

## *Hydrostratigraphic Database of West-Central Wisconsin*

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<b>Site:</b>	River Falls Landfill
<b>Location:</b>	River Falls, Pierce County, Wisconsin
<b>Unit Evaluated:</b>	Ordovician Prairie du Chien, Cambrian Jordan

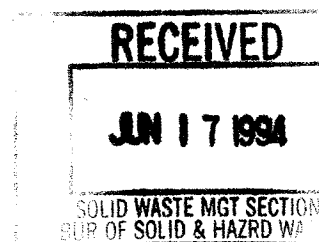
### ***File includes excerpts from:***

Conestoga-Rovers & Associates, Inc., 1994, Environmental Contamination Assessment, River Falls Landfill Site, River Falls, Wisconsin, on file at Wisconsin Department of Natural Resources.

- Text: executive summary, discussion of hydrogeology, karst, slug testing
- Tables: well construction, groundwater sampling data, water-level elevations
- Figures: site plan, joint-orientation rose diagram, potentiometric surface maps, cross-sections.
- Well logs
- Slug test results

Conestoga-Rovers & Associates, Inc., 1994, Letter to WDNR Re: Five Year Report, Groundwater and Landfill Gas Monitoring, Former River Falls Sanitary Landfill, River Falls, Wisconsin, on file at Wisconsin Department of Natural Resources.

- Figures: site plan and water table map
- Table: long-term groundwater elevation summary table



# **ENVIRONMENTAL CONTAMINATION ASSESSMENT**

**River Falls Landfill Site  
River Falls, Wisconsin**

**MAY 1994**

**REF. NO. 5349 (5)**

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**CONESTOGA-ROVERS & ASSOCIATES**

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ABANDONMENT OF LANDFILL

CROSS SECTION FOR ABANDONMENT OF LANDFILL

## EXECUTIVE SUMMARY

This document presents the results of the Environmental Contamination Assessment (ECA) of the River Falls Landfill (Site), near River Falls Wisconsin. In October 1993 the City of River Falls (City) and the Wisconsin Department of Natural Resources (WDNR) entered into a consent order (No. WD-93-21) to conduct an ECA at the site. CRA prepared a work plan to conduct the ECA in August 1993. The work plan proposed a two phased approach to the ECA. Phase I was completed in December 1993 and Phase II was completed in April 1994. The work included installing and sampling ten monitoring wells, conducting a geophysical survey, reviewing city records, collecting water levels, sampling the landfill cap and conducting hydraulic tests.

The landfill operated from 1962 to 1976 when it was closed under a consent order between the City and the WDNR. Monitoring at the Site since 1984 revealed the presence of Volatile Organic Compounds (VOC) in groundwater. The Site is bordered to the north by the Birch Cliff subdivision which relies on private wells for domestic supply. There are thirty six residential wells near the landfill. Sampling of the residential wells in 1993 indicated three wells with intermittently detectable VOCs with two wells at or above Wisconsin Enforcement Standards (ES) for vinyl chloride.

Groundwater at the Site flows primarily in a northeasterly direction. The aquifer beneath the Site is the Prairie du Chien limestone formation. The Prairie du Chien exhibits Karst features (sinkholes, caves, fractures) in this part of Wisconsin. The presence of Karst features makes predicting flow directions and velocities uncertain. The northeasterly flow direction was determined largely from the contaminant distribution around the Site.

VOCs are the groundwater contaminants of concern at the Site. In particular vinyl chloride is the VOC detected at the highest concentration relative to its Wisconsin ES and Preventative Action Limit (PAL). The groundwater plume has impacted all monitoring wells on the landfill proper. However, off site it has only impacted the monitoring wells



immediately northeast of the landfill and the two residences. Sampling of the Rocky Branch Creek east of the Site indicated no VOC impact.

Sampling of the cap was conducted to define cap soil conditions. Borings were conducted and they determined that the Site is capped with several feet of fine to medium grained sand.

Four remedial technologies were identified as potential components of the remedy at the Site. These are:

1. Monitoring;
2. Landfill cap with passive gas venting;
3. Landfill cap with active gas venting; and
4. Groundwater extraction and treatment.

The alternative chosen for the site is monitoring, a multi-layer landfill cap and passive gas venting.

The estimated capital cost for installing the remedy is \$983,000 to \$1,214,000. The estimated annual cost for monitoring, maintenance and operation is \$61,900 to 114,900. The thirty year present value, based on a 5% discount rate is \$1,936,000 to \$2,765,000.

## 1.0 INTRODUCTION

This document comprises the Environmental Contamination Assessment (ECA) of the River Falls Landfill (Site), near River Falls, Wisconsin. The Site is located in northwestern Pierce County, approximately one mile southwest of the City of River Falls. Figure 1.1 shows the Site location. The ECA was conducted in response to a Consent Order (No. WD-93-21) between the Wisconsin Department of Natural Resources (WDNR) and the City of River Falls (City) signed in October 1993.

Conestoga Rovers & Associates (CRA) was retained by Briggs and Morgan, the City's counsel in this matter, in May 1993 to provide environmental consulting services at the Landfill. CRA was immediately directed to prepare a work plan to study the environmental situation at the Site. CRA submitted the ECA work plan, dated August 17, 1993, which fulfilled the first requirement of the Consent Order. The work plan proposed a two phased approach to the investigation.

Phase I of the investigation was completed by the end of 1994 and consisted of the following:

1. Installing four new monitoring wells;
2. Conducting an electro-magnetic (EM) geophysical survey of the landfill;
3. Collecting water levels;
4. Collecting groundwater samples;
5. Analyzing groundwater samples for Volatile Organic Compounds (VOCs), metals and general water quality parameters; and
6. Conducting single well response tests of the new wells.

Phase II of the investigation was scoped based on the results of Phase I. The work plan for Phase II was submitted to the WDNR in

4. Sampling the Rocky Branch Creek;
5. Analyzing the groundwater and surface water samples for VOCs, metals and general water quality parameters; and
6. Measuring water levels at all monitoring wells and the creek.

## 1.1 BACKGROUND

The landfill occupies approximately 16 acres approximately one mile southwest of River Falls. The Site is capped with approximately two feet of fine to medium grained sand and six inches of topsoil. The cap appears to be in good condition with no erosion occurring.

The landfill operated from 1962 to 1976 and was closed in 1977 according to the requirements of a Consent Order (#2A-76-1139B) between the City and the WDNR. The Consent Order required capping of the landfill and installing two monitoring wells. The consent order was canceled on August 3, 1979 following compliance with its requirements by the City.

A second Consent Order was signed by the WDNR and the City on August 6, 1986 (#2A-85-1266). This order required that three additional monitoring wells be installed for a total of five monitoring wells. A report titled "Hydrogeologic Evaluation and Ground Water Monitoring Results, River Falls Landfill, River Falls Wisconsin," by Twin Cities Testing Corporation, dated December 14, 1987, presented the first two rounds of analytical data.

The landfill is bordered to the north by the Birch Cliff subdivision where residents have private wells for their water supply. Residential wells were first sampled in December 1984. In that round VOCs were detected in one well. A comprehensive residential sampling effort was conducted on March 25, 1993 when the City sampled 36 residential wells north of the landfill. VOCs were detected in three of the residential wells sampled. A second comprehensive residential sampling round was conducted in October 1993. VOCs were detected in the same three residential wells during this round.

## 2.0 FIELD WORK

### 2.1 WELL INSTALLATIONS

Monitoring wells were installed during both phases of the investigation. The first phase was completed during October of 1993, the second phase was completed during March of 1994. Figure 2.1 shows the locations of all Site monitoring wells.

Four monitoring wells (MW6, MW7, MW8 and MW9) were installed during Phase I. The wells were installed by Bergerson Caswell Inc. of Maple Plain Minnesota using a truck mounted drill rig. The wells were drilled by advancing 10 1/4-inch inside diameter hollow stem augers approximately one to two feet into the bedrock (Prairie du Chien Limestone). The borehole was then drilled to the target depth by advancing a 6 1/4-inch diameter tri-cone roller bit through the augers a using air rotary techniques.

Six wells were completed during the second phase of drilling (MW10, MW11, MW12, MW13, MW4D, and MW7D). During the second phase of drilling, the borings were installed by advancing a 10-inch diameter borehole through the unconsolidated material using air hammer drilling techniques. A 10-inch diameter steel casing was then seated approximately one to two feet into the bedrock. The boring was then completed to the target depth by a downhole hammer and air technique.

All monitoring wells were constructed with 2.0-inch diameter, 20-foot long, 0.01-inch slot stainless steel screens attached to 2.0-inch diameter coupled and threaded, low carbon steel riser pipe. A coarse sand pack was installed around and two feet above the top of the well screen. A 3-foot thick bentonite pellet seal was placed above the sand pack. The remaining annulus was backfilled using bentonite cement grout emplaced with a tremie tube. Surface protection consists of a 6-inch diameter steel locking protective casing and three 4-inch by 4-inch wooden bumper posts around the well.

During the first phase of drilling, the tops of the well screens were installed at or just below the water table surface. During the second phase of drilling, the well screens were installed to straddle the water table surface as requested by the WDNR. Appendix A contains the well logs for the new and preexisting monitoring wells at the Site. Table 2.1 presents a summary of the well construction.

Wells were developed by first purging with a stainless steel bailer to remove solid materials, followed by purging with a 2.0-inch Grundfos submersible pump. Well stability was determined by measuring the field parameters pH, conductivity and temperature. Table 2.2 summarizes well development.

## 2.2 CAP BORING AND GAS MONITORING

Ten boreholes were drilled on the landfill to characterize the landfill cover. The borehole locations are presented on Figure 2.2. Drilling was conducted by American Testing and Engineering Inc. of St. Paul, Minnesota using a truck mounted drill rig. Borings were advanced with 4 1/4-inch inside diameter hollow stem auger. Split spoon samples were collected for visual soil classification. Five thin walled "Shelby tube" samples were collected with the intent of performing permeability testing.

Each borehole was advanced to either a depth of six feet or until waste was encountered. Upon reaching the target depth, a tygon tube attached to an oxygen/methane meter was lowered to the bottom of the borehole. Readings of % oxygen and % of Lower Explosive Limit (LEL) were recorded. VOC readings were collected over the open borehole using a Mine Safety Appliances Co. (MSA) "Photon" photoionization device. Both meters were calibrated prior to the beginning of work. Table 2.3 presents a summary of borehole findings, including depth, confirmation of waste and field measurements collected.

In all borings, a tan-white, well sorted, medium grained sand was the soil type encountered. Waste was verified in eight of ten

boreholes. Based on the visual classification of the clay soils, the permeability tests were deleted from the program. The purpose of the permeability testing was to determine if the cap met current low permeability cap standards. The visual classification was sufficient to determine that the cap does not qualify as a low permeability cap.

## 2.3 MONITORING WELL SAMPLING

Groundwater sampling was conducted after the first and second drilling phases. After the first phase of drilling, the four new monitoring wells were sampled for chemical analysis. The existing monitoring wells (MW1 through MW5) were sampled in December 1993 by another consultant under the pre-existing monitoring plan. After the second phase of drilling, all Site monitoring wells were sampled as well as three residential wells. Table 2.2 summarizes both rounds of groundwater sampling.

Monitoring wells were purged using a 2.0 inch diameter Grundfos submersible pump except for wells MW1 and MW2 which were purged using bailers. These two wells are constructed with 1.5-inch diameter riser pipes and no other method was available for purging. Field measurements of pH, conductivity, and temperature were collected which are included on Table 2.2. Groundwater samples were collected following purging by using Teflon bailers attached to new nylon rope.

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## 2.4 RESIDENTIAL WELL SAMPLING

Three residential wells were sampled: the Hajewski residence old well, the Frank residence old well, and the Pfremer residence well. In addition, the new Hajewski and Frank wells (see Section 2.5) were sampled immediately following their installation, and during the comprehensive sampling round conducted in March of 1994. The old Hajewski and Frank wells, and the Pfremer well were sampled once during

the comprehensive Phase II sampling round. Table 2.2 summarizes the sampling of these wells including analytical parameters, and field parameters.

## 2.5 NEW RESIDENTIAL WELL INSTALLATIONS

VOCs were detected above the Wisconsin ES in March 1993 in two Prairie du Chien residential wells immediately north of the landfill. Section 5.0 discusses the location of all residential wells near the Site. In response, the City provided these two homes (the Hajewski and Frank residences) with temporary alternative water supplies consisting of above ground tanks piped into the home plumbing systems. In parallel with the ECA, new Jordan sandstone wells were constructed for these homes in December 1993 and January 1994. The wells were drilled by Steve Martell Well Drilling of Somerest, Wisconsin.

The wells were drilled using air rotary drilling techniques. A 10-inch borehole was advanced 50 feet into the Jordan Sandstone and a 6-inch diameter steel casing was set and tremie grouted in place. After allowing the grout to set a six inch diameter open hole was drilled. The final depth of the new wells was 360 feet at the Frank Home and 350 feet at the Hajewski home. The wells required large quantities of grout, confirming that there are significant fractures and voids within the Prairie du Chien. Appendix A contains copies of the drillers logs for these wells.

Both of the new Frank and Hajewski wells were developed by pumping and sampled for VOCs. In these samples, no VOCs were detected above quantitation limits in either well. Subsequently, the wells were supplied with new pumps and plumbed into the homes by the drilling contractor. The homes were also provided with aeration-type iron removal systems by Culligan Inc., of Stillwater, Minnesota in April 1994.



### 3.0 HYDROGEOLOGY

#### 3.1 PHYSICAL SETTING

The River Falls landfill is located approximately six miles east of the St. Croix River in a dissected plateau landscape which escaped recent (Wisconsin age) glaciation. Numerous flat topped bluffs punctuate the landscape. The Kinnickinnic River valley runs in an east west direction one-half mile north of the Site. Rocky Branch Creek, a small intermittent stream which flows north into the Kinnickinnic River, lies one-eighth mile east of the landfill.

The landfill itself has a maximum elevation of 934 feet AMSL in its center. The surrounding land is farmland ranging in elevation from approximately 900 feet AMSL to 920 feet AMSL. Bluffs located north and south of the Site reach elevations of over 1000 feet AMSL. In the Rocky Branch Creek stream valley the elevations reach a low of approximately 855 feet AMSL. Surface drainage in the Site vicinity is primarily toward the Rocky Branch Creek and to a lesser extent the Kinnickinnic River. Figure 3.1 is a topographic map of the Site vicinity.

#### 3.2 REGIONAL GEOLOGY

The Site area lies approximately five miles south of the farthest southern extent of Wisconsin age glacial sediment. Surficial sediment in the region consists of older re-worked glacial sediment, wind blown sediment or loess, alluvium (in stream valleys) and weathered bedrock material.

Bedrock in the area lies exposed at the surface along bluff faces in stream valleys and consists of flat lying Ordovician and Cambrian carbonates and sandstone units. The uppermost exposed bedrock is the Ordovician Platteville Formation and Glenwood Shale which form a caprock on area bluffs. Underlying the Platteville is the St. Peter Sandstone which is easily eroded and is exposed in area road cuts. Below the St. Peter is the

a letter dated January 4, 1994. The Phase II work plan was approved with minor modifications in a conditional approval letter from the WDNR dated February 4, 1994.

In their approval letter, the WDNR deleted a proposed shallow monitoring well (MW13) west of the Site and asked for an additional deep monitoring well (MW4D) to be nested with existing well MW4. In subsequent discussions WDNR agreed to install MW4D but decided not to delete the shallow well west of the Site. This was based on Phase I data that suggested that part of the plume may be migrating to the west of the landfill. Also, during subsequent discussions WDNR agreed to delete the borings through the waste at the Site. The purpose of these borings was to measure the thickness of the waste in the landfill. However, the City's construction records included cross sections of the waste trenches making the borings unnecessary.

The Phase II work plan included plans for a pumping test on one of the residential wells immediately north of the Site. The test required installing a 6-inch diameter pump into the well. A 6-inch pump was needed to achieve a suitable range of flow rates. During several attempts to install the pump, CRA and the contractor discovered that the well casing is severely out of plumb. Consequently it was impossible to install the pump without damaging it and risking jamming the unit in the well. After a discussion with the WDNR the pumping test was deleted from the work with the provision that a suitable test well may be installed if a groundwater pumping remedy is required.

The field work completed during Phase II included:

1. Installing four shallow (water table) monitoring wells;
2. Installing two deep (approximately 40 feet below the water table) monitoring wells;
3. Sampling all monitoring wells and three residential wells at the Site;

Ordovician Prairie du Chien group carbonates and Cambrian Jordan Sandstone. The Prairie du Chien units outcrop in local stream valleys. Below the Jordan Sandstone lies the St. Lawrence Formation which consists of primarily shale and siltstone. The St. Lawrence Formation does not outcrop in the Site vicinity.

The Prairie du Chien and Jordan formations constitute a major regional aquifer system in this portion of Wisconsin. The Prairie du Chien is the aquifer of concern at the Site and is used for both domestic and municipal supply in the Site area. Groundwater flow in this formation is generally west toward the St. Croix River in western Pierce County. In the vicinity of the Site, regional flow is more to the north toward the Kinnickinnic River. On a local scale flow is influenced by smaller streams, in particular the Rocky Branch Creek.

### 3.2.1 Regional Karst Features

The hydrogeology of Pierce County is characterized by a well developed Karst terrain that includes sinkholes, springs and caves. Karst terrains are marked by closed depressions and other topographic features that result when large cavities or caves in the bedrock collapse. These features result from dissolution of soluble bedrock, such as the Prairie du Chien formation. Conditions that favor the development of Karst topography include soluble bedrock and a water table that fluctuates within the bedrock thereby promoting variable dissolution.

The development of a Karst terrain in Pierce County was aided by a well developed fracture network within the Prairie du Chien. The Karst features tend to develop along joints and fractures which enlarge as moving groundwater dissolves the soluble host rock. The Karst features in Pierce County were mapped by R.W. Baker, E.J. Bauer, S.F. Huffman and E. Haas. Figure 3.2 is a portion of the map they prepared showing the Karst features in the Site vicinity. CRA obtained the map following a discussion with Dr. Baker at the University of River Falls, Wisconsin.

As Figure 3.2 indicates, a major Karst feature was mapped immediately west of the Site.

To aid in understanding the general orientation of the fractures in the bedrock at the Site, the orientation of fractures in outcrops along the bank of Rocky Branch Creek were measured and compiled into a "Rose" diagram. This work was done by Rick Van Allen, a student at the University of Wisconsin River Falls, as part of a senior field study course. Figure 3.3 presents the results of the fracture measurements. The measurements indicate that the primary fracture orientation is east-northeast. This corresponds with the general regional fracture orientation as reported by Dr. Baker. The fracture orientation suggest that the preferential groundwater flow direction is also to the east-northeast.

### 3.3 SITE GEOLOGY

Figure 3.4 is a Site map showing the alignment of two cross-sections prepared for the Site. Figures 3.5 and 3.6 present the cross-sections showing the Site geology.

Three general soil types were encountered during the Site investigation. At the landfill Site proper, a fill cover of silty sand and nearly pure sand was defined which was typically about six feet thick. Below this cover, weathered loose St. Peter sandstone was encountered. Off Site, soils consisted of silt and fine sand mixtures ranging in thickness from 7 to 15 feet.

Three bedrock units were encountered during the drilling of monitoring wells and deep residential wells. These are: the St. Peter Sandstone, the Prairie du Chien group of carbonate sediments and sandstone, and the Jordan formation which consists of primarily sandstone.

The St. Peter is a well sorted and rounded, medium grained, poorly cemented quartz sandstone. This unit is easily eroded and occurs sporadically above the underlying Prairie du Chien Group.

The Prairie du Chien Group of carbonate and sandstone sediments was encountered at a range of 7 to 25 feet below ground surface. The Prairie du Chien Formation consists of interbedded dolomite, limestone and to a lesser extent sandstone. The thickness of the Prairie du Chien as determined during the drilling of the new deep residential wells is approximately 260 feet. The upper portion of this unit is moderately to highly weathered and fractured. While grouting the deep residential well, the most excessive grout loss occurred in the upper one-third of the formation, indicating a high degree of fracturing.

The Jordan Formation consists of moderate to loosely cemented sandstone similar in appearance and texture to the St. Peter Sandstone.

### 3.4 SITE HYDROGEOLOGY

The uppermost aquifer at the Site is the Prairie du Chien Group. The Prairie du Chien is an unconfined aquifer with groundwater occurring at approximately 50 feet below ground surface. Flow in the Prairie du Chien is primarily via secondary porosity features (joints, fractures, etc.). As discussed in Section 3.2.1, the presence of Karst features has an influence on groundwater flow patterns in the area. No confining unit overlays the Prairie du Chien so recharge occurs throughout the area.

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#### 3.4.1 Horizontal Groundwater Flow

Water levels at the Site monitoring wells have been periodically measured since 1986. Table 3.1 presents the groundwater elevation database for the Site. The new monitoring wells permit a more detailed mapping of the water table than was possible in the past. Figure 3.7 presents the groundwater contours from April 19, 1994. As the figure indicates, the groundwater elevations are highest on the landfill itself and drop by nearly 20 feet to the northeast and northwest of the landfill. The contours suggest a potentiometric mound or groundwater divide beneath the

landfill. Of particular note is an 18-foot difference in water levels between MW1 and MW2. This drop is reflected in the contours by the steep hydraulic gradient along the northwestern corner of the landfill (from approximately MW1 to MW13). This steep gradient appears to indicate an area of relatively low permeability in the bedrock. The area of the steep gradient is roughly parallel to the major fracture orientation indicating that area in the bedrock is relatively unfractured.

The groundwater contours indicate a potentiometric "mound" beneath the landfill. Ordinarily (in a horizontally isotropic aquifer) this would indicate there is radial groundwater flow from the landfill to the east, west and north. However, due to the Karstic nature of the aquifer the groundwater flow direction cannot be determined from the contours alone. The groundwater contours suggest radial flow but the chemical data and the geologic structure of the aquifer indicate flow is primarily toward the northeast.

As discussed in Section 6 monitoring wells MW10, MW11, MW12, MW13, MW4 and MW4D were all non detect or virtually non detect for the VOCs. Given the landfill is over twenty years old and the aquifer is highly permeable one would expect that if contaminants were migrating radially from the landfill, as the groundwater contours suggest, these six monitoring wells would show significant VOC impact. The only off site monitoring wells that are impacted are the monitoring wells to the northeast of the landfill (MW5, MW7 and MW7D). This VOC distribution indicates flow is to the northeast. This flow direction also correlates with the fracture orientation measurements discussed in section 3.2.1 which also indicated a preferential flow direction to the northeast.

Vertical gradients were measured at the two nested well locations (MW4/4D and MW7/7D). the vertical gradient was slightly upward at MW4/4D and strongly downward at MW7/7D. These variable gradients reflect the variable fracturing and hydraulic interconnection within the aquifer. VOCs were found at MW7D at similar concentrations as MW7 indicating that downward flow is occurring at this location.

The northeasterly flow direction indicates that the local flow direction is toward the Rocky Branch Creek. During January and February 1994, the Rocky Branch Creek remained unfrozen, probably due to relatively warm groundwater discharging to the creek. Sampling data from the creek indicated no impact from the landfill (see Section 6).

#### 3.4.2 Single Well Response Testing

Single well response testing was conducted on MW6, MW7, MW8 and MW9. The tests were conducted by quickly lowering a PVC "slug" of known volume into the well resulting in a sudden rise of the water in the well casing in response to the increase volume. The change in water levels over time was recorded using a pressure transducer and data logging tool. This test is termed a "falling head" test. After the water levels reached equilibrium, the slug was quickly removed causing a drop in the water level and water level changes over time were again recorded on the data logger. This is termed a "rising head" test.

