South Cass Lake
Pumping Station
Remedial Investigation Report
(MPCA Spill # 54827)

CASS LAKE, MINNESOTA

Prepared by:

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Company

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## I. INTRODUCTION

On behalf of Enbridge Energy, Limited Partnership (Enbridge), Natural Resources Engineering Company performed an investigation of shallow groundwater quality at Enbridge's South Cass Lake, Minnesota pumping station (from hereon referred to as the "Site"). Initial work was performed as part of Enbridge's voluntary Detection Monitoring Program. The location of the Site is shown on Figure 1. The objectives of the Detection Monitoring Program were as follows:

- Characterize the near surface geology and aquifer properties of the Site;
- Determine whether soil or groundwater contamination was present on the Site;
- Establish sampling frequency protocol based upon site specific fate and transport characteristics; and
- Provide an early warning system for a possible release.

The following is a chronology of events relative to this project:

- Shallow groundwater quality was first assessed via four monitoring wells (MW-1, -2, -3 and -4) which were installed in May 2001 and subsequently sampled in June 2001. Well locations are shown on Figure 2;
- Impacted soil and groundwater were discovered during the installation of MW-3 on May 23, 2001, and the Minnesota State Duty Officer was notified.
   The MPCA assigned Spill Number 54827 to the incident;
- Based upon the data gathered from monitoring wells MW-1 through MW-4, a network of push-probe borings (GP-1 to -16) were advanced across the Site in September 2001. The objectives of the push-probes were to define the magnitude and extent of impacted soil and groundwater. Findings from this phase of the investigation indicated that off-site monitoring wells would be required;
- In February 2002, a leaking flange was discovered approximately 75-feet upgradient of MW-3 (refer to Figure 2). The MPCA assigned Spill Number 56253 to this incident. This Spill Number was later (August 2003) retracted

because the weeping flange was found to be the source of oil for the initial incident (Spill Number 54827). Approximately 304 cubic yards of crude oil impacted soil were removed from the Site in association with the repair of the weeping flange. The excavation progressed laterally to clean soil on the sidewalls but due to concerns regarding pipeline integrity, impacted soil was still present in the base of the excavation at approximately 12 feet below ground surface. For details on the excavation and cleanup of Spill 56253, refer to the report titled "Remedial Action Report: February 13, 2002 Release South Cass Lake Station" submitted to the MPCA in June 2002.

• Upon gaining landowner permission to set permanent wells, four push-probe borings (GP-17, -18, -19 and -20) were advanced on August 13 and 14, 2002 to define off-site groundwater impacts, and as a pre-cursor for monitoring well installation. Four permanent monitoring wells (MW-6, -7, -8 and -9) were subsequently installed on November 19 and 20, 2002.

Monitoring well and push-probe boring locations associated with the Site are illustrated on Figure 2.

### A. Purpose/Content

This report serves to detail investigation and monitoring activities conducted at the Site, document existing conditions, and set forth recommendations for future activities.

Including this section, this report is divided into seven parts: Section II summarizes the local topography, near surface geology, and hydraulic setting; Section III details the subsurface investigation; Section IV details the aquifer characterization results; Section V gives conclusions and recommendations for future activities at the Site; and references are given in Section VI.

## II. PHYSICAL SETTING

### A. Hydrology

The area surrounding the Site is characterized by rolling hills and heavy forestation. The topography is also pilled with many small, closed basins containing lakes or wetlands. Average annual precipitation is on the order of 24 inches per year, with approximately 15 inches per year runoff, and the remainder lost to evapotranspiration or seepage into the ground (Gerbert, 1987).

### B. Hydrogeology

Regionally, the Cass Lake area is located in an outwash plain that is pitted and dissected by gravel-filled channels that are now partially occupied by kettle lakes. This unconsolidated glacial drift is horizontally and vertically extensive, with the saturated portion serving as the water supply for nearby municipalities and private wells (Oakes and Bidwell, 1968).

Local geology consists of Wisconsin-aged unconsolidated glacial deposits approximately 350 feet thick and underlain by Precambrian intrusive rocks. The glacial deposits near the surface are primarily composed of well-sorted fine sands (SW) and silts (ML). Near-surface geology at the Site consists of an unconsolidated, brown, medium-grained, moderately sorted sand and silt to a depth of greater than 40 feet.

The piezometric gradient in the near-surface aquifer is 0.1% to the southeast toward Fox Creek (part of the Pike Bay drainage). Flow in the aquifer occurs under unconfined conditions. Depth to groundwater varies in response to topographic and piezometric relief, but is on the order of 25-feet in the vicinity of the Site. The nearest surface water body is Spike Lake, located approximately ½-mile to the southwest of the Site.

## C. Groundwater Receptor Survey

Sixteen residential wells were identified within a 1-mile radius of the Site. Of these wells, none were potentially downgradient and located within ½-mile of the Site. The wells range in depth from 42 to 218 feet below ground surface. Well logs were obtained from the Minnesota Geological Survey's County Well Index and are included as Appendix A. The residential well locations are shown on Figure 3.

# III. SITE INVESTIGATION

To assess shallow groundwater quality, a network of four monitoring wells was initially installed in May 2001 as part of the Detection Monitoring Program. Wells were placed as follows:

- One well placed hydraulically upgradient as a background well (MW-1);
- Three wells downgradient of the main portion of the pumping station (MW-2, MW-3, MW-4).

Based upon the findings at MW-3, plans for an expanded investigation were laid. In general, these plans called for determining the extent and magnitude of crude oil impacts in the near surface aquifer via advancement of push-probes followed by placement of monitoring wells at select locations. To the degree feasible, these goals were achieved. However, the complexity of buried infrastructure and station construction activities prevented the installation of additional monitoring wells in the source area (the weeping flange). The following provides specifics of the investigation.

## A. Investigation Procedures

## Push-Probe Groundwater Sampling:

Based on the analytical results of groundwater samples collected from the on-site monitoring wells, a network of sixteen push-probe borings was advanced across the Site. Using the presence of oil-stained soil as an indicator, boring locations were selected to define the extent and magnitude of impacted soil and assess shallow groundwater quality. This phase of the investigation indicated impacted groundwater migrated off-site to the southeast, and access from the adjacent landowner would be required to complete the investigation. In August 2002, landowner access was secured, and additional push-probes were advanced until the extent of impacted groundwater was defined. Information from these push-probes was also used as an aid for placement of the four off-site monitoring wells in November 2002. Push-probe boring logs are included in

Appendix B.

Water samples collected during the investigation were analyzed for concentrations of BTEX and ERDRO. Trip, temperature and field blanks were also submitted with the samples for analysis by EnChem, Inc. in Green Bay, WI.

## Monitoring Well Installation:

Monitoring wells were constructed in accordance with Minnesota Well Code and Chapter 4725. Wells were designed to have the screened interval bisect the water table. Boreholes for the monitoring wells were advanced with a nominal 4 ½-inch inner diameter hollow stem auger. One deep boring (adjacent to MW-1) was completed to a depth of approximately 46 feet and sampled continuously using two-foot split-spoons to characterize the near-surface geology at the Site. In the remainder of the monitoring well boreholes, split-spoon samples were collected on five-foot intervals. Boring logs with headspace screening results are included as Appendix B.

Wells were completed with 2-inch diameter, flush-threaded schedule 40 PVC risers and ten-foot, 0.01-inch slot screens. Risers extend to a height of approximately two feet above grade. The filter pack was completed to a depth of two feet above the top of the screen using Red Flint Sand (# 30) followed by bentonite chips and neat cement grout acting as the sealing material and surface seal, respectively. Lastly, protective tops were placed over the wells locked with padlocks. Bumper posts were also placed in a triangular configuration around wells located in high-traffic areas. Well construction detail is shown on forms in Appendix C.

# Monitoring Well Development and Groundwater Sampling:

Wells were developed using a vigorous pump and surge technique. The process was repeated until water bailed from the well was relatively clear of sediment and stable with respect to pH, specific conductivity and temperature.

Groundwater samples were collected following well development and stabilization. Samples were analyzed for benzene, toluene, ethylbenzene, xylenes (BTEX), and extended range DRO (ERDRO). Trip, temperature, and field blanks were also submitted with the samples for analysis by EnChem, Inc. in Green Bay, WI.

#### Surveying:

Horizontal and vertical well locations were surveyed by LW Survey of Duluth, Minnesota. Horizontal locations are based on the NAD83 Minnesota North State Plane coordinate system and elevations are referenced to the NAVD 88 datum.

## B. Groundwater Quality

### - Dissolved Phase:

Analytical results from the water samples are summarized on Table 1, and complete analytical reports are included in Appendix D. In general, water samples were not collected at locations where there was evidence of free oil or a smear zone. These locations were: GP-1; GP-2; GP-7; GP-9; GP-12; GP-13; GP-14; and MW-3.

Benzene is the predominant compound of concern dissolved in the shallow groundwater at the Site (refer to Table 1). Concentrations of benzene above the Minnesota Department of Health's Health Risk Limits (HRLs) were present in three borings (GP-3, GP-4, and GP-16), and ranged from below detectable concentrations around the periphery of the Site, to a maximum of 1,300 µg/l at GP-4 along the axis of the plume approximately 180-feet downgradient from MW-3. The lateral extent of the impacted groundwater plume is depicted on Figure 4.

## Non-Aqueous Liquid Phase:

Excluding a petroleum sheen in MW-3, the initial monitoring event did not reveal a presence of free-oil in any of the monitoring wells. During the July 2003 event however, oil was present in MW-3 at a thickness of approximately 8-inches.

In an effort to determine product recovery rate in monitoring well MW-3, product thickness measurements were collected on six occasions. The following table summarizes these results.

Date		Crude Oil Thickness
	Time	(inches)
July 21, 2003	2:30 PM	8.4
July 22, 2003	9:45 AM	2.5
July 29, 2003	12:45 PM	
July 31, 2003	<del></del>	5.0
August 21, 2003	1:30 PM	4.0
<del></del>	7:30 AM	8.4
September 4, 2003	9:49 AM	8.0

During each Site visit, product thickness was determined using an oil/water interface probe. Product present in the well was, and is continuing to be manually removed and placed in a 55-gallon drum on-site located adjacent to monitoring well MW-3. Figure 5 indicates the approximate lateral extent of residual product at the Site, and is based on the presence of a smear zone across the water table as observed in the push probes and oil measurements at MW-3. This footprint does not necessarily represent the extent of recoverable oil, but rather the area where the potential for recoverable oil exists.

# IV. AQUIFER CHARACTERIZATION

## A. Aquifer Characterization Procedures

### Groundwater Levels:

Water levels in the monitoring wells were measured electronically using a Solonist M-Scope resolved to 0.01 foot. Water level measurements in the monitoring wells were referenced to a mark on the top of the inner well casing.

### Hydraulic Conductivity:

Slug testing was completed in the monitoring wells to determine the hydraulic conductivity of the aquifer immediately about each monitoring well. A slug test consists of displacing a volume of water in a well by insertion or removal of a slug tool. The addition or removal of the slug tool from the water in the monitoring wells is equivalent to displacing an equal volume of water. By monitoring the transient water level in the well, it is possible to estimate the conductivity immediately surrounding the gravel pack of the well.

The slug used was constructed of 1-inch diameter PVC pipe, filled with sand, and sealed with silicone and PVC caps. The total length of the slug was 3.7 feet, which displaced approximately 0.2 cubic feet of water (or resulted in a change in head of approximately 0.9 feet). The time required for the well to dissipate the water and approach the initial static level was measured with a 20 psi In-Situ pressure transducer and recorded with a Hermit 3000 data logger at a very high frequency. Measurements were taken at 1-second intervals initially and 10-second intervals as the water level in the well approached steady state. Refer to Appendix C for well dimensions and construction specifics, and Appendix E for a discussion of the slug test analysis and for figures which graphically show the dissipation or recovery of the water displaced during the slug tests.

### Organic Carbon Content:

A soil sample of the aquifer matrix was collected at the upgradient location (MW-1), and analyzed for Total Organic Carbon (TOC) content. The TOC sample was analyzed by En Chem, Inc. in Green Bay, Wisconsin. This aquifer characteristic is one of the key parameters for future fate and transport analysis of crude oil compounds dissolved in the shallow aquifer.

## B. Aquifer Characteristics

### Groundwater Levels:

Groundwater elevations in the monitoring wells are summarized in Table 2. Depth to groundwater across the Site varies from approximately 26 to nearly 28 feet below ground surface. Regionally, the groundwater flow gradient is expected to be to the southeast toward Fox Creek (part of the Pike Bay drainage) with a slope of approximately 0.1%. Locally, the distribution of compounds dissolved in the groundwater is consistent with the regional flow regime. However, survey elevations of the off-site wells should be checked prior to further analysis of the local flow regime.

# Hydraulic Conductivity and Mean Groundwater Velocity:

Hydraulic conductivity and groundwater velocity calculations are detailed in Appendix E. Table 3 summarizes the hydraulic conductivity testing results. The hydraulic conductivity appears to be normally distributed about an arithmetic mean of 20 feet/day. This is in general agreement with reference values published for a fine to medium grained clean sand (Strack, 1989). Using the hydraulic gradient and assuming an effective porosity typical of a clean sand (0.25), the mean groundwater flow velocity was calculated at approximately 30 feet per year.

## Organic Carbon Content:

The soil sample for TOC analysis was collected from the aquifer matrix at the upgradient well location (MW-1). The TOC concentration registered at 920 mg/kg (0.09%).

# V. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations have been drawn based on the findings of the investigation and monitoring activities at the Site.

### A. CONCLUSIONS

- The near-surface geology at the Site is an unconsolidated, brown, medium-grained SW sand to a depth of greater than 40 feet below ground surface;
- Regionally, the groundwater flow regime appears to be to the southeast with a flow gradient of 0.1% toward Cass Lake. Locally, the distribution of crude oil related compounds in the groundwater is consistent with regional flow;
- Hydraulic conductivities across the Site appear to be normally distributed about an arithmetic mean of 20 ft/day;
- Mean groundwater velocity across the Site is approximately 30 feet/year;
- Sixteen residential wells were identified within 1-mile of the Site, with but none were located within ½-mile downgradient of the Site;
- Benzene concentrations dissolved in the groundwater ranged from below detection limit around the periphery of the Site, to a maximum of 1,300 ug/l at GP-4 along the axis of the plume downgradient of the source area (the weeping flange); and
- Crude oil was first observed in MW-3 during the July 2003 monitoring event at a thickness of 8.4 inches.

### B. Recommendations

To adequately determine the lateral extent of crude oil on the watertable at the Site, two to four additional monitoring wells should be installed. The exact number of wells needed will be based on field observations during drilling activities. The proposed well locations are shown on Figure 6.

In addition to defining the magnitude of crude oil on the watertable, quarterly groundwater monitoring will continue at monitoring wells MW-1, -2, -4, -6, -7, -8 and -9 in order to evaluate BTEX and ERDRO trends and to document the natural attenuation process. The survey coordinates of these wells will also be checked in Fall 2003.

Following completion of the additional well installation and one round of sampling, a letter update will be submitted to the MPCA detailing the findings and recommendations for future activities.

## VI. REFERENCES

Gerbert, W.H., Graczyk, D.J., and Krug, W.R. 1987. "Average annual runoff in the United States, 1951-80". U.S. Geological Survey Hydrologic Investigations Atlas. 730-J.

Strack, O.D.L., 1989, Groundwater Mechanics, Prentice-Hall, Inc., Englewood Cliffs, New Jersey. 732p.

## **TABLES**

Table 1: Groundwater Sampling Results Enbridge Energy Company - South Cass Lake Station

	•					om CHON	,
Location		Benzene (ug/l)	Ethylbenzene (ug/l)	Toluene (ug/l)	Xylenes, -m, -p (ug/L)	V	ERDRO
MW-1	6-Jun-01		< 1.0	< 1.0	< 2.0	Xylenes, -o (ug/L)	(ug/L)
MW-1	16-Jul-03	< 1.0	< 1.0	< 1.0		< 1.0	< 100
				1.0	< 2.0	< 1.0	< 100
MW-2	6-Jun-01	< 1.0	< 1.0	< 1.0			
MW-2	16-Jul-03		< 1.0		< 2.0	< 1.0	< 100
		v. <b>-2</b>	* 1. <b>Q</b>	< 1.0	< 2.0	, < 1.0	< 100
MW-4	6-Jun-01	< 1.0	< 1.0				,
MW-4	16-Jul-03	< 1.0	· ·	< 1.0	< 2.0	< 1.0	< 100
	10 00.00	· 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 100
MW-6	16-Jul-03	< 1.0	. 4 0				100
	10-341-03	<b>~ 1.0</b>	< 1.0	< 1.0	< 2.0	< 1.0	< 100
MW-7	16 1 00						· 100
	16-Jul-03	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	- 100
8-WM	40 64 00			,		- 1.0	< 100
14144-0	16-Jul-03	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	- 400
MW-9	40					٠١.٥	< 100
MAA-A	16-Jul-03	0.51	< 1.0	< 1.0	< 2.0	-10 ·	
CD a					2.0	< 1.0	< 100
GP-3	25-Sep-01	340	< 1.0	< 1.0	< 2.0	.40	
			•		~ 2.0	< 1.0	< 160
GP-4	25-Sep-01	1300	<b>230</b> .	< 10	~ 20 ·		
				- 10	< 20	< 10	830
GP-5	25-Sep-01	< 1.0	< 1.0	< 1.0			
	•		• 1.0	<b>\ 1.0</b>	< 2.0	< 1.0	< 180
GP-6	25-Sep-01	< 1.0	< 1.0	.40			
	_ op •,	1.0	<b>~ 1.0</b>	< 1.0	< 2.0	< 1.0	< 160
GP-10	26-Sep-01	< 1.0	. 4.0				
	-0 0cp-0;	<b>- 1.0</b>	< 1.0	< 1.0	< 2.0	< 1.0	< 160
GP-15	26-Sep-01	440					100
	20-36p-01	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 160
GP-16	26 Can 04	4.0					<b>~ 100</b>
01-10	26-Sep-01	19	< 1.0	< 1.0	< 2.0	< 1.0	- 400
GP-17	44.4		•			1.0	< 160
GF-17	14-Aug-02						-
00.40							<230
GP-18	14-Aug-02	< 1.0	< 1.0	< 1.0	< 2.0	. 4.0	
					~ 2.0	< 1.0	<250
GP-19	14-Aug-02						
						•	<220
GP-20	13-Aug-02						
	. <del>-</del> -	-	-				<230
Trip Blank	16-Jul-03	<1.0	< 1.0	-10		•	
		<del>-</del>	· 1.0	< 1.0	< 2.0	< 1.0	
							•

Table 2: Groundwater Elevations
Enbridge Energy Company - South Cass Lake Station

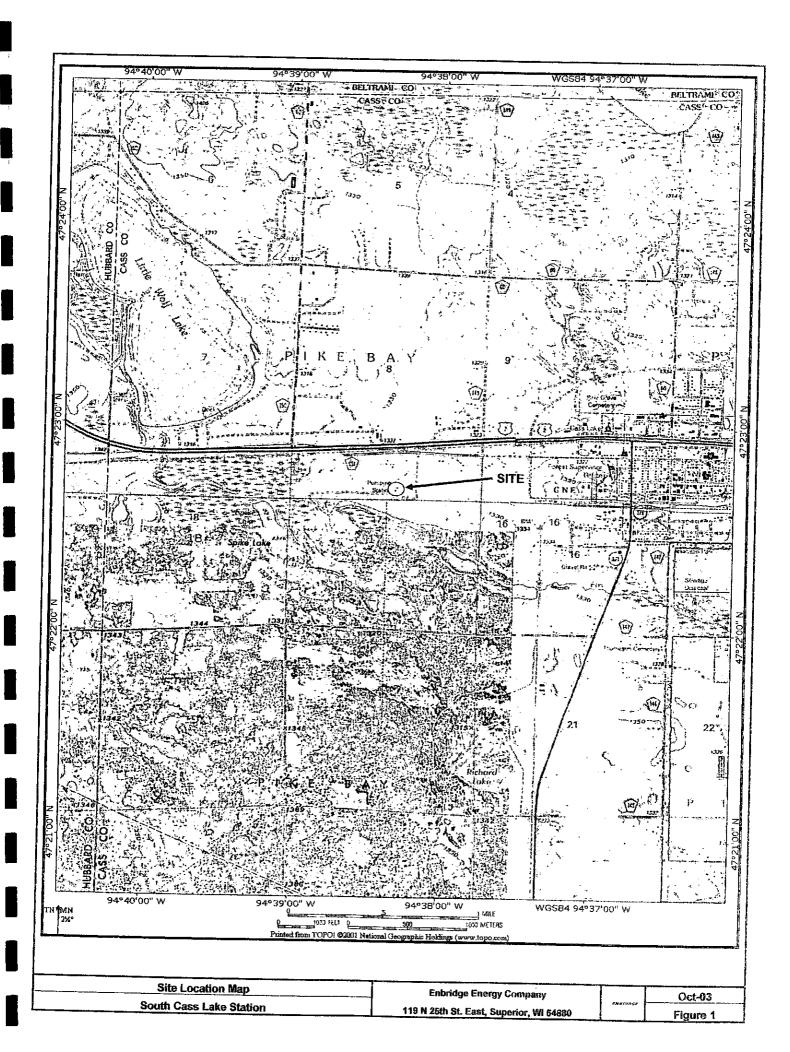
Location		Top of Casing Elevation (feet MSL)	Depth to Groundwater(feet MSL)	Groundwater Elevation (feet MSL)
MW-1	06-Jun-01	1339.94	26.29	1313.65
MW-1	10-May-02	,	27.57	1312.37
MW-1	14-May-02	•	27.60	1312.34
MW-1	21-Jul-03		28.07	1311.87
MW-2 MW-2 MW-2 MW-2	06-Jun-01 10-May-02 14-May-02	1339.59	25.87 None Recorded 27.25	1313.72 1312.34
IVI VV -Z	21-Jul-03		27.71	1311.88
MW-3 MW-3 MW-3 MW-4	06-Jun-01 10-May-02 14-May-02 21-Jul-03 06-Jun-01	1339.63 1340.39	25.92 27.19 27.22 28.30	1313.71 1312.44 1312.41 1315.62
MW-4	10-May-02	1340.39	26.68	1313.71
MW-4	14-May-02		27.92	1312.47
MW-4	21-Jul-03		27.96	1312.43
MW-6	21-Jul-03	1338.67	28.35	1312.04
MW-7	21-Jul-03	1340.29	28.75	1309.92
MW-8	21-Jul-03	1338.97	29.37	1309.60
MW-9	21-Jul-03	1338.38	26.41	1311.97

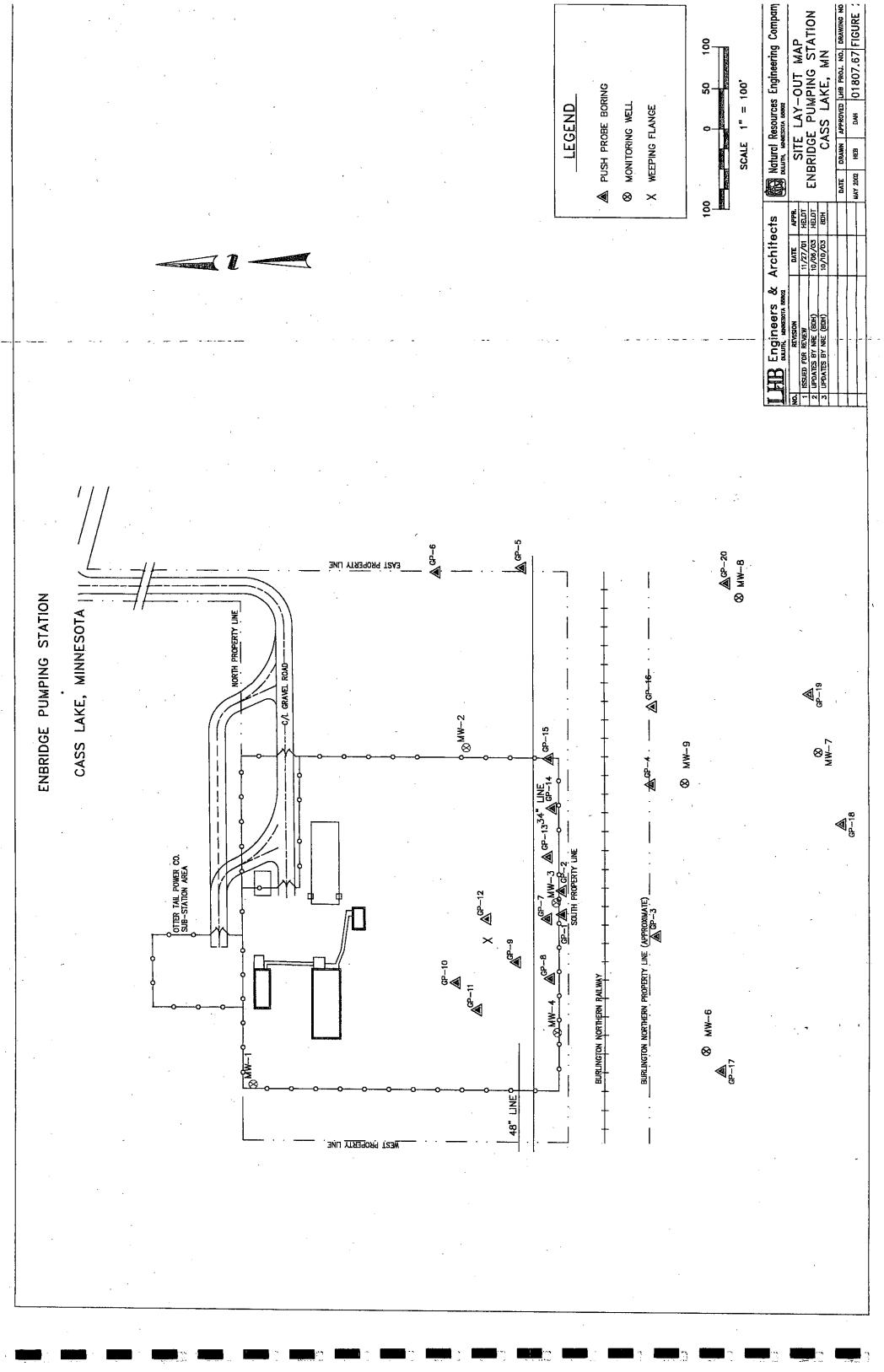
Table 3: Hydraulic Conductivity Values Enbridge Energy Company - South Cass Lake Station

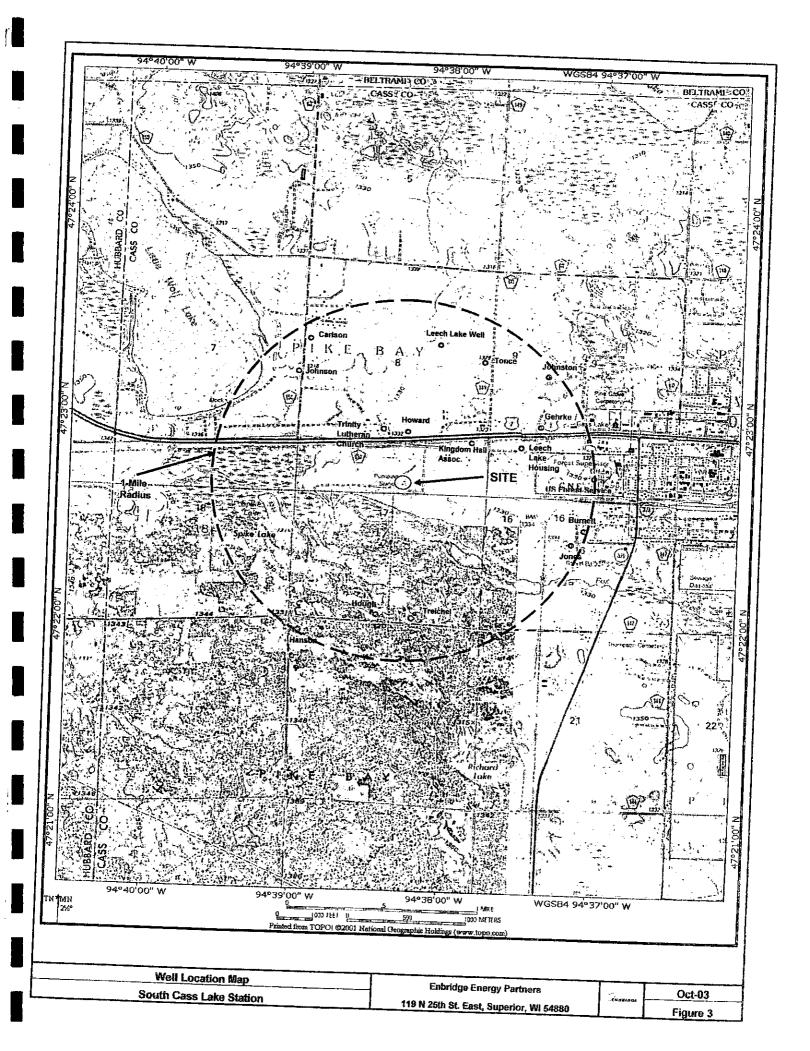
Well	Hydraulic Conductivity (feet/day)	Comments
MW-1	4.0	Dissipation
MW-1	13.2	Recovery
MW-2	19.8	Dissipation
MW-2	27.6	•
MW-3	9.7	Recovery
MW-3	27.6	Dissipation
MW-4	17.4	Recovery
MW-4	24.5	Dissipation
MW-6	33.6	Recovery
MW-7	15.7	Recovery
MW-7		Dissipation
MW-8	15.4	Recovery
MW-8	27.4	Dissipation
MIAA-O	16.8	Recovery

