID WATER W/ 0.5-1.0 INCHES OF FINE SAND, CONSISTENTLY IN BAILER	WATER CLEAR AFTER 1-2 MINUTES OF PUMPING

Fill in if drilling fluids were used and well is at solid waste facility:

	Before	After
14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: GEORGE J. HUDAK

Firm: RREM, INC.

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: [signature] PE

Print Initials: WCK

Firm: GME CONSULTANTS, INC.

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☒ Underground Tanks ☐ Other ☐ ______

MONITORING WELL CONSTRUCTION
Form 4400-113A Rev. 4-90

Facility/Project Name: VILLAGE OF WEBSTER-WATER SUPPLY	Local Grid Location of Well: ______ ft. ☐N. ☐S. ______ ft. ☐E. ☐W.	Well Name: MW-91-7
Facility License, Permit or Monitoring Number: ________	Grid Origin Location: WELL LOCATION Lat. ______ Long. ______ or	Wis. Unique Well Number: DL-571 DNR Well Number: ____
Type of Well: Water Table Observation Well ☒ 11 Piezometer ☒ 12	St. Plane 268313.61 ft. N. 1397588.05 ft. E.	Date Well Installed: 08/05/91 (m m / d d / y y)
Distance Well Is From Waste/Source Boundary ______ ft.	Section Location of Waste/Source: ___1/4 of ___1/4 of Sec. ___, T. ___ N, R. ___ ☐E. ☐W.	Well Installed By: (Person's Name and Firm) Jamie Tuura GME Consultants, Inc.
Is Well A Point of Enforcement Std. Application? ☒ Yes ☐ No	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	

A. Protective pipe, top elevation __AT GRADE__ ft. MSL

B. Well casing, top elevation __980.99__ ft. MSL

C. Land surface elevation __981.0__ ft. MSL

D. Surface seal, bottom ______ ft. MSL or __58.0__ ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☒ Yes ☐ No

14. Drilling method used: Rotary ☐ 50
Hollow Stem Auger ☒ 41
__________ Other ☐ __

15. Drilling fluid used: Water ☐ 02 Air ☐ 01
Drilling Mud ☐ 03 None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No

Describe ______________

17. Source of water (attach analysis):
WEBSTER CITY GARAGE or COUNTY FAIRGROUNDS

E. Bentonite seal, top __54.0__ ft. MSL or ______ ft.

F. Fine sand, top __58.0__ ft. MSL or ______ ft.

G. Filter pack, top __58.0__ ft. MSL or ______ ft.

H. Screen joint, top __64.0__ ft. MSL or ______ ft.

I. Well bottom __69.0__ ft. MSL or ______ ft.

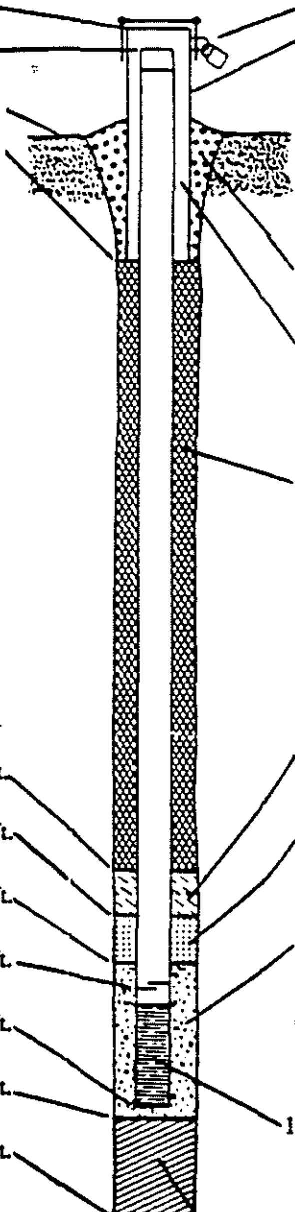
J. Filter pack, bottom __71.0__ ft. MSL or ______ ft.

K. Borehole, bottom __71.0__ ft. MSL or ______ ft.

L. Borehole, diameter __8.0__ in.

M. O.D. well casing __2.39__ in.

N. I.D. well casing __2.09__ in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 10.0 in.
b. Length: 0.5 ft.
c. Material: Steel ☒ 04
STEEL @ Grade Manhole Other ☒ __
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ______________
3. Surface seal: Bentonite ☐ 30
Concrete ☒ 01
______ Other ☐ __
4. Material between well casing and protective pipe:
Bentonite ☐ 30
Annular space seal ☐ __
Concrete Other ☒ __
5. Annular space seal: a. Granular Bentonite ☐ 33
b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
c. ____Lbs/gal mud weight . . . . . Bentonite slurry ☐ 31
d. ____ % Bentonite . . . . . . Bentonite-cement grout ☒ 50
e. ______ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ 01
Tremie pumped ☐ 02
Gravity ☒ 08
6. Bentonite seal: a. Bentonite granules ☒ 33
b. ☐1/4 in. ☐3/8 in. ☐1/2 in. Bentonite pellets ☐ 32
c. ______ Other ☐ __
7. Fine sand material: Manufacturer, product name & mesh size
a. None USED __
b. Volume added ______ ft^3
8. Filter pack material: Manufacturer, product name and mesh size
a. NATIVE SAND __
b. Volume added ______ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☐ 23
Flush threaded PVC schedule 80 ☒ 24
______ Other ☐ __
10. Screen material: Schedule 80 PVC __
a. Screen type: Factory cut ☒ 11
Continuous slot ☐ 01
______ Other ☐ __
b. Manufacturer Johnson
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☒ 14
______ Other ☐ __

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm
[signature] PE	GME CONSULTANTS, INC.

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Ad. Code. In accordance with ch.144, Wis Stats., failure to file this form may result in a forfeiture of not less than $10, nor more than $5000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than $10,000 for each

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☒ Underground Tanks ☐ Other ☐ ______

Facility/Project Name	County Name	Well Name	
WEBSTER	BURNETT	MW-91-7	
Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
________	__	DL-571	____

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method
   - surged with bailer and bailed ☐ 41
   - surged with bailer and pumped ☒ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - Other ______ ☐ __

3. Time spent developing well 60 min.

4. Depth of well (from top of well casisng) 68.6 ft.

5. Inside diameter of well 2.00 in.

6. Volume of water in filter pack and well casing 11.2 gal.

7. Volume of water removed from well 60.0 gal.

8. Volume of water added (if any) 0.0 gal.

9. Source of water added ______

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 32.92 ft.	32.93 ft.
Date	b. 09/10/91 (m m / d d / y y)	09/10/91 (m m / d d / y y)
Time	c. 8:07 ☒ a.m. ☐ p.m.	10:15 ☒ a.m. ☐ p.m.
12. Sediment in well bottom	0.4 inches	0.1 inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☒ 20 Turbid ☐ 25
(Describe)	WATER BROWN, TURBID, WITH SUSPENDED BENTONITE AND FINE SAND	WATER CLEAR AFTER 3-5 MINUTES OF PUMPING

Fill in if drilling fluids were used and well is at solid waste facility:

	Before Development	After Development
14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: GEORGE J. HUDAK

Firm: RREM, INC.

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: [signature] PE

Print Initials: WCK

Firm: EME CONSULTANTS, INC

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT
Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☒ Underground Tanks ☐ Other ☐ ______

Facility/Project Name	County Name	Well Name	
WEBSTER	BURNETT	MW-91-8	
Facility License, Permit or Monitoring Number	**County Code**	**Wis. Unique Well Number**	**DNR Well Number**
_ _ _ _ _ _ _	07	DL-572	

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method
   - surged with bailer and bailed ☐ 41
   - surged with bailer and pumped ☒ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - Other ______ ☐

3. Time spent developing well: 60 min.
4. Depth of well (from top of well casisng): 68.6 ft.
5. Inside diameter of well: 2.00 in.
6. Volume of water in filter pack and well casing: 11.3 gal.
7. Volume of water removed from well: 60.0 gal.
8. Volume of water added (if any): 0.0 gal.
9. Source of water added ______

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 32.11 ft.	32.15 ft.
Date	b. 09/04/91 (mm dd yy)	09/04/91 (mm dd yy)
Time	c. 11:23 ☒ a.m. ☐ p.m.	1:15 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	0.8 inches	0.2 inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☒ 20 Turbid ☐ 25
(Describe)	MILKY WHITE NEAR BOTTOM DUE TO ABUNDANT BENTONITE	CLEAR AFTER 5-10 GALLONS PUMPED

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	_ _ _ _ _ . _ mg/l	_ _ _ _ _ . _ mg/l
15. COD	_ _ _ _ _ . _ mg/l	_ _ _ _ _ . _ mg/l

16. Additional comments on development:

Well developed by: Person's Name and Firm

Name: GEORGE J. HUDAK

Firm: RREM INC

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: [signature] PG

Print Initials: WCK

Firm: GME CONSULTANTS, INC

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

State of Wisconsin
Department of Natural Resources

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☒ Underground Tanks ☐ Other ☐ ______

MONITORING WELL CONSTRUCTION

Form 4400-113A Rev. 4-90

Facility/Project Name: VILLAGE OF WEBSTER - WATER SUPPLY	Local Grid Location of Well ______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	Well Name: MW-91-8
Facility License, Permit or Monitoring Number: ________	~~Grid Origin Location~~ WELL LOCATION Lat. ______ Long. ______ or	Wis. Unique Well Number: DL-572 DNR Well Number: ______
Type of Well: Water Table Observation Well ☐ 11; Piezometer ☒ 12	St. Plane 268 416.32 ft. N. 1397934.73 ft. E.	Date Well Installed: 08/06/91 (m m / d d / y y)
Distance Well Is From Waste/Source Boundary ______ ft.	Section Location of Waste/Source: ___1/4 of ___ 1/4 of Sec. ___, T. ___ N, R. ___ ☐ E. ☐ W.	Well Installed By: (Person's Name and Firm) Jamie Tuura, GME Consultants, Inc.
Is Well A Point of Enforcement Std. Application? ☒ Yes ☐ No	Location of Well Relative to Waste/Source: u ☐ Upgradient; s ☐ Sidegradient; d ☐ Downgradient; n ☐ Not Known	

A. Protective pipe, top elevation AT GRADE ft. MSL

B. Well casing, top elevation 980.50 ft. MSL

C. Land surface elevation 980.5 ft. MSL

D. Surface seal, bottom ____ ft. MSL or 57.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☒ Yes ☐ No

14. Drilling method used: Rotary ☐ 50; Hollow Stem Auger ☒ 41; Other ☐ __

15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☐ 03; None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis): WEBSTER CITY GARAGE or COUNTY FAIRGROUNDS

E. Bentonite seal, top 53.0 ft. MSL or ____ ft.

F. Fine sand, top 57.0 ft. MSL or ____ ft.

G. Filter pack, top 57.0 ft. MSL or ____ ft.

H. Screen joint, top 64.0 ft. MSL or ____ ft.

I. Well bottom 69.0 ft. MSL or ____ ft.

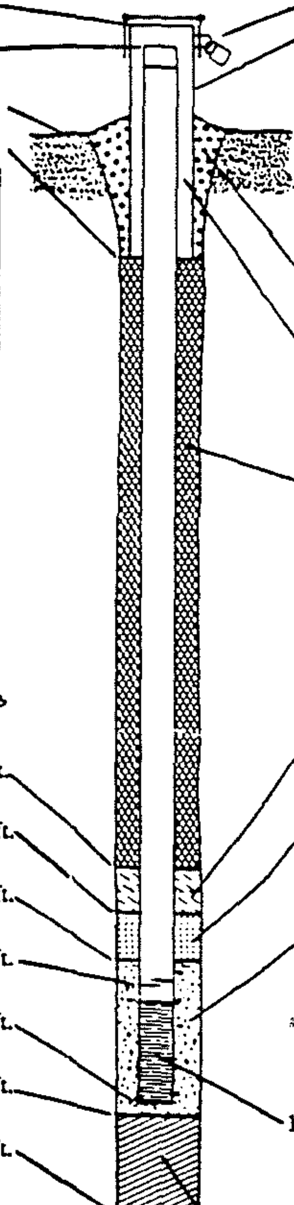
J. Filter pack, bottom 71.0 ft. MSL or ____ ft.

K. Borehole, bottom 71.0 ft. MSL or ____ ft.

L. Borehole, diameter 8.0 in.

M. O.D. well casing 2.39 in.

N. I.D. well casing 2.09 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 10.0 in.
   b. Length: 0.5 ft.
   c. Material: Steel ☒ 04; Other ☐ __ STEEL @ Grade Manhole
   d. Additional protection? ☐ Yes ☒ No
   If yes, describe: ______
3. Surface seal: Bentonite ☐ 30; Concrete ☒ 01; Other ☐ __
4. Material between well casing and protective pipe: Bentonite ☐ 30; Annular space seal ☐ __; Concrete Other ☒ __
5. Annular space seal: a. Granular Bentonite ☐ 33
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐ 35
   c. ____ Lbs/gal mud weight . . . . . Bentonite slurry ☐ 31
   d. ____ % Bentonite . . . . . Bentonite-cement grout ☒ 50
   e. ______ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08
6. Bentonite seal: a. Bentonite granules ☒ 33
   b. ☐ 1/4 in. ☐ 3/8 in. ☐ 1/2 in. Bentonite pellets ☐ 32
   c. ______ Other ☐ __
7. Fine sand material: Manufacturer, product name & mesh size
   a. None Used __
   b. Volume added ______ ft^3
8. Filter pack material: Manufacturer, product name and mesh size
   a. NATIVE SAND __
   b. Volume added ______ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☐ 23; Flush threaded PVC schedule 80 ☒ 24; Other ☐ __
10. Screen material: Schedule 80 PVC __
    a. Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐ __
    b. Manufacturer Johnson
    c. Slot size: 0.010 in.
    d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☒ 14; Other ☐ __

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: [signature] PE Firm: GME CONSULTANTS, INC.

Please complete both sides of this form and return to the appropriate DNR office listed at the top of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Ad. Code. In accordance with ch.144, Wis Stats., failure to file this form may result in a forfeiture of not less than \$10, nor more than \$5000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than \$10,000 for each

Appendix D

Well Recovery Graphs with Hydraulic Conductivity Calculations

JOB 9114 WEBSTER

SHEET NO. ______ OF ______

RREM ENGINEERING
DULUTH, MN.

CALCULATED BY G. HUDAK DATE 11-8-91

CHECKED BY ______ DATE ______

SCALE HYDRAULIC CONDUCTIVITY CALCULATIONS

WELL #	WELL DEPTH	STATIC H_2O	WELL SCREEN LENGTH	(SECONDS) TIME (T_0)	K (cm/s)
91-1	43.00	35.82	7.18 (218.84)	4.00	1.35×10^{-2}
91-2A	42.90	36.72	6.18 (188.37)	3.55	1.70×10^{-2}
91-4	40.15	32.42	7.73 (235.61)	2.10	2.42×10^{-2}
91-5A	40.46	32.55	7.91 (241.10)	4.05	1.23×10^{-2}
91-6	39.71	33.85	5.86 (178.61)	4.01	1.57×10^{-2}
OW-1	46.75	36.04	10.71 (326.44)	1.75	2.25×10^{-2}
OW-2	45.47	36.19	9.28 (282.85)	2.70	1.63×10^{-2}
OW-3	45.80	35.33	10.47 (319.13)	2.43	1.65×10^{-2}
OW-4	45.45	34.83	10.62 (323.70)	2.17	1.83×10^{-2}
OW-5	47.77	35.34	12.43 (378.87)	1.81	1.93×10^{-2}
OW-6	46.07	35.39	10.68 (325.53)	2.27	1.74×10^{-2}
OW-7	45.46	33.92	11.54 (351.74)	1.28	2.90×10^{-2}
OW-8	46.52	35.59	10.93 (333.15)	2.92	1.33×10^{-2}
OW-9	44.26	33.55	10.71 (326.44)	2.00	1.97×10^{-2}

$$K = \frac{r_e^2 \ln(L/R)}{2LT_0}$$ where r_e = effective radius

LET 2.54 cm = 1"

THEN 30.48 cm = 1'

AREA OF WELL = 20.27 cm^2

AREA OF HOSE = 2.85 cm^2

AREA OF TRANS CORD = 0.50 cm^2

AREA OF PUMP CORD = 0.3 cm^2

AREA OF WELL = AREA OF WELL — (AREA OF PUMP HOSE) – (AREA OF PUMP CORD) — AREA OF TRANSDUCER CORD

$= 20.27 - (2.85 + .5 + .3) = 16.62 cm^2$

AREA $= \pi r^2$, $\therefore$ $r_e = 2.30$ cm

HYDRAULIC CONDUCTIVITY DATA AND CALCULATIONS
WEBSTER, WISCONSIN

WELL #	WELL DEPTH	STATIC WATER LEVEL	WELL SCREEN LENGTH (FT)	TIME (To) SECONDS	HYD. COND. K x 100	ln HYD.COND.
91-1	43.00	35.82	7.18	4.00	1.35	-4.31
91-2A	42.90	36.72	6.18	3.55	1.70	-4.07
91-4	40.15	32.42	7.73	2.10	2.42	-3.72
91-5A	40.46	32.55	7.91	4.05	1.23	-4.40
91-6	39.71	33.85	5.86	4.01	1.57	-4.15
OW-1	46.75	35.04	10.71	1.75	2.25	-3.79
OW-2	45.47	36.19	9.28	2.70	1.63	-4.12
OW-3	45.80	35.33	10.47	2.43	1.65	-4.10
OW-4	45.45	34.83	10.62	2.17	1.83	-4.00
OW-5	47.77	35.34	12.43	1.81	1.93	-3.95
OW-6	46.07	35.39	10.68	2.27	1.74	-4.05
OW-7	45.46	33.92	11.54	1.28	2.90	-3.54
OW-8	46.52	35.59	10.93	2.92	1.33	-4.32
OW-9	44.26	33.55	10.71	2.00	1.97	-3.93
				d	25.5	-56.45

ARITHMETIC MEAN	(25.5 x 10-2) / 14 = 1.82 x 10-2 cm/s
GEOMETRIC MEAN	-56.45 / 14 = -4.032
	e -4.032 = 1.77 x 10-2 cm/s

RREM ENGINEERING
DULUTH, MN.

JOB 9114
SHEET NO. ______ OF ______
CALCULATED BY G. HUDAK DATE 11-13-91
CHECKED BY ______ DATE ______
SCALE GEOMETRIC MEAN CALCULATIONS

WELL #	HYD. COND.	ln HYD. COND
91-1	1.35×10^{-2}	-4.31
91-2A	1.70×10^{-2}	-4.07
91-4	2.42×10^{-2}	-3.72
91-5A	1.23×10^{-2}	-4.40
91-6	1.57×10^{-2}	-4.15
OW-1	2.25×10^{-2}	-3.79
OW-2	1.63×10^{-2}	-4.12
OW-3	1.65×10^{-2}	-4.10
OW-4	1.83×10^{-2}	-4.00
OW-5	1.93×10^{-2}	-3.95
OW-6	1.74×10^{-2}	-4.05
OW-7	2.90×10^{-2}	-3.54
OW-8	1.33×10^{-2}	-4.32
OW-9	1.97×10^{-2}	-3.93
Σ	25.5 cm/s	-56.45