The single well response test data was then interpreted to obtain estimates for hydraulic conductivity of the aquifer at the well. The method developed by Horslev was used to interpret the data. The resulting data plots and curves are presented in Appendix B. The tests yielded hydraulic conductivities ranging from  $1.03 \times 10^{-4}$  cm/sec to  $1.53 \times 10^{-2}$  cm/sec. These estimates of hydraulic conductivity must be used with caution. The fractured nature of the bedrock results in highly variable conductivities on a local scale. Slug tests only measure the hydraulic conductivity in the immediate vicinity of the monitoring well screen.

TABLE 2.1

**MONITORING WELL INSTALLATION SUMMARY  
RIVER FALLS LANDFILL**

<i>Well #</i>	<i>Date Installed</i>	<i>Well Depth (ft BGS)</i>	<i>Mid Screen Elevation (ft AMSL)</i>	<i>Ground Elevation (ft AMSL)</i>	<i>TOC Elevation (ft AMSL)</i>	<i>Screen Length (ft)</i>	<i>Well Diameter (in)</i>
<u>Phase I</u>							
MW6	9/28/93	75	857.5	922.5	924.72	20	2.0
MW7	10/4/93	72	859.0	921.0	923.01	20	2.0
MW8	9/29/93	75	853.5	918.5	920.65	20	2.0
MW9	9/29/93	75	863.5	928.5	930.47	20	2.0
<u>Phase II</u>							
MW4D	3/17/94	110	816.4	916.4	918.21	20	2.0
MW7D	3/16/94	116	814.1	920.1	922.09	20	2.0
MW10	3/17/94	65.1	852.4	907.5	908.48	20	2.0
MW11	3/17/94	65.4	851.1	906.5	908.86	20	2.0
MW12	3/16/94	68.0	848.5	906.5	909.21	20	2.0
MW13	3/16/94	68.0	855.4	913.4	915.47	20	2.0

Note:

TOC - Top of Casing

BGS - Below Ground Surface

AMSL - Above Mean Sea Level



TABLE 2.2

**SUMMARY OF GROUNDWATER SAMPLING AND DEVELOPMENT  
RIVER FALLS LANDFILL**

<i>Well ID</i>	<i>Sample Date</i>	<i>Sample Number</i>	<i>Parameter Sampled</i>	<i>Volume Purged (gallons)</i>	<i>pH</i>	<i>Conductivity (µmhos)</i>	<i>Temp. (°C)</i>	<i>Water Clarity</i>
<b><u>Round 1</u></b>								
MW6	10/15/93	W931015-JM-02	VOC, metals, cyanide, GWQ	195	6.95	500	12	Clear
MW7	10/15/93	W931015-JM-06	VOC, metals, cyanide, GWQ	90	7.1	NA	NA	Clear
MW8	10/15/93	W931015-JM-01	VOC, metals, cyanide, GWQ	70	6.95	500	11	Clear
MW9	10/15/93	W931015-JM-04	VOC, metals, cyanide, GWQ	90	7.0	NA	NA	Clear
Frank's New Well	1/27/94	W940127-JM-01	VOC	20,160	7.83	395	8.9	Clear
Hajewski's New Well	1/22/94	W940127-JM-02	VOC	21,600	7.6	790	8.9	Clear
<b><u>Round 2</u></b>								
MW1	3/16/94	W940316-JM-09	VOC, metals GWQ, cyanide	18	7.6	730	8.6	Clear

TABLE 2.2

**SUMMARY OF GROUNDWATER SAMPLING AND DEVELOPMENT  
RIVER FALLS LANDFILL**

<i>Well ID</i>	<i>Sample Date</i>	<i>Sample Number</i>	<i>Parameter Sampled</i>	<i>Volume Purged (gallons)</i>	<i>pH</i>	<i>Conductivity (µmhos)</i>	<i>Temp. (°C)</i>	<i>Water Clarity</i>
MW2	3/17/94	W-940317-JM-13	VOC, metals, GWQ, cyanide	9	7.1	840	8.6	Slightly Cloudy
MW3	3/17/94	W-940317-JM-11	VOC, metals, GWQ, cyanide	50.0	7.1	830	8.9	Slightly Cloudy
MW4	3/17/94	W-940317-JM-10	VOC, metals, cyanide, GWQ	50	7.0	1130	9.4	Clear
MW4D	3/21/94	W-940321-JM-16	VOC, metals, cyanide, GWQ	53	7.3	600	10	Clear
MW5	3/17/94	W-940317-JM-14	VOC, metals, cyanide, GWQ	35	7.3	680	7.0	Cloudy
MW6	3/15/94	W-940315-JM-04	VOC, metals, cyanide, GWQ	30	7.8	1040	12.2	Clear
MW7	3/15/94	W-940315-JM-05	VOC, metals, cyanide, GWQ	30	7.9	750	8.9	Clear
MW7D	3/23/94	W-940323-JM-25	VOC, metals, cyanide, GWQ	139	7.4	620	9.4	Slightly Cloudy

TABLE 2.2

**SUMMARY OF GROUNDWATER SAMPLING AND DEVELOPMENT  
RIVER FALLS LANDFILL**

<i>Well ID</i>	<i>Sample Date</i>	<i>Sample Number</i>	<i>Parameter Sampled</i>	<i>Volume Purged (gallons)</i>	<i>pH</i>	<i>Conductivity (µmhos)</i>	<i>Temp. (°C)</i>	<i>Water Clarity</i>
<b><u>Round 2 (Cont'd.)</u></b>								
MW8	3/15/94	W-940315-JM-01	VOC, metals, cyanide, GWQ	30	7.4	980	8.3	Clear
MW9	3/15/94	W-940315-JM-02	VOC, metals, cyanide, GWQ	30	8.53	490	8.9	Clear Odor Noted
MW10	3/22/94	W-940322-JM-20	VOC, metals, cyanide, GWQ	40	7.2	790	11.1	Clear
MW11	3/23/94	W-940323-JM-24	VOC, metals, cyanide, GWQ	35	7.0	600	7.2	Cloudy
MW12	3/22/94	W-940322-JM-19	VOC, metals, cyanide, GWQ	35	7.1	840	10.6	Clear
MW13	3/22/94	W-940322-JM-17	VOC, metals, cyanide, GWQ	51	7.6	690	10.3	Clear
Frank's Old Well	3/17/94	W-940317-JM-12	VOC, metals, cyanide, GWQ	350	7.0	770	7.5	Clear

TABLE 2.2

**SUMMARY OF GROUNDWATER SAMPLING AND DEVELOPMENT  
RIVER FALLS LANDFILL**

<i>Well ID</i>	<i>Sample Date</i>	<i>Sample Number</i>	<i>Parameter Sampled</i>	<i>Volume Purged (gallons)</i>	<i>pH</i>	<i>Conductivity (µmhos)</i>	<i>Temp. (°C)</i>	<i>Water Clarity</i>
<u>Round 2 (Cont'd.)</u>								
Franks's New Well	3/15/94	W-9403015-JM-21	VOC, iron	30	8.0	423	8.3	Clear
Hajewski's New Well	3/15/94	W-9403015-JM-22	VOC, iron	50	8.3	552	7.8	Clear
Pfremmer Well	3/23/94	W-940323-JM-23	VOC, iron	Taken from faucet	7.2	670	8.5	Clear
Hajewski's Old Well	4/6/94	W-940406-DG-01	VOC	348	7.1	400	10	Clear
<u>Duplicate/Rinsate Blank/MS/MSD**</u>								
<u>Round 1</u>								
MW6	10/15/93	W-931015-JM-03/ RB						
MW9	10/15/94	W-931015-JM-05/ Dup						

TABLE 2.2

**SUMMARY OF GROUNDWATER SAMPLING AND DEVELOPMENT  
RIVER FALLS LANDFILL**

<i>Well ID</i>	<i>Sample Date</i>	<i>Sample Number</i>	<i>Parameter Sampled</i>	<i>Volume Purged (gallons)</i>	<i>pH</i>	<i>Conductivity (µmhos)</i>	<i>Temp. (°C)</i>	<i>Water Clarity</i>
<u>Duplicate/Rinsate Blank/MS/MSD** (Cont'd.)</u>								
<u>Round 1 (Cont'd.)</u>								
MW7	10/15/94	W-931015-JM-06/ MS/MSD						
<u>Round 2</u>								
MW9	3/15/94	W-940315-JM-03/ Dup						
MW13	3/22/94	W-940322-JM-18/ Dup						
MW7D	3/23/94	W-940323-JM-25/ MS/MSD						
MW4D	3/21/94	W-9940321-JM-15/ RB						
<u>Surface Water - Rocky Branch Creek</u>								
SW1	3/15/94	W-940315-JM-06	SE edge of landfill		NA	890	10	Slightly Cloudy

TABLE 2.2

**SUMMARY OF GROUNDWATER SAMPLING AND DEVELOPMENT  
RIVER FALLS LANDFILL**

<i>Well ID</i>	<i>Sample Date</i>	<i>Sample Number</i>	<i>Parameter Sampled</i>	<i>Volume Purged (gallons)</i>	<i>pH</i>	<i>Conductivity (µmhos)</i>	<i>Temp. (°C)</i>	<i>Water Clarity</i>
<u>Surface Water - Rocky Branch Creek (Cont'd.)</u>								
SW2	3/15/94	W-940315-JM-07	Approximately 250 feet upstream of Co. Rd. FF Bridge		8.64	444	6.3	Clear
SW3	3/15/94	W-940315-JM-08	Approximately 100 feet downstream from Co. Rd. FF Bridge		8.4	508	5.6	Clear

Notes:

- \* GWQ - General Water Quality Parameters Including Total Alkalinity, Chemical Oxygen Demand/Total Hardness, Chloride Sulfate, Total Dissolved Solids, Nitrate and Nitrite and Fluoride.
- VOC - Volatile Organic Compounds - EPA Method 8260.
- Metals - Arsenic, Barium, Cadmium, Chromium, Manganese, Mercury, Selenium, Silver and Zinc.
- \*\* Dup - Duplicate
- RB - Rinse Blank
- MS/MSD - Matrix Spike/Matrix Spike Duplicate
- NA - Not Available

**TABLE 2.3**  
**SUMMARY OF CAP BORING PROGRAM**  
**RIVER FALLS LANDFILL**

<i>Borehole</i>	<i>Depth</i>	<i>O2*</i>	<i>Methane**</i>	<i>VOC***</i>	<i>Waste Encountered</i>
BH1	6	21.8	10	0	Paper, Tire
BH2	6	18	>100	5.5	None
BH3	6	18.5	>100	1.9	Mixed, black material
BH4	6	17.4	>100	0.5	None
BH5	4	21.5	0	0.9	Mixed waste
BH6	4	21.5	0	0.7	Paper, cardboard
BH7	6	18	>100	0	Mixed waste
BH8	6	17.5	>100	0	Mixed waste
BH9	6	20	50	0.5	Black waste - debris
BH10	6	18	>100	0	Newspaper

Notes:

\* O2 in percent.

\*\* Methane as percent of lower explosive limit.

\*\*\* VOCs in ppm

TABLE 3.1

HISTORICAL GROUNDWATER ELEVATIONS (FT AMSL)  
RIVER FALLS LANDFILL

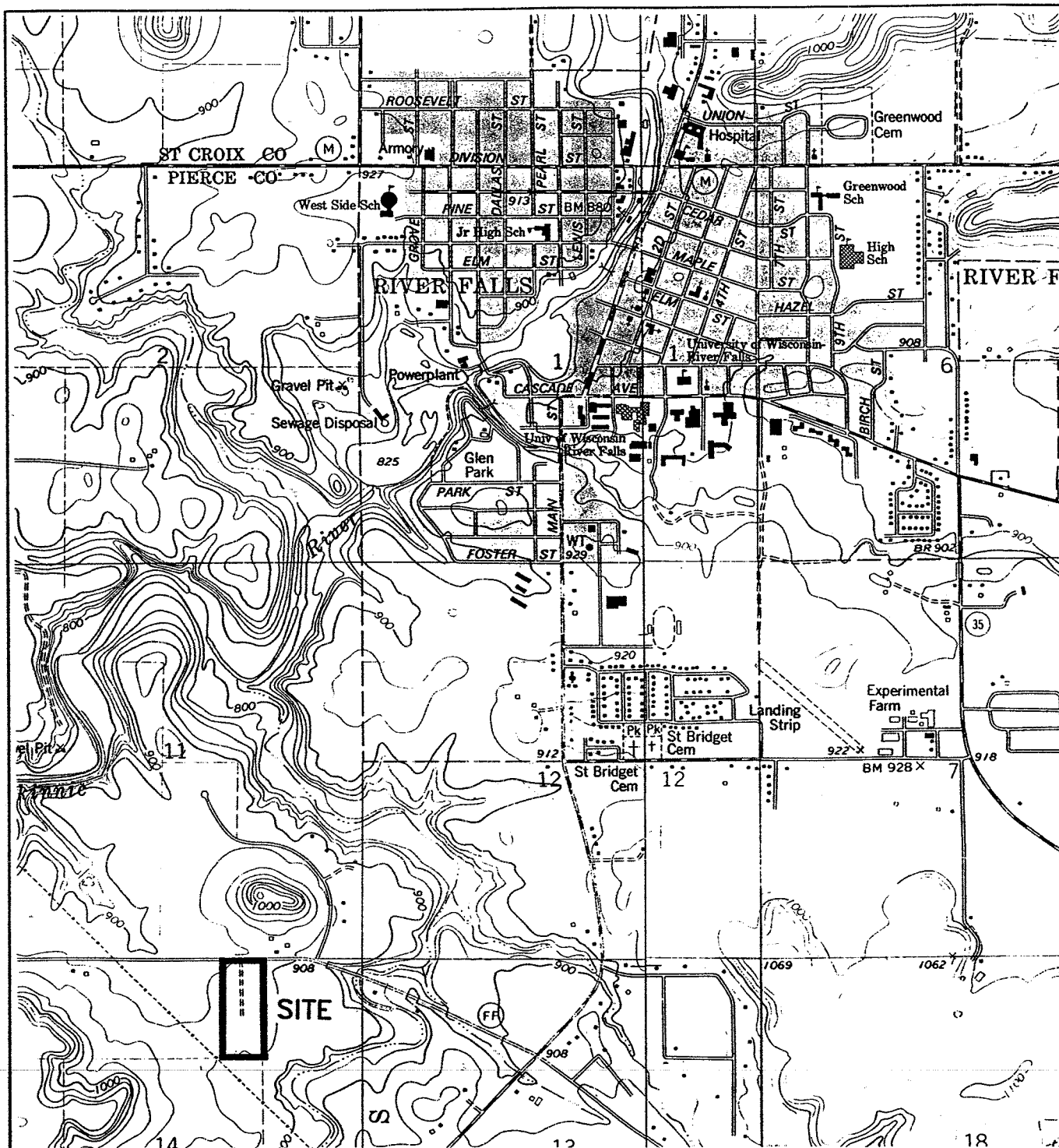
Location	Reference Elevation	9/10/86	8/25/87	7/1/88	1/1/89	7/1/89	12/1/89	6/1/90	12/1/90	6/1/91	12/1/91	6/1/92	12/1/92	10/18/93	10/22/93	10/26/93	11/2/93	11/17/93	1/6/94	4/15/94	4/19/94
MW-1	922.60	855.94	856.03	852.60	851.84	851.87	850.09	853.80	851.68	852.50	851.52	853.45	854.37	858.72	858.46	858.48	858.41	857.85	857.70	856.26	855.77
MW-2	924.55	874.25	872.78	871.80	871.90	871.53	871.60	871.67	873.03	872.58	872.45	873.56	874.33	876.88	876.59	876.71	876.69	876.09	875.93	874.37	873.52
MW-3	922.00	878.41	878.51	875.70	874.90	873.67	873.08	873.28	874.63	874.36	875.00	876.47	878.56	883.80	883.45	883.60	883.56	882.92	882.74	880.80	879.91
MW-4	917.75	858.08	862.72	852.40	852.20	852.23	851.08	853.79	851.98	852.63	851.99	853.28	854.01	858.60	858.34	858.34	858.37	857.70	857.55	855.67	855.29
MW-4D	918.21	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	856.09	855.67
MW-5	924.60	870.84	870.09	869.40	869.60	869.29	869.25	869.22	870.42	870.00	870.40	871.10	872.60	873.19	873.00	873.10	873.14	872.77	872.72	871.28	870.75
MW-6	924.72	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	878.43	877.82	877.78	877.61	876.77	876.58	873.70	873.08
MW-7	923.01	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	872.02	871.79	871.87	871.97	871.65	871.43	868.27	867.58
MW-7D	922.09	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	855.06	854.76
MW-8	920.64	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	872.68	872.51	872.50	872.52	872.10	872.00	870.84	870.36
MW-9	930.47	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	881.25	880.90	881.04	880.99	880.40	880.25	878.49	877.69
MW-10	908.48	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	854.86	854.54
MW-11	908.86	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	859.36	859.20
MW-12	909.21	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	856.01	855.48
MW-13	915.47	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	862.23	861.48
Old Hajewski	928.27	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	854.35	854.02
Old Frank	935.37	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	875.05
Creek Staff Gauge	867.83	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NM	855.03

**Notes:**

NI - Not Installed

NM - Not Measured





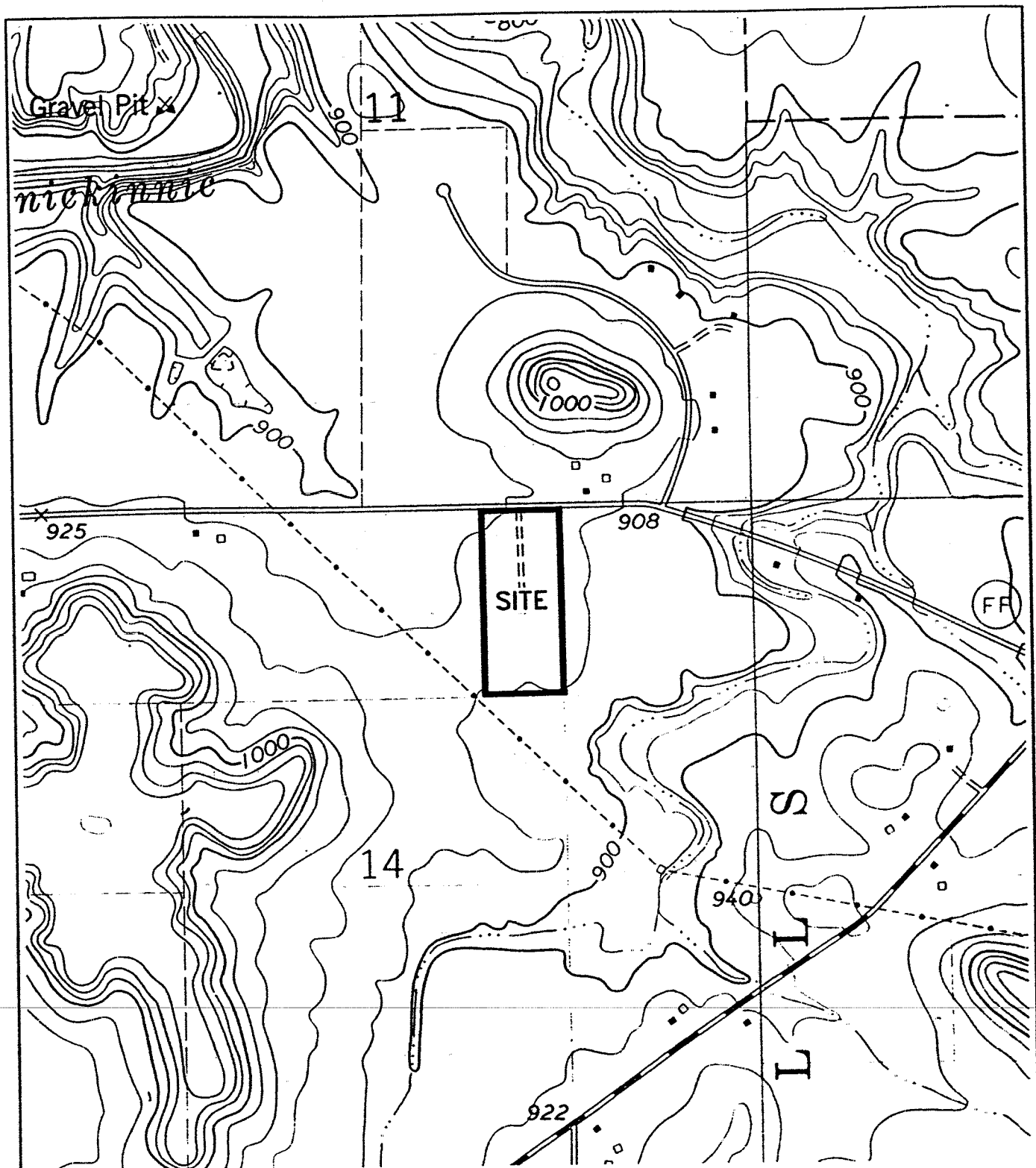
SOURCE: USGS TOPOGRAPHIC MAPS  
RIVER FALLS WEST &  
RIVER FALLS EAST QUADS



SCALE: 1"=2000'

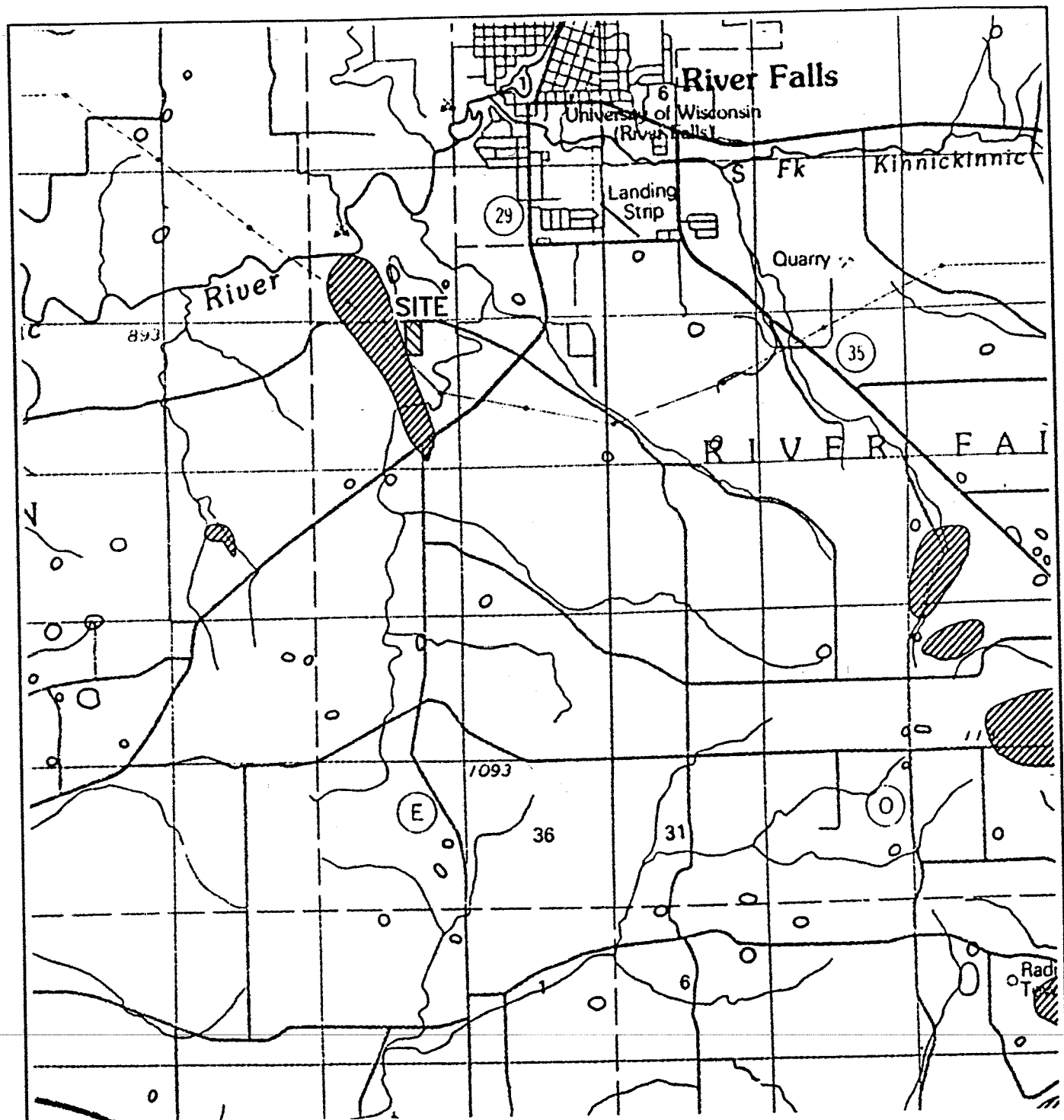
**CRA**

figure 1.1  
SITE LOCATION  
RIVER FALLS LANDFILL  
*River Falls, Wisconsin*



**SCALE: 1"=1000'**

figure 3.1  
SITE AREA TOPOGRAPHY  
RIVER FALLS LANDFILL  
*River Falls, Wisconsin*



