

## *Hydrostratigraphic Database of West-Central Wisconsin*

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<b>Site:</b>	Cedar Falls Store
<b>Location:</b>	Cedar Falls, Dunn County, Wisconsin
<b>Formation evaluated:</b>	Cambrian Mt. Simon

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

Tinker, J.R. and H.F. Grote, 1991a, Preliminary Work Plan for Remedial Investigation and Action at Cedar Falls, Wisconsin, on file at Wisconsin Department of Natural Resources.

- Text: introduction, capture zone calculations
- Figures: site plan, benzene distribution, cross-section, hydraulic conductivity test summary

Tinker, J.R. and H.F. Grote, 1991b, Progress Report on Remediation of Groundwater at Cedar Falls Store, Cedar Falls, Wisconsin, on file at Wisconsin Department of Natural Resources.

- Text
- Table: pumping test results (2)
- Figure: site plan
- Boring logs
- Pumping test data

PRELIMINARY WORK PLAN FOR REMEDIAL  
INVESTIGATION AND ACTION AT CEDAR FALLS, WISCONSIN

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FEB 25 1991

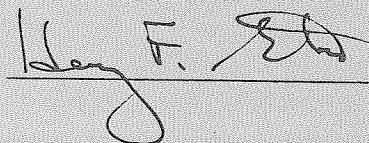
BUREAU OF SOLID  
HAZARDOUS WASTE MANAGEMENT

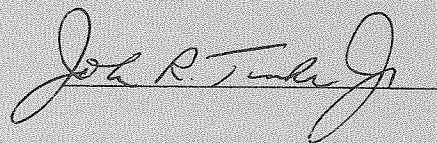
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## TABLE OF CONTENTS

	Page
Introduction	1
Remedial Action Objectives	2
Soil Remediation Plan	3
Soil-Venting Remediation Plan	4
Extent of Contamination	4
Removal Rate Estimation	6
Well Location Considerations	7
Vapor Extraction Well Screening Calculations	9
Vapor Extraction Well Details	12
Vapor Flow Rate-Testing	14
Analytical Protocols	14
Ground-Water Remediation Plan	16
Decision-Flow Diagram	16
Proposed Location of Ground-Water Extraction Wells	17
Predicted Capture Zones for EW-1	18
Predicted Capture Zones for EW-2A	22
Predicted Capture Zones for EW-2B	25
Well Construction of EW-1 and EW-2A	25
Ground-Water Sampling Plan	26
Air Stripper and Activated Carbon Adsorption	27
Access to Private Property	28
Time Frame for Implementation of Plan	28
Literature Cited	30



# LIST OF FIGURES

	Page
Figure 1. Decision-flow diagram for soil contamination	31
Figure 2. Remedial alternatives for petroleum-contaminated soils	32
Figure 3. Map of the location of vapor extraction wells	33
Figure 4. Water table rise with vacuum increase	34
Figure 5. Predicted steady-state flow rates (per unit well screen thickness) for a range of soil permeabilities and applied vacuums ( $P_v$ )	35
Figure 6. Air-tight ground-water level measuring system	36
Figure 7. Decision-flow diagram for ground-water remediation	37
Figure 8. Map of benzene isoconcentrations and proposed ground-water extraction well locations	38
Figure 9. Cross section A-A' with water table and isoconcentration lines of PID measurements in ppm	39
Figure 10. Hydraulic conductivity testing results	40
Figure 11. EW-1 drawdowns predicted by Theis equation for a pump rate of 0.3 gpm and transmissivity of 63 ft <sup>2</sup> /day	41
Figure 12. EW-1 drawdowns predicted by Theis equation for a pump rate of 4 gpm and transmissivity of 63 ft <sup>2</sup> /day	42
Figure 13. EW-1 drawdowns predicted by Theis equation for a pump rate of 3.8 gpm and transmissivity of 805 ft <sup>2</sup> /day	43
Figure 14. Zone of capture, $X_L$ and $Y_L$	44
Figure 15. EW-2A drawdowns predicted by Theis equation for a pump rate of 0.6 gpm and transmissivity of 63 ft <sup>2</sup> /day	45
Figure 16. EW-2A drawdowns predicted by Theis equation for a pump rate of 8.4 gpm and transmissivity of 805 ft <sup>2</sup> /day	46

LIST OF TABLES

	Page
Table 1. Decreasing concentration of petroleum product with depth	4
Table 2. Estimated contaminant mass contained in a 10 foot by 10 foot by 43 foot rectangular volume	5

INTRODUCTION

The Wisconsin Department of Natural Resources' consent order No. WD-90-08 issued to and signed by Dale and Deborah Styers requires, in part, the submittal of a work plan outlining further remedial investigation and remedial action to be taken as a result of contamination at the Cedar Falls Store in Cedar Falls, Wisconsin. A time frame for implementation of the work plan is a requirement of the consent order.

The work plan was to be submitted within 30 days of the effective date (12/21/90) of the consent order. A request for an extension to February 21, 1991 was submitted and approved by Bill Evans of the Department of Natural Resources (D.N.R.).

The reports by Grote and Tinker (January 16, 1990 and June 21, 1990) confirm petroleum product releases related to the tanks at the Cedar Falls Store (WI. D.N.R. Consent Order WD-90-08). The report by Hydro Search (1990) indicates that the Cedar Falls Store is a source of groundwater contamination and the contamination of two private wells in Cedar Falls (WI. D.N.R. Consent Order WD-90-08).

This preliminary work plan discusses the remediation of the soil beneath the previously existing gasoline tanks at the Cedar Falls Store and of the ground water beneath and downgradient of the store.

the location for EW-2A is preferred because it minimizes the movement of the contaminant plume toward existing private water-supply wells. See Figure 8 for these extraction well locations. ✓

*sounds like we should assume EW-2A and 2B are needed.*

#### Predicted Capture Zones for EW-1

Hydro Search (September, 1990) presents the following data: a map of the benzene isocenters (Figure 8); cross section A-A' with water table and isoconcentration lines of PID measurements in ppm (Figure 9); the average hydraulic conductivity of the sand ( $1.2 \times 10^{-1}$  ft/min), sandstone ( $1.6 \times 10^{-2}$  ft/min), and sandstone with shale layers ( $1.7 \times 10^{-4}$  ft/min); the hydraulic gradient ( $i = 0.0015$ ) between the Cedar Falls and Malhus residence; a porosity ( $n = 0.25$ ); and an average linear velocity of 50 ft/year. Cross Section A-A' shows the water table is mostly within the sandstone between Cedar Falls Store (CFS-1) and monitoring well MW-12. This is almost the entire 750-foot length of the contaminant plume (Figure 8). Cross Section A-A' also indicates the zone of contamination is mostly restricted to the upper 35 feet of the aquifer. Hydro Search states the impacted ground water appears to be limited to the upper 30 feet of the saturated zone (Hydro Search, September 1990, page 10-2). Therefore, the ground-water extraction effort only involves the sandstone aquifer and not the overlying glacial aquifer. }

Hydro Search presents the hydraulic conductivity of the screened portions of monitoring wells 2 through 14 (Figure 10).

Hydro Search states the average hydraulic conductivity of the sandstone is  $1.6 \times 10^{-2}$  ft/min (23 ft/day). The geometric mean of the hydraulic conductivity values for monitoring wells screened in sandstone is  $1.26^{-3}$  ft/min (1.8 ft/day). Therefore, the range of mean hydraulic conductivity for the sandstone is 1.8 ft/day to 23 ft/day. The hydraulic conductivity values of the three closest monitoring wells to EW-1 are 5.8 ft/day for MW-2, 86 ft/day for MW-8, and 2.9 ft/day for MW-9.

The field value of hydraulic conductivity, transmissivity, and storativity for EW-1 should be determined by a pumping test. In the meantime, the predicted cone of depression by the Theis Method for EW-1 is determined from the following data:

1. The cross sectional area of the plume at the proposed site for EW-1 is width (150 ft) times depth (35 ft) equals 5,250 ft<sup>2</sup>.
2. Average linear velocity,  $V = Ki/n$ , with geometric mean of hydraulic conductivity:

$$V = \frac{(1.8 \text{ ft/day}) (.0015)}{0.25}$$

$$= 0.01 \text{ ft/day}$$

3. Average linear velocity with average hydraulic conductivity from Hydro Search (September, 1990):

$$V = \frac{(23 \text{ ft/day}) (.0015)}{0.25}$$

$$= 0.14 \text{ ft/day}$$



4. Volume of water passing through cross sectional area of plume:

Low Value

$$\begin{aligned}\text{Volume 1} &= (5,250 \text{ ft}^2) (0.01 \text{ ft/day}) \\ &= 52.5 \text{ ft}^3/\text{day} \text{ or } 0.3 \text{ gpm}\end{aligned}$$

High Value

$$\begin{aligned}\text{Volume 2} &= (5,250 \text{ ft}^2) (0.14 \text{ ft/day}) \\ &= 735 \text{ ft}^3/\text{day} \text{ or } 3.8 \text{ gpm}\end{aligned}$$

5. The drawdowns predicted by the Theis equation for a pump rate of 0.3 gpm for three days, a transmissivity value of  $63 \text{ ft}^2/\text{day}$  ( $471 \text{ g/d/ft}$ ), and a storativity value of 0.25 are presented in Figure 11. A pump rate of 0.3 gpm is not sufficient to affect the 150-foot width of the plume. With the pump rate at 4 gpm, the radius of the cone of depression to the  $(.72'')$  0.06-foot drawdown is 75 feet (Figure 12). Discharge is directly proportional to drawdown in the Theis equation, for example, at 8 gpm the drawdowns on Figure 8 would be multiplied by two.
6. The drawdowns predicted by the Theis equation for a pump rate of 3.8 gpm for three days, a transmissivity value of  $805 \text{ ft}^2/\text{day}$  ( $6,018 \text{ g/d/ft}$ ), and a storativity value of 0.25 are presented in Figure 13. The radius of the cone of depression to the 0.1-foot drawdown is slightly less than 100 feet which would probably influence the entire 150-foot width of the benzene plume.

75' radius

The drawdowns for pump rates at 3.8 and 4 gpm would capture the ground water adjacent to the monitoring well CFS-1 in front of the Cedar Falls Store (Figure 8). However, with a rise of two feet in the water table at the vapor extraction well and a radius of influence of 40 feet, the pump rate of EW-1 may have to be increased to 8 to 10 gpm in order to capture the entire plume. The assumptions to the Theis equation are not fully met for the sandstone aquifer, but the results are useful until a pumping test is completed on EW-1.

The zone of capture,  $X_L$  and  $Y_L$ , (Figure 14) predicted by the very conservative method described by Todd (1980) and the U.S. E.P.A. (1987) is determined with the following data:

1. A pump rate,  $Q$ , of 52.5 ft<sup>3</sup>/day, a geometric mean hydraulic conductivity,  $K$ , of 1.8 ft/day, aquifer thickness,  $b$ , of 35 ft, and hydraulic gradient,  $i$ , of .0015.

$$Y_L = \frac{Q}{2 K b i} = \frac{52.5 \text{ ft}^3/\text{day}}{2 (1.8 \text{ ft/day}) (35 \text{ ft})(.0015)} = 278 \text{ ft}$$

$$X_L = \frac{Q}{2\pi K b i} = \frac{52.5 \text{ ft}^3/\text{day}}{2\pi (1.8 \text{ ft/day}) (35 \text{ ft})(.0015)} = 88 \text{ ft}$$

With a pump rate of 700 ft<sup>3</sup>/day (4 gpm),  $Y_L$  equals 3,704 feet and  $X_L$  equals 1,179 feet. This capture zone is much too large and is probably not realistic. The pump rate for EW-1 based on a hydraulic conductivity of 1.8 ft/day and aquifer thickness or 35 feet will probably be between 0.3 and 4 gpm.

2. A pump rate of 735 ft<sup>3</sup>/day (3.8 gpm), an average hydraulic conductivity of 23 ft/day, aquifer thickness of 35 ft, and hydraulic gradient of 0.0015.

$$Y_L = \frac{Q}{2 K b i} = \frac{735 \text{ ft}^3/\text{day}}{2 (23 \text{ ft/day}) (35 \text{ ft}) (.0015)} = 301 \text{ ft}$$

$$X_L = \frac{Q}{2\pi K b i} = \frac{735 \text{ ft}^3/\text{day}}{2\pi (23 \text{ ft/day}) (35 \text{ ft}) (.0015)} = 97 \text{ ft}$$

Again, the U.S. E.P.A. method predicts a larger capture zone, but both methods capture the ground water adjacent to monitoring well CFS-1 in front of the Cedar Falls Store.

The final pump rate for EW-1 will be determined after a pumping test is completed on EW-1 while vapor extraction wells are in operation. Existing monitoring wells MW-2, CFS-1, CFS-2, CFS-3, MW-8, and MW-9 will serve as observation wells for the pumping test of EW-1.

The final pump rate will establish a capture zone large enough to capture the plume. The pump rate and drawdowns for EW-1 will be correlated with the pump rate and effects of the vapor extraction well in order to complete soil and groundwater remediation within the shortest time frame.

#### Predicted Capture Zones for EW-2A

The predicted cone of depression by the Theis Method for EW-2A is determined by the following data:

1. The cross sectional area of plume at the proposed site

of EW-2A is width (300 ft) times depth (35 ft) equals 10,500 ft<sup>2</sup>.

2. Average linear velocity with geometric mean of hydraulic conductivity equals 0.01 ft/day. (See computations for EW-1.)
3. Average linear velocity with average hydraulic conductivity from Hydro Search (September, 1990) equals 0.14 ft/day. (See computations for EW-1.)
4. Volume of water passing through cross sectional area of plume:

Low Value

$$\begin{aligned}\text{Volume 1} &= (10,500 \text{ ft}^2) (0.01 \text{ ft/day}) \\ &= 105 \text{ ft}^3/\text{day} \text{ or } 0.6 \text{ gpm}\end{aligned}$$

High Value

$$\begin{aligned}\text{Volume 2} &= (10,500 \text{ ft}^2) (0.14 \text{ ft/day}) \\ &= 1470 \text{ ft}^3/\text{day} \text{ or } 8.4 \text{ gpm}\end{aligned}$$

5. The drawdowns predicted by the Theis equation for a pump rate of 0.6 gpm for three days, a transmissivity value of 63 ft<sup>2</sup>/day (471 g/d/ft), and a storativity value of 0.25 do not cover a significant portion of the 300-foot width of the plume. The drawdowns at 10 gpm for three days are shown in Figure <sup>14</sup>15. The maximum drawdown is 18.1 feet with a radius of the cone of depression to the 0.02-foot drawdown equal to 100 feet. The data indicates that it may be impossible to capture the entire 300-width of the

plume with one well if hydraulic conductivity is of the magnitude of 1.8 ft/day.

6. The drawdowns predicted by the Theis equation for a pump rate of 8.4 gpm for three days, a transmissivity value of 805 ft<sup>2</sup>/day (6,018 g/d/ft), and a storativity value of 0.25 are presented in Figure 16. The radius of the cone of depression to the 0.08-foot drawdown equals 150 feet which probably would capture most of the width of the 300-foot plume.

The zone of capture predicted by the method described by the U.S. E.P.A. (1987) is determined with the following data:

1. A pump rate of 105 ft<sup>3</sup>/day, a geometric mean hydraulic conductivity of 1.8 ft/day, aquifer thickness of 35 feet, and hydraulic gradient of .0015.

$$Y_L = \frac{Q}{2 K b i} = \frac{105 \text{ ft}^3/\text{day}}{2 (1.8 \text{ ft/day}) (35 \text{ ft}) (0.0015)} = 556 \text{ ft}$$

$$X_L = \frac{Q}{2\pi K b i} = \frac{556 \text{ ft}^3/\text{day}}{2\pi (1.8 \text{ ft/day}) (35 \text{ ft}) (0.0015)} = 177 \text{ ft}$$

2. A pump rate of 1470 ft<sup>3</sup>/day, an average hydraulic conductivity of 23 ft/day, aquifer thickness of 35 feet, and hydraulic gradient of 0.0015.

$$Y_L = \frac{Q}{2 K b i} = \frac{1470 \text{ ft}^3/\text{day}}{2 (23 \text{ ft/day}) (35 \text{ ft}) (.0015)} = 609 \text{ ft}$$

$$X_L = \frac{Q}{2\pi K b i} = \frac{609 \text{ ft}^3/\text{day}}{2\pi (23 \text{ ft/day}) (35 \text{ ft}) (0.0015)} = 194 \text{ ft}$$

Except for the low transmissivity value with the Theis equation, the predicted capture zones cover the area adjacent to EW-1 and EW-2A and extend approximately 77 to 94 feet southeast of the Malhus home. The final pump rate for EW-2A will be determined after a pumping test is completed on EW-2A.

Existing monitoring wells MW-7, MW-8, and possibly MW-3 will serve as observation wells for the pumping test of EW-2A.

#### Predicted Capture Zones for EW-2B

The dimensions of the zone of capture for EW-2B are approximately the same as for EW-2A because the cross sectional areas of the plume are similar: 10,500 ft<sup>2</sup> for EW-2A and 12,250 ft<sup>2</sup> for EW-2B. ✓

#### Well Construction of EW-1 and EW-2A

EW-1 will probably pump at approximately 8-10 gpm with a drawdown in the well from 2.2 to 14.5 feet. EW-2A will probably pump at approximately 8 to 10 gpm with a drawdown in the well from 1.6 to 18.1 feet. The exact well depth, well diameter, and pump size are being discussed with personnel of Recovery Equipment Supply Inc. of Maple Grove, MN and Ground Water Technology of Elgin, Illinois.

