Environmental Resources Management

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March 2, 1999

Mr. Mark Putra
Wisconsin Department of Natural Resources
Horicon Area Headquarters
N7725 Highway 28
Horicon, WI 53032

ERM®

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RE: Natural Attenuation Assessment and "Bedrock Well" Installation
Johnson Controls, Inc.
Watertown, Wisconsin

Dear Mr. Putra:

This letter describes the natural attenuation assessment and bedrock well installation activities proposed for the Johnson Controls Inc. (JCI) site located in Watertown, Wisconsin (the "Site"). Environmental Resources Management-North Central, Inc. (ERM) will complete this work on behalf of JCI pursuant to your October 28, 1998 request.

SITE HISTORY

Results of investigations performed previously at the Site identified the presence of trichloroethene (TCE); 1,1,1-trichloroethane (1,1,1-TCA); tetrachloroethene (PCE); and their breakdown products in soil and ground water. Three source areas for soil contamination were identified: (1) the area beneath the existing building where the former chemical shed was located, (2) the area on the north side of the existing building where the aboveground storage tank (AST) was located, and (3) the area east of the existing building where the former waste storage area was located. Soil was removed from the former AST area and ground water extraction and treatment remediation activities were conducted in the former waste storage area.

Results of the investigations conducted at the Site indicated that the former chemical shed located beneath the existing building is the primary source of concentrations of volatile organic compounds (VOCs) in the ground water beneath the Site. To address this area, ERM prepared and submitted the *Remedial Action Design Report* in July 1996 (the RADR) to

Wisconsin Department of Natural Resources (WDNR) on behalf of JCI. The RADR proposed source control using soil vapor extraction (SVE) and natural attenuation as the remedial action. The SVE system has been operating since February 1997. Since August 1996 JCI has been monitoring the concentration of chlorinated solvents in the ground water underlying the Site by sampling nine ground water monitoring wells for VOCs semiannually.

At the time of submittal of the RADR, the state of Wisconsin was revising the response action case closure regulations to include the use of natural attenuation. The revisions became effective November 1996. In 1997, WDNR promulgated a guidance document entitled, *Selection of Natural Attenuation of Ground Water Restoration and Case Closure Under Section NR 726.05(2)(b)* (the "Guidance Document". The regulations and guidance document define the requirements for demonstrating that natural attenuation is effective and acceptable as a final ground water remedy. In your letter to Richard Tietz dated October 28, 1998 you requested that JCI conduct a natural attenuation assessment in accordance with the new regulations and guidance. In addition, you recommended that JCI install two bedrock monitoring wells to determine the vertical extent of the existing chlorinated solvent plume.

SITE GEOLOGY AND HYDROGEOLOGY

Watertown is located within the glaciated zone of Wisconsin. Surface deposits consist of 30 to 100 feet of unconsolidated till material overlain by silt loam or silty clay loam soils. Ordovician-aged bedrock is encountered beneath the unconsolidated material.

The uppermost bedrock unit in the Watertown area is the Sinnipee Group, which is composed primarily of the Galena Dolomite. The Galena Dolomite ranges from 200 to 250 feet thick and dips toward the east in this region. In some areas, in the vicinity of Watertown, the Ancell Group is the uppermost bedrock unit encountered. This unit underlies the Sinnipee Group stratigraphically, but due to the eastern dip of the units, the Sinnippee/Ancell contact can be located in the area. The Ancell Group consists primarily of the St. Peter sandstone with some shale and conglomerate units. The St. Peter sandstone ranges from 0 to 200 feet thick and is one of the major water-bearing formations in southern and southeastern Wisconsin.

Soil samples obtained during monitoring well installation, soil boring and Geoprobe® sampling activities at the Site were used to develop a description of the geology beneath the Site. The geology beneath the Site generally consists of sandy, silty clay and clayey, silty sand from the ground surface to 30 to 40 feet below ground surface (BGS) where bedrock has been encountered. Figure 1 presents a cross-section of the geology beneath the Site. Ground water has generally been encountered from 6 to 8 feet BGS. Water level measurements taken in monitoring wells during semiannual ground water monitoring events at the Site indicate that there is consistently a ground water flow divide that runs in a north-south direction beneath the plant building (see Figure 2).