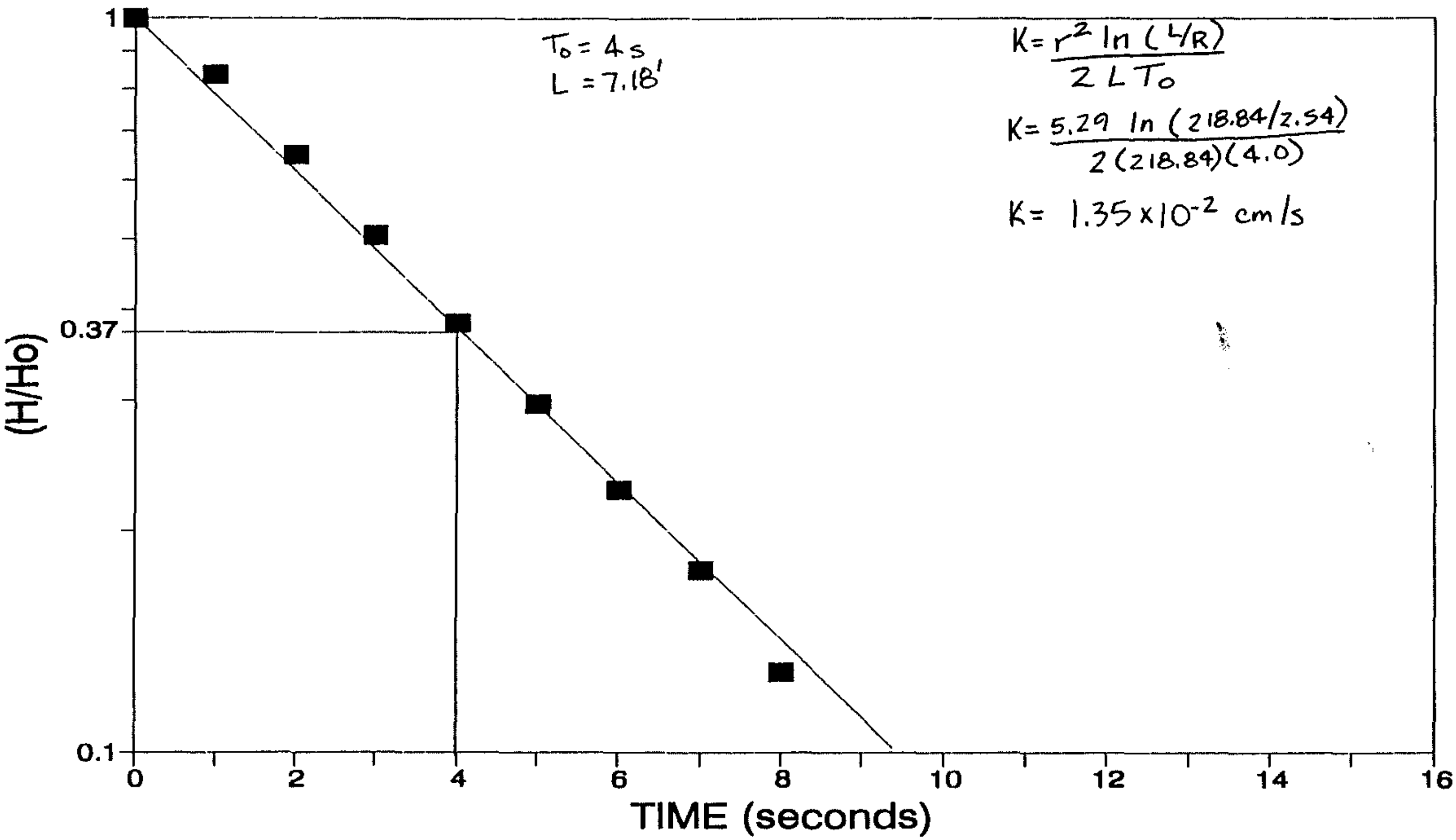
ARITHMETIC MEAN: 1.82×10^{-2} cm²/s

GEOMETRIC MEAN: $-56.45/14 = -4.032$

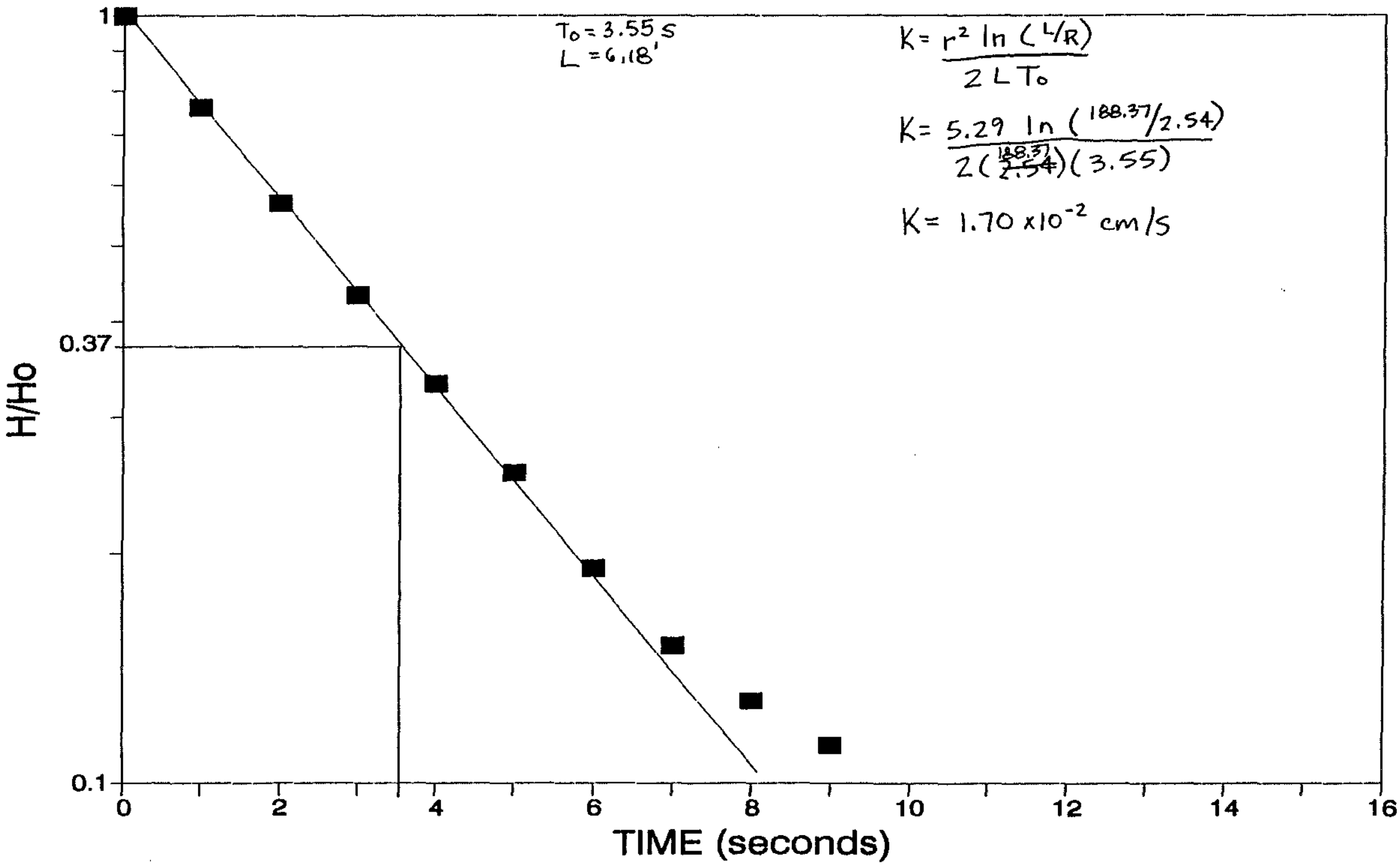
$e^{-4.032} = 1.77 \times 10^{-2}$ cm/s

* METHOD FROM FETTER, 1988, PP. 82-83

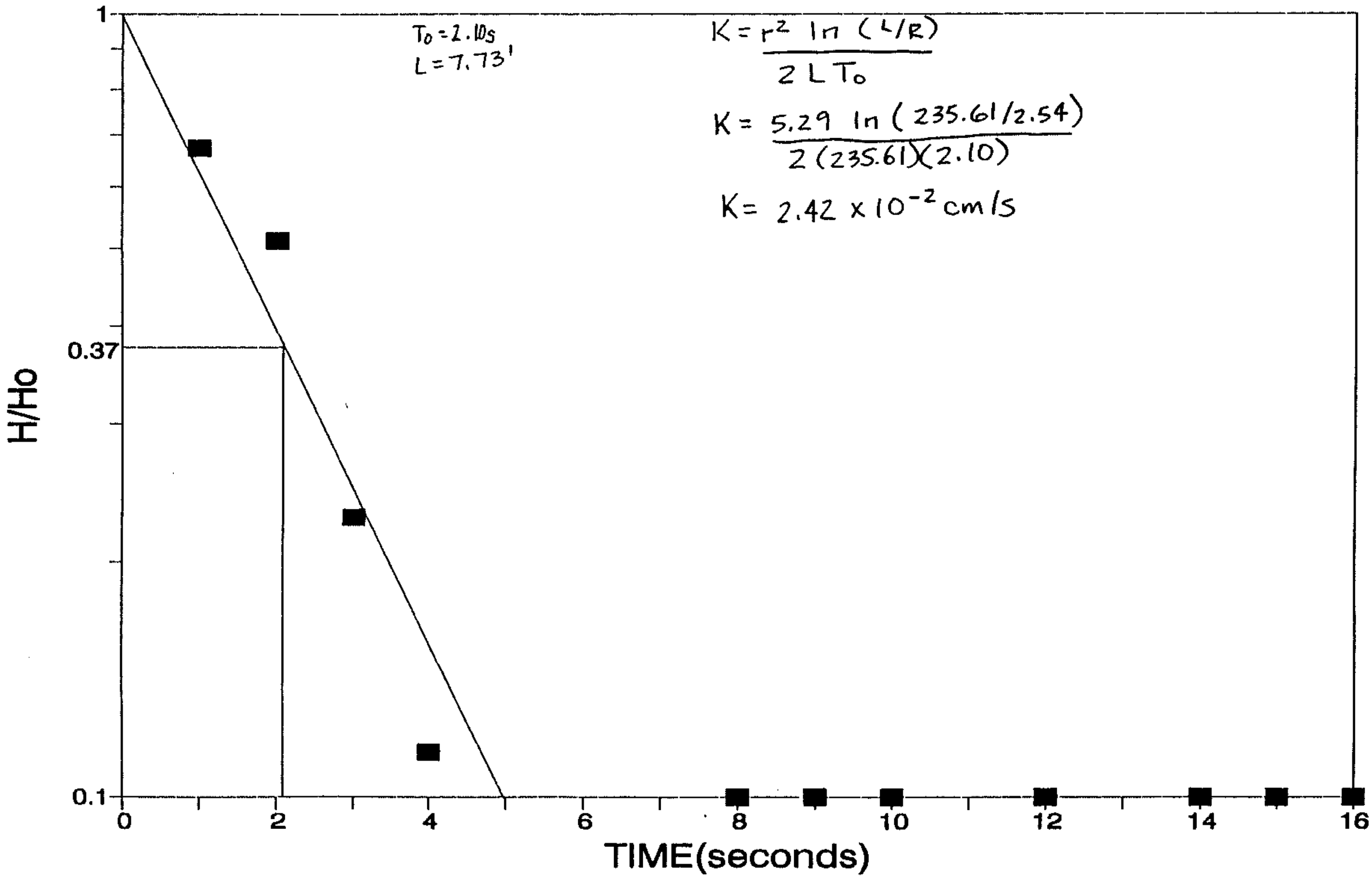
WEBSTER, WISCONSIN
91-1



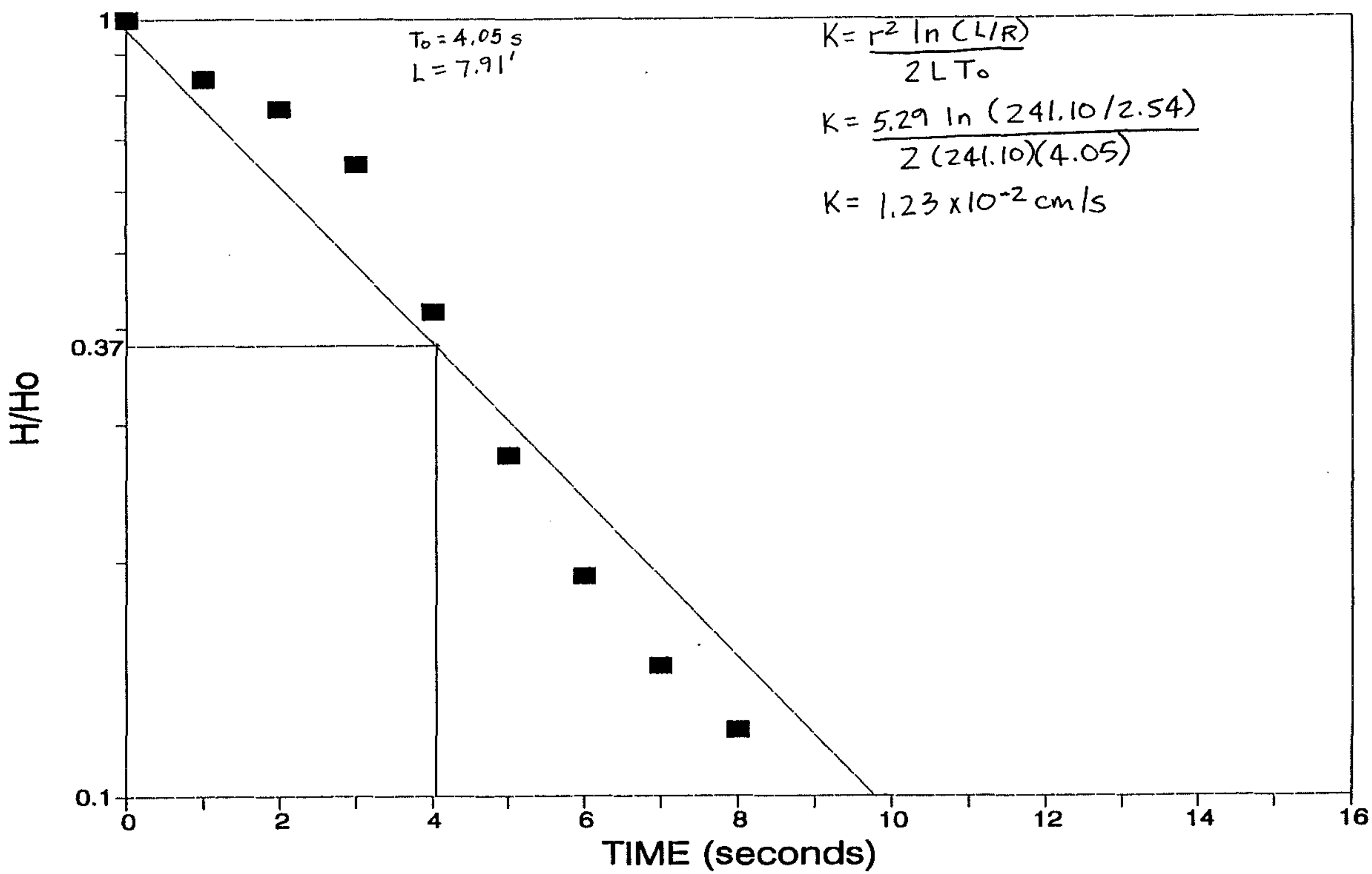
WEBSTER, WISCONSIN
91-2A



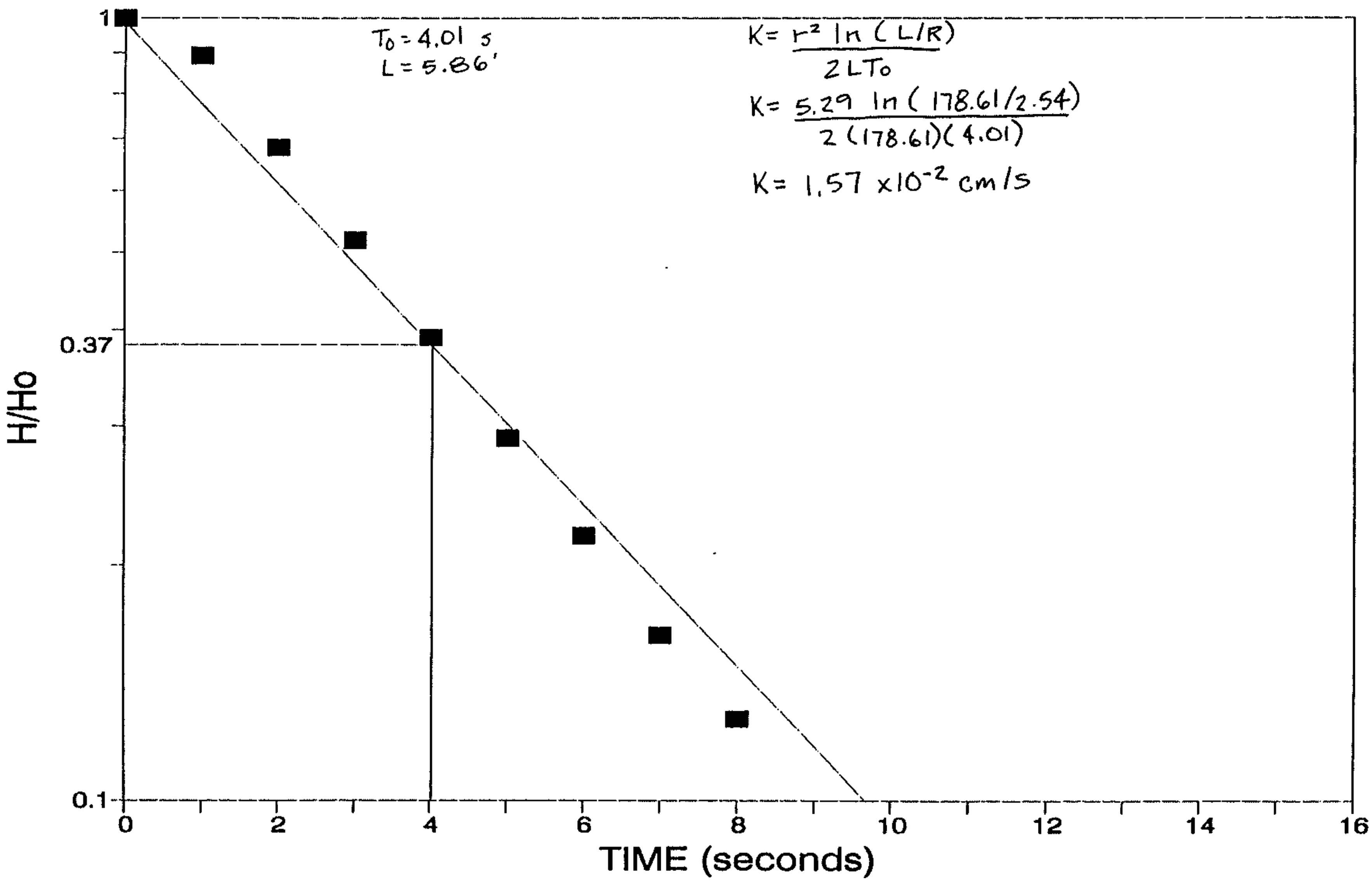
WEBSTER, WISCONSIN
91-4



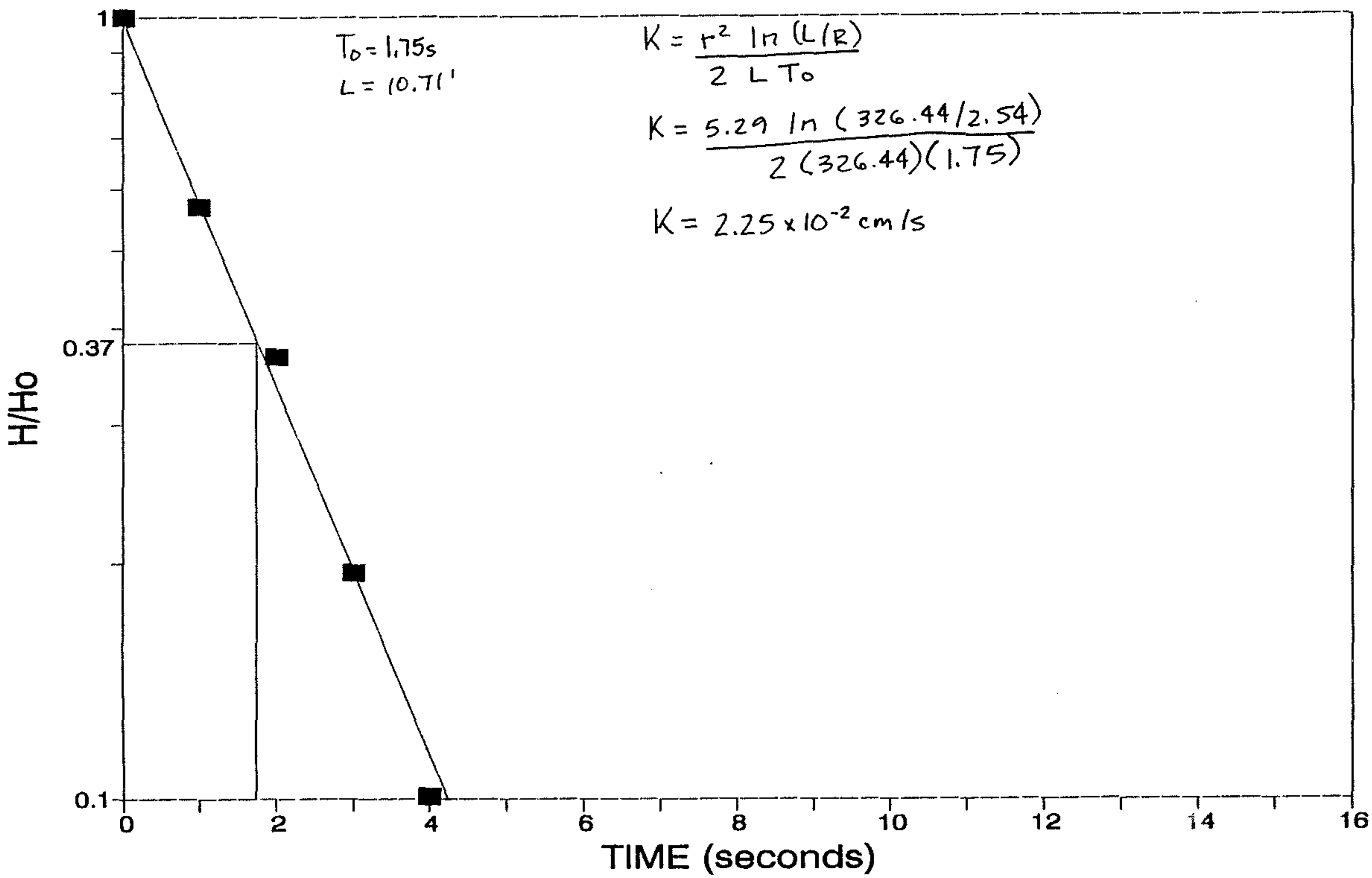
WEBSTER, WISCONSIN
91-5A



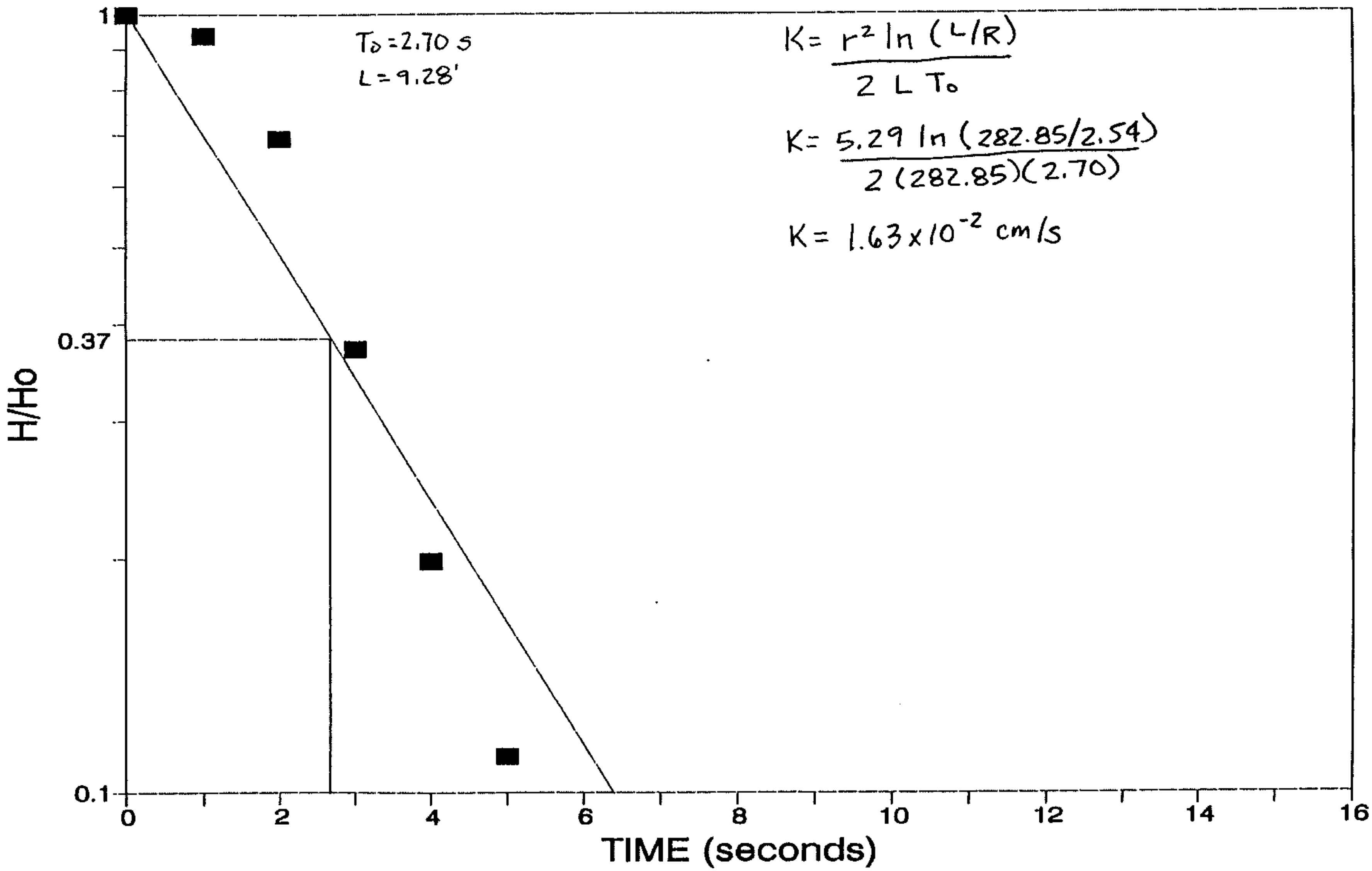
WEBSTER, WISCONSIN
91-6



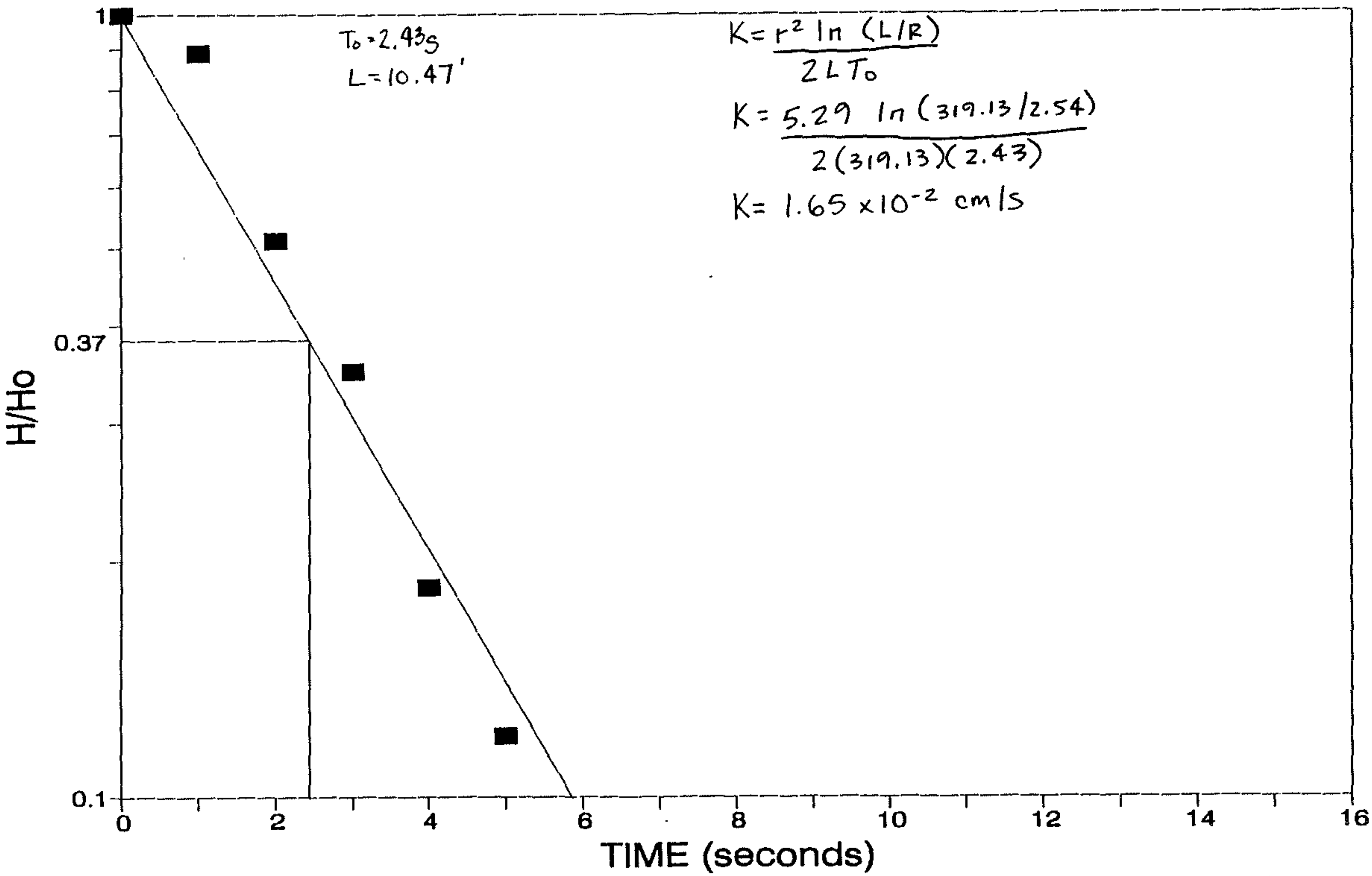
WEBSTER, WISCONSIN
OW-1

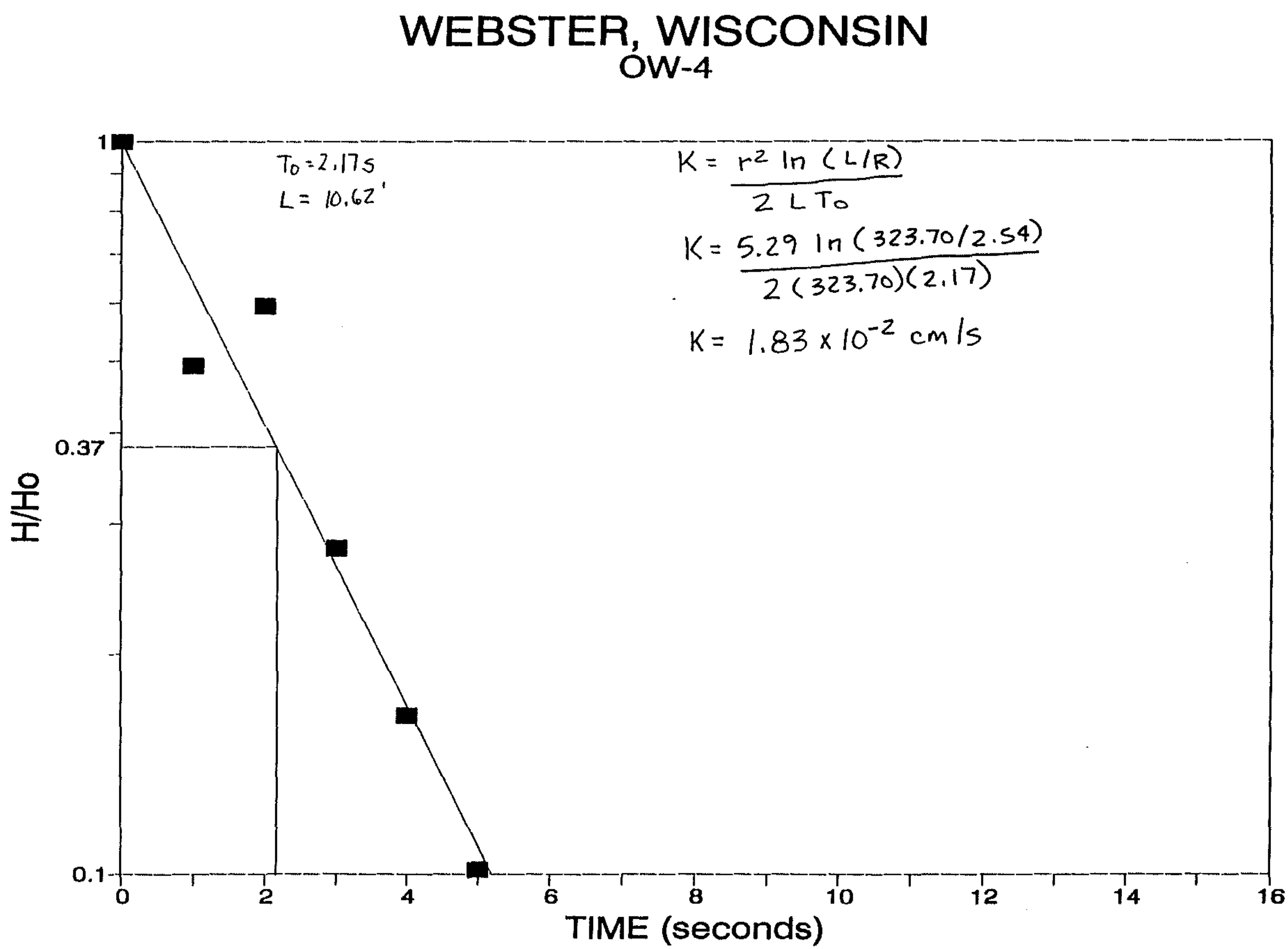


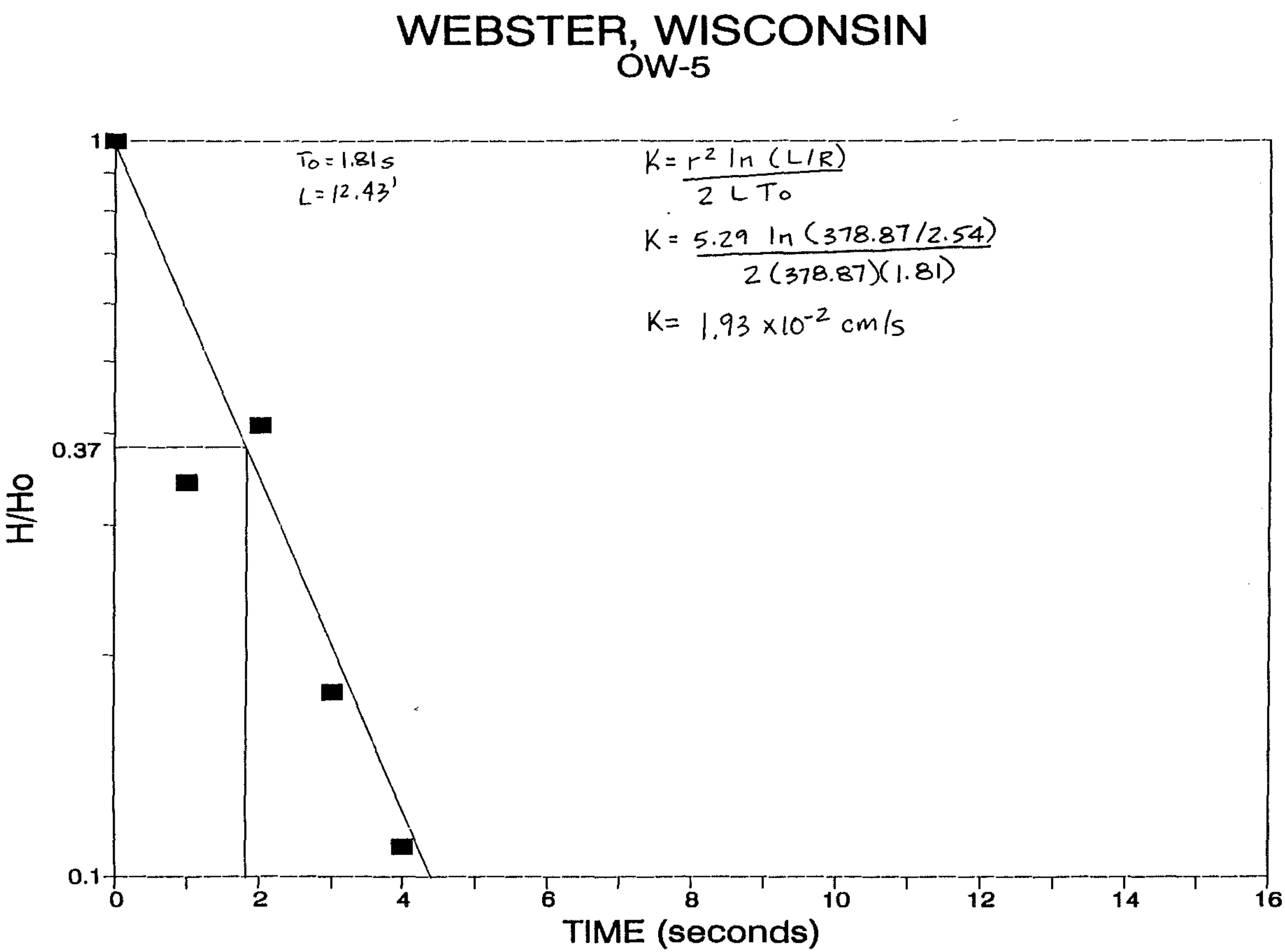
WEBSTER, WISCONSIN
OW-2



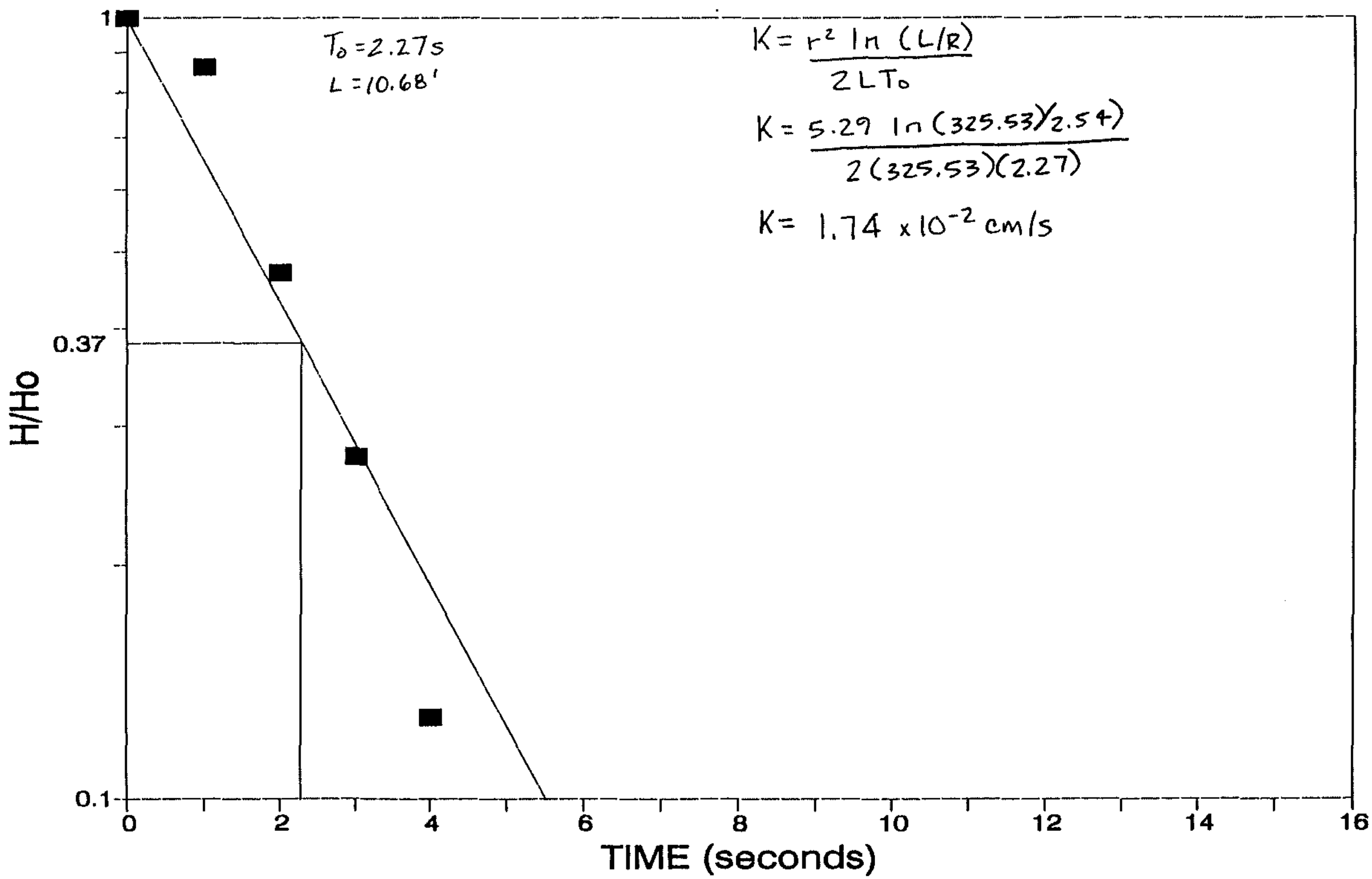
WEBSTER, WISCONSIN
OW-3



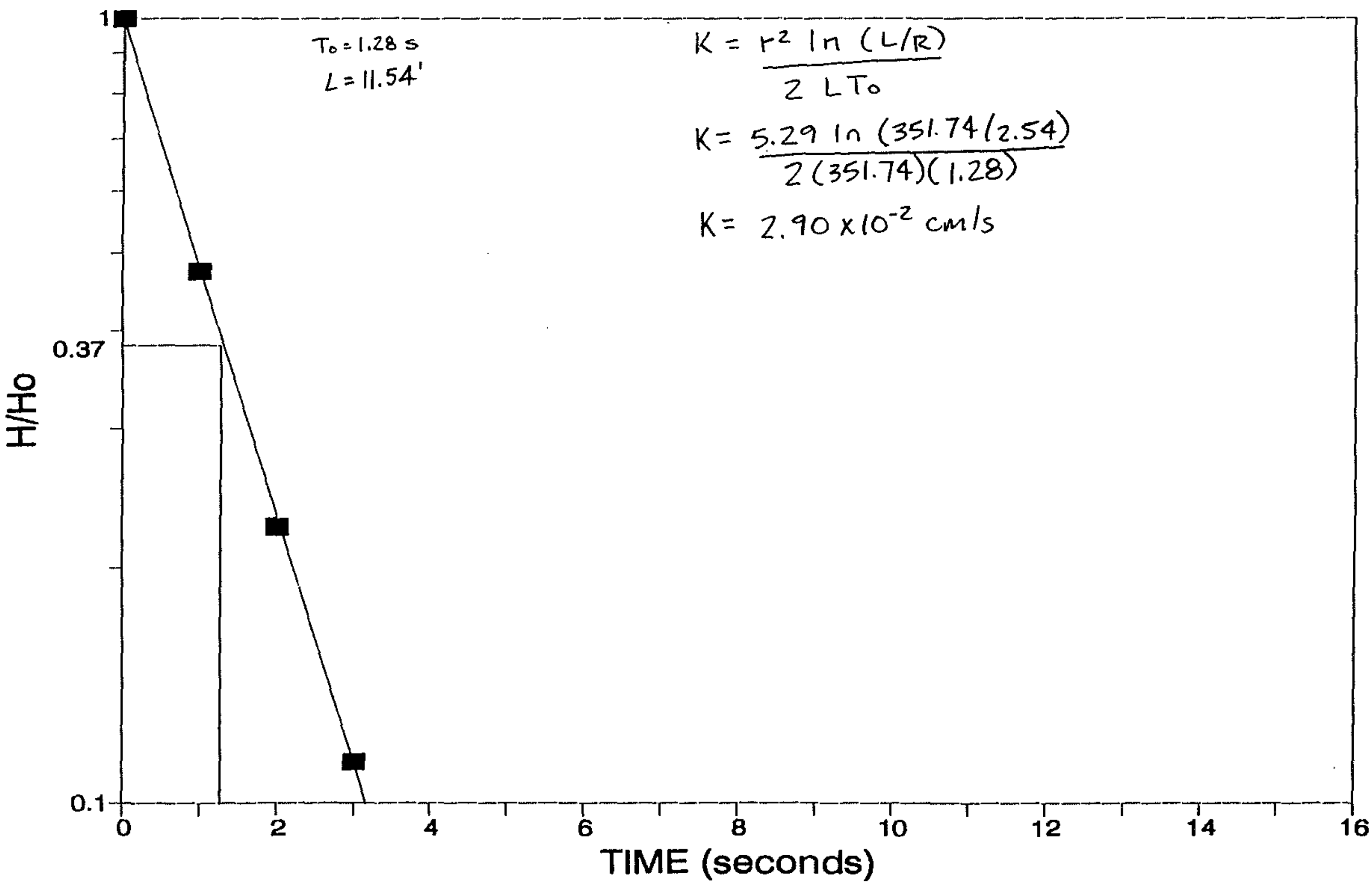

WEBSTER, WISCONSIN
OW-4
H/Ho
1
0.37
0.1
0
2
4
6
8
10
12
14
16
TIME (seconds)
To = 2.17s
L = 10.62'
K = r² ln (L/R) / 2 L To
K = 5.29 ln (323.70/2.54) / 2 (323.70)(2.17)
K = 1.83 x 10⁻² cm/s


WEBSTER, WISCONSIN
OW-5
To = 1.81 s
L = 12.43'
K = r² ln (L/R) / 2 L To
K = 5.29 ln (378.87/2.54) / 2 (378.87)(1.81)
K = 1.93 x10⁻² cm/s
H/Ho
1
0.37
0.1
0
2
4
6
8
10
12
14
16
TIME (seconds)

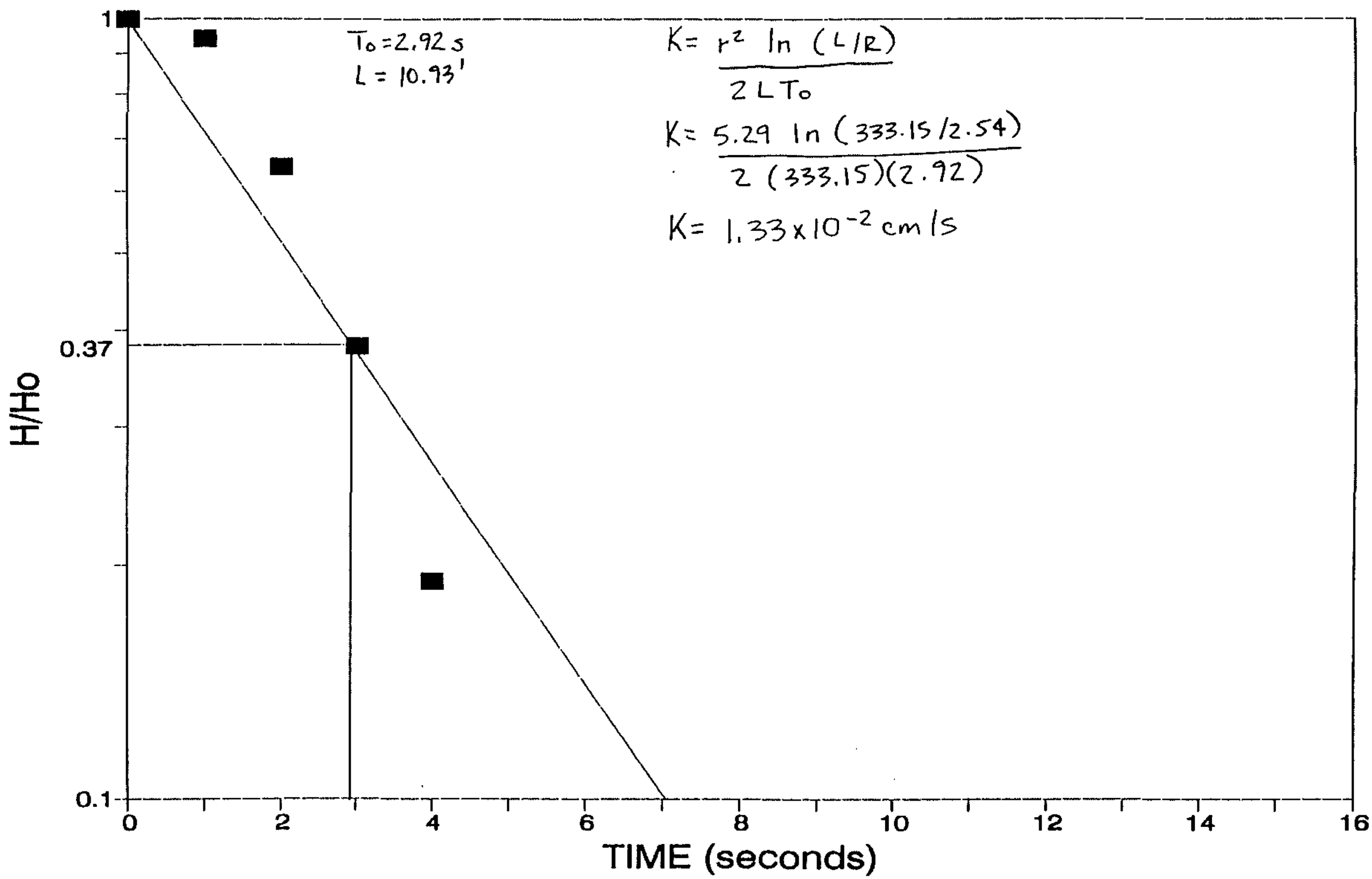
WEBSTER, WISCONSIN
OW-6



WEBSTER, WISCONSIN
OW-7

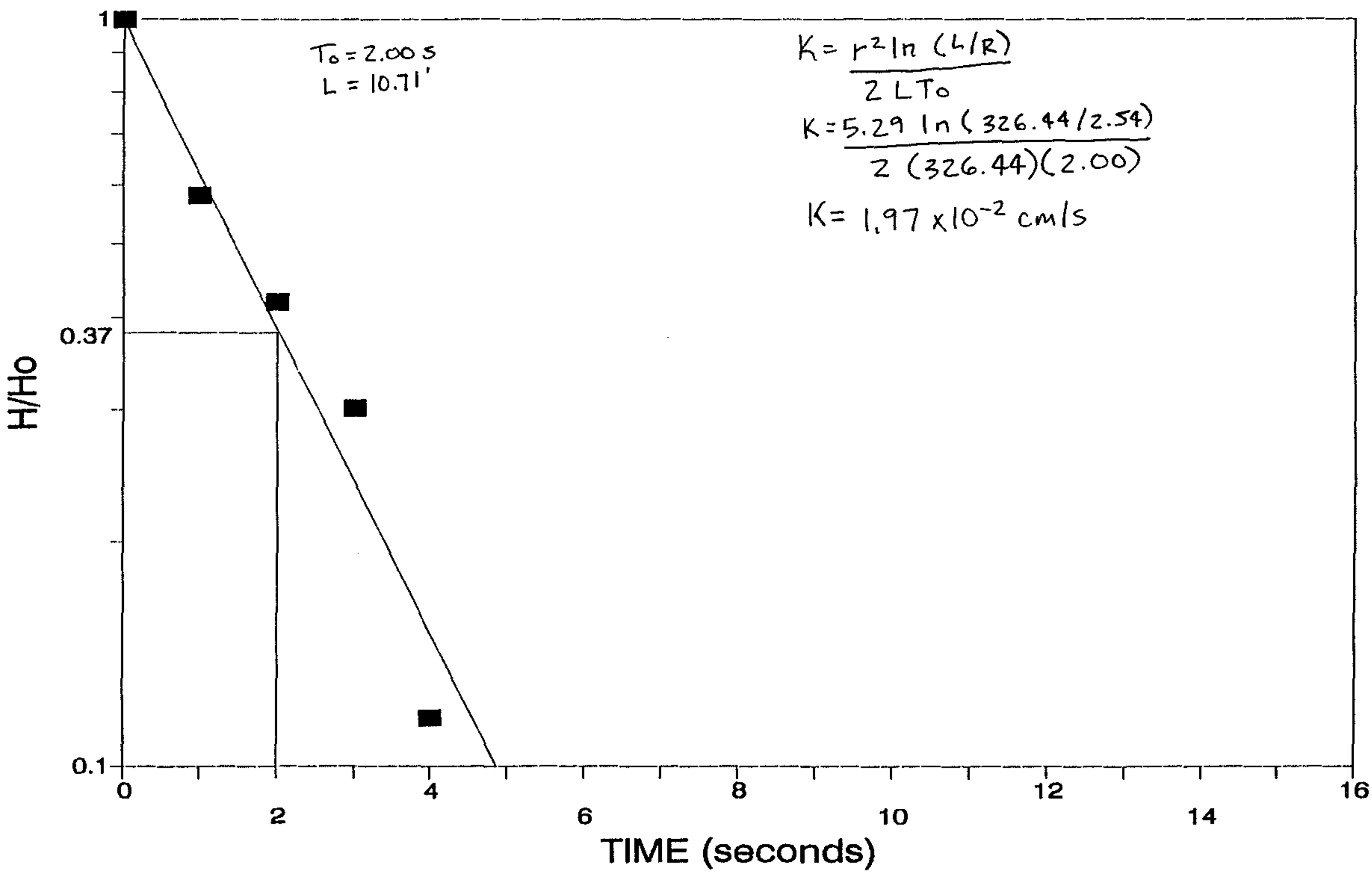


WEBSTER, WISCONSIN
OW-8



WEBSTER, WISCONSIN

OW-9



$$K = \frac{r^2 \ln (L/R)}{2 L T_o}$$

$$K = \frac{5.29 \ln (326.44/2.54)}{2 (326.44)(2.00)}$$

$$K = 1.97 \times 10^{-2} \text{ cm/s}$$

Appendix E

Enviroscan 1991 Soil Geochemistry Results and Chain-of-Custody Documents

ENVIROSCAN

July 15, 1991

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

JUL 1991
RECEIVED
RREM, Inc.

