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TECHNICAL MEMORANDUM #3
BASELINE RISK
ASSESSMENT DATA SUMMARY

July 17, 1992

Prepared For:

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TECHNICAL MEMORANDA APPENDICES

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ACRONYMS

ARARs	Applicable or Relevant and Appropriate Regulations, Guidelines, and Criteria
BRA	Baseline Risk Assessment
NPL	National Priority List
OU	Operable Unit
RD/RA	Remedial Design/Remedial Action
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SER	Task I Site Evaluation Report, Remedial Investigation/Feasibility Study, Sta-Rite Industries, Inc., Delavan, Wisconsin
Work Plans	Task II Project Work Plans, Remedial Investigation/Feasibility Study, Sta-Rite Industries, Inc., Delavan, Wisconsin
Sta-Rite	Sta-Rite Industries, Inc.
SVES	Soil Vapor Extraction System
TCA	1,1,1-Trichloroethane
TCE	Trichloroethylene
TOC	Total Organic Carbon
USCS	Unified Soil Classification System
U.S. EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compound
WDHSS	Wisconsin Department of Health and Social Services
WDNR	Wisconsin Department of Natural Resources
WGNHS	Wisconsin Geologic and Natural History Survey

1.0 EXECUTIVE SUMMARY

This Technical Memorandum presents the results of Remedial Investigation (RI) activities which were performed to enable the Wisconsin Department of Natural Resources (WDNR) to prepare a Baseline Risk Assessment at the Sta-Rite Industries, Inc. (Sta-Rite) manufacturing facility in Delavan, Wisconsin. The objectives included characterization of the human population around the Sta-Rite facility including identification of sensitive receptors and downgradient private water supply wells; evaluation of volatile organic compound (VOC) concentrations in the municipal distribution system; evaluation of VOC emissions from the existing Plant #2 Soil Vapor Extraction System (SVES) and from the extraction well discharges to the storm sewer; evaluation of surface water, sediments, and air where extraction well discharges exit the storm sewer system; identification of flora and fauna in and around the site and critical habitats; and evaluation of VOC mobility in soil via pH and total organic carbon (TOC) analysis.

The population of the City of Delavan is currently about 6,000 persons. Agriculture, some industry and residential and commercial development are present near the Sta-Rite facility. A total of five potentially sensitive receptors were identified within a one-mile radius of the facility. Through a cooperative effort with the City of Delavan, the location of potentially operational private water supply wells within the area of investigation were investigated. One of the two private water wells found within the study area was sampled as part of this effort and no VOCs were detected. The second private well is a closed-loop air conditioning system and permission to sample has not been granted by the well owner.

A sample of City water was to be collected to evaluate the quality of water in the municipal distribution system utilizing water from City Well #4; however the City of Delavan ceased pumping from City Well #4 for use in the water supply during RI field activities. No water sample was therefore collected from the distribution system. A water sample will be collected if City Well #4 is put back on the system for a period long enough to allow a representative sample of blended water to be collected. However, the results of trichloroethylene (TCE) analysis from samples collected during pumping at City Well #3 and City Well #4 are available from 1982 through February 1992. The results of these analyses indicate a substantial decrease in TCE in City Well #4 over time.

Direct measurement of VOCs in air samples from the air discharge for the existing Plant #2 SVES and the storm sewer SS-2 outlet which receives extraction well water discharges revealed no VOCs. Mass balance calculations were performed to evaluate the potential emission of VOCs from extraction well water to the storm sewer system. These calculations indicated approximately 75% of the VOCs in extracted ground water volatilize along the storm sewer system. The remaining 25% are discharged to surface water. The compound which accounted for the majority of the VOCs was 1,1,1-trichloroethane.

Two surface water and three sediment samples were collected from the storm sewer discharge point SS-2 and analyzed for VOCs. The sediment samples were collected at three different locations in the creek bed at distances from 0 to 12 feet from the storm sewer discharge point. The results of surface water and sediment sampling analyses indicated VOCs at the storm sewer SS-2 discharge point in concentrations below relevant standards.

An ecological assessment of the area was conducted to identify the vascular flora and vertebrate fauna, to locate sensitive and critical habitats and species of concern, and to identify potential threats to humans or the environment which may be associated with Sta-Rite operations. The results of the ecological investigations indicate the Sta-Rite facility offers no significant habitat for native flora and fauna.

Surface storm water runoff from the site is discharged mainly into the city storm sewer which discharges to Lower Swan Creek and thence to Turtle Creek. A small portion of the storm water from the southeast portion of the facility drains to a five-acre pond located southeast of Plant #2. Ground-water extracted from the seven Sta-Rite extraction wells is also discharged to the storm sewer system. No endangered non-fish vertebrates nor terrestrial species consumed by humans were found along the surface water corridor downstream of the SS-2 discharge point. One state-listed threatened plant species was found in one raised peat hump at an elevation well above base flow and flood levels.

No evidence of damage to terrestrial or wetland flora or fauna or their habitats was found which could be attributed to past or present operations at Sta-Rite. In contrast, historic agricultural and urban events in the area likely cause ongoing impacts to these natural areas, including flash floods, silt deposition, alien species invasion, and possible ground water diversion unrelated to Sta-Rite affecting the local wetlands and waterways.

Per WDNR request, fifteen soil samples were collected and submitted for analysis of TOC and pH; five samples from one borehole at Plant #2, and five samples each from two boreholes at Plant #1. The results indicate a neutral to slightly basic pH and TOC concentrations ranging from 16,800 ppm for topsoil to 1,330 ppm for the sand and gravel outwash unit. TOC values for the silty sand unit ranged between 1,470 ppm and 10,900 ppm. The higher TOC concentrations were found in the borehole which had the highest VOC impacts according to laboratory results.

2.0 INTRODUCTION

2.1 Purpose

Technical Memorandum #3 presents the results of Remedial Investigation (RI) activities which were performed to enable the Wisconsin Department of Natural Resources (WDNR) to prepare a Baseline Risk Assessment (BRA) at the Sta-Rite Industries, Inc. (Sta-Rite) manufacturing facility in Delavan, Wisconsin (Figure 2-1).

2.2 Scope

The scope of work performed during the RI investigation is detailed in the Task II Project Work Plans (Work Plans), Sta-Rite Industries, Inc., Delavan, Wisconsin (Hydro-Search, Inc., September 27, 1991). The Work Plans organized the RI activities into operable units (OUs) based on an earlier evaluation of likely response actions for the site and identification of those remedial activities which had the potential to be conducted independently during the Remedial Investigation/Feasibility Study (RI/FS) and Remedial Design/Remedial Action (RD/RA). The OUs were categorized by specific media (e.g. soil, ground water, etc.) and/or location (e.g. Plant #1, Plant #2; Plate I) based on work elements which could be conducted relatively independently.

Pump tests and other hydraulic studies conducted previously by Hydro-Search, Inc. (Hydro-Search, January 23, 1990) have indicated that the City of Delavan Well #4 capture zone includes the area of Sta-Rite Plant #2. Therefore, the RI activities for the City of Delavan Well #4 National Priority List (NPL) Site (City Well #4) encompasses BRA investigations related to Plant #2 (OU-2E). Plant #1, which appears to be hydraulically isolated from City Well #4, is addressed in OU-1E. Figure 2-1 shows the location of City Well #4 in relation to the Sta-Rite facility. The site layout is presented on Plate I.

Activities reported in this Technical Memorandum were performed to fulfill the objectives of the two OUs which focused on BRA characterizations OU-1E and OU-2E. In addition to the activities in OU-2E and OU-1E, this Technical Memorandum describes soil sample collection and analysis for pH and total organic carbon (TOC) to evaluate the mobility of volatile organic compounds (VOCs) in soil. These activities were addressed in the Work Plans as OU-2C for the City of Delavan NPL site, and OU-1A for Plant #1. The objectives of OUs as related to BRA characterization activities are summarized below.

OU-2E

- Characterize the human population served by City of Delavan Well #4;
- Evaluate VOC concentrations in the municipal distribution system;
- Identify private water supply wells downgradient of Plant #2;
- Identify sensitive receptors such as schools, hospitals, and nursing homes;
- Provide general identification of flora and fauna in and around the site, species in the human food chain, and critical habitats (ecological investigations);
- Evaluate VOC emissions from the existing Plant #2 Soil Vapor Extraction System (SVES);
- Evaluate possible VOC emissions to the atmosphere from the Plant #2 extraction well discharges to the storm sewer; and,
- Evaluate surface water, sediments, and air where extraction well discharges exit the storm sewer system.

OU-1E

- Characterize the human population served by City of Delavan Well #4;
- Identify potential private water supply wells downgradient of Plant #1;
- Identify sensitive receptors such as schools, hospitals, and nursing homes;
- Provide general identification of flora and fauna in and around the site, species in the human food chain, and critical habitats (ecological investigations); and,
- Evaluate possible VOC emissions to the atmosphere from the Plant #1 extraction well discharges to the storm sewer.

2.3 Background

The following section provides a summary of the site history. A more complete site history and background can be found in the Task I Site Evaluation Report (SER), Remedial Investigation/Feasibility Study, Sta-Rite Industries, Inc., Delavan, Wisconsin (Hydro-Search, Inc, 1990).

In March, 1982, trichloroethylene (TCE) in excess of suggested water quality standards as set by the Wisconsin Department of Health and Social Service (WDHSS) was detected in City Well #4 (Figure 2-1, Plate I) during a random public well sampling program by the WDNR. The concentration of TCE in the sample exceeded the WDHSS suggested drinking water limit at that time of 45 ppb. WDNR subsequently recommended that City Well #4 be removed from the municipal water supply system and investigations were initiated by the City and WDNR to identify the source of TCE in the well.

Sta-Rite has operated manufacturing facilities located at 293 Wright Street, Delavan, Wisconsin since 1958. These facilities are located in proximity to City Well #4 (Figure 2-1). Various solvents have been used during past manufacturing processes and cleaning processes at the Sta-Rite facilities including TCE which was released in the vicinity of both plants until 1977. Other solvents used at the facilities included 1,1,1-trichloroethane (TCA) and tetrachloroethylene. Since discovery of the impacts to City Well #4, Sta-Rite initiated investigations on-site which resulted in the installation of several remedial systems including extraction and hydraulic control of impacted ground water as well as vapor extraction of solvents from source areas in soil.