### LEGEND

-  KARST FEATURE
-  OVERLAPPING KARST FEATURE

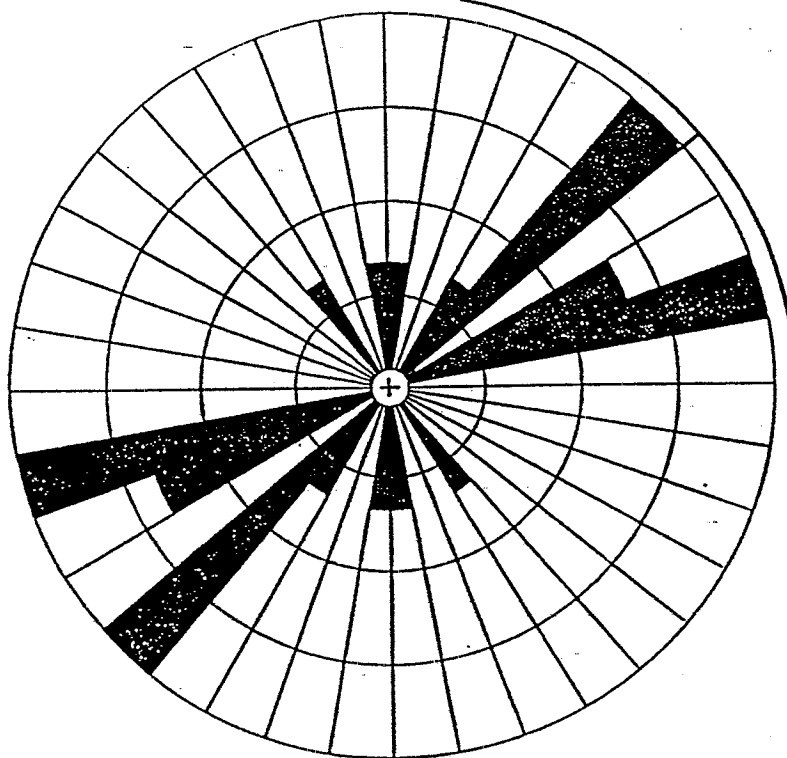
MAP SOURCE: KARST MAP OF PIERCE  
COUNTY, WISCONSIN BY  
BAKER et al

**CRA**



SCALE: 1"=1 MILE

figure 3.2  
AREA KARST FEATURES  
RIVER FALLS LANDFILL  
*River Falls, Wisconsin*



Prairie du Chien Joint Orientations	Statistics
N = 12	Vector Mean = 50.3
Class Interval = 10 degrees	Conf. Angle = 39.67
Maximum Percentage = 25.0	R Magnitude = 0.531
Mean Percentage = 14.29 Standard Deviation = 7.62	Rayleigh = 0.0338

### Prairie du Chien Joint Measurements

Measured on 11 Nov 93

All dips Vertical

N72E  
N76E  
N68E  
N71E  
N6E  
N65E  
N12W  
N42E  
N48E  
N36E  
N37E  
N42E

figure 3.3  
PRAIRIE DU CHIEN JOINTS  
RIVER FALLS LANDFILL  
*River Falls, Wisconsin*

**CRA**

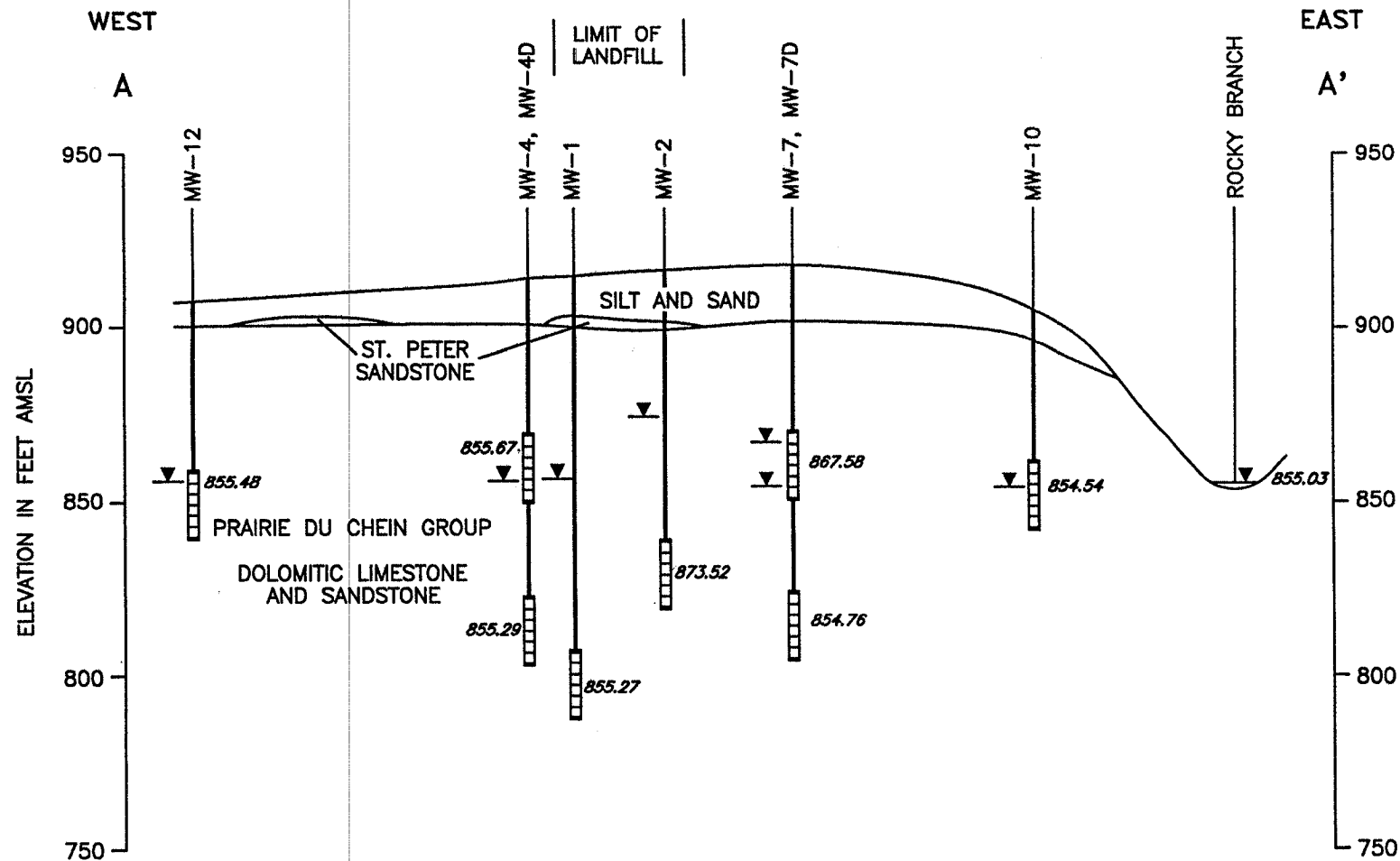
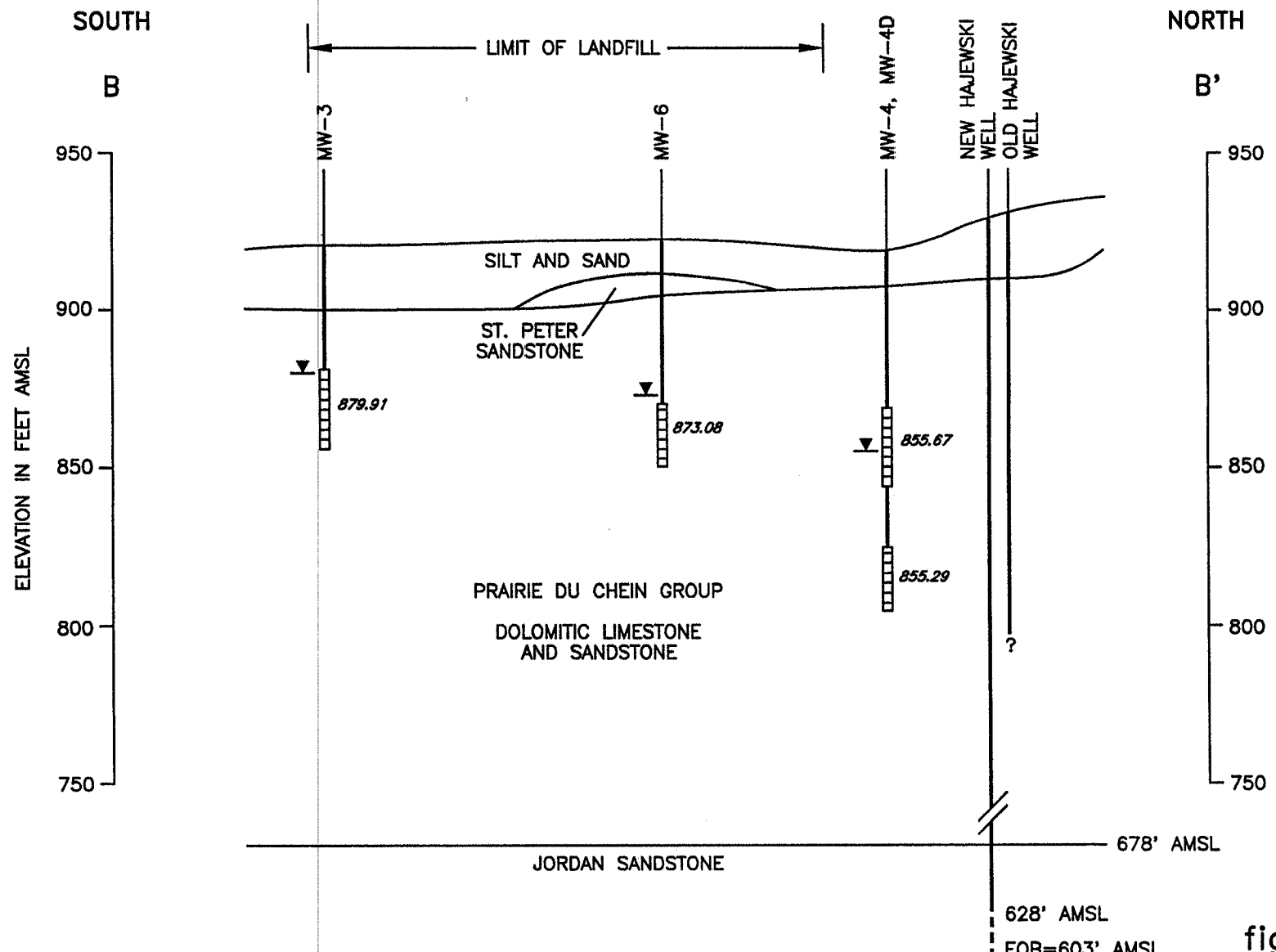


figure 3.5  
GEOLOGIC CROSS SECTION A-A'  
RIVER FALLS LANDFILL  
*River Falls, Wisconsin*

**CRA**



SCALE: 1"=400' HOR., 1"=50' VER.

figure 3.6  
GEOLOGIC CROSS SECTION B-B'  
RIVER FALLS LANDFILL  
*River Falls, Wisconsin*

**CRA**

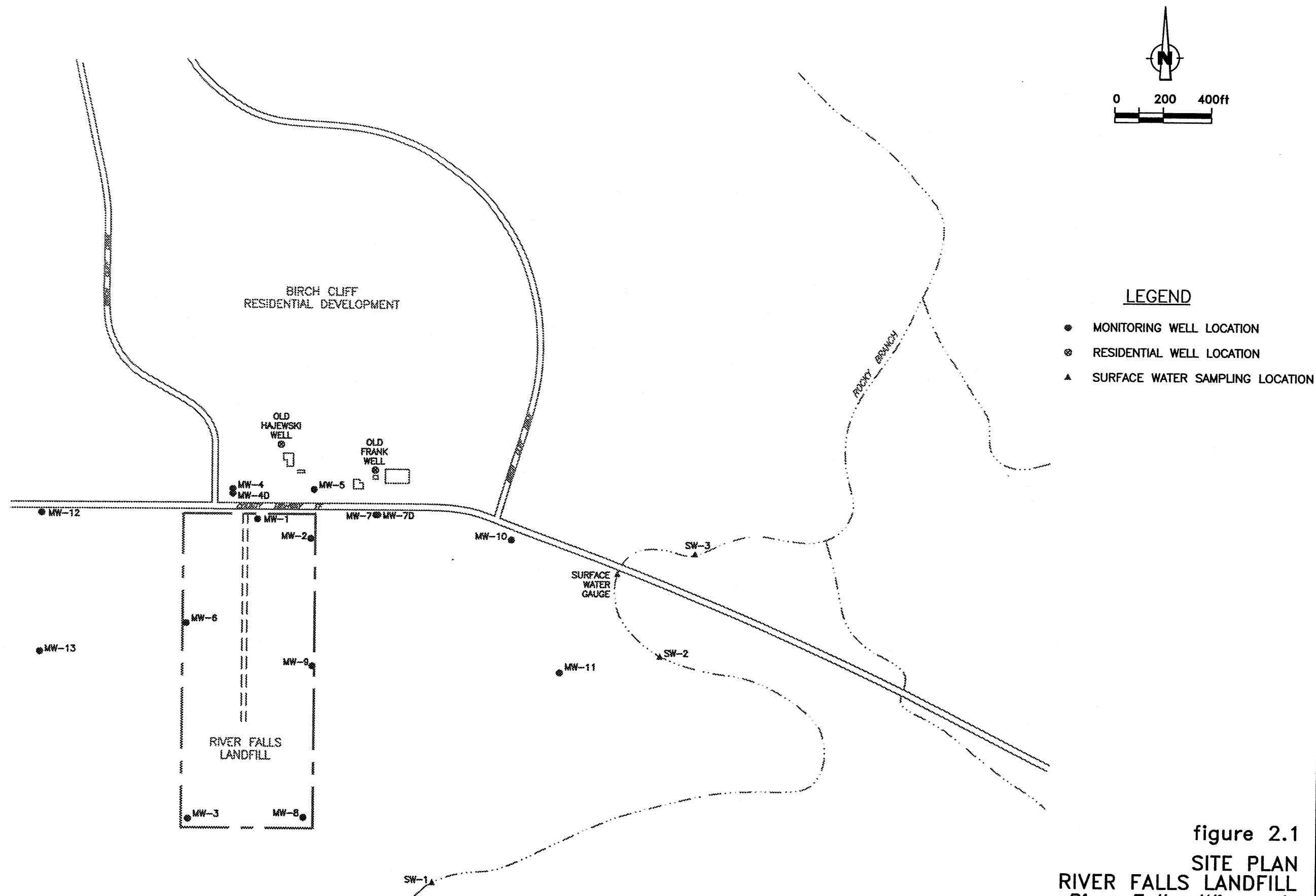


figure 2.1  
SITE PLAN  
RIVER FALLS LANDFILL  
*River Falls, Wisconsin*

**CRA**

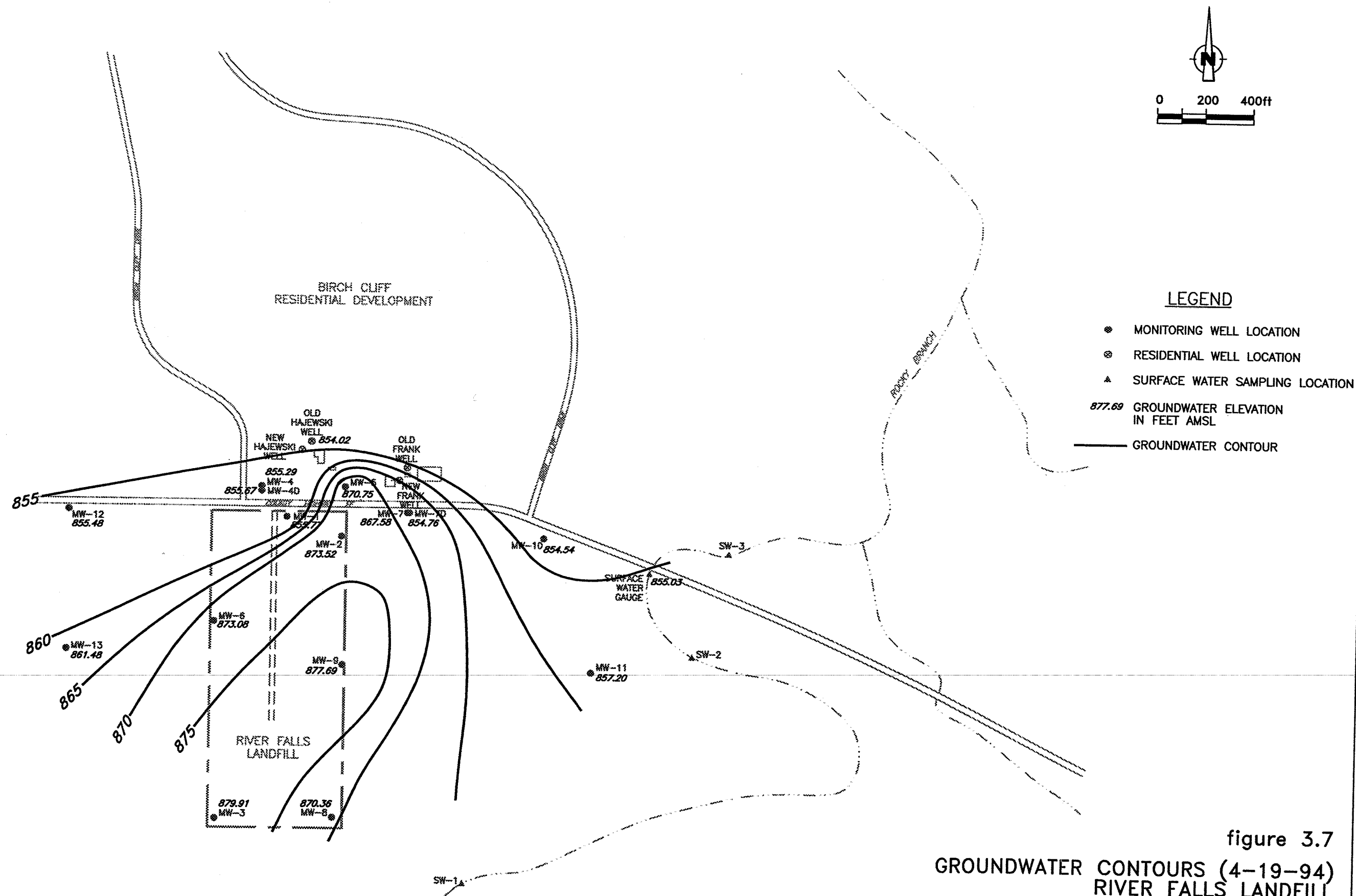


figure 3.7  
GROUNDWATER CONTOURS (4-19-94)  
RIVER FALLS LANDFILL  
*River Falls, Wisconsin*