The extraction wells will be constructed and eventually abandoned in accordance with NR 141.



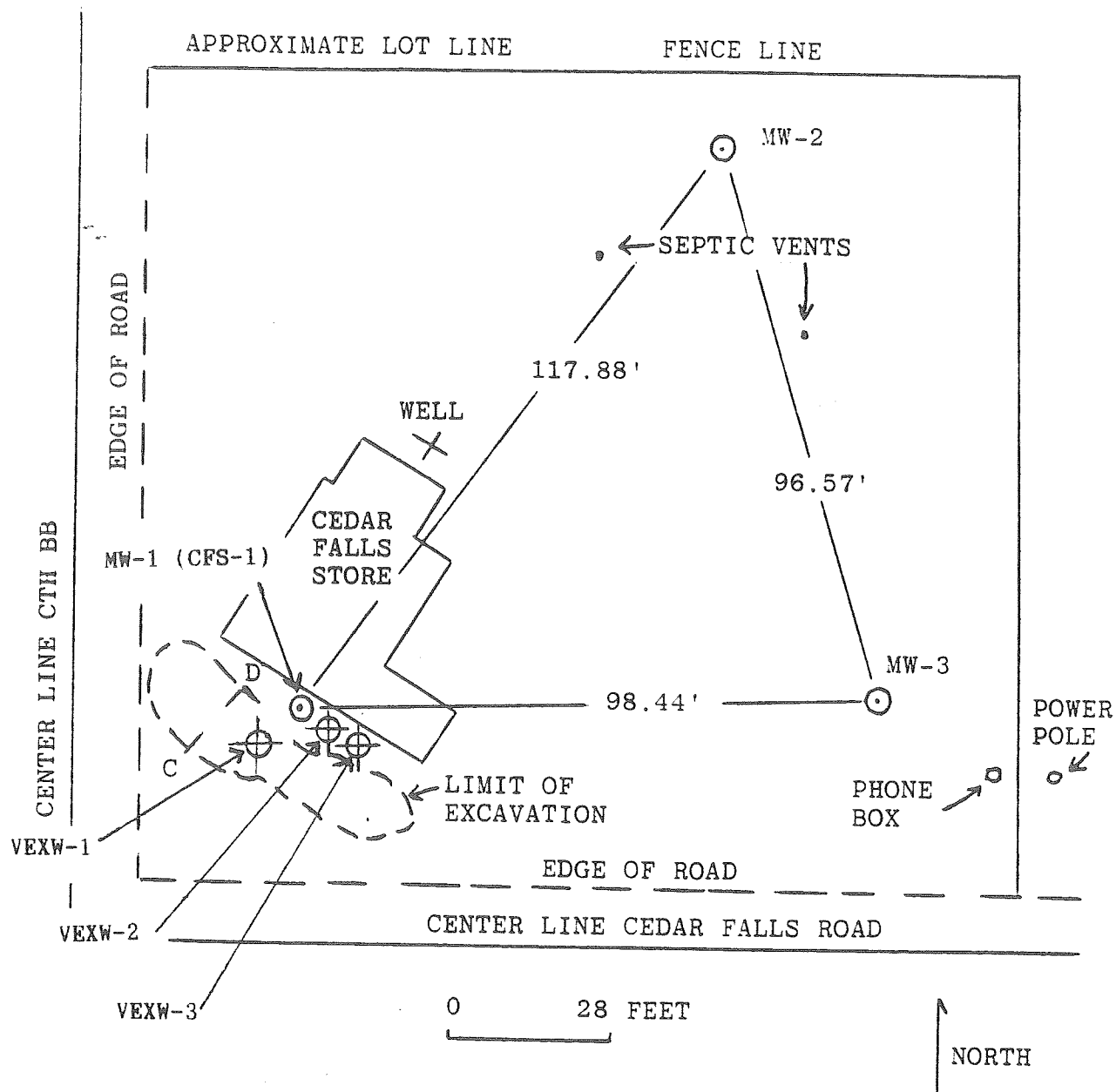


Figure 3. Map of the location of vapor extraction wells

= Enclosure ?

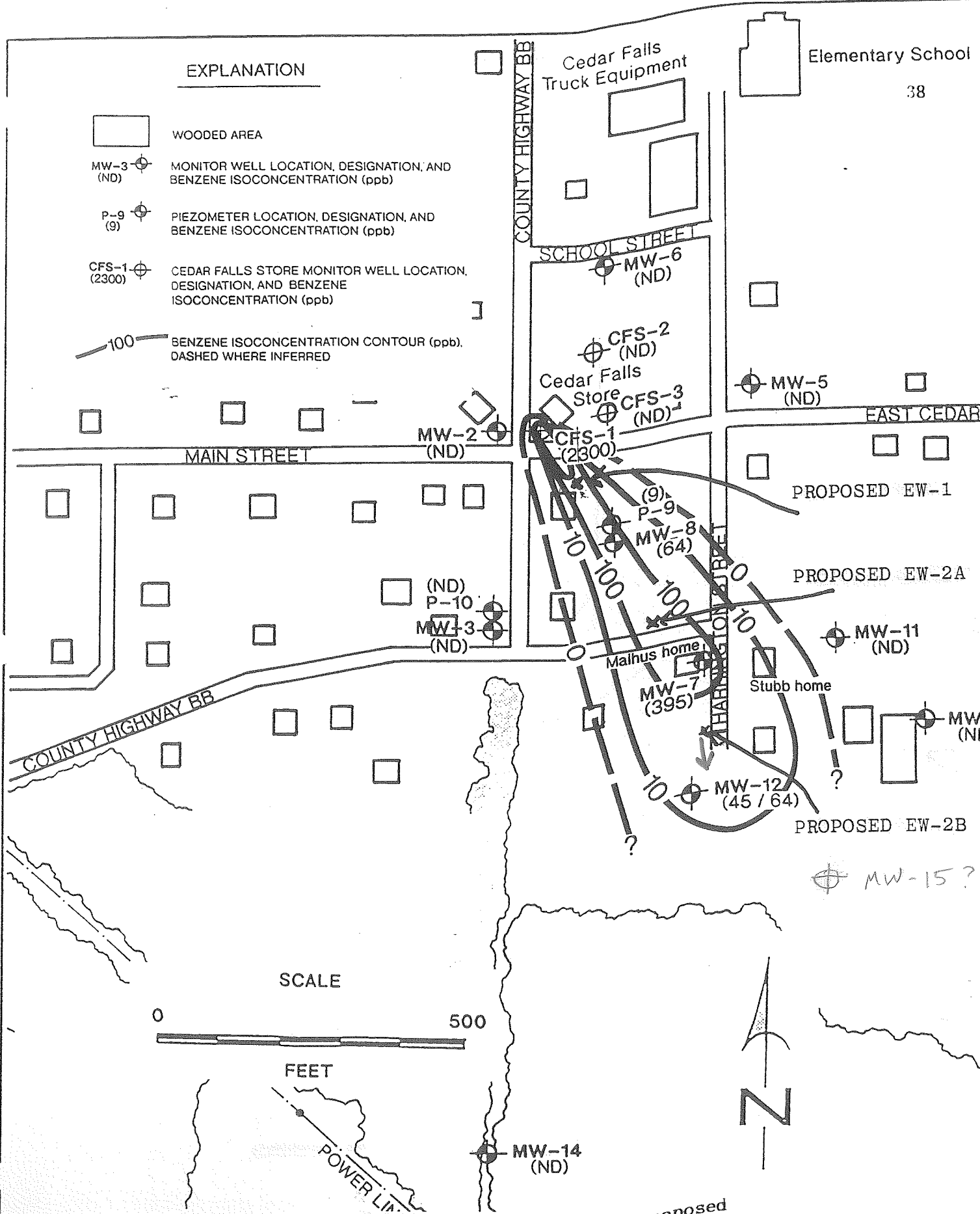


Figure 8. Map of benzene isoconcentrations and proposed ground-water extraction well locations

# A

## NORTHWEST

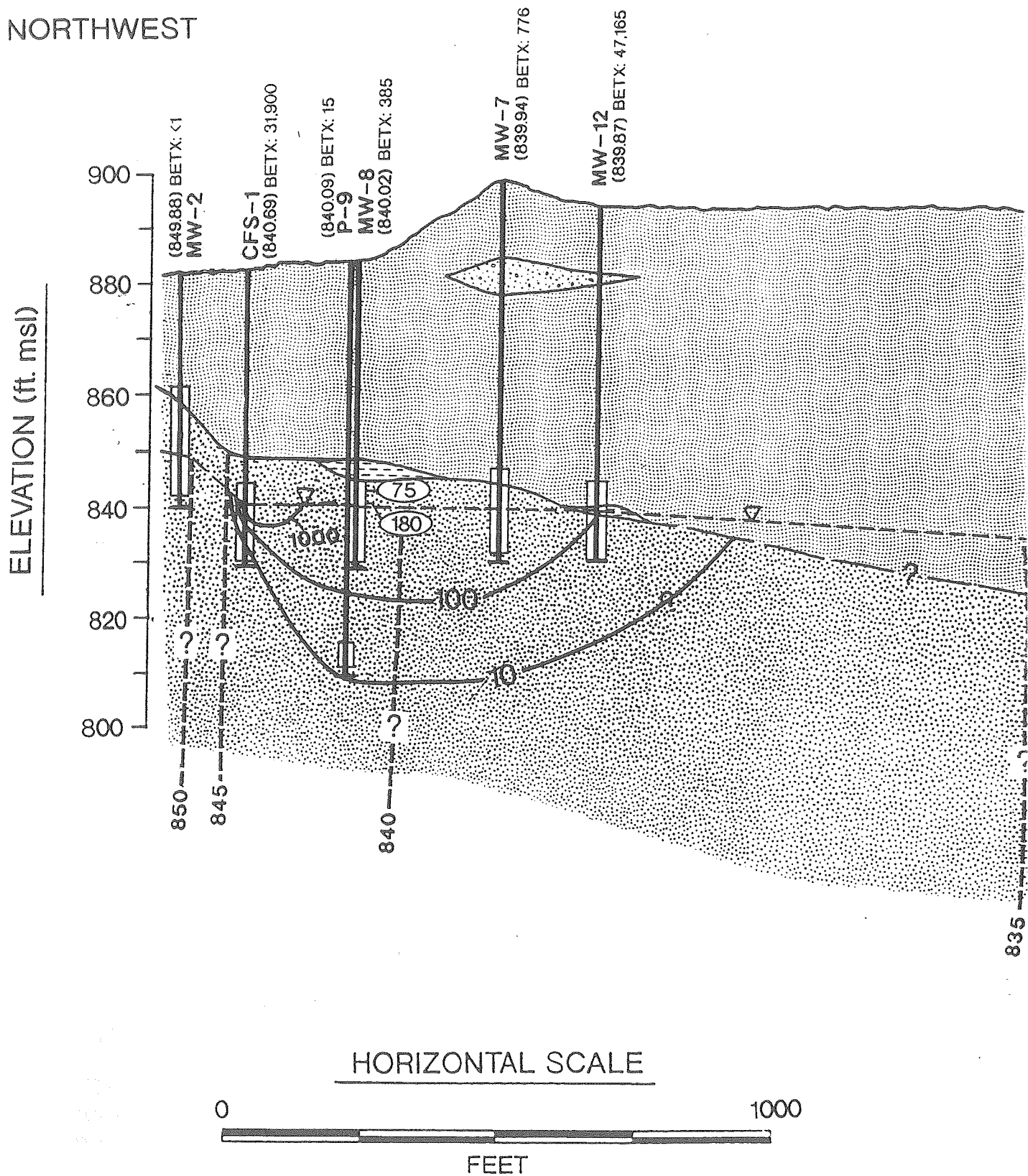


Figure 9. Cross section A-A' with water table and isoconcentration lines of PID measurements in ppm

<u>Well #</u>	<u>Calculated Hydraulic Conductivity</u>	<u>Screened Geologic Material</u>
MW-2	$4 \times 10^{-3}$ ft/min	Sandstone
MW-3	$4 \times 10^{-5}$ ft/min	Sandstone with shale layers
MW-4	$2 \times 10^{-1}$ ft/min	Sand
MW-5	$5 \times 10^{-3}$ ft/min	Sand (3 ft) + sandstone (12 ft)
MW-6	$7 \times 10^{-3}$ ft/min	Sand (1 ft) + sandstone (14 ft)
MW-7	$3 \times 10^{-2}$ ft/min	Sand (2 ft) + sandstone (13 ft)
MW-8	$6 \times 10^{-2}$ ft/min	Sandstone
MW-9	$2 \times 10^{-3}$ ft/min	Sandstone (5 ft)
MW-10	$1 \times 10^{-3}$ ft/min	Sandstone (5 ft)
MW-11	$6 \times 10^{-2}$ ft/min	Sand
MW-12	$1 \times 10^{-1}$ ft/min	Sand (8 ft) + sandstone (7 ft)
MW-13	$1 \times 10^{-1}$ ft/min	Sand
MW-14	$3 \times 10^{-4}$ ft/min	Sandstone w/shale layers

(5 ft) screen length in geologic material

#### AVERAGE HYDRAULIC CONDUCTIVITY

<u>Geologic Material</u>	<u>Average Hydraulic Conductivity</u>
Sand (3)	$1.2 \times 10^{-1}$ ft/min = 63,000 ft/yr
Sandstone (7)	$1.6 \times 10^{-2}$ ft/min = 8400 ft/yr
Sandstone with shale layers (2)	$1.7 \times 10^{-4}$ ft/min = 90 ft/yr

(7) number of wells included in average

Figure 10. Hydraulic conductivity testing results

PROGRESS REPORT ON THE REMEDIATION OF  
GROUNDWATER AT CEDAR FALLS STORE,  
CEDAR FALLS, WISCONSIN

*Submitted on  
Oct. 29, 1991*

Date: October 21, 1991

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## Table of Contents

	Page
Introduction	2
Progress Update	2
Work To Be Completed	11
References Cited	12
Appendix A Correspondence and Reports	13
Appendix B Preliminary Well Logs	16
Appendix C TPH and BTEX Analyses	38
Appendix D Pumping Test Data EW-1	56
Appendix E Pumping Test Data EW-2	63
Appendix F As-Built Plot Plan of Project Area	69
Appendix G As-Built Plot Plan of Cedar Falls Store Area	71
Appendix H Survey Data for MW-15, EW-1, and EW-2	73
Appendix I Easement Agreements	75

## Figure and Table

Figure 1. Location of monitoring well MW-15 and extraction wells EW-1 and EW-2	4
Table 1. Initial calculations of transmissivity and storativity based on pumping tests of EW-1 and EW-2.	6



## Introduction

Bill Evans, Environmental Repair Unit Leader of the WI Department of Natural Resources (DNR), requested on October 11, 1991 a progress report on the groundwater remediation effort (WI Consent Order No. WD-90-08) in Cedar Falls, WI. The purpose of the progress report is to provide information pertinent to the continuance of PEFCA payments and to the finalization of decisions for the soil venting and air stripping systems to be used at the site.

The correspondence and prior progress reports on the Cedar Falls project are summarized in Appendix A.

## Progress Update

The following is a progress update as of October 14, 1991.

1. One water-table observation well (MW-15) has been installed approximately 300 feet S43E of MW-12 (Figure 1).

This well is approximately 55 feet deep and terminates in glacial drift (SW soils). The depth to the water table is approximately 44.23 feet below the top of the north side of the PVC casing (Water table elevation of 840.44, casing elevation of 884.67 feet, and ground elevation of 882.3 feet).

Appendix B contains preliminary forms 4400-113A, 4400-113B, and 4400-122 for this well.

Water samples were collected on August 7, 1991 and analyzed by Enviroscan of Rothschild, WI for TPH gasoline/diesel, benzene, ethylbenzene, toluene, m-xylene, and o & p-xylene. All analytes were below detection limits (Appendix C).

2. Two extraction wells were installed as described in the preliminary work plan for the remedial investigation (Figure 1) (Grote and Tinker, February 20, 1991). EW-1 is approximately 75 feet deep with the water table in the sandstone at approximately 44.01 feet (8842.39 feet in elevation) below the top of the casing (8842.39 feet in elevation). EW-2 is approximately 82 feet deep (842.06 feet in elevation) with the water table in the sandstone at approximately 50.23 feet below the top of the casing (892.29 feet in elevation). Appendix B contains preliminary forms 4400-113A, 4400-113B, and 4400-122 for these wells.

Exploration Technology Inc. of Madison, WI installed and developed the extraction wells under the supervision of Henry Grote and John Tinker, Jr. All development waters were containerized and temporarily stored in a 1500-gallon

drum on the Cedar Falls Store property. This water was subsequently treated by activated charcoal and pumped to Lake Tainter.

A 31.25 hour pumping test of EW-1 was completed on October 6, 1991. The well was pumped at approximately 10.6 gallons per minute (gpm) with a maximum drawdown of 1.45 feet at EW-1, 0.50 foot at CFS-1, 0.34 foot at MW-8, and 0.03 foot at CFS-3. Table 1 and Appendix D present the preliminary transmissivity and storativity values and data for the pumping test of EW-1.