City Well site #4 was nominated to the NPL in 1983 and listed in 1984. In March, 1988, the WDNR also listed the site on the Hazard Ranking List as part of the State's Environmental Response and Repair Program. Sta-Rite and WDNR subsequently executed a contract (SF-90-02), effective September 28, 1990, to conduct an RI/FS and RD/RA on the City of Delavan Well #4 NPL site.

The scope of RI activities is described in the Work Plans, which was approved by WDNR with input from United States Environmental Protection Agency (U.S. EPA) on September 13, 1991. RI-related activities were begun in August, 1991, and three addenda to the Work Plans have been submitted to and approved by WDNR, expanding the scope of the Work Plans at Sta-Rite's request.

The results of RI activities have been presented to WDNR as raw data in monthly progress reports and in a series of Technical Memoranda per contract requirements. Interim Draft Technical Memorandum #1, Source Characterization, was submitted to WDNR for review March 12, 1992. The second submittal is Technical Memorandum #3, presenting the results of the Baseline Risk Assessment Characterization activities. Investigative activities performed to evaluate the migration pathways is presented in Technical Memorandum #2. Technical Memorandum #4 summarizes the nature and extent of impacts, based on all RI

activities. The results of additional investigations performed as part of supplementary site investigations related to source characterization are submitted in the Draft Final Technical Memorandum #1.

3.0 BASELINE RISK ASSESSMENT CHARACTERIZATION INVESTIGATION

A summary of investigative activities performed as part of OU-2E, OU-1E and applicable portions of OU-1A, and OU-2C is presented below. Borehole and monitor well installation and soil sample collection were observed by staff from Camp, Dresser, and McKee, who were retained by WDNR to provide oversight of field activities. The methods of investigation used during the RI activities conformed to procedures presented in the Work Plans unless deviations approved by WDNR are noted herein.

3.1 Human Population Characterization

The human population in the vicinity of the Sta-Rite facility was characterized as part of the Contract requirements. The information required included the following:

- Determining the area and population served by the City of Delavan municipal water supply system, especially to the north, northwest, and west of the Sta-Rite facility,

- Determining the location of potential private wells downgradient of the Sta-Rite Facility.

- Determining the population within a one-half mile radius of the Sta-Rite property, and preparing a land use map for the one-half mile radius described.

- Determining the presence of potentially sensitive receptors within a one-mile radius of the Sta-Rite property.

Information regarding human population characterization was obtained through maps and other published materials, through interviews with City of Delavan personnel, and through field observations.

3.1.1 Population and Land Use

The population and land use for a radius of one-half mile from the Sta-Rite facility and the area and population served by the City of Delavan municipal water supply system were evaluated by review of census data, United States Geological Survey (USGS) maps and other publications, City of Delavan 1980 Comprehensive Land Use and Thoroughfare Plan, U.S. Department of Agriculture Soil Survey and WDHSS publications, aerial photographs, and regional planning commission records. Information regarding the municipal water-supply system was obtained directly from the City of Delavan water utility.

3.1.2 Sensitive Receptors

A survey of the sensitive receptors for a radius of one mile from the Sta-Rite facility was evaluated through a review of City of Delavan land use maps, directories, and observations by Sta-Rite personnel in order to locate schools, hospitals, nursing homes, and day-care facilities.

3.2 Downgradient Private Water Supply Well Investigation

The location of private water supply wells within the area of investigation shown on Figure 3-1 was performed to evaluate the potential for downgradient receptors via ground-water migration pathway. Simon Hydro-Search obtained Wisconsin Geologic and Natural History Survey (WGNHS) records of private water supply wells within the sections encompassed by the study area. Sta-Rite subsequently performed a drive by survey in an

attempt to locate these private wells and determine if the well still exited and, if present, its current use. The well records include a large number of obsolete addresses which were changed by the City, and a number of addresses known to be incorrect based on the street or owner's name. Therefore a correlation between the WGNHS well logs and current addressees was not feasible and deemed unreliable for the purposes of the RI.

The City of Delavan and Sta-Rite subsequently performed a cooperative survey of the area. The effort by the City involved mailing all City residents a Private Water Well Operation Registration Form (Figure 3-2) with the November, 1991 water bill. The survey conducted by Sta-Rite consisted of distributing a flyer to all residents within the vicinity of the site. This was accomplished by inserting a survey notice (Figure 3-3) in the Local Community Shopper newspaper which is delivered free of charge to all residents in the Delavan area. Based on public response to these surveys, two private water wells were found to exist within the study area. Several attempts were subsequently made to sample these two wells for VOCs.

3.3 Municipal Distribution System Evaluation

A sample of City water was to be collected from the municipal distribution system, after blending of water from City Well #3 with City Well #4 water, at the closest system distribution point. No sample was collected from the municipal distribution system, however, because the City of Delavan ceased pumping from City Well #4 for use in the City water supply prior to the end of RI investigations. A water sample will be collected if City Well #4 is put back on the system for a period long enough to allow a representative sample of blended water to be collected. The City of Delavan was requested to notify Sta-Rite of any anticipated plans to use City Well #4 so a sample can be collected.

3.4 Air Emissions of Volatile Organic Carbon Compounds

Air emissions were directly measured from two locations; the air discharge for the existing Plant #2 SVES, and the storm sewer discharge point, SS-2 (Figure 3-4), where the storm sewer which receives extraction well water discharges to the surface water system. Sample collection, preservation and handling conformed to methods presented in the Work Plans.

In addition, mass balance calculations were performed to evaluate the potential emission of VOCs at the point where extraction well water is discharged into the storm sewer system (Figure 3-3). The calculation for VOC volatilization at the manhole spray nozzles consisted of subtracting the pounds per day of VOCs in the water sample collected at the spray nozzle (concentration x flow x 8.3 pounds/gal. water) from the pounds per day of VOCs influent to the spray nozzles from the extraction wells' concentrations x flow x 8.34 pounds/gal. The calculation for emissions along the storm sewer consisted of subtracting the calculated pounds per day of VOCs at the storm sewer terminus (SS-2) from the calculated pounds per day at the manhole spray nozzles.

3.5 Surface Water and Sediment Investigations

Surface water and sediment samples were collected from the storm sewer discharge point SS-2 (Figure 3-4) per Work Plan requirements. Surface water samples were collected on November 7, 1991 and December 10, 1991, from the point of storm sewer discharge and analyzed for VOCs via U.S. EPA Method 502.2. Three sediment samples were collected on November 7, 1991 along with the first of the surface water samples. The sediment samples were collected at three different locations in the creek bed, at distances of 0 feet, 6 feet, and 12 feet immediately downstream of the storm sewer discharge point. Sediment samples were analyzed for VOCs via U.S. EPA Method 8021. Sample collection,

preservation, and analyses methods conformed to Standard Operating Procedures presented in the Work Plans.

3.6 Ecological Assessment

An ecological assessment of the area was conducted consisting of five field visits performed between September 1991 and February, 1992, and review of pertinent WDNR records. The purpose of the visits was to identify the vascular flora and vertebrate fauna, to locate sensitive and critical habitats and species of concern, and to identify potential threats to humans or the environment which may be associated with Sta-Rite operations.

Information was compiled from field observations and supplemented by interviews with Sta-Rite, WDNR, USGS, and City of Delavan Public Works personnel, as well as published materials obtained from WDNR, U.S. EPA, and Sta-Rite.

3.7 Total Organic Carbon and pH Soil Sampling

Fifteen soil samples were collected and submitted for analysis of TOC and pH. Five samples were analyzed from one borehole, SB-2009 (Plate I), at the City of Delavan Well #4 NPL site (Plant #2), and five samples each were analyzed from two boreholes, SB-1016 and SB-1018, at Plant #1. The samples were collected at five foot intervals or multiples thereof. The analyses were requested by WDNR for use in preparing the BRA. Sampling and analysis methodologies conformed to those presented in the Work Plans.

4.0 RESULTS OF INVESTIGATIONS

4.1 Human Population Characterization

The Sta-Rite facilities are located at 293 Wright Street, within the corporate limits of the City of Delavan, Walworth County, Wisconsin, and occupy approximately 70 acres (HSI, 1990, Figure 2-1). The site is located in the SE 1/4 of Section 17 in Delavan Township (T2N, R16E). The site is bordered on the south by a commercial strip shopping center, on the west by Wright Street, on the north by the Wisconsin Calumet Railroad, and on the east by agricultural farmland. The west side of Wright Street, adjacent to the site, is occupied by industrial and commercial properties, and City Well #4.

4.1.1 Population and Land Use

Walworth County has a largely rural population, which has been experiencing rapid growth in recent years. According to the 1970 census, 38.7 percent of the population lived in incorporated cities or villages with 2,500 or more inhabitants. The 1990 census showed little change from this distribution.

Dairying is the main farm industry (Haszel, 1971). The tourist industry is also important to Walworth County's economy, its lakes and parks attract outdoor enthusiasts and the dog track also attracts tourists.

The City of Delavan is located in west-central Walworth County, approximately 45 miles southwest of Milwaukee, in south-central Wisconsin (Figure 4-1). Delavan was founded in 1836, and was incorporated as a City in 1897. The current City population is approximately 6,100 (HSI, 1990). A population of greater than 3,000 resides within a 1 mile radius of the site (WDHSS, 1989).

Land use within a one-half mile radius of the Sta-Rite facilities is shown in Figure 4-2. This figure was adapted from the "Comprehensive Land Use and Thoroughfare Plan" for the City of Delavan (Donohue, 1980). Since that time, several land use changes have occurred in the vicinity of the site, and are shown on the adapted figure. Little or no changes have taken place with respect to residential land use in the vicinity of the site.

