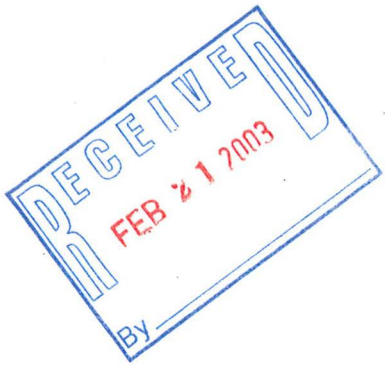
Superior Water Light & Power
Superior, Wisconsin

Phase II, Part II Site Investigation Report
Former Manufactured Gas Plant
Superior, Wisconsin



ENSR *International*
February 2003
Document Number 09413-098-400

Superior Water Light & Power Company

February 20, 2003

Ms. Danielle Lancour
Remediation and Redevelopment Program
Wisconsin Department of Natural Resources
107 Sutliff Avenue
Rhinelander, WI 54501

RE: Superior Manufactured Gas Plant – WDNR BRRTS # 02-16-275446

Dear Ms. Lancour:

Enclosed with this letter is the Phase II, Part II Site Investigation Report for the former manufactured gas plant located near the intersection of Winter Street and Water Street in Superior, WI. The report contains the results of the site investigation that was completed in September of 2002.

The purpose of the Phase II, Part II investigation was to:

- Define the nature of the BTEX impact near MW-4 in Area 1.
- Define the nature of the PAH and BTEX impact around well MW-7 and the former shore line of Superior Bay in Area 2
- Determine the extent of the clay tile pipe found near the former MGP building.
- Perform chemical "fingerprinting" analysis on samples from each of the above three areas to characterize these materials.

ENSR International's St. Louis Park, MN office conducted the investigation and prepared the report. The "fingerprinting" analysis was performed by the Gas Technology Institute of Des Plaines, IL.

If you have any questions or would like additional information regarding this report, please contact me at (715) 395-6288.

Thank you.

Sincerely,

William S Bombich

William S. Bombich
General Manager

Enc
cc: Jamie Dunn, WDNR – Spooner, WI
William Gregg, ENSR International

Superior Water Light & Power
Superior, Wisconsin

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1.0 INTRODUCTION

This report presents the results of the Phase II Part II site investigation completed in September 2002 at the Superior Water Light & Power (SWL&P) Former Manufactured Gas Plant (MGP), located at the intersection of Winter and Water Street in Superior, Wisconsin (Site). The Site location is shown in Figure 1-1.

This investigation follows the scope of work and methodologies outlined in the Phase II Investigation, Part II Work Plan submitted to the Wisconsin Department of Natural Resources (WDNR) in July 2002. The field work for this investigation was completed on September 18 through September 20, 2002.

1.1 Purpose of Investigation

ENSR conducted a Phase I environmental assessment at the Site for SWL&P in September/October of 2001. The Phase I report indicated that gas was manufactured at the Site for fifteen years, ending in 1904. Areas of the Site that had the potential to contain MGP-related chemicals and/or byproducts were identified as part of the Phase I assessment. ENSR performed an initial Phase II site investigation from November 2001 through February 2002. The initial Phase II work consisted of collecting soil samples from borings and test trenches and installing monitoring wells and collecting groundwater samples. One area of the Site contained exclusively benzene, toluene, ethylbenzene and xylene (BTEX) compounds in the soil above Wisconsin Department of Natural Resources (WDNR) Recommended Contaminant Levels (RCL). Other areas of the Site contained both BTEX and polyaromatic hydrocarbons (PAH) compounds in the soil above RCL. Downgradient groundwater samples contained BTEX and PAH compounds above the WDNR groundwater enforcement standards. A test trench excavation around the building encountered clay tile pipes oriented toward the shoreline. The Phase II Site Investigation Report, dated January 2002, contains the complete investigation results.

The purpose of the Phase II Part II investigation includes the following:

1. Define the nature of the BTEX impact near MW-4 (Area 1).
2. Define the nature of the PAH and BTEX impact around well MW-7 and the former shoreline of Superior Bay (Area 2).
3. Determine the extent of the clay tile pipe found near the building.
4. Perform "fingerprinting" analysis on samples from each of the above three areas to characterize these materials.

1.2 Scope of Work

The scope of work for the Phase II Part II investigation was outlined in the July 2002 Work Plan and was slightly modified based on field conditions. The Phase II Part II scope of work is summarized below.

The scope consisted of first creating a project health and safely plan and clearing underground utilities at the Site. The field work consisted of installing sixteen soil borings using a Geoprobe® hydraulic push drilling method, completing one test trench with a backhoe, and sampling groundwater from the seven existing monitoring wells. One or more soil samples were collected from each boring/trench for laboratory analysis. Figure 1-2 presents the locations of soil borings, monitoring wells, and the test trench completed for this investigation.

1.3 Site Location and Ownership

The former MGP Site is located in the vicinity of the intersection of Winter and Water Streets in Superior, Wisconsin. The Site occupies a portion of the northwest quarter of Section 13, Township 49 North and Range 14 West (NW ¼ of Sec. 13, T49N, R14W).

Portions of the former MGP property are now owned by SWL&P, the City of Superior, the U.S. Department of Transportation, and CLM, Inc. Figure 1-3 is a color-coded map indicating property ownership in the vicinity of the MGP Site.

The SWL&P owner contact is:

Bill Bombich
Superior Water Light & Power Company
2915 Hill Avenue
Superior, Wisconsin 54880
(715) 395-6288

1.4 Consultant and Contractor Identification

The Site investigation activities were conducted by ENSR. The contact for this investigation is:

William M. Gregg
ENSR *International*
4500 Park Glen Road, Suite 210
St. Louis Park, MN 55416
(952) 924-0117 - phone
(952) 924-0317 – fax

Subcontractors that provided services for this investigation are identified below.

Laboratory Analytical Services

EnChem, Inc.
Attn: Laurie Woelfel
1795 Industrial Drive
Green Bay, WI 54302
(800) 736-2436 – phone
(414) 469-8827 – fax
(WDNR Certification 405132750)

Laboratory Analytical Services

GTI
Attn: Diane Saber
1700 South Mount Prospect Road
Des Plaines, IL 60018
(847) 768-0500 – phone
(847) 768-0501 – fax

Surveying

Salo Engineering
Attn: Dale Berntsen
15 East First Street
Duluth, MN 55802
(218) 727-8796 – phone
(218) 727-0216 – fax

Trenching and Geoprobe Boring

Thein Well Company
Attn: Will Greeley
PO Box 429
Clara City, MN 56222
(320) 847-3207 – phone
(320) 847-3459 – fax

2.0 SITE BACKGROUND

2.1 Site Description

A 3,000-square foot brick building, that was an original MGP building reconstructed in 1929, is located on the northeast side of Water Street, between Water Street and the railroad tracks that roughly parallel the shoreline of Superior Bay. Gravel parking areas surround the building. Several parcels of land adjacent to the building were part of the former MGP property including a vacant grass-covered field to the west of the building where two gas holders were once located. Another larger gas holder was located on the now-vacant property south of the building, immediately south of U.S. Highway 53. A city street and vacant, grass-covered lots are now located where the larger gas holder was situated.

The Site is irregularly shaped consisting of approximately five acres, and is situated approximately two miles from downtown Superior. The area surrounding the Site consists of industrial land along the Superior Bay shoreline and commercial/residential properties further inland. The property east of the Site is a fenced parcel used by Lakehead Cement Company for storage and a ready mix plant. East of the Site is the City of Superior wastewater treatment plant. North of the Site is a former coal dock that is now owned and operated by CLM, Inc. for the production of lime. Adjacent to the CLM, Inc. dock are two large aboveground storage tanks that formerly contained fuel oil. Commercial and residential properties are located along Winter Street and other city streets south of the Site.

2.2 Site History

The gas plant was built in 1888 and began operations on November 1, 1889. The gas produced was a water gas made by the improved "Springer" process. Two gas holders were initially constructed on the Site: one single lift of 35,000 cubic feet capacity, built in October 1889, and one double lift holder of 250,000 cubic feet capacity, dimensions of 92 ft x 21 ft x 21 ft, completed in October 1891. In 1924, a third gas holder was constructed at the subject property. This 750,000-cubic foot gas holder was located southwest of the former MGP building. A spherical gas holder called the "Horton Sphere" was constructed in 1950.

Gas was produced at the Superior MGP from November 1889 to August 1904. After August 1904, all gas sold by SWL&P was purchased from the Zenith Furnace Company (later known as Interlake, Corporation). The gas purchased from Zenith/Interlake was purified in West Duluth before it was piped to SWL&P's plant in Superior. Therefore, no purifier wastes were generated at the Site after August 1904. The MGP at the Site produced a total of approximately 262,000 MCF (million cubic feet) of gas during its 15-year production history.

In 1929, the gas plant building was rebuilt to its present configuration. Gas purchased from Zenith/Interlake was stored in the gas holders, and pumped and metered from the reconstructed building. Storage and metering of manufactured gas purchased from Zenith/Interlake continued until natural gas supplies became available in 1959. The 35,000-cubic foot gas holder was removed prior to

1938. The 250,000-cubic foot gas holder was removed between 1940 and 1961. The 750,000-cubic foot gas holder was removed between 1962 and 1966, and the Horton Sphere was removed in 1985.

In 1978, SWL&P sold the former gas plant building and portions of the property to CLM, Inc. The building was gutted, concrete floors were poured over the existing sand floors, and the building has been used for storage since that time.

Rough estimates of the amount of MGP wastes produced by the plant were calculated in the Phase I report. Based on a total plant gas production of 262,000 MCF, an estimated 200-cubic yards of coal ash, 2 to 22 cubic yards of coal tar sludge, and 70 to 350 cubic yards of gas purification wastes were produced at the Superior MGP.

2.3 Source Areas

The initial Phase II investigation identified areas that had elevated levels of PAH and BTEX compounds. The results of the initial Phase II sampling indicated there are three general areas where RCLs/enforcement standards are exceeded, as illustrated on Figure 2-1. These areas have been loosely defined based on the soil type, the presence or absence of groundwater, the types of compounds detected, and their concentrations. The purpose of this Phase II Part II investigation was to further investigate Areas 1 and 2.

2.4 Geologic and Hydrogeologic Setting

The subject property lies at an elevation between 610 and 620 feet above mean sea level. The topography in the area of the subject property is relatively flat with little or no slope. The results of the subsurface investigations indicate that there are two distinct soil types encountered: a red high-plasticity clay and a fill material consisting primarily of white to dark gray lime-like material. There were also small amounts of miscellaneous fill, such as bricks, wood, and cinders, encountered in several locations. Sandstone bedrock (Keweenawan Formation) may be found beneath the unconsolidated soils. Depth to bedrock is estimated to be from 100 to 200 feet below the ground surface.

A perched groundwater table was encountered in the lime-like material above the clay 6 to 10 feet below the ground surface. Based on the proximity to Lake Superior and groundwater gauging data, the overall groundwater flow direction is assumed to be east to northeast towards Lake Superior.

3.0 OVERVIEW OF PHASE II INVESTIGATION

3.1 Geoprobe Borings

Sixteen borings, B-8 through B-23, were advanced at the Site with a truck-mounted Geoprobe by ENSR's subcontractor Thein Well Company. Borings were completed to a depth ranging from 8 to 20 feet below the ground surface. Soil samples were collected on a continuous-depth basis using a 4-foot long, 2-inch diameter sampling spoon with new disposable plastic liners. The soil samples were field screened with a photo-ionization detector (PID), calibrated with 100 parts per million isobutylene, using a headspace screening technique. One or two soil samples were retained from each Geoprobe boring for laboratory analysis. The depths of the samples submitted for analysis were selected based on field observations (visible staining) and/or PID field screening results. Soil samples from Area 1 were analyzed for BTEX by EnChem. In addition, two samples from B-23 were collected from Area 1 for fingerprinting analysis by GTI. Soil samples from Area 2 were analyzed for VOCs and PAH by EnChem. A sample of pulverized wood material from B-14 was submitted to EnChem for cyanide analysis. In addition, three soil samples from borings B-11, B-12 and B-13 were collected from Area 2 for fingerprinting analysis by GTI. Soil samples were immediately transferred from the sample sleeve to laboratory supplied containers and placed in an ice-filled cooler. Samples were shipped on ice overnight via courier or FedEx, under chain-of-custody, to EnChem and GTI. The borings were abandoned with granular bentonite. Geoprobe boring logs and borehole abandonment forms are included in Appendix A.

3.2 Test Trench

Test trench T-10 was dug using a small backhoe operated by ENSR's subcontractor Thein Well Company. The purpose of the test trench was to follow the course of the clay pipe discovered in the initial Phase II investigation and to collect samples of it's contents. The test trench was logged, samples were collected, and then backfilled with the excavated material. Three samples of material encountered in the pipe were collected for fingerprinting analysis by GTI.

3.3 Groundwater Sampling

3.3.1 Monitoring Well Water Level Gauging

Groundwater level measurements were collected from all monitoring wells with an interface probe. The depth to water was recorded and the well was checked for non-aqueous phase liquids (free product). The measurements were made from a surveyed measuring point established on the north side of the top of the PVC well casing.

3.3.2 Groundwater Sample Collection and Handling

Groundwater samples were collected from wells MW-1 through MW-7. The monitoring wells MW-5, 6, and 7 were purged and sampled in general accordance with the WDNR "Groundwater Sampling Field Manual," September 1996. Purging was conducted using a peristaltic pump and new dedicated polyurethane tubing utilizing a low-flow purging technique. Samples from wells MW-1 through MW-4 were collected without any purging prior to sampling. These wells have extremely slow recharge rates making purging infeasible. Samples were collected directly from the tubing into laboratory supplied containers. The samples were stored on ice in a cooler and shipped overnight, under chain-of custody, to EnChem. Groundwater samples were analyzed for PAH and VOC. The groundwater collection logs are included as Appendix B.

