

SLMS # 159290

STATE OF MICHIGAN



JOHN ENGLER, Governor

DEPARTMENT OF ENVIRONMENTAL QUALITY

"Better Service for a Better Environment"

HOLLISTER BUILDING, PO BOX 30473, LANSING MI 48909-7973

INTERNET: www.deq.state.mi.us

RUSSELL J. HARDING, Director

REPLY TO:

ENVIRONMENTAL RESPONSE DIVISION
KNAPPS CENTRE
PO BOX 30426
LANSING MI 48909-7926

September 30, 1999

Mr. William E. Muno, Director
Superfund Division
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard (S-6J)
Chicago, Illinois 60604-3590

Dear Mr. Muno:

Attached is the five-year review for the Sturgis Municipal Wells Superfund Site located in the city of Sturgis, St. Joseph County, Michigan.

The five-year review for the Sturgis site includes the following recommendations, which we will be pursuing with the potentially liable party, the Kirsch Company.

- Continue operation of the soil vapor extraction system until soil cleanup standards have been met.
- Construction of the groundwater component should proceed on schedule.
- Operation of the groundwater extraction and treatment system should be continuous until cleanup standards have been achieved throughout the affected aquifers.
- Periodic monitoring should continue to ensure that progress continues toward eventual cleanup.
- Hydrogeological characterization of the bedrock should be conducted to the east and southeast of the center of the lower aquifer contaminant plume.
- Once the new groundwater extraction and treatment system is constructed and operational, an analysis should be conducted to determine if the existing long-term groundwater-monitoring plan and monitor well network remain adequate. If necessary, adjust the monitoring plan and/or install additional monitoring wells.

September 30, 1999

The completion of this five-year review fulfills MDEQ's obligation under Multi-Site Cooperative Agreement V995560-01 for the Sturgis site. If you have any questions, please contact Mr. Robert L. Franks, Project Manager, Superfund Section, Environmental Response Division, at 517-335-3392, or you may contact me.

Sincerely,

A handwritten signature in blue ink that reads "Claudia Kerbawy". The signature is written in a cursive style with a large, stylized initial 'C'.

Claudia Kerbawy, Chief
Superfund Section
Environmental Response Division
517-335-3397

Attachment

cc: Mr. J. P. Singh, EPA
Mr. Steven Padovani, EPA
Ms. Gladys Beard, EPA
Mr. David Kline, MDEQ
Mr. Robert L. Franks, MDEQ

FIVE-YEAR REVIEW REPORT

STURGIS MUNICIPAL WELLS SUPERFUND SITE
STURGIS, MICHIGAN

SEPTEMBER 1999

Prepared By:
Michigan Department of Environmental Quality

Prepared For:
U.S. Environmental Protection Agency
Region V
Chicago, Illinois

FIVE-YEAR REVIEW REPORT

STURGIS MUNICIPAL WELLS STURGIS, MICHIGAN

I. Introduction

A. Authority and Purpose

This five-year review was conducted pursuant to Comprehensive Environmental Response, Compensation, and Liability Act Section 121 (c), National Oil and Hazardous Substances Pollution Contingency Plan Section 300.400 (f) (4) (ii), and OSWER Directives 9355.7-02 (May 23, 1991), and 9355.7-02A (July 26, 1994). It is a policy review. The purpose of a five-year review is to ensure that a remedial action remains protective of public health and the environment and is functioning as designed. This document will become a part of the site file. This review (Type 1a) is applicable to a site at which response is ongoing.

B. Site Characteristics and History

The Sturgis Municipal Wells site is located in the city of Sturgis, St. Joseph County, Michigan approximately two miles north of the Indiana state line (please see Figure 1).

Routine sampling by the Michigan Department of Public Health (MDPH) in 1982 revealed two of the four municipal water supply wells serving the city of Sturgis were contaminated with the industrial solvents trichloroethylene (TCE) and tetrachloroethylene (PCE). In 1983 the city asked approximately 10,000 residents in its service area to limit their water usage. In 1984 the city began utilizing a new well called the Oaklawn well, bringing the total to three usable wells (the Broadus, Lakeview, and Oaklawn) and two contaminated wells (the Layne and Jackson). In 1985 the Broadus well was found to be contaminated. In 1989 the MDPH advised the city not to rely on the Layne, Jackson, and Broadus wells. The city is now relying on the Thurston Woods well installed in 1989, and the Oaklawn and Lakeview wells to serve their needs.

The site was placed on the National Priorities List in October 1984. The state of Michigan served as the lead agency for site investigations. The Michigan Department of Natural Resources (MDNR) undertook a Remedial Investigation/Feasibility Study (RI/FS) from September 1987 through May 1991. Results of the RI documented large plumes of TCE and PCE-contaminated groundwater in at least two aquifers, as well as in soils of two source areas referred to as the Kirsch and Wade source areas (please see Figures 2, 3 and 4). Levels of TCE and PCE exceed state and federal standards in both the groundwater and soil. It is unclear as to how the releases occurred at the two source areas; however, both were former industrial sites where solvent degreasing was known to have been practiced.

A Record of Decision (ROD) outlining the chosen Remedial Action (RA) was issued in September 1991. The selected remedy included extraction and treatment of the contaminated groundwater until the former Michigan Environmental Response Act, 1982 PA 307, as amended, Type B levels were met, soil vapor extraction (SVE) of the contaminated on-site soils, and excavation of the remaining contaminated soils that cannot be treated by SVE.

In 1992 the United States Environmental Protection Agency (EPA) designed an interim groundwater pump and treat system. The primary goal of the interim response was to halt the migration of contaminants toward uncontaminated city municipal wells. The EPA issued a unilateral administrative order to the Potentially Responsible Party (PRP) for completion of the interim response. The PRP completed the design and began construction of the groundwater pump and treat system in late summer/early fall 1993. Construction of the interim pump and treat system was completed in May 1994, and has been operating since that time.