Several commercial and industrial properties are located adjacent to or near the Sta-Rite site. The Wisconsin Calumet Railroad tracks and right-of-way are located directly north of the site. The Roadmaster Corporation facility is located on the west side of Wright Street, directly across from Plant #1. A variety of small commercial properties are located on both sides of Wright Street south of the site. Several small light industrial facilities are located on Wright Street southwest of the site, and on the other side of the railroad, to the north of the site. Two automobile dealerships, one of which currently has a leaking underground storage tank investigation pending, are located along State Highway 50 southwest of the site. The nearest municipal properties, besides City Well #4, is City Well #3 and an adjacent water storage tank tower located approximately 2,000 feet west of Plant #2.

4.1.2 Sensitive Receptors

Sta-Rite personnel determined the location of the potentially sensitive receptors within in the Well #4 distribution area. Potential sensitive receptors are identified on Table 4-1 and the locations are shown on Figure 4-2. A total of five potentially sensitive receptors were identified as part of these investigations, including one day-care facility, three schools, and one nursing home.

4.2 Downgradient Private Water Supply Wells

No residential properties directly border the Sta-Rite site. The nearest residences are located approximately 500 feet northwest of Plant No. 1, on the northern side of the Wisconsin Calumet Railroad.

The results of the private water supply well investigation indicated that two private wells exist downgradient of the Sta-Rite facility within the area of investigation (Figure 4-2). One of these wells, PW-1, was sampled for VOCs via U.S. EPA method 8021. No VOCs were detected in that sample. The second "well" is a closed-loop air conditioning system which does not have ready access to a sampling port, and the well owner has not given permission to attempt to collect a sample.

4.3 Municipal Distribution System

As described in Section 3.3, no sampling of the municipal distribution system was attempted. However, the results of TCE analysis from samples collected during pumping at City Well #3 and City Well #4 are available from 1982 through February 1992. The results of these analyses are tabulated in Appendix J.1 and presented graphically on Figures 4-3 and 4-4.

4.4 Air Emissions of VOC Compounds

Two air samples were collected for analysis of VOCs; one from the existing SVES discharge and one from the storm sewer SS-2 discharge location. No VOCs were detected in the air samples collected from either location. Laboratory analyses are included in Appendix F.5 and Quality Assurance data is included in Appendix G.1. Historically, however, low-level air impacts of the target compound TCE have been detected at the SVES system discharge. Pilot testing is in progress to evaluate potential enhancement of this system.

The mass balance calculations for VOC discharge to air from volatilization of extracted ground water to the storm sewer system indicated substantial volatilization occurs at the storm sewer manhole, and additional volatilization (and/or dilution by other inputs) occurs along the storm sewer system. Due to possible inputs of target compounds along the storm sewer from non-Sta-Rite sources in the City of Delavan, only a semi-quantitative account of VOCs is possible once the water leaves the Sta-Rite facility.

TCA is the compound which accounts for the majority of VOCs discharged daily to the storm sewer system. Assuming that no additional sources or dilution occurred along the storm sewer at the time of sampling, approximately 75% of the VOCs discharged from the extraction wells are volatilized at the spray nozzles and along the storm sewer. The remainder are discharged to surface waters. The results of these mass balance calculations are presented in Appendix F.7.

Although volatilization occurs at the manholes, a venturi effect was noted by Sta-Rite at the latter two manholes using "liquid smoke" over the manhole to ascertain air flow direction. By this method, it was determined that air from immediately above the manhole is drawn into the storm sewer, effectively entraining volatilized VOCs into the storm sewer system as well. It is surmised that the surrounding air which is drawn into the storm sewer system at that point and others, as well as the existing air within the storm sewer system immediately dilutes the concentration of VOCs emitted to insignificant levels. The diluted VOCs are probably emitted at various points along the storm sewer system.

The mass balance calculations indicated the compound which accounted for the majority of the VOCs was TCA. The results of these mass balance calculations are presented in Appendix F.7.

4.5 Surface Water and Sediment Investigations

The results of surface water and sediment sampling analyses indicated the presence of low levels of VOCs at the storm sewer SS-2 discharge point. The analytical results are presented in Appendix F.6 and summarized on Table 4-2. The levels of VOCs detected in surface water samples are less than Wisconsin Pollutant Discharge Elimination System permit requirements.

4.6 Ecological Assessment

Based on the data review and investigations performed for the Ecological Assessment, the Sta-Rite facility offers no significant habitat for native flora and fauna. The eastern half of the 50-acre site is agricultural cropland, the western half is industrial, with buildings, lawns, storage areas, and fenced paved parking areas. Surface storm water runoff from the site is discharged mainly into the city storm sewer located along Wright Street (Figure 3-4) which discharges via the south Delavan Ditch to Lower Swan Creek in Springs Park, and thence to Turtle Creek west of Delavan. A small portion of the storm water from the southeast portion of the facility drains to a five-acre pond located southeast of Plant #2 (Figure 3-4). The small, steep-sided pond appears to offer minimal habitat for native biota, but might occasionally attract migratory or wintering waterfowl.

Ground water from the seven Sta-Rite extraction wells is discharged to the storm sewer system, which in turn discharges to Lower Swan Creek. Per contract requirements, the ecological assessment focused on natural areas comprising the surface water corridor beginning at discharge point SS-2 (Figure 3-4) and extending along Lower Swan Creek to its juncture with Turtle Creek near Comus Lake. This surface-water corridor also receives discharge from Sta-Rite storm water runoff, ambient ground water discharge along its banks and runoff from urbanized land uses within the City.

No endangered non-fish vertebrates nor terrestrial species consumed by humans were found along the surface water corridor described above. One state listed threatened plant species was found in a raised peat hump (calcareous fen) in Springs Park (Figure 3-4) at an elevation well above base flow and flood levels.

No evidence of damage to terrestrial or wetland flora or fauna or their habitats was found which could be attributed to past or present operations at Sta-Rite. In contrast, historic agricultural and urban events likely cause ongoing impacts to these natural areas, including flash floods, silt deposition, alien species invasion, and possible ground-water diversion unrelated to Sta-Rite affecting the local wetlands and waterways.

4.7 Total Organic Carbon and pH Sampling

The results of the TOC and pH analyses are summarized on Table 4-3. The analytical results are presented in Appendix F.3. The PID screening results for the soil collected at the indicated depth and the appropriate USCS classification for the soil type at each depth are also indicated on the table to assist in interpreting data. Where available, the total VOCs measured in the soil sample are also indicated.

The results indicate a neutral to slightly basic pH, ranging from 6.78 to 8.75 with an average pH of 7.80, and TOC concentrations ranging from 16,800 ppm for topsoil to 1,330 ppm for the lower sand and gravel outwash unit. TOC values for the silty sand unit between the topsoil and the sand and gravel unit ranged between 1,470 ppm and 10,900 ppm. The higher TOC concentrations were found in borehole SB-1018, which also had the highest VOC impacts, according to laboratory results.

5.0 REFERENCES

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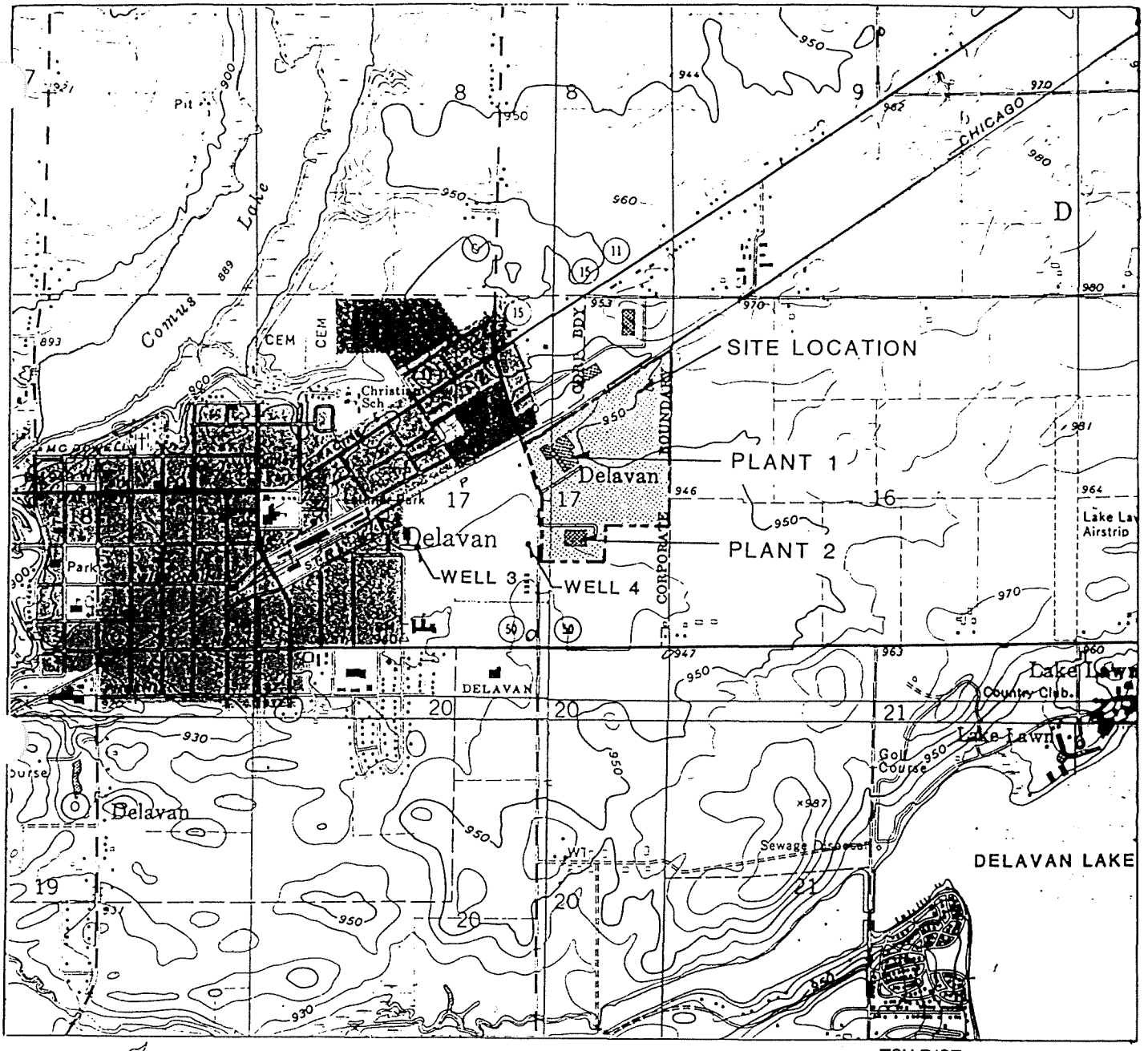


SCALE

0 5000

FEET

N

BASE MAP FROM 7.5' U.S.G.S. DELAVAN AND ELKHORN, WI. TOPOGRAPHIC QUADRANGLE MAPS. PHOTOREVISED 1971

DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL IS 10 FT.