3.4 Decontamination Procedures

Drilling and sampling equipment were decontaminated before and between sampling events to prevent potential cross contamination between soil boring locations, soil sampling intervals, and monitoring wells. Sampling equipment, including Geoprobe samplers and water level indicators, were decontaminated prior to each use with a detergent wash followed by a potable water rinse.

3.5 Elevation Survey

Upon completion of the field investigation, the elevation and location of the test trench and soil borings were surveyed by ENSR's subcontractor Salo Engineering. The results of the survey are illustrated in the map found in Appendix C.

4.0 INVESTIGATION RESULTS

4.1 Results of Geologic/Hydrogeologic Site Investigation

The results of the soil sampling at the Site indicate that there were two distinct soil types encountered: a red high-plasticity clay and a fill material consisting primarily of white to dark gray lime-like material. There were also small amounts of miscellaneous fill, such as bricks, wood and cinders, encountered in several locations. The lime-like fill material was encountered in the northern portion of the Site in the north half of the test trench and in borings B-11 through B-18. The lime-like material extended to depths ranging from three to eleven feet below the ground surface. The total depth of the lime material generally increased towards the northeast. In borings B-11, B-12, B-13, and B-14, a layer of cinders and/or pulverized wood saturated with water and a tar-like material was encountered below the lime-like material and above the clay layer. The red clay soil was encountered in the remaining borings beneath the lime-like material or from the ground surface to the total depth explored. In borings B-19 through B-21, brick was encountered below a foot of gravel to a depth of 6.5 to 8 feet below the ground surface. A detailed description of the soil is included on the boring logs in Appendices A. Figures 4-1 and 4-2 illustrate geologic cross-sections of site.

During the investigation, groundwater was encountered in borings B-11 through B-16, B-18, and B-22 in the fill material perched above the red clay or in sand or granular fill material layers. The groundwater was encountered approximately 10.5 to 12 feet below the ground surface in the borings. No groundwater was encountered during the investigation in the native red clay soil. All of the existing monitoring wells were gauged for depth to water during this investigation. The gauging data results are summarized in Table 4-1. Based on the gauging data, the apparent groundwater flow direction at the Site appears to be east to northeast, towards Lake Superior.

4.2 Results of Test Trench

Test trench T10 was completed to investigate the clay pipe discovered near the building in the initial Phase II investigation. A cross-section of the test trench is illustrated in Figure 4-3. The test trench log illustrates the pipe locations, soil types, and trench details. A 5-inch diameter steel pipe was discovered originating from the building approximately 2 to 3 feet below the ground surface. Below the steel pipe, approximately 4-5 feet below the ground surface, a 12-inch clay pipe was discovered. Both pipes ran northeast towards Lake Superior and sloped downwards towards the northeast. The steel pipe was clean and dry inside and had no visible residues. The clay pipe was cracked open in several spots and it contained a mixture of tar-like material and water. The clay pipe was followed approximately 70 feet northeast of the building where it ended. Groundwater was encountered near the end of the pipe at a depth of approximately 8 feet below the ground surface. The pipe was about 8 to 9 feet below the ground surface at it's end point.

The soil encountered in the excavation consisted of lime-like fill material and clay fill material. The lime-like fill material was found in the northern half of the trench. Below the lime-like material was mixed

clay, cinders, brick, wood and tar-like material. The red clay material was encountered at two feet below the ground surface at the south end of the excavation and it gradually sloped downward to a depth of greater than eight feet at the north end of the excavation. Photographs of the excavation are included in Appendix D.

4.3 Results of Soil Analyses

The laboratory results for VOC and PAH analyses for soil are summarized in Tables 4-2. The complete EnChem soil analytical report is included as Appendix E. Figure 4-4 provides a summary of the soil analytical results on a site map.

VOC Results

Soil samples from Area 1 were analyzed for BTEX and soil samples from Area 2 were analyzed for VOC. The soil analytical results were compared to the WDNR residual contaminant levels (RCL) based on the protection of groundwater (NR 720, Table 1). These RCLs are based on generic site conditions and were used as a basic soil screening level. As shown in the results summary tables, twelve borings exceeded one or more RCL for BTEX. The compound that exceeded the RCL most frequently was benzene with an RCL of 5.5 micrograms per kilogram (ug/kg). Borings B-8, 9, and 10 in Area 1 exceeded the benzene RCL with concentrations of 54,000 ug/kg, 100 ug/kg, and 120,000 ug/kg, respectively. In addition, boring B-10 also exceeded the RCL for ethyl benzene, toluene, and xylenes.

Soil samples from nine of the twelve borings in Area 2 exceeded the RCL for benzene, with concentrations ranging from 36 ug/kg to 590,000 ug/kg. Several borings also exceeded the RCL for ethyl benzene, toluene, and/or xylenes, with the highest concentrations found in the northeast portion of Area 2. Several other VOC were detected in the soil samples from Area 2: 1,2,4-trimethylbenzene, 1,3,5-Trimethylbenzene, Isopropylbenzene, and styrene. No RCLs exist for these compounds.

PAH Results

Soil samples from Area 2 were analyzed for PAH. The PAH soil analytical results were compared to the WDNR RCL based on the protection of groundwater and the WDNR RCL for the protection of human health from direct contact for industrial sites. The RCLs for PAH compounds are published in the Soil Cleanup Levels for PAHs Interim Guidance, Table 1. The RCL are based on generic site conditions and are considered a cleanup guidance. As shown in the summary tables, six of the borings had PAH compounds that exceeded one or more of the RCL. The compounds that most commonly exceeded the RCL were acenaphthylene with a RCL of 700 ug/kg, benzo (a) pyrene with a RCL of 390 ug/kg, naphthalene with a RCL of 400 ug/kg, and phenanthrene with a RCL of 1,800 ug/kg.

The highest acenaphthylene exceedance was 930 ug/kg, the highest benzo (a) pyrene exceedance was 2,300 ug/kg, the highest naphthalene exceedance was 36,000ug/kg, and the highest

phenanthrene exceedance was 9,200 ug/kg. The RCL exceedances in Area 2 are fairly uniformly distributed, but appear to be slightly higher in the eastern portion of the Area.

Cyanide Results

One soil sample was analyzed for cyanide – boring B-14 from 11 to 12 feet in depth. The soil material encountered at that depth consisted of a pulverized black wood-like material. The results indicated that the sample contained 3 mg/kg cyanide.

4.4 Results of Fingerprinting Analyses

Soil samples were collected from borings B-11, B-12, B-13, and B-23 for fingerprinting analysis by GTI using GC/FID fingerprinting techniques. Also, three samples were collected from the clay pipe in test trench T10 for fingerprinting. Figure 4-5 illustrates the locations of the samples collected for fingerprinting analysis. The complete GTI fingerprinting report is included as Appendix F. The fingerprinting report includes the GC/FID fingerprints, a summary and interpretation of the results, and supporting documentation.

The results of the fingerprinting analyses for the two samples from Area 1 (B-23) revealed the presence of a gasoline-range material consisting mainly of benzene and toluene, with lesser amounts of xylenes, ethylbenzene, and styrene. However, the lack of other gasoline-range compounds, including tri-alkyl benzene and tetra-alkyl benzene, indicate the material is not gasoline. The chemical compositions are clearly visible in the GC/FID fingerprint of sample number B-23 6-8 as shown in Figure 4-6. The fingerprint shows that the sample contains primarily benzene and toluene (shown as peaks one and two in Figure 4-6) and the sample did not contain any PAH. Most of the peaks shown in Figure 4-6 are for internal standards and surrogate standards added to the sample by the laboratory. The sample fingerprint, is similar to reference fingerprints for aromatic solvents or degreasers.

The results of the fingerprinting analyses for samples from Area 2 (B-11, B-12, B-13, and T10) revealed all the samples had relatively similar fingerprints. The fingerprints were similar to PAH patterns and diagnostic ratios of carburetted water gas tar byproducts. The fingerprints also contained an unresolved complex petroleum mixture exhibiting a pattern similar to heavy oil. The fingerprints contained ratios of benzene, toluene, ethylbenzene, and xylenes that were higher than is normally seen in carburetted water gas tar. Figure 4-7 shows the GC/FID fingerprint for sample T10-1, which represents a typical fingerprint for Area 2.

4.5 Results of Groundwater Investigation

On September 18th and 20th, 2002, groundwater samples were collected from monitoring wells MW-1 through MW-7. The groundwater samples were analyzed for PAH and VOC. The results of the groundwater sampling are summarized in Table 4-3 and Figure 4-8. The complete groundwater analytical report is included in Appendix E.

The groundwater results were compared to the WDNR groundwater enforcement standards, which are based on the protection of public health (NR 140, Table 1). The analytical results indicate exceedances of the enforcement standard for benzene (5 ug/l) in wells MW-3, MW-4, and MW-7. In addition, the sample from MW-7 exceeded the enforcement standards for ethyl benzene, toluene, and xylenes. Well MW-7 had the highest BTEX concentrations: the benzene concentration was 110,000 micrograms per liter (ug/l) and the total BTEX concentration was 230,670 ug/l. Two other VOC were detected in the groundwater samples from wells MW-3, MW-6 and MW-7: 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene. The sum of 1,2,4- trimethylbenzene and 1,3,5- trimethylbenzene in MW-7 was 770 ug/l which exceeded the enforcement standard of 480 ug/kg.

The only PAH compound that exceeded the enforcement standards was naphthalene. The concentration of naphthalene in MW-7 was 490 ug/l, which is greater than the enforcement standard of 40 ug/l. Naphthalene did not exceed the enforcement standards in any of the other samples.

4.6 Quality Assurance and Quality Control Samples

Quality assurance and quality control (QA/QC) samples were collected to ensure that accurate and reliable data was obtained for this investigation. The laboratory conducted standard QA\QC procedures. In addition, duplicates, field blanks, and trip blanks were collected and analyzed as discussed in the following sections.

4.6.1 Duplicates

One soil duplicate sample and two duplicate groundwater samples were collected for this investigation. The sample IDs followed by the suffix "dup" represent duplicate samples. The duplicate data was spot checked to assure that the relative percent difference (RPD) was within an acceptable range. The RPD was calculated using the following equation:

$$RPD = \{ (D_1 - D_2) / [(D_1 + D_2)/2] \} \times 100$$

Where D_1 = First Sample Result
D_2 = Second Sample Result (Duplicate)

For example, the groundwater sample from MW-4 was duplicated. The RPD for sample MW-4 and the MW-4 duplicate for benzene is 8% and the RPD for naphthalene is 17%. The groundwater sample from MW-6 was also duplicated. The RPD for sample MW-6 and the MW-6 duplicate for benzene is 0% and the RPD for naphthalene is 18%. These RPDs represent an acceptable range of difference.

4.6.2 Field Blanks

One field blank was collected for this investigation. Pre-measured laboratory supplied methanol was poured into laboratory supplied sample containers in the same manner as was done during soil sample

collection and preservation. The field blank sample was analyzed for BTEX. No BTEX was detected in the field blank sample.

4.6.3 Trip blanks

A trip blank sample accompanied the water samples collected for this investigation. One trip blank was analyzed for BTEX as part of this investigation. No BTEX was detected in the trip blank sample.

4.7 Discussion of Results

The soil and groundwater analytical results from Area 1 (B-8, B-9, B-10, B-23, and MW-4) indicated the dominant compounds detected were benzene and toluene. Benzene, toluene, and xylene exceeded the soil and/or groundwater regulatory limits. Very low concentration (less than 1 ug/l) of naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene were detected in MW-4. No other PAH compounds were detected. Based on the results of the fingerprinting, the VOC appears to be similar to a custom blended solvent or degreaser.

The soil and groundwater results from Area 2 (B-11 through B-17, B-19, B-20, MW-6, and MW-7) contained a mix of PAH and VOC compounds, with benzene and toluene being the dominant compounds. Several VOC and PAH compounds in the soil and groundwater exceeded the regulatory limits. Based on the results of the fingerprinting, there appears to be mixed water gas tar and heavy oil impacting Area 1. The tar and oil have a consistent "fingerprint" for all the samples. This fingerprint defines the MGP source material and will be useful for comparison with fingerprints from off-site samples.

The analytical results for soil samples from borings B-21 and B-22 indicate no detectable concentrations of VOC or PAH. The results help define the southern extent of impact in Area 2 and the northern extent of impact in Area 1 and clearly shows a separation in the two areas.

The analytical results of the cyanide analysis performed on a wood/peat-like soil layer samples from B-14 indicate relatively low concentrations of cyanide. This indicates that the woody material is not oxide box waste.

5.0 SUMMARY

This report presents the results of the Phase II Part II subsurface investigation performed at the Site in September 2002. Sixteen borings, B-8 through B-23, were advanced at the Site with a truck-mounted Geoprobe. Soil samples were collected from the borings for VOC, PAH, and fingerprinting analysis. A trench was dug to follow the extent of a clay pipe originating at the on-site building and heading northeast towards the former Lake Superior shoreline. Samples of tar-like material were collected from the interior of the pipe for fingerprinting analysis. Groundwater samples were collected from all seven on-site monitoring wells.

The results of sampling and analysis in Area 1 indicate that benzene, toluene, and xylene exceed the soil and/or groundwater regulatory limits. No PAH compounds exceeded the regulatory limits in Area 1. The northern extent of the VOC impact was defined. The results of the fingerprinting analyses of soil samples collected in Area 1 indicate that gasoline is not the source of the VOC impact. The VOC fingerprint more closely resembles a solvent or degreaser.

