WARZYN

PROJECT
7005100

149200

VOLUME II OF IV

REMEDIAL INVESTIGATION

NORTH BRONSON INDUSTRIAL AREA
BRONSON, MICHIGAN

JULY 1993

PREPARED FOR:
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
LANSING, MICHIGAN

•••

PREPARED BY:
WARZYN INC.
NOVI, MICHIGAN

TABLE OF CONTENTS

Volume I of IV

EXECUTIVE SUMMARY ii

1

INTRODUCTION 1-1
1.1 RI Purpose and Objectives 1-2
1.2 Report Organization 1-2

2

SITE BACKGROUND 2-1
2.1 Site Description 2-1
2.2 Previous Investigations 2-2
2.3 Site History 2-3
2.4 Status of Private and Public Wells 2-12

3

REMEDIAL INVESTIGATION ACTIVITIES 3-1
3.1 Overview of RI Project Plans 3-1
3.2 Overview of RI Activities 3-2
3.3 Industrial Site Survey 3-3
3.4 Surface Geophysical Survey 3-4
3.5 Drilling, Soil Sampling, and Well Installation 3-5
3.5.1 Drilling and Sampling Procedures 3-5
3.5.2 Monitoring Well and Piezometer Installation and Development Procedures 3-8
3.5.3 Location and Elevation Survey 3-10
3.6 Waste Characterization 3-10
3.7 Surface Water, Sediment, and Outfall Sampling 3-14
3.8 Surface and Subsurface Soil Sampling 3-15
3.9 Groundwater Sampling 3-16
3.10 Groundwater Level Monitoring 3-18
3.11 Hydraulic Conductivity (Aquifer) Testing 3-18

4

PHYSICAL CHARACTERISTICS OF STUDY AREA....4-1
4.1 Surface Features and Topography....4-1
4.2 Hydrology....4-1
4.3 Site Geology....4-2
4.4 Site Hydrogeology....4-4
4.5 Demography and Land Use....4-7
4.6 Climatology....4-8

5

NATURE AND EXTENT OF CONTAMINATION....5-1
5.1 Introduction....5-1
5.2 Evaluation of Data Quality....5-1
5.3 Discussion of Presentation Approach....5-4
5.4 Background Samples....5-7
5.4.1 Background Surface Soils....5-8
5.4.2 Background Subsurface Soils....5-8
5.4.3 Background Groundwater Wells....5-9
5.4.4 Private Wells....5-10
5.4.5 Background Surface Water in CD#30....5-12
5.4.6 Background Sediments....5-13
5.5 Industrial Complex Area....5-14
5.5.1 LA Darling Subarea....5-15
5.5.2 Scott Fetzer Subarea....5-22
5.5.3 Abandoned Industrial Sewer Subarea....5-31
5.5.4 Overview and Summary of the Industrial Complex Area....5-38
5.6 Waste Lagoons....5-38
5.6.1 Eastern Lagoons....5-40
5.6.2 Western Lagoons....5-56
5.6.3 Summary and Overview of Contamination in and near the Eastern and Western Lagoons....5-70
5.7 County Drain #30 (CD#30)....5-71
5.7.1 Overview of Contaminants in CD#30....5-82
5.8 Overview of the North Bronson Site....5-83

6

CONTAMINANT FATE AND MIGRATION....6-1
6.1 Processes Affecting Contaminant Transport....6-2
6.1.1 Sorption/Desorption (Organic Analytes)....6-3
6.1.2 Sorption/Desorption (Inorganic Analytes)....6-3
6.1.3 Volatilization....6-5
6.1.4 Leaching....6-5
6.1.5 Degradation....6-6
6.1.6 Overall Mobility....6-7
6.1.7 Precipitation (Inorganic Analytes)....6-7
6.1.8 Advection....6-7
6.1.9 Dilution....6-8
6.2 Site Contaminant Migration Pathways....6-8
6.2.1 Air and Wind....6-8
6.2.2 Surface Water and Sediments....6-10
6.2.3 Groundwater....6-10
6.3 Fate and Persistence of Site Contaminants....6-12
6.3.1 Air and Wind....6-12
6.3.2 Groundwater....6-13
6.3.3 CD#30 Surface Water and Sediments....6-17
6.4 Summary....6-19

7

CONCLUSIONS....7-1

8

REFERENCES....8-1

LIST OF TABLES

Table 3-1	Location and Elevation Survey Data
Table 4-1	Summary of Hydraulic Conductivity Test Results
Table 4-2	Aquitard Depth Elevation Data
Table 4-3	Groundwater Elevation Data
Table 4-4	Summary of Horizontal Gradients
Table 4-5	Summary of Vertical Gradients
Table 5-1	Summary of Field Sampling Activities
Table 5-2	Listing of Constituent Organic Groups
Table 5-3	Summary of Metal Concentrations in Exceedance of Local Background Concentrations - Surface Soils
Table 5-4	Summary of Organic Compound Exceedances of Act 307 Type B Criteria - Subsurface Soils
Table 5-5	Summary of Metal Concentrations in Exceedance of Local Background Concentrations - Subsurface Soils - LA Darling
Table 5-6	Summary of Maximum Contaminant Levels (MCLs) and/or Act 307 Type B Criteria Exceedances - Groundwater
Table 5-7	Summary of Metal Concentrations in Exceedance of Local Background Concentrations - Groundwater
Table 5-8	Summary of Indicator Parameter Concentrations in Exceedance of Local Background, MCL and/or Act 307 Type B Criteria - Groundwater
Table 5-9	Summary of Metal Concentrations in Exceedance of Local Background Concentrations - Subsurface Soils at Scott Fetzer
Table 5-10	Summary of Metal Concentrations in Exceedance of Local Background Concentrations - Abandoned Industrial Sewer Line
Table 5-11	Summary of Organic Compound Exceedances of Act 307 Type B Criteria - Lagoon Sludge
Table 5-12	Summary of Metal Concentrations in Exceedance of Local Background Concentrations and/or Act 307 Type B Criteria in Lagoon Sludge - Eastern Lagoons
Table 5-13	Summary of RCRA Hazardous Waste Characteristics Exceedances - Lagoon Sludge
Table 5-14	Summary of Metal Concentrations in Exceedance of Local Background Metal Concentrations in Subsurface Soils and Lagoon Berm Soil Samples - Eastern Lagoons
Table 5-15	Summary of Ambient Water Quality Criteria Exceedances - Western Lagoons
Table 5-16	Summary of Indicator Parameters - Lagoon Water
Table 5-17	Summary of Metal Concentrations in Exceedance of Local Background Concentrations and/or Act 307 Type B Criteria in Sludges - Western Lagoons
Table 5-18	Summary of Metal Concentrations in Exceedance of Local Background Concentrations and/or Act 307 Type B Criteria in Subsurface Soils and Lagoon Berm Soils - Western Lagoons
Table 5-19	Summary of Ambient Water Quality Criteria (AWQC) Exceedances - County Drain #30
Table 5-20	Summary of Indicator Parameters in Exceedance of Local Background Concentrations - Surface Water and Outfalls
Table 5-21	Summary of Groundwater Exceedances of Act 307 Type B Groundwater/Surface Water Interface (GSI) Values - Near CD#30

Table 5-22 Summary of Metal Concentrations in Exceedance of Act 307 Type B Criteria - GSI Values - Groundwater Wells Near CD#30
Table 5-23 Summary of Organic Compounds in Exceedance of Act 307 Type B Criteria - County Drain #30 Sediments
Table 5-24 Minimum, Maximum, and Mean Concentrations and Frequency of Detection of Metals in Sediments - County Drain #30
Table 6-1 Physical/Chemical Properties of Target Compound List Chemicals
Table 6-2 Summary of Important Solubility Controlling Solids Reported in the Literature

LIST OF FIGURES

Figure 2-1 Regional Site Location Map
Figure 2-2 Site Map Showing Existing Monitoring Wells and Public/Residential Wells prior to RI
Figure 3-1 Site Map Showing All Sampling Points
Figure 3-2 Further Definition of Area covered by Geophysical Summary
Figure 3-3 Further Definition of Western Lagoons
Figure 3-4 Further Definition of Eastern Lagoons
Figure 3-5 Site Map Showing Surveyed Sample Points
Figure 3-6 Groundwater Table Contour Map - December 9, 1991
Figure 3-7 Groundwater Table Contour Map - April 22, 1992
Figure 3-8 Groundwater Table Contour Map - 6/25/92
Figure 4-1 Aquitard Map
Figure 4-2 Lines of Geological Cross Sections
Figure 4-3 Geological Cross Sections (Profiles) - A-A'
Figure 4-4 Geological Cross Sections (Profiles) - B-B'
Figure 4-5 Geological Cross Sections (Profiles) - C-C'
Figure 4-6 Geological Cross Sections (Profiles) - D-D'
Figure 5-1 Delineation of Discussion Areas
Figure 5-2 Predominant Areas of Inorganic Contamination of Soils (0-5 ft)
Figure 5-3 Total Chlorinated Ethene Concentrations in Groundwater
Figure 5-4 Predominant Metals and Cyanide in Groundwater Above Background and/or MCLs and Michigan Act 307 Type B Criteria

Volume II of IV

LIST OF APPENDICES

Appendix A Western Lagoons and Industrial Survey Information
- A1 Historical Construction Diagram of Western Lagoons
- A2 Industrial Survey (Technical Memorandum, Section 5.0 Warzyn, March 1989)

Appendix B Geophysical Survey Results
Appendix C Soil Boring and Well Information
- C1 RI Boring Logs, Monitoring Well Construction Details and Piezometer Construction Details
- C2 Residential Well Logs
- C3 Public Well #3 Boring Log

C4 Pre RI - Western Lagoon Area Boring Logs with Sketch (Sterling Drilling Co.)
C5 Pre RI - Bronson Plating Well Logs (Keck Consulting Services, Inc.)
Appendix D Grain Size Analysis Results - Laboratory
Appendix E Permeability Analysis Results - Laboratory
Appendix F Gamma Logs
Appendix G Sample Identification and Control Information
Appendix H Hydraulic Conductivity Test Analyses

Volume III of IV

Appendix I Complete Analytical Results
I1 Surface Soil Analytical Results
I2 Soil Boring Analytical Results
I3 Groundwater Analytical Results
I4 Residential Wells Analytical Results
I5 Lagoon Berm Soils Analytical Results
I6 Lagoon Waters Analytical Results
I7 Lagoon Sludge Analytical Results
I8 Surface Water and Outfall - CD#30 Analytical Results
I9 Sediments - CD#30 Analytical Results
I10 Summary of pH, Specific Conductivity, and Field Observations
I11 Summary of Bronson Municipal Wells #3, #4, and #5 MDPH Analytical Results (1990 and 1992)

Volume IV of IV

Appendix J Background calculations and Guidance Documents
J1 Background Concentration Calculations
J2 MERA - Operational Memorandum #8, Revision 1, March 16, 1992
J3 MDNR - Waste Management Division Clean-up Verification Guidance Document (November 1991)
Appendix K National Pollutant Discharge Elimination System Permits (NPDES)
K1 Bronson Wastewater Treatment Plant NPDES Permit
K2 Bronson Plating NPDES Permit

[mad-605-67x]

A

WESTERN LAGOONS AND INDUSTRIAL SURVEY INFORMATION

A1 Historical Construction Diagram of Western Lagoons

A2 Industrial Survey (Technical Memorandum, Section 5.0 Warzyn, March 1989)

A1

HISTORICAL CONSTRUCTION DIAGRAM OF WESTERN LAGOONS

SDMS US EPA REGION V
FORMAT- OVERSIZED - 5
IMAGERY INSERT FORM

The item(s) listed below are not available in SDMS. In order to view original document or document pages, contact the Superfund Records Center.

SITE NAME	NORTH BRONSON INDUSTRIES		
DOC ID #	148200		
DESCRIPTION OF ITEM(S)	MAP - PLANT #2 INDUSTRIAL SEWER LAGOON RENOVATION		
REASON WHY UNSCANNABLE	__X__ OVERSIZED	OR	___ FORMAT
DATE OF ITEM(S)	3/78		
NO. OF ITEMS	1		
PHASE	RMD		
PRP	RMD NORTH BRONSON		
PHASE (AR DOCUMENTS ONLY)	___ Remedial ___ Removal ___ Deletion Docket ___ AR ___ Original ___ Update # ___ Volume ___ of ___		
O.U.			
LOCATION	Box # ___ Folder # ___ Subsection ___		
COMMENT(S)			
EPA REGION V RECORDS CENTER			

A2

INDUSTRIAL SURVEY
(TECHNICAL MEMORANDUM,
SECTION 5.0 WARZYN, MARCH 1989)

SECTION 5.0
Industrial Site Survey

The industrial site survey was conducted by Warzyn on December 7 through December 9, 1988 in accordance with the MDNR approved Work Plan (September, 1988) Subtask 3.1. Personnel conducting the survey were;

- Sandra M. Pelowski, Warzyn
- Brady W. Boyce, MDNR

5.1 Purpose

The purpose of the industrial site survey was to obtain additional information pertaining to present and past on-site industries and attempt to identify possible contaminants and potential source areas.

5.2 Site Survey

The surveys were conducted at the following facilities:

- Bronson Specialties, Inc. - December 7
- Anderson Farm Service - December 7
- Bronson Plating Co. - December 7
- Putnam Manufacturing Co. - December 7
- Branch County Road Commission - December 8
- Douglas Components Corp. - December 8
- Wastewater Treatment Plant - December 8
- H. G. Geiger Manufacturing Co. - December 8
- Interview with Bill Gillette - December 9
- Bronson Precision Products - December 9
- G & W Display Fixtures, Inc. - December 9

These industries were selected for inspection based on proximity to suspected on-site contamination. The survey consisted of a brief tour of the facility and discussion with a facility representative. The information provided to Warzyn during the survey was assumed to be accurate and there was no attempt to verify or follow up on the information provided.

5.2.1 Bronson Specialties, Inc.

Address: Subsidiary of Kuhlman Corporation
404 Union Street
(517) 369-2435

Survey: December 7, 1988 10:00 a.m.

Facility Representatives:

Paul H. Winbigler, President
David C. Westgate, Plant Manager
Glenn T. Van Volkom, Chemist
Larry Decker, Engineer Supervisor

Discussion:

- There are two divisions within Bronson Specialties, Inc. (Kuhlman Corporation Subsidiary) located at 404 Union Street:
  - Bronson Plastics Division (146,000 sq ft)
  - Bronson Tool Division (44,000 sq ft)
- Bronson Specialties, Inc. (BSI) is a conditionally exempt generator. U.S. EPA ID Number is MID 005480843.
- Bronson Tool Division is situated in the southeast corner of the facility.
- Bronson Fiberglass previously operated on-site. It no longer exists.
- The original building was constructed in the 1940's. Bronson Specialties, Inc. purchased the facility in 1958.
- BSI had a third division (Bronson Products) which was sold to Bronson Precision Products in 1985. Bronson Precision Products leases the space in the facility formerly utilized by Bronson Products from Bronson Specialties, Inc. who owns the property and building. The building is approximately 38,000 sq ft.

Bronson Plastics Division:

- Bronson Plastics Division performs custom blow-molding. They manufacture several custom molding products (i.e., gasoline fuel tanks for pickup trucks). The plastic molding operations were performed from the late 1960's to 1970's. Blow molding operations began at that time and continue to the present.

- Raw materials used are plastic pellets stored in silos north of the facility. MEK was not used on-site to their knowledge.

- By-products generated from their operations include ammonia salts, sulfate salts and sulfuric acid. The sulfonation process is outlined in a figure provided to Warzyn during the survey (Appendix B).

- Bronson Specialties, Inc. has one National Pollutant Discharge Elimination System (NPDES) permit for two outfalls. Both divisions (Bronson Plastics and Bronson Tool) are listed under the same permit. (NPDES Permit # MI0037761).

- There is a litigation pending which Bronson Specialties, Inc. is involved in regarding surface soil contamination at Bronson Precision Products. There is a surficial oil stain on the soil. The area has been excavated and soils stockpiled on-site awaiting disposal. The Westside landfill may be selected for disposal.

- Soil samples were taken of the excavation area. The excavated area is approximately 250 ft x 200 ft x 5 ft. Analytical Results of the Soil Samples Collected are in Appendix B.

- One underground storage tank exists on-site (installed 2 to 3 years ago). It is an oil/water separator. Once a year it is pumped out and the oil is disposed. No monitoring wells have been established around the tank. The tank size is 1,500 gallons. The tank is registered. The current status of the tank is unknown.

- There are two aboveground tanks (one with liquid nitrogen and one for ammonia storage). There is an equalization tank on-site to adjust the pH. There are four silos for raw material (plastic pellets) north of the facility.

- Warzyn was provided a copy of the Material Safety Data Sheets (MSDS) Index for materials used on-site (Appendix B).

- Specialty painting does occur on-site. Typically the paint arrives in less than 5 gallon containers. It is stored in the paint room.

- No floor drains were observed on-site.

- No spills are known to have occurred on-site.

Bronson Tool Division:

- Bronson Tool Division (BTD) was built in 1956 as a tool and die shop. They manufacture specialty machines.
- Degreaser chemicals they use are provided by Safety Kleen. Safety Kleen supplies and disposes of solvent (approximately 25 gallons/6 months). BTD also uses a water based coolant and cutting oils (approximately 55 gallons/2 to 3 years).
- Two PCB containing capacitors/transformers were removed. The location and amount of PCBs on-site are summarized in a table provided to Warzyn during the survey. None of the capacitors/transformers had leaked or were damaged. Great Lakes Environmental Services, Inc. removed the transformers and capacitors.
- Bronson Specialties, Inc. conducted a VOC and metals soil survey. Results reportedly expressed by BSI indicated low organic solvent contamination.
- The facility was inspected by MDNR (Lee M. Carter) approximately one year ago (Winter 1987). MDNR should have a copy of the inspection in their files.
- No maintenance of company vehicles is performed on-site. Local gasoline stations perform routine maintenance.
- They do possess a permit for air scrubbers.
- No floor drains were observed on-site.
- No spills are known to have occurred on-site.
- Copies of material provided Warzyn during the survey are presented in Appendix B.

5.2.2 Anderson Farm Service

Address: Two Locations:
Mill Street - Facility #1
Union Street - Facility #2

Survey: December 7, 1988 Noon

Facility Representative:

Mr. Anderson, Owner

Discussion:

- The Mill Street location contains offices and a garage. The Farm Service business closed in 1984.
- Various farm equipment is currently stored and repaired on the Mill Street location.
- The Union Street location distributed bulk fertilizers. The business closed in 1984 and burned in 1986.
- Eight aboveground storage tanks are visible at the Union Street location, which were used for holding liquid fertilizer (nitrogen).
- Seven of the eight aboveground storage tanks were reported empty.
- One of the eight aboveground storage tanks still holds liquid fertilizer (nitrogen). NA-CHURS liquid fertilizer label appears on the tank.
- The tank numbers are as follows:

25	9189
189	10340
10	25003

  Two have no numbers. The significance of the tank numbers is unknown.
- The aboveground tanks are on gravel pads. There are no dikes or retaining walls associated with this installation.
- One underground storage tank is on-site at the Union Street location. It had contained regular gasoline, and is now empty. The age and status of the tank is unknown.
- No materials were provided to Warzyn during the industrial survey.

5.2.3 Bronson Plating Company

Address: 135 Industrial Avenue
Bronson, Michigan 49028
(517) 369-2885

Survey: December 7, 1988 1:30 p.m.

Facility Representative:

Stanley R. Welch, President

Discussion:

- Bronson Plating Company (BPC) performs nickel and chrome plating, buffing and polishing operations.

- BPC was established in 1946 and was originally located at Railroad Street and Matteson Street (SW corner). BPC moved operations in 1953 to their present location at 135 Industrial Avenue.

- BPC has an U.S. EPA generator ID Number (MID 005480900). They manifest approximately 40,000 lbs of hazardous waste every 2 1/2 months (metal hydroxide sludges F006 and nickel strip operation wastes F006). BPC has utilized Wayne Disposal for waste hauling and disposal since 1988. Their prior disposal firm was Wolverine Disposal Inc. Waste is stored on-site in 20 yd bulk containers.

- MDNR Water Quality Division inspects their wastewater system. Reports should be in MDNR files.

- BPC has a current NPDES permit.

- BPC submits monthly operating reports on surface water discharge.

- BPC used the "new" lagoons from 1965 until 1980.

- BPC discharges bulk treated (pH adjusted) waste to County Drain #30 under their NPDES permit (MI 0000825).

- A RCRA inspection was performed by MDNR, Lee M. Carter on November 4, 1985. The facility was in compliance with RCRA requirements at the time of inspection.

- BPC submitted a Spill Prevention, Control and Countermeasure Plan (SPCC) and Pollution Incident Prevention Plan (PIPP). A copy of each should be in MDNR files.

- As stated in the NPDES permit, BPC monitors the following parameters daily: hexavalent chromium, total chromium, total nickel, total copper, pH and flow volumes.

- No PCBs were reportedly used on-site.

- No underground storage tanks presently exist on-site. One (1-2,000 gallon) diesel fuel underground storage tank was reportedly removed sometime within the last two years. No inventory losses were reported to have occurred. A BPC maintenance crew excavated the tank and reported no stained soils.

- No spills are known to have occurred.
- No floor drains were observed on-site.
- Copies of material BPC provided Warzyn during the Industrial Survey are presented in Appendix C.

5.2.4 Putnam Manufacturing Co.

Address: Two Locations:
211 Industrial Avenue - Plant #1
735 Matteson Street - Plant #2
(517) 369-2165

Survey: December 7, 1988 3:30 p.m.
December 9, 1988 8:00 a.m.

Facility Representatives:

Rex Putnam, President
Bill Gillette, Foreman (12/09/88 meeting only)

Discussion:

211 Industrial Avenue Facility - Plant #1

- Putnam Manufacturing Co. (PMC) purchased the facility five years ago.
- Prior to purchase, modular homes were built at the facility.
- PMC manufactures screw machine and related products (i.e., hitches and trailer hitch balls).
- Cold drawn steel bars arrive on-site as raw material.
- PMC use oil as a lubricant.
- PMC recycles scraps and chips which are removed by Sturgis Iron and Metal.
- Present on-site was one 55-gallon drum of mineral spirits (they reportedly use about one drum/month).
- Some parts painting was done on-site in the past. This work is now subcontracted and performed off-site. Paint is stored on a cement pad outside the facility. They typically received paint in 5 gallon containers.

- No underground storage tanks were reported to be on-site.
- PMC purchases recycled oil from Brinner & Warner.
- Warzyn and MDNR observed oil stains on a dirt road around the facility.
- No spills were reported to have occurred on-site.
- No floor drains were observed on-site.
- PMC extracts oil from cuttings prior to selling. They reuse the oil.
- A metal chip storage bin is enclosed within the facility.

735 Matteson Street Facility - Plant #2

- Similar manufacturing process as the Industrial Avenue facility.
- No paints were involved in current processing operations.
- No floor drains were observed on-site.
- Putnam purchased the facility in 1976.
- Prior to purchase, facility was operated as a foundry for two years.
- No underground storage tanks were reported to be on-site.
- No spills are reported to have occurred on-site.
- The facility is built on a cement slab.
- No materials were provided Warzyn during the Industrial Site Survey. However, an index of their MSDS' are provided in Appendix D.

5.2.5 Branch County Road Commission

Address: 626 N. Matteson Street
(517) 369-4775

Survey: December 8, 1988 8:45 a.m.

Facility Representatives:

James M. Waite, Bronson District Foreman
Leo B. Hoard, Road Commission Manager
Richard G. Losinski, Coldwater District Foreman

Discussion:

- The Bronson Garage of the Branch County Road Commission was built in 1945/1946.
- General maintenance on road commission vehicles is performed on-site.
- The underground storage tanks currently on-site consist of the following:
  - One 5,000 to 10,000 gallon regular gasoline tanks installed in 1947.
  - One 6,000 gallon diesel fuel tank installed in 1974.
  - One 500 gallon used oil tank installed in 1983.
  - One 4,000 gallon fuel oil furnace tank installed in the late 1950's. It has been empty for 4 to 5 years.
- The current integrity status of the tanks is unknown.
- Used oil is removed every 3 months by Fort Wayne Disposal.
- Four drains are located inside the garage area which lead to the storm sewer.
- Sanitary sewer was established for the area in 1958.
- The materials present on-site arrive in 55-gallon drums include:
  - Engine Oil
  - Hydraulic Oil
  - Power Steering Fluid
  - Transmission Fluid
  - Mineral Spirits (use 5 to 6 fifty-five gallon drums per year)
  - Holcomb (5 gallon container) degreaser
- An on-site salt storage shed holds approximately one ton on an asphalt floor.
- Warzyn observed that floors within the building were oil stained.
- They have not had any known or reported spills.
- Copies of material provided Warzyn during the Industrial Site Survey are presented in Appendix E.

5.2.6 Douglas Components

Address: 141 Railroad Street - Plant #1
300 Albers Road - Plant #2
(517) 369-2315

Survey: December 8, 1988 10:00 a.m.

Facility Representative:

Norbert P. Strobel, Douglas Components Corp.

Discussion:

Corporate History

- In approximately 1910 Harry A. Douglas arrived in Bronson and started H.A. Douglas Manufacturing which designed automobile electric parts. Plating was designed to act as a rust inhibitor and was standard operating practice at the time.

- In the late 1940's, H.A. Douglas merged with Kingston Products Corp. of Indiana. Kingston Products produced some automobile products and vacuum cleaners.

- In the late 1940s, the Bronson Plant of Kingston Products Corp. manufactured automobile electrical products, military products including track links and electrical switches, consumer products components including appliance timers and floor care products including vacuum cleaners.

- H.A. Douglas became known as Kingston Products Douglas Division with plants in Bronson, Michigan and Kokomo, Indiana.

- The two plants grew, then in 1968, Kingston Products Corp. sold to Scott Fetzer Company of Cleveland, Ohio. Scott Fetzer Company produced vacuum cleaners (Kirby vacuum).

- Scott Fetzer Co. acquired Kingston Products by means of a stock sale.

- In 1969, the two plants were split into the Kingston Division in Kokomo, Indiana, and the Douglas Division in Bronson, Michigan. At that time, timers and other products were produced in the Kingston Division Plant and vacuum switches and other vehicle components in the Douglas Division Plant.

- In 1980, the plants were again one Division.

- On January 31, 1984, a group of investors purchased the assets of what was then known as Douglas Division from Scott Fetzer Company.

- February 1, 1984, Douglas Components Corporation began operations.

Plant #1 - Douglas Components Corporation, Scott and Fetzer Division

- Plant #1 began operations in approximately 1916.
- Initially produced automobile parts (switches, connectors, electrical parts).
- Operations consisted of machining, stamping, plating, and assembly.
- Operations remained the same for approximately 30 to 40 years.
- Initially the facility was half the present size. Additions were completed in the 1940's and 1950's.
- In the late 1930's H.A. Douglas, L.A. Darling and Bronson Reel were performing plating operations on their respective plant sites.
- The industrial sewer line and the "old" lagoons were established in 1939.
- After WWII, houses were torn down on the SW corner of West Railroad Street and Matteson Street for construction of Bronson Plating Co. (original location).
- In 1949 four facilities were using the "old" lagoons. Approximately 60-65% of the volume received in the "old" lagoons was from L.A. Darling.
- The "old" lagoons were used as settling basins.
- In the 1940s, the Water Resources Commission became concerned about the lagoons. In approximately 1948, State records indicate that there were capacity issues and spills.
- In 1949, the "new" lagoons were constructed and an interceptor industrial sewer from Douglas Components Corp., Bronson Plating Co. (old site) and L.A. Darling was installed and connected.
- In 1959, the Water Resources Commission requested the users of the lagoons to stop using them and start using other methods to handle plating wastes.
- As of 1951, Douglas Components Corp. no longer used the industrial sewer line, the "old" lagoons, or the "new" lagoons.
- Douglas Components Corp. abandoned and closed their connection to the industrial sewer line from State Street to Railroad Street in the early 1950s.

- An industrial sewer line cleaning and inspection occurred in the late 1970's. The sewer line cleaning report was provided to Warzyn at an earlier date (Appendix F).

- In 1951, Douglas Components Corp. constructed the cyanide destruction facility (treatment plant) and started discharging treated wastes to the city storm sewers.

- Bronson Reel used their plating facility until 1968. Shortly after the sale of Bronson Reel to True Temper in 1968, the plating facility was shut down and moved. Successor companies continued to use the industrial sewers and "old" lagoons for small amounts of non-plating waste through about 1980.

- Douglas Components Corp. applied for an NPDES permit in approximately 1974.

- Douglas Components Corp. discharged rinse water to the storm sewer.

- Plant #1 plating operations originally consisted of cadmium, silver, chromium (at one point), zinc and zinc phosphate.

- In September, 1973, Plant #1 changed its plating operation to include only zinc phosphate, tin plating and zinc plating. The other plating operations had ceased earlier.

- In 1973, the plating operation was re-constructed for proper spill prevention and separation of rinse wastes from other plating solutions.

- In November, 1973, the cyanide destruction operation ended. They switched to an alkaline zinc and an acid tin line. The cyanide destruction plant became a metals and phosphate removal plant.

- In 1977/1978 operation of the acid tin lines ceased.

- In 1981 operation of the alkaline zinc line ceased.

- In 1987 operation of the zinc phosphate line ceased. All plating in Plant #1 had ceased.

- The sludge from the cyanide plant has been hauled away.

- No underground storage tanks were reported to have existed in Plant #1.

- As plating operations were shut down, equipment and any residual wastes were cleaned, properly disposed of and equipment was scrapped.

- In November, 1988, PCB transformers were removed by Great Lakes Environmental Services, Inc. (approximately 325 gallons).
- No photographs were allowed to be taken at the time of this industrial survey.
- The building contained numerous forms of debris including: empty drums, scrap metal, various machines, and construction debris.
- Douglas Components Corp. are reported to be in the process of cleaning out the building.
- Plant #1 ceased all operations in 1987. It is currently secured, has electric power and is used for various equipment, tool and material storage.

Cyanide Destruction Facility (CDF)

- Operation of the CDF began in 1951 and ceased in 1973.
- In 1972/1973 MDNR grew concerned about releases to storm sewer from Douglas Components Corporation's cyanide destruction facility. In the permit development for the NPDES Permit, Douglas Division was required to reduce risks of cyanide in effluent.
- CDF operations consisted of adding a chemical to the waste in order to expedite the settling process. The supernate (water) was separated out and disposed of in the storm sewer while the sludge was removed with a vacuum truck.
- The facility was inspected by MDNR and a copy should be in the MDNR files.
- The facility also housed a chip storage shed area.
- In November, 1973, the cyanide destruction operation ended. It was switched over to a metals and phosphate removal plant.