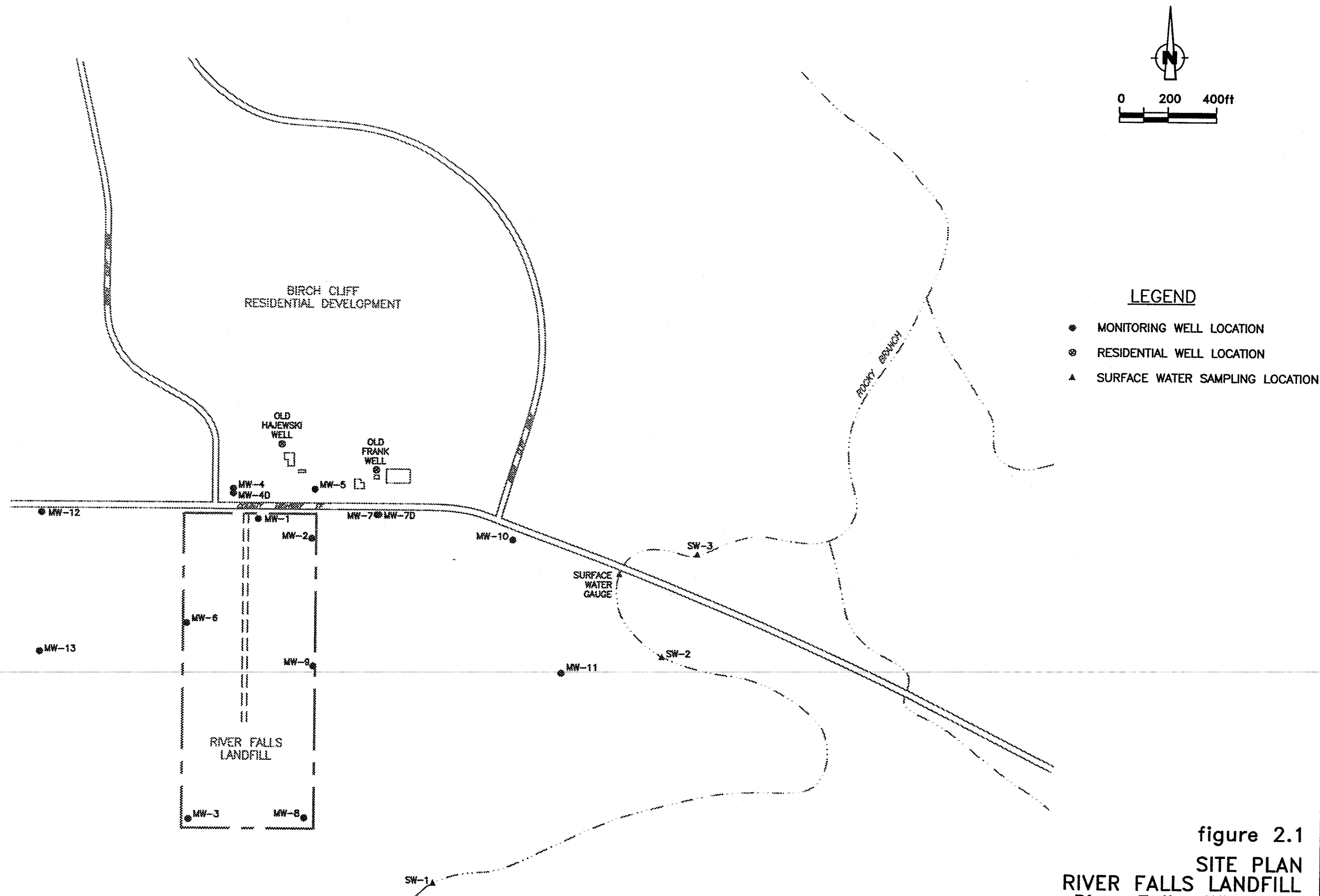
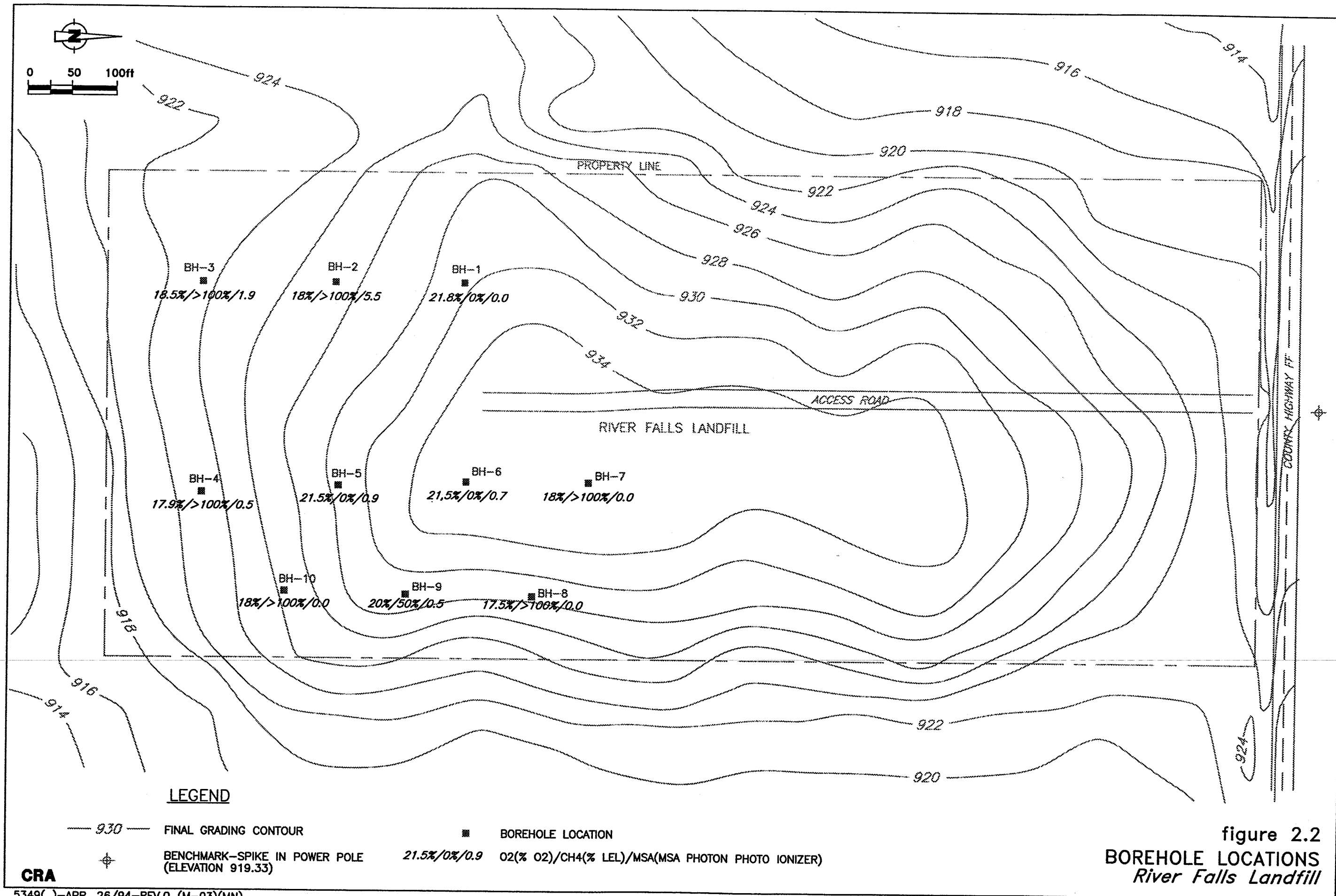


figure 2.1  
SITE PLAN  
RIVER FALLS LANDFILL  
*River Falls, Wisconsin*



CRA

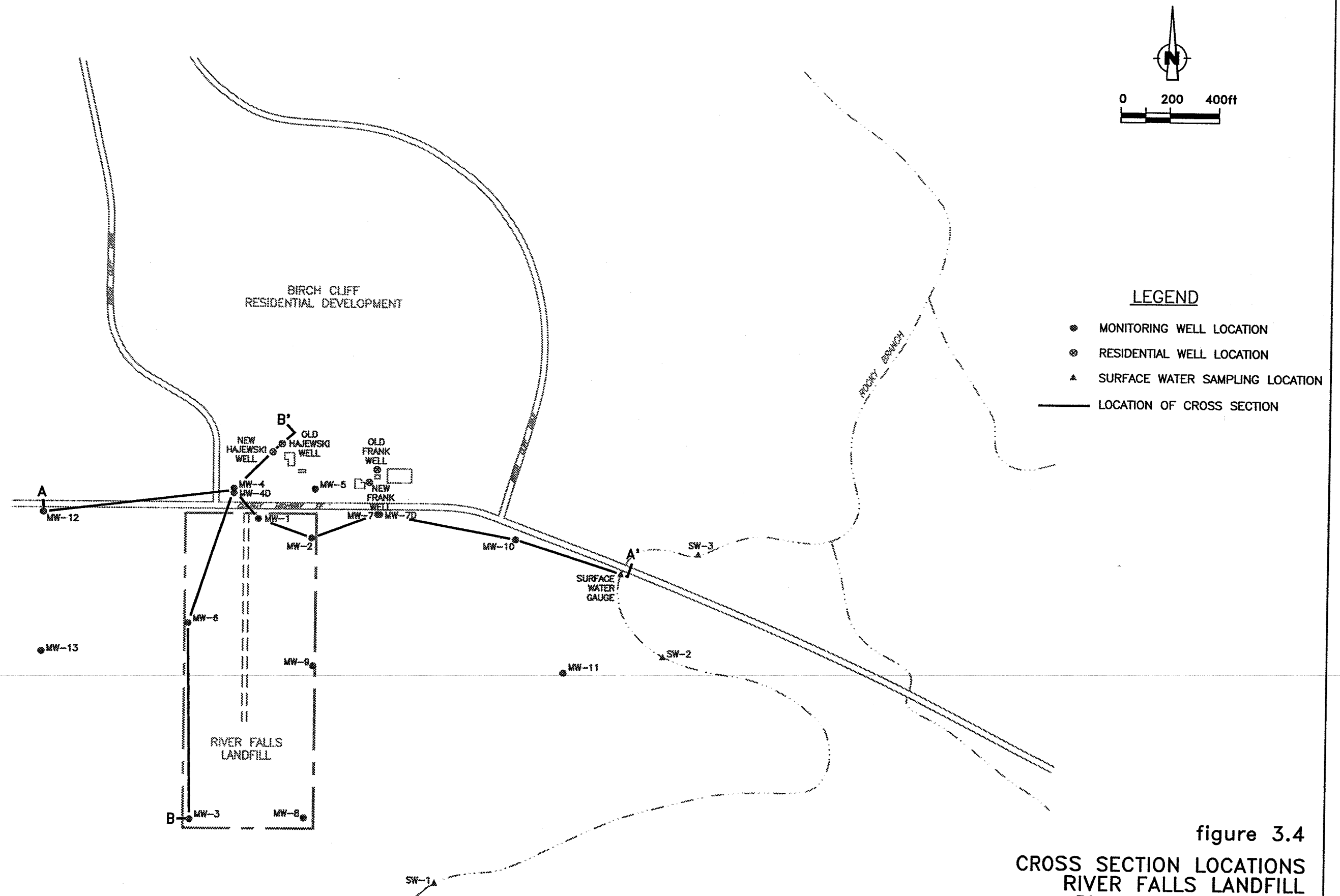


figure 3.4  
CROSS SECTION LOCATIONS  
RIVER FALLS LANDFILL  
*River Falls, Wisconsin*

## APPENDIX A

### WELL LOGS

## PRE-EXISTING WELLS

## LOG OF TEST BORING

LAB NO 820-556

VERTICAL SCALE 1" = 6'

BORING NO. \_\_\_\_\_

PROJECT MONITORING WELL INSTALLATION - RIVER FALLS LANDFILL - RIVER FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL SURFACE ELEVATION 920.7'	GEOLOGIC ORIGIN	OT	N	R	WL	SAMPLE		LABORATORY TESTS			
							NO	TYPE	W	D	LL PL	Qu
2	SILTY SAND, fine grained, dark brown to brown, moist, loose (SM)	COARSE ALLUVIUM	6				1	SS				
	SILTY SAND, fine grained, brown, wet, loose, a few lenses of silty clay(SM)		5				2	SS				
	WEATHERED SANDSTONE, brown to white, moist	WEATHERED SANDSTONE	20				3	SS				
			59				4	SS				
12 1/2	VOID	VOID	75				-	--				
12 1/2	DOLOMITIC LIMESTONE, weathered above 18 1/2', contains an occasional badly weathered and fractured zone, brown, light brown, light grayish brown to tan and light brownish gray, some lenses and layers of sandstone above 30', a few lenses and layers of sandstone below 30', sandstone from about 95'± - 98 1/2'±	PRAIRIE DU CHIEN GROUP	0.2									
			66%					NQ				
			80%					NQ				
			98%					NQ				
			100%					NQ				
			40%					NQ				
			92%					NQ				
			96%					NQ				
			74%					NQ				
50			Continued on next page									

# LOG OF TEST BORING

JOB NO 820-336

VERTICAL SCALE 1" = 6'

BORING NO 1 Cont.

~~PROJECT MONITORING WELL INSTALLATION - RIVER FALLS LANDFILL - RIVER FALLS, WISCONSIN~~

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	OR <sup>N</sup> R	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	$\frac{LL}{PL}$	Qu
50	DOLOMITIC LIMESTONE (Cont.)		98%			NQ				
			98%		NQ					
			88%		NQ					
			100%		NQ					
			100%		NQ					
			100%		NQ					
			92%		NQ					
			73%		NQ					
			100%		NQ					
			90%		NQ					
			98%		NQ					
100			Continued on next page							

# LOG OF TEST BORING

820-336

VERTICAL SCALE 1" = 6'

BORING NO 1 Cont.

PROJECT MONITORING WELL INSTALLATION - RIVER FALLS LANDFILL - RIVER FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	Gr <sup>N</sup> R	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	LL PL	Qu
100	DOLOMITIC LIMESTONE (Cont.)		96%			NQ				
			84%			NQ				
			76%			NQ				
			100%			NQ				
			96%			NQ				
			100%			NQ				
122.0	End of Boring									
	<p>R = percent core recovery</p> <p>Note: 5-23-78 @10:30-piezometer installed in boring with bottom of screen at depth of 89½' below ground surface and top of standpipe at 2' above ground surface. Piezometer consists of 1½" PVC pipe with 20' slot-ted section at the bottom.</p> <p>*Upon bailing for ½ hour</p> <p>**Piezometer measurement</p>									

## WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
5-18	3:00	122.0'	23½'		to	72.2'
5-18	4:00	122.0'	23½'		to	72.2'
5-18	4:30	122.0'	23½'		72.2' to 72.2'	72.2'
5-19	7:00	122.0'	23½'		to	72.3'
5-19	3:30	122.0'	23½'		to	72.0'
5-22	10:15	122.0'	23½'		to	71'
5-23	10:40				to	**70.6'

START 5-16-78 COMPLETE 5-18-78

METHOD 6 FA 0'-8', @ 3:00

4C 0'-8', NWC 0'-23½', DM 6'-18.6'

NQ wireline-cored 18.6'-122.0'



# LOG OF TEST BORING

DB NO 820-336 VERTICAL SCALE 1" = 6' BORING NO 2  
 PROJECT MONITORING WELL INSTALLATION - RIVER FALLS LANDFILL - RIVER FALLS, WISCONSIN

PTH IN FEET	DESCRIPTION OF MATERIAL SURFACE ELEVATION 922.7'	GEOLOGIC ORIGIN	OR N R	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	-	OL
6.9	FILL, mostly WEATHERED SANDSTONE, light tan and brown	FILL	6		1	SS				
			6		2	SS				
			15		3	SS				
			79		4	SS				
			5		5	SS				
20.4	SANDSTONE, light gray and light brown	MAY BE SANDSTONE OR PRAIRIE*	50 0.3		6	SS				
45	DOLOMITIC LIMESTONE, brown, light grayish brown and light brown to tan and light brownish gray, contains lenses and layers of sandstone and a few lenses of shaly dolomitic above about 40', a few lenses of sandstone	PRAIRIE DU CHIEN GROUP	100%			NQ				
			68%			NQ				
			88%			NQ				
			86%			NQ				
			96%			NQ				
			94%			NQ				
Continued on next page		*DU CHIEN GROUP								

# LOG OF TEST BORING

3 NO 820-336 VERTICAL SCALE 1" = 6' BORING NO 2 Cont.  
 OBJECT MONITORING WELL INSTALLATION - RIVER FALLS LANDFILL - RIVER FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	OR	N	R	WL	SAMPLE		LABORATORY TESTS			
							NO	TYPE	W	D	LL PL	Qu
5	DOLOMITIC LIMESTONE (Cont.)				92%			NQ				
					60%			NQ				
					100%			NQ				
					76%			NQ				
					100%			NQ				
					84%			NQ				
					70%			NQ				
					94%			NQ				
					100%			NQ				
85					80%			NQ				
Continued on next page												

# LOG OF TEST BORING

JOB NO 820-336 VERTICAL SCALE 1" = 6' BORING NO 2 Cont.  
 PROJECT MONITORING WELL INSTALLATION - RIVER FALLS LANDFILL - RIVER FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	OTN	R	WL	SAMPLE		LABORATORY TESTS			
						NO	TYPE	W	D	LL PL	Qu
85	DOLOMITIC LIMESTONE (Cont.)			76%			NQ				
				80%			NQ				
89.6	End of Boring										
<p>R = percent core recovery</p> <p>Note: 5-2-78 @2:00-piezometer in-                      stalled in boring with bottom of                      screen at depth of 68½' below ground                      surface and top of standpipe at 2'                      above ground surface. Piezometer                      consists of 1½" PVC pipe with 20'                      slotted section at the bottom.</p> <p>*Piezometer measurement.</p>											

## WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
5-19	3:00	79.6'	20.4'		to	54.3'
5-19	5:00	89.6'	20.4'		to	52.4'
5-19	5:30	89.6'	20.4'		to	52.8'
5-22	9:10	89.6'	20.4'		to	52.5'
5-22	9:15	89.6'	20.4'		52.5' to 53.4'	53.4'
5-22	9:45	89.6'	20.4'		to	52.8'
5-22	10:00	89.6'	20.4'		to	52.9'
5-23	10:30				to	* 51.1'

START 5-18-78 COMPLETE 5-19-78

METHOD 6 FA 0'-8' @ 5:00  
4C 0'-8½', NWC 0'-20.4', DM 0'-20.4'

NQ wireline-cored 20.4'-89.6'

CREW CHIEF Francis


# LOG OF TEST BORING

NO 120-86-797 VERTICAL SCALE 1" = 3' BORING NO MW-3  
 SUBJECT RIVER FALLS LANDELL RIVER FALLS WISCONSIN

DEPTH N FEET	DESCRIPTION OF MATERIAL SURFACE ELEVATION <u>920.34</u>	GEOLOGIC ORIGIN	N	WL	SAMPLE		COMMENTS
					NO	TYPE	
	SILTY SAND, with pieces of dolomitic limestone, dark brown, (may be fill) (SM)	FILL OR MIXED ALLUVIUM			1	*	
	SAND W/SILT, fine grained, brown and light brown (SP-SM) (Appears to be sandstone or redeposited sandstone)	COARSE ALLUVIUM OR ST. PETER FORMATION			2	*	
					3	*	
					4	*	
20	(CONTINUED ON NEXT PAGE)						

# LOG OF TEST BORING

B NO. 120 86-797 VERTICAL SCALE 1" = 3' BORING NO. MW-3 (Cont.)  
 OBJECT RIVER FALLS LANDFILL, RIVER FALLS, WISCONSIN

PTH N ET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		COMMENTS
					NO	TYPE	
20	DOLOMITIC LIMESTONE, brown to tan and buff, interbedded with layers of dolomitic sandstone and a few layers of oolitic dolomite	PRAIRIE DU CHIEN FORMATION SHAKOPEE MEMBER			5	*	
					6	*	
					7	*	
					8	*	
					9	*	
45							
	(CONTINUED ON NEXT PAGE)						

# LOG OF TEST BORING

120 86-797

VERTICAL SCALE 1" = 3'

BORING NO. MW-3 (Cont.)

RIVER FALLS LANDFILL. RIVER FALLS, WISCONSIN

## DESCRIPTION OF MATERIAL

## GEOLOGIC ORIGIN

N

WL

## SAMPLE

NO

TYPE

## COMMENTS

DOLOMITIC LIMESTONE, light gray and buff, interbedded with a few lenses or layers of oolitic dolomite and dolomitic sandstone

PRARIE  
DU CHIEN  
FORMATION  
SHAKOPEE  
MEMBER  
(Cont.)

10

\*

11

\*

12

\*

SANDSTONE, tan to white

POSSIBLE  
NEW  
RICHMOND  
SANDSTONE  
MEMBER

13

\*

End of Boring

\*Air/rotary cuttings sample  
Note: Monitoring well installed in boring. See attached "Installation of Monitoring Well" data sheet

## WATER LEVEL MEASUREMENTS

START 8-19-86 COMPLETE 8-19-86

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
					10	
8-19		65'			10	45'
					10	
					10	

METHOD @

CREW CHIEF Drilled by others-

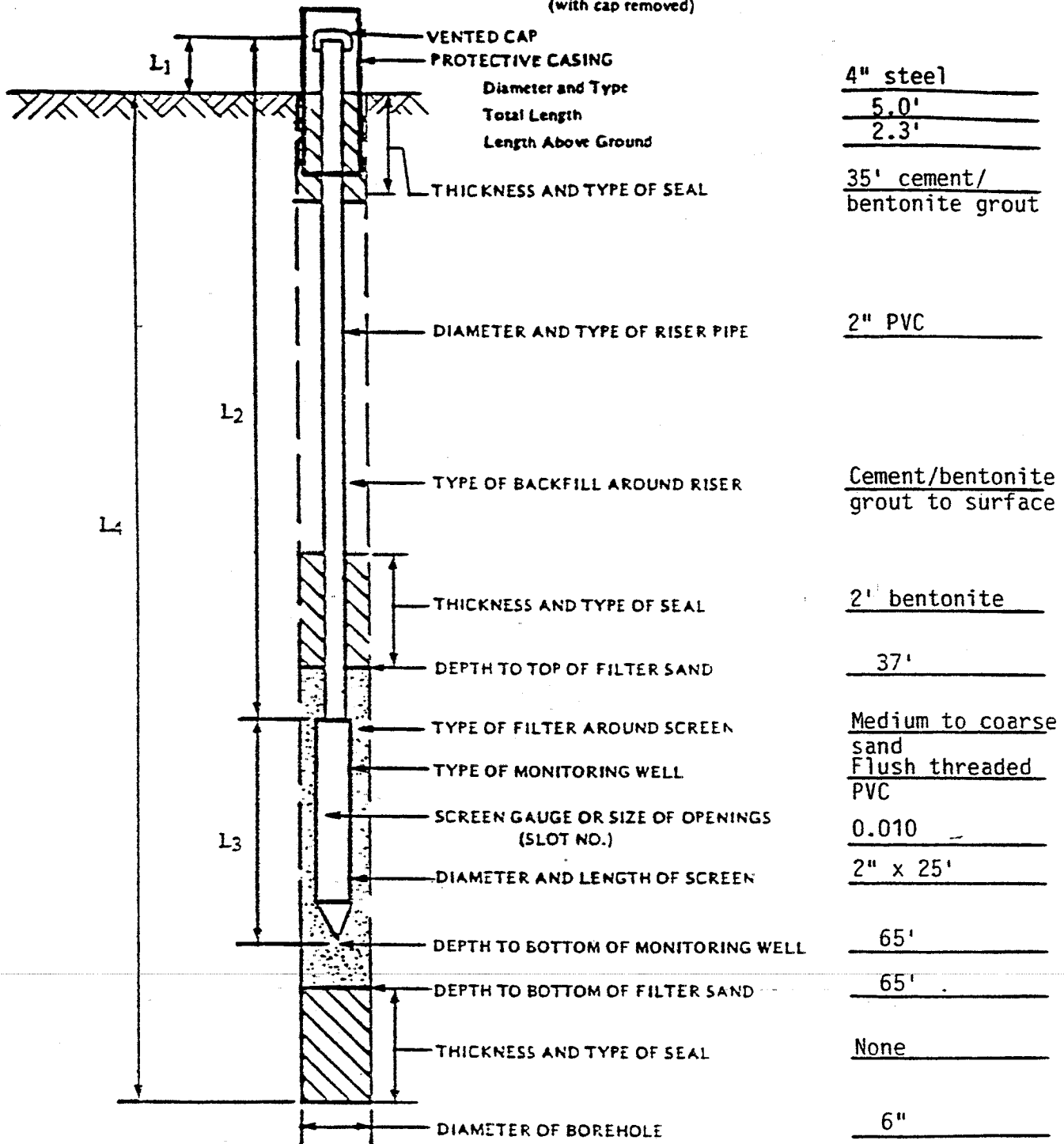
# INSTALLATION OF MONITORING WELL

DB NO. 120 86-797

MONITORING WELL NO. MW-3

ROUND SURFACE ELEVATION 920.34

TOP OF RISER PIPE ELEVATION 922.00  
(with cap removed)



1= 1.7 FT

2= 46.7 FT

3= 25.0 FT

4= 65.0 FT

INSTALLATION COMPLETED:

Date 8-19-86 Time D.M.

MONITORING WELL WATER LEVEL MEASUREMENTS			
DATE	TIME	BAILED DEPTHS	WATER LEVEL (1)
8-19-86	D.M.		45'

(1) DEPTH BELOW TOP OF RISER PIPE

# LOG OF TEST BORING

B NO. 120 86-797 VERTICAL SCALE 1" = 3' BORING NO. MW-4  
 IECT RIVER FALLS LANDFILL, RIVER FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL SURFACE ELEVATION _____	GEOLOGIC ORIGIN	N	WL	SAMPLE		COMMENTS
					NO	TYPE	
	SAND W/SILT, fine grained, traces of gravel, tan, moist (SP-SM) (Appears to be redeposited sandstone)	COARSE ALLUVIUM OR POSSIBLE ST PETER FORMATION			1	*	
					2	*	
10	DOLOMITIC LIMESTONE, brown to tan and buff, interbedded with layers of dolomitic sandstone and a few layers of dolomitic dolomite	PRAIRIE DU CHIEN FORMATION SHAKOPEE MEMBER			3	*	
					4	*	
					5	*	
25							

(CONTINUED ON NEXT PAGE)



# LOG OF TEST BORING

JOB NO. 120 86-797 VERTICAL SCALE 1" = 3' BORING NO. MW-4 (Cont.)  
 PROJECT RIVER FALLS LANDFILL, RIVER FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		COMMENTS
					NO.	TYPE	
5	DOLOMITIC LIMESTONE (Cont.)	PRAIRIE DU CHIEN FORMATION SHAKOPEE MEMBER (Cont.)			6	*	
					7	*	
					8	*	
					9	*	
45	DOLOMITIC LIMESTONE, light gray and buff, interbedded with a few lenses or layers of dolomitic sandstone and oolitic dolomite				10	*	
50	(CONTINUED ON NEXT PAGE)						

# LOG OF TEST BORING

MW-4 (Cont.)