In early 1993 the EPA and MDNR entered into settlement negotiations with the PRPs for the Remedial Design (RD)/RA of the ROD remedies. Because these negotiations were not successful, the EPA decided to fund the RD/RA. The MDNR was chosen as the lead agency and began the design in 1994.

During fall 1994 the MDNR's consultants conducted a pre-design investigation at the site to determine the exact nature and extent of soil contamination at the Kirsch and Wade source areas for the purpose of designing soil remediation systems. A deep aquifer hydrogeological investigation was also conducted to determine whether contamination exists further downgradient than the agencies had believed. Results of the deep aquifer investigation revealed that there was groundwater contamination further downgradient than previously thought. After the pre-design investigation was complete, the state's consultant began the engineering design for the SVE systems. In 1995 the MDNR's environmental programs were placed in the new Michigan Department of Environmental Quality (MDEQ) and Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended was passed.

During much of 1996 the state negotiated a settlement with the PRP for their takeover of all activities at the site under the direction of the MDEQ. In late summer an agreement was reached and a Consent Decree (CD) and statement of work were lodged in federal court under the authority of Part 201. The court entered the CD on October 25, 1996.

Also during 1996 the EPA issued a ROD amendment, which altered the 1991 remedy for the site. The ROD amendment changed groundwater and soil cleanup standards to comply with current state law, eliminated the Wade Electric source area from requiring SVE remediation and eliminated the requirement of excavation of soils contaminated with polynuclear aromatic hydrocarbons due to changes in state cleanup criteria.

Construction of the SVE system at the Kirsch source area began in December 1996, was completed in March 1997, and has been operational since that time (please see Figure 5). The PRP, Kirsch, Inc., is currently operating the interim pump and treat system and Kirsch SVE system in accordance with the CD.

In 1999 the MDEQ determined that the interim groundwater pump and treat system would need to be augmented in order to meet the RODs objectives. To this end, on January 29, 1999, the MDEQ requested that the PRP design, install and operate additional groundwater extraction and treatment as necessary to stop the plume from migrating to industrial wells and to complete

capture of the plume along the west side of the site. The design for the new pump and treat system is currently at the 60 percent design stage. Construction will begin in spring 2000.

II. Discussion of Remedial Objectives; Areas of Noncompliance.

The objective of this remedial action is to eliminate the source of groundwater contamination and restore the aquifers to their beneficial use. Specifically, the remedy calls for the following:

- Soil vapor extraction (SVE) of volatile organic compounds (VOCs) in the Kirsch property source area soils until the Part 201 generic residential cleanup levels are achieved.
- Extraction and treatment of groundwater using air stripping with vapor phase granular activated carbon to be used to treat the off-gases and/or treatment of groundwater with liquid phase carbon. Extraction and treatment will be conducted until federal drinking water standards maximum contaminant levels are reached for VOCs. In addition to achieving federal cleanup levels, a risk evaluation shall be performed to verify that there is no unacceptable risk associated with the groundwater.
- Discharge of treated water to surface waters via storm sewer or to the municipal system.
- A minimum of a 30-year groundwater monitoring program to assure the effectiveness of the RA and the quality of the municipal water supply.

Progress toward full implementation of the ROD remedy is ongoing. The SVE portion of the ROD remedy has been operational since early 1997. Operation of the SVE system has been conducted in compliance with the CD, toward meeting the remedial goals of the ROD. Monitoring data from individual vapor extraction wells indicate a steady decline in TCE levels over time (please see Figure 6). It has been estimated that the soils may reach cleanup levels within another one to two years of operation. Once samples from individual vapor extraction wells indicate TCE levels below cleanup standards, extensive soil sampling will be conducted to verify that cleanup standards have been met.

Progress toward full implementation of the groundwater restoration portion of the ROD remedy is ongoing. The interim groundwater extraction and treatment system has been operational since 1994 and consists of one high capacity extraction well pumping at 3,000 gallons per minute (gpm) and treatment via an 80 feet tall, 12 feet diameter air stripper with two 20,000-pound granular activated carbon units to treat the off-gasses. While it was not intended to be the final remedy for groundwater at the site, the interim system has performed very well. An analysis of the system's performance in late 1998 yielded the following results:

- VOC concentrations in the upper aquifer at the Kirsch source area have decreased approximately 80 percent since implementation of the interim system.

- The VOC plume in the lower aquifer has been significantly reduced in areal extent since implementation of the interim system with the size and mass of the plume being reduced by approximately 50 percent.
- The contaminant mass removed by the interim system since startup totals more than 47,000 pounds (23.5 tons) which is the equivalent of approximately 3,900 gallons of TCE.

While the interim groundwater extraction and treatment system has accomplished the goals set for it, it cannot be designated the final groundwater remedy. This is due to a large portion of the lower aquifer plume that continues to migrate and impact a series of industrial pumping wells on the northwest side of Sturgis, as well as the fact that capture of the downgradient western edge of the plume has been marginal to date (please see Figure 7 for groundwater monitoring data). Due to these reasons, the MDEQ requested that the PRP design another groundwater extraction and treatment system to intercept the plume such that it will not continue to migrate to the industrial pumping wells, and pump at a rate sufficient to capture the western portion of the plume.

Design of the final groundwater remedy is currently at the 60 percent stage. The design calls for a new high capacity extraction well pumping at a rate of 2,000 gpm, a 70 feet tall, 10 feet diameter air stripper and two 13,000-pound granular activated carbon units. The design is scheduled to be completed in early 2000 with construction completed during the 2000 construction season.

Review of the hydrogeological aspects of the Sturgis site has revealed one area of concern. The hydrogeological characterization of the site has documented that the majority of the groundwater contaminant plume exists within a bedrock valley at the base of the lower aquifer. The bedrock valley has been adequately characterized from the center of the lower aquifer plume and to the west, which is the direction of the regional groundwater flow. However, there is little to no characterization of the bedrock to the east and southeast of the center of the lower aquifer plume (please see Figure 8). The potential exists for contaminant migration to the east or southeast, against the regional groundwater flow, depending on the topography of the bedrock. This lack of bedrock characterization to the east and southeast is a significant data gap.