BEDROCK WELL INSTALLATION

Prior to the conducting the natural attenuation assessment, JCI installed two new ground water monitoring wells (MW-24 and MW-25 approximate locations shown on Figure 2) and replaced one existing shallow well (MW-3RR replaces MW-3R). The "bedrock wells" are were installed to determine if concentrations of chlorinated solvents in the unconsolidated soils at the Site have impacted the ground water in the bedrock unit. Therefore, the bedrock wells were installed where previous investigations and data analyses indicate the bedrock unit may be affected. The existing shallow well was replaced to investigate ground water quality in the former AST location.

Under the supervision of an ERM geologist, Boart Longyear Company (Boart Longyear) of Schofield, Wisconsin advanced three borings at the Site for the purpose of installing monitoring wells MW-3RR, MW-24, and MW-25 on November 23, 24, 25, 30, and December 1 and 2, 1998, using the following procedures. Details of the well installation and development will be provided in a well construction report.

Boart Longyear, along with ERM personnel, developed monitoring wells MW-3RR, MW-24, and MW-25 on December 4, 1998. The bedrock wells were developed using a submersible purge pump, and MW-3RR was developed using a dedicated bailer. Approximately 100 gallons were removed each from MW-24 and MW-25, and 25 gallons from MW-3RR. Ground water removed during the development of the wells was placed in DOT-approved steel drums, labeled appropriately, and stored on site for future characterization and management.

NATURAL ATTENUATION ASSESSMENT

ERM and JCI followed WDNR's Guidance Document in developing the scope of work for the natural attenuation assessment.

Well Selection

There are 36 existing wells at the Site. ERM proposes to sample 19 of the existing monitoring wells, replacement well MW-3RR, and the two new "bedrock wells". The wells to be sampled generally fall into four groups based on their locations at the Site: background wells, wells along the centerline of the primary plume from the main source area, wells along the centerline of a directional shift in the cis-1,2, dichloroethene (cis-1,2-DCE) and vinyl chloride portions of the plume, wells comprising "transects" across the primary plume, and wells installed in small secondary sources areas. Within these groups, ERM attempted to select wells from various depths. The wells to be sampled are listed on Table 1. On Table 1, ERM has roughly determined the well type based on depth (i.e., shallow, intermediate, deep, and bedrock).

Background Wells

Background wells are intended to assess background ground water quality. Background wells are usually wells located upgradient of source areas. The Site is unique in that there is a ground water divide below the main building. However, there are five existing wells that can serve at background wells because: (1) the wells are upgradient of source areas and/or they are located on the other side of the ground water divide, and (2) ground water samples collected from the wells have not shown detectable concentrations of chlorinated solvents. The potential background wells are: MW-1, MW-2, MW-7, MW-9, and MW3-93-4. ERM proposes to sample MW3-93-4 as the background well.

Primary Plume Centerline Wells

The primary chlorinated solvent plume extends from the former chemical storage shed (the primary source area), under the existing shed, and toward the wetland area in a southeasterly direction. There are a number of wells lying within or near the centerline of the primary plume. ERM proposes to sample six of these wells and new bedrock well MW-24 located west of the existing shed.

Directional Shift Centerline Wells

In 1996, ERM analyzed the Site's historic ground water sampling results and prepared a three-dimensional approximation of the TCE, cis-1,2-DCE,

and vinyl chloride plumes. As part of the development of the RADR, ERM prepared two-dimensional figures showing isconcentration lines at various depths. These figures were essentially cross sections of the three-dimensional approximations (RADR Appendix A). The two-dimensional plots show a slight shift in the direction of cis-1,2-DCE and vinyl chloride portions of the primary plume. This may be the result of the former ground water extraction and treatment in the existing shed area conducted approximately 1993 to 1995.

There are several wells located along or near the centerline of this plume shift. ERM proposes to sample five of these wells and the new bedrock well MW-25 installed east of the existing shed.