The results of the soil and groundwater sampling and analysis in Area 2 indicate the several VOCs and PAHs exceed the soil and/or groundwater regulatory limits. The fingerprinting analyses of soil samples from Area 2 and the tar-like material from the test trench pipe exhibit a fingerprint similar to water gas MGP tar mixed with heavy oil. The fingerprints for the soil samples and the tar-like material in the pipe show a very similar chemical fingerprint. The tar and oil have a consistent "fingerprint" that is similar between all the samples. This fingerprint defines the MGP source material and will be useful for comparison with fingerprints from off-site samples.

Tables

Table 4-1
Summary of Monitoring Well Gauging Data
Superior MGP Phase II Part II
Superior Wisconsin

Date: 11/20/01

Well ID	Ground Elevation [a]	TOC Elevation [b]	Depth to Water [c]	Groundwater Elevation	Hydraulic Conductivity [d]
MW-1	616.2	619.11	Dry	---	---
MW-2	614.2	617.15	Dry	---	---
MW-3	613.9	617.07	Dry	---	---
MW-4	614.0	617.11	Dry	---	---
MW-5	610.1	612.40	9.32	603.08	9.9×10^{-5}
MW-6	611.4	613.74	11.23	602.51	6.2×10^{-4}
MW-7	612.3	614.91	12.72	602.19	3.6×10^{-3}

Date: 12/6/01

Well ID	Ground Elevation [a]	TOC Elevation [b]	Depth to Water [c]	Groundwater Elevation	Hydraulic Conductivity [d]
MW-1	616.2	619.11	Dry	---	---
MW-2	614.2	617.15	19.26	597.89	---
MW-3	613.9	617.07	Dry	---	---
MW-4	614.0	617.11	Dry	---	---
MW-5	610.1	612.40	7.86	604.54	9.9×10^{-5}
MW-6	611.4	613.74	9.73	604.01	6.2×10^{-4}
MW-7	612.3	614.91	12.31	602.60	3.6×10^{-3}

Date: 1/8/02

Well ID	Ground Elevation [a]	TOC Elevation [b]	Depth to Water [c]	Groundwater Elevation	Hydraulic Conductivity [d]
MW-1	616.2	619.11	18.79	600.32	---
MW-2	614.2	617.15	15	602.15	---
MW-3	613.9	617.07	13.95	603.12	---
MW-4	614.0	617.11	17.82	599.29	---
MW-5	610.1	612.40	8.96	603.44	9.9×10^{-5}
MW-6	611.4	613.74	11.24	602.50	6.2×10^{-4}
MW-7	612.3	614.91	12.78	602.13	3.6×10^{-3}

Table 4-1
Summary of Monitoring Well Gauging Data
Superior MGP Phase II Part II
Superior Wisconsin

Date: 2/11/02					
Well ID	Ground Elevation [a]	TOC Elevation [b]	Depth to Water [c]	Groundwater Elevation	Hydraulic Conductivity [d]
MW-1	616.2	619.11	17.22	601.89	---
MW-2	614.2	617.15	12.26	604.89	---
MW-3	613.9	617.07	11.19	605.88	---
MW-4	614.0	617.11	15.44	601.67	---
MW-5	610.1	612.40	9.74	602.66	9.9×10^{-5}
MW-6	611.4	613.74	11.80	601.94	6.2×10^{-4}
MW-7	612.3	614.91	13.44	601.47	3.6×10^{-3}

9/18/2002					
Well ID	Ground Elevation [a]	TOC Elevation [b]	Depth to Water [c]	Groundwater Elevation	Hydraulic Conductivity [d]
MW-1	616.2	619.11	8.58	610.53	---
MW-2	614.2	617.15	4.65	612.50	---
MW-3	613.9	617.07	4.94	612.13	---
MW-4	614.0	617.11	6.8	610.31	---
MW-5	610.1	612.40	6.57	605.83	9.9×10^{-5}
MW-6	611.4	613.74	9.63	604.11	6.2×10^{-4}
MW-7	612.3	614.91	11.31	603.60	3.6×10^{-3}

a. The ground elevation and top of casings were surveyed by Salo Engineering in November 2001. Elevation is given in feet above mean sea level.
b. TOC = top of casing elevation. Elevation is given in feet above mean sea level.
c. Depth to water in feet as measured from the top of casing.
d. Hydraulic conductivity (cm/sec) was measured in November 2001 by conducting slug tests.

Table 4-2
Summary of Soil Analytical Results
Superior MGP
Superior, Wisconsin

Analyte[a]	Units	B-8-6-8	B-9-10-12	B-10-6-8	B-11-1-3	B-11-10-12	B-12-8-10	B-13-15-16
Metals								
Cyanide, total	mg/kg	---[b]	---	---	---	---	---	---
PAH								
1-Methylnaphthalene	ug/kg	---	---	---	73	3,400	2,300	85
2-Methylnaphthalene	ug/kg	---	---	---	74	3,400	3,200	77
Acenaphthene	ug/kg	---	---	---	<23	3,500	820Q[c]	82
Acenaphthylene	ug/kg	---	---	---	25Q	**930**[d]	630Q	<17
Anthracene	ug/kg	---	---	---	<17	2,300	420Q	<16
Benzo(a)anthracene	ug/kg	---	---	---	52Q	2,700	690Q	<18
Benzo(a)pyrene	ug/kg	---	---	---	51Q	**2,300**	**690Q**	<17
Benzo(b)fluoranthene	ug/kg	---	---	---	30Q	1,200	500Q	<15
Benzo(g,h,i)perylene	ug/kg	---	---	---	54	1,900	1000Q	<16
Benzo(k)fluoranthene	ug/kg	---	---	---	43Q	1,800	580Q	<18
Chrysene	ug/kg	---	---	---	57Q	3,400	1000Q	<18
Dibenzo(a,h)anthracene	ug/kg	---	---	---	<16	**460Q**	<350	<15
Fluoranthene	ug/kg	---	---	---	30Q	4,200	1,500	<14
Fluorene	ug/kg	---	---	---	<18	2,100	<400	23Q
Indeno(1,2,3-cd)pyrene	ug/kg	---	---	---	36Q	1,200	710Q	<16
Naphthalene	ug/kg	---	---	---	**660**	**8,900**	**36,000**	42Q
Phenanthrene	ug/kg	---	---	---	32Q	**9,200**	**2,200**	42Q
Pyrene	ug/kg	---	---	---	98	8,100	2,000	<16
VOC								
1,2,4-Trimethylbenzene	ug/kg	---	---	---	130	7,100	38,000	220
1,3,5-Trimethylbenzene	ug/kg	---	---	---	79	5,200	24,000	<100
Isopropylbenzene	ug/kg	---	---	---	<25	<1000	<5000	<100
Styrene	ug/kg	---	---	---	<25	40,000	140,000	<100
Benzene	ug/kg	**54,000**	**100**	**120,000**	**2,200**	**240,000**	**590,000**	**27,000**
Ethylbenzene	ug/kg	380	<25	410	120	**7,200**	**45,000**	370
Toluene	ug/kg	<130	<25	**59,000**	900	**340,000**	**1,700,000**	460
Xylene, -o	ug/kg	<130	<25	**1,700**	160	**35,000**	**150,000**	<100
Xylenes, -m, -p	ug/kg	1,100	<25	**6,700**	260	**130,000**	**540,000**	260

Table 4-2
Summary of Soil Analytical Results
Superior MGP
Superior, Wisconsin

Analyte[a]	Units	B-14-15-16	B-14-11-12	B-15-1-3	B-15-6-8	B-16-6-8	B-17-6-8
Metals							
Cyanide, total	mg/kg	---	3	---	---	---	---
PAH							
1-Methylnaphthalene	ug/kg	<20	---	860	270Q	25Q	730
2-Methylnaphthalene	ug/kg	<17	---	1,100	420Q	32Q	1,300
Acenaphthene	ug/kg	<23	---	95Q	<220	23Q	<210
Acenaphthylene	ug/kg	<18	---	**920**	<160	<17	310Q
Anthracene	ug/kg	<17	---	350	180Q	<17	<160
Benzo(a)anthracene	ug/kg	<19	---	1,600	330Q	<19	410Q
Benzo(a)pyrene	ug/kg	<18	---	**1,900**	270Q	<17	180Q
Benzo(b)fluoranthene	ug/kg	<15	---	1,700	210Q	<15	280Q
Benzo(g,h,i)perylene	ug/kg	<16	---	1,900	300Q	<16	510
Benzo(k)fluoranthene	ug/kg	<18	---	1,800	260Q	<18	280Q
Chrysene	ug/kg	<19	---	2,200	340Q	<19	480Q
Dibenzo(a,h)anthracene	ug/kg	<15	---	**570**	<140	<15	<140
Fluoranthene	ug/kg	<15	---	1,600	780	<14	910
Fluorene	ug/kg	<18	---	110Q	190Q	<17	230Q
Indeno(1,2,3-cd)pyrene	ug/kg	<16	---	1,400	<150	<16	310Q
Naphthalene	ug/kg	**410N[e]**	---	**840**	**4,900**	**410**	**7,900**
Phenanthrene	ug/kg	<15	---	1,200	1,200	41Q	**1,800**
Pyrene	ug/kg	<17	---	2,900	1,400	20Q	1,200
VOC							
1,2,4-Trimethylbenzene	ug/kg	71	---	980	130,000	1,400	1,900
1,3,5-Trimethylbenzene	ug/kg	<25	---	460	83,000	700	1,200
Isopropylbenzene	ug/kg	<25	---	160	<2,500	74	<50
Styrene	ug/kg	<25	---	<50	240,000	290	1,400
Benzene	ug/kg	**12,000**	---	**21,000**	**76,000**	**10,000**	**16,000**
Ethylbenzene	ug/kg	160	---	**5,100**	**100,000**	**3,500**	350
Toluene	ug/kg	230	---	**9,300**	**790,000**	**5,500**	**16,000**
Xylene, -o	ug/kg	39Q	---	**1,400**	**310,000**	**2,100**	**3,400**
Xylenes, -m, -p	ug/kg	140	---	**5,800**	**1,100,000**	**7,600**	**11,000**

Table 4-2
Summary of Soil Analytical Results
Superior MGP
Superior, Wisconsin

Analyte[a]	Units	B-18-10-12	B-19-10-12	B-20-10-12	B-21-10-12-dup	B-22-8-10
Metals						
Cyanide, total	mg/kg	---	---	---	---	---
PAH						
1-Methylnaphthalene	ug/kg	<19	<18	28Q	<19	<19
2-Methylnaphthalene	ug/kg	<16	<16	44Q	<16	<17
Acenaphthene	ug/kg	<22	<21	<20	<22	<23
Acenaphthylene	ug/kg	<17	<16	<15	<17	<17
Anthracene	ug/kg	<16	<16	23Q	<16	<17
Benzo(a)anthracene	ug/kg	<18	<18	<16	<18	<19
Benzo(a)pyrene	ug/kg	<17	<16	<15	<17	<17
Benzo(b)fluoranthene	ug/kg	<15	<14	<13	<15	<15
Benzo(g,h,i)perylene	ug/kg	<15	<15	<14	<16	<16
Benzo(k)fluoranthene	ug/kg	<17	<17	<16	<18	<18
Chrysene	ug/kg	<18	<18	<16	<18	<19
Dibenzo(a,h)anthracene	ug/kg	<15	<14	<13	<15	<15
Fluoranthene	ug/kg	<14	<14	<13	<14	<14
Fluorene	ug/kg	<17	<16	<15	<17	<17
Indeno(1,2,3-cd)pyrene	ug/kg	<15	<15	<14	<16	<16
Naphthalene	ug/kg	<23	<22	<20	<23	<23
Phenanthrene	ug/kg	<15	<14	22Q	<15	<15
Pyrene	ug/kg	<16	<16	<14	<16	<17
VOC						
1,2,4-Trimethylbenzene	ug/kg	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	ug/kg	<25	<25	<25	<25	<25
Isopropylbenzene	ug/kg	<25	<25	<25	<25	<25
Styrene	ug/kg	<25	<25	<25	<25	<25
Benzene	ug/kg	<25	**36Q**	**54Q**	<25	<25
Ethylbenzene	ug/kg	<25	<25	<25	<25	<25
Toluene	ug/kg	<25	<25	35Q	<25	<25
Xylene, -o	ug/kg	<25	<25	<25	<25	<25
Xylenes, -m, -p	ug/kg	<25	<25	<25	<25	<25

Table 4-2
Summary of Soil Analytical Results
Superior MGP
Superior, Wisconsin

Analyte[a]	Units	WDNR Soil Cleanup Standard	
Metals		**RCL Groundwater**	**RCL Direct Contact**
Cyanide, total	mg/kg	NE[f]	NE
PAH		**RCL Groundwater**	**RCL Direct Contact**
1-Methylnaphthalene	ug/kg	23,000	70,000,000
2-Methylnaphthalene	ug/kg	20,000	40,000,000
Acenaphthene	ug/kg	38,000	60,000,000
Acenaphthylene	ug/kg	700	360,000
Anthracene	ug/kg	3,000,000	30,000,000
Benzo(a)anthracene	ug/kg	17,000	3,900
Benzo(a)pyrene	ug/kg	48,000	390
Benzo(b)fluoranthene	ug/kg	360,000	3,900
Benzo(g,h,i)perylene	ug/kg	6,800,000	39,000
Benzo(k)fluoranthene	ug/kg	870,000	39,000
Chrysene	ug/kg	37,000	390,000
Dibenzo(a,h)anthracene	ug/kg	38,000	390
Fluoranthene	ug/kg	500,000	40,000,000
Fluorene	ug/kg	100,000	40,000,000
Indeno(1,2,3-cd)pyrene	ug/kg	680,000	3,900
Naphthalene	ug/kg	400	110,000
Phenanthrene	ug/kg	1,800	390,000
Pyrene	ug/kg	8,700,000	30,000,000
VOC		**RCL Groundwater**	**RCL Direct Contact**
1,2,4-Trimethylbenzene	ug/kg	NE	NE
1,3,5-Trimethylbenzene	ug/kg	NE	NE
Isopropylbenzene	ug/kg	NE	NE
Styrene	ug/kg	NE	NE
Benzene	ug/kg	5.5	NE
Ethylbenzene	ug/kg	2,900	NE
Toluene	ug/kg	1,500	NE
Xylene, -o	ug/kg	4,100 [g]	NE
Xylenes, -m, -p	ug/kg	4,100 [g]	NE

a. Only defected compounds are listed. See Appendix E for the complete laboratory report.
b. --- Means not analyzed.
c. Q means the analyte has been detected between the limit of detection (LOD) and limit of quantitation (LOQ). The results are qualified due to the uncertainty of analyte concentrations within this range.
d. Bold results indicate concentrations greater than applicable RCL.
e. N means spiked sample recovery not within control limits.
f. NE means not established.