A 13 hour pumping test of EW-2 was completed on October 8, 1991. The well was pumped at approximately 6.26 gpm with a maximum drawdown of 25.81 feet at EW-2, 0.10 foot at MW-7, 0.17 foot at MW-8, and 0.05 foot at MW-12. After 13 hours of pumping at 6.26 gpm, the water level was approximately 3 feet above the pump and declining. Table 1 and Appendix E present the preliminary transmissivity and storativity values and data for the pumping test of EW-2.

The pumping test was completed by John Tinker, Jr., Henry Grote, and two field assistants.

4. Two-inch diameter water pipes, conduit containing power lines, and conduit to contain control wires for the submersible pumps have been installed from EW-1 and EW-2 to the Cedar Falls Store property at a depth greater than 3 feet in the right-of-way of the roads of the Town of Red Cedar (Appendix F). These pipes and power lines were used during the pumping tests of EW-1 and EW-2.

Pipe and conduit were installed from the Cedar Falls Store to the corner of the road immediately north of the Malhus residence. This installation is to facilitate the potential construction of a third extraction well on the Stubb's property south and east of the Malthus residence.

Sod and black dirt plus grass seed were used to restore the disturbed surfaces along the right-of-way of town roads. Roads excavated have been resurfaced.

The excavation work was by Groepper Excavating; the plumbing work by Halverson Bros, Inc.; and the electrical work by J & J Electric, Inc. all from Menomonie, WI.

5. A 4-inch diameter discharge pipe was installed at a depth greater than 3 feet from Cedar Falls Store west along Main Street to Pine Point Road, then north along Pine Point Road, and west across the Rhead property to Lake Tainter (Appendix F). This pipe conveyed the treated pumping-test water from the Cedar Falls Store property to Lake Tainter.

Sod and black dirt plus grass seed were used to restore the disturbed surfaces along the right-of-way of town roads and on the Rhead property. Crushed rock was used to repair the driveway on the Rhead property. Town and county roads and private driveways crossed have been resurfaced.

6. A 1,000 gallon pump tank has been installed on the Cedar Falls Store property to serve as a pump chamber to move extracted and treated groundwater from the Cedar Falls Store property to Lake Tainter (Appendix G). A SJE Series 1200 single phase, duplex alternating pump with control/alarm system has been installed in the pump chamber. This system was used during the pumping test.
7. Two, 200-pound, activated carbon water purification canisters from Carbtrol Corporation of Westport, CT were installed and used to treat the water pumped during the pumping test and the well development. One influent and one effluent sample were obtained for TPH and BTEX analyses at the beginning and end of each pumping test. This procedure was approved by Steve Thon of the WI DNR. Results of these laboratory tests have not been received from Enviroscan.
8. Three, 4-inch diameter, soil gas extraction wells were installed in front of the Cedar Falls Store in the area of highest photoionization readings as reported by Grote and

Tinker (June 21, 1990)(Figure 1). The depths and screen lengths for these extraction wells follow the suggestions of the WI DNR (Letter of April 2, 1991 from William Evans to Dale and Deborah Styer). The deepest soil gas extraction well is screened from 59.0 to 45 feet; the intermediate well from 39 to 24 feet; and the shallow well from 16 to 6 feet below the earth's surface. The soil gas extraction wells terminate approximately 2.5 feet below existing grade. Two-inch diameter pipes sleeved in 4-inch pipes were connected to the 4-inch diameter soil gas venting wells in front of the store east along the right-of-way of Cedar Falls Road to the east side of the Cedar Falls Store property, near the location of the planned treatment building.

The soils encountered in the deepest soil gas venting well were described, and samples were obtained for TPH and BTEX analyses (Appendix C). Observation of soils during well construction indicated that gasoline contamination appeared to be preferentially adsorbed on finer soil particles encountered in the shallow and intermediate wells.



9. The elevations of the top of the metal casings, protective cap, and PVC casing for MW-15, EW-1, and EW-2 have been determined by REAL Land Surveying, Inc. of Altoona, WI. REAL Land Surveying also surveyed the location of the southern boundary of the Rhead Property to help determine the location of the 4-inch diameter drain pipe (Appendix H).
10. On September 14 and 16, 1991, water samples were obtained from water outlets at the Kraft, Stubbs, Malhus, Powers, and Morse residences. These homes are adjacent to the contaminant plume as mapped by Hydro Search (September 28, 1990) and Tinker (August 30, 1991). The water samples were analyzed by Enviroscan of Rothschild, WI for BTEX and TPH. All samples were below the detection limits (Appendix C).
11. EW-1 and EW-2 have been connected via the pit-less-adapters to the permanent water lines.
12. Easements for well installations have been received from David Kraft, Dave Stubbs, and the Town of Red Cedar. Easements for the water pipe and electrical conduit installations have been obtained from David Kraft, Dave Stubbs, Don Rhead, the Town of Red Cedar, and Dunn County. Private property easements have been recorded at the Dunn County Register of Deeds office (Appendix I).

## Work To Be Completed

The following is work to be completed.

1. The Kraft's lawn must be landscaped to repair damages caused by the drill rig and by the excavation to connect water and power lines to EW-1.
2. Further analysis of the pumping test data must be completed to determine zones of capture and drawdown for EW-1 and EW-2.
3. Decisions must be finalized and approved by WI DNR on the soil venting and water treatment systems.
4. The building to house the soil venting and water treatment systems must be constructed, equipment installed and made operable. A soil gas and groundwater monitoring program must be finalized, approved, and implemented.
5. Landscaping of the disturbed areas adjacent to and on the Cedar Falls Store must be completed.
6. The area adjacent to EW-2 must be landscaped, and both well casings painted green.
7. A 4-foot, PVC, dedicated bailer for MW-15 needs to be ordered and installed.

8. Finalize 4400-122 forms of Exploration Technology, Inc. for  
EW-1, EW-2, and MW-15.
9. Prepare final report for this phase of the project.

#### References Cited

- Bradbury, K.R. and Rothschild, E.R., 1985, A computerized technique for estimating the hydraulic conductivity of aquifers from specific capacity data: Groundwater, v. 23, no. 2.
- Dansby, D.A. and Price, C.A., 1987, Graphical well analysis package: Groundwater Graphics, 5209 Windmill Street, Oceanside, CA.
- Grote, Henry and Tinker, Jr., John, February 20, 1991: Preliminary work plan for remedial investigation and action at Cedar Falls, Wisconsin, 46 p.
- Neuman, S.P., 1975, Analysis of pumping test data from anisotropic unconfined aquifers considering delayed gravity response: Water Resources Research, v. 11, p. 329-342.

1. January 16, 1990, "Investigation of a Potential Gasoline Leak at Cedar Falls Store, Cedar Falls, Wisconsin" by Henry Grote and John Tinker, Jr., report.
2. March 2, 1990, "Phase 1 Ground-Water Contamination Investigation Cedar Falls, Wisconsin" by Hydro-Search, Inc. Brookfield, Wisconsin 53005, report.
3. June 21, 1990, "Report #2 Investigation of a Potential Gasoline Leak at Cedar Falls Store, Cedar Falls, Wisconsin" by Henry Grote and John Tinker, Jr., report
4. September 28, 1990, "Phase II Groundwater Contamination Investigation Cedar Falls, Wisconsin" by Hydro-Search, Inc. Brookfield, Wisconsin 53005, report.
5. October 10, 1990, "Dale and Deborah Styer Site - PECFA Grant Application" from Henry Grote to Russel Haupt, WI DILHR, letter.
6. December 15, 1990, Wisconsin Department of Natural Resources Consent Order No. WD-90-08 signed by Dale and Deborah Styer.
7. January 11, 1991, "Request for Extension of Deadline for Work Plan" from Henry Grote to Bill Evans, WI. D.N.R., letter.
8. February 20, 1991, "Preliminary Work Plan for Remedial Investigation and Action at Cedar Falls, Wisconsin" by Henry Grote and John Tinker, Jr., report.
9. April 2, 1991, "Cedar Falls Store Remedial Action Work Plan Approval" from William Evans, WI. D.N.R. to Dale and Deborah Styer, letter.
10. April 11, 1991, " Air Monitoring Guidelines for Soil Venting and Air Stripper Systems" from George Mickelson, WI. D.N.R. to Henry Grote, letter.
11. May 2, 1991, "Cedar Falls Store-Project Progress to Date" from Henry Grote to Bill Evans, WI. D.N.R., letter.
12. May 6, 1991, "Cedar Falls Store-Blacktop" from Henry Grote to Bill Evans, WI. D.N.R., letter.
13. June 13, 1991, "Application fo a WPDES General Permit- Cedar Falls Store, Cedar Falls, WI. from John Tinker, Jr., JRT HYDRO, Inc. to Steve Thon, WI. D.N.R., permit application.
14. July 3, 1991, "Cedar Falls Store-Progress Update" from Henry Grote to Bill Evans, WI. D.N.R., letter.

15. August 7, 1991, "Wastewater Discharge Permit WPDES WI-0046566" from State of Wisconsin to Dale and Deborah Styer.
16. August 24, 1991, "Cedar Falls Store Ground Water Remediation Effort WI Department of Natural Resources Consent Order No. WD-90-08" from John Tinker, Jr., JRT HYDRO, Inc. to Russel Haupt, WI DILHR, request to asphalt area in front of Cedar Falls Store, letter .
17. August 30, 1991, "Update on the Ground-Water Remediation Effort at Cedar Falls Store" from John Tinker, Jr., JRT HYDRO, Inc. to Bill Evans, WI. D.N.R., letter.
18. September 17, 1991, "Cedar Falls Store Project Update" from Henry Grote to Bill Evans, WI D.N.R. letter.
19. September 24, 1991, "PECFA Reimbursement for Treatment of Wastewater Discharge During Pump Tests" from Bill Evans to Karen Pitt, Valley Bank of Menomonie, Menomonie, WI.

Table 1. Initial calculations of transmissivity and storativity based on pumping tests of EW-1 and EW-2.

Pumping Test	Distance in Feet from Extraction Well	Transmissivity <sup>*</sup> Gallons/Day/Ft	Storativity
EW-1	0	307	--
MW-8	119.9	9,650	.015
CFS-1	111.0	10,300	.004
CFS-3	95.0	(Insufficient drawdown)	
EW-2	0	280	--
MW-8	188.95	14,300	.002
MW-7	113.27	21,700	.014

\* Transmissivity and storativity for the monitoring wells are calculated by the software package entitled "Graphical Well Analysis Package" (Dansby and Price, 1987) based on Neuman (1975) for unconfined aquifers.

Transmissivity for extraction wells are calculated by the method described by Bradbury and Rothschild (1985).



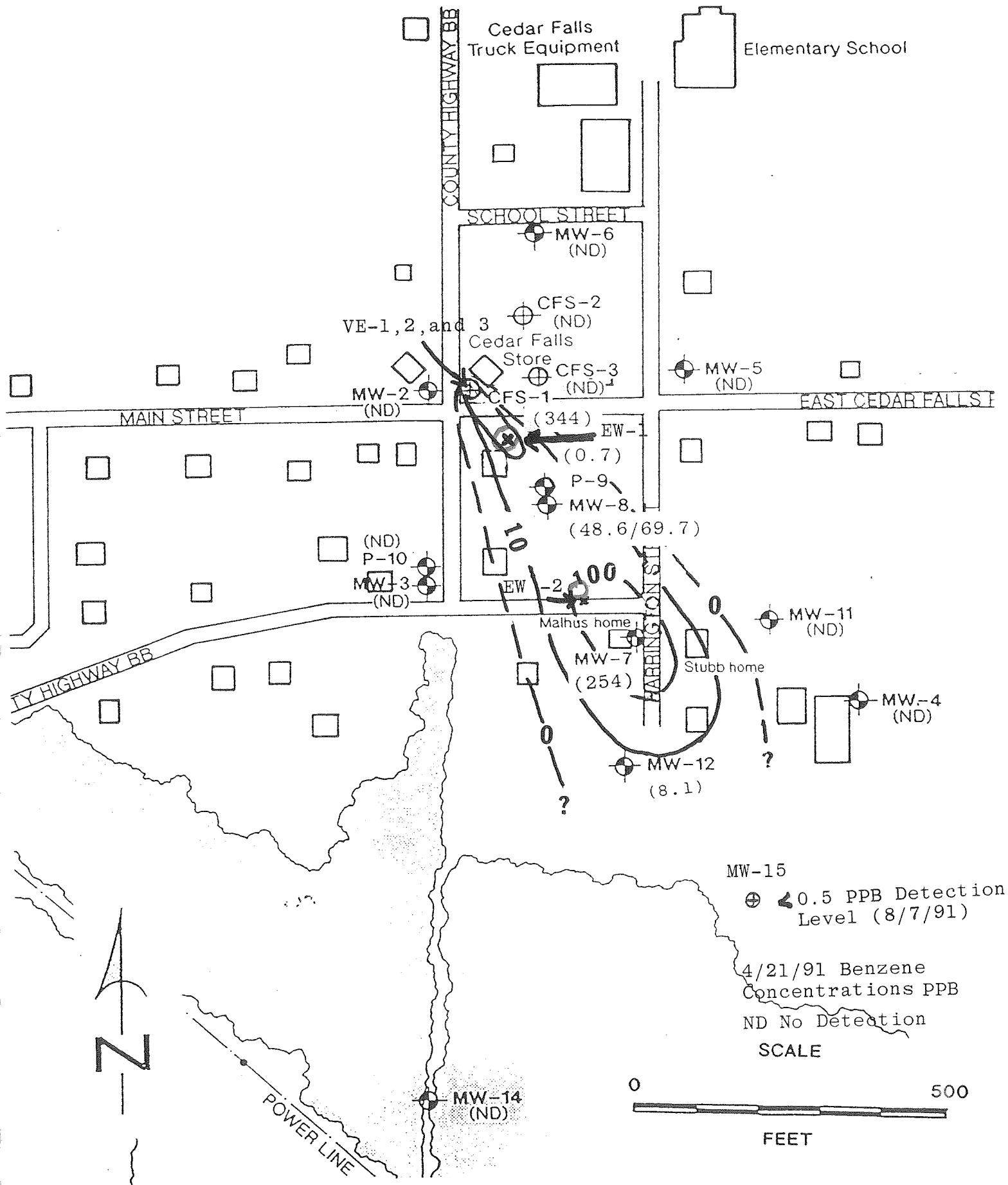


Figure 1. Location of monitoring well MW-15 and extraction wells EW-1 and EW-2.

Appendix B

Preliminary Forms 4400-122, 4400-113A, and 4400-113B for  
Extraction Wells EW-1, EW-2; Monitoring Well MW-15; and  
Soil Gas Venting Wells VE-1, VE-2, and VE-3

PAGE 1 OF 3

FACILITY NAME Cedar Falls Remediation  
DRILLED BY Dan North  
COMMON WELL NAME EW-2A

DATE DRILLING STARTED 7-31-91	DATE DRILLING COMPLETE 7-31-91	DRILLING METHOD Mud Rotary and Air Rotary
WATER LEVEL	SURFACE ELEV.	BOREHOLE DIAMETER 10.0"

SW 1/4 of NE 1/4 of Section 6 T 28N R 12W

GRID LOCATION (IF APPLICABLE)  
FT W OR S FEET W OR W

COUNTY Dunn COUNTY CODE

CIVIL TOWN Red Cedar, Cedar Falls, WI

				SOIL PROPERTIES										RQD COMMENTS		
				M		O		C		L		P			P	
				G	D	P	I	O	I	L	L	L	L			
				U	R	W	I	S	S	N	Q	I	A		I	2
				S	A	L	E	S	S	N	Q	I	A		I	0
				C	P	O	L	P	T	T	U	M	S		M	0
				S	H	G	L	T	U	E	I	I	T		I	0
				I	A	I		R	N	D	T	I	T			
				C	M	D		E	T			C				
Sample																
No	Rec.	DEPTH IN FEET		SOIL/ROCK DESCRIPTION												
		BLOW COUNTS														

-0	Black Dirt
-1	
-2	Brown fine to medium SAND, some Gravel
-3	
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-9	
-10	
-11	
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I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm:

Exploration Technology Inc.

This form is authorized by Chapters 144, 147 and 162, WI Stats. Completion of the report is mandatory.  
Penalties; Forfeiture not less than \$10 not more than \$5,000 for each violation, fined not less than  
\$10 or more than \$100 or imprisoned not less than 30 days, or both for each violation  
Each day of continued violation is a separate offense, pursuant to ss 144.99 and 162.06 WI stats.

EXPLORATION  
TECHNOLOGY  
INC.

