Village of Whitefish Bay

The Geoprobe and Monitoring Well Investigation

Whitefish Bay Demolition Landfill Site
Milwaukee, Wisconsin

5/94

May 19, 1994

Mr. Edmund Henschel
Village of Whitefish Bay
Village Manager
5300 Marlborough Drive
Whitefish Bay, WI 53217

RE: The Geoprobe and Monitoring Well Investigation at the Whitefish Bay Demolition Landfill Site in Milwaukee, Wisconsin -- STS Project No. 82149XF

Dear Mr. Henschel:

This report summarizes the Geoprobe groundwater sampling, monitoring well installation and monitoring well groundwater sampling recently performed at the Whitefish Bay Landfill site in Milwaukee, Wisconsin. The site location is shown on Figure 1. STS was retained by the Village of Whitefish Bay to perform these services to further investigate the extent of affected groundwater at the site and vicinity.

1.0 INTRODUCTION

1.1 Background

Subsequent to a preliminary soil and groundwater investigation, the Village reported NR 140 groundwater standard exceedances to the Wisconsin Department of Natural Resources (WDNR) in January, 1989. Additional on-site investigation, including borings, wells and a soil gas survey, documented chlorinated solvent impacts in the soil and groundwater, primarily in the southwest corner of the site. During the April 1989 sampling round, which was the most recent round, groundwater impacts were in exceedance of the NR140 enforcement standards for seven different volatile organic compounds (VOCs).

During this same sampling round, depth to groundwater was measured to be approximately 10 to 25 feet below the ground surface, which varied considerably in elevation. Water table elevations determined from wells on site indicated a groundwater flow direction to the southwest.

Based on the data gathered, STS developed a conceptual remediation plan including groundwater extraction and treatment at the southwest corner of the site. In August, 1992, the WDNR sent a letter to the Village ordering additional information regarding the complex hydrogeology and potential downgradient, off-site impacts. Through various discussions with Pam Mylotta of the WDNR, a basic approach to the next phase of investigation was agreed upon. The work performed as a result of these discussions is summarized in the following Scope of Work section.

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1.2 Scope of Work

Although groundwater impacts had been documented on-site, the lateral and downgradient extent of the impacts off-site had not been defined. STS proposed using Geoprobe investigation techniques to further explore the extent of affected off-site groundwater. The Geoprobe is often an effective means of estimating the extent of groundwater impacts and directing the placement of additional groundwater monitoring wells. This approach minimizes the installation of unnecessary monitoring wells. Since unsaturated zone soil impacts would not be expected away from the source area and given the budgetary constraints, soil samples were not collected during Geoprobe sampling.

The original scope of work outlined in our September 3, 1993 proposal included the following:

- Perform six Geoprobe sampling points.
- Install one additional monitoring well.
- Conduct a full round of groundwater sampling.
- Record a round of water levels to allow calculation of groundwater elevation and estimation of flow direction.
- Prepare this letter report summarizing the findings.

The following additional tasks were recommended by STS and were completed subsequent to authorization by a representative of the Village.

- Repair monitoring wells, if necessary.
- Install a second, shallower well adjacent to the well installed as part of the original scope of work.

2.0 GEOPROBE INVESTIGATION

2.1 Purpose

The purpose of the Geoprobe investigation was to explore downgradient, off-site groundwater impacts. The intent of the investigation was to obtain and field-analyze groundwater samples from the sand and gravel stratum in which impacts were observed on-site. The investigation was completed on County-owned land located southwest of the landfill, in the apparent hydraulically downgradient direction (see Figure 2).

2.2 General

Groundwater samples were collected at six locations by Geoprobe sampling techniques. The sampling instrument was driven, if possible, until water was encountered at an elevation similar to the affected sand and gravel layer on site. In some cases, however, the Geoprobe

could not be advanced to the desired depth, possibly because of dense soils or cobble. Sampling equipment was decontaminated between each sampling.

Groundwater samples were analyzed in the field by a gas chromatograph for:

- vinyl chloride
- 1,1-dichloroethene
- 1,2-dichloroethene
- 1,1-dichloroethane
- 1,2-dichloroethane
- 1,1,1-trichloroethane
- trichloroethene
- tetrachloroethene

Sampling and analysis were performed by Layne Geosciences and were observed by STS.

2.3 Results

As the probes were advanced, a water bearing unit was consistently encountered between 16 and 25 feet below ground surface. At the deepest, the elevation appeared consistent with the affected sand stratum observed on site. A groundwater sample was collected from this depth range and analyzed at each Geoprobe location. At locations GP2 and GP4, water was also encountered at a shallower interval that appeared to be hydraulically separated from the lower unit by a clay layer. The water in this unit was sampled and analyzed at GP2 and GP4.

Field analysis of the groundwater samples indicated that vinyl chloride and 1,2-dichloroethene were present in the groundwater within the lower sand unit in excess of the NR 140 Enforcement Standards (ES) at GP1 and GP2-W2. In addition, 1,1,1-trichloroethane was detected in GP5 in excess of the NR 140 Preventive Action Limit (PAL). These results were consistent with our expectations both in the locations where the impacts were detected and the compounds detected. All other samples had concentrations below detection limits for the analyzed parameters. A summary of the results is presented in Table 1 and the Layne report is in Appendix A. Only the detected parameters are listed. The results are also shown on Figure 3. The results of the Geoprobe survey were used to direct the monitoring well placement which is discussed in Section 3.

3.0 GROUNDWATER MONITORING WELL INSTALLATION AND SAMPLING

Based on the results of the Geoprobe sampling, a well nest consisting of two wells was installed approximately 600 feet west-southwest of MW-22 to confirm and monitor the results of Geoprobe samples GP2-W1 and GP2-W2.

3.1 Soils

The soil encountered in the off-site borings was primarily silty clay with varying amounts of sand and gravel to approximately 17 feet below ground surface (bgs). A 2.5-foot thick medium to coarse-grained saturated sand layer was encountered at 2 feet bgs and a 0.3-foot

thick sand seam was encountered at approximately 9 feet bgs. The soil encountered from 17 feet to the boring terminus at 26 feet bgs was primarily sand and silty sand with varying amounts of gravel. A 1.5-foot thick clay layer was encountered at 20 feet bgs. The sand and gravel from 18 feet to the boring terminus appeared to be below the groundwater table. The soil profile observed in the borings is generally similar to that encountered in borings performed on the landfill property, and indicated that the Geoprobe samples at this location had been obtained from a sand stratum similar in composition to the impacted stratum on-site. The soil boring log for B-24D is presented in Appendix B.

3.2 Well Construction

Monitoring well MW-24S was installed with a 5-foot screen to a depth of 12.7 feet bgs. The elevation of the screened interval was from 696.0 to 701.0 feet above mean sea level (msl).

Piezometer MW-24D was installed with a 5-foot screen to a depth of 22.8 feet bgs. The elevation of the screened interval was from 686.0 to 691 feet above msl. This sensing elevation is consistent with the elevation where GP2-W2 was collected (689 feet above msl), but was above the elevation of the groundwater observed in well MW-22.

Both MW-24S and D were constructed with a medium-grained sand filter pack from the bottom of the boring to at least 3 feet above the screen. The remainder of the annular space was backfilled with bentonite chips to seal the well off from surface water infiltration. The wells were finished off with 4-inch diameter steel protector pipes which extended to approximately 2 feet above ground surface. The well construction forms are presented in Appendix B.

3.3 Groundwater Elevations

Depth to water measurements were taken in all wells on November 11, 1993. In addition, the elevations of the top of the casings were determined by a professional land surveyor. From this information groundwater elevations were calculated.

The groundwater elevations on-site were consistently approximately 1-foot higher than in November, 1992. The general flow direction on-site has not changed significantly. Based on current and past elevation data, the groundwater appears to flow away from Lincoln Creek across the site to the west-southwest. The results are presented on Table 2 and are illustrated and contoured on Figure 4. The groundwater elevations from monitoring well MW-16 should not be considered in calculating flow, since it appears to monitor a different water bearing unit than the other wells on-site.

The new well, MW-24D, installed approximately 600 feet west-southwest of MW-22, has a significantly higher groundwater elevation (approximately 698.20 feet) than any of the wells on the landfill property. This would seem to indicate an eastward groundwater flow direction in the area of MW-24, assuming that MW-24D is screened in the same soil unit as the wells on-site, and that the unit is continuous from the site to MW-24D. If these assumptions are correct, MW-24 may not be downgradient of the site and the impacts detected in the area of GP2-W2 would appear to be from another source. The groundwater elevation in MW-24S, the

shallow well installed near MW-24D, was approximately 1 foot higher than MW-24D, indicating a downward vertical gradient.

3.4 Groundwater Analytical Results

The eight previously existing and two newly installed monitoring wells were sampled on November 11 and 12, 1993. The results indicate that 14 chlorinated solvents or petroleum-related compounds exceeded ES concentrations. Most of the impacts appear to be on the southwest portion of the site. In general, concentrations of most parameters have decreased from those reported for previous sampling rounds. One major exception is the parameter concentrations in MW-22. Several compounds, including ethylbenzene, tetrachloroethene, toluene, 1,1,1-trichloroethane, and xylenes are present in groundwater collected from MW-22 in significantly higher concentrations than previously measured.

In addition, vinyl chloride has been detected at concentrations above the ES in several wells where it was not previously detected. STS investigated possible sampling and analytical reasons for the increase, and the results for this round appear to be valid. One possible reason given by the analytical laboratory for the observed increase was improvements in laboratory sample handling and analysis. The improvements have apparently resulted in less loss of highly volatile compounds such as vinyl chloride, which in turn results in apparent higher measured concentrations.

The groundwater sample collected from MW-24D, which was intended to confirm the results of Geoprobe sample GP2-W2, indicated that parameter concentrations were below analytical detection limits for all VOC parameters except toluene. Toluene was not present in excess of the NR140 PAL. The laboratory results are inconsistent with the Geoprobe results from the same location and depth. An STS chemist reviewed the Enviroscan and Layne chromatograms for errors or discrepancies, and do not find anything in the quality control procedures or analytical methods used which would account for the discrepancy.

A summary of the concentrations of the detected parameters is presented on Table 3 and the laboratory report is presented in Appendix A. Estimated contours for the sum of the concentrations of two representative parameters (vinyl chloride and 1,2-dichloroethene) are illustrated on Figure 3.

A thin film (less than one-inch) of floating free product was observed in monitoring well MW-22 during the purging of the well prior to sampling. No free product was observed in the well after purging. On April 1, 1994, a hydrocarbon probe was used to further investigate the presence of light and dense non-aqueous phase liquids (LNAPL and DNAPL, respectively). Neither was observed. The LNAPL issue was further explored on April 12, 1994 using a bailer. Again, no LNAPL was observed.

4.0 SUMMARY AND CONCLUSIONS

The following is a summary of the investigation results and our conclusions based on those results.

- The Geoprobe study indicated that vinyl chloride and 1,2-dichloroethene impacts, commonly observed on site, were detected above NR140 ESs in GP1 and GP2-W2. These sample points are located 400 and 600 feet west-southwest of MW-22, respectively. However, concentrations of vinyl chloride and 1,2-dichloroethene were below detection in groundwater samples collected from MW-24D. Monitoring well MW-24D is directly adjacent to GP2-W2.

- An NR140 PAL exceedance for 1,1,1-trichloroethane was observed in a groundwater sample collected from GP5. Groundwater samples collected from the other Geoprobe sample locations indicated concentrations below the analysis detection limit for the analyzed parameters.

- Water levels observed in MW-24D were approximately 15 feet higher than those observed in the on-site wells. This suggests that the hydrogeology in the area may be more complex than the on-site investigation indicated, and that the direction of off-site groundwater flow may not be understood.