Table 4-3
Summary of Groundwater Analytical Results
Superior MGP
Superior, Wisconsin

Analyte[a]	Units	MW-1	MW-1	MW-2	MW-2	MW-3	MW-3
Sampling Date		2/11/2002	9/20/2002	2/11/2002	9/18/2002	2/11/2002	9/20/2002
Metals							
Arsenic	ug/L	<4.4	---[b]	<4.4	---	<4.4	---
Barium	ug/L	280	---	260	---	180	---
Cadmium	ug/L	<0.51	---	<0.51	---	<0.51	---
Chromium	ug/L	1.2	---	<0.83	---	<0.83	---
Lead	ug/L	<2.1	---	<2.1	---	<2.1	---
Mercury	ug/L	<0.088	---	<0.088	---	<0.088	---
Selenium	ug/L	1.7	---	1.0	---	2.7	---
Silver	ug/L	<1.3	---	<1.3	---	<1.3	---
Cyanide, total	mg/L	<0.0021	---	<0.0021	---	<0.0021	---
PAH							
1-Methylnaphthalene	ug/L	<0.027	<0.027	<0.027	<0.027	<0.027	22
2-Methylnaphthalene	ug/L	<0.028	<0.028	<0.028	<0.028	<0.028	15
Acenaphthene	ug/L	<0.018	<0.018	<0.018	<0.018	<0.018	<7.2
Acenaphthylene	ug/L	<0.023	<0.023	<0.023	<0.023	<0.023	<9.2
Anthracene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.27
Benzo(a)anthracene	ug/L	<0.019	<0.019	<0.019	<0.019	<0.019	<0.019
Benzo(a)pyrene	ug/L	<0.012	<0.012	<0.012	<0.012	<0.012	0.014
Benzo(b)fluoranthene	ug/L	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014
Benzo(g,h,i)perylene	ug/L	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Benzo(k)fluoranthene	ug/L	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Chrysene	ug/L	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018
Dibenzo(a,h)anthracene	ug/L	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017
Fluoranthene	ug/L	<0.028	<0.028	<0.028	<0.028	<0.028	0.061
Fluorene	ug/L	<0.021	<0.021	<0.021	<0.021	<0.021	<8.4
Indeno(1,2,3-cd)pyrene	ug/L	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014
Naphthalene	ug/L	0.21	<0.027	<0.027	<0.027	<0.027	160
Phenanthrene	ug/L	0.028	<0.019	<0.019	<0.019	<0.019	<7.6
Pyrene	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.076
VOC							
1,2,4-Trimethylbenzene	ug/l	---	<0.69	---	<0.69	---	26
1,3,5-Trimethylbenzene	ug/l	---	<0.64	---	<0.64	---	11
Benzene	ug/l	<0.45	<0.25	<0.45	<0.25	**21**[c]	**620**
Ethylbenzene	ug/l	<0.82	<0.53	<0.82	<0.53	4.8	45
Toluene	ug/l	<0.68	<0.84	<0.68	<0.84	26	100
Xylene, -o	ug/l	<1.7	<0.73	<1.7	<0.73	8.5	96
Xylenes, -m, -p	ug/l	<0.77	<1.1	<0.77	<1.1	44	130

Table 4-3
Summary of Groundwater Analytical Results
Superior MGP
Superior, Wisconsin

Analyte	Units	MW-4	MW-4	MW-4-dup	MW-5	MW-5	MW-5
Sampling Date		2/11/2002	9/20/2002	9/20/2002	11/20/2001	2/11/2002	9/18/2002
Metals							
Arsenic	ug/L	<4.4	---	---	3.4	4.6	---
Barium	ug/L	81	---	---	150	90	---
Cadmium	ug/L	<0.51	---	---	0.15	<0.51	---
Chromium	ug/L	<0.83	---	---	0.60	<0.83	---
Lead	ug/L	<2.1	---	---	1.4	<2.1	---
Mercury	ug/L	<0.088	---	---	<0.088	<0.088	---
Selenium	ug/L	<0.45	---	---	0.65	<0.45	---
Silver	ug/L	<1.3	---	---	<1.6	<1.3	---
Cyanide, total	mg/L	<0.0021	---	---	0.0071	0.0065	---
PAH							
1-Methylnaphthalene	ug/L	0.055	0.042	0.033	0.058	<0.027	0.19
2-Methylnaphthalene	ug/L	0.088	0.059	0.048	<0.028	<0.028	0.15
Acenaphthene	ug/L	<0.018	<0.018	<0.018	3.8	0.11	0.43
Acenaphthylene	ug/L	<0.023	<0.023	<0.023	0.16	<0.023	<0.023
Anthracene	ug/L	<0.020	<0.020	<0.020	0.22	<0.020	0.059
Benzo(a)anthracene	ug/L	<0.019	<0.019	<0.019	0.053	<0.019	<0.019
Benzo(a)pyrene	ug/L	<0.012	<0.012	<0.012	0.023	<0.012	<0.012
Benzo(b)fluoranthene	ug/L	<0.014	<0.014	<0.014	0.022	<0.014	<0.014
Benzo(g,h,i)perylene	ug/L	<0.015	<0.015	<0.015	0.017	<0.015	<0.015
Benzo(k)fluoranthene	ug/L	<0.013	<0.013	<0.013	0.014	<0.013	<0.013
Chrysene	ug/L	<0.018	<0.018	<0.018	0.037	<0.018	<0.018
Dibenzo(a,h)anthracene	ug/L	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017
Fluoranthene	ug/L	<0.028	<0.028	<0.028	1.3	0.030	0.051
Fluorene	ug/L	<0.021	<0.021	<0.021	1.2	0.035	0.24
Indeno(1,2,3-cd)pyrene	ug/L	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014
Naphthalene	ug/L	0.47	0.38	0.32	0.2	0.092	1.3
Phenanthrene	ug/L	0.028	<0.019	<0.019	0.42	<0.19	0.22
Pyrene	ug/L	<0.020	<0.020	<0.020	1.4	0.039	0.039
VOC							
1,2,4-Trimethylbenzene	ug/l	---	<690	<690	---	---	<0.69
1,3,5-Trimethylbenzene	ug/l	---	<640	<640	---	---	<0.64
Benzene	ug/l	**110,000**	**120,000**	**130,000**	**6.2**	<0.45	0.99
Ethylbenzene	ug/l	<820	<530	<530	<0.82	<0.82	<0.53
Toluene	ug/l	**19,000**	<840	960	2.1	<0.68	<0.84
Xylene, -o	ug/l	<1,700	<730	<730	3.0	<1.7	<0.73
Xylenes, -m, -p	ug/l	<770	<1,100	<1,100	6.1	<0.77	<1.1

Table 4-3
Summary of Groundwater Analytical Results
Superior MGP
Superior, Wisconsin

Analyte	Units	MW-6	MW-6	MW-6	MW-6-dup
Sampling Date		11/20/2001	2/11/2002	9/18/2002	9/18/2002
Metals					
Arsenic	ug/L	1.6	<4.4	---	---
Barium	ug/L	440	1,100	---	---
Cadmium	ug/L	<0.070	<0.51	---	---
Chromium	ug/L	0.35	<0.83	---	---
Lead	ug/L	<0.39	<2.1	---	---
Mercury	ug/L	<0.088	<0.088	---	---
Selenium	ug/L	6.0	2.7	---	---
Silver	ug/L	<1.6	<1.3	---	---
Cyanide, total	mg/L	<0.0021	<0.0021	---	---
PAH					
1-Methylnaphthalene	ug/L	3.0	5.0	2.5	2.1
2-Methylnaphthalene	ug/L	2.3	3.7	1.6	1.3
Acenaphthene	ug/L	4.8	5.0	4.5	3.9
Acenaphthylene	ug/L	0.26	0.22	<0.92	<0.92
Anthracene	ug/L	0.96	<0.80	<0.8	<0.8
Benzo(a)anthracene	ug/L	0.12	0.083	<0.76	<0.76
Benzo(a)pyrene	ug/L	0.026	<0.012	<0.48	<0.48
Benzo(b)fluoranthene	ug/L	0.022	<0.014	<0.56	<0.56
Benzo(g,h,i)perylene	ug/L	0.016	<0.015	<0.6	<0.6
Benzo(k)fluoranthene	ug/L	0.018	<0.013	<0.52	<0.52
Chrysene	ug/L	0.095	0.081	<0.72	<0.72
Dibenzo(a,h)anthracene	ug/L	<0.017	<0.017	<0.68	<0.68
Fluoranthene	ug/L	1.1	<1.1	<1.1	<1.1
Fluorene	ug/L	0.76	<0.84	<0.84	<0.84
Indeno(1,2,3-cd)pyrene	ug/L	<0.014	<0.014	<0.56	<0.56
Naphthalene	ug/L	9.8	34	12.0	10.0
Phenanthrene	ug/L	3.1	2.1	3.4	3.8
Pyrene	ug/L	1.2	0.88	1.1	1.2
VOC					
1,2,4-Trimethylbenzene	ug/l	---	---	0.8	0.81
1,3,5-Trimethylbenzene	ug/l	---	---	<0.64	<0.64
Benzene	ug/l	**5.0**	**10**	3.1	3.1
Ethylbenzene	ug/l	1.5	5.8	1.1	1.2
Toluene	ug/l	1.6	2.0	0.84	0.85
Xylene, -o	ug/l	1.4	2.3	<0.73	<0.73
Xylenes, -m, -p	ug/l	2.2	2.6	<1.1	<1.1

Table 4-3
Summary of Groundwater Analytical Results
Superior MGP
Superior, Wisconsin

Analyte	Units	MW-7	MW-7	MW-7-dup	MW-7	Enforcement Standard [d]
Sampling Date		11/20/2001	2/11/2002	2/11/2002	9/18/2002	
Metals						
Arsenic	ug/L	15	15	12	---	**50**
Barium	ug/L	73	120	100	---	**2,000**
Cadmium	ug/L	<0.070	0.70	<0.051	---	**5**
Chromium	ug/L	1.4	1.3	<0.83	---	**100**
Lead	ug/L	<0.39	2.1	<2.1	---	**15**
Mercury	ug/L	<0.088	<0.088	<0.088	---	**2**
Selenium	ug/L	5.3	1.2	1.2	---	**50**
Silver	ug/L	<1.6	<1.3	<1.3	---	**50**
Cyanide, total	mg/L	0.012	0.012	0.0093	---	**200**
PAH						
1-Methylnaphthalene	ug/L	4.7	4.1	3.8	10	**NE** [e]
2-Methylnaphthalene	ug/L	6.3	5.6	5.2	13	**NE**
Acenaphthene	ug/L	1.9	2.4	2.0	5.4	**NE**
Acenaphthylene	ug/L	3.4	2.8	2.5	<4.6	**NE**
Anthracene	ug/L	0.75	<0.40	<0.40	<4	**3,000**
Benzo(a)anthracene	ug/L	<0.38	<0.38	<0.38	<3.8	**NE**
Benzo(a)pyrene	ug/L	<0.24	<0.24	<0.24	<2.4	**0.2**
Benzo(b)fluoranthene	ug/L	<0.28	<0.28	<0.28	<2.8	**0.2**
Benzo(g,h,i)perylene	ug/L	<0.30	<0.30	<0.30	<3	**NE**
Benzo(k)fluoranthene	ug/L	<0.26	<0.26	<0.26	<2.6	**NE**
Chrysene	ug/L	<0.36	<0.36	<0.36	<3.6	**0.2**
Dibenzo(a,h)anthracene	ug/L	<0.34	<0.34	<0.34	<3.4	**NE**
Fluoranthene	ug/L	<0.56	<0.56	<0.56	<5.6	**400**
Fluorene	ug/L	2.2	1.7	1.7	<4.2	**400**
Indeno(1,2,3-cd)pyrene	ug/L	<0.28	<0.28	<0.28	<2.8	**NE**
Naphthalene	ug/L	**350**	**430**	**290**	**490**	**40**
Phenanthrene	ug/L	1.4	1.2	1.3	6.7	**NE**
Pyrene	ug/L	0.62	0.72	0.74	<4	**250**
VOC						
1,2,4-Trimethylbenzene		---	---	---	**770**	**480** [f]
1,3,5-Trimethylbenzene		---	---	---	<640	**480** [f]
Benzene	ug/l	**230,000**	**190,000**	**200,000**	**110,000**	**5**
Ethylbenzene	ug/l	**1,900**	**3,600**	**3,700**	**6,100**	**700**
Toluene	ug/l	**130,000**	**120,000**	**120,000**	**64,000**	**1,000**
Xylene, -o	ug/l	**11,000**	**17,000**	**17,000**	4,800	**10,000**
Xylenes, -m, -p	ug/l	**14,000**	9,500	**10,000**	**18,000**	**10,000**

a. Only detected compunds are listed. See Appendix E for the complete laboratory report.

b. --- = Sample was not analyzed for this parameter.