Plant #2-Douglas Components Corporation

- Plant #2 was built in 1953.
- Additions to the facility occurred up to 1965 and the new offices were built in 1987.
- No plating operations were on-site.

- Plant #2 is primarily a fabricating, machining, and assembly facility.
- A paint line still exists on-site. The paint line consists of five stages:
  - Alkaline cleaner
  - Rinse
  - Iron phosphotizer
  - Rinse
  - Sealer (non-chromic)
  - Cleaning process.
- In 1975 a chip shed facility was built west of Plant #2.
- In October, 1985, the crack in the floor of the chip shed was discovered and reported. Oil seeped into the ground which ultimately reached the groundwater.
- The chip shed was concreted over and is currently used to store inactive equipment.
- Test wells were prepared, soil samples taken by EDI Engineering and Science on behalf of Douglas and a report of the investigation was furnished to MDNR in early 1986.
- In 1987, the U.S. EPA Field Investigation Team (FIT) inspected the facility to determine it's scoring for a possible NPL site.
- FIT reported an 80 ft to 100 ft horizontal oil plume on the groundwater north of the chip shed.
- The conclusion drawn was that there was no co-mingling of the oil with water and that the oil plume originated at the Chip Shed.
- An unknown amount of oil had been lost. Oil drained from the chips, therefore volume loss calculations were not possible.
- Plant #2 has a PIPP and SPCC plans which will detail chemicals and storage locations on-site. MDNR should have copies of these in their files.
- There is an old underground storage tank at the chip shed facility and an old gasoline tank north of the chip shed which has been empty for 6 to 7 years.
- Wash and rinse waters are discharged to the storm sewers. (NPDES Permit # MI0005738 and MI0005720)

- Paints are stored in a new area which is explosion proof. The old paint storage now serves as the conference room.
- Plant #2 uses enamel paints based with solvents. These are discussed in the PIPP and SPCC.
- No known spill was reported to have occurred at Plant #2.
- Three years ago the PCB transformers were removed from Plant #2.

General Area History

- Bronson Plastics Division was formerly Bronson Fiberglass. They produced fiberglass seats and rapid transit commuter train modules (front end).
- Environmental concerns arose in the 1930's when stories were heard of cows dying after drinking water from the County Drain #30.
- In 1949 effluent received by the "old" lagoons exceeded their capacity. Green material oozed from the sewers; newspaper articles reported the green material oozing from the sewers and discussed health issues.
- A court case in 1949 described the battle over the use of the industrial sewer lines and lagoons.
- The "new" lagoons were constructed in approximately 1949.
- As of 1949, Bronson Reel still continued to use the "old" lagoons. L.A. Darling, Douglas Components Corp., and Bronson Plating Co. had switched to the "new" lagoons.
- In November, 1951, Douglas Components Corp. stopped using the Industrial Sewer and the "new" lagoons.
- Stories of livestock dying after drinking the County Drain #30 water occurred again in the mid-1950's.
- Copies of material provided Warzyn are presented in Appendix F.

5.2.7 Wastewater Treatment Plant

Address: Access Road

Survey: December 8, 1988 1:30 p.m.

Facility Representatives:

Charles Buckley, Wastewater Treatment, Supervisor
Carl E. Ransbottom, Public Works Facility, Supervisor
Gerald A. Hollister, City Manager

Discussion:

Wastewater Treatment Plant:

- The NPDES permit for the Wastewater Treatment facility is MI0020729.
- The Facility Operating Number is 120019.
- Figure 2 of the North Bronson RI/FS Work Plan had two of the County drain outfall locations shifted. They should be shifted east approximately 600 ft (Bronson Sewage Treatment Plant Outfall and Bronson Storm Sewer Outfall). Also, there is an additional outfall located north of the Public Works facility.
- The wastewater treatment facility was built in 1957. It was expanded in 1978. In 1978 a removal system for phosphates was also installed.

Public Works:

- The Public Works facility was built in 1977.
- The facility stores equipment, tractors, and trucks. A 100 ton covered salt storage shed is located north of the facility on an asphalt surface.
- One unleaded gasoline tank (3,000 gallons) was installed in 1977. It is still in use. The integrity status of the tank is unknown.
- They are not aware of needing any environmental permits to operate.
- They currently use the following chemicals:
  - 55-gallon drum/3 years; solvent degreasers
  - 55-gallon drum/2 years; hydraulic fluid
  - 55-gallon drum/2 years; antifreeze
  - 55-gallon drum/year; oil

General Area History:

- County Drain #30 was dredged (cleaned) in 1983/1984. Bronson Plating Co. was responsible for dredging the drain from their outfall (eastern extent) to Matteson Street overpass (western extent). The County

dredged County Drain #30 from the Matteson Street overpass (eastern extent) to the Bronson Sewage Treatment Plant Outfall (western extent). It was stated that the County removed the dredged material and stockpiled it along the northern bank. This material was allegedly left on the north bank with no additional follow-up for removal. Bronson Plating Co. arranged for a waste hauler to remove their dredged material. The name of the waste hauler used was unknown.

- L.A. Darling Co. was established around 1900's and operated until 1967. They manufactured display fixtures for retail shelving and racks. L.A. Darling used their own lagoons until approximately 1939 when the city established the "old" lagoons.

- During peak operations, L.A. Darling ran two shifts. Operations performed at the facility included chromium plating and, perhaps some cadmium plating and painting operations.

- The city acquired the L.A. Darling property in 1983. The L.A. Darling owner donated the property and buildings to the city in lieu of a $7-8,000 payment for back taxes. The city wanted the water tower which L.A. Darling established in 1960/1961. As part of the donation, L.A. Darling contracted and tore down the facility buildings. Only the foundations remain on-site.

5.2.8 H.G. Geiger Manufacturing Company

Address: 416 Mill Street
(517) 369-7357

Survey: December 8, 1988 3:00 p.m.

Facility Representative:

Julie Geiger, Owner

Discussion:

- H.G. Geiger Manufacturing Company (HGG) was started by Julie Geiger and her husband in 1972.

- A house owned by the city occupied the site. The basement of the house was backfilled with clean dirt prior to building construction.

- HGG is connected to the city storm and sanitary sewer.

- There have been two additions: one in 1978 and one in 1984.

- HGG produces screw machine products using lathes and screw machines.

- Raw material is steel bars.
- Chemicals used on-site involve:
  - They use about 40 gallons/6 weeks of Napthia for cleaning parts. Safety Kleen is contracted to deliver new supplies and dispose of used solvents.
  - HGG uses water soluble and synthetic oil (use two 55 gallon drums/month.)
- Building is presently 20,000 sq ft, "L" shaped: 50 ft x 140 ft for the long portion of the "L", and 80 ft x 120 ft for the short portion of the "L", plus the attached office.
- No PCBs or underground storage tanks were reported to have been used on-site.
- Rinse water is discharged to the sanitary sewer.
- No NPDES permit is required.
- They are a small quantity generator; EPA ID Number MI0048994370.
- Copies of MSDS' are available.
- No floor drains were observed in the facility.
- General facility appearance was neat, clean and orderly.
- Metal chips are removed by Tri-State Industrial. Chips are stored on cement floor. The chip bin is partially covered by an over hanging roof.
- Copies of material provided Warzyn are presented in Appendix G.

5.2.9. Bill Gillette Interview

(Employee of Putnam Manufacturing, Inc.)

Survey: December 9, 1988 8:00 a.m.

Facility Representatives:

Rex Putnam, President
Bill Gillette, Foreman (12/09/88 meeting only)

Discussion:

- Bill Gillette has lived in the Bronson area since 1936, and worked for L.A. Darling in 1940 in their tool and die shop and again in the mid-1950's in their plating shop.

- He recalls pits/lagoons near a ditch during the early years. Exact location is unknown.

- In the 1950's containments were built around the aboveground tanks and the pits/lagoons were gone (filled in or somehow covered over).

- Prior to World War II, Bronson Plating was run by the Wilber family. The Welsh family then purchased the business.

- About 1 1/2 years ago the City of Bronson conducted a similar survey. Results of the survey are unknown.

- The vacant building located on Matteson Street between the Branch County Road Commission facility and L.A. Darling Co. was used in the 1960's by Robert Motors (they built electric motors). After Robert Motors, the facility was occupied by a specialty screw machine manufacturer for two to three years. The building has been vacant since the screw operation.

- There were two bulk oil terminal facilities in the area; one off Matteson Street (Mobil Oil Co.), and a second off Albers Road (Standard Oil Co.). The Standard Oil Co. terminal no longer operates. The Mobil Oil Co. terminal is still active.

- The area near city well PW-03, was a dill pickle facility consisting of six to eight vats. The pickle facility was owned by Kehoe from 1936 to approximately 1945/1946.

- Assembly Service, Inc. located on Industrial Street across from Putnam Manufacturing Co. started about two years ago. The owner is Chris Tell. They preform copper brazing and production welding operations for several components in ovens.

- The vacant building on Mill Street located between Anderson Farm Service and the Wheeler residence, was utilized as a shear factory. It had a grinding operation. Bill Gillette recalls that the ground surrounding the facility was stained red from the iron filings and rust by-products from the manufacturing operation.

- An old Grain Mill building stands on the northwest corner of West Railroad Street and Matteson Street. The building is in need of repair. The building is owned by a lawyer in Detroit.

- A lumber yard occupied the vacant building located on West Railroad Street, west of the old Grain Mill. The building is now vacant.

- Remnants of the old railroad depot are located on West Railroad Street west of the lumber yard.

- Bill suggested we contact:

  - Morris Wood, retired product engineer for Bronson Reel and Bronson Products.

  - Elmer Holton, retired former owner of Bronson Specialties, Inc.

To date, Warzyn has not contacted the above individuals.

5.2.10 Bronson Precision Products

Address: 505 Douglas Street
(517) 369-7361

Survey: December 9, 1988 9:00 a.m.

Facility Representatives:

Chuck Hawkins, Engineer
Cecil Davis, Controller

Discussion:

- January 2, 1985 Bronson Precision Products purchased the Bronson Products operation from Bronson Specialties, Inc. Bronson Specialties, Inc. still owns the building and land.

- Chuck Hawkins suggested Warzyn contact Lyle Modert, a former Bronson Products employee who would be familiar with past operations. He presently works in the Plastics Division of Bronson Specialties, Inc. He was also an old L.A. Darling employee.

- Bronson Reel ran the operations at the facility prior to Bronson Products. Bronson Reel was established in the 1920's.

- Bronson Reel and Bronson Products did not have any lagoons or pits that Hawkins or Davis were aware of.

- In 1988, The MDNR requested the surface staining on the soil be remediated (removed). Analytical data from one soil sample was provided to Warzyn. It is of limited value because the location from where it was collected is unknown. It was reported that soil contamination

resulted from disposal of materials in the back lot from previous operations. Bronson Precision Products started the removal; Bronson Specialties, Inc. took over the project from Bronson Precision Products. The excavation is approximately 5 ft deep and includes most of the Bronson Precision Products back lot (west of the facility building). The excavated soil is stored on-site awaiting disposal . The excavation remains open. The Westside Landfill may be selected for disposal.

- Hawkins informed Warzyn that PCBs were sometimes present in recycled oil and Bronson Precision Products has in the past and continues to purchase recycled oil. However, Hawkins and Davis do not have any direct knowledge of PCB oils in the oil they used or use on-site.

- No plating operations were reported to have been performed by Bronson Precision Products or Bronson Products. However, Bronson Reel did have a small (one) line plating operation on-site.

- Bronson Precision Products and Bronson Products ran similar operations consisting of screw machine, casting machines, and metal turning shop. Their clients include Detroit Diesel and Ford Engine Parts.

- Chemical compounds used on-site include: cutting oils, lubricating oils, Napthia (Safety Kleen), water soluble oils, and synthetic oils.

- Safety Kleen removed approximately 60 old drums which were stored/left on-site during the past year. The old drums were left on-site from former operations when Bronson Precision Products purchased the facility.

- Tri-State Industrial Service Corp. (Coldwater 517-278-2586) removes cuttings and sells the metal as scrap.

- Storage for cuttings is outside, uncovered, not bermed, or placed on a pad. The storage area is on the unprotected ground surface.

- No environmental permits are held by Bronson Precision Products for them to operate. Hawkins and Davis believe none are needed.

- Non-contact and contact cooling water is presently discharged into the storm sewer. They will hook up to the sanitary sewer after the back lot excavation is completed. After they convert to the sanitary sewer, Hawkins and Davis stated that an NPDES permit would not be needed.

- One underground storage tank existed on-site. It has been removed as part of the back lot excavation. It was a 6,000 gallon tank which held #2 fuel oil which was converted to cutting oil storage. Hawkins reported that he observed the removal and stated that there were no leaks, product or stained soils observed when the tank was pulled.

- There is a partially underground oil recovery system active on-site, consisting of a cemented pit with steel liner and a sump. It will soon be removed. There have been no reported leaks or spills from this operation.
- Hawkins stated that they are planning to move their facility in a few years. They will move near City well PW-03 and East Railroad Street.
- Hawkins believes that there were fiberglass molds from Bronson Fiberglass (presently called Bronson Specialties Products Inc.) buried there in 1970.
- They have no U.S. EPA generator identification number.
- Hawkins and Davis stated that they are not considered a generator or small quantity generator.
- No painting operations were reported to be or have ever present on-site.
- 1969 Bronson Reel sold the business to Bronson Products which began their current operations.
- They use less than 5 gallons/month of 1,1,1-trichloroethane.

5.2.11 G&W Display Fixtures, Inc.

Address: 804 N. Matteson Street
(517) 369-7341

Survey: December 9, 1988 10:35 a.m.

Facility Representative:

Dave Wischmeyer, President

Discussion:

- G&W Display Fixtures, Inc. (G&W) was established in 1982.
- They manufacture display fixtures from tubular steel.
- The facility is approximately 27,000 sq ft.
- Prior to establishing G&W Display Fixtures, the building was used as a beer distributor (approximately 1957 to 1982) and a machine shop prior to 1957.

- G&W sends the tubular steel to Bronson Plating for chromium plating.
- G&W receives the tubular steel, cuts the steel, performs spot welding, operates punch presses, and assembles the retail display fixtures.
- Three 55-gallon drums were noted within the facility. They appeared to contain cutting oils and kerosene.
- Two underground storage tanks still exist beside the building (east). They were used to hold fuel for trucks during the ownership of the beer distributor and are reported empty.
- Tanks are approximately 13 years old and one was filled with diesel and the other with gasoline.
- Ralph Schaffer was the owner of the beer distributor.
- G&W believes no environmental permits are needed.
- G&W does not have an U.S. EPA ID number to operate.
- G&W is not a small quantity generator.
- G&W has not had any known or reported spills.
- Cutting oils are recycled.
- G&W has sanitary sewer hook-ups.
- There were no floor drains observed in the operations section of the facility. However, two floor drains exist that were installed by the beer distributor to wash down trucks in the central portion near the loading dock.
- They do not use solvents.
- Copies of material provided Warzyn are presented in Appendix H.

REPORT ON CLEANING AND TV INSPECTION
OF
INDUSTRIAL SEWER
FROM
DOUGLAS DIVISION PLANT NO. 1
TO
THE CITY LAGOONS

McNAMEE, PORTER AND SEELEY
CONSULTING ENGINEERS
2223 PACKARD ROAD
ANN ARBOR, MICHIGAN 48104

DECEMBER 22, 1977

Introduction

Douglas Division of Scott Fetzer Corporation contracted with A & B Sewer Cleaning of Kalamazoo, Michiganto clean, TV inspect, and if necessary, pressure grout the industrial sewer from Douglas Division Plant No. 1 to the City Lagoons located near the City of Bronson Wastewater Treatment Plant. The industrial sewer has not been used by Douglas for about 30 years. Douglas retained McNamee, Porter and Seeley to make an evaluation, based on the cleaning and TV inspection of the line, as to whether the sewer can be rehabilitated to a condition where it can again be used to dispose of the waste discharge from Plant No. 1. Following is a report on the cleaning and TV inspection program conducted from December 12 to December 21, 1977 and an evaluation and recommendation as to the work required to make this sewer useable.

Investigation, Cleaning and TV Inspection

A & B Sewer Cleaning Company began their investigative program by removing enough of the concrete plug in the manhole at the intersection of Railroad Street and North Walker Street to run water from that point downstream to the City Lagoons to determine if the industrial sewer was open. This was accomplished and the decision was made that the entire length of sewer from the concrete plug manhole to the lagoons should be cleaned. A & B Sewer Cleaning Company then probed for the 8-inch industrial sewer line along State Street south of Douglas Division Plant No. 1. They located a tee in the 8-inch line which previously had been used as a service connection from Plant No. 1. This tee was removed and this opening was used as an entry point to investigate the line to the intersection of State Street and North Walker Street. No manhole was found at this intersection and in talking with the City of Bronson DPW crew it was concluded that this manhole and perhaps a good portion of the industrial sewer on North Walker Street from State Street to Railroad Street was removed when the sanitary sewer line was laid down this block. After cleaning, the industrial sewer on State Street was TV inspected by pushing the camera downstream. This reach proved to be in excellent condition all the way to the concrete plug that was found in the end of the sewer at the intersection of State Street and Walker Street. The only noteworthy items found in this reach were two open joints about 1/2 inch wide and two offset joints about 1/4 inch. These are considered very minor and do not merit any pressure grouting or any renovative work.

The next reach of industrial sewer cleaned and TV inspected was on Railroad Street between North Walker Street and North Douglas Street. Upon review of the TV video tapes it was observed

that this reach of sewer was likewise in excellent condition with only two open 1/4 inch joints and one 1/4 inch offset joint considered to be minor enough not to warrant any repair work. The manhole at the intersection of Railroad Street and North Douglas Street is a brick manhole in relatively poor condition, however it does have a good flow channel through it.

They next cleaned and inspected the reach of sewer on North Douglas Street between Railroad Street and the NYCRR tracks. A service connection pipe was observed in the upstream manhole at the intersection of Railroad Street and North Douglas Street coming from Bronson Reel Company which is located on the west side of this block. This reach of industrial sewer was again found to be in excellent condition with the only observable flaw being a chip crack in the crown of the pipe near the upstream manhole, and this was considered to be superficial and not warranting any attempt to repair it.

The next reach of industrial sewer investigated was parallel to the NYCRR tracks. Virtually the entire length of this reach lies within Bronson Reel Company and a good portion of it actually runs under the plant building. As was suspected, three service connections from Bronson Reel Company was found and located in this reach. The first service connection is located 108 feet from the upstream manhole and comes vertically into the top of the 12-inch sewer. This service connection definitely lies under the Bronson Reel Company plant floor. No wastewater was observed inflowing into this service connection and upon investigation inside the plant we were unable to determine the source of discharge to this service connection. The second service connection was located 161 feet from the upstream manhole and again it comes into the top of the 12-inch sewer. We were able to determine by flow that Bronson Reel's boiler blowdown water discharges into this service connection. This service connection lies under the yard outside of the Bronson Reel Company plant building so could be accessible to be dug up and plugged. At 168 feet from the upstream manhole a manhole was discovered. This manhole was obviously constructed quite a while back and is square with a heavy square concrete cover. This manhole was constructed over the top of the industrial sewer with the upper half of the sewer through the manhole cracked open. There is one service connection coming into this manhole and this is from storm runoff from the plant roof downspout. Since it was raining when the TV inspection of this reach was being done we were able to observe inflow into the industrial sewer in this manhole. Again the overall condition of the entire reach of industrial sewer running parallel to the RR tracks was excellent with only one open 1/4 inch joint and two 1/4 offset joints noted none of which requires further repair work. The manholes at both ends are constructed of brick and are in generally poor condition however the flow channel through both of them are good.

The last reach of sewer to be cleaned and TV inspected was the short reach running under the RR tracks between Bronson Reel Company and Mill Street. To everybody's amazement this reach, even through having shallow cover and made of 12-inch vitrified clay pipe, had no observable structural cracking or any other damaging effects from the RR passing over above it. This reach had four open joints 1/4 inch wide and one offset joint 1/4 inch wide which again was determined not to warrant any repair work. The manhole on Mill Street was also constructed of brick, in generally poor condition, but with a fairly good flow line through it. This manhole will be replaced in the future to accommodate the flow from Plant No. 2. There is a possibility that pipe under the tracks could be concrete encased however we found no evidence to confirm or deny this. This completed the TV inspection work required at this time.

The remaining sewer from Mill Street to the manhole near the lagoon pumping station, consisting of 1070 feet of 12-inch vitrified clay pipe, was cleaned but not TV inspected because this line will be replaced with a new reach of sewer designed to handle both the flows from Plant No. 1 and Plant No. 2.

Conclusions from the Cleaning and TV Inspection Work

It is concluded that the industrial sewer that was cleaned and TV inspected was in surprisingly excellent condition, and it is further determined that pressure grouting or any other repair work of the joints is unnecessary. It was also observed that although the grade of the industrial sewer is extremely flat (averaging about 0.10% in grade which is less than half of the minimum recommended grade of 0.22% for a 12-inch sanitary sewer) there were no observable dips or sags in the line that even though the line will not be self cleaning because of the grade upon construction of the required new manholes and pipe sections this industrial sewer can once again be put into service in discharging the waste flow from Douglas Plant No. 1.

Recommendations of Work Required to Make Industrial Sewer from Douglas Plant No. 1 to the City Lagoons Useable

Since the existing industrial sewer along North Walker Street between Railroad Street and State Street has been partially or nearly entirely removed, along with the manhole at the intersection of State Street and North Walker Street, it is recommended that an entirely new stretch of industrial sewer be constructed from State Street to Railroad Street to avoid the costly proposition of tearing up North Walker Street to lay the new reach of industrial sewer, and to avoid the congestion of sanitary and storm sewers

under North Walker Street, it is recommended that the new industrial sewer be constructed beneath the Plant No. 1 parking lot as shown on Figure No. 1 which is attached to this report. Examination should be made of all of the maps and plans of the Plant No. 1 layout to see if there are any buried pipes, tanks, electrical ducts etc. that perhaps may be lying along the proposed sewer route beneath the parking lot and which would conflict with the construction of the new sewer. There will need to be two new manholes constructed on State Street as shown on Figure 1, one at the location of the old existing tee which was removed and the second manhole where the sewer turns north through the parking lot. It will require 255 feet of 10-inch vitrified clay pipe to extend from the new manhole on State Street to a new manhole on Railroad Street. There are two existing industrial sewer lines running East on Railroad Street from North Walker Street. The new manhole on Railroad Street will be constructed in the 10-inch sewer which runs along the north edge of the street. If the existing 12-inch sewer interfers with the new 10-inch sewer then as much of the 12-inch sewer as needs to be removed should be removed with the ends of the sewer in both the east and west direction bulkheaded. The existing manhole at the intersection of North Walker Street and Railroad Street, that was plugged with concrete, should be completely removed and a section of 12-inch vitrified clay pipe with a 12-inch to 10-inch reducer should be installed across the section where the old manhole was located. The reach of sewer on Railroad Street between the old removed manhole and the new manhole should be thoroughly cleaned before completing the sewer work in this area. All of the existing 12-inch industrial sewer and the existing 10-inch industrial sewer extending from the new manhole east on Railroad Street would be abandoned.

As mentioned previously there are four service connections from Bronson Reel Company into the industrial sewer. At the time of the writing of this report negotiations had not commenced between Douglas Division and Bronson Reel Company on whether Bronson will come into the industrial sewer or whether these service connections will be plugged. If it is decided that these are to be plugged the following recommendations and observations are made: The two service connections coming into the manholes have good accessibility and can be plugged readily with grout or concrete. The service connection that is 7 feet from the old square manhole can easily be dug up and plugged since it lies outside of the Bronson Reel Company building. It appears that the one service connection most difficult to plug will be the one that lies under the Bronson Reel Company plant building floor. However, it does appear that this service connection lies close enough to the edge of the building so that a trench could be dug and a small amount of tunneling required to get to and plug this service connection. The only other work seen necessary to get the Plant No. 1 industrial sewer useable is cleanout and minor repair of some of the existing manholes.

Douglas Division has retained a copy of the sewer cleaning and TV inspection log along with the video tapes. These can be examined to supplement the observations and conclusions arrived at in this report. Figure 2 depicts the entire industrial sewer from Plant No. 1 to the City Lagoons and notes the main work and findings described in this report.

INDUSTRIAL SEWER SYSTEM

CITY OF BRONSON MICHIGAN 1940

INDEX:

Sheet No.1 Tanks location, sewer detail to Mill St. including detail of Railroad Crossing.
Sheet No.2 Sewer detail from Mill St. to factories.
Sheet No.3 Details of tanks and diversion chamber.
Sheet No.4 Detail of Bronson Reel Co. connections and Manholes No. 4-5&6 measurements.
Sheet No.5 Detail measurements of Manholes No. 7 & 10.
Sheet No.6 Detail measurements of Manhole No.8.
Sheet No.7 Detail of L. E. Darling Co. connections and Manhole No. 9 measurements.
Sheet No.8 Detail of H. A. Douglas Mfg. Co. connections and Manhole No. 11 measurements;
Sheet No.9 Elevations at manholes.

This system is constructed of vitrified clay sewer tile with precast asphalt joints throughout, all manhole covers are sealed with no ventilation and covers are located 4" below surface of streets.

Measurements taken at right angles to curb and gutter are taken from back or property side of curb, measurements parallel to curb and gutter are taken to nearest edge of cast iron curb and gutter inlet boxes.

CAUTION TO ALL MAINTENANCE MEN: Due to the various chemicals used in the plating processes at the three factories it is possible for this system to become full of hydrocranic gas which is deadly. All persons having to enter or open any of these manholes are cautioned to wear a gas mask equipped with a canister capable of filtering cyanide gas.

Sheet No. 9

ELEVATIONS

Ground Water at Tank No. 1	(October, 1939)	112.94
Ground Water at Tank No. 2	(October, 1939)	112.76
Invert of tile at Tank No. 1		115.40
Invert of tile at Tank No. 2		115.28
Invert of tile at Diversion Chamber		115.46
Invert of tile at Manhole No. 2		115.84
	No. 3	115.91
	No. 4	117.00
	No. 5	117.27
	No. 6	117.38
	No. 7	117.86
	No. 8	118.31
	No. 9	118.60
	No. 10	118.12
	No. 11	118.41

NOTE- Water height gauge sticks were installed in both tanks with lowest graduation at the top of ground water as of Dec. 28th, 1939. With 3'-6" of graduated marks above this level.

SDMS US EPA REGION V
FORMAT- OVERSIZED - 5
IMAGERY INSERT FORM

The item(s) listed below are not available in SDMS. In order to view original document or document pages, contact the Superfund Records Center.

SITE NAME	NORTH BRONSON INDUSTRIES		
DOC ID #	148200		
DESCRIPTION OF ITEM(S)	MAP		
REASON WHY UNSCANNABLE	_X_ OVERSIZED	OR	___ FORMAT
DATE OF ITEM(S)	NOT DATED		
NO. OF ITEMS	1		
PHASE	RMD		
PRP	RMD NORTH BRONSON		
PHASE (AR DOCUMENTS ONLY)	___ Remedial ___ Removal ___ Deletion Docket ___ AR ___ Original ___ Update # ___ Volume ___ of ___		
O.U.			
LOCATION	Box # ___ Folder # ___ Subsection ___		
COMMENT(S)			
EPA REGION V RECORDS CENTER			

B

GEOPHYSICAL SURVEY

JAN - 5 1989

Report on the Electromagnetic and Electrical Resistivity Surveys Conducted at the North Bronson Area Site Bronson, Michigan

for

Warzyn Engineering, Inc.
Novi, Michigan

by

Fromm Applied Technology
Mequon, Wisconsin

December 12, 1988

Abstract

In October of 1988, a formalized grided electromagnetic survey, nine electromagnetic profiles, and six electrical resistivity soundings were conducted over the North Bronson Area Site, Bronson, Michigan. The results are as follows:

1. At the Bronson Plating Site there is geophysical confirmation of the two known lagoons. Apparently, the horizontal extents of other previous lagoons are not geophysically detectable. However, there are strong indications of soil contamination at depth from these preexisting lagoons.

2. At the Bronson Old Lagoon Site, the electromagnetic survey indicated signs of slight near surface contamination less than 15 feet deep near the lagoons. In addition, electrical resistivity soundings identified possible soil/ground water contamination down to a depth of 80 meters.

3. The industrial waste water line is not detectable due to buried metal piping. However, a portion of it may have been located in the southeast corner of the Old Lagoon Site.

4. At the L.A. Darling Site three electromagnetic transects were conducted and each indicated the presence of fill material.