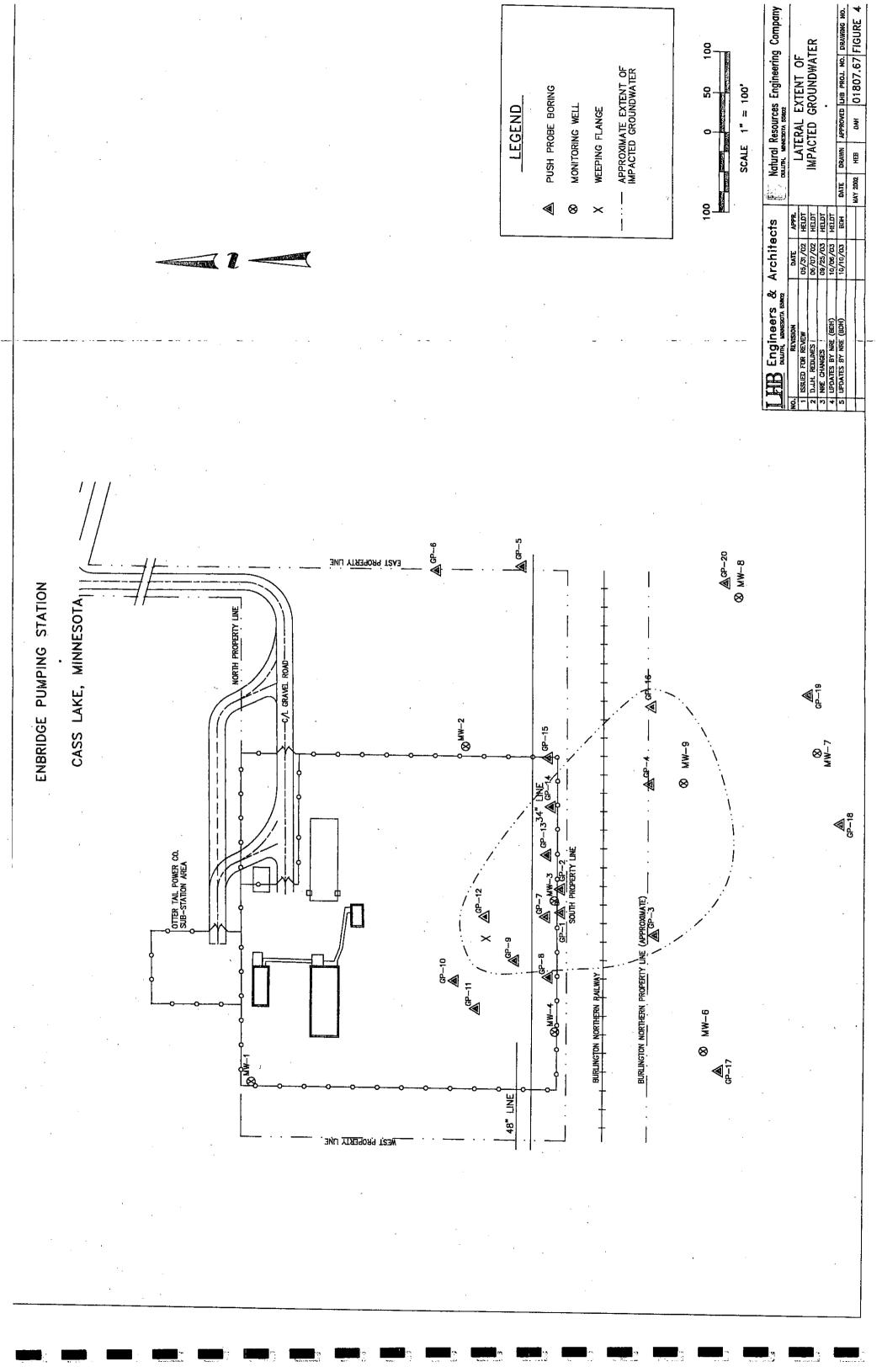
Arithmetic Mean	19.4	feet/day
Geometric Mean	17.3	feet/day

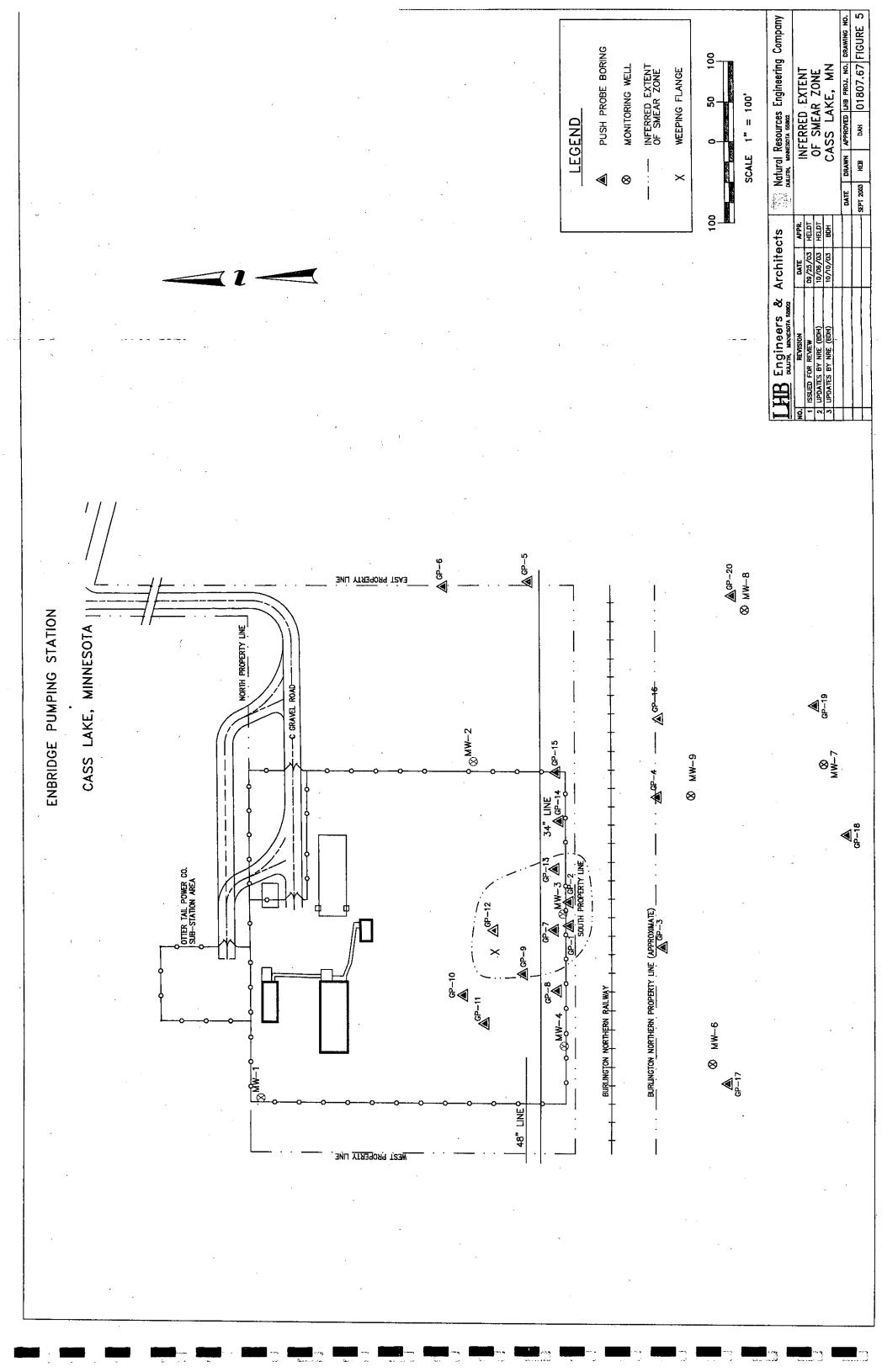
## **FIGURES**

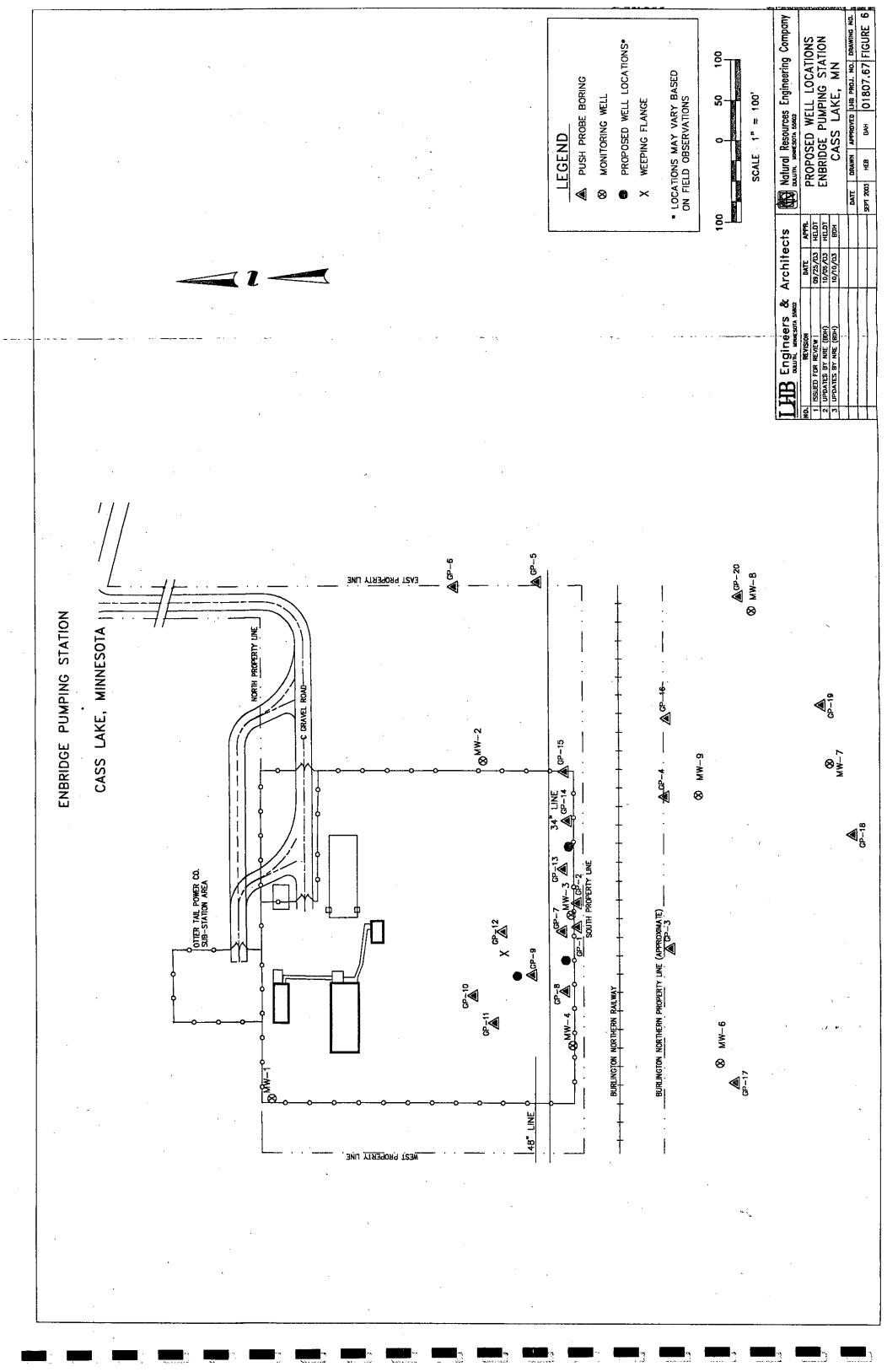












### **APPENDICES**

## APPENDIX A – RESIDENTIAL WELL LOGS

Unique No. 643007			A DEPARTMENT OF HEALTH Update Date 2000/06/06
County Name Cass			NB BORING RECORD
Township Name Townshi	p Range Dir Secti	on Subsection	Well Depth Depth Completed Date 2000/06/01
145	31 W 16		Well Depth Depth Completed Date Well Completed 218 ft. 218 ft. 2000/01/10
Well Name BURNETT, R	ANDELL		Drilling Method Non-specified Rotary
		·	Drilling Florid
		•	Drilling Fluid Well Hydrofractured? Yes Bentonite Fro ft. to
			Use Domestic
			Casing Drive Shoe?
GEOLOGICAL MATERIAL	COLOR HARDNESS	FROM TO	Casing Diameter Weight(ibs/ft) in. t 218
ABOVE GRADE		0 2	4 in. t 214 ft
SAND	BROW SOFT	2 40	
CLAY AND SAND	GRAY SOFT	40 126	
SAND	GRAY SOFT	126 127	
CLAY AND SAND	GRAY HARD		Screen Y Open Holo From 4 to
SAND	GRAY SOFT	127 215 215 218	Make totalogy
	oor i	215 218	Diameter Clet Leadt a (
			- Truting
•			4 7 4 214 ft. to 218 ft
		,	Static Water Level 21 ft. from Land surface Date 2000/01
,			PUMPING LEVEL (below land surface)
			ft. after hrs. pumping 100 g.p.m.
			Well Head Completion
			Pitless adapter mf MAASS Model JC Casing Protection Maass Model JC
			☐ At-grade(Environmental Wells and Borings ONLY)
			Grouting Information Well grouted? Ves No
			Material From To (ft.) Amount(yds/bags)
			10 160 16 S
			·
			Nearest Known Source of Contamination
			70 ft. direction SE type SDF
			Well disinfected upon completion? ✓ Yes ☐ No
			Pump ✓ Not installed Date installed N
			Mfr nam
			Mode HP Volts
			Drop Pipe Length ft. Capacity g.p.m Type
			Any not in use and not sealed well(s) on property? ☐ Yes ✔ No
S Quad	Floretion	•	Was a variance granted from the MDH for this Well? ☐ Yes ✓ No
fer:	Elevation Alt Id:		MALE ADDRESS OF THE STATE OF TH
D			License Business Name <u>Freeman Well Co.</u>
	rt Copy		Name of Driller FREEMAN, J.

Unique No. 009	553311 ss	WELL	AND BORING RECORD  Update Date 1994/11/03
	ownship Range Di 145 31	r Section Subsec	Date Well Completed
Well Name JONI	ES, RUSSELL		Drilling Method
Contact's Name BOX 156 CASS LAKE MN (	JONES, RUSS	ELL	Drilling Fluid Well Hydrofractured?  Yes No
CASS LAKE MIN	06633		Use Domestic
			Casing Drive Shoe? Yes N Hole Diameter
-			Screen Open Hole From ft. to ft.  Make Type
			#.
	-		Static Water Level 29 ft. from Land surface Date 1994/08/30  PUMPING LEVEL (below land surface) ft. after hrs. pumping g.p.m.
			Well Head Completion Pitless adapter mf Model Casing Protection 12 in. above grade At-grade(Environmental Wells and Borings ONLY)
-			Grouting Information Well grouted? ✓ Yes
			Nearest Known Source of Contamination  89 ft. direction SW type SDF  Well disinfected upon completion?  Yes No
			Pump Not installed Date Installed  Mfr nam  Mode HP Voits  Drop Pipe Length ft. Capacity g.p.m  Type
			Any not in use and not sealed well(s) on property? Yes No
GS Quad	Elevat	ion	Was a variance granted from the MDH for this Well? Yes No
uifer:	Alt Id:	,	Well CONTRACTOR CERTIFICATION Lic. Or Reg. No. 11064  License Business Name Freeman Well Co.  Name of Driller

	0497051 Bass	WELL AN	A DEPARTMENT OF HE ND BORING RE ota Statutes Chapter 10	CORD	Update		12/20
Township Name	Township Range Di	r Section Subsection W 16	Well Depth	Depth Cor	npleted Dat	te Well Comple	
Well Name US	FORESTRY SERVICE	S	Drilling Method			991/09/11	<del>-</del>
Contact's Name 200 ASH AV MN	US FORESTR'	Y SERVICES	Drilling Fluid		Well Hydrofrad	tured?  Ye	
			Use Domestic				ft.
	·			Prive Shoe?	Yes N	Hole Diamet	er
					ı		
			Screen	0-			
			Make	Орг	en Hole From Type	ft. to	ft.
			PUMPING LEVEL (t	below land surfa		Date 19	991/09/11
			Well Head Completing Pitless adapter mf Casing Protection At-grade(Environ		. 🗀	odel 12 in. above gra	ade
			Grouting Informatio			·	No
					•		
			Nearest Known Sour 20 ft. Well disinfected upo	direction S		/pe O	
			Pump Not In Mfr nam Mode	stalled	Date Insta	lled Volts	
			Drop Pipe Length Type	ft.	Capa		.m
			Any not in use and not	sealed well(s) on	property?	Yes No	
GS Quad	Elevat	ion	Was a variance granted	d from the MDH f	or this Well?	Yes No	
uifer:	Alt Id:		Well CONTRACTOR C License Business Nar Name of Driller	ERTIFICATION			

Unique No. (	00560998					A DEPARTMENT OF HEALTH Update Date 1996/02/09
						ota Statutes Chapter 1031 Entry Date 1996/02/09
Township Name		=		on Subs		Well Depth Depth Completed Date Well Completed
Well Name GF	145	31	W 9	с	DD	51 ft. 51 ft. 1995/06/07
	HRKE, DAV	· · · · · · ·		-··- <u>·</u> -·-		Drilling Method Mud Rotary
Contact's Name RT 3 BOX 620	e GE	HRKE, D	AVID			Drilling Fluid Well Hydrofractured? ☐ Yes ☐ No
CASS LAKE MN	56633					Bentonite Fro ft. to ft.
						Use Domestic
			•			Casing Drive Shoe?  Yes N Hole Diameter
GEOLOGICAL MA	ATERIAL	COLOR	HARDNESS	FRON	то ТО	Casing Diameter Weight(lbs/ft) in. t 51 ft
SAND		YELLO	SOFT	0	12	4 in. t 47 ft
CLAY		YELLO	SOFT	12	30	
CLAY		BLUE	SOFT	30	45	_
SAND		BLUE	HARD	45	51	
						Screen Y Open Hole From ft. to ft.
						Make JOHNSON Type L
						Diameter Slot Length Set Fitting
						2 10 4 47 ft. to 51 ft
						Static Water Level 24 ft. from Land surface Date 1995/06/07
						PUMPING LEVEL (below land surface)  Date 1995/06/07
						ft. after hrs. pumping g.p.m.
						Well Head Completion
						Pitless adapter mf SNAPPY . Model 8PL41U
						Casing Protection
						Grouting Information Well grouted? Yes No
						Material From To (ft.) Amount(yds/bags)
						B 0 30 3 S
						F
						Noorest Known Barrer & Barrer
				•		Nearest Known Source of Contamination  70 ft. direction N type SDF
			•			Well disinfected upon completion?  Yes No
						Pump
						Mfr nam MYERS
		<del></del>			<del></del> -	Mode HP 0.5 Volts 220
			,			Drop Pipe Length 40 ft. Capacity 12 g.p.m  Type S
						Any not in use and not sealed well(s) on property?
GS Quad		Ele	evation			Was a variance granted from the MDH for this Well?  Yes  No
uifer:		Alt			j	Well CONTRACTOR CERTIFICATION Lic. Or Reg. No. 04121
	Rona	# C-		<del></del>		License Business Name Nelson Well Drilling
	Repo	LO	ру			Name of Driller <u>REED, G</u>

Unique No. 00478284  County Name Cass	WELL AN	DEPARTMENT OF HEALTI D BORING RECOIT TO Statutes Chapter 1031		Update Date	
Township Name Township Range Dir 145 31 W	Section Subsection 9 DAC	Well Depth 55 ft.	Depth Complete 55 ft.	Entry Date  d Date We	1992/03/24 ell Completed
Well Name JOHNSTON, PAULINE		Drilling Method			
Contact's Name JOHNSTON, PAUL RT 3, BOX 100	LINE	Drilling Fluid		lydrofractured	
CASS LAKE MN 56633		Use Domestic	Fro	ft.	to ft.
		Use Domestic  Casing Drive 9	Shoe? Yes	□ N Ho	le Diameter
		Screen	Open Hol	e From	ft. to ft.
		Make		/pe	1. 10
		Static Water Level 35 ft  PUMPING LEVEL (below ft. after  Well Head Completion Pitless adapter mf Casing Protection  At-grade(Environment  Grouting Information	land surface) hrs. pumping	Model □ 12 in. gs ONLY)	Date 1991/10/1
	, 		•		·
·	,	Nearest Known Source of 100 ft. dire Well disinfected upon con	ection	type	SDF
		Pump Not Installe Mfr nam Mode	_	ate Installed	
		Drop Pipe Length Type	HP ft.	Capacity	Volts g.p.m
		Any not in use and not seale	d well(s) on prope	rty? 🗌 Yes	☐ No
S Quad Elevation	-	Was a variance granted from	the MDH for this	Well? Yes	☐ No
fer: Alt ld:		Well CONTRACTOR CERTI Licerise Business Name	FICATION Lic.	Or Reg. No.	49588

Unique No.	00160276 Cass				WELL AN	A DEPARTMENT OF HEALTH  ND BORING RECORD  of a Statutes Chapter 1031  Update Date 1991/08/14  Entry Date 1989/03/02
Township Na	me Township	Range	Dir	Section	Subsection	
	145	31	W	8	ACA	Well Depth Depth Completed Date Well Completed 83 ft. 83 ft. 1979/07/06
Well Name	LEECH LAKE	WELL	···	<del></del> -		Drilling Method
						Deilling Fluid
					•	Drilling Fluid     Well Hydrofractured?     ☐ Yes     ☐ N       Fro     ft. to     ft.
		•				Use Municipal
						Casing Drive Shoe? Yes N Hole Diameter
	·			-		
					,	
			Ç.			Screen Open Hole From ft. to ft.
						Make Type
						Static Water Level 26 ft. from Land surface Date 1979/07/0
						PUMPING LEVEL (below land surface) ft. after hrs. pumping g.p.m.
						Well Head Completion
						Pitless adapter mf Model
						Casing Protection
						Grouting Information Well grouted?  Yes No
		•				
•	·					·
						Nearest Known Source of Contamination
			÷			75 ft. direction type
					•	Well disinfected upon completion?  Yes  No
						Pump Not Installed Date Installed  Mfr nam
· · · · · · · · · · · · · · · · · · ·	•					Mode HP Volts
						Drop Pipe Length ft. Capacity g.p.m Type
						Any not in use and not sealed well(s) on property? Yes No
GS Quad						Was a variance granted from the MDH for this Well? Yes No
uifer:			evatior t ld:	า		Well CONTRACTOR CERTIFICATION Lic. Or Reg. No.
	D					License Business Name
	Repo	T C	opy	· 		Name of Driller

Unique No.	00195009 e Cass			MINNESOTA DEPARTMENT OF HEALTH WELL AND BORING RECORD					Update Dat		1991/08/14	
Township No	ıme Township	- <u> </u>	<u> </u>			a Statutes Chapter 1031			Entry Date 198		989/03/02	
TOWNSHIP NE	145	Range D	vir W	Section 8	Subsection BCC	Well Depth 57 ft.	Depth Cor 57	-			npleteď	
Well Name	ALBIN CARLS					Drilling Method	- Jr	ft.	1982 	/09/16		
								<u> </u>				
					•	Drilling Fluid		Well	Hydrofracture		Yes No	
						Use Domestic		1110	I	t. to ———	ft.	
						_	rive Shoe?					
						July Di		] Yes	□ N   H	ole Dia	meter	
							_					
,												
									,			
						Screen	On	en Ho	le From	ft.	to ft.	
						Make	1		ype			
		•	-									
						Static Water Level	23 ft. from Lan	d surfa	ice	Date	1982/09/16	
						PUMPING LEVEL (b		•				
	•					ft. after		umpin	g g.p	o.m.		
						Well Head Completion Pitless adapter mf	on		Model	t		
						Casing Protection			☐ 12 i		e grade	
						At-grade(Environ			ngs ONLY)	<del></del>		
٠						Grouting Information	n Welligr	outed?	Yes	Ĺ	] No	
					. *							
						4					•	
				*		Nearest Known Sour	ce of Contamin	etion				
						200 ft.	direction	iation	type			
						Well disinfected upor	n completion?	□ Y	es 🗌 N	0		
						Pump Not In	stalled		Date Installed			
						Mfr nam Mode		115		h # - 2:		
						Drop Pipe Length	ft.	HP	Capacity	Volts		
					i	Туре	***		Jupacity		g.p.m	
						Any not in use and not	sealed well(s) or	пргоре	erty? 🔲 Yo	es [	No	
GS Quad		Eleva	ation			Was a variance granted	from the MDH	for this	Well? Y		No	
uifer:		Alt Id				Well CONTRACTOR C		Lic.	Or Reg. No.	<del></del>		
	Repo	t Cor	)V			License Business Nan	me		-			
			<b>-</b> y			Name of Driller						

Unique No.	00415148			<del></del>	MINNES	SOTA DEPARTME	NT OF HEA	LTH	·			<del>,</del>	
County Name	Cass				WELL	AND BORIN	IG REC	ORD	-	Update	Date	1991/0	8/14
Township Nam	e Townshin	Danse				nesota Statutes C		1		Entry D	ate	1988/04	1/07
	145	31	W	Section 8	on Subsect	tion · Well De	pth ft.	Depth Co				Complete	ed
Well Name	ONCE, DELC	IE.				Drilling			ft. ———		986/06/	17 	
					<del></del> -	Drilling	· · · · · · · · · · · · · · · · · · ·						
						Drining	riula		Well F   Fro	lydrofrac		_	□ N
						Use D	omestic		1110		ft. to		ft.
						Casing		/e Shoe?					
						Judania	Ditt	re snoe?	」Yes	∐ N	Hole	Diameter	ſ
1													
									•				
		,											
						Screen		Ор	en Hole	From		ft. to	ft.
						Make			Ту	oe .			<del></del>
•													
•													
						Static Water	r Level 20	) ft. from Lan	d surfac	<del></del>		Date 1986	 6/07/08
	·,					1		ow land surfa	ıce)				
						<del></del>	t. after		umping	<u> </u>	g.p.m.		
						Well Head		1					
						Casing Pro	otection			Mo: ☐ 1	2 in at	ove grad	P
						At-grade	e(Environme	ental Wells and		s ONLY)			_
						Grouting In	Tormation	Well gr	outed?	<b>✓</b> Ye	s	☐ No	_
												•	
													j
•						Nearest Kno	Wn Source	of Contamin					
						100	-	direction	асіол	typ	e		
						Well disinfe	ected upon c	completion?	Ye	s 🗆	No		}
						Pump [	Not Insta	illed	Da	te Install	ed		
						Mfr nam Mode							
MARKS, ELEVAT	TION, SOURC	E OF DA	TA, etc	 c.	<del></del>	Drop Pipe L	ength	ft.	HP	Conne	Vol		
ECH LAKE INDIA						Туре	·g ···	14.		Capaci	ıy	g.p.m	1
				,		Any not in use	and not sea	aled well(s) on	propert	y? 🗀	Yes		
GS Quád		FI.	.m&! =			Was a varianc				_		□ No	
ifer:		Elev Alt I	ation d:			Well CONTRA							
	Renor				·	License Busi		ISAIION	mo. C	r Reg. N	IŪ.		
	Repor	1 CO	μy			Name of Drill	ler						

Unique No. 657409	,				A DEPARTMENT OF HEALTH  Update Date 2001/06/05
County Name Cass			AAC	LL A. Minnes	AD BOKING RECORD
Township Name Townsh	ip Range D	Dir Secti	ion Sub		ota Statutes Chapter 1031 Entry Date 2001/01/10
145	31	W 8		OCB	Date Well Completed
Well Name HOWARD, S	SHERYL				Drilling Method Non-specified Rotary
					- William Total y
					Drilling Fluid Well Hydrofractured? Yes Bentonite Fro ft. to
					Use Domestic
	.,	•			Casing Drive Shoe? Yes N Hole Diameter
GEOLOGICAL MATERIAL	COLOR	HARDNESS	EDO	/I TO	Casing Diameter Weight(Ibs/ft) in. t 88
ABOVE GRADE			· <del>-</del>		Casing Diameter Weight(Ibs/ft)  4 in. t 84 ft
SANDY LOAM	BROW 8	SOFT	0	2	
SAND	BROW S		2	7	
CLAY		IARD	7	51 ———	
SAND	BROW H		51 	83	
	DIVOVV H	IARD	83	88	Screen Y Open Hole From ft. to
					Make JOHNSON Type O
					Diameter Slot Length Set Fitting
		•			4 7 4 84 ft. to 88 ft
					Static Water Level 25 ft. from Land surface Date
•					PUMPING LEVEL (below land surface)
					ft. after hrs. pumping 50 g.p.m.
					Well Head Completion
					Pitless adapter mf MAASS Model JC
					Casing Protection
					☐ At-grade(Environmental Wells and Borings ONLY)  Grouting Information Well grouted? ✓ Yes ☐ No.
					Grouting Information Well grouted? ✓ Yes No  Material From To (ft.) Amount(yds/bags)
				•	B 10 60 6 S
					·
		•			
					Nearest Known Source of Contamination  80 ft. direction s
					Well disinfected upon completions
					Pump ✓ Not Installed Date Installed N  Mfr nam
					Mode
MARKS, ELEVATION, SOUR	CE OF DATA	A, etc.			Drop Pipe I ength
E: TELESCOPE					Type Capacity g.p.m
				Ì	Any not in use and not sealed well(s) on property? ☐ Yes ☑ No
SS Quad	<del>-</del>			ľ	Was a variance grant of the U
ifer:	Elevai Alt Id:			}	W-II CONTRACTOR
-			<del>-</del>		License Business Name Freeman Well Co.
Керо	rt Cop	у			Name of Driller FREEMAN, J

Unique No. 604794					DEPARTMENT OF HEALTH  DEPARTMENT OF HEALTH  Update Date 1999/12/17
County Name Cass					D BORING RECORD  ta Statutes Chapter 1031  Update Date 1999/12/17  Entry Date 1999/05/10
Township Name Townshi	p Range Dir	Section	-		
145	31 W	8			Well Depth Depth Completed Date Well Completed 42 ft. 42 ft. 1998/04/09
	HERAN CHUR				Drilling Method Non-specified Rotary
Contact's Name T 3RD & CENTRAL CASS LAKE MN 56633-	RINITY LUTHEI	RAN CHUR	CH		Drilling Fluid Well Hydrofractured? Yes N Bentonite Fro ft. to ft
	RINITY LUTHER	PAN CUUDO		<del></del>	Use Domestic
HWY 2 W		VIII OHUKC	νΠ		Casing Drive Shoe? Yes N Hole Diameter
GEOLOGICAL MATERIAL	COLOR HAR	RDNESS	FROM	то	Casing Diameter Weight(lbs/ft) in t 42
SAND	BROW MEI			36	4 in. t 38 ft
SAND	BROW HAF		 	42	
					Screen Y Open Hole From ft. to ft.
					Make JOHNSON Type B
					Diameter Slot Length Set Fitting
	,				2 10 4 38 ft. to 42 ft
	,				Static Water Level 9 ft. from Date 1998/09/0
					PUMPING LEVEL (below land surface)  14 ft. after 2 hrs. pumping 30 g.p.m.
•					Well Head Completion
					Pitless adapter mf SNAPPY Model 8PL41U
					Casing Protection 12 in, above grade
					☐ At-grade(Environmental Wells and Borings ONLY)  Grouting Information Well grouted? ✓ Yes □ No.
					Grouting Information Well grouted? ✓ Yes No  Material From To (ft.) Amount(yds/bags)
					B 7 30 3 S
					Nearest Known Source of Contamination  110 ft. direction NE type SDF
					Well disinfected upon completion? Yes No
,					Pump
			· .		Mode 2N52 - 12 HP 0.5 Volts 220
					Drop Pipe Length 30 ft. Capacity 12 g.p.m Type S
					Any not in use and not sealed well(s) on property? ☐ Yes ✔ No
GGS Quad	Elevatio	n			Was a variance granted from the MDH for this Well? ☐ Yes ☑ No
uifer:	Alt id:	••			Well CONTRACTOR CERTIFICATION Lic. Or Reg. No. 04121
Repo	rt Copy	7			License Business Name Nelson Well Drilling
				Ţ	Name of Driller <u>REED, G.</u>