BORING NUMBER      EW-2A

ETI JOB NUMBER 814483

[illegible]

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

Signature

!firm:

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					SOIL PROPERTIES														
Sample		No	Rec.	DEPTH IN FEET	SOIL/ROCK DESCRIPTION	U	G	D	P	M	O	C	L	P	P				
						S	A	L	E	A	D	S	S	N	Q	I	A	I	2
						C	P	O	L	G	/	P	T	T	U	M	S	M	0
						S	H	G	L	R	F	T	U	E	I	I	T	I	0
						I	A	I				R	N	D	T	I	T		
						C	M	D				E	T			C			
				-56	Brown SANDSTONE														
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				-79															
				-80															
				-81															
				-82															
				-83	End of boring EW-2A @ 82.0'														
				-84															
				-85															

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

Signature

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FACILITY NAME Ceder Falls Remediation Project  
DRILLED BY Dan North  
COMMON WELL NAME EW-2B, Monitor Well

DATE DRILLING STARTED		DATE DRILLING COMPLETE		DRILLING METHOD	
7-29-91		7-29-91		4 1/4" Hollow Stem Auger	
WATER LEVEL 42.0'		SURFACE ELEV.		BOREHOLE DIAMETER 8.0"	
GRID LOCATION (IF APPLICABLE)					
FT	W	OR	S	FEET	W OR W

COUNTY     Dunn                      COUNTY CODE

CIVIL TOWN Red Cedar, Cedar Falls, WI

Sample		SOIL/ROCK DESCRIPTION	SOIL PROPERTIES										RQD COMMENTS				
No	Rec.		BLOW COUNTS	DEPTH IN FEET	U	G	D	P	M	O	C	L		P	P		
				S	A	L	E	A	D	S	S	N	Q	I	A	I	2
				C	P	O	L	G	/	P	T	T	U	M	S	M	0
				S	H	G	L	R	F	T	U	E	I	I	T	I	0
					I		A	I			R	N	D	T	I	T	
					C		M	D			E	T			C		

			-0	Topsoil
			-1	
			-2	Dense brown fine to medium SAND, some coarse
			-3	Gravel
			-4	
1	18	25	-5	
			-6	
			-7	
			-8	
			-9	
2	12	26	-10	
			-11	
			-12	
			-13	
			-14	
3	12	46	-15	
			-16	
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4	6	42	-20	
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			-22	
			-23	
			-24	
5	12	70	-25	

Signature

Firm:  
Exploration Technology Inc.

Penalties; Forfeiture not less than \$10 not more than \$5,000 for each violation, fined not less than \$10 or more than \$100 or imprisoned not less than 30 days, or both for each violation  
Each day of continued violation is a separate offense, pursuant to ss 144.99 and 162.06 WI stats.

EXPLORATION  
TECHNOLOGY  
INC.

			SOIL/ROCK DESCRIPTION	SOIL PROPERTIES										RQD COMMENTS
Sample		DEPTH IN FEET		U S C S	G R A P H I C	W I P O L H I C	D I / R A M D	S P T	M O I S T U R E	C O N T E N T	L I Q U I D T Y	P L A S T I C	P L I T T I C	
No	Rec.													
6	12	78	-26 -27 -28 -29 -30 -31 -32 -33 -34											
7	18	57	-35 -36 -37 -38 -39											
8	0	87	-40 -41 -42 -43 -44											
9	6	96	-45 -46 -47 -48 -49											
10	12	73	-50 -51 -52 -53 -54											
11	18	62	-55 -56											
			Water											
			End of boring EW 2B @ 55.0'											

End of boring EW 2B @ 55.0'

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

Signature

Firm:

Exploration Technology Inc.

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PAGE 1 OF 3

FACILITY NAME Cedar Falls Remediation Project  
DRILLED BY Dan North  
COMMON WELL NAME EW-1, Extraction Well

DATE DRILLING STARTED 7-31-91	DATE DRILLING COMPLETE 7-31-91	DRILLING METHOD Mud Rotary
WATER LEVEL	SURFACE ELEV.	BOREHOLE DIAMETER 10.0"

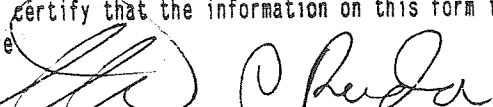
SW 1/4 of NE 1/4 of section 6 T 28N R 12W

GRID LOCATION (IF APPLICABLE)  
FT W OR S FEET W OR W

COUNTY Dunn COUNTY CODE

CIVIL TOWN Red Cedar, Cedar Falls, WI

			SOIL PROPERTIES										RQD COMMENTS			
			G	D	P	M	O	C	L	P	P					
			U	R	W	I	I	I	O	I	L	L				
			S	A	L	E	A	D	S	S	N	Q		I	A	I
Sample			SOIL/ROCK DESCRIPTION													
No	Rec.		C	P	O	L	G	/	P	T	T	U	M	S	M	0
		BLOW COUNTS	S	H	G	L	R	F	T	U	E	I	I	T	I	0
		DEPTH IN FEET	I	A	I				R	N	D	T	I	T		
			C	M	D				E	T		C				
		-0	TOPSOIL													
		-1														
		-2	Brown fine to medium SAND, some Gravel													
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I hereby certify that the information on this form is true and correct to the best of my knowledge.  
Signature 

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EXPLORATION  
TECHNOLOGY  
INC.



BORING NUMBER

EW-1

ETI JOB NUMBER

814483

Sample		DEPTH IN FEET	SOIL/ROCK DESCRIPTION	SOIL PROPERTIES										P	RQD COMMENTS								
No	Rec.			BLOW COUNTS	U S C S	G R A P H I C	D I L E P O L Y M E R	P I D / F I D	S P T	M O I S T U R E	C O N T E N T	L I Q U I D	P L A S T I C			L I M I T							
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Brown weathered SANDSTONE

Brown Sandstone

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

Signature

Firm:

Exploration Technology Inc.

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 \$10 or more than \$100 or imprisoned not less than 30 days, or both for each violation  
 Each day of continued violation is a separate offense, pursuant to ss 144.99 and 162.06 WI stats.

BORING NUMBER

EE-1

ETI JOB NUMBER

814483

SOIL/ROCK  
DESCRIPTION

## SOIL PROPERTIES

Sample

No	Rec
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Brown SANDSTONE

End of boring EW-1 @ 75.0'

Signature

Firm:

Exploration Technology Inc.

This form is authorized by Chapters 144, 147 and 162, WI Stats. Completion of the report is mandatory. Penalties; Forfeiture not less than \$10 not more than \$5,000 for each violation, fined not less than \$10 or more than \$100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 144.99 and 162.06 WI stats.

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

Please complete and return both sides of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with ch. 144, Wis. Stats., failure to file this form may result in a forfeiture of not less than \$10, nor more than \$5,000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than \$10,000 for each day of violation.

NOTE: Shaded areas are for DNR use only. See instructions for more information. -26-

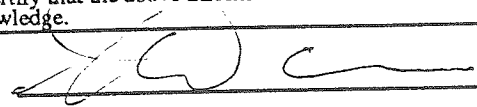
Facility/Project Name <u>Cedar Falls Remediation</u>		Well Name <u>VE-1</u>					
License, Permit or Monitoring Number _____		<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%;">Wis. Unique Well Number</td> <td style="width:50%;">DNR Well Number</td> </tr> <tr> <td>_____</td> <td>_____</td> </tr> </table>		Wis. Unique Well Number	DNR Well Number	_____	_____
Wis. Unique Well Number	DNR Well Number						
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1. Can this well be purged dry? <span style="float:right;"><input type="checkbox"/> Yes <input type="checkbox"/> No</span>  2. Well development method <table style="width:100%;"> <tr><td>surged with bailer and bailed</td><td><input type="checkbox"/> 4 1</td></tr> <tr><td>surged with bailer and pumped</td><td><input type="checkbox"/> 6 1</td></tr> <tr><td>surged with block and bailed</td><td><input type="checkbox"/> 4 2</td></tr> <tr><td>surged with block and pumped</td><td><input type="checkbox"/> 6 2</td></tr> <tr><td>surged with block, bailed and pumped</td><td><input type="checkbox"/> 7 0</td></tr> <tr><td>compressed air</td><td><input type="checkbox"/> 2 0</td></tr> <tr><td>bailed only</td><td><input type="checkbox"/> 1 0</td></tr> <tr><td>pumped only</td><td><input type="checkbox"/> 5 1</td></tr> <tr><td>pumped slowly</td><td><input type="checkbox"/> 5 0</td></tr> <tr><td>Other _____</td><td><input type="checkbox"/> <span style="border: 1px solid black; padding: 2px;">  </span></td></tr> </table> 3. Time spent developing well _____ min.  4. Depth of well (from top of well casing) _____ ft.  5. Inside diameter of well _____ in.  6. Volume of water in filter pack and well casing _____ gal.  7. Volume of water removed from well _____ gal.  8. Volume of water added (if any) _____ gal.  9. Source of water added _____  10. Analysis performed on water added? <span style="float:right;"><input type="checkbox"/> Yes <input type="checkbox"/> No</span> (If yes, attach results)	surged with bailer and bailed	<input type="checkbox"/> 4 1	surged with bailer and pumped	<input type="checkbox"/> 6 1	surged with block and bailed	<input type="checkbox"/> 4 2	surged with block and pumped	<input type="checkbox"/> 6 2	surged with block, bailed and pumped	<input type="checkbox"/> 7 0	compressed air	<input type="checkbox"/> 2 0	bailed only	<input type="checkbox"/> 1 0	pumped only	<input type="checkbox"/> 5 1	pumped slowly	<input type="checkbox"/> 5 0	Other _____	<input type="checkbox"/> <span style="border: 1px solid black; padding: 2px;">  </span>	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th style="width:30%;"></th> <th style="width:35%;">Before Development</th> <th style="width:35%;">After Development</th> </tr> <tr> <td>11. Depth to Water (from top of well casing)</td> <td>_____ ft.</td> <td>_____ ft.</td> </tr> <tr> <td>Date</td> <td>____/____/____ m m / d d / y y</td> <td>____/____/____ m m / d d / y y</td> </tr> <tr> <td>Time</td> <td>____:____ <input type="checkbox"/> a.m. <input type="checkbox"/> p.m.</td> <td>____:____ <input type="checkbox"/> a.m. <input type="checkbox"/> p.m.</td> </tr> <tr> <td>12. Sediment in well bottom</td> <td>_____ inches</td> <td>_____ inches</td> </tr> <tr> <td>13. Water clarity</td> <td>           Clear <input type="checkbox"/> 10            Turbid <input type="checkbox"/> 15            (Describe) _____         </td> <td>           Clear <input type="checkbox"/> 20            Turbid <input type="checkbox"/> 25            (Describe) _____         </td> </tr> </table> <div style="border: 1px solid black; padding: 5px;">         Fill in if drilling fluids were used and well is at solid waste facility:       </div> <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:30%;">14. Total suspended solids</td> <td style="width:35%;">_____ mg/l</td> <td style="width:35%;">_____ mg/l</td> </tr> <tr> <td>15. COD</td> <td>_____ mg/l</td> <td>_____ mg/l</td> </tr> </table>		Before Development	After Development	11. Depth to Water (from top of well casing)	_____ ft.	_____ ft.	Date	____/____/____ m m / d d / y y	____/____/____ m m / d d / y y	Time	____:____ <input type="checkbox"/> a.m. <input type="checkbox"/> p.m.	____:____ <input type="checkbox"/> a.m. <input type="checkbox"/> p.m.	12. Sediment in well bottom	_____ inches	_____ inches	13. Water clarity	Clear <input type="checkbox"/> 10 Turbid <input type="checkbox"/> 15 (Describe) _____	Clear <input type="checkbox"/> 20 Turbid <input type="checkbox"/> 25 (Describe) _____	14. Total suspended solids	_____ mg/l	_____ mg/l	15. COD	_____ mg/l	_____ mg/l
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Additional comments on development:

No development necessary vapor extraction well

Well developed by: Person's Name and Firm  Name: _____  Firm: _____	I hereby certify that the above information is true and correct to the best of my knowledge.  Signature:   Firm: <u>Exploration Technology Inc.</u>
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NOTE: Shaded areas are for DNR use only. See instructions for more information.

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

Please complete and return both sides of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with ch. 144, Wis. Stats., failure to file this form may result in a forfeiture of not less than \$10, nor more than \$5,000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than \$10,000 for each day of violation.

NOTE: Shaded areas are for DNR use only. See instructions for more information. -28-

Facility/Project Name <div style="text-align: center; font-weight: bold;">Cedar Falls Remediation</div>		Well Name <div style="text-align: center; font-weight: bold;">VE-2</div>			
License, Permit or Monitoring Number <div style="border: 1px solid black; height: 15px; width: 100%;"></div>		<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%; padding: 2px;">           Wis. Unique Well Number  <div style="border: 1px solid black; height: 15px; width: 100%;"></div> </td> <td style="width:50%; padding: 2px;">           DNR Well Number  <div style="border: 1px solid black; height: 15px; width: 100%;"></div> </td> </tr> </table>		Wis. Unique Well Number <div style="border: 1px solid black; height: 15px; width: 100%;"></div>	DNR Well Number <div style="border: 1px solid black; height: 15px; width: 100%;"></div>
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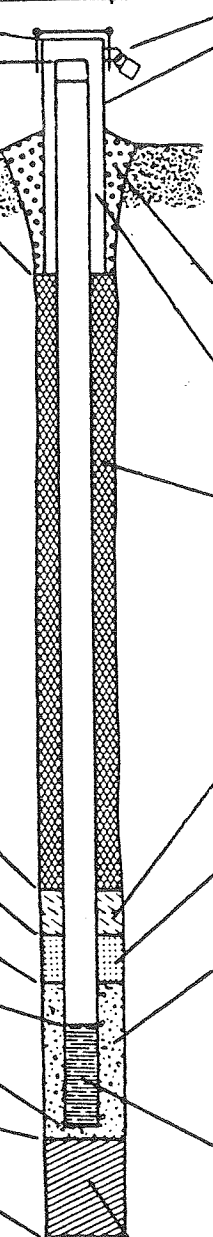
Additional comments on development:

Vapor Extraction Well - No Development necessary

Well developed by: Person's Name and Firm  Name: _____  Firm: _____	I hereby certify that the above information is true and correct to the best of my knowledge.  Signature:  Firm: <u>Exploration Technology Inc.</u>
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NOTE: Shaded areas are for DNR use only. See instructions for more information.

Facility/Project Name <b>Cedar Falls Remediation</b>	Grid Location _____ ft. <input type="checkbox"/> N. <input type="checkbox"/> S. _____ ft. <input type="checkbox"/> E. <input type="checkbox"/> W.	Well Name <b>VE-3</b>
Facility License, Permit or Monitoring Number _____		Wis. Unique Well Number _____ DNR Well Number _____
Type of Well Water Table Observation Well <input type="checkbox"/> 11 Vapor Extraction Well <input checked="" type="checkbox"/> 12	Section Location SW 1/4 of NE 1/4 of Section <b>6</b> T <b>28</b> N, R <b>12</b> E, S <b>4</b> W	Date Well Installed <b>08 / 04 / 91</b> m m d d y y
Distance Well Is From Waste/Source Boundary _____ ft.	Location of Well Relative to Waste/Source <input type="checkbox"/> Upgradient <input type="checkbox"/> Sidegradient <input type="checkbox"/> Downgradient <input checked="" type="checkbox"/> Not Known	Well Installed By: (Person's Name and Firm) <b>Dan North</b> <b>Exploration Technology Inc.</b>
Is Well A Point of Enforcement Std. Application? <input type="checkbox"/> Yes <input type="checkbox"/> No		

<p>A. Protective pipe, top elevation _____ ft. MSL</p> <p>B. Well casing, top elevation <b>1 0</b> ft. MSL</p> <p>C. Land surface elevation <b>0.0</b> ft. MSL</p> <p>D. Surface seal, bottom _____ ft. MSL or <b>2 0</b> ft.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>12. USCS classification of soil near screen:  <input type="checkbox"/> GP <input type="checkbox"/> GM <input type="checkbox"/> GC <input type="checkbox"/> GW <input type="checkbox"/> SW <input type="checkbox"/> SP  <input type="checkbox"/> SM <input type="checkbox"/> SC <input type="checkbox"/> ML <input type="checkbox"/> MH <input type="checkbox"/> CL <input type="checkbox"/> CH  <input checked="" type="checkbox"/> Bedrock         </p> <p>13. Sieve analysis attached? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>14. Drilling method used: Rotary <input type="checkbox"/> 50          Hollow Stem Auger <input type="checkbox"/> 41          Other <input type="checkbox"/> _____</p> <p>15. Drilling fluid used: Water <input type="checkbox"/> 02 Air <input type="checkbox"/> 01          Drilling Mud <input type="checkbox"/> 03 None <input type="checkbox"/> 99</p> <p>16. Drilling additives used? <input type="checkbox"/> Yes <input type="checkbox"/> No          Describe _____</p> <p>17. Source of water (attach analysis):          _____</p> </div> <p>E. Bentonite seal, top _____ ft. MSL or <b>40.0</b> ft.</p> <p>F. Fine sand, top _____ ft. MSL or _____ ft.</p> <p>G. Filter pack, top _____ ft. MSL or <b>42.0</b> ft.</p> <p>H. Well screen, top _____ ft. MSL or <b>45.0</b> ft.</p> <p>I. Well screen, bottom _____ ft. MSL or <b>59.0</b> ft.</p> <p>J. Filter pack, bottom _____ ft. MSL or <b>60.0</b> ft.</p> <p>K. Borehole, bottom _____ ft. MSL or <b>60.0</b> ft.</p> <p>L. Borehole, diameter <b>12.0</b> in.</p> <p>M. O.D. well casing <b>6.60</b> in.</p> <p>N. I.D. well casing <b>6.06</b> in.</p>	 <p>1. Cap and lock? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>2. Protective cover pipe:          a. Inside diameter: _____ in.          b. Length: _____ ft.          c. Material: _____ Steel <input type="checkbox"/> 04          _____ Other <input checked="" type="checkbox"/> _____          d. Additional protection? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No          If yes, describe: _____</p> <p>3. Surface seal: Bentonite <input type="checkbox"/> 30          Concrete <input checked="" type="checkbox"/> 01          Other <input type="checkbox"/> _____</p> <p>4. Material between well casing and protective pipe:          Bentonite <input type="checkbox"/> 30          Annular space seal <input type="checkbox"/> _____          Other <input type="checkbox"/> _____</p> <p>5. Annular space seal: Granular Bentonite <input type="checkbox"/> 33          _____ Lbs/gal mud weight ... Bentonite-sand slurry <input type="checkbox"/> 35          _____ Lbs/gal mud weight ... Bentonite slurry <input type="checkbox"/> 31  <b>5</b> % Bentonite ... Bentonite-cement grout <input checked="" type="checkbox"/> 50  <b>17.5</b> Ft<sup>3</sup> volume added for any of the above          How installed: Tremie <input type="checkbox"/> 01          Tremie pumped <input type="checkbox"/> 02          Gravity <input checked="" type="checkbox"/> 08</p> <p>6. Bentonite seal: Bentonite granules <input checked="" type="checkbox"/> 33  <input type="checkbox"/> 1/4 in. <input type="checkbox"/> 3/8 in. <input type="checkbox"/> 1/2 in. Bentonite pellets <input type="checkbox"/> 32          Other <input type="checkbox"/> _____</p> <p>7. Fine sand material: Manufacturer, product name and mesh size          Volume added _____ ft<sup>3</sup></p> <p>8. Filter pack material: Manufacturer, product name and mesh size  <b>American Materials #30 Flint</b>          Volume added <b>8.0</b> ft<sup>3</sup></p> <p>9. Well casing: Flush threaded PVC schedule 40 <input checked="" type="checkbox"/> 23          Flush threaded PVC schedule 80 <input type="checkbox"/> 24          Other <input type="checkbox"/> _____</p> <p>10. Screen material: <b>PVC</b>          Screen type: Factory cut <input checked="" type="checkbox"/> 11          Continuous slot <input type="checkbox"/> 01          Other <input type="checkbox"/> _____</p> <p>Manufacturer <b>Diedrich Drilling</b>          Slot size: _____ 0.010 in.          Slotted length: <b>14.0</b> ft.</p> <p>11. Backfill material (below filter pack): None <input checked="" type="checkbox"/> _____          Other <input type="checkbox"/> _____</p>
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I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature \_\_\_\_\_ Firm **Exploration Technology Inc.**