Table of Contents

Title Page	i
Abstract	ii
Table of Contents	iii
List of Figures	iv
Introduction	1
Overview of Geophysical Theory	1
Methodology	3
Conclusions	5
Table 1	6
Bronson Plating Site	6
The Bronson Old Lagoon Site	9
Industrial Sewer Line	11
L.A. Darling Site	11
Quality Assurance/Quality Control	12
Standard Disclaimer	13
Geophysical Figures	14
Legend for Base Maps	15

Appendix A: Electromagnetic Data for Bronson Plating Site

Appendix B: Resistivity Data for Bronson Plating Site

Appendix C: Electromagnetic Data for Bronson Old Lagoon Site

Appendix D: Resistivity Data for Bronson Old Lagoon Site

Appendix E: Non-useful Geophysical Data

List of Figures Continued

13. Figure 12: Bronson Old Lagoon Site Base Map pg.27

14. Figure 13: Bronson Old Lagoon Electromagnetic Station Locations pg.28

15. Figure 14: Bronson Old Lagoon Site N-S Em Transect A to A' pg.29

16. Figure 15: Bronson Old Lagoon Site E-W Em Transect B to B' pg.30

17. Figure 16: Bronson Old Lagoon Site E-W Em Transect C to C' pg.31

18. Figure 17: Model of Resistivity Data for Stations (0,31) and (7,31) pg.32

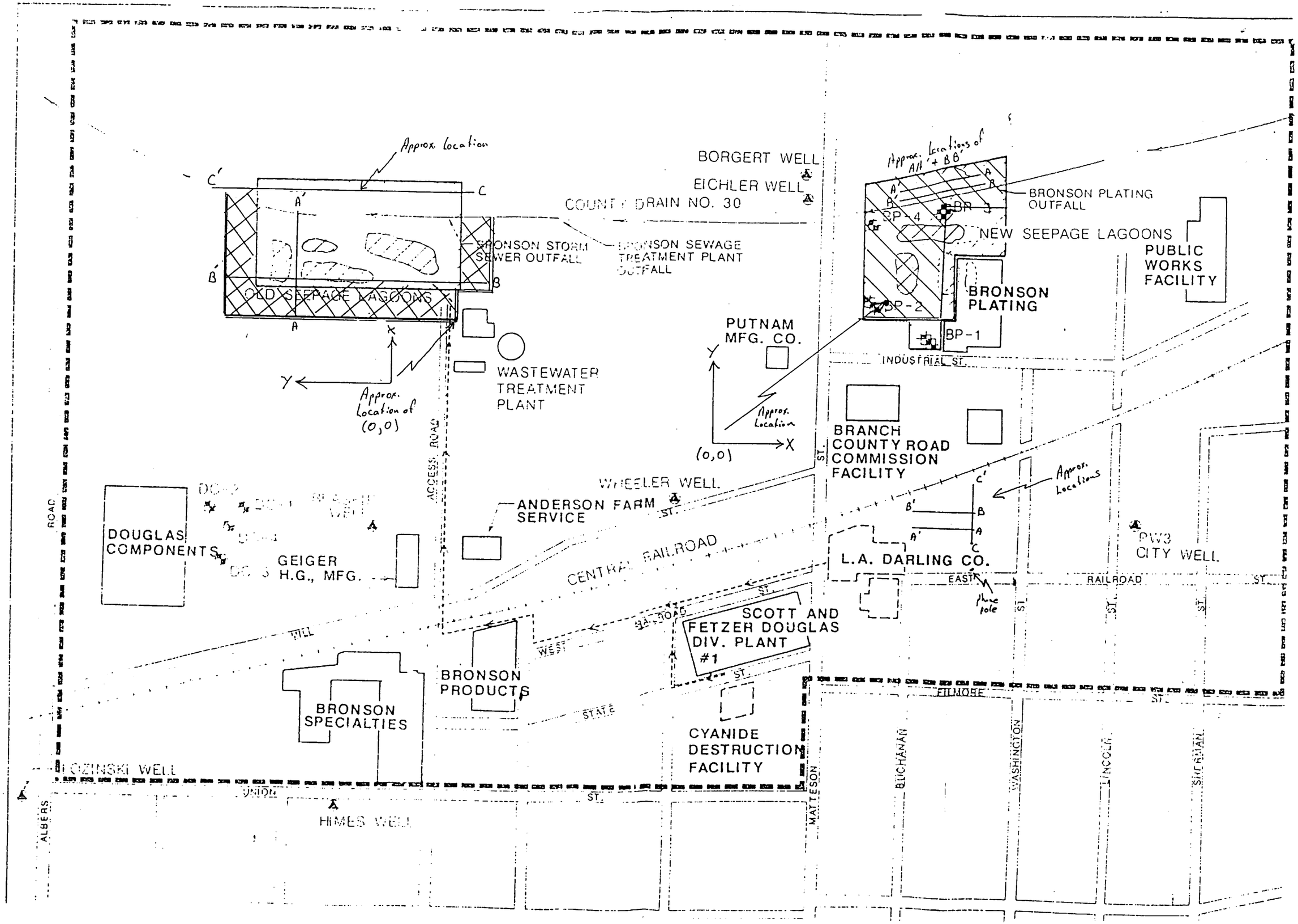
19. Figure 18: Model of Resistivity Data for Stations (19,43) and (19,52) pg.33

20. Figure 19: Bronson Old Lagoon Site Line Y=52 Used for Repeatability Profile pg.34

21. Figure 20: L.A. Darling Site Em Transect A to A' pg.35

22. Figure 21: L.A. Darling Site Em Transect B to B' pg.36

23. Figure 22: L.A. Darling Site Em Transect C to C' pg.37


Approx. location
C'
C
A'
B'
B
A
OLD SEEPAGE LAGOONS
BRONSON STORM SEWER OUTFALL
BRONSON SEWAGE TREATMENT PLANT OUTFALL
BORGERT WELL
EICHLER WELL
COUNTY DRAIN NO. 30
WASTEWATER TREATMENT PLANT
X
Y
Approx. Location of (0,0)
ACCESS ROAD
ROAD
DOUGLAS COMPONENTS
GEIGER H.G., MFG.
ANDERSON FARM SERVICE
WHEELER WELL
CENTRAL RAILROAD
WEST
STATE
BRONSON PRODUCTS
BRONSON SPECIALTIES
ROZINSKI WELL
HIMES WELL
UNION
ST.
ALBERS
PUTNAM MFG. CO.
Approx. Location
(0,0)
Approx. locations of AA' + BB'
BRONSON PLATING OUTFALL
BP-4
BP-3
BP-2
BP-1
NEW SEEPAGE LAGOONS
BRONSON PLATING
PUBLIC WORKS FACILITY
INDUSTRIAL ST.
BRANCH COUNTY ROAD COMMISSION FACILITY
Approx. Locations
L.A. DARLING CO.
EAST
Phone pole
RAILROAD
PW3 CITY WELL
SCOTT AND FETZER DOUGLAS DIV. PLANT #1
CYANIDE DESTRUCTION FACILITY
FILLMORE
MATTESON
BUCHANAN
WASHINGTON
LINCOLN
SHERMAN

Introduction

From October 17th through October 22nd, 1988, several geophysical surveys were conducted at the North Bronson Area Site, Bronson, Michigan. As described in the North Bronson Work Plan (C 70051) May, 1988, electromagnetic conductivity methods(Em) were used to aid in determining the following: "Detect areas of high conductivity," "Estimate boundaries of filled lagoons," "Delineate lateral extent of contaminated groundwater," "Aid in locating monitoring wells," and evaluate the industrial sewer line as a potential waste source, where possible. Electrical resistivity methods were used to support the Em methods and to provide greater depths of investigation. A complete site description and history can be obtained from Warzyn Engineering, Inc., Novi, Michigan.

Overview of Geophysical Theory

A brief tutorial in geophysical methods and theory is provided here for those who are unfamiliar with electromagnetic and resistivity surveys.

In electromagnetic surveys, a transmitter produces an electromagnetic field which induces a current into the ground. This induced current generates its own electromagnetic field which is a reflection of the soils' bulk conductance. This

synthesized field is detected by a receiver that translates the amplitude and phase of the electromagnetic field into a numerical value of conductance. Electrical conductors, generally iron, less than ten feet deep, will result in field distortion and yield "zero" or negative values of conductance. Hence, shallow metallic objects are easily identified by their negative or "zero" value of conductance.

In contrast, resistivity techniques directly inject a current into the soil with the use of a transmitter connected to current electrodes that are placed into the ground. The current, which is being conducted through the ground produces a potential field that can be measured by a receiver that also has two electrodes placed into the ground. Knowing the electrical potential between two points and the amount of current that is being injected into the ground, one can determine the bulk resistivity of the subsurface with respect to the geometry of the four electrodes.

Bulk resistivity values, for several electrode spacings, directly lead to forward electrical resistivity modeling. The modeling method creates apparent resistivity plots by using various combinations of absolute resistivity values and stratigraphic thicknesses. These computer generated values are then compared to the bulk resistivity values recorded in the field until a significant correlation is obtained. It should be pointed out that most resistivity models are not unique; however, a model

that is characteristic of the known conditions (i.e. ground water conductivities, and geology) can be constructed.

Penetration of the electromagnetic (Em) gear can range from the surface (near surface metallic objects can inhibit deeper penetrations) to fifteen feet depending on soil conditions and interference from metallic objets. On the other hand, the depths of investigation, using resistivity methods, are only limited by the electrode spacing and the available electrical power from the transmitter.

The source of anomalies should be independently determined.

Methodology

The geophysical investigations were broken down into four areas: "The "old" waste disposal lagoons" (referenced in this paper as the Bronson Old Lagoon site), "The "new" lagoons" (referenced in this paper as the Bronson Plating Site), the industrial sewer line, and the L.A. Darling Site. See **Figure 9: North Bronson Site Map** for the approximate locations of the surveyed areas, Em profile lines, and orientation of each Cartesian coordinate system used. Resistivity sounding locations are seen in their appropriate base maps.

In general, Em readings (stations) were taken throughout a survey area on a fifteen foot by fifteen foot grid system. In addition, individual transects were conducted in areas that were not fully accessible or not contiguous to the main survey areas.

A Geonics Em 31D Electromagnetic Terrain Conductivity Meter was used to take conductivity measurements. All electromagnetic data was recorded on a TRS Model 100 portable computer and later up loaded into a mainframe system.

The resistivity soundings were strategically located to enhance the known Em data or to provide electrical data at locations where the electromagnetic readings were distorted by cultural noise. Six soundings were completed throughout the North Bronson Area Site. Each sounding used a Sintrex IPC-9 Resistivity Transmitter and a Scintrex IPR-8 Receiver with Wenner electrode "a" - spacings of 1, 2, 3, 5, 7, 8.5, 10, 15, 25, and 50 meters(where possible).

Resistivity profile data was generated along five lines, however the results are poor and led to inconclusive findings. Thus, the data was not directly used in this report. See Appendix E: Non-useful Geophysical Data for a listing of the data.

Station numbers are referenced in most of the diagrams and the distance between stations is fifteen feet, unless otherwise noted. Because of the complex combinations of soundings,

profiles, and 2 dimensional grided data, the reader should thoroughly familiarize themself with where the resistivity soundings and Em transect locations, see **Figure 4: Bronson Plating Site Base Map** and **Figure 12: Bronson Old Lagoon Site Base Map**. In addition, note where Em readings were taken, see **Figure 5: Bronson Plating Site Electromagnetic Station Locations** and **Figure 13: Bronson Old Lagoon Electromagnetic Station Locations.**

Conclusions

Most of the electromagnetic interpretations are straight forward and obvious. Resistivity requires the greatest amount of care in order to develop a model characteristic of the present soil conditions.

Interpretation of the data is broken down into three parts: class one anomalies, class two anomalies and class three anomalies. Class one through class three anomalies are based on size, their relative intensity, and correlation between other contour maps. Class one anomalies, present in the pit and/or lagoon areas, are some of the largest, produce the greatest changes in values, and are detected both electrically and electromagnetically. Class two anomalies are regions of prevalent soil and/or ground water contamination, are electromagnetically intense and are most likely due to high concentrations of heavy metals at depth. Class three anomalies are only electromagnetically significant and are caused by buried metal and could have been potential sources of

cultural noise (i.e. culverts and drain pipes). In this report, class one anomalies are colored coded in red, class two anomalies in blue, and class three anomalies in green. An approximate quantitative definition of the three classes are provided in Table 1.

Table 1

Anomaly Class	Color	Definition	Meaning
Class one	Red	Em > 25 mmhos/m and Resis. < 10 ohm*m	Pit/Lagoon Area
Class two	Blue	Em > 12 mmhos/meter & <= 25 mmhos/meter Reduced Resistivities	Non-Pit Contaminated Soil
Class three	Green	Em < 10 mmhos/meter	Buried Metal

Bronson Plating Site

Surveys at this site were handicapped by surface obstacles. Many of the obstacles (i.e., power-lines, topographic features, and sources of cultural noise) associated with the Bronson Plating Site are shown in Figure 4.

The electromagnetics did detect several metallic objects as seen by the class three anomalies in **Figure 1: Bronson Plating Site Low Em Values (0 to 15 mmhos/m)**. The origin of several of these anomalies were identified. Anomaly #1 is due to buried steel crossover drainage pipes and anomaly #2 is thought to be caused

by a drainage culvert leading into county ditch 30. The origin of the remaining three anomalies is unknown.

The lateral extent of the electromagnetically detectable contamination is best seen in **Figure 2: Bronson Plating Site Medium Em Values (15 to 25 mmhos/m)**, anomaly #3. The slightly elevated conductivity values indicated by the contour line connecting coordinates (0,2) to (0,8) is probably due to the electrical high power station located less than fifty feet west of this area.

The electromagnetic survey at the Bronson Plating Site confirmed the visible and obvious presence of two large pit areas, anomalies #4 and #5 in **Figure 3: Bronson Plating Site High Em Values (25 to 145 mmhos/m)**. However, it does not show any conclusive evidence of the presence of any previous lagoons or previous lateral boundaries of the now existing lagoons. There is some evidence of boundary distortion in the northeast corner of anomaly #4, Figure 3, which may be due to past overflow/seepage conditions or simple soil contamination unrelated to previous lagoon boundaries.

The high conductivity values seen in Figure 3 at (17,0) to (17,19) is most likely caused by the Bronson Plating building. Because a pit is suspected to exist in the northern portion of this area, near station (17,15), a resistivity sounding was

conducted. **Figure 7: Bronson Plating Site Modeled Resistivity Sounding Located at Station (17,15)** shows the modeled results of this sounding. If a pit is present, one would expect station (17,15)'s results to resemble the outcome of the sounding completed inside the southern most pit at station (9,5), **Figure 8: Bronson Plating Site Modeled Resistivity Sounding Located at Station (9,5)**. However, the sounding at station (17,15) shows significant contamination at depth, while the sounding at station (9,5) implies approximately four meters of highly contaminated soil with very little contamination below. Soil borings may confirm this.

The profiles in **Figure 6: Bronson Plating Site Em Transects on the North Side of Co. Ditch 30** were conducted along lines AA' and BB' in order to determine whether or not ground water contamination had leached into this area. The fairly consistent conductivities observed along lines AA' indicate the absence of any electromagnetically detectable contaminates at this location. The higher and varying conductivities of line BB', about 25 feet south of line AA', suggest some type of contamination. However, it could be due to spoils associated with previous dredging of county ditch 30 located about 25 feet south of line BB'.

A resistivity sounding was attempted on the west side of the Bronson Plating Site, but, was unsuccessful due to transient currents from the near by electrical power station (no data was obtained).

The Bronson Old Lagoon Site

The primary concern of the old lagoon area was to delineate and determine the extent of any contaminate plume associated with the settling of plating waste water. To efficiently accomplish this, a grid system was employed over the outer one hundred feet of the east, west, and south sides of the site (see Figure 9). Because of limited property access and time constraints, only an east-west profile was conducted on the north side. The surveys were, again, limited by near surface obstacles, like the ones seen at the Bronson Plating Site, are seen in **Figure 12: Bronson Old Lagoon Site Base Map.** Again, Em station locations can be found in Figure 13.

Figure 10: Bronson Old Lagoon Site Low Em Values (0 to 10 mmhos/m) indicates three areas of buried metal. The elongated features at station (0,-1) is understood to be an underground pipe. While the pipe extends under much of the property, it is only detected at this location. The two other lows at station (10,13) and (13,-3) are associated with buried metal of unknown origin.

The class two anomaly (anomaly #1) in **Figure 11: Bronson Old Lagoon Site High Em Values (12 to 28 mmhos/m)** reveals a possible near surface, less than fifteen feet, ground water plum or zone of soil contamination. The background conductivities are about

eight to eleven millimhos/meter and the anomalous areas are as high as 31 millimhos/meter near station (10,36).

The two east-west trending anomalies near station (0,3) and (0,42) are the result of interference from the fence. The two sets of resistivity soundings, **Figure 17: Model of Resistivity Data for Stations (0,31) and (7,31)** and **Figure 18: Model of Resistivity Data for Stations (19,43) and (19,52)**, indicate that the greatest soil contamination is closest to the old lagoons. Furthermore, detectable levels of contamination diminish outwardly in the southerly and westerly directions. It appears that close to the lagoons, station (19,43) in Figure 18, the contamination may extend to a depth of 80 meters.

The three Em transects requested by the Michigan DNR are presented in **Figure 14: Bronson Old Lagoon Site N-S Em Transect A to A'**, **Figure 15: Bronson Old Lagoon Site E-W Em Transect B to B'**, and **Figure 16: Bronson Old Lagoon Site E-W Em Transect C to C'**. The locations for each of these transects are provided in Figure 12. Transect AA', Figure 14, generally indicates surface conductivities of 9 mmhos/m, which is within the background region and, hence, considered representative of uncontaminated near surface material. The high conductivity between stations 5 and 10 reflects the near surface contamination previously noted in Figure 11. The high conductivity near station 25 in Figure 14 is probably due to the effect of an exposed concrete drain tile. The BB' transect, Figure 15, essentially parallels the class one

anomaly defined in Figure 11. The transect supports the contamination suggested by Figure 11. Transect CC', Figure 16, indicates background conductivities along the entire northern side of the old lagoon area with the exception of one anomaly due to a buried gas pipe.

Industrial Sewer Line

One of the original objectives of the geophysical survey was to delineate the industrial sewer line that went from the L.A.Darling Co. on Matteson Street west on West Railroad Street and then north on Access Road to the Old Lagoon site, Figure 9. Part of an afternoon was devoted to trying to locate this sewer line. Extensive interference from a number of buried pipes, other than the clay sewer line, would not allow sensitive measurements to be obtained. Thus, the amount of soil contamination present, if any, and the location of the industrial sewer line could not be determined. However, a small portion of a metal pipe located in the southeast corner of the Bronson Old Lagoon area was found and may be associated with the industrial sewer line (reference the section on Bronson Old Lagoon site).

L.A. Darling Site

The last task to be performed was to conduct three Em transects over portions of the L.A. Darling Site, see Figure 9. The purpose of the transects were to determine if there were any indications of fill and/or contamination. **Figure 20: L.A. Darling Site Em Transect From A to A'** shows background values from 0 feet to 45 feet. From 60 feet to 90 feet, there is an unknown source of

buried metal and, from about 95 feet to 210 feet, a general upward trend exists implying a possible thickening of fill.

In Figure 21: L.A. Darling Site Em Transect From B to B' there is some apparent foreign material present that is causing the readings to vary from 0 to 60 feet. From 60 to 210 feet, values appear to represent natural background readings except for the reading taken at 100 feet, which is probably due to a piece of buried metal. To more accurately determine which areas may have been disturbed, a grided 2 dimensional electromagnetic survey should be conducted over the entire site. In addition, the source of the anomalies shown in figures 20, 21, and 22 should be independently determined.

Quality Assurance/Quality Control

To establish QA/QC, a base station reading was taken at the start of a day, at the end of a day, and several times during the day or portions of the data set were repeated.

At the Bronson Plating Site, a base station reading of 15 millimhos/meter, plus or minus .5 millimhos/meter, was maintained.

Repeatability of the electromagnetic data at the Bronson Old Lagoon site was excellent and can be seen in Figure 19: Bronson Old Lagoon Site Line Y=52 Used for Repeatability Profile.

STANDARD DISCLAIMER

The objective of any geophysical survey is to define the existence and configuration of features at depth. However, these features may bear a highly complex relationship to the geophysical measurements recorded. Therefore, conclusions drawn, no matter how logically deduced, should not be misconstrued as fact. We shall not and will not, except in the case of gross or willful negligence on our part, be liable or responsible for any losses, costs, damages or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, employees and agents or by anyone else not related to Fromm Applied Technology or Wooddell Logging, Inc. who might base interpretations and opinions on our geophysical surveys.

Geophysical Figures

Legend for Base Maps

Comments	Symbol
Berm	⚒
Concrete	□
Ditch	△
Fence	†
Guide Wires	✚
Metal	✱
Meter Fluctuations	✡
Noted Soil Boring or Well	
Parking Lot or Road	◇
Pit	○
Power Pole and/or Power Lines	
Tree Line	

One Station is equal to fifteen feet, unless otherwise marked.

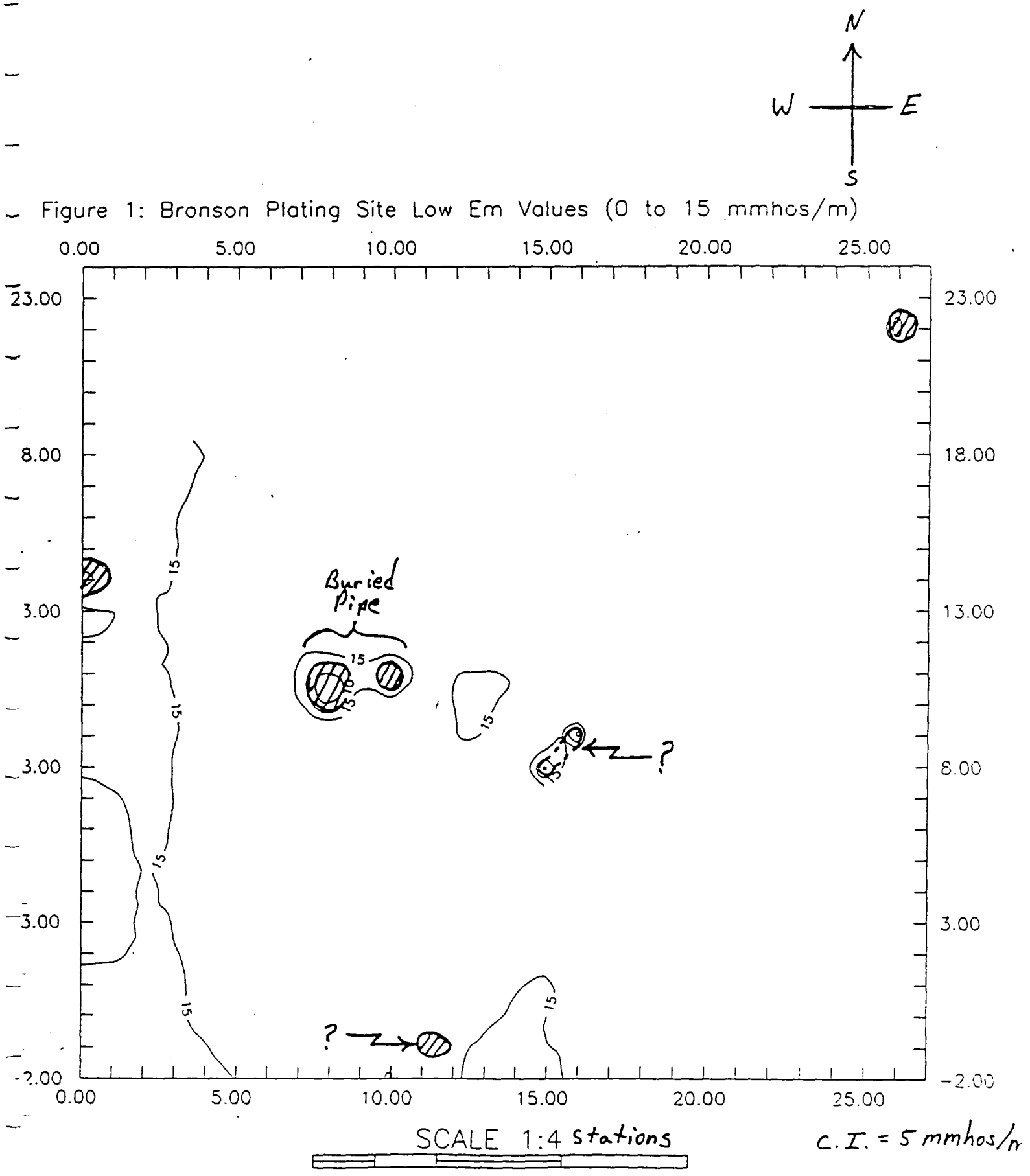
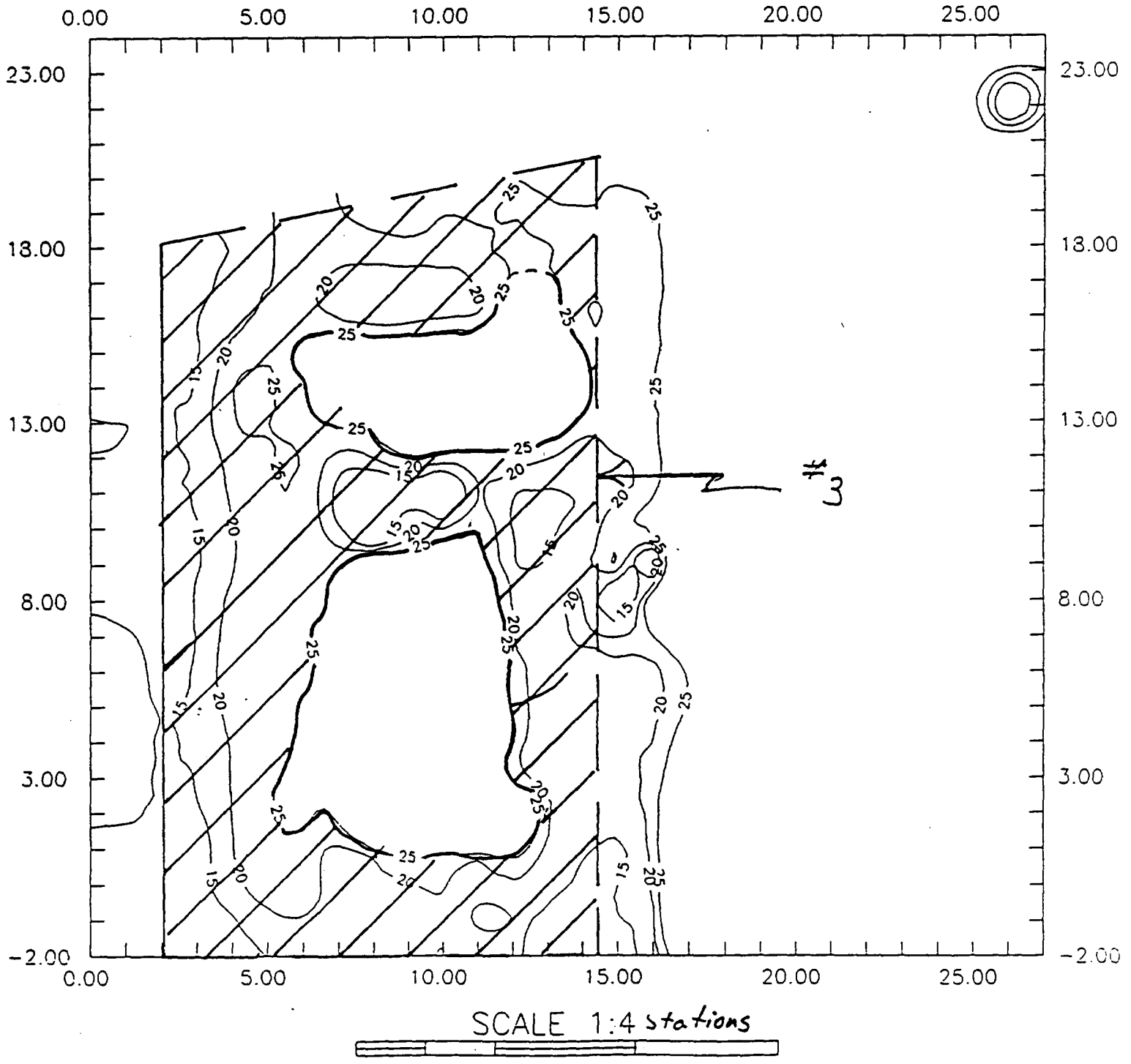


Figure 1: Bronson Plating Site Low Em Values (0 to 15 mmhos/m)

Figure 2: Bronson Plating Site Medium Em Values (15 to 25 mmhos/m)



Fromm Applied Technology

13129 N. GREENBAY ROAD
MEQUON, WISCONSIN 53092
(414) 242-4280

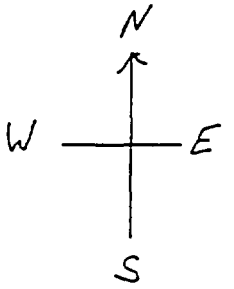
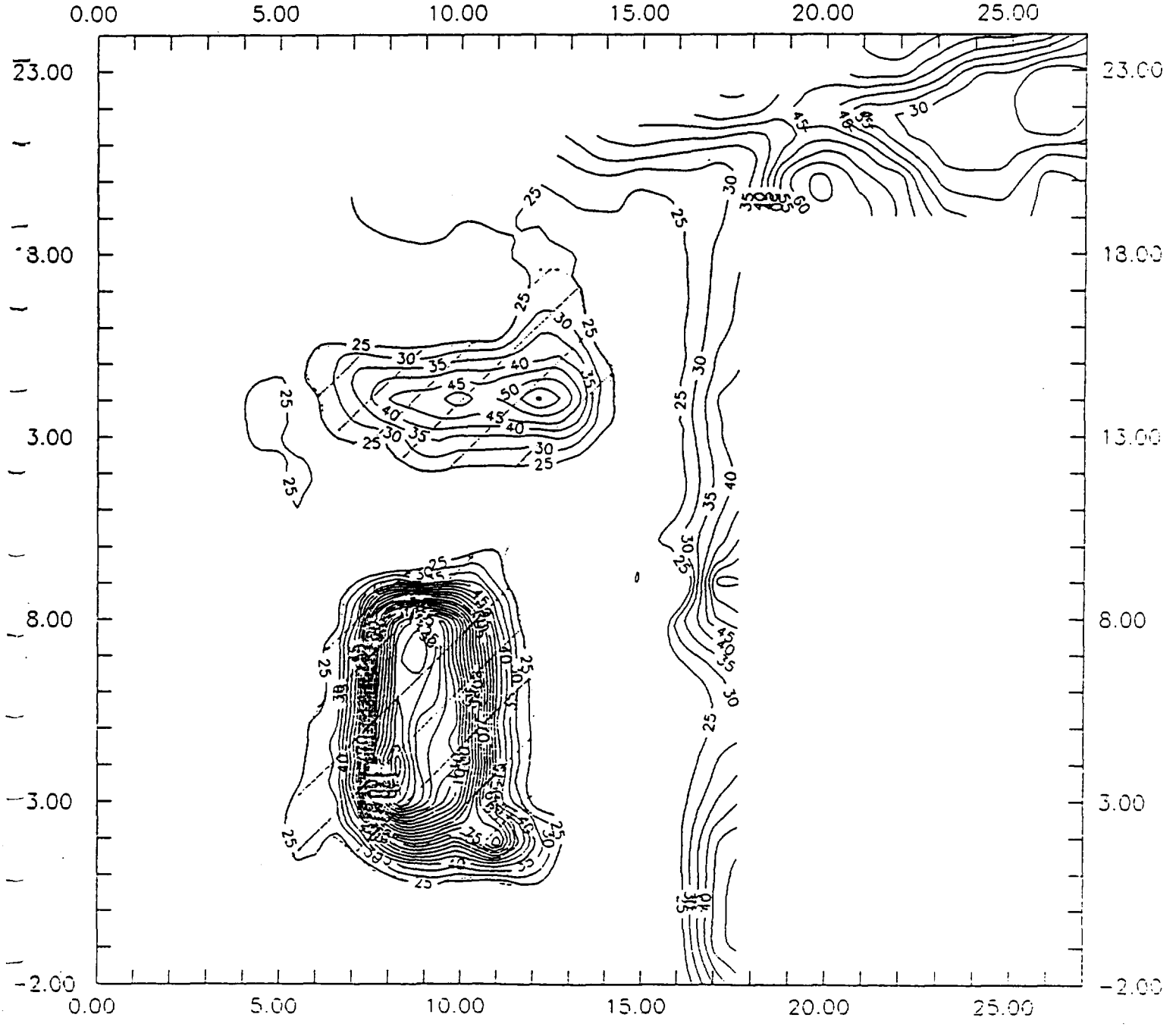