Attn: Brian Hayden

Re: Project No. 9114

Please find enclosed the analytical results for the samples received June 20, 1991.

The VOC and Lead analyses were done in accordance with EPA Methods (EPA-600/4-79-020, March, 1983 or SW-846, Third Edition). The Total Petroleum Hydrocarbons (TPH) analysis was completed using the California Method with a capillary GC/FID. The notes which follow the TPH results give an accurate description of any contamination. This was done to give you a better idea of the different types of petroleum contamination which could occur.

All results on soil/solid samples have been calculated on a dry weight basis.

The chain of custody document is enclosed. If you have any questions about the results, please call. Thank you for using Enviroscan Corp. for your analytical needs.

Sincerely,

Enviroscan Corp.

Victoria J Kakes

Victoria J. Kakes
Analytical Chemist

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

Attn: Brian Hayden

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 06/20/91
REPORT DATE: 07/13/91
APPROVED BY: VJK VJK

	Units	Detection Limit	SB-14	SB-12 34-36'
Benzene	ng/g	2.2	X	X
Bromoform	ng/g	8.6	X	X
Bromomethane	ng/g	17.0	X	X
Carbon Tetrachloride	ng/g	2.2	X	X
Chlorobenzene	ng/g	8.6	X	X
Chloroethane	ng/g	8.6	X	X
2-Chloroethylvinyl Ether	ng/g	21.0	X	X
Chloroform	ng/g	2.2	X	X
Chloromethane	ng/g	8.6	X	X
Chlorodibromomethane	ng/g	2.2	X	X
1,2-Dichlorobenzene	ng/g	4.2	X	X
1,3-Dichlorobenzene	ng/g	4.2	X	X
1,4-Dichlorobenzene	ng/g	2.2	X	X
Bromodichloromethane	ng/g	2.2	X	X
1,1-Dichloroethane	ng/g	2.2	X	X
1,2-Dichloroethane	ng/g	2.2	X	X
1,1-Dichloroethylene	ng/g	4.2	X	X
1,2-Dichloroethylene	ng/g	4.2	X	X
Methylene Chloride(1)	ng/g	11.0	13.5	X
1,2-Dichloropropane	ng/g	2.2	X	X
cis-1,3-Dichloropropene	ng/g	8.6	X	X
trans-1,3-Dichloropropene	ng/g	2.2	X	X
Ethylbenzene	ng/g	4.2	X	X
1,1,2,2-Tetrachloroethane	ng/g	4.2	X	X
Tetrachloroethylene	ng/g	2.2	X	X
Toluene	ng/g	2.2	X	X
1,1,1-Trichloroethane	ng/g	2.2	X	X
1,1,2-Trichloroethane	ng/g	2.2	X	X
Trichloroethylene	ng/g	2.2	X	X
Vinyl Chloride	ng/g	8.6	X	X
Trichlorofluoromethane	ng/g	4.2	X	X
Dichlorodifluoromethane	ng/g	8.6	X	X
m-Xylene	ng/g	4.2	X	X
o & p-Xylene	ng/g	4.2	X	X
Analytical No.:			52508	52510

X = Analyzed but not detected.
Results calculated on a dry weight basis.
(1) = May be due to lab contamination.

ANALYTICAL REPORT

ENVIROSCAN

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

Attn: Brian Hayden

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 06/20/91
REPORT DATE: 07/13/91
APPROVED BY: VJK VJK

	Units	Detection Limit	SB-12
Benzene	ng/g	4.3	X
Bromoform	ng/g	17.0	X
Bromomethane	ng/g	34.0	X
Carbon Tetrachloride	ng/g	4.3	X
Chlorobenzene	ng/g	17.0	X
Chloroethane	ng/g	17.0	X
2-Chloroethylvinyl Ether	ng/g	43.0	X
Chloroform	ng/g	4.3	X
Chloromethane	ng/g	17.0	X
Chlorodibromomethane	ng/g	4.3	X
1,2-Dichlorobenzene	ng/g	8.5	X
1,3-Dichlorobenzene	ng/g	8.5	X
1,4-Dichlorobenzene	ng/g	4.3	X
Bromodichloromethane	ng/g	4.3	X
1,1-Dichloroethane	ng/g	4.3	X
1,2-Dichloroethane	ng/g	4.3	X
1,1-Dichloroethylene	ng/g	8.5	X
1,2-Dichloroethylene	ng/g	8.5	X
Methylene Chloride	ng/g	21.0	X
1,2-Dichloropropane	ng/g	4.3	X
cis-1,3-Dichloropropene	ng/g	17.0	X
trans-1,3-Dichloropropene	ng/g	4.3	X
Ethylbenzene	ng/g	8.5	X
1,1,2,2-Tetrachloroethane	ng/g	8.5	X
Tetrachloroethylene	ng/g	4.3	X
Toluene	ng/g	4.3	X
1,1,1-Trichloroethane	ng/g	4.3	X
1,1,2-Trichloroethane	ng/g	4.3	X
Trichloroethylene	ng/g	4.3	X
Vinyl Chloride	ng/g	17.0	X
Trichlorofluoromethane	ng/g	8.5	X
Dichlorodifluoromethane	ng/g	17.0	X
m-Xylene	ng/g	8.5	X
o & p-Xylene	ng/g	8.5	X
Analytical No.:			52509

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 06/20/91
REPORT DATE: 07/15/91
APPROVED BY: VJK VJK

Attn: Brian Hayden

	Units	Detection Limit	SB-15
Benzene	ng/g	1.8	X
Bromoform	ng/g	7.4	X
Bromomethane	ng/g	15.0	X
Carbon Tetrachloride	ng/g	1.8	X
Chlorobenzene	ng/g	7.4	X
Chloroethane	ng/g	7.4	X
2-Chloroethylvinyl Ether	ng/g	19.0	X
Chloroform	ng/g	1.8	X
Chloromethane	ng/g	7.4	X
Chlorodibromomethane	ng/g	1.8	X
1,2-Dichlorobenzene	ng/g	3.8	X
1,3-Dichlorobenzene	ng/g	3.8	X
1,4-Dichlorobenzene	ng/g	1.8	X
Bromodichloromethane	ng/g	1.8	X
1,1-Dichloroethane	ng/g	1.8	X
1,2-Dichloroethane	ng/g	1.8	X
1,1-Dichloroethylene	ng/g	3.8	X
1,2-Dichloroethylene	ng/g	3.8	X
Methylene Chloride	ng/g	9.2	X
1,2-Dichloropropane	ng/g	1.8	X
cis-1,3-Dichloropropene	ng/g	7.4	X
trans-1,3-Dichloropropene	ng/g	1.8	X
Ethylbenzene	ng/g	3.8	X
1,1,2,2-Tetrachloroethane	ng/g	3.8	X
Tetrachloroethylene	ng/g	1.8	X
Toluene	ng/g	1.8	X
1,1,1-Trichloroethane	ng/g	1.8	X
1,1,2-Trichloroethane	ng/g	1.8	X
Trichloroethylene	ng/g	1.8	X
Vinyl Chloride	ng/g	7.4	X
Trichlorofluoromethane	ng/g	3.8	X
Dichlorodifluoromethane	ng/g	7.4	X
m-Xylene	ng/g	3.8	X
o & p-Xylene	ng/g	3.8	X
Analytical No.:			52511

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 06/20/91
REPORT DATE: 07/15/91
APPROVED BY: VJK VJK

Attn: Brian Hayden

	Units	Detection Limit	SB-3	SB-1 9-11'
Benzene	ng/g	2.1	X	X
Bromoform	ng/g	8.5	X	X
Bromomethane	ng/g	17.0	X	X
Carbon Tetrachloride	ng/g	2.1	X	X
Chlorobenzene	ng/g	8.5	X	X
Chloroethane	ng/g	8.5	X	X
2-Chloroethylvinyl Ether	ng/g	21.0	X	X
Chloroform	ng/g	2.1	X	X
Chloromethane	ng/g	8.5	X	X
Chlorodibromomethane	ng/g	2.1	X	X
1,2-Dichlorobenzene	ng/g	4.3	X	X
1,3-Dichlorobenzene	ng/g	4.3	X	X
1,4-Dichlorobenzene	ng/g	2.1	X	X
Bromodichloromethane	ng/g	2.1	X	X
1,1-Dichloroethane	ng/g	2.1	X	X
1,2-Dichloroethane	ng/g	2.1	X	X
1,1-Dichloroethylene	ng/g	4.3	X	X
1,2-Dichloroethylene	ng/g	4.3	X	X
Methylene Chloride	ng/g	11.0	X	X
1,2-Dichloropropane	ng/g	2.1	X	X
cis-1,3-Dichloropropene	ng/g	8.5	X	X
trans-1,3-Dichloropropene	ng/g	2.1	X	X
Ethylbenzene	ng/g	4.3	X	X
1,1,2,2-Tetrachloroethane	ng/g	4.3	X	X
Tetrachloroethylene	ng/g	2.1	X	X
Toluene	ng/g	2.1	X	X
1,1,1-Trichloroethane	ng/g	2.1	X	X
1,1,2-Trichloroethane	ng/g	2.1	X	X
Trichloroethylene	ng/g	2.1	X	X
Vinyl Chloride	ng/g	8.5	X	X
Trichlorofluoromethane	ng/g	4.3	X	X
Dichlorodifluoromethane	ng/g	8.5	X	X
m-Xylene	ng/g	4.3	X	X
o & p-Xylene	ng/g	4.3	X	X
Analytical No.:			52512	52513

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 06/20/91
REPORT DATE: 07/15/91
APPROVED BY: VJK VJK

Attn: Brian Hayden

	Units	Detection Limit	SB-1 34-36'
Benzene	ng/g	2.2	X
Bromoform	ng/g	8.6	X
Bromomethane	ng/g	17.0	X
Carbon Tetrachloride	ng/g	2.2	X
Chlorobenzene	ng/g	8.6	X
Chloroethane	ng/g	8.6	X
2-Chloroethylvinyl Ether	ng/g	21.0	X
Chloroform	ng/g	2.2	X
Chloromethane	ng/g	8.6	X
Chlorodibromomethane	ng/g	2.2	X
1,2-Dichlorobenzene	ng/g	4.3	X
1,3-Dichlorobenzene	ng/g	4.3	X
1,4-Dichlorobenzene	ng/g	2.2	X
Bromodichloromethane	ng/g	2.2	X
1,1-Dichloroethane	ng/g	2.2	X
1,2-Dichloroethane	ng/g	2.2	X
1,1-Dichloroethylene	ng/g	4.3	X
1,2-Dichloroethylene	ng/g	4.3	X
Methylene Chloride	ng/g	11.0	X
1,2-Dichloropropane	ng/g	2.2	X
cis-1,3-Dichloropropene	ng/g	8.6	X
trans-1,3-Dichloropropene	ng/g	2.2	X
Ethylbenzene	ng/g	4.3	X
1,1,2,2-Tetrachloroethane	ng/g	4.3	X
Tetrachloroethylene	ng/g	2.2	34.9
Toluene	ng/g	2.2	X
1,1,1-Trichloroethane	ng/g	2.2	X
1,1,2-Trichloroethane	ng/g	2.2	X
Trichloroethylene	ng/g	2.2	X
Vinyl Chloride	ng/g	8.6	X
Trichlorofluoromethane	ng/g	4.3	X
Dichlorodifluoromethane	ng/g	8.6	X
m-Xylene	ng/g	4.3	X
o & p-Xylene	ng/g	4.3	X
Analytical No.:			52514

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

ENVIROSCAN

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 06/20/91
REPORT DATE: 07/15/91
APPROVED BY: VJK VJK

Attn: Brian Hayden

Customer Number	Lead	Analytical Number
SB-14	3.7	52508
SB-12	X	52509
SB-12 34-36'	X	52510
SB-15	X	52511
SB-3	2.0	52512
SB-1 9-11'	2.5	52513
SB-1 34-36'	X	52514
Detection Limit	1.7	
Units	µg/g	

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 06/20/91
REPORT DATE: 07/11/91
APPROVED BY: DJB DJB

Attn: Brian Hayden

Total Petroleum Hydrocarbon (TPH) Analysis

	TPH Gasoline	TPH Diesel	Analytical No.
SB-14	X	X	52508
SB-12	X	X	52509
SB-12 34-36'	X	X	52510
SB-15	X	X	52511
SB-3	X	X	52512
SB-1 9-11'	X	X	52513
SB-1 34-36'	X	X	52514
Detection Limit	6.1	6.1	
Units	µg/g	µg/g	

X = Analyzed but not detected.
Results calculated on a dry weight basis.

Date Rec'd 6/20/91

SAMPLE RECEIPT REPORT

CLIENT: RREM Inc.

Anal. No.: 20-52508 to 52514

Reference Code	Explanation
1.	Sample(s) received at 22.1 °C which is above the EPA protocol of 4 °C.
2.	Samples received without appropriate paperwork. Explain ______
3.	VOC vial(s) received with headspace contrary to EPA protocol. Explain ______
4.	Sample(s) received in bottles not furnished by Enviroscan. Preservation method, if used, are unknown.
5.	Sample(s) not properly preserved per EPA protocol for the following: ______
6.	Sample(s) not field filtered. Lab filtered upon receipt.
7.	Sample(s) received beyond EPA holding time for: ______
8.	Sample date/time not supplied by client. Actual holding time unknown.
9.	Insufficient sample size to complete analysis or obtain required detection limit.
10.	Other: ______

REQUEST FOR SERVICES

ANALYTICAL SCAN

303 W. MILITARY RD. ROTHSCHILD, WI 54474 1-800-338-SCAN

CLIENT INFORMATION

Name: BRIAN HAYDEN
Company: RREM INC
Address: 408 Board of Trade Bld.
Duluth MN 55802
Phone: (218) 722-3915
P.O. # / Project #: 9114
Quote / Reference #: 01111-9
Note: Terms and conditions printed on back apply.

Turnaround Time
☒ Normal
☐ Rush
Date Needed ______
(Preapproved by Lab)

Sample Type
(Check all that apply)
☐ Groundwater
☐ Wastewater
☒ Soil
☐ Solid Waste
☐ Oil
☐ Other ______

Sample Handling
☒ Nonhazardous
☐ Flammable
☐ Skin Irritant
☐ Highly Toxic
☐ Other (specify) ______
☒ Refrigerate
☐ Work in Hood
☐ Wear Gloves

ANALYTICAL REQUESTS
(use separate sheet if necessary)

LAB USE ONLY	DATE	TIME	No. of Containers COMP	GRAB	SAMPLE ID	O-TS/ 5-OEXT 5-F00CX	EPA 8010/8020	TPH as Gasoline	~~EPA 6010~~ ~~EPA 7421~~	Lead total MPREP		REMARKS
20052508 ✓	6-19			1	SB-14 34'-36'							
20052509 ✓	6-19			1	SB-12 9'-11'							
20052510 ✓	6-19			1	SB-12 34'-36'							
20052511 ✓	6-18			1	SB-15 34'-36'							
20052512 ✓	6-18			1	SB-3 34'-36'							
20052513 ✓	6-17			1	SB-1 9'-11'							
20052514 ✓	6-17			1	SB-1 34'-36'							

RREM

CHAIN OF CUSTODY RECORD

SAMPLERS: (Signature)
Brian T Hayden

Del'v: Hand Comm.
Ship. Cont. OK? Y N N/A
Rec'd Refrig.? Y N N/A 22.1°c
Seals OK? Y N N/A
Samples leaking? Y N N/A
Comments:

RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED BY: (Signature)	
Brian Hayden RREM	6-19-91	2:00	Deborah E. Rausch	
RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED BY: (Signature)	
Deborah E. Rausch	19 Jun 91	3:55	George Hudak RREM	
RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED FOR LABORATORY BY: (Signature)	DATE/TIME
[illegible]	[illegible]		[illegible]	6/20/91 9:50 AM

ENVIROSCAN

July 19, 1991

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

JUL 1991
RECEIVED
RREM, Inc.

Attn: Colin Reichhoff / George Hudak

Re: Project No. 9114

Please find enclosed the analytical results for the samples received June 28, 1991.

The volatile organic compounds were determined in accordance with EPA method 8010/8020 (GC with Hall and PI detectors). The TPH analyses were completed in accordance with the California Method (GC-FID). The notes which follow the TPH results give an accurate description of any contamination observed. The lead was determined in accordance with EPA method 6010 (ICP-AES).

The chain of custody document is enclosed. If you have any questions about the results, please call. Thank you for using Enviroscan Corp. for your analytical needs.

Sincerely,

Enviroscan Corp.

James B Edwards

James B. Edwards
Senior Analytical Chemist

303 West Military Road Rothschild, WI 54474 (715) 359-7226

ANALYTICAL REPORT

ENVIROSCAN

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 06/28/91
REPORT DATE: 07/19/91
APPROVED BY: JBE

Attn: Colin Reichhoff / George Hudak

	Units	Detection Limit	WEBSTER SB-6	WEBSTER SB-5
Benzene	ng/g	2.0	X	X
Bromoform	ng/g	7.8	X	X
Bromomethane	ng/g	16.	X	X
Carbon Tetrachloride	ng/g	2.0	X	X
Chlorobenzene	ng/g	7.8	X	X
Chloroethane	ng/g	7.8	X	X
2-Chloroethylvinyl Ether	ng/g	20.	X	X
Chloroform	ng/g	2.0	X	X
Chloromethane	ng/g	7.8	X	X
Chlorodibromomethane	ng/g	2.0	X	X
1,2-Dichlorobenzene	ng/g	3.9	X	X
1,3-Dichlorobenzene	ng/g	3.9	X	X
1,4-Dichlorobenzene	ng/g	2.0	X	X
Bromodichloromethane	ng/g	2.0	X	X
1,1-Dichloroethane	ng/g	2.0	X	X
1,2-Dichloroethane	ng/g	2.0	X	X
1,1-Dichloroethylene	ng/g	3.9	X	X
1,2-Dichloroethylene	ng/g	3.9	X	X
Methylene Chloride	ng/g	9.8	X	X
1,2-Dichloropropane	ng/g	2.0	X	X
cis-1,3-Dichloropropene	ng/g	7.8	X	X
trans-1,3-Dichloropropene	ng/g	2.0	X	X
Ethylbenzene	ng/g	3.9	X	X
1,1,2,2-Tetrachloroethane	ng/g	3.9	X	X
Tetrachloroethylene	ng/g	2.0	2.4	X
Toluene	ng/g	2.0	X	X
1,1,1-Trichloroethane	ng/g	2.0	X	X
1,1,2-Trichloroethane	ng/g	2.0	X	X
Trichloroethylene	ng/g	2.0	X	X
Vinyl Chloride	ng/g	7.8	X	X
Trichlorofluoromethane	ng/g	3.9	X	X
Dichlorodifluoromethane	ng/g	7.8	X	X
m-Xylene	ng/g	3.9	X	X
o- & p-Xylene	ng/g	3.9	X	X
Lead	µg/g	1.8	X	3.47
Analytical No.:			52948	52947

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 06/28/91
REPORT DATE: 07/19/91
APPROVED BY: JBE

Attn: Colin Reichhoff / George Hudak

	Units	Detection Limit	WEBSTER SB-10	WEBSTER SB-11
Benzene	ng/g	2.4	X	X
Bromoform	ng/g	9.7	X	X
Bromomethane	ng/g	19.	X	X
Carbon Tetrachloride	ng/g	2.4	X	X
Chlorobenzene	ng/g	9.7	X	X
Chloroethane	ng/g	9.7	X	X
2-Chloroethylvinyl Ether	ng/g	24.	X	X
Chloroform	ng/g	2.4	X	X
Chloromethane	ng/g	9.7	X	X
Chlorodibromomethane	ng/g	2.4	X	X
1,2-Dichlorobenzene	ng/g	4.8	X	X
1,3-Dichlorobenzene	ng/g	4.8	X	X
1,4-Dichlorobenzene	ng/g	2.4	X	X
Bromodichloromethane	ng/g	2.4	X	X
1,1-Dichloroethane	ng/g	2.4	X	X
1,2-Dichloroethane	ng/g	2.4	X	X
1,1-Dichloroethylene	ng/g	4.8	X	X
1,2-Dichloroethylene	ng/g	4.8	X	X
Methylene Chloride	ng/g	12.	X	X
1,2-Dichloropropane	ng/g	2.4	X	X
cis-1,3-Dichloropropene	ng/g	9.7	X	X
trans-1,3-Dichloropropene	ng/g	2.4	X	X
Ethylbenzene	ng/g	4.8	X	X
1,1,2,2-Tetrachloroethane	ng/g	4.8	X	X
Tetrachloroethylene	ng/g	2.4	X	X
Toluene	ng/g	2.4	X	X
1,1,1-Trichloroethane	ng/g	2.4	X	X
1,1,2-Trichloroethane	ng/g	2.4	X	X
Trichloroethylene	ng/g	2.4	X	X
Vinyl Chloride	ng/g	9.7	X	X
Trichlorofluoromethane	ng/g	4.8	X	X
Dichlorodifluoromethane	ng/g	9.7	X	X
m-Xylene	ng/g	4.8	X	X
o- & p-Xylene	ng/g	4.8	X	X
Lead	µg/g	1.7	2.26	3.34
Analytical No.:			52949	52950

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 06/28/91
REPORT DATE: 07/19/91
APPROVED BY: JBE

Attn: Colin Reichhoff / George Hudak

	Units	Detection Limit	WEBSTER SB-13
Benzene	ng/g	2.3	X
Bromoform	ng/g	9.4	X
Bromomethane	ng/g	19.	X
Carbon Tetrachloride	ng/g	2.3	X
Chlorobenzene	ng/g	9.4	X
Chloroethane	ng/g	9.4	X
2-Chloroethylvinyl Ether	ng/g	24.	X
Chloroform	ng/g	2.3	X
Chloromethane	ng/g	9.4	X
Chlorodibromomethane	ng/g	2.3	X
1,2-Dichlorobenzene	ng/g	4.7	X
1,3-Dichlorobenzene	ng/g	4.7	X
1,4-Dichlorobenzene	ng/g	2.3	X
Bromodichloromethane	ng/g	2.3	X
1,1-Dichloroethane	ng/g	2.3	X
1,2-Dichloroethane	ng/g	2.3	X
1,1-Dichloroethylene	ng/g	4.7	X
1,2-Dichloroethylene	ng/g	4.7	X
Methylene Chloride	ng/g	12.	X
1,2-Dichloropropane	ng/g	2.3	X
cis-1,3-Dichloropropene	ng/g	9.4	X
trans-1,3-Dichloropropene	ng/g	2.3	X
Ethylbenzene	ng/g	4.7	X
1,1,2,2-Tetrachloroethane	ng/g	4.7	X
Tetrachloroethylene	ng/g	2.3	X
Toluene	ng/g	1.8	4.2
1,1,1-Trichloroethane	ng/g	2.3	X
1,1,2-Trichloroethane	ng/g	2.3	X
Trichloroethylene	ng/g	2.3	X
Vinyl Chloride	ng/g	9.4	X
Trichlorofluoromethane	ng/g	4.7	X
Dichlorodifluoromethane	ng/g	9.4	X
m-Xylene	ng/g	4.7	X
o- & p-Xylene	ng/g	4.7	X
Lead	µg/g	1.8	X
Analytical No.:			52951

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 06/28/91
REPORT DATE: 07/15/91
APPROVED BY: DJB DJB

Attn: Colin Reichhoff/george Hudak

Total Petroleum Hydrocarbon (TPH) Analysis

	TPH Gasoline	TPH Diesel	Analytical No.
WEBSTER SB-5	X	X	52947
WEBSTER SB-6	X	X	52948
WEBSTER SB-10	X	X	52949
WEBSTER SB-11	X	X	52950
WEBSTER SB-13	X	X	52951
Detection Limit	6.3	6.3	
Units	µg/g	µg/g	

X = Analyzed but not detected.
Results calculated on a dry weight basis.

ANALYTICAL REPORT ENVIROSCAN

Date Rec'd 6/28/91

SAMPLE RECEIPT REPORT

CLIENT: RREM

Anal. No.: 6052947 to 6052952

Reference Code	Explanation
1.	Sample(s) received at WARM°C which is above the EPA protocol of 4°C. Cold Packs NOT Cold
2.	Samples received without appropriate paperwork. Explain ______
3.	VOC vial(s) received with headspace contrary to EPA protocol. Explain ______
4.	Sample(s) received in bottles not furnished by Enviroscan. Preservation method, if used, are unknown.
5.	Sample(s) not properly preserved per EPA protocol for the following: ______
6.	Sample(s) not field filtered. Lab filtered upon receipt.
7.	Sample(s) received beyond EPA holding time for: ______
8.	Sample date/time not supplied by client. Actual holding time unknown.
9.	Insufficient sample size to complete analysis or obtain required detection limit.
10.	Other: ______

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

REQUEST FOR SERVICES

ENVIROSCAN

303 W. MILITARY RD. ROTHSCHILD, WI 54474 1-800-338-SCAN

CLIENT INFORMATION

Name: COLIN REICHHOFF / GEORGE HUDAK
Company: RREM INC.
Address: 408 BOARD OF TRADE BUILDING
DULUTH, MN 55802
Phone: (218) 722-3915
P.O. # / Project #: 9114
Quote / Reference #: 01111-9
Note: Terms and conditions printed on back apply.

Turnaround Time
☒ Normal
☐ Rush
Date Needed ______
(Preapproved by Lab)

Sample Type
(Check all that apply)
☐ Groundwater
☐ Wastewater
☒ Soil
☐ Solid Waste
☐ Oil
☐ Other ______

Sample Handling
☒ Nonhazardous
☐ Flammable
☐ Skin Irritant
☐ Highly Toxic
☐ Other (specify) ______
☒ Refrigerate
☐ Work in Hood
☐ Wear Gloves

ANALYTICAL REQUESTS
(use separate sheet if necessary)

LAB USE ONLY	DATE	TIME	No. of Containers COMP	No. of Containers GRAB	SAMPLE ID	EPA 8010/8020 S-FV00X	TPH GASOLINE S-PEXT Q-TS	EPA 7421 LEAD	MPREP		REMARKS
06052947 ✓	6/26/91	11:30		1	WEBSTER SB-5, #7, 34-36'	X	X	X			
06052948 ✓	6/26/91	3:20		1	WEBSTER SB-6, #7, 34-36'	X	X	X			
06052949 ✓	6/25/91	11:36		1	WEBSTER SB 10, #8, 34-36'	X	X	X			
06052950 ✓	6/25/91	3:20		1	WEBSTER SB 11, #8, 34-36'	X	X	X			
06052951 ✓	6/24/91	3:43		1	WEBSTER SB 13, #7, 34-36'	X	X	X			

RREM

CHAIN OF CUSTODY RECORD

SAMPLERS: (Signature) George J. Hudak

RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED BY: (Signature)
George J. Hudak	6/27/91	9:45	
RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED FOR LABORATORY BY: (Signature)

DATE/TIME

Del'v: Hand Comm
Ship. Cont. OK? Y N N/A
Rec'd Refrig.? Y N N/A WARM
Seals OK? Y N N/A
Samples leaking? Y N N/A
Comments:
Cold Packs warm

ENVIROSCAN

AUG 1991
RECEIVED
RREM, Inc.

July 31, 1991

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

Attn: Colin Reichhoff

Re: 9114

Please find enclosed the analytical results for the samples received July 11, 1991.

All analyses were done in accordance with EPA Methods (EPA-600/4-79-020, March, 1983 or SW-846, Third Edition). The Total Petroleum Hydrocarbon (TPH) analysis was completed using the California Method with a capillary GC/FID. All results on soil/solid samples have been calculated on a dry weight basis.

The chain of custody document is enclosed.

If you have any questions about the results, please call. Thank you for using Enviroscan Corp. for your analytical needs.

Sincerely,

Enviroscan Corp.

Dominic Bush

Dominic J. Bush
Analytical Chemist

303 West Military Road Rothschild, WI 54474 (715) 359-7226

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

Attn: Colin Reichhoff

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/11/91
REPORT DATE: 07/26/91
APPROVED BY: BMS
BMS

Customer Number	Lead	Detection Limit	Units	Analytical Number
SB-8,#7	2.27	1.7	µg/g	53499
SB-2,#7	X	1.8	µg/g	53500
SB-2,#5	X	1.6	µg/g	53501

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/11/91
REPORT DATE: 07/26/91
APPROVED BY: JCH J.C.H.

Attn: Colin Reichhoff

	Units	Detection Limit	SB-8,#7 07/08/91
Benzene	ng/g	1.8	X
Bromoform	ng/g	7.4	X
Bromomethane	ng/g	15.0	X
Carbon Tetrachloride	ng/g	1.8	X
Chlorobenzene	ng/g	7.4	X
Chloroethane	ng/g	7.4	X
2-Chloroethylvinyl Ether	ng/g	19.0	X
Chloroform	ng/g	1.8	X
Chloromethane	ng/g	7.4	X
Chlorodibromomethane	ng/g	1.8	X
1,2-Dichlorobenzene	ng/g	3.7	X
1,3-Dichlorobenzene	ng/g	3.7	X
1,4-Dichlorobenzene	ng/g	1.8	X
Bromodichloromethane	ng/g	1.8	X
1,1-Dichloroethane	ng/g	1.8	X
1,2-Dichloroethane	ng/g	1.8	X
1,1-Dichloroethylene	ng/g	3.7	X
1,2-Dichloroethylene	ng/g	3.7	X
Methylene Chloride	ng/g	9.2	X
1,2-Dichloropropane	ng/g	1.8	X
cis-1,3-Dichloropropene	ng/g	7.4	X
trans-1,3-Dichloropropene	ng/g	1.8	X
Ethylbenzene	ng/g	3.7	X
1,1,2,2-Tetrachloroethane	ng/g	3.7	X
Tetrachloroethylene	ng/g	1.8	X
Toluene	ng/g	1.8	X
1,1,1-Trichloroethane	ng/g	1.8	X
1,1,2-Trichloroethane	ng/g	1.8	X
Trichloroethylene	ng/g	1.8	X
Vinyl Chloride	ng/g	7.4	X
Trichlorofluoromethane	ng/g	3.7	X
Dichlorodifluoromethane	ng/g	7.4	X
m-Xylene	ng/g	3.7	X
o & p-Xylene	ng/g	3.7	X
Analytical No.:			53499

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/11/91
REPORT DATE: 07/26/91
APPROVED BY: JCH J.C.H.