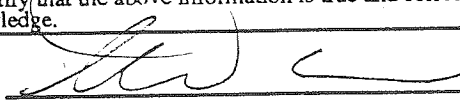
Facility/Project Name <b>Cedar Falls Remediation</b> License, Permit or Monitoring Number _____		Well Name <b>VE-3</b> Wis. Unique Well Number _____ DNR Well Number _____	
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1. Can this well be purged dry? <input type="checkbox"/> Yes <input type="checkbox"/> No  2. Well development method surged with bailer and bailed <input type="checkbox"/> 4 1 surged with bailer and pumped <input type="checkbox"/> 6 1 surged with block and bailed <input type="checkbox"/> 4 2 surged with block and pumped <input type="checkbox"/> 6 2 surged with block, bailed and pumped <input type="checkbox"/> 7 0 compressed air <input type="checkbox"/> 2 0 bailed only <input type="checkbox"/> 1 0 pumped only <input type="checkbox"/> 5 1 pumped slowly <input type="checkbox"/> 5 0 Other <input type="checkbox"/> _____  3. Time spent developing well _____ min.  4. Depth of well (from top of well casing) _____ ft.  5. Inside diameter of well _____ in.  6. Volume of water in filter pack and well casing _____ gal.  7. Volume of water removed from well _____ gal.  8. Volume of water added (if any) _____ gal.  9. Source of water added _____  10. Analysis performed on water added? <input type="checkbox"/> Yes <input type="checkbox"/> No (If yes, attach results)	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th style="width:30%;"></th> <th style="width:35%;">Before Development</th> <th style="width:35%;">After Development</th> </tr> <tr> <td>11. Depth to Water (from top of well casing)</td> <td>_____ ft.</td> <td>_____ ft.</td> </tr> <tr> <td>Date</td> <td>____/____/____ m m / d d / y y</td> <td>____/____/____ m m / d d / y y</td> </tr> <tr> <td>Time</td> <td>____:____ <input type="checkbox"/> a.m. <input type="checkbox"/> p.m.</td> <td>____:____ <input type="checkbox"/> a.m. <input type="checkbox"/> p.m.</td> </tr> <tr> <td>12. Sediment in well bottom</td> <td>_____ inches</td> <td>_____ inches</td> </tr> <tr> <td>13. Water clarity</td> <td>           Clear <input type="checkbox"/> 1 0            Turbid <input type="checkbox"/> 1 5            (Describe) _____         </td> <td>           Clear <input type="checkbox"/> 2 0            Turbid <input type="checkbox"/> 2 5            (Describe) _____         </td> </tr> </table> Fill in if drilling fluids were used and well is at solid waste facility: 14. Total suspended solids _____ mg/l _____ mg/l 15. COD _____ mg/l _____ mg/l		Before Development	After Development	11. Depth to Water (from top of well casing)	_____ ft.	_____ ft.	Date	____/____/____ m m / d d / y y	____/____/____ m m / d d / y y	Time	____:____ <input type="checkbox"/> a.m. <input type="checkbox"/> p.m.	____:____ <input type="checkbox"/> a.m. <input type="checkbox"/> p.m.	12. Sediment in well bottom	_____ inches	_____ inches	13. Water clarity	Clear <input type="checkbox"/> 1 0 Turbid <input type="checkbox"/> 1 5 (Describe) _____	Clear <input type="checkbox"/> 2 0 Turbid <input type="checkbox"/> 2 5 (Describe) _____
	Before Development	After Development																	
11. Depth to Water (from top of well casing)	_____ ft.	_____ ft.																	
Date	____/____/____ m m / d d / y y	____/____/____ m m / d d / y y																	
Time	____:____ <input type="checkbox"/> a.m. <input type="checkbox"/> p.m.	____:____ <input type="checkbox"/> a.m. <input type="checkbox"/> p.m.																	
12. Sediment in well bottom	_____ inches	_____ inches																	
13. Water clarity	Clear <input type="checkbox"/> 1 0 Turbid <input type="checkbox"/> 1 5 (Describe) _____	Clear <input type="checkbox"/> 2 0 Turbid <input type="checkbox"/> 2 5 (Describe) _____																	

Additional comments on development:

Vapor Extraction well - No Development necessary

Well developed by: Person's Name and Firm  Name: _____ Firm: _____	I hereby certify that the above information is true and correct to the best of my knowledge. Signature:  Firm: <u>Exploration Technology Inc.</u>
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NOTE: Shaded areas are for DNR use only. See instructions for more information.



Facility/Project Name <b>Cedar Falls Remediation</b>	Grid Location ft. <input type="checkbox"/> N. <input type="checkbox"/> S. ft. <input type="checkbox"/> E. <input type="checkbox"/> W.	Well Name <b>EW-1</b>
Facility License, Permit or Monitoring Number		Wis. Unique Well Number <b>DNR Well Number</b>
Type of Well Water Table Observation Well <input type="checkbox"/> 11 Extraction Well <input checked="" type="checkbox"/> 12	Section Location <b>SW 1/4 of NE 1/4 of Section 6</b>	Date Well Installed <b>07 / 31 / 91</b> m m d d y y
Distance Well Is From Waste/Source Boundary ft.	T <b>28</b> N, R <b>12</b> <input type="checkbox"/> E <input checked="" type="checkbox"/> W	Well Installed By: (Person's Name and Firm) <b>Dan North</b>
Is Well A Point of Enforcement Sid. Application? <input type="checkbox"/> Yes <input type="checkbox"/> No	Location of Well Relative to Waste/Source <input type="checkbox"/> Upgradient <input type="checkbox"/> Sidegradient <input type="checkbox"/> Downgradient <input type="checkbox"/> Not Known	<b>Exploration Technology Inc.</b>

A. Protective pipe, top elevation	ft. MSL	1. Cap and lock?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
B. Well casing, top elevation	3.00 ft. MSL	2. Protective cover pipe:	
C. Land surface elevation	0.0 ft. MSL	a. Inside diameter:	0.0 in.
D. Surface seal, bottom	2.0 ft.	b. Length:	ft.
		c. Material:	Steel <input type="checkbox"/> 04 Well Cap <input checked="" type="checkbox"/> Other <input type="checkbox"/>
		d. Additional protection?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
		If yes, describe:	
12. USCS classification of soil near screen:		3. Surface seal:	Bentonite <input type="checkbox"/> 30 Concrete <input checked="" type="checkbox"/> 01 Other <input type="checkbox"/>
<input type="checkbox"/> GP <input type="checkbox"/> GM <input type="checkbox"/> GC <input type="checkbox"/> GW <input type="checkbox"/> SW <input type="checkbox"/> SP <input type="checkbox"/> SM <input type="checkbox"/> SC <input type="checkbox"/> ML <input type="checkbox"/> MH <input type="checkbox"/> CL <input type="checkbox"/> CH <input checked="" type="checkbox"/> Bedrock		4. Material between well casing and protective pipe:	Bentonite <input type="checkbox"/> 30 Annular space seal <input type="checkbox"/>
13. Sieve analysis attached? <input type="checkbox"/> Yes <input type="checkbox"/> No		None	Other <input checked="" type="checkbox"/>
14. Drilling method used:	Rotary <input checked="" type="checkbox"/> 50 Hollow Stem Auger <input type="checkbox"/> 41 Other <input type="checkbox"/>	5. Annular space seal:	Granular Bentonite <input type="checkbox"/> 33 Lbs/gal mud weight . . . Bentonite-sand slurry <input type="checkbox"/> 35 Lbs/gal mud weight . . . . Bentonite slurry <input type="checkbox"/> 31 5 % Bentonite . . . . Bentonite-cement grout <input checked="" type="checkbox"/> 50 Ft <sup>3</sup> volume added for any of the above
15. Drilling fluid used: Water <input type="checkbox"/> 02 Air <input type="checkbox"/> 01 Drilling Mud <input checked="" type="checkbox"/> 03 None <input type="checkbox"/> 99		How installed:	Tremie <input type="checkbox"/> 01 Tremie pumped <input checked="" type="checkbox"/> 02 Gravity <input type="checkbox"/> 08
16. Drilling additives used? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		6. Bentonite seal:	Bentonite granules <input type="checkbox"/> 33 <input type="checkbox"/> 1/4 in. <input checked="" type="checkbox"/> 3/8 in. <input type="checkbox"/> 1/2 in. Bentonite pellets <input checked="" type="checkbox"/> 32 Other <input type="checkbox"/>
Describe <b>Bentonite</b>		7. Fine sand material: Manufacturer, product name and mesh size	None
17. Source of water (attach analysis):		Volume added	ft <sup>3</sup>
		8. Filter pack material: Manufacturer, product name and mesh size	American Materials, #30 Flint
		Volume added	12.0 ft <sup>3</sup>
E. Bentonite seal, top	35.0 ft.	9. Well casing:	Flush threaded PVC schedule 40 <input type="checkbox"/> 23 Flush threaded PVC schedule 80 <input type="checkbox"/> 24 6.0" Black Pipe <input checked="" type="checkbox"/> Other <input type="checkbox"/>
F. Fine sand, top	ft.	10. Screen material:	Stainless Steel
G. Filter pack, top	37.0 ft.	Screen type:	Factory cut <input type="checkbox"/> 11 Continuous slot <input checked="" type="checkbox"/> 01 Other <input type="checkbox"/>
H. Well screen, top	38.0 ft.	Manufacturer	Johnson Screen Co.
I. Well screen, bottom	73.0 ft.	Slot size:	0.010 in.
J. Filter pack, bottom	74.0 ft.	Slotted length:	33.0 ft.
K. Borehole, bottom	74.0 ft.	11. Backfill material (below filter pack):	None <input checked="" type="checkbox"/> Other <input type="checkbox"/>
L. Borehole, diameter	10.0 in.		
M. O.D. well casing	6.50 in.		
N. I.D. well casing	6.00 in.		

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

Signature [Signature] Firm **Exploration Technology Inc.**

Please complete and return both sides of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with ch. 144, Wis. Stats., failure to file this form may result in a forfeiture of not less than \$10, nor more than \$5,000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than \$10,000 for each day of violation.

NOTE: Shaded areas are for DNR use only. See instructions for more information. -32-

Facility/Project Name <u>Cedar Falls Remediation</u> License, Permit or Monitoring Number _____		Well Name <u>FW-1</u> Wis. Unique Well Number _____ DNR Well Number _____	
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1. Can this well be purged dry? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  2. Well development method surged with bailer and bailed <input type="checkbox"/> 4 1 surged with bailer and pumped <input type="checkbox"/> 6 1 surged with block and bailed <input type="checkbox"/> 4 2 surged with block and pumped <input type="checkbox"/> 6 2 surged with block, bailed and pumped <input type="checkbox"/> 7 0 compressed air <input type="checkbox"/> 2 0 bailed only <input type="checkbox"/> 1 0 pumped only <input checked="" type="checkbox"/> 5 1 pumped slowly <input type="checkbox"/> 5 0 Other _____  3. Time spent developing well <u>142</u> min. 4. Depth of well (from top of well casing) <u>77.5</u> ft. 5. Inside diameter of well <u>1 0 0</u> in. 6. Volume of water in filter pack and well casing <u>1 3 4 2</u> gal. 7. Volume of water removed from well <u>334 6</u> gal. 8. Volume of water added (if any) <u>0</u> gal. 9. Source of water added _____  10. Analysis performed on water added? <input type="checkbox"/> Yes <input type="checkbox"/> No (If yes, attach results)	11. Depth to Water (from top of well casing) Before Development <u>44 95</u> ft. After Development <u>45 5</u> ft.  Date <u>08 / 16 / 91</u> m m d d y y Time <u>10 23</u> <input checked="" type="checkbox"/> a.m. <input type="checkbox"/> p.m. 12. Sediment in well bottom <u>    </u> inches 13. Water clarity Clear <input type="checkbox"/> 10 Turbid <input checked="" type="checkbox"/> 15 (Describe) <u>suspended fine sediment</u> <u>clear-no suspended sediment</u>  Fill in if drilling fluids were used and well is at solid waste facility: 14. Total suspended solids _____ mg/l 15. COD _____ mg/l
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Additional comments on development:

Well developed by: Person's Name and Firm <u>Scott Cruise</u> <u>Exploration Technology Inc.</u>	I hereby certify that the above information is true and correct to the best of my knowledge. Signature: <u>Scott Cruise</u> Firm: <u>Exploration Technology Inc.</u>
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NOTE: Shaded areas are for DNR use only. See instructions for more information.

Facility/Project Name <b>Cedar Falls Remediation</b>	Grid Location ft. <input type="checkbox"/> N. <input type="checkbox"/> S. ft. <input type="checkbox"/> E. <input type="checkbox"/> W.	Well Name <b>EW-2A EW-2</b>
Facility License, Permit or Monitoring Number		Wis. Unique Well Number <b>DNR Well Number</b>
Type of Well Water Table Observation Well <input type="checkbox"/> 11 Extraction Well <input checked="" type="checkbox"/> 12	Section Location <b>SW 1/4 of NE 1/4 of Section 6</b>	Date Well Installed <b>08 / 05 / 91</b> m m d d y y
Distance Well Is From Waste/Source Boundary ft.	T <b>28</b> N, R <b>12</b> <input type="checkbox"/> E <input checked="" type="checkbox"/> W	Well Installed By: (Person's Name and Firm) <b>Dan North</b>
Is Well A Point of Enforcement Std. Application? <input type="checkbox"/> Yes <input type="checkbox"/> No	Location of Well Relative to Waste/Source <input type="checkbox"/> Upgradient <input type="checkbox"/> Sidegradient <input checked="" type="checkbox"/> Downgradient <input type="checkbox"/> Not Known	<b>Exploration Technology Inc.</b>

A. Protective pipe, top elevation	ft. MSL	1. Cap and lock?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
B. Well casing, top elevation	ft. MSL	2. Protective cover pipe:	
C. Land surface elevation	ft. MSL	a. Inside diameter:	6.0 in.
D. Surface seal, bottom	ft. MSL or 2.0 ft.	b. Length:	ft.
		c. Material:	Steel <input checked="" type="checkbox"/> 0.4 Other <input type="checkbox"/>
12. USCS classification of soil near screen:		d. Additional protection?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<input type="checkbox"/> GP <input type="checkbox"/> GM <input type="checkbox"/> GC <input type="checkbox"/> GW <input type="checkbox"/> SW <input type="checkbox"/> SP		If yes, describe:	<b>Locking Well Cover</b>
<input type="checkbox"/> SM <input type="checkbox"/> SC <input type="checkbox"/> ML <input type="checkbox"/> MH <input type="checkbox"/> CL <input type="checkbox"/> CH		3. Surface seal:	Bentonite <input type="checkbox"/> 3.0 Concrete <input checked="" type="checkbox"/> 0.1 Other <input type="checkbox"/>
<input checked="" type="checkbox"/> Bedrock		4. Material between well casing and protective pipe:	Bentonite <input type="checkbox"/> 3.0 Annular space seal <input type="checkbox"/>
13. Sieve analysis attached? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		5. Annular space seal:	Granular Bentonite <input type="checkbox"/> 3.3 Lbs/gal mud weight ... Bentonite-sand slurry <input type="checkbox"/> 3.5 Lbs/gal mud weight ... Bentonite slurry <input type="checkbox"/> 3.1 5 % Bentonite ... Bentonite-cement grout <input checked="" type="checkbox"/> 5.0 12.7 Ft <sup>3</sup> volume added for any of the above
14. Drilling method used:	Rotary <input checked="" type="checkbox"/> 5.0 Hollow Stem Auger <input type="checkbox"/> 4.1 Other <input type="checkbox"/>	How installed:	Tremie <input type="checkbox"/> 0.1 Tremie pumped <input checked="" type="checkbox"/> 0.2 Gravity <input type="checkbox"/> 0.8
15. Drilling fluid used: Water <input checked="" type="checkbox"/> 0.2 Air <input type="checkbox"/> 0.1 Drilling Mud <input checked="" type="checkbox"/> 0.3 None <input type="checkbox"/> 9.9		6. Bentonite seal:	Bentonite granules <input type="checkbox"/> 3.3 <input type="checkbox"/> 1/4 in. <input type="checkbox"/> 3/8 in. <input type="checkbox"/> 1/2 in. Bentonite pellets <input type="checkbox"/> 3.2 None <input type="checkbox"/> Other <input type="checkbox"/>
16. Drilling additives used? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		7. Fine sand material:	Manufacturer, product name and mesh size
Describe <b>Pure Bentonite</b>		Volume added	ft <sup>3</sup>
17. Source of water (attach analysis):		8. Filter pack material:	Manufacturer, product name and mesh size
		Volume added	ft <sup>3</sup>
E. Cement Grout	ft. MSL or 51.0 ft.	9. Well casing:	Flush threaded PVC schedule 40 <input type="checkbox"/> 2.3 Flush threaded PVC schedule 80 <input type="checkbox"/> 2.4 6.0" Black Pipe <input checked="" type="checkbox"/>
F. Fine sand, top	ft. MSL or	10. Screen material:	None Open Hole <input checked="" type="checkbox"/>
G. Filter pack, top	ft. MSL or	Screen type:	Factory cut <input type="checkbox"/> 1.1 Continuous slot <input type="checkbox"/> 0.1 Other <input type="checkbox"/>
H. Well screen, top	ft. MSL or	Manufacturer	
I. Well screen, bottom	ft. MSL or	Slot size:	0. in.
J. Filter pack, bottom	ft. MSL or	Slotted length:	ft.
K. Borehole, bottom	ft. MSL or 80.0 ft.	11. Backfill material (below filter pack):	None <input type="checkbox"/> Other <input type="checkbox"/>
L. Borehole, diameter	10.0 in. 6.0" Into Rock		
M. O.D. well casing	6.50 in.		
N. I.D. well casing	6.00 in.		