120 86-797

VERTICAL SCALE 1" = 3'

BORING NO.

PROJECT RIVER FALLS LANDFILL, RIVER FALLS, WISCONSIN

DEPTH  
IN  
FEET

DESCRIPTION OF MATERIAL

GEOLOGIC  
ORIGIN

N

WL

SAMPLE

NO

TYPE

COMMENTS

DOLOMITIC LIMESTONE (Cont.)

PRAIRIE  
DU CHIEN  
FORMATION  
SHAKOPEE  
FORMATION  
(Cont.)

11 \*

12 \*

13 \*

14 \*

68

End of Boring

\*Air/Rotary cuttings sample  
Note: Monitoring well installed in  
boring. See attached "Instal-  
lation of Monitoring Well"  
data sheet.

## WATER LEVEL MEASUREMENTS

START 8-21-86 COMPLETE 8-21-86

DATE TIME SAMPLED DEPTH CASING DEPTH CAVE-IN DEPTH BAILED DEPTHS WATER LEVEL

METHOD

@

8-21 68'

48'

CREW CHIEF

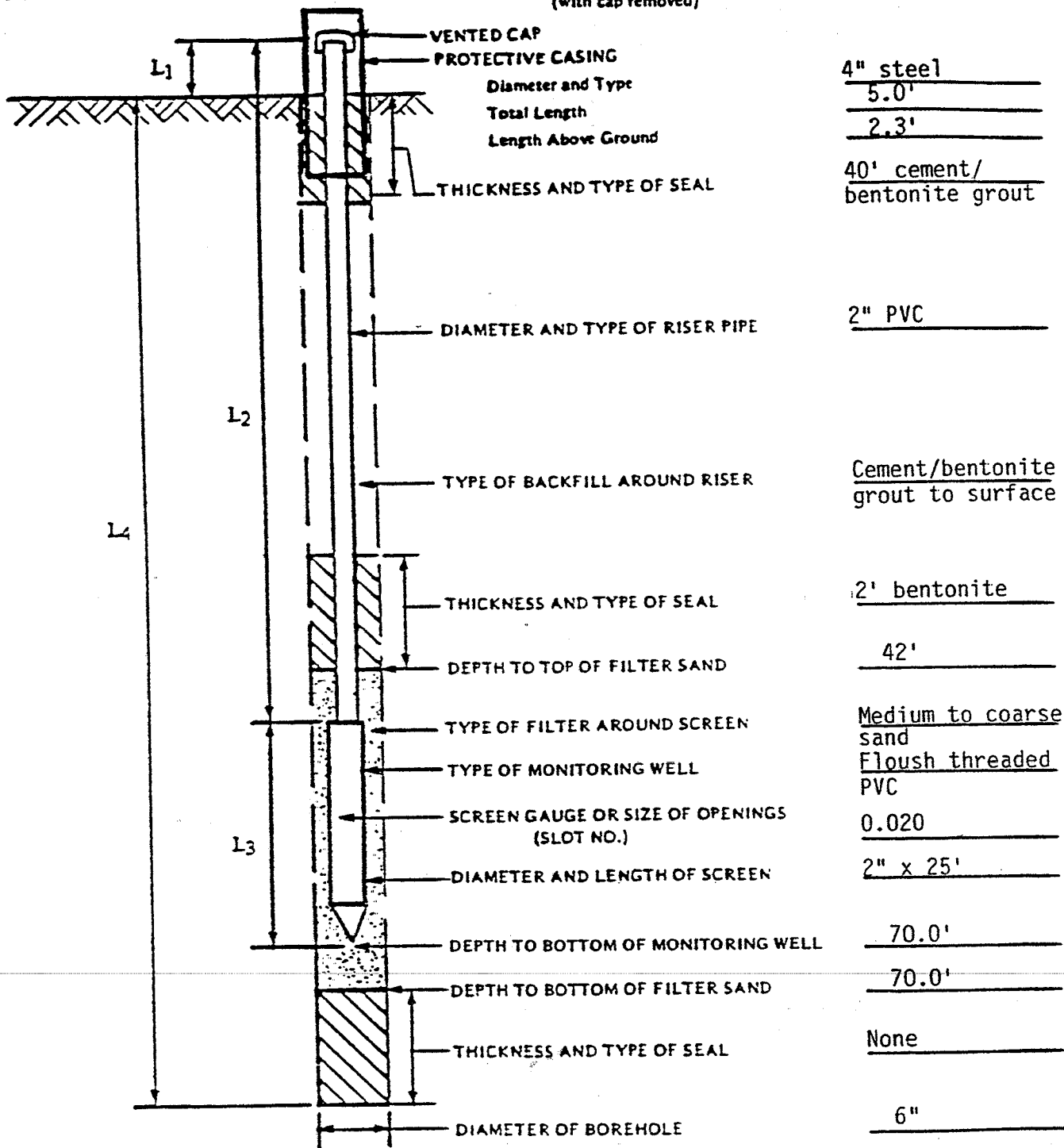
Drilled by others

# INSTALLATION OF MONITORING WELL

DB NO. 120 86-797

MONITORING WELL NO. MW-4

GROUND SURFACE ELEVATION 915.74 TOP OF RISER PIPE ELEVATION (with cap removed) 917.75



L<sub>1</sub> = 2.0 FT

L<sub>2</sub> = 47.0 FT

L<sub>3</sub> = 25.0 FT

L<sub>4</sub> = 70.0 FT

INSTALLATION COMPLETED:

Date 8-21-86 Time P.M.

MONITORING WELL WATER LEVEL MEASUREMENTS			
DATE	TIME	BAILED DEPTHS	WATER LEVEL (1)
8-21-86	p.m.		48'

(1) DEPTH BELOW TOP OF RISER PIPE

# LOG OF TEST BORING

120 86-797

VERTICAL SCALE 1" = 3'

BORING NO MW-5

PROJECT RIVER FALLS LANDFILL, RIVER FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL ↓ SURFACE ELEVATION	GEOLOGIC ORIGIN	N	WL	SAMPLE		COMMENTS
					NO	TYPE	
	SAND W/SILT, fine grained, brown and some dark brown (SP-SM)	COARSE ALLUVIUM			1	*	
5							
	SANDSTONE, tan and light brown	POSSIBLE ST. PETER FORMATION			2	*	
					3	*	
15							
	DOLOMITIC LIMESTONE, brown, tan and buff, interbedded with a few layers of dolomitic sandstone	PRAIRIE DU CHIEN FORMATION SHAKOPEE MEMBER			4	*	
					5	*	
25							
	(CONTINUED ON NEXT PAGE)						

# LOG OF TEST BORING

OB NO. 120 86-797 VERTICAL SCALE 1" = 3' BORING NO. MW-5 (Cont.)  
 PROJECT RIVER FALLS LANDFILL, RIVER FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		COMMENTS
					NO	TYPE	
25	DOLOMITIC LIMESTONE, brown, tan and buff, interbedded with layers of dolomitic sandstone and a few lenses of oolitic dolomite	PRAIRIE DU CHIEN FORMATION SHAKOPEE MEMBER (Cont.)			6	*	
					7	*	
35	DOLOMITIC LIMESTONE, light gray to buff, interbedded with a few layers of dolomitic sandstone				8	*	
					9	*	
45	DOLOMITIC LIMESTONE, light gray and buff, interbedded with layers of dolomitic sandstone and a few lenses of oolitic dolomite				10	*	
50	(Continued on Next Page)						

# LOG OF TEST BORING

FILE NO. 120 86-797

VERTICAL SCALE 1" = 3'


BORING NO MW-5 (Cont.)

PROJECT RIVER FALLS LANDFILL, RIVER FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL ↓ SURFACE ELEVATION	GEOLOGIC ORIGIN	N	WL	SAMPLE		COMMENTS
					NO	TYPE	
4	DOLOMITIC LIMESTONE, light gray and buff, interbedded with layers of dolomitic sandstone and a few lenses of oolitic dolomite	PRAIRIE DU CHIEN FORMATION SHAKOPEE MEMBER			10	SB	
					11	SB	
55	DOLOMITIC LIMESTONE, light gray and buff, interbedded with layers of dolomitic sandstone from about 60-65' and a few lenses of oolitic dolomite				12	SB	
					13	SB	
65	(CONTINUED ON NEXT PAGE)						

# LOG OF TEST BORING

OB NO 120-86-797 VERTICAL SCALE 1" = 3' BORING NO MW-5 (Cont.)  
 PROJECT RIVER FALLS LANDFILL, RIVER FALLS, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		COMMENTS
					NO	TYPE	
50	DOLOMITIC LIMESTONE (Cont.)	PRAIRIE DU CHIEN FORMATION SHAKOPEE MEMBER (Cont.)					
					11	*	
55	DOLOMITIC LIMESTONE, light gray and buff, interbedded with layers of dolomitic sandstone at about 60'-65' and a few lenses of oolitic dolomite				12	*	
					13	*	
					14	*	
71	End of Boring *Air/Rotary cuttings sample Note: Monitoring well installed in boring. See attached "Installation of Monitoring Well" data sheet.						

## WATER LEVEL MEASUREMENTS

START 8-22-86 COMPLETE 8-22-86

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL	METHOD	@
8-22		71'			to	51'		
					to			
					to			
					to			

CREW CHIEF Drilled by Others

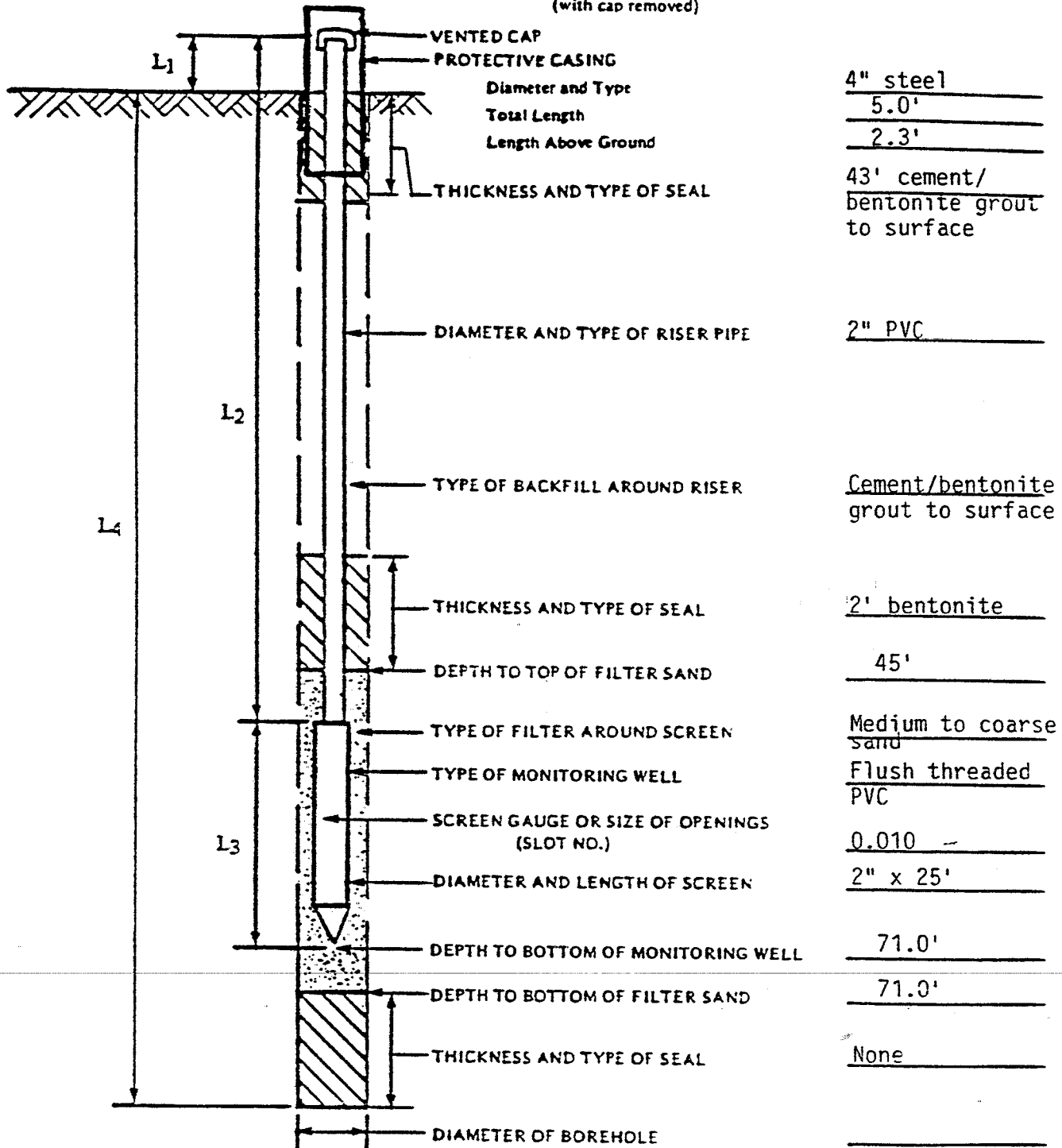
# INSTALLATION OF MONITORING WELL

OB NO. 120 86-797

MONITORING WELL NO. MW-5

GROUND SURFACE ELEVATION 922.59

TOP OF RISER PIPE ELEVATION 924.60  
(with cap removed)



2.0 FT  
48.0 FT  
25.0 FT  
71.0 FT

INSTALLATION COMPLETED:

on 8-22-86 Time p.m.

MONITORING WELL WATER LEVEL MEASUREMENTS			
DATE	TIME	BAILED DEPTHS	WATER LEVEL (1)
8-22-86	p.m.		51'

(1) DEPTH BELOW TOP OF RISER PIPE



## **PHASE I AND PHASE II WELL LOGS**

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# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-04)

PROJECT NAME: RIVER FALLS LANDFILL

HOLE DESIGNATION: MW-6

PROJECT NO.: 5349



(Page 1 of 3)  
DATE COMPLETED: SEPTEMBER 28, 1993

CLIENT: CITY OF RIVER FALLS

DRILLING METHOD: 6" HSA/  
6" AIR ROTARY

LOCATION: RIVER FALLS, WI

CRA SUPERVISOR: P. J. STORLIE

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE				
				NUMBER	STATE	VALUE	PID	
	REFERENCE POINT (Top of Riser) GROUND SURFACE	924.72 922.5						
	TOPSOIL							
2.5	SANDSTONE, layered buff and brown(1 to 2") then primary layer (1/8" thick), fine grained, possibly weathered, well rounded, moist - colored layering - light orange, white, light green, (6" layers)	921.0		1SS	X	8	1.8	
5.0								
7.5								
10.0								
12.5								
15.0	LIMESTONE, weathered - colored layering - gray green brown, trace shale partings	908.7			3SS	X		0.4
17.5								
20.0								
22.5								
25.0	SANDSTONE, buff, fine to medium grained, well rounded, poorly consolidated, trace light green, dry, shale partings	897.5						
27.5								
30.0								
32.5	LIMESTONE, some sandstone, colored, dry	892.5			5WC	X		

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-04)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-6

DATE COMPLETED: (Page 2 of 3)  
SEPTEMBER 28, 1993

DRILLING METHOD: 6" HSA/  
6" AIR ROTARY

CRA SUPERVISOR: P. J. STORLIE

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
							(ppm)
35.0							
37.5							
40.0	SANDSTONE, some limestone interbeds, colored	882.5		6WC	X		
42.5			CEMENT/ BENTONITE GROUT				
45.0			6" BOREHOLE				
47.5							
50.0	LIMESTONE, some sandstone	872.5		7WC	X		
52.5			BENTONITE PELLET SEAL				
55.0			2" STEEL PIPE				
57.5							
60.0			SAND PACK	8WC	X		
62.5			WELL SCREEN				
65.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS ○ WATER FOUND ∇ STATIC WATER LEVEL ▼

# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-04)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

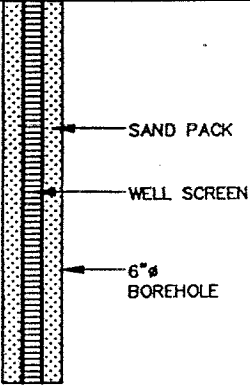
LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-6

(Page 3 of 3)  
DATE COMPLETED: SEPTEMBER 28, 1993

DRILLING METHOD: 6" Ø HSA/  
6" Ø AIR ROTARY

CRA SUPERVISOR: P. J. STORLIE

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
							(ppm)
67.5			 <p>SAND PACK</p> <p>WELL SCREEN</p> <p>6" Ø BOREHOLE</p>	9WC			
70.0							
72.5							
75.0	END OF HOLE @ 75.0 FT. BGS	847.5		10WC			
77.5							
80.0			<p><u>SCREEN DETAILS:</u>  Screened Interval:  55.0 to 75.0' BGS  Length -20.0'  Diameter --2.0"  Slot # 10  Material -Stainless Steel  Sand pack interval:  52.0 to 75.0' BGS  Material -Medium Sand</p>				
82.5							
85.0							
87.5							
90.0							
92.5							
95.0							
97.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-01)

PROJECT NAME: RIVER FALLS LANDFILL

HOLE DESIGNATION: MW-7

PROJECT NO.: 5349

(Page 1 of 3)  
DATE COMPLETED: OCTOBER 4, 1993

CLIENT: CITY OF RIVER FALLS

DRILLING METHOD: 6"Ø AIR ROTARY

LOCATION: RIVER FALLS, WI

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
	REFERENCE POINT (Top of Riser) GROUND SURFACE	923.01 921.0					
	TOPSOIL	920.5					
	SANDSTONE, buff, loose, weathered						
2.5				1SS	X		
5.0							
7.5							
10.0							
12.5				2SS	X		
15.0	LIMESTONE, buff, orange @ upper 2.0', fractured	906.2		3SS	X		
17.5							
20.0	SANDSTONE, buff, dolomitic	901.0		4SS	X		
22.5							
25.0	LIMESTONE, buff, trace shale partings, trace sand	897.0					
27.5							
30.0							
32.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L--01)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-7

(Page 2 of 3)

DATE COMPLETED: OCTOBER 4, 1993

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
						(ppm)	
35.0							
37.5							
40.0							
42.5							
45.0							
47.5							
50.0							
52.5							
55.0							
57.5							
60.0							
62.5							
65.0							

CEMENT/  
BENTONITE  
GROUT

2"Ø  
STEEL PIPE

BENTONITE  
PELLET SEAL

SAND PACK

6"Ø  
BOREHOLE

WELL SCREEN

**NOTES:**

MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-01)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

LOCATION: RIVER FALLS, WI

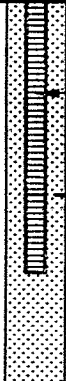
HOLE DESIGNATION: MW-7

(Page 3 of 3)

DATE COMPLETED: OCTOBER 4, 1993

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
							(ppm)
67.5			 <p style="margin-left: 100px;">WELL SCREEN</p> <p style="margin-left: 100px;">SAND PACK</p> <p style="margin-left: 100px;">6"Ø BOREHOLE</p>				
70.0							
72.5							
75.0	END OF HOLE @ 75.0 FT. BGS	846.0					
77.5							
80.0			<p><u>SCREEN DETAILS:</u>  Screened Interval:  52.0 to 72.0' BGS  Length -20.0'  Diameter -2.0"  Slot # 10  Material -Stainless Steel  Sand pack interval:  50.0 to 75.0' BGS  Material -Coarse Sand</p>				
82.5							
85.0							
87.5							
90.0							
92.5							
95.0							
97.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-02)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS






LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-8

(Page 1 of 3)  
DATE COMPLETED: SEPTEMBER 29, 1993

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
	REFERENCE POINT (Top of Riser) GROUND SURFACE	920.65 918.5					
-2.5	ML-SILT, some sand, black to gray, moist	916.5		1SS	X	10	
-5.0	SANDSTONE, buff to orange, loose, weathered			2SS	X		
-7.5	- saturated			3SS	X		
-10.0		906.5					
-12.5	LIMESTONE, buff to red to orange, fractured in upper 5.0'						
-15.0							
-17.5		898.5					
-20.0	SANDSTONE, buff, trace limestone						
-22.5							
-25.0	LIMESTONE, buff, green shale partings	894.5					
-27.5							
-30.0							
-32.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL





# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-02)

PROJECT NAME: RIVER FALLS LANDFILL

HOLE DESIGNATION: MW-8

PROJECT NO.: 5349

(Page 2 of 3)

DATE COMPLETED: SEPTEMBER 29, 1993

CLIENT: CITY OF RIVER FALLS

DRILLING METHOD: 6"Ø AIR ROTARY

LOCATION: RIVER FALLS, WI

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID (ppm)
35.0							
37.5							
40.0							
42.5	SANDSTONE, buff, dolomitic	875.5	CEMENT/ BENTONITE GROUT 2"Ø STEEL PIPE				
45.0							
47.5	LIMESTONE, tan, dolomitic	872.5					
50.0			BENTONITE PELLET SEAL				
52.5							
55.0			6"Ø BOREHOLE				
57.5			SAND PACK				
60.0							
62.5			WELL SCREEN				
65.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-02)

PROJECT NAME: RIVER FALLS LANDFILL

HOLE DESIGNATION: MW-8

PROJECT NO.: 5349

(Page 3 of 3)

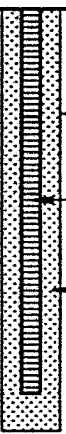
DATE COMPLETED: SEPTEMBER 29, 1993

CLIENT: CITY OF RIVER FALLS

DRILLING METHOD: 6"Ø AIR ROTARY

LOCATION: RIVER FALLS, WI

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID (ppm)
67.5			 <p>6"Ø BOREHOLE</p> <p>WELL SCREEN</p> <p>SAND PACK</p> <p>SCREEN DETAILS:  Screened Interval:  55.0 to 75.0' BGS  Length -20.0'  Diameter -2.0"  Slot # 10  Material -Stainless Steel  Sand pack interval:  50.0 to 76.0' BGS  Material -Coarse Sand</p>				
70.0							
72.5							
75.0							
77.5	END OF HOLE @ 76.0 FT. BGS	842.5					
80.0							
82.5							
85.0							
87.5							
90.0							
92.5							
95.0							
97.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-03)