The final remedy for the Sturgis Municipal Wells Superfund site will meet all applicable or relevant and appropriate requirements (ARARs). For a thorough discussion of ARARs for the Sturgis site, the reader should refer to section V.A.2 of the September 1996 ROD amendment.

III. Recommendations

Additional hydrogeological characterization of the bedrock should be conducted to the east and southeast of the center of the lower aquifer contaminant plume.

Once the new groundwater extraction and treatment system is constructed and operational, an analysis should be conducted to determine if the existing long-term groundwater-monitoring

plan and monitor well network remain adequate. If the analysis concludes that the existing monitoring plan and monitor well network are not adequate, the MDEQ and the PRP should take steps to develop an acceptable monitoring plan and if necessary, install additional monitoring wells.

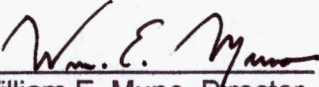
Other than the bedrock issue discussed above, this five-year review has revealed no new evidence that would require corrective action. The only additional recommendations evident are reaffirmations of the ROD. That is, operation of the SVE system should continue until soil cleanup standards have been achieved, construction of the groundwater component should proceed on schedule, operation of the groundwater extraction and treatment system should be continuous until cleanup standards have been achieved throughout the affected aquifers and periodic monitoring should continue to ensure that progress continues toward eventual cleanup.

IV. Statement on Protectiveness

The remedy selected for this site remains protective of human health and the environment.

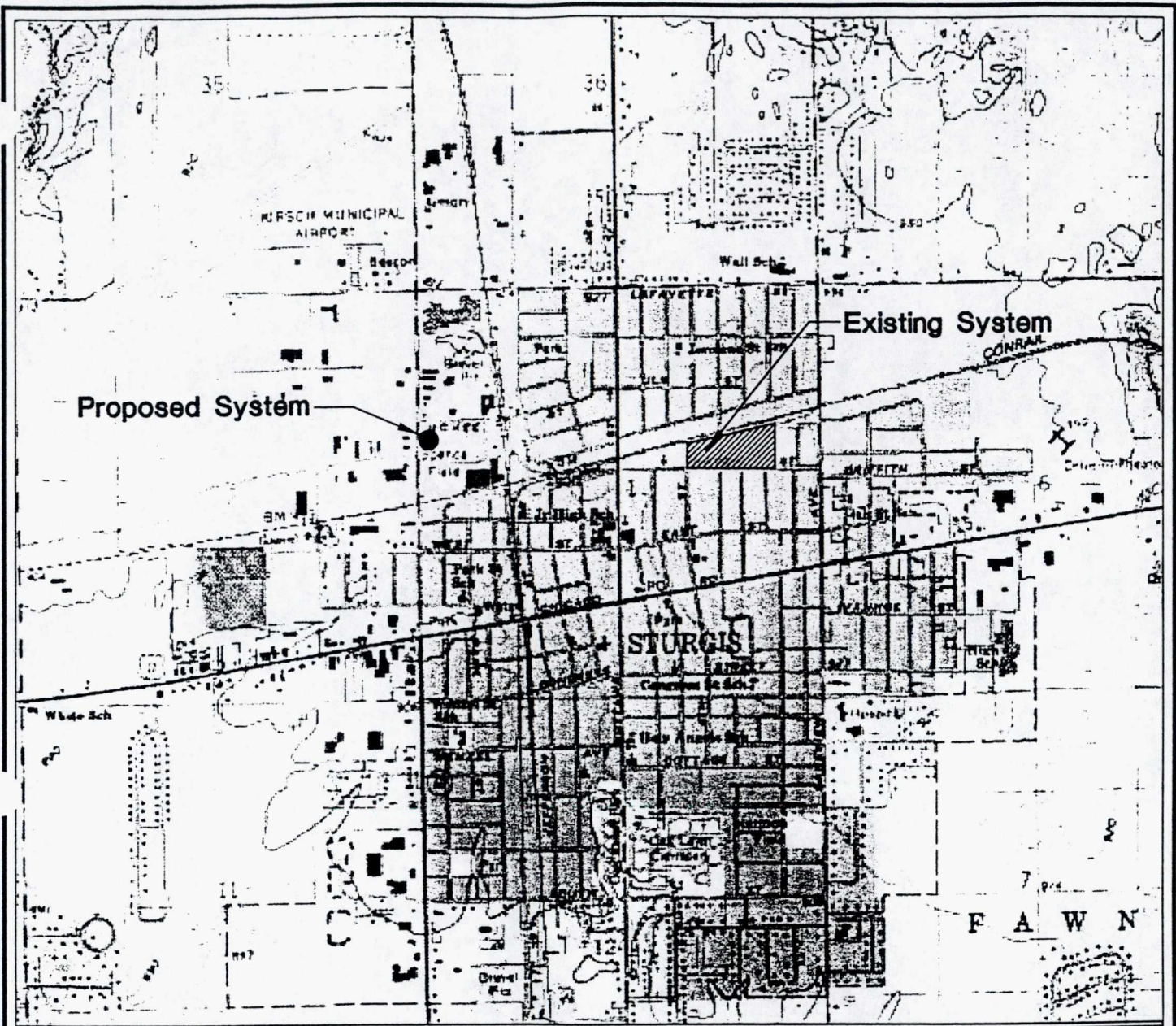
V. Next Five-Year Review

The next five-year review will be conducted by September 30, 2004.