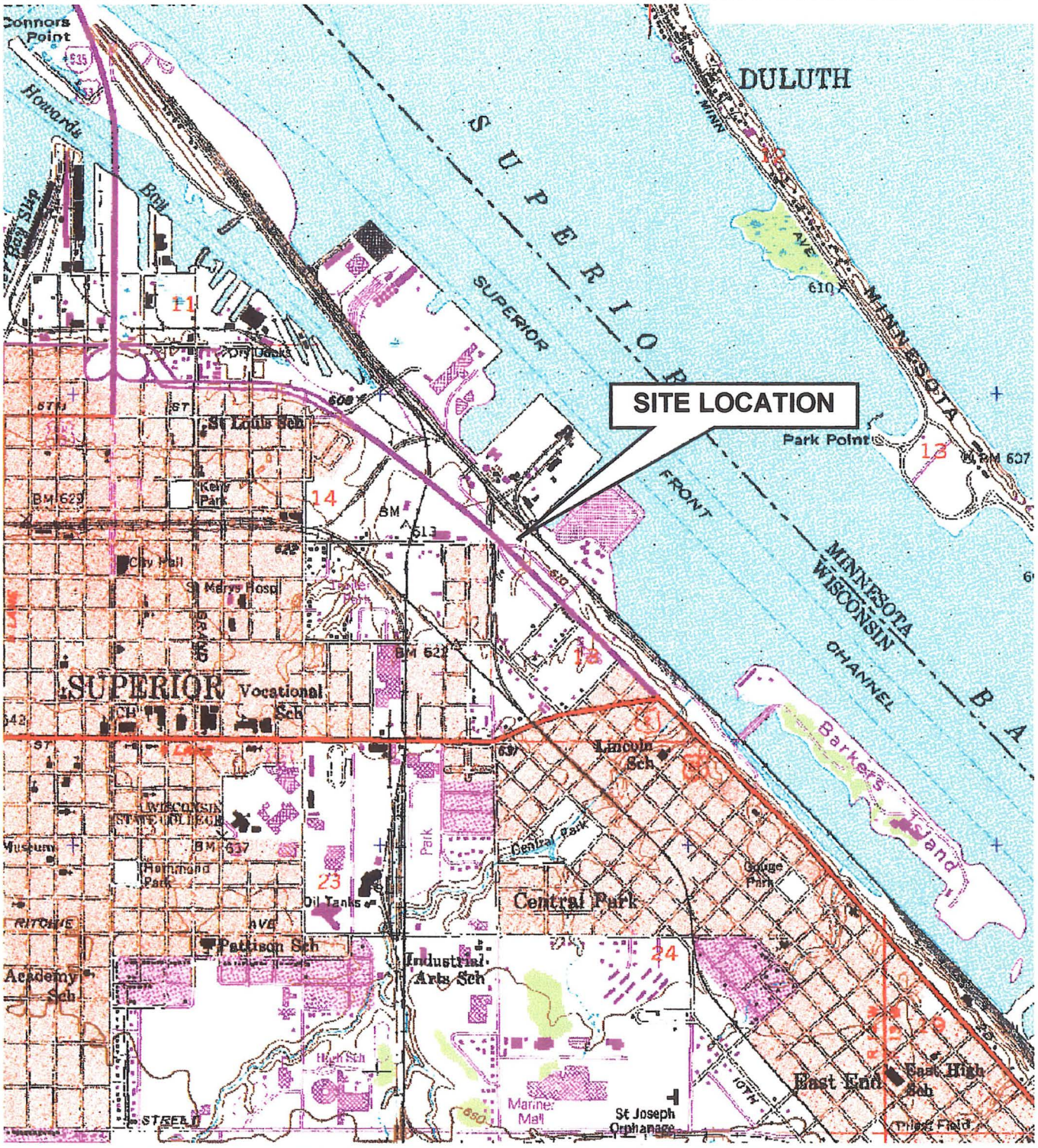
c. Bold results indicate concentrations greater than the enforcement standards.

d. The Wisconsin Department of Natural Resources Groundwater Enforcement Standards for the protection of public health (NR 140, Table 1).

e. No enforcement standard exists for this compound.

f. The enforcement standard is 480 ug/L for the sum of 1,2,4-Trimethylbenzene and 1,3,5-Trimethylbenzene concentrations.

Figures



SOURCE: USGS 7½ Minute Topographic Quadrangle from DeLorme Superior, Wisconsin, 1993

SCALE

0 1/4 1/2 1 MILE

N

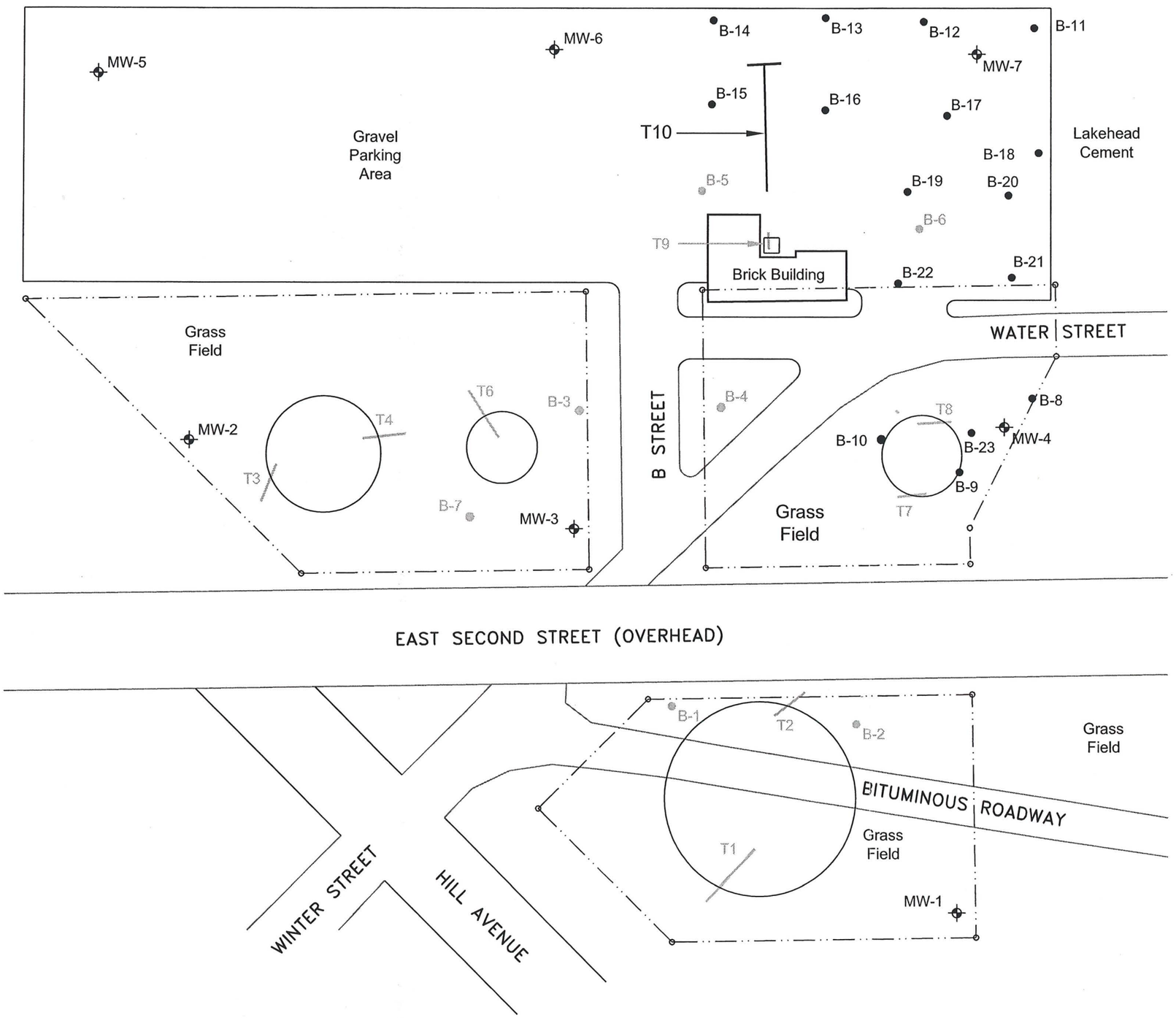
ENSR INTERNATIONAL

Figure 1-1

SITE LOCATION MAP

Superior Water Light & Power Former MGP
Superior, Wisconsin

PREPARED BY: CMB	DATE: Nov 2002	PROJECT NO: 09413-098	REV: 0
FILE NO.: FIG1-1.doc	CHECKED: WMG		



EXPLANATION:

- Railroad Tracks
- SWL&P Property Boundary
- B-2 — Geoprobe Soil Boring Location (Sept 2002)
- B-2 — Previous Geoprobe Soil Boring Location (Nov 2001)
- MW-1 — Monitoring Well Location
- T10 — Test Trench Location (Sept 2002)
- T3 — Previous Test Trench Location (Nov 2001)
- Former Gas Holder

NOTES:

TR1 to TR4 and TR6 to TR9, B-1 to B-7, and MW-1 to MW-7 were in were installed in November 2001.

TR10 and B-9 to B-23 were in were installed in September 2002.

SOURCE:

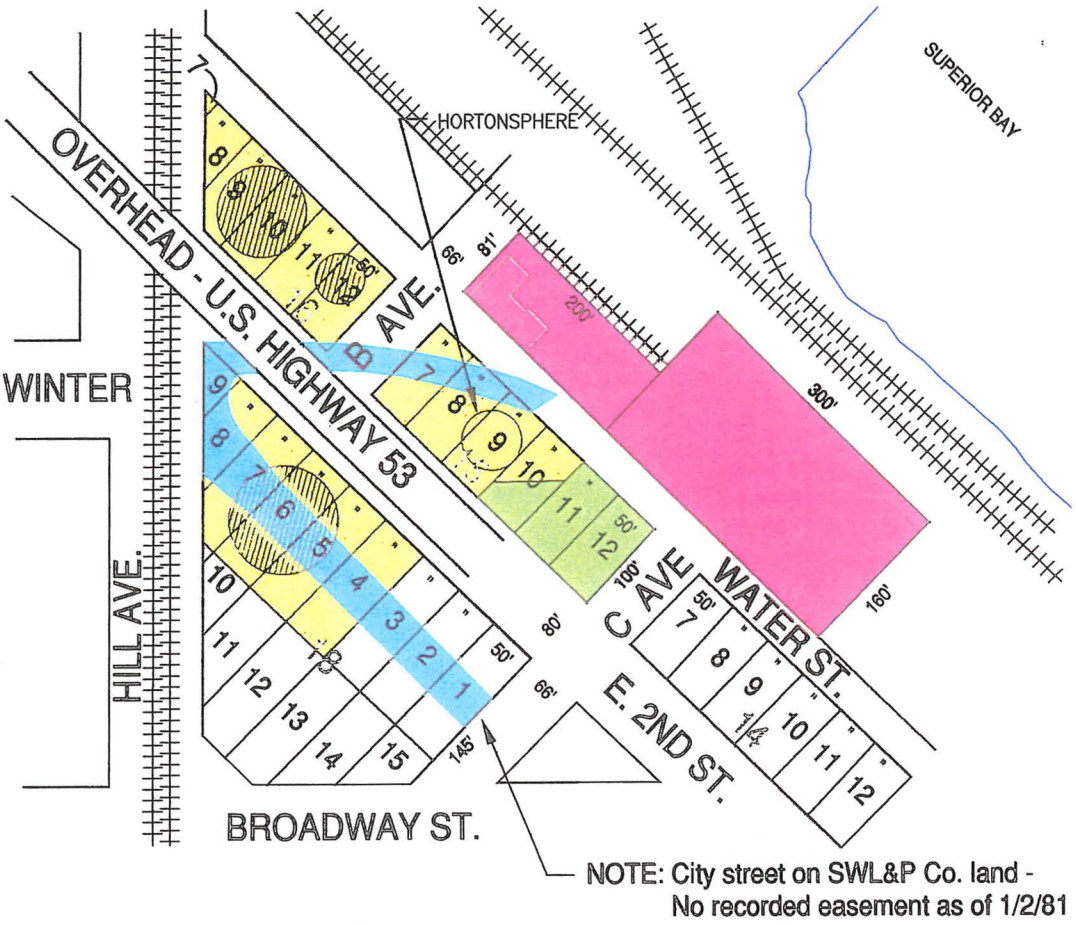
Survey of SWL&P Property performed by Salo Engineering, dated 12/13/01 and ENSR field observations.

APPROXIMATE SCALE
1 INCH = 60 FEET

0 30 60 120

Figure 1-2
SAMPLE LOCATIONS
Superior Water Light & Power
Former MGP
Superior, Wisconsin

DRAWN: CMB/5802	DATE: Nov 2002	ENSR INTERNATIONAL
FILE No.: Fig 1-2.dwg	PROJECT: 09413-098	



ROY'S ADDITION TO THE
CITY OF SUPERIOR

N

FORMER GAS HOLDERS

DEEDED TO STATE

OWNED BY SWL&P CO.