Plume "Transect" Wells

USEPA is currently conducting a series of seminars across the country presenting their criteria for selection natural attenuation as a remedial action. USEPA requires a number of "transects" or lines of wells (or ground water sample points) perpendicular to the plume centerline to establish plume width. Although the monitoring wells at the Site were not installed with this in mind, there are several wells at the Site that can be used to define the width of the existing plume. ERM proposes to sample six of these wells.

Secondary Source Wells

There are two small source areas that have impacted ground water in areas other than the primary plume at the Site. One is the former AST formerly located on the north side of the Site. ERM proposes to sample monitoring well MW-3RR to assess ground water conditions in this area. The second small source that has impacted ground water is located near the north east corner of the main building. ERM proposes to sample MW-12S and MW-12D located in this area.

Ground Water Analyses

Ground water samples will be analyzed for the following parameters recommended in the current natural attenuation assessment guidance literature:

- Target Compound List VOCs using the Contract Laboratory Program low concentration method Statement of Work OLC02.0;

- Dissolved oxygen, temperature, reduction-oxidation potential, and pH using field instrumentation;

- Nitrate and nitrite using USEPA Method 353.2;
- Sulfate using USEPA Method 375.4;
- Alkalinity using USEPA Method 310.2;
- Dissolved total iron, ferrous iron, and manganese using USEPA Method 6010 and 6010A;
- Total organic carbon using USEPA Method 415.1;
- Ethene and ethane; and
- Chloride using USEPA Method 325.2.

Water levels will be measured in all existing monitoring wells and the two new "bedrock wells." The water levels will be used to develop shallow and deep water table maps and to determine general ground water direction in the bedrock unit, if possible.

CONCLUSION

The results of the ground water sample analyses will be evaluated to determine effectiveness of natural attenuation as a final ground water remedy. In completing the evaluation, JCI will make use of current natural attenuation guidance literature including the following:

- WDNR's Guidance Document;
- *Technical Protocol for Implementing Intrinsic Remediation with Long-Term Monitoring for Natural Attenuation of Chlorinated Solvents Dissolved in Ground Water*, United States Air Force Center for Environmental Excellence, Technology Transfer Division, 1998;
- *Seminars - Monitored Natural Attenuation for Ground Water*, USEPA Office of Research and Development, Washington DC, September 1998;

- *Use of Monitoring Natural Attenuation at Superfund, RCRA Corrective Action and Underground Storage Tank Sites*, Office of Solid Waste and Emergency Response Directive 9200.4-17, December 1, 1997; and

- *Natural Attenuation of Chlorinated Solvents in Ground Water: Principles and Practices*, Industrial Members of the Bioremediation of Chlorinated Solvents Consortium of The Remediation Technologies Development Forum, August 1997.

JCI will present WDNR with a report outlining the results of this natural attenuation assessment, including the concentration of VOCs detected in samples collected from the new bedrock wells. The report will include a description of the field activities, laboratory reports, a summary of the evaluation of the effectiveness of natural attenuation, and a proposed list of geochemical indicator parameters for long term monitoring of natural attenuation.

If you have any questions or comments, please call me or Jim Polich at (847) 680-6868.

Very truly yours,

ERM-NORTH CENTRAL, INC.

Victoria L. Oster

Victoria L. Oster, P.E.
Senior Project Engineer

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Attachment

cc: Richard A. Tietz, Johnson Controls, Inc.
James Polich, ERM-North Central, Inc.