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

Signature 

Firm

**Exploration Technology Inc.**

Please complete and return both sides of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with ch. 144, Wis. Stats., failure to file this form may result in a forfeiture of not less than \$10, nor more than \$5,000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than \$10,000 for each day of violation.

NOTE: Shaded areas are for DNR use only. See instructions for more information.

Facility/Project Name Cedar Falls Remediation		Well Name EW-2A EW-2	
License, Permit or Monitoring Number _____		Wis. Unique Well Number _____ DNR Well Number _____	
<p>1. Can this well be purged dry? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>2. Well development method</p> <p>surged with bailer and bailed <input type="checkbox"/> 4 1</p> <p>surged with bailer and pumped <input type="checkbox"/> 6 1</p> <p>surged with block and bailed <input type="checkbox"/> 4 2</p> <p>surged with block and pumped <input type="checkbox"/> 6 2</p> <p>surged with block, bailed and pumped <input type="checkbox"/> 7 0</p> <p>compressed air <input type="checkbox"/> 2 0</p> <p>bailed only <input type="checkbox"/> 1 0</p> <p>pumped only <input checked="" type="checkbox"/> 5 1</p> <p>pumped slowly <input type="checkbox"/> 5 0</p> <p>Other _____ <input type="checkbox"/> _____</p> <p>3. Time spent developing well _____ 3 4 0 min.</p> <p>4. Depth of well (from top of well casing) _____ 8 3 . _____ ft.</p> <p>5. Inside diameter of well _____ 6 . 0 _____ in.</p> <p>6. Volume of water in filter pack and well casing _____ 4 8 . 7 _____ gal.</p> <p>7. Volume of water removed from well 1050 . 0 _____ gal.</p> <p>8. Volume of water added (if any) _____ 0 _____ gal.</p> <p>9. Source of water added _____</p> <p>10. Analysis performed on water added? <input type="checkbox"/> Yes <input type="checkbox"/> No (If yes, attach results)</p>		<p>11. Depth to Water (from top of well casing)</p> <p>Before Development: _____ 4 9 8 5 _____ ft.</p> <p>After Development: _____ 4 9 9 2 _____ ft.</p> <p>Date: _____ 0 8 / 2 3 / 9 1 _____ m m d d y y</p> <p>Time: _____ 7 : 15 _____ a.m. p.m.</p> <p>12. Sediment in well bottom _____ inches</p> <p>13. Water clarity</p> <p>Clear <input type="checkbox"/> 10</p> <p>Turbid <input checked="" type="checkbox"/> 15</p> <p>(Describe) _____</p> <p>Clear <input checked="" type="checkbox"/> 20</p> <p>Turbid <input type="checkbox"/> 25</p> <p>(Describe) _____</p> <p>much suspended fine sediment</p> <p>clear slight lemonade appearance</p> <p>Fill in if drilling fluids were used and well is at solid waste facility:</p> <p>14. Total suspended solids _____ mg/l</p> <p>15. COD _____ mg/l</p>	

Additional comments on development:

Well developed by: Person's Name and Firm <i>John T. Cruise</i> <i>JRT HYDRO, INC.</i>	I hereby certify that the above information is true and correct to the best of my knowledge.
Name: <u>Scott Cruise</u>	Signature: <u><i>Scott Cruise</i></u>
Firm: <u>Exploration Technology Inc.</u>	Firm: <u>Exploration Technology Inc.</u>

NOTE: Shaded areas are for DNR use only. See instructions for more information.

Facility/Project Name <b>Cedar Falls Remediation</b>	Grid Location _____ ft. <input type="checkbox"/> N. <input type="checkbox"/> S. _____ ft. <input type="checkbox"/> E. <input type="checkbox"/> W.	Well Name <b>EW-2B/ MW-15</b>
Facility License, Permit or Monitoring Number _____		Wis. Unique Well Number _____ DNR Well Number _____
Type of Well Water Table Observation Well <input checked="" type="checkbox"/> 11 Piezometer <input type="checkbox"/> 12	Section Location <b>SW 1/4 of NE 1/4 of Section 6</b>	Date Well Installed <b>07 / 29 / 91</b> m m d d y y
Distance Well Is From Waste/Source Boundary _____ ft.	T <b>28</b> N, R <b>12</b> <input type="checkbox"/> E <input checked="" type="checkbox"/> W	Well Installed By: (Person's Name and Firm) <b>Dan North</b> <b>Exploration Technology Inc.</b>
Is Well A Point of Enforcement Std. Application? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Location of Well Relative to Waste/Source <input type="checkbox"/> Upgradient <input type="checkbox"/> Sidegradient <input type="checkbox"/> Downgradient <input type="checkbox"/> Not Known	

A. Protective pipe, top elevation _____ ft. MSL	1. Cap and lock? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
B. Well casing, top elevation _____ ft. MSL	2. Protective cover pipe: a. Inside diameter: _____ in. b. Length: _____ ft. c. Material: Steel <input checked="" type="checkbox"/> 04 Other <input type="checkbox"/>
C. Land surface elevation _____ ft. MSL	d. Additional protection? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If yes, describe: <u>expanding well cap</u>
D. Surface seal, bottom _____ ft. MSL or _____ ft.	3. Surface seal: Bentonite <input type="checkbox"/> 30 Concrete <input checked="" type="checkbox"/> 01 Other <input type="checkbox"/>
12. USCS classification of soil near screen: <input type="checkbox"/> GP <input type="checkbox"/> GM <input type="checkbox"/> GC <input type="checkbox"/> GW <input checked="" type="checkbox"/> SW <input type="checkbox"/> SP <input type="checkbox"/> SM <input type="checkbox"/> SC <input type="checkbox"/> ML <input type="checkbox"/> MH <input type="checkbox"/> CL <input type="checkbox"/> CH <input type="checkbox"/> Bedrock	4. Material between well casing and protective pipe: Bentonite <input type="checkbox"/> 30 Annular space seal <input type="checkbox"/> Other <input type="checkbox"/>
13. Sieve analysis attached? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	5. Annular space seal: Granular Bentonite <input type="checkbox"/> 33 Lbs/gal mud weight . . . Bentonite-sand slurry <input type="checkbox"/> 35 Lbs/gal mud weight . . . Bentonite slurry <input type="checkbox"/> 31 <u>5</u> % Bentonite . . . Bentonite-cement grout <input checked="" type="checkbox"/> 50 <u>9.0</u> Ft <sup>3</sup> volume added for any of the above
14. Drilling method used: Rotary <input type="checkbox"/> 50 Hollow Stem Auger <input checked="" type="checkbox"/> 41 Other <input type="checkbox"/>	How installed: Tremie <input type="checkbox"/> 01 Tremie pumped <input checked="" type="checkbox"/> 02 Gravity <input type="checkbox"/> 08
15. Drilling fluid used: Water <input type="checkbox"/> 02 Air <input type="checkbox"/> 01 Drilling Mud <input type="checkbox"/> 03 None <input checked="" type="checkbox"/> 99	6. Bentonite seal: Bentonite granules <input type="checkbox"/> 33 <input type="checkbox"/> 1/4 in. <input type="checkbox"/> 3/8 in. <input checked="" type="checkbox"/> 1/2 in. Bentonite pellets <input type="checkbox"/> 32 Other <input type="checkbox"/>
16. Drilling additives used? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	7. Fine sand material: Manufacturer, product name and mesh size <u>Wedron #530</u> Volume added _____ ft <sup>3</sup>
Describe _____	8. Filter pack material: Manufacturer, product name and mesh size <u>American Materials #30 Flint</u> Volume added <u>6.0</u> ft <sup>3</sup>
17. Source of water (attach analysis): _____	9. Well casing: Flush threaded PVC schedule 40 <input checked="" type="checkbox"/> 23 Flush threaded PVC schedule 80 <input type="checkbox"/> 24 Other <input type="checkbox"/>
E. Bentonite seal, top _____ ft. MSL or <u>33.0</u> ft.	10. Screen material: <u>PVC</u> Screen type: Factory cut <input checked="" type="checkbox"/> 11 Continuous slot <input type="checkbox"/> 01 Other <input type="checkbox"/>
F. Fine sand, top _____ ft. MSL or <u>35.0</u> ft.	Manufacturer <u>Diedrich Drilling equipment</u> Slot size: <u>0.010</u> in. Slotted length: <u>13.5</u> ft.
G. Filter pack, top _____ ft. MSL or <u>36.0</u> ft.	11. Backfill material (below filter pack): None <input checked="" type="checkbox"/> Other <input type="checkbox"/>
H. Well screen, top _____ ft. MSL or <u>38.0</u> ft.	
I. Well screen, bottom _____ ft. MSL or <u>53.0</u> ft.	
J. Filter pack, bottom _____ ft. MSL or <u>55.0</u> ft.	
K. Borehole, bottom _____ ft. MSL or <u>55.0</u> ft.	
L. Borehole, diameter <u>8.0</u> in.	
M. O.D. well casing <u>2.40</u> in.	
N. I.D. well casing <u>2.01</u> in.	

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

Signature \_\_\_\_\_

Firm

Exploration Technology Inc.

Please complete and return both sides of this form as required by chs. 144, 147 and 160, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with ch. 144, Wis. Stats., failure to file this form may result in a forfeiture of not less than \$10, nor more than \$5,000 for each day of violation. In accordance with ch. 147, Wis. Stats., failure to file this form may result in a forfeiture of not more than \$10,000 for each day of violation.  
NOTE: Shaded areas are for DNR use only. See instructions for more information.

Facility/Project Name <b>Cedar Falls Remediation</b>		Well Name <b>EW-2B/ MW-15</b>	
License, Permit or Monitoring Number _____		Wis. Unique Well Number _____	
DNR Well Number _____			

		Before Development	After Development
1. Can this well be purged dry? <span style="float:right;"><input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</span>			
2. Well development method			
surged with bailer and bailed	<input checked="" type="checkbox"/> 4 1		
surged with bailer and pumped	<input type="checkbox"/> 6 1		
surged with block and bailed	<input type="checkbox"/> 4 2		
surged with block and pumped	<input type="checkbox"/> 6 2		
surged with block, bailed and pumped	<input type="checkbox"/> 7 0		
compressed air	<input type="checkbox"/> 2 0		
bailed only	<input type="checkbox"/> 1 0		
pumped only	<input type="checkbox"/> 5 1		
pumped slowly	<input type="checkbox"/> 5 0		
Other _____	<input type="checkbox"/> <span style="background-color: #cccccc; padding: 2px;">  </span>		
3. Time spent developing well	9 5 min.		
4. Depth of well (from top of well casing)	53.2 ft.		
5. Inside diameter of well	1.913 in.		
6. Volume of water in filter pack and well casing	6.6 gal.		
7. Volume of water removed from well after 30 minutes of surge and bail	45.0 gal.		
8. Volume of water added (if any)	0 gal.		
9. Source of water added	NA		
10. Analysis performed on water added? <span style="float:right;"><input type="checkbox"/> Yes <input type="checkbox"/> No</span>	(If yes, attach results)		

	Before Development	After Development
11. Depth to Water (from top of well casing)	44.23 ft.	44.25 ft.
Date	08/07/91 m m d d y y	08/07/91 m m d d y y
Time	3:45 <input type="checkbox"/> a.m. <input checked="" type="checkbox"/> p.m.	5:45 <input type="checkbox"/> a.m. <input checked="" type="checkbox"/> p.m.
12. Sediment in well bottom	inches	inches
13. Water clarity	Clear <input type="checkbox"/> 10 Turbid <input checked="" type="checkbox"/> 15 (Describe) <u>suspended fine sediment</u>	Clear <input checked="" type="checkbox"/> 20 Turbid <input type="checkbox"/> 25 (Describe) <u>clear, no suspended sediment</u>
Fill in if drilling fluids were used and well is at solid waste facility:		
14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

Additional comments on development:

Well developed by: Person's Name and Firm <div style="text-align: center;">   <b>SCOTT CRUISE</b>  <b>EXPLORATION TECHNOLOGY INC.</b> </div>	I hereby certify that the above information is true and correct to the best of my knowledge. <div style="text-align: center;">   <b>SCOTT CRUISE</b>  <b>EXPLORATION TECHNOLOGY INC.</b> </div>
---------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

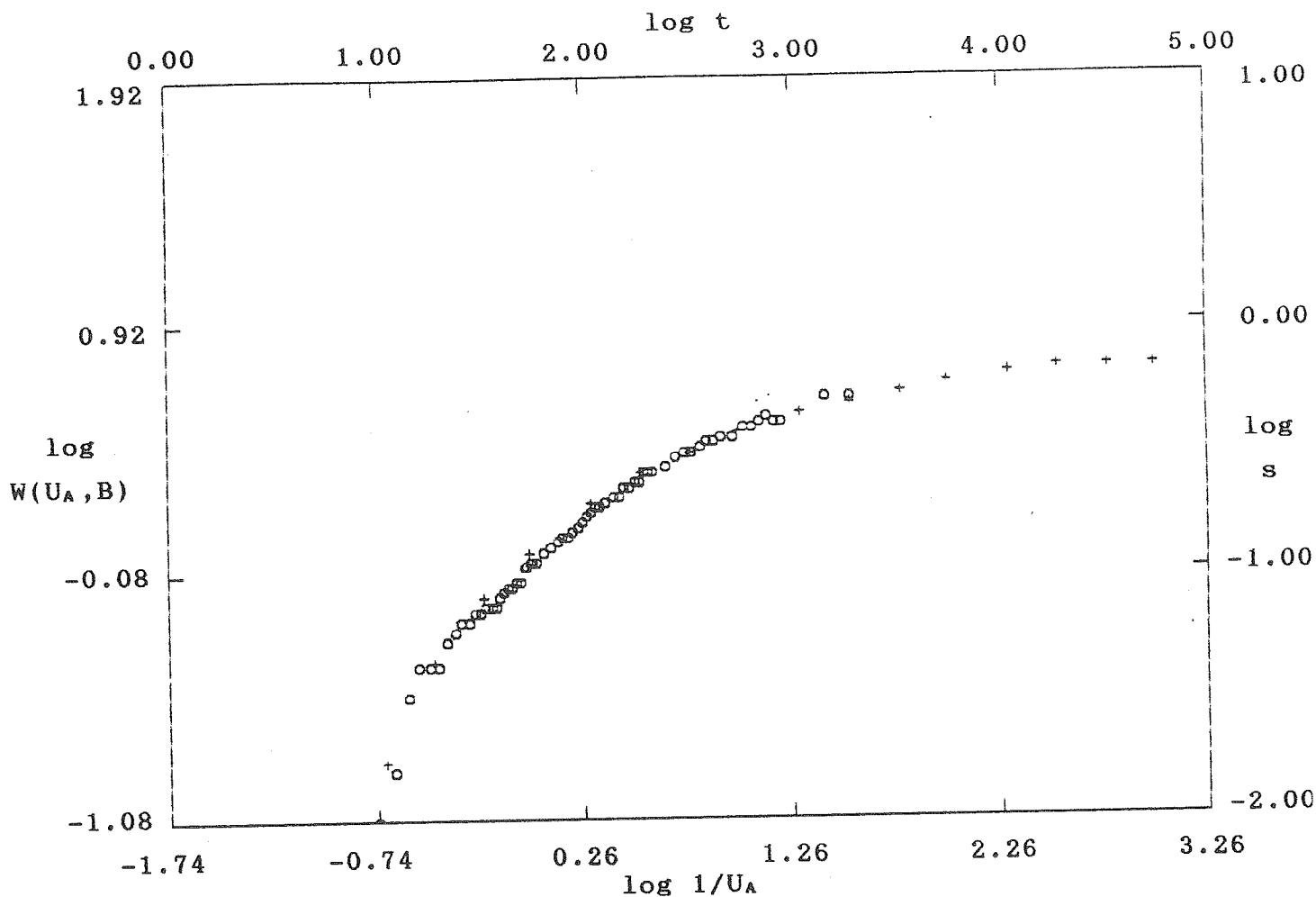
NOTE: Shaded areas are for DNR use only. See instructions for more information.