	00437450	,		MINNESOTA WELL AN	DEPARTMENT				Update I	Date	1991/08/	/14
	Cass				a Statutes Cha				Entry Da	ite _	1991/03/	30
Township Name	Township			Section Subsection	Well Dept			omplete			omplete	d
Well Name J	·····	31	W	7	58	ft.	58	ft.	19	87/10/3	31	
	OHNSON, KE				Drilling M	ethod			·			
Contact's Nam RR 3 BOX 637 CASS LAKE M	х	HNSON, F	KEN		Drilling F	luid		Well	Hydrofract	ured?	Yes	☐ No
					Use Do	mestic	<del>-</del>					
					Casing	Drive	e Shoe?	Yes Yes	□ N	Hole I	Diameter	
							-					
						·						
					Screen			Open Ho	le From		ft. to	ft.
					Make			Т	ype			
	•				Static Water	<del></del>			ace		Date 198	- <u>-</u> 7/10/31
						. after	hrs.	ırface) . pumpin	9	g.p.m.		
					Well Head ( Pitless ada Casing Pro	pter mf		and Bori		odel 12 in. al	bove grad	e
					Grouting Int			l grouted			No	<del></del>
	·											
					Nearest Kno 100 Well disinfe	ft.	direction			/pe No		
					Pump [ Mfr nam	Not Insta	ailed	· .	Date Insta	iled		
		·			Mode Drop Pipe L Type	ength	ft.	HP	Capa		olts g.p.r	n
					Any not in use	and not se	aled well(s	) on prop	erty? · [	Yes	No	
S08 04					Was a variand						No	
SGS Quad quifer:			evation	n	Well CONTR	ACTOR CE	RTIFICATI		c. Or Reg.			
	Repo	ort Co	ру		Name of Dri		. 140/11	· orai Dili	<u>my</u>			

	0555769	WELL AND	BORING RECORD	Update D					
County Name C	ass	Minnesota	Statutes Chapter 1031						
Township Name	Township Range D	ir Section Subsection W 17	Well Depth Depth C 60 ft. 59	•	Well Completed 94/02/20				
Well Name TR	EICHEL, WALTER		Drilling Method	·					
Contact's Name RR 2 BOX 407		ALTER	Drilling Fluid	Well Hydrofract	ured? Yes No				
CASS LAKE M	N 56633		Use Domestic						
	•		Casing Drive Shoe?	☐ Yes ☐ N	Hole Diameter				
,									
			Screen	Open Hole From	ft. to ft.				
			Make	Туре	,				
		•	Static Water Level 15 ft. from	Land surface	Date 1995/02/20				
	,		PUMPING LEVEL (below land ft. after	I surface) hrs. pumping	g.p.m.				
		`	Well Head Completion Pitless adapter mf Casing Protection At-grade(Environmental W		Model ] 12 in. above grade LY)				
			Grouting Information	Well grouted?	Yes No				
		·							
			Nearest Known Source of Co 50 ft. directi Well disinfected upon compl	on	type SDF				
			Pump Not Installed  Mfr nam  Mode  Drop Pipe Length	HP	nstalled Volts Capacity g.p.m				
			Type	well(s) on property?	☐ Yes ☐ No				
			Any not in use and not sealed  Was a variance granted from						
USGS Quad		Elevation			Reg. No. <u>49588</u>				
Aquifer:	<b>D</b>	Alt id:	Well CONTRACTOR CERTIF  License Business Name  Name of Driller	North Star Drilling	110g. 110. <u>110900</u>				
	Report	copy	Name of Diffice	HI	E-01205-06 (Rev. 9/96)				

Unique No. 00566263					BORING RECORD	Update Date 1995/12/30
County Name Cass	-				Statutes Chapter 1031	Entry Date 1995/12/30
Township Name Township	-	Section		ection		pleted Date Well Completed ft. 1995/08/21
Well Name KINGDOM HA	ALL ASSOC.				Drilling Method Mud Rotary	
Contact's Name K RT 3 BOX 597	INGDOM HAL	L ASSOC.			Drilling Fluid Bentonite	Well Hydrofractured? Yes No
CASS LAKE MN 56633						
					Use Public Supply/non-commtra	
					Casing Drive Shoe?	,
GEOLOGICAL MATERIAL	COLOR H	ARDNESS	FROM	то		in. t 70 ft
SAND	BROW S	OFT	0	44	4 in. t 66 ft	
CLAY/ROCK	GRAY M	IEDIUM	44	98		
SAND	GRAY S	OFT	98	111		
					Screen Y Op	en Hole From ft. to ft.
1					Make JOHNSON	Type L
					Diameter Slot Length Set	Fitting
					2 12 4 66	ft. to 70 ft
					Static Water Level 15 ft. from Lar	nd surface Date 1995/08/21
<b>1</b>					PUMPING LEVEL (below land surf	ace)
					ft. after hrs. p	oumping g.p.m.
					Well Head Completion	
					Pitless adapter mf MONITOR Casing Protection	Model SNAPPY ☐ 12 in. above grade
•					At-grade(Environmental Wells a	_
<b>!</b>					1	routed? 🗹 Yes 🗌 No
	•				-	Amount(yds/bags) 2 S
<b>.</b>					0 30	
				-		•
•						
					Nearest Known Source of Contami	ination
					100 ft. direction W	
1					Well disinfected upon completion?	Yes No
					Pump Not Installed	Date Installed
•					Mfr nam GUNFOS  Mode	HP 0.5 Volts 230
					Drop Pipe Length 70 ft.	Capacity 10 g.p.m
_					Type S	
					Any not in use and not sealed well(s)	on property?    Yes    No
1000.0					Was a variance granted from the MD	H for this Well? Yes No
SGS Quad	Ele Alt	evation Id: 511	1088S0 <sup>-</sup>	I	Well CONTRACTOR CERTIFICATION	ON Lic. Or Reg. No. <u>04463</u>
				-	License Business Name Ameri	can Water Co.
Rep	ort Co	ру			Name of Driller CESO	LINI, C.

Unique No. 619870 County Name Cass			WELI	LAND	BORING RECORD  Statutes Chapter 1031  Update Date 1999/12/17  Entry Date 1999/05/10
Township Name Township	Range I	Dir Section W 17	n Subse		Well Depth Depth Completed Date Well Completed 60 ft. 60 ft. 1998/08/21
Well Name HOUGH, JOE					Drilling Method Non-specified Rotary
Well Owner's Name HO	UGH, JOI	 E			Drilling Fluid Well Hydrofractured? Yes No
04001445 1411 55500					Bentonite Fro ft. to ft.
CASS LAKE MN 56633-				<del></del>	Use Domestic
					Casing Drive Shoe? Yes N Hole Diameter in. t 60 ft
GEOLOGICAL MATERIAL	COLOR	HARDNESS	FROM	то	Casing Diameter Weight(lbs/ft)
ABOVE GRADE			0	2	4 in. t ft
SAND	BRN	SOFT	2	5	-
SANDY LOAM	BRN	SOFT	5	8	-
SAND	BRN	SOFT	8	18	
CLAY	GRY	SOFT	18	21	Screen Y Open Hole From ft. to ft.
CLAY, SAND	GRY	SOFT	21	23	Make JOHNSON Type L
SAND	GRY	SOFT	23	47	Diameter Slot Length Set Fitting
CLAY, SAND	GRY	SOFT	47	54	3 4 56 ft. to 60 ft
SAND	GRY	SOFT	54	60	Static Water Level ft. from Date
					PUMPING LEVEL (below land surface)  9 ft. after 1 hrs. pumping 15 g.p.m.  Well Head Completion Pitless adapter mf Model  Casing Protection 12 in. above grade  At-grade(Environmental Wells and Borings ONLY)  Grouting Information Well grouted? Yes No  Material From To (ft.) Amount(yds/bags)  B 10 50  Nearest Known Source of Contamination ft. direction type  Well disinfected upon completion? Yes No
					Pump Not Installed Date Installed N  Mifr nam  Mode HP Volts  Drop Pipe Length ft. Capacity g.p.m  Type  Any not in use and not sealed well(s) on property? Yes No  Was a variance granted from the MDH for this Well? Yes No
USGS Quad Aquifer:		Elevation Alt Id:			Well CONTRACTOR CERTIFICATION Lic. Or Reg. No. 11064
	ort (	Сору			License Business Name  Freeman Well Co.  Name of Driller  FREEMAN, J.
<u> </u>					HE-01205-06 (Rev. 9/96)

Unique No. 659161 County Name Cass			WEL	LANE	BORING RECORD Statutes Chapter 1031  Update Date 2001/08/08 Entry Date 2001/07/20
Township Name Township	Panas D	ir Section	Subse		Well Depth   Depth Completed   Date Well Completed
145	31	W 17	AB		58 ft. 58 ft. 2001/03/12
Well Name LEECH LAKE	HOUSING	AUTHO			Drilling Method Non-specified Rotary
Well Owner's Name LE 6677 160TH ST CASS LAKE MN 56633-	ECH LAKE	HOUSING AI	UTHORI	ΤΥ	Drilling Fluid     Well Hydrofractured?     Yes     No       Bentonite     Fro     ft. to     ft.
CASS DARE WIN SOOSS					Use Domestic
•					Casing Drive Shoe? Yes N Hole Diameter in. t 58 ft
GEOLOGICAL MATERIAL	COLOR	HARDNESS	FROM	то	Casing Dlameter Weight(lbs/ft)
ABOVE GRADE			0	2	4 in. t 53 ft
SAND	BROW	SOFT	2	46	
CLAY	GRAY	HARD	46	48	-
SAND ·	GRAY	SOFT	48	58	
					Screen Y       Open Hole From ft. to ft.         Make JOHNSON       Type L         Diameter Slot       Length       Set       Fitting         2       10       4       53       ft. to 58       ft         Static Water Level 26 ft. from Land surface       Date 2001/03/12         PUMPING LEVEL (below land surface)         26 ft. after       2 hrs. pumping       25 g.p.m.         Well Head Completion         Pitless adapter mf       Model         Casing Protection       12 in. above grade         At-grade(Environmental Wells and Borings ONLY)         Grouting Information       Well grouted?       ✓ Yes       No         Material       From To (ft.) Amount(yds/bags)         B       0       40
					Nearest Known Source of Contamination 80 ft. direction S type SDF Well disinfected upon completion? ✓ Yes No  Pump Not Installed Date Installed Mfr nam STA-RITE Mode HP 0.5 Volts 230  Drop Pipe Length ft. Capacity g.p.m
•					Drop Pipe Length ft. Capacity g.p.m  Type S
•					Any not in use and not sealed well(s) on property? Yes V No
·					Was a variance granted from the MDH for this Well? Yes No
USGS Quad		Elevation			Well CONTRACTOR CERTIFICATION Lic. Or Reg. No. 11064
Aquifer:		Alt Id:		··	License Business Name Freeman Well Co.
Rei	nort C	vao			Name of Driller FREEMAN, J.

HE-01205-06 (Rev. 9/96)

Unique No.	00519525		,		DODING DECO		Update	Date 1	993/03/1	5
County Name	Cass				) BORING RECO Statutes Chapter 1031	KU	Entry D	ate 1	993/03/1	5
Township Nam	e Township 145	Range Dir		Subsection BBB	Well Depth 135 ft.	Depth Con	•	e Well Co	mpleted	
Well Name	IANSON, DIA	NNE			Drilling Method					
					Drilling Fluid		Well Hydrofrac	tured? [	Yes [	No
							Fro	ft. to		ft.
		,			Use Domestic					
					Casing Driv	re Shoe?	Yes N	Hole D	iameter	
								ļ		
					Screen	0	pen Hole Fron	<u> </u> 	ft. to	ft.
					Make	1	Туре			
•					Static Water Level 4	40 ft. from La	and surface		Date 199	 2/10/08
	•				PUMPING LEVEL (be			<del></del>		
					ft. after	hrs.	pumping	g.p.m.		
	• •				Well Head Completion Pitless adapter mf	on		Model		
	·		æ		Casing Protection  At-grade(Environ	mental Wells			bove grad	e
					Grouting Information	n Well	grouted?	Yes	□ No	5
,			-							
						*				
			•	·						٠.
				•	Nearest Known Sou	rce of Contai				
					ft.	direction		type		
					Well disinfected upo	on completion	? Tyes	☐ No		
					Pump Not II  Mfr nam	nstailed	Date I	ıstalled		
Ī			_		Mode		HP	'	/olts	
REMARKS, EL	EVATION, SC	DURCE OF DA	ATA, etc.		Drop Pipe Length	ft.	· C	apacity	g.p	o.m
S. CASS LAKE					Туре	المسلمة المحاجمة	a) or property?		. □ No	
}					Any not in use and no			Yes		
USGS Quad		Ele	evation		Was a variance grant					
Aquifer:		Alt	t ld:		Well CONTRACTOR License Business N		TON Lic. Or I th Star Drilling	Reg. No.	49588	
	Rei	port Co	ру		Name of Driller				<u>.</u>	

## APPENDIX B - BORING LOGS

#### NATURAL RESOURCES ENGINEERING COMPANY 13 W. Superior St. Duluth, MN 55802 PROBE LOG NO: GP-1 PROJECT NAME: **EEC Detection Monitoring** PROJ. NO. PROJECT LOCATION: South Cass Lake Station, MN CHECKED BY: DJH SUBSURFACE PROFILE SOIL SAMPLE DATA Interval (feet) USCS OVM (ppm) Description Depth (Ft.) Analytical Sample Analysis Blows/6" 0 to 4 SP Brown, medium grained, well-sorted, moist SP SP sand < 5 SP SP < 5 None None 4 to 8 SP Collected Recorded SP < 5 Same SP sand as above. Slightly coarser SP 7-8 feet SP < 5 8 to 12 SP Same SP sand as above. SP < 5 SP SP < 5 \ 12 to 16 SP Same SP sand as above. SP 20.5 SP SP 25.7 16 to 20 SP Same SP sand as above. SP 26.3 SP SP 28.2 20 to 24 SP Same SP sand as above. SP Faint petro odor. Wet at 24 feet 42.4 SP SP 24 to 28 SW 242 Coarsens to a SW sand at 25 feet SW Oil saturated from 24 to 26 feet SW SW 497 TOTAL DEPTH: DRILLING METHOD: 28 feet Push-Probe DRILLING DATE: 9/25/2001 INSPECTOR: DJH ' WATER LEVEL OBSERVATION:

CONTRACTOR:

Thein Well Company

#### NATURAL RESOURCES ENGINEERING COMPANY 13 W. Superior St. Duluth, MN 55802 GP-2 PROBE LOG NO: PROJ. NO. PROJECT NAME: **EEC Detection Monitoring CHECKED BY:** DJH PROJECT LOCATION: South Cass Lake Station, MN SOIL SAMPLE DATA SUBSURFACE PROFILE Interval OVM (ppm) (feet) USCS Description Depth (Ft.) Analytical Sample Analysis Blows/6" 0 to 4 SP Brown, medium grained, well-sorted, moist SP SP sand < 5 SP SP < 5 None None SP Collected Recorded 4 to 8 SP < 5 Same SP sand as above. SP Lighter color at 6 feet . SP < 5 8 to 12 SP Same SP sand as above. SP < 5 SP SP < 5 12 to 16 SP Same SP sand as above. SP < 5 SP . SP < 5 SP 16 to 20 Same SP sand as above. SP < 5 SP SP 11.5 20 to 24 SP Same SP sand as above. SP 7.6 SP SP 15.4 24 to 28 SP Same SP as above, but slightly coarser. SP 1082 Wet at 25 feet. SP Oil saturated from 24-26 feet SP 1093 Push-Probe TOTAL DEPTH: **DRILLING METHOD:**

28 feet

DRILLING DATE:

9/25/2001

INSPECTOR:

WATER LEVEL OBSERVATION:

CONTRACTOR: Thein Well Company

### NATURAL RESOURCES ENGINEERING COMPANY 13 W. Superior St. Duluth, MN 55802

PROBE LOG NO: GP-3

PROJECT NAME: **EEC Detection Monitoring**  PROJ. NO.

PROJECT LOCATION: South Cass Lake Station, MN

CHECKED BY:

DJH

Interval (feet) USCS Description  O to 4 SP Brown, medium grained, well-sorted, moist SP		LOOM	ON. SOUTH CASS Lake Station, MIN	german en en flekt fent i 1970.	Name and Address of the Address of t	COL CAMPLE DATA	חלום
Cited   USCS   Description   Depth (Ft.)   OVM (ppm)   Analytical Sample Analysis   Blows/6"	late	<del></del>	SUBSURFACE PROFILE	<del></del>	<b> </b>	SOIL SAMPLE DATA	<del></del>
SP   SP   SP   SP   SP   SP   SP   SP	9	uscs	Description	Depth (Ft.)	OVM (ppm)	Analytical Sample Analysis	Blows/6"
SP SP SP SP SP SP SP SP SP SAME SP SAM	0 to 4				,		
SP   Same SP sand as above.   SP   Same SP sand as above.   SP   Same SP sand as above.   SP   SP   Same SP sand as above.   SP   SP   SP   SP   SP   SP   SP   S			SP sand		< 5	ł I	1
4 to 8 SP Same SP sand as above. SP Series SP Same SP sand as above. Light brown color at 6 feet SP SP Coarser grained at 10.5 feet SP SP SP Same SP sand as above. SP S			1	X 200 3		,	1
SP Same SP sand as above. Light brown color at 6 feet SP Same SP sand as above. SP Same SP sand as above. Coarser grained at 10.5 feet SP SP SP Same SP sand as above.  12 to 16 SP Same SP sand as above. SP S					< 5		
SP Light brown color at 6 feet SP SP Same SP sand as above. SP Coarser grained at 10.5 feet  12 to 16 SP Same SP sand as above. SP S	4 to 8	1	1			1	Recorded
SP			1		< 5	1	]
8 to 12			Light brown color at 6 feet			from water table	
SP   Coarser grained at 10.5 feet   < 5     SP   SP     < 5     12 to 16   SP   Same SP sand as above.   < 5     SP   SP     < 5     SP   SP     < 5     16 to 20   SP   Same SP sand as above.   < 5     SP   SP     < 5     SP   SP     < 5     SP   SP     < 5     20 to 24   SP   Same SP sand as above.   < 5     SP   SP     < 5     SP   SP     < 5     SP   SP   SP     < 5     SP   SP   SP   SP   SP   SP   < 5     SP   SP   SP   SP   SP   SP   SP					< 5		
SP   SP   SP   Same SP sand as above.   SP   Finer grained at 13 feet   SP   SP   SP   SP   SP   SP   SP   S	8 to 12		i		_		
SP   Same SP sand as above.   SP   Siner grained at 13 feet   SP   SP   SP   SP   SP   SP   SP   S			Coarser grained at 10.5 feet		< 5		i I
12 to 16		i			_	-	<u> </u>
SP   Finer grained at 13 feet   < 5     SP   SP     SP     < 5     16 to 20   SP   Same SP sand as above.   < 5     SP   SP     < 5     SP   SP     < 5     20 to 24   SP   Same SP sand as above.   < 5     SP   SP     < 5     SP   SP     < 5     SP   SP   SP   Search SP sand as above.   < 5     SP   SP   SP   Search SP sand as above.   < 5     SP   SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as above.   < 5     SP   SP   Search SP sand as a	40 : 40				< 5	,	
SP SP SP SP Same SP sand as above.  16 to 20 SP Same SP sand as above.  SP S	12 to 16		4				
SP		L*	Finer grained at 13 feet		< 5		i
16 to 20 SP Same SP sand as above.  SP S	*. *		Į.				
SP SP SP SP Same SP sand as above.  20 to 24 SP	40 1 00			_	< 5		
SP SP SP SP SP SP Same SP sand as above.  20 to 24 SP	16 to 20		Same SP sand as above.				
SP Same SP sand as above.  SP SP SP Wet at 24 feet  24 to 28 SP Grades to a coarse grained, poorly- SP sorted, SW sand at 26 feet SP SP SP Sorted, SW sand at 26 feet SP SP SORTED SP			,		< 5	,	
20 to 24 SP Same SP sand as above.  SP SP Wet at 24 feet  24 to 28 SP Grades to a coarse grained, poorly- SP sorted, SW sand at 26 feet SP SP Sorted, SW sand at 26 feet SP SP Sorted, SW sand at 26 feet				28.82	1.5		
SP SP SP SP Wet at 24 feet SP SP Grades to a coarse grained, poorly-SP sorted, SW sand at 26 feet SP SP SP Sorted, SW sand at 26 feet SP	204-24		10.00	4	< 5		-
SP SP Wet at 24 feet	20 to 24		Same SP sand as above.			,	
SP Wet at 24 feet < 5  24 to 28 SP Grades to a coarse grained, poorly- SP sorted, SW sand at 26 feet	, 1				<b>^</b> 5		
24 to 28 SP Grades to a coarse grained, poorly- SP sorted, SW sand at 26 feet 20.2 SP SP			IMpt at 24 East		-5		
SP sorted, SW sand at 26 feet 20.2	24 to 28				\ 0		i
SP SP	24 10 20				20.2		
t Innividual at the Control of the C			sorted, SVV sand at 26 feet		20.2	,	
		•			- 15.7	*	
		•			15.7		
					_	•	
						(	
				l l			

TOTAL DEPTH:

28 feet

DRILLING DATE:

9/25/2001

INSPECTOR: CONTRACTOR: DJH

Thein Well Company

DRILLING METHOD:

Push-Probe

WATER LEVEL OBSERVATION: 24 feet

22.72 feet following development

#### NATURAL RESOURCES ENGINEERING COMPANY 13 W. Superior St. Duluth, NiN 55802 PROBE LOG NO: GP-4 PROJECT NAME: **EEC Detection Monitoring** PROJECT LOCATION: South Cass Lake Station, MN PROJ. NO. CHECKED BY: DJH SUBSURFACE PROFILE SOIL SAMPLE DATA Interval (feet) USCS Description OVM (ppm) Depth (Ft.) Analytical Sample Analysis 0 to 4 Blows/6" SP Brown, medium grained, well-sorted, moist SP SP sand < 5 SP SP < 5 4 to 8 SP None Water: SP Recorded Same SP sand as above. < 5 BTEX, DRO collected SP Light brown color at 7 feet from water table SP < 5 8 to 12 SP Same SP sand as above. SP Coarser grained at 10.5 feet < 5 SP SP < 5 12 to 16 SP Same SP sand as above. SP < 5 SP SP < 5 16 to 20 SP Same SP sand as above. SP < 5 SP SP < 5 20 to 24 SP Same SP sand as above. SP Becomes more fine grained at 22 feet. < 5 SP SP 8.2 24 to 28 SP Same SP as above to 25 feet, then grades SP to a SW sand. 6.3 SP Wet at 25 feet SP 7.2 TOTAL DEPTH: 28 feet DRILLING METHOD: Push-Probe DRILLING DATE: 9/25/2001 INSPECTOR: DJH WATER LEVEL OBSERVATION: CONTRACTOR: 25 feet Thein Well Company 22.55 feet following development

#### NATURAL RESOURCES ENGINEERING COMPANY 13 W. Superior St. Duluth, MM 55802 PROBE LOG NO: GP-5 PROJECT NAME: **EEC Detection Monitoring** PROJ. NO. PROJECT LOCATION: South Cass Lake Station, MN CHECKED BY: DJH SUBSURFACE PROFILE SOIL SAMPLE DATA Interval (feet) USCS Description Depth (Ft.) OVM (ppm) Analytical Sample Analysis Blows/6" 0 to 4 **TPSL** Black, organic-rich topsoil to 1 foot. SP Brown, medium grained, well-sorted, moist < 5 SP SP sand SP < 5 4 to 8 SP None Water: Recorded SP Same SP sand as above. < 5 BTEX, DRO collected SP Light brown color at 7 feet from water table SP < 5 8 to 12 SP Same SP sand as above. SP < 5 SP SP < 5 12 to 16 SP Same SP sand as above. SP < 5 SP SP < 5 16 to 20 SP Same SP sand as above. SP 1-inch thick silt layer at 20 feet. < 5 SP SP < 5 20 to 24 SP Same SP sand as above. SP Becomes more fine grained at 22 feet. < 5 SP SP Wet at 24 feet < 5 24 to 28 SP Same SP sand as above. SP < 5 SP SP < 5 TOTAL DEPTH: 28 feet DRILLING METHOD: Push-Probe DRILLING DATE: 9/25/2001 INSPECTOR: DJH WATER LEVEL OBSERVATION: CONTRACTOR: 24 feet Thein Well Company

23.40 feet following development

#### NATURAL RESOURCES ENGINEERING COMPANY 13 W. Superior St. Duluth, MN 55802 PROBE LOG NO: PROJECT NAME: GP-6 **EEC Detection Monitoring** PROJECT LOCATION: South Cass Lake Station, MN PROJ. NO. CHECKED BY: SUBSURFACE PROFILE DJH SOIL SAMPLE DATA Interval (feet) USCS Description OVM (ppm) Depth (Ft.) Analytical Sample Analysis 0 to 4 Blows/6" SP Black, organic-rich topsoil to 1 foot. SP Brown, medium grained, well-sorted, moist < 5 SP SP sand SP < 5 4 to 8 SP None Water: Recorded SP Same SP sand as above. < 5 BTEX, DRO collected SP Light brown color at 5.5 feet from water table SP ≥ 5 8 to 12 SP Same SP sand as above. SP < 5 SP SP. < 5 12 to 16 SP Same SP sand as above. SP < 5 SP SP < 5 16 to 20 SP Same SP sand as above. SP 1-inch thick silt layer at 20 feet. < 5 SP SP < 5 20 to 24 SP Same SP sand as above. SP Becomes more fine grained at 22 feet. < 5 SP SP Wet at 24 feet W < 5 24 to 28 SP Same SP sand as above. SP < 5 SP SP < 5 TOTAL DEPTH: 28 feet **DRILLING METHOD:** Push-Probe DRILLING DATE: 9/25/2001 INSPECTOR: DJH WATER LEVEL OBSERVATION:

CONTRACTOR:

Thein Well Company

24 feet

22.32 feet following development

#### NATURAL RESOURCES ENGINEERING COMPANY 13 W. Superior St. Duluth, MN 55802 PROBE LOG NO: GP-7 PROJECT NAME: **EEC Detection Monitoring** PROJ. NO. PROJECT LOCATION: South Cass Lake Station, MN CHECKED BY: DJH SUBSURFACE PROFILE SOIL SAMPLE DATA interval (feet) USCS Description OVM (ppm) Analytical Sample Analysis Depth (Ft.) Blows/6" 0 to 4 Brown, medium grained, well-sorted, moist SP SP sand < 5 SP SP 7.1 None None 4 to 8 SP Collected Recorded SP Same SP sand as above. 12.3 SP SP 21.7 8 to 12 SP Same SP sand as above. SP 6.3 SP Light brown to gray color at 9 feet. SP Faint petroleum odor. 7.9 12 to 16 SP Same SP sand as above. SP < 5 SP SP < 5 16 to 20 SP Same SP sand as above. SP 28.3 SP SP 32.6 20 to 24 SP Same SP sand as above. SP 107 SP Oil saturated from 23-24 feet SP Wet at 24 feet 337 TOTAL DEPTH: 24 feet DRILLING METHOD: Push-Probe DRILLING DATE: 9/25/2001 INSPECTOR: DJH WATER LEVEL OBSERVATION: 24 feet CONTRACTOR: Thein Well Company

### NATURAL RESOURCES ENGINEERING COMPANY 13 W. Superior St. Duluth, MN 55802

PROJECT NAME: PROBE LOG NO: GP-8

**EEC Detection Monitoring** PROJECT LOCATION: South Cass Lake Station, MN PROJ. NO. CHECKED BY: DJH

	<u></u>	SUBSURFACE PROFILE	ted with a first product	1	CHECKED BY	: DJH
Interval (feet)	LICOD	ļ	<del></del>	₩	SOIL SAMPLE DATA	<u> </u>
0 to 4	USCS	Description	Depth (Ft.)	OVM (ppm)	Analytical Sample Analysis	Blows/6"
0 10 4	SP SP		(4.4%) 3.4%		Ostripic / iliaysis	DIOM2/P
	SP	Brown, medium grained, well-sorted, moist		< 5 -		ĺ
	SP	SP sand		-		
4 to 8	SP			< 5		<b>.</b>
7 10 0		· · · · · · · · · · · · · · · · · · ·				None
	SP	Same SP sand as above.		< 5		Recorde
	SP	Light brown color at 7.5 feet			•	}
B to 12	SP			< 5		
J 10 12	SP	Same SP sand as above.	7	1		l
	SP	1		< 5	•	[
	SP			``		1
04. 40	SP			< 5		
2 to 16	SP	Same SP sand as above.		- 5		,
	SP			< 5		
	SP			`		
	SP_	<u> </u>				
6 to 20	SP	Same SP sand as above.		< 5		
j	SP				1	
	SP	1		< 5	ļ	
	SP	1		_	ł	
0 to 24	SP	Same SP sand as above to 22 feet		< 5		
1	SP	Then becomes coarser grained, poorly-		_ 1	Ţ	
,	SW	sorted SW		< 5	[	-
	SW			1	1	
to 28	SP	Same SP sand as above.		< 5		
[	_	Wet at 26 feet		i	. 1	
	SP		V	< 5 ∫ .		
1	SP			j	+	
				< 5	1	
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		}	ı	[		Ì
Al D	ter entry of everyone ore		A	1	•	
AL DEPTI	<del>1</del> : 2	28 feet	RILLING MET	100	AND HE SHEET BERNESS STEELS	

DRILLING DATE:

9/25/2001

DJH

INSPECTOR: CONTRACTOR:

Thein Well Company

DRILLING METHOD:

Push-Probe

WATER LEVEL OBSERVATION:

#### NATURAL RESOURCES ENGINEERING COMPANY 13 W. Superior St. Duluth, MN 55802 PROBE LOG NO: PROJECT NAME: **EEC Detection Monitoring** GP-9 PROJECT LOCATION: South Cass Lake Station, MN PROJ. NO. CHECKED BY: SUBSURFACE PROFILE DJH SOIL SAMPLE DATA interval (feet) USCS Description OVM (ppm) Depth (Ft.) Analytical Sample Analysis 0 to 4 Blows/6" Brown, medium grained, well-sorted, moist SP SP SP sand < 5 SP SP < 5 4 to 8 None SP None Collected SP Recorded Same SP sand as above. < 5 SP Lighter color at 6 feet. SP < 5 8 to 12 SP Same SP sand as above. SP Gray color at 11 feet. < 5 SP SP 12 to 16 7.3 SP Same SP sand as above. SP 14.6 SP SP 17.9 16 to 20 SP Same SP sand as above. SP 28.4 SP SP 20 to 24 29.0 SP Same SP sand as above. SP 47.6 SP SP 24 to 28 56.3 SP Same SP as above to 26 feet, then coarsens SP to a SW sand. 787 SP Oil saturated from 24-26 feet SP Wet at 25 feet 802 TOTAL DEPTH: 28 feet **DRILLING METHOD:** DRILLING DATE: Push-Probe 9/25/2001 INSPECTOR: DJH WATER LEVEL OBSERVATION: CONTRACTOR: Thein Well Company 25 feet

		NATURAL RES	OURCES	ENGINE	ERING C	OMPANY	ent rom Alas America, village, des
PRO IEC	TAIABEE	10 17.	Superior S	E. Duluth, N	PROBE L	00.10	
PROJEC	STIOCA	EEC Detection Monitoring	3		LUOPE L		
	/ LOCA	TION: South Cass Lake Stati	on, MN			PROJ. NO CHECKED BY	
Interval	T	SUBSURFACE PROFILE				SOIL SAMPLE DATA	: DJH
(feet)	USCS	Description					<del></del>
0 to 4	,			Depth (Ft.)	OVM (ppm)	Analytical Sample Analysis	Blows/6"
	1	Not Sampled					
	[	. '					,
44.6						Analytical Samples:	
4 to 8		Not Sampled				144	None
j		. [				Water:	Recorded
ł	•		į		-	BTEX, DRO collected from water table	
3 to 12		N-10			ļ	HOITI Water table	
		Not Sampled			1		
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		1	1		j		
2 to 16		Not Sampled			ł		l
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to 24		Not Sampled	/	· \	· 1		
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AL DEPTH:	: 2	ô feet					
LING DATI		25/2001	DRII	LING METH	IOD: Pus	h-Probe	**************************************
ECTOR:		JH	ται <b>Λ</b> Ι	EDIEV	000=		
TRACTOR:	Tr	ein Well Company	VVAI	CK LEVEL	OBSERVAT	ION: 25 feet	Ĭ