Attn: Colin Reichhoff

	Units	Detection Limit	SB-2,#7 07/09/91
Benzene	ng/g	3.6	X
Bromoform	ng/g	14.0	X
Bromomethane	ng/g	28.0	X
Carbon Tetrachloride	ng/g	3.6	X
Chlorobenzene	ng/g	14.0	X
Chloroethane	ng/g	14.0	X
2-Chloroethylvinyl Ether	ng/g	35.0	X
Chloroform	ng/g	3.6	X
Chloromethane	ng/g	14.0	X
Chlorodibromomethane	ng/g	3.6	X
1,2-Dichlorobenzene	ng/g	7.1	X
1,3-Dichlorobenzene	ng/g	7.1	X
1,4-Dichlorobenzene	ng/g	3.6	X
Bromodichloromethane	ng/g	3.6	X
1,1-Dichloroethane	ng/g	3.6	X
1,2-Dichloroethane	ng/g	3.6	X
1,1-Dichloroethylene	ng/g	7.1	X
1,2-Dichloroethylene	ng/g	7.1	X
Methylene Chloride	ng/g	18.0	X
1,2-Dichloropropane	ng/g	3.6	X
cis-1,3-Dichloropropene	ng/g	14.0	X
trans-1,3-Dichloropropene	ng/g	3.6	X
Ethylbenzene	ng/g	7.1	X
1,1,2,2-Tetrachloroethane	ng/g	7.1	X
Tetrachloroethylene	ng/g	3.6	X
Toluene	ng/g	3.6	X
1,1,1-Trichloroethane	ng/g	3.6	X
1,1,2-Trichloroethane	ng/g	3.6	X
Trichloroethylene	ng/g	3.6	X
Vinyl Chloride	ng/g	14.0	X
Trichlorofluoromethane	ng/g	7.1	X
Dichlorodifluoromethane	ng/g	14.0	X
m-Xylene	ng/g	7.1	X
o & p-Xylene	ng/g	7.1	X
Analytical No.:			53500

X = Analyzed but not detected.
Results calculated on a dry weight basis.

ll analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/11/91
REPORT DATE: 07/26/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff

	Units	Detection Limit	SB-2,#5 07/09/91
Benzene	ng/g	3.5	X
Bromoform	ng/g	14.0	X
Bromomethane	ng/g	28.0	X
Carbon Tetrachloride	ng/g	3.5	X
Chlorobenzene	ng/g	14.0	X
Chloroethane	ng/g	14.0	X
2-Chloroethylvinyl Ether	ng/g	35.0	X
Chloroform	ng/g	3.5	X
Chloromethane	ng/g	14.0	X
Chlorodibromomethane	ng/g	3.5	X
1,2-Dichlorobenzene	ng/g	6.9	X
1,3-Dichlorobenzene	ng/g	6.9	X
1,4-Dichlorobenzene	ng/g	3.5	X
Bromodichloromethane	ng/g	3.5	X
1,1-Dichloroethane	ng/g	3.5	X
1,2-Dichloroethane	ng/g	3.5	X
1,1-Dichloroethylene	ng/g	6.9	X
1,2-Dichloroethylene	ng/g	6.9	X
Methylene Chloride	ng/g	17.0	X
1,2-Dichloropropane	ng/g	3.5	X
cis-1,3-Dichloropropene	ng/g	14.0	X
trans-1,3-Dichloropropene	ng/g	3.5	X
Ethylbenzene	ng/g	6.9	X
1,1,2,2-Tetrachloroethane	ng/g	6.9	X
Tetrachloroethylene	ng/g	3.5	X
Toluene	ng/g	3.5	X
1,1,1-Trichloroethane	ng/g	3.5	X
1,1,2-Trichloroethane	ng/g	3.5	X
Trichloroethylene	ng/g	3.5	X
Vinyl Chloride	ng/g	14.0	X
Trichlorofluoromethane	ng/g	6.9	X
Dichlorodifluoromethane	ng/g	14.0	X
m-Xylene	ng/g	6.9	X
o & p-Xylene	ng/g	6.9	X
Analytical No.:			53501

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/11/91
REPORT DATE: 07/31/91
APPROVED BY: DJB DSB

Attn: Colin Reichhoff

Total Petroleum Hydrocarbon (TPH) Analysis

	TPH Gasoline	TPH Diesel	Analytical No.
SB-8,#7	X	X	53499
SB-2,#7	X	X	53500
SB-2,#5	X	X	53501
Detection Limit	6.1	6.1	
Units	µg/g	µg/g	

X = Analyzed but not detected.
Results calculated on a dry weight basis.

ENVIROSCAN

REQUEST FOR SERVICES

303 W. MILITARY RD. ROTHSCHILD, WI 54474 1-800-338-SCAN

CLIENT INFORMATION

Name: COLIN REICHHOFF / GEORGE HUDAK
Company: RREM INC.
Address: 408 BOARD OF TRADE BLDG.
DULUTH, MN 55802
Phone: (218) 722-3915
P.O. # / Project #: 9114 WEBSTER
Quote / Reference #: 0111-9
Note: Terms and conditions printed on back apply.

Turnaround Time
☒ Normal
☐ Rush
Date Needed
(Preapproved by Lab)

Sample Type
(Check all that apply)
☒ Groundwater
☐ Wastewater
☒ Soil
☐ Solid Waste
☐ Oil
☐ Other

Sample Handling
☐ Nonhazardous
☐ Flammable
☐ Skin Irritant
☐ Highly Toxic
☐ Other (specify)
☒ Refrigerate
☐ Work in Hood
☐ Wear Gloves

ANALYTICAL REQUESTS
(use separate sheet if necessary)

LAB USE ONLY	DATE	TIME	No. of Containers COMP	GRAB	SAMPLE ID	EPA 8010/8020 S-FVOC	TPH GASOLINE S-OEE D-T	EPA 7421 LEAD PD MPREP			REMARKS
13053499	7/8/91	4:42 pm		X	SB-8, #7, 34'-36' Webster	X	X	X			
	~~[illegible]~~				~~[illegible]~~						
13053500	7/9/91	4:12 pm		X	SB2, #7, 34'-36', Webster	X	X	X			
13053501	7/9/91	3:45		X	SB2, #5, 24'-26', WEBSTER	X	X	X			
RREM											

CHAIN OF CUSTODY RECORD

SAMPLERS: (Signature) George J. Hudak

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
George J. Hudak	7/10/91 9:15am	
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED FOR LABORATORY BY: (Signature) — DATE/TIME

Del'v: Hand Comm
Ship. Cont. OK? Y N N/A
Rec'd Refrig.? Y N N/A Room temp
Seals OK? Y N N/A
Samples leaking? Y N N/A
Comments:

ANALYTICAL REPORT

ENVIROSCAN

Date Rec'd 7 / 11 / 91

SAMPLE RECEIPT REPORT

CLIENT: RREM

Anal. No.: B053499 to 53501

Reference Code	Explanation
1.	Sample(s) received at Room Temp °C which is above the EPA protocol of 4 °C
2.	Samples received without appropriate paperwork. Explain ______
3.	VOC vial(s) received with headspace contrary to EPA protocol. Explain ______
4.	Sample(s) received in bottles not furnished by Enviroscan. Preservation method, if used, are unknown.
5.	Sample(s) not properly preserved per EPA protocol for the following: ______
6.	Sample(s) not field filtered. Lab filtered upon receipt.
7.	Sample(s) received beyond EPA holding time for: ______
8.	Sample date/time not supplied by client. Actual holding time unknown.
9.	Insufficient sample size to complete analysis or obtain required detection limit.
10.	Other: ______

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ENVIROSCAN

August 12, 1991

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

AUG 1991
RECEIVED
RREM, Inc.

Attn: Colin Reichhoff

Re: 9114

Please find enclosed the analytical results for the samples received July 16, 1991.

All analyses were done in accordance with EPA Methods (EPA-600/4-79-020, March, 1983 or SW-846, Third Edition). The Total Petroleum Hydrocarbon (TPH) analysis was completed using the California Method with a capillary GC/FID. All results on soil/solid samples have been calculated on a dry weight basis.

The chain of custody document is enclosed.

If you have any questions about the results, please call. Thank you for using Enviroscan Corp. for your analytical needs.

Sincerely,

Enviroscan Corp.

Dominic Bush

Dominic J. Bush
Analytical Chemist

ANALYTICAL REPORT

ENVIROSCAN

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/16/91
REPORT DATE: 08/09/91
APPROVED BY: BMS
BMS

Attn: Colin Reichhoff

Customer Number	Lead	Detection Limit	Analytical Number
SB-4,7	5.34	1.9	53678
SB-4,8	5.29	1.8	53679
SB-4,10	9.47	2.0	53680
SB-4,15	X	1.9	53681
Units	µg/g	µg/g	

X = Analyzed but not detected.
Results calculated on a dry weight basis.

ll analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

ENVIROSCAN

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/16/91
REPORT DATE: 08/12/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff

	Units	Detection Limit	SB-4,8	SB-4,7
Benzene	ng/g	2.5	X	X
Bromoform	ng/g	9.9	X	X
Bromomethane	ng/g	20.0	X	X
Carbon Tetrachloride	ng/g	2.5	X	X
Chlorobenzene	ng/g	9.9	X	X
Chloroethane	ng/g	9.9	X	X
2-Chloroethylvinyl Ether	ng/g	25.0	X	X
Chloroform	ng/g	2.5	X	X
Chloromethane	ng/g	9.9	X	X
Chlorodibromomethane	ng/g	2.5	X	X
1,2-Dichlorobenzene	ng/g	4.9	X	X
1,3-Dichlorobenzene	ng/g	4.9	X	X
1,4-Dichlorobenzene	ng/g	2.5	X	X
Bromodichloromethane	ng/g	2.5	X	X
1,1-Dichloroethane	ng/g	2.5	X	X
1,2-Dichloroethane	ng/g	2.5	X	X
1,1-Dichloroethylene	ng/g	4.9	X	X
1,2-Dichloroethylene	ng/g	4.9	X	X
Methylene Chloride(1)	ng/g	12.3	46.0	42.9
1,2-Dichloropropane	ng/g	2.5	X	X
cis-1,3-Dichloropropene	ng/g	9.9	X	X
trans-1,3-Dichloropropene	ng/g	2.5	X	X
Ethylbenzene	ng/g	4.9	X	X
1,1,2,2-Tetrachloroethane	ng/g	4.9	X	X
Tetrachloroethylene	ng/g	2.5	X	X
Toluene	ng/g	2.5	X	X
1,1,1-Trichloroethane	ng/g	2.5	X	X
1,1,2-Trichloroethane	ng/g	2.5	X	X
Trichloroethylene	ng/g	2.5	X	X
Vinyl Chloride	ng/g	9.9	X	X
Trichlorofluoromethane	ng/g	4.9	X	X
Dichlorodifluoromethane	ng/g	9.9	X	X
m-Xylene	ng/g	4.9	X	X
o & p-Xylene	ng/g	4.9	X	X
Analytical No.:			53679	53678

X = Analyzed but not detected.
Results calculated on a dry weight basis.
(1) = May be due lab contamination.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

Attn: Colin Reichhoff

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/16/91
REPORT DATE: 08/12/91
APPROVED BY: JCH JCH

	Units	Detection Limit	SB-4,15	SB-4,10
Benzene	ng/g	2.9	X	X
Bromoform	ng/g	12.0	X	X
Bromomethane	ng/g	23.0	X	X
Carbon Tetrachloride	ng/g	2.9	X	X
Chlorobenzene	ng/g	12.0	X	X
Chloroethane	ng/g	12.0	X	X
2-Chloroethylvinyl Ether	ng/g	29.0	X	X
Chloroform	ng/g	2.9	X	X
Chloromethane	ng/g	12.0	X	X
Chlorodibromomethane	ng/g	2.9	X	X
1,2-Dichlorobenzene	ng/g	5.8	X	X
1,3-Dichlorobenzene	ng/g	5.8	X	X
1,4-Dichlorobenzene	ng/g	2.9	X	X
Bromodichloromethane	ng/g	2.9	X	X
1,1-Dichloroethane	ng/g	2.9	X	X
1,2-Dichloroethane	ng/g	2.9	X	X
1,1-Dichloroethylene	ng/g	5.8	X	X
1,2-Dichloroethylene	ng/g	5.8	X	X
Methylene Chloride(1)	ng/g	14.5	43.1	49.2
1,2-Dichloropropane	ng/g	2.9	X	X
cis-1,3-Dichloropropene	ng/g	12.0	X	X
trans-1,3-Dichloropropene	ng/g	2.9	X	X
Ethylbenzene	ng/g	5.8	X	X
1,1,2,2-Tetrachloroethane	ng/g	5.8	X	X
Tetrachloroethylene	ng/g	2.9	X	5.8
Toluene	ng/g	2.9	X	X
1,1,1-Trichloroethane	ng/g	2.9	X	X
1,1,2-Trichloroethane	ng/g	2.9	X	X
Trichloroethylene	ng/g	2.9	X	X
Vinyl Chloride	ng/g	12.0	X	X
Trichlorofluoromethane	ng/g	5.8	X	X
Dichlorodifluoromethane	ng/g	12.0	X	X
m-Xylene	ng/g	5.8	X	X
o & p-Xylene	ng/g	5.8	X	X
Analytical No.:			53681	53680

X = Analyzed but not detected.
Results calculated on a dry weight basis.

ANALYTICAL REPORT

ENVIROSCAN

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/16/91
REPORT DATE: 08/12/91
APPROVED BY: DJB DJB

Attn: Colin Reichhoff

Total Petroleum Hydrocarbon (TPH) Analysis

	TPH Gasoline	TPH Diesel	Analytical No.
SB-4,7	X	X	53678
SB-4,8	X	X	53679
SB-4,10	X	X	53680
SB-4,15	X	X	53681
Detection Limit	6.5	6.5	
Units	µg/g	µg/g	

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ENVIROSCAN

REQUEST FOR SERVICES

303 W. MILITARY RD. ROTHSCHILD, WI 54474 1-800-338-SCAN

CLIENT INFORMATION

Name: COLIN REICHHOFF / GEORGE HUDAK
Company: RREM INC
Address: 408 BOARD OF TRADE BUILDING
DULUTH, MN 55802
Phone: (218) 722-3915
P.O. # / Project #: 9114
Quote / Reference #: 01111-9
Note: Terms and conditions printed on back apply.

Turnaround Time
☒ Normal
☐ Rush
Date Needed ______
(Preapproved by Lab)

Sample Type
(Check all that apply)
☐ Groundwater
☐ Wastewater
☒ Soil
☐ Solid Waste
☐ Oil
☐ Other ______

Sample Handling
☐ Nonhazardous
☐ Flammable
☐ Skin Irritant
☐ Highly Toxic
☐ Other (specify) ______
☒ Refrigerate
☐ Work in Hood
☐ Wear Gloves

ANALYTICAL REQUESTS
(use separate sheet if necessary)

LAB USE ONLY	DATE	TIME	No. of Containers COMP	No. of Containers GRAB	SAMPLE ID	EPA 8010/8020 5-FUEL	TPH GASOLINE 5-OEU	EPA 7421 LEAD	MPREP			REMARKS
16053678 ✓	7/11/91	10:52		X	SB-4, #7, WEBSTER	X	X	X	✓			
16053679 ✓	7/11/91	10:59		X	SB-4, #8, WEBSTER	X	X	X	✓			
16053680 ✓	7/11/91	11:28		X	SB-4, #10, WEBSTER	X	X	X	✓			
16053681 ✓	7/11/91	6:02		X	SB-4, #15, WEBSTER	X	X	X	✓			

RREM

CHAIN OF CUSTODY RECORD

Del'v: Hand Comm.
Ship. Cont. OK? Y N N/A
Rec'd Refrig.? Y N N/A 20°C
Seals OK? Y N N/A
Samples leaking? Y N N/A
Comments:

SAMPLERS: (Signature) George J. Hudak

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	
George J. Hudak	7/15/91 8:45		
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE/TIME

ANALYTICAL REPORT

ENVIROSCAN

Date Rec'd 7/16/91

SAMPLE RECEIPT REPORT

CLIENT: RREM

Anal. 16 No.: 53678 to 53681

Reference Code	Explanation
1	Sample(s) received at 20.0 °C which is above the EPA protocol of 4 °C.
2.	Samples received without appropriate paperwork. Explain
3.	VOC vial(s) received with headspace contrary to EPA protocol. Explain
4.	Sample(s) received in bottles not furnished by Enviroscan. Preservation method, if used, are unknown.
5.	Sample(s) not properly preserved per EPA protocol for the following:
6.	Sample(s) not field filtered. Lab filtered upon receipt.
7.	Sample(s) received beyond EPA holding time for:
8.	Sample date/time not supplied by client. Actual holding time unknown.
9.	Insufficient sample size to complete analysis or obtain required detection limit.
10.	Other:

ENVIROSCAN

August 13, 1991

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

RECEIVED AUG 1991 RREM, Inc.

Attn: Colin Reichhoff/George Hudak

Re: 9114

Please find enclosed the analytical results for the samples received July 19, 1991.

All analyses were done in accordance with EPA Methods (EPA-600/4-79-020, March, 1983 or SW-846, Third Edition). The Total Petroleum Hydrocarbon (TPH) analysis was completed using the California Method with a capillary GC/FID. All results on soil/solid samples have been calculated on a dry weight basis.

The chain of custody document is enclosed.

If you have any questions about the results, please call. Thank you for using Enviroscan Corp. for your analytical needs.

Sincerely,

Enviroscan Corp.

Dominic Bush

Dominic J. Bush
Analytical Chemist

303 West Military Road Rothschild, WI 54474 (715) 359-7226

ANALYTICAL REPORT

ENVIROSCAN

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/19/91
REPORT DATE: 08/09/91
APPROVED BY: BMS BMS

Attn: Colin Reichhoff/George Hudak

Sample # (Webster)	Lead	Total Solids	Analytical No.
#3	2.66	89.2	54044
#9	2.31	85.2	54045
#16	3.90	85.2	54046
#17	3.52	86.0	54047
#18	2.34	84.3	54048
Detection Limit	1.8	-	
Units	µg/g	%	

Results calculated on a dry weight basis.

ANALYTICAL REPORT

ENVIROSCAN

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/19/91
REPORT DATE: 08/12/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	#3	#9
Benzene	ng/g	2.0	X	X
Bromoform	ng/g	7.9	X	X
Bromomethane	ng/g	16.0	X	X
Carbon Tetrachloride	ng/g	2.0	X	X
Chlorobenzene	ng/g	7.9	X	X
Chloroethane	ng/g	7.9	X	X
2-Chloroethylvinyl Ether	ng/g	20.0	X	X
Chloroform	ng/g	2.0	X	X
Chloromethane	ng/g	7.9	X	X
Chlorodibromomethane	ng/g	2.0	X	X
1,2-Dichlorobenzene	ng/g	3.9	X	X
1,3-Dichlorobenzene	ng/g	3.9	X	X
1,4-Dichlorobenzene	ng/g	2.0	X	X
Bromodichloromethane	ng/g	2.0	X	X
1,1-Dichloroethane	ng/g	2.0	X	X
1,2-Dichloroethane	ng/g	2.0	X	X
1,1-Dichloroethylene	ng/g	3.9	X	X
1,2-Dichloroethylene	ng/g	3.9	X	X
Methylene Chloride	ng/g	9.9	X	X
1,2-Dichloropropane	ng/g	2.0	X	X
cis-1,3-Dichloropropene	ng/g	7.9	X	X
trans-1,3-Dichloropropene	ng/g	2.0	X	X
Ethylbenzene	ng/g	3.9	X	X
1,1,2,2-Tetrachloroethane	ng/g	3.9	X	X
Tetrachloroethylene	ng/g	2.0	X	X
Toluene	ng/g	2.0	X	X
1,1,1-Trichloroethane	ng/g	2.0	X	X
1,1,2-Trichloroethane	ng/g	2.0	X	X
Trichloroethylene	ng/g	2.0	X	X
Vinyl Chloride	ng/g	7.9	X	X
Trichlorofluoromethane	ng/g	3.9	X	X
Dichlorodifluoromethane	ng/g	7.9	X	X
m-Xylene	ng/g	3.9	X	X
o & p-Xylene	ng/g	3.9	X	X
Analytical No.:			54044	54045

NA = Not Analyzed.
X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

ENVIROSCAN

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/19/91
REPORT DATE: 08/12/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	#18	#16
Benzene	ng/g	2.5	X	X
Bromoform	ng/g	10.0	X	X
Bromomethane	ng/g	20.0	X	X
Carbon Tetrachloride	ng/g	2.5	X	X
Chlorobenzene	ng/g	10.0	X	X
Chloroethane	ng/g	10.0	X	X
2-Chloroethylvinyl Ether	ng/g	25.0	X	X
Chloroform	ng/g	2.5	X	X
Chloromethane	ng/g	10.0	X	X
Chlorodibromomethane	ng/g	2.5	X	X
1,2-Dichlorobenzene	ng/g	4.9	X	X
1,3-Dichlorobenzene	ng/g	4.9	X	X
1,4-Dichlorobenzene	ng/g	2.5	X	X
Bromodichloromethane	ng/g	2.5	X	X
1,1-Dichloroethane	ng/g	2.5	X	X
1,2-Dichloroethane	ng/g	2.5	X	X
1,1-Dichloroethylene	ng/g	4.9	X	X
1,2-Dichloroethylene	ng/g	4.9	X	X
Methylene Chloride(1)	ng/g	12.4	22.4	13.7
1,2-Dichloropropane	ng/g	2.5	X	X
cis-1,3-Dichloropropene	ng/g	10.0	X	X
trans-1,3-Dichloropropene	ng/g	2.5	X	X
Ethylbenzene	ng/g	4.9	X	X
1,1,2,2-Tetrachloroethane	ng/g	4.9	X	X
Tetrachloroethylene	ng/g	2.5	X	X
Toluene	ng/g	2.5	X	X
1,1,1-Trichloroethane	ng/g	2.5	X	X
1,1,2-Trichloroethane	ng/g	2.5	X	X
Trichloroethylene	ng/g	2.5	X	X
Vinyl Chloride	ng/g	10.0	X	X
Trichlorofluoromethane	ng/g	4.9	X	X
Dichlorodifluoromethane	ng/g	10.0	X	X
m-Xylene	ng/g	4.9	X	X
o & p-Xylene	ng/g	4.9	X	X
Analytical No.:			54048	54046

X = Analyzed but not detected.
Results calculated on a dry weight basis.
(1) = May be due to lab contamination.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

ENVIROSCAN

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/19/91
REPORT DATE: 08/12/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	#17
Benzene	ng/g	4.9	X
Bromoform	ng/g	19.0	X
Bromomethane	ng/g	39.0	X
Carbon Tetrachloride	ng/g	4.9	X
Chlorobenzene	ng/g	19.0	X
Chloroethane	ng/g	19.0	X
2-Chloroethylvinyl Ether	ng/g	48.0	X
Chloroform	ng/g	4.9	X
Chloromethane	ng/g	19.0	X
Chlorodibromomethane	ng/g	4.9	X
1,2-Dichlorobenzene	ng/g	9.6	X
1,3-Dichlorobenzene	ng/g	9.6	X
1,4-Dichlorobenzene	ng/g	4.9	X
Bromodichloromethane	ng/g	4.9	X
1,1-Dichloroethane	ng/g	4.9	X
1,2-Dichloroethane	ng/g	4.9	X
1,1-Dichloroethylene	ng/g	9.6	X
1,2-Dichloroethylene	ng/g	9.6	X
Methylene Chloride(1)	ng/g	24.1	35.7
1,2-Dichloropropane	ng/g	4.9	X
cis-1,3-Dichloropropene	ng/g	19.0	X
trans-1,3-Dichloropropene	ng/g	4.9	X
Ethylbenzene	ng/g	9.6	X
1,1,2,2-Tetrachloroethane	ng/g	9.6	X
Tetrachloroethylene	ng/g	4.9	X
Toluene	ng/g	4.9	X
1,1,1-Trichloroethane	ng/g	4.9	X
1,1,2-Trichloroethane	ng/g	4.9	X
Trichloroethylene	ng/g	4.9	X
Vinyl Chloride	ng/g	19.0	X
Trichlorofluoromethane	ng/g	9.6	X
Dichlorodifluoromethane	ng/g	19.0	X
m-Xylene	ng/g	9.6	X
o & p-Xylene	ng/g	9.6	X
Analytical No.:			54047

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

ENVIROSCAN

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/19/91
REPORT DATE: 08/13/91
APPROVED BY: DJB DJB

Attn: Colin Reichhoff/George Hudak

Total Petroleum Hydrocarbon (TPH) Analysis

	TPH Gasoline	TPH Diesel	Analytical No.
#3	X	X	54044
#9	X	X	54045
#16	X	X	54046
#17	X	X	54047
#18	X	X	54048
Detection Limit	5.9	5.9	
Units	µg/g	µg/g	

X = Analyzed but not detected.
Results calculated on a dry weight basis.

REQUEST FOR SERVICES

HAZEN SCAN

303 W. MILITARY RD. ROTHSCHILD, WI 54474 1-800-338-SCAN

CLIENT INFORMATION

Name: COLIN REICHHOFF / GEORGE HUDAK
Company: RREM INC
Address: 408 BOARD OF TRADE BUILDING
DULUTH, MN 55802
Phone: (218) 727-3915
P.O. # / Project #: 9114
Quote / Reference #: 01111-9
Note: Terms and conditions printed on back apply.

Turnaround Time
☒ Normal
☐ Rush
Date Needed ______
(Preapproved by Lab)

Sample Type
(Check all that apply)
☐ Groundwater
☐ Wastewater
☒ Soil
☐ Solid Waste
☐ Oil
☐ Other

Sample Handling
☐ Nonhazardous
☐ Flammable
☐ Skin Irritant
☐ Highly Toxic
☐ Other (specify)
☒ Refrigerate
☐ Work in Hood
☐ Wear Gloves

ANALYTICAL REQUESTS
(use separate sheet if necessary)

LAB USE ONLY	DATE	TIME	No. of Containers COMP	GRAB	SAMPLE ID	0-TS S-UEXT S-FUOC X EPA 8010/8020	TPH GASOLINE	EPA 7421 LEAD	MPREP		REMARKS
19054044	7/16/91	3:37		X	SB-7, #3, WEBSTER	X	X	X			
19054045	7/17/91	10:15		X	SB-7, #9, WEBSTER	X	X	X			
19054046	7/17/91	3:00		X	SB-7, #16, WEBSTER	X	X	X			
19054047	7/17/91	3:05		X	SB-7, #17, WEBSTER	X	X	X			
19054048	7/17/91	3:30		X	SB-7, #18, WEBSTER	X	X	X			

RREM

CHAIN OF CUSTODY RECORD

Del'v: Hand Comm.
Ship. Cont. OK? Y N N/A
Rec'd Refrig.? Y N N/A 3.6°C
Seals OK? Y N N/A
Samples leaking? Y N N/A
Comments:

SAMPLERS: (Signature) George Hudak

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
George Hudak	7/18/91 9:15	
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED FOR LABORATORY BY: (Signature)

DATE/TIME

ENVIROSCAN

August 22, 1991

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

AUG 1991
RECEIVED
RREM, Inc.

Attn: Colin Reichhoff/George Hudak

Re: Project No. 9114

Please find enclosed the analytical results for the samples received August 8, 1991.

The VOC analyses were completed using a modified EPA Method 8021. All results on soil/solid samples have been calculated on a dry weight basis.

The chain of custody document is enclosed. If you have any questions about the results, please call. Thank you for using Enviroscan Corp. for your analytical needs.

Sincerely,

Enviroscan Corp.

Jay C. Hunger

Jay C. Hunger
Analytical Chemist

ENVIROSCAN ANALYTICAL REPORT

303 W. Military Rd., Rothschild, WI 54474
1/800 338-SCAN Wisconsin Lab Certification No. 737053130

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 08/08/91
REPORT DATE: 08/22/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	SB-16,#1	SB-16,#9
Benzene	ng/g	2.3	X	X
Bromoform	ng/g	9.2	X	X
Bromomethane	ng/g	18.0	X	X
Carbon Tetrachloride	ng/g	2.3	X	X
Chlorobenzene	ng/g	9.2	X	X
Chloroethane	ng/g	9.2	X	X
2-Chloroethylvinyl Ether	ng/g	23.0	X	X
Chloroform	ng/g	2.3	X	X
Chloromethane	ng/g	9.2	X	X
Chlorodibromomethane	ng/g	2.3	X	X
1,2-Dichlorobenzene	ng/g	4.5	X	X
1,3-Dichlorobenzene	ng/g	4.5	X	X
1,4-Dichlorobenzene	ng/g	2.3	X	X
Bromodichloromethane	ng/g	2.3	X	X
1,1-Dichloroethane	ng/g	2.3	X	X
1,2-Dichloroethane	ng/g	2.3	X	X
1,1-Dichloroethylene	ng/g	4.5	X	X
1,2-Dichloroethylene	ng/g	4.5	X	X
Methylene Chloride	ng/g	11.0	X	X
1,2-Dichloropropane	ng/g	2.3	X	X
cis-1,3-Dichloropropene	ng/g	9.2	X	X
trans-1,3-Dichloropropene	ng/g	2.3	X	X
Ethylbenzene	ng/g	4.5	X	X
1,1,2,2-Tetrachloroethane	ng/g	4.5	X	X
Tetrachloroethylene	ng/g	2.3	X	X
Toluene	ng/g	2.3	X	X
1,1,1-Trichloroethane	ng/g	2.3	X	X
1,1,2-Trichloroethane	ng/g	2.3	X	X
Trichloroethylene	ng/g	2.3	X	X
Vinyl Chloride	ng/g	9.2	X	X
Trichlorofluoromethane	ng/g	4.5	X	X
Dichlorodifluoromethane	ng/g	9.2	X	X
m-Xylene	ng/g	4.5	X	X
o & p-Xylene	ng/g	4.5	X	X
Analytical No.:			55042	55043

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ENVIROSCAN ANALYTICAL REPORT

303 W. Military Rd., Rothschild, WI 54474
1/800 338-SCAN Wisconsin Lab Certification No. 737053130

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 08/08/91
REPORT DATE: 08/22/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	SB-17,#1	SB-16,#13
Benzene	ng/g	2.5	X	X
Bromoform	ng/g	9.7	X	X
Bromomethane	ng/g	19.0	X	X
Carbon Tetrachloride	ng/g	2.5	X	X
Chlorobenzene	ng/g	9.7	X	X
Chloroethane	ng/g	9.7	X	X
2-Chloroethylvinyl Ether	ng/g	24.0	X	X
Chloroform	ng/g	2.5	X	X
Chloromethane	ng/g	9.7	X	X
Chlorodibromomethane	ng/g	2.5	X	X
1,2-Dichlorobenzene	ng/g	4.8	X	X
1,3-Dichlorobenzene	ng/g	4.8	X	X
1,4-Dichlorobenzene	ng/g	2.5	X	X
Bromodichloromethane	ng/g	2.5	X	X
1,1-Dichloroethane	ng/g	2.5	X	X
1,2-Dichloroethane	ng/g	2.5	X	X
1,1-Dichloroethylene	ng/g	4.8	X	X
1,2-Dichloroethylene	ng/g	4.8	X	X
Methylene Chloride	ng/g	12.0	X	X
1,2-Dichloropropane	ng/g	2.5	X	X
cis-1,3-Dichloropropene	ng/g	9.7	X	X
trans-1,3-Dichloropropene	ng/g	2.5	X	X
Ethylbenzene	ng/g	4.8	X	X
1,1,2,2-Tetrachloroethane	ng/g	4.8	X	X
Tetrachloroethylene	ng/g	2.5	X	X
Toluene	ng/g	2.5	X	X
1,1,1-Trichloroethane	ng/g	2.5	X	X
1,1,2-Trichloroethane	ng/g	2.5	X	X
Trichloroethylene	ng/g	2.5	X	X
Vinyl Chloride	ng/g	9.7	X	X
Trichlorofluoromethane	ng/g	4.8	X	X
Dichlorodifluoromethane	ng/g	9.7	X	X
m-Xylene	ng/g	4.8	X	X
o & p-Xylene	ng/g	4.8	X	X
Analytical No.:			55045	55044

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ENVIROSCAN ANALYTICAL REPORT

303 W. Military Rd., Rothschild, WI 54474
1/800 338-SCAN Wisconsin Lab Certification No. 737053130

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 08/08/91
REPORT DATE: 08/22/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	SB-18,#2	SB-17,#9
Benzene	ng/g	2.0	X	X
Bromoform	ng/g	8.2	X	X
Bromomethane	ng/g	16.0	X	X
Carbon Tetrachloride	ng/g	2.0	X	X
Chlorobenzene	ng/g	8.2	X	X
Chloroethane	ng/g	8.2	X	X
2-Chloroethylvinyl Ether	ng/g	20.0	X	X
Chloroform	ng/g	2.0	X	X
Chloromethane	ng/g	8.2	X	X
Chlorodibromomethane	ng/g	2.0	X	X
1,2-Dichlorobenzene	ng/g	4.1	X	X
1,3-Dichlorobenzene	ng/g	4.1	X	X
1,4-Dichlorobenzene	ng/g	2.0	X	X
Bromodichloromethane	ng/g	2.0	X	X
1,1-Dichloroethane	ng/g	2.0	X	X
1,2-Dichloroethane	ng/g	2.0	X	X
1,1-Dichloroethylene	ng/g	4.1	X	X
1,2-Dichloroethylene	ng/g	4.1	X	X
Methylene Chloride	ng/g	10.0	X	X
1,2-Dichloropropane	ng/g	2.0	X	X
cis-1,3-Dichloropropene	ng/g	8.2	X	X
trans-1,3-Dichloropropene	ng/g	2.0	X	X
Ethylbenzene	ng/g	4.1	X	X
1,1,2,2-Tetrachloroethane	ng/g	4.1	X	X
Tetrachloroethylene	ng/g	2.0	X	X
Toluene	ng/g	2.0	X	X
1,1,1-Trichloroethane	ng/g	2.0	X	X
1,1,2-Trichloroethane	ng/g	2.0	X	X
Trichloroethylene	ng/g	2.0	X	X
Vinyl Chloride	ng/g	8.2	X	X
Trichlorofluoromethane	ng/g	4.1	X	X
Dichlorodifluoromethane	ng/g	8.2	X	X
m-Xylene	ng/g	4.1	X	X
o & p-Xylene	ng/g	4.1	X	X
Analytical No.:			55048	55046