Hydro-Search, Inc.

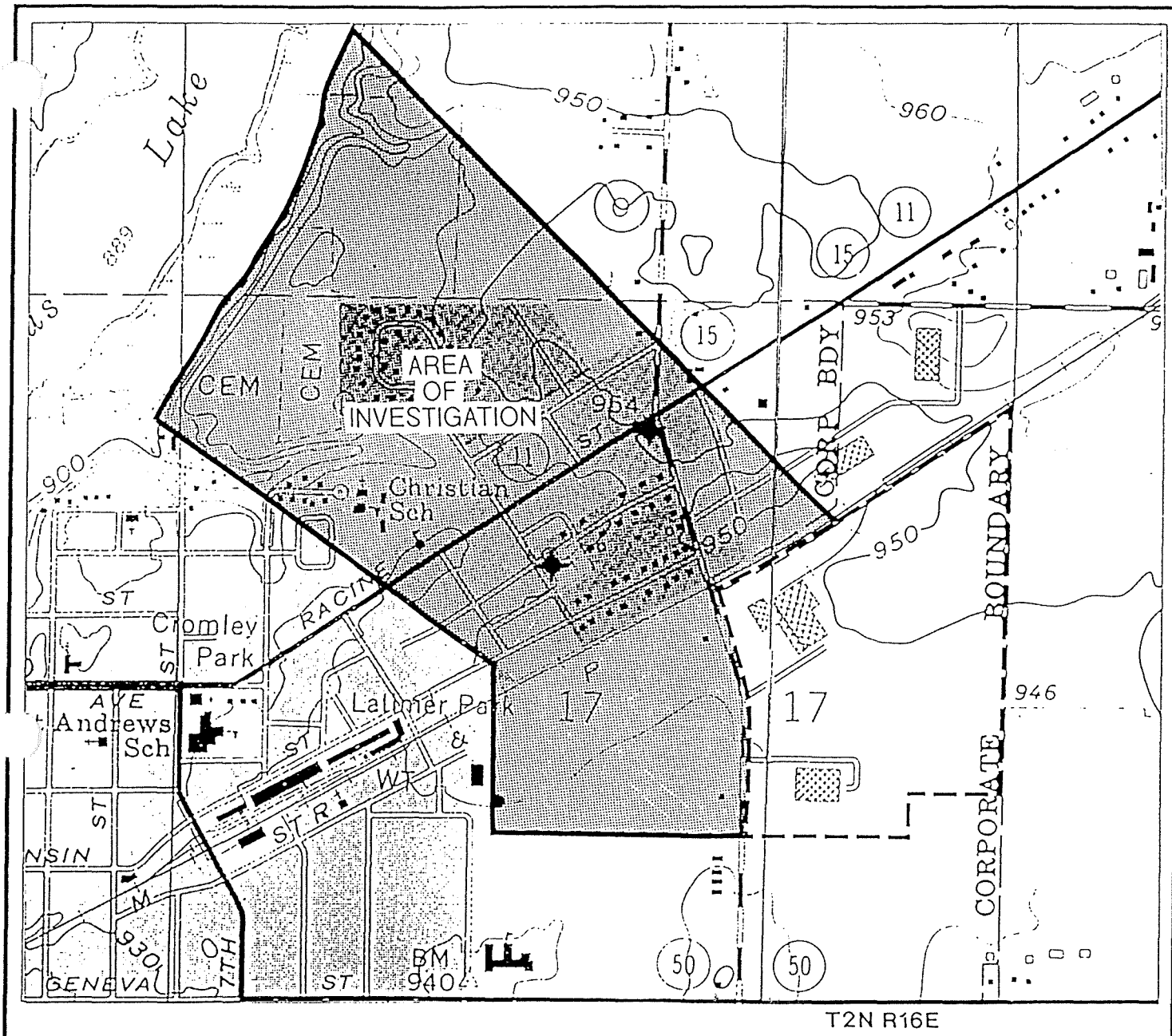
HYDROLOGISTS
GEOLOGISTS
ENGINEERS

Reno Denver Milwaukee Irvine

STA-RITE INDUSTRIES, INC.
DELAVAN, WI

SITE LOCATION AND LOCAL TOPOGRAPHY

PROJECT: 351E12113	DATE:	DRAWING NO.:	FIGURE: 2-1



EXPLANATION

PROPERTY BOUNDARY

PRELIMINARY OFF-SITE HYDRO-PUNCH WELL LOCATION

SCALE

0 2000

FEET

N

SIMON HYDRO-SEARCH

Brookfield Lakes Corporate Center XII
175 N. Corporate Drive, Suite 100
Brookfield, Wisconsin 53045

STA-RITE INDUSTRIES, INC.
DELAVAN, WISCONSIN

PRIVATE WELL AREA OF INVESTIGATION

Dsgn. by:	Chk. by:	Apprv. by:
PROJECT: 350115013	DATE: 06/03/92	DRAWING NO.: 1211-7

FIGURE: 3-1

PERMIT #_____ Permit Fee $50.00

CITY OF DELAVAN
DELAVAN WATER & SEWAGE COMMISSION

PRIVATE WATER WELL OPERATION REGISTRATION

A permit to allow a well owner to operate a private water well in the City of Delavan for a period of one (1) year may be granted provided that the requirements of Section 16.19 (3) of the Delavan Municipal Code are met. If a permit is desired, please fill in the following information on the form and submit it to the Business Manager, Delavan Water & Sewage Commission.

After this form has been submitted to the Business Manager, a licensed well driller, pump installer or certified well inspector must inspect the well to verify that the well is safe, has a functional pumping system and its use can be justified. Two water samples, each taken at least 30 days apart, must be taken from the private well to determine if the water is bacteriologically safe.

Property Owner _____Phone No._____

Property Address _____

Well Information:

1. Is property served by public water system? Yes____No____

2. Has a well construction report been filed with the Department of Natural Resources (attach copy)? Yes____No____
   If no, complete the following:
   a. Date well constructed_____
   b. Well drilling contractor_____
   c. Construction type_____
   d. Well diameter_____Well depth_____

3. List proposed use of well_____
   _____

4. Attach a statement or report from a certified well driller or pump installer stating that the well has been inspected and is in compliance with Wis. Adm. Code NR 112.

5. Attached is a report of the bacteriological water sample No 1:
   Date taken_____Results_____

   Attached is a report of the bacteriological water sample No2:
   Date taken_____Results_____

I certify that the above information is accurate to the best of my knowledge:

Applicants Signature_____Date_____

Application Fee:_____Date Paid_____

Received By:_____

Director of Utilities Report:

1. Well location and installation complies with Chapter NR 112 of the Wis. Adm. Code, as verified by certified well inspectors report? Yes____No____

   If no, explain_____

2. Inspection verifies that no cross connection exists between the public water system and the private well? Yes____No____

   Water Utility Directors Signature_____
   Date_____

SIMON HYDRO-SEARCH
Brookfield Lakes Corporate Center XII
175 N. Corporate Drive, Suite 100
Brookfield, Wisconsin 53045

Dsgn. by:	Chk. by:	Apprv. by:
PROJECT: 350115013	DATE: 07/16/92	

STA-RITE INDUSTRIES, INC.
DELAVAN, WISCONSIN

PRIVATE WATER WELL OPERATION REGISTRATION

DRAWING NO.: FIGURE: 3-2

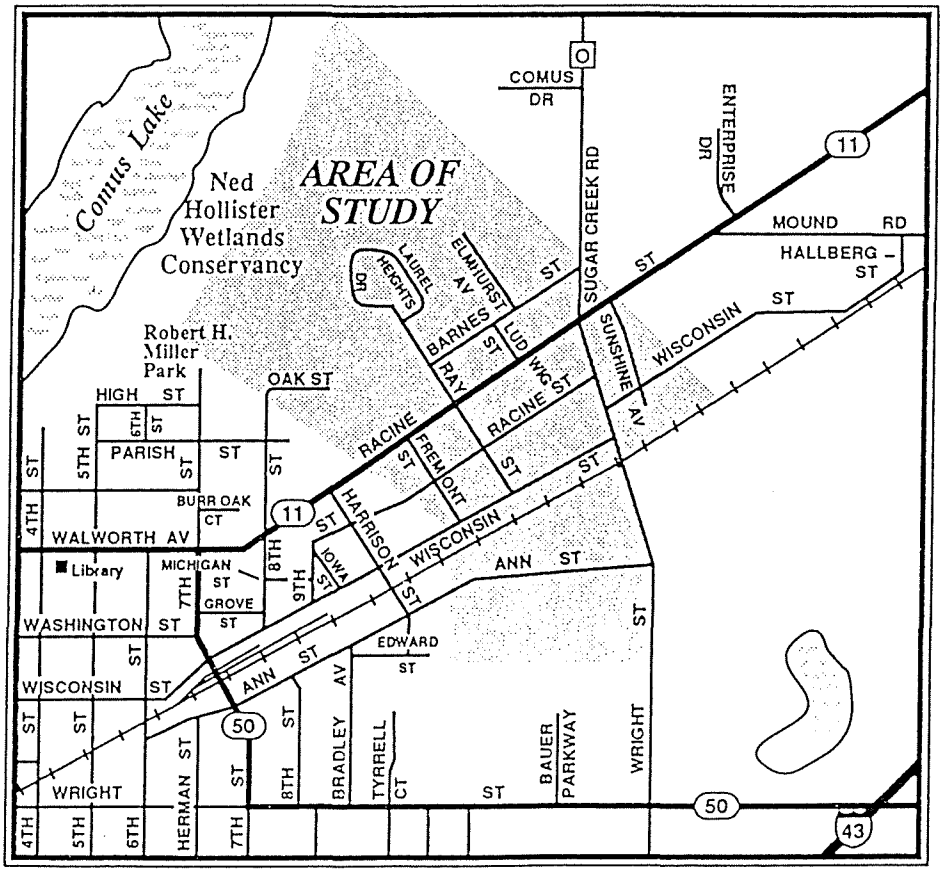
NOTICE!