TABLE 1

WELLS SELECTED FOR GROUND WATER SAMPLING
NATURAL ATTENUATION ASSESSMENT
JOHNSON CONTROLS, INC.
WATERTOWN, WISCONSIN

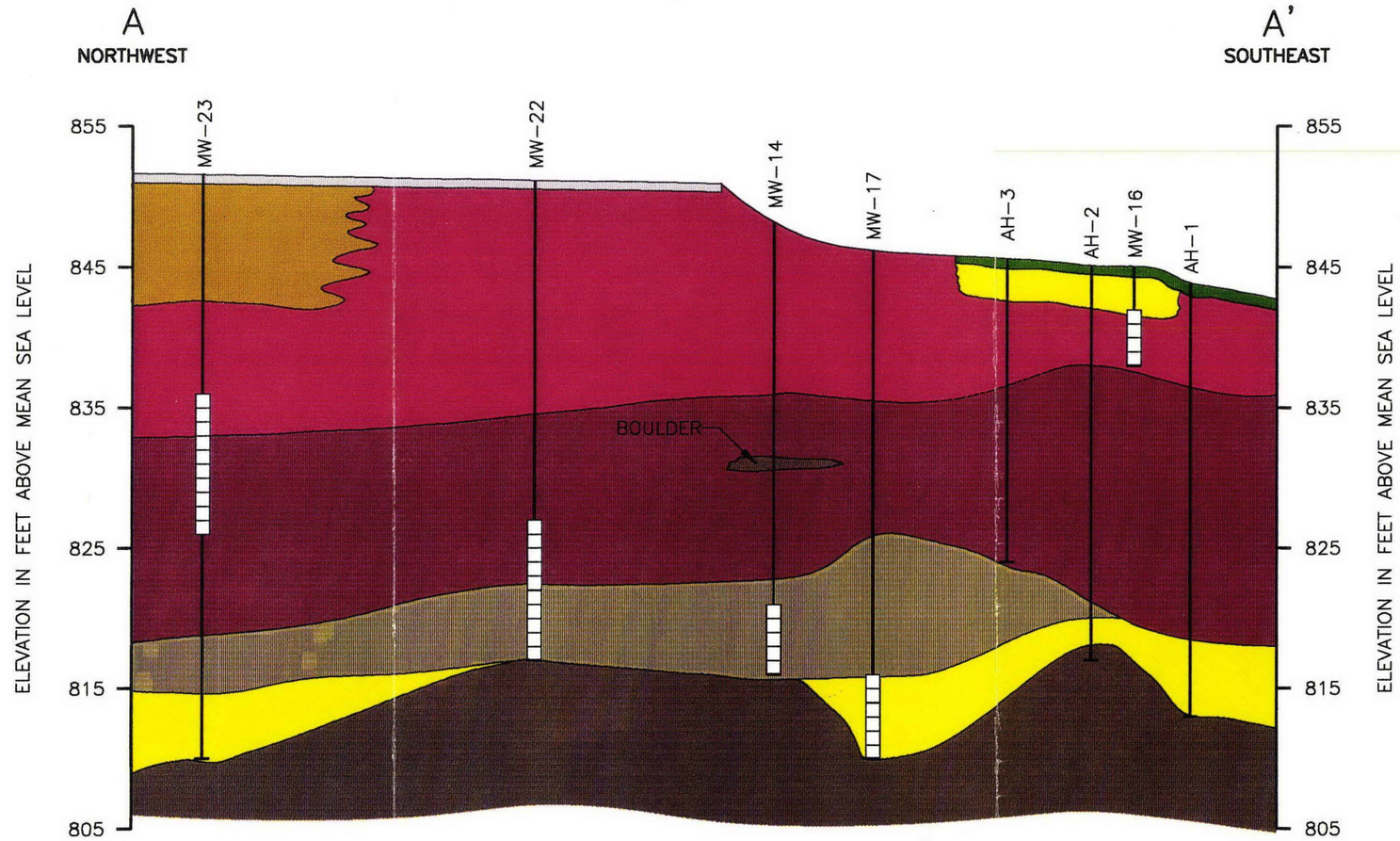
Location	*Total Depth (feet bgs)*	*Well Type*	*Top of Screen (feet bgs)*	*Bottom of Screen (feet bgs)*	*Screen Midpoint (feet bgs)*	*Bedrock (feet bgs)*	*Surface Elevation (feet)*	*Top of Casing (feet)*
Background Wells								
MW3-93-4	21	Shallow	11	16	13.5	-	851.04	853.92
Primary Plume Centerline Wells								
MW-11	13.4	Shallow	3.1	13.1	8.1	-	849.18	851.5
MW-14	31	Deep	26	31	28.5	31	846.99	849.67
MW-16	7.5	Shallow	3	7.5	5.25	-	845.16	848.47
MW-22	34.5	Intermediate	24.5	34.5	29.5	35	851.54	851.08
MW-23	25.5	Shallow	15.5	25.5	20.5	42	851.88	851.36
MW-24	47	Bedrock	42	47	44.5	34.5	TBD	TBD
Directional Shift Centerline Wells								
MW-13	28.5	Shallow	12	17	14.5	28.5	845.39	847.9
MW-17	35	Deep	30	35	32.5	35.5	845.86	848.75
MW-18	15	Shallow	10	15	12.5	-	846.29	849.01
MW-19	15	Shallow	10	15	12.5	-	845.48	848.26
MW3-93-3	22	Shallow	9	19	14	-	846.99	849.28
MW-25	52	Bedrock	47	52	49.5	40	TBD	TBD
Plume "Transect" Wells								
MW3-93-2	22	Intermediate	18	23	20.5	29	846.38	849.28
MW3-93-5	30	Shallow	11	16	13.5	-	850.29	853.19
MW-8	13.1	Shallow	13.1	13.1	8.1	-	848.02	844.92
MW-15	33	Deep	27.5	32.5	30	33	847.53	849.76
MW-20	35	Intermediate	25	35	30	35.5	851.22	851.12
MW-21	30	Intermediate	20	30	25	31	850.93	850.84
Secondary Source Wells								
MW-12S	18	Shallow	13	18	15.5	-	850.93	854.41
MW-12D	42.5	Deep	37	42	39.5	42	850.96	854.27
MW-3RR	14	Shallow	10	14	12	-	TBD	TBD