Based on the investigation summarized in the report, it appears that groundwater flow off-site may not be to the southwest as it is on-site. Water elevations in well MW-24D suggest that an easterly component to the groundwater flow direction. The Geoprobe results appear to confirm the above in that 1) groundwater was often observed at the Geoprobe locations at elevations above that observed in the southwest corner of the site, and 2) based on the Geoprobe analytical data and the well data collected from MW-24D, groundwater does not appear to be significantly affected in the quadrant southwest of the site.

At present, groundwater is most affected in the southwest portion of the site. Groundwater remediation by extraction should be started in the southwest corner of the site. The groundwater remediation approach is further discussed in the following section.

5.0 RECOMMENDATIONS

Based upon the data collected on and off-site in this and prior explorations, there remain three main issues that must be addressed regarding the conditions at the former Whitefish Bay landfill. These issues are:

- The presence of groundwater contamination in the southwest corner of the site.

- The lateral extent of affected groundwater off-site.

- The presence of similar chemicals in the vadose zone on-site.

In our opinion the most immediately significant of these is the first. We believe that it is in the best interest of the Village, and the environment, to proceed with a groundwater removal action in the southwest corner of the site where the most significantly affected groundwater exists. In so doing, the spread of contamination will be slowed or arrested. In combination with additional off-site investigation, as discussed subsequently, this work will also allow a

refinement of the current hydrogeologic data base and further definition of whether, and where, additional extraction efforts may be required to capture the plume.

While the most recent investigation has confirmed that the affected groundwater plume has not migrated a great distance to the southwest, it remains uncertain where the plume limits exist. Therefore, in a parallel effort with the remediation activities noted above, we recommend that additional observation wells be installed off-site to further define the extent of affected groundwater and to aid in evaluating the capture zone of the planned remediation system. The wells will also provide hydrogeological information regarding the stratum from which the groundwater will be extracted. We further recommend, therefore, that the monitoring wells be installed before the final design of the extraction system.

The DNR letter of August 13, 1992 indicated that an on-going evaluation of soil remediation approach is also necessary. We concur with this comment but suggest that this be completed following the activities discussed above. Further details regarding these recommendations are provided in the following paragraphs.

5.1 Additional Groundwater Investigation:

STS recommends the installation of three groundwater monitoring wells located approximately 200 feet from the southwest corner of the site. The proposed locations of the wells are indicated as wells A, B and C on the attached Figure 5. The purposes of the wells are:

1) To provide information regarding the hydrogeology and contaminant concentrations in this area necessary to design the groundwater extraction system.

2) To provide information regarding the the effective radius of influence and effectiveness after the groundwater system has been installed.

3) To further resolve the issues regarding the direction of groundwater flow off-site.

4) To provide information which will be used to direct further investigation regarding off-site groundwater quality.

The proposed monitoring well locations are on Milwaukee County, Milwaukee Public School and private property. Installation of the wells in the proposed locations is subject to reaching a mutually acceptable access agreement with the property owners. If an access agreement can not be negotiated, wells may be eliminated or placed in different locations. It is expected that the proposed Phase I investigation will provide sufficient information to design and implement a groundwater extraction and treatment system for the southwest corner of the site.

The borings in which the wells would be installed would extend to approximately 35 feet below the ground surface. At that depth, the borings should be sufficiently deep to completely penetrate the permeable sand and gravel stratum. The borings will also be used to confirm the presence and elevation of the sandy clay/silty sand stratum observed below the sand stratum in boring B-22. Based upon the data from Boring B-22, this layer appears to have effectively

limited the downward movement of contaminants to lower levels and therefore functions as a semi-confining layer. As such, its presence and continuity affect the groundwater extraction rates and system operating strategy.

The three borings will be converted to groundwater monitoring wells constructed in accordance to NR 141. The wells will be constructed of 2-inch diameter Schedule 40 PVC pipe with 0.01-inch mechanically-slotted well screens. The well screens will be from 10 to 15 feet in length and will be installed to fully penetrate the sand stratum.

Following installation, the wells will be developed in accordance to NR 141. Prior to sampling, the wells will be purged following WDNR well sampling guidelines. All development and purge water will be placed in 55-gallon drums and properly secured on-site until disposal arrangements are completed.

The three wells will be purged and sampled using either Teflon or disposable bailers. Samples from each of the three wells will be laboratory- analyzed for volatile organic compounds by EPA Method 8021. Quality assurance/quality control samples will include a duplicate, field blank and trip blank. One round of groundwater depth measurements will be completed on all monitoring wells.

5.2 Groundwater Remediation

At this time, we are recommending the installation of one extraction well in the southwest corner of the site. The well and treatment system will be designed and installed as outlined in the conceptual design presented in the STS report titled Site Investigation Report, dated May 20, 1994.

In that report, STS outlined a remedial approach which included three extraction wells. Additional wells will probably be required; however, at this time, there is sufficient uncertainty regarding the groundwater extraction rate and water quality, treatment efficiencies, radius of influence and off-site groundwater flow patterns to warrant a phased approach. The need for and design of additional wells will be determined after operating the proposed system for approximately three months. At that time, a report will be prepared for submittal to the WDNR which documents the system installation, summarizes system performance, and presents recommendations for additional groundwater remediation.

The treatment system will be designed with sufficient capacity to treat 75 gallons of water per minute (gpm). The maximum extraction rate from a given well is estimated at 25 gpm. The system will be designed with flexibility to allow for additional extraction wells, and, if needed, added shallow-tray treatment equipment.

Given the intermittent observations of floating product in well MW-22, the system will also be designed to accommodate the addition of free product extraction and storage equipment. Piping and electrical connections, as well as physical space, will be included in the design to allow relatively easy system modifications. A free product sensor will be installed in the extraction well to prevent the accidental pumping of product through the remediation system. The final system design will be submitted to the WDNR for approval prior to installation.

STS Consultants, Ltd. appreciates the opportunity to be of service to you. If you have any questions concerning this report, please contact us at (414) 359-3030.

Sincerely,

STS CONSULTANTS, LTD.

Thomas W. Kroeger
Associate

Thomas W. Wolf, P.E.
Executive Vice President

TWK/kw-m11/82149XF WFB Landfill Rpt 3/94
Attachments

cc: Dennis Fisher
Jim Gormley
Ray Krueger
Bill Pagel

Table 1
Geoprobe Groundwater Analytical Results
Whitefish Bay Demolition Landfill
Milwaukee, Wisconsin

(concentrations in ppb)

Parameters	ES	PAL	GP1	GP2-W1	GP2-W2	GP3	GP4-W1	GP4-W2	GP5	GP6
Approximate Sample Collection Elevation (ft)			694	701	689	682	701	685	690	692
Vinyl Chloride	0.2	0.0015	247	ND	246	ND	ND	ND	ND	ND
Dichloroethene	100	10	635	ND	863	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	200	40	ND	ND	ND	ND	ND	ND	42	ND

ES - Enforcement Standard as established in Chapter NR 140 Wisconsin Administrative Code
PAL - Preventive Action Limit as established in Chapter NR 140 Wisconsin Administrative Code
ND - Not Detected
ppb - parts per billion

Table 2
Groundwater Elevation Summary
Whitefish Bay Demolition Landfill
Milwaukee, Wisconsin

Well No.	Casing Top Elevation	Ground Surface Elevation	Depth to Bottom of Well	Date 11-11-93 Depth to Water	Date 11-11-93 Elevation of Water
W-4	698.05	696.42	20.63	14.66	683.39
W-6	702.93	700.77	20.60	18.65	684.28
W-9	694.27	692.02	21.90	10.68	683.59
W-10	708.32	706.26	30.35	24.94	683.38
W-11	704.93	702.98	27.74	21.56	683.37
W-16	696.92	694.33	12.36	10.90	686.02
W-18	703.30	701.26	27.40	19.57	683.73
W-22	709.13	706.83	31.55	25.93	683.20
W-24D	711.00	708.83	24.50	12.80	698.20
W-24S	711.01	708.70	14.97	11.73	699.28

Notes:

1. *Elevations are relative to Mean Sea Level.*
2. *Measurements are in feet.*

Table 3
Groundwater Analytical Results
Whitefish Bay Demolition Landfill
Milwaukee, Wisconsin
(concentrations in ug/l)

	Parameters	ES	PAL	Date Sampled 10-5-88	11-10-88	4-19-89	11-16-93
W-4	VOC						
	Benzene	5	0.067	<1	<1	<1	<0.2
	Bromodichloromethane	179	36	<1	<1	<1	<0.5
	Carbon Tetrachloride	5	0.5	<1	<1	<1	<0.5
	Dibromochloromethane	215	43	<1	<1	<1	<0.5
	1,1-Dichloroethane	850	85	3.6	<1	6	2.3
	1,1-Dichloroethene	7	0.024	<1	<1	2.3	1.0
	1,2-Dichloroethane	5	0.05	1.3	<1	<1	<0.5
	cis-1,2-Dichloroethene	100	10	NA	NA	NA	212
	trans-1,2-Dichloroethene	100	20	<1	<1	229	2.2
	Ethylbenzene	1360	272	<1	<1	<1	<1
	Methylene Chloride	150	15	<1	<1	<1	<2.5
	Tetrachloroethene	1	0.1	400	223	110	87.1
	Toluene	343	68.6	<1	<1	<1	<1
	Trichloroethene	5	0.18	425	341	264	104
	1,1,1-Trichloroethane	200	40	<1	<1	<1	<0.5
	1,1,2-Trichloroethane	0.6	0.06	<1	<1	<1	<0.5
	Vinyl Chloride	0.2	0.0015	<1	<1	<1	38.7
	Total Xylenes	620	124	<1	<1	<1	<1
W-6	VOC						
	Benzene	5	0.067	NA	NA	NA	0.3
	Bromodichloromethane	179	36	NA	NA	NA	<0.5
	Carbon Tetrachloride	5	0.5	NA	NA	NA	<0.5
	Dibromochloromethane	215	43	NA	NA	NA	<0.5
	1,1-Dichloroethane	850	85	NA	NA	NA	<0.5
	1,1-Dichloroethene	7	0.024	NA	NA	NA	<0.4
	1,2-Dichloroethane	5	0.05	NA	NA	NA	<0.5
	cis-1,2-Dichloroethene	100	10	NA	NA	NA	0.9
	trans-1,2-Dichloroethene	100	20	NA	NA	NA	<0.5
	Ethylbenzene	1360	272	NA	NA	NA	<1.0
	Methylene Chloride	150	15	NA	NA	NA	<2.5
	Tetrachloroethene	1	0.1	NA	NA	NA	<0.5
	Toluene	343	68.6	NA	NA	NA	<2.0
	Trichloroethene	5	0.18	NA	NA	NA	0.7
	1,1,1-Trichloroethane	200	40	NA	NA	NA	<0.5
	1,1,2-Trichloroethane	0.6	0.06	NA	NA	NA	<0.5
	Vinyl Chloride	0.2	0.0015	NA	NA	NA	1.3
	Total Xylenes	620	124	NA	NA	NA	1.0

-- - Standard Not Established
NA - Not Analyzed
ES - Enforcement Standard as established in Chapter NR 140 WAC
PAL - Preventive Action Limit as established in Chapter NR 140 WAC
(1) - Concentration of this compound is estimated because it exceeds the highest standard used for calibration, but does not exceed the range of the instrument detector.