Appendix D

Pumping Test Data for EW-1

# DRAWDOWN DATA CFS #1

FOR EW-1



o - Data

+ - Type Curve

Unconfined Elastic:  $\beta = 0.001$

## SOLUTION

Transmissivity =  $1.03E+004$  gal/day/ft  
 Aquifer Thick. =  $2.00E+001$  ft  
 Hydraulic Cond. =  $5.15E+002$  gal/day/sq ft  
 Storativity =  $4.26E-003$

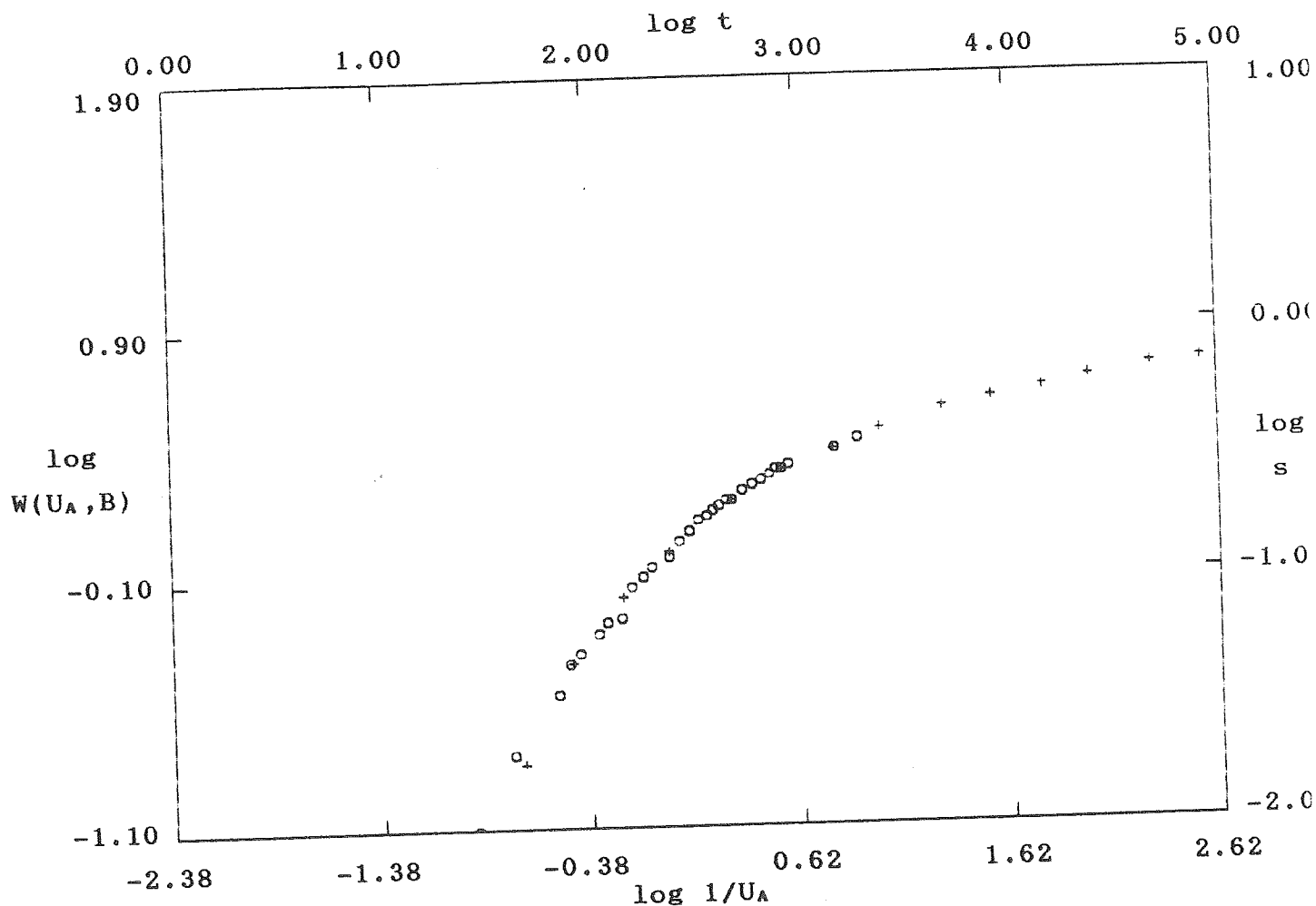


## Data for Pump Test

Well Name: CFS1 FOR EW-1 Date of Test: 10/5/91  
 Aquifer Thickness (b): 20.000 feet  
 Pumped Well Discharge(Q) = 10.800 gpm  
 Radius of Pumping Well = 0.025 feet  
 Distance of Observation Well from Pumping Well = 111.000 feet

Entry No.	Time(t) (min.)	Drawdown(s) (ft.)	$\frac{t}{d^2}$ (min./sq.ft.)
1	2.000	0.000	1.6E-004
2	4.000	0.000	3.2E-004
3	6.000	0.000	4.9E-004
4	8.000	0.005	6.5E-004
5	10.000	0.010	8.1E-004
6	12.000	0.016	9.7E-004
7	14.000	0.031	1.1E-003
8	16.000	0.042	1.3E-003
9	18.000	0.042	1.5E-003
10	20.000	0.042	1.6E-003
11	22.000	0.052	1.8E-003
12	24.000	0.057	1.9E-003
13	26.000	0.063	2.1E-003
14	28.000	0.063	2.3E-003
15	30.000	0.068	2.4E-003
16	32.000	0.068	2.6E-003
17	34.000	0.073	2.8E-003
18	36.000	0.073	2.9E-003
19	38.000	0.073	3.1E-003
20	40.000	0.078	3.2E-003
21	42.000	0.083	3.4E-003
22	44.000	0.088	3.6E-003
23	46.000	0.088	3.7E-003
24	48.000	0.093	3.9E-003
25	50.000	0.093	4.1E-003
26	52.000	0.104	4.2E-003
27	54.000	0.104	4.4E-003
28	56.000	0.109	4.5E-003
29	58.000	0.109	4.7E-003
30	60.000	0.109	4.9E-003
31	65.000	0.120	5.3E-003
32	70.000	0.125	5.7E-003
33	75.000	0.130	6.1E-003
34	80.000	0.135	6.5E-003
35	85.000	0.141	6.9E-003
36	90.000	0.146	7.3E-003
37	95.000	0.151	7.7E-003
38	100.000	0.156	8.1E-003
39	105.000	0.167	8.5E-003
40	110.000	0.177	8.9E-003
41	115.000	0.182	9.3E-003
42	120.000	0.182	9.7E-003
43	130.000	0.188	1.1E-002
44	140.000	0.198	1.1E-002
45	150.000	0.203	1.2E-002
46	160.000	0.219	1.3E-002
47	170.000	0.219	1.4E-002
48	180.000	0.224	1.5E-002
49	190.000	0.224	1.5E-002
50	200.000	0.250	1.6E-002
51	210.000	0.250	1.7E-002
52	220.000	0.250	1.8E-002
53	250.000	0.260	2.0E-002
54	280.000	0.292	2.3E-002
55	310.000	0.307	2.5E-002
56	340.000	0.307	2.8E-002
57	370.000	0.323	3.0E-002
58	400.000	0.328	3.2E-002
59	430.000	0.330	3.5E-002
60	464.000	0.340	3.8E-002
61	524.000	0.354	4.3E-002
62	584.000	0.375	4.7E-002
63	644.000	0.375	5.2E-002
64	704.000	0.396	5.7E-002
65	764.000	0.411	6.2E-002
66	824.000	0.396	6.7E-002
67	884.000	0.400	7.2E-002
68	1460.000	0.500	1.2E-001
69	1887.000	0.500	1.5E-001

# DRAWDOWN DATA MW-8 FOR EW-1



o - Data

+ - Type Curve

Unconfined Elastic:  $\beta = 0.001$

## SOLUTION

Transmissivity =  $9.65\text{E}+003$  gal/day/ft  
 Aquifer Thick. =  $2.16\text{E}+001$  ft  
 Hydraulic Cond. =  $4.46\text{E}+002$  gal/day/sq ft  
 Storativity =  $1.49\text{E}-002$

# Data for Pump Test

Well Name: MW-8 For EW-1 Date of Test: 10/5/91  
 Aquifer Thickness (b): 21.640 feet  
 Pumped Well Discharge(Q) = 10.600 gpm  
 Radius of Pumping Well = 0.250 feet  
 Distance of Observation Well from Pumping Well = 119.900 feet

Entry No.	Time(t) (min.)	Drawdown(s) (ft.)	$\frac{t}{d^2}$ (min./sq.ft.)
*****	*****	*****	*****
1	0.000	0.000	
2	28.000	0.010	1.9E-003
3	43.000	0.020	3.0E-003
4	70.000	0.035	4.9E-003
5	80.000	0.045	5.6E-003
6	90.000	0.050	6.3E-003
7	110.000	0.060	7.7E-003
8	120.000	0.065	8.3E-003
9	140.000	0.070	9.7E-003
10	160.000	0.090	1.1E-002
11	180.000	0.100	1.3E-002
12	200.000	0.110	1.4E-002
13	240.000	0.120	1.7E-002
14	270.000	0.140	1.9E-002
15	300.000	0.150	2.1E-002
16	330.000	0.165	2.3E-002
17	360.000	0.175	2.5E-002
18	390.000	0.180	2.7E-002
19	420.000	0.190	2.9E-002
20	450.000	0.195	3.1E-002
21	480.000	0.200	3.3E-002
22	540.000	0.220	3.8E-002
23	600.000	0.230	4.2E-002
24	660.000	0.240	4.6E-002
25	720.000	0.250	5.0E-002
26	780.000	0.260	5.4E-002
27	840.000	0.260	5.8E-002
28	900.000	0.270	6.3E-002
29	1494.000	0.320	1.0E-001
30	1904.000	0.340	1.3E-001

## Data for Pump Test

Well Name: EW-1 Date of Test: 10/5/91  
 Aquifer Thickness (b): 40.000 feet  
 Pumped Well Discharge(Q) = 10.600 gpm  
 Radius of Pumping Well = 0.250 feet  
 Distance of Observation Well from Pumping Well = 1.000 feet

Entry No.	Time(t) (min.)	Drawdown(s) (ft.)	$\frac{t}{d^2}$ (min./sq.ft.)
1	0.500	0.410	5.0E+001
2	1.000	0.450	1.0E+000
3	1.500	0.460	1.5E+000
4	2.000	0.470	2.0E+000
5	2.500	0.470	2.5E+000
6	3.000	0.480	3.0E+000
7	3.500	0.480	3.5E+000
8	4.000	0.480	4.0E+000
9	4.500	0.480	4.5E+000
10	5.000	0.480	5.0E+000
11	5.500	0.485	5.5E+000
12	6.000	0.490	6.0E+000
13	6.500	0.490	6.5E+000
14	7.000	0.490	7.0E+000
15	8.000	0.500	8.0E+000
16	9.000	0.500	9.0E+000
17	10.000	0.510	1.0E+001
18	11.000	0.510	1.1E+001
19	12.000	0.510	1.2E+001
20	13.000	0.520	1.3E+001
21	14.000	0.520	1.4E+001
22	15.000	0.520	1.5E+001
23	20.000	0.550	2.0E+001
24	25.000	0.590	2.5E+001
25	30.000	0.600	3.0E+001
26	35.000	0.600	3.5E+001
27	40.000	0.600	4.0E+001
28	45.000	0.600	4.5E+001
29	50.000	0.620	5.0E+001
30	55.000	0.600	5.5E+001
31	60.000	0.640	6.0E+001
32	65.000	0.650	6.5E+001
33	70.000	0.680	7.0E+001
34	89.000	0.820	8.9E+001
35	120.000	0.870	1.2E+002
36	150.000	0.820	1.5E+002
37	180.000	0.910	1.8E+002
38	210.000	0.860	2.1E+002
39	240.000	0.870	2.4E+002
40	270.000	0.890	2.7E+002
41	300.000	0.910	3.0E+002
42	330.000	1.050	3.3E+002
43	360.000	1.050	3.6E+002
44	390.000	1.070	3.9E+002
45	420.000	1.120	4.2E+002
46	450.000	1.100	4.5E+002
47	480.000	1.150	4.8E+002
48	510.000	1.180	5.1E+002
49	570.000	1.210	5.7E+002
50	630.000	1.250	6.3E+002
51	690.000	1.275	6.9E+002
52	750.000	1.290	7.5E+002
53	810.000	1.330	8.1E+002
54	870.000	1.340	8.7E+002
55	1455.000	1.450	1.5E+003
56	1875.000	1.610	1.9E+003

RUN

A PROGRAM TO ESTIMATE AQUIFER TRANSMISSIVITY  
AND HYDRAULIC CONDUCTIVITY  
FROM SPECIFIC CAPACITY TESTS

WRITTEN BY K. BRADBURY AND E. ROTHSCHILD, SEPTEMBER 1981

\*\*\*\*\*  
\*\*\*\*\*LIST OF VARIABLES\*\*\*\*\*

NUM = IDENTIFICATION NUMBER OF WELL  
DIAM = DIAMETER OF WELL (INCHES)  
LGTH = LENGTH OF OPEN INTERVAL OR WELL SCREEN (FEET)  
LVL = STATIC WATER LEVEL.. NEGATIVE FOR FLOWING WELL (DEPTH I N FEET)  
PUMP = DEPTH TO WATER WHILE PUMPING DURING SPECIFIC CAPACITY TEST (FEET)  
LN = LENGHT OF TEST (HOURS)  
GPM = PUMPING RATE DURING EST (GALLONS/MINUTE)  
AQTHIC = THICKNESS OF AQUIFER (FEET)  
S = ESTIMATED OR MEASURE STORAGE COEFFICIENT (UNITLESS)  
C = WELL LOSS COEFFICIENT (WALTON, BULL 49)..USE 1 IF UNKNOWN  
SC = SPECIFIC CAPACITY CORRECTED FOR WELL LOSS (GALLONS/MINUTE /FOOT)  
T = TRANSMISSIVITY (FEET \* FEET/SECOND)  
K = HYDRAULIC CONDUCTIVITY (FEET/SECOND)  
ERR = CONVERGENCE CRITERIA FOR T ESTIMATE (FEET \* FEET/SECOND)  
\*\*\*\*\*

HOW MANY WELLS WILL BE ANALYZED?