PROJECT NAME: EEC Detection Monitoring PROJECT LOCATION: South Cass Lake Station, MN  PROJECT LOCATION: South Cass Lake Station, MN  CHECKED BY: D. SOIL SAMPLE DATA  Interval (teet) USCS Description  Not Sampled  Not Sampled  Not Sampled  Not Sampled  Not Sampled  Not Sampled  To 20  Not Sampled  Not Sampled  Not Sampled  Not Sampled  To 24  Not Sampled  Not Sampled  Not Sampled  Not Sampled  To 25  PROJECT NO.  CHECKED BY: D.  SOIL SAMPLE DATA  Nor Record  Nor Sampled  Nor Sampled  Nor Sampled  To 26 SP Brown, medium grained, well-sorted, molst SP sand  DRILLING METHOD: Push-Probe			NATURAL RESOURCE 13 W. Superior	St. Duluth, MI	V 55802			
PROJECT LOCATION: South Cass Lake Station, MN SUBSURFACE PROFILE SUBSURFACE PROFILE SUBSURFACE PROFILE SOIL SAMPLE DATA (feet) USCS Description Obot 4 Not Sampled Not Sampled Not Sampled  Not Sampled  Not Sampled  Not Sampled  Not Sampled  10 20 Not Sampled  Not Sampled  10 24 Not Sampled  Not Sampled  10 24 Not Sampled  Not Sampled  10 24 Not Sampled  Not Sampled  10 24 Not Sampled  Not Sampled  10 25 Not Sampled  Not Sampled  10 26 Not Sampled  Not Sampled  10 27 Not Sampled  10 28 Not Sampled  Not Sampled  Not Sampled  10 29 Not Sampled  Not Sampled  Not Sampled  10 29 Not Sampled  Not Sampled	PROJEC	T NAME:	FEC Detection Maril		PROBE LO	OG NO:	GP-11	<del></del> -
Interval (teet) USCS Description Depth (Ft) OVM (opm) Analytical Sample Analysis Blows/ Not Sampled No	PROJEC	T LOCATI	ION: South Cass Lake Station MAN					
Interval (feet) USCS Description Depth (Ft) OVM (ppm) Analytical Sample Analysis Blows/ Not Sampled  A to 8 Not Sampled  Not Sampled  Not Sampled  Not Sampled  Not Sampled  10 20 Not Sampled  Not Sampled  10 20 Not Sampled  10 20 Not Sampled  10 20 Not Sampled  Not Sampled  12.8	<u></u>		SUBSURFACE PROFILE	The state of the s		c	HECKED BY	DJF
O to 4	RF .	T	TOTAL PROPILE	<del></del>		SOIL SAI	MPLE DATA	
Not Sampled  Not Sampled  Not Sampled  Not Sampled  Not Sampled  Not Sampled  Not Sampled  Not Sampled  Not Sampled  Not Sampled  10 24 Not Sampled  Not Sampled  Not Sampled  10 24 Not Sampled  Not Sampled  10 24 Not Sampled  Not Sampled		USCS	Description	D-4- 0-1	0.44	ł		Τ
Not Sampled  Not Sampled  Not Sampled  Not Sampled  Not Sampled  Not Sampled  To 20  Not Sampled  Not Sampled  To 24  Not Sampled  To 25  To 26  To 26  To 27  To 28	0 to 4		The second secon	Deptn (Ft.)	OVM (ppm)	Analytical Sa	ample Analysis	Blows/6"
Ito 12 Not Sampled  2 to 16 Not Sampled  To 20 Not Sampled  To 24 Not Sampled  To 26 SP SP SP Shown, medium grained, well-sorted, moist SP sand  12.8  AL DEPTH: 26 feet DRILLING METHOD: Push-Probe SCTOR: 9/25/2001		j	Not Sampled					
Ito 12 Not Sampled  2 to 16 Not Sampled  To 20 Not Sampled  To 24 Not Sampled  To 26 SP SP SP Shown, medium grained, well-sorted, moist SP sand  12.8  AL DEPTH: 26 feet DRILLING METHOD: Push-Probe SCTOR: 9/25/2001	· .	,				]		ł
Ito 12 Not Sampled  2 to 16 Not Sampled  To 20 Not Sampled  To 24 Not Sampled  To 26 SP SP SP Shown, medium grained, well-sorted, moist SP sand  12.8  AL DEPTH: 26 feet DRILLING METHOD: Push-Probe SCTOR: 9/25/2001	1 to 0	<del> </del>	<b></b>	- i\				l
To 12 Not Sampled  2 to 16 Not Sampled  To 24 Not Sampled  To 24 Not Sampled  To 26 SP SP SP SP SP Sand  To 28 SP SP SP SP SP Sand  To 28 SP SP SP SP SP SP SP SP SP SP SP SP SP	4 10 6		Not Sampled	\				None
2 to 16  Not Sampled  To 20  Not Sampled  To 24  Not Sampled  To 24  Not Sampled  To 25  Brown, medium grained, well-sorted, moist SP sand  12.8  AL DEPTH: 26 feet  LING DATE: 9/25/2001 ECTOR: D.IH		<u> </u>					ı	Recorde
2 to 16  Not Sampled  To 20  Not Sampled  To 24  Not Sampled  To 24  Not Sampled  To 25  Brown, medium grained, well-sorted, moist SP sand  12.8  AL DEPTH: 26 feet  LING DATE: 9/25/2001 ECTOR: D.IH								Į
2 to 16  Not Sampled  To 20  Not Sampled  To 24  Not Sampled  To 24  Not Sampled  To 25  Brown, medium grained, well-sorted, moist SP sand  12.8  AL DEPTH: 26 feet  LING DATE: 9/25/2001 ECTOR: D.IH	3 to 12	<u> </u>	<u> </u>				·	
To 20 Not Sampled  To 24 Not Sampled  To 26 SP SP Sy Sand  To 28 SP Sy Sand  To 29 SP Send  To 29 SP Send  To 20 Not Sampled  To 24 Not Sampled  To 26 Feet SP Send  To 26 Feet DRILLING METHOD: Push-Probe  ECTOR: D.IH	- 10 12		Not Sampled		1		ſ	
To 20 Not Sampled  To 24 Not Sampled  To 26 SP SP Sy Sand  To 28 SP Sy Sand  To 29 SP Send  To 29 SP Send  To 20 Not Sampled  To 24 Not Sampled  To 26 Feet SP Send  To 26 Feet DRILLING METHOD: Push-Probe  ECTOR: D.IH		-	,		ĺ		ł	
To 20 Not Sampled  To 24 Not Sampled  To 26 SP SP Sy Sand  To 28 SP Sy Sand  To 29 SP Send  To 29 SP Send  To 20 Not Sampled  To 24 Not Sampled  To 26 Feet SP Send  To 26 Feet DRILLING METHOD: Push-Probe  ECTOR: D.IH							.	
To 20 Not Sampled  To 24 Not Sampled  To 26 SP SP Sy Sand  To 28 SP Sy Sand  To 29 SP Send  To 29 SP Send  To 20 Not Sampled  To 24 Not Sampled  To 26 Feet SP Send  To 26 Feet DRILLING METHOD: Push-Probe  ECTOR: D.IH	2 to 16		Net C	_	1		1	
to 24 Not Sampled  to 26 SP Brown, medium grained, well-sorted, moist SP sand  12.8  L DEPTH: 26 feet DRILLING METHOD: Push-Probe SECTOR: D.I.H	- '-		Not Sampled		ł		1	
to 24 Not Sampled  to 26 SP Brown, medium grained, well-sorted, moist SP sand  12.8  L DEPTH: 26 feet DRILLING METHOD: Push-Probe SECTOR: D.I.H	ļ		ļ		ſ		j	
to 24 Not Sampled  to 26 SP Brown, medium grained, well-sorted, moist SP sand  12.8  L DEPTH: 26 feet DRILLING METHOD: Push-Probe SECTOR: D.I.H	.]		,	-				
to 24 Not Sampled  to 26 SP Brown, medium grained, well-sorted, moist SP sand  12.8  L DEPTH: 26 feet DRILLING METHOD: Push-Probe SECTOR: D.I.H	6 to 20		Not Sampled		•		<u> </u>	
to 26 SP SP sand 12.8  Line Depth: 26 feet Drilling Date: 9/25/2001  ECTOR: D.IH	1		- 15t Campied		1		1	
to 26 SP SP sand 12.8  Line Depth: 26 feet Drilling Date: 9/25/2001  ECTOR: D.IH		-					l	
to 26 SP SP sand 12.8  Line Depth: 26 feet Drilling Date: 9/25/2001  ECTOR: D.IH			,				1	
to 26 SP SP SP sand  12.8  LIDEPTH: 26 feet DRILLING METHOD: Push-Probe ECTOR: D.IH	) to 24		Not Sampled		1		1	
SP SP sand 12.8  Line Depth: 26 feet Drilling Method: Push-Probe Ector: D.IH		- 1			}			
SP SP sand 12.8  Line Depth: 26 feet Drilling Method: Push-Probe Ector: D.IH	1		•	// //	j		٠ }	
SP SP sand 12.8  Line Depth: 26 feet Drilling Method: Push-Probe Ector: D.IH	+= 20			Y W	1	•	<u>.</u>	
AL DEPTH: 26 feet LING DATE: 9/25/2001 ECTOR: D.IH	10 26		Brown, medium grained, well-sorted, moist			•	1	
AL DEPTH: 26 feet  LING DATE: 9/25/2001  ECTOR: D.IH		SP 18	SP sand		120		ł	
LING DATE: 9/25/2001 DRILLING METHOD: Push-Probe					12.0			
LING DATE: 9/25/2001 DRILLING METHOD: Push-Probe								
LING DATE: 9/25/2001 DRILLING METHOD: Push-Probe				1 1	-, ]		1	•
LING DATE: 9/25/2001 DRILLING METHOD: Push-Probe				l			1	
LING DATE: 9/25/2001 DRILLING METHOD: Push-Probe	•				j		.	
LING DATE: 9/25/2001 DRILLING METHOD: Push-Probe		,					1	l
LING DATE: 9/25/2001 DRILLING METHOD: Push-Probe			İ		}	•	1	
LING DATE: 9/25/2001 DRILLING METHOD: Push-Probe	*		·		1	•	J	
LING DATE: 9/25/2001 DRILLING METHOD: Push-Probe			j		- 1			
LING DATE: 9/25/2001 DRILLING METHOD: Push-Probe	AL DEPTH	26	fact		-		1	3
ECTOR: D.IH	LING DATE	_ <del>-</del>		DRILLING MET	IOD: Pusi	n-Probe		
	ECTOR:				. 331			

#### NATURAL RESOURCES ENGINEERING COMPANY 13 W. Superior St. Duluth, MN 55802 PROJECT NAME: PROBE LOG NO: **EEC Detection Monitoring GP-12** PROJECT LOCATION: South Cass Lake Station, MN PROJ. NO. SUBSURFACE PROFILE CHECKED BY: DJH Interval SOIL SAMPLE DATA (feet) USCS Description Depth (Ft.) OVM (ppm) 0 to 4 Analytical Sample Analysis Brown, medium grained, well-sorted, moist SP Blows/6" SP SP sand < 5 SP SP 4 to 8 SP < 5 None None SP Collected Same SP sand as above. Recorded 10.6 SP SP 8 to 12 Same SP sand as above to 9 feet, then SP 13.2 SW coarsens to a SW. SW 14.1 SW 12 to 16 SP 14.6 Grades back to a SP sand at 12 feet. SP SP 14.8 SP 16 to 20 SP 16.2 Same SP sand as above. SP 20.3 SP SP 20 to 24 SP 29.5 Same SP sand as above. SP 32.3 SP SP 24 to 28 SP 34.1 Same SP sand as above. SP 107 SP Stained 1/2-inch thick at 27 feet. W SP Wet at 27 feet 538 TOTAL DEPTH: 28 feet DRILLING DATE: DRILLING METHOD: Push-Probe 9/25/2001 INSPECTOR: DJH WATER LEVEL OBSERVATION: CONTRACTOR:

27 feet .

Thein Well Company

## NATURAL RESOURCES ENGINEERING COMPANY

13 W. Superior St. Duluth, MN 55802 PROBE LOG NO: PROJECT NAME: **GP-13 EEC Detection Monitoring** PROJECT LOCATION: South Cass Lake Station, MN PROJ. NO. CHECKED BY: SUBSURFACE PROFILE DJH SOIL SAMPLE DATA interval (feet) USCS Description OVM (ppm) Analytical Sample Analysis 0 to 4 Brown, medium grained, well-sorted, moist SP Biows/6" SP SP sand < 5 SP SP 4 to 8 < 5 None SP None Collected SP Same SP sand as above. Recorded < 5 SP SP 8 to 12 < 5 SP Same SP sand as above. SP Lighter brown color. < 5 SP SP

SP 11.8 SP SP 16 to 20 7.3 SP Same SP sand as above. SP 19.3 SP SP 20 to 24 20.7 SP Same SP sand as above. SP 1630 SP Oil stained 23-24 feet SP Wet at 24 feet V 1198

Same SP sand as above.

5.7

TOTAL DEPTH:

12 to 16

SP

24 feet DRILLING DATE: 9/25/2001

INSPECTOR:

CONTRACTOR:

DJH

Thein Well Company

DRILLING METHOD:

Push-Probe

WATER LEVEL OBSERVATION:

24 feet .

# NATURAL RESOURCES ENGINEERING COMPANY

13 W. Superior St. Duluth, MN 55802

PROJECT NAME: PROBE LOG NO: **EEC Detection Monitoring** GP-14

Interval	T	SUBSURFACE PROFILE		S CONTRACTOR	CHECKED BY	<u>/:</u> DJH
(feet)	uscs		<del></del>	<del> </del>	SOIL SAMPLE DATA	A. C. Charles of Control Spinster, Spinster,
0 to 4	SP	Description	Depth (Ft.)	OVM (npm)	· ——	7
	SP	Brown, medium grained, well-sorted, moist			Analytical Sample Analysis	Blows/6"
	SP	SP sand		< 5		1
	SP					1
4 to 8	SP			< 5	None	1
	SP	Same SP sand as above.			Collected	None
	SP	Sand as above.		< 5		Recorde
	SP	ł		-		İ
8 to 12	SW	Grades to a coarse		< 5	*	ļ
i	SW	Grades to a coarse grained, poorly-sorted, moist, SW sand.		ı		
	SW	July Starte.		< 5		
	SW			1	ł	
12 to 16	SP	Grades back to a SP sand at 12 feet.	-1	< 5		
	SP	dano at 12 leet.		[	1	
- 1	SP			< 5	. 1	
C4- 00	SP			1	j	
6 to 20	SP	Same SP sand as above.	-	< 5		
· [	SP	* '		·	·	
1	SP			< 5		ļ
) to 24	SP	<del></del>			1	
10 24	SP	Same SP sand as above.		< 5	1	1
	SP SP			< 5	ļ	
	SP			13		
to 28				< 5		
		Same SP sand as above to 27 feet, then			,	į.
ŀ	_ (9	rades to a SW sand.		25.2		Ē
	/	Oil stained from 26-27.5 Vet at 27.5 feet	<b>.</b>	<del>-</del>		
		100 tal 21.5 lee(	A	954		
		•	i de la companya de l	1	İ	
		1		}		
•				1	•	10 A
		{		İ	*	
		·			ĺ	
		1	1	· [		
AL DEPTH			и			

DRILLING DATE:

9/25/2001

INSPECTOR:

DJH

CONTRACTOR:

Thein Well Company

DRILLING METHOD:

Push-Probe

WATER LEVEL OBSERVATION:

27.5 feet

<u> </u>	<del></del>	NATURAL RESC 13 W. S	Superior St. Du	duth, MN	55802	MALPANY		
PROJEC	T NAME:	EEC Doto-U. M.	<del></del>		PROBE L	OG NO:	GP-15	
PROJEC*	LOCAT	EEC Detection Monitorin ION: South Cass Lake Statio	g - 1411				PROJ. NO	
	er som andered and	SUBSURFACE PROFIL	n, IVIN	Carlotter paragraphic	No. of Section 1		HECKED BY	
Intonial (6		TOL PROFIL	<del></del>			SOIL SA	MPLE DATA	
Interval (feet	USCS	Description	lo.	epth (Ft.)	O\/\\\ (m=)	ľ		7
0 to 4	ŀ	and the state of t		chii (Ft.)	OVIVI (ppm)	Analytical 5	ample Analysis	Blows/6"
		Not Sampled		A		ł		
	1		18	. //				1
4 to 8	<del> </del>	Not 0				Í		
•	1	Not Sampled				Water:		None
		·					RO collected	Record
						from wate	r tabla	
to 12		Not Sampled	'			······································	. table	
j		. Tot Oampied	1		j			 
1		1 .			-		1	
				M	[		j	-
2 to 16		Not Sampled		V	1		ł	
- 1		1			1			
j			,	/\	1		ĺ	
to 20			1 1		- 1		-	
10 20		Not Sampled			1		1	
1		1			ł			
1	•				ĺ		· }	
to 24							1	
		Not Sampled			ł		İ	
					- 1		}	
			III				1	
to 26	SP	Brown medium control	#	_			1	
		Brown, medium grained, well-sorted SP sand	, moist				j	
,		And the second s			< 5		}	
			ĺ		1		1	
			į .	1	- 1		ĺ	
ê	-		ł		}			. 6
								40240
	•		1		1		ĺ	
		•	J	200			1.	
		•	`		1			H
			1		.		1	
I DENT.	et sage in which against the sage	of the state of th	1					
L DEPTH: JNG DATE:		6 feet	DRII D	NG METH	20.	erice of the service	THE RESERVE THE PARTY OF THE PA	
ECTOR:		25/2001	DIVILLI	INC INC INC	บบ: Pusl	1-Probe		
RACTOR:	D.	JH ·			BSERVATI			1

		NATURAL RESOUR	ES ENGINE	ERING C	OMPANY	The state of the s
		13 W. Superi	or St. Duluth, I	VIN 55802 PROBE L	00.110	
PROJECT	NAME:	EEC Detection Monitoring		PROBE L	OG NO: <b>GP-16</b> PROJ. NO	
PROJECT	LOCATI	ON: South Cass Lake Station, MN	and the constant of the constant of the		CHECKED BY	
		JBSURFACE PROFILE			SOIL SAMPLE DATA	
Interval (feet)	USCS	Description	Depth (Ft.)	OVM (ppm)	Analytical Sample Analysis	Blows/6"
0 to 4		Not Sampled				
4 to 8		Not Sampled	$-   \setminus /  $	. ,	Water: BTEX, DRO collected from water table	None Recorded
8 to 12		Not Sampled		·		
12 to 16		Not Sampled				
6 to 20	<u> </u>	Not Sampled				
0 to 24		Not Sampled		·		
4 to 26	SP SP	Brown, medium grained, well-sorted, moist SP sand	<b>Y</b>	< 5		
TAL DEPTH ILLING DATI		26 feet 9/25/2001	DRILLING ME	THOD: P	ush-Probe	The second secon
PECTOR: NTRACTOR		DJH Thein Well Company	WATER LEVE	EL OBSERVA	ATION: 25 feet	-

]		NATURAL RESOURCES 13 W. Superior S	Parallerelle Delet	EEGAA			
PROJECT N	A BAE		C. Designin, soure	PROBE LO	OC NO.		
PROJECT	MINIE. DOATIONE (	EEC Detection Monitoring		1 NOBE LC		GP-17	
The second secon	TOTAL C	South Cass Lake Station, MN			CHE	ROJ. NO.	_
Interval (feet)	lises	SUBSURFACE PROFILE	the transfer of the same than the same and the same of		UHE(	CKED BY:	BDH
0 to 4	words to a second of the second section of	Description	Depth (Ft.)	OVM (ppm)	SOIL SAMPLE DA Analytical Sample Ana	ATA	
	SP SP	Topsoil, with organic material to 6", then		3,777	Analytical Sample Ana	lysis   B	lows/6"
	SP	fine-grained, well sorted dry sand.		1			
	SP	1		i I		į	
4 to 8	SP SP		- K		Vater:	1	
		Same SP sand as above to 6'. Then a 4" thick				}	None
	SP	sit layer. Then SP again to the end of the			STEX and ERDRO	) [R	ecorde
	SP	interval.		ļ ē	at watertable.	1	
8 to 12	SP	<u> </u>				- 1	
	SP	Same SP sand as above.	<del>-</del>			1	
· [	SP			1	•	1	
· .	SP	1	ka is	. [		1	
12 to 16	SP	<u> </u>		1			
12 10 10	SP	Same SP sand as above.		1			
	SP			}		- 1	
1	SP	·		ĺ		1	,
6 to 20	SP			· [.		ĺ	
01020	SP	Same SP sand as above.		ľ		1	
	SP .			1		- 1	
]	SP			ſ		i	
0 to 24	<u>SP</u>	<u> </u>		}		ı	
5 10 24	SP	Same SP sand as above.	<b>-</b> 100	ł		- 1	
	SP			1		i	
1	SP				•	ĺ	
to 28	SP SP	· ·				- 1	
20	SP	Same SP sand as above.	100	1		1	
	SP			ł	,		
i	SP SP	Fine-grained SP at 28'.	V	ľ	•		!
	- 10	Wet at 26 feet				- 1	1
				1		1	
		· -		ĺ			
						j	
				i	•	1	
	•			!		}	
		ŕ	M P	1			
		ĺ	H	l			
AL DEPTH:		A design of the state of the st	. 8	· 1		1	
LLING DATE:		8 feet	DRILLING METI	100	and the second second to the second second second second second second		
	D.	14.470.000	といったいれつ MEII	JUU: Pireb	-Probe	The state of the s	
PECTOR:		/14/2002 JH		· · · · · · · · · · · · · · · · · · ·	-1 100e		H

		NATURAL RESOURCES ( 13 W. Superior St.	Duluth, MN	55802			
PROJECT	NAME:	EEC Detection Monitoring		PROBE L	OG NO:	SP-18	
PROJECT	LOCATIO	DN: South Cass Lake Station, MN				ROJ. NO	
	e wit planten e disablem i tij i en with the	SUBSURFACE PROFILE	Printed and the state of the st	ANTIC WITH PRINCIPLE AND PRINC		KED BY	
		- GODDONI ACE PROFILE			SOIL SAMPI	E DATA	And the Cold and ready of the last the Cold
Interval (feet)	USCS	Description	Depth (Ft.)	OV#4 (pp.m)			T
0 to 4	SP	Organic rich topsoil with roots to 6". Then	Deput (FL.)	Ovivi (ppin)	Analytical Sampl	le Analysis	Blows/6"
	SP	brown, fine-grained, well-sorted, dry SP sand.		N .	1		
	SP	January Co. Saing.		<5.0	,		1
44.5	SP			-E0			<b>.</b>
4 to 8	SP	Same SP sand as above.		<5.0	Water:		None
[	SP	Slightly coarse grained sand.	190 at 180	√E ∩	BTEX and ER		Recorde
}	SP			<5.0	at watertable.		[
24- 40	SP			<5.0			
3 to 12	SP	Same SP sand as above.		\5.U			
	SP	Alternates between fine and medium grained.		<5.0	_		
Ĭ	SP -						
2 to 16	SP			<5.0			
21010	SP SP	Same SP sand as above.		, 10.0		i	
	SP SP			<5.0		ĺ	
j	SP	.:					
6 to 20	SP	0		<5.0			
10 20	SP	Same SP sand as above.			•	1	κ.
	SP	•		<5.0			
	SP			1			
to 24	SP	Samo SD acad		<5.0			
	SP	Same SP sand as above to 22', then				ł	
j	SW	becomes a medium grained SW.		<5.0		1	
	SW	ĺ					
to 27	SW	Same SW as above.		<5.0		}	
ĺ	SW	OTT US ADOVE.				İ	
. `	SW	Fine-grained SP at 28'.	V	<5.0	*	- 1	
	SW	Wet at 25 feet				}	•
S. Services Principles Services	SVV	Wet at 25 feet					•
			***************************************				
		•				j	
						.	
			ľ		-	f	
AL DEPTH:	A CONTRACTOR OF THE PARTY OF TH	27 500		_		]	į
LLING DATE		27 feet 3/14/2002	DRILLING MET	HOD: Pus	h-Probe	The second of the second of	Mayor appendiction of the second
PECTOR:	[	# 1917UNI					,

		NATURAL RESOURCES 13 W. Superior St	- Duluth, MN 8	NG COM 5802	PANY	
PROJECT	NAME:	EEC Dota di		PROBE L	OG NO: GP-19	
PROJECT	LOCATION	ON: South Cass Lake Station, MN			PROJ. NO	<del></del>
		SUBSURFACE PROFILE	or the state of th	August new Polestine to will arrive any the	CHECKED BY	: BDI
Interval (feet)	11000		<del></del>		SOIL SAMPLE DATA	1
0 to 4	Statement of the State of Stat	Description	Depth (Ft.)	OVM (mm)		
0 10 4	SP	Organic rich topsoil with roots to 6". Then	[Doput (Ft.)	O vivi (ppiii)	Analytical Sample Analysis	Blows/6"
	SP	brown, fine-grained, well-sorted, dry SP sand.				
	SP	, , , , = , = ,		<5.0	:	
4 to 8	<u> </u>		1000	45.0		1
1.00	SP	Same SP sand as above to 5'.	<del>-  </del>	<5.0	Water:	None
	SW	Then medium grained and poorly to moderately	, 1.465	_E ^	BTEX and ERDRO	Record
ļ	SW	sorted SW sand.		<5.0	at watertable.	
8 to 12	SW SW			<5.0		ł
	SP SP	Same SW as above to 9'. Then back to	_	70.0		
1	SP	well-sorted, fine-grained SP sand.		<5.0	~	
1	SP ·			13.0		
2 to 16	SP	Some CD		<5.0		
}	SP	Same SP sand as above.		0.0	}	
	SP	Medium grained from 12-14', then fine grained SP sand.		<5.0		
	SP	Or saile.		0		
6 to 20	SP	Same SP sand as above.		<5.0		
1	SP	ourne or sand as above.				
	SP			<5.0	1	
	SP					
to 24	SP	Grades to a fine grained		<5.0		
	SP (	Grades to a fine grained gravel or coarse sand at 23'		[		
	GP			<5.0	1	•
	_GP	·		-		
to 26	GP	Same GP as above.		<5.0		
	GP					
1	GP	Fine-grained SP at 28'.	V	<5.0		
The second secon	GP	Wet at 25.5 feet	V			
		en en en en en en en en en en en en en e		· [	į	
		j	Ā	1		E L
		•			1	
				ŀ	j	
AL DES	and the few streets are foreign to		ı	1		7
AL DEPTH:		6 feet		ومدود المادود ومحمدان والمقادمين		
LING DATE: PECTOR:	-	_ · · · · ·	RILLING METH	OD: Pus	n-Probe	
TRACTOR:		JH				
···VIOTUK!	M	ESA "	VATER LEVEL C	DESERVATION	ON: 25.5 feet	Ŋ.