Table 3
Groundwater Analytical Results
Whitefish Bay Demolition Landfill
Milwaukee, Wisconsin
(concentrations in ug/l)

Parameters		ES	PAL	Date Sampled 10-5-88	11-10-88	4-19-89	11-16-93
W-9	VOC						
	Benzene	5	0.067	<1	NA	0.1	<1
	Bromodichloromethane	179	36	<1	NA	<1	<2.5
	Carbon Tetrachloride	5	0.5	<1	NA	<1	<2.5
	Dibromochloromethane	215	43	<1	NA	<1	<2.5
	1,1-Dichloroethane	850	85	<1	NA	<1	<2.5
	1,1-Dichloroethene	7	0.024	<1	NA	0.3	<2.0
	1,2-Dichloroethane	5	0.05	3	NA	<1	<2.5
	cis-1,2-Dichloroethene	100	10	NA	NA	NA	61.8
	trans-1,2-Dichloroethene	100	20	<1	NA	136	<2.5
	Ethylbenzene	1360	272	<1	NA	<1	<5.0
	Methylene Chloride	150	15	<1	NA	<1	<12.5
	Tetrachloroethene	1	0.1	3.7	NA	<1	<2.5
	Toluene	343	68.6	<1	NA	<1	<10.0
	Trichloroethene	5	0.18	1.5	NA	0.5	<1
	1,1,1-Trichloroethane	200	40	<1	NA	<1	<2.5
	1,1,2-Trichloroethane	0.6	0.06	<1	NA	<1	<2.5
	Vinyl Chloride	0.2	0.0015	<1	NA	<1	64.7
	Total Xylenes	620	124	<1	NA	<1	<5.0
W-10	VOC						
	Benzene	5	0.067	<1	3.9	<1	0.3
	Bromodichloromethane	179	36	2	<1	<1	<0.5
	Carbon Tetrachloride	5	0.5	<1	<1	<1	<0.5
	Dibromochloromethane	215	43	<1	<1	<1	<0.5
	1,1-Dichloroethane	850	85	23	31	18.8	2.4
	1,1-Dichloroethene	7	0.024	46	54	35.6	2.3
	1,2-Dichloroethane	5	0.05	<1	<1	<1	<0.5
	cis-1,2-Dichloroethene	100	10	NA	NA	NA	1060
	trans-1,2-Dichloroethene	100	20	<1	<1	10,400	20.2
	Ethylbenzene	1360	272	<1	<1	3.5	<1
	Methylene Chloride	150	15	8.2	<1	<1	<2.5
	Tetrachloroethene	1	0.1	138	34	477	751
	Toluene	343	68.6	24	3.4	11.5	<2.0
	Trichloroethene	5	0.18	2630	877	3400	2740 (1)
	1,1,1-Trichloroethane	200	40	30	<1	<1	<0.5
	1,1,2-Trichloroethane	0.6	0.06	<1	<1	<1	<0.5
	Vinyl Chloride	0.2	0.0015	<1	<1	3400	303
	Total Xylenes	620	124	10	<1	<1	<1

-- - Standard Not Established
NA - Not Analyzed
ES - Enforcement Standard as established in Chapter NR 140 WAC
PAL - Preventive Action Limit as established in Chapter NR 140 WAC

Table 3
Groundwater Analytical Results
Whitefish Bay Demolition Landfill
Milwaukee, Wisconsin
(concentrations in ug/l)

	Parameters	ES	PAL	Date Sampled 10-5-88	11-10-88	4-19-89	11-16-93
W-11	VOC						
	Benzene	5	0.067	<1	<1	3.6	1.1
	Bromodichloromethane	179	36	5	<1	<1	<0.5
	Carbon Tetrachloride	5	0.5	<1	<1	<1	<0.5
	Dibromochloromethane	215	43	10.1	<1	<1	<0.5
	1,1-Dichloroethane	850	85	19.4	20.6	30.2	22.9
	1,1-Dichloroethene	7	0.024	18.7	20.8	26	7.0
	1,2-Dichloroethane	5	0.05	9.1	<1	<1	1.1
	cis-1,2-Dichloroethene	100	10	NA	NA	NA	2660 (2)
	trans-1,2-Dichloroethene	100	20	<1	<1	9130	21.3
	Ethylbenzene	1360	272	<1	<1	0.7	39.8
	Methylene Chloride	150	15	<1	<1	<1	<2.5
	Tetrachloroethene	1	0.1	15.6	9.0	11.8	<0.5
	Toluene	343	68.6	3.6	<1	2.2	30.4
	Trichloroethene	5	0.18	<1	11.9	69	7.2
	1,1,1-Trichloroethane	200	40	27.9	42.6	48.4	21.8
	1,1,2-Trichloroethane	0.6	0.06	<1	<1	<1	<0.5
	Vinyl Chloride	0.2	0.0015	<1	<1	825	1750
	Total Xylenes	620	124	<1	<1	<1	17.7
W-16	VOC						
	Benzene	5	0.067	<1	NA	NA	<0.2
	Bromodichloromethane	179	36	<1	NA	NA	<0.5
	Carbon Tetrachloride	5	0.5	<1	NA	NA	<0.5
	Dibromochloromethane	215	43	<1	NA	NA	<0.5
	1,1-Dichloroethane	850	85	<1	NA	NA	<0.5
	1,1-Dichloroethene	7	0.024	<1	NA	NA	<0.4
	1,2-Dichloroethane	5	0.05	<1	NA	NA	<0.5
	cis-1,2-Dichloroethene	100	10	NA	NA	NA	<0.5
	trans-1,2-Dichloroethene	100	20	<1	NA	NA	<0.5
	Ethylbenzene	1360	272	<1	NA	NA	<1
	Methylene Chloride	150	15	<1	NA	NA	<2.5
	Tetrachloroethene	1	0.1	<1	NA	NA	<0.5
	Toluene	343	68.6	<1	NA	NA	<2.0
	Trichloroethene	5	0.18	<1	NA	NA	<0.3
	1,1,1-Trichloroethane	200	40	<1	NA	NA	<0.5
	1,1,2-Trichloroethane	0.6	0.06	<1	NA	NA	<0.5
	Vinyl Chloride	0.2	0.0015	<1	NA	NA	<0.2
	Total Xylenes	620	124	<1	NA	NA	<1

-- - Standard Not Established
NA - Not Analyzed
ES - Enforcement Standard as established in Chapter NR 140 WAC
PAL - Preventive Action Limit as established in Chapter NR 140 WAC
(1) - Concentration of this compound is estimated because it exceeds the highest standard used for calibration, but does not exceed the range of the instrument detector.
(2) - Concentration of this compound is estimated because it exceeds the range of the instrument detector.

Table 3
Groundwater Analytical Results
Whitefish Bay Demolition Landfill
Milwaukee, Wisconsin
(concentrations in ug/l)

	Parameters	ES	PAL	Date Sampled 10-5-88	11-10-88	4-19-89	11-16-93
W-18	VOC						
	Benzene	5	0.067	NA	NA	<1	0.2
	Bromodichloromethane	179	36	NA	NA	<1	<0.5
	Carbon Tetrachloride	5	0.5	NA	NA	<1	<0.5
	Dibromochloromethane	215	43	NA	NA	<1	<0.5
	1,1-Dichloroethane	850	85	NA	NA	4.8	2.5
	1,1-Dichloroethene	7	0.024	NA	NA	0.4	<0.4
	1,2-Dichloroethane	5	0.05	NA	NA	<1	<0.5
	cis-1,2-Dichloroethene	100	10	NA	NA	NA	111
	trans-1,2-Dichloroethene	100	20	NA	NA	106	1.3
	Ethylbenzene	1360	272	NA	NA	<1	<1
	Methylene Chloride	150	15	NA	NA	<1	<2.5
	Tetrachloroethene	1	0.1	NA	NA	<1	<0.5
	Toluene	343	68.6	NA	NA	<1	<2.0
	Trichloroethene	5	0.18	NA	NA	9.4	3.2
	1,1,1-Trichloroethane	200	40	NA	NA	<1	<0.5
	1,1,2-Trichloroethane	0.6	0.06	NA	NA	<1	<0.5
	Vinyl Chloride	0.2	0.0015	NA	NA	<1	30.5
	Total Xylenes	620	124	NA	NA	<1	<1
W-22	VOC						
	Benzene	5	0.067	NA	NA	16.8	13.8
	Bromodichloromethane	179	36	NA	NA	<1	<2.5
	Carbon Tetrachloride	5	0.5	NA	NA	<1	20.1
	Dibromochloromethane	215	43	NA	NA	<1	<2.5
	1,1-Dichloroethane	850	85	NA	NA	165	153
	1,1-Dichloroethene	7	0.024	NA	NA	82.3	58.7
	1,2-Dichloroethane	5	0.05	NA	NA	132	29.6
	cis-1,2-Dichloroethene	100	10	NA	NA	NA	1,830 (2)
	trans-1,2-Dichloroetlene	100	20	NA	NA	22,200	195
	Ethylbenzene	1360	272	NA	NA	24.7	3,680 (2)
	Methylene Chloride	150	15	NA	NA	<1	<12.5
	Tetrachloroethene	1	0.1	NA	NA	36.4	823 (2)
	Toluene	343	68.6	NA	NA	25.3	2,310 (2)
	Trichloroethene	5	0.18	NA	NA	1,180	1,720 (2)
	1,1,1-Trichloroethane	200	40	NA	NA	<1	468 (2)
	1,1,2-Trichloroethane	0.6	0.06	NA	NA	<1	3.4
	Vinyl Chloride	0.2	0.0015	NA	NA	2,490	770 (2)
	Total Xylenes	620	124	NA	NA	41.3	8,300

-- - Standard Not Established
NA - Not Analyzed
ES - Enforcement Standard as established in Chapter NR 140 WAC
PAL - Preventive Action Limit as established in Chapter NR 140 WAC

Table 3
Groundwater Analytical Results
Whitefish Bay Demolition Landfill
Milwaukee, Wisconsin
(concentrations in ug/l)