Figure 3: Bronson Plating Site High Em Values (25 to 145 mmhos/m)



SCALE 1:4 Stations

C.I. = 5 mmhos/m

Fromm Applied Technology

13129 N. GREENBAY ROAD
MEQUON, WISCONSIN 53092
(414) 242-4280

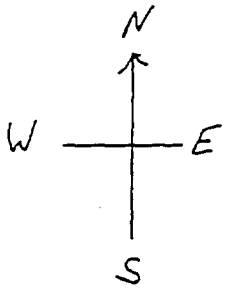
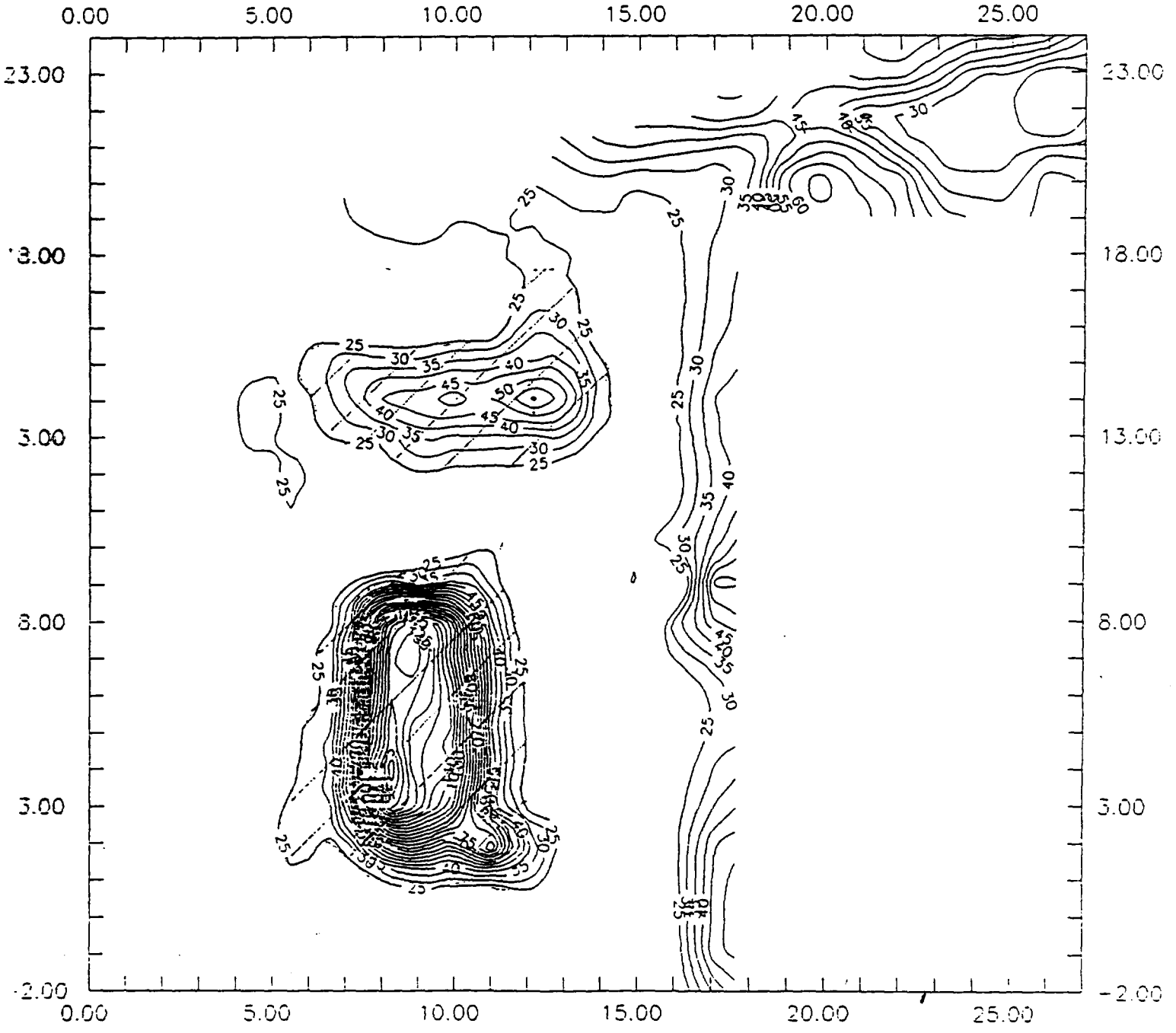


Figure 3: Bronson Plating Site High Em Values (25 to 145 mmhos/m)



SCALE 1:4 Stations

C.I. = 5 mmhos/m

Fromm Applied Technology

13129 N. GREENBAY ROAD
MEQUON, WISCONSIN 53092
(414) 242-4280

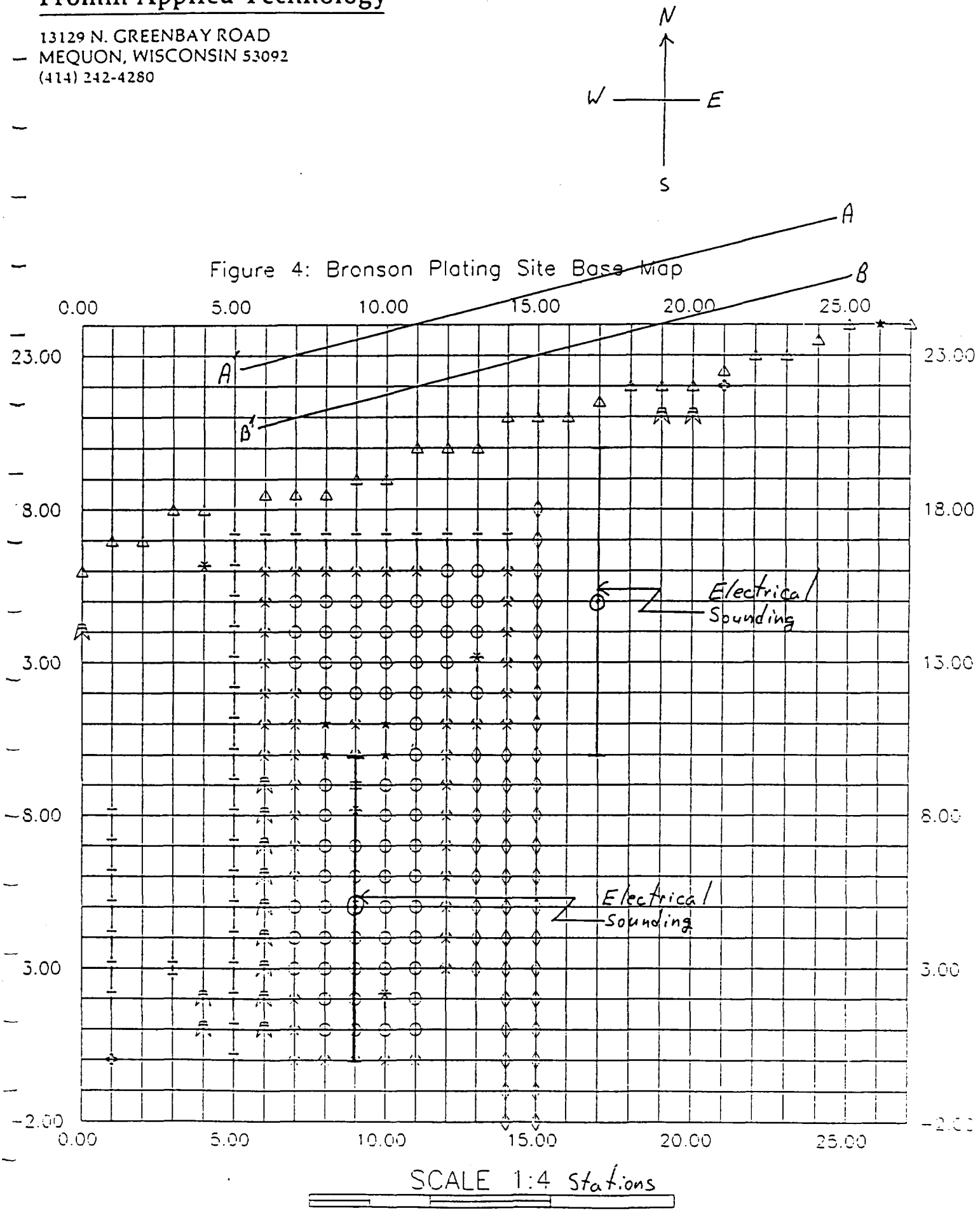
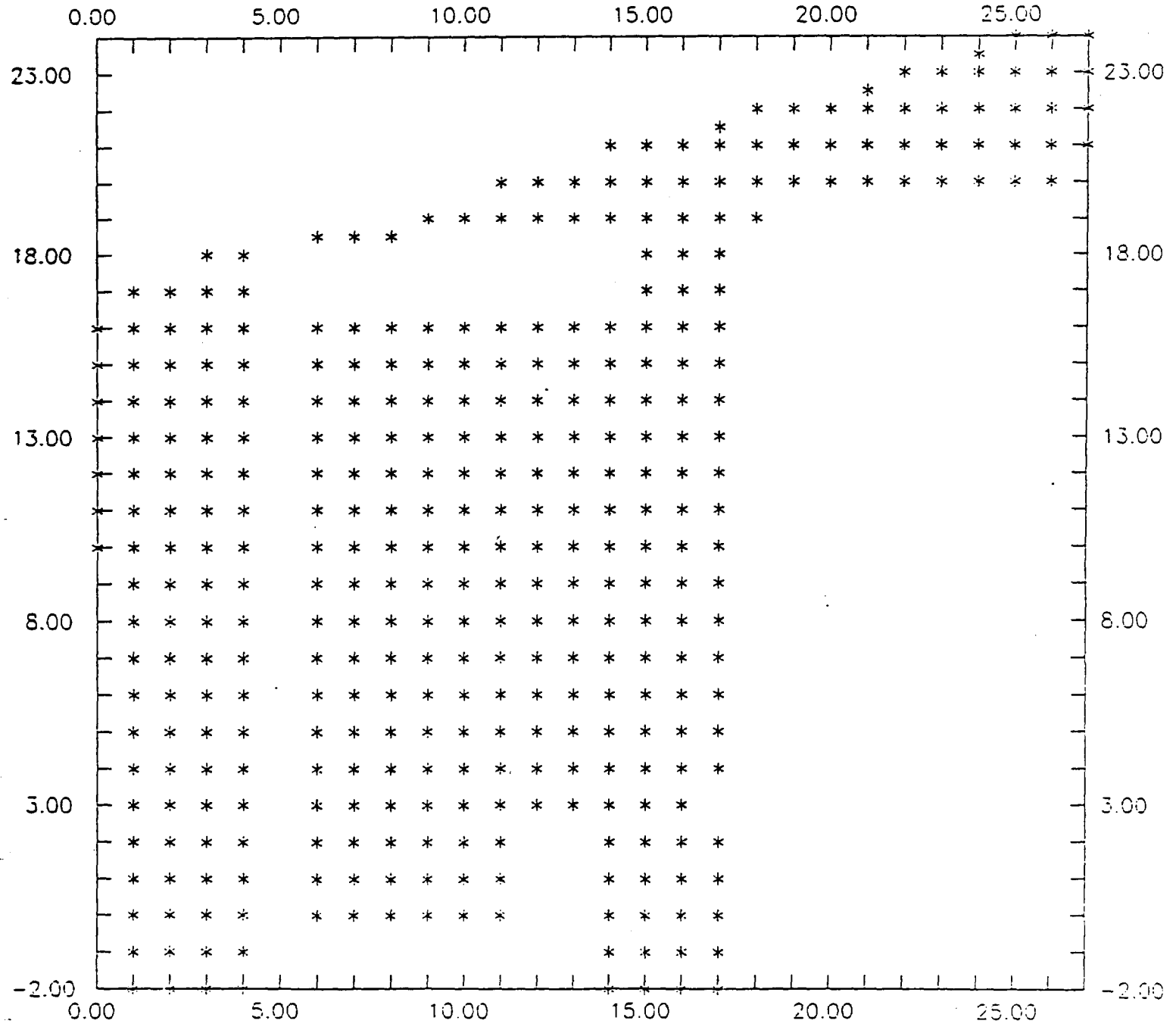


Figure 4: Bronson Plating Site Base Map

Fromm Applied Technology

13129 N. GREENBAY ROAD
MEQUON, WISCONSIN 53092
(414) 242-4280

Figure 5: Bronson Plating Site Electromagnetic Station Locations



SCALE 1:4 stations

Fromm Applied Technology
13129 N. GREENBAY ROAD
MEQUON, WISCONSIN 53092
(414) 242-4280

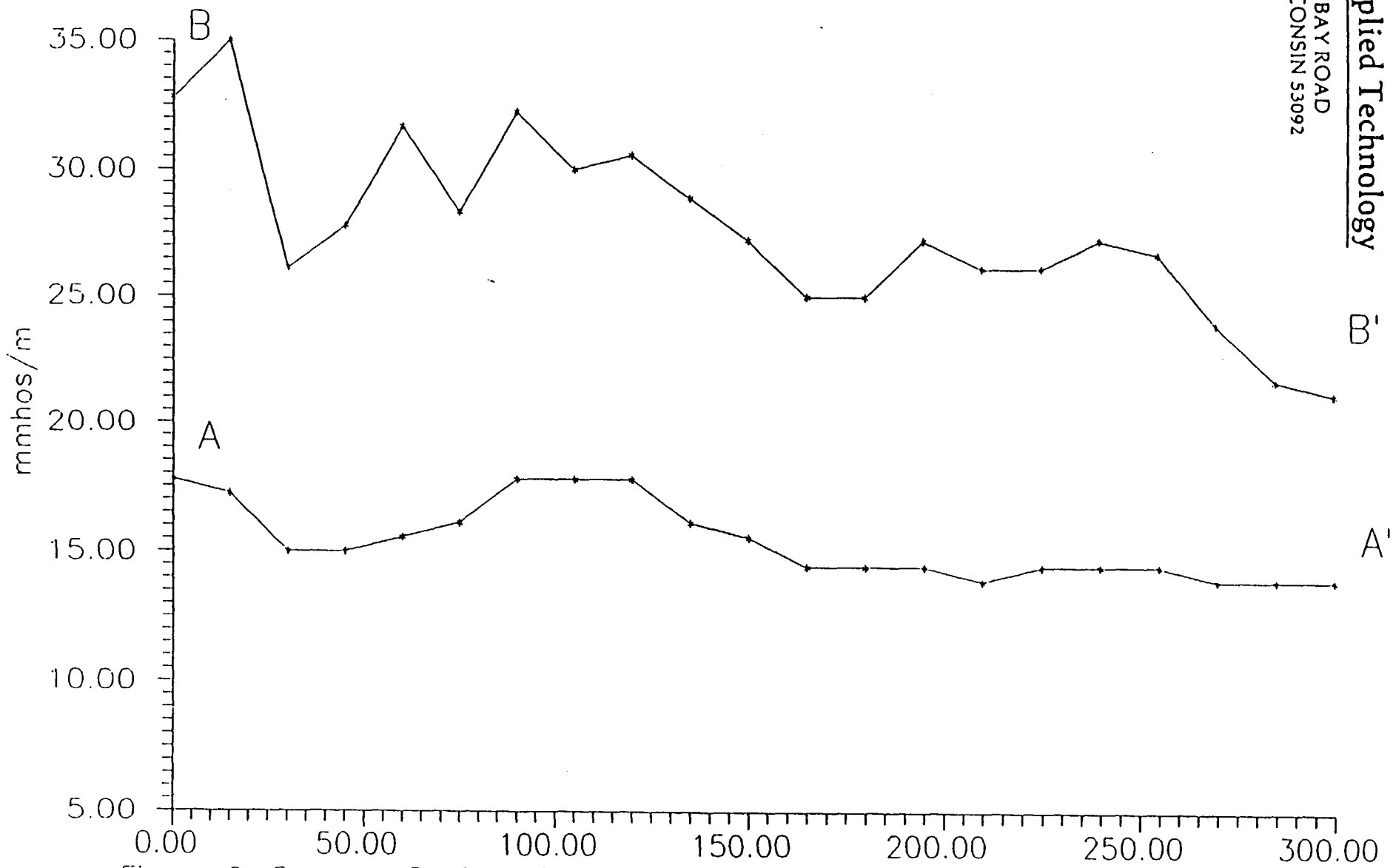


Figure 6: Bronson Plating Site Em Transects on the North Side of Co. Ditch 30
(distance in feet)

Fromm Applied Technology

13129 N. GREENBAY ROAD
MEQUON, WISCONSIN 53092
(414) 242-4280

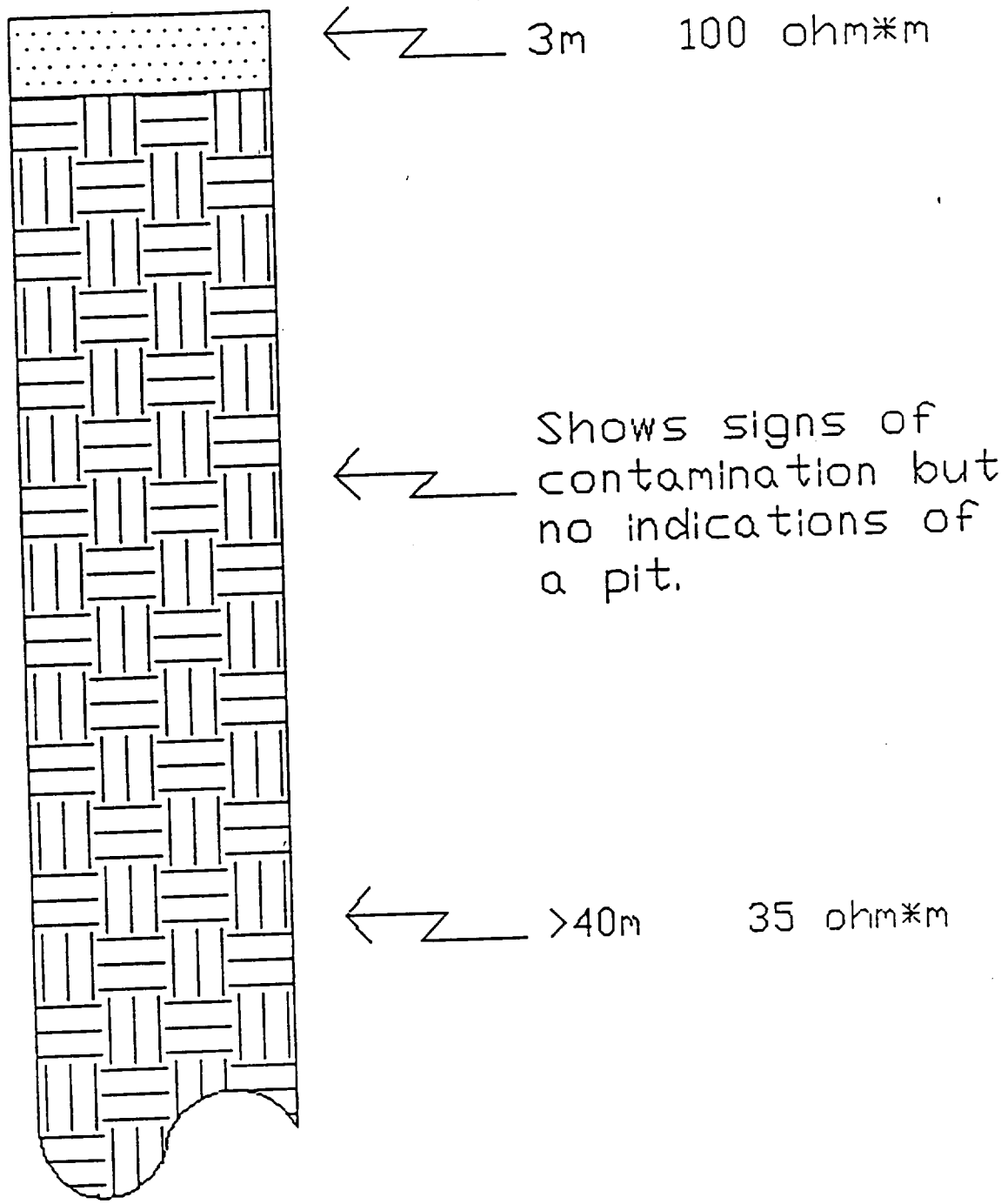


Figure 7: Bronson Plating Site Modeled Resistivity Sounding Located at Station (17,15).

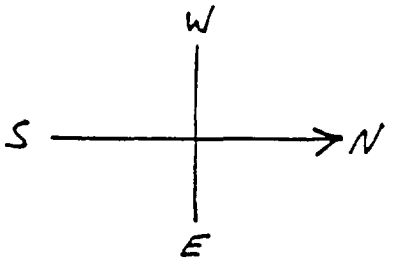
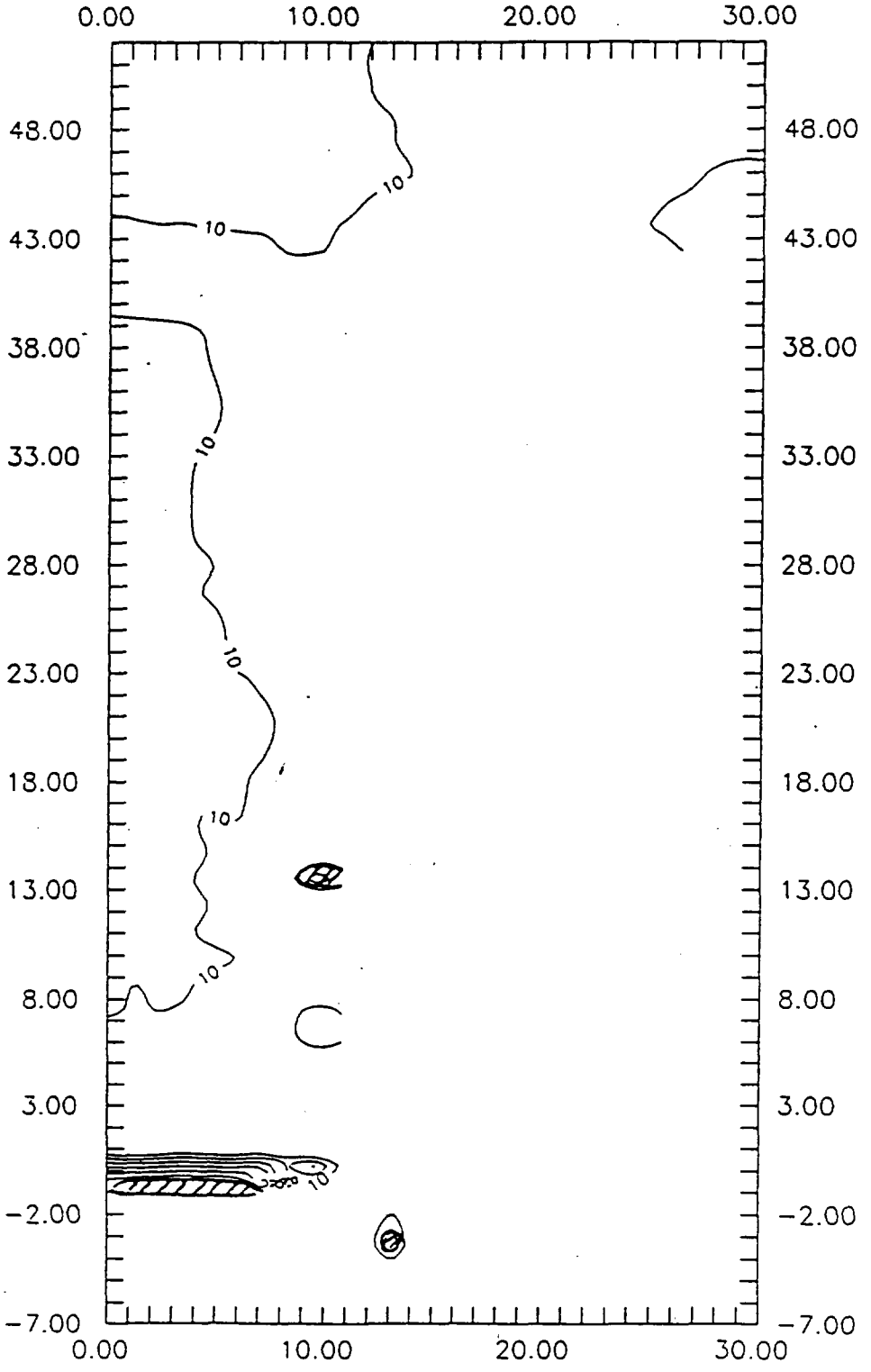


Figure 10: Bronson Old Lagoon Site Low Em Values (0 to 10 mmhos/m)



SCALE 1:8 Stations

C.I. = 2 mmhos/m

Fromm Applied Technology

13129 N. GREENBAY ROAD
MEQUON, WISCONSIN 53092
(414) 242-4280

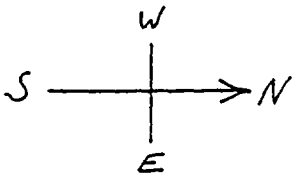
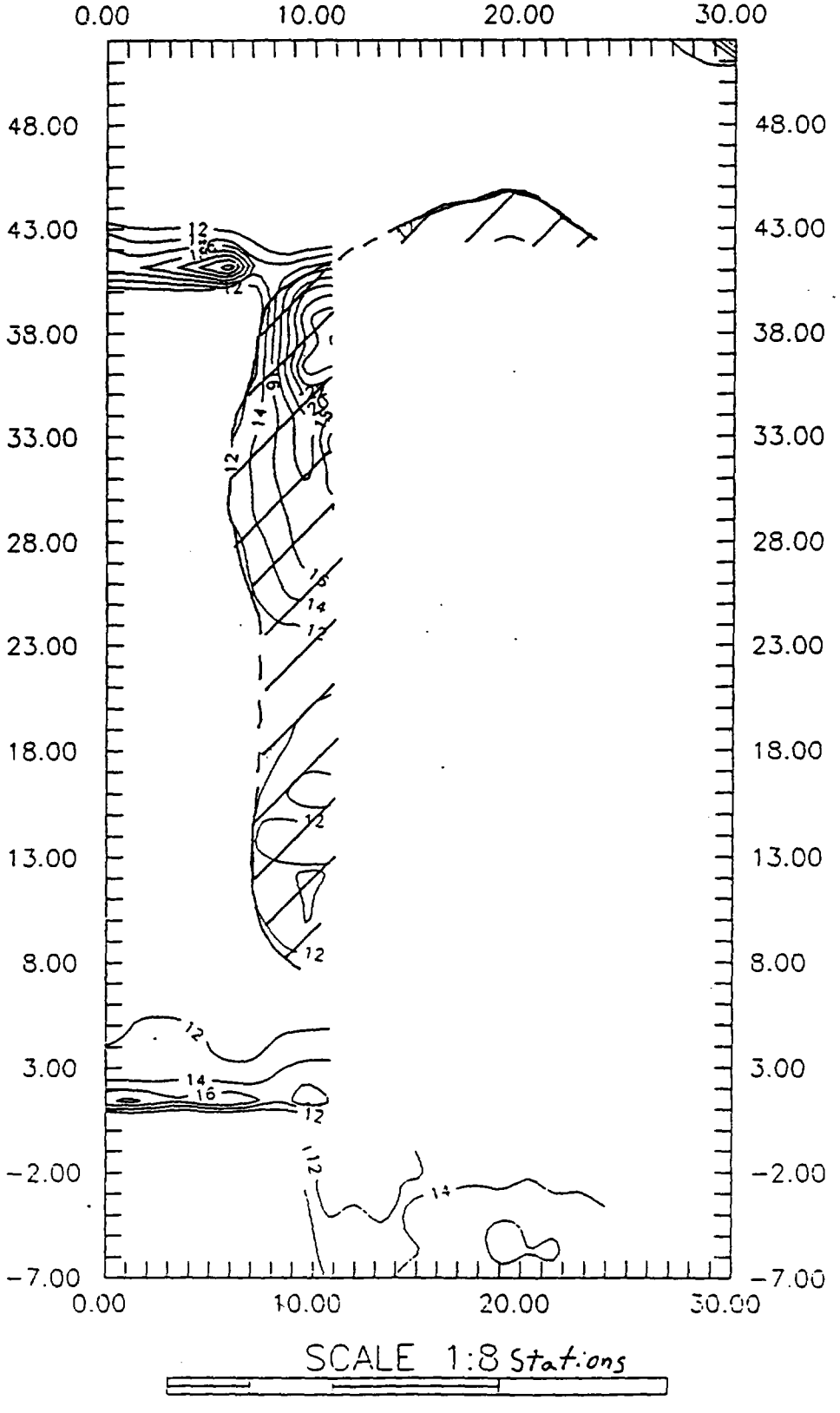


Figure 11: Bronson Old Lagoon Site High Em Values (12 to 28 mmhos/m)