OWNED BY CLM

PROPERTY OWNED BY
SUPERIOR WATER, LIGHT & POWER
SUPERIOR, WI

APPROXIMATE SCALE

0 190'

ENSR INTERNATIONAL

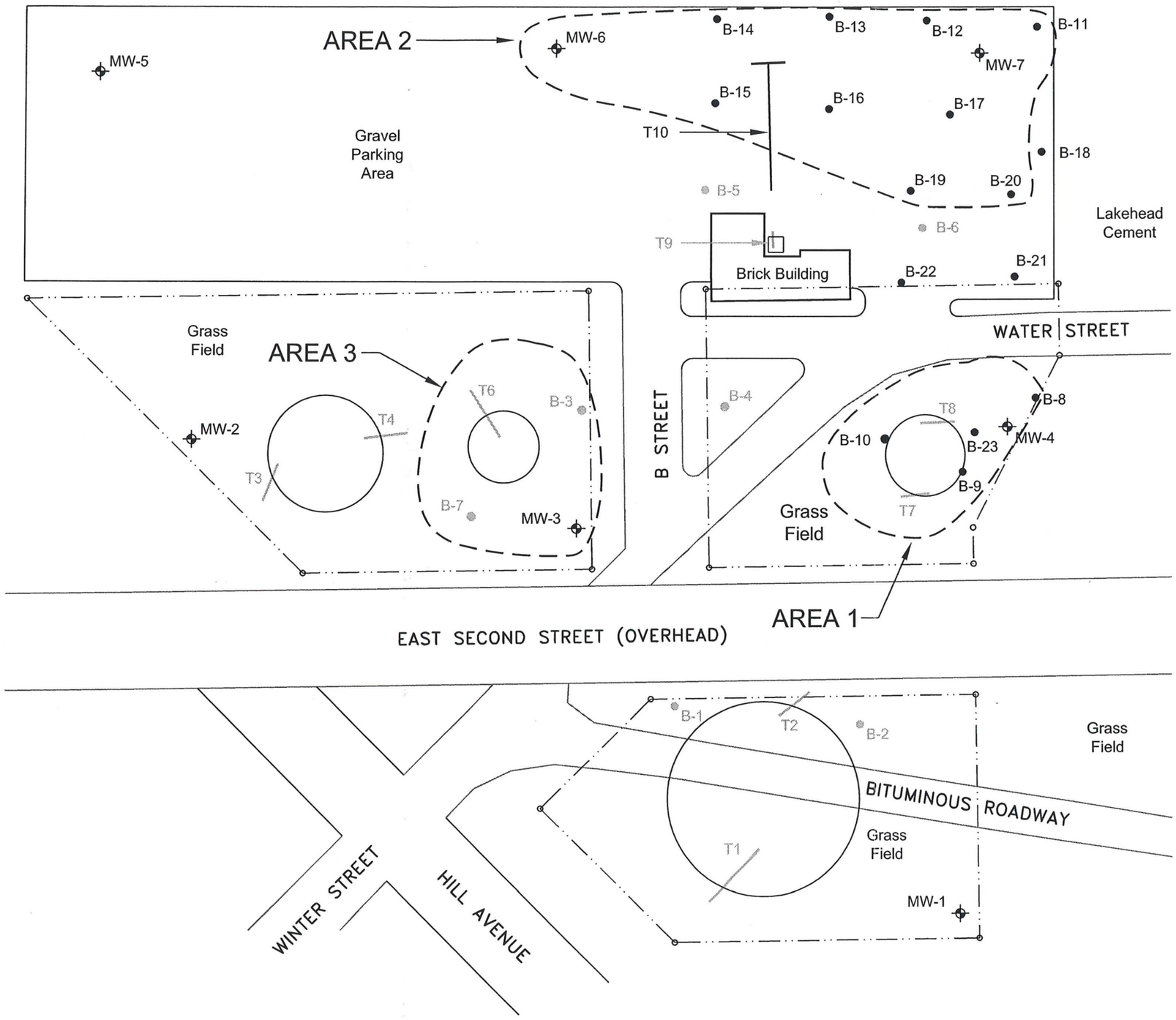
FIGURE 1-3

PROPERTY OWNERSHIP MAP

SUPERIOR MGP

Source: SWL&P Co. Records

PREPARED BY: AJT	DATE: SEP 2001	PROJECT NO: 9413-098	REV: 0
FILE NO.: Property.DOC	CHECKED: WMG		



EXPLANATION:

- Railroad Tracks
- SWL&P Property Boundary
- B-2 — Geoprobe Soil Boring Location (Sept 2002)
- B-2 — Previous Geoprobe Soil Boring Location (Nov 2001)
- MW-1 — Monitoring Well Location
- T10 — Test Trench Location (Sept 2002)
- T3 — Test Trench Location (Nov 2001)
- Former Gas Holder

NOTES:

TR1 to TR4 and TR6 to TR9, B-1 to B-7, and MW-1 to MW-7 were in were installed in November 2001.

TR10 and B-9 to B-23 were in were installed in September 2002.

SOURCE:

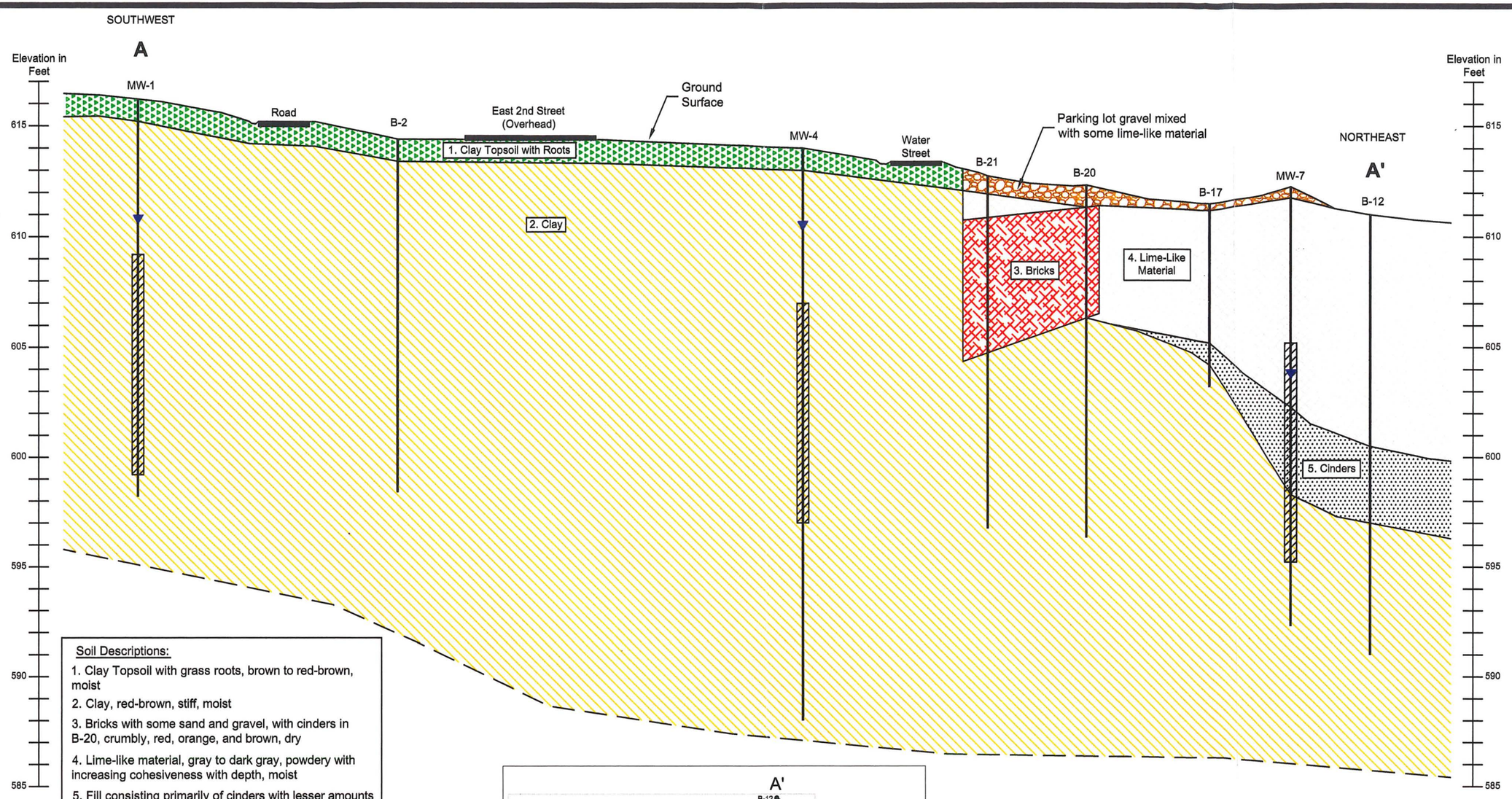
Survey of SWL&P Property performed by Salo Engineering, dated 12/13/01 and ENSR field observations.

APPROXIMATE SCALE
1 INCH = 60 FEET

0 30 60 120

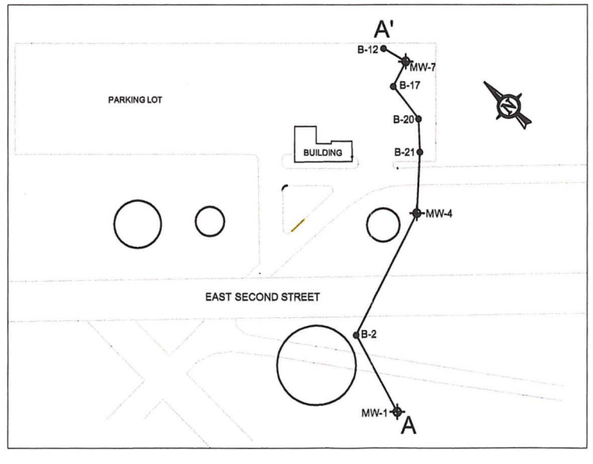
Figure 2-1
AREAS WITH SOIL AND GROUNDWATER EXCEEDANCES
Superior Water Light & Power
Former MGP
Superior, Wisconsin

DRAWN: CMB/5802	DATE: Oct 2002	ENSR INTERNATIONAL
FILE No.: Fig 2-1.dwg	PROJECT: 09413-098	



Soil Descriptions:

1. Clay Topsoil with grass roots, brown to red-brown, moist
2. Clay, red-brown, stiff, moist
3. Bricks with some sand and gravel, with cinders in B-20, crumbly, red, orange, and brown, dry
4. Lime-like material, gray to dark gray, powdery with increasing cohesiveness with depth, moist
5. Fill consisting primarily of cinders with lesser amounts of pulverized wood, black-stained, wet, strong odor



Explanation

▼ Depth of groundwater gauged on 9/18/02

Monitoring Well Screen

Sources:

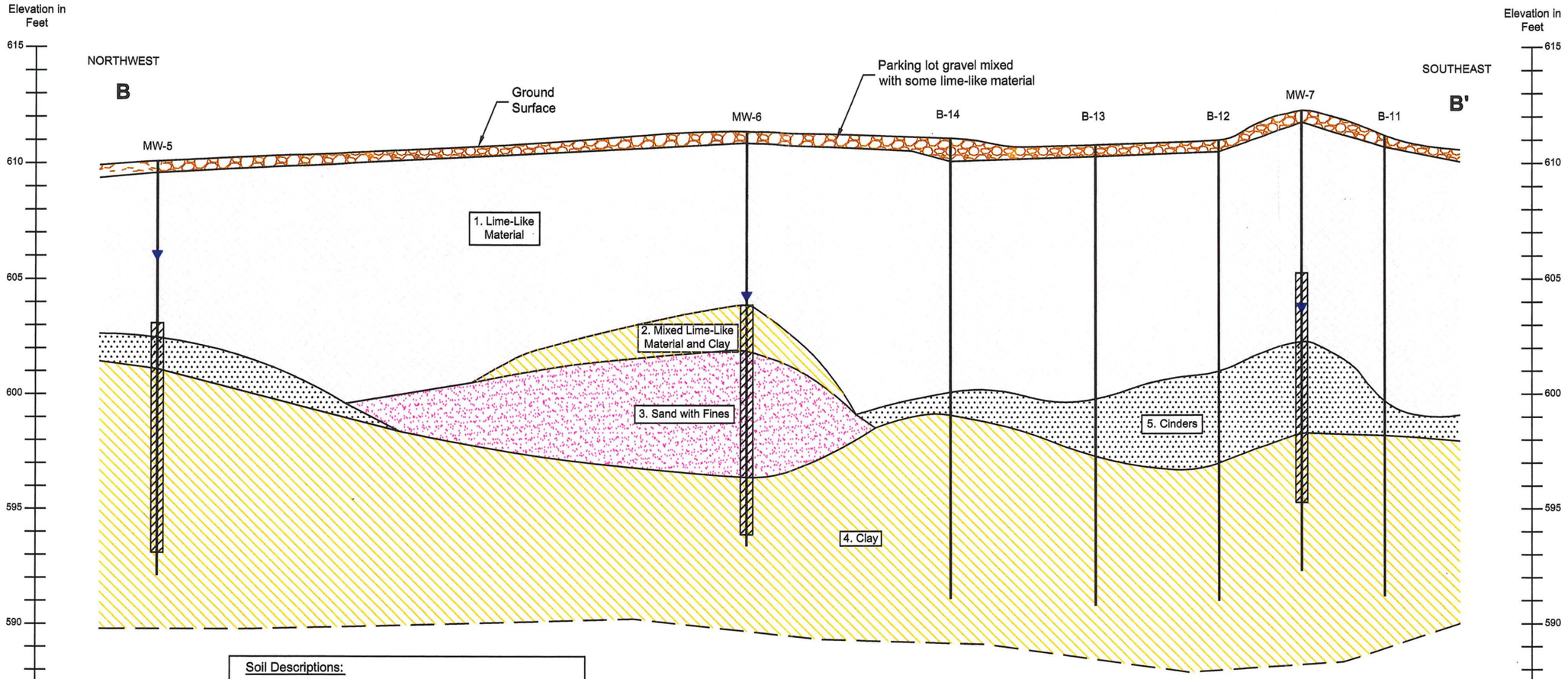
ENSR Field Observations; and
Salo Engineering Survey completed 9/19/02, Job # L-4116B.