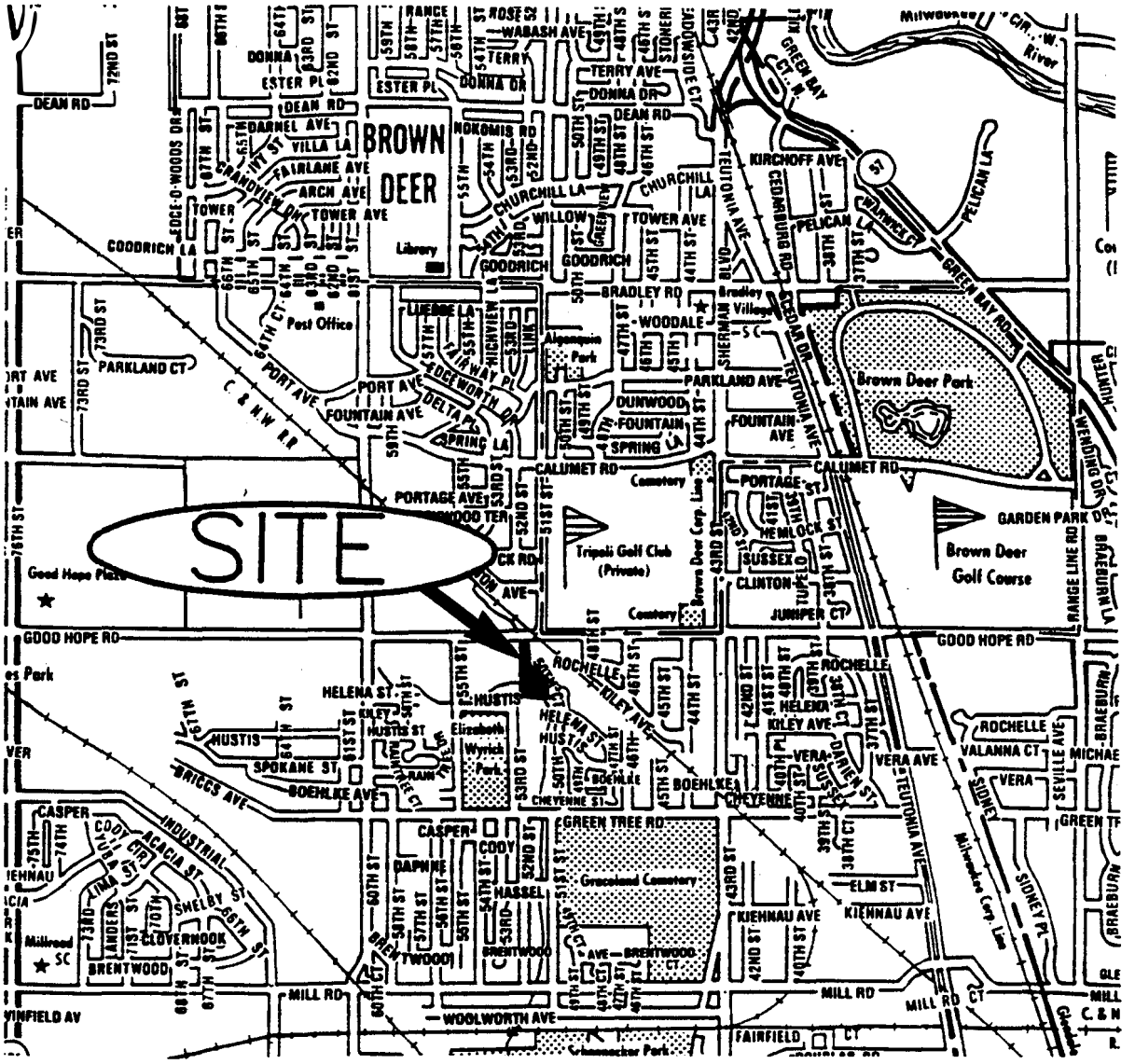
	Parameters	ES	PAL	Date Sampled 10-5-88	11-10-88	4-19-89	11-16-93
W-24-S	VOC						
	Benzene	5	0.067	NA	NA	NA	<0.2
	Bromodichloromethane	179	36	NA	NA	NA	<0.5
	Carbon Tetrachloride	5	0.5	NA	NA	NA	<0.5
	Dibromochloromethane	215	43	NA	NA	NA	<0.5
	1,1-Dichloroethane	850	85	NA	NA	NA	<0.5
	1,1-Dichloroethene	7	0.024	NA	NA	NA	<0.4
	1,2-Dichloroethane	5	0.05	NA	NA	NA	<0.5
	cis-1,2-Dichloroethene	100	10	NA	NA	NA	<0.5
	trans-1,2-Dichloroethene	100	20	NA	NA	NA	<0.5
	Ethylbenzene	1360	272	NA	NA	NA	<1.0
	Methylene Chloride	150	15	NA	NA	NA	<2.5
	Tetrachloroethene	1	0.1	NA	NA	NA	<0.5
	Toluene	343	68.6	NA	NA	NA	<2.0
	Trichloroethene	5	0.18	NA	NA	NA	0.5
	1,1,1-Trichloroethane	200	40	NA	NA	NA	<0.5
	1,1,2-Trichloroethane	0.6	0.06	NA	NA	NA	<0.5
	Vinyl Chloride	0.2	0.0015	NA	NA	NA	<0.2
	Total Xylenes	620	124	NA	NA	NA	<1.0
W-22 Dupe	VOC						
	Benzene	5	0.067	NA	NA	NA	15.4
	Bromodichloromethane	179	36	NA	NA	NA	<5.0
	Carbon Tetrachloride	5	0.5	NA	NA	NA	28.2
	Dibromochloromethane	215	43	NA	NA	NA	<5.0
	1,1-Dichloroethane	850	85	NA	NA	NA	110
	1,1-Dichloroethene	7	0.024	NA	NA	NA	45.9
	1,2-Dichloroethane	5	0.05	NA	NA	NA	16.3
	cis-1,2-Dichloroethene	100	10	NA	NA	NA	12500 (2)
	trans-1,2-Dichloroethene	100	20	NA	NA	NA	151
	Ethylbenzene	1360	272	NA	NA	NA	14,000 (1
	Methylene Chloride	150	15	NA	NA	NA	<25
	Tetrachloroethene	1	0.1	NA	NA	NA	5,840 (2)
	Toluene	343	68.6	NA	NA	NA	3,330
	Trichloroethylene	5	0.18	NA	NA	NA	10,900 (2
	1,1,1-Trichloroethane	200	40	NA	NA	NA	818
	1,1,2-Trichloroethane	0.6	0.06	NA	NA	NA	<5.0
	Vinyl Chloride	0.2	0.0015	NA	NA	NA	2,960
	Total Xylenes	620	124	NA	NA	NA	55,300 (1

-- - Standard Not Established
NA - Not Analyzed
ES - Enforcement Standard as established in Chapter NR 140 WAC
PAL - Preventive Action Limit as established in Chapter NR 140 WAC
(1) - Concentration of this compound is estimated because it exceeds the highest standard used for calibration, but does not exceed the range of the instrument detector.
(2) - Concentration of this compound is estimated because it exceeds the range of the instrument detector.

Table 3
Groundwater Analytical Results
Whitefish Bay Demolition Landfill
Milwaukee, Wisconsin
(concentrations in ug/l)

Parameters	ES	PAL	Date Sampled			
			10-5-88	11-10-88	4-19-89	11-16-93
W-24-D VOC						
Benzene	5	0.067	NA	NA	NA	<0.2
Bromodichloromethane	179	36	NA	NA	NA	<0.5
Carbon Tetrachloride	5	0.5	NA	NA	NA	<0.5
Dibromochloromethane	215	43	NA	NA	NA	<0.5
1,1-Dichloroethane	850	85	NA	NA	NA	<0.5
1,1-Dichloroethene	7	0.024	NA	NA	NA	<0.4
1,2-Dichloroethane	5	0.05	NA	NA	NA	<0.5
cis-1,2-Dichloroethene	100	10	NA	NA	NA	<0.5
trans-1,2-Dichloroethene	100	20	NA	NA	NA	<0.5
Ethylbenzene	1360	272	NA	NA	NA	<1.0
Methylene Chloride	150	15	NA	NA	NA	<2.5
Tetrachloroethene	1	0.1	NA	NA	NA	<0.5
Toluene	343	68.6	NA	NA	NA	5.9
Trichloroethene	5	0.18	NA	NA	NA	<0.3*
1,1,1-Trichloroethane	200	40	NA	NA	NA	<0.5
1,1,2-Trichloroethane	0.6	0.06	NA	NA	NA	<0.5
Vinyl Chloride	0.2	0.0015	NA	NA	NA	<0.2
Total Xylenes	620	124	NA	NA	NA	<1.0

-- - Standard Not Established
NS - Not Sampled
NA - Not Analyzed
ES - Enforcement Standard as established in Chapter NR 140 WAC
PAL - Preventive Action Limit as established in Chapter NR 140 WAC
* - Detection limit raised due to possible carry over.



SOURCE: GREATER MILWAUKEE STREET GUIDE

STS Consultants, Ltd.

PROJECT/CLIENT

WHITEFISH BAY LANDFILL

MILWAUKEE, WISCONSIN

SITE LOCATION DIAGRAM

DRAWN BY	T.J.J.	4/24/92
CHECKED BY	A.J.G.	4/24/92
APPROVED BY	K.R.H.	4/24/92
SCALE	FIGURE NO.	1
CADFILE 149-1.DWG	STS PROJECT NO.	82149XF
PLOT DATE 4/24/92		