Sta-Rite Industries, in cooperation with the Wisconsin Dept. of Natural Resources, is conducting a study of ground water characteristics in the Delavan Area. One phase of the study is to locate and sample water from private wells.

If you are a qualified resident living within the test area shown (shaded area below), you may have your water tested free.

If you have a drilled or driven point well on your property, and are located in the study area, please fill out the well-survey form and return it to:

Colin Beveridge
Sta-Rite
293 Wright Street
Delavan, WI 53115



STA-RITE INDUSTRIES WELL-SURVEY FORM

Name _____

Address _____

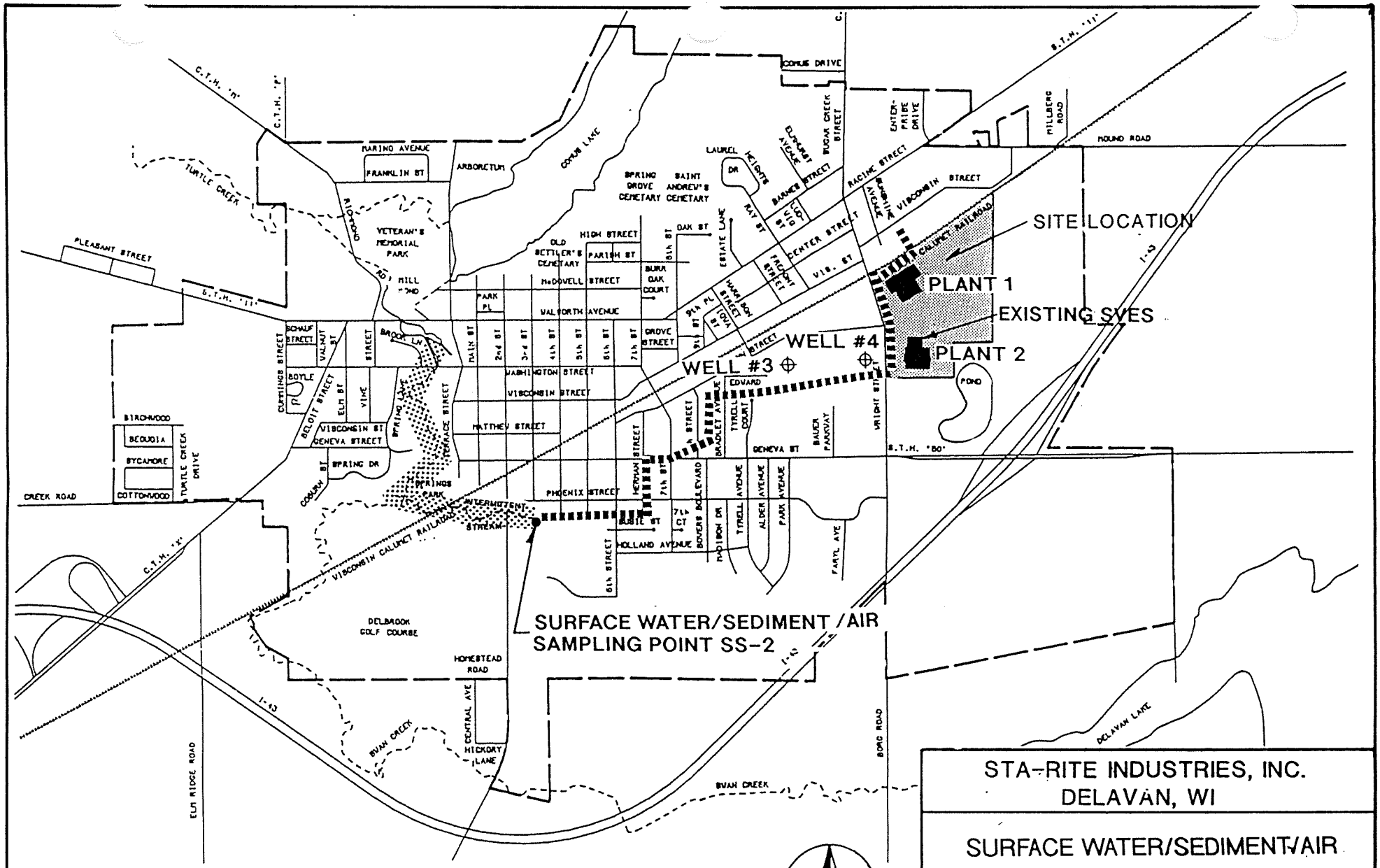
Tel. No. _____

STA-RITE
a WICOR company

SIMON HYDRO-SEARCH
Brookfield Lakes Corporate Center XII
175 N. Corporate Drive, Suite 100
Brookfield, Wisconsin 53045

WELL SURVEY FORM

FIGURE: 3-3



EXPLANATION

CITY STORM SEWER

ECOLOGICAL ASSESSMENT AREA

SCALE

0 400 1000 2000 3000 4000

FEET

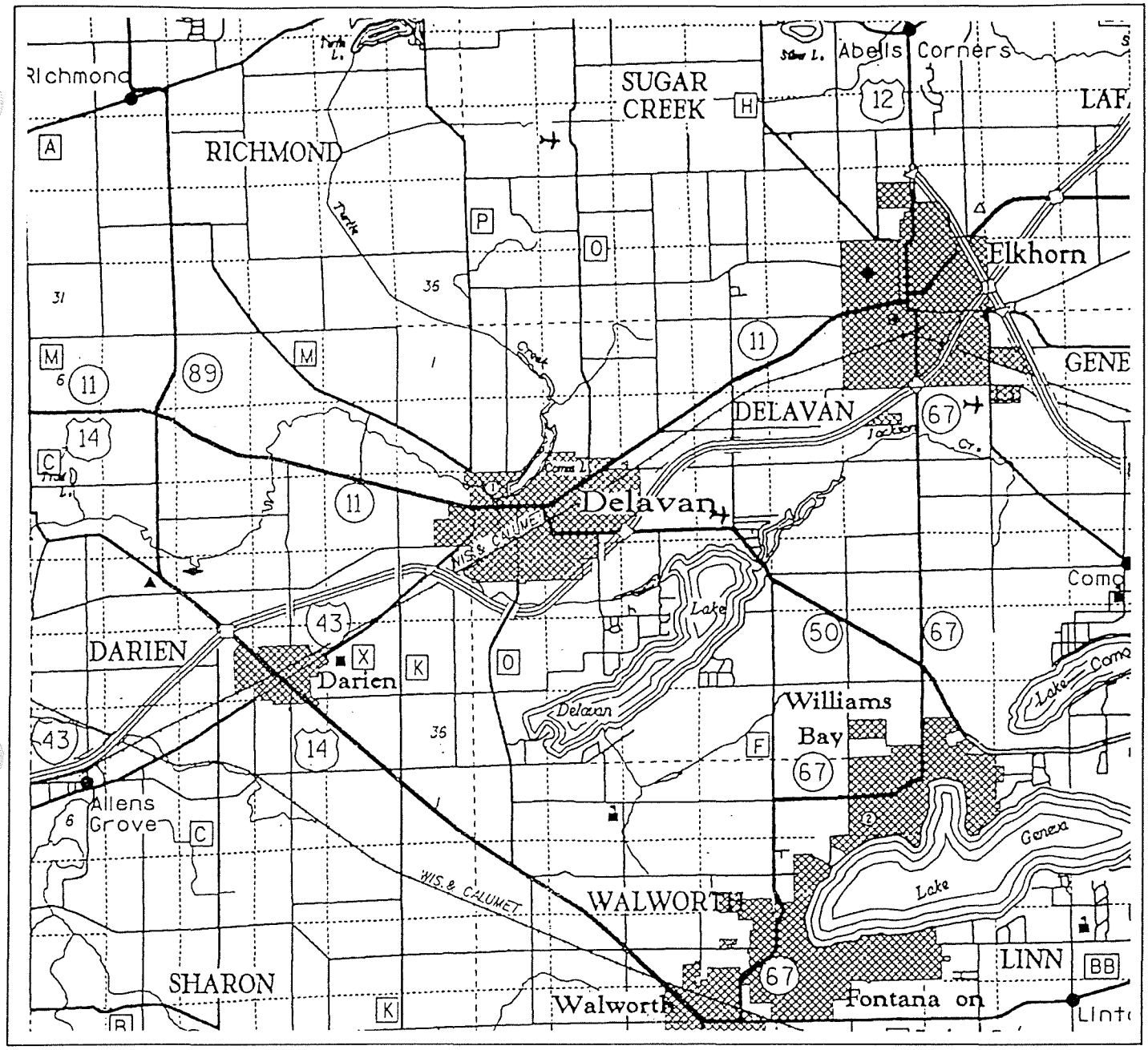
STA-RITE INDUSTRIES, INC.
DELAVAN, WI

SURFACE WATER/SEDIMENT/AIR SAMPLING AND ECOLOGICAL ASSESSMENT SURVEY LOCATIONS

PROJECT: 350115013 | DATE: 04/21/92

SIMON HYDRO-SEARCH
Brookfield Lakes Corporate Center XII
175 N. Corporate Drive, Suite 100
Brookfield, Wisconsin 53045

FIGURE 3-4



WALWORTH CO.
DEPARTMENT OF TRANSPORTATION

JAN. 1988

STA-RITE INDUSTRIES, INC.
DELAVAN, WISC.