1 inch = 5 feet
10 x vertical exaggeration
1 inch = 50 feet

ENSR INTERNATIONAL

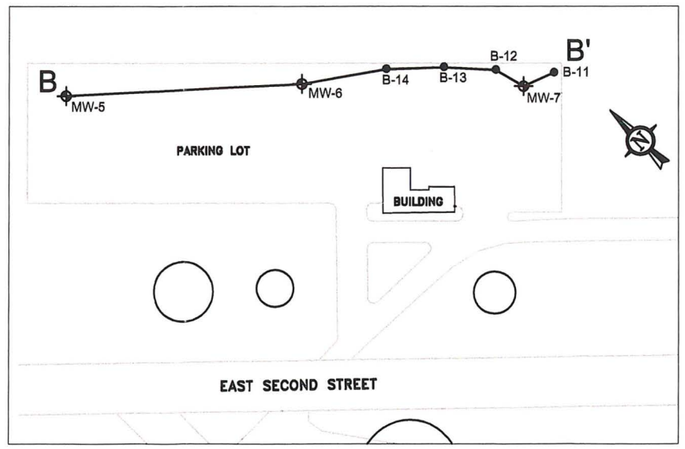
FIGURE 4-1
GEOLOGIC CROSS-SECTION A TO A'
SWL&P FORMER MGP
PHASE II PART II
SUPERIOR, WISCONSIN

DRAWN: CMB/5802	DATE: Nov 2002	PROJECT No.: 09413-098	REV:
FILE No.: Fig 4-1.dwg	CHECKED: WMG		



Soil Descriptions:

1. Lime-like material, gray to dark gray, powdery with increasing cohesiveness with depth, moist
2. Mixed Clay and Lime-Like Material, red-brown and gray, soft, moist
3. Fine to medium Sand with fines, well sorted, red-brown, moist to wet
4. Clay, red-brown, stiff, moist
5. Fill consisting primarily of cinders with lesser amounts of pulverized wood and sand, black-stained, wet, strong odor



1 inch = 5 feet

10 x vertical exaggeration

1 inch = 50 feet

Explanation

▼ Depth of groundwater gauged on 9/18/02

Monitoring Well Screen

Sources:

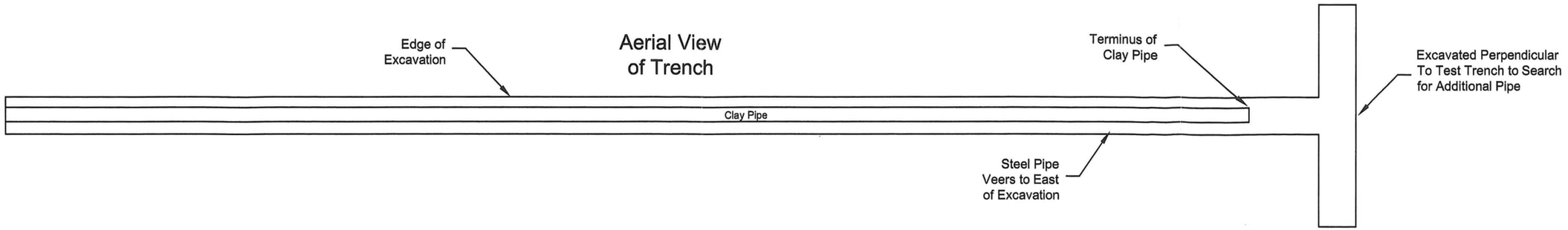
ENSR Field Observations; and
Salo Engineering Survey completed 9/19/02, Job # L-4116B.

ENSR INTERNATIONAL

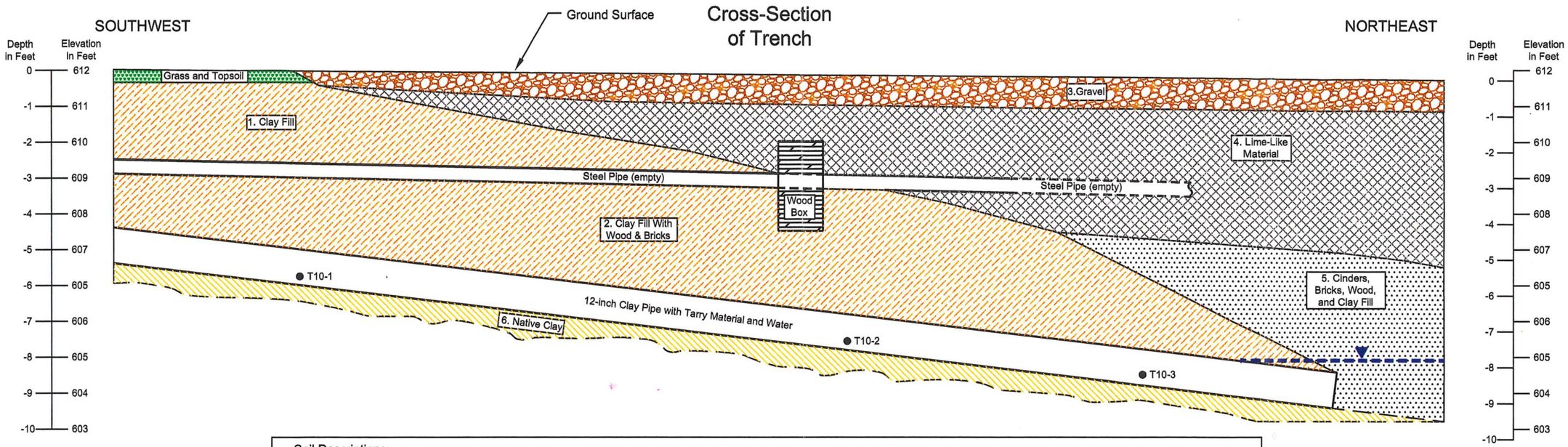
FIGURE 4-2
GEOLOGIC CROSS-SECTION B TO B'
SWL&P FORMER MGP
PHASE II PART II
SUPERIOR, WISCONSIN

DRAWN:	CMB/5802	DATE:	Nov. 2002	PROJECT No.: 09413-098	REV:
FILE No.:	Fig 4-2.dwg	CHECKED:	WMG		

Aerial View of Trench



Cross-Section of Trench



Soil Descriptions:

1. Clay Fill with some roots and gravel, brown to red-brown, moist
2. Clay Fill with wood pieces (whole boards and wood chips), brick and gravel, red-brown, moist
3. Gravel (Parking Lot), mixed with some lime-like material, gray, dry to slightly moist
4. Lime-like material, gray to dark gray, powdery with increasing cohesiveness with depth, moist
5. Fill consisting primarily of bricks and cinders, with lesser amounts of wood and clay, black-stained, wet
6. Clay, undisturbed, red-brown, stiff, moist

Explanation

- ● T10-1 — Location of tar sample collected from clay pipe for laboratory analysis
- ▼ — Estimated depth of groundwater as encountered during excavation.

1 inch = 3 feet
2 x vertical exaggeration
1 inch = 6 feet

Sources:

ENSR Field Observations; and
Salo Engineering Survey completed 9/19/02, Job # L-4116B.

Note:

Test trench T10 was completed to the depth of the clay pipe on September 18, 2002.

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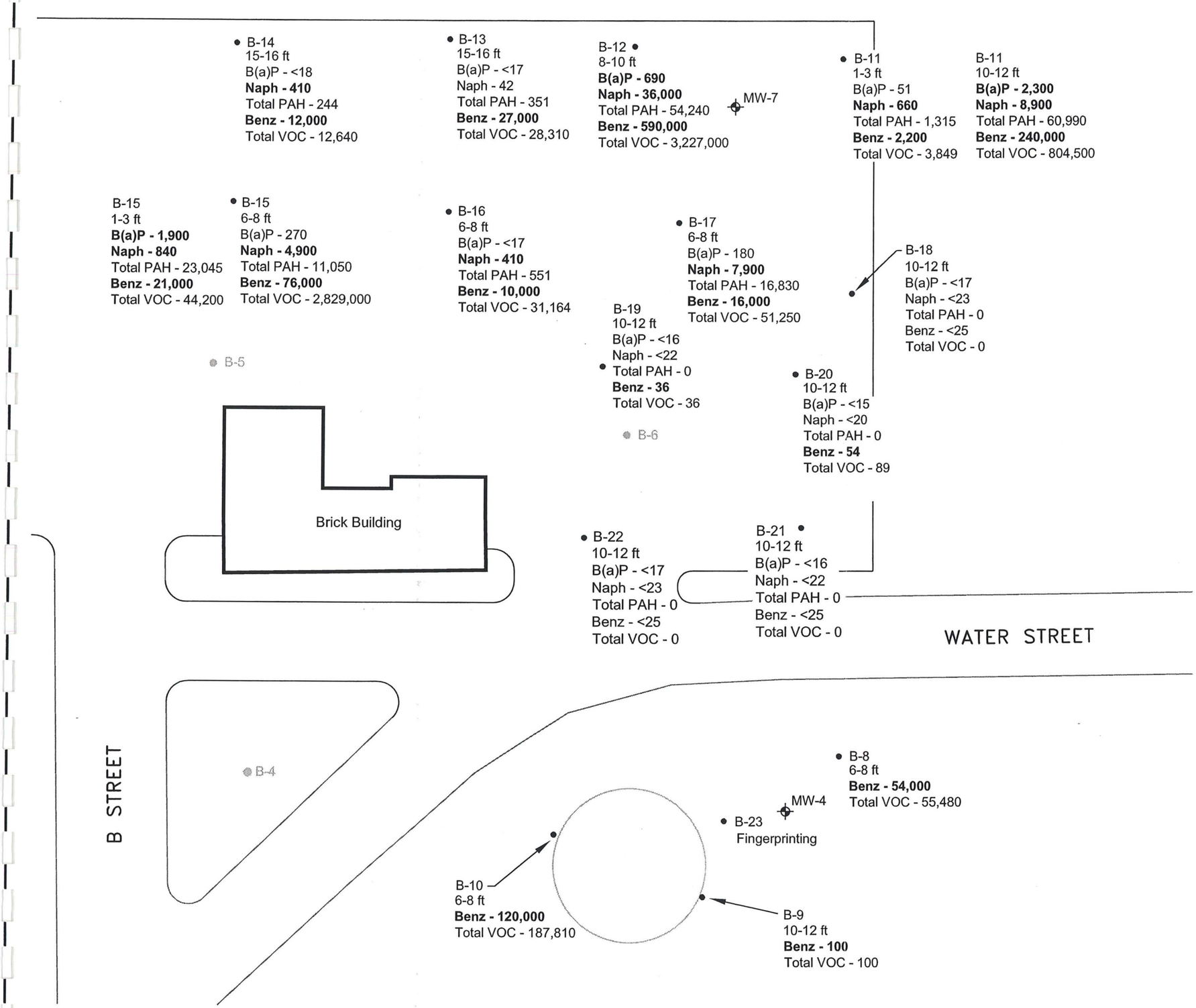
FIGURE 4-3
CROSS-SECTION OF TEST TRENCH T10
SWL&P FORMER MGP
PHASE II PART II
SUPERIOR, WISCONSIN

DRAWN: CMB/5802	DATE: Nov 2002	PROJECT No.: 09413-098	REV:
FILE No.: Fig 4-3.DWG	CHECKED: WMG		



EXPLANATION:

- SWL&P Property Boundary
- B-12 — Geoprobe Soil Boring Location (Sept 2002)
- B-2 — Geoprobe Soil Boring Location (Nov 2001)
- MW-7 — Monitoring Well Location
- Former Gas Holder

Notes:

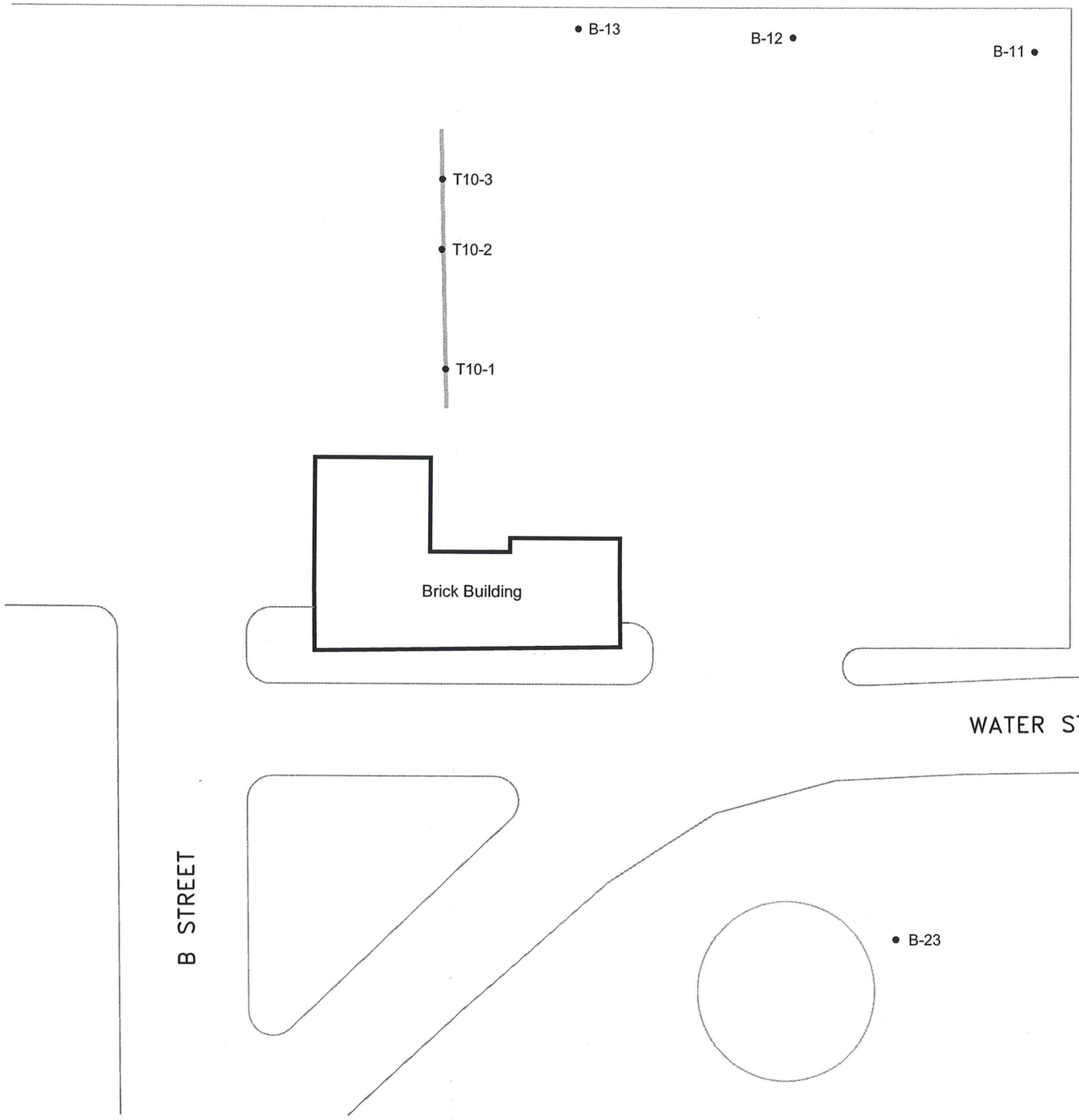
Soil analytical results reported in ug/kg (parts per billion) with sampling depth in feet below the ground surface.
B(a)P = benzo(a)pyrene
Naph = naphthalene
Total PAH = the sum of all PAH compounds detected in the sample
Benz = benzene
Total VOC = the sum of all volatile organic compounds detected in the sample
Bold result indicates the compound exceeds the corresponding residual contaminant level.
Soil samples were collected in September 2002.

N

APPROXIMATE SCALE
1 INCH = 30 FEET
0 15 30 60

Figure 4-4
SOIL SAMPLE ANALYTICAL RESULTS
Phase II Part II Investigation
Superior Water Light & Power
Former MGP
Superior, Wisconsin

DRAWN: CMB/5802	DATE: Nov 2002	ENSR INTERNATIONAL
FILE No.: Fig 4-4.dwg	PROJECT: 09413-098	



EXPLANATION:

- SWL&P Property Boundary
- B-2 — Geoprobe Soil Boring Location
- T10 — Test Trench Location
- Former Gas Holder

Notes:

Soil samples were collected in September 2002 for Fingerprinting analysis by GTI.

N

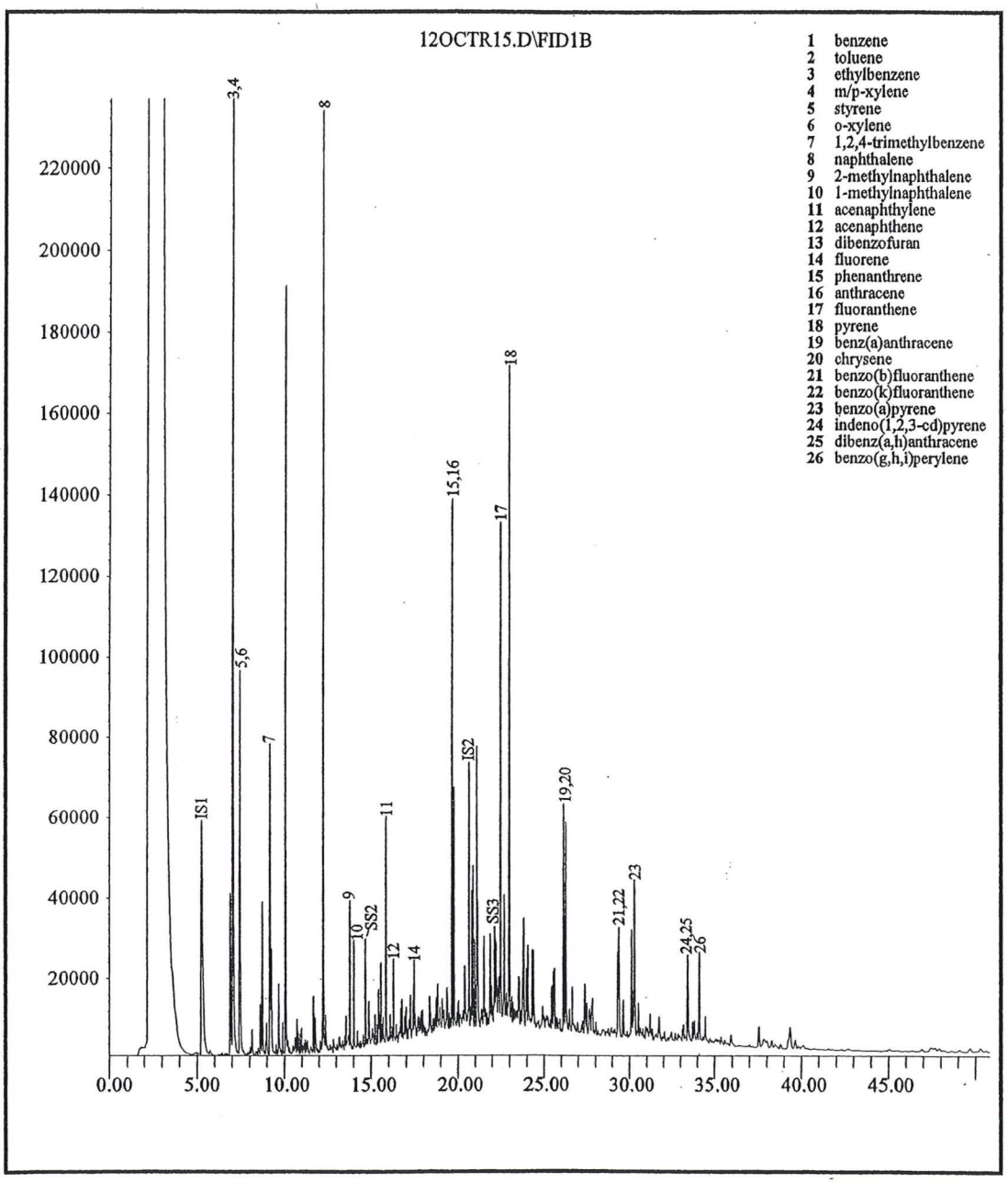
APPROXIMATE SCALE
1 INCH = 30 FEET

0 15 30 60

Figure 4-5
FINGERPRINTING SAMPLE LOCATIONS
Phase II Part II Investigation
Superior Water Light & Power
Former MGP
Superior, Wisconsin

DRAWN: CMB/5802	DATE: Nov 2002	ENSR INTERNATIONAL
FILE No.: Fig 4-5.dwg	PROJECT: 09413-098	

GC/FID Fingerprint



IS1 - 2,4-difluorotoluene
IS2 - o-terphenyl
SS1 - fluorobenzene
SS2 - 2-fluorobiphenyl
SS3 - 5α-androstane

Field ID:	**T10-1**
Laboratory ID:	GT020924-01
Method:	MET4007D

NOTE:

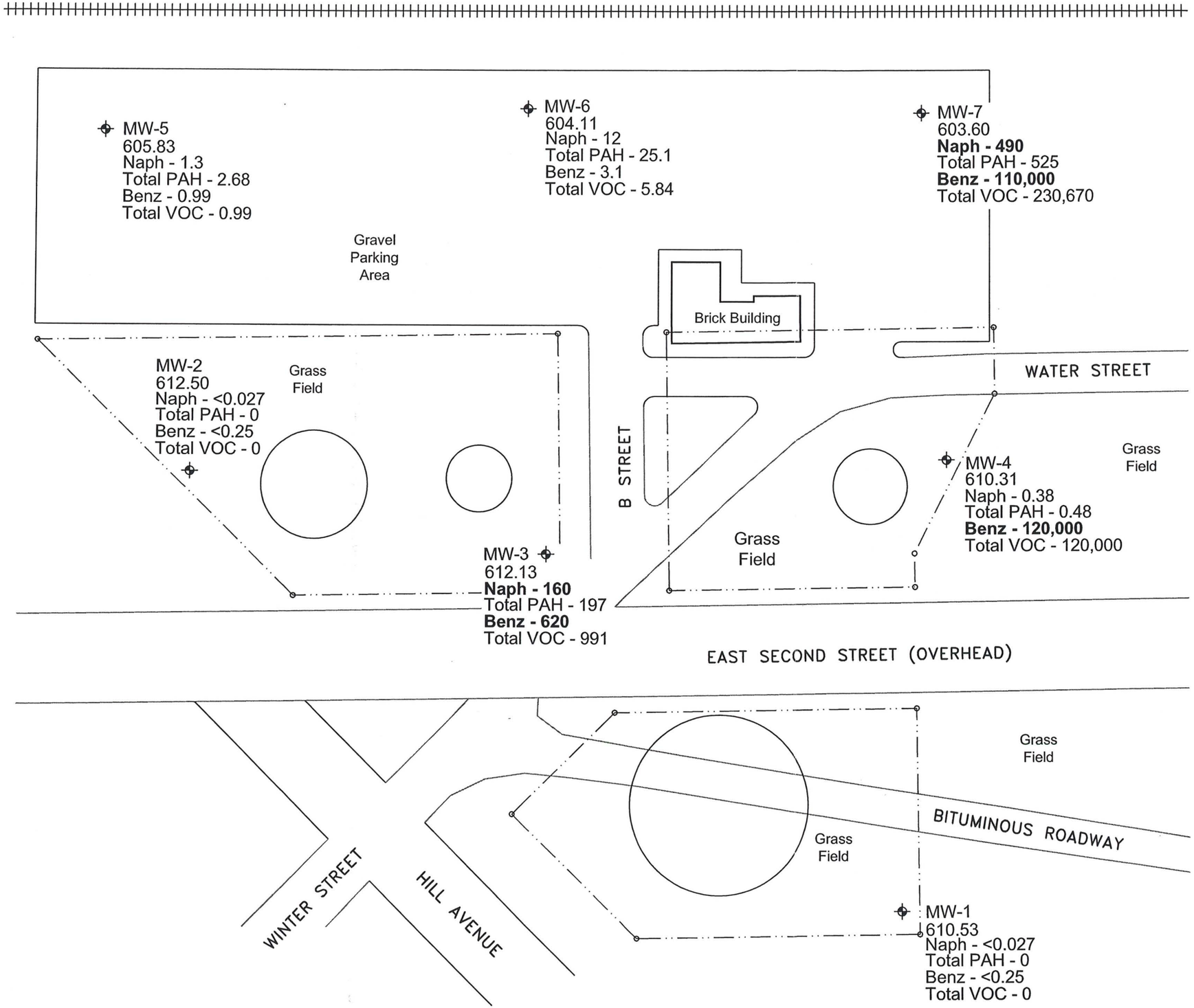
IS1, IS2, SS1, SS2, and SS3 are standards added to the sample by the laboratory.

SOURCE:

Comparative Analysis of Eight Samples from the SWL&P Former MGP Site, Superior, Wisconsin; GTI, Feb 2003 (Appendix F)

Figure 4-7
FINGERPRINT OF SAMPLE T10-1 (AREA 2)
Superior Water Light & Power
Former MGP
Superior, Wisconsin

DRAWN: CMB/05802	DATE: Feb 2003	PROJECT No.: 09413-098	ENSR INTERNATIONAL
FILE No.: Fig 4-7.dwg	CHECKED: WMG		



EXPLANATION:

- Railroad Tracks
- SWL&P Property Boundary
- MW-1 Monitoring Well Location
- Former Gas Holder

NOTES:

Groundwater elevation is reported in feet above mean seal level.
Groundwater analytical results reported in ug/l (parts per billion).
Naph = naphthalene
Total PAH = the sum of all PAH compounds detected in the sample
Benz = benzene
Total BTEX = the sum of benzene, toluene, ethyl benzene, and xylene in the sample
Bold indicates the compound exceeded the corresponding groundwater enforcement standard.
Groundwater samples were collected on 9/18/02 and 9/20/02.

N

APPROXIMATE SCALE
1 INCH = 60 FEET

0 30 60 120

Figure 4-8
GROUNDWATER ANALYTICAL RESULTS MAP
Phase II Part II Investigation
Superior Water Light & Power
Former MGP
Superior, Wisconsin

DRAWN: CMB/5802	DATE: Nov 2002	ENSR INTERNATIONAL
FILE No.: Fig 4-8.dwg	PROJECT: 09413-098	