N.E. CORNER
SECTION 23

LINCOLN CREEK

MW-16

MW-9

MW-6

MW-11

MW-4

MW-18

MW-10

MW-22

GP-4

WEST GOOD HOPE ROAD

PROPERTY LINE

WEST HUSTIS STREET

GP-1

GP-5

GP-2

MW-24S
MW-24D

GP-6

GP-3

55th STREET

SCALE IN FEET

200 100 0 200 400

LEGEND

MW-4 MONITORING WELL LOCATION

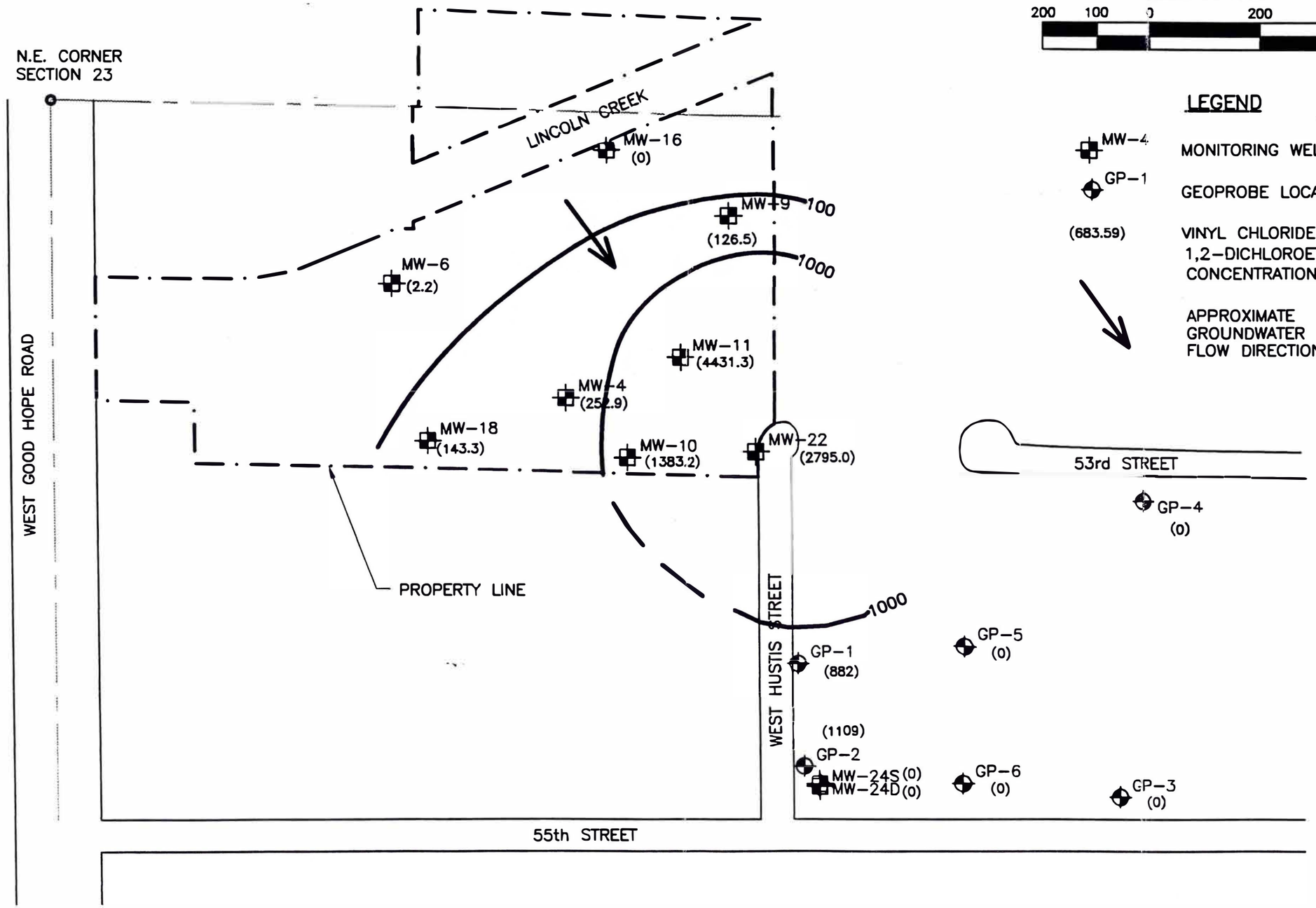
GP-1 GEOPROBE LOCATION

DRAWN BY	J.M.I.	DATE 1/18/94
CHECKED BY	E.T.F.	DATE 1/18/94
APPROVED BY	K.R.H.	DATE 1/18/94
AUTOCAD FILE	82149011	

GEOPROBE AND MONITORING WELL LOCATION DIAGRAM WHITEFISH BAY LANDFILL MILWAUKEE, WISCONSIN

STS Consultants Ltd.
Consulting Engineers

STS PROJECT NO.	82149XF
STS PROJECT FILE	82149XF
SCALE	1" =200'
FIGURE NO.	2

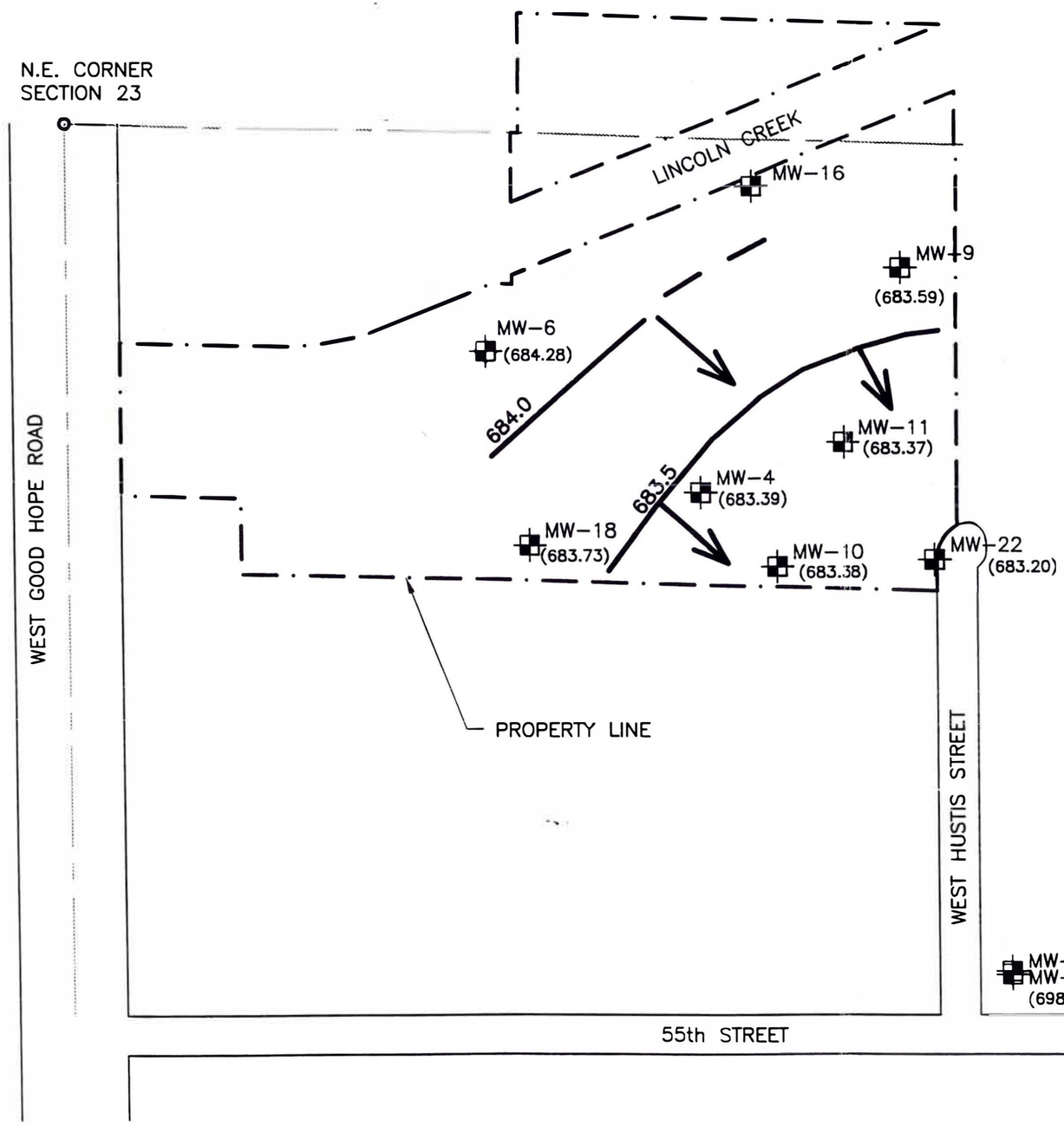


DRAWN BY J.M.I. DATE 1/27/94
CHECKED BY E.T.F. DATE 1/27/94
APPROVED BY K.R.H. DATE 1/27/94
AUTOCAD FILE 82149013

INDICATOR PARAMETER CONCENTRATIONS
WHITEFISH BAY LANDFILL
MILWAUKEE, WISCONSIN

STS Consultants Ltd.
Consulting Engineers

STS PROJECT NO. 82149XF
STS PROJECT FILE 82149XF
SCALE 1" =200'
FIGURE NO. 3



SCALE IN FEET

200 100 0 200 400

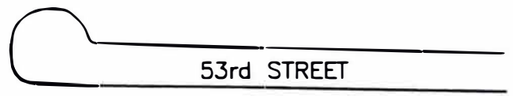
LEGEND

MW-4 — MONITORING WELL LOCATION

(683.59) — GROUNDWATER ELEVATION

APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTE: WATER LEVELS COLLECTED ON NOVEMBER 11, 1993



DRAWN BY	J.M.I.	DATE 1/14/94
CHECKED BY	E.T.F.	DATE 1/14/94
APPROVED BY	K.R.H.	DATE 1/14/94
AUTOCAD FILE	82149012	

GROUNDWATER ELEVATIONS (NOVEMBER 11, 1993) WHITEFISH BAY LANDFILL MILWAUKEE, WISCONSIN

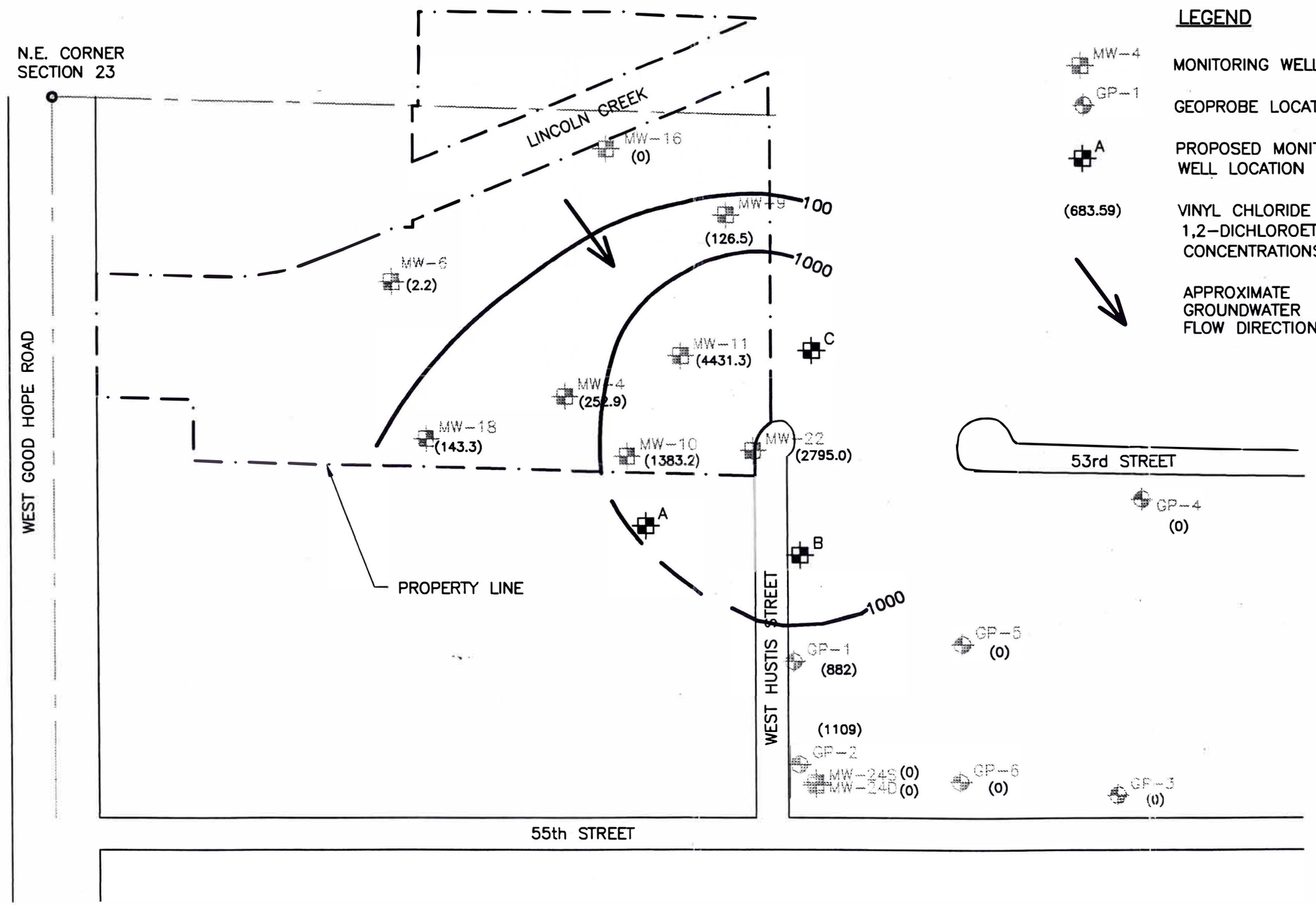
STS Consultants Ltd.
Consulting Engineers

STS PROJECT NO.
82149XF

STS PROJECT FILE
82149XF

SCALE
1" = 200'

FIGURE NO.
4



SCALE IN FEET

200 100 0 200 400

LEGEND

- MW-4 — MONITORING WELL LOCATION
- GP-1 — GEOPROBE LOCATION
- A — PROPOSED MONITORING WELL LOCATION
- (683.59) — VINYL CHLORIDE AND 1,2-DICHLOROETHENE CONCENTRATIONS (ug/l)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

DRAWN BY	J.M.I.	DATE 4/13/94
CHECKED BY	E.T.F.	DATE 4/13/94
APPROVED BY	T.W.K.	DATE 4/13/94
AUTOCAD FILE	82149014	

PROPOSED SAMPLE LOCATIONS
WHITEFISH BAY LANDFILL
MILWAUKEE, WISCONSIN

STS Consultants Ltd.
Consulting Engineers

STS PROJECT NO.	82149XF
STS PROJECT FILE	82149XF
SCALE	1" =200'
FIGURE NO.	5

GZA
GeoEnvironmental, Inc.

Engineers and Scientists

November 24, 1993
File No. 150009

NOV 26 1993

STS Consultants, Ltd.
11425 West Lake Drive
Milwaukee, WI 53224

Attention: Mr. Eric Frauen

Subject: Results of the In-field Sampling and Analytical Survey near 55th and Good Hope Road, Milwaukee, Wisconsin

N4140 Duplainville Road
Pewaukee, Wisconsin
53072
414-691-2662
FAX 414-691-9279

Dear Mr. Frauen:

In accordance with our proposal dated August 24, 1993, Proposal No. 61.10040, GZA GeoEnvironmental, Inc. (GZA) has completed an in-field sampling and analytical survey located near 55th and Good Hope Road, Milwaukee, Wisconsin ("Site") for STS Consultants, Ltd. on October 15, 1993. The objective of the survey was to determine the extent of halocarbon contamination detected in previous investigative work at the Site. To attain this objective, GZA utilized its field sampling and analytical van equipped with a Geoprobe® hydraulic ram for groundwater sample acquisition and a laboratory-grade gas chromatograph (GC) for on-site sample analysis.

SAMPLING PROCEDURES

Groundwater samples were collected by driving a slotted rod (1 inch O.D.) to the anticipated watertable. Groundwater was then allowed to infiltrate the rod and the static water level measured with an electronic water level indicator. A section of Tygon tubing was then inserted down the center of the probe rod, and a peristaltic pump was used to purge the rods until the sample was as sediment-free as possible. The actual sample collected for analysis was collected from the tubing prior to entering the pump head. All boreholes were backfilled with granular bentonite.

A Subsidiary of GZA GeoEnvironmental Technologies, Inc.