Fromm Applied Technology

13129 N. GREENBAY ROAD
MEQUON, WISCONSIN 53092
(414) 242-4280

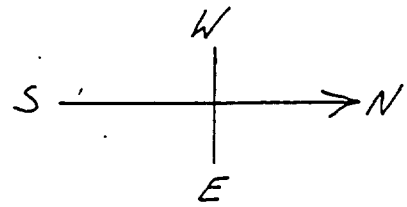
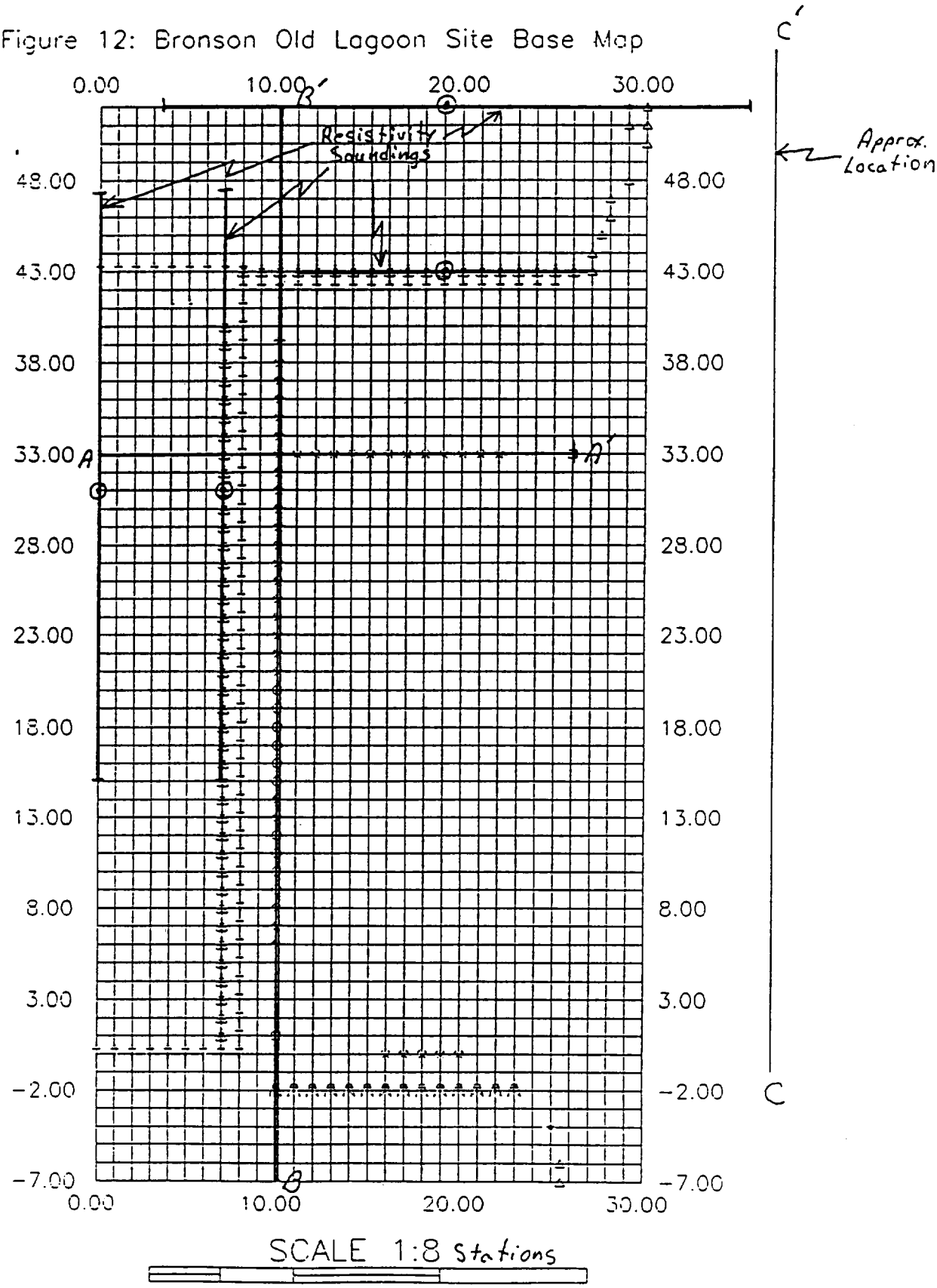


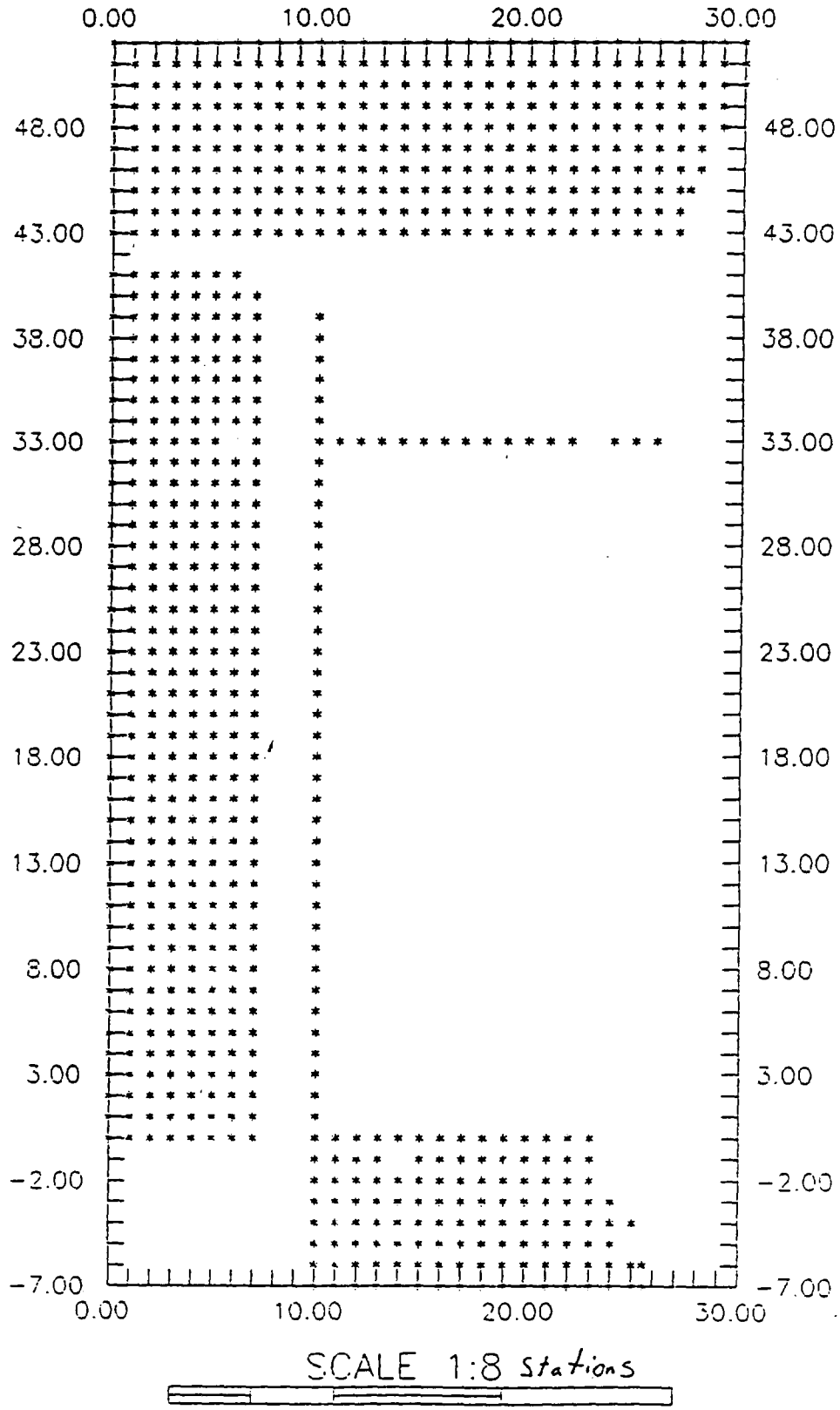
Figure 12: Bronson Old Lagoon Site Base Map



Fromm Applied Technology

13129 N. GREENBAY ROAD
MEQUON, WISCONSIN 53092
(414) 242-4280

Figure 13: Bronson Old Lagoon Electromagnetic Station Locations



Fromm Applied Technology
13129 N. GREENBAY ROAD
MEQUON, WISCONSIN 53092
(414) 242-4280

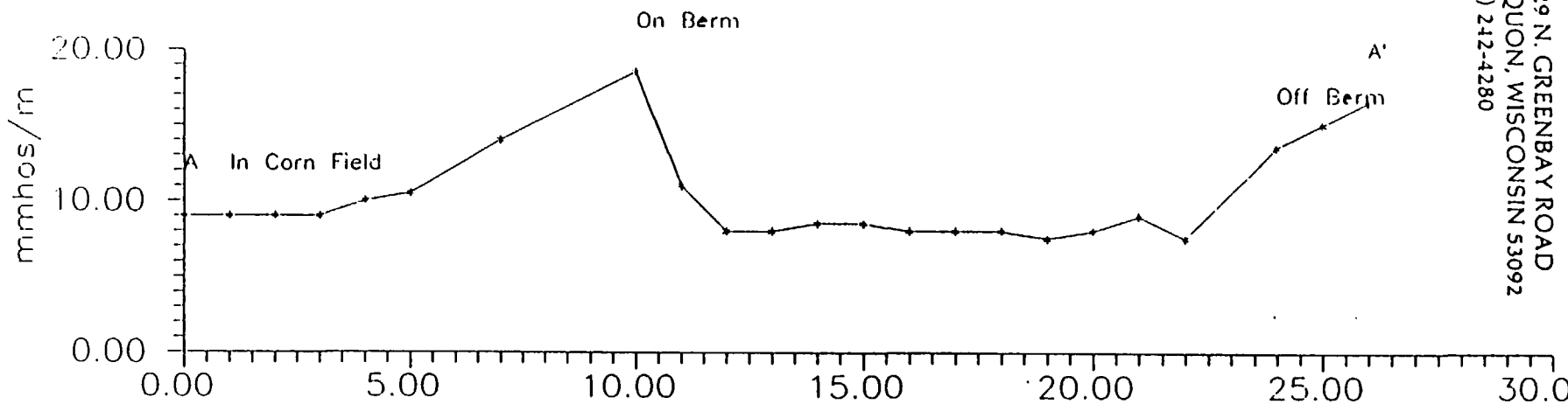


Figure 14: Bronson Old Lagoon Site N-S Em Transect A to A'

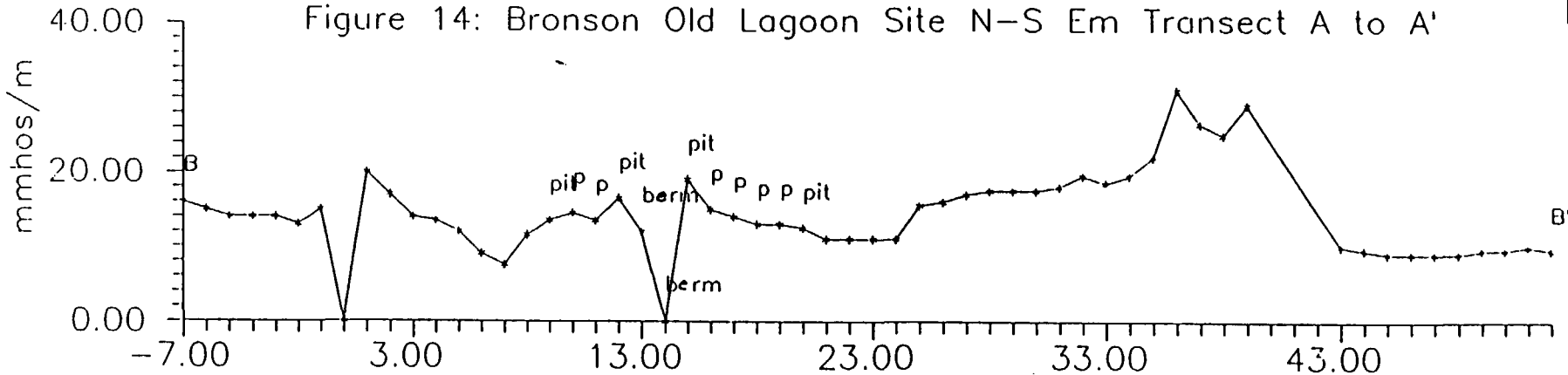


Figure 15: Bronson Old Lagoon Site E-W Em Transect B to B'

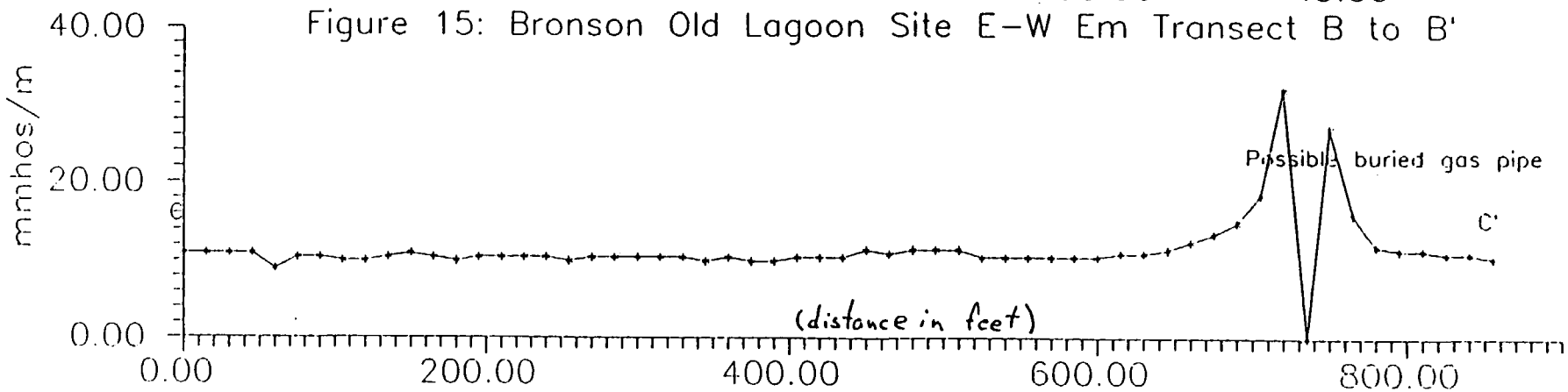


Figure 16: Bronson Old Lagoon Site E-W Em Transect C to C'

Fromm Applied Technology

13129 N. GREENBAY ROAD
MEQUON, WISCONSIN 53092
(414) 242-4280

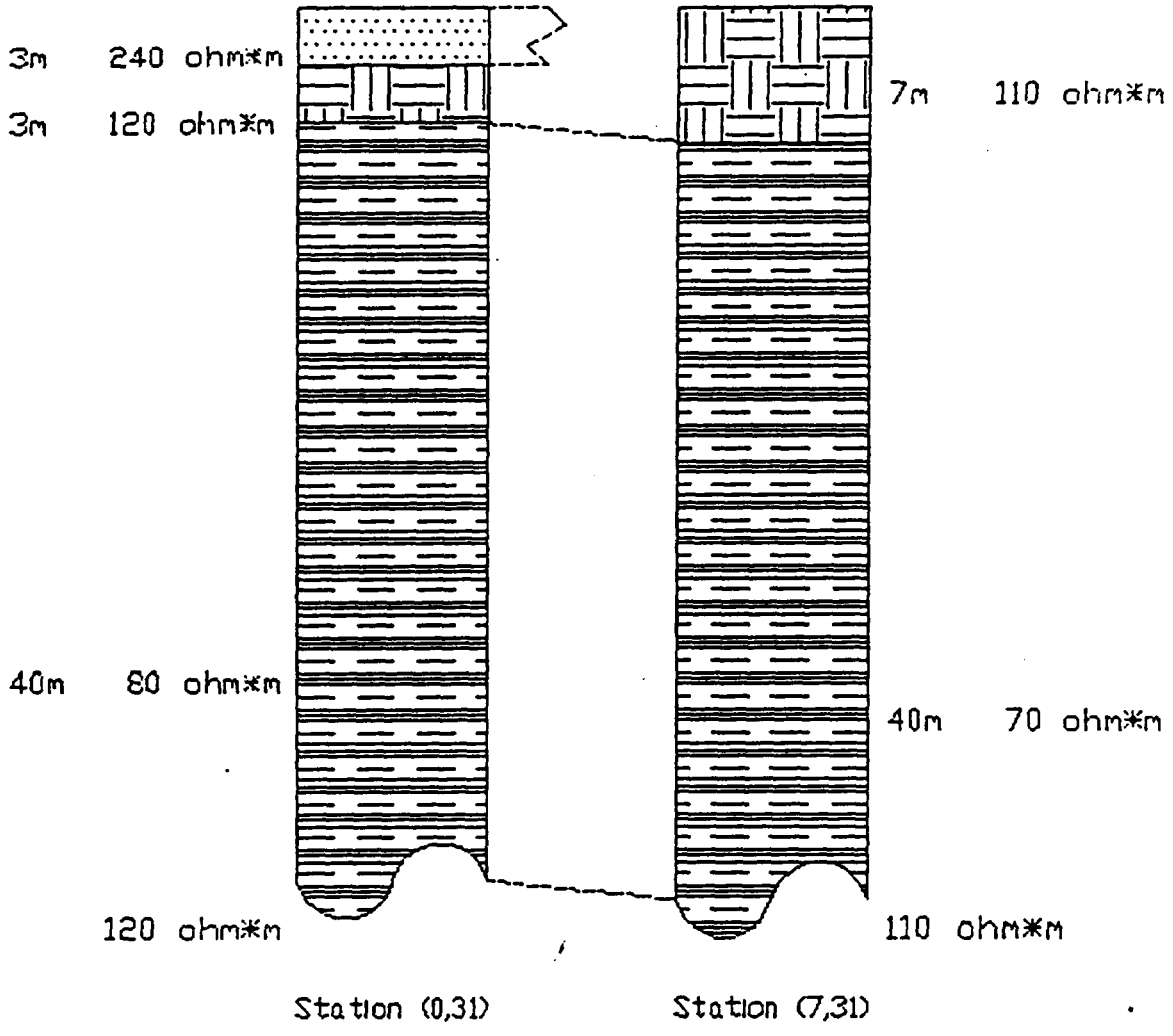


Figure 17: Model of Resistivity Data for Stations (0,31) and (7,31). Station (7,31) does show a significant decrease in resistivities, which indicates possible contamination.

Fromm Applied Technology

13129 N. GREENBAY ROAD
MEQUON, WISCONSIN 53092
(414) 242-4280

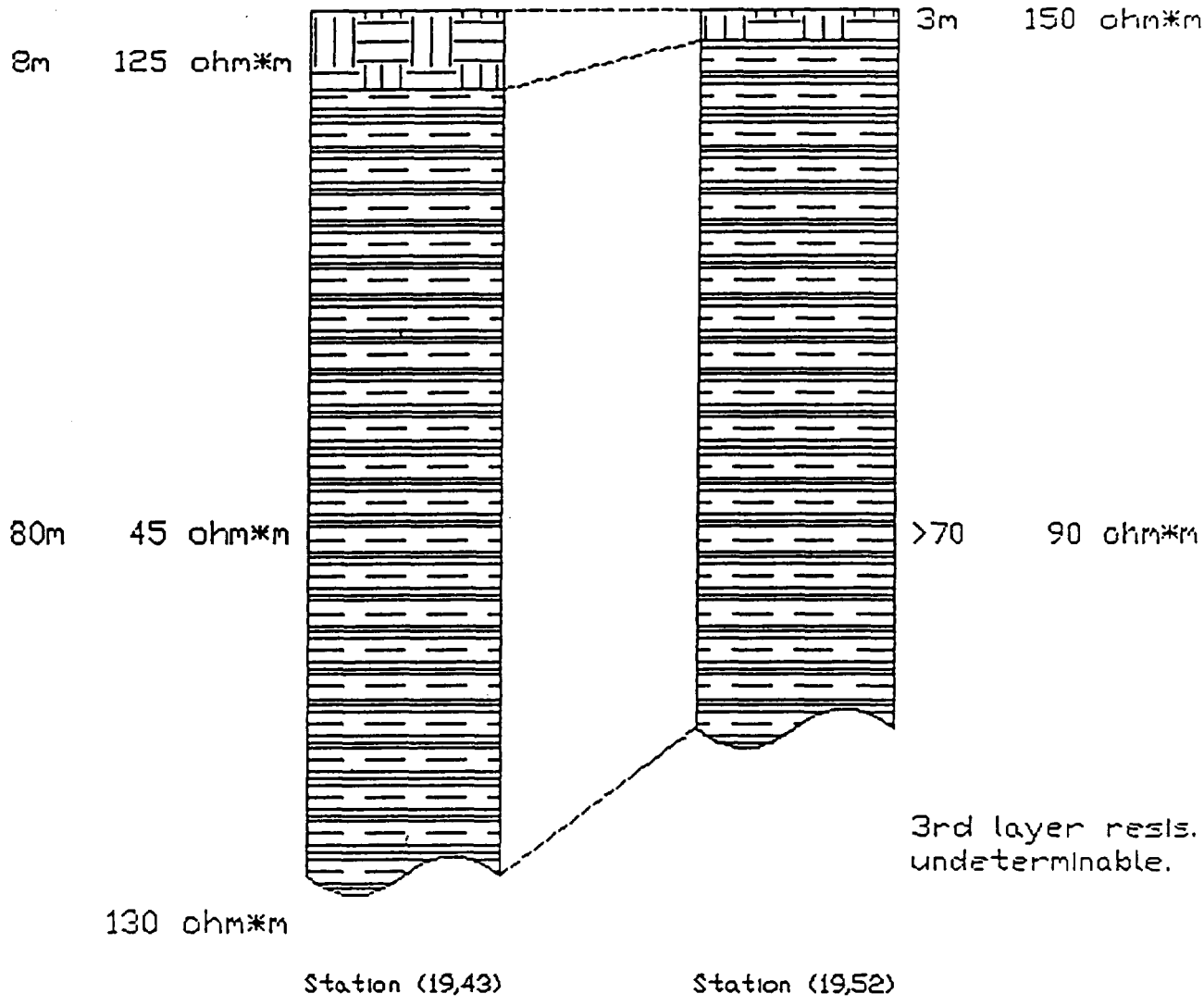


Figure 18: Model of Resistivity Data for Stations (19,43) and (19,52). Station (19,43) indicates a large zone of contamination at depth. Station (19,52) indicates no apparent contamination.

Fromm Applied Technology

13129 N. GREENBAY ROAD
MEQUON, WISCONSIN 53092
(414) 242-4280

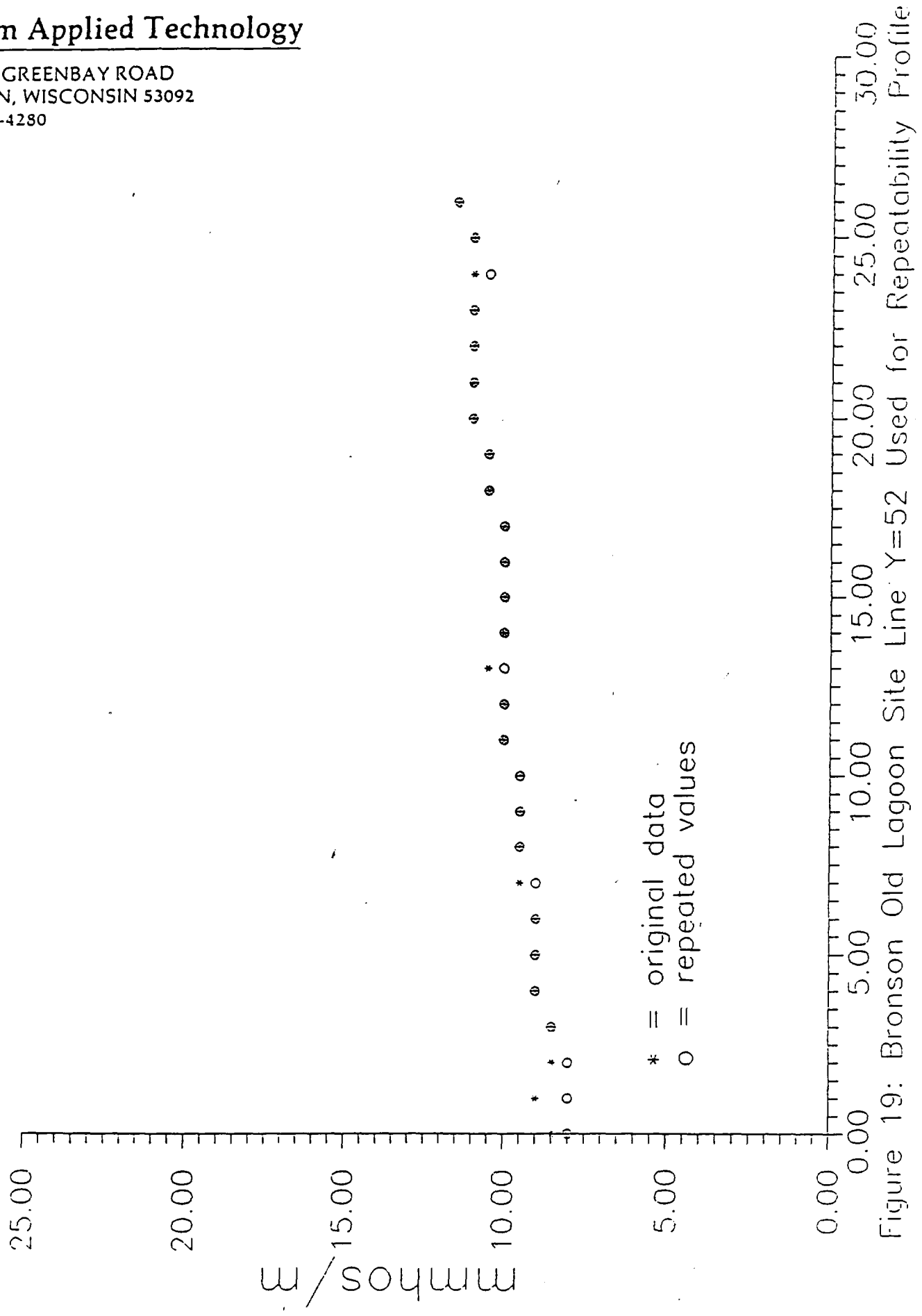
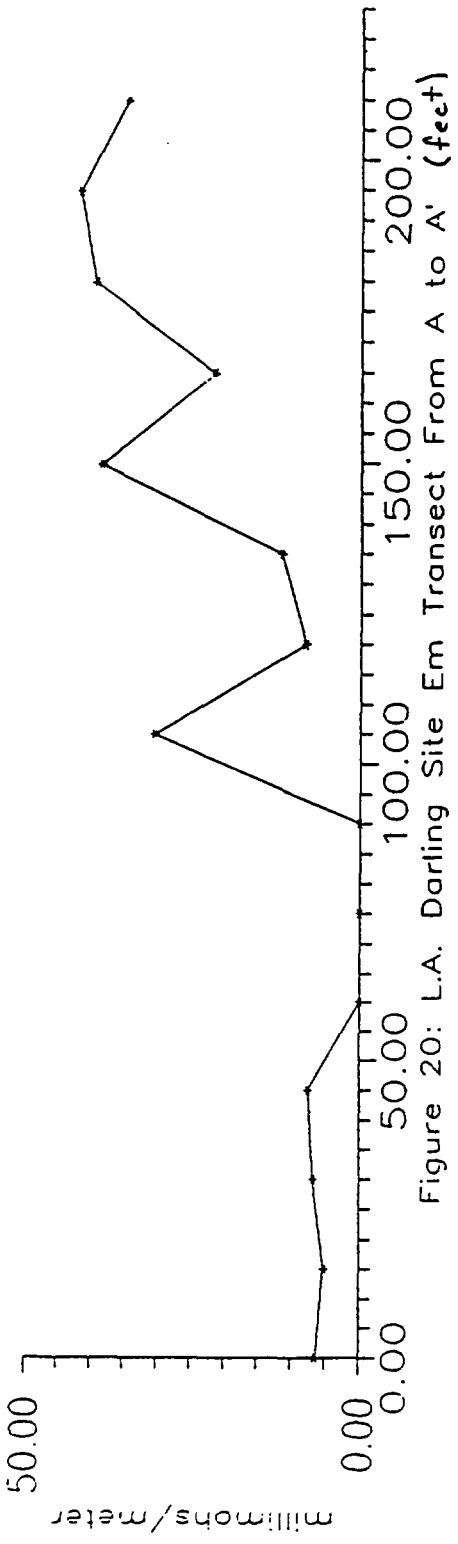
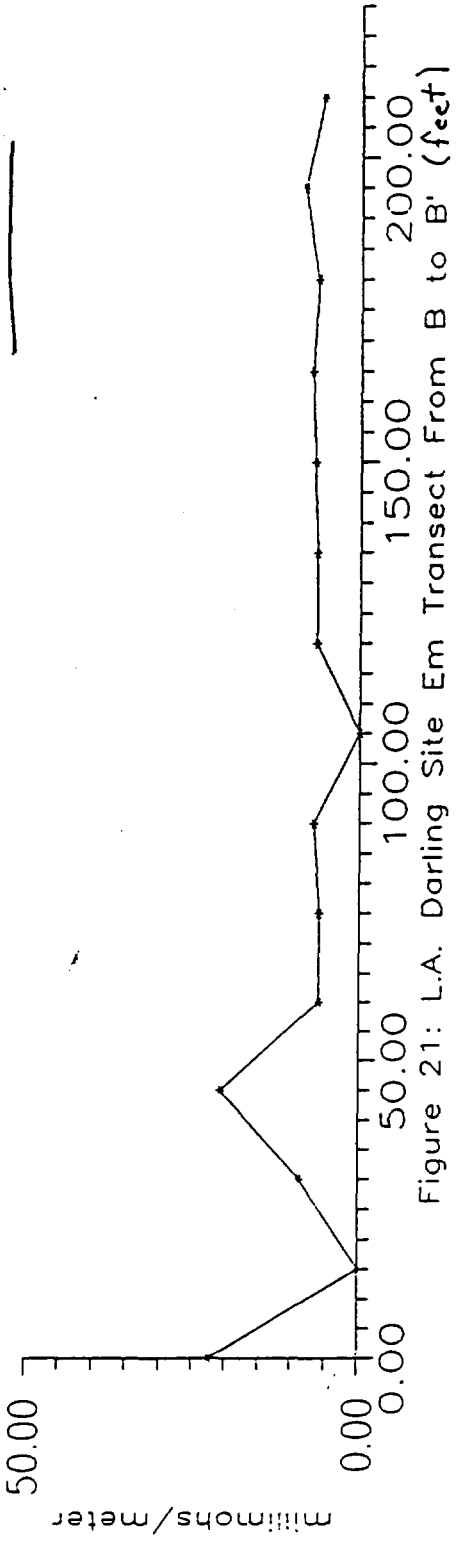