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ENVIROSCAN **ANALYTICAL REPORT**

303 W. Military Rd., Rothschild, WI 54474
1/800 338-SCAN Wisconsin Lab Certification No. 737053130

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 08/08/91
REPORT DATE: 08/22/91
APPROVED BY: JCH TCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	SB-17,#14	SB-18,#7
Benzene	ng/g	2.2	X	X
Bromoform	ng/g	8.8	X	X
Bromomethane	ng/g	18.0	X	X
Carbon Tetrachloride	ng/g	2.2	X	X
Chlorobenzene	ng/g	8.8	X	X
Chloroethane	ng/g	8.8	X	X
2-Chloroethylvinyl Ether	ng/g	22.0	X	X
Chloroform	ng/g	2.2	X	X
Chloromethane	ng/g	8.8	X	X
Chlorodibromomethane	ng/g	2.2	X	X
1,2-Dichlorobenzene	ng/g	4.3	X	X
1,3-Dichlorobenzene	ng/g	4.3	X	X
1,4-Dichlorobenzene	ng/g	2.2	X	X
Bromodichloromethane	ng/g	2.2	X	X
1,1-Dichloroethane	ng/g	2.2	X	X
1,2-Dichloroethane	ng/g	2.2	X	X
1,1-Dichloroethylene	ng/g	4.3	X	X
1,2-Dichloroethylene	ng/g	4.3	X	X
Methylene Chloride	ng/g	11.0	X	X
1,2-Dichloropropane	ng/g	2.2	X	X
cis-1,3-Dichloropropene	ng/g	8.8	X	X
trans-1,3-Dichloropropene	ng/g	2.2	X	X
Ethylbenzene	ng/g	4.3	X	X
1,1,2,2-Tetrachloroethane	ng/g	4.3	X	X
Tetrachloroethylene	ng/g	2.2	X	9.3
Toluene	ng/g	2.2	X	X
1,1,1-Trichloroethane	ng/g	2.2	X	X
1,1,2-Trichloroethane	ng/g	2.2	X	X
Trichloroethylene	ng/g	2.2	X	X
Vinyl Chloride	ng/g	8.8	X	X
Trichlorofluoromethane	ng/g	4.3	X	X
Dichlorodifluoromethane	ng/g	8.8	X	X
m-Xylene	ng/g	4.3	X	X
o & p-Xylene	ng/g	4.3	X	X
Analytical No.:			55047	55049

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ENVIROSCAN ANALYTICAL REPORT

303 W. Military Rd., Rothschild, WI 54474
1/800 338-SCAN Wisconsin Lab Certification No. 737053130

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 08/08/91
REPORT DATE: 08/22/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	SB-19,#7	SB-19,#3
Benzene	ng/g	2.0	X	X
Bromoform	ng/g	7.8	X	X
Bromomethane	ng/g	16.0	X	X
Carbon Tetrachloride	ng/g	2.0	X	X
Chlorobenzene	ng/g	7.8	X	X
Chloroethane	ng/g	7.8	X	X
2-Chloroethylvinyl Ether	ng/g	19.0	X	X
Chloroform	ng/g	2.0	X	X
Chloromethane	ng/g	7.8	X	X
Chlorodibromomethane	ng/g	2.0	X	X
1,2-Dichlorobenzene	ng/g	3.9	X	X
1,3-Dichlorobenzene	ng/g	3.9	X	X
1,4-Dichlorobenzene	ng/g	2.0	X	X
Bromodichloromethane	ng/g	2.0	X	X
1,1-Dichloroethane	ng/g	2.0	X	X
1,2-Dichloroethane	ng/g	2.0	X	X
1,1-Dichloroethylene	ng/g	3.9	X	X
1,2-Dichloroethylene	ng/g	3.9	X	X
Methylene Chloride	ng/g	9.8	X	X
1,2-Dichloropropane	ng/g	2.0	X	X
cis-1,3-Dichloropropene	ng/g	7.8	X	X
trans-1,3-Dichloropropene	ng/g	2.0	X	X
Ethylbenzene	ng/g	3.9	X	X
1,1,2,2-Tetrachloroethane	ng/g	3.9	X	X
Tetrachloroethylene	ng/g	2.0	X	X
Toluene	ng/g	2.0	X	X
1,1,1-Trichloroethane	ng/g	2.0	X	X
1,1,2-Trichloroethane	ng/g	2.0	X	X
Trichloroethylene	ng/g	2.0	X	X
Vinyl Chloride	ng/g	7.8	X	X
Trichlorofluoromethane	ng/g	3.9	X	X
Dichlorodifluoromethane	ng/g	7.8	X	X
m-Xylene	ng/g	3.9	X	X
o & p-Xylene	ng/g	3.9	X	X
Analytical No.:			55051	55050

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

REQUEST FOR SERVICES

ENVIROSCAN

303 W. MILITARY RD. ROTHSCHILD, WI 54474 1-800-338-SCAN

CLIENT INFORMATION

Name: COLIN REICHHOFF / GEORGE HUDAK
Company: RREM INC
Address: 408 BOARD OF TRADE BLDG.
DULUTH, MN 55802
Phone: (218) 722-3915
P.O. # / Project #: 9114
Quote / Reference #: 01111-9
Note: Terms and conditions printed on back apply.

Turnaround Time
☒ Normal
☐ Rush
Date Needed ____
(Preapproved by Lab)

Sample Type
(Check all that apply)
☐ Groundwater
☐ Wastewater
☒ Soil
☐ Solid Waste
☐ Oil
☐ Other ____

Sample Handling
☒ Nonhazardous
☐ Flammable
☐ Skin Irritant
☐ Highly Toxic
☐ Other (specify) ____
☒ Refrigerate
☐ Work in Hood
☐ Wear Gloves

ANALYTICAL REQUESTS
(use separate sheet if necessary)

LAB USE ONLY	DATE	TIME	No. of Containers COMP	No. of Containers GRAB	SAMPLE ID	S-FUOCX 0-13 EPA 8010/8020					REMARKS
13055042 ✓	8/5/91	10:30		X	SB-16, #1, WEBSTER	X					
13055043 ✓	8/5/91	1:17		X	SB-16, #9, WEBSTER	X					
13055044 ✓	8/5/91	2:10		X	SB-16, #13, WEBSTER	X					
13055045 ✓	8/6/91	5:25		X	SB-17, #1, WEBSTER	X					
13055046 ✓	8/6/91	6:30		X	SB-17, #9, WEBSTER	X					
13055047 ✓	8/6/91	8:27		X	SB-17, #14, WEBSTER	X					
13055048 ✓	8/6/91	1:00		X	SB-18, #2, WEBSTER	X					
13055049 ✓	8/6/91	1:32		X	SB-18, #7, WEBSTER	X					
13055050 ✓	8/6/91	10:02		X	SB-19, #3, WEBSTER	X					
13055051 ✓	8/6/91	10:35		X	SB-19, #7, WEBSTER	X					

RREM

CHAIN OF CUSTODY RECORD

SAMPLERS: (Signature) George J. Hudak

RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED BY: (Signature)
George J. Hudak	8/7/91	9:30	
RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED FOR LABORATORY BY: (Signature)

DATE/TIME 8/9/91

Del'v: Hand Comm.
Ship. Cont. OK? Y N N/A 68°
Rec'd Refrig.? Y N N/A
Seals OK? Y N N/A
Samples leaking? Y N N/A
Comments:

ANALYTICAL REPORT

ENVIROSCAN

Date Rec'd 8/08/91

SAMPLE RECEIPT REPORT

CLIENT: RREM, Inc.

Anal. No.: 13-55042 to 55051

Reference Code	Explanation
1.	Sample(s) received at 6.8 °C which is above the EPA protocol of 4 °C. Rec'd in cooler & Blue cold pk.
2.	Samples received without appropriate paperwork. Explain ______
3.	VOC vial(s) received with headspace contrary to EPA protocol. Explain ______
4.	Sample(s) received in bottles not furnished by Enviroscan. Preservation method, if used, are unknown.
5.	Sample(s) not properly preserved per EPA protocol for the following: ______
6.	Sample(s) not field filtered. Lab filtered upon receipt.
7.	Sample(s) received beyond EPA holding time for: ______
8.	Sample date/time not supplied by client. Actual holding time unknown.
9.	Insufficient sample size to complete analysis or obtain required detection limit.
10.	Other: ______

ENVIROSCAN

August 27, 1991

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

SEP 1991
RECEIVED
RREM, Inc.

Attn: Colin Reichhoff/George Hudak

Re: Project No. #9114

Please find enclosed the analytical results for the samples received July 25, 1991.

All analyses were done in accordance with EPA Methods (EPA-600/4-79-020, March, 1983 or SW-846, Third Edition).

The VOC analyses were completed using a modified EPA Method 8021. The Total Petroleum Hydrocarbons (TPH) analysis was completed using the California Method with a capillary GC/FID.

All results on soil/solid samples have been calculated on a dry weight basis.

The chain of custody document is enclosed. If you have any questions about the results, please call. Thank you for using Enviroscan Corp. for your analytical needs.

Sincerely,

Enviroscan Corp.

Jay C. Hunger

Jay C. Hunger
Analytical Chemist

303 West Military Road Rothschild, WI 54474 (715) 359-7226
An Affiliate of the Black Clawson Co.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/25/91
REPORT DATE: 08/27/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	SB-9 #3	SB-9 #11
Benzene	ng/g	1.9	X	X
Bromoform	ng/g	7.9	X	X
Bromomethane	ng/g	16.0	X	X
Carbon Tetrachloride	ng/g	1.9	X	X
Chlorobenzene	ng/g	7.9	X	X
Chloroethane	ng/g	7.9	X	X
2-Chloroethylvinyl Ether	ng/g	20.0	X	X
Chloroform	ng/g	1.9	X	X
Chloromethane	ng/g	7.9	X	X
Chlorodibromomethane	ng/g	1.9	X	X
1,2-Dichlorobenzene	ng/g	3.9	X	X
1,3-Dichlorobenzene	ng/g	3.9	X	X
1,4-Dichlorobenzene	ng/g	1.9	X	X
Bromodichloromethane	ng/g	1.9	X	X
1,1-Dichloroethane	ng/g	1.9	X	X
1,2-Dichloroethane	ng/g	1.9	X	X
1,1-Dichloroethylene	ng/g	3.9	X	X
1,2-Dichloroethylene	ng/g	3.9	X	X
Methylene Chloride	ng/g	9.8	X	X
1,2-Dichloropropane	ng/g	1.9	X	X
cis-1,3-Dichloropropene	ng/g	7.9	X	X
trans-1,3-Dichloropropene	ng/g	1.9	X	X
Ethylbenzene	ng/g	3.9	X	X
1,1,2,2-Tetrachloroethane	ng/g	3.9	X	X
Tetrachloroethylene	ng/g	1.9	X	X
Toluene	ng/g	1.9	X	X
1,1,1-Trichloroethane	ng/g	1.9	X	X
1,1,2-Trichloroethane	ng/g	1.9	X	X
Trichloroethylene	ng/g	1.9	X	X
Vinyl Chloride	ng/g	7.9	X	X
Trichlorofluoromethane	ng/g	3.9	X	X
Dichlorodifluoromethane	ng/g	7.9	X	X
m-Xylene	ng/g	3.9	X	X
o & p-Xylene	ng/g	3.9	X	X
Analytical No.:			54352	54353

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/25/91
REPORT DATE: 08/27/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	SB-9 #16	SB-9 #18
Benzene	ng/g	2.3	X	X
Bromoform	ng/g	9.2	X	X
Bromomethane	ng/g	18.0	X	X
Carbon Tetrachloride	ng/g	2.3	X	X
Chlorobenzene	ng/g	9.2	X	X
Chloroethane	ng/g	9.2	X	X
2-Chloroethylvinyl Ether	ng/g	23.0	X	X
Chloroform	ng/g	2.3	X	X
Chloromethane	ng/g	9.2	X	X
Chlorodibromomethane	ng/g	2.3	X	X
1,2-Dichlorobenzene	ng/g	4.5	X	X
1,3-Dichlorobenzene	ng/g	4.5	X	X
1,4-Dichlorobenzene	ng/g	2.3	X	X
Bromodichloromethane	ng/g	2.3	X	X
1,1-Dichloroethane	ng/g	2.3	X	X
1,2-Dichloroethane	ng/g	2.3	X	X
1,1-Dichloroethylene	ng/g	4.5	X	X
1,2-Dichloroethylene	ng/g	4.5	X	X
Methylene Chloride(1)	ng/g	11.0	14.6	X
1,2-Dichloropropane	ng/g	2.3	X	X
cis-1,3-Dichloropropene	ng/g	9.2	X	X
trans-1,3-Dichloropropene	ng/g	2.3	X	X
Ethylbenzene	ng/g	4.5	X	X
1,1,2,2-Tetrachloroethane	ng/g	4.5	X	X
Tetrachloroethylene	ng/g	2.3	X	X
Toluene	ng/g	2.3	X	X
1,1,1-Trichloroethane	ng/g	2.3	X	X
1,1,2-Trichloroethane	ng/g	2.3	X	X
Trichloroethylene	ng/g	2.3	X	X
Vinyl Chloride	ng/g	9.2	X	X
Trichlorofluoromethane	ng/g	4.5	X	X
Dichlorodifluoromethane	ng/g	9.2	X	X
m-Xylene	ng/g	4.5	X	X
o & p-Xylene	ng/g	4.5	X	X
Analytical No.:			54354	54355

X = Analyzed but not detected.
Results calculated on a dry weight basis.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/25/91
REPORT DATE: 08/23/91
APPROVED BY: BMS BMS

Attn: Colin Reichhoff/George Hudak

Customer Number	Lead	Detection Limit	Analytical Number
SB-9 #3	X	1.7	54352
SB-9 #11	4.62	1.8	54353
SB-9 #16	X	1.8	54354
SB-9 #18	1.82	1.8	54355
Units	µg/g	µg/g	

X = Analyzed but not detected.
Results calculated on a dry weight basis.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 07/25/91
REPORT DATE: 08/28/91
APPROVED BY: CKC ckc

Attn: Colin Reichhoff/George Hudak

Total Petroleum Hydrocarbon (TPH) Analysis

	TPH Gasoline	TPH Diesel	Analytical
SB-9 #3	X	X	54352
SB-9 #11	X	X	54353
SB-9 #16	X	X	54354
SB-9 #18	X	X	54355
Detection Limit	6.1	6.1	
Units	μg/g	μg/g	

X = Analyzed but not detected.
Results calculated on a dry weight basis.

ENVIROSCAN

ANALYTICAL REPORT

Date Rec'd 7/25/91

SAMPLE RECEIPT REPORT

CLIENT: RREM, Inc.

Anal. No.: 3-54352 to 54355

Reference Code	Explanation
1.	Sample(s) received at 17.1 °C which is above the EPA protocol of 4 °C. in cooler + cold pks (
2.	Samples received without appropriate paperwork. Explain ______
3.	VOC vial(s) received with headspace contrary to EPA protocol. Explain ______
4.	Sample(s) received in bottles not furnished by Enviroscan. Preservation method, if used, are unknown.
5.	Sample(s) not properly preserved per EPA protocol for the following: ______
6.	Sample(s) not field filtered. Lab filtered upon receipt.
7.	Sample(s) received beyond EPA holding time for: ______
8.	Sample date/time not supplied by client. Actual holding time unknown.
9.	Insufficient sample size to complete analysis or obtain required detection limit.
10	Other: ______

REQUEST FOR SERVICES

303 W. MILITARY RD. ROTHSCHILD, WI 54474 1-800-338-SCAN

CLIENT INFORMATION

Name: COLIN REICHHOFF / GEORGE HUDAK
Company: RREM INC
Address: 408 BOARD OF TRADE BUILDING
DULUTH, MN 55802
Phone: (218) 722-3915
P.O. # / Project #: #9114
Quote / Reference #: 01111-9
Note: Terms and conditions printed on back apply.

Turnaround Time
☒ Normal
☐ Rush
Date Needed ____________
(Preapproved by Lab)

Sample Type
(Check all that apply)
☐ Groundwater
☐ Wastewater
☒ Soil
☐ Solid Waste
☐ Oil
☐ Other ________

Sample Handling
☐ Nonhazardous
☐ Flammable
☐ Skin Irritant
☐ Highly Toxic
☐ Other (specify) ________
☒ Refrigerate
☐ Work in Hood
☐ Wear Gloves

ANALYTICAL REQUESTS
(use separate sheet if necessary)

LAB USE ONLY	DATE	TIME	No. of Containers COMP	GRAB	SAMPLE ID	S-FUCCX EPA 8010/8020	TPH GASOLINE	EPA 7421 LEAD 5-0EXT 0-15	MPREP		REMARKS
03054352 ✓	7/22/91	1:57 pm		X	SB-9, #3, WEBSTER	X	X	X			
03054353 ✓	7/23/91	10:36 am		X	SB-9, #11, WEBSTER	X	X	X			
03054354 ✓	7/23/91	3:50 pm		X	SB-9, #16, WEBSTER	X	X	X			
03054355 ✓	7/23/91	5:20 pm		X	SB-9, #18, WEBSTER	X	X	X			

RREM

CHAIN OF CUSTODY RECORD

SAMPLERS: (Signature) George J. Hudak

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
George J. Hudak	7/24/91 9:15 am	
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED FOR LABORATORY BY: (Signature) — DATE/TIME 7/25/91

Del'v: Hand Comm.
Ship. Cont. OK? Y N N/A 17.1°C
Rec'd Refrig.? Y N N/A
Seals OK? Y N N/A
Samples leaking? Y N N/A
Comments:

Appendix F

Enviroscan Groundwater Chemistry Results and Chain-of-Custody Documents

ENVIROSCAN

October 9, 1991

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

OCT 1991
RECEIVED
RREM, Inc

Attn: Colin Reichhoff/George Hudak

Re: Project No. 9114

Please find enclosed the analytical results for the samples received September 20, 1991.

The VOC analyses were completed using EPA Method 8010/8020.

The chain of custody document is enclosed. If you have any questions about the results, please call. Thank you for using Enviroscan Corp. for your analytical needs.

Sincerely,

Enviroscan Corp.

Jay C. Hunger

Jay C. Hunger
Analytical Chemist

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 09/20/91
REPORT DATE: 10/07/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	91-1	91-2A
Benzene	µg/l	0.2	X	X
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	X
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	X	X
Toluene	µg/l	0.5	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			57277	57278

X = Analyzed but not detected.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 09/20/91
REPORT DATE: 10/09/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	91-2B	91-3
Benzene	µg/l	0.2	0.5	1.6
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	1.4	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	83.6
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	0.7	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	112.	X
Toluene	µg/l	0.5	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	6.1	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			57279	57280

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 09/20/91
REPORT DATE: 10/07/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	91-4	91-5A-1
Benzene	µg/l	0.2	X	X
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	2.9	X
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	15.3	8.0
Toluene	µg/l	0.5	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	0.2	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			57281	57282

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 09/20/91
REPORT DATE: 10/07/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	91-5A-2	91-5B
Benzene	µg/l	0.2	X	0.3
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	0.8
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	7.7	X
Toluene	µg/l	0.5	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			57283	57284

X = Analyzed but not detected.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 09/20/91
REPORT DATE: 10/09/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	91-6	91-7
Benzene	µg/l	0.2	X	X
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	X
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	31.8	X
Toluene	µg/l	0.5	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	0.4	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			57285	57286

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 09/20/91
REPORT DATE: 10/07/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	91-8	OW-1
Benzene	µg/l	0.2	X	X
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	X
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	X	13.8
Toluene	µg/l	0.5	0.6	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			57287	57288

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 09/20/91
REPORT DATE: 10/07/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	OW-2	OW-3
Benzene	µg/l	0.2	X	X
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	4.3	X
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	2.3	X
Toluene	µg/l	0.5	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			57289	57290

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

Attn: Colin Reichhoff/George Hudak

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 09/20/91
REPORT DATE: 10/07/91
APPROVED BY: JCH JCH

	Units	Detection Limit	OW-4	OW-5
Benzene	µg/l	0.2	X	X
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	X
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	X	3.5
Toluene	µg/l	0.5	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			57291	57292

X = Analyzed but not detected.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 09/20/91
REPORT DATE: 10/07/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	OW-6	OW-7
Benzene	µg/l	0.2	X	X
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	X
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	1.3	1.3
Toluene	µg/l	0.5	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			57293	57294

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 09/20/91
REPORT DATE: 10/07/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	OW-8	OW-9-1
Benzene	µg/l	0.2	X	X
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	X
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	13.2	X
Toluene	µg/l	0.5	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			57295	57296

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 09/20/91
REPORT DATE: 10/07/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	OW-9-2	VW-2
Benzene	µg/l	0.2	X	X
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	2.8
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	X	X
Toluene	µg/l	0.5	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			57297	57298

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 09/20/91
REPORT DATE: 10/07/91
APPROVED BY: JCH JCH

Attn: Colin Reichhoff/George Hudak

	Units	Detection Limit	FB	TRIP BLK-LW
Benzene	µg/l	0.2	X	X
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	X
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	X	X
Toluene	µg/l	0.5	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			57299	57300

X = Analyzed but not detected.

ll analyses conducted in accordance with Enviroscan Quality Assurance Program.

REQUEST FOR SERVICES

ENVIROSCAN

303 W. MILITARY RD. ROTHSCHILD, WI 54474 1-800-338-SCAN

CLIENT INFORMATION

Name: GEORGE HUDAK / COLIN REICHHOFF
Company: RREM INC.
Address: 408 BOARD OF TRADE BUILDING
DULUTH, MN 55802
Phone: (218) 722-3915
P.O. # / Project #: W.O. # 9114
Quote / Reference #: 01111-9
Note: Terms and conditions printed on back apply.

Turnaround Time
- [x] Normal
- [ ] Rush

Date Needed ____________
(Preapproved by Lab)

Sample Type
(Check all that apply)
- [x] Groundwater
- [ ] Wastewater
- [ ] Soil
- [ ] Solid Waste
- [ ] Oil
- [ ] Other ____________

Sample Handling
- [x] Nonhazardous
- [ ] Flammable
- [ ] Skin Irritant
- [ ] Highly Toxic
- [ ] Other (specify) pres. HCL
- [x] Refrigerate
- [ ] Work in Hood
- [ ] Wear Gloves

ANALYTICAL REQUESTS
(use separate sheet if necessary)

LAB USE ONLY	DATE	TIME	No. of Containers COMP	No. of Containers GRAB	SAMPLE ID	FUOCX EPA 8010/8020					REMARKS
03057277 ✓	9/17/91	12:54pm		3	91-1	X					
03057278 ✓	9/17/91	2:51pm		3	91-2A	X					
03057279 ✓	9/17/91	3:40pm		3	91-2B	X					
03057280 ✓	9/17/91	12:05pm		3	91-3	X					
03057281 ✓	9/18/91	8:45am		3	91-4	X					
03057282 ✓	9/17/91	5:08pm		3	91-5A-1	X					
03057283 ✓	9/17/91	5:08pm		3	91-5A-2	X					
03057284 ✓	9/17/91	4:50pm		3	91-5B	X					
03057285 ✓	9/18/91	10:45am		3	91-6	X					
03057286 ✓	9/18/91	9:55am		3	91-7	X					
RREM											

Del'v: Hand Comm.
Ship. Cont. OK? Y N N/A
Rec'd Refrig.? Y N N/A 2.0°C
Seals OK? Y N N/A
Samples leaking? Y N N/A
Comments:
Rec'd on ice

CHAIN OF CUSTODY RECORD

SAMPLERS: (Signature) George Hudak

RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED BY: (Signature)	
George Hudak	9/19/91	2:30pm		
RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED BY: (Signature)	
RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED FOR LABORATORY BY: (Signature)	DATE/TIME
			[illegible]	9/20/91 [illegible]

ENVIROSCAN
REQUEST FOR SERVICES

303 W. MILITARY RD. ROTHSCHILD, WI 54474 1-800-338-SCAN

CLIENT INFORMATION

Name: GEORGE HUDAK / COLIN REICHHOFF
Company: RREM INC
Address: 408 BOARD OF TRADE BUILDING
DULUTH, MN 55802
Phone: (218) 722-3915
P.O. # / Project #: WO # 9114
Quote / Reference #: 01111-9
Note: Terms and conditions printed on back apply.

Turnaround Time
- [x] Normal
- [ ] Rush

Date Needed ______
(Preapproved by Lab)

Sample Type
(Check all that apply)
- [x] Groundwater
- [ ] Wastewater
- [ ] Soil
- [ ] Solid Waste
- [ ] Oil
- [ ] Other ______

Sample Handling
- [x] Nonhazardous
- [ ] Flammable
- [ ] Skin Irritant
- [ ] Highly Toxic
- [ ] Other (specify) pres-HCl
- [x] Refrigerate
- [ ] Work in Hood
- [ ] Wear Gloves

ANALYTICAL REQUESTS
(use separate sheet if necessary)

LAB USE ONLY	DATE	TIME	No. of Containers COMP	GRAB	SAMPLE ID	FUOCK EPA 8010/8020					REMARKS
03057287 ✓	9/17/91	10:30am		3	91-8	X					
03057288 ✓	9/18/91	4:42pm		3	OW-1	X					
03057289 ✓	9/18/91	4:08pm		3	OW-2	X					
03057290 ✓	9/19/91	10:40am		3	OW-3	X					
03057291 ✓	9/19/91	1:15pm		3	OW-4	X					
03057292 ✓	9/18/91	1:55pm		3	OW-5	X					
03057293 ✓	9/18/91	2:33pm		3	OW-6	X					
03057294 ✓	9/19/91	11:20am		3	OW-7	X					
03057295 ✓	9/18/91	3:33pm		3	OW-8	X					
03057296 ✓	9/19/91	9:55am		3	OW-9-1	X					

RREM

Del'v: Hand Comm
Ship. Cont. OK? Y N N/A
Rec'd Refrig.? Y N N/A 2.0°C
Seals OK? Y N N/A
Samples leaking? Y N N/A
Comments:
Rec'd on ice

CHAIN OF CUSTODY RECORD

SAMPLERS: (Signature) George Hudak

RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED BY: (Signature)
George Hudak	9/19/91	2:30pm	
RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED FOR LABORATORY BY: (Signature)

DATE/TIME
9/

REQUEST FOR SERVICES

303 W. MILITARY RD. ROTHSCHILD, WI 54474 1-800-338-SCAN

CLIENT INFORMATION

Name: GEORGE HUDAK / COLIN REICHHOFF
Company: RREM, INC.
Address: 408 BOARD OF TRADE BUILDING
DULUTH, MN 55802
Phone: (218) 722-3915
P.O. # / Project #: W.O. #, 9114
Quote / Reference #: 01111-9
Note: Terms and conditions printed on back apply.

Turnaround Time
☒ Normal
☐ Rush
Date Needed ______
(Preapproved by Lab)

Sample Type
(Check all that apply)
☒ Groundwater
☐ Wastewater
☐ Soil
☐ Solid Waste
☐ Oil
☐ Other ______

Sample Handling
☒ Nonhazardous
☐ Flammable
☐ Skin Irritant
☐ Highly Toxic
☐ Other (specify) pres. HCL
☒ Refrigerate
☐ Work in Hood
☐ Wear Gloves

ANALYTICAL REQUESTS
(use separate sheet if necessary)

LAB USE ONLY	DATE	TIME	No. of Containers COMP	GRAB	SAMPLE ID	FUOCK EPA 8010/8020					REMARKS
03057297 ✓	9/19/91	9:55am		3	OW-9-2	X					
03057298 ✓	9/19/91	12:31pm		3	VW-2	X					
03057299 ✓	9/17/91	3:22pm		3	FB	X					
03057300 ✓	9/11/91			6	TRIP BLANK LW	X					
RREM											

Del'v: Hand Comm.
Ship. Cont. OK? Y N N/A
Rec'd Refrig.? Y N N/A 2.0°c
Seals OK? Y N N/A
Samples leaking? Y N N/A
Comments:
Rec'd on ice

CHAIN OF CUSTODY RECORD

SAMPLERS: (Signature) George Hudak

RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED BY: (Signature)	
George Hudak	9/19/91	2:30pm		
RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED BY: (Signature)	
RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED FOR LABORATORY BY: (Signature)	DATE/TIME 9/

ENVIROSCAN

November 5, 1991

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

NOV 1991
RECEIVED
RREM, Inc.

Attn: George Hudak

Re: Project No. 9114

Please find enclosed the analytical results for the samples received October 18, 1991. The results were faxed to you on November 1, 1991.

The VOC analyses were completed using EPA Method 8010/8020.

The chain of custody document is enclosed. If you have any questions about the results, please call. Thank you for using Enviroscan Corp. for your analytical needs.

Sincerely,

Enviroscan Corp.

Jay C. Hunger

Jay C. Hunger
Analytical Chemist

303 West Military Road Rothschild, WI 54474 (715) 359-7226

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

Attn: George Hudak

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 10/18/91
REPORT DATE: 11/01/91
APPROVED BY: JCH J.C.H.

	Units	Detection Limit	91-8	91-3
Benzene	µg/l	0.2	0.4	0.7
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	90.2
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	X	X
Toluene	µg/l	0.5	5.6	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	0.3
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			58756	58757

X = Analyzed but not detected.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

Attn: George Hudak

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 10/18/91
REPORT DATE: 11/01/91
APPROVED BY: JCH J.C.H.

	Units	Detection Limit	91-1	91-2A
Benzene	µg/l	0.2	0.6	0.5
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	X
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	X	X
Toluene	µg/l	0.5	1.0	0.9
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			58758	58759

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

NALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

Attn: George Hudak

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 10/18/91
REPORT DATE: 11/01/91
APPROVED BY: JCH J.C.H.

	Units	Detection Limit	91-2B	91-4
Benzene	µg/l	0.2	X	0.5
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	1.4	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	1.5
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	2.2	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	0.6	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	105.	11.5
Toluene	µg/l	0.5	X	0.7
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	7.2	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			58760	58761

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 10/18/91
REPORT DATE: 11/01/91
APPROVED BY: JCH J.C.H.

Attn: George Hudak

	Units	Detection Limit	91-5A	91-5B
Benzene	µg/l	0.2	0.4	0.4
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	0.8
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	5.1	X
Toluene	µg/l	0.5	0.8	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			58762	58763

X = Analyzed but not detected.

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ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 10/18/91
REPORT DATE: 11/01/91
APPROVED BY: JCH J.C.H.

Attn: George Hudak

	Units	Detection Limit	91-7	91-6-1
Benzene	µg/l	0.2	X	0.3
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	X
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	0.6	32.0
Toluene	µg/l	0.5	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	0.7
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			58764	58765

X = Analyzed but not detected.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

Attn: George Hudak

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 10/18/91
REPORT DATE: 11/01/91
APPROVED BY: JCH J.C.H.

	Units	Detection Limit	91-6-2	OW-4
Benzene	µg/l	0.2	0.2	X
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	X
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	52.5	X
Toluene	µg/l	0.5	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	0.6	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			58766	58767

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

Wisconsin Lab Certification No. 737053130

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

Attn: George Hudak

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 10/18/91
REPORT DATE: 11/01/91
APPROVED BY: JCH J.C.H.

	Units	Detection Limit	OW-5-1	OW-5-2
Benzene	μg/l	0.2	X	X
Bromoform	μg/l	2.0	X	X
Bromomethane	μg/l	4.0	X	X
Carbon Tetrachloride	μg/l	0.5	X	X
Chlorobenzene	μg/l	2.0	X	X
Chloroethane	μg/l	2.0	X	X
2-Chloroethylvinyl Ether	μg/l	5.0	X	X
Chloroform	μg/l	0.5	X	X
Chloromethane	μg/l	2.0	X	X
Chlorodibromomethane	μg/l	0.5	X	X
1,2-Dichlorobenzene	μg/l	1.0	X	X
1,3-Dichlorobenzene	μg/l	1.0	X	X
1,4-Dichlorobenzene	μg/l	0.5	X	X
Bromodichloromethane	μg/l	0.5	X	X
1,1-Dichloroethane	μg/l	0.5	X	X
1,2-Dichloroethane	μg/l	0.5	X	X
1,1-Dichloroethylene	μg/l	0.4	X	X
1,2-Dichloroethylene	μg/l	1.0	X	X
Methylene Chloride	μg/l	2.5	X	X
1,2-Dichloropropane	μg/l	0.5	X	X
cis-1,3-Dichloropropene	μg/l	2.0	X	X
trans-1,3-Dichloropropene	μg/l	0.5	X	X
Ethylbenzene	μg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	μg/l	1.0	X	X
Tetrachloroethylene	μg/l	0.5	2.1	2.1
Toluene	μg/l	0.5	X	X
1,1,1-Trichloroethane	μg/l	0.5	X	X
1,1,2-Trichloroethane	μg/l	0.5	X	X
Trichloroethylene	μg/l	0.2	X	X
Vinyl Chloride	μg/l	0.2	X	X
Trichlorofluoromethane	μg/l	1.0	X	X
Dichlorodifluoromethane	μg/l	2.0	X	X
m & p-Xylene	μg/l	1.0	X	X
o-Xylene	μg/l	1.0	X	X
Analytical No.:			58768	58769

X = Analyzed but not detected.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

Attn: George Hudak

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 10/18/91
REPORT DATE: 11/01/91
APPROVED BY: JCH J.C.H.

	Units	Detection Limit	OW-6	OW-8
Benzene	µg/l	0.2	X	0.2
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	X
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	0.9	12.9
Toluene	µg/l	0.5	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			58770	58771

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

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RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

Attn: George Hudak

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 10/18/91
REPORT DATE: 11/01/91
APPROVED BY: JCH J.C.H.

	Units	Detection Limit	OW-9	OW-3
Benzene	µg/l	0.2	X	0.2
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	X
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	X	X
Toluene	µg/l	0.5	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			58772	58773

X = Analyzed but not detected.

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NALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

Attn: George Hudak

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 10/18/91
REPORT DATE: 11/01/91
APPROVED BY: JCH J.C.H.

	Units	Detection Limit	OW-7	OW-2
Benzene	µg/l	0.2	0.3	0.2
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	2.5
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	1.6	1.2
Toluene	µg/l	0.5	0.5	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			58774	58775

X = Analyzed but not detected.

l analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 10/18/91
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APPROVED BY: JCH J.C.H.