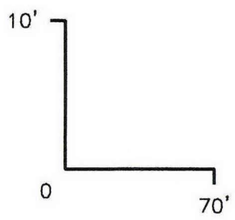
Key:

bgs = Below ground surface

\- = The well installation soil boring was not advanced to bedrock.

TBD = To be determined.



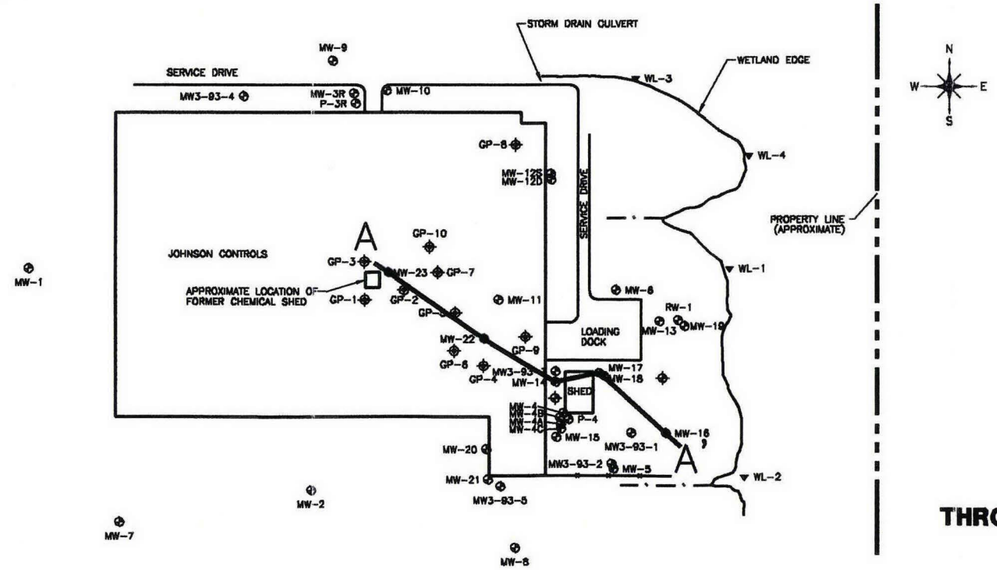


SCALE

VERTICAL EXAGGERATION = 7x

SYMBOL LEGEND

CONTACT	CONCRETE
INFERRED CONTACT	SANDY, SILTY CLAY
BORING	BEDROCK
SCREENED INTERVAL	PEAT
BOTTOM OF BORING	SAND AND GRAVEL
	PEBBLY SAND
	CLAYEY, SILTY SAND
	SILTY SAND