PROJECT NAME: RIVER FALLS LANDFILL

HOLE DESIGNATION: MW-9

PROJECT NO.: 5349

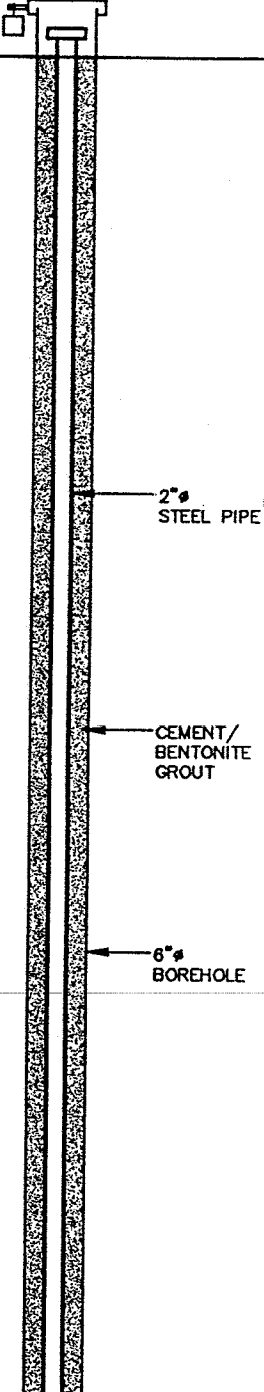
(Page 1 of 3)  
DATE COMPLETED: SEPTEMBER 29, 1993

CLIENT: CITY OF RIVER FALLS

DRILLING METHOD: 6"Ø AIR ROTARY

LOCATION: RIVER FALLS, WI

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
	REFERENCE POINT (Top of Riser) GROUND SURFACE	930.47 928.5					
	TOPSOIL	928.0					
2.5	SANDSTONE, buff, fine grained, weathered						
5.0							
7.5							
10.0							
12.5							
15.0							
17.5							
20.0							
22.5	LIMESTONE, orange brown, weathered	906.5					
25.0							
27.5							
30.0	SANDSTONE, fine to medium grained, poorly cemented, trace shale	900.5					
32.5	LIMESTONE, buff, dolomitic, trace sand	897.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-03)

PROJECT NAME: RIVER FALLS LANDFILL

HOLE DESIGNATION: MW-9

PROJECT NO.: 5349

(Page 2 of 3)  
DATE COMPLETED: SEPTEMBER 29, 1993

CLIENT: CITY OF RIVER FALLS

DRILLING METHOD: 6" Ø AIR ROTARY

LOCATION: RIVER FALLS, WI

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID (ppm)
35.0							
37.5							
40.0							
42.5	SANDSTONE, buff, dolomitic, limestone interbeds	886.5	6" Ø BOREHOLE				
45.0			CEMENT/ BENTONITE GROUT				
47.5			2" Ø STEEL PIPE				
50.0							
52.5	LIMESTONE, buff, dolomitic, trace buff sandstone	875.5	BENTONITE PELLET SEAL				
55.0							
57.5			SAND PACK				
60.0							
62.5			WELL SCREEN				
65.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-03)

PROJECT NAME: RIVER FALLS LANDFILL

HOLE DESIGNATION: MW-9

PROJECT NO.: 5349

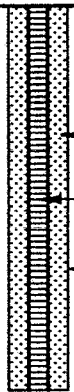
(Page 3 of 3)  
DATE COMPLETED: SEPTEMBER 29, 1993

CLIENT: CITY OF RIVER FALLS

DRILLING METHOD: 6"Ø AIR ROTARY

LOCATION: RIVER FALLS, WI

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID (ppm)
67.5			 <p>SAND PACK</p> <p>WELL SCREEN</p> <p>6"Ø BOREHOLE</p>				
70.0							
72.5							
75.0	END OF HOLE @ 75.0 FT. BGS	853.5	<p><u>SCREEN DETAILS:</u>  Screened Interval:  55.0 to 75.0' BGS  Length -20.0'  Diameter -2.0"  Slot # 10  Material -Stainless Steel  Sand pack interval:  52.0 to 75.0' BGS  Material -Coarse Sand</p>				
77.5							
80.0							
82.5							
85.0							
87.5							
90.0							
92.5							
95.0							
97.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-04)

PROJECT NAME: RIVER FALLS LANDFILL

HOLE DESIGNATION: MW-6

PROJECT NO.: 5349

(Page 1 of 3)  
DATE COMPLETED: SEPTEMBER 28, 1993

CLIENT: CITY OF RIVER FALLS

DRILLING METHOD: 6" HSA/  
6" AIR ROTARY

LOCATION: RIVER FALLS, WI

CRA SUPERVISOR: P. J. STORLIE

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID (ppm)
	REFERENCE POINT (Top of Riser) GROUND SURFACE	924.72 922.5					
	TOPSOIL						
2.5	SANDSTONE, layered buff and brown(1 to 2") then primary layer (1/8" thick), fine grained, possibly weathered, well rounded, moist - colored layering - light orange, white, light green, (6" layers)	921.0		1SS	X	8	1.8
5.0							
7.5							
10.0	LIMESTONE, weathered - colored layering - gray green brown, trace shale partings	908.7		2SS	X	10	1.5
12.5							
15.0				3SS	X		0.4
17.5							
20.0				4WC	X		
22.5							
25.0	SANDSTONE, buff, fine to medium grained, well rounded, poorly consolidated, trace light green, dry, shale partings	897.5					
27.5							
30.0							
32.5	LIMESTONE, some sandstone, colored, dry	892.5			5WC	X	

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS: WATER FOUND STATIC WATER LEVEL

# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-04)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-6

(Page 2 of 3)

DATE COMPLETED: SEPTEMBER 28, 1993

DRILLING METHOD: 6" HSA/  
6" AIR ROTARY

CRA SUPERVISOR: P. J. STORIE

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
							(ppm)
35.0							
37.5							
40.0	SANDSTONE, some limestone interbeds, colored	882.5		6WC	X		
42.5			CEMENT/ BENTONITE GROUT				
45.0			6" BOREHOLE				
47.5				7WC	X		
50.0	LIMESTONE, some sandstone	872.5					
52.5			BENTONITE PELLET SEAL				
55.0			2" STEEL PIPE				
57.5				8WC	X		
60.0			SAND PACK				
62.5			WELL SCREEN				
65.0							

**NOTES:** MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-04)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS


LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-6

(Page 3 of 3)  
DATE COMPLETED: SEPTEMBER 28, 1993

DRILLING METHOD: 6" HSA/  
6" AIR ROTARY

CRA SUPERVISOR: P. J. STORLIE

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
							(ppm)
67.5			 <p>SAND PACK</p> <p>WELL SCREEN</p> <p>6" BOREHOLE</p>	9WC	X		
70.0							
72.5							
75.0	END OF HOLE @ 75.0 FT. BGS	847.5		10WC	X		
77.5			<p><u>SCREEN DETAILS:</u>  Screened Interval:  55.0 to 75.0' BGS  Length -20.0'  Diameter -2.0"  Slot # 10  Material -Stainless Steel  Sand pack interval:  52.0 to 75.0' BGS  Material -Medium Sand</p>				
80.0							
82.5							
85.0							
87.5							
90.0							
92.5							
95.0							
97.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL





# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-05)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

LOCATION: RIVER FALLS, WI



HOLE DESIGNATION: MW-4D

(Page 1 of 4)

DATE COMPLETED: MARCH 17, 1994

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE				
				NUMBER	STATE	VALUE	PID (ppm)	
	REFERENCE POINT (Top of Riser) GROUND SURFACE	918.21 916.4						
2.5	ML/SP-SILT and SAND, weathered, gray and tan, dry	903.4						
5.0								
7.5								
10.0								
12.5	LIMESTONE, fractured, tan and brown	903.4		2"Ø STEEL CASING				
15.0								
17.5				CEMENT/ BENTONITE GROUT				
20.0								
22.5				6"Ø BOREHOLE				
25.0								
27.5								
30.0								
32.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-05)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-4D

(Page 2 of 4)

DATE COMPLETED: MARCH 17, 1994

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID (ppm)
35.0							
37.5							
40.0							
42.5							
45.0							
47.5							
50.0							
52.5							
55.0							
57.5							
60.0							
62.5							
65.0							

2"Ø  
STEEL CASING

CEMENT/  
BENTONITE  
GROUT

6"Ø  
BOREHOLE

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-05)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-4D

DATE COMPLETED: MARCH 17, 1994

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
							(ppm)
67.5							
70.0							
72.5							
75.0							
77.5							
80.0							
82.5							
85.0							
87.5							
90.0							
92.5							
95.0							
97.5							

CEMENT/  
BENTONITE  
GROUT

2"Ø  
STEEL CASING

BENTONITE  
PELLET SEAL

6"Ø  
BOREHOLE

SAND PACK

WELL SCREEN

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-05)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

LOCATION: RIVER FALLS, WI

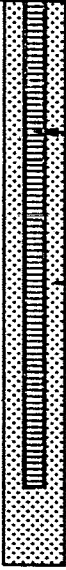
HOLE DESIGNATION: MW-4D

(Page 4 of 4)

DATE COMPLETED: MARCH 17, 1994

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID (ppm)
100.0			 <p>WELL SCREEN</p> <p>SAND PACK</p> <p>6"Ø BOREHOLE</p>				
102.5							
105.0							
107.5							
110.0							
112.5	END OF HOLE @ 112.0 FT. BGS	804.4	<p><u>SCREEN DETAILS:</u>  Screened Interval:  90.0 to 110.0' BGS  Length -20.0'  Diameter -2.0"  Slot # 10  Material -Stainless Steel  Sand pack interval:  87.0 to 112.0' BGS  Material -Coarse Sand</p>				
115.0							
117.5							
120.0							
122.5							
125.0							
127.5							
130.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-06)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS


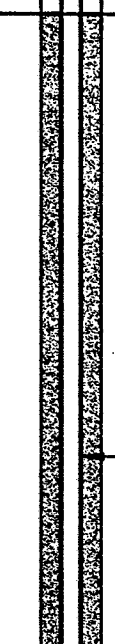

LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-7D

(Page 1 of 4)  
DATE COMPLETED: MARCH 16, 1994

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
	REFERENCE POINT (Top of Riser) GROUND SURFACE	922.09 920.1					
-2.5	SP-SAND, loose, medium grained, poorly graded, tan						
-5.0							
-7.5							
-10.0							
-12.5							
-15.0							
-17.5	LIMESTONE, buff, dolomitic	903.6					
-20.0							
-22.5							
-25.0							
-27.5							
-30.0							
-32.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-06)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-7D

DATE COMPLETED: MARCH 16, 1994  
(Page 2 of 4)

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
							(ppm)
-35.0							
-37.5							
-40.0							
-42.5							
-45.0							
-47.5							
-50.0		870.1					
-52.5							
-55.0							
-57.5							
-60.0							
-62.5							
-65.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-06)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-7D

(Page 3 of 4)  
DATE COMPLETED: MARCH 16, 1994

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID (ppm)
67.5							
70.0							
72.5							
75.0							
77.5							
80.0							
82.5							
85.0							
87.5							
90.0							
92.5							
95.0							
97.5							

6"Ø  
BOREHOLE

CEMENT/  
BENTONITE  
GROUT

2"Ø  
STEEL CASING

BENTONITE  
PELLET SEAL

SAND PACK

WELL SCREEN

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-06)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

LOCATION: RIVER FALLS, WI

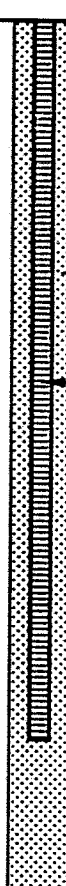
HOLE DESIGNATION: MW-7D

(Page 4 of 4)

DATE COMPLETED: MARCH 16, 1994

DRILLING METHOD: 6"  $\phi$  AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID (ppm)
100.0			 <p>6" <math>\phi</math> BOREHOLE</p> <p>SAND PACK</p> <p>WELL SCREEN</p>				
102.5							
105.0							
107.5							
110.0							
112.5							
115.0							
117.5							
120.0	END OF HOLE @ 120.0 FT. BGS	800.1					
122.5							
125.0							
127.5							
130.0							

## SCREEN DETAILS:

Screened Interval:

96.0 to 116.0' BGS

Length -20.0'

Diameter -2.0"

Slot # 10

Material -Stainless Steel

Sand pack interval:

90.0 to 120.0' BGS

Material -Coarse Sand

## NOTES:

MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL





# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-07)

PROJECT NAME: RIVER FALLS LANDFILL

HOLE DESIGNATION: MW-10

PROJECT NO.: 5349


(Page 1 of 3)  
DATE COMPLETED: MARCH 17, 1994

CLIENT: CITY OF RIVER FALLS

DRILLING METHOD: 6"Ø AIR ROTARY

LOCATION: RIVER FALLS, WI

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
	REFERENCE POINT (Top of Riser) GROUND SURFACE	908.48 907.5					
2.5	ML/SP-SILT and SAND, weathered, gray and tan, dry						
5.0							
7.5							
10.0	LIMESTONE, buff and brown, strongly fractured	899.5					
12.5							
15.0							
17.5							
20.0							
22.5							
25.0							
27.5							
30.0							
32.5							

**NOTES:**

MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-07)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-10

DATE COMPLETED: MARCH 17, 1994  
(Page 2 of 3)

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID (ppm)
-35.0							
-37.5							
-40.0							
-42.5							
-45.0		862.5					
-47.5							
-50.0							
-52.5							
-55.0							
-57.5							
-60.0							
-62.5							
-65.0							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-07)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

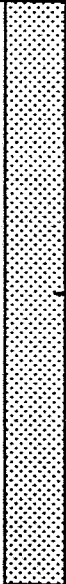
LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-10

DATE COMPLETED: (Page 3 of 3)  
MARCH 17, 1994

DRILLING METHOD: 6" Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
67.5							
70.0							
72.5							
75.0							
77.5							
80.0	END OF HOLE @ 80.0 FT. BGS	827.5					
82.5			<b>SCREEN DETAILS:</b> Screened Interval: 45.1 to 65.1' BGS Length -20.0' Diameter -2.0" Slot # 10 Material -Stainless Steel Sand pack interval: 39.5 to 80.0' BGS Material -Coarse Sand				
85.0							
87.5							
90.0							
92.5							
95.0							
97.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-08)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

LOCATION: RIVER FALLS, WI


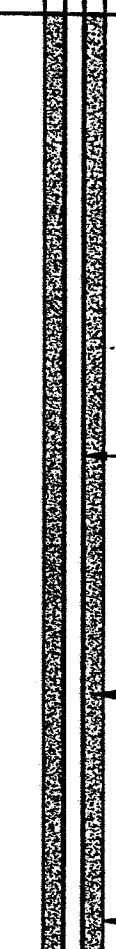
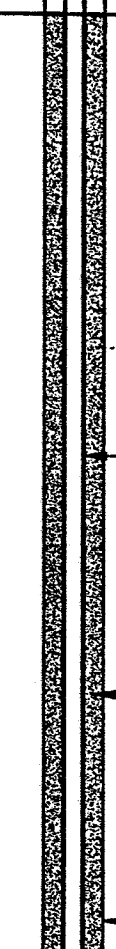
HOLE DESIGNATION: MW-11

(Page 1 of 3)

DATE COMPLETED: MARCH 17, 1994

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID (ppm)
	REFERENCE POINT (Top of Riser) GROUND SURFACE	908.86 906.5					
-2.5	ML-SILT, some sand, gray, dry	902.2					
-5.0	SP-SAND, medium grained, poorly graded, weathered, tan and white, dry						
-7.5							
-10.0		895.2					
-12.5	LIMESTONE, tan and brown, dolomitic, fractured						
-15.0							
-17.5							
-20.0							
-22.5							
-25.0							
-27.5							
-30.0							
-32.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-08)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-11

DATE COMPLETED: (Page 2 of 3)  
MARCH 17, 1994

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
						(ppm)	
35.0			CEMENT/ BENTONITE GROUT				
37.5			BENTONITE PELLET SEAL				
40.0			6"Ø BOREHOLE				
42.5			2"Ø STEEL CASING				
45.0		860.5					
47.5							
50.0							
52.5							
55.0			SAND PACK				
57.5							
60.0			WELL SCREEN				
62.5							
65.0							

**NOTES:**

MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-08)

PROJECT NAME: RIVER FALLS LANDFILL

HOLE DESIGNATION: MW-11

PROJECT NO.: 5349

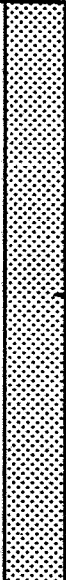
(Page 3 of 3)  
DATE COMPLETED: MARCH 17, 1994

CLIENT: CITY OF RIVER FALLS

DRILLING METHOD: 6"Ø AIR ROTARY

LOCATION: RIVER FALLS, WI

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID (ppm)
-67.5			 <p>6"Ø BOREHOLE</p> <p>SAND PACK</p>				
-70.0							
-72.5							
-75.0							
-77.5							
-80.0	END OF HOLE @ 80.0 FT. BGS	826.5	<p><u>SCREEN DETAILS:</u>  Screened Interval:  45.4 to 65.4' BGS  Length -20.0'  Diameter -2.0"  Slot # 10  Material -Stainless Steel  Sand pack interval:  40.0 to 80.0' BGS  Material -Coarse Sand</p>				
-82.5							
-85.0							
-87.5							
-90.0							
-92.5							
-95.0							
-97.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-09)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

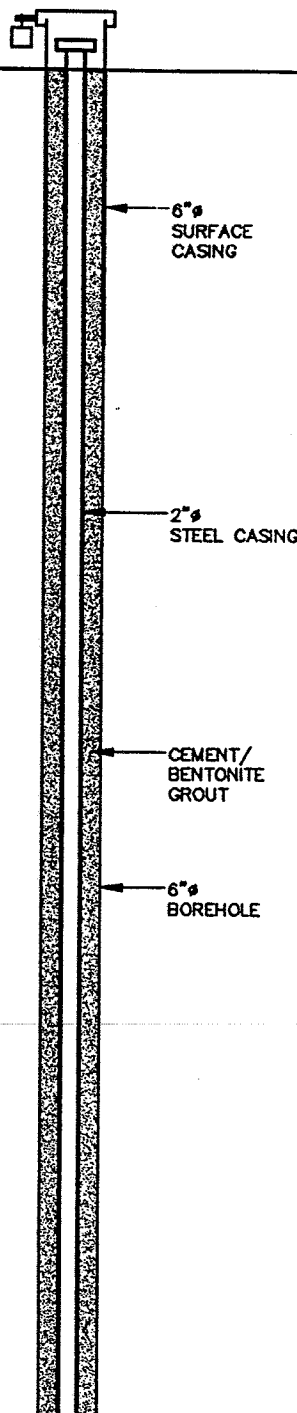
LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-12

DATE COMPLETED: MARCH 16, 1994  
(Page 1 of 3)

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
	REFERENCE POINT (Top of Riser) GROUND SURFACE	909.21 906.5					
	ML-SILT, weathered sandstone, loose						
-2.5							
-5.0							
-7.5	LIMESTONE, dolomitic, frequent voids	899.5					
-10.0							
-12.5							
-15.0							
-17.5							
-20.0							
-22.5							
-25.0							
-27.5							
-30.0							
-32.5							

**NOTES:** MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-09)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-12

DATE COMPLETED: MARCH 16, 1994  
(Page 2 of 3)

DRILLING METHOD: 6" Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
35.0							
37.5							
40.0							
42.5							
45.0							
47.5							
50.0							
52.5							
55.0							
57.5							
60.0							
62.5							
65.0							

855.5



CEMENT/  
BENTONITE  
GROUT

8" Ø  
BOREHOLE

BENTONITE  
PELLET SEAL

2" Ø  
STEEL CASING

SAND PACK

WELL SCREEN

**NOTES:**

MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL





# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-09)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS

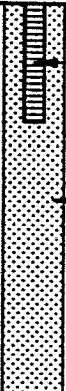
LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-12

DATE COMPLETED: (Page 3 of 3)  
MARCH 16, 1994

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID (ppm)
67.5			 <p>WELL SCREEN</p> <p>6"Ø BOREHOLE</p> <p>SAND PACK</p>				
70.0							
72.5							
75.0	END OF HOLE @ 75.0 FT. BGS	831.5					
77.5							
80.0							
82.5							
85.0							
87.5							
90.0							
92.5							
95.0							
97.5							

**SCREEN DETAILS:**

Screens Interval:  
48.0 to 68.0' BGS

Length -20.0'

Diameter -2.0"

Slot # 10

Material -Stainless Steel

Sand pack interval:

45.0 to 75.0' BGS  
Material -Coarse Sand

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-10)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS


LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-13

DATE COMPLETED: MARCH 16, 1994  
(Page 1 of 3)

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
	REFERENCE POINT (Top of Riser) GROUND SURFACE	915.47 913.4					
	ML-SILT, some sand, gray, dry						
-2.5	SP-SAND, medium grained, poorly graded, weathered, tan, dry	911.4					
-5.0							
-7.5							
-10.0							
-12.5	LIMESTONE, brown and tan, dolomitic, fractured	901.4					
-15.0							
-17.5							
-20.0							
-22.5							
-25.0							
-27.5							
-30.0							
-32.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-10)

PROJECT NAME: RIVER FALLS LANDFILL

HOLE DESIGNATION: MW-13

PROJECT NO.: 5349

DATE COMPLETED: (Page 2 of 3)  
MARCH 16, 1994

CLIENT: CITY OF RIVER FALLS

DRILLING METHOD: 6"Ø AIR ROTARY

LOCATION: RIVER FALLS, WI

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID (ppm)
35.0							
37.5							
40.0							
42.5							
45.0							
47.5							
50.0	— frequent fractures	862.4					
52.5							
55.0							
57.5							
60.0							
62.5							
65.0							

**NOTES:** MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS ○

WATER FOUND ∇

STATIC WATER LEVEL ▼

# STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-10)

PROJECT NAME: RIVER FALLS LANDFILL

PROJECT NO.: 5349

CLIENT: CITY OF RIVER FALLS


LOCATION: RIVER FALLS, WI

HOLE DESIGNATION: MW-13

(Page 3 of 3)  
DATE COMPLETED: MARCH 16, 1994

DRILLING METHOD: 6"Ø AIR ROTARY

CRA SUPERVISOR: J. MICHELS

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE			
				NUMBER	STATE	VALUE	PID
-67.5			 <p>WELL SCREEN</p> <p>6"Ø BOREHOLE</p> <p>SAND PACK</p>				
-70.0							
-72.5							
-75.0	END OF HOLE @ 75.0 FT. BGS	838.4					
-77.5							
-80.0			<p><u>SCREEN DETAILS:</u>  Screened Interval: 48.0 to 68.0' BGS  Length -20.0'  Diameter -2.0"  Slot # 10  Material -Stainless Steel  Sand pack interval: 45.0 to 75.0' BGS  Material -Coarse Sand</p>				
-82.5							
-85.0							
-87.5							
-90.0							
-92.5							
-95.0							
-97.5							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS



WATER FOUND



STATIC WATER LEVEL



Well Construction Report For  
WISCONSIN UNIQUE WELL NUMBER

117 102

Property Owner John Najewski Telephone Number 715) 425 8026Mailing Address N8491 1015th St.City Union Falls State MN Zip Code 54022County of Well Location Polk Co. Well Permit No. W Well Completion Date (mm-dd-yy) 2-3-94Well Constructor (Business Name) Steve Martell Drilling License # 125Address P.O. Box 28City Somerset State WI Zip Code 54025

Somerset WI

2. Mark well location with a dot in correct 40 acre parcel of section. N

W		E
	X	
		S

State of Wisconsin  
Private Water Supply - WS/2  
Department of Natural Resources  
Box 7921  
Madison, WI 53707(Please type or print  
using a black pen.)Darkened for  
Legibility

## 1. Well Location Please use decimals instead of fractions.

☐ Town ☐ City ☐ Village Fire # (if avail.)of River Falls  
Grid or Street Address or Road Name and Number (if avail.)