DDO IEC	\	13 W. Superior :	or. Duluth, MN	55802		
PROJEC	T NAME:	EEC Detection Monitoring		PROBE L		
, NOSEC	LUCAII	ON: South Cass Lake Station, MiN			PROJ. N	Ο.
<b>}</b>	<del></del>	SUBSURFACE PROFILE	The second section of the second section of		CHECKED E	Y:E
Interval (fee	USCS				SOIL SAMPLE DAT	Α
0 to 4	SP	Description	Depth (Ft.)	OVM (ppm)	Annhaires	
	SP	Light brown, fine grained, well sorted,			Analytical Sample Analys	is Blows
	SP	dry SP sand.	- K 4 : 2 ×	<5.0		
	SP			~5.0	i .	
4 to 8	SP			<5.0	VAI-4.	ŀ
	SP	Same SP sand as above (moist).		\3.0	Water:	No
	SP ·			<5.0	BTEX and ERDRO	Reco
-	SP			~5.0	at watertable.	1
8 to 12	SP			<5.0		1
- 10 /2	SP	Same SP as above.		\0.0		İ
	SP	Slightly coarser grained SP sand.		<5.0	•	·
	SP			10.0		
2 to 16	SP			<5.0		] .
	SP	Same SP sand as above.		0.0	÷	1
	SP			<5.0		1
	SP	•		10.0		
6 to 20	SP	Day 02		<5.0		1
	SP	Same SP sand as above.		-0,0		
j	SP	j		<5.0		
	SP	1		0.0		
to 26	SW	Grades up to		<5.0		
- 1	SW	Grades up to a coarser SW sand.				•
`	SW			<5.0		
	SW	Same SW as above.			İ	
to 30		Same SW as above.		<5.0		
1		Same SW as above to 28', then becomes a sifty sand.	128869		j	
	1	Wet at 26'.		<5.0	1	
	SM		V			
	and the last to the last two states	er kannada sering samunan gara dalam samunan digan mendang sahun danangkandan salam digan bisan danan kannada			1	
					j	
		,		1		
				·		
		•			,	
		`		.		_*
or fat pade the state of skilling and	·				1	
AL DEPTH	: 3	0 feet				
LING DAT		/13/2002	DRILLING METH	IOD: Pur:	h-Probe	and make a such sections of the
ECTOR:		JH				

#### NATURAL RESOURCES ENGINEERING COMPANY 13 W. Superior St. Duluth, MN 55802 PROJECT NAME: BORING LOG NO: **EEC Detection Monitoring** WW-1 PROJECT LOCATION: South Cass Lake Station, MN PROJ. NO. SUBSURFACE PROFILE CHECKED BY: DJH SOIL SAMPLE DATA (feet) USCS Description OVM (ppm) Deptin (Ft.) PSL/SP Analytical : ample Analysis Black, organic topsoil to 1/2-foot. Blows/6" 2 Then brown, medium-grained, well-sorted, SP 3. SP < 5 dry sand. SP None 4 SP 5 SW < 5 None Collected Recorded 6 SW Brown, medium grained, well-graded, 7 SW < 5 SW sand 8 SW 9 SW < 5 10 SW 11 SW < 5 12 SW Same SW as above. Grades to SP at 11 feet 13 SP < 5 14 SP 15 SP < 5 16 SW Grades back to SW from 15-16 feet 17 < 5 SP Then same SP as above 18 SP 19 < 5 SP Wet at 24.5 feet 20 SP 21 SP < 5 22 SP Then same SP as above 23 SP < 5 24 SP Wet at 24.5 feet 25 SP < 5 V 26 SP Same SP as above 27 SP < 5 28 SP 29 SP < 5 30 SP 31 SP < 5 Same SP as above 32 SP 33 SW < 5 Grades back to SW at 32 feet 34 SW 35 SW < 5 36 SW Same SW as above 37 SW < 5 38 SW 39 SW < 5 40 SW 41 SW < 5 Same SW as above 42 SW 43 SW < 5 44 SW 45 SW < 5 46 SW < 5 46 feet DRILLING METHOD: 5/21/2001 Hollow Stem Auger DJH

TOTAL DEPTH: DRILLING DATE: INSPECTOR: CONTRACTOR:

Thein Well Company

WATER LEVEL OBSERVATION: 24. i feet

#### NATURAL RESOURCES ENGINEERING COMPANY 13 W. Superior St. Duluth, MN 55802 PROJECT NAME: EEC Detection Monitoring BORING LOG VO: WW-2 PROJECT LOCATION: South Cass Lake Station, MN PROJ. NO. SUBSURFACE PROFILE CHECKED BY: DJH SO L SAMPLE DATA (feet) **USCS** Description Depth (Ft.) OVM (ppm) TPSL/SP Anal tical Sample Analysis Black, organic topsoil to 1/2-foot. Blows/6" 1'to 5 SP Then brown, medium-grained, well-sorted SP poorly-graded, SP sand. Dry. SP < 5 None SP Non ∋ Collected Recorded 8 to 10 SP Same SP as above SP < 5 13 to 15 SP Same SP as above SP < 5 18 to 20 SP Same SP as above SP < 5 24 SP Same SP as above 17.5 25 SP Wet at 24 feet. < 5 26 SP 27 SP 28 SP < 5 Same wet SP as above 29 SP 30 SP < 5 TOTAL DEPTH 30 feet DRILLING DATE: DRILLING METHOD: 5/22/2001 Hollow Stem Auger INSPECTOR: DJH WATER LEVEL OBSERVATION: CONTRACTOR: Thein Well Company 24 feet

#### NATURAL RESOURCES ENGINEERING COMPANY 13 W. Superior St. Duluth, MN 55802 **BORING LOG NO:** PROJECT NAME: **EEC Detection Monitoring** MW-3 PROJECT LOCATION: South Cass Lake Station, MN PROJ. NO. CHECKED BY: SUBSURFACE PROFILE DJH Interval SCIL SAMPLE DATA (feet) USCS Description Depth (Ft.) OVM (ppm) An: lytical Sample Analysis **TPSL/SP** Black, organic topsoil to 1/2-foot. Blows/6" 1 < 5 SP Then brown, medium-grained, well-sorted to SP poorly-graded, SP sand. Dry. 5 < 5 SP None SP No re Collected Recorded 8 to 10 SP Same SP as above SP 11.1 13 to 15 SP Same SP as above SP < 5 18 to 20 SP Same SP as above SP Faint petroleum odor < 5 24 SW Grades to SW. Wet at 24 feet. 416 25 SW Petro saturated 23.5 to 24 feet 26 SW 27 SW 28 SW Same wet SW as above 29 SW 30 19.6 SW Stiff, moist silt 29-30 feet TOTAL DEPTH: 30 feet DRILLING DATE: DRILLING METHOD: Hollow Stem Auger 5/22/2001 INSPECTOR: DJH CONTRACTOR: WATER LEVEL OBSERVATION: Thein Well Company 25 feet

#### NATURAL RESOURCES ENGINEERING COMPANY 13 W. Superior St. Duluth, MN 55802 PROJECT NAME: BORING LOG NO: **EEC Detection Monitoring** MW-4 PROJECT LOCATION: South Cass Lake Station, MN PROJ. NO. SUBSURFACE PROFILE CHECKED BY: DJH Interval SCIL SAMPLE DATA (feet) USCS Description Depth (Ft.) OVM (ppm) Analytical Sample Analysis TPSL/SP Black, organic topsoil to 1/2-foot. Blows/6" 0 to 5 < 5 SP Then brown, medium-grained, well-sorted SP poorly-graded, SP sand. Dry. < 5 SP None SP None Collected Recorded 8 to 10 SW Light brown, medium to coarse grained, SW poorly-sorted, moist sand. < 5 13 to 15 SP Grades back to a SP sand SP < 5 18 to 20 SP Same SP as above SP < 5 24 SP Same SP as above 25 < 5 SP Wet at 25 feet. 26 SP 27 SP 28 < 5 SP Same wet SP as above 29 SP 30 < 5 SP TOTAL DEPTH: 30 feet DRILLING DATE: DRILLING METHOD: Hollow Stem Auger 5/21/2001 INSPECTOR: DJH WATER LEVEL OBSERVATION: CONTRACTOR: Thein Well Company 25 feet

## APPENDIX C - MONITORING WELL CONSTRUCTION LOGS

## Monitoring Well Construction Information

WELL DESIGNATION		M	N-1	_		PROJECT	EEC - So	uth Cass Lake
DRILLER	Thein We	ell Company		_		COMPLETIO	ON DATE	5/22/2001
Elev.( <u>+</u> 0.01')			•			CONCRET	E SURFACI	E SEAL:
(Grade Eleva	tion)		<u>-</u>				Y/N	Υ
Elev.( <u>+</u> 0.01')	· 1	337.88				OUTER CA	SING	
(Top of Inner	Casing w/c	Cover)		] ].		Type		on Steel
		•	1		1	Diameter		nches
State Plane		652316.8167	1			Total Length		feet
Coord.:	E	E 2243499.933				Lock		Yes
Method of Ad						INNER CAS	SING:	
	Hollow St	em Auger				Туре	F	PVC
Borehole Dia						Diameter	2-	inch
porenoie Dia	meter:	8 inches				Total Length	18	feet
Drilling Fluid		None				Sections Used		2
	•	None				Joints		1
						GROUT AB	OVE SEAL:	
Depth to Bott	om						at Cement G	
of Grout :		16.5 feet				<u> </u>		
Depth to Botto of Seal :	om	18.5 feet				SEALING M	ATERIAL: entonite Chi	ps
Depth to top o	of	20.5 feet				FILTER MA # 30	TERIAL: ) Red Flint S	and
						SCREEN:		
Donth to Bott						Туре	P\	VC
Depth to Botto of Boring:	om ·	20 5 5				Length		feet
or borning .		30.5 feet				Diameter		nch
Depth to First						Slot Size	.0.01	-inch
Water Encoun						PUMP:		
during Drilling	):	24.5 feet	**Note: All d	epths are.t	from	Туре	· · N/	/Δ
			Ground Leve			Length	N/	
Depth to Water		a.				Diameter		<u> </u>
before installa	tion :	24.5 feet		u.		-		· · · · · · · · · · · · · · · · · · ·
METHOD OF D	EVELOP	SENT:	Surge with w	reighted ba	iler an	d dewater with	h Brainard-K	ülman Pump
CONSTRUCTION	ON NOTES	3:						

WELL DESIGNA	TION	MW-2		PROJECT	EEC - Sou	ıth Cass Lake
DRILLER Th	ein Well Company	·		COMPLETIC	ON DATE .	5/22/2001
Elev.( <u>+</u> 0.01')		:		CONCRET	E SURFACE	SFAI:
(Grade Elevation)		<del></del> . 	1		Y/N <sup>-</sup>	Y
Elev.( <u>+</u> 0.01')	1337,29		<u> </u>	OUTER CA	- CINIC.	and the second s
(Top of Inner Cas	ing w/o Cover)			Type		on Charl
			, i	Diameter		n Steel ches
State Plane	N 652039.754	10	ŀ	Total Length		eet
Coord.:	E 2243905.52			Lock		es
Method of Advan		-		INNER CAS		
Hol	llow Stem Auger	_		Туре		VC
Possibala Diament				Diameter	2-ir	nch
Borehole Diamet	er: 8 inches	_ ////////		Total Length	20 1	feet
Drilling Fluid:	Nama			Sections Used	2	<u>}</u>
Dinning Fluid.	None	<b></b>		Joints	1	1
					•	
	,					
•					•	
Depth to Bottom				GROUT ABO		÷
of Grout:				Nea	at Cement Gre	out
o. Glowe.	16 feet				-	
Depth to Bottom	•			SEALING M		Ÿ
of Seal :	18 feet				entonite Chips	<u> </u>
	· · · · · · · · · · · · · · · · · · ·	-		FILTER MAT	FRIAL.	
Depth to top of					Red Flint Sa	ınd
Screen :	20 feet	_	•			
				SCREEN:		
Depth to Bottom				Туре	PV	
of Boring:	30 feet			Length	10 fe	et
	30 1661		and the second second second	Diameter	2-ind	
Depth to First				Slot Size	0.01-iı	nch
Water Encountere	d			PUMP:		
during Drilling :	24 feet	**Note: All depths		rowr: Type	NI/A	
_		Ground Level		ength	N/A N/A	
Depth to Water Lev				Diameter	N/A N/A	
efore Installation	: 24 feet	,	_	-		1
METHOD OF DEVE	LOPMENT:	Surge with weighte	ed bailer and	dewater with	ı Brainard-Kilı	man Pump
ONSTRUCTION N	IOTES.		The state of the s			· · · · · · · · · · · · · · · · · · ·
	IV I E3;			Ý		

WELL DESIGNA	TION	MW-3	,	PROJECT	EEC - Soi	uth Cass Lake
DRILLER The	ein Well Company			COMPLETIC	ON DATE	5/22/2001
Elev.( <u>+</u> 0.01')	<u> </u>			CONCRET	E SURFACE	SFAI.
(Grade Elevation)					Y/N	Υ
Elev.( <u>+</u> 0.01')	1337.27		7	OUTER CA	SING	
(Top of Inner Casi	ng w/o Cover)			Туре		on Steel
	•	'		Diameter		nches
State Plane	N 651936.179			Total Length	Market Street, Square and Street, Square and Street, Square and Street, Square and Street, Square and Street,	feet
Coord.:	E 2243713.88	33		Lock		es es
Method of Advan	ce: low Stem Auger			INNER CAS	SING:	VC
				Diameter	The second secon	inch
Borehole Diamete	er: 8 inches	_ ////////		Total Length		feet
Daille - Etc.				Sections Used	The second secon	2
Drilling Fluid:	None	_ ////////		Joints		1
						•
				GROUT ABO	OVE SEAL .	•
Depth to Bottom	•				it Cement Gi	rout .
of Grout :	15 feet					
Don'th 4- D-41				SEALING M	ATERIAL:	
Depth to Bottom of Seal :	44.			Be	entonite Chip	s
Or Sear.	17 feet	_				
Depth to top of	*			FILTER MAT		
Screen :	19 feet			# 30	Red Flint Sa	and
	10100	-		SCREEN:		·
				Type	PV	
Depth to Bottom				Length	10 fe	
of Boring :	29 feet		⊒	Diameter	2-in	
	,			Slot Size	0.0,1-	
Depth to First						
Water Encountered during Drilling:		delta de la compansión de la compansión de la compansión de la compansión de la compansión de la compansión de		PUMP:		
waning binning .	24 feet	**Note: All der	oths are fro	om Type	N/A	<u>4</u>
Depth to Water Lev	rel	Ground Level		Length	N/A	*
before installation				Diameter	N/A	+
	- 27 ICCL	•				
METHOD OF DEVE	LOPMENT:	Surge with wei	ohted bail	er and dewater with	Brainard 14:	lman D
3			J. 1204 DOIN	or uno dewater with	pramaro-Ki	ıman Pump
CONSTRUCTION N	OTES:				•	

WELL DESIGN	ATION A	/W-4		PROJECT	EEC - So	uth Cass Lak
DRILLER ]	Thein Well Company			COMPLETIC	ON DATE	5/21/200
Elev.( <u>+</u> 0.01')		_		CONCRET	E SURFACE	E SEAL:
(Grade Elevatio	n) -	_	.		Y/N	Y
Elev.(± 0.01')	1338.50			OUTER CA	SING	
(Top of Inner Ca	sing w/o Cover)			Type		on Steel
<b></b>			<b>'</b>	Diameter		nches
State Plane	N 651941.070	· •		Total Length		feet
Coord.:	E 2243552.65	4		Lock		'es
Method of Adva	ince: ollow Stem Auger			INNER CAS		vc
Porchala Diama				Diameter	2-i	nch
Borehole Diame	eter: 8 inches	_		Total Length	18	feet
Drilling Fluid:	None			Sections Used		2
- mig i juid.	None	-		Joints		1
•						•
Depth to Bottom	1			GROUT ABO		
of Grout :	16 feet			Nea	t Cement Gr	Out
Depth to Bottom of Seal :	18 feet			SEALING M	ATERIAL: entonite Chip	9S
Depth to top of Screen:	20 feet			FILTER MA1 # 30	ERIAL: Red Flint Sa	and
				SCREEN:		
Depth to Bottom	•			Туре	PV	C
of Boring :				Length	10 fe	eet
or borning .	30 feet			Diameter	2-in	ch
Depth to First				Slot Size	0.01-i	nch
Water Encounter	ed			PUMP:		
during Drilling :	24.5 feet	**Note: All der	oths are from	Type	N/A	
	The state of the s	Ground Level		Length	N/A	
Depth to Water Lo		•		Diameter	N/A	
before Installation	1: 24.5 feet		•	-		-
wethod of Dev	ELOPMENT:	Surge with we	ighted bailer a	nd dewater with	Brainard-Kil	man Pump
CONSTRUCTION	NOTES:	g water the same of the same o			,	

WELL DESIGNATION	ON N	/W-6	• ,	PROJECT	EEC - So	uth Cass Lak
DRILLER Their	1 Well Company			COMPLETIO	ON DATE	11/19/2002
Elev.(± 0.01')	1321.60			CONCRET	E SURFACI	E SEAL:
(Grade Elevation)					Y/N	Y
Elev.(± 0.01')	1323.55		7	OUTER CA	SIMG.	
(Top of Inner Casing	w/o Cover)			Type	(	on Steel
				Diameter		nches
State Plane	N 651762.485		İ	Total Length		feet
Coord.:	E 2243525.59	02		Lock	The second secon	res
Method of Advance Hollov	: v Stem Auger			INNER CAS	SING:	
		- ////////		Type Diameter		VC
Borehole Diameter:	8 inches			Total Length		inch feet
		- /////////		Sections Used		3
Drilling Fluid:	None			Joints		2
•		-		55		
•						-
	•			CROUT AR	OVE OF AL.	
Depth to Bottom				GROUT ABO	ove SEAL: at Cement G	
of Grout:	20 feet			INGS	it Gement G	rout
Depth to Bottom of Seal :	22 feet			SEALING M	ATERIAL: entonite Chip	os ·
Depth to top of Screen:	24 feet			FILTER MAT	TERIAL: Red Flint S	and
		'l 📗		SCREEN:		
<b>B</b>	<u>.</u>			Type	P۷	/C
Depth to Bottom				Length	10 f	
of Boring :	· 36 feet		-	Diameter	2-in	
Da-45-4- P1 4	•		,	Slot Size	0.01-	
Depth to First Water Encountered				-		
during Drilling:	p <sup>a</sup>			PUMP:		
acounted materials:		**Note: All dep	oths are from	Туре	N//	Α
Depth to Water Level		Ground Level		Length	N//	Α.
before installation:	the state of the s			Diameter	N//	1
METHOD OF DEVELO	PMENT:	Surge with wei	ghted bailer ar	nd dewater with	Brainard-Ki	lman Pump
CONSTRUCTION NOT	TES:	·				

WELL DESIGNA	TION	MW-7	P	ROJECT	EEC - Sou	ith Cass Lak
DRILLER The	ein Well Company		C	OMPLETIC	ON DATE	11/19/2002
Elev.( <u>+</u> 0.01')	1322.70			CONCRET	E QUDEACE.	054
(Grade Elevation)				O ACKE I	E SURFACE Y/N	SEAL:
Elev.( <u>+</u> 0.01')	1320.78			· · · · · · · · · · · · · · · · · · ·	· , •	Ţ
(Top of Inner Casi			1 i ==	UTER CA		_
	5			уре		n Steel
State Plane	N 651624.26	08		iameter		ches
Coord.:	E 2243894.5			otal Length		eet
			Le	ck	Y	es
Method of Advance			AI	INER CAS	ING:	
Holi	ow Stem Auger	_		pe .		/C
Borehole Diamete			Di	ameter	2-ir	nch
Potetiole Diamete	r: 8 inches	<b>—</b>	То	tal Length	24 f	eet
Drilling Fluid:			Se	ctions Used	3	}
Diming Fible:	<u>None</u>		Joi	ints	.2	}
					-	
	•					
_			G	ROUT ARC	OVE SEAL:	
Depth to Bottom					t Cement Gr	out.
of Grout:	19 feet		_	, 100	COCITICITE OIL	Jul
D=41.4 = 44			SE	ALING MA	ATERIAI :	
Depth to Bottom					ntonite Chips	3
of Seal :	21 feet					
Depth to top of			FIL	TER WAT	ERIAL:	
Screen:	24 feet			# 30	Red Flint Sa	nd
- 3. 33, 1	24 1661	-				
	,			REEN:		
Depth to Bottom			Тур	Circ.	PV(	
of Boring :	34 feet		Lenç		10 fe	
			Dian	-	2-inc	
Depth to First		, ,	Slot	Size —	0.01-ir	ich
Water Encountered			PU	MD.		
during Drilling :		**Note: All depths	are from Type		NI/A	-
		Ground Level	Leng	-	N/A N/A	
Depth to Water Leve			Diam		N/A N/A	
before Installation :	Chapter things to the same of		- Ciam	Name of the last o		<del> </del>
METHOD OF DEVEL	OPMENT:	Surge with weight	ed bailer and de	water with	Brainard-Kile	nan Puma
CONSTRUCTION NO	OTES:		and the same of th			Gara anth
		the space of spaces of the same of the sam				

WELL DESIGNATION	ON	IW-8		PROJECT	EEC - So	outh Cass Lak
DRILLER Thein	Well Company			COMPLETIO	ON DATE	11/20/2002
Elev.( <u>+</u> 0.01')	1321.80			CONCRET	E SURFAC	E SFAI:
(Grade Elevation)			. 1		Y/N	- <b></b> Y
Elev.(± 0.01')	1323.85		=-	OUTER CA	SING.	,
(Top of Inner Casing	w/o Cover)	7		Туре		on Steel
State Diama	N 05/75/		.	Diameter		nches
State Plane Coord.:	N 651721.074			Total Length	5	feet
Coord	E 2244083.10 <sup>-</sup>	14		Lock		Yes
Method of Advance:	: / Stem Auger			INNER CAS		
	Otom Auger	-		Type		PVC
Borehole Diameter:	8 inches			Diameter  Total Length	The second second second second second second second second second second second second second second second se	inch feet
				Sections Used	44	3
Drilling Fluid:	None	_		Joints	-	2
	•				· · · · · · · · · · · · · · · · · · ·	
Depth to Bottom				GROUT ABO	OVE SEAL: at Cement G	
of Grout :  Depth to Bottom of Seal :	19 feet 21 feet			SEALING M		
Depth to top of Screen :	24 feet			FILTER MAT	Red Flint S	and
				SCREEN:		
Depth to Bottom				Туре	P\	/C
of Boring:	34 feet			Length		feet
	J4 ICCL			Diameter	2-ir	
Depth to First Water Encountered				Slot Size - PUMP:	0.01-	inch
during Drilling :		**Note: All de	oths are from		. N/	Α
Depth to Water Level Defore Installation :		Ground Level		Length Diameter	N/. N/.	A
METHOD OF DEVELO	PMENT:	Surge with we	ghted bailer	and dewater with	ı Brainard-K	ilman Pumo
ONSTRUCTION NOT	ES:			Annual State of the State of th	- Carlotte - Carlotte	- Carrie

Well Design	NOITA	M	W-9	<del></del> .	PROJECT EEC - South Cass La				
DRILLER ]	Thein We	ll Company		<b></b>	COMPLETIO	ON DATE	11/19/2002		
Elev.(± 0.01')	1	319.03	,		CONCRET	E SURFAC	F SEAL -		
(Grade Elevatio	n)		·	.	-	Y/N	Υ ΄		
Elev.( <u>+</u> 0.01')	1:	321.10	1	77	OUTER CA	SING.	***************************************		
(Top of Inner Ca	asing w/o	Cover)			Type		on Steel		
	_		' '		Diameter		nches		
State Plane	N	651788.2945	Í .		Total Length		feet		
Coord.:	E	###########			Lock		Yes		
Method of Adv					INNER CAS	SING:			
Н	lollow Ste	m Auger			Туре		PVC		
	•				Diameter		-inch		
Borehole Diame	eter:	8 inches			Total Length		? feet		
D-1111					Sections Used		3		
Drilling Fluid:		None			Joints		2		
Depth to Botton	n			-	GROUT AB				
of Grout :	. •	17 feet				at Cement G	rout		
Depth to Bottom of Seal :	1	19 feet			SEALING M	IATERIAL: entonite Chi	ps		
Danish da da a c					FILTER MA	TERIAL:	•		
Depth to top of Screen :		22 feet			# 30	Red Flint S	and		
	-	22 1661			SCREEN:				
Depth to Bottom	1	-			Туре		VC		
of Boring :		32 feet	į		Length		feet		
_	•				Diameter Slot Size		nch ,		
Depth to First Water Encounter	red			•	PUMP:	0.01	-inch		
during Drilling :			**Note: All d	epths are from	Type	N/	/A		
	<u> </u>	to the second second second second second second second second second second second second second second second	Ground Leve		Length	And the last of th	A.		
Depth to Water L pefore installatio			•		Diameter	· N/			
METHOD OF DEV	/ELOPM	ENT:	Surge with w	eighted bailer a	nd dewater with	n Brainard V	îlman Bur		
ONSTRUCTION	' ልነውን ድድ			- J	dotrater with	· Diamaiu-N	uman rump		
- IOI INOCION	FUU I ES:		g			· .			

# APPENDIX D - LABORATORY ANALYTICAL REPORTS



#### Corporate Office & Laboratory

1241 Believue Street, Suite 9, Green Bay, WI 54302 920-469-2436, 800-7-ENCHEM, Fax: 920-469-8827

www.enchem.com

Analytical Report Number: 836821

Client: NREC

Project Name: SOUTH CASS LAKE

Project Number:

Lab Sample Number	Field ID	Collection Matrix Date
836821-001	MW-1	WATER 07/16/03
836821-002	MW-2	WATER 07/16/03
836821-003	MW-4	WATER 07/16/03
836821-004	MW-6	WATER 07/16/03
836821-005	MW-7	WATER 07/16/03
836821-006	MW-8	WATER 07/16/03
836821-007	MW-9	WATER 07/16/03
836821-008	TRIP BLANK	WATER 07/16/03

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and Laboratory Standard Operating Procedure. Exceptions, if any, are discussed in the accompanying sample comments. Release of this final report is authorized by Laboratory management, as is verified by the following signature. Reported results shall not be reproduced, except in full, without the written approval of the lab. The sample results relate only to the analytes of interest

Approval Signature

Date

-8/06/02

1241 Believue Street Green Bay, WI 54302 920-469-2436 800-7-ENCHEM Fax: 920-469-8827

Analytical Report Number: 836821

Client: NREC

Matrix Type: WATER

Project Name: SOUTH CASS LAKE

Collection Date: 07/16/03

Project Number:

Report Date: 08/06/03

Field ID: MW-1

DRO Extended Range C10-	C40			Prep Date	e: 07/22/03		•		
Analyte		Result	EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis Method
DRO Ext. Range C10 - C40	<	100	100	1	ug/L		07/31/03	WI MOD DRO	WI MOD DRO
ВТЕХ				Prep Date	: 07/23/03				<u>-</u>
Analyte		Result	EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis Method
Benzene	<	1.0	1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021B
Ethylbenzene	<	1.0	1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021B
Toluene	<	1.0	1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021B
Xylene, o	<	1.0	1.0	.1	ug/l		07/23/03	SW846 5030B	SW846 M8021B
Xylenes, m + p	<	2.0	2.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021B
a,a,a-Trifluorotoluene		107		1	%Recov		07/23/03	SW846 5030B	SW846 M8021B
BTEX BLANK				Prep Date	: 07/23/03				
Analyte	,	Result	EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis Method
BTEX Blank ID		1275-32		1				···	<del></del>

1241 Bellevue Street Green Bay, WI 54302 920-469-2436 800-7-ENCHEM Fax: 920-469-8827

## Analytical Report Number: 836821

Client: NREC

Project Name: SOUTH CASS LAKE

Project Number :

Field ID: MW-2

Matrix Type: WATER

Collection Date: 07/16/03

Report Date: 08/06/03

					<u> </u>		Lab Samp	ole Number: 83	6821-002
DRO Extended Range C10	-C40			Prep Dai	te: 07/22/03				
Analyte		Result	EQL	Dilution	Units	Code	Analysis	Prep Method	Analysis
DRO Ext. Range C10 - C40	<	100	100	1					Method
DTCV				<del></del>	ug/L		07/31/03	WI MOD DRO	WI MOD DRO
BTEX			-	Prep Date	e: 07/23/03			· · · · · ·	
Analyte		Result	EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis
Benzene	. <	1.0	1.0	1 .	ug/i				Method
Ethylbenzene	<	1.0	1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021E
Toluene	<	1.0	1.0	1	_		07/23/03	SW846 5030B	SW846 M8021B
Xylene, o	<	1.0	1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021B
Kylenes, m + p	<	2.0	2.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021B
a,a,a-Trifluorotoluene		107		1	ug/l		07/23/03	SW846 5030B	SW846 M8021B
				1	%Recov	1	07/23/03	SW846 5030B	SW846 M8021B
BTEX BLANK				Prep Date:	07/23/03				
Analyte		Result	EQL.	Dilution	Units	Code	Analysis Date	Prep Method	Analysis
BTEX Blank ID		1275-32		1			Date		Method

1241 Bellevue Street Green Bay, WI 54302 920-469-2436 800-7-ENCHEM Fax: 920-469-8827

**Analytical Report Number: 836821** 

Client: NREC

Project Name: SOUTH CASS LAKE

Project Number:

Field ID: MW-4

Matrix Type: WATER

Collection Date: 07/16/03

Report Date: 08/06/03

— ·									
DRO Extended Range C10-	C40 ·		•	Prep Date	e: 07/22/03				
Analyte		Result	EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis Method
DRO Ext. Range C10 - C40	<	100	100	1	ug/L		07/31/03	WI MOD DRO	WI MOD DRO
втех		• •		Prep Date	e: 07/23/03			,	,
Analyte		Result	EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis Method
Benzene	. <	1.0	1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021E
Ethylbenzene	. <	1.0	1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021E
Toluene	<	1.0 `	1.0	1	ug/l	•	07/23/03	SW846 5030B	SW846 M8021E
Xylene, o	<	1.0	1.0	- 1	ug/l		07/23/03	SW846 5030B	SW846 M8021E
Xylenes, m + p	<	2.0	2.0	1 .	ug/l		07/23/03	SW846 5030B	SW846 M8021B
a,a,a-Trifluorotoluene		108		1	%Recov		07/23/03	SW846 5030B	SW846 M8021B
BTEX BLANK			,	Prep Date	: 07/23/03				
Analyte		Result	EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis Method
BTEX Blank ID		1275-32		1.	+				
· ·									

1241 Bellevue Street Green Bay, WI 54302 920-469-2436 800-7-ENCHEM Fax: 920-469-8827

#### Analytical Report Number: 836821

Client: NREC

Project Name: SOUTH CASS LAKE

Project Number:

Field ID: MW-6

Matrix Type: WATER

Collection Date: 07/16/03

Report Date: 08/06/03

DRO Extended Range C10-	C40			Prep Date	e: 07/22/03				
Analyte		Result	EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis Method
DRO Ext. Range C10 - C40	<	100	100	1	ug/L		07/31/03	WI MOD DRO	WI MOD DRO
втех				Prep Date	: 07/23/03		.,		
Analyte		Result	EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis Method
Benzene	<	1.0	1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021E
Ethylbenzene	<	1.0	1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021E
Toluene	<	1.0	1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021E
Xylene, o	<	1.0	1.0	1 .	ug/l	•	07/23/03	SW846 5030B	SW846 M8021B
Xylenes, m + p	<	2.0	2.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021B
a,a,a-Trifluorotoluene	<del> </del>	99		1	%Recov	•	07/23/03	SW846 5030B	SW846 M8021B
BTEX BLANK				Prep Date	: 07/23/03				
Analyte		Result	EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis Method
STEX Blank ID		1275-33		1			··-···································		

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Analytical Report Number: 836821

Client: NREC

Project Name: SOUTH CASS LAKE

. Project Number :

Field ID: MW-7

Matrix Type: WATER

Collection Date: 07/16/03

Report Date: 08/06/03

DRO Extended Range C10-	C40			Prep Dat	e: 07/22/03				
Analyte	_	Result	EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis
DRO Ext. Range C10 - C40	<	100	100	1	ug/L		07/31/03	140 4400 000	Method
BTEX							07/31/03	WI MOD DRO	WI MOD DRO
				Prep Date	e: 07/23/03				
Analyte		Result	EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis
Benzene	<	1.0	1.0	1	ug/l		07/23/03	CIA/RAC FOREM	Method
Ethylbenzene	<	1.0	1.0	1	ug/I		07/23/03	SW846 5030B	SW846 M8021
Toluene	<	1.0	1.0	1	ug/i			SW846 5030B	SW846 M8021
Kylene, o	<	1.0	1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021
(ylenes, m + p	<	2.0	2.0	1	_		07/23/03	SW846 5030B	SW846 M8021
a,a,a-Trifluorotoluene		98		•	ug/l		07/23/03	SW846 5030B	SW846 M80218
				<del></del>	%Recov	<del></del> _	07/23/03	SW846 5030B	SW846 M8021E
BTEX BLANK				Prep Date:	07/23/03				<u> </u>
nalyte		Result	EQL	Dilution	Units	Code	Analysis	Prep Method	Analysis
TEX Blank ID		1275-33	<del></del>	1		Gode	Date		Method

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Analytical Report Number: 836821

Client: NREC

Project Name: SOUTH CASS LAKE

Project Number:

Field ID: MW-8

Matrix Type: WATER

Collection Date: 07/16/03

Report Date: 08/06/03

					Lab Sample Number: 836821-006				
DRO Extended Range C10-	C40		Prep Date: 07/22/03						
Analyte	٠.	Result	EQL	- Dilution	Units	Code	Analysis	Prep Method	Analysis
DRO Ext. Range C10 - C40	<	100	100	1					Method
DTCV					ug/L		07/31/03	WI MOD DRO	WI MOD DRO
BTEX				Prep Date	e: 07/23/03				<del></del>
Analyte		Result	EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis
Benzene	<	1.0	1,0	1	ua/l				Method
thylbenzene	<	1.0	1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021
Гоіиеле	<	1.0	1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021E
(ylene, o	<	1.0	1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021E
(ylenes, m + p	<	2.0	2.0		ug/l		07/23/03	SW846 5030B	SW846 M8021E
,a,a-Trifluorotoluene		99		1	ug/i		07/23/03	SW846 5030B	SW846 M80218
	<del></del>		<del></del>		%Recov	_	07/23/03	SW846 5030B	SW846 M8021B
ITEX BLANK		•	,	Prep Date:	07/23/03				· · · · · · · · · · · · · · · · · · ·
nalyte	,	Result	EQL	Dilution	Units	Code	Analysis	Prep Method	Analysis
TEX Blank ID		1275-33		1			Date		Method

1241 Bellevue Street Green Bay, WI 54302 920-469-2436 800-7-ENCHEM Fax: 920-469-8827

### Analytical Report Number: 836821

Client: NREC

Project Name: SOUTH CASS LAKE

Project Number:

Field ID: MW-9

Matrix Type: WATER

Collection Date: 07/16/03

Report Date: 08/06/03

DRO Extended Range C10-C	40				Prep Date	e: 07/22/03				
Analyte		Result		EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis . Method
DRO Ext. Range C10 - C40	<	100	•	100	1	ug/L		07/31/03	WI MOD DRO	WI MOD DRO
BTEX					Prep Date	: 07/23/03				
Analyte		Result		EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis Method
Benzene		0.51	J	1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021E
Ethylbenzene	<	1.0		1.0	1	ug/i		07/23/03	SW846 5030B	SW846 M8021E
Toluene	<	1.0		1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021B
Xylene, o	<	1.0		1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021B
Xylenes, m + p	<	2.0		2.0	1	ug/l	•	07/23/03	SW846 5030B	SW846 M8021B
a,a,a-Trifluorotoluene		98			<u> 1 ·                                    </u>	%Recov		` 07/23/03	SW846 5030B	SW846 M8021B
BTEX BLANK					Prep Date	: 07/23/03				
Analyte		Result		EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis Method
BTEX Blank ID	<del></del>	1275-33			1			-		

1241 Bellevue Street Green Bay, WI 54302 920-469-2436 800-7-ENCHEM Fax: 920-469-8827

# Analytical Report Number: 836821

Client: NREC

Project Name: SOUTH CASS LAKE

Project Number:

Field ID: TRIP BLANK

Matrix Type: WATER

Collection Date: 07/16/03

Report Date: 08/06/03

BTEX				Prep Date	e: 07/23/03				
Analyte		Result	EQL	Dilution	Units	Code	Analysis	Prep Method	Analysis
Benzene	<	1.0	1.0	4		Code		-	Method
Ethylbenzene		1.0	1.0	1 -	ug/i		07/23/03	SW846 5030B	SW846 M8021B
Toluene		1.0		1	ug/l		07/23/03	SW846 5030B	SW846 M8021B
Xylene, o			1.0	1	ug/i		07/23/03	SW846 5030B	SW846 M8021B
Xylenes, m + p		1.0	1.0	1	ug/l		07/23/03	SW846 5030B	SW846 M8021B
a,a,a-Trifluorotoluene		2.0	2.0	1 , ,	ug/l		07/23/03	SW846 5030B	SW846 M8021B
-late imposoratelle		8		1	%Recov		07/23/03	SW846 5030B	SW846 M8021B
BTEX BLANK				Prep Date:	07/23/03		-		THE MINISTER IN
Analyte	R	lesult	EQL	Dilution	Units	Code	Analysis Date	Prep Method	Analysis
BTEX Blank ID	1:	275-33		1			Date		Method

# **Qualifier Codes**

Flag	Applies To	D Explanation
A	Inorganic	Analyte is detected in the method blank. Method blank criteria is evaluated to the laboratory method detection limit. Additionally, method blank acceptance may be based on project specific criteria or determined from analyte concentrations in the sample and are evaluated on a sample by sample basis.
В	Inorganic	The analyte has been detected between the method detection limit and the reporting limit.
В	Organic	Analyte is present in the method blank. Method blank criteria is evaluated to the laboratory method detection limit. Additionally, method blank acceptance may be based on project specific criteria or determined from analyte concentrations in the sample and are evaluated on a sample by sample basis.
C ]	All	Elevated detection limit.
D	All	Analyte value from diluted analysis or surrogate result not applicable due to sample dilution.
E	Inorganic	Estimated concentration due to matrix interferences. During the metals analysis using the inductively coupled plasma (ICP), the serial dilution failed to meet the established control limits of 0-10% and the sample concentration is greater than 50 times the IDL (100 times the IDL for analysis done on the ICP-MS). The result was flagged with the E qualifier to indicate that a physical interference was observed.
E	Organic	Analyte concentration exceeds calibration range.
F	Inorganic	Due to potential interferences for this analysis by Inductively Coupled Plasma techniques (SW-846 Method 6010), this analyte has been confirmed by and reported from an alternate method.
F	Organic	Surrogate results outside control criteria.
H	All	Preservation, extraction or analysis performed past holding time.
J	Inorganic	The analyte has been detected between the method detection limit and the reporting limit.
J	Organic	Concentration detected is greater than the method detection limit but less than the reporting limit.
K	Inorganic	Sample received unpreserved. Sample was either preserved at the time of receipt or at the time of sample preparation.
<	Organic	Detection limit may be elevated due to the presence of an unrequested analyte.
-	All .	Elevated detection limit due to low sample volume.
V	Ali	Spiked sample recovery not within control limits.
	Organic	The relative percent difference between the two columns for detected concentrations was greater than 40%.
Ω.	Ali	The analyte has been detected between the limit of detection (LOD) and limit of quantitation (LOQ). The results are qualified due to the uncertainty of analyte concentrations within this range.
6 (	Organic	The relative percent difference between quantitation and confirmation columns exceeds internal quality control criteria. Because the result is unconfirmed, it has been reported as a non-detect with an elevated detection limit.
J , A	All	The analyte was not detected at or above the reporting limit.
' 1	All	Sample received with headspace.
V /	411	A second aliquot of sample was analyzed from a container with headspace.
	Ali	See Sample Narrative.
	All .	Laboratory Control Spike recovery not within control limits.
P	All	Precision not within control limits.
P	Alf	The analyte was not detected at or above the reporting limit.
lı	norganic	Dissolved analyte or filtered analyte greater than total analyte; analyses passed QC based on precision criteria.
ir	norganic	Dissolved analyte or filtered analyte greater than total analyte; analyses failed QC based on precision criteria.
Īt	norganic	BOD result is estimated due to the BOD blank exceeding the allowable oxygen depletion.
Į,	norganic	BOD duplicate precision not within control limits. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
lr	norganic	BOD result is estimated due to insufficient oxygen depletion. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
lr	norganic i	BOD laboratory control sample not within control limits. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
In	organic i	BOD result is estimated due to complete oxygen depletion. Due to the 48 hour holding time for this test, it is not practical to eanalyze and try to correct the deficiency.

# Analysis Summary by Laboratory

1241 Bellevue Street Green Bay, WI 54302

1090 Kennedy Avenue Kimberly, WI 54136

Test Group Name	836821-001	836821-002	836821-003	836821-004	836821-005	836821-006	836821-007	836821-008
BTEX	G	G	G		G			G
BTEX BLANK								_
DDO Estandad D	G	G	G	G	G	G	G	G
DRO Extended Range C10-C40	G	G	G	G	G	G	G	

Minnesota Certification								
G = En Chem Green Bay	055-999-334							
K = En Chem Kimberly	055-999-107							
S = Subcontracted Analysis	-							

32 34 36 38 40 -유 -œ \\gbtarget2\tar2data\chem\dro1.i\o73103.b\oo6Ro101.D Column diameter: 0,53 -% -2--<sub>83</sub> 20 Min -8 -ЕХІЕИЛЕЛ ВӨИСЕ ЛКО (47,465) -4 4 -21 **\$** Column phase: RTX-5/1,6.

Instrument; dro1.1

Operator: KEG

Date : 31-JUL-2003 15:10 Client ID: 836821-002

Sample Info: 36821E002MUK1 Volume Injected (uL); 2,0

Page 2 - <del>4</del> . **. .** . . - 99 M 32 34 -R -8 \\gbtarget2\tar2data\chem\drd1.i\073103.b\008R0101.D Instrument: dro1.i Column diameter: -% Operator: KEG -2 -8 -Si -00 -EXTENDED RANCE DRO (17,465) raca File: \\gotarget2\tar2data\chem\dro1.i\073103.b\008R0101.D -위 -4 -각 Sample Info: 36821E004WUX1 Volume Injected (uL): 2.0 Column phase: RTX-5/1.G. Date : 31-JUL-2003 16:45 Client ID: 836821-004

3.9

3.0

### FORM 1 VOLATILE ORGANICS ANALYSIS DATA SHEET

			I .		
Lab Name: ENCHEM INC	GREEN BAY	Contract:		BLKZ 108	3-71
Lab Code: ENCHEMGB	Case No :	SAS No.:	SDG No	O.: GRO2	-082102
Matrix: (soil/water)	WATER	Lab Sample	-		
Sample wt/vol:	(g/mL) ML				
Level: (low/med)	LOW	Date Recei		.1 0101	
% Moisture: not dec.	· <u></u>	Date Analy	<del></del>	21/02	
GC Column: DB-624	ID: 0.32 (mm)	Dilution F			
Soil Extract Volume:	(uL)	Soil Aliqu			(uL)
CAS NO.	COMPOUND	CONCENTRATION UN (ug/L or ug/Kg)	ITS: UG/L	Q	
108-88-3 100-41-4 108-38-3 95-47-6 108-67-8 95-63-6 91-20-3	TolueneEthylbenzenem/p-Xyleneo-Xylene1,3,5-Trimethyl		0.7700 0.3300 0.7300 0.7200 1.500 0.7400 0.7200 0.7100 0.6900 2.200	ממממממ	

#### FORM 1 VOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

Lab Name: ENCHEM INC	GREEN BAY C	ontract:	BLKC 1275-33
Lab Code: ENCHEMGB C	ase No.:	SAS No.:	DG No.: GRO1-072303
Matrix: (soil/water) WA	TER		: BLKC 1275-33
Sample wt/vol:	(g/ml) ML	Lab File ID:	
Level: (low/med) Low	<b>₩</b>	Date Received	
% Moisture: not dec	·	Date Analyzed	
GC Column: DB-624 ID:	: 0.32 (mm)	Dilution Facto	
Soil Extract Volume:	(uL)	Soil Aliquot V	
CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/I	
1634-04-4M 71-43-2B 108-88-3	enzene oluene thylbenzene /p-Xylene -Xylene ,3,5-Trimethylbe		1.00 U 1.00 U 1.00 U 1.00 U 2.00 U 1.00 U 1.00 U 1.00 U 1.00 U

## FORM 3 WATER VOLATILE BLANK SPIKE RECOVERY

Lab Name: ENCHEM INC. - GREEN BAY

Contract:

Lab Code: ENCHEMGB

Case No.:

SAS No.:

SDG No.: GRO1-072303

Matrix Spike - Sample No.: BLKC 1275-33

Methyl tert-butyl ether Benzene         20.00         0.00         19.83         99         80-120           Benzene         20.00         0.00         19.68         98         80-120           Toluene         20.00         0.00         19.21         96         80-120           Ethylbenzene         20.00         0.00         18.48         92         80-120           m/p-Xylene         40.00         0.00         36.52         91         80-120           o-Xylene         20.00         0.00         18.51         92         80-120           1,3,5-Trimethylbenzene         20.00         0.00         17.89         89         80-120           1,2,4-Trimethylbenzene         20.00         0.00         17.48         87         80-120           Naphthalene         20.00         0.00         16.99         85         80-120           Total Xylenes         60.00         0.00         55.03         92         80-120	COMPOUND	SPIKE ADDED (ug/L)	BLANK CONCENTRATION (ug/L)	BS CONCENTRATION (ug/L)	BS % REC #	QC. LIMITS REC.
	Benzene Toluene Ethylbenzene m/p-Xylene o-Xylene 1,3,5-Trimethylbenzene 1,2,4-Trimethylbenzene Naphthalene	20.00 20.00 20.00 40.00 20.00 20.00 20.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00	19.68 19.21 18.48 36.52 18.51 17.89 17.48 16.99	98 96 92 91 92 89 87 85	80-120 80-120 80-120 80-120 80-120 80-120 80-120 80-120

	SPIKE ADDED	BSD CONCENTRATION	BSD %	olo Olo	QC L	IMITS	
COMPOUND	(ug/L)	(ug/L)	REC #	RPD #	RPD	REC.	
Methyl tert-butyl ether	20.00	20.14	101	2	.20	80-120	ŀ
Benzene	20.00	19.07	95	3	20	80-120	
Toluene	20.00	18.65	93	3	20	80-120	ł
Ethylbenzene	20.00	17.92	90	. 3	20	80-120	ĺ
m/p-Xylene	40.00	35.43	88	3	20	80-120	
o-Xylene	20.00	18.07	90	2	20	80-120	
1,3,5-Trimethylbenzene	20.00	17.39	87	3	- 20	80-120	ĺ
1,2,4-Trimethylbenzene	20.00	17.20	86	2	20	80-120	ĺ
Naphthalene	20.00	17.81	89	5	20	80-120	ĺ
Total Xylenes	60.00	53.50	89	3	20	80-120	
						<u> </u>	

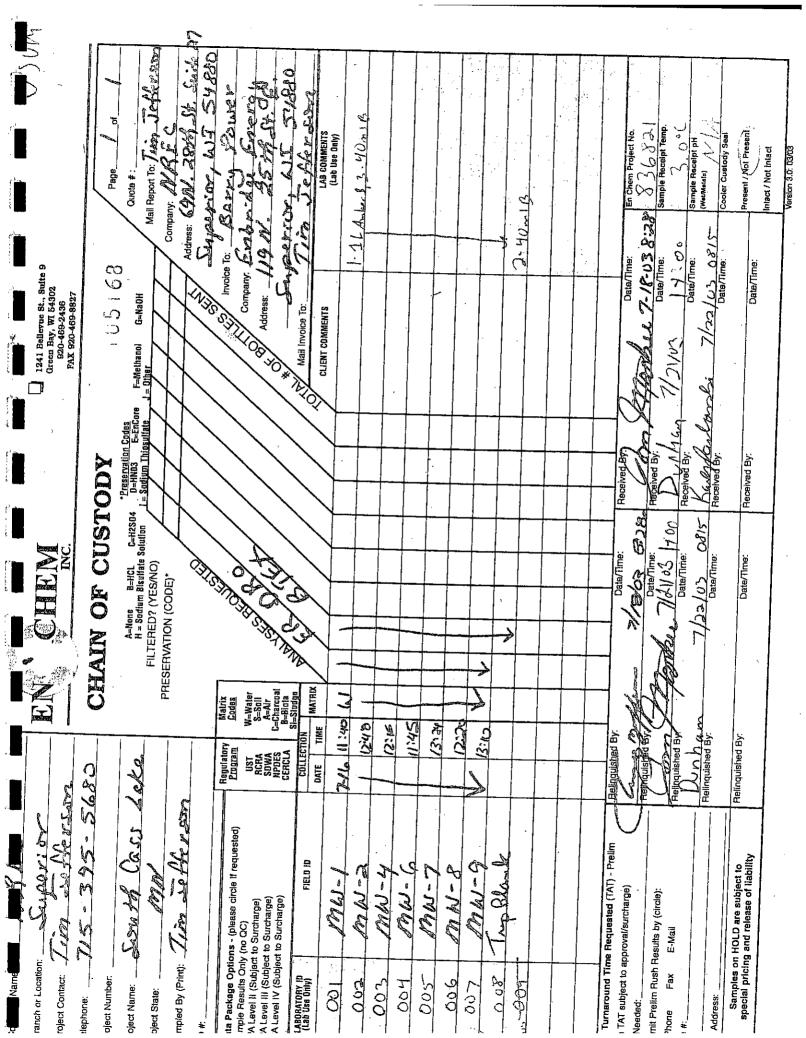
# Column to be used to flag recovery and RPD values with an asterisk

* V	alues	outside	οf	QC	limits
-----	-------	---------	----	----	--------

RPD: 0 out of 10 outside limits

Spike Recovery: 0 out of 20 outside limits

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ľ	~~	/L-11		TA 7		



Batch No. 836821 En Chem, Inc. Cooler I	Receip	t Log		_
Project Name or ID South Cass Lake No. of Coolers	s:	Tem	ps: 3.0°C	<u>'</u>
A. Receipt Phase: Date cooler was opened: 7/22/03 By:	Kon		· · · ·	
1: Were samples received on ice? (Must be ≤ 6 C )		NO <sup>2</sup>		
2. Was there a Temperature Blank?	<u>(E</u> S	NO		П
3: Were custody seals present and intact? (Record on COC)	YES	<b>®</b>		ال
4: Are COC documents present?	(YE\$	NO <sup>2</sup>	•	
5: Does this Project require quick turn around analysis?	YES	<b>®</b>	•	
6: Is there any sub-work?	YES	(MB)		
7: Are there any short hold time tests?	(YES)	NO		!
8: Are any samples nearing expiration of hold-time? (Within 2 days)	Æ\$	NO	Contacted by/Who S. /h.	— <u> </u> _
9: Do any samples need to be Filtered or Preserved in the lab?	YES <sup>1</sup>	(NG)	Contacted by/Who	
B. Check-In Phase: Date samples were Checked-In: 7/22/03 By:	140	$\overline{y}$		_
1: Were all sample containers listed on the COC received and intact?	(YES	NO <sup>2</sup>	NA	
2: Sign the COC as received by En Chem. Completed	<u>(*E</u> S	NO		_
3: Do sample labels match the COC?	(YE3	NO <sup>2</sup>	•	
4: Completed pH check on preserved samples.		NO	<b>N</b>	_
(This statement does not apply to water: VOC, O&G, TOC, DRO, Total Rec. Phenol. 5: Do samples have correct chemical preservation?	YES	NO <sup>2</sup>		_
(This statement does not apply to water: VOC, O&G, TOC, DRO, Total Rec. Phenol. 6: Are dissolved parameters field filtered?	YES	NO <sup>2</sup>	<b>®</b>	_
7: Are sample volumes adequate for tests requested?	(YES	NO <sup>2</sup>	•	_
8: Are VOC samples free of bubbles >6mm	YES	NO <sup>2</sup>	NA	·
9: Enter samples into logbook. Completed	VE8	NO		
10: Place laboratory sample number on all containers and COC. Completed	<b>y<del>E</del>3</b> )	NO		!
11: Complete Laboratory Tracking Sheet (LTS). Completed	YES	NO	<b>®</b>	
12: Start Nonconformance form.	YES	NO.	<b>®</b>	-
13: Initiate Subcontracting procedure. Completed	YES	NO	<b>™</b>	_
14: Check laboratory sample number on all containers and COC	(YES	NO_	NA	
Short Hold-time tests:				·
48 Hours or less Coliform (6 hrs) Hexavalent Chromium (24 Hrs) BOD Total Solids TDS Low Level Mercury Ortho Phosphorus Turbidity Surfactants Sulfite En Core Preservation Color  7 days Flashpoint TSS Sulfact TDS Sulfide Free Liquids Total Volatile Solids Aqueous Extractable Organics- ALL Unpreserved VOC's Ash	immedia	proper lal	o group onformance memo.	
Rev. 4/11/03, Attachment to 1-REC-5. Subject to QA Audit. Review	ved by/da	ite_ <i>{</i> {	5 7/23/03	

Batch No. 824906 En Chem, Inc. Cooler Receipt Log	
Project Name or ID	
A. Receipt Phase: Date cooler was opened: 8/20/02 By: UR	_
1: Were samples received on ice? (Must be ≤ 6 C )	
2. Was there a Temperature Blank?	
3: Were custody seals present and intact? (Record on COC)YES (NO)	
4: Are COC documents present?	
5: Does this Project require quick turn around analysis?YES NO	
6: Is there any sub-work?YES NO	
7: Are there any short hold time tests?	
8: Are any samples nearing expiration of hold-time? (Within 2 days)	
9: Do any samples need to be Filtered or Preserved in the lab?	_
B. Check-in Phase: Date samples were Checked-in: 8/20/02 By: UR	
Were all sample containers listed on the COC received and intact?YES  NO <sup>2</sup> NA	
2: Sign the COC as received by En Chem. CompletedYES NO	
3: Do sample labels match the COC?YES NO <sup>2</sup>	
4: Check sample pH of preserved samples. (Not VOCs) CompletedYES NO. NA	
5: Do samples have correct chemical preservation?	
6: Are dissolved parameters field filtered?YES NO <sup>2</sup> NA	
7: Are sample volumes adequate for tests requested?	
8: Are VOC samples free of bubbles >6mmYES NO <sup>2</sup> NA	
9: Enter samples into logbook. Completed	
10: Place laboratory sample number on all containers and COC. CompletedYES NO	
11: Complete Laboratory Tracking Sheet (LTS). CompletedYES NO NA	
12: Start Nonconformance form	
13: Initiate Subcontracting procedure. Completed	
14: Check laboratory sample number on all containers and COC NO NA	
Short Hold-time tests:	
48 Hours or less Coliform (6 hrs) Hexavalent Chromium (24 Hrs) BOD Nitrite or Nitrate Low Level Mercury Ortho Phosphorus Total Volatile Solids Turbidity Surfactants Sulfite Unpreserved VOC's En Core Preservation  Footnotes 1 Notify proper lab group immediately. 2 Complete nonconformance memo.  Footnotes 1 Notify proper lab group immediately. 2 Complete nonconformance memo.  Total Volatile Solids Aqueous Extractable Organics- ALL Unpreserved VOC's Ash	
Rev. 9/5/2001, Attachment to 1-REC-5. Subject to QA Audit.  Reviewed by/date 55/21/22	

p:/everyone/forms/samplereceiving/crl.doc

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#### - Analytical Report -

Project Name: SOUTH CASS LAKE

Project Number:

Field ID: GP-18

Lab Sample Number: 824906-002

MDH LAB ID: 055-999-334

Client: NRE

Report Date: 8/29/02

Collection Date: 8/14/02

Matrix Type: WATER

#### **Organic Results**

BTEX - WATER	B٦	ſΕΧ	_ 1	W	TFR
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Prep Method: SW846 5030B Prep Date: 8/21/02

Analyst: PMS

Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
a,a,a-Trifluorotoluene	101		%Recov		8/21/02	WI MOD GRO
Benzene	< 1.0	1.0	ug/l		8/21/02	WI MOD GRO
Ethylbenzene	< 1.0	1.0	ug/l		8/21/02	WI MOD GRO
Toluene	< 1.0	1.0	ug/l		8/21/02	WI MOD GRO
Xylenes, -m, -p	< 2.0	2.0	ug/l		8/21/02	WI MOD GRO
Xylene, -o	< 1.0	1.0	ug/l		8/21/02	WI MOD GRO

#### **Organic Results**

#### **BTEX BLANK**

Prep Method:

Prep Date:

8/21/02

Analyst:

Analyte

Result

EQL

Units

Code

Analysis Date

**Analysis** Method

BTEX - Blank

1083-71

#### **Organic Results**

#### **DIESEL RANGE ORGANICS - WATER**

Prep Method: WI MOD DRO Prep Date:

Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
DIESEL RANGE ORGANICS	< 250	250	ug/L	****	8/23/02	WI MOD DRO
Blank spike	91.0		%recov		8/23/02	WI MOD DRO
Blank spike duplicate	88.0	<del></del>	% recov		8/23/02	WI MOD DRO
Blank	< 200	200	ug/L	•	8/23/02	WI MOD DRO

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#### - Analytical Report -

Project Name: SOUTH CASS LAKE

Project Number :

Field ID: GP-20

MDH LAB ID: 055-999-334

Lab Sample Number: 824906-004

Client: NRE

Report Date: 8/29/02

Collection Date: 8/13/02

Matrix Type: WATER

#### **Organic Results**

DIESEL RANGE ORGANICS - WATER		Prep Method	Prep Method: WI MOD DRO P		8/20/02	Analyst: KEG
Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
DIESEL RANGE ORGANICS	< 230	230	ug/L	<del></del>	8/23/02	<del></del>
Blank spike	91.0		%recov	-		WI MOD DRO
Blank spike duplicate	88.0				8/23/02	WI MOD DRO
· ·	00.0		% recov		8/23/02	WI MOD DRO
Blank	< 200	200	ug/L		8/23/02	_
			-9	•	0/23/02	WI MOD DRO

#### FORM 3 WATER VOLATILE BLANK SPIKE RECOVERY

Lab Name: ENCHEM INC. - GREEN BAY Contract:

Lab Code: ENCHEMGB Case No.:

SAS No.:

SDG No.: GRO2-082102

Matrix Spike - Sample No.: BLKZ 1083-71

COMPOUND	SPIKE ADDED (ug/L)	BLANK CONCENTRATION (ug/L)	BS CONCENTRATION (ug/L)	BS % REC #	QC. LIMITS REC.
_======================================				======	=====
Methyl tert-butyl ether	20.000	• 0.0000	19.418	97	85-115
Benzene	20.000	0.0000	19.364	97	85-115
Toluene	20.000	0.0000	19.741	~ 99	85-115
Ethylbenzene	20.000	0.0000	19.634	98	85-115
m/p-Xylene	40.000	0.0000	39.491	99	85-115
o-Xylene	20.000	0.0000	19.837	99	85-115
1,3,5-Trimethylbenzene	20.000	0.0000	19.364	97	85-115
1,2,4-Trimethylbenzene	20.000	0.0000	19.137	96	85-115
Naphthalene	20.000	0.0000	19.441	97	85-115
Total Xylenes	60.000	0.0000	59.329	99	85-115
					l

	SPIKE ADDED	BSD CONCENTRATION	BSD %	o <sub>f</sub> o	QC L	IMITS
COMPOUND	(ug/L)	(ug/L)	REC #	RPD#	RPD	REC.
Methyl tert-butyl ether	20.000	19.660	98	1	20	85-115
Benzene	20.000	19.587	98	1	20	85-115
Toluene	20.000	19.815	99	0	20	85-115
Ethylbenzene	20.000	19.766	99	1	20	85-115
m/p-Xylene	40.000	39.737	99	0	20	85-115
o-Xylene	20.000	19.933	100	1	20	85-115
1,3,5-Trimethylbenzene	20.000	19.651	98	1	20	85-115
1,2,4-Trimethylbenzene	20.000	19.410	97	1	20	85-115
Naphthalene	20.000	20.633	103	6	20	85-115
Total Xylenes	60.000	59.670	99	0	20	85-115
	<del></del>	 				

# Column to be used to flag recovery and RPD values with an asterisk

* Values outside of OC limits	*	Values	outside	of OC	1:	Lmit	2
-------------------------------	---	--------	---------	-------	----	------	---

RPD: 0 out of 10 outside limits
Spike Recovery: 0 out of 20 outside limits

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Madison Office & Laboratory

525 Science Drive Madison, WI 53711 608-232-3300 • Fax: 608-233-0502 888-5-ENCHEM

#### - Analytical Report -

Project Name: SOUTH CASS LAKE STATION

**Project Number:** 

MDH LAB ID: 055-999-334

Client: NRE

Sample No.	Field ID	Collection Date	Sample No.	Field ID	Collection
814647-001	GP-4	9/25/01			Date
814647-002	GP-3	9/25/01	,	•	
814647-003	GP-5	9/25/01			
814647-004	GP-6	9/25/01	,		
814647-005	GP-10	9/26/01			
814647-006	GP-15	9/26/01			
814647-007	GP-16	9/26/01			
814647-008	TRIP BLANK	9/26/01			

Please visit our Internet homepage at: www.enchem.com

Soil VOC detects are corrected for the total solids, unless otherwise noted.

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and Laboratory Standard Operating Procedure. Exceptions, if any, are discussed in the accompanying sample comments. Release of this final report is authorized by Laboratory management, as is verified by the following signature. Reported results shall not be reproduced, except in full, without the written approval of the lab. The sample results relate only to the analytes of interest

Approval Signature

Date

Batch No. 814647	En Chem, Inc. Cool	er Receipt L		
Project Name or ID South CASS LAK	No. of Co	olers:/	Temps: 4.0	)°C
A. Receipt Phase: Date cooler was opene	d: <u>9/28/01</u> ву	:		
1: Were samples received on ice? (Must be		(YES)	NO <sup>2</sup>	
2. Was there a Temperature Blank?		YES	NO .	,.
3: Were custody seals present and intact? (	Record on COC)		NO	
4: Are COC documents present?	***************************************	YES	NO <sup>2</sup>	•
5: Does this Project require quick turn aroun	d analysis?	YES (	NO	
6: Is there any sub-work?		· · · · · · · · · · · · · · · · · · ·	NO	,
7: Are there any short hold time tests?			NO	
8: Are any samples nearing expiration of hol			NO Contacted by	·
9: Do any samples need to be Filtered or Pro	eserved in the lab?	YES <sup>1</sup>	NO Contacted by	/Who
B. Check-in Phase: Date samples were Ch	necked-in: 9-38-01	_ву:6_О		E-mail attached
1: Were all sample containers listed on the 0	COC received and intact?			E-Mail attacked
2: Sign the COC as received by En Chem.			NO -	
3: Do sample labels match the COC?			NO <sup>2</sup>	~
4: Check sample pH of preserved samples.			NO (NA)	
5: Do samples have correct chemical preser		(.	NO <sup>2</sup> NA	,
6: Are dissolved parameters field filtered?			NO <sup>2</sup> (NA	•
7: Are sample volumes adequate for tests re			NO <sup>2</sup>	
8: Are VOC samples free of bubbles >6mm			NO <sup>2</sup> NA	" 
9: Enter samples into logbook. Completed			NO .	
10: Place laboratory sample number on all o		\	NO	•
11: Complete Laboratory Tracking Sheet (L			NO NA	
12: Start Nonconformance form			NO NA	•
13: Initiate Subcontracting procedure. Com			NØ NA	·
14: Check laboratory sample number on all	containers and COC/	(YES	NO NA	•
Short Hold-time tests:				
Coliform (6 hrs) Hexavalent Chromium (24 Hrs) BOD Nitrite or Nitrate Low Level Mercury Ortho Phosphorus Turbidity Surfactants Sulfite	days Flashpoint FSS Fotal Solids FDS FUS FUS FOTAL Solids FOTAL Solids FOTAL Volatile Solids Aqueous Extractable Organics- ALL Jippreserved VOC's Fisch Solids Fi	immediate	roper lab group	no.
Rev. 9/5/2001, Attachment to 1-REC-5.		Reviewed by/date	EB 10/10	. * .

Subject to QA Audit.