CROSS SECTION LOCATION MAP

FIGURE 1

GEOLOGIC CROSS SECTION THROUGH PROPOSED SOIL BORING AREA JOHNSON CONTROLS, INC. WATERTOWN, WISCONSIN

ERM

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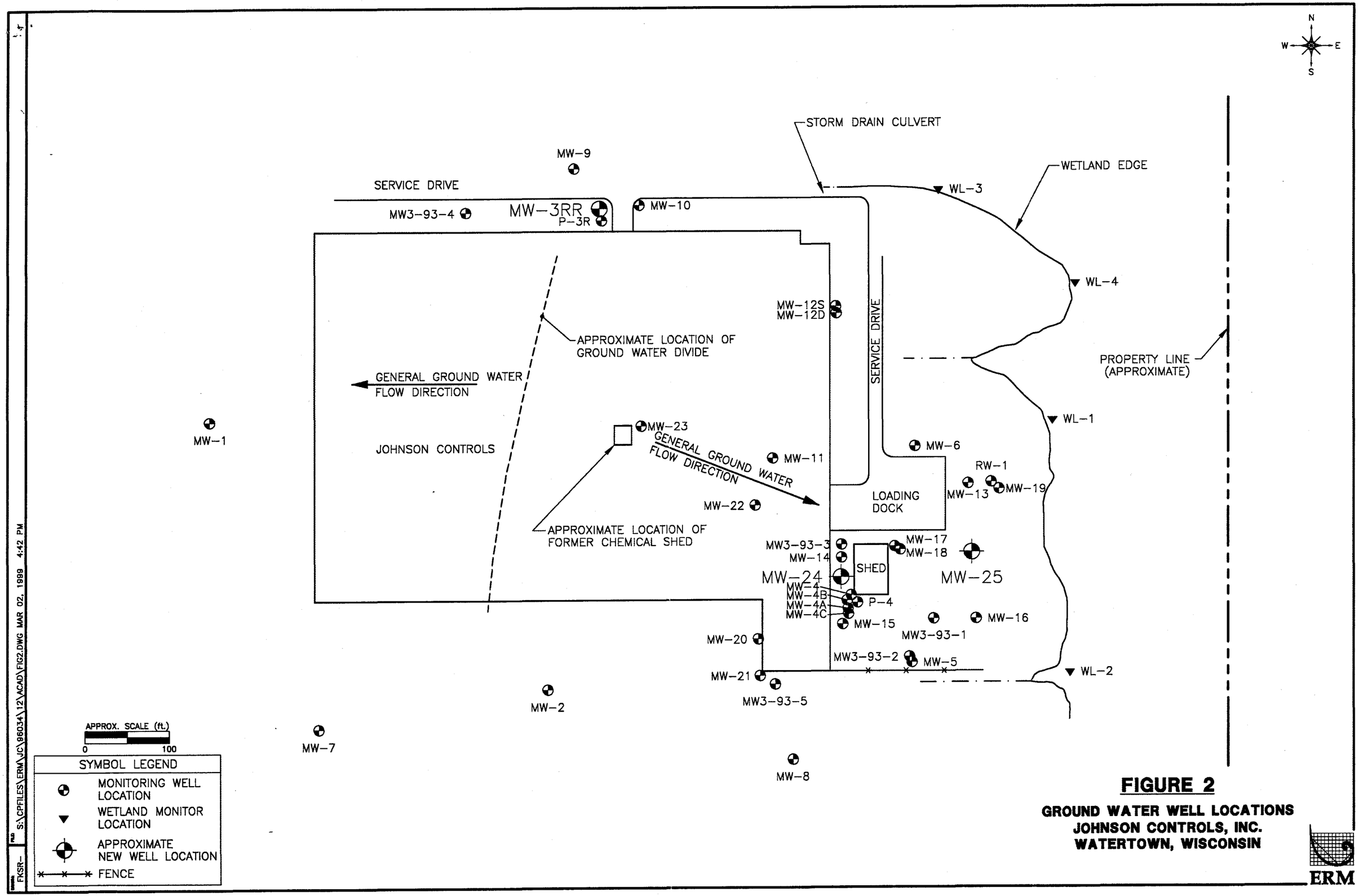

FIGURE 2

GROUND WATER WELL LOCATIONS
JOHNSON CONTROLS, INC.
WATERTOWN, WISCONSIN

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