IN-FIELD ANALYTICAL PROCEDURES

All samples collected from the site were field analyzed for vinyl chloride, 1,1-dichloroethene (DCE), 1,2-DCE, 1,1-dichloroethane (DCA), 1,2-DCA, 1,1,1-trichloroethane (TCA), trichloroethene (TCE), and tetrachloroethene (PCE). Sample analysis was performed utilizing a heated headspace method which involved placing 20 milliliters (ml) of sample into a volatile organic analysis (VOA) vial. The vial was then capped with a teflon septum lid, labeled, and warmed to approximately 50°C in a hot

water bath. Before analysis, the vial was agitated to promote volatilization of the contaminants. A 1 ml syringe was then purged several times with vapor from the vial headspace prior to withdrawing a 0.5 mil sample for immediate injection into the GC.

The GC used for the in-field analyses was a Shimadzu GC-14a, equipped with a J&W Scientific megabore capillary column, designed specifically for environmental analysis of volatile organic compounds (VOCs). Compound detection was accomplished with a photoionization detector (PID) and an electron capture detector mounted in a series with a detection limit of 0.005 parts per million (ppm) for each of the compounds.

QUALITY ASSURANCE/QUALITY CONTROL

The GC was calibrated prior to the project with standards prepared by spiking a 20 ml sample of distilled water to known concentrations of the desired contaminants. This standard was then analyzed in the same manner as the samples.

All probe rods and screen sections were decontaminated between samples with a Liquinox solution and distilled water rinse. The Tygon tubing used in sample collection was disposed after each sample. Blanks were run a minimum of one every 10 samples to ensure that there was no cross contamination of samples. VOA/deionized water blanks were run by placing 20 ml of distilled water in a VOA vial and analyzing it by the same method as the samples. Duplicate runs on samples were conducted a minimum of once a day to check method precision. The analytical results are included in Appendix A along with all the quality assurance/quality control runs in order of occurrence.

RESULTS

Groundwater sampling was conducted at varying depths between 4-25 feet below grade at each of the six (6) proposed locations (GP1-GP6). The only detections were in samples GP1 with 0.247 ppm vinyl chloride and 0.635 ppm DCE, and GP2 with 0.246 ppm vinyl chloride and 0.863 ppm DCE.

LIMITATIONS

GZA's in-field analytical survey was performed in accordance with generally accepted practices of other consultants undertaking similar studies at the same time in the same geographical areas, and GZA observed the degree of care and skill generally exercised by other consultants under similar circumstances and conditions. No other warranty, express or implied, is made.

This survey and report have been prepared on behalf of and for the exclusive use of STS Consultants, Ltd. and its client, solely for the use in the environmental evaluation of the

Site. This report and the findings contained herein shall not, in whole or in part, be disseminated or conveyed to any other party, nor used by any other party in whole or in part, without written consent by GZA.

GZA appreciates the opportunity of performing this work for STS Consultants, Ltd. and looks forward with you on future projects. If you have any questions regarding this or any other project, feel free to call me at your convenience.

Very truly yours,

GZA GeoEnvironmental, Inc.

Jon Roraff
Environmental Chemist

Bernard G. Fenelon
Senior Project Manager/Geophysicist
Project Reviewer

John C. Osborne
Associate Principal/District Manager

\wp51\jmr\150009.rpt

Attachment

ATTACHMENT 1

Field Analytical Results

Layne GeoSciences, Inc.
Field Analytical Survey
Client: STS
Project: 55th & Goodhope
Date: 10/22/93

Sample	Depth	Analyte	Concentration	Comments
Standard	na	Vinyl Chloride	0.035	Calibration
		1,1-DCE	0.318	
		DCE	0.312	
		1,1-DCA	nd	
		1,2-DCA	nd	
		1,1,1-TCA	1.62	
		TCE	nd	
		PCE	0.141	
DCE & TCA Standard	na	Vinyl Chloride	nd	Calibration
		1,1-DCE	nd	
		DCE	0.036	
		1,1-DCA	nd	
		1,2-DCA	nd	
		1,1,1-TCA	0.25	
		TCE	nd	
		PCE	nd	
GP1	16'	Vinyl Chloride	0.247	
		1,1-DCE	nd	
		DCE	0.635	
		1,1-DCA	nd	
		1,2-DCA	nd	
		1,1,1-TCA	nd	
		TCE	nd	
		PCE	nd	
Syringe Blank	na	Vinyl Chloride	nd	
		1,1-DCE	nd	
		DCE	nd	
		1,1-DCA	nd	
		1,2-DCA	nd	
		1,1,1-TCA	nd	
		TCE	nd	
		PCE	nd	

Sample	Depth	Analyte	Conc.	Comments
GP1	16'	Vinyl Chloride	0.375	
Dup.		1,1-DCE	nd	
		DCE	1.06	
		1,1-DCA	nd	
		1,2-DCA	nd	
		1,1,1-TCA	nd	
		TCE	nd	
		PCE	nd	
VOA/DI	na	Vinyl Chloride	nd	
Blank		1,1-DCE	nd	
		DCE	nd	
		1,1-DCA	nd	
		1,2-DCA	nd	
		1,1,1-TCA	0.005	
		TCE	nd	
		PCE	nd	
GP2-W1	9'	Vinyl Chloride	nd	
		1,1-DCE	nd	
		DCE	nd	
		1,1-DCA	nd	
		1,2-DCA	nd	
		1,1,1-TCA	nd	
		TCE	nd	
		PCE	nd	
GP2-W2	21'	Vinyl Chloride	0.246	
		1,1-DCE	nd	
		DCE	0.863	
		1,1-DCA	nd	
		1,2-DCA	nd	
		1,1,1-TCA	nd	
		TCE	nd	
		PCE	nd	
Standard	na	Vinyl Chloride	0.048	Calibration check
		1,1-DCE	0.446	
		DCE	0.436	
		1,1-DCA	nd	
		1,2-DCA	nd	
		1,1,1-TCA	nd	
		TCE	nd	
		PCE	0.101	

Sample	Depth	Analyte	Conc.	Comments
GP4-W1	2'	Vinyl Chloride	nd	
		1,1-DCE	nd	
		DCE	nd	
		1,1-DCA	nd	
		1,2-DCA	nd	
		1,1,1-TCA	nd	
		TCE	nd	
		PCE	nd	
GP4-W2	18'	Vinyl Chloride	nd	
		1,1-DCE	nd	
		DCE	nd	
		1,1-DCA	nd	
		1,2-DCA	nd	
		1,1,1-TCA	nd	
		TCE	nd	
		PCE	nd	
GP3	25'	Vinyl Chloride	nd	
		1,1-DCE	nd	
		DCE	nd	
		1,1-DCA	nd	
		1,2-DCA	nd	
		1,1,1-TCA	nd	
		TCE	nd	
		PCE	nd	
1,1-1,2-DCA Standard	na	Vinyl Chloride	nd	
		1,1-DCE	nd	
		DCE	nd	
		1,1-DCA	8.25	
		1,2-DCA	9.3	
		1,1,1-TCA	1.23	
		TCE	nd	
		PCE	nd	
GP5	16'	Vinyl Chloride	nd	
		1,1-DCE	nd	
		DCE	nd	
		1,1-DCA	nd	
		1,2-DCA	nd	
		1,1,1-TCA	0.042	Likely background
		TCE	nd	
		PCE	nd	

Sample	Depth	Analyte	Conc.	Comments
Syringe Blank	na	Vinyl Chloride	nd	
		1,1-DCE	nd	
		DCE	nd	
		1,1-DCA	nd	
		1,2-DCA	nd	
		1,1,1-TCA	nd	
		TCE	nd	
		PCE	nd	
GP5 Dup.	16'	Vinyl Chloride	nd	
		1,1-DCE	nd	
		DCE	nd	
		1,1-DCA	nd	
		1,2-DCA	nd	
		1,1,1-TCA	0.007	
		TCE	nd	
		PCE	nd	
GP6	16'	Vinyl Chloride	nd	
		1,1-DCE	nd	
		DCE	nd	
		1,1-DCA	nd	
		1,2-DCA	nd	
		1,1,1-TCA	nd	
		TCE	nd	
		PCE	nd	

na - not applicable
nd - no detect
VOA/DI- volatile organic analysis vial/deionized water blank
DCE - dichloroethylene (cis and trans)
DCA - dichloroethane
TCA - 1,1,1-trichloroethane
TCE - trichloroethylene
PCE - tetrachloroethylene

ENVIROSCAN

December 8, 1993

STS Consultants
11425 W. Lake Park Dr.
Milwaukee, WI 53224

DEC 9 1993

Attn: Eric Frauen

Re: 82149XF

Please find enclosed the analytical results for the samples received November 16, 1993.

The VOC analysis was completed using a modified EPA Method 8021.

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.

Laurie M. Pietrowski

Laurie M. Pietrowski
Analytical Chemist

303 West Military Road Rothschild, WI 54474 (715) 359-7226
An Affiliate of the Black Clawson Co.

ANALYTICAL REPORT

STS Consultants
11425 W. Lake Park Dr.
Milwaukee, WI 53224

CUST NUMBER: 82149XF
SAMPLED BY: Client
DATE REC'D: 11/16/93
REPORT DATE: 12/08/93
PREPARED BY: LMP LMP
REVIEWED BY: JR

Attn: Eric Frauen

	Units	Detection Limit	W-24-D	W-16
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
cis-1,2-Dichloroethylene	µg/l	0.5	X	X
trans-1,2-Dichloroethylene	µg/l	0.5	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
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	2.0	5.9	X
1,1,1-Trichloroethane	µg/l	0.5	X	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.3 *	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
Date of VOC analysis:			11/21/93	11/21/93
Analytical No.:			95760	95765

X = Analyzed but not detected.
* = Detection limit raised due to possible carry over.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

[redacted]

STS Consultants
11425 W. Lake Park Dr.
Milwaukee, WI 53224

CUST NUMBER: 82149XF
SAMPLED BY: Client
DATE REC'D: 11/16/93
REPORT DATE: 12/08/93
PREPARED BY: LMP
REVIEWED BY:

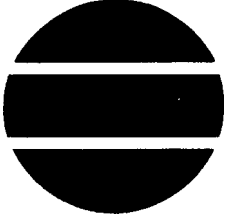
Attn: Eric Frauen

	Units	Detection Limit	W-22	W-9
Benzene	µg/l	1.0	13.8	X
Bromoform	µg/l	10.0	X	X
Bromomethane	µg/l	20.0	X	X
Carbon Tetrachloride	µg/l	2.5	20.1	X
Chlorobenzene	µg/l	10.0	X	X
Chloroethane	µg/l	10.0	X	X
2-Chloroethylvinyl Ether	µg/l	25.0	X	X
Chloroform	µg/l	2.5	X	X
Chloromethane	µg/l	10.0	X	X
Chlorodibromomethane	µg/l	2.5	X	X
1,2-Dichlorobenzene	µg/l	5.0	X	X
1,3-Dichlorobenzene	µg/l	5.0	X	X
1,4-Dichlorobenzene	µg/l	2.5	X	X
Bromodichloromethane	µg/l	2.5	X	X
1,1-Dichloroethane	µg/l	2.5	153.	X
1,2-Dichloroethane	µg/l	2.5	29.6	X
1,1-Dichloroethylene	µg/l	2.0	58.7	X
cis-1,2-Dichloroethylene	µg/l	2.5	1830. (3)	61.8
trans-1,2-Dichloroethylene	µg/l	2.5	195.	X
Methylene Chloride	µg/l	12.5	X	X
1,2-Dichloropropane	µg/l	2.5	X	X
cis-1,3-Dichloropropene	µg/l	10.0	X	X
1,3-Dichloropropene	µg/l	2.5	X	X
Ethylbenzene	µg/l	5.0	3680. (3)	X
1,1,2,2-Tetrachloroethane	µg/l	5.0	X	X
Tetrachloroethylene	µg/l	2.5	823. (3)	X
Toluene	µg/l	10.0	2310. (3)	X
1,1,1-Trichloroethane	µg/l	2.5	468. (3)	X
1,1,2-Trichloroethane	µg/l	2.5	3.4	X
Trichloroethylene	µg/l	1.0	1720. (3)	X
Vinyl Chloride	µg/l	1.0	770. (3)	64.7
Trichlorofluoromethane	µg/l	5.0	X	X
Dichlorodifluoromethane	µg/l	10.0	X	X
m- & p-Xylene	µg/l	5.0	4390. (3)	X
o-Xylene	µg/l	5.0	3910. (3)	X
Date of VOC analysis:			11/22/93	11/25/93
Analytical No.:			95761	95762