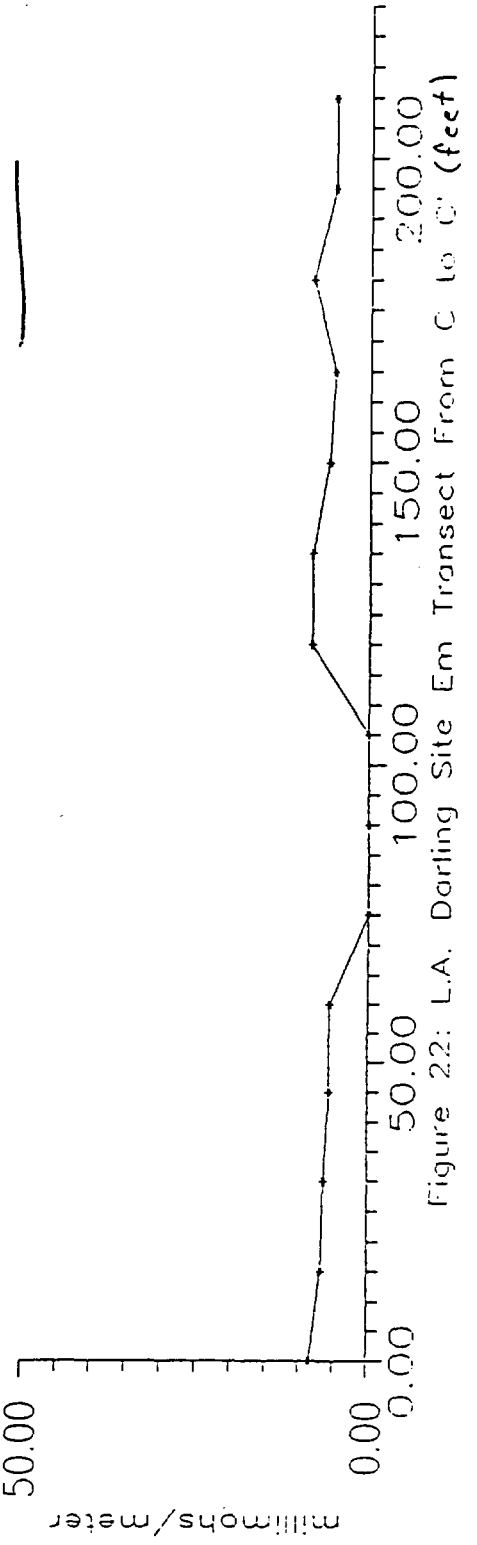
Figure 19: Bronson Old Lagoon Site Line Y=52 Used for Repeatability Profile

Fromm Applied Technology

13129 N. GREENBAY ROAD
MEQUON, WISCONSIN 53092
(414) 242-4280







Appendix A: Electromagnetic Data for Bronson Plating Site

Feet	mmhos/m	
0	16.5	JUST NORTH OF NEW BRONSON PLATING LAGOONS
15	16	150 MARK OF TAPE IS APPROX. LOCATED ON STATION 15,25
30	14	AND IS APPROX PARRALEL AND 50FT FROM DITCH 30.
45	14	THE LINE RUNS APPROX 80 DEG EAST OF NORTH
60	14.5	THE ZERO END OF TAPE IS ON THE EAST END
75	15	AND THE 300 FOOT MARK IS ON THE WEST END
90	16.5	
105	16.5	
120	16.5	
135	15	
150	14.5	
165	13.5	
180	13.5	
195	13.5	
210	13	
225	13.5	
240	13.5	
255	13.5	
270	13	
285	13	

0	30	SECOND RUN
15	32	JUST NORTH OF NEW BRONSON PLATING LAGOONS
30	24	150 MARK OF TAPE IS APPROX. LOCATED ON STATION 15,23
45	25.5	AND IS APPROX PARRALEL AND 25 FT FROM DITCH 30.
60	29	
75	26	
90	29.5	
105	27.5	
120	28	
135	26.5	
150	25	
165	23	
180	23	
195	25	
210	24	
225	24	
240	25	
255	24.5	
270	22	
285	20	
300	13	
300	19.5	

X	Y	mmhos/m
0	10	13.5
0	11	13.5
0	12	14
0	13	18.5
0	14	0
0	15	15
0	16	13
1	-2	13
1	-1	12.5
1	0	12
1	1	11.5
1	2	16.5
1	3	17.5
1	4	16.5
1	5	16.5
1	6	16.5
1	7	15.5
1	8	14
1	9	13.5
1	10	13.5
1	11	14
1	12	13.5
1	13	15
1	14	10.5
1	15	14
1	16	12.5
1	17	12.5
2	-2	11.5
2	-1	11.5
2	0	12.5
2	1	11.5
2	2	14
2	3	14
2	4	14.5
2	5	14.5
2	6	14
2	7	14
2	8	13.5
2	9	13.5
2	10	10.5
2	11	14.5
2	12	14
2	13	14.5
2	14	14.5
2	15	14
2	16	13
2	17	12.5
3	-2	11
3	-1	11
3	0	12.5
3	1	11.5
3	2	13.5
3	3	15
3	4	16
3	5	16
3	6	15
3	7	14
3	8	15
3	9	14
3	10	14.5
3	11	15.5
3	12	15.5
3	13	16.5

X	Y	mmhos/m
3	14	14.5
3	15	13.5
3	16	15
3	17	13.5
3	18	14
4	-2	12.5
4	-1	14
4	0	19.5
4	1	20.5
4	2	20.5
4	3	20.5
4	4	20.5
4	5	22
4	6	24.5
4	7	23.5
4	8	21.5
4	9	20
4	10	20
4	11	21
4	12	22
4	13	25.5
4	14	26
4	15	22.5
4	16	17.5
4	17	16.5
4	18	15
6	0	25.5
6	1	24.5
6	2	27
6	3	28.5
6	4	26.5
6	5	26.5
6	6	23.5
6	7	24.5
6	8	24
6	9	25
6	10	24.5
6	11	24.5
6	12	26
6	13	23.5
6	14	24.5
6	15	25.5
6	16	24
6	18.5	23
7	0	15
7	1	17.5
7	2	24
7	3	38
7	4	41
7	5	40
7	6	34
7	7	36
7	8	28
7	9	23
7	10	16
7	11	12.5
7	12	17
7	13	26.5
7	14	33
7	15	36
7	16	17
7	18.5	24.5
8	0	19.5

X	Y	mmhos/m
8	1	21
8	2	63
8	3	140
8	4	155
8	5	140
8	6	135
8	7	125
8	8	120
8	9	38
8	10	0
8	11	0
8	12	23
8	13	24
8	14	49
8	15	33
8	16	16
8	18.5	25
9	0	20
9	1	26.5
9	2	78
9	3	125
9	4	115
9	5	120
9	6	130
9	7	140
9	8	135
9	9	29
9	10	24.5
9	11	12
9	12	25
9	13	37
9	14	50
9	15	32
9	16	17.5
9	19	28
10	0	22
10	1	25.5
10	2	60
10	3	100
10	4	115
10	5	115
10	6	115
10	7	100
10	8	100
10	9	43
10	10	19.5
10	11	0
10	12	24
10	13	33
10	14	54
10	15	37
10	16	18.5
10	19	25
11	0	17.5
11	1	22
11	2	95
11	3	43
11	4	48
11	5	43
11	6	48
11	7	48
11	8	41
11	9	29

X	Y	mmhos/m
11	10	26
11	11	22
11	12	22
11	13	34
11	14	50
11	15	38
11	16	18.5
11	19	25.5
11	20	27.5
12	3	21.5
12	4	23
12	5	23.5
12	6	22
12	7	19
12	8	18
12	9	15
12	10	13
12	11	14
12	12	24
12	13	32
12	14	63
12	15	39
12	16	35
12	19	24.5
12	20	24.5
13	3	17.5
13	4	16.5
13	5	16.5
13	6	17.5
13	7	17
13	8	16.5
13	9	15.5
13	10	14.5
13	11	14.5
13	12	19.5
13	13	35
13	14	55
13	15	42
13	16	31
13	19	24.5
13	20	26.5
14	-2	13
14	-1	13.5
14	0	15
14	1	15.5
14	2	16.5
14	3	16.5
14	4	17
14	5	17
14	6	17
14	7	21.5
14	8	23.5
14	9	17.5
14	10	16.5
14	11	15
14	12	16
14	13	22
14	14	25
14	15	23.5
14	16	18
14	19	24.5
14	20	28.5
14	21	41

X	Y	mmhos/m
15	-2	14
15	-1	15
15	0	15
15	1	13.5
15	2	17.5
15	3	18.5
15	4	18
15	5	18.5
15	6	18
15	7	22
15	8	0
15	9	27
15	10	24
15	11	19
15	12	20
15	13	24
15	14	24
15	15	22
15	16	22
15	17	21.5
15	18	23.5
15	19	25
15	20	24
15	21	42
16	-2	16.5
16	-1	18
16	0	19
16	1	20.5
16	2	21
16	3	21.5
16	4	20
16	5	17.5
16	6	18
16	7	24.5
16	8	33
16	9	0
16	10	30
16	11	22.5
16	12	21.5
16	13	23
16	14	24
16	15	22
16	16	23
16	17	22
16	18	23.5
16	19	24.5
16	20	27.5
16	21	38
17	-2	35
17	-1	48
17	0	47
17	1	46
17	2	44
17	4	30
17	5	26
17	6	26
17	7	33
17	8	49
17	9	62
17	10	42
17	11	38
17	12	36
17	13	39

X	Y	mmhos/m
17	14	40
17	15	36
17	16	33
17	17	32
17	18	31
17	19	28
17	20	28
17	21	33
17	21.5	51
18	19	38
18	20	33
18	21	33
18	22	55
19	20	65
19	21	44
19	22	45
20	20	68
20	21	52
20	22	40
21	20	56
21	21	49
21	22	24
21	22.5	50
22	20	54
22	21	32
22	22	31
22	23	54
23	20	33
23	21	27
23	22	26
23	23	45
24	20	32
24	21	25.5
24	22	26
24	23	29
24	23.5	46
25	20	32
25	21	27
25	22	31
25	23	29
25	24	53
26	20	43
26	21	32
26	22	0
26	23	22
26	24	49
27	21	31
27	22	25
27	23	24
27	24	36

Appendix B: Resistivity Data for Bronson Plating Site

Bronson Plating Site

Station	(17,15)	(9,5)
"A" Spacing Meters	Apparent Resistivity ohm*meters	Apparent Resistivity ohm*meters
1	112	7.4
2	62	6.9
3	89	6.9
5	80	11.5
7	65	17
8.5	62	21
10	50	21
15	40	36
25		
50		

Appendix C: Electromagnetic Data for Bronson Old Lagoon Site

Feet	mmhos/m	
0	11	
15	11	
30	11	
45	11	
60	9	
75	10.5	
90	10.5	
105	10	UNDER LARGE POWER LINE
120	10	UP
135	10.5	UP
150	11	UP
165	10.5	UP
180	10	UP
195	10.5	
210	10.5	
225	10.5	
240	10.5	
255	10	
270	10.5	
285	10.5	
300	10.5	
315	10.5	
330	10.5	
345	10	
360	10.5	
375	10	
390	10	
405	10.5	
420	10.5	
435	10.5	
450	11.5	
465	11	
480	11.5	
495	11.5	
510	11.5	
525	10.5	
540	10.5	
555	10.5	
570	10.5	
585	10.5	
600	10.5	
615	11	
630	11	
645	11.5	
660	12.5	
675	13.5	
690	15	
705	18.5	
720	32	MOST LIKELY A MICH. GAS UTILITY LINE
735	0	IT WAS TRACED TO YELLOW POLE LABELED MICH. GAS
750	27	
765	16	
780	12	
795	11.5	
810	11.5	
825	11	
840	11	
855	10.5	

X	Y	mmhos/m
0	0	0
0	1	19.5
0	2	14
0	3	13
0	4	12
0	5	11.5
0	6	11
0	7	10
0	8	9.5
0	9	9.5
0	10	9.5
0	11	9.5
0	12	9.5
0	13	9.5
0	14	9.5
0	15	9.5
0	16	9.5
0	17	9.5
0	18	9
0	19	9.5
0	20	9
0	21	8.5
0	22	9
0	23	9.5
0	24	9
0	25	9.5
0	26	9.5
0	27	10
0	28	9.5
0	29	9
0	30	9.5
0	31	9
0	32	9.5
0	33	9
0	34	9
0	35	9
0	36	9
0	37	9
0	38	9
0	39	9.5
0	40	10.5
0	41	17.5
0	43	14.5
0	44	8.5
0	45	9
0	46	8.5
0	47	8.5
0	48	8
0	49	8
0	50	8
0	51	8
0	52	8.5
1	0	0
1	1	20
1	2	14.5
1	3	12.5
1	4	12
1	5	12
1	6	11.5
1	7	10.5
1	8	10
1	9	10
1	10	9.5

X	Y	mmhos/m
1	11	10
1	12	9.5
1	13	9.5
1	14	10
1	15	9.5
1	16	9.5
1	17	9
1	18	9
1	19	9.5
1	20	9.5
1	21	9
1	22	9.5
1	23	9.5
1	24	9.5
1	25	9.5
1	26	9.5
1	27	10
1	28	9.5
1	29	9.5
1	30	9.5
1	31	9
1	32	9.5
1	33	9
1	34	9
1	35	9
1	36	9
1	37	9
1	38	9
1	39	9.5
1	40	10.5
1	41	17.5
1	43	12
1	44	9.5
1	45	8.5
1	46	8.5
1	47	8.5
1	48	8
1	49	8.5
1	50	8
1	51	8.5
1	52	9
2	0	0
2	1	20
2	2	14
2	3	12.5
2	4	13
2	5	12
2	6	11.5
2	7	10.5
2	8	9.5
2	9	10.5
2	10	9.5
2	11	9.5
2	12	9.5
2	13	9.5
2	14	9.5
2	15	9
2	16	9.5
2	17	9
2	18	9
2	19	9
2	20	9
2	21	9

X	Y	mmhos/m
2	22	9
2	23	9.5
2	24	9
2	25	9
2	26	9.5
2	27	10
2	28	9.5
2	29	9.5
2	30	9.5
2	31	9
2	32	9.5
2	33	9
2	34	9
2	35	9
2	36	8.5
2	37	9
2	38	9
2	39	9.5
2	40	10.5
2	41	19
2	43	11.5
2	44	9
2	45	8.5
2	46	8.5
2	47	8.5
2	48	8.5
2	49	8.5
2	50	8.5
2	51	8.5
2	52	8.5
3	0	0
3	1	17
3	2	14
3	3	13
3	4	12.5
3	5	13.5
3	6	10.5
3	7	10.5
3	8	9.5
3	9	9.5
3	10	9.5
3	11	9.5
3	12	9.5
3	13	9.5
3	14	9.5
3	15	9
3	16	9.5
3	17	9.5
3	18	9
3	19	9.5
3	20	9
3	21	9.5
3	22	9.5
3	23	9
3	24	9
3	25	9.5
3	26	9
3	27	9.5
3	28	9.5
3	29	9.5
3	30	9.5
3	31	9
3	32	9.5

X	Y	mmhos/m
3	33	9
3	34	9
3	35	9
3	36	9
3	37	9
3	38	9
3	39	9.5
3	40	10.5
3	41	19
3	43	12
3	44	9
3	45	8.5
3	46	8.5
3	47	8.5
3	48	8
3	49	8.5
3	50	8.5
3	51	8.5
3	52	8.5
4	0	0
4	1	17
4	2	15
4	3	13
4	4	12
4	5	11.5
4	6	12
4	7	11
4	8	9.5
4	9	10.5
4	10	9.5
4	11	10
4	12	10
4	13	9.5
4	14	10.5
4	15	9.5
4	16	10
4	17	9.5
4	18	9.5
4	19	9.5
4	20	9.5
4	21	9.5
4	22	10
4	23	9.5
4	24	9.5
4	25	9.5
4	26	9.5
4	27	10
4	28	9.5
4	29	10
4	30	10.5
4	31	10
4	32	10.5
4	33	10
4	34	10
4	35	9.5
4	36	9.5
4	37	10
4	38	9.5
4	39	10
4	40	10.5
4	41	22
4	43	11.5
4	44	9

X	Y	mmhos/m
4	45	8.5
4	46	8.5
4	47	8.5
4	48	8
4	49	9
4	50	8.5
4	51	9
4	52	9
5	0	0
5	1	19
5	2	14.5
5	3	12.5
5	4	12
5	5	12
5	6	11.5
5	7	11.5
5	8	10.5
5	9	10.5
5	10	9.5
5	11	10.5
5	12	10
5	13	10.5
5	14	10.5
5	15	10
5	16	10.5
5	17	10
5	18	9.5
5	19	9.5
5	20	9.5
5	21	9.5
5	22	10
5	23	10
5	24	10
5	25	9.5
5	26	10
5	27	10.5
5	28	10
5	29	10.5
5	30	10.5
5	31	10.5
5	32	11
5	33	10.5
5	34	10
5	35	9.5
5	36	10
5	37	10
5	38	10.5
5	39	10.5
5	40	10.5
5	41	23.5
5	43	10.5
5	44	9
5	45	8.5
5	46	8.5
5	47	9
5	48	8.5
5	49	9
5	50	9
5	51	9
5	52	9
6	0	0
6	1	19
6	2	14

X	Y	mmhos/m
6	3	12
6	4	11.5
6	5	11
6	6	10.5
6	7	10.5
6	8	10.5
6	9	10
6	10	10
6	11	10.5
6	12	10
6	13	10.5
6	14	11
6	15	10.5
6	16	10
6	17	9.5
6	18	9.5
6	19	9.5
6	20	9
6	21	9
6	22	9.5
6	23	10
6	24	10
6	25	10.5
6	26	10.5
6	27	11
6	28	11
6	29	12
6	30	12
6	31	12
6	32	12
6	34	11
6	35	11
6	36	10.5
6	37	10.5
6	38	10
6	39	10.5
6	40	11
6	41	26
6	43	9.5
6	44	8.5
6	45	8.5
6	46	8.5
6	47	9
6	48	9
6	49	9
6	50	9
6	51	9.5
6	52	9
7	0	0
7	1	19
7	2	14
7	3	12
7	4	11.5
7	5	11.5
7	6	11.5
7	7	11.5
7	8	10.5
7	9	11
7	10	11.5
7	11	12
7	12	12
7	13	12
7	14	12

X	Y	mmhos/m
7	15	12
7	16	11.5
7	17	11
7	18	10.5
7	19	10
7	20	9.5
7	21	9.5
7	22	10
7	23	11
7	24	11
7	25	12
7	26	12
7	27	12.5
7	28	13
7	29	14
7	30	14
7	31	14.5
7	32	14.5
7	33	14
7	34	13
7	35	12.5
7	36	11.5
7	37	12
7	38	11
7	39	10.5
7	40	10.5
7	43	9.5
7	44	9
7	45	9
7	46	9
7	47	9.5
7	48	9
7	49	9.5
7	50	9.5
7	51	9.5
7	52	9.5
8	43	9
8	44	9
8	45	9
8	46	9
8	47	9.5
8	48	9
8	49	9.5
8	50	9.5
8	51	9
8	52	9.5
9	43	9.5
9	44	9.5
9	45	9
9	46	9.5
9	47	9.5
9	48	9
9	49	9.5
9	50	9.5
9	51	9.5
9	52	9.5
10	-7	16
10	-6	15
10	-5	14
10	-4	14
10	-3	14
10	-2	13
10	-2	13

X	Y	mmhos/m
10	-1	15
10	0	0
10	1	20
10	2	17
10	3	14
10	4	13.5
10	5	12
10	6	9
10	7	7.5
10	8	11.5
10	9	13.5
10	10	14.5
10	11	13.5
10	12	16.5
10	13	12
10	14	0
10	15	19
10	16	15
10	17	14
10	18	13
10	19	13
10	20	12.5
10	21	11
10	22	11
10	23	11
10	24	11
10	25	15.5
10	26	16
10	27	17
10	28	17.5
10	29	17.5
10	30	17.5
10	31	18
10	32	19.5
10	33	18.5
10	33	19
10	34	19.5
10	35	22
10	36	31
10	37	26.5
10	38	25
10	39	29
10	43	10
10	44	9.5
10	45	9
10	46	9
10	47	9
10	48	9
10	49	9.5
10	50	9.5
10	51	10
10	52	9.5
11	-7	13
11	-6	12.5
11	-5	12.5
11	-4	12.5
11	-3	8
11	-2	10.5
11	-1	11.5
11	0	11
11	33	11
11	43	10.5
11	44	10

X	Y	mmhos/m
11	45	9.5
11	46	9.5
11	47	9.5
11	48	9.5
11	49	9.5
11	50	9.5
11	51	10
11	52	10
12	-7	12.5
12	-6	12.5
12	-5	12.5
12	-4	13.5
12	-3	12.5
12	-2	11
12	-1	12
12	0	11
12	33	8
12	43	11
12	44	10.5
12	45	10
12	46	9.5
12	47	9.5
12	48	9.5
12	49	10
12	50	10
12	51	10
12	52	10
13	-7	13.5
13	-6	14
13	-5	13
13	-4	12.5
13	-3	0
13	-2	11.5
13	-1	11.5
13	0	8.5
13	33	8
13	43	11.5
13	44	11
13	45	10
13	46	9.5
13	47	10
13	48	10
13	49	10
13	50	10.5
13	51	10.5
13	52	10.5
14	-7	14
14	-6	13.5
14	-5	13.5
14	-4	14.5
14	-3	12
14	-2	11
14	0	12
14	33	8.5
14	43	12
14	44	11.5
14	45	10.5
14	46	10
14	47	10
14	48	10
14	49	10.5
14	50	10
14	51	10.5

X	Y	mmhos/m
14	52	10
15	-7	14.5
15	-6	14.5
15	-5	13.5
15	-4	14.5
15	-3	14
15	-2	11
15	-1	12
15	0	11
15	33	8.5
15	43	12.5
15	44	11.5
15	45	11
15	46	10.5
15	47	10.5
15	48	10.5
15	49	10.5
15	50	10.5
15	51	11
15	52	10
16	-7	14.5
16	-6	14
16	-5	14
16	-4	15.5
16	-3	14.5
16	-2	12
16	-1	13
16	0	12.5
16	33	8
16	43	12.5
16	44	12
16	45	11
16	46	10.5
16	47	10.5
16	48	10.5
16	49	10
16	50	10.5
16	51	10
16	52	10
17	-7	14.5
17	-6	14.5
17	-5	14.5
17	-4	15
17	-3	15
17	-2	12.5
17	-1	13
17	0	12
17	33	8
17	43	13
17	44	12
17	45	11.5
17	46	11
17	47	10
17	48	11
17	49	11
17	50	10.5
17	51	10.5
17	52	10
18	-7	14.5
18	-6	14.5
18	-5	13.5
18	-4	15.5
18	-3	15

X	Y	mmhos/m
18	-2	13
18	-1	12.5
18	0	10.5
18	33	8
18	43	13.5
18	44	12
18	45	11.5
18	46	10.5
18	47	11
18	48	11
18	49	10.5
18	50	11
18	51	11
18	52	10.5
19	-7	14.5
19	-6	14
19	-5	12.5
19	-4	15
19	-3	14
19	-2	13
19	-1	13
19	0	10
19	33	7.5
19	43	14
19	44	12.5
19	45	12
19	46	11
19	47	11.5
19	48	11
19	49	11
19	50	10.5
19	51	11
19	52	10.5
20	-7	14
20	-6	13.5
20	-5	14.5
20	-4	14.5
20	-3	16
20	-2	13
20	-1	14
20	0	11.5
20	33	8
20	43	14
20	44	12.5
20	45	11.5
20	46	11
20	47	10.5
20	48	11
20	49	11
20	50	11.5
20	51	11
20	52	11
21	-7	15
21	-6	14.5
21	-5	13.5
21	-4	14
21	-3	14.5
21	-2	14
21	-1	13.5
21	0	13.5
21	33	9
21	43	13
21	44	12

X	Y	mmhos/m
21	45	11.5
21	46	11
21	47	11
21	48	11
21	49	10.5
21	50	10.5
21	51	11
21	52	11
22	-7	14
22	-6	13.5
22	-5	14
22	-4	15
22	-3	14
22	-2	12.5
22	-1	12.5
22	0	13.5
22	33	7.5
22	43	13
22	44	11
22	45	11
22	46	11
22	47	11
22	48	10.5
22	49	10.5
22	50	10.5
22	51	11
22	52	11
22	52	11
23	-7	14
23	-6	15
23	-5	14
23	-4	15
23	-3	14.5
23	-2	12.5
23	-1	12.5
23	-1	
23	0	13.5
23	43	12
23	44	10.5
23	45	11
23	46	10.5
23	47	11
23	48	10.5
23	49	10.5
23	50	10.5
23	51	10.5
23	52	11
24	-7	14
24	-6	14
24	-5	16
24	-4	14
24	-3	13
24	33	13.5
24	43	11
24	44	10
24	45	11
24	46	11
24	47	10.5
24	48	10.5
24	49	10.5
24	50	10.5
24	51	10.5
24	52	11

X	Y	mmhos/m
25	-7	14.5
25	-6	13
25	-4	16.5
25	33	15
25	43	10.5
25	44	9.5
25	45	10.5
25	46	10.5
25	47	10.5
25	48	10.5
25	49	10.5
25	50	10.5
25	51	10.5
25	52	11
25.5	-7	9
25.5	-6	14
26	33	16.5
26	43	10
26	44	9.5
26	45	10
26	46	10.5
26	47	10.5
26	48	10.5
26	49	10.5
26	50	10.5
26	51	10.5
26	52	11.5
27	43	9.5
27	44	9.5
27	45	10
27	46	10.5
27	47	10.5
27	48	11
27	49	10.5
27	50	11
27	51	11.5
27	52	12
27.5	45	10
28	46	9.5
28	47	10.5
28	48	11
28	49	11
28	50	11.5
28	51	11.5
28	52	13
29	48	10.5
29	49	10.5
29	50	11
29	51	12.5
29	52	14.5
30	50	11.5
30	51	12
30	52	21

Appendix D: Resistivity Data for Bronson Old Lagoon Site

Bronson Old Lagoon Site

Station	(0,31)	(7,31)
"A" Spacing Meters	Apparent Resistivity ohm*meters	Apparent Resistivity ohm*meters
1	129	111
2	231	105
3	198	117
5	168	107
7	150	104
8.5	139	104
10	126	92
15	101	81
25	91	79
50	96	84

Bronson Old Lagoon Site

Station	(19,43)	(19,52)
"A" Spacing Meters	Apparent Resistivity ohm*meters	Apparent Resistivity ohm*meters
1	112	127
2	135	149
3	122	145
5	121	117
7	104	100
8.5	100	95
10	94	97
15	86	95
25	57	94
50		98

Appendix E: Non-useful Geophysical Data

Bronson Site

Station/"A"space	Resistivity ohm*meters 2 meters	7 meters
(17,9)	85	54
(17,13)	103	63
(17,17)	83	57

Bronson Old Lagoon Site

Station/"A"space	Resistivity ohm*meters 2 meters	7 meters
(4,31)	200	136
(19,46)	149	104

C

SOIL BORING AND WELL INFORMATION

C1 RI BORING LOGS, MONITORING WELL CONSTRUCTION DETAILS & PIEZOMETER CONSTRUCTION DETAILS

C2 RESIDENTIAL WELL LOGS

C3 PUBLIC WELL NO. 3 BORING LOG

C4 PRE RI WESTERN LAGOON AREA BORING LOGS AND SKETCHES (STERLING DRILLING CO.)

C5 PRE RI BRONSON PLATING WELL LOGS (KECK CONSULTING SERVICES, INC.)

C1

BORING LOGS AND WELL CONSTRUCTION DETAILS

METHOD FOR DETERMINING TOP AND BOTTOM DEPTH/ELEVATION OF WELL SCREEN (SEE MONITORING WELL CONSTRUCTION INFORMATION SHEETS)

1. The depth and elevation of the bottom of the well screen is provided on each Monitoring Well Construction Information Sheet (Item 7) and Nested PIezometer Detail Sheet (Item 6) on the diagram located on the left hand side of the page.

2. To calculate the DEPTH of the top of the well screen, subtract the overall screen length, provided on the particular Monitoring Well Construction Information Sheet (Section 7) or Nested Piezometer Detail Sheet (Section 6), located on the right hand side of the page, from the bottom of well screen depth identified in Step 1, above. The resulting value is the DEPTH of the top fo well screen.

3. To calculate the ELEVATION of the top of well screen, add the overall screen length to the elevation of the bottom fo the well screen identified in Step 1, above. The resulting value is the ELEVATION of the top of well screen.

For an example, refer to Monitoring Well Construction Information Sheet MW29.

Depth of Well Screen

A. The diagram indicates that the depth at the bottom fo the well screen (Item 7) is 20 ft.

   To calculate the depth at the top of the well screen, subtract the Screen Length, 5.15 ft (Section 7), from the depth at the bottom of the well screen. The resulting number is the depth at the top of the well screen.

Depth at bottom of well screen = 20.0 ft.
Depth at top of well screen = 20.0 - 5.15 = 14.85 ft.

Elevation of Well Screen

B. The diagram indicates that the elevation at the bottom of the well screen (Item 7) is 894.2 ft.

To calculate the elevation at the top of the well screen, add the screen length, 5.15 ft (Section 7), to the elevation at the bottom of the well screen. The resulting number is the elevation at the top of the well screen.

Elevation at bottom of well screen = 894.2 ft.
Elevation at top of well screen = 894.2 + 5.15 = 899.35 ft.