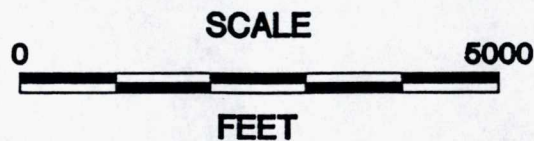


William E. Muno, Director
Superfund Division
U. S. Environmental Protection Agency

10/15/97
Date




/cad/newell/p140/newell-silt



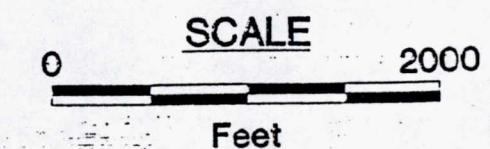
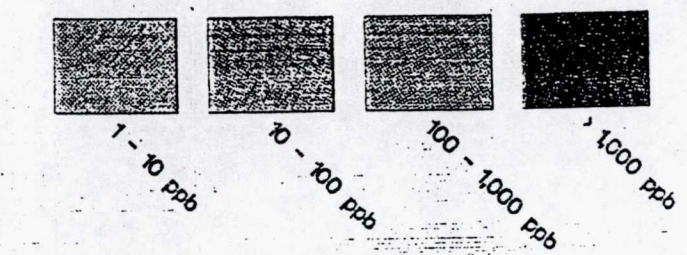
National Geodetic Vertical Datum of 1929
Contour Interval 10 Feet



NEWELL RUBBERMAID INC. STURGIS, MICHIGAN		DATE: 8/24/99
SITE LOCATION and LOCAL TOPOGRAPHY		DESIGNED: BOB
		CHECKED: MRN
		APPROVED: MRN
		DRAWN: BOB
		PROJ: P140
		

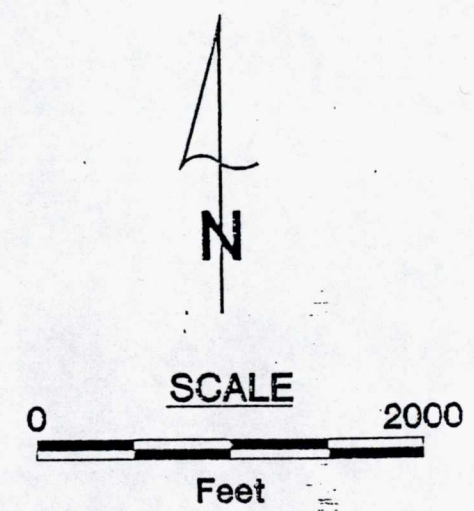
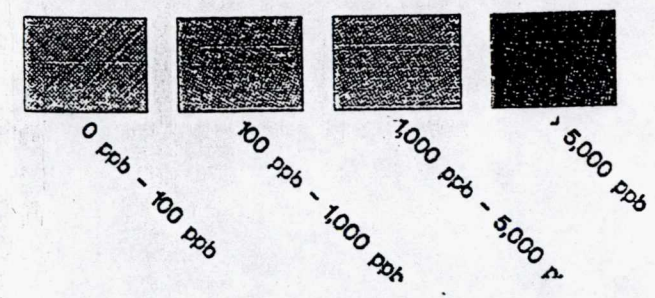
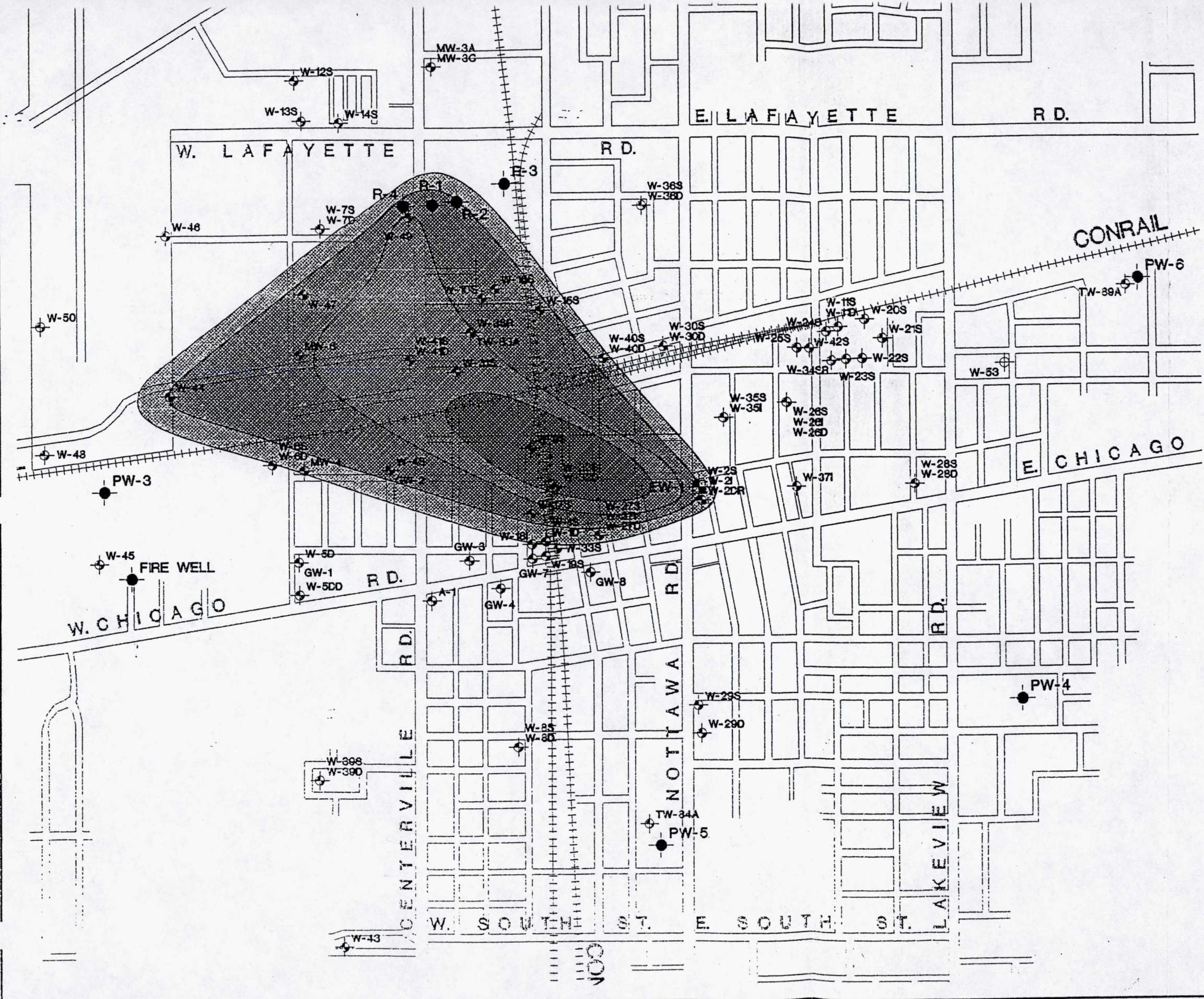
Base map from U.S.G.S. 7.5' Sturgis, Michigan
topographic quadrangle map, revised 1982.