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT



STS Consultants
11425 W. Lake Park Dr.
Milwaukee, WI 53224

CUST NUMBER: 82149XF
SAMPLED BY: Client
DATE REC'D: 11/16/93
REPORT DATE: 12/08/93
PREPARED BY: LMP
REVIEWED BY:

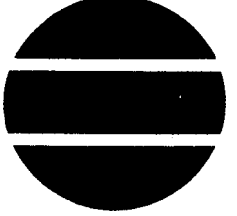
Attn: Eric Frauen

	Units	Detection Limit	W-24-S	W-10
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	2.4
1,2-Dichloroethane	µg/l	0.5	X	X
1,1-Dichloroethylene	µg/l	0.4	X	2.3
cis-1,2-Dichloroethylene	µg/l	0.5	X	1,060.
trans-1,2-Dichloroethylene	µg/l	0.5	X	20.2
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
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	751.
Toluene	µg/l	2.0	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	0.5	2740. (2)
Vinyl Chloride	µg/l	0.2	X	303.
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
Date of VOC analysis:			11/21/93	11/26/93
Analytical No.:			95759	95763

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT



STS Consultants
11425 W. Lake Park Dr.
Milwaukee, WI 53224

CUST NUMBER: 82149XF
SAMPLED BY: Client
DATE REC'D: 11/16/93
REPORT DATE: 12/08/93
PREPARED BY: LMP
REVIEWED BY:

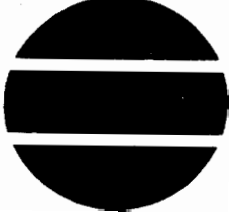
Attn: Eric Frauen

	Units	Detection Limit	W-11	W-4
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	22.9	2.3
1,2-Dichloroethane	µg/l	0.5	1.1	X
1,1-Dichloroethylene	µg/l	0.4	7.0	1.0
cis-1,2-Dichloroethylene	µg/l	0.5	2660. (3)	212. (2)
trans-1,2-Dichloroethylene	µg/l	0.5	21.3	2.2
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
1,3-Dichloropropene	µg/l	0.5	X	X
Ethylbenzene	µg/l	1.0	39.8	X
1,1,2,2-Tetrachloroethane	µg/l	1.0	X	X
Tetrachloroethylene	µg/l	0.5	X	87.1
Toluene	µg/l	2.0	30.4	X
1,1,1-Trichloroethane	µg/l	0.5	21.8	X
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	7.2	104.
Vinyl Chloride	µg/l	0.2	1750. (3)	38.7
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m- & p-Xylene	µg/l	1.0	14.2	X
o-Xylene	µg/l	1.0	3.5	X
Date of VOC analysis:			11/25/93	11/21/93
Analytical No.:			95764	95766

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT



STS Consultants
11425 W. Lake Park Dr.
Milwaukee, WI 53224

CUST NUMBER: 82149XF
SAMPLED BY: Client
DATE REC'D: 11/16/93
REPORT DATE: 12/08/93
PREPARED BY: LMP
REVIEWED BY:

Attn: Eric Frauen

	Units	Detection Limit	W-18	FB-1
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	2.5	X
1,2-Dichloroethane	µg/l	0.5	X	X
1,1-Dichloroethylene	µg/l	0.4	X	X
cis-1,2-Dichloroethylene	µg/l	0.5	111.	X
trans-1,2-Dichloroethylene	µg/l	0.5	1.8	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
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	2.0	X	X
1,1,1-Trichloroethane	µg/l	0.5	X	4.6
1,1,2-Trichloroethane	µg/l	0.5	X	X
Trichloroethylene	µg/l	0.2	3.2	X
Vinyl Chloride	µg/l	0.2	30.5	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
Date of VOC analysis:			11/21/93	11/21/93
Analytical No.:			95767	95769

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT

[redacted]

STS Consultants
11425 W. Lake Park Dr.
Milwaukee, WI 53224

CUST NUMBER: 82149XF
SAMPLED BY: Client
DATE REC'D: 11/16/93
REPORT DATE: 12/08/93
PREPARED BY: LMP LMP
REVIEWED BY: [signature]

Attn: Eric Frauen

	Units	Detection Limit	DUPE
Benzene	µg/l	10.0	15.4
Bromoform	µg/l	20.0	X
Bromomethane	µg/l	40.0	X
Carbon Tetrachloride	µg/l	10.0	28.2
Chlorobenzene	µg/l	20.0	X
Chloroethane	µg/l	20.0	X
2-Chloroethylvinyl Ether	µg/l	50.0	X
Chloroform	µg/l	5.0	X
Chloromethane	µg/l	20.0	X
Chlorodibromomethane	µg/l	5.0	X
1,2-Dichlorobenzene	µg/l	10.0	X
1,3-Dichlorobenzene	µg/l	10.0	X
1,4-Dichlorobenzene	µg/l	5.0	X
Bromodichloromethane	µg/l	5.0	X
1,1-Dichloroethane	µg/l	10.0	110.
1,2-Dichloroethane	µg/l	10.0	16.3
1,1-Dichloroethylene	µg/l	8.0	45.9
cis-1,2-Dichloroethylene	µg/l	20.0	12500. (3)
trans-1,2-Dichloroethylene	µg/l	10.0	151.
Methylene Chloride	µg/l	25.0	X
1,2-Dichloropropane	µg/l	5.0	X
cis-1,3-Dichloropropene	µg/l	20.0	X
1,3-Dichloropropene	µg/l	5.0	X
Ethylbenzene	µg/l	20.0	14000. (2)
1,1,2,2-Tetrachloroethane	µg/l	10.0	X
Tetrachloroethylene	µg/l	10.0	5840. (3)
Toluene	µg/l	20.0	3,330.
1,1,1-Trichloroethane	µg/l	10.0	818.
1,1,2-Trichloroethane	µg/l	5.0	X
Trichloroethylene	µg/l	4.0	10900. (3)
Vinyl Chloride	µg/l	4.0	2,960.
Trichlorofluoromethane	µg/l	10.0	X
Dichlorodifluoromethane	µg/l	20.0	X
m- & p-Xylene	µg/l	20.0	41800. (3)
o-Xylene	µg/l	20.0	13500. (2)

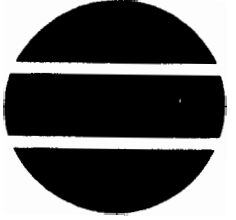
Date of VOC analysis: 11/26/93

Analytical No.: 95768

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

ANALYTICAL REPORT



STS Consultants
11425 W. Lake Park Dr.
Milwaukee, WI 53224

CUST NUMBER: 82149XF
SAMPLED BY: Client
DATE REC'D: 11/16/93
REPORT DATE: 12/08/93
PREPARED BY: LMP
REVIEWED BY:

Attn: Eric Frauen

	Units	Detection Limit	TRIP BLANK-DR	W-6
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
cis-1,2-Dichloroethylene	µg/l	0.5	X	0.9
trans-1,2-Dichloroethylene	µg/l	0.5	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
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	2.0	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	1.3
Trichlorofluoromethane	µg/l	1.0	X	X
Dichlorodifluoromethane	µg/l	2.0	X	X
m- & p-Xylene	µg/l	1.0	X	1.0
o-Xylene	µg/l	1.0	X	X
Date of VOC analysis:			11/21/93	11/25/93
Analytical No.:			95770	95771

X = Analyzed but not detected.

All analyses conducted in accordance with Enviroscan Quality Assurance Program.

State of Wisconsin
Department of Natural Resources

MONITORING WELL CONSTRUCTION
Form 4400-113A 8-89

Facility/Project Name: Whitefish Bay Landfill	Grid Location: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: W24-S
Facility License, Permit or Monitoring Number: _____		Wis. Unique Well Number: _____ DNR Well Number: _____
Type of Well: Water Table Observation Well ☒ 11; Piezometer ☐ 12	Section Location: ____ 1/4 of NW 1/4 of Section 23, T 8 N, R 21 ☒ E ☐ W	Date Well Installed: 11/02/93 (m m d d y y)
Distance Well Is From Waste/Source Boundary: 600 ft.	Location of Well Relative to Waste/Source: ☐ Upgradient ☐ Sidegradient ☒ Downgradient ☐ Not Known	Well Installed By: (Person's Name and Firm): Joe Weaver; STS Consultants
Is Well A Point of Enforcement Std. Application? ☐ Yes ☒ No		

A. Protective pipe, top elevation _____ ft. MSL
B. Well casing, top elevation 711.01 ft. MSL
C. Land surface elevation 708.7 ft. MSL
D. Surface seal, bottom _____ ft. MSL or 2.5 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

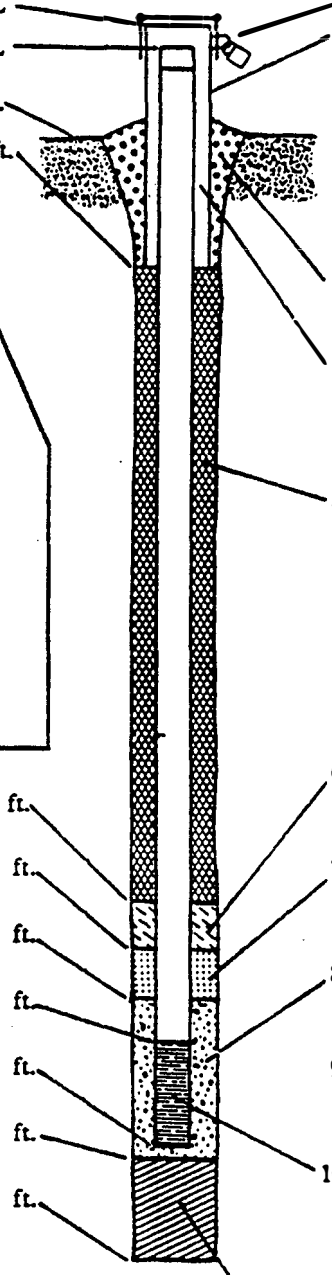
14. Drilling method used: Rotary ☐ 50; Hollow Stem Auger ☒ 41; Other ☐ ____

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

16. Drilling additives used? ☐ Yes ☒ No
Describe N/A

17. Source of water (attach analysis):
N/A

E. Bentonite seal, top _____ ft. MSL or 3.7 ft.
F. Fine sand, top _____ ft. MSL or 4.7 ft.
G. Filter pack, top _____ ft. MSL or 5.7 ft.
H. Well screen, top _____ ft. MSL or 7.7 ft.
I. Well screen, bottom _____ ft. MSL or 12.7 ft.
J. Filter pack, bottom _____ ft. MSL or 13.2 ft.
K. Borehole, bottom _____ ft. MSL or 13.2 ft.
L. Borehole, diameter 8.0 in.
M. O.D. well casing 2.38 in.
N. I.D. well casing 2.00 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ 04; Other ☐ ____
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Screw on Cap
3. Surface seal: Bentonite ☒ 30; Concrete ☐ 01; Other ☐ ____
4. Material between well casing and protective pipe: Bentonite ☐ 30; Annular space seal ☐; None ☒; Other ☐ ____
5. Annular space seal: Granular Bentonite ☒ 33
____ Lbs/gal mud weight ... Bentonite-sand slurry ☐ 35
____ Lbs/gal mud weight ..... Bentonite slurry ☐ 31
____ % Bentonite .... Bentonite-cement grout ☐ 50
____ Ft^3 volume added for any of the above
How installed: Tremie ☐ 01; Tremie pumped ☐ 02; Gravity ☒ 08
6. Bentonite seal: Bentonite granules ☐ 33
☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite pellets ☒ 32
Other ☐ ____
7. Fine sand material: Manufacturer, product name and mesh size
Badger Mining Badger Sand 40/60
Volume added ____ ft^3 2 Bags
8. Filter pack material: Manufacturer, product name and mesh size
Red Flint, Red Flint Sand 45/55
Volume added ____ ft^3 5 Bags
9. Well casing: Flush threaded PVC schedule 40 ☒ 23; Flush threaded PVC schedule 80 ☐ 24; Other ☐ ____
10. Screen material: PVC
Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐ ____
Manufacturer Timco
Slot size: 0.010 in.
Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☒; Other ☐
none

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

Signature: Eric Flamm
Firm: STS Consultants

Please complete and return both sides of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Adm. 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 $5,000 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.