[mad-605-67r]

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB1
Surface Elevation
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, • NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNu	HCN	LEL
SS-01		24	M	8 15 28 27		Dense, Dark Brown, C - F Sandy, Silty, Gravelly FILL.	0.0	0	0
SS-02		18	M	10 30 24 15		Dense, Dark Brown, C - F Sandy, Silty, Gravelly FILL.	4.0	0	
SS-03		24	M	6 6 7 7	5	Loose, Black, C - F Sandy, Silty, Gravelly FILL.	3.0	0	
SS-04		24	M/W	1 3 3 5		Loose, Dark Gray - Black, C - F Sandy, Silty, Gravelly FILL.	4.0	0	
SS-05		24	W	2 2 2 18	10	Loose, Dark Brown - Black, C - F Sandy, Silty, Gravelly FILL.	3.0	0	
						Dark Staining at 10.0'. Dense, Gray, C - F SAND, trace C - F Gravel (SP).			
SS-06		12	W	16 18 25	15	Dense, Gray, C - F SAND, little C - F Gravel (SP).	3.0	0	
						End of Boring at 16.5' NOTE: 3" Split-Spoons used			

20 25 30 35 40

WATER LEVEL OBSERVATIONS

While Drilling ▽ 7.0 Upon Completion of Drilling
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/8/89 End 8/8/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB2
Surface Elevation
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	HNu	HCN	LEL
SS-01		24	M	6 10 8 13		Loose, Dark Brown, C - F Sandy, Silty, Gravelly FILL.	4.0	0	
SS-02		24	M	7 16 21 20		Dense, Dark Brown, C - F Sandy, Silty, Gravelly FILL.	3.0	0	
SS-03		24	M	5 11 13 9	5	Loose, Black, M - F Sandy, C - F Gravelly FILL.	3.0	0	
SS-04		24	M/W	2 1/2 1/2 1			2.0	0	
SS-05		24	W	7 13 5 24	10	Loose, Black with Yellow Smearings, Greasy, Organic, Sludge-like Muck (FILL).	2.0	0	
						Loose, Dark Gray, M - F Sand, trace Gravel (SP).			
SS-06		20	W	28 48 43 44	15	Dense, Gray, C - F SAND, trace to little C - F Gravel, trace Silt (SP).	3.0	0	
						End of Boring at 17.0' NOTE: 3" Split-Spoons used			
					20				
					25				
					30				
					35				
					40				

WATER LEVEL OBSERVATIONS

While Drilling ▽ 7.0 Upon Completion of Drilling

Time After Drilling

Depth to Water

Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/8/89 End 8/8/89

Driller DE Chief GFP Rig D-50

Logger CSY Editor CSY

Drill Method 4.25" HSA

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB3
Surface Elevation
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNu	HCN	LEL
SS-01		24	D/M	10 8 9 8		Loose, Dark Brown - Black, C - F Sandy, Silty FILL.	0.0	0	
SS-02		16	M	4 6 5 6		Loose, Dark Brown, C - F Sandy, Silty, Gravelly FILL.	0.0	0	
SS-03		2	M	4 0 0 0	5	Loose, Dark Brown, C - F Sandy, Silty, Gravelly FILL.	0.0	0	
SS-04		16	M	6 15 7 16 ▽		Only 2" recovery, because the Spoon was driven into a Red Brick.	0.0	0	
SS-05		20	M/W	9 12 6 20	10	Dense, Dark Brown, C - F Sandy, Silty, Gravelly FILL, with Black zone at 7.0' on Surface of Red Brick.	0.0	0	
						Loose, Dark Brown, C - F Sand, some C - F Gravel, trace Silt (SP).			
SS-06		8	W	3 22 28 38	15	Dense, Gray, C - F SAND, and C - F Gravel, trace Silt (SP-GP).	0.0	0	
						End of Boring at 17.0'			
						NOTE: 3" Split-Spoons used			
					20				
					25				
					30				
					35				
					40				

WATER LEVEL OBSERVATIONS

While Drilling ▽ 8.0 Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/7/89 End 8/7/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB4
Surface Elevation 909.7
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES	HNu	HCN	LEL
						Grass and weeds, Sandy, Clayey FILL.		0.0	0	0
					5	Loose, Gold and Green, M - F Sandy Sludge FILL.		0.0	0	0
						Loose, Black, M - F SAND (SP).		0.0	0	0
						Loose, Gray, M - F SAND (SP).		0.0	0	0
						End of Boring at 8.0'				
					10					
					15					
					20					
					25					
					30					
					35					
					40					

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/11/91 End 11/11/91
Driller SGW Chief SGW Rig
Logger SGW Editor CSY
Drill Method 3.0" HAND AUGER

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB5
Surface Elevation 907.5
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES			
No.	TYPE	Rec (in.)	Moist	N	Depth			HNu	HCN	LEL
						Loose Green, Yellow and Dark Blue, M - F Sandy (Sludge) FILL.		0.0	0	0
								0.0	0	0
					5	Loose, Gray, M - F SAND (SP).		0.0	0	0
								0.0	0	0
						End of Boring at 7.5'				
					10					
					15					
					20					
					25					
					30					
					35					
					40					

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/11/91 End 11/11/91
Driller SGW Chief SGW Rig
Logger SGW Editor CSY
Drill Method 3.0" HAND AUGER

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB6
Surface Elevation 911.4
Job No. 70051
Sheet 1 of 2

41551 ELEVEN MILE ROAD, PO BOX 8012, • NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNu	HCN	LEL
SS-01		24	M	5 10 8 16		Loose, Brown, Road Gravel and Sand, some Clay FILL.		0	0
SS-02		24	M	4 3 3 2	5	Medium Dense, Gray, C - F SAND and C - F GRAVEL, some Clay (SP-GP).		0	0
SS-03		20	M/W	1 2 2 2		Loose, Dark Gray, C - F SAND and C - F GRAVEL, some Clay (SP-GP).		0	0
SS-04		24	W	0 1 2 4	10	Loose, Dark Gray/Green, C - F SAND and C - F GRAVEL, some Clay (SP-GP).		0	
SS-05		20	W	3 6 12 13	15	Very Loose, Gray/Green, C - F SAND, some C - F Gravel (SP). 3" Black, Oily Seam at 8.5'.		0	
SS-06		20	W	5 8 11 10	20	Medium Dense, Light Gray, C - F Gravelly, C - F SAND (SP-GP). Medium Dense, Gray, C - F Gravelly, C - F SAND (SP-GP).			
SS-07		20	W	7 14 18 19	25	Dense, Gray, M - F SAND (SP).			
SS-08		12	W	7 16 18 21	30	Dense, Gray, M - F SAND (SP).			
SS-09		20	W	5 7 14 12	35	Medium Dense, Gray, M - F SAND, some Gravel (SP).			
SS-10		24	W	4 15 30 45	40	Dense, Gray, M - F SAND (SP).			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0 Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/20/91 End 11/20/91
Driller MATHES Chief CSY Rig CME -75
Logger CSY Editor CSY
Drill Method 4.25" HSA

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB6
Surface Elevation 911.4
Job No. 70051
Sheet 2 of 2

41551 ELEVEN MILE ROAD, PO BOX 8012, NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES			
No.	TYPE	Rec (in.)	Moist	N	Depth			Hnu	HCN	LEL
SS-11		24	W/M	5 21 24 31	45	Dense (Hard), Gray, C - F SAND and SILT, some Clay and Gravel (SM-ML)				
						End of Boring at 45.0'				
					50					
					55					
					60					
					65					
					70					
					75					
					80					
					85					

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB7
Surface Elevation 910.9
Job No. 70051
Sheet 1 of 2

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	HNu	HCN	LEL
SS-01		24	M	5 2 / 6 4		Loose, Dark Brown, M - F, Sandy, Gravelly, Clayey FILL. Red Brick at 1.0'.	0.0	0	0
SS-02		24	M	3 4 / 8 10	5	Medium Dense, Reddish/Yellowish Brown and Gray, C - F SAND and Fine GRAVEL (SP-GP).	0.0	0	0
SS-03		20	M/W	5 8 / 7 8			0.0	0	0
SS-04		24	W	5 6 / 9 10	10	Medium Dense, Gray, C - M SAND (SP).	0.0	0	0
						Medium Dense, Gray, C - F Gravelly, C - F SAND (SP-GP).			
SS-05		20	W	4 12 / 7 18	15	Medium Dense to Dense, Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
SS-06		20	W	7 15 / 5 16	20	Dense, Brown/Gray, C - F Gravelly, C - F SAND (SP-GP).			
SS-07		20	W	1 2 / 5 5	25	Loose, Brown/Gray, C - F Gravelly, C - F SAND (SP-GP).			
SS-08		18	W	6 15 / 21 32	30	Dense, Gray, C - F Gravelly, C - F SAND (SP-GP).			
SS-09		20	W	2 4 / 2 15	35	Medium Dense, C - F Gravelly, C - F SAND (SP-GP).			
SS-10		0	W	2 3 / 6 10	40	No or Little Sample Recovery. Loose, Gray, M - F SAND (SP).			

WATER LEVEL OBSERVATIONS

While Drilling ▽ 7.0 Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/20/91 End 11/21/91
Driller MATHES Chief CSY Rig CME -75
Logger CSY Editor CSY
Drill Method 4.25" HSA

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB7
Surface Elevation 910.9
Job No. 70051
Sheet 2 of 2

41551 ELEVEN MILE ROAD, PO BOX 8012, NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES			
No.	TYPE	Rec (in.)	Moist	N	Depth			Hnu	HCN	LEL
SS-11		0	W	9 12 12 25						
SS-12		0	W	3 4 6 6	45	Sample Washed Out of the Split Spoon as the Drillers Were Unscrewing it from the "AW" Rods. M - F SAND (SP).				
SS-13		20	W/M	4 6 7 10	50	Medium Dense, Gray, Very Fine, Silty SAND, some Clay (SM-ML).				
						End of Boring at 50.0'				
					55					
					60					
					65					
					70					
					75					
					80					
					85					

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB8
Surface Elevation 908.8
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, • NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	HNU	HCN	LEL
						Black, Sandy, Silty TOPSOIL.			
SS-01		24	M	2 1 1 2	5	Very Loose, Yellow Brown and Brown, C - F SAND, trace Fine Gravel and Silt (SP).	0.0	0	0
SS-02		20	M/W	3 4 5 5	10	Loose, Brown to Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
SS-03		24	W	1 2 4 6	15	Loose, Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
SS-04		24	W	6 6 7 8	20	Medium Dense, Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
SS-05		20	W	5 8 8 8	25	Medium Dense, Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
SS-06		24	W/M	9 9 12 13	30	Medium Dense, Gray, M - F, Silty SAND, some Clay (SM-ML).			
						End of Boring at 30.0'			
					35				
					40				

WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0 Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/26/91 End 11/26/91
Driller MATHES Chief CSY Rig CME
Logger CSY Editor CSY -75
Drill Method 4.25" HSA

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB9
Surface Elevation 908.9
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNU	HCN	LEL
						Black, Sandy, Silty TOPSOIL.			
SS-01		24	M	5 10 / 0 12	5	Medium Dense, Yellowish Brown, Brown and Gray, C - F Gravelly, C - F SAND, trace Silt (SP-GP).	0.0	0	0
SS-02		20	M/W	3 6 / 8 7	10	Medium Dense, Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
SS-03		24	W	14 18 / 19 32	15	Dense, Gray, C - F Gravelly, C - F SAND, some M - F SAND, little Gravel (SP-GP).	0.0	0	0
SS-04		24	W	5 7 / 8 6	20	Medium Dense, Gray, Silty, M - F SAND, some Clay (SM-ML).	0.0	0	0
						End of Boring at 20.0'			

25 30 35 40

WATER LEVEL OBSERVATIONS

While Drilling ▽ 8.0 Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/26/91 End 11/26/91
Driller MATHES Chief CSY Rig CME -75
Logger CSY Editor CSY
Drill Method 4.25" HSA

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB10
Surface Elevation 913.5
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNU	HCN	LEL
						Black, Silty, Sandy TOPSOIL.			
SS-01		20	M	2 4 7 11	5	Loose, Brown, C - F SAND, some C - F Gravel (SP).	0.0	0	0
SS-02		24	M/W	8 7 12 11	10	Medium Dense, Brown to Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
SS-03		24	W	4 5 8 11	15	Loose, Brown to Gray, C - F SAND, little C - F Gravel (SP).	0.0	0	0
SS-04		24	W	10 22 36 36	20	Loose, Brown to Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
						Dense to Very Dense, Tan, C - F SAND, trace C - F Gravel (SP).			
SS-05		20	W	4 6 10 12	25	Medium Dense, Light Gray, C - F SAND, trace to little, C - F Gravel (SP).	0.0	0	0
SS-06		24	W	4 5 12 13	30	Medium Dense, Light Gray, C - F SAND, some C - F Gravel (SP).	0.0	0	0
						End of Boring at 30.0'			
					35				
					40				

WATER LEVEL OBSERVATIONS

While Drilling ▽ 8.0 Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/18/91 End 11/18/91
Driller MATHES Chief CSY Rig CME -75
Logger CSY Editor CSY
Drill Method 4.25" HSA

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB11
Surface Elevation 913.4
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, • NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	HNu	HCN	LEL
						Black, Oily, Gravelly, Silty, TOPSOIL. Old Coal Storage Area.	0.0	0	0
SS-01		22	M	2 2 3 2	5	Loose, Reddish Brown, C - F Gravelly, C - F SAND, some Silt (SP-GP).	0.0	0	0
SS-02		24	M/W	6 4 11 9	10	Medium Dense, Brown and Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
SS-03		20	W	3 6 7 8	15	Medium Dense, Brown to Gray, C - F SAND, trace C - F Gravel (SP).	0.0	0	0
SS-04		24	W	10 15 16 28	20	Dense, Brown to Gray, M - F SAND (SP). C - F SAND and Fine GRAVEL (SP-GP) at 19.0 to 19.3'.		0	0
SS-05		20	W	2 7 12 14	25	Medium Dense, Brown to Gray, M - F SAND, little, C - F Gravel (SP).		0	0
SS-06		24	W	2 6 8 8	30	Medium Dense, Brown to Gray, C - F Gravelly, C - F SAND (SP-GP).		0	0
					35	End of Boring at 30.0'			
					40				

WATER LEVEL OBSERVATIONS

While Drilling ▽ 8.0 Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/20/91 End 11/20/91
Driller MATHES Chief CSY Rig CME -75
Logger CSY Editor CSY
Drill Method 4.25" HSA

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB12
Surface Elevation 909.6
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, • NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	HNU	HCN	LEL
						Black, Oily, Sandy, Silty, TOPSOIL.			
SS-01		24	M	8 13 4 16	5	Loose to Medium Dense, Brown, C - F SAND, some C - F Gravel (SP).	0.0	0	0
SS-02		20	M/W	2 8 8 9	10	Loose, Brown and Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
SS-03		20	W	4 7 9 12	15	Medium Dense, Tan, M - F SAND, trace to little Gravel (SP).	0.0	0	0
SS-04		24	W	9 22 22 22	20	Dense, Gray, C - F Gravelly, C - F SAND (SP-GP). Two - 4" Layers of M - F SAND, some Gravel.	0.0	0	0
SS-05		12	W	4 14 7 19	25	Dense, Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
SS-06		20	W	9 15 27 22	30	Dense, Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
						End of Boring at 30.0'			
					35				
					40				

WATER LEVEL OBSERVATIONS

While Drilling ▽ 8.0 Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/19/91 End 11/19/91
Driller MATHES Chief CSY Rig CME -75
Logger CSY Editor CSY
Drill Method 4.25" HSA

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB13
Surface Elevation 913.6
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, • NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNU	HCN	LEL
						Black, Gravelly, Sandy, TOPSOIL, little Silt and Clay.	0.0	0	0
SS-01		20	M	2 3 / 2 4	5	Very Loose, Brown, C - F SAND, some C - F Gravel (SP).	0.0	0	0
SS-02		20	M/W	5 12 / 13 9 ▽	10	Medium Dense, Brown, C - F SAND, some C - F Gravel (SP).	0.0	0	0
SS-03		20	W	3 8 / 15 16	15	Medium Dense, Brown, C - F SAND, some C - F Gravel (SP). 2" Gravel Seam.	0.0	0	0
SS-04		20	W	6 15 / 18 17	20	Dense, Brown, C - F SAND, some C - F Gravel (SP).	0.0	0	0
SS-05		20	W	6 18 / 22 26	25	Dense, Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
SS-06		20	W	5 21 / 26 17	30	Dense, Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
						End of Boring at 30.0'			
					35				
					40				

WATER LEVEL OBSERVATIONS

While Drilling ▽ 10.0 Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/19/91 End 11/19/91
Driller MATHES Chief CSY Rig CME -75
Logger CSY Editor CSY
Drill Method 4.25" HSA

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB14
Surface Elevation 913.8
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	HNu	HCN	LEL
						Dark Brown, Gravelly, Sandy, Silty TOPSOIL.			
SS-01		20	M	4 4 / 4 3	5	Loose, Reddish Brown, C - F SAND, some C - F Gravel (SP).	0.0	0	0
SS-02		24	M/W	0 13 / 6 10	10	Medium Dense, Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
SS-03		22	W	9 11 / 11 9	15	Medium Dense, Brown, C - F SAND, little C - F Gravel (SP).	0.0	0	0
SS-04		20	W	5 12 / 3 10	20	Medium Dense, Brown and Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
SS-05		20	W	3 10 / 20 17	25	Medium Dense to Dense, Brown and Gray, C - F SAND, little Fine Gravel (SP).	0.0	0	0
SS-06		20	W	5 18 / 27 13	30	Dense, Brown to Gray, C - F SAND, some C - F Gravel (SP).	0.0	0	0
						End of Boring at 30.0'			
					35				
					40				

WATER LEVEL OBSERVATIONS

While Drilling ▽ 9.0 Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/19/91 End 11/19/91
Driller MATHES Chief CSY Rig CME -75
Logger CSY Editor CSY
Drill Method 4.25" HSA

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. SB15
Surface Elevation 913.6
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, • NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNu	HCN	LEL
						Dark Brown to Black, Silty, Sandy, Gravelly TOPSOIL.	0.0	0	0
SS-01		20	M	4 5 3 2	5	Loose, Brown and Reddish Brown, C - F SAND, little C - F Gravel, Silt and Clay (SP).	0.0	0	0
SS-02		24	M/W	8 12 12 11	10	Medium Dense, Brown, C - F Gravelly, C - F SAND, trace Silt and Clay (SP-GP).	0.0	0	0
SS-03		20	W	7 7 12 12	15	Medium Dense, Brown, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
SS-04		20	W	8 10 16 14	20	Medium Dense, Brown and Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
SS-05		20	W	11 16 19 26	25	Dense, Brown to Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
SS-06		22	W	7 18 7 13	30	Dense, Gray, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
					35	End of Boring at 30.0'			
					40				

WATER LEVEL OBSERVATIONS

While Drilling ▽ 8.0 Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/19/91 End 11/19/91
Driller MATHES Chief CSY Rig CME -75
Logger CSY Editor CSY
Drill Method 4.25" HSA

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW1S
Surface Elevation 913.3
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNu	HCN	LEL
						Black, Sandy TOPSOIL.	0.0	0	
SS-01		14	M	5 11 6 21	5	Loose, Brown, M - F SAND, trace Silt, trace C - F Gravel (SP).	0.4	0	
SS-02		12	W	5 7 7 8	10		0.0	0	
SS-03		7	W	4 6 2 14	15	Loose, Brown, C - F SAND, little C - F Gravel, trace Silt (SP).			
						End of Boring at 16.5'			
					20				
					25				
					30				
					35				
					40				

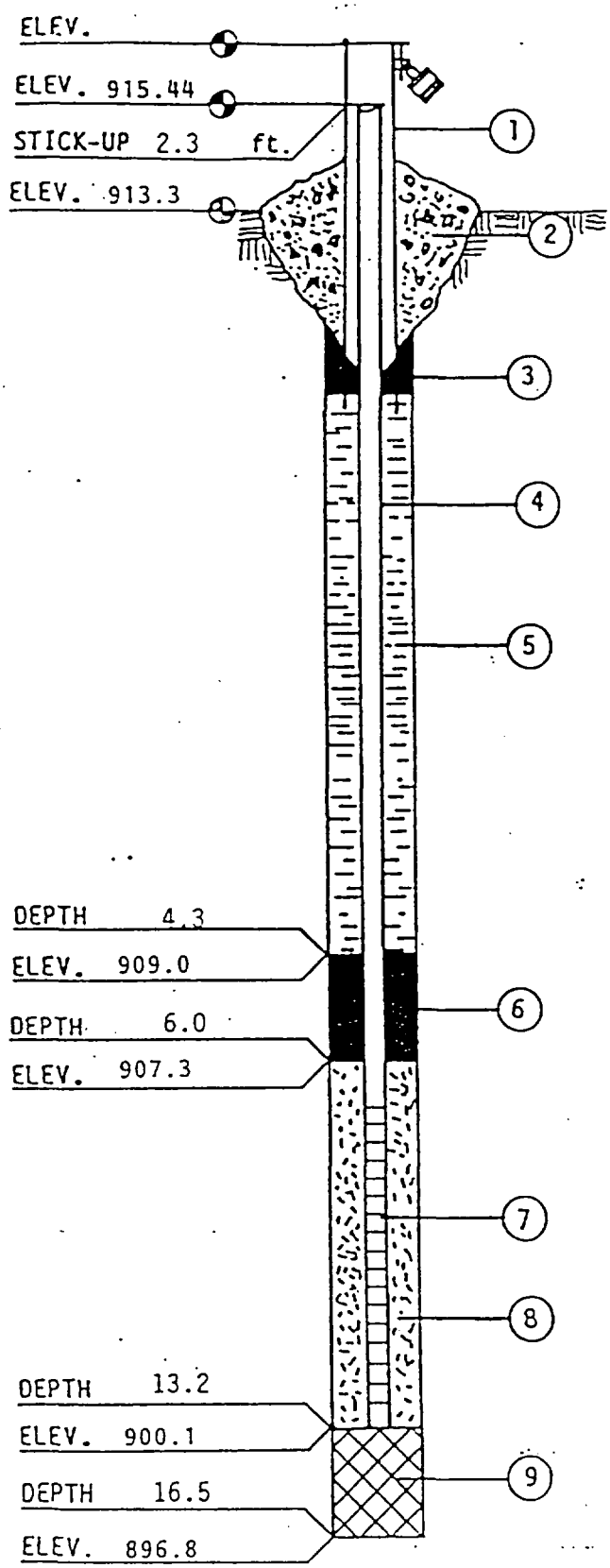
WATER LEVEL OBSERVATIONS

While Drilling ▽ 14.5 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 10.16 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/2/89 End 8/2/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-01S

DATE August 2, 1989

CHIEF/UNIT Dave/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 10.1 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Granular Bentonite

   HOW INSTALLED - TREMIE FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Hole Plug Bentonite

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Flint Sand

9. TYPE OF BACKFILL Caved Sands

10. DRILLING METHOD 4 1/4 in. HSA 0-16.5 ft

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 10.16 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN ENGINEERING INC

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW2S
Surface Elevation 911.8
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, • NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNU	HCN	LEL
						Loose, Dark Brown, Sandy TOPSOIL.	0.0	0	
SS-01		18	M	2 15 5 16	5	Dense, Gray, C - F SAND, some C - F Gravel (SP).	0.1	0	
SS-02		16	W	6 8 3 13	10	Loose, Gray, C - F SAND, Some C - F Gravel (SP).	0.0	0	
SS-03		18	W	1 16 21 33	15	Dense, Gray, C - F SAND, some C - F Gravel, some Silt at 16.4' (SP). Orange - Brown staining at 16.3 to 16.5'.			
					20	End of Boring at 16.5'			
					25				
					30				
					35				
					40				

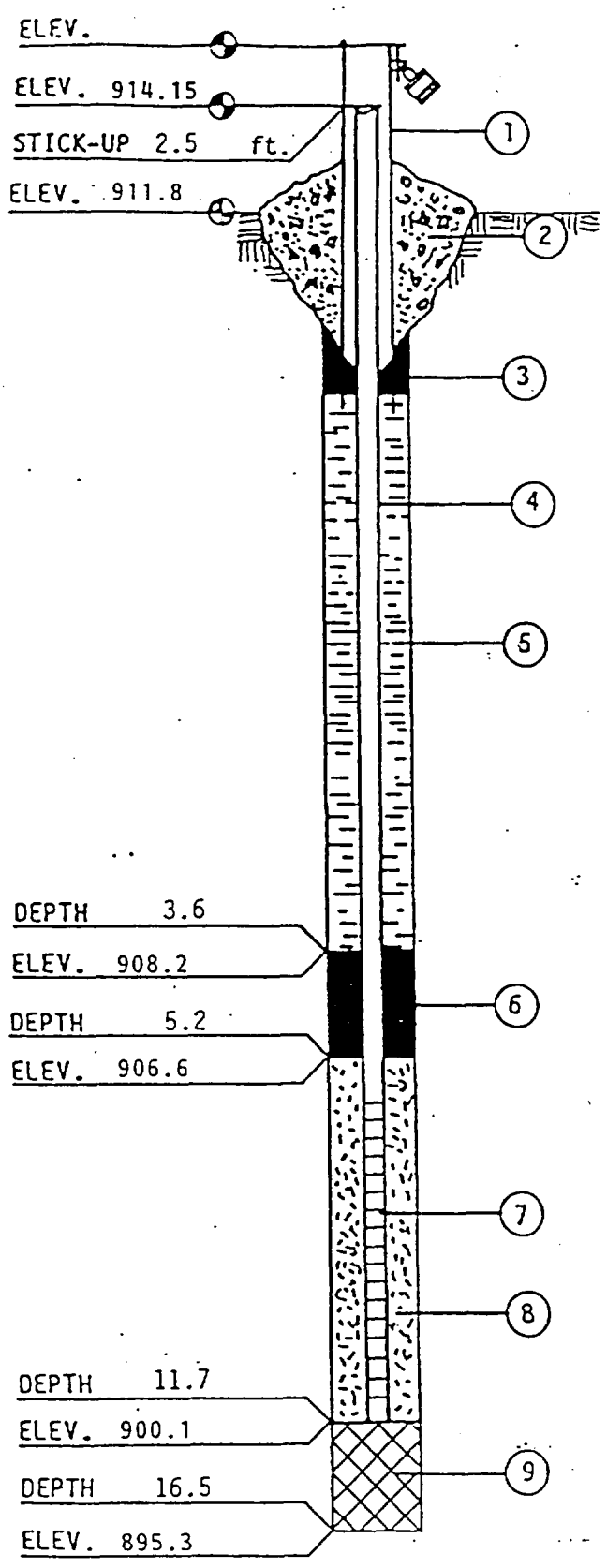
WATER LEVEL OBSERVATIONS

While Drilling ▽ 10.0 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 8.98 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/6/89 End 8/6/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-02S

DATE August 6, 1989

CHIEF/UNIT Dave Ellis/D-5

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 8.8 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Granular Bentonite

   HOW INSTALLED - TREMIE
   FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Bentonite Pellets

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Sand

9. TYPE OF BACKFILL Natural Collapse/Coarse Sand

10. DRILLING METHOD 4.25 HSA

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 8.98 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN ENGINEERING INC

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW3S
Surface Elevation 912.5
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, • NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNu	HCN	LEL
						Loose, Light Brown, C - F Sandy TOPSOIL.	0.0	0	
						Dense, Dark Brown, Silty, Sandy FILL.			
SS-01		14	M	5 13 8 15	5	Dense, Light Brown - Gray, C - F SAND, some C - F Gravel (SP).	0.0	0	
SS-02		12	W	5 9 10 10	10	Loose, Gray C - F SAND, some C - F Gravel (SP).	0.0	0	
SS-03		8	W	5 8 2 13	15	Loose, Gray, C - F SAND, trace Silt and C - F Gravel (SP).	0.0	0	
						End of Boring at 16.5'			
					20				
					25				
					30				
					35				
					40				

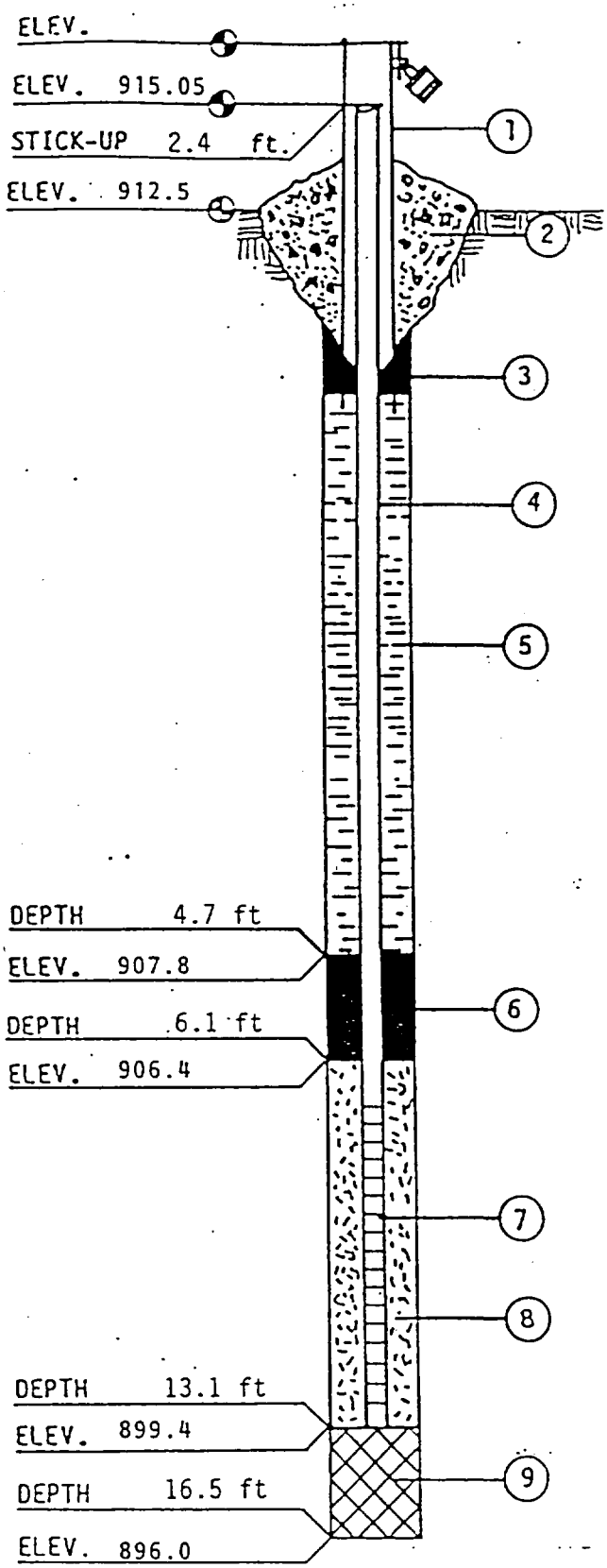
WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.5 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 9.94 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/6/89 End 8/6/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-03S

DATE August 6, 1989

CHIEF/UNIT Dave Ellis/D-5

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 10.5 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Granular Bentonite

   HOW INSTALLED - TREMIE
   FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Bentonite Pellets

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Sand

9. TYPE OF BACKFILL Natural Collapse

10. DRILLING METHOD 4.25 HSA

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 9.94 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN ENGINEERING INC

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW4S
Surface Elevation 911.4
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNu	HCN	LEL
						Loose, Dark Brown, Sandy TOPSOIL.	0.0	0	
SS-01		18	M	6 10 11 16	5	Loose, Dark Brown, C - F SAND, some C - F Gravel (SP).	0.0	0	
SS-02		18	W	7 10 6 8	10	Loose, Brown - Gray, C - F SAND, some C - F Gravel (SP). 3" Thick Orange - Brown stain at 10.2'.	0.0	0	
SS-03		18	W	3 7 8 10	15	Loose, Brown - Gray, C - F SAND, some C - F Gravel (SP).			
						End of Boring at 16.5'			
					20				
					25				
					30				
					35				
					40				