Attn: George Hudak

	Units	Detection Limit	OW-1	VW-2
Benzene	µg/l	0.2	1.1	X
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	2.7
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	3.3	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	9.4	X
Toluene	µg/l	0.5	0.5	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	1.1	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			58776	58777

X = Analyzed but not detected.

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ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

Attn: George Hudak

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 10/18/91
REPORT DATE: 11/01/91
APPROVED BY: JCH J.C.H.

	Units	Detection Limit	FB-1	FB-2
Benzene	µg/l	0.2	X	X
Bromoform	µg/l	2.0	X	X
Bromomethane	µg/l	4.0	X	X
Carbon Tetrachloride	µg/l	0.5	X	X
Chlorobenzene	µg/l	2.0	X	X
Chloroethane	µg/l	2.0	X	X
2-Chloroethylvinyl Ether	µg/l	5.0	X	X
Chloroform	µg/l	0.5	X	X
Chloromethane	µg/l	2.0	X	X
Chlorodibromomethane	µg/l	0.5	X	X
1,2-Dichlorobenzene	µg/l	1.0	X	X
1,3-Dichlorobenzene	µg/l	1.0	X	X
1,4-Dichlorobenzene	µg/l	0.5	X	X
Bromodichloromethane	µg/l	0.5	X	X
1,1-Dichloroethane	µg/l	0.5	X	X
1,2-Dichloroethane	µg/l	0.5	X	X
1,1-Dichloroethylene	µg/l	0.4	X	X
1,2-Dichloroethylene	µg/l	1.0	X	X
Methylene Chloride	µg/l	2.5	X	X
1,2-Dichloropropane	µg/l	0.5	X	X
cis-1,3-Dichloropropene	µg/l	2.0	X	X
trans-1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	X	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	X	X
Toluene	µg/l	0.5	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	X	X
Vinyl Chloride	µg/l	0.2	X	X
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m & p-Xylene	µg/l	1.0	X	X
o-Xylene	µg/l	1.0	X	X
Analytical No.:			58778	58779

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

RREM, Inc.
408 Board of Trade Building
Duluth, MN 55802

Attn: George Hudak

CUST NUMBER: 9114
SAMPLED BY: Client
DATE REC'D: 10/18/91
REPORT DATE: 11/01/91
APPROVED BY: JCH J.C.H.

	Units	Detection Limit	TRIP BLK-BR
Benzene	μg/l	0.2	X
Bromoform	μg/l	2.0	X
Bromomethane	μg/l	4.0	X
Carbon Tetrachloride	μg/l	0.5	X
Chlorobenzene	μg/l	2.0	X
Chloroethane	μg/l	2.0	X
2-Chloroethylvinyl Ether	μg/l	5.0	X
Chloroform	μg/l	0.5	X
Chloromethane	μg/l	2.0	X
Chlorodibromomethane	μg/l	0.5	X
1,2-Dichlorobenzene	μg/l	1.0	X
1,3-Dichlorobenzene	μg/l	1.0	X
1,4-Dichlorobenzene	μg/l	0.5	X
Bromodichloromethane	μg/l	0.5	X
1,1-Dichloroethane	μg/l	0.5	X
1,2-Dichloroethane	μg/l	0.5	X
1,1-Dichloroethylene	μg/l	0.4	X
1,2-Dichloroethylene	μg/l	1.0	X
Methylene Chloride	μg/l	2.5	X
1,2-Dichloropropane	μg/l	0.5	X
cis-1,3-Dichloropropene	μg/l	2.0	X
trans-1,3-Dichloropropene	μg/l	0.5	X
Ethylbenzene	μg/l	1.0	X
1,1,2,2-Tetrachloroethane	μg/l	1.0	X
Tetrachloroethylene	μg/l	0.5	X
Toluene	μg/l	0.5	X
1,1,1-Trichloroethane	μg/l	0.5	X
1,1,2-Trichloroethane	μg/l	0.5	X
Trichloroethylene	μg/l	0.2	X
Vinyl Chloride	μg/l	0.2	X
Trichlorofluoromethane	μg/l	1.0	X
Dichlorodifluoromethane	μg/l	2.0	X
m & p-Xylene	μg/l	1.0	X
o-Xylene	μg/l	1.0	X

Analytical No.: 58780

X = Analyzed but not detected.

l analyses conducted in accordance with Enviroscan Quality Assurance Program.

ENVIROSCAN

REQUEST FOR SERVICES

303 W. MILITARY RD. ROTHSCHILD, WI 54474 1-800-338-SCAN

CLIENT INFORMATION

Name: GEORGE HUDAK / COLIN REICHHOFF
Company: RREM INC.
Address: 408 BOARD OF TRADE BUILDING
DULUTH, MN 55802
Phone: (218) 722-7935
P.O. # / Project #: 9114
Quote / Reference #: 01111-9
Note: Terms and conditions printed on back apply.

Turnaround Time
☒ Normal (SEE BELOW)
☐ Rush
Date Needed 11/7/91
(Preapproved by Lab)

Sample Type
(Check all that apply)
☒ Groundwater
☐ Wastewater
☐ Soil
☐ Solid Waste
☐ Oil
☐ Other ______

Sample Handling
☒ Nonhazardous
☐ Flammable
☐ Skin Irritant
☐ Highly Toxic
☐ Other (specify) ______
☒ Refrigerate
☐ Work in Hood
☐ Wear Gloves

ANALYTICAL REQUESTS
(use separate sheet if necessary)

LAB USE ONLY	DATE	TIME	No. of Containers COMP	No. of Containers GRAB	SAMPLE ID	FVOC X EPA 8010/8020 VOC RUN					REMARKS
03058756 ✓	10/14/91	12:02pm		3	91-8	X					2 WEEK
03058757 ✓	10/14/91	1:59pm		3	91-3	X					TURNAROUND ON
03058758 ✓	10/14/91	2:54pm		3	91-1	X					ANALYSIS RESULTS -
03058759 ✓	10/14/91	4:04pm		3	91-2A	X					CONSULT WITH
03058760 ✓	10/14/91	4:42pm		3	91-2B	X					MARY C. CHRISTIE
03058761 ✓	10/15/91	9:24am		3	91-4	X					HEUSER.
03058762 ✓	10/15/91	10:05am		3	91-5A	X					
03058763 ✓	10/15/91	10:40am		3	91-5B	X					
03058764 ✓	10/15/91	11:35am		3	91-7	X					
03058765 ✓	10/15/91	12:06pm		3	91-6-1	X					

RREM

Del'v: Hand Comm
Ship. Cont. OK? Y N N/A
Rec'd Refrig.? Y N N/A 0.7°C
Seals OK? Y N N/A
Samples leaking? Y N N/A
Comments:

CHAIN OF CUSTODY RECORD

SAMPLERS: (Signature) George J. Hudak

RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED BY: (Signature)	
George J. Hudak	10/17/91	3:00pm		
RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED BY: (Signature)	
RELINQUISHED BY: (Signature)	DATE/TIME		RECEIVED FOR LABORATORY BY: (Signature)	DATE/TIME
			[illegible] Wilson	10/18/91 12:35 pm

GA

3-SCAN

d Time

rn (SEE BELOW)

ed 11/1/91

Pre proved by Lab)

ALYTICAL REQUESTS
e separate sheet if necessary)

REMARKS

2 WEEK TURN-
AROUND ON
ANALYSIS RESULT
CONSULT WITH
MARY C. CHRISTI
HEUSER

and Comm
nt. OK? Y N N/A
'd efrig.? Y N N/A 0.7°c.
s K? Y N N/A
leaking? Y N N/A
its:
8 72 1 vial broken

TF TIME
12:25 pm

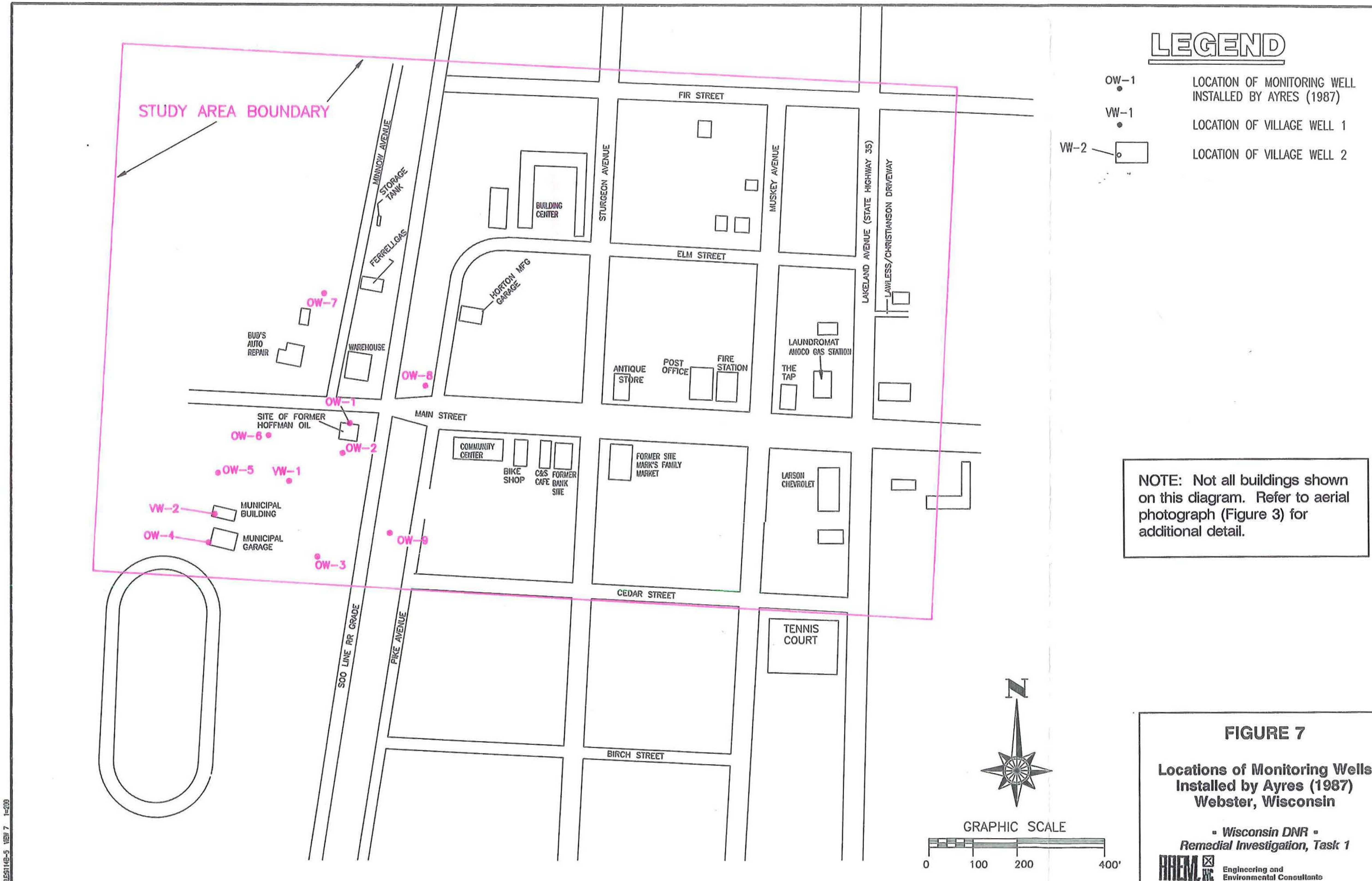
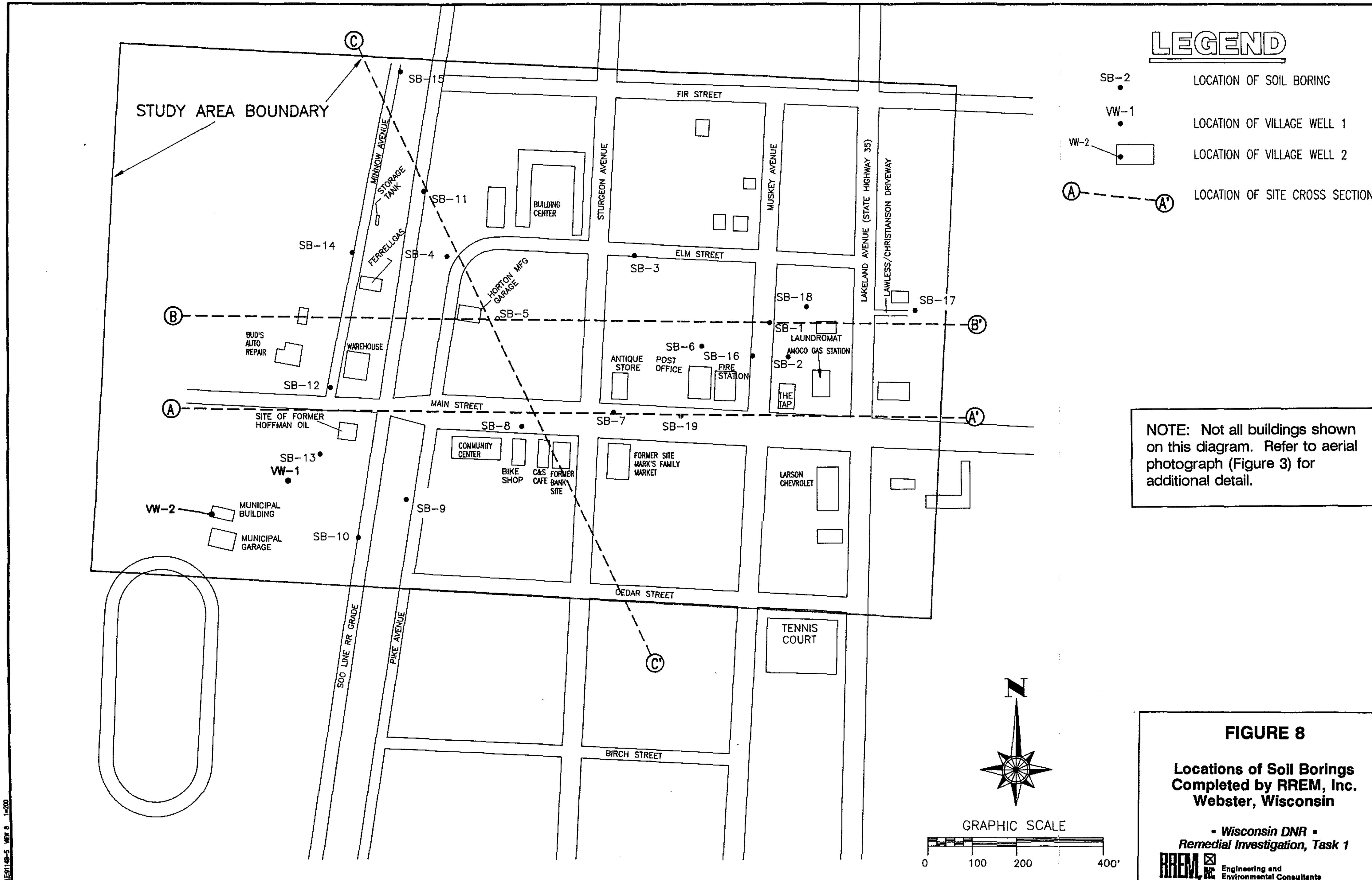


FIGURE 7

Locations of Monitoring Wells Installed by Ayres (1987) Webster, Wisconsin

▪ Wisconsin DNR ▪
Remedial Investigation, Task 1

RMT, INC. Engineering and Environmental Consultants



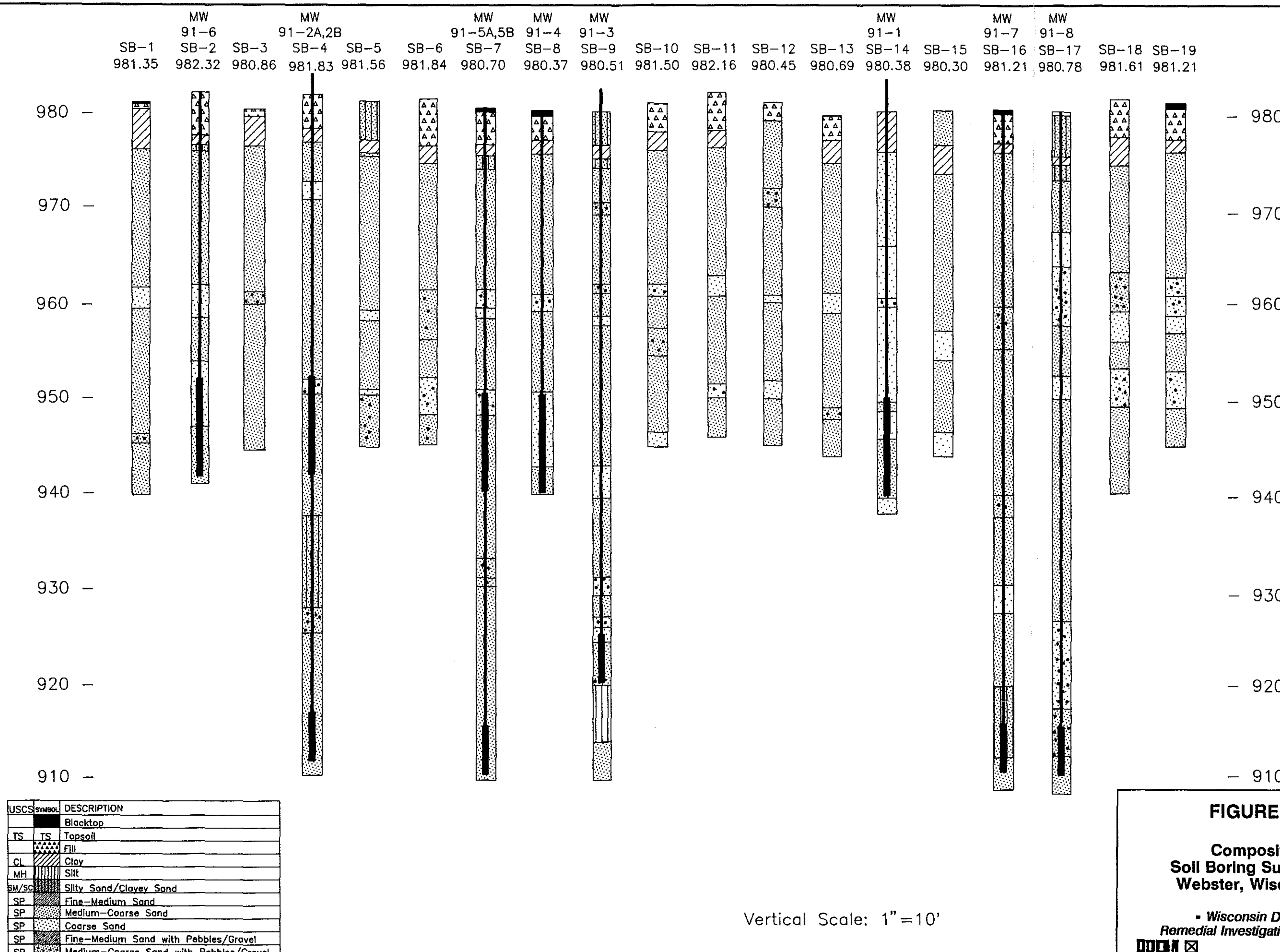
NOTE: Not all buildings shown on this diagram. Refer to aerial photograph (Figure 3) for additional detail.

FIGURE 8

Locations of Soil Borings Completed by RREM, Inc. Webster, Wisconsin

- Wisconsin DNR -
Remedial Investigation, Task 1

RREM, INC. Engineering and Environmental Consultants



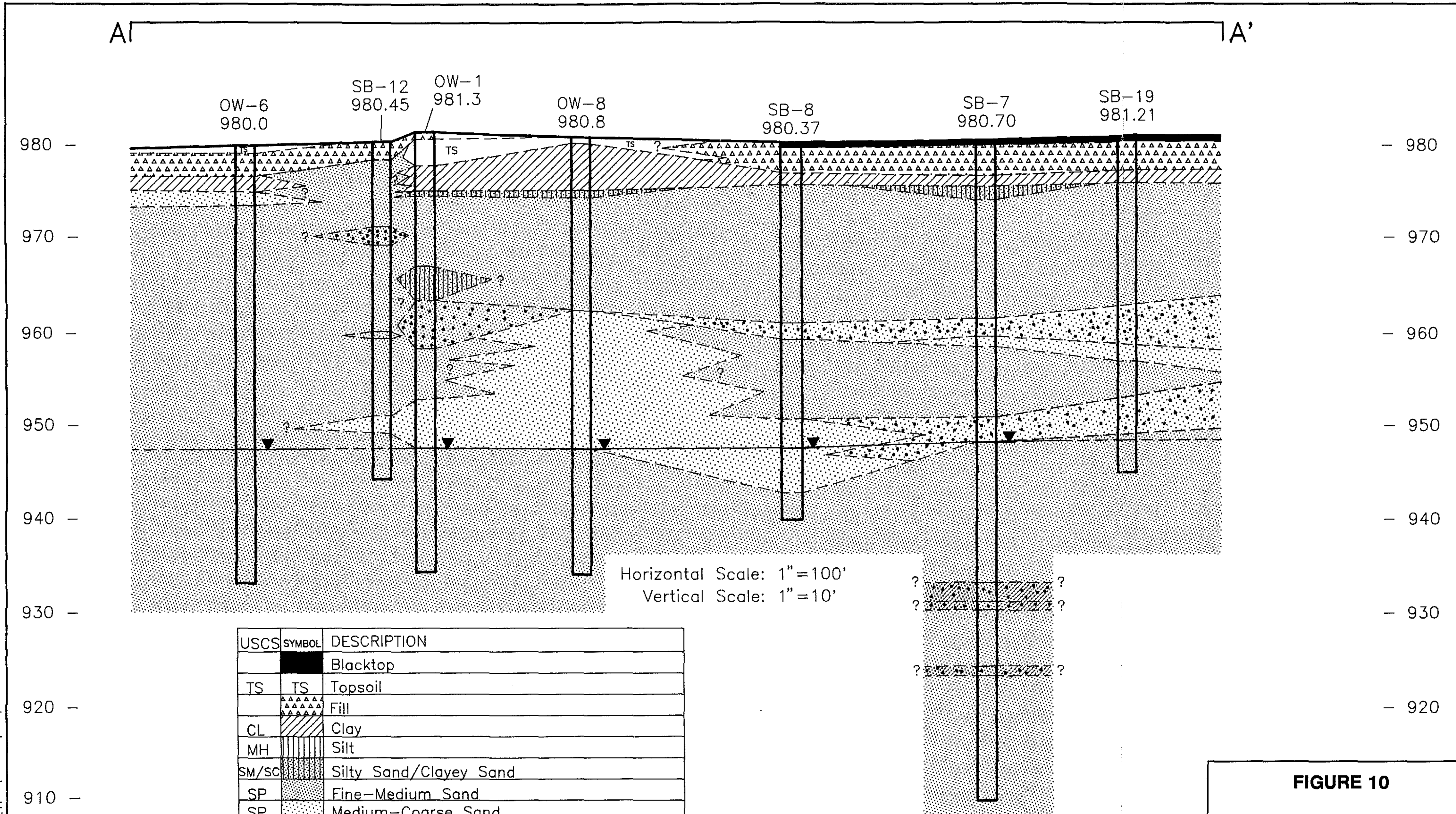
file 9114COMP VIEW 1 1=1

FIGURE 9

Composite Soil Boring Summary Webster, Wisconsin

- Wisconsin DNR -
Remedial Investigation, Task 1

RMT, INC. Engineering and Environmental Consultants



USCS	SYMBOL	DESCRIPTION
		Blacktop
TS	TS	Topsoil
		Fill
CL		Clay
MH		Silt
SM/SC		Silty Sand/Clayey Sand
SP		Fine-Medium Sand
SP		Medium-Coarse Sand
SP		Coarse Sand
SP		Fine-Medium Sand with Pebbles/Gravel
SP		Medium-Coarse Sand with Pebbles/Gravel

All top of boring elevations are ground elevations
Dashed line represents interpreted contacts
Geology is projected onto vertical plane A-A'

▼ Represents Water Table

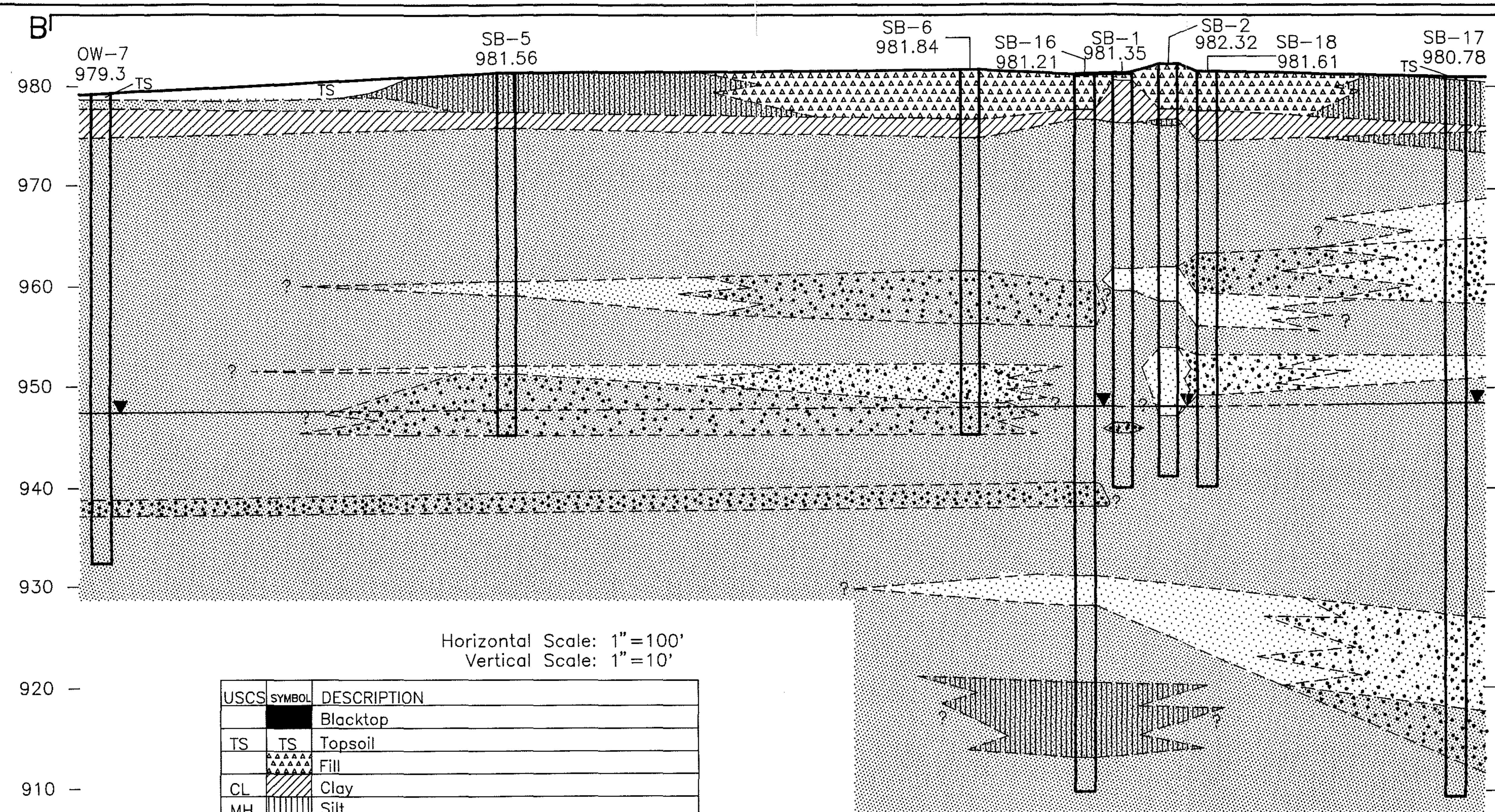
FIGURE 10

Site Cross-Section
A — A'
Webster, Wisconsin

- Wisconsin DNR -
Remedial Investigation, Task 1

RREM, Inc. Engineering and Environmental Consultants

X-REF.=FILL,SP-FM,SP-M
9114XSA VIEW 1 1=1



USCS	SYMBOL	DESCRIPTION
		Blacktop
TS	TS	Topsoil
		Fill
CL		Clay
MH		Silt
SM/SC		Silty Sand/Clayey Sand
SP		Fine–Medium Sand
SP		Medium–Coarse Sand
SP		Coarse Sand
SP		Fine–Medium Sand with Pebbles/Gravel
SP		Medium–Coarse Sand with Pebbles/Gravel

All boring elevations are ground elevations
Dashed line represents interpreted contacts
Geology is projected onto vertical plane B–B'

▼ REPRESENTS WATER TABLE

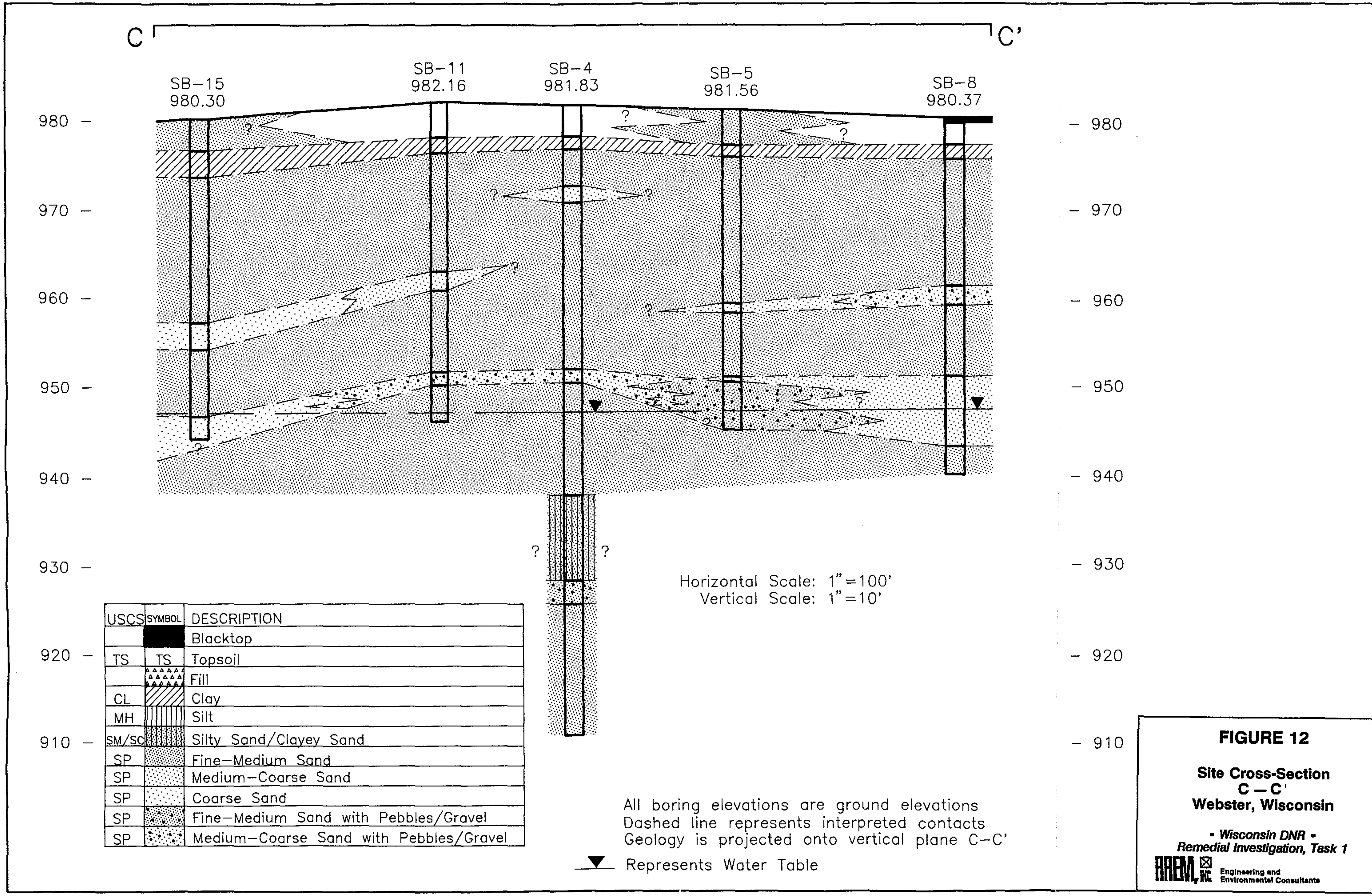
FIGURE 11

Site Cross-Section
B — B'
Webster, Wisconsin

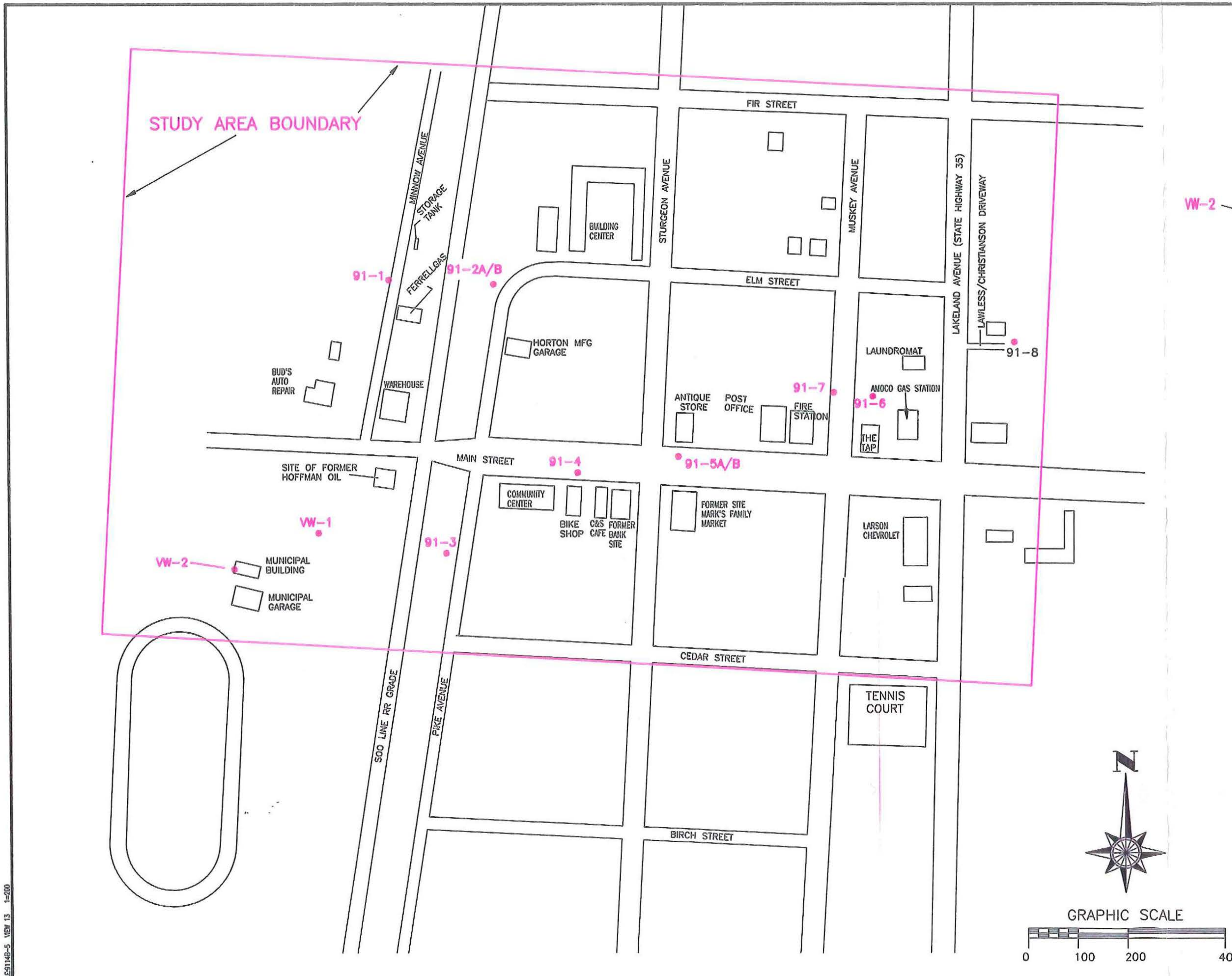
▪ *Wisconsin DNR* ▪
Remedial Investigation, Task 1

RREM, INC. Engineering and Environmental Consultants

file: 9114XSB X-REF\DETAILS\SP VIEW 1 SCALE 1=1



filename:9114XSC
PLOT VIEW:1
PLOT SCALE:1=1
XREF:FILL,CLAY,SP_FM,SP_FP,SM_SC,SP_C,SP_MC



LEGEND

91-6 LOCATION OF MONITORING WELL INSTALLED BY RREM (1991)

VW-1 LOCATION OF VILLAGE WELL 1

VW-2 LOCATION OF VILLAGE WELL 2

NOTE: Not all buildings shown on this diagram. Refer to aerial photograph (Figure 3) for additional detail.