FIGURE 1



KIRSCH STURGIS, MICHIGAN	DATE: 06/02/99
	DESIGNED: BOB
CONTAMINANT PLUME UPPER AQUIFER (April, 1999)	CHECKED: MRN
	APPROVED: MRN
	DRAWN: BOB
	PROJ: P-140

FIGURE 2




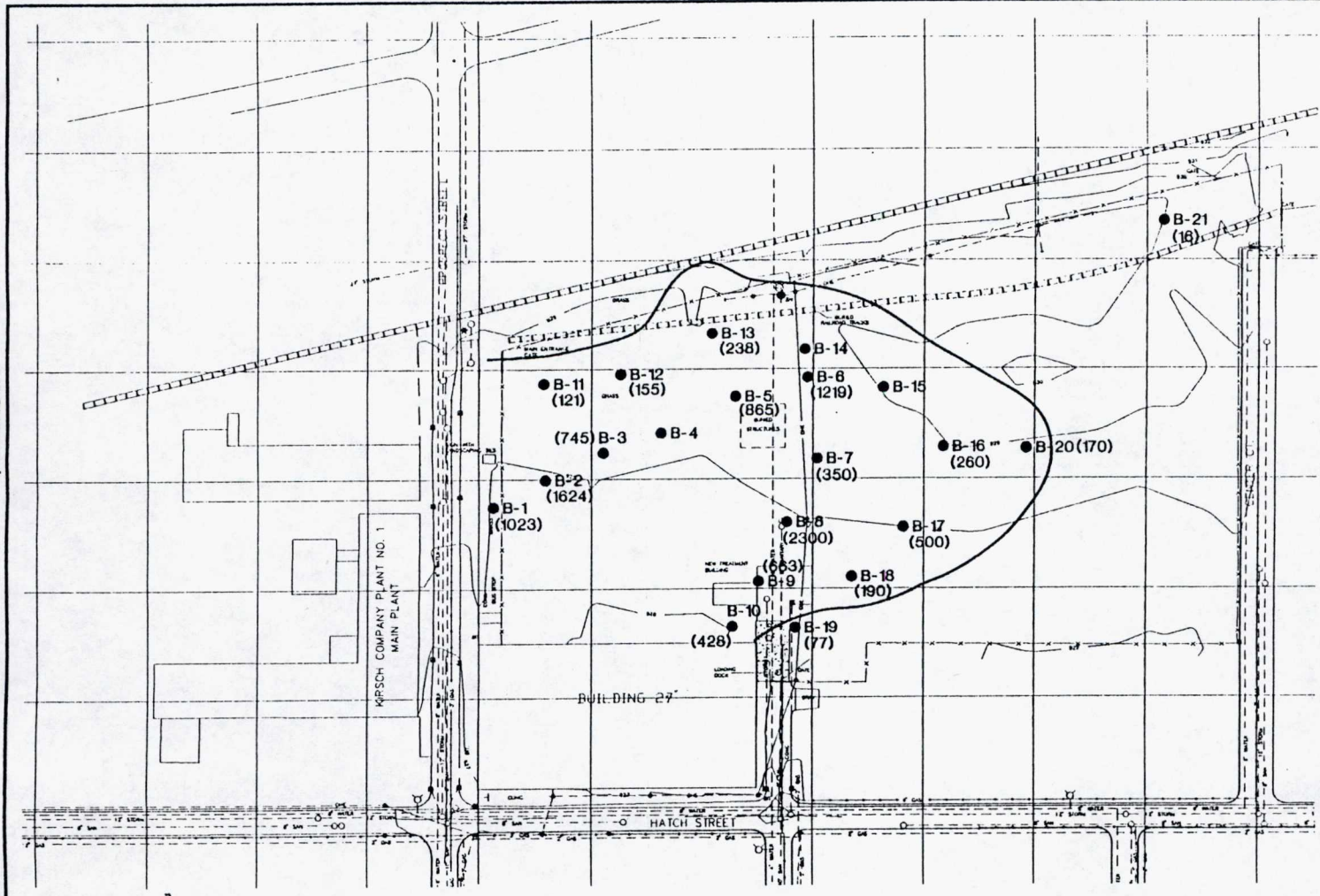
KIRSCH STURGIS, MICHIGAN CONTAMINANT PLUME LOWER AQUIFER (April, 1999)	DATE: 08/02/99
	DESIGNED: BOB
	CHECKED: MRN
	APPROVED: MRN
	DRAWN: BOB
	PROJ: P-140