Subdivision Name Lot # Block #

Gov't Lot # or 1/4 of 1/4 of

Section 11, T 27 N; R 19 ☐ E ☒ W3. Well Type ☐ New☒ Replacement ☐ Reconstruction

of previous unique well # constructed in 19 Reason for new, replaced or reconstructed well?

Well serves 1 # of homes and or 1 home  
(Ex: barn, restaurant, church, school, industry, etc.)Well located on highest point of property, consistent with the general layout and surroundings? ☒ Yes ☐ No If no, explain on back side.Well located in floodplain? ☐ Yes ☒ No  
Distance in Feet From Well To Nearest:

1. Landfill
2. Building Overhang
3. Septic or Holding Tank (circle one)
4. Sewage Absorption Unit
5. Nonconforming Pit
6. Buried Home Heating Oil Tank
7. Buried Petroleum Tank
8. Shoreline/Swimming Pool

## 9. Downspout/Yard Hydrant

10. Privy

11. Foundation Drain to Clearwater

12. Foundation Drain to Sewer

13. Building Drain

☐ Cast Iron or Plastic ☐ Other14. Building Sewer ☐ Gravity ☐ Pressure☐ Cast Iron or Plastic ☐ Other

15. Collector or Street Sewer

16. Clearwater Sump

17. Wastewater Sump

18. Paved Animal Barn Pen

19. Animal Yard or Shelter

20. Silo - Type

21. Barn Gutter

22. Manure Pipe ☐ Gravity ☐ Pressure☐ Cast Iron or Plastic ☐ Other

23. Other Manure Storage

Other NR 112 Waste Source

24.

6. Drillhole Dimensions  
From To  
Dia. (in.) (ft.) (ft.)

10 surface 325

6 325 350

Method of constructing upper  
enlarged drillhole only.☒ 1. Rotary - Mud Circulation☒ 2. Rotary - Air☒ 3. Rotary - Foam☐ 4. Reverse Rotary☐ 5. Cable-tool Bit in. dia.☒ 6. Temp. Outer Casing 12 in. dia.Removed? ☒ Yes ☐ No

If no, explain

☐ 7. OtherDNK  
USE  
ONLY9. Geology  
Type, Caving/Noncaving, Color, Hardness, Etc.From To  
(ft.) (ft.)

Sand

Surface 20

Lime Rock

20 275

Sand Rock

275 350

Casing, Liner, Screen  
Material, Weight, Specification  
Manufacturer & Method of Assembly

Dia. (in.) 6 19.45 # ft ASTAN-53

From To  
(ft.) (ft.)

surface 325

Dia. (in.) screen type, material &amp; slot size

From To

## 8. Grout or Other Sealing Material

Method PUMP From To Sacks  
Kind of Sealing Material (ft.) (ft.) Cement

Neat cement surface 325 133

## 10. Static Water Level

ft. above ground surface  
50 ft. below ground surface

## 12. Well Is:

12 in. ☒ Above ☐ Below Grade

## 11. Pump Test

Pumping Level 50.6 ft. below surface

Developed? ☒ Yes ☐ NoDisinfected? ☒ Yes ☐ NoCapped? ☒ Yes ☐ No

Pumping at 20 GPM for 1 hours

## 13. Did you permanently seal all unused, noncomplying, or unsafe wells?

☐ Yes ☐ No If no, explain14. Signature of Point Driver or Licensed Supervisory Driller Steve Martell Date Signed 3/8/94

Signature of Drill Rig Operator (Mandatory unless same as above) Date Signed

Make additional comments on reverse side about geology, additional screens, water quality, etc.  
Comments on reverse side (Check V, if yes)

WELL CONSTRUCTOR

WELL CONSTRUCTION REPORT  
Form 3300-77A Rev. 7-93

Well Construction Report For  
WISCONSIN UNIQUE WELL NUMBER

446

State of Wisconsin

Private Water Supply - WS/2  
Department of Natural Resources  
Box 7921Madison, WI 53701 (Please type or print  
using a black pen.)Darkened for  
LegibilityProperty Owner David Frank Telephone Number 015 425 6826Mailing Address W10184 City TH FFCity River Falls State WI Zip Code 54022County of Well Location Pierce Co. Well Permit No. W Well Completion Date (mm-dd-yy) 01-11-94Well Constructor (Business Name) Remer Water Well Drilling License # 105Address P.O. Box 28City Grand Port WI State WI Zip Code 54025Somerset WI1. Well Location Please use decimals instead of fractions.  
☐ Town ☐ City ☐ Village Fire # (if avail.)  
of Five Falls  
Grid or Street Address or Road Name and Number (if avail.)Subdivision Name \_\_\_\_\_ Lot # \_\_\_\_\_ Block # \_\_\_\_\_  
Gov't Lot # \_\_\_\_\_ or \_\_\_\_\_ 1/4 of \_\_\_\_\_ 1/4 of \_\_\_\_\_  
Section 11 T 27 N; R 19 ☐ E ☒ W3. Well Type ☐ New  
☒ Replacement ☐ Reconstruction  
of previous unique well # \_\_\_\_\_ constructed in 19 \_\_\_\_\_  
Reason for new, replaced or reconstructed well?1. Well serves 1 # of homes and/or Home  
(Ex: barn, restaurant, church, school, industry, etc.)Well located on highest point of property, consistent with the general layout and surroundings? ☒ Yes ☐ No If no, explain on back side.Well located in floodplain? ☐ Yes ☒ No

Distance in Feet From Well To Nearest:

1. Landfill 252. Building Overhang 203. Septic or Holding Tank (circle one) 75

4. Sewage Absorption Unit

5. Nonconforming Pit

6. Buried Home Heating Oil Tank

7. Buried Petroleum Tank

8. Shoreline/Swimming Pool

9. Downspout/Yard Hydrant

10. Privy

11. Foundation Drain to Clearwater

12. Foundation Drain to Sewer

13. Building Drain

☐ Cast Iron or Plastic ☐ Other14. Building Sewer ☐ Gravity ☐ Pressure☐ Cast Iron or Plastic ☐ Other

15. Collector or Street Sewer

16. Clearwater Sump

17. Wastewater Sump

18. Paved Animal Barn Pen

19. Animal Yard or Shelter

20. Silo - Type \_\_\_\_\_

21. Barn Gutter

22. Manure Pipe ☐ Gravity ☐ Pressure☐ Cast Iron or Plastic ☐ Other

23. Other Manure Storage

Other NR 112 Waste Source

24.

Drillhole Dimensions From To

Dia. (in.) (ft.) (ft.)

10 surface 332

3 332 360

Method of constructing upper enlarged drillhole only.

☒ 1. Rotary - Mud Circulation☒ 2. Rotary - Air☒ 3. Rotary - Foam☒ 4. Reverse Rotary☐ 5. Cable-tool Bit \_\_\_\_\_ in. dia.☒ 6. Temp. Outer Casing 12 in. dia.Removed? ☒ Yes ☐ No

If no, explain \_\_\_\_\_

☐ 7. Other \_\_\_\_\_

9. Geology

Type, Caving/Noncaving, Color, Hardness, Etc.

From To

(ft.) (ft.)

Sandy Clay Surface 15

Lime Rock 15 378

Sand Rock 378 360

10. Static Water Level

ft. above ground surface

ft. below ground surface

55

11. Pump Test

Pumping Level 56 ft. below surfacePumping at 20 GPM for 1 hours

12. Well Is:

☒ Above Grade☐ BelowDeveloped? ☒ Yes ☐ NoDisinfected? ☒ Yes ☐ NoCapped? ☒ Yes ☐ No

13. Did you permanently seal all unused, noncomplying, or unsafe wells?

☐ Yes ☐ No If no, explain \_\_\_\_\_

14. Signature of Point Driver or Licensed Supervisory Driller

Signature of Drill Rig Operator (Mandatory unless same as above) Date Signed

Date Signed 2/9/94

Grout or Other Sealing Material

Method PUMP From To # Sacks

Kind of Sealing Material (ft.) (ft.) Cement

Seal Cement surface 332 768

Additional comments on reverse side, about geology, additional screens, water quality, etc.

Comments on reverse side (Check V, if yes)

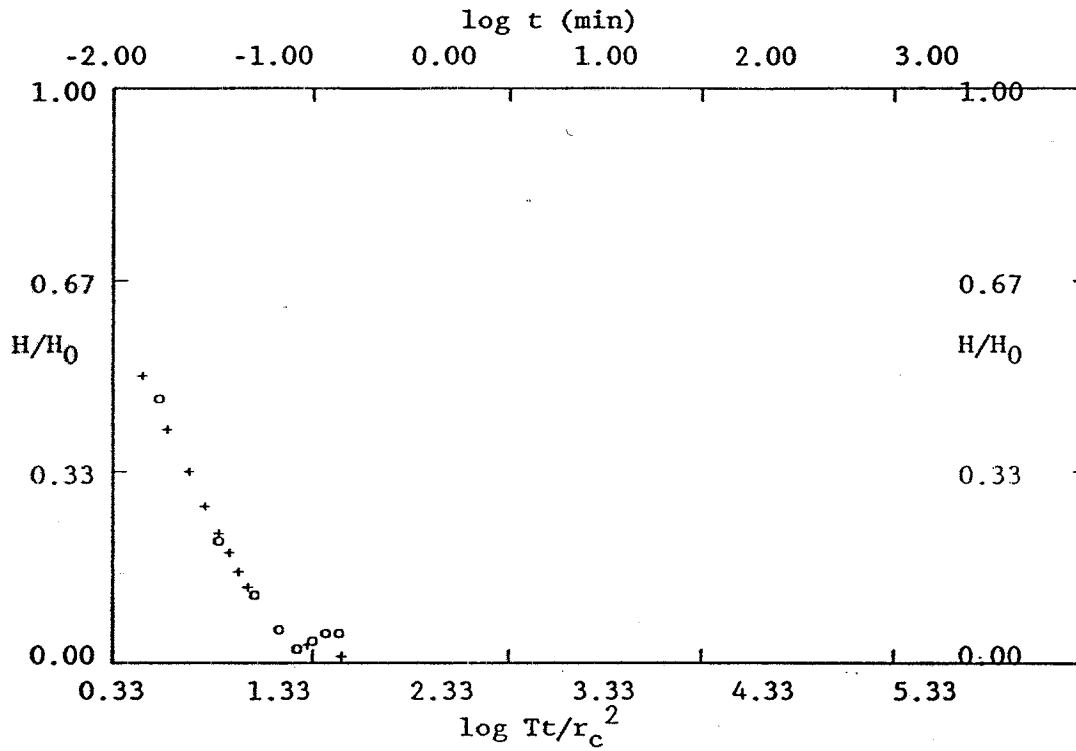
WELL CONSTRUCTOR

WELL CONSTRUCTION REPORT  
Form 3300-77A  
Rev 7.03

## **APPENDIX B**

### **SLUG TEST RESULTS**

# MW 6 RISING HEAD



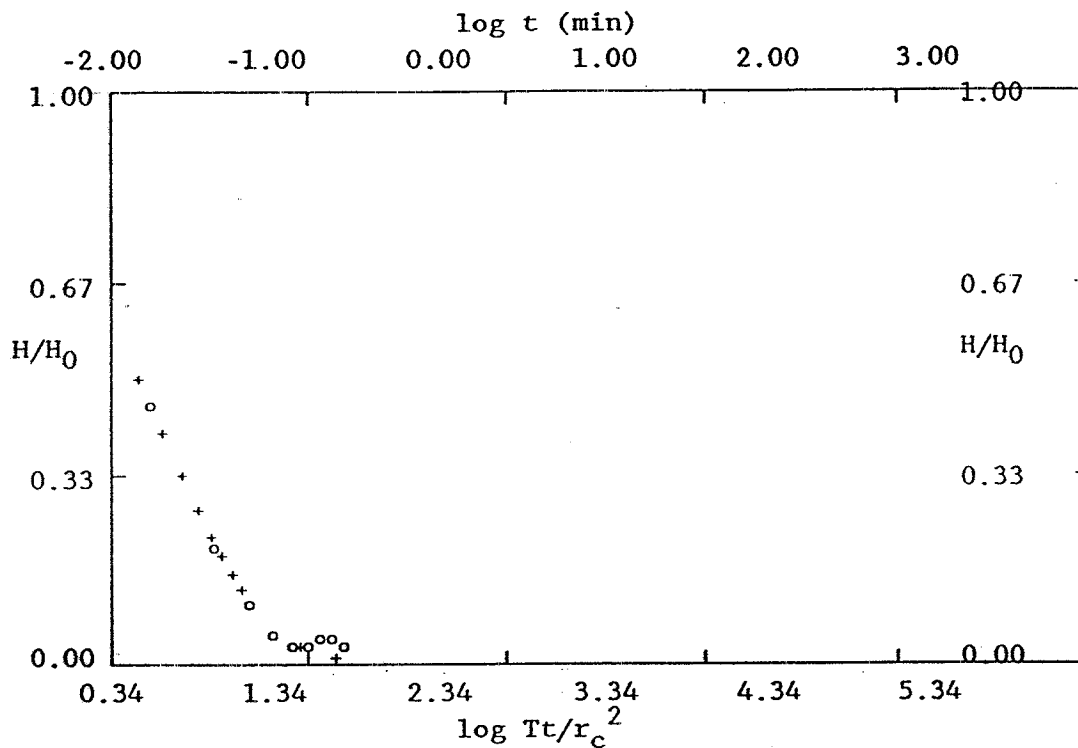
o - Data  
 + - Type Curve  
 Slug Test:  $\alpha = -7.0$

## SOLUTION

Transmissivity =  $2.281\text{E-}0003$  sq m/sec  
 Aquifer Thick. =  $1.524\text{E+}0001$  m  
 Hydraulic Cond. =  $1.496\text{E-}0004$  m/sec  
 Storativity =  $1.000\text{E-}0013$



# MW 6 FALLING HEAD



o - Data

+ - Type Curve

Slug Test:  $\alpha = -7.0$

## SOLUTION

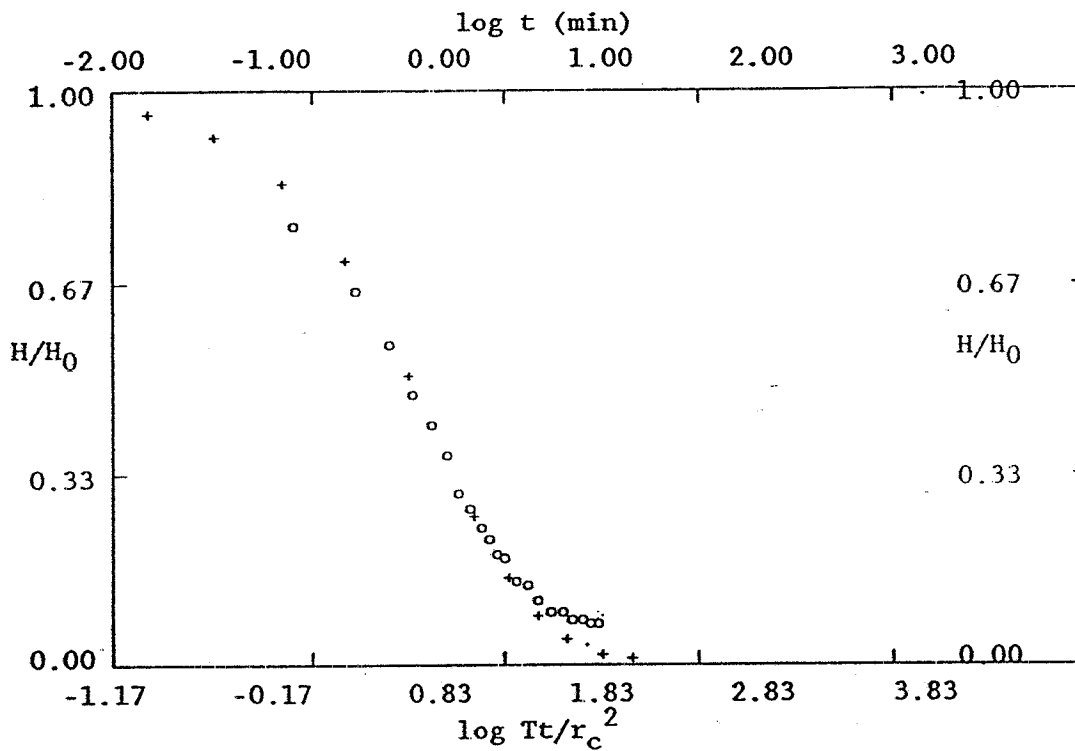
Transmissivity =  $2.334\text{E-}0003$  sq m/sec

Aquifer Thick. =  $1.524\text{E+}0001$  m

Hydraulic Cond. =  $1.531\text{E-}0004$  m/sec

Storativity =  $1.000\text{E-}0007$

# MW 7 RISING HEAD



o - Data

+ - Type Curve

Slug Test:  $\alpha = -5.0$

## SOLUTION

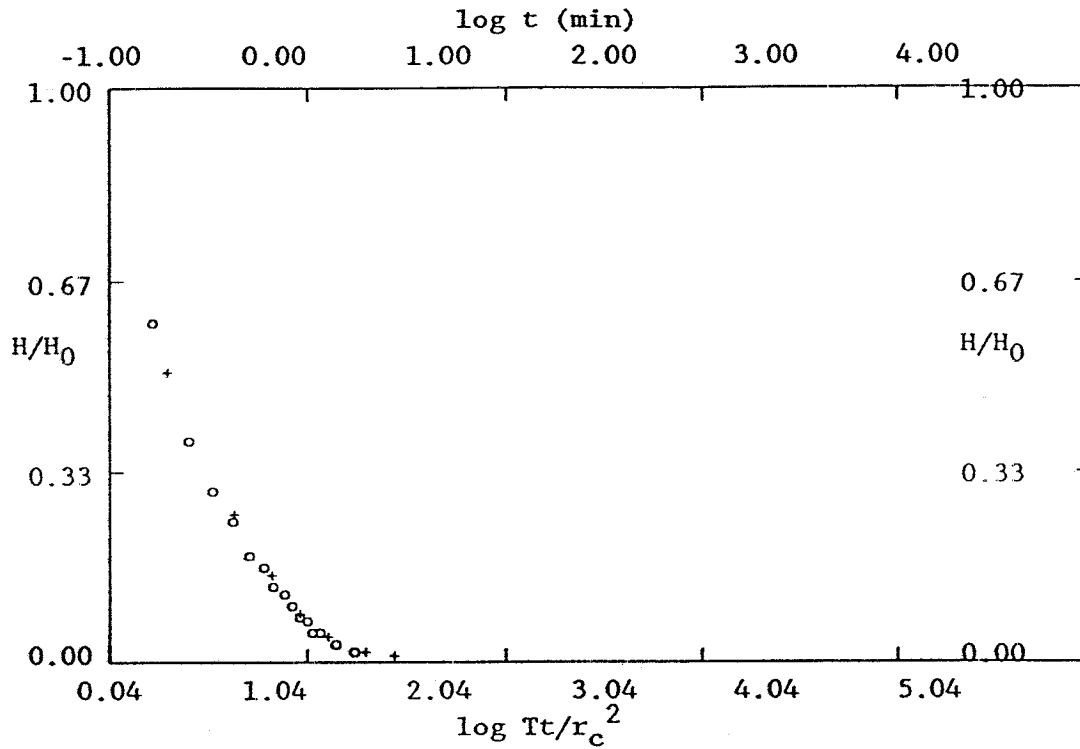
Transmissivity =  $7.212\text{E-}0005$  sq m/sec

Aquifer Thick. =  $1.524\text{E+}0001$  m

Hydraulic Cond. =  $4.732\text{E-}0006$  m/sec

Storativity =  $1.000\text{E-}0005$

# MW 7 FALLING HEAD



o - Data

+ - Type Curve

Slug Test:  $\alpha = -5.0$

## SOLUTION

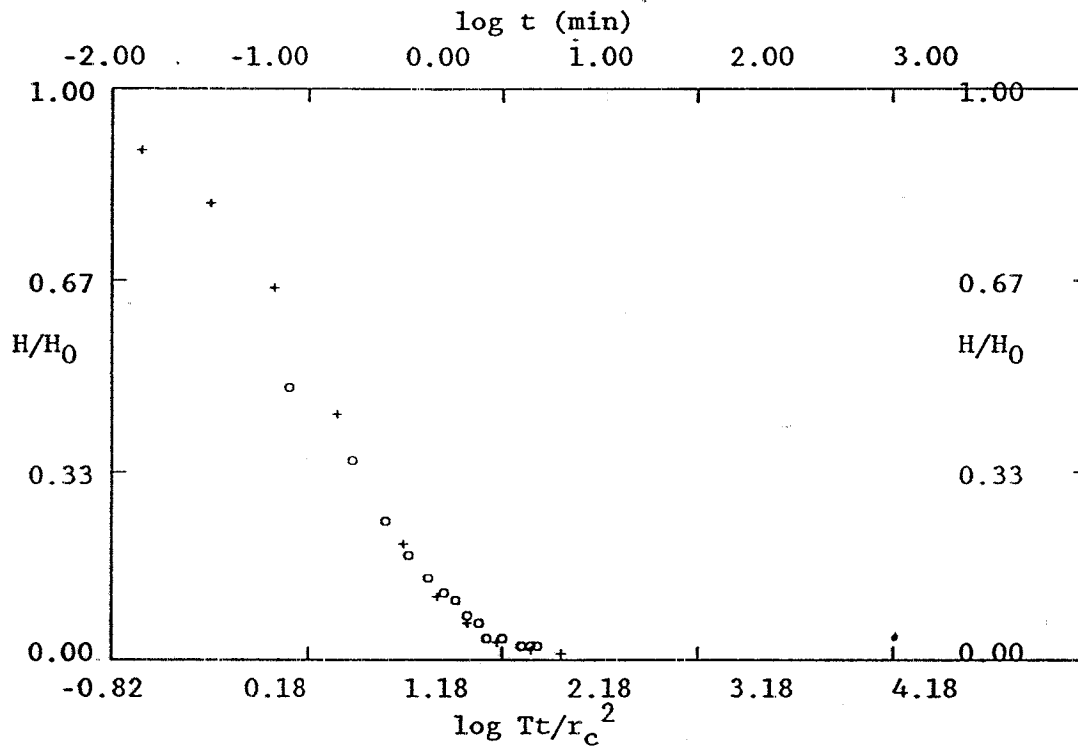
Transmissivity =  $1.528\text{E-}0005$  sq m/sec