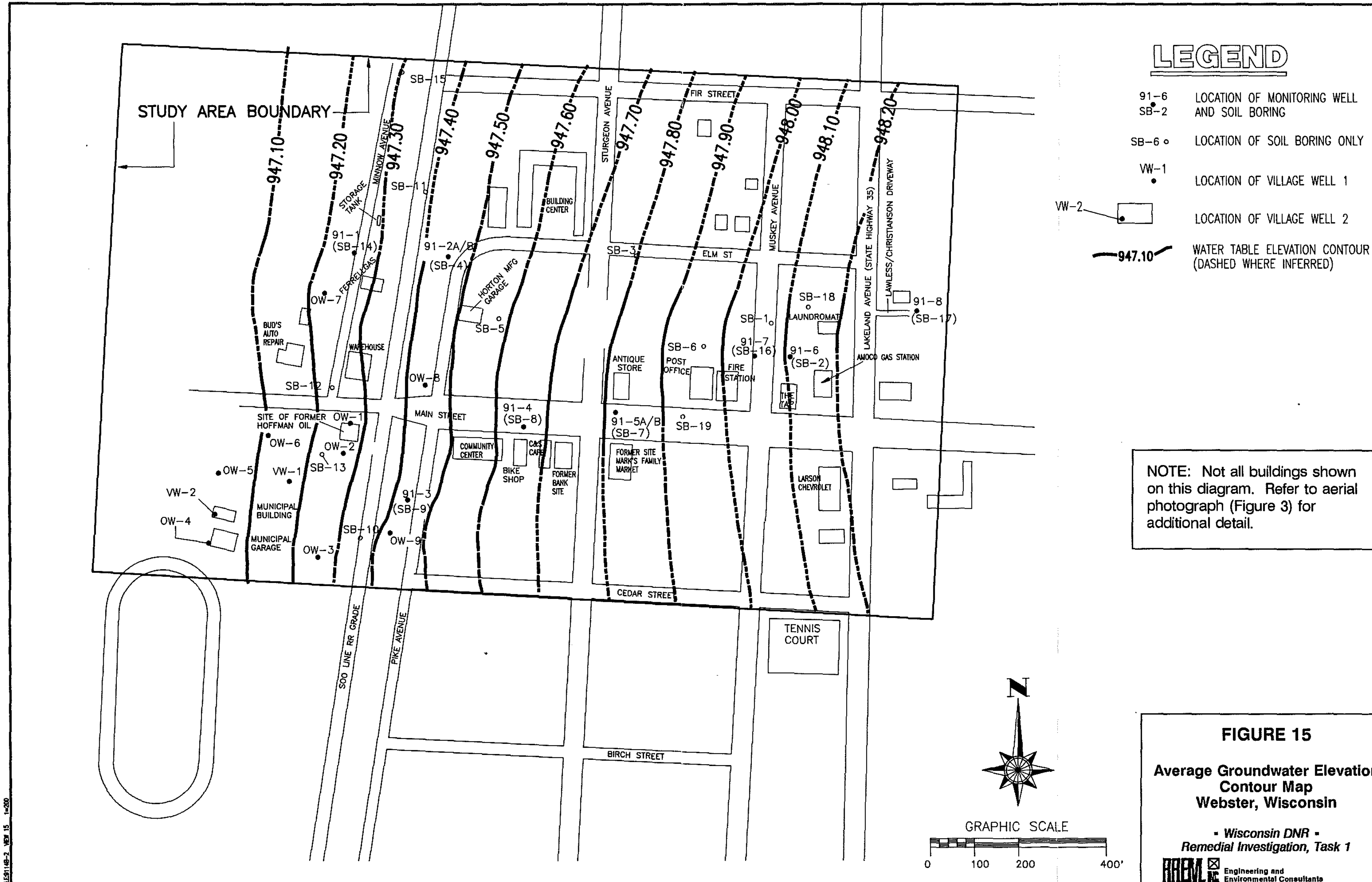
FIGURE 13

Locations of Monitoring Wells Installed by RREM, Inc. (& Webster Village Wells 1 & 2)

▪ Wisconsin DNR ▪
Remedial Investigation, Task 1

Engineering and Environmental Consultants

FILE:91148-5 VIEW 13 1=200



NOTE: Not all buildings shown on this diagram. Refer to aerial photograph (Figure 3) for additional detail.

FIGURE 15

Average Groundwater Elevation Contour Map
Webster, Wisconsin

- Wisconsin DNR -
Remedial Investigation, Task 1

RREM, INC. Engineering and Environmental Consultants

FILE:91148-2 VIEW 15 1=200

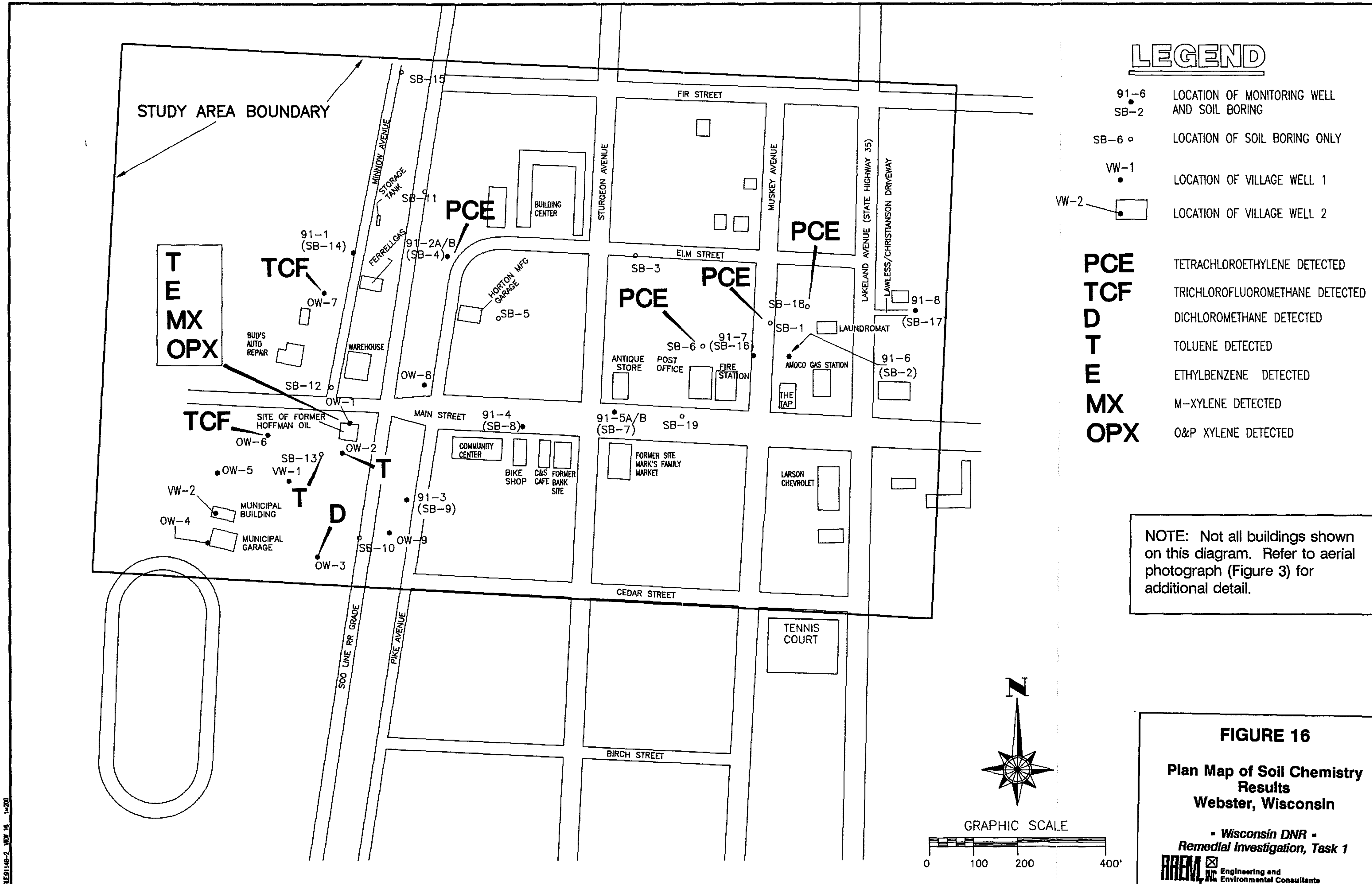
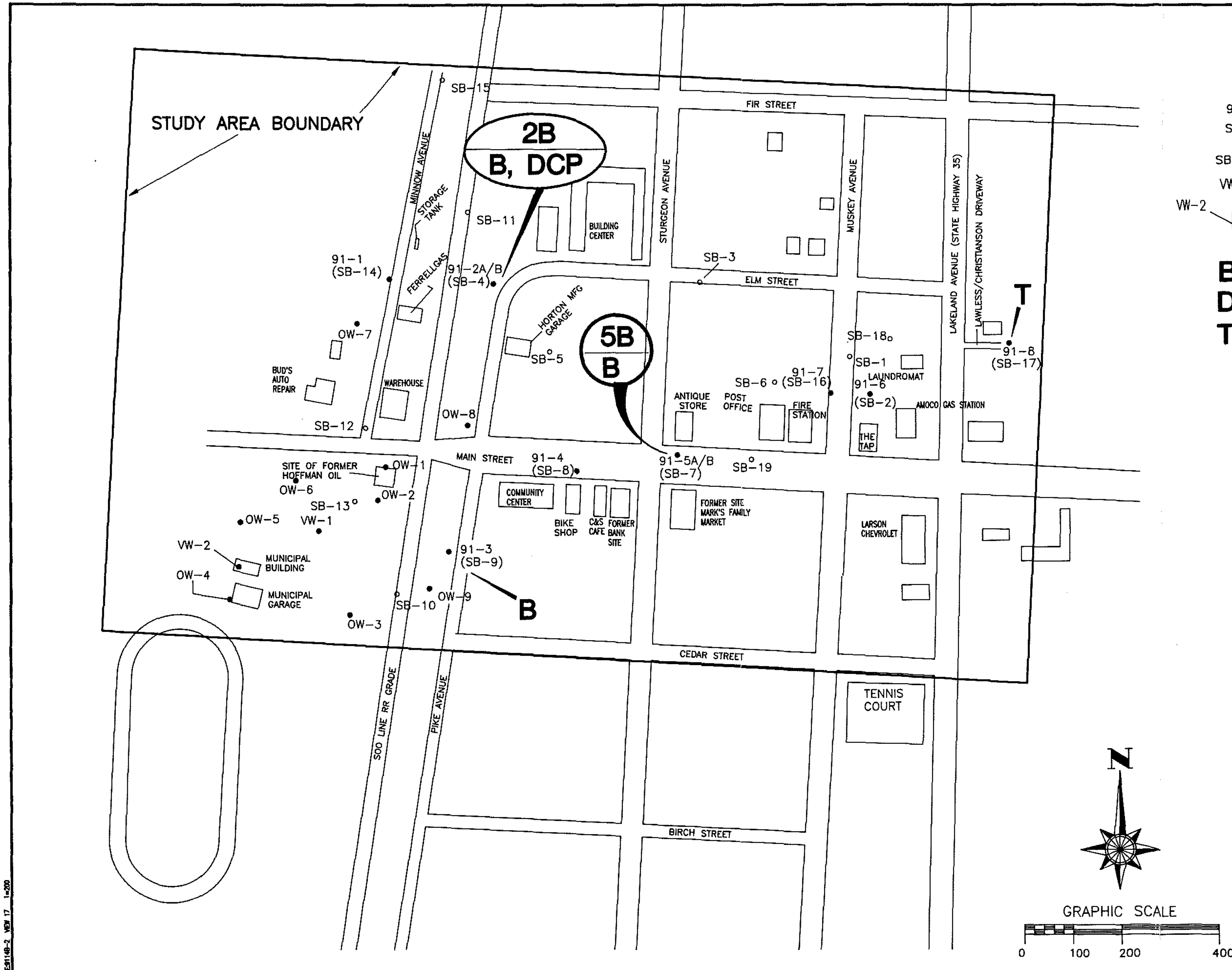


FIGURE 16

Plan Map of Soil Chemistry Results Webster, Wisconsin

▪ Wisconsin DNR ▪ Remedial Investigation, Task 1

RREM, INC. Engineering and Environmental Consultants



LEGEND

91-6 • SB-2	LOCATION OF MONITORING WELL AND SOIL BORING
SB-6 ∘	LOCATION OF SOIL BORING ONLY
VW-1 •	LOCATION OF VILLAGE WELL 1
VW-2	LOCATION OF VILLAGE WELL 2
B	BENZENE DETECTED
DCP	DICHLOROPROPANE DETECTED
T	TOLUENE DETECTED

NOTE: Not all buildings shown on this diagram. Refer to aerial photograph (Figure 3) for additional detail.

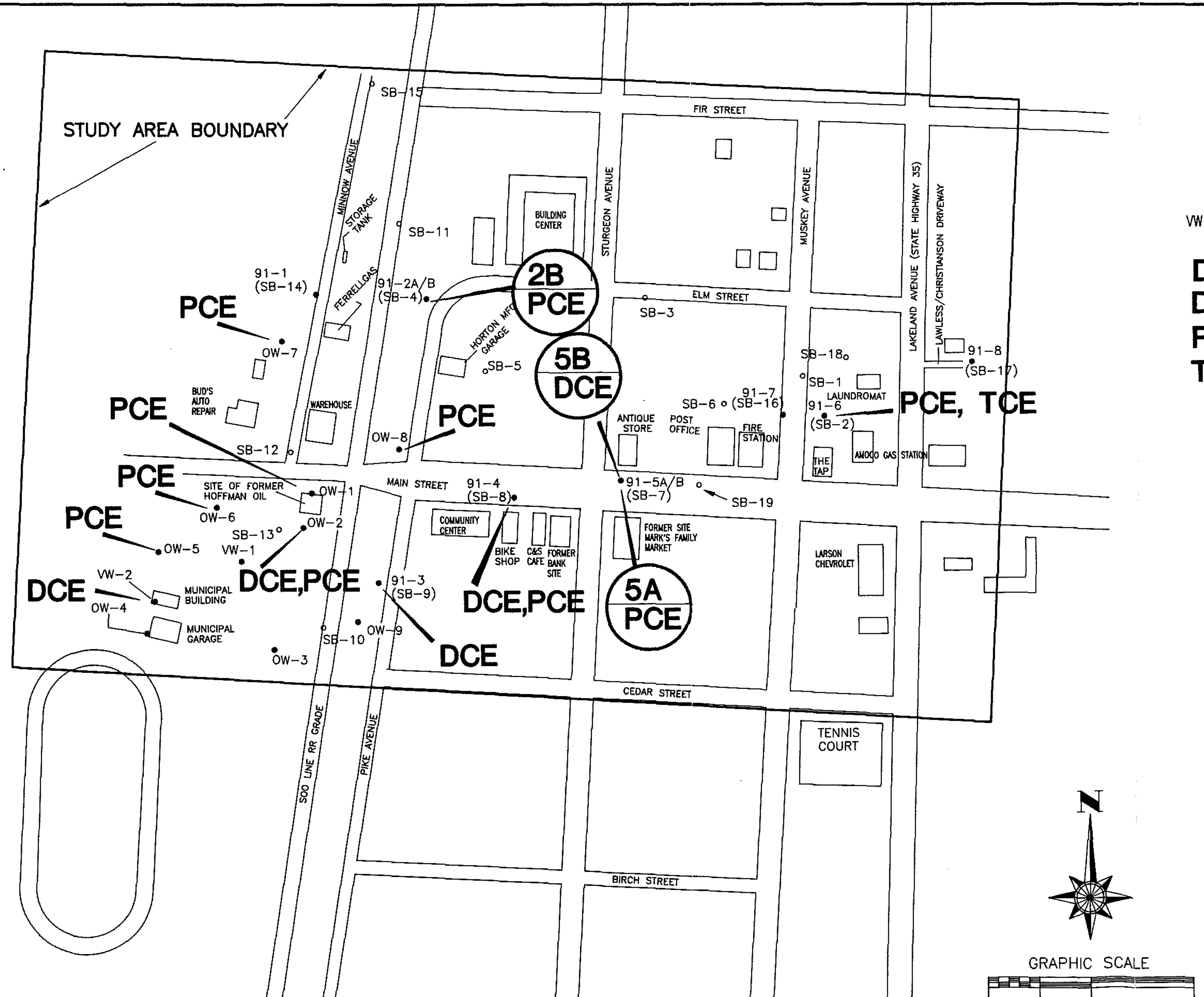
FIGURE 17

Distribution of Misc. VOC Contamination in Groundwater Round 1, Webster, Wisconsin

- Wisconsin DNR -
Remedial Investigation, Task 1

RMT INC. Engineering and Environmental Consultants

FILE:91148-2 VIEW 17 1=200



LEGEND

91-6 / SB-2	LOCATION OF MONITORING WELL AND SOIL BORING
SB-6	LOCATION OF SOIL BORING ONLY
VW-1	LOCATION OF VILLAGE WELL 1
VW-2	LOCATION OF VILLAGE WELL 2
DCB	DICHLOROBENZENE DETECTED
DCE	DICHLOROETHANE DETECTED
PCE	TETRACHLOROETHYLENE DETECTED
TCE	TRICHLOROETHYLENE DETECTED

NOTE: Not all buildings shown on this diagram. Refer to aerial photograph (Figure 3) for additional detail.

FIGURE 18

Distribution of Solvent-Related Contamination in Groundwater Round 1, Webster, Wisconsin

• Wisconsin DNR •
Remedial Investigation, Task 1

RREM, INC. Engineering and Environmental Consultants

FILE-91149-2 VIEW 18 1=200

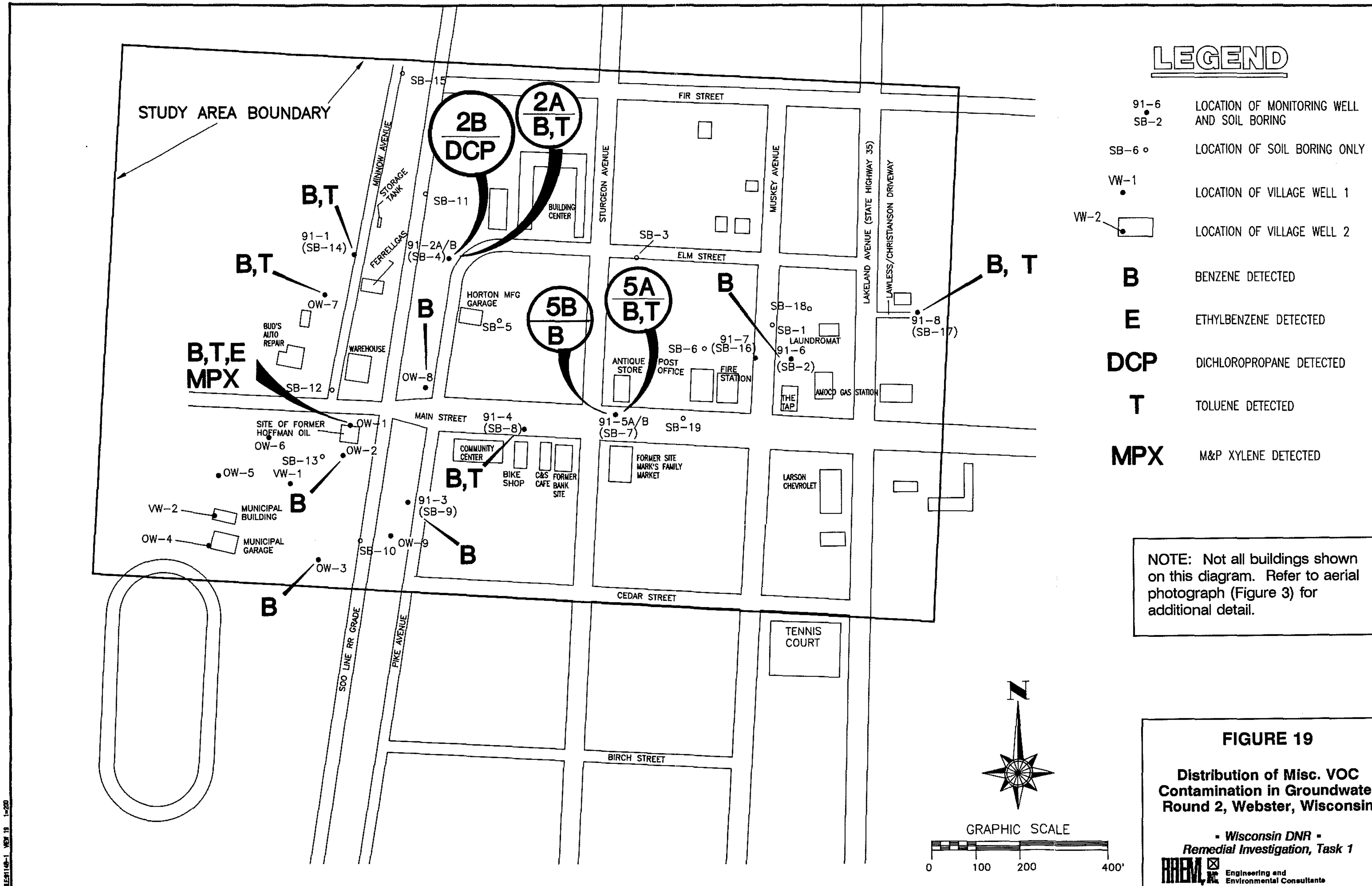


FIGURE 19

Distribution of Misc. VOC Contamination in Groundwater Round 2, Webster, Wisconsin

- Wisconsin DNR -
Remedial Investigation, Task 1

RREM, INC. Engineering and Environmental Consultants

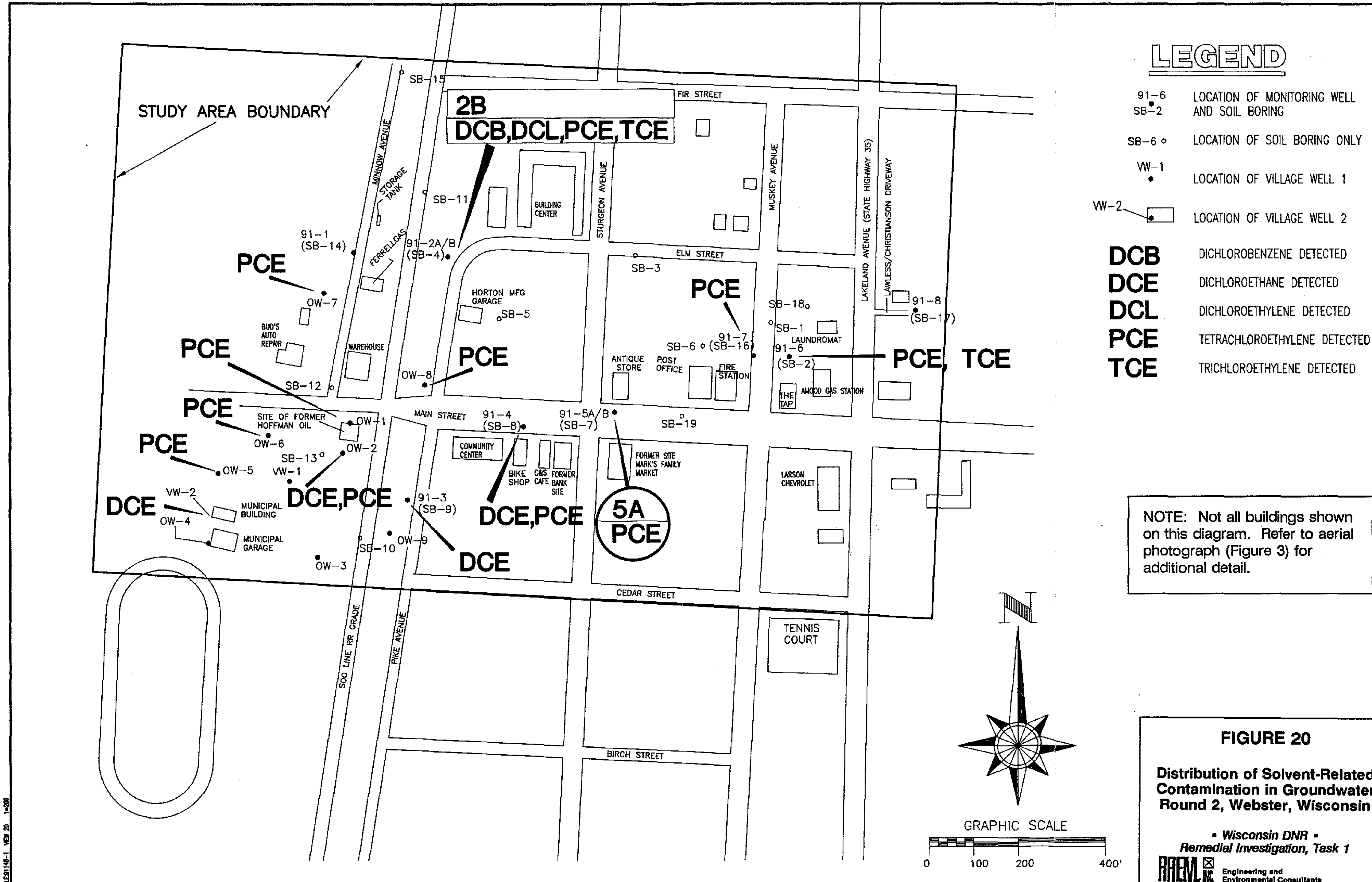
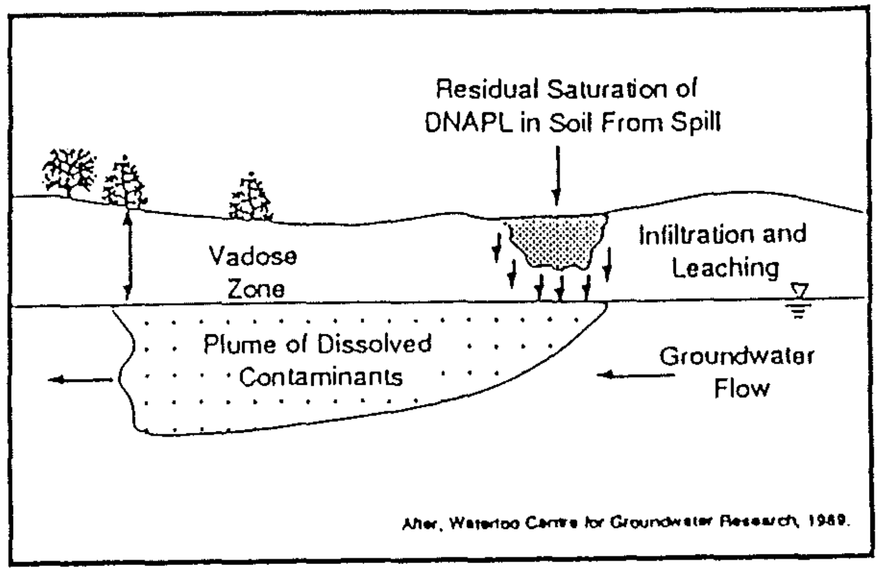


FIGURE 20

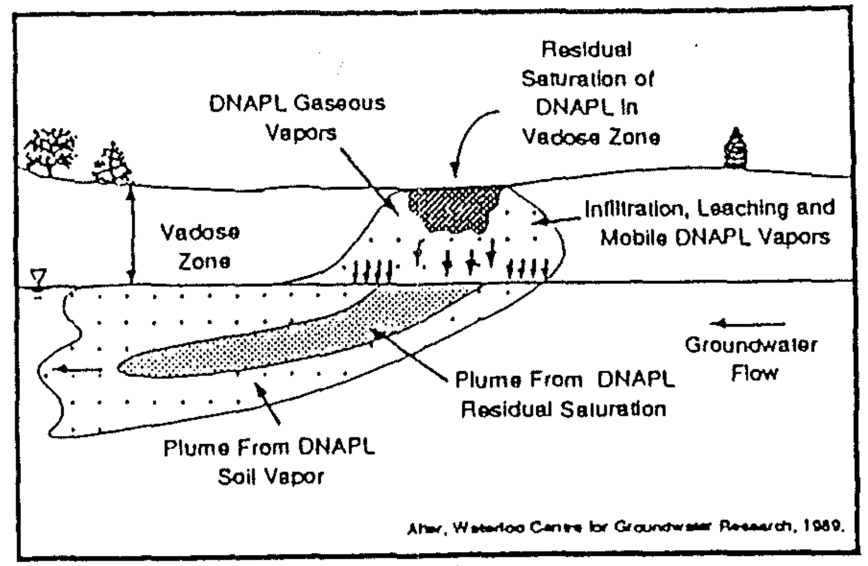
Distribution of Solvent-Related Contamination in Groundwater Round 2, Webster, Wisconsin

• Wisconsin DNR •
Remedial Investigation, Task 1

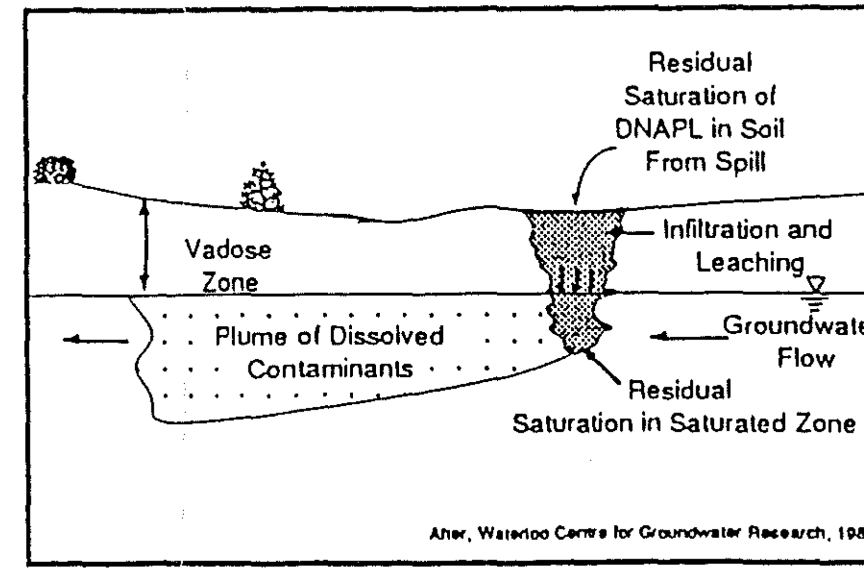
Engineering and Environmental Consultants



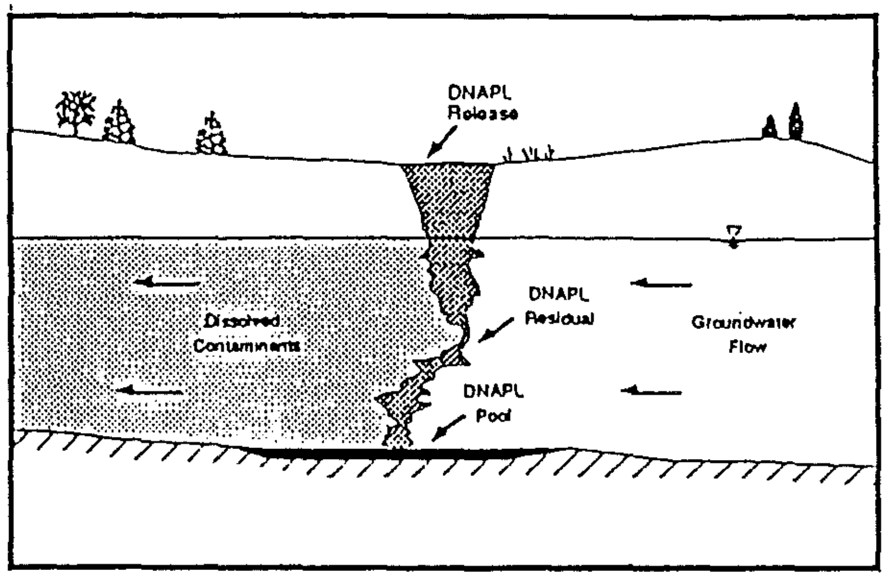
The entire volume of DNAPL is exhausted by residual saturation in the vadose zone prior to DNAPL reaching the water table. Soluble phase compounds may be leached from the DNAPL residual saturation and contaminate the ground water.