FIGURE 3

FIELD V



EXPLANATION

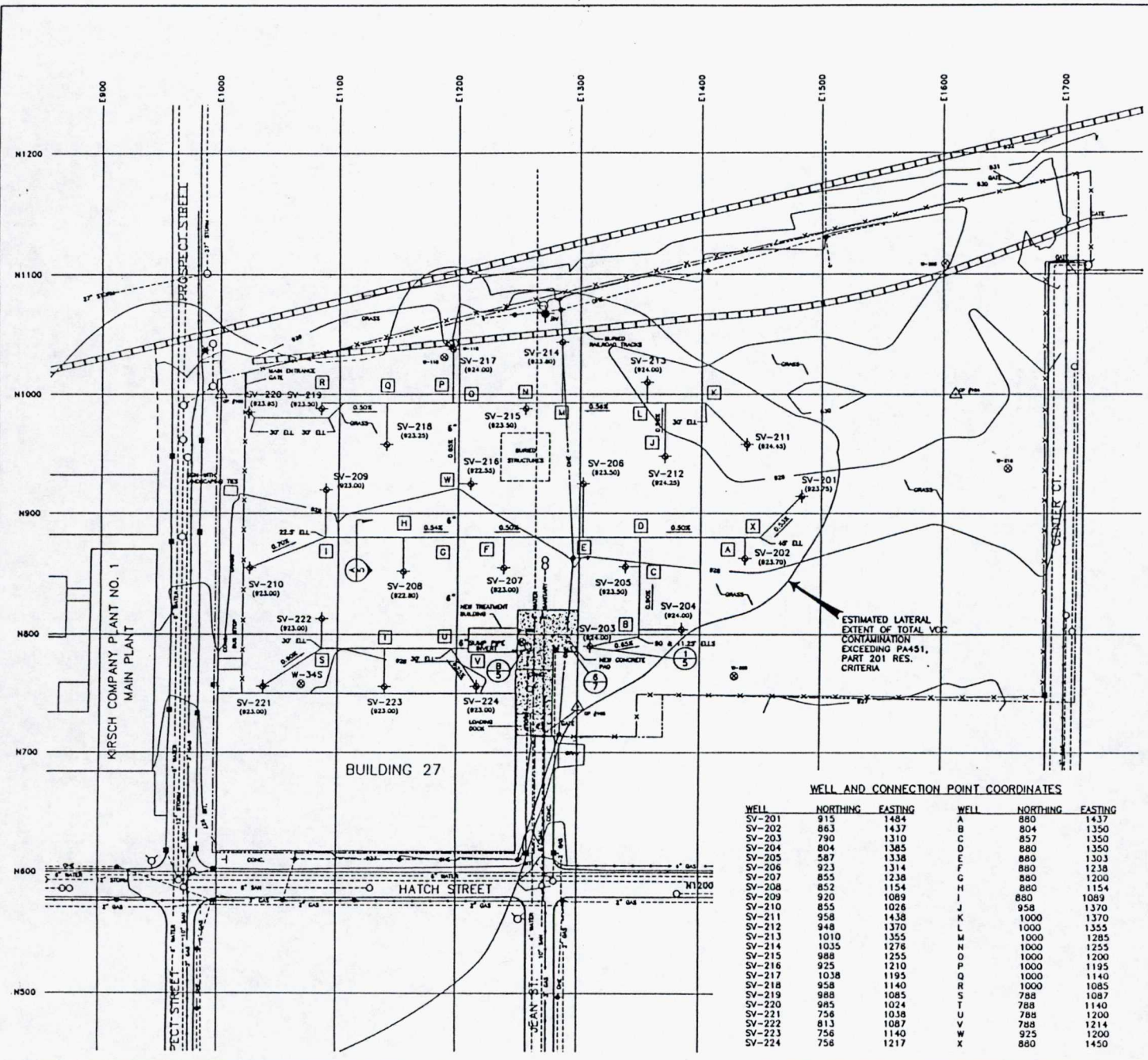
- B-5 (865) GEOPROBE SAMPLING LOCATION, DESIGNATION, AND TOTAL VOC CONCENTRATION IN (ppb)
- EXTENT OF TOTAL VOC CONTAMINATION EXCEEDING ACT 451, PART 201 CRITERIA



KIRSCH STURGIS, MICHIGAN TOTAL SOIL VOC CONCENTRATION AT DEPTH OF 25 FEET	DATE: 09/25/98
	DESIGNED: bob
HYDRO-SEARCH INC A Tetra Tech Company	CHECKED: mfn
	APPROVED: mfn
	DRAWN: bob
	PROJ: 304583382

Base map from Snel Environmental Group, Inc. 2/19/96
 File: 4587338213597.p5

FIGURE 5



- NOTES:**
- LEGEND IS TYPICAL FOR ALL DRAWING SHEETS.
 - UTILITY INFORMATION IS FROM AVAILABLE EXISTING UTILITY MAPS. ADDITIONAL UTILITIES MAY BE WITHIN THE LIMITS OF WORK. THE CONTRACTOR IS RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES PRESENT. EXISTING WATER LINES ARE SHOWN AT DEPTH OF 4 FEET. GAS LINES ARE SHOWN AT A DEPTH OF 3 FEET. STORM AND SANITARY LINES ARE SHOWN BASED ON AVAILABLE INFORMATION AND MAPS. THESE LOCATIONS AND DEPTHS ARE APPROXIMATE AND ARE SHOWN TO GIVE THE CONTRACTOR AN IDEA OF WHAT UTILITIES ARE PRESENT. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE EXACT LOCATION AND DEPTH OF THE UTILITIES IN THE LIMITS OF THE WORK.
 - ALL THE PIPING IS 4 INCH DIAMETER SCHEDULE 40 PVC UNLESS OTHERWISE NOTED.

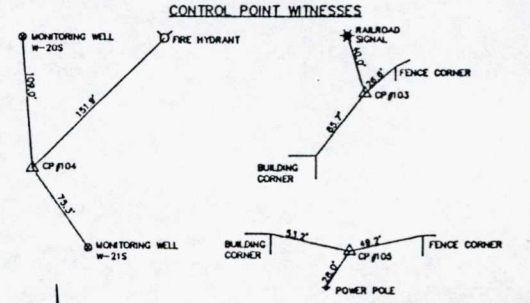
- EXPLANATION**
- SV-# MARKED THE WELLHEAD W/ (SLIP) PIPE SHORT CONNECTION ELEVATION
 - THE CONNECTION ELEVATION NETWORK SYMBOL (SEE SCHEDULE THIS SHEET)
 - EXISTING MONITOR WELL LOCATION
 - PROPOSED CONDENSATE SLUMP
 - MANHOLE
 - CATCH BASIN
 - POWER POLE
 - FIRE HYDRANT
 - RAILROAD SIGNAL
 - SURVEY CONTROL POINT
 - SURVEY BENCH MARK
 - FENCE
 - UTILITY (AS NOTED)
 - ONE-WIRE/ONE ELECTRIC SAN-SANITARY SENDER LINE
 - PROPOSED SENDER LINE
 - PROPERTY LINE
 - ABANDONED GAS LINE
 - RAILROAD TRACKS
 - ABANDONED RAILROAD TRACKS
 - TOPOGRAPHY LINE
 - OVERHEAD ELECTRIC POWER LINES
 - NEW U.S. ONE INCH (302)