? 1  
DO YOU WANT TO ENTER DATA INTERACTIVELY OR FROM A FILE?  
ENTER 0 IF INTERACTIVELY OR 1 IF FROM FILE

? 0  
WELL NUMBER=

? EW1  
Redo from start

? 1  
WELL DIAMETER (IN)=

? 6  
STATIC WATER LEVEL (FT)=

? 44.01  
DEPTH TO WATER DURING TEST (FT)=

? 45.61  
THE LENGTH OF THE TEST (HR)=

? 31.25  
PUMPING RATE (GPM)=

? 10.6  
THICKNESS OF AQUIFER (FT)=

? 40  
OPEN INTERVAL (FT)=

? 30  
STORAGE COEFFICIENT=

? .01  
WELL LOSS COEFFICIENT=

? 1  
CHANGED 1140 PR# 1

\*\*\*\*\*  
AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF  
SPECIFIC CAPACITY TESTS  
\*\*\*\*\*

WELL NUMBER 1 EW-1  
SPECIFIC CAPACITY (GPM/FT) = 6.62686  
TRANSMISSIVITY (FT\*FT/SEC) = 1.899919E-02  
USING A STORAGE COEFFICIENT = .01  
NUMBER OF ITERATIONS = 4  
HYDRAULIC CONDUCTIVITY (FT/SEC) = 4.749797E-04  
THE NUMBER OF WELLS IN THIS RECORD IS 1  
Ok

THICKNESS OF AQUIFER (FT)=

? 40  
OPEN INTERVAL (FT)=

? 30  
STORAGE COEFFICIENT=

? .01  
WELL LOSS COEFFICIENT=

? 1  
CHANGED 1140 PR# 1

\*\*\*\*\*  
AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF  
SPECIFIC CAPACITY TESTS  
\*\*\*\*\*

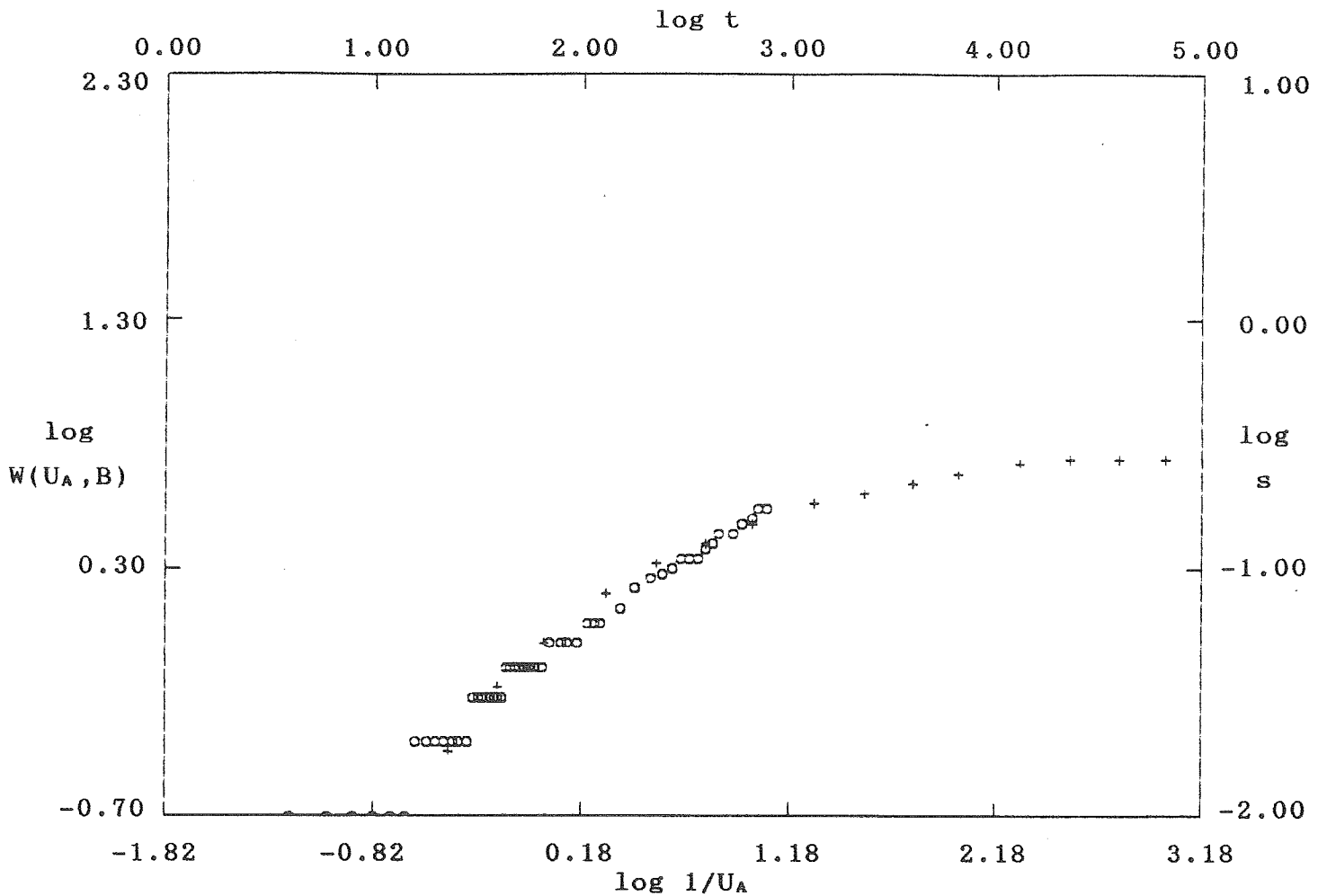
WELL NUMBER 1  
SPECIFIC CAPACITY (GPM/FT) = 6.62686  
TRANSMISSIVITY (FT\*FT/SEC) = 1.899919E-02  
USING A STORAGE COEFFICIENT = .01  
NUMBER OF ITERATIONS = 4  
HYDRAULIC CONDUCTIVITY (FT/SEC) = 4.749797E-04  
THE NUMBER OF WELLS IN THIS RECORD IS 1  
Ok

12274 43 5/11/77  
14477 x .54 = 1.45 x 10<sup>2</sup>  
3067 2/11/77

Appendix E

Pumping Test Data for EW-2

# DRAWDOWN DATA MW-8 FOR EW2



o - Data

+ - Type Curve

Unconfined Elastic:  $\beta = 0.001$

## SOLUTION

Transmissivity =  $1.43\text{E}+004$  gal/day/ft

Aquifer Thick. =  $2.16\text{E}+001$  ft

Hydraulic Cond. =  $6.61\text{E}+002$  gal/day/sq ft

Storativity =  $2.46\text{E}-003$

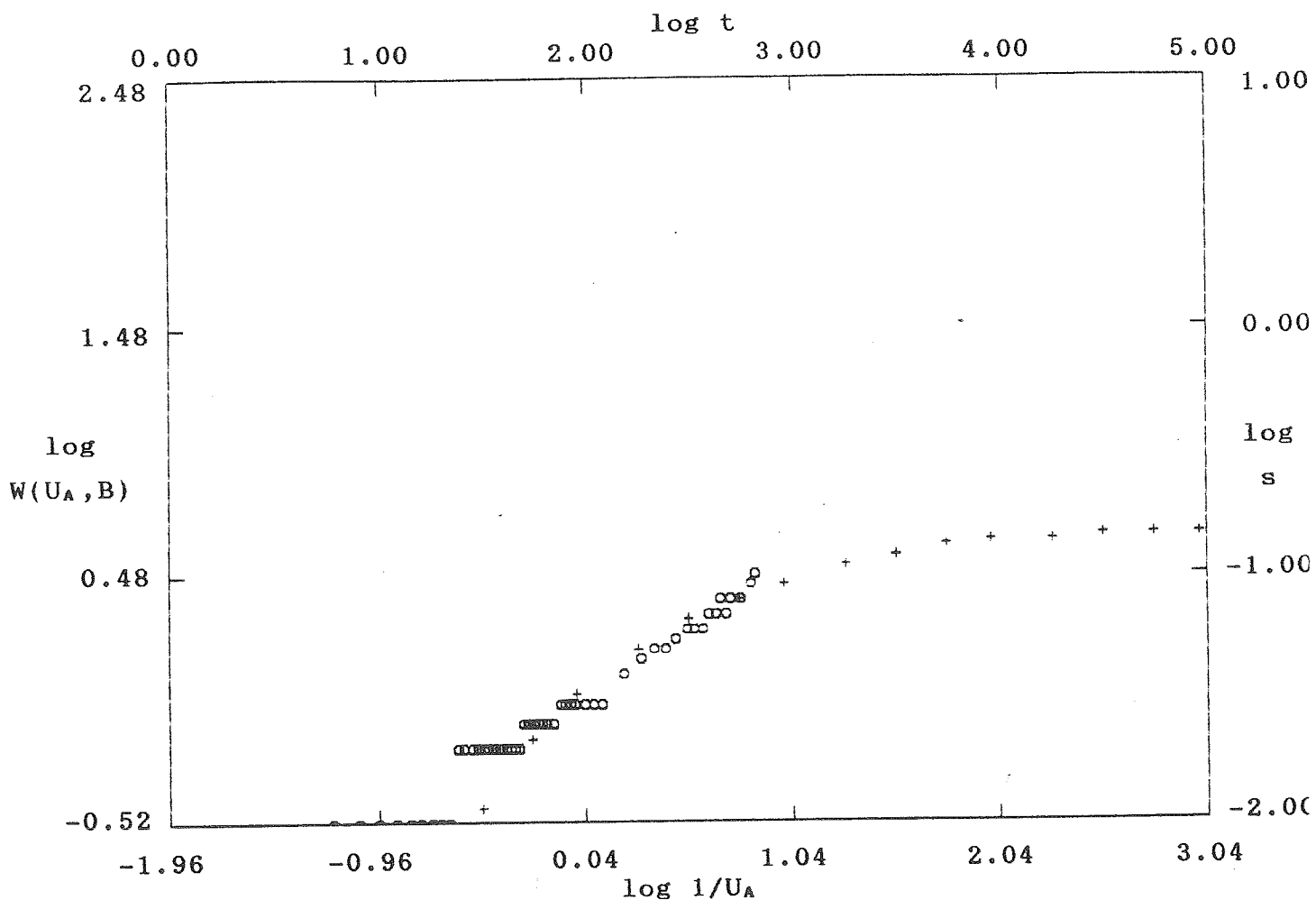
# Data for Pump Test

Well Name: MW-8 FOR EW-2 Date of Test: 10/8/91  
 Aquifer Thickness (b): 21.640 feet  
 Pumped Well Discharge(Q) = 6.260 gpm  
 Radius of Pumping Well = 0.250 feet  
 Distance of Observation Well from Pumping Well = 188.950 feet

Entry No.	Time(t) (min.)	Drawdown(s) (ft.)	$\frac{t}{d^2}$ (min./sq.ft.)
*****	*****	*****	*****
1	2.000	0.000	5.6E-005
2	4.000	0.010	1.1E-004
3	6.000	0.010	1.7E-004
4	8.000	0.010	2.2E-004
5	10.000	0.010	2.8E-004
6	12.000	0.010	3.4E-004
7	14.000	0.010	3.9E-004
8	16.000	0.020	4.5E-004
9	18.000	0.020	5.0E-004
10	20.000	0.020	5.6E-004
11	22.000	0.020	6.2E-004
12	24.000	0.020	6.7E-004
13	26.000	0.020	7.3E-004
14	28.000	0.020	7.8E-004
15	30.000	0.030	8.4E-004
16	32.000	0.030	9.0E-004
17	34.000	0.030	9.5E-004
18	36.000	0.030	1.0E-003
19	38.000	0.030	1.1E-003
20	40.000	0.030	1.1E-003
21	42.000	0.030	1.2E-003
22	44.000	0.040	1.2E-003
23	46.000	0.040	1.3E-003
24	48.000	0.040	1.3E-003
25	50.000	0.040	1.4E-003
26	52.000	0.040	1.5E-003
27	54.000	0.040	1.5E-003
28	56.000	0.040	1.6E-003
29	58.000	0.040	1.6E-003
30	60.000	0.040	1.7E-003
31	65.000	0.040	1.8E-003
32	70.000	0.050	2.0E-003
33	80.000	0.050	2.2E-003
34	85.000	0.050	2.4E-003
35	95.000	0.050	2.7E-003
36	106.000	0.060	3.0E-003
37	116.000	0.060	3.2E-003
38	124.000	0.060	3.5E-003
39	154.000	0.070	4.3E-003
40	184.000	0.085	5.2E-003
41	214.000	0.090	6.0E-003
42	244.000	0.095	6.8E-003
43	274.000	0.100	7.7E-003
44	304.000	0.110	8.5E-003
45	334.000	0.110	9.4E-003
46	367.000	0.110	1.0E-002
47	398.000	0.120	1.1E-002
48	431.000	0.125	1.2E-002
49	460.000	0.135	1.3E-002
50	539.000	0.140	1.5E-002
51	593.000	0.150	1.7E-002
52	659.000	0.160	1.8E-002
53	715.000	0.170	2.0E-002
54	780.000	0.170	2.2E-002



# DRAWDOWN DATA FOR MW-7 FOR EW2



o - Data

+ - Type Curve

Unconfined Elastic:  $\beta = 0.004$

## SOLUTION

Transmissivity =  $2.17E+004$  gal/day/ft

Aquifer Thick. =  $2.98E+001$  ft

Hydraulic Cond. =  $7.28E+002$  gal/day/sq ft

Storativity =  $1.43E-002$

# Data for Pump Test

Well Name: MW-7 FOR EW-2 Date of Test: 10/8/91  
 Aquifer Thickness (b): 29.770 feet  
 Pumped Well Discharge(Q) = 6.260 gpm  
 Radius of Pumping Well = 0.250 feet  
 Distance of Observation Well from Pumping Well = 113.270 feet

Entry No.	Time(t) (min.)	Drawdown(s) (ft.)	$\frac{t}{d^2}$ (min./sq.ft.)
1	0.000	0.000	
2	2.000	0.000	1.6E-004
3	4.000	0.000	3.1E-004
4	6.000	0.010	4.7E-004
5	8.000	0.010	6.2E-004
6	10.000	0.010	7.8E-004
7	12.000	0.010	9.4E-004
8	14.000	0.010	1.1E-003
9	16.000	0.010	1.2E-003
10	18.000	0.010	1.4E-003
11	20.000	0.010	1.6E-003
12	22.000	0.010	1.7E-003
13	24.000	0.020	1.9E-003
14	26.000	0.020	2.0E-003
15	28.000	0.020	2.2E-003
16	30.000	0.020	2.3E-003
17	32.000	0.020	2.5E-003
18	34.000	0.020	2.7E-003
19	36.000	0.020	2.8E-003
20	38.000	0.020	3.0E-003
21	40.000	0.020	3.1E-003
22	42.000	0.020	3.3E-003
23	44.000	0.020	3.4E-003
24	46.000	0.020	3.6E-003
25	48.000	0.020	3.7E-003
26	50.000	0.025	3.9E-003
27	52.000	0.025	4.1E-003
28	54.000	0.025	4.2E-003
29	56.000	0.025	4.4E-003
30	58.000	0.025	4.5E-003
31	60.000	0.025	4.7E-003
32	62.000	0.025	4.8E-003
33	64.000	0.025	5.0E-003
34	70.000	0.025	5.5E-003
35	75.000	0.030	5.8E-003
36	80.000	0.030	6.2E-003
37	85.000	0.030	6.6E-003
38	90.000	0.030	7.0E-003
39	100.000	0.030	7.8E-003
40	110.000	0.030	8.6E-003
41	120.000	0.030	9.4E-003
42	154.000	0.040	1.2E-002
43	185.000	0.045	1.4E-002
44	215.000	0.050	1.7E-002
45	245.000	0.050	1.9E-002
46	276.000	0.055	2.2E-002
47	306.000	0.060	2.4E-002
48	336.000	0.060	2.6E-002
49	371.000	0.060	2.9E-002
50	400.000	0.070	3.1E-002
51	428.000	0.070	3.3E-002
52	477.000	0.070	3.7E-002
53	445.000	0.080	3.5E-002
54	504.000	0.080	3.9E-002
55	567.000	0.080	4.4E-002
56	624.000	0.090	4.9E-002
57	667.000	0.100	5.2E-002

RUN

A PROGRAM TO ESTIMATE AQUIFER TRANSMISSIVITY  
AND HYDRAULIC CONDUCTIVITY  
FROM SPECIFIC CAPACITY TESTS

WRITTEN BY K. BRADBURY AND E. ROTHSCHILD, SEPTEMBER 1981

\*\*\*\*\*  
\*\*\*\*\*LIST OF VARIABLES\*\*\*\*\*

NUM = IDENTIFICATION NUMBER OF WELL  
DIAM = DIAMETER OF WELL (INCHES)  
LGTH = LENGTH OF OPEN INTERVAL OR WELL SCREEN (FEET)  
LVL = STATIC WATER LEVEL.. NEGATIVE FOR FLOWING WELL (DEPTH I N FEET)  
PUMP = DEPTH TO WATER WHILE PUMPING DURING SPECIFIC CAPACITY TEST (FEET)  
LN = LENGHT OF TEST (HOURS)  
GPM = PUMPING RATE DURING EST (GALLONS/MINUTE)  
AQTHIC = THICKNESS OF AQUIFER (FEET)  
S = ESTIMATED OR MEASURE STORAGE COEFFICIENT (UNITLESS)  
C = WELL LOSS COEFFICIENT (WALTON, BULL 49)..USE 1 IF UNKNOWN  
SC = SPECIFIC CAPACITY CORRECTED FOR WELL LOSS (GALLONS/MINUTE /FOOT)  
T = TRANSMISSIVITY (FEET \* FEET/SECOND)  
K = HYDRAULIC CONDUCTIVITY (FEET/SECOND)  
ERR = CONVERGENCE CRITERIA FOR T ESTIMATE (FEET \* FEET/SECOND)  
\*\*\*\*\*

HOW MANY WELLS WILL BE ANALYZED?

? 1

DO YOU WANT TO ENTER DATA INTERACTIVELY OR FROM A FILE?

ENTER 0 IF INTERACTIVELY OR 1 IF FROM FILE

? 0

WELL NUMBER=

? 2

WELL DIAMETER (IN)=

? 6

STATIC WATER LEVEL (FT)=

? 50.23

DEPTH TO WATER DURING TEST (FT)=

? 76.04

THE LENGTH OF THE TEST (HR)=

? 12.97

PUMPING RATE (GPM)=

? 6.26

THICKNESS OF AQUIFER (FT)=

? 29.77

OPEN INTERVAL (FT)=

? 29.77

STORAGE COEFFICIENT=

? .01

WELL LOSS COEFFICIENT=

? 1

CHANGED 1140 PR# 1

\*\*\*\*\*  
AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF  
SPECIFIC CAPACITY TESTS

\*\*\*\*\*

WELL NUMBER 2

SPECIFIC CAPACITY (GPM/FT) = .2425431

TRANSMISSIVITY (FT\*FT/SEC) = 4.330362E-04

USING A STORAGE COEFFICIENT = .01

NUMBER OF ITERATIONS = 4

HYDRAULIC CONDUCTIVITY (FT/SEC) = 1.454606E-05

THE NUMBER OF WELLS IN THIS RECORD IS 1

Ok

FIN ~

280 8/10/87

443 x 10<sup>-5</sup> m/sec

443 x 10<sup>-5</sup> m/sec

9.39 2/11/87