State of Wisconsin
Department of Natural Resources

MONITORING WELL CONSTRUCTION
Form 4400-113A 8-89

Facility/Project Name: Whitefish Bay Landfill	Grid Location: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: W24D
Facility License, Permit or Monitoring Number: ----------		Wis. Unique Well Number / DNR Well Numbe
Type of Well: Water Table Observation Well ☐ 11; Piezometer ☒ 12	Section Location: ____ 1/4 of NW 1/4 of Section 23, T 8 N, R 21 ☒ E ☐ W	Date Well Installed: 11/02/93 (m m d d y y)
Distance Well Is From Waste/Source Boundary: 600 ft.	Location of Well Relative to Waste/Source: ☐ Upgradient ☐ Sidegradient ☒ Downgradient ☐ Not Known	Well Installed By: (Person's Name and Firm): Joe Weaver; STS Consultants
Is Well A Point of Enforcement Std. Application? ☐ Yes ☒ No		

A. Protective pipe, top elevation ---------- ft. MSL
B. Well casing, top elevation 711.00 ft. MSL
C. Land surface elevation 708.8 ft. MSL
D. Surface seal, bottom ---------- ft. MSL or 4.8 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 ☐ ____

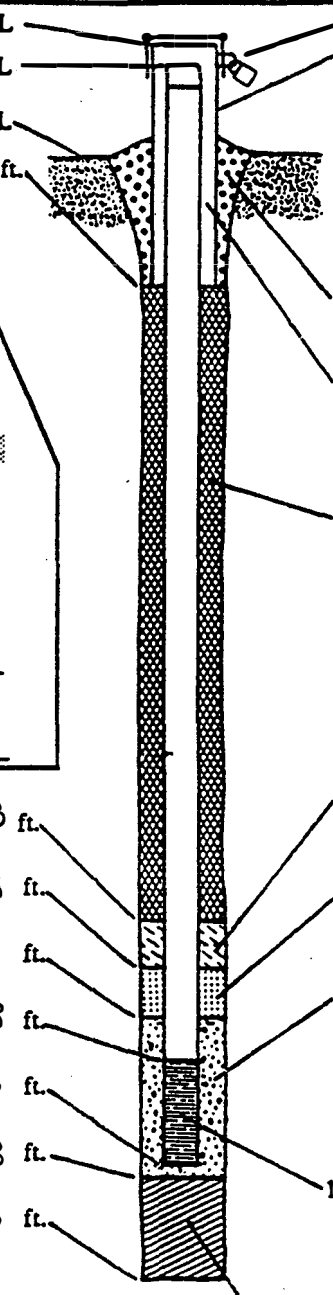
15. Drilling fluid used: Water ☐ 02; Air ☐ 01; Drilling Mud ☐ 03; None ☒ 99

16. Drilling additives used? ☐ Yes ☒ No
Describe N/A

17. Source of water (attach analysis):
N/A

E. Bentonite seal, top ---------- ft. MSL or 12.3 ft.
F. Fine sand, top ---------- ft. MSL or 14.3 ft.
G. Filter pack, top ---------- ft. MSL or 15.8 ft.
H. Well screen, top 691.0 ft. MSL or 17.8 ft.
I. Well screen, bottom 681.0 ft. MSL or 22.8 ft.
J. Filter pack, bottom ---------- ft. MSL or 23.3 ft.
K. Borehole, bottom ---------- ft. MSL or 23.3 ft.
L. Borehole, diameter 8.0 in.
M. O.D. well casing 2.38 in.
N. I.D. well casing 2.00 in.

1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 7.0 ft
c. Material: Steel ☒ 04; Other ☐ ____
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Screw on cap
3. Surface seal: Bentonite ☒ 3; Concrete ☐ 0; Other ☐ ____
4. Material between well casing and protective pipe: Bentonite ☐ 3; Annular space seal ☐; none Other ☒ ____
5. Annular space seal: Granular Bentonite ☒ 3; ____ Lbs/gal mud weight ... Bentonite-sand slurry ☐ 3; ____ Lbs/gal mud weight ..... Bentonite slurry ☐ 3; ____ % Bentonite .... Bentonite-cement grout ☐ 5; ____ Ft³ volume added for any of the above
How installed: Tremie ☐ 0; Tremie pumped ☐ 0; Gravity ☒ 0
6. Bentonite seal: Bentonite granules ☐ 3; ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite pellets ☒ 3; Other ☐ ____
7. Fine sand material: Manufacturer, product name and mesh size: Badger Mining Badger Sand 40/60
Volume added ____ ft³ 2 Bags
8. Filter pack material: Manufacturer, product name and mesh size: Red Flint, Red Flint Sand 45/55
Volume added ____ ft³ 5 Bags
9. Well casing: Flush threaded PVC schedule 40 ☒ 23; Flush threaded PVC schedule 80 ☐ 24; Other ☐ ____
10. Screen material: PVC
Screen type: Factory cut ☒ 11; Continuous slot ☐ 01; Other ☐ ____
Manufacturer Timco
Slot size: 0.010 in
Slotted length: 7.0 ft
11. Backfill material (below filter pack): None ☒; none Other ☐ ____



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

Signature: [signature] Firm: STS Consultants

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State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste
☐ Emergency Response
☐ Wastewater
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other:

SOIL BORING LOG INFORMATION

Form 4400-122 7-91

82149XF

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Whitefish Bay Demolition Landfill		*W24-S*

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
STS Consultants, Ltd. *J. Weaver*	*11/02/93*	*11/02/93*	*Hollow Stem Auger*

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Water Level	Surface Elevation	Borehole Diameter
				708.7 Feet MSL	

Boring Location State Plane	Grid of Origin Lat Long	Local Grid Location (if applicable)
1/4 of 1/4 of Section, T N, R		*Feet S* *Feet W*

County	DNR County Code	Civil Town/City/ or Village
Milwaukee County	*41*	*Milwaukee, Wisconsin*

Sample Number	Sample Length Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plastic Limit	P 200	RQD/ Comments
			2.5 5 7.5 10 12.5	Blind Drill										
			15 17.5 20 22.5 25 27.5	END OF BORING Boring advanced to 13.5 feet by hollow stem auger. Groundwater monitoring well installed to 12.7 feet on 11/2/93.										

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

Signature	Firm

This form is authorized by Chapters 144.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 144.99 and 162.06, Wis. Stats.

State of Wisconsin
Department of Natural Resources

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☐ Emergency Response
☐ Wastewater
☐ Haz. Waste
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☐ Water Resources
☐ Other:

SOIL BORING LOG INFORMATION

Form 4400-122 7-91

82149XF

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Whitefish Bay Demolition Landfill		*W24-D*

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
STS Consultants, Ltd. *J. Weaver*	*11/02/93*	*11/02/93*	*Hollow Stem Auger*

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Water Level	Surface Elevation	Borehole Diameter
				708.8 Feet MSL	*8 3/4 inches*

Boring Location State Plane *1/4 of 1/4 of Section, T N, R*	Grid of Origin Lat Long	Local Grid Location (If applicable) *Feet S* *Feet W*

County	DNR County Code	Civil Town/City/ or Village
Milwaukee County	*41*	*Milwaukee, Wisconsin*

Sample Number	Sample Length Recovered (in)	Sample Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plastic Limit	P 200	RQD/ Comments
1	13	11		Silty clay, trace sand-dark brown-moist-firm-fill	CL				.70					
2	18	55	2.5	Medium to coarse sand, some gravel-brown-wet-very dense-till	SP									
3	24	18	5	Silty clay, trace sand-brown-moist-firm-till	CL				.82					
4	24	18	7.5	Silt-brown-moist-medium dense-lacustrine	ML									
5	14	12	10	Silty clay, .3 foot sand seam-brown to gray-moist-firm to stiff-lacustrine	CL				1.15					
6	24	23	12.5	Silty clay, some sand, trace cobble-gray-moist-firm to stiff-till	CL				1.20					
7	17	43							.90					
8	19	31	15	Silty clay, trace sand-gray to brown-moist-firm to stiff-till	CL				1.50					
9	8	32	17.5	Silty sand-grayish brown-wet-dense to extremely dense-till	SM				1.4					
10		100/4												
11	16	50/3	20	Silty clay-brown-moist-stiff-till	CL				1.2					
12	9	100/3	22.5	Fine to coarse sand, trace gravel-gray-moist to wet-extremely dense-till	SP SM									
13	22	61	25	Silty sand-gray-wet-till Fine to coarse sand and gravel-brown-wet-very dense-outwash	SP-GP									
			27.5	END OF BORING Boring advanced to 26 feet by hollow stem										

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

Signature Firm

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State of Wisconsin
Department of Natural Resources

Route To:
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☐ Other:

SOIL BORING LOG INFORMATION

Form 4400-122 7-91

82149XF

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Whitefish Bay Demolition Landfill		*W24-D*

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started	Date Drilling Completed	Drilling Method
STS Consultants, Ltd. *J. Weaver*	*11/02/93*	*11/02/93*	*Hollow Stem Auger*

DNR Facility Well No.	WI Unique Well No.	Common Well Name	Water Level	Surface Elevation	Borehole Diameter
				708.8 Feet MSL	*8 3/4 inches*

Boring Location State Plane *1/4 of 1/4 of Section , T N, R*	Grid of Origin Lat Long	Local Grid Location (if applicable) *Feet S* *Feet W*

County	DNR County Code	Civil Town/City/ or Village
Milwaukee County	*41*	*Milwaukee, Wisconsin*

Sample Number	Sample Length Recovered (in)	Sample Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plastic Limit	Soil Properties: P 200	RQD/ Comments
1	13	11		Silty clay, trace sand-dark brown-moist-firm-fill	CL				.70					
2	16	55	2.5	Medium to coarse sand, some gravel-brown-wet-very dense-till	SP									
3	24	16	5	Silty clay, trace sand-brown-moist-firm-till	CL				.82					
4	24	16	7.5	Silt-brown-moist-medium dense-lacustrine	ML									
5	14	12	10	Silty clay, .3 foot sand seam-brown to gray-moist-firm to stiff-lacustrine	CL				1.15					
6	24	23	12.5	Silty clay, some sand, trace cobble-gray-moist-firm to stiff-till	CL				1.20					
7	17	43							.90					
8	19	31	15	Silty clay, trace sand-gray to brown-moist-firm to stiff-till	CL				1.50					
9	8	32	17.5	Silty sand-grayish brown-wet-dense to extremely dense-till	SM				1.4					
10		100/4												
11	16	50/3	20	Silty clay-brown-moist-stiff-till	CL				1.2					
12	9	100/3	22.5	Fine to coarse sand, trace gravel-gray-moist to wet-extremely dense-till	SP SM									
13	22	61	25	Silty sand-gray-wet-till Fine to coarse sand and gravel-brown-wet-very dense-outwash	SP-GP									
			27.5	END OF BORING Boring advanced to 26 feet by hollow stem										

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

Signature	Firm