PIPE INVERT CONNECTION ELEVATIONS SV NETWORK

CONNECTION POINT	PIPE INVERT ELEVATION
A	923.44
B	923.72
C	923.25
D	923.00
E	922.77
F	922.44
G	921.93
H	922.17
I	922.52
J	924.07
K	923.83
L	923.75
M	923.35
N	923.18
O	922.87
P	922.89
Q	923.17
R	923.44
S	922.48
T	921.98
U	921.47
V	921.38
W	922.38
X	923.51

CONTROL POINT COORDINATES

CONTROL POINT	LOCAL COORDINATE		STATE PLANE COORDINATE	
	NORTHING	EASTING	NORTHING	EASTING
CP #103	1000.0	1000.0	113,086.5	1,705,398.6
CP #104	1000.0	1810.0	113,081.9	1,706,008.7
CP #105	738.9	1300.7	112,824.2	1,705,696.7



WELL AND CONNECTION POINT COORDINATES

WELL	NORTHING	EASTING	WELL	NORTHING	EASTING
SV-201	915	1484	A	880	1437
SV-202	883	1437	B	804	1350
SV-203	790	1310	C	857	1350
SV-204	804	1385	D	880	1350
SV-205	587	1338	E	880	1303
SV-206	923	1314	F	880	1238
SV-207	855	1238	G	880	1200
SV-208	852	1154	H	880	1154
SV-209	920	1089	I	880	1089
SV-210	855	1028	J	958	1370
SV-211	958	1438	K	1000	1370
SV-212	948	1370	L	1000	1355
SV-213	1010	1355	M	1000	1285
SV-214	1035	1278	N	1000	1255
SV-215	988	1255	O	1000	1200
SV-216	925	1210	P	1000	1195
SV-217	1038	1195	Q	1000	1140
SV-218	958	1140	R	1000	1085
SV-219	988	1085	S	788	1087
SV-220	985	1024	T	788	1140
SV-221	756	1038	U	788	1200
SV-222	813	1087	V	788	1214
SV-223	756	1140	W	925	1200
SV-224	756	1217	X	880	1450

VERSION	DATE	APPROVED
REV 1		
REV 2		

COOPER STURGIS, MI	DATE: 8-30-96
CHECKED BY: JWR/HC	
APPROVED BY: JWR/HC	
DRAWN BY: JDD	
PROJECT NO.: 0048488	

HYDRO-SEARCH INC.	DATE: 3 9	SCALE: NTS
A Terra Tech Company		

SVE Well Sampling

Date	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	Combined	
16-Apr-97	c	c	1	c	12	12	40	40	14	40	c	3.5	c	c	20	5	c	6	c	c	50	30	71	15		
06-Jun-97	c	c	c	c	10	10	40	45	10	45	c	c	c	c		c	c	c	c	c	45	40	45	10		
08-Jul-97	c	c	c	c	8	5	30	25	5	30	c	c	c	c	2	c	c	c	c	c	30	35	30	2		
10-Oct-97	c	c	c	c	<2	<2	10	10	<2	10	c	c	c	c	<2	c	c	c	c	c	20	20	20	<2	5	
17-Feb-98	c	c	c	c	c	c	5	5	c	5	c	1.8*	c	c	c	5	c	0.94*	c	c	10	10	5	c	5	
23-Apr-98	c	c	c	c	c	c	7.5*	12.9*	c	<2	c	1.0*	c	c	c	3.0*	c	0.42*	c	c	5	5	5.9*	c	8.7*	
GC Analysis					15-Jul	15-Jul			15-Jul															15-Jul		
25-Jul-98	c	c	c	c	1.6	2.6	9.4	10	0.88	9.9	c	c	c	c	c	2.8	c	c	c	c	24	18	6.3	0.8	6.7	
12-Aug-98																									4.6	
27-Aug-98																										5.2
29-Sep-98	Kirsch GC out of service. This analysis was conducted by an outside lab.																									
04-Nov-98	c	c	c	c	0.02	0.25	1	0.9	0.17	1.6	c	c	c	c	c	0.3	c	c	c	c	4	2.6	1.3	0.11	1.3	
18-Nov-98	Opened all closed wells																									
25-Feb-99	0.1	0.1	0.0	0.0	0.3	0.3	1.3	1.2	0.2	2.1	0.3	0.2	0.0	0.0	0.1	0.4		0.1	0.0	0.1	4	2.8	0.9	0.1	1	
25-Feb-99			Vent	Vent									Vent	Vent					Vent							
01-May-99	0.04	ND	Vent	Vent	ND	0.14	0.57	0.56	0.30	1.10	0.09	ND	Vent	Vent	0.03	ND	0.03	0.04	Vent	0.34	2.30	1.90	0.70	0.10	0.65	

FIGURE 6

First 1999 Semiannual Monitoring Event Analytical Results

Well ID	1,1-dichloroethene	cis-1,2-dichloroethene	Chloroform	tetrachloroethene	1,1,1-trichloroethane	1,1,2-trichloroethane	trichloroethene	1,2-dichlorobenzene	total chlorinated VOC
W-1S				1		2	120		123
W-11S							0.6		0.6
W-19S		4					120		124
W-23S				6			300		306
W-26S				19	0.6		2500		2519.6
W-42S				25		2	840		867
W-2DR							8		8
W-5DD									NS
W-26D									0
W-27D							21		21
W-32D		2				1	7900		7903
W-40D		0.8					3		3.8
W-41D		4				2	3000		3006
W-44		0.7					200		200.7
W-45									0
W-46									0
W-47	0.7	13	2		14	1	190		220.7
W-48									0
W-49		8	0.8			3	1500		1511.8
W-50									0
TW-84A									0