REGIONAL LOCATION MAP

PROJECT: 351E12113 | DATE: 11/02/89

Hydro-Search, Inc.
HYDROLOGISTS·GEOLOGISTS·ENGINEERS
RENO DENVER MILWAUKEE

FIGURE 4-1

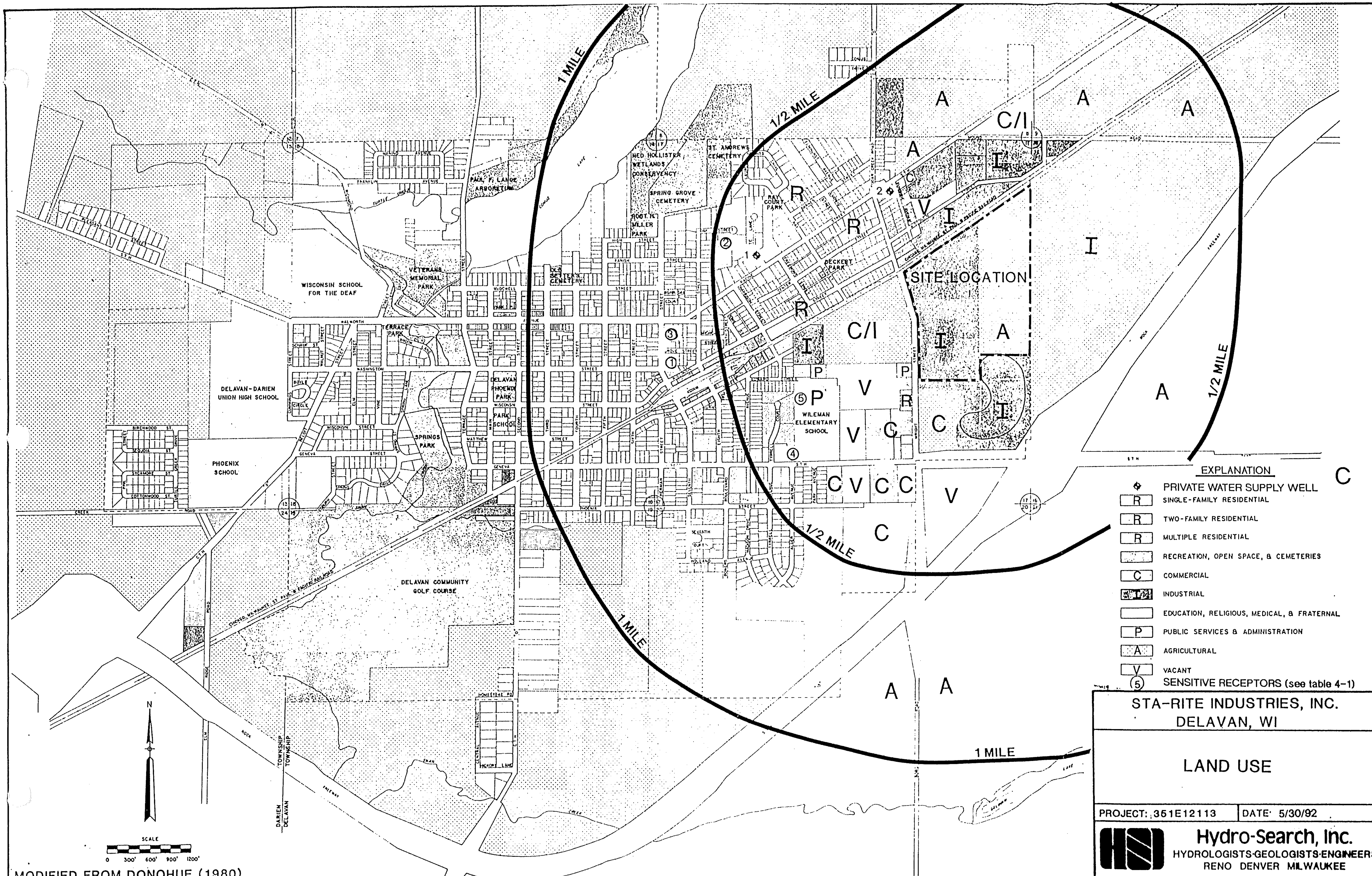
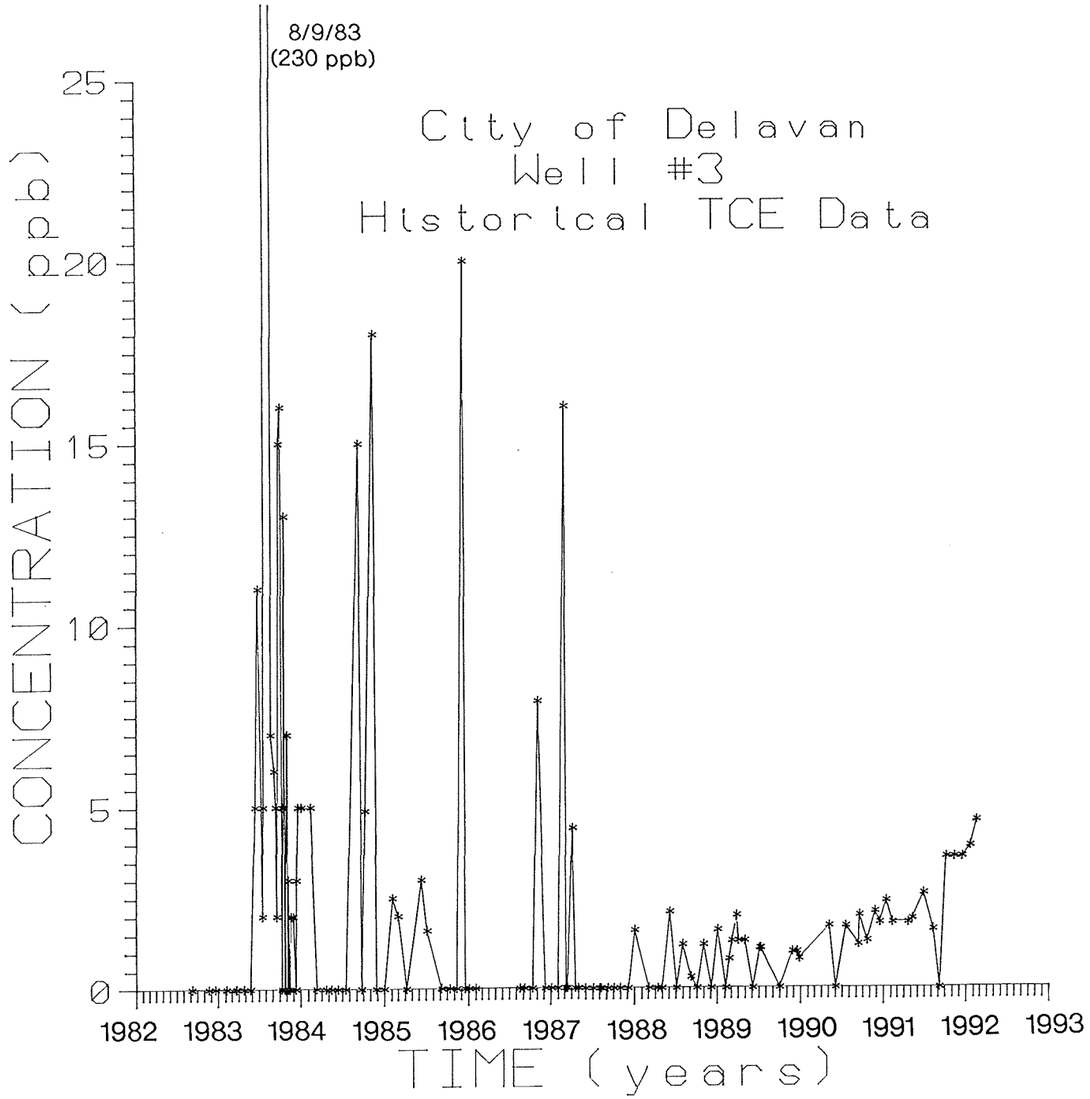
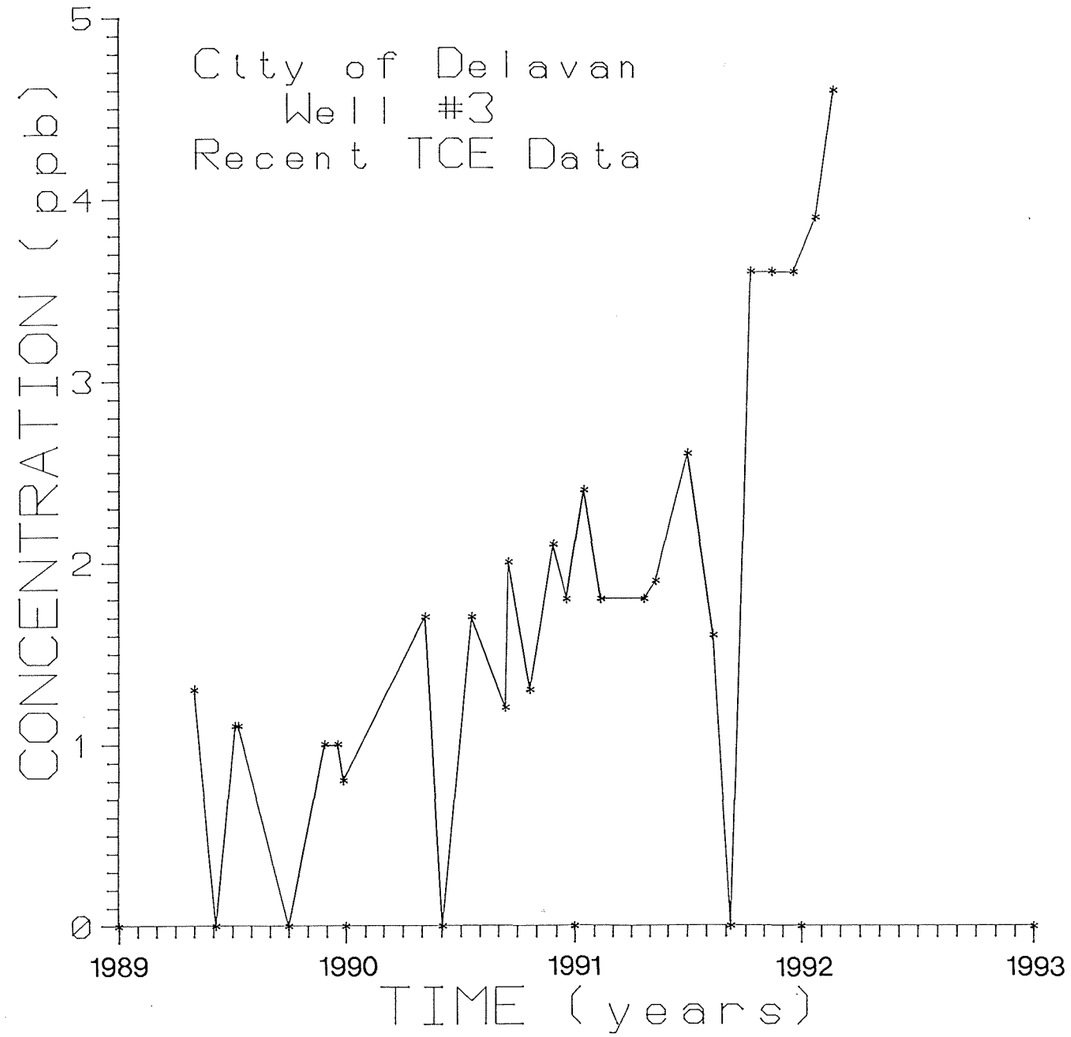
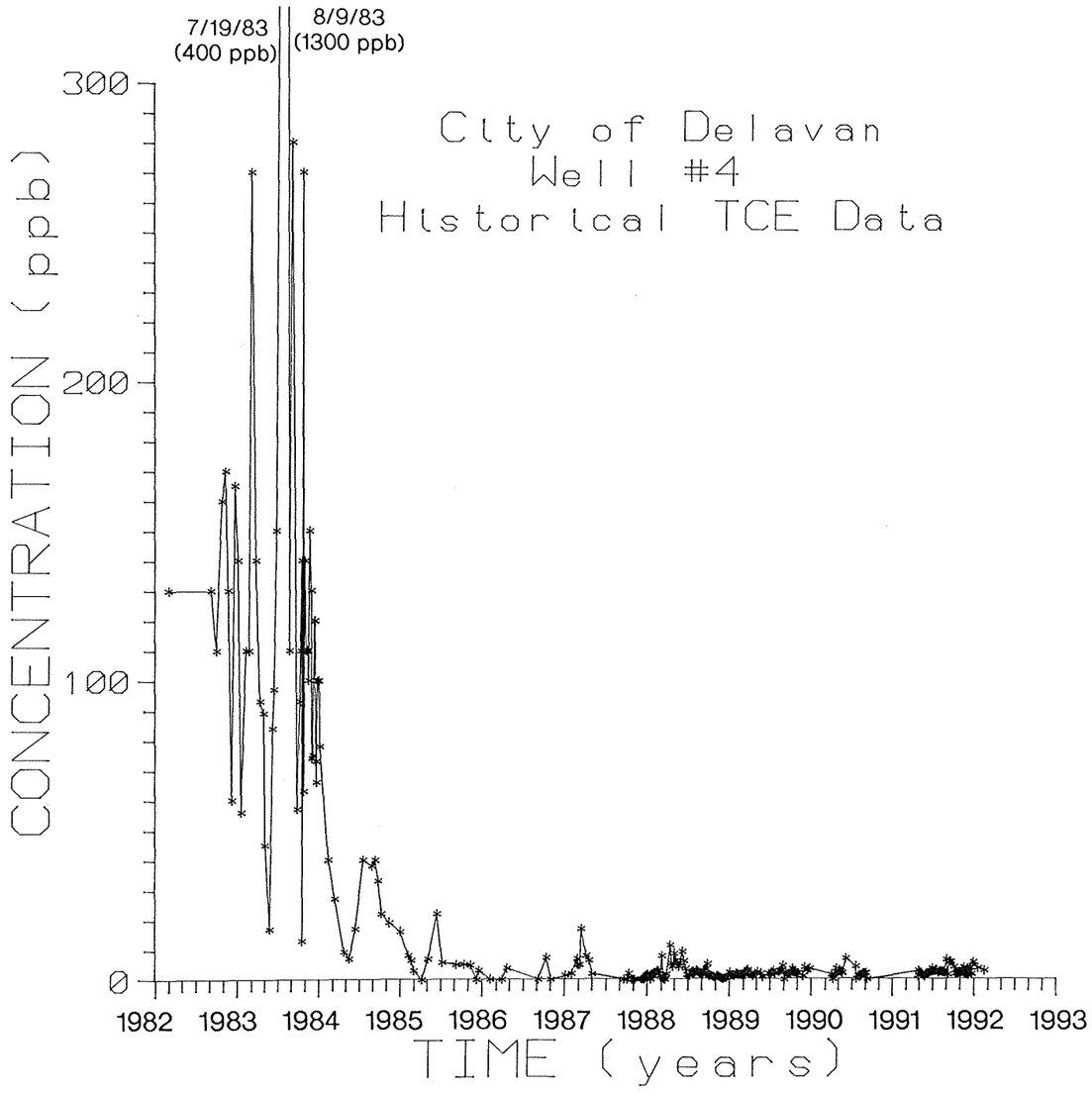