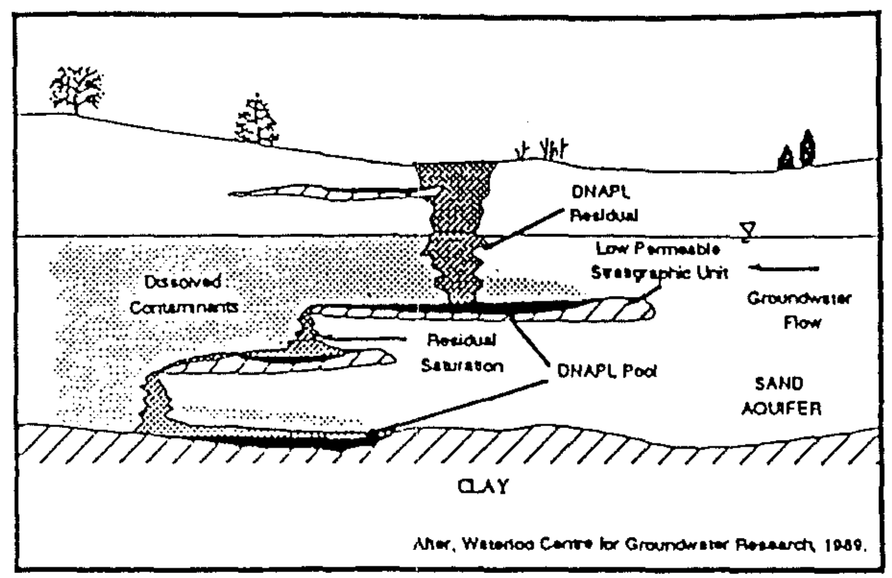
Migration of DNAPL vapors from the spill area and subsequent contamination of the soils and ground water.



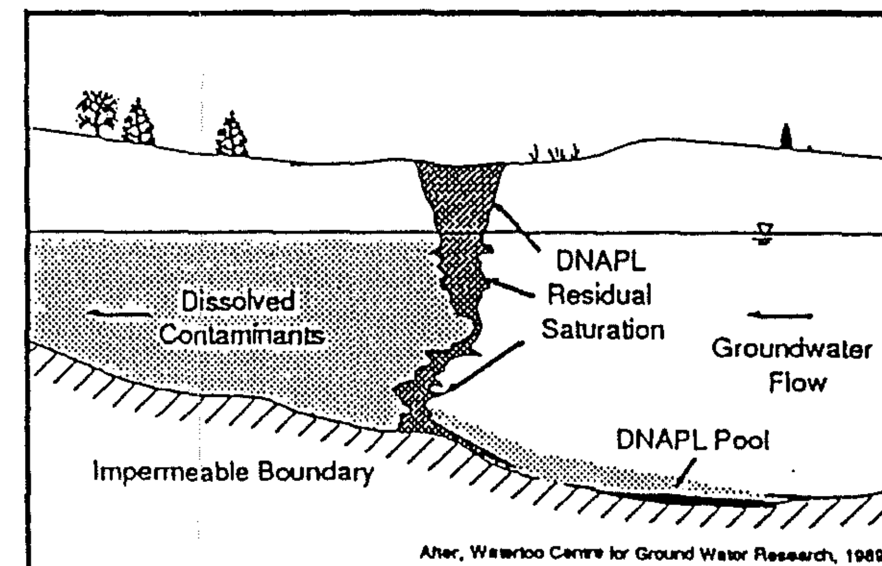
The volume of DNAPL is sufficient to overcome the residual saturation in the vadose zone and consequently penetrates the water table.



Migration of DNAPL through the vadose zone to an impermeable boundary.



Perched and deep DNAPL reservoirs.



Stratigraphic gradient different from ground water gradient results in a different direction of flow of the ground water and continuous phase DNAPL.

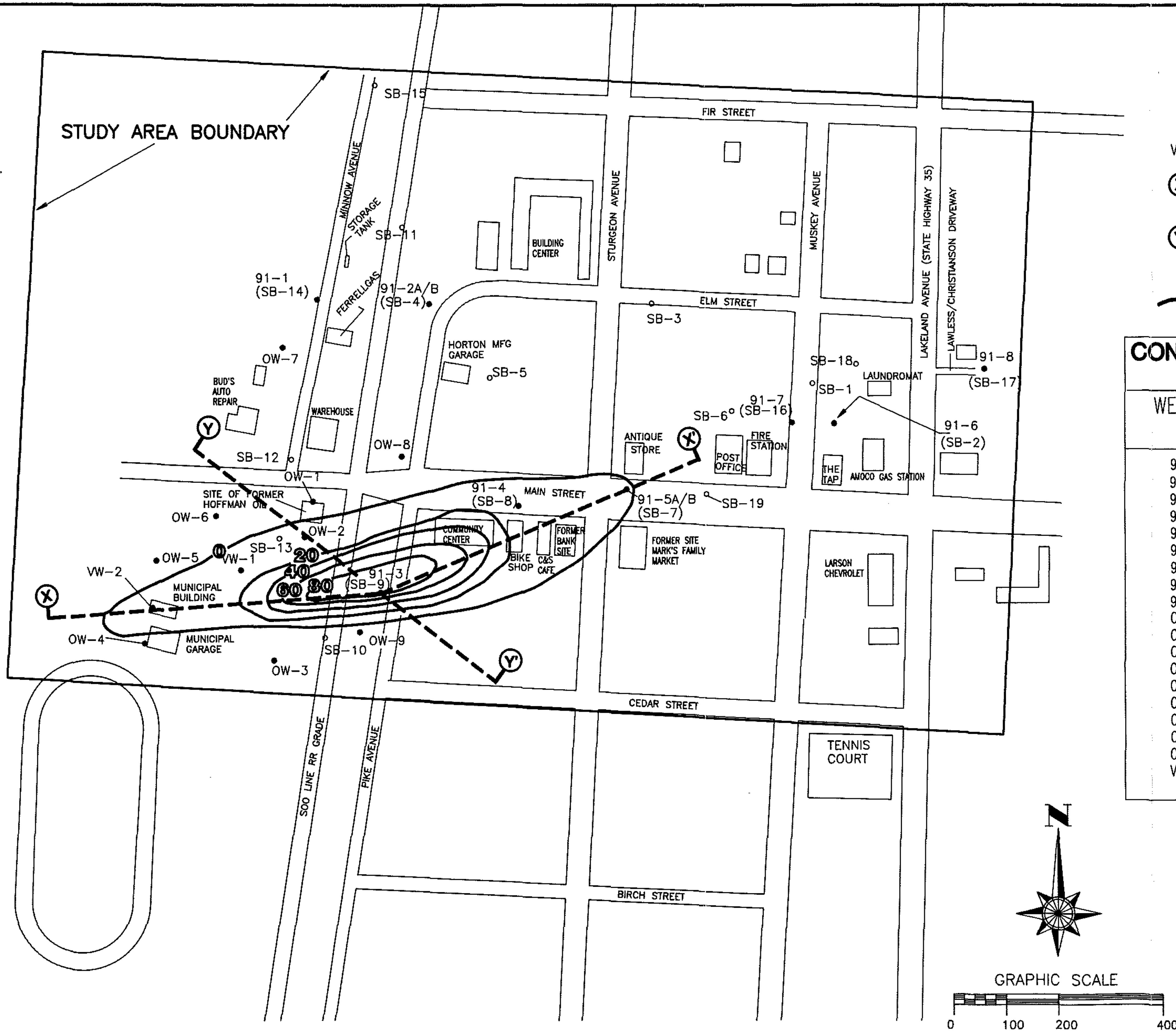
After Huling and Weaver (1991)

FIGURE 21

Various Schemes of Dense Non-Aqueous Phase Liquids (DNAPL) Migration

• Wisconsin DNR •
Remedial Investigation, Task 1

RREM, INC. Engineering and Environmental Consultants



LEGEND

91-6 (SB-2)	LOCATION OF MONITORING WELL AND SOIL BORING
SB-6	LOCATION OF SOIL BORING ONLY
VW-1	LOCATION OF VILLAGE WELL 1
VW-2	LOCATION OF VILLAGE WELL 2
X — X' / Y — Y'	CENTERLINES OF CONCEPTUAL CONTAMINANT PLUME X-SECTIONS
10	1,2 DICHLOROETHANE ISOCON (CONTOURED IN ug/l)

CONTAMINANT CONCENTRATION DATA

WELL #	1,2-DICHLOROETHANE CONCENTRATION
91-1 ------	ND (NOT DETECTED)
91-2A ------	ND
91-2B ------	ND
91-3 ------	83.6
91-4 ------	2.9
91-5A ------	ND
91-6 ------	0.8
91-7 ------	ND
91-8 ------	ND
OW-1 ------	ND
OW-2 ------	4.3
OW-3 ------	ND
OW-4 ------	ND
OW-5 ------	ND
OW-6 ------	ND
OW-7 ------	ND
OW-8 ------	ND
OW-9 ------	ND
VW-2 ------	2.8

FIGURE 22

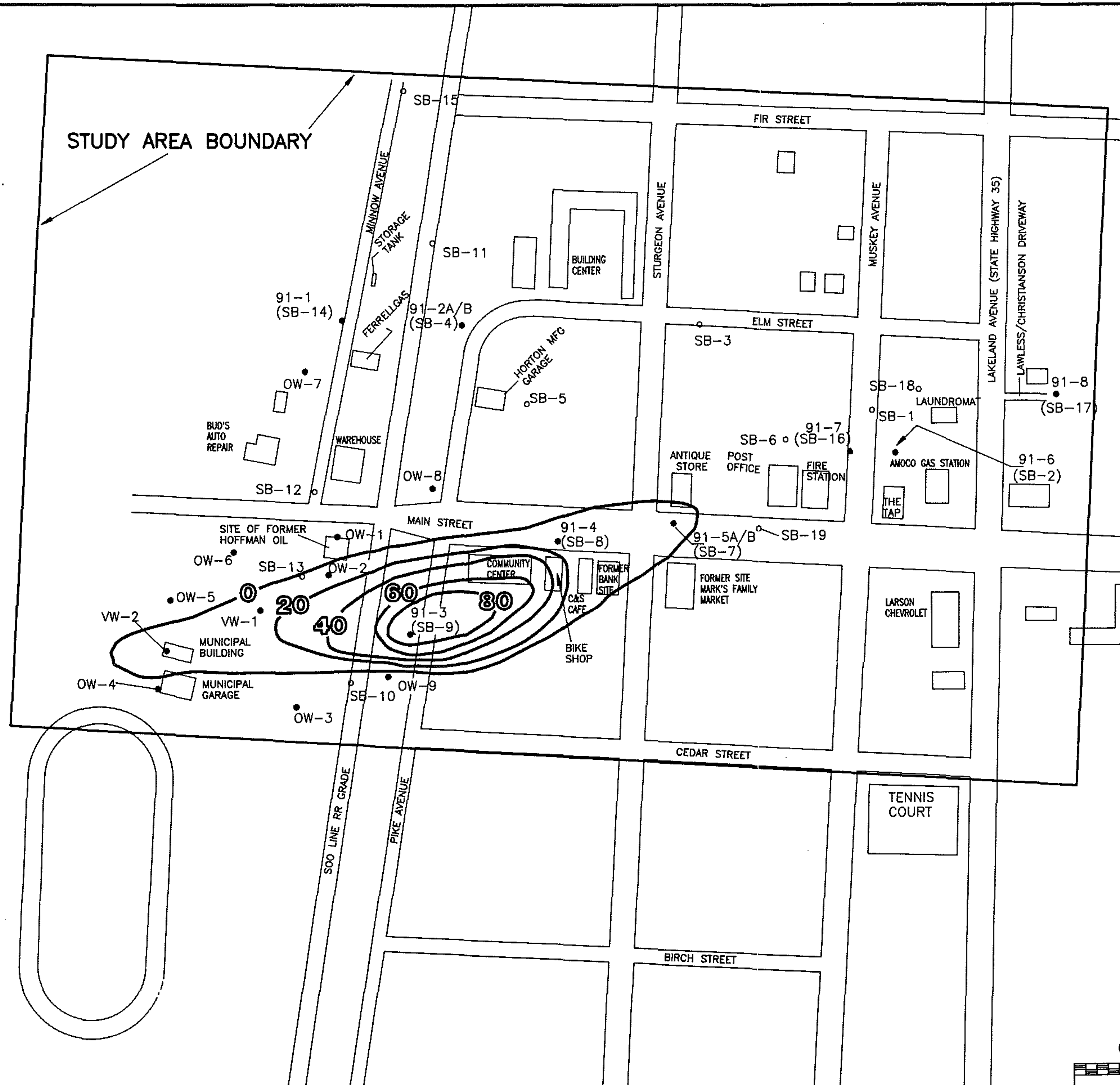
Round 1 Contour Diagram of 1,2-Dichloroethane Concentrations in Groundwater Webster, Wisconsin

- Wisconsin DNR -

Remedial Investigation, Task 1

RMT, INC. Engineering and Environmental Consultants

FILE:9114B-3 VIEW 22 1=200



LEGEND

91-6 (SB-2)	LOCATION OF MONITORING WELL AND SOIL BORING
SB-6	LOCATION OF SOIL BORING ONLY
VW-1	LOCATION OF VILLAGE WELL 1
VW-2	LOCATION OF VILLAGE WELL 2
10	1,2 DICHLOROETHANE ISOCON (CONTOURED IN ug/l)

CONTAMINANT CONCENTRATION DATA

WELL #	1,2-DICHLOROETHANE CONCENTRATION
91-1	ND (NOT DETECTED)
91-2A	ND
91-2B	ND
91-3	90.2
91-4	1.5
91-5A	ND
91-5B	0.8
91-6	ND
91-7	ND
91-8	ND
OW-1	ND
OW-2	2.5
OW-3	ND
OW-4	ND
OW-5	ND
OW-6	ND
OW-7	ND
OW-8	ND
OW-9	ND
VW-2	2.7

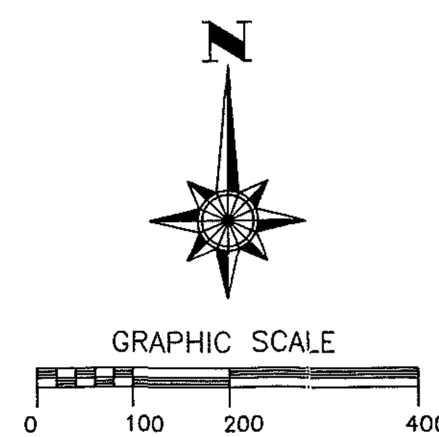


FIGURE 23

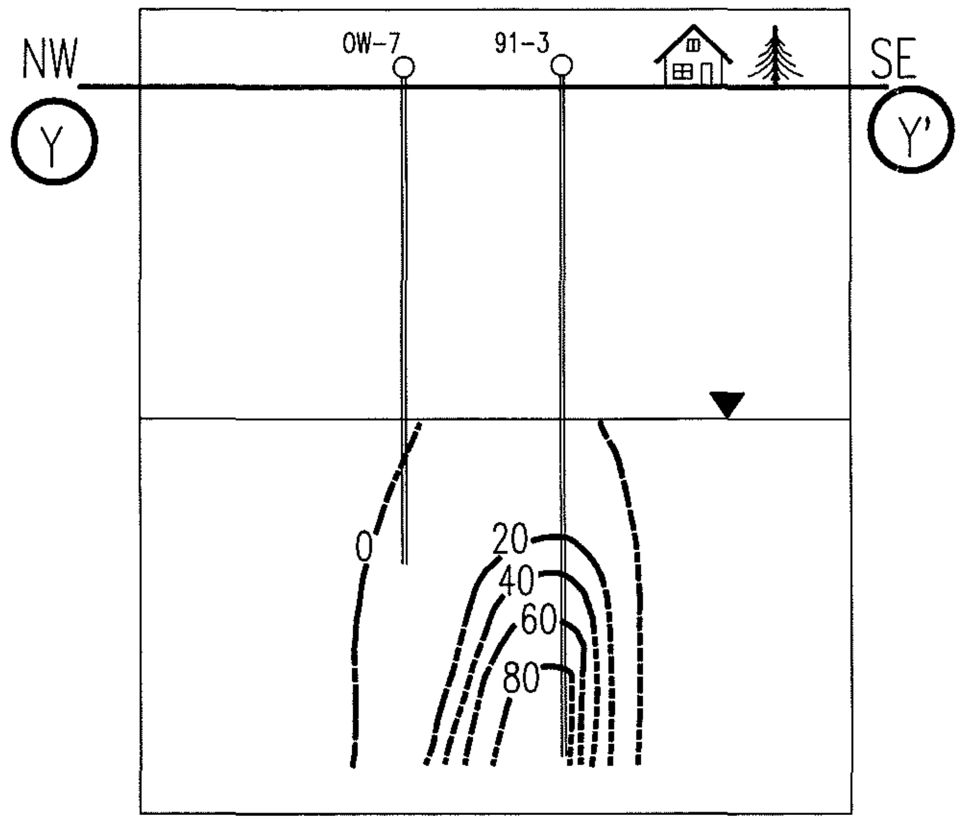
Round 2 Contour Diagram of 1,2-Dichloroethane Concentrations in Groundwater Webster, Wisconsin

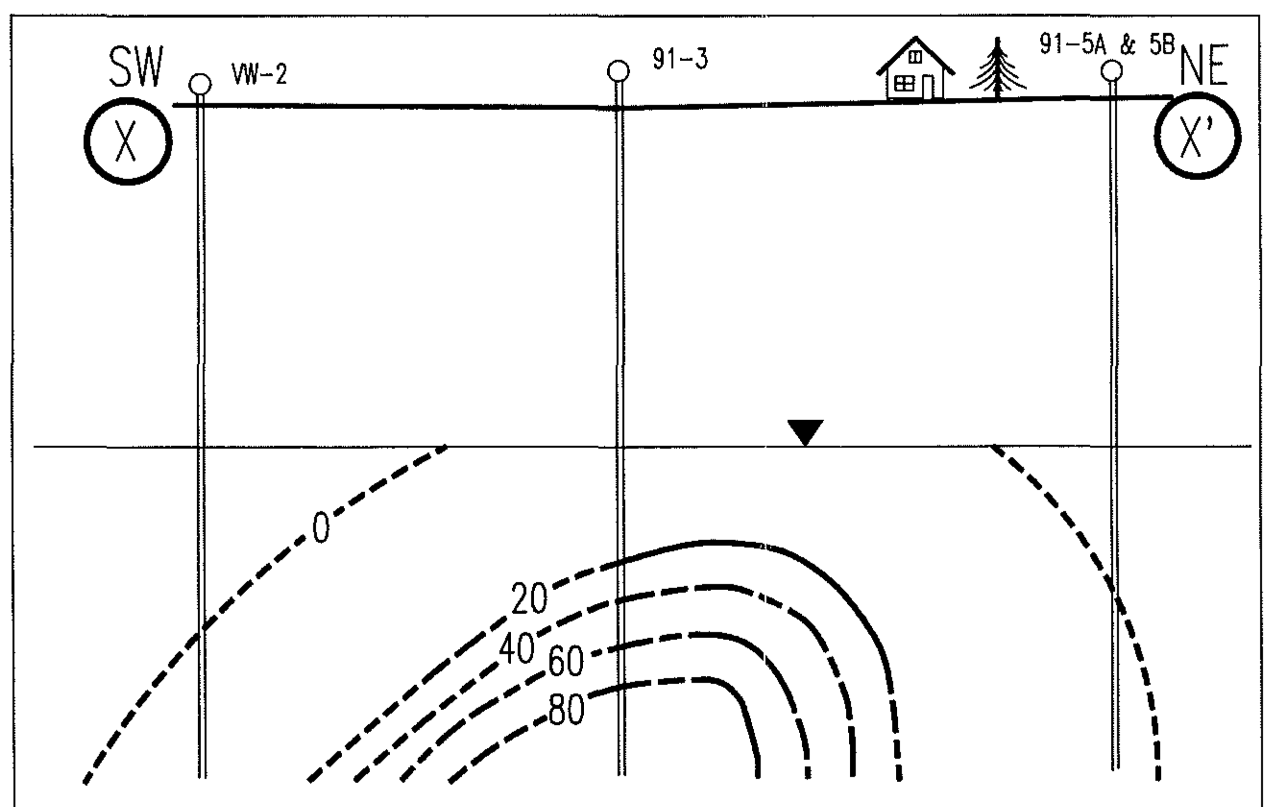
- Wisconsin DNR -

Remedial Investigation, Task 1

RREM, INC. Engineering and Environmental Consultants

FILE:9114B-3 VIEW 23 1=200





LEGEND

91-6 LOCATION OF MONITORING WELL

SB-6 LOCATION OF SOIL BORING

20 1,2 DICHLOROETHANE ISOCON (CONTOURED IN ug/l)

WATER TABLE

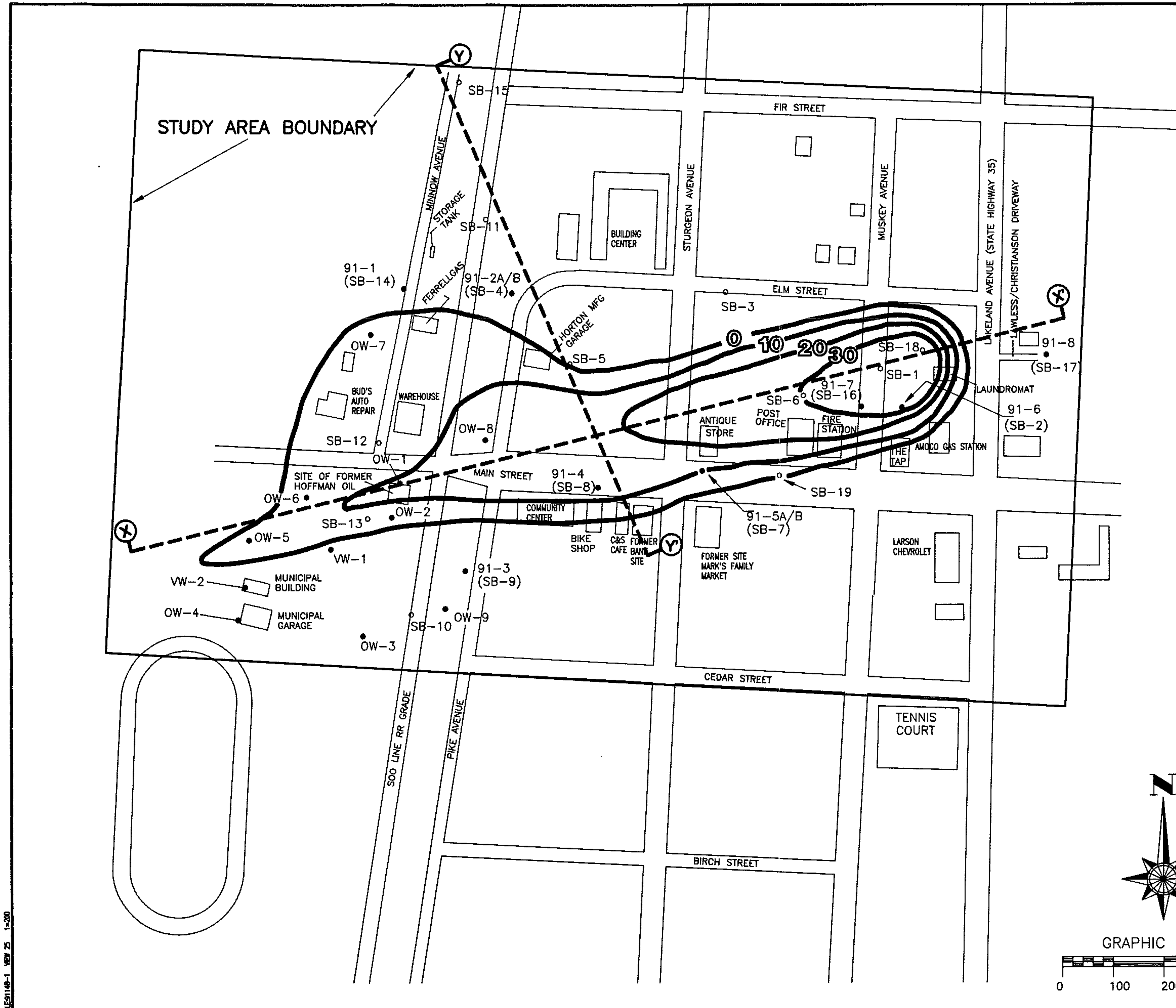
HORZ. SCALE 1"=200'
VERT. SCALE 1"=20'

FIGURE 24

Conceptual Vertical Distribution of 1,2-Dichloroethane Contamination in Groundwater Webster, Wisconsin
- Wisconsin DNR -
Remedial Investigation, Task 1

Engineering and Environmental Consultants

FILE: 9114B-4 VIEW 23 SCALE 1=1



CONTAMINANT CONCENTRATION DATA

WELL #		PCE CONCENTRATION(ug/l)
91-1	------	ND (NOT DETECTED)
91-2A	------	ND
91-2B	------	112
91-3	------	ND
91-4	------	15.3
91-5A	------	8
91-5B	------	ND
91-6	------	31.8
91-7	------	ND
91-8	------	ND
OW-1	------	13.8
OW-2	------	2.3
OW-3	------	ND
OW-4	------	ND
OW-5	------	3.5
OW-6	------	1.3
OW-7	------	1.3
OW-8	------	13.2
OW-9	------	ND
VW-2	------	ND

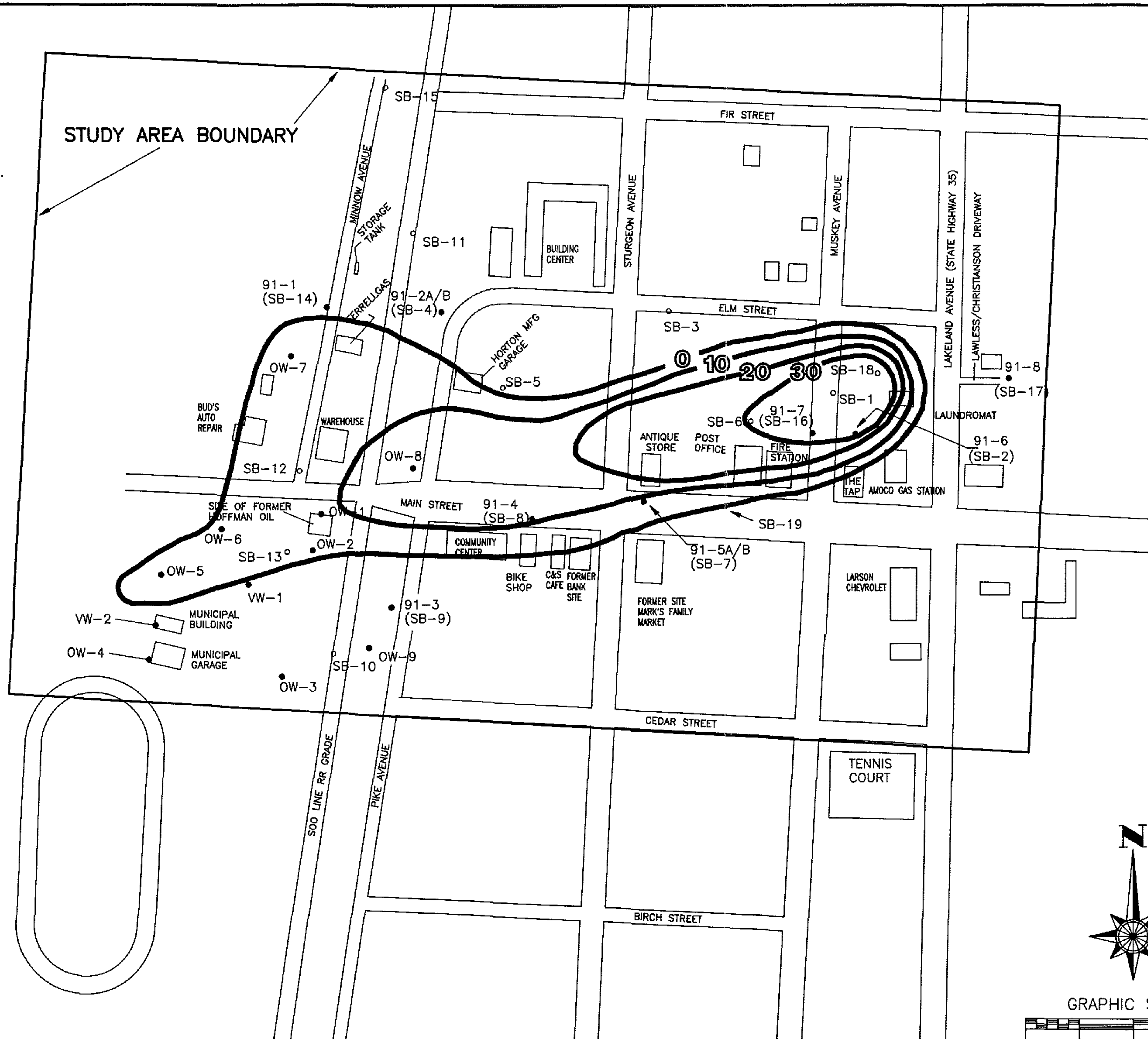
FIGURE 25

Round 1 Contour Diagram of Tetrachloroethylene Contamination in Groundwater Webster, Wisconsin

• Wisconsin DNR •

Remedial Investigation, Task 1

RMT, INC. Engineering and Environmental Consultants



LEGEND

91-6 (SB-2)	LOCATION OF MONITORING WELL AND SOIL BORING
SB-6	LOCATION OF SOIL BORING ONLY
VW-1	LOCATION OF VILLAGE WELL 1
VW-2	LOCATION OF VILLAGE WELL 2
10	TETRACHLOROETHYLENE ISOCON (CONTOURED IN ug/l) AT TOP OF WATER TABLE

CONTAMINANT CONCENTRATION DATA

WELL #		PCE CONCENTRATION(ug/l)
91-1	------	ND (NOT DETECTED)
91-2A	------	ND
91-2B	------	105
91-3	------	ND
91-4	------	11.5
91-5A	------	5.1
91-5B	------	ND
91-6	------	32
91-7	------	0.6
91-8	------	ND
OW-1	------	9.4
OW-2	------	1.2
OW-3	------	ND
OW-4	------	ND
OW-5	------	2.1
OW-6	------	0.9
OW-7	------	1.6
OW-8	------	12.9
OW-9	------	ND
VW-2	------	ND

FIGURE 26

Round 2 Contour Diagram of Tetrachloroethylene Contamination in Groundwater Webster, Wisconsin

- Wisconsin DNR -

Remedial Investigation, Task 1

RRBM, INC. Engineering and Environmental Consultants

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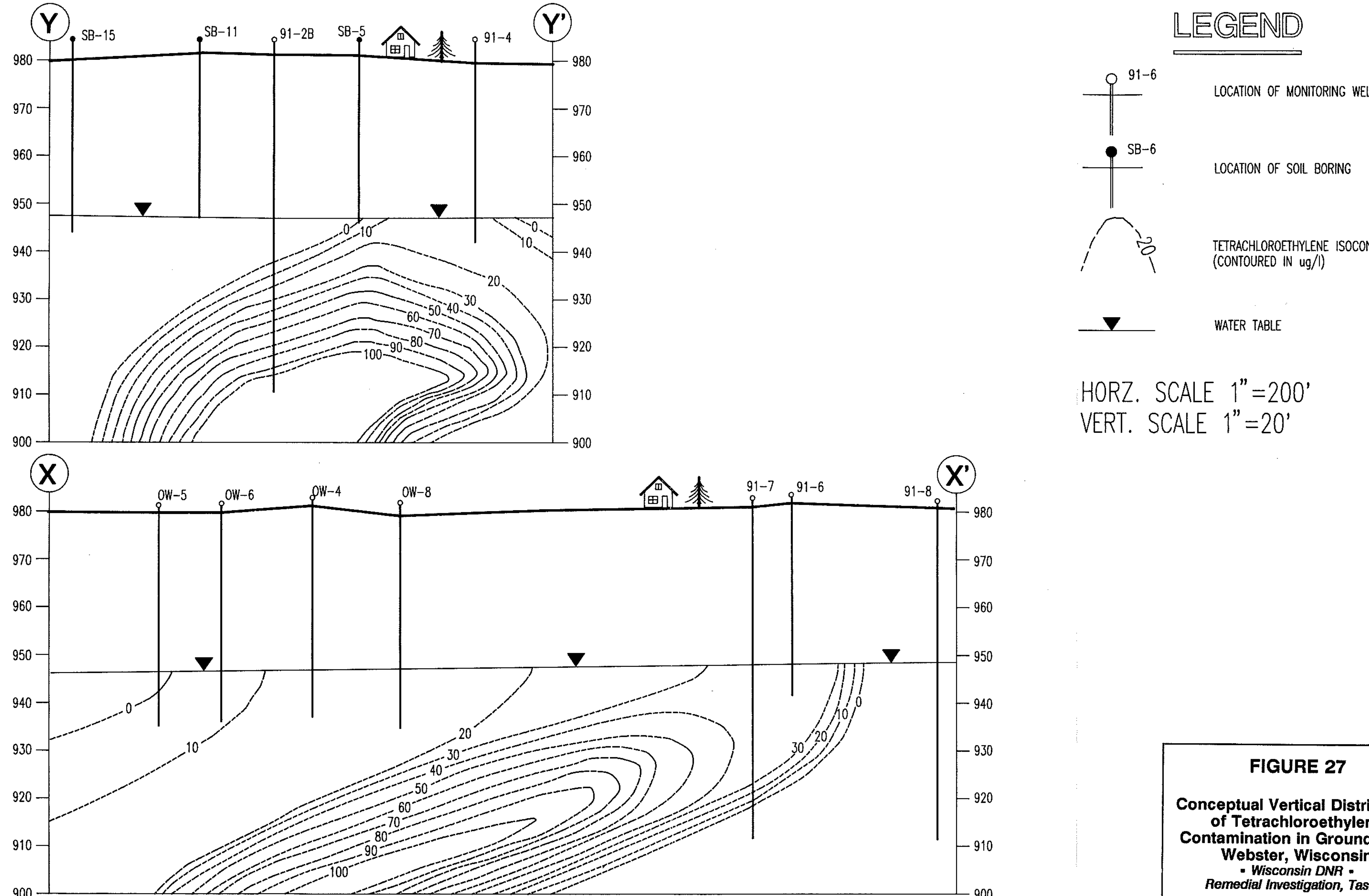

FIGURE 27

Conceptual Vertical Distribution of Tetrachloroethylene Contamination in Groundwater Webster, Wisconsin

• Wisconsin DNR •

Remedial Investigation, Task 1

Engineering and Environmental Consultants

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