FIGURE 7

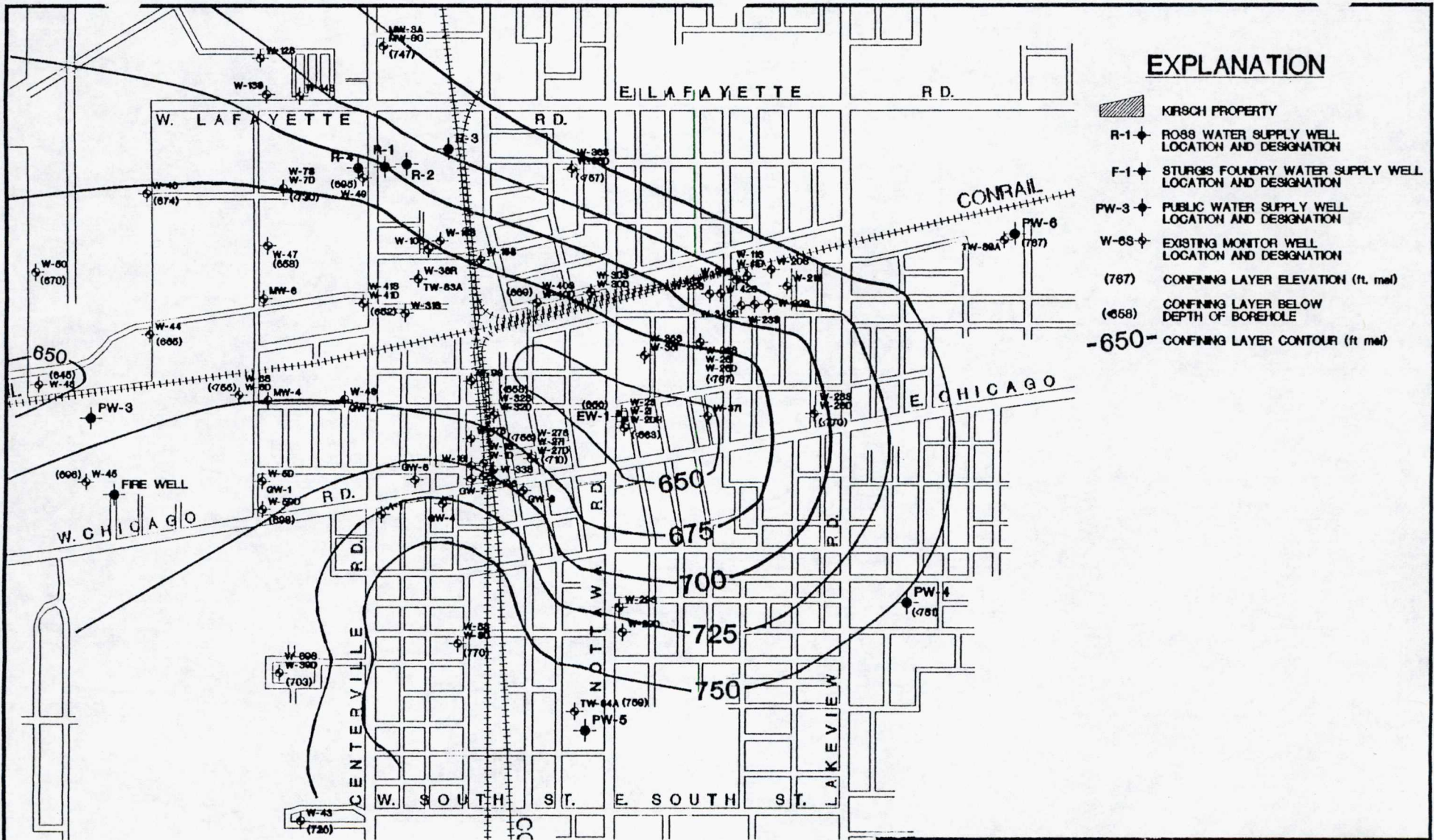
All values in ug/l

Blank indicates concentration below reporting limit


Samples collected between April 27 - May 1, 1999

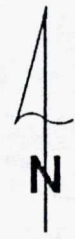
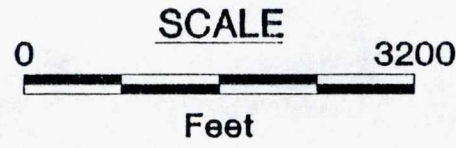
B qualifier indicates compound was also detected in field and/or trip blank

NS qualifier indicates well not sampled



EXPLANATION

-  KIRSCH PROPERTY
- R-1  ROSS WATER SUPPLY WELL LOCATION AND DESIGNATION
- F-1  STURGIS FOUNDRY WATER SUPPLY WELL LOCATION AND DESIGNATION
- PW-3  PUBLIC WATER SUPPLY WELL LOCATION AND DESIGNATION
- W-63  EXISTING MONITOR WELL LOCATION AND DESIGNATION
- (787) CONFINING LAYER ELEVATION (ft. msl)
- (658) CONFINING LAYER BELOW DEPTH OF BOREHOLE
- 650- CONFINING LAYER CONTOUR (ft. msl)




<p>KIRSCH STURGIS, MICHIGAN</p>	<p>DATE: 07/13/98</p>
<p>ELEVATION OF TOP OF LOWER CONFINING LAYER (CLAY TILL OR SHALE BEDROCK)</p>	<p>DESIGNED: BOB</p>
 <p>HSI GEOTRANS A TETRA TECH COMPANY</p>	<p>CHECKED: MRN</p>
<p>Figure</p>	<p>APPROVED: MRN</p>
	<p>DRAWN: BOB</p>
	<p>PROJ: 307343287</p>

FIGURE 8