1 MILE
1/2 MILE
SITE LOCATION
WISCONSIN SCHOOL FOR THE DEAF
DELAVAN-DARIEN UNION HIGH SCHOOL
PHOENIX SCHOOL
VETERANS MEMORIAL PARK
TERRACE PARK
SPRINGS PARK
DELAVAN PHOENIX PARK
PARK SCHOOL
PAUL F. LANGE ARBORETUM
NED HOLLISTER WETLANDS CONSERVENCY
SPRING GROVE CEMETERY
ROOT. H. MILLER PARK
ST. ANDREWS CEMETERY
RAY COURT PARK
DECKERT PARK
WILEMAN ELEMENTARY SCHOOL
DELAVAN COMMUNITY GOLF COURSE
DARIEN TOWNSHIP
DELAVAN TOWNSHIP
SCALE
0 300' 600' 900' 1200'
N
MODIFIED FROM DONOHUE (1980).
EXPLANATION
PRIVATE WATER SUPPLY WELL
R SINGLE-FAMILY RESIDENTIAL
R TWO-FAMILY RESIDENTIAL
R MULTIPLE RESIDENTIAL
RECREATION, OPEN SPACE, & CEMETERIES
C COMMERCIAL
I INDUSTRIAL
EDUCATION, RELIGIOUS, MEDICAL, & FRATERNAL
P PUBLIC SERVICES & ADMINISTRATION
A AGRICULTURAL
V VACANT
5 SENSITIVE RECEPTORS (see table 4-1)
STA-RITE INDUSTRIES, INC.
DELAVAN, WI
LAND USE
PROJECT: 351E12113
DATE: 5/30/92
Hydro-Search, Inc.
HYDROLOGISTS·GEOLOGISTS·ENGINEERS
RENO DENVER MILWAUKEE

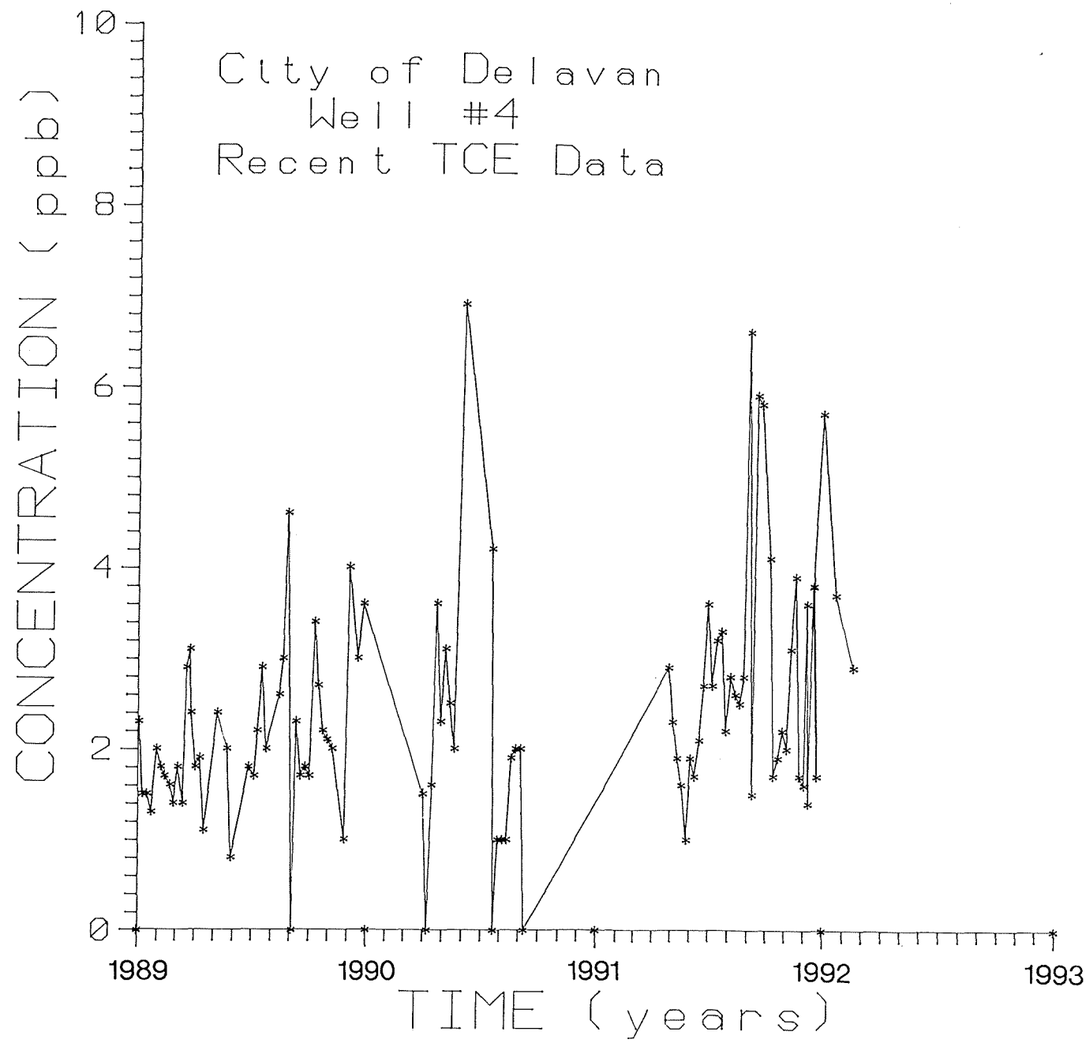
FIGURE 4-





SIMON HYDRO-SEARCH Brookfield Lakes Corporate Center XII 175 N. Corporate Drive, Suite 100 Brookfield, Wisconsin 53045			STA-RITE INDUSTRIES, INC. DELAVAN, WI
Dsgn. by:	Chk. by:	Apprv. by:	CITY WELL #3 HISTORICAL TCE CONCENTRATIONS
PROJECT: 350115013	DATE: 6/1/92		DRAWING NO.: FIGURE: 4-3