# - Analytical Report -

Project Name: SOUTH CASS LAKE STATION

**Project Number:** 

Field ID: GP-4

Lab Sample Number: 814647-001

MDH LAB ID: 055-999-334

Client: NRE

Report Date: 10/5/2001

Collection Date: 9/25/2001

Matrix Type: WATER

#### **Organic Results**

**BTEX - WATER** 

Prep Method: SW846 5030B Prep Date: 10/1/2001 Analyst: PMS

Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
a,a,a-Trifluorotoluene	96		%Recov		10///2004	
Benzene	1300	40			10/4/2001	MOD 8021B
··· <del>-</del>	-	10	ug/l		10/4/2001	MOD 8021B
Ethylbenzene	230	10	ug/l		10/4/2001	-
Toluene	< 10	10			10/4/2001	MOD 8021B
Vulanas		10	ug/l		10/4/2001	MOD 8021B
Xylenes, -m, -p	< 20	20	ug/i		10/4/2001	
Xylene, -o	< 10	10	ug/l			MOD 8021B
			ug/i		10/4/2001	MOD 8021B
		Orga	inic Resulte			

**BTEX BLANK** 

Prep Method:

EQL,

Prep Date:

10/1/2001 Analyst:

Analyte

Result

Units

Code

**Analysis** Date

**Analysis** Method

BTEX - Blank

968-69

# Organic Results

**DIESEL RANGE ORGANICS - WATER** 

Prep Method: Wi MOD DRO Prep Date:

9/28/1901 Analyst: DJB

Analyte	Result	EQL	Units	Code	Analysis Date	Analysis
EXTENDED RANGE	830	160	ug/l			Method
Blank spike	79		-		9/28/2001	Wi MOD DRO
Blank spike duplicate			%Recov		9/28/2001	Wi MOD DRO
•	87		%Recov		9/28/2001	Wi MOD DRO
Blank	< 160	160	· ug/l			ANI MOD DKO
		,,,,,	ugn		9/28/2001	Wi MOD DRO

#### - Analytical Report -

Project Name: SOUTH CASS LAKE STATION

Project Number:

Client: NRE

Field ID: GP-3

Report Date: 10/5/2001

Lab Sample Number: 814647-002

Collection Date: 9/25/2001

MDH LAB ID: 055-999-334

Matrix Type: WATER

#### **Organic Results**

HTEX	1	1254	TED

Prep Method: SW846 5030B Prep Date: 10/1/2001 Analyst: PMS

<u> </u> Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
a,a,a-Trifluorotoluene	86	-	%Recov		10/2/2001	MOD 8021B
Веплеле	340	1.0	ug/l	•	10/2/2001	MOD 8021B
Ethylbenzene	< 1.0	1.0	ug/l		10/2/2001	MOD 8021B
Toluene	< 1.0	1.0	ug/l		10/2/2001	MOD 8021B
Xylenes, -m, -p	< 2.0	2.0	ug/l		10/2/2001	MOD 8021B
Xylene, -o	< 1.0	1.0	ug/l		10/2/2001	MOD 8021B
•						

#### **Organic Results**

#### BTEX BLANK

Prep Method:

Prep Date:

10/1/2001 Analyst:

Analyte

EQL

Units

Code Date

**Analysis** 

Analysis Method

BTEX - Blank

968-69

Result

#### **Organic Results**

#### **DIESEL RANGE ORGANICS - WATER**

Prep Method: Wi MOD DRO Prep Date:

9/28/1901 Analyst: DJB

Analyte	Result	EQL.	Units	Code	Analysis Date	Analysis Method
EXTENDED RANGE	< 160	160	ug/l		9/28/2001	Wi MOD DRO
Blank spike	79		%Recov		9/28/2001	WI MOD DRO
Blank spike duplicate	87		%Recov		9/28/2001	WI MOD DRO
Blank	< 160	160	ug/l	•	9/28/2001	Wi MOD DRO

# - Analytical Report -

Project Name: SOUTH CASS LAKE STATION

Project Number:

Field ID: GP-5

Lab Sample Number: 814647-003

MDH LAB ID: 055-999-334

Client: NRE

Report Date: 10/5/2001

Collection Date: 9/25/2001

Matrix Type: WATER

#### **Organic Results**

BTE	Х -	WΔ	TER

Analyte

EQL

Prep Method: SW846 5030B Prep Date: 10/1/2001 Analyst: PMS

			•
Units	Code	Analysis Date	Analysis Method

<del></del>				Coue	Date	Method
a,a,a-Trifluorotoluene	108		%Recov		10/2/2001	
Benzene	< 1.0	1.0	uall			MOD 8021B
Ethydhaaa			ug/		10/2/2001	MOD 8021B
Ethylbenzene	< 1.0	1.0	ug/l		10/2/2001	MOD 8021B
Toluene	< 1.0	1.0	ug/l		10/2/2001	-, <del>-</del>
Xylenes, -m, -p	< 2.0	2.0	-	•	10/2/2001	MOD 8021B
•	2.0	2.0	ug/l		10/2/2001	MOD 8021B
Xylene, -o	< 1.0	1.0	ug/l		10/2/2001	MOD sone
			•			MOD 8021B

#### **Organic Results**

#### **BTEX BLANK**

Prep Method:

Prep Date:

10/1/2001 Analyst:

						_	
Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method	
BTEX - Blank	069.60					MISCHOOL	

Result

#### Organic Results

#### **DIESEL RANGE ORGANICS - WATER**

Prep Method: Wi MOD DRO Prep Date: 9/28/1901 Analyst: DJB

Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
EXTENDED RANGE	< 180	180	ug/l	· · · · · · · · · · · · · · · · · · ·	9/28/2001	
Blank spike	79		%Recov			Wi MOD DRO
Blank spike duplicate	<b>87</b> .		%Recov		9/28/2001	WI MOD DRO
Blank	< 160	160	ug/l		9/28/2001	Wi MOD DRO Wi MOD DRO

#### - Analytical Report -

Project Name: SOUTH CASS LAKE STATION

Project Number:

Client: NRE

Field ID: GP-6

Report Date: 10/5/2001

Lab Sample Number: 814647-004

Collection Date: 9/25/2001

MDH LAB ID: 055-999-334

Matrix Type: WATER

#### **Organic Results**

RTEX	MAZAT	reb
HIEX	. VVA	ı – ĸ

Prep Method: SW846 5030B Prep Date: 10/1/2001 Analyst: PMS

Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
a,a,a-Trifluorotoluene	107		%Recov		10/2/2001	MOD 8021B
Веплепе	< 1.0	1.0	ug/l		10/2/2001	MOD 8021B
Ethylbenzene	< 1.0	1.0	ug/l		10/2/2001	MOD 8021B
Toluene	< 1.0	1.0	ug/l		10/2/2001	MOD 8021B
Xylenes, -m, -p	< 2.0	2.0	ug/l		10/2/2001	MOD 8021B
Xylene, -o	< 1.0	1.0	ug/l		10/2/2001	MOD 8021B

#### **Organic Results**

#### **BTEX BLANK**

Prep Method:

Prep Date:

10/1/2001 Analyst:

Analyte

EQL

Units

Code

**Analysis** Date

**Analysis** Method

BTEX - Blank

968-69

Result

#### **Organic Results**

#### **DIESEL RANGE ORGANICS - WATER**

Prep Method: Wi MOD DRO Prep Date: 9/28/1901 Analyst: DJB

Analyte	Result	EQL.	Units	Code	Analysis Date	Analysis Method
EXTENDED RANGE	< 160	160	ug/l		9/28/2001	Wi MOD DRO
Blank spike	79	· <del>_</del>	%Recov		9/28/2001	Wi MOD DRO
Blank spike duplicate	87		. %Recov	, •	9/28/2001	Wi MOD DRO
Blank	< 160	160	ug/l		9/28/2001	WI MOD DRO

## - Analytical Report -

Project Name: SOUTH CASS LAKE STATION

**Project Number:** 

Field ID: GP-10

Lab Sample Number: 814647-005

MDH LAB ID: 055-999-334

Client: NRE

Report Date: 10/5/2001

Collection Date: 9/26/2001

Matrix Type: WATER

#### **Organic Results**

**BTEX - WATER** 

Prep Method: SW846 5030B Prep Date: 10/1/2001 Analyst: PMS

Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
a,a,a-Trifluorotoluene	108		%Recov		10/2/2001	
Benzene	< 1.0	1.0				MOD 8021B
Ethylbenzene	,		ug/l		10/2/2001	MOD 8021B
•	< 1.0	1.0	ug/l		10/2/2001	MOD 8021B
Toluene	< 1.0	1.0	ug/l		10/2/2001	MOD 8021B
. Xylenes, -m, -p	< 2.0	2.0	ug/l			
Xylene, -o	- 10		•		10/2/2001	, MOD 8021B
Aylend, -0	< 1.0	1.0	ug/l		10/2/2001	MOD 8021B
		Orac	nio Desults			

#### Organic Results

**BTEX BLANK** 

Prep Method:

EQL

Prep Date:

10/1/2001 Analyst:

Analyte

Result

Code

**Analysis** Date

Analysis Method

BTEX - Blank

968-69

#### **Organic Results**

Units

**DIESEL RANGE ORGANICS - WATER** 

Prep Method: Wi MOD DRO

Prep Date:

9/28/2001

9/28/1901 Analyst: DJB

**Analysis** 

Method

Wi MOD DRO

Wi MOD DRO

Wi MOD DRO

Analyte Result **Analysis EQL** Units Code Date EXTENDED RANGE < 160 160 ug/ 9/28/2001 Blank spike 79 %Recov 9/28/2001 Wi MOD DRO Blank spike duplicate 87 %Recov 9/28/2001 Blank < 160 -160 ug/l

#### - Analytical Report -

Project Name: SOUTH CASS LAKE STATION

**Project Number:** 

Field ID: GP-15

Lab Sample Number: 814647-006

MDH LAB ID: 055-999-334

Client: NRE

Report Date: 10/5/2001

Collection Date: 9/26/2001

Matrix Type: WATER

#### **Organic Results**

EX		

Prep Method: SW846 5030B Prep Date: 10/1/2001 Analyst: PMS

Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
a,a,a-Trifluorotoluene	108	-	%Recov		10/2/2001	MOD 8021B
Benzene	< 1.0	1.0	ug/l		10/2/2001	MOD 8021B
Ethylbenzene	< 1.0	1.0	ug/l		10/2/2001	MOD 8021B
Toluene	< 1.0	1.0	ug/l		10/2/2001	MOD 8021B
Xylenes, -m, -p	< 2.0	2.0	ug/l -		10/2/2001	MOD 8021B
Xylene, -o	< 1.0	1.0	ug/l		10/2/2001	MOD 8021B
-		_	1 - 1:			

#### **Organic Results**

#### **BTEX BLANK**

Prep Method:

EQL

Prep Date:

10/1/2001 Analyst:

Analyte

Result

Units 1

Code

Analysis Date

Analysis Method

BTEX - Blank

968-69

#### **Organic Results**

#### **DIESEL RANGE ORGANICS - WATER**

Prep Method: Wi MOD DRO Prep Date: 9/28/1901 Analyst: DJB

Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
EXTENDED RANGE	< 160	160	ug/l		9/28/2001	WI MOD DRO
Blank spike	79	. <del></del>	%Recov	,	9/28/2001	Wi MOD DRO
Blank spike duplicate	87	_	%Recov		9/28/2001	WI MOD DRO
Blank	< 160	160	. ug/l		9/28/2001	WI MOD DRO

#### - Analytical Report -

Project Name: SOUTH CASS LAKE STATION

Project Number :

Field JD: GP-16

Lab Sample Number: 814647-007

MDH LAB ID: 055-999-334

Client: NRE

Report Date: 10/5/2001

Collection Date: 9/26/2001

Matrix Type: WATER

#### **Organic Results**

BTEX - WATER

Prep Method: SW846 5030B Prep Date: 10/3/2001 Analyst: SMT

Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
a,a,a-Trifluorotoluene	102		%Recov		10/3/2001	MOD 8021P
Benzene	19	1.0	ug/l	-	10/3/2001	
Ethylbenzene	< 1.0	1.0	ug/l			MOD 8021E
Toluene	< 1.0	1.0			10/3/2001	MOD 8021E
Xylenes, -m, -p	< 2.0		ug/i		10/3/2001	MOD 8021B
·		2.0	ug/l	•	10/3/2001	MOD 80218
Xylene, -o	< 1.0	1.0	ug/l		10/3/2001	MOD 8021B

#### **Organic Results**

**BTEX BLANK** 

Prep Method:

EQL

Prep Date:

10/3/2001 Analyst:

Analyte

Result

Units

Code

**Analysis** Date

Analysis Method

BTEX - Blank

968-73

#### **Organic Results**

DIESEL RANGE ORGANICS - WATER

Prep Method: Wi MOD DRO Prep Date: 9/28/1901 Analyst: DJB

Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
EXTENDED RANGE	< 160	160	ug/l	······································	9/28/2001	
Blank spike	79	· <u>-</u>	%Recov			WI MOD DRO
Blank spike duplicate		<del>-</del>	•		9/28/2001	Wi MOD DRO
•	87	_	%Recov		9/28/2001	Wi MOD DRO
Blank	< 160	160	ug/i		9/28/2001	Wi MOD DRO

#### - Analytical Report -

Project Name: SOUTH CASS LAKE STATION

Project Number:

Lab Sample Number: 814647-008

Field ID: TRIP BLANK

Client: NRE

Report Date: 10/5/01

Collection Date: 9/26/01

Matrix Type: WATER

MDH LAB ID: 055-999-334

#### **Organic Results**

BTEX - WATER		Prep Me	thod: SW846 5030B	Prep Date:	10/1/01 A	nalyst: PMS
Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
a,a,a-Trifluorotoluene	· 107		%Recov		10/2/01	MOD 8021B
Benzene	< 1.0	1.0	ug/l		10/2/01	MOD 8021B
Ethylbenzene	< 1.0	1.0	ug/l		10/2/01	MOD 8021B
Toluene	< 1.0	1.0	ug/l		10/2/01	MOD 8021B
Xylenes, -m, -p	< 2.0	2.0	ug/l		10/2/01	MOD 8021B
Xylene, -o	< 1.0	1.0	ug/l		10/2/01	MOD 8021B
		Orga	anic Results			
TEX BLANK	,	Prep Me	thod:	Prep Date:	10/1/01 <b>A</b>	nalyst:
Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
BTEX - Blank	968-69	-				-

		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
	Page of of Mail Report To: Page of Austral Report To: Page of Control of Cont	7 600 58 10 808 60 10 808 600 10 808 600 10 808 600	(Lab Use Gnly)	En Chem Project No. Sample Receipt Temp. Sample Receipt pH (Wet/Metals) Cooler Custody Seal
525 Science Drive Madison, WT 63711 608-232-3300 FAX: 608-233-0502	Com	is to SARR	7 200	ter Time:
e e e e e e e e e e e e e e e e e e e	F-Wethanol G-MaOH	SIJITOS 15	CLIENT COMMENTS	Pad Digital
Green Bay, WI 54302 920-469-2436 FAX 920-469-8827	**Ereservation Codes D=HW03 E=EnCore			Received By: Received By: Received By:
HEM Green Be 920-4 INC. PAX 920	A=None B=HCL C=H2SO4 H = Sodium Bisuitate Solution ERED? (YES/NO) TION (CODE)*	The state of the s	DateOffine	Date/Time:  Date/Time:  ReDate/Time:  Red  Date/Time:  Red  Date/Time:  Red  Date/Time:
	A=Nona B=HGL H = Sodium Bisuithin FILTERED? (YES/NO) PRESERVATION (CODE)*	STATE OF THE PERSON OF THE PER	X	
	Station	Regulatory Godes UST W=Water RCHA S=Soil SDIWA N-PDES C=CHATCA! CERCIA 8-Blota SESOIL SERVINGE	1000 1000 1000 1000 1000 1000 1000 100	Relinquished By: Relinquished By: Relinquished By: Relinquished By:
EUTH MAN MOBER	Lake	urcharge) urcharge).	Prolim	ed to ability
mb, The state of the state o	act Number.  Set Name: \$22. 4a	I Package Options Se circle if requested) lits Only Jem Level III (Subject to Surcharge) Jem Level IV (Subject to Surcharge) Bittanian III (Subject to Surcharge)	maround Time Requested (IAT) - Prelim	ded: Prellm Rush Results by (circle):  The Fax E-Mail  Tress: Samples on HOLD are subject to special pricing and release of liability.



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## - Analytical Report -

Project Name: SOUTH CASS LAKE STATION

Project Number:

Client: NRE

MDH LAB ID: 055-999-334

Sample No.	Field ID	Collection Date	`	Sample No.	Field ID		Collection Date
812488-001	MW-1	6/6/2001					
812488-002	MW-2	6/6/2001				•	
812488-003	MW-4	6/6/2001				•	
812488-004	FIELD BLANK	6/6/2001					
812488-005	TRIP BLANK	6/6/2001					

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Soil VOC detects are corrected for the total solids, unless otherwise noted.

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and Laboratory Standard Operating Procedure. Exceptions, if any, are discussed in the accompanying sample comments. Release of this final report is authorized by Laboratory management, as is verified by the following signature. Reported results shall not be reproduced, except in full, without the written approval of the lab. The sample results relate only to the analytes of interest tested.

Approval signature

Batch No. 812488	Project Name or ID_SoutUC <sub>4</sub> SS	LAKE STATION No. of Coolers:	( •
Temps://	125 m	ROI	
A Receipt Phase: Date cooler.	was opened: 6-8-01 By:	<b>₹</b> 0.∧	•
•		·	Initals/Date
	ent?(record temperatures above)		6D 6-8
	(Also record on COC)		ļ
	)		
4: vvere all sample containers for	r tests requested on the COC received?	YES NO <sup>2</sup>	
5: Do sample labels match the Co	OC?	YES NO2	
	ests?		
7: Are sample volumes adequate	for tests requested?	YES NO2	
8: Are VOC samples free of bubb	es >6mm	YES NO <sup>2</sup> NA	
	filtered?		
	d samples. (not VOCs) Completed		
11: Are samples preserved proper	rly?	YES NO <sup>2</sup>	
	ne log record if applicable. Completed	,	+
	gbook. Completed		1,
4: Place laboratory sample numb	ž.	YES NO	
The same same same same same same same sam	on on an containers Completed	/ VER / NO	1 1
	,	YES NO	1
5: Check laboratory sample numb	per on all containers and COC Completed	(YES) NO	2/
5: Check laboratory sample numb	oer on all containers and COC Completed ere logged-in: State (4 or By:	VES NO	2
5: Check laboratory sample numb  Log-in Phase: Date samples we : Were samples received on ice?	oer on all containers and COC Completed ere logged-in: SEG(4 o C By:	VES NO	C/ S 6/8/01
5: Check laboratory sample numb Log-in Phase: Date samples we Were samples received on ice? Is the COC signed as received b	oer on all containers and COC Completed ere logged-in: SEG(4 o C By:	VES NO 2.5	C/ 9/6/
5: Check laboratory sample numb Log-in Phase: Date samples we Were samples received on ice? Is the COC signed as received b Is this Project a Quick Turn Proje	oer on all containers and COC Completed ere logged-in: SEG(4 o C By:	VES NO  2.5	2/ 886/8/a/
5: Check laboratory sample numb 3. Log-in Phase: Date samples we 5: Were samples received on ice? 6: Is the COC signed as received b 6: Is this Project a Quick Turn Project lis there any sub-work?	oer on all containers and COC Completed ere logged-in: SEG(4 o ( By:	YES NO  25 NO  25 NO  25 NO  25 NO  25 NO  25 NO  25 NO  25 NO  25 NO  26 NO  27 NO  28 NO  28 NO  29 NO  20 NO  2	\$66/8/d1
5: Check laboratory sample numb 3. Log-in Phase: Date samples we 5: Were samples received on ice? 6: Is the COC signed as received b 6: Is this Project a Quick Turn Project las there any sub-work?	oer on all containers and COC Completed ere logged-in: SEGGGO By:  (Must be ≤4C)  by En Chem?  ect?  tion of hold-time? (Within 2 days)	YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO	
5: Check laboratory sample numb 3. Log-in Phase: Date samples we 5: Were samples received on ice? 6: Is the COC signed as received b 6: Is this Project a Quick Turn Project last there any sub-work?	oer on all containers and COC Completed ere logged-in: SEG(4 o ( By:	YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO	
5: Check laboratory sample numb Log-in Phase: Date samples we Were samples received on ice? Is the COC signed as received b Is this Project a Quick Turn Project to the samples nearing expirate the littate Subcontracting procedure that Hold-time tests:	per on all containers and COC Completed ere logged-in: SEGGGO By:  (Must be ≤4 C)  by En Chem ?  ect?  tion of hold-time? (Within 2 days)  e, SOP 1-REC-4, if applicable. Completed	VES NO  VES NO  VES NO  VES Ø  VES Ø  VES Ø  VES NO  VES Ø  VES NO  VES NO  VES NO  NA	
5: Check laboratory sample numb 3. Log-In Phase: Date samples we 5: Were samples received on ice? 6: Is the COC signed as received b 6: Is this Project a Quick Turn Project last there any sub-work?	per on all containers and COC Completed ere logged-in: SEGGGC By:  (Must be ≤4 C)  by En Chem ?  ect?  tion of hold-time? (Within 2 days)  e, SOP 1-REC-4, if applicable. Completed  7 days	VES NO  VES NO  VES NO  VES Ø  VES VO  VES VO  VES VO  VES NO	
5: Check laboratory sample numb Log-in Phase: Date samples we Were samples received on ice? Is the COC signed as received b Is this Project a Quick Turn Proje Is there any sub-work? Are any samples nearing expirat Initiate Subcontracting procedure nort Hold-time tests: Hours or less Officer (6 hrs) exavalent Chromium (24 Hrs)	per on all containers and COC Completed ere logged-in: SEGGGO By:  (Must be ≤4 C)  by En Chem ?  ect?  tion of hold-time? (Within 2 days)  e, SOP 1-REC-4, if applicable. Completed	YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  NA  Footnotes  1 Notify proper lab group	
5: Check laboratory sample numb Log-in Phase: Date samples we Were samples received on ice? Is the COC signed as received b Is this Project a Quick Turn Proje Is there any sub-work? Are any samples nearing expirat Initiate Subcontracting procedure nort Hold-time tests: Hours or less Difform (6 hrs) exavalent Chromium (24 Hrs)	per on all containers and COC Completed ere logged-in: SEGGGG No C By:  (Must be ≤ 4 C )  by En Chem ?  ect?  tion of hold-time? (Within 2 days)  e, SOP 1-REC-4, if applicable. Completed  7 days  Flashpoint	YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  NA  Footnotes  1 Notify proper lab group immediately.	
5: Check laboratory sample numb Log-in Phase: Date samples we Were samples received on ice? Is the COC signed as received b Is this Project a Quick Turn Proje Is there any sub-work?	per on all containers and COC Completed ere logged-in: SEGGGG No C By:  (Must be ≤ 4 C )  by En Chem ?  ect?  tion of hold-time? (Within 2 days)  e, SOP 1-REC-4, if applicable. Completed  7 days  Flashpoint TSS	YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  NA  Footnotes  1 Notify proper lab group	
5: Check laboratory sample numb Log-in Phase: Date samples we Were samples received on ice? Is the COC signed as received b Is this Project a Quick Turn Proje Is there any sub-work? Are any samples nearing expirat Initiate Subcontracting procedure fort Hold-time tests: Hours or less Difform (6 hrs) Exavalent Chromium (24 Hrs) Dirite tho Phosphorus	per on all containers and COC Completed ere logged-in: SEGGGG (By:  (Must be ≤4 C)  by En Chem ?  ect?  tion of hold-time? (Within 2 days)  p. SOP 1-REC-4, if applicable. Completed  7 days  Flashpoint TSS Total Solids	YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  NA  Footnotes  1 Notify proper lab group immediately.	
5: Check laboratory sample numb Log-in Phase: Date samples we Were samples received on ice? Is the COC signed as received b Is this Project a Quick Turn Proje Is there any sub-work? Are any samples nearing expirat Initiate Subcontracting procedure nort Hold-time tests: Hours or less Oliform (6 hrs) Exavalent Chromium (24 Hrs) Contracting Phosphorus Project a Quick Turn Project In the Phosphorus Project a Quick Turn Project Is the COC signed as received by Is the COC signed as received	per on all containers and COC Completed ere logged-in: SEGGGO By:  (Must be ≤4 C)	YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  NA  Footnotes  1 Notify proper lab group immediately.	
5: Check laboratory sample numb Log-In Phase: Date samples we Were samples received on ice? Is the COC signed as received b Is this Project a Quick Turn Proje Is there any sub-work? Are any samples nearing expirat Initiate Subcontracting procedure nort Hold-time tests: Hours or less Difform (6 hrs) Exavalent Chromium (24 Hrs) DD Inite tho Phosphorus rbidity rfactants	per on all containers and COC Completed ere logged-in: SEGGGO By:  (Must be ≤4C)  by En Chem?  ect?  tion of hold-time? (Within 2 days)  e, SOP 1-REC-4, if applicable. Completed  7 days  Flashpoint TSS Total Solids TDS Sulfide Free Liquids Total Volatile Solids	YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  NA  Footnotes  1 Notify proper lab group immediately.	
5: Check laboratory sample numb  3. Log-In Phase: Date samples we  3. Were samples received on ice?  4: Is the COC signed as received b  5: Is this Project a Quick Turn Project  6: Is there any sub-work?  6. Are any samples nearing expirated limitate Subcontracting procedured the contraction of less colliform (6 hrs)  6. Hours or less colliform (6 hrs)  6. Savavalent Chromium (24 Hrs)  6. Do tritte the Phosphorus proidity practants  7. Initiation of the contraction of the phosphorus proidity practants  8. Initiation of the contraction of the phosphorus proidity practants  8. Initiation of the contraction of the phosphorus proidity practants  8. Initiation of the contraction of the phosphorus proidity of the phosphorus proidity of the phosphorus proidity of the phosphorus proidity of the phosphorus proidity of the phosphorus proidity of the phosphorus proidity of the phosphorus proidity of the phosphorus proidity of the phosphorus proidity of the phosphorus phosphor	per on all containers and COC Completed ere logged-in: SEGGGO By:  (Must be ≤4C)  by En Chem?  ect?  tion of hold-time? (Within 2 days)  e, SOP 1-REC-4, if applicable. Completed  7 days  Flashpoint TSS Total Solids TDS Sulfide Free Liquids Total Volatile Solids	YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  NA  Footnotes  1 Notify proper lab group immediately.	
5: Check laboratory sample numb Log-in Phase: Date samples we Were samples received on ice? Is the COC signed as received b Is this Project a Quick Turn Proje Is there any sub-work? Are any samples nearing expirat Initiate Subcontracting procedure Inort Hold-time tests: Hours or less Difform (6 hrs) Exavalent Chromium (24 Hrs) Diritte tho Phosphorus rbidity Infactants Iffite Core Preservation	per on all containers and COC Completed  ere logged-in: SEGGGO By:  (Must be ≤4C)	YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  NA  Footnotes  1 Notify proper lab group immediately.	
5: Check laboratory sample numb Log-in Phase: Date samples we Were samples received on ice? Is the COC signed as received b Is this Project a Quick Turn Proje Is there any sub-work? Are any samples nearing expirat Initiate Subcontracting procedure Hours or less Officer (6 hrs) Exavalent Chromium (24 Hrs) Do Tritte tho Phosphorus rbidity rfactants Iffice	ere on all containers and COC Completed ere logged-in: SEGGGG By:  (Must be ≤ 4 C)	YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  YES NO  NA  Footnotes  1 Notify proper lab group immediately.	

I have reviewed Log-in sheets, resolved all nonconformance issues corrected and properly documented these actions Project Mgmt reviewed by/date UV | U | U |

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#### - Analytical Report -

Project Name: SOUTH CASS LAKE STATION

Project Number:

Client: NRE

Field ID: MW-1

Report Date: 6/12/01

Lab Sample Number: 812488-001

Collection Date: 6/6/01

MDH LAB ID: 055-999-334

Matrix Type: WATER

#### **Organic Results**

ОТ	CV			TER
<b>D</b> i	EX	-	VV	⊏

Prep Method: SW846 5030B Prep Date: 6/11/01

Analyst: MSB

Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
a,a,a-Trifluorotoluene	104	***	%Recov	,	6/11/01	MOD 8021E
Benzene	< 1.0	1.0	ug/l		6/11/01	MOD 8021E
Ethylbenzene	< 1.0	1.0	ug/l		6/11/01	MOD 8021E
Toluene	< 1.0	1.0	ug/l	•	6/11/01	MOD 8021B
Xyleлes, -m, -p	< 2.0	2.0	ug/l		6/11/01	MOD 8021B
Xylene, -o	< 1.0	1.0	ug/l		6/11/01	MOD 8021B

#### **Organic Results**

**BTEX BLANK** 

Prep Method:

EQL.

Prep Date:

6/11/01

Analyst:

Analyte

Units

Code

**Analysis** Date

**Analysis** Method

BTEX - Blank

939-19

Result

#### **Organic Results**

**DIESEL RANGE ORGANICS - WATER** 

Prep Method: Wi MOD DRO Prep Date:

Analyst: DJB

Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
DIESEL RANGE ORGANICS	< 100	100	ug/l	•	6/8/01	Wi MOD DRO
Blank spike	86 -	. —	%Recov		6/8/01	WI MOD DRO
Blank spike duplicate	88		%Recov		6/8/01	Wi MOD DRO
Blank	< 50	50	ug/l	,	6/8/01	~ Wi MOD DRO

# En Chem Inc.

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# - Analytical Report -

Project Name: SOUTH CASS LAKE STATION

Project Number:

Field ID: MW-2

Lab Sample Number: 812488-002

MDH LAB ID: 055-999-334

Client: NRE

Report Date: 6/12/01

Collection Date: 6/6/01

Matrix Type: WATER

# Organic Results -

DTEV	- WATED
	- WA JED

Prep Method: SW846 5030B Prep Date: 6/11/01

Analyst: MSB

Result	EQL	Units	Code	Analysis Date	Analysis Method
104	-	%Poony			wernog
- 10		MINECOV		6/11/01	MOD 8021B
< 1.0	1.0	ug/l		6/11/01	
< 1.0	1.0	ua/l		•	MOD 8021B
- 10		ugn		6/11/01	MOD 8021B
, 1.0	1.0 -	ug/l		6/11/01	
< 2.0	2.0	ue/l			MOD 8021B
- 10		ug/r		6/11/01	MOD 8021B
- 1.0	1.0	ug/l		6/11/01	
	Orga	nic Populs			MOD 8021B
	104 < 1.0 < 1.0 < 1.0	104 —  < 1.0 1.0  < 1.0 1.0  < 1.0 1.0  < 2.0 2.0  < 1.0 1.0	104 — %Recov  < 1.0 1.0 ug/l  < 1.0 1.0 ug/l  < 1.0 1.0 ug/l  < 2.0 2.0 ug/l	104	104

#### Organic Results

#### BTEX BLANK

Prep Method:

EQL

Prep Date:

6/11/01

Analyst:

 Analyte
_

Result

Units

Code

Analysis Date

**Analysis** Method

BTEX - Blank

939-19

# Organic Results

#### **DIESEL RANGE ORGANICS - WATER**

Prep Method: Wi MOD DRO Prep Date:

Analyst: DJB

			Allalyst; DJB		
Result	EQL	Units	Code	Analysis Date	Analysis
< 100	100	uall	<del></del>	Date	Method
86	100	_		6/8/01	Wi MOD DRO
		%Recov		6/8/01	Wi MOD DRO
88	-	%Recov			
< 50	50		•	6/8/01	Wi MOD DRO
-	50	ng/i	_	6/8/01	Wi MOD DRO
	< 100 86 88	< 100 100 86 88	< 100 100 ug/l 86 — %Recov 88 — %Recov	Code < 100 100 ug/l 86 — %Recov 88 — %Recov < 50 50	Result         EQL         Units         Code         Analysis Date           < 100

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#### - Analytical Report -

Project Name: SOUTH CASS LAKE STATION

Project Number:

Client: NRE

Field ID: MW-4

Report Date: 6/12/01

Lab Sample Number: 812488-003

Collection Date: 6/6/01

MDH LAB ID: 055-999-334

Matrix Type: WATER

#### **Organic Results**

LEX		

Prep Method: SW846 5030B Prep Date: 6/11/01

Analyst: MSB

Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
a,a,a-Trifluorotoluene	. 103		%Recov		6/11/01	MOD 8021E
Benzene	< 1.0	1.0	ug/l		6/11/01	MOD 8021E
Ethylbenzene	< 1.0	1.0	ug/l	,	6/11/01	MOD 8021E
Toluene	< 1.0	1.0	ug/l		6/11/01	MOD 8021E
Xylenes, -m, -p	< 2.0	2.0	ug/l		6/11/01	MOD 8021B
Xylene, -o	< 1.0	1.0	ug/l		6/11/01	MOD 8021B

#### **Organic Results**

**BTEX BLANK** 

Prep Method:

Prep Date:

6/11/01 Analyst:

Analyte

Result EQL

Units

Code

**Analysis** Date

Analysis Method

BTEX - Blank

939-19

#### **Organic Results**

DIESEL RANGE ORGANICS - WATER

Prep Method: Wi MOD DRO Prep Date: 6/8/01

. Analyst: DJB

Analyte	Result	EQL.	Units	Code	Analysis Date	Analysis Method
DIESEL RANGE ORGANICS	< 100	100	ug/l		6/8/01	Wi MOD DRO
Blank spike	86	<del></del> .	%Recov		6/8/01	Wi MOD DRO
Blank spike duplicate	88	<del></del>	%Recov	v .	6/8/01	Wi MOD DRO
Blank	< 50	- 50	ug/l		6/8/01	Wi MOD DRO

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# - Analytical Report -

Project Name: SOUTH CASS LAKE STATION

Project Number:

Field ID: FIELD BLANK

Client: NRE

Lab Sample Number: 812488-004

MDH LAB ID: 055-999-334

Report Date: 6/12/01

Collection Date: 6/6/01

Matrix Type: WATER

#### **Organic Results**

DTCV	10/4
BTEX	- WATER

Prep Method: SW846 5030B Prep Date:

6/11/01

Analyst: MSB

Analyte	Result	EQL	Units	Code	Analysis Date	Analysis Method
a,a,a-Trifluorotoluene	104	700	%Recov	-		Method
Benzene .	< 1.0	4.5			6/11/01	MOD 8021B
	~ 1.0	1.0	ng/l	-	6/11/01	MOD 8021B
Ethylbenzene	< 1.0	1.0	ug/l		CH 4 10 4	
Toluene	< 1.0	10	_		6/11/01	MOD 8021B
Vulan-		1.0	ug/l		6/11/01	MOD 8021B
Xylenes, -m, -p	< 2.0	2.0	ug/i		CHAIDA	
Xylene, -o	< 1.0	1.0	_	-	6/11/01	MOD 8021B
	1.0	1.0	· ug/i		6/11/01	MOD 8021B
		Orga	nic Resulte			05 00215

**BTEX BLANK** 

Prep Method:

Prep Date:

6/11/01

Analyst:

Analyte

**EQL** 

Units

Code

Analysis Date

Analysis Method

BTEX - Blank

939-19

Result

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#### - Analytical Report -

Project Name: SOUTH CASS LAKE STATION

Project Number:

Client: NRE

Field ID: TRIP BLANK

Report Date: 6/12/01

Lab Sample Number: 812488-005

Collection Date: 6/6/01

MDH LAB ID: 055-999-334

Matrix Type: WATER

#### **Organic Results**

**BTEX - WATER** 

Prep Method: SW846 5030B Prep Date: 6/11/01

Analyst: MSB

Result	EQL	Units	Code	Analysis Date	Analysis Method
103		%Recov		6/11/01	MOD 8021B
< 1.0	1.0	ug/l		6/11/01	MOD 8021B
< 1.0	1.0	ug/l		6/11/01	MOD 8021B
< 1.0	1.0	· ug/l		6/11/01	MOD 8021B
< 2.0	2.0	ug/l		6/11/01	MOD 8021B
< 1.0	1.0	ug/i		6/11/01	MOD 8021B
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#### Organic Results

Units

**BTEX BLANK** 

Prep Method:

6/11/01

Analyst:

Analyte

**EQL** 

Prep Date:

Code

**Analysis** 

Date

Analysis Method

BTEX - Blank

939-19

Result

#### Form I Extraction Blank

MSB

Anal by: Anal date:

6/11/01

Blank #:

939-19

#### KEPOKIED

	LOD		LOQ	RESULT	UNITS	Q <sub>1</sub>
Benzene	] "	0.45	1.5	ND	ug/L	T T
Toluene		0.68	2.27	ND	ug/L	<del> </del>
Ethylbenzene		0.82	2.73	ND	ug/L	<del> </del>
m/p-Xylene		1.70		ND	ug/L	<del> </del>
o-Xylene		0.77		ND	ug/L	
Methyl tert-butyl ether		0.43		ND	ug/L	
a,a,a-Trifluorotoluene				103	% recov	

В

Analyte present in blank. Value in sample(s)

may be suspect.