Aquifer Thick. =  $1.524\text{E+}0001$  m

Hydraulic Cond. =  $1.003\text{E-}0006$  m/sec

Storativity =  $1.306\text{E-}0006$

# MW 8 RISING HEAD



o - Data

+ - Type Curve

Slug Test:  $\alpha = -4.0$

## SOLUTION

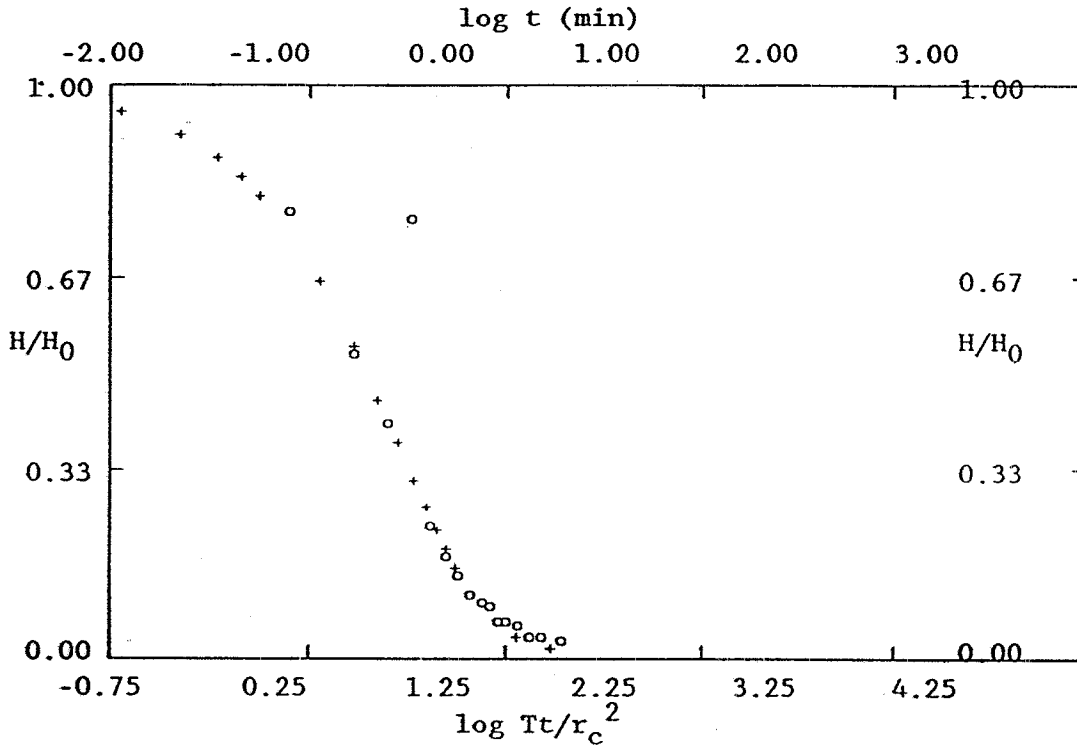
Transmissivity =  $1.614\text{E-}0004$  sq m/sec

Aquifer Thick. =  $1.524\text{E+}0001$  m

Hydraulic Cond. =  $1.059\text{E-}0005$  m/sec

Storativity =  $1.000\text{E-}0004$

# MW 8 FALLING HEAD



o - Data

+ - Type Curve

Slug Test:  $\alpha = -8.0$

## SOLUTION

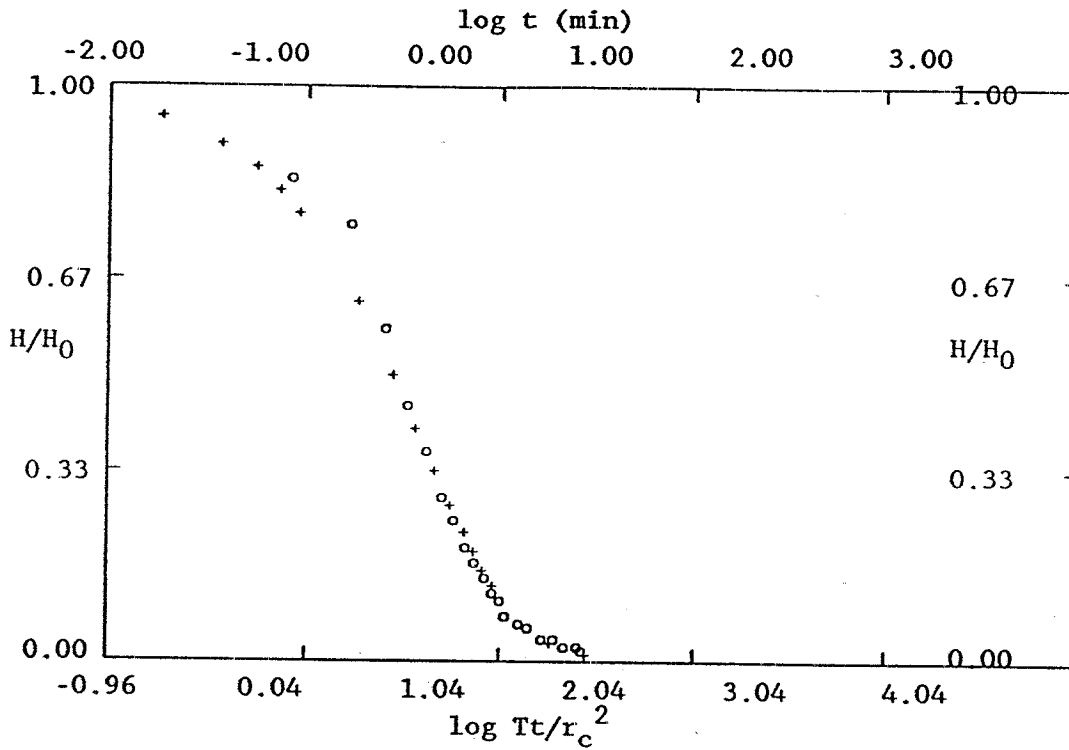
Transmissivity =  $1.897\text{E-}0004$  sq m/sec

Aquifer Thick. =  $1.524\text{E+}0001$  m

Hydraulic Cond. =  $1.245\text{E-}0005$  m/sec

Storativity =  $1.000\text{E-}0008$

# MW 9 RISING HEAD



o - Data

+ - Type Curve

Slug Test:  $\alpha = -7.0$

## SOLUTION

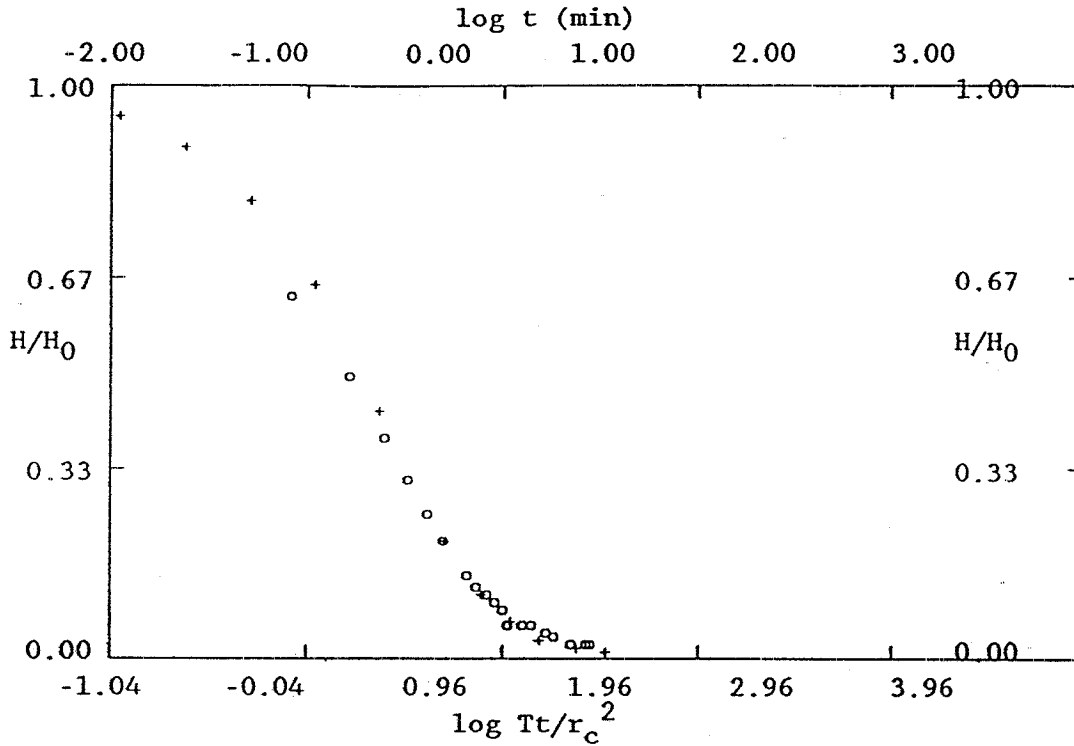
Transmissivity =  $1.170\text{E-}0004 \text{ sq m/sec}$

Aquifer Thick. =  $1.524\text{E+}0001 \text{ m}$

Hydraulic Cond. =  $7.674\text{E-}0006 \text{ m/sec}$

Storativity =  $1.000\text{E-}0007$

# MW 9 FALLING HEAD



o - Data

+ - Type Curve

Slug Test: alpha = -4.0

## SOLUTION

Transmissivity = 9.728E-0005 sq m/sec

Aquifer Thick. = 1.524E+0001 m

Hydraulic Cond. = 6.383E-0006 m/sec

Storativity = 1.000E-0004



**CONESTOGA-ROVERS  
& ASSOCIATES**

1801 Old Highway 8 N.W., Ste. #114, St. Paul MN 55112  
Telephone: 651-639-0913 Facsimile: 651-639-0923  
www.CRAworld.com

July 25, 2001

Reference No. 5349

Mr. Doug Joseph  
WISCONSIN DEPARTMENT OF NATURAL RESOURCES  
Western District Office  
1300 West Clairemont Avenue  
Eau Claire, Wisconsin 54702-4001

**RECEIVED**

**JUL 26 2001**

**DNR-WCR**

Dear Mr. Joseph:

Re: Five Year Report  
Groundwater and Landfill Gas Monitoring  
Former River Falls Sanitary Landfill, River Falls, Wisconsin

On behalf of the City of River Falls, and in accordance with Consent Order WD-94-16, this letter presents a five year trend analysis of the groundwater quality at the former City of River Falls Landfill. Based on this trend analysis, this letter also requests modifications to the current groundwater and landfill gas monitoring requirements.

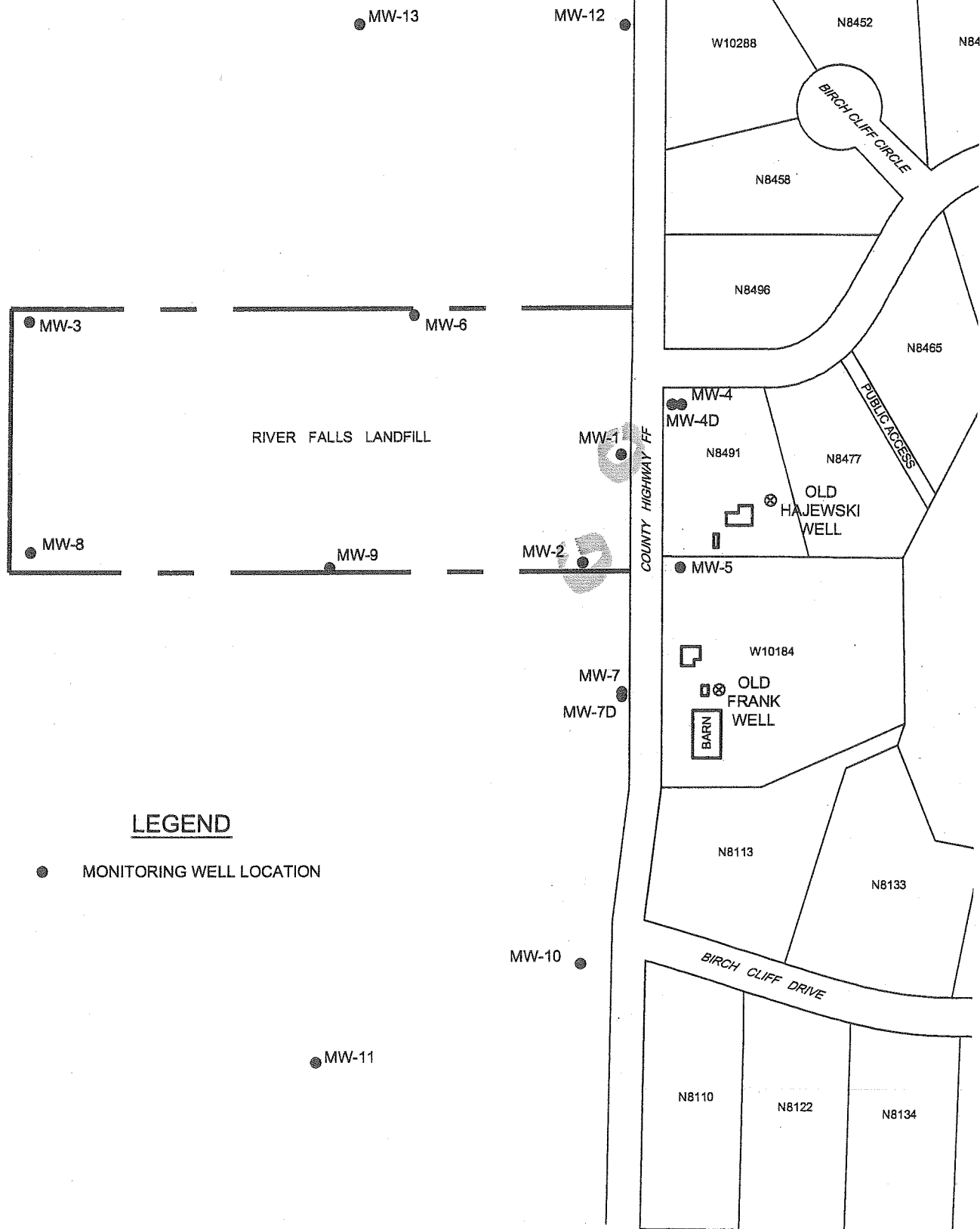
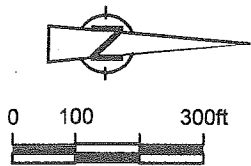
### Background

The landfill occupies approximately 16 acres approximately one mile southwest of River Falls. The Site location is presented on Figure 1 and a Site Plan is presented on Figure 2.

The landfill operated from 1962 to 1976 and was closed in 1977 according to the requirements of a Consent Order (#2A-76-1139B) between the City of River Falls (City) and the Wisconsin Department of Natural Resources (WDNR). Additional groundwater and landfill investigations were completed from 1986 through 1996 under additional Consent Orders, culminating with the construction of a multilayer clay cap, passive landfill gas venting, and routine groundwater monitoring.

The landfill is bordered to the north by the Birch Cliff subdivision where residents have private wells for their water supply. Residential wells were first sampled in December 1984. In that round, volatile organic compounds (VOC) were detected in one well (the David Frank residence). A comprehensive residential sampling effort was conducted on March 25, 1993 when the City sampled 36 residential wells north of the landfill. A second comprehensive residential sampling round was conducted in October 1993. Sampling of the residential wells in 1993 indicated three wells with intermittently detectable VOCs with two wells (the Hajewski and Frank residences) at or above Wisconsin Enforcement Standards (ES) for vinyl chloride

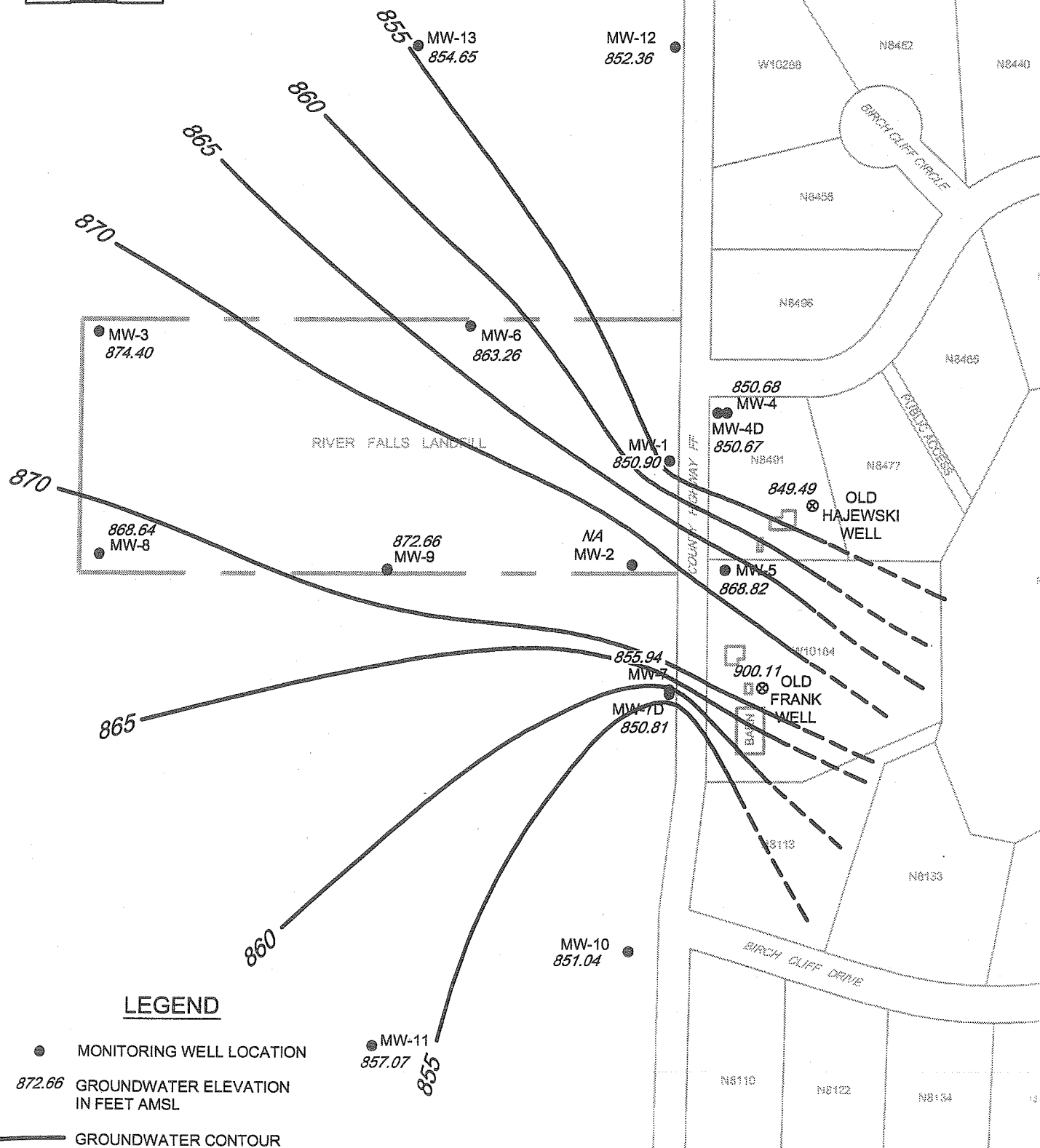
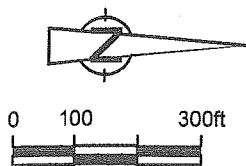




### LEGEND

● MONITORING WELL LOCATION

CRA



**CRA**

TABLE 2

HISTORICAL GROUNDWATER ELEVATIONS  
FORMER RIVER FALLS LANDFILL

LOCATION	REFERENCE ELEVATION	6/26/95	9/25/95	12/6/95	3/26/96	6/19/96	9/19/96	3/17/97	7/10/97	9/18/97	12/15/97	3/16/98	6/18/98	9/21/98
MW-1	922.60	854.40	854.56	854.74	855.77	854.36	NM	NA	855.33	856.35	855.55	854.80	856.90	856.89
MW-2	924.55	872.56	872.81	872.78	873.60	872.47	NM	NA	NA	NA	NA	NA	NA	NA
MW-3	922.61	877.77	NM	NM	879.27	878.30	877.62	878.09	879.15	880.73	880.28	878.56	881.46	882.07
MW-4	917.75	853.93	853.95	854.11	855.21	853.85	853.13	853.63	854.94	856.08	855.39	854.18	856.63	856.65
MW-4D	918.21	854.26	854.35	854.42	855.54	848.22	853.53	854.05	855.26	856.30	855.69	854.61	856.84	856.84
MW-5	924.60	870.58	870.95	870.81	871.66	870.49	870.89	871.36	871.14	871.79	872.58	870.72	872.38	872.53
MW-6	924.72	871.70	872.11	871.91	872.96	871.63	870.62	871.09	871.22	871.53	871.29	869.26	872.09	872.75
MW-7	923.01	861.15	860.29	861.32	862.39	861.06	860.67	861.13	860.81	861.97	861.16	860.03	862.23	862.06
MW-7D	922.09	853.75	853.88	853.95	855.12	853.68	853.03	853.53	854.34	855.23	854.61	853.85	855.46	855.41
MW-8	920.64	868.67	869.07	868.88	869.71	868.59	868.01	863.53	870.47	871.48	870.53	869.80	871.86	871.67
MW-9	930.47	877.86	877.74	878.05	878.92	877.79	877.73	878.21	878.11	879.28	878.56	876.93	879.69	879.82
MW-10	908.48	853.76	853.81	853.94	854.86	853.70	857.86	858.36	861.25	855.37	854.60	853.85	861.43	855.41
MW-11	908.86	858.61	858.83	858.81	859.62	858.54	853.41	853.86	859.26	859.83	859.28	858.95	859.71	859.54
MW-12	909.21	856.35	856.37	856.56	857.41	856.28	NA	NA	857.75	858.92	858.26	857.00	859.77	859.85
MW-13	915.47	859.44	859.79	859.66	860.56	859.37	860.27	NA	860.99	862.18	861.55	860.17	862.95	863.25
OLD HAJEWSKI	928.27	NA	NA	NA	NA	NA	NA	NA	NA	854.76	NA	853.13	854.97	854.64
OLD FRANK	935.37	NA	NA	NA	NA	NA	NA	NA	NA	903.75	NA	903.22	903.70	903.18

TABLE 2

**HISTORICAL GROUNDWATER ELEVATIONS  
FORMER RIVER FALLS LANDFILL**

LOCATION	REFERENCE ELEVATION	12/14/98	3/16/99	6/21/99	9/23/99	12/14/99	3/27/00	6/22/00	9/11/00	12/4/00	3/26/01
MW-1	922.60	855.96	855.18	854.85	853.92	853.48	853.07	852.17	852.41	851.87	850.90
MW-2	924.55	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-3	922.61	880.56	879.39	878.49	877.64	876.62	876.46	875.33	876.01	875.47	874.40
MW-4	917.75	855.41	854.43	854.17	853.32	852.97	852.47	851.65	851.95	851.58	850.68
MW-4D	918.21	855.81	854.92	854.59	853.72	853.41	852.91	852.05	852.25	851.70	850.67
MW-5	924.60	871.36	870.94	870.23	870.53	870.05	869.72	868.80	869.27	869.30	868.82
MW-6	924.72	871.62	869.26	866.33	868.82	867.39	865.35	863.62	864.15	864.35	863.26
MW-7	923.01	860.50	859.59	858.98	858.84	857.87	857.10	855.91	856.53	856.79	855.94
MW-7D	922.09	854.52	854.02	853.84	853.20	852.86	852.49	851.87	852.00	851.61	850.81
MW-8	920.64	870.73	870.01	869.58	868.18	868.14	867.69	866.54	866.93	868.99	868.64
MW-9	930.47	878.38	877.13	876.76	876.57	875.45	875.09	873.50	873.98	873.66	872.66
MW-10	908.48	854.42	853.97	854.14	853.34	852.94	852.58	852.20	852.25	851.82	851.04
MW-11	908.86	859.13	858.96	858.98	858.55	858.25	858.04	857.75	857.84	857.58	857.07
MW-12	909.21	858.23	857.44	856.98	855.95	855.58	854.92	853.74	854.10	853.46	852.36
MW-13	915.47	861.56	860.72	860.04	858.95	858.29	857.56	856.44	856.62	855.89	854.65
OLD HAJEWSKI	928.27	853.92	853.25	853.06	852.12	852.07	851.52	850.92	850.77	850.50	849.49
OLD FRANK	935.37	901.60	898.37	902.51	902.51	901.13	902.52	895.47	900.07	899.86	900.11

Notes:

MW-3 REFERENCE CHANGED FROM 922.0 TO 922.61 ON 3/1/96 DUE TO REPAIRS

NA - NOT AVAILABLE

UNITS: FEET ABOVE MEAN SEA LEVEL (AMSL)