SIMON HYDRO-SEARCH Brookfield Lakes Corporate Center XII 175 N. Corporate Drive, Suite 100 Brookfield, Wisconsin 53045			STA-RITE INDUSTRIES, INC. DELAVAN, WI
Dsgn. by:	Chk. by:	Apprv. by:	CITY WELL #4 HISTORICAL TCE CONCENTRATIONS
PROJECT: 350115013	DATE: 6/1/92		DRAWING NO.: FIGURE: 4-4

Table 4-1. Sensitive Receptors

1. Delavan Day Care & Preschool
   133 S. 7th Street
   Delavan, WI 53115

2. Delavan Christian Grade School
   North Oak Street
   Delavan, WI 53115

3. St. Andrews Catholic School
   115 S. 7th Street
   Delavan, WI 53115

4. Willowfield Nursing Home
   905 E. Geneva
   Delavan, WI 53115

5. Wileman Elementary
   1001 Geneva
   Delavan, WI 53115

Table 4-2. Surface Water and Sediment Sampling Results

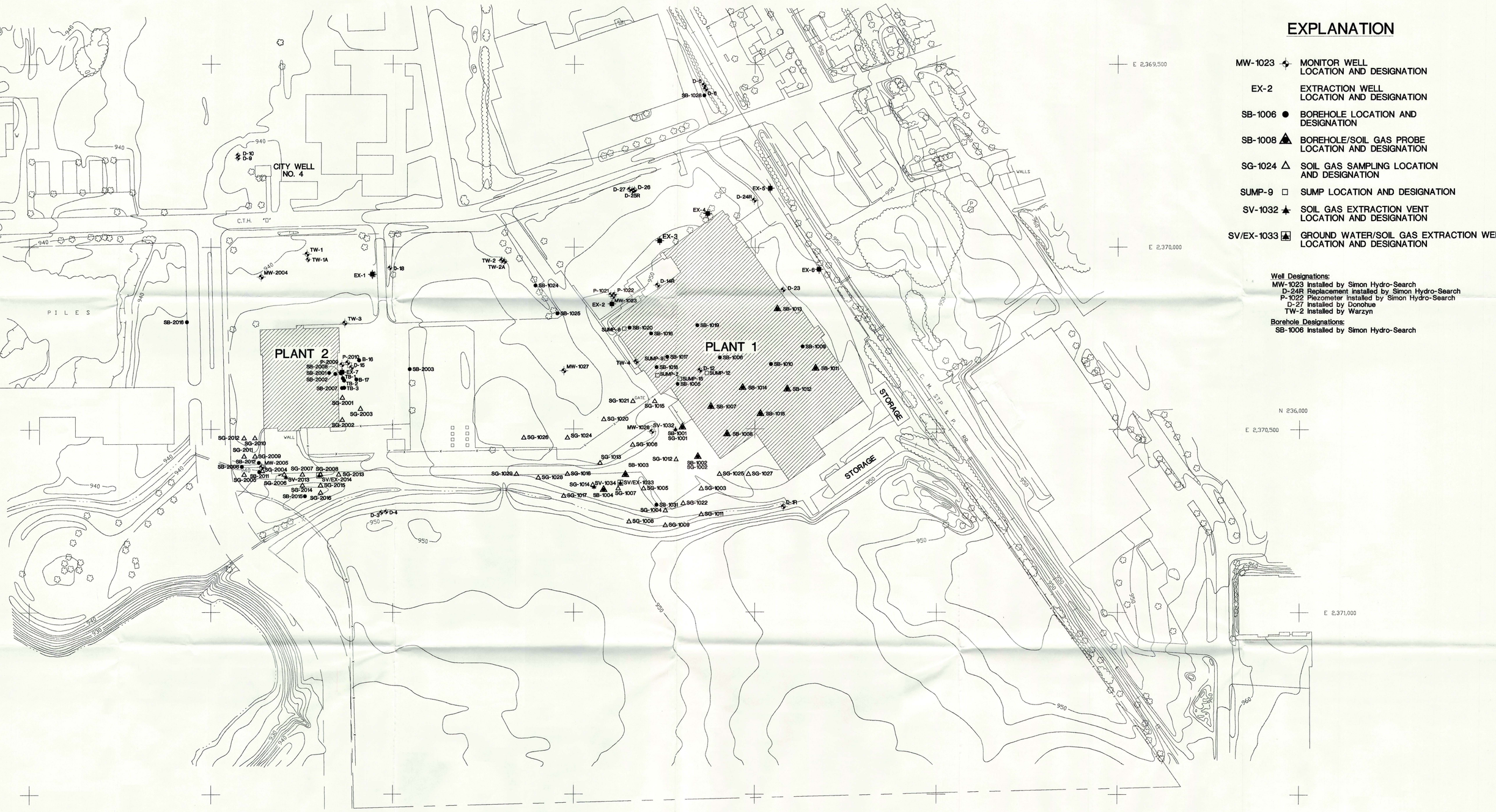
Parameter	SS-2 Discharge					
	Sediment Samples				Surface Water	
	0 - 5'	5 - 10'	10 - 15'	Field Blank		
Date Sampled:	11/7/91	11/7/91	11/7/91	11/7/91	11/7/91	12/10/91
TARGET COMPOUNDS (ppm)						
Tetrachloroethylene	<0.05	<0.05	<0.05	<0.7	<0.05	<0.05
1,1,1-Trichloroethane	3	4	3	<0.7	14	16
Trichloroethylene	2	2	2	<0.7	5.1	5.1
OTHER DETECTED VOCs (ppb)						
Chloromethane	<2	<2	<2	<2	<0.05	<0.05
Chloroform	2	<1	3	<1	<0.05	<0.05
1,1-Dichloroethane	<1	<1	<1	<1	<0.05	<0.05
1,2-Dichloroethane	<1	<1	<1	<1	<0.05	<0.05
1,1-Dichloroethylene	<2	<2	<2	<2	0.9	1.0
1,2-Dichloroethylene, cis	--	--	--	--	<0.05	<0.05
Dichloromethane	<2	<2	<2	7	<1	1.2
1,2-Dichloropropane	<1	<1	1	<1	<0.05	<0.05
Toluene	<1	<1	2	<1	<0.05	<0.05
1,1,2-Trichloroethane	<1	<1	1	<1	<0.05	<0.05
1,4-Dichlorobenzene	<2	<2	3	<2	--	--
Ethylbenzene	<1	<1	2	<1	<0.05	<0.05

-- = Analysis was not conducted for this parameter

Table 4-3. Soil pH and Total Organic Carbon Analytical Results

Sample ID	Sample Depth (ft.)	pH (standard units)	TOC* (ppm, mg/kg)	USCS** Classification
SB-1016	1 - 3	7.59	3,750	SM (fill)
	5 - 7	6.78	5,350	CL (topsoil)
	9 - 11	7.95	1,880	SM-ML (till)
	15 - 17	7.88	5,460	SM-ML (till)
	17 - 19	7.81	1,530	SM-ML (till)
		7.60 Average		
SB-1018	1 - 3	7.97	8,980	SM (fill)
	5 - 7	7.76	9,530	CL-ML (till)
	9 - 11	7.95	2,680	ML-SM (till)
	14 - 15	7.88	10,900	ML-SM (till)
	19	7.86	12,400	ML-SM (till)
		7.88 Average		
P-2009	0 - 1	8.75	16,800	OL (topsoil)
	5 - 6	7.76	1,470	ML (till)
	10 - 11	7.69	1,670	ML (till)
	20 - 21	7.81	2,440	ML (till)
	31 - 33	7.60	1,330	ML/SP (till/ outwash)
		7.92 Average		

* Detection Limit 50 ppm
** Unified Soil Classification System



EXPLANATION

MW-1023 ⊕	MONITOR WELL LOCATION AND DESIGNATION
EX-2	EXTRACTION WELL LOCATION AND DESIGNATION
SB-1006 ●	BOREHOLE LOCATION AND DESIGNATION
SB-1008 ▲	BOREHOLE/SOIL GAS PROBE LOCATION AND DESIGNATION
SG-1024 △	SOIL GAS SAMPLING LOCATION AND DESIGNATION
SUMP-9 □	SUMP LOCATION AND DESIGNATION
SV-1032 ⊕	SOIL GAS EXTRACTION VENT LOCATION AND DESIGNATION
SV/EX-1033 ⊞	GROUND WATER/SOIL GAS EXTRACTION WELL LOCATION AND DESIGNATION

Well Designations:
MW-1023 Installed by Simon Hydro-Search
D-24R Replacement installed by Simon Hydro-Search
P-1022 Piezometer installed by Simon Hydro-Search
D-27 Installed by Donohue
TW-2 Installed by Warzyn

Borehole Designations:
SB-1006 Installed by Simon Hydro-Search

SCALE
0 500
FEET

Base map from Aero-Metric Engineering, 04/16/88.
Contour interval two foot based on mean sea level datum.

map 12

STA-RITE INDUSTRIES, INC.
DELAVAN, WISCONSIN

EXISTING SITE LAYOUT

DATE:	07/07/92	
DESIGNED BY:	jjj	02/27/92
CHECKED BY:		
APPROVED BY:		
DRAWING NO:	1501-P1	
PROJECT:	350115013	

SIMON HYDRO-SEARCH
Brookfield Lakes Corporate Center XII
175 N. Corporate Drive, Suite 100
Brookfield, Wisconsin 53045

SHEET: 1 of 6