ND

Not Detected

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te 9 525 Science Drive Medison, WI 53711 608-22-3300 FAX: 608-233-0502	19069	F-Wethanoi G-MADH	TO THE STATE OF TH	Invoice (Company: 4 Address: 2	Mail Invoice To:	CELENT COMMISSION							Date/Time	Date/Time:	Main Date	Date/Time:	Date/Time:	
Lat Bellevue St., Suite 9 Green Bay, WI 54302 920-469-2436 FAX 920-469-8827	CUSTODY	12504 *Preservation Codes  D=HN03 E=EnGore  On I=Other  N N			/	579	3				,		File Received By:	Received By:	Herelynd Bur	. Company	Received By:	
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330 SO. CLEVELAND ST. CAMBRIDGE, MN 55008 LAB (612) 689-2175 METRO (612) 444-9270 FAX (612) 689-3660



MINNESOTA CERTIFIED LABORATORY NUMBER 027-059-156



205 WEST 2ND STREET SUITE 105 DULUTH, MN 55802 LAB (218) 722-9884 FAX (218) 722-9964

- 1.4-Jun-01

#### Natural Resources Engineering

13 W. Superior Street Duluth, MN 55802

#### Report of Analysis

Chain of Custody: 32473

ID: 22696

Project Description:

Cass Lake Station

Received: 05/30/2001 1:52:04 PM by Lori A. Baillargeon

Date Required: 06/13/2001

Matrix: Soil SB - 1 Date Sampled: 05/22/2001 Analyte Units #71660 Analyzed **Total Organic Carbon** mg/Kg 920 06/11/01

Results reported on as received basis. TOC analysis performed by an outside laboratory.

Reviewed by

frue Uttoffewrath 6/14/01 Anne Hoppenrath

Organic Chemist

MGALSERVIOE 330 SO. CLEVELAND ST. P.O. BOX 349 CAMBRIDGE, MN 55008 LAB (612) 689-2175 FAX (612) 689-3660 

# CHAIN OF CUSTADY RECORD

40

UTH OFFICE: 205 WEST 2ND STREET DULUTH, MN 55802 PHONE (218) 722-9884 AND REQUEST FOR ANALYSIS (Instructions on Back of Form)

FAX (218) 722-9964	SHADED AREAS FOR LABORATORY USE ONLY		/ 57/ (NIC)	100 / OSS   100 /	10 00 00 00 00 00 00 00 00 00 00 00 00 0	Q Q Q Q Q Q	×									_	Hecelved by: (Signature)  CHECK HERE FOR DRINKING  WATER DETECTION I MATTER	Received by: (Signature)		/	
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# APPENDIX E - AQUIFIER CHARACTERIZATION

# **AQUIFER CHARACTERIZATION**

#### A. Hydraulic Conductivity Calculation

Slug test data was analyzed using a Bouwer-Rice unconfined aquifer analysis. This method of analysis is valid for fully or partially penetrating wells in unconfined aquifers. It is a semi-empirical relationship based upon the conservation of mass. It incorporates empirical relationships between the well geometry and groundwater flow using electric analog models.

The method assumes that the aquifer is locally homogeneous and isotropic with respect to conductivity, the groundwater flow is laminar, and there is no resistance to flow in the vertical direction. It also assumes that the change in head due to the slug is much less than the saturated thickness of the aquifer. Hydraulic conductivity is calculated with the use of equation (1).

$$K = \frac{r_c^2 \ln(\frac{R_e}{r_w})}{2L} \frac{1}{t} \ln(\frac{Y_o}{Y_t})$$
 (1)

Where:

K = mean hydraulic conductivity (1/t)

 $r_c = radius of casing (1)$ 

r<sub>w</sub> = radius of screened section plus gravel pack (1)

 $Y_0$  = static head (1)  $Y_t$  = heat at time t (1)

R<sub>e</sub> = effective distance over which Y is dissipated (1)

L = length of screened section (1)

The term  $1/t*ln(Y_o/Y_t)$  in equation (1) is the slope of a line regressed on the straight portion of the data as plotted on semi-logarithmic paper. These plots can be found following the text in this appendix.

From the data for recovery and dissipation, both a geometric mean and an arithmetic mean were calculated. These values were 20.0 ft/day and 17.2 ft/day, respectively. Table 4 is a summary of calculated hydraulic conductivities from the slug test data. Distribution plots for both hydraulic conductivity values and their natural logarithms are included in this appendix. These plots show that a normal distribution of hydraulic conductivity values is appropriate for the Site. Thus, a normal distribution for hydraulic conductivity values with a mean hydraulic conductivity of 20.0 ft/day will be used for any calculations and further references.

# B. Groundwater Velocity Calculations

For the purpose of this report, the x direction or axis will be aligned with the direction of groundwater flow and mean groundwater velocity can be expressed as:

$$\overline{V}_{x} = \frac{K}{n_{a}} \frac{dh}{dx} \tag{2}$$

Where:

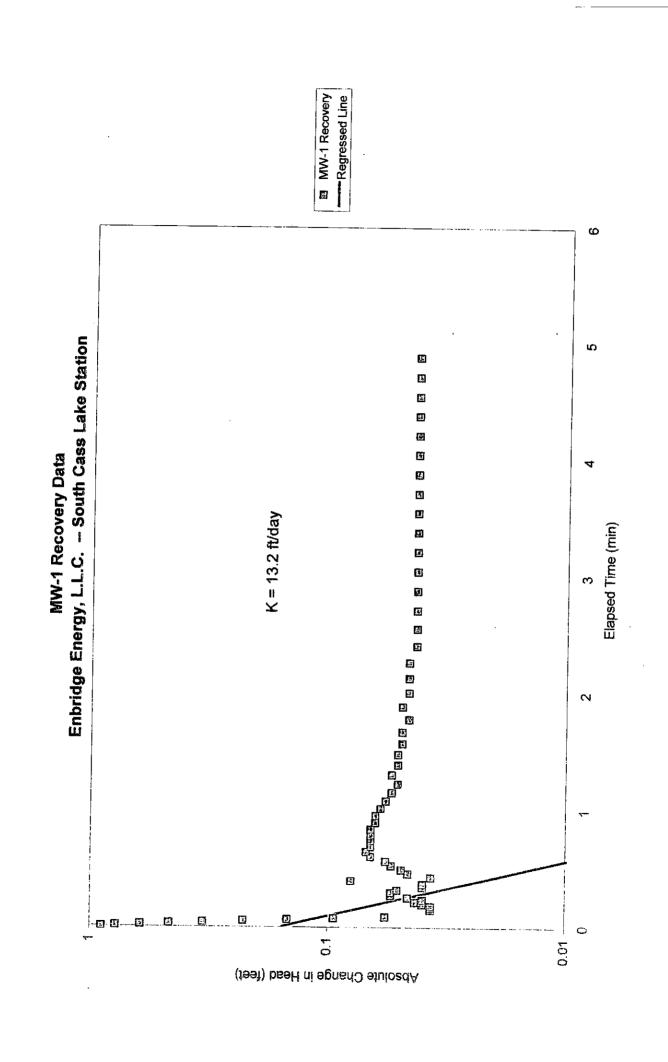
K = mean hydraulic conductivity from slug test data (1/t)

 $V_x$  = mean groundwater flow velocity in the x direction (1/t)

n<sub>e</sub> = effective porosity (dimensionless)

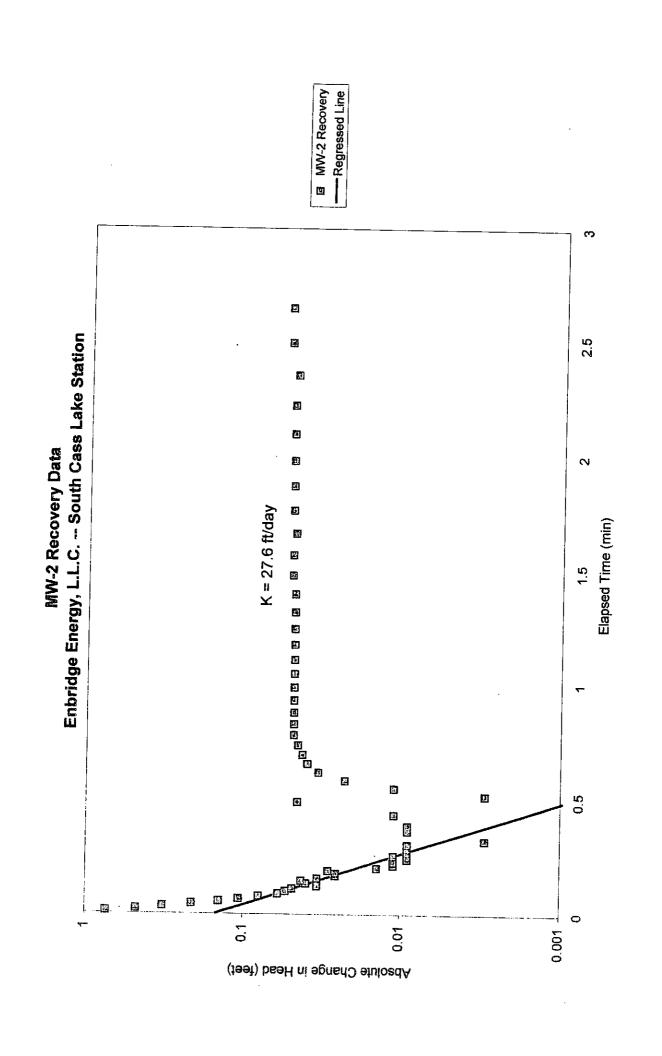
dh/dx = hydraulic gradient or i (dimensionless)

Using a typical value of 0.30 for the effective porosity of clean sand, the hydraulic gradient of 0.03% from the Site, and a hydraulic conductivity of 20.0 ft/day from the slug test data; the mean groundwater velocity calculated for the Site is approximately 0.02 feet/day or 7 feet/year.



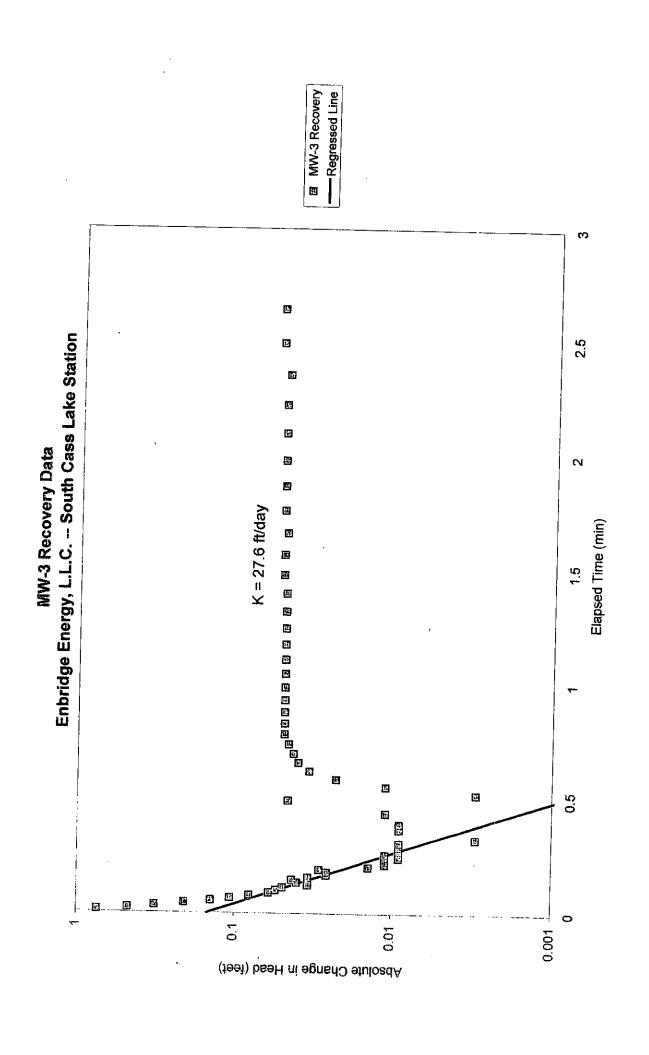
■ MW-1 Dissipation —Regressed Line 16 5 7 Enbridge Energy, L.L.C. -- South Cass Lake Station 5  $\overline{\zeta}$ 10 K= 4.0 ft/day Elapsed Time (min) တ ∞ တ Ŋ 3 S 0.1 0 0.01 Absolute Change in Head (feet)

**NW-1 Dissipation Data** 



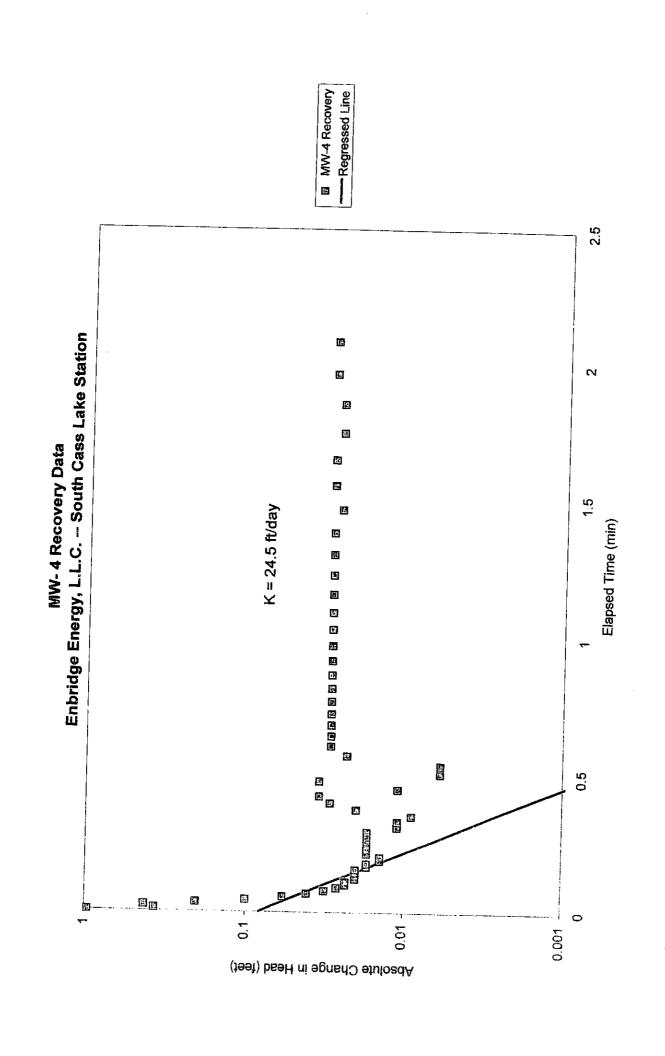
MW-2 Dissipation Regressed Line က Enbridge Energy, L.L.C. - South Cass Lake Station 迕 U ы 25 0 K = 19.8 ft/dayĔ Elapsed Time (min) 24 82 ã, 3 Ü 22 23 多名 医自己自己自己自己 U Ш 旦 0 0 0.01 Absolute Change in Head (feet)

MW-2 Dissipation Data



MW-3 Dissipation Regressed Line œ **2** Đ, P 12 Φ Œ 13 3 K = 9.72 ft/dayS Elapsed Time (min) N (jeel) beer. 0.01 Absolute Change in Head (feet)

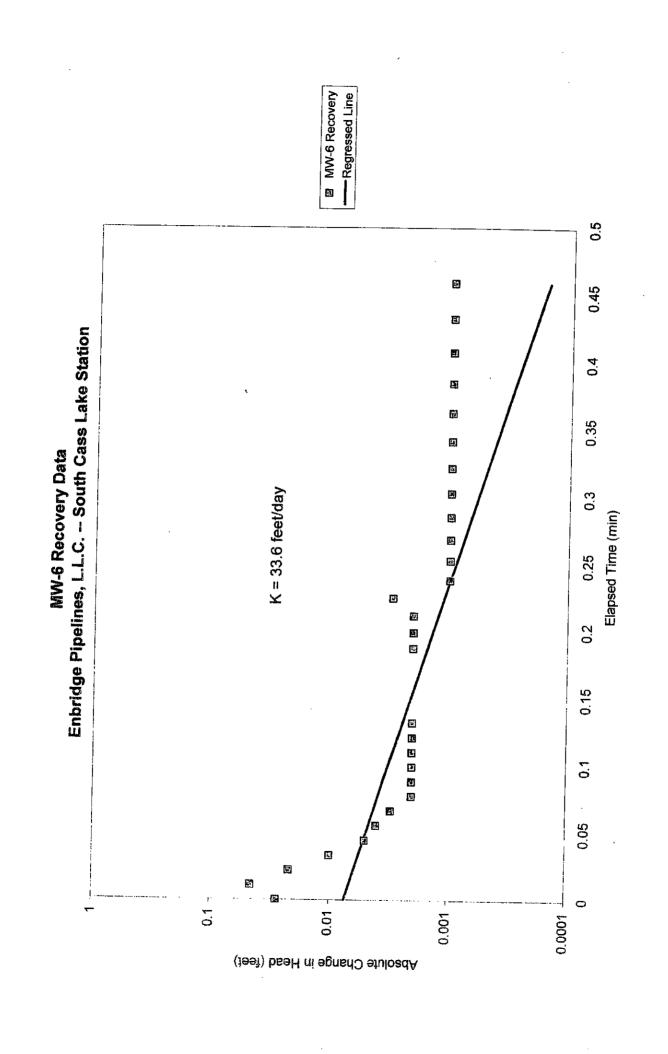
MW-3 Dissipation Data Enbridge Energy, L.L.C. -- South Cass Lake Station

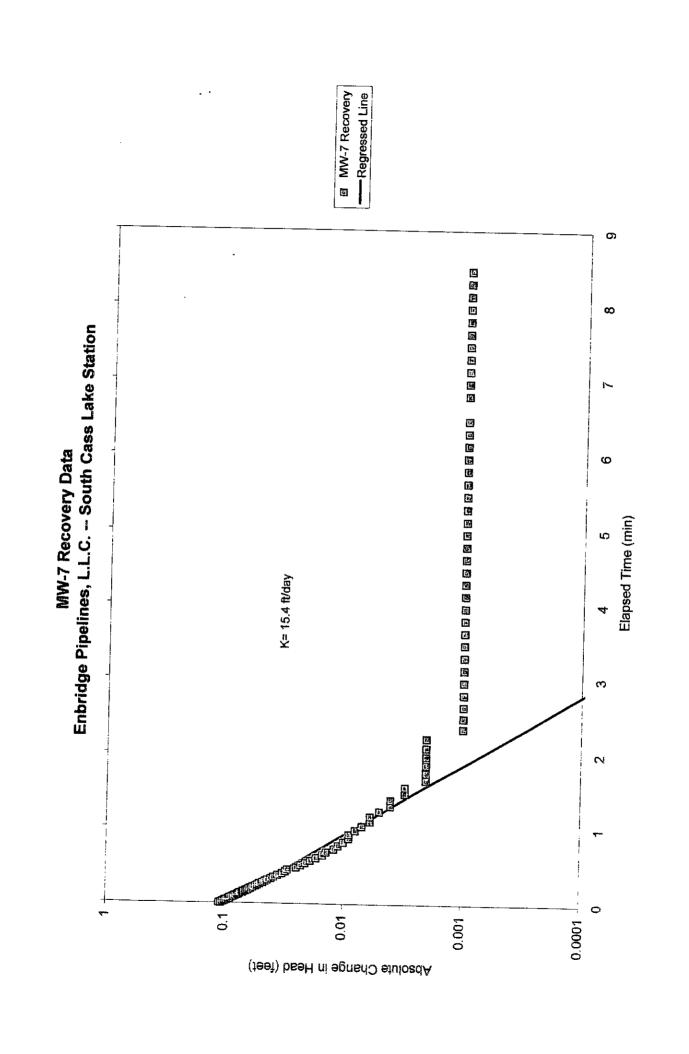


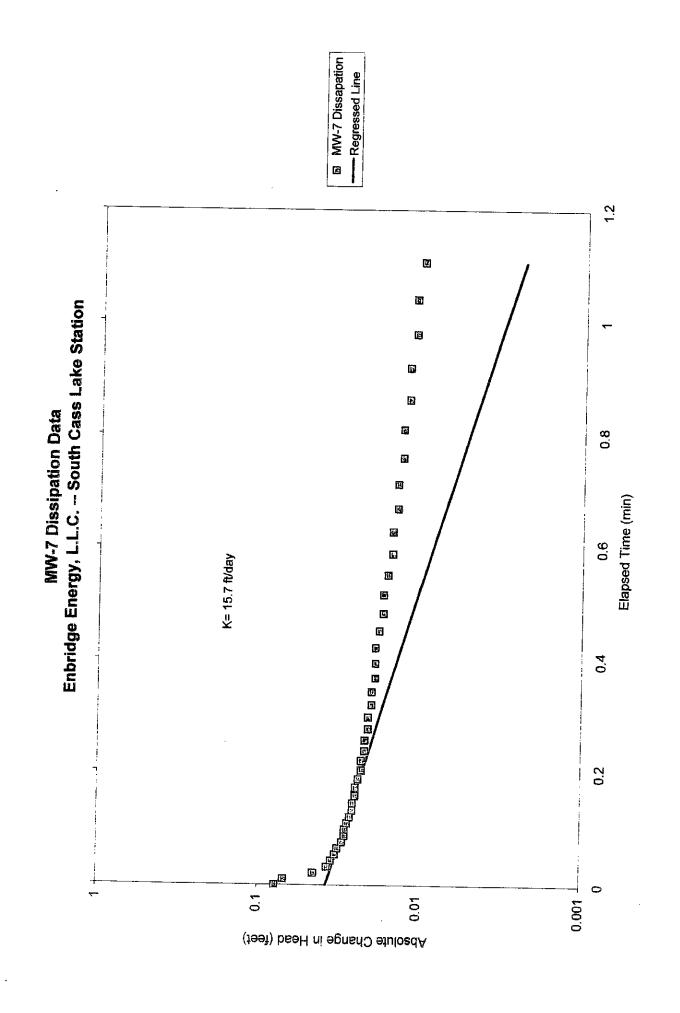
MW-4 Dissipation -Regressed Line  $\infty$ Œ 医医院院医医院院 φ 3 S Elapsed Time (min) K= 17.4 ft/day Haite Care Cesses Communication in the communication is a communication in the communication in the communication is a communication in the communication in the communication is a communication in the communication in the communication is a communication in the communication in the communication is a communication in the communication in the communication is a communication in the communication in the communication is a communication in the communication in the communication is a communication in the communication in the communication is a communication in the communication in the communication is a communication in the communication in the communication is a communication in the communication in the communication is a communication in the communication in the communication is a communication in the communication in 0.1 0.01 0.001 Absolute Change in Head (feet)

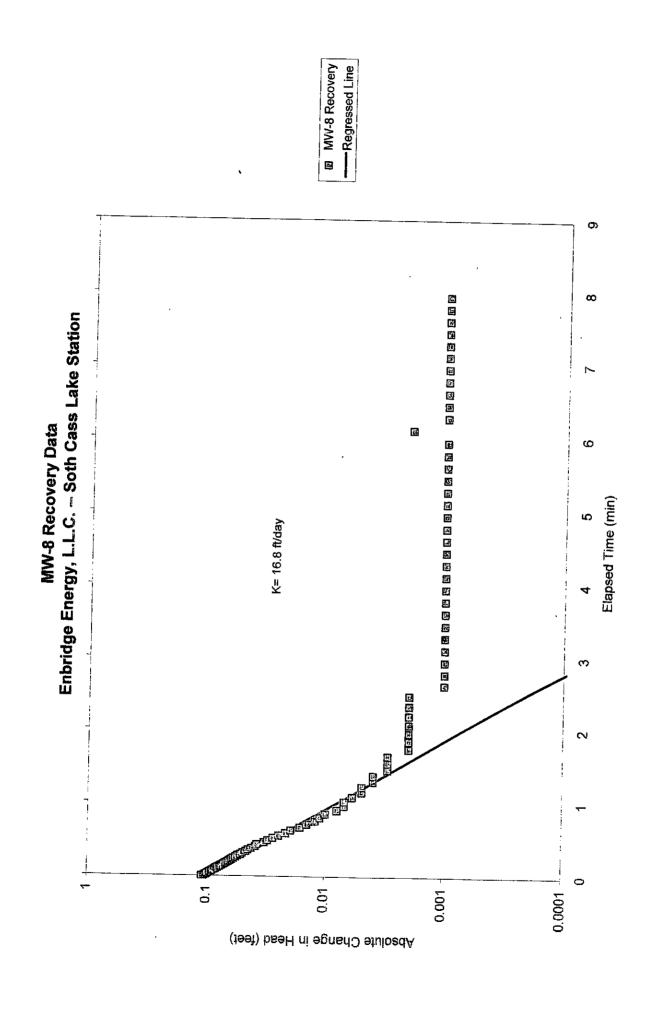
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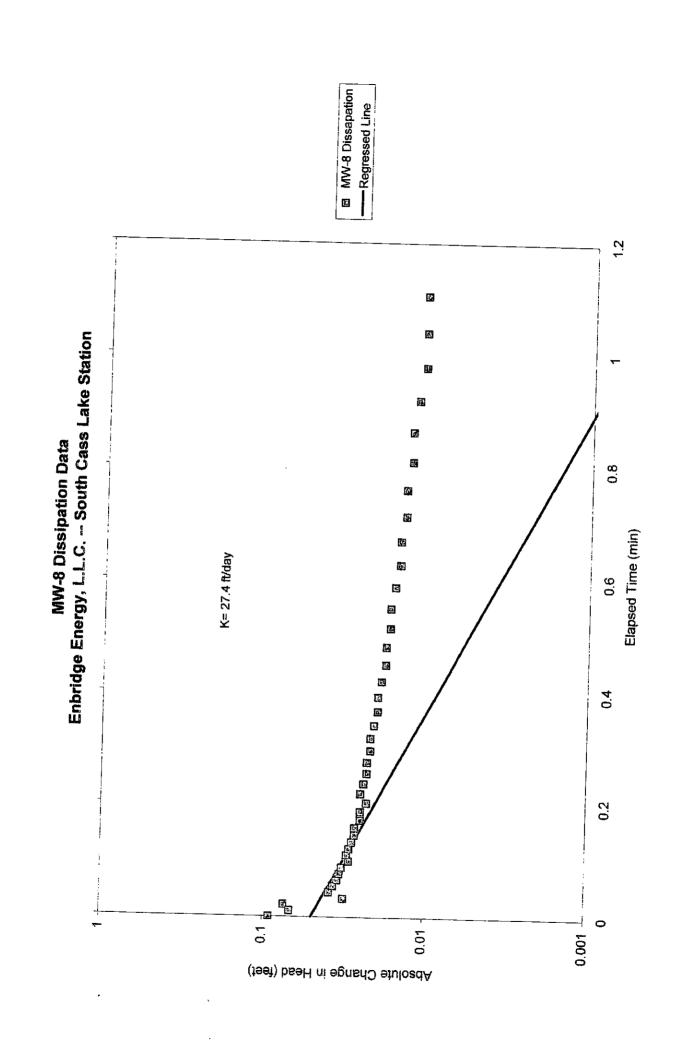
MW- 4 Dissipation Data











Conductivity 40 35 30 25 Hydraulic Conductivity ft/day ŔΩ 40 ហ  $\Box$ О Я φ Frequency

Hydraulic Conductivity, Normal Distribution Enbridge Energy, L.L.C. – South Cass Lake

--- Conductivity Distribution Conductivity Hydraulic Conductivity, Log-Normal Distribution Enbridge Energy, L.L.C. – South Cass Lake Natural Log Hydraulic Conductivity ft/day <del>د</del>. Ø S  $\alpha$ Frequency