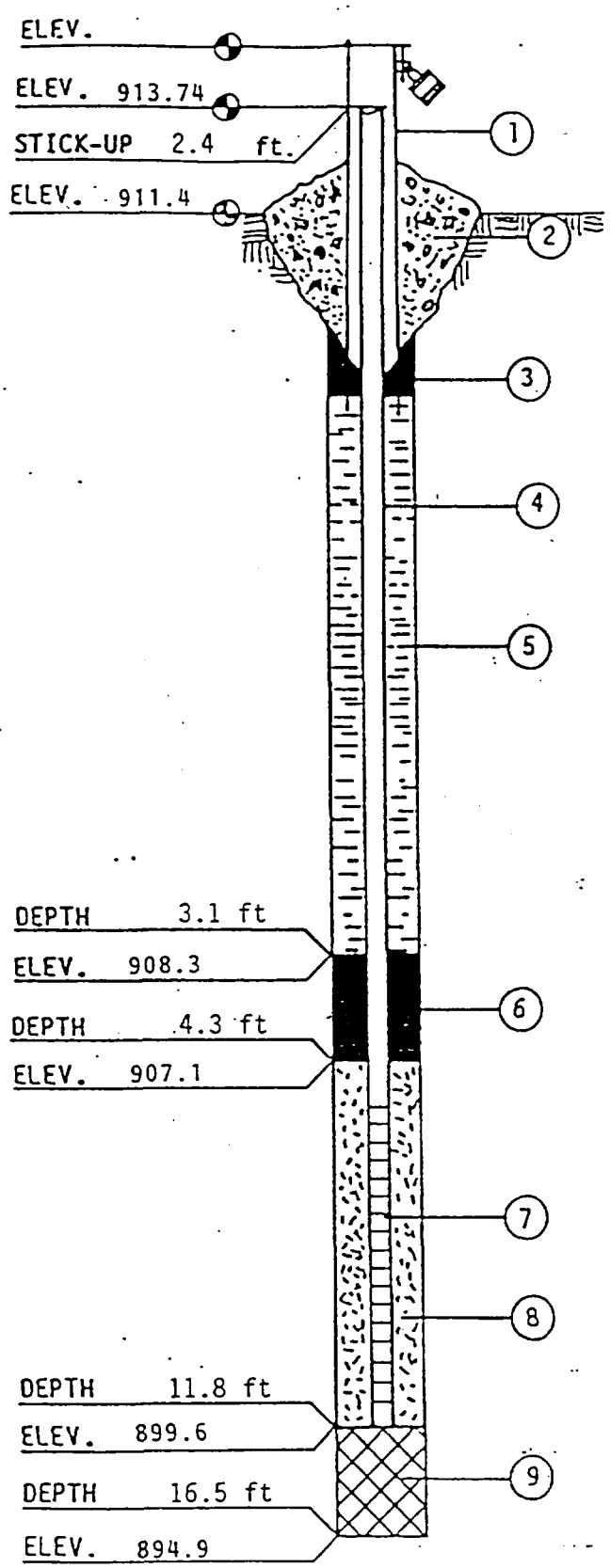
WATER LEVEL OBSERVATIONS

While Drilling ▽ 10.2 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 8.67 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/5/89 End 8/5/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-04S

DATE August 5, 1989

CHIEF/UNIT Dave Ellis/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 6.0 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Granular Bentonite

   HOW INSTALLED - TREMIE FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Bentonite Pellets

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Sand

9. TYPE OF BACKFILL Natural Collapse/Coarse Sand

10. DRILLING METHOD 4.25 HSA

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 8.67 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN ENGINEERING INC

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW5D
Surface Elevation 910.8
Job No. 70051
Sheet 1 of 2

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	HNu	HCN	LEL
						Loose, Dark Brown, Sandy TOPSOIL.	0.0	0	
SS-01		16	M/W	5 7 12 13	5	Loose, Brown, C - F SAND, some C - F Gravel (SP).	0.0	0	
SS-02		4	W	6 8 10 16	10	Loose, Brown, C - F SAND, trace C - F Gravel (SP).	0.0	0	
SS-03		14	W	10 19 24 26	15	Dense, Brown - Gray, C - F SAND, some C - F Gravel (SP). Orange - Brown staining at 15.0'	0.0	0	
SS-04		18	W	7 10 21 20	20	Dense, Brown - Gray, C - F SAND, some C - F Gravel (SP).			
					25				
SS-05		4	W	10 22 31 27	30	Dense, Gray, M - F SAND, some Silt, trace C - F Gravel (SP).			
					35				
					40				

WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 8.03 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/5/89 End 8/5/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA

WARZYN

LOG OF TEST BORING

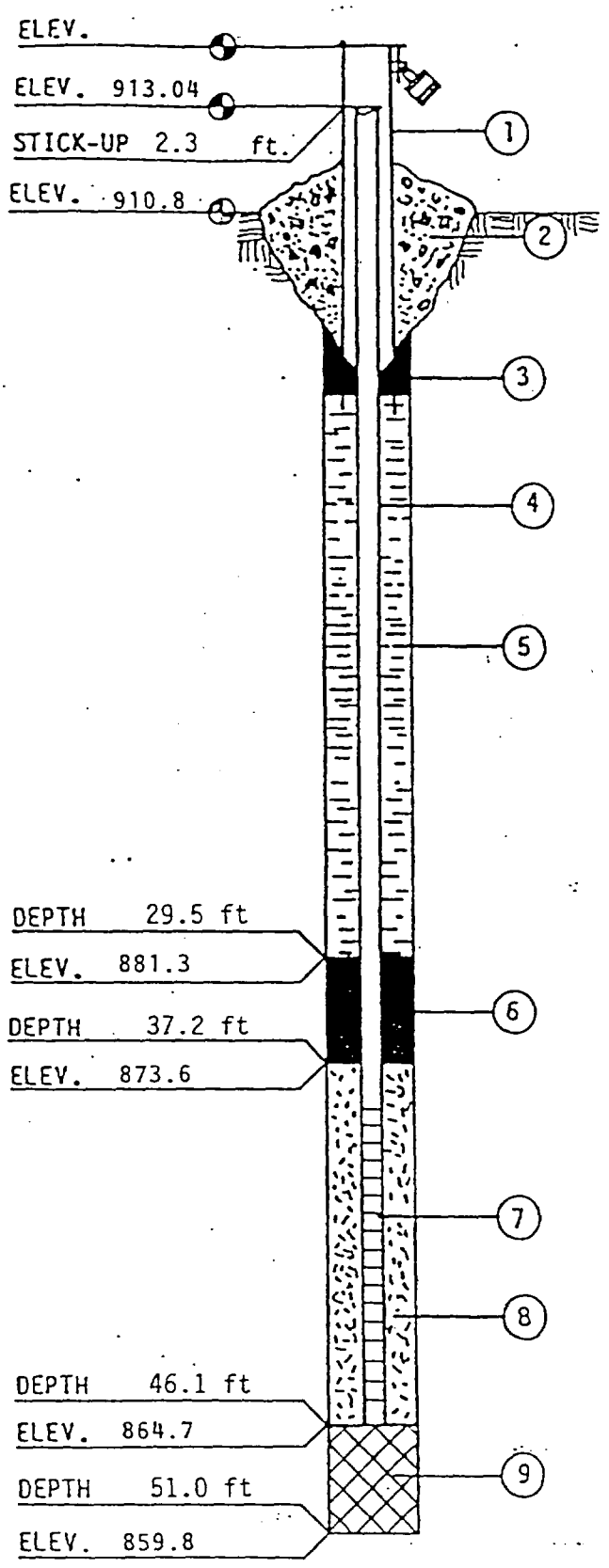
Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW5D
Surface Elevation 910.8
Job No. 70051
Sheet 2 of 2

41551 ELEVEN MILE ROAD, PO BOX 8012, NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES			
No.	TYPE	Rec (in.)	Moist	N	Depth		Hnu	HCN	LEL	
SS-06		18	W	5 5 5 5		Loose, Gray, C - F SAND. 1" Gravel seams at 40.0 and 40.5' (SP).				
					45					
SS-07		10	W	12 14 14 17	50	Loose, Gray, C - F SAND, some C - F Gravel (SP).				
						End of Boring at 51.0'				
					55					
					60					
					65					
					70					
					75					
					80					
					85					



WARZYN ENGINEERING INC

MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-05D

DATE August 5, 1989

CHIEF/UNIT Dave Ellis/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 43.0 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Bentonite Slurry and Granular Bentonite

   HOW INSTALLED - TREMIE FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Hole Plug Bentonite/Natural Collapse

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4 ft

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Silica Sand

9. TYPE OF BACKFILL Natural Collapse

10. DRILLING METHOD 4.25 HSA

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 8.03 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW5S
Surface Elevation 910.8
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, • NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES			
No.	TYPE	Rec (in.)	Moist	N	Depth			HNu	HCN	LEL
						Loose, Dark Brown, Sandy TOPSOIL.				
					5	Loose, Brown, C - F SAND, some C - F Gravel (SP).				
					10	Loose, Brown, C - F SAND, trace C - F Gravel (SP)				
						End of Boring at 12.0' See Log of Soil Boring for MW5D				
					15					
					20					
					25					
					30					
					35					
					40					

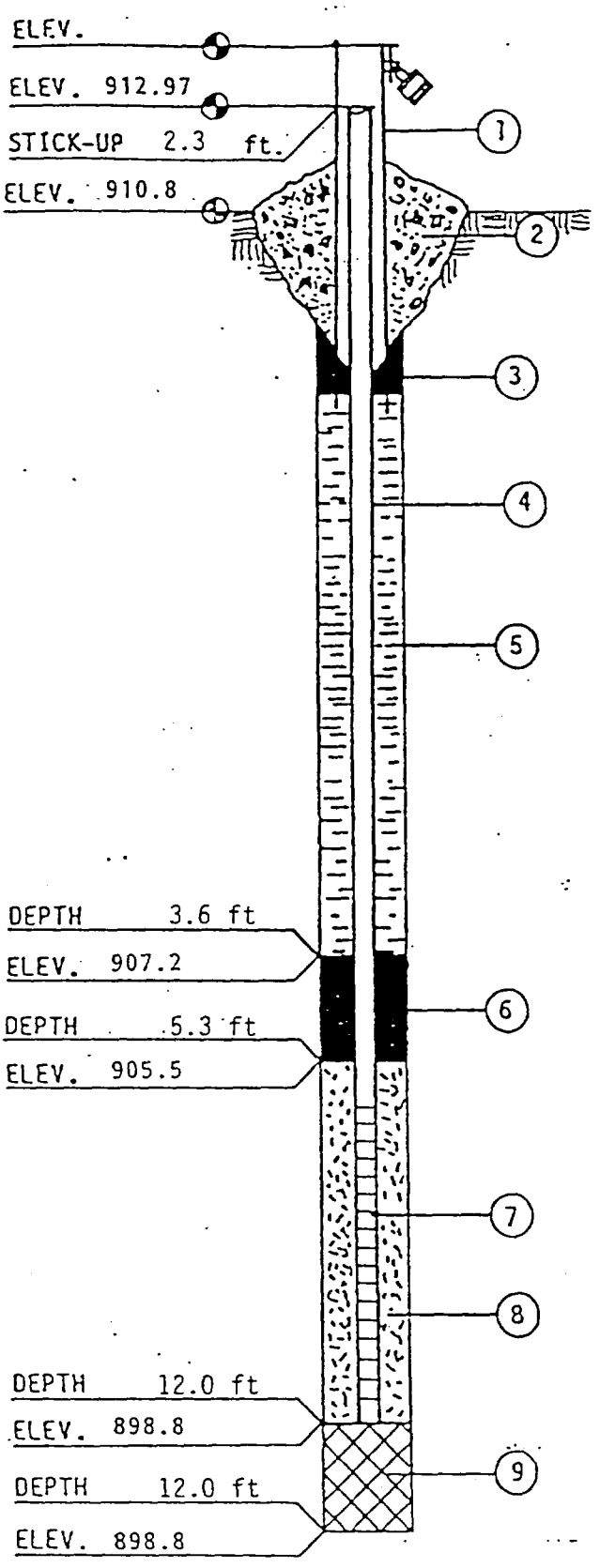
WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 7.97 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/5/89 End 8/5/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



WARZYN ENGINEERING INC

MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-05S

DATE August 5, 1989

CHIEF/UNIT Dave Ellis/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 8.9 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Granular Bentonite

   HOW INSTALLED - TREMIE FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Bentonite Pellets

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Sand/Natural Collapse

9. TYPE OF BACKFILL Natural Collapse

10. DRILLING METHOD 4.25 HSA

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 7.97 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW6S
Surface Elevation 907.9
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, • NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNu	HCN	LEL
						Loose, Dark Brown, Sandy TOPSOIL.	0.0	0	
SS-01		18	M	6 16 17 13	5	Dense, Gray, C - F SAND, little C - F Gravel, trace Silt (SP).	0.0	0	
SS-02		16	W	8 14 6 15	10	Medium Dense, Gray, C - F SAND, some C - F Gravel (SP-GP).	0.0	0	
ST-03		13	M		15	Driller noted change in Lithology at 12.5'. Pushed Shelby tube from 13.2 to 15.2' with 12.5" recovery. Firm, Gray, M - F Sandy SILT, trace C - F Gravel, some Clay (Till) (ML).			
					20	End of Boring at 15.2'			
					25				
					30				
					35				
					40				

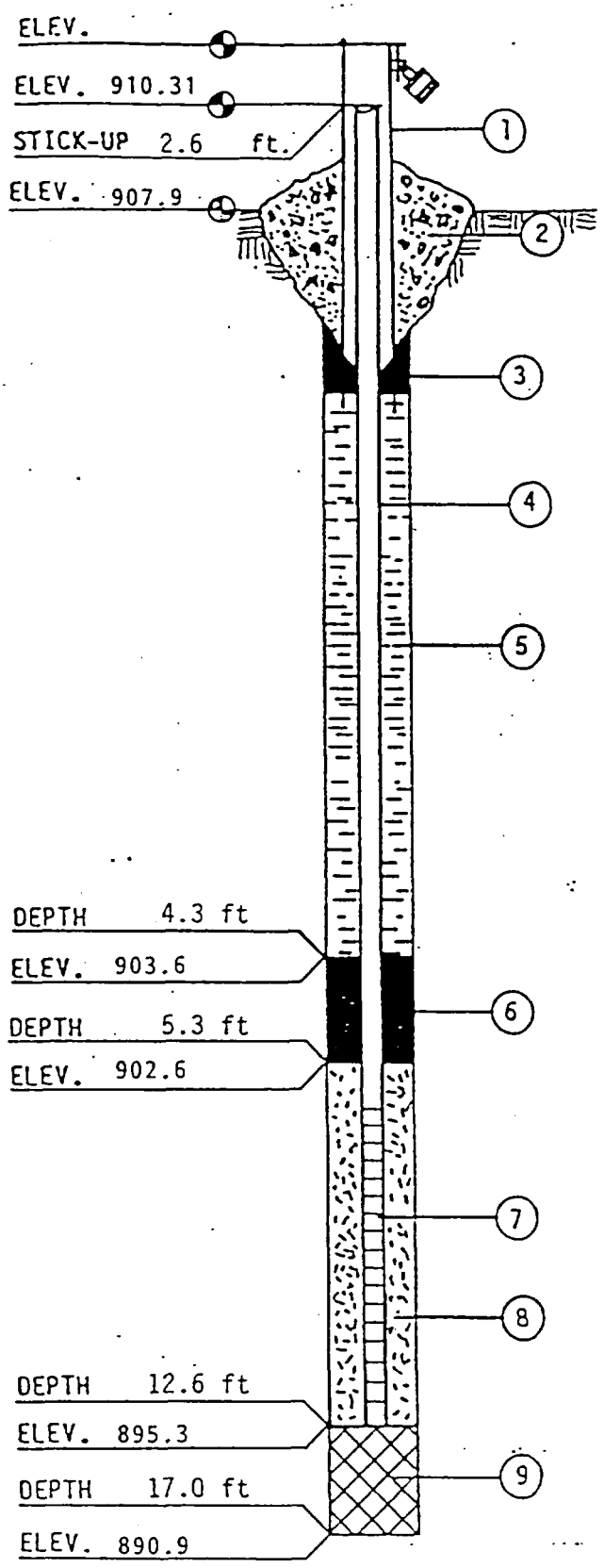
WATER LEVEL OBSERVATIONS

While Drilling ▽ 7.0 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 6.65 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/8/89 End 8/8/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



WARZYN ENGINEERING INC

MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-06S

DATE August 8, 1989

CHIEF/UNIT Dave Ellis/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Hole Plug

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 9.8 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Hole Plug

   HOW INSTALLED - TREMIE FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Bentonite Pellets

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4 ft

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Sand

9. TYPE OF BACKFILL Natural Collapse/Coarse Sand

10. DRILLING METHOD 4.25 HSA

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 6.65 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW7S
Surface Elevation 907.8
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNu	HCN	LEL
						Black, Sandy, Silty FILL.	0.0	0	
SS-01		8	M	4 4 6 5	5		0.0	0	
						Black, Organic PEAT (PT).			
SS-02		14	W	10 16 23	10	Dense, Gray, C - F SAND, some C - F Gravel (SP).	0.0	0	
SS-03		8	W	11 11 20	15	Driller noted change in Lithology at 14.0'. Stiff, Gray, M - F Sandy SILT, little C - F Gravel, little Clay (Till) (ML).	0.0	0	
					20	End of Boring at 16.0'			
					25				
					30				
					35				
					40				

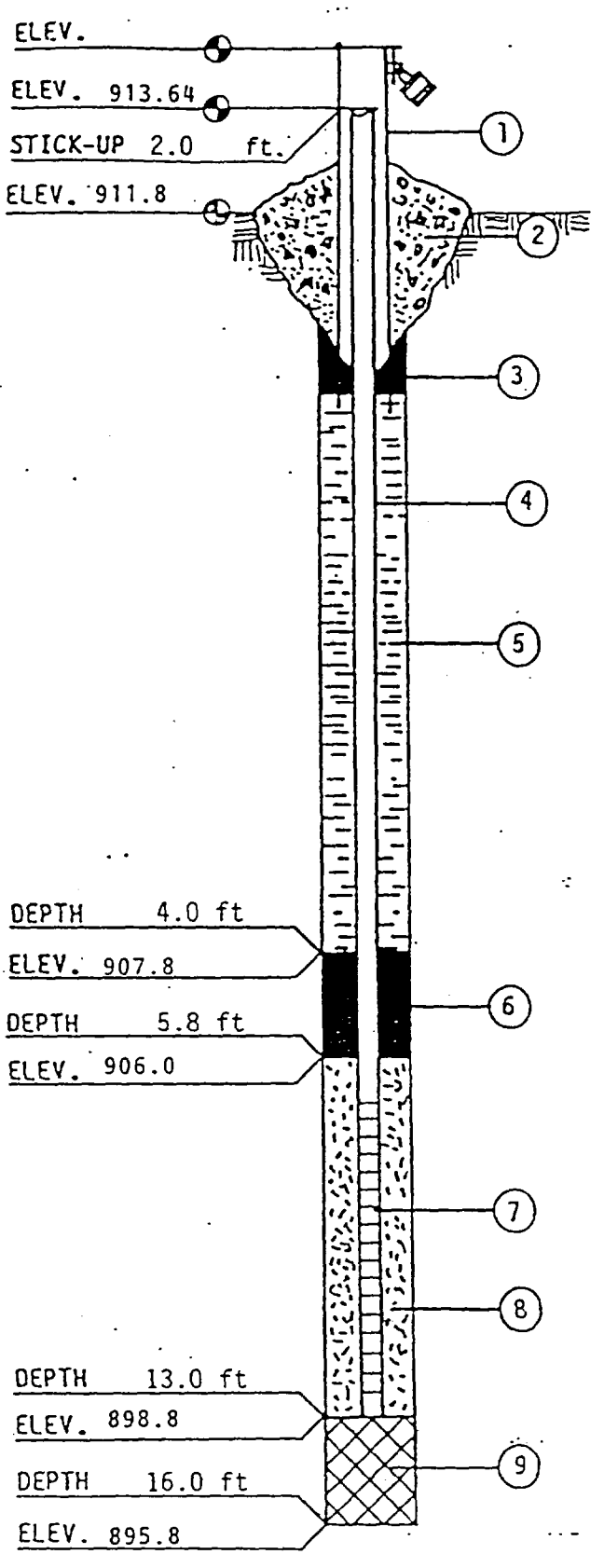
WATER LEVEL OBSERVATIONS

While Drilling ▽ 9.5 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 9.87 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/3/89 End 8/3/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-07S (Formerly MW-07D)

DATE August 3, 1989

CHIEF/UNIT Dave Ellis/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 9.6 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Granular Bentonite

   HOW INSTALLED - TREMIE FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Bentonite Pellets

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Sand

9. TYPE OF BACKFILL Coarse Sand

10. DRILLING METHOD 4 1/4 in. HSA

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 9.87 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN ENGINEERING INC

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW8D
Surface Elevation 908.4
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	HNu	HCN	LEL
						Black, Organic TOPSOIL.	0.0	0	
SS-01		14	W	5 7 9 10	5	Loose, Gray, M - F SAND, trace Silt, occasional 1/8" Thick Black Organic Seams (SP).	0.0	0	
SS-02		12	W	12 11 15 15	10	Loose, Gray, C - F SAND, little C - F Gravel, trace Silt (SP).	0.0	1	
SS-03		16	W	4 8 11 9	15		0.0	1	
						Dense, Gray, Silty, C - F SAND, some Clay, little Gravel (Till) (SM-ML).			
SS-04		20	M/W	2 4 20 21	20	Medium Dense, Brown, C - F SAND, little C - F Gravel, 4" seams of Silty Sand (SP).	0.0	0	
SS-05		20	W	4 8 15 17			0.0	0	
					25				
						Very Stiff, Gray, M - F Sandy SILT, some Gravel, little Clay (Till) (ML).			
SS-06		20	M	7 12 17 23	30		0.0	0	
						End of Boring at 31.0'			
					35				
					40				

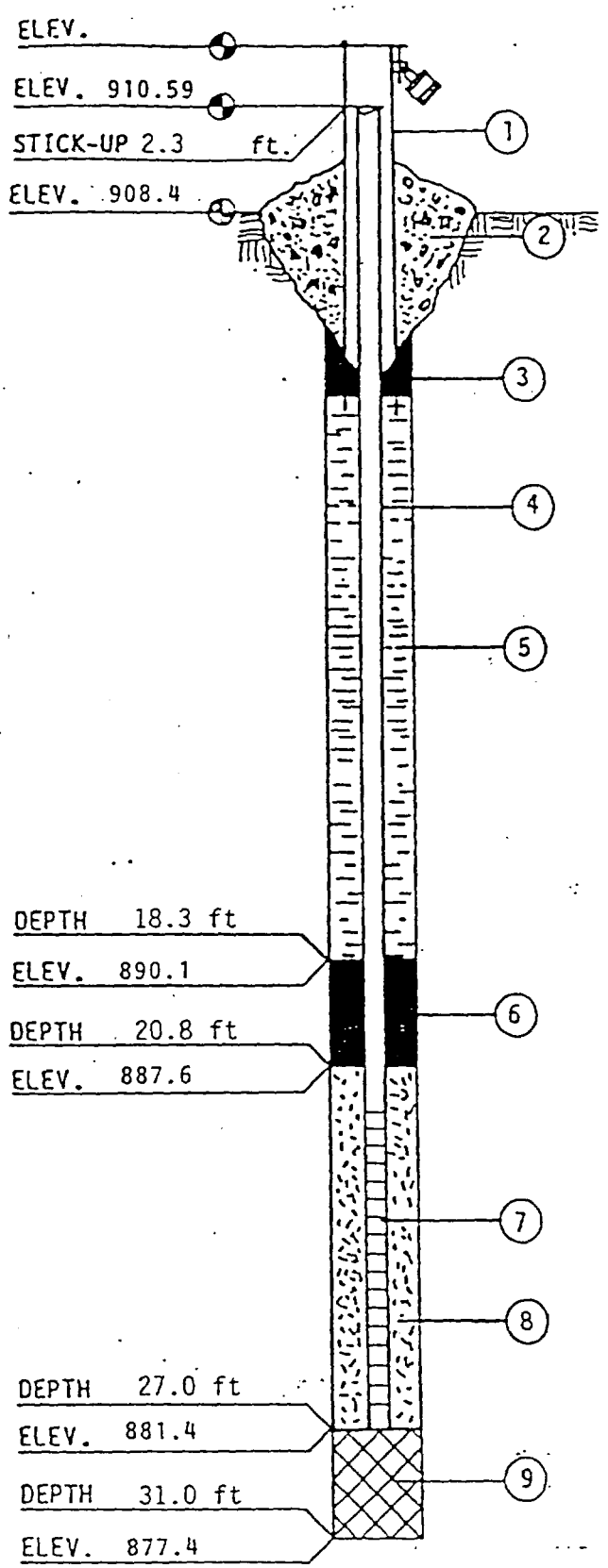
WATER LEVEL OBSERVATIONS

While Drilling ▽ 5.0 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 6.41 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/3/89 End 8/3/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-08D (Added well at this location)

DATE August 3, 1989

CHIEF/UNIT Dave Ellis/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 23.9 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Granular Bentonite and Bentonite Slurry

   HOW INSTALLED - TREMIE FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Bentonite Pellets

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4 ft

   SLOT-SIZE 0.010 LENGTH 5.4 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Sand

9. TYPE OF BACKFILL Coarse Sand

10. DRILLING METHOD 4 1/4 in. HSA 0-29 ft

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 6.41 DATE August 9, 1989

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN ENGINEERING INC

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW8S
Surface Elevation 908.3
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, • NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES			
No.	TYPE	Rec (in.)	Moist	N	Depth			HNu	HCN	LEL
						Black, Organic TOPSOIL.				
					5	Loose, Gray, M - F SAND, trace Silt, occasional 1/8" Thick Black Organic Seams (SP).				
					10	Loose, Gray, C - F SAND, little C - F Gravel, trace Silt (SP).				
					15	End of Boring at 14.5' See Log of Soil Boring for MW8D				
					20					
					25					
					30					
					35					
					40					

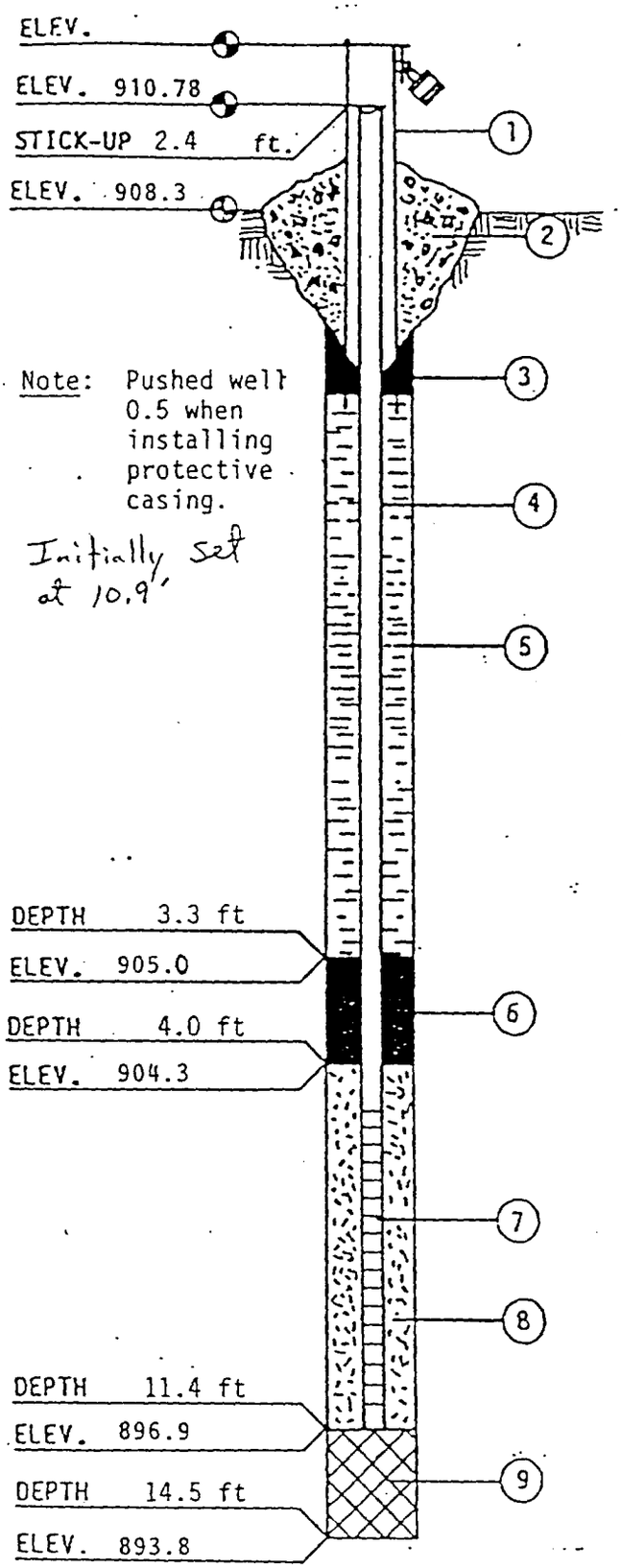
WATER LEVEL OBSERVATIONS

While Drilling ▽ 5.0 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 7.04 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/6/89 End 8/6/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-08S

DATE August 6, 1989

CHIEF/UNIT Dave Ellis/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 8.4 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Granular Bentonite

   HOW INSTALLED - TREMIE FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Bentonite Pellets

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Sand

9. TYPE OF BACKFILL Natural Collapse

10. DRILLING METHOD 4.25 HSA

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 7.04 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN ENGINEERING INC

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW9S
Surface Elevation 909.4
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNu	HCN	LEL
						Loose, Dark Brown - Black, Silty, Sandy TOPSOIL.	0.0	0	
SS-01		18	M/W	5 10 13 18	5	Loose, Gray, C - F SAND, some C - F Gravel, trace Silt (SP).	0.0	0	
SS-02		14	W	3 5 6 7	10	Loose, Gray, C - F SAND, some C - F Gravel, trace Silt (SP).	0.0	0	
SS-03		6	W	2 4 8 7	15	Loose, Gray, C - F SAND, some C - F Gravel, Trace Silt (SP).			
						End of Boring at 16.5'			
					20				
					25				
					30				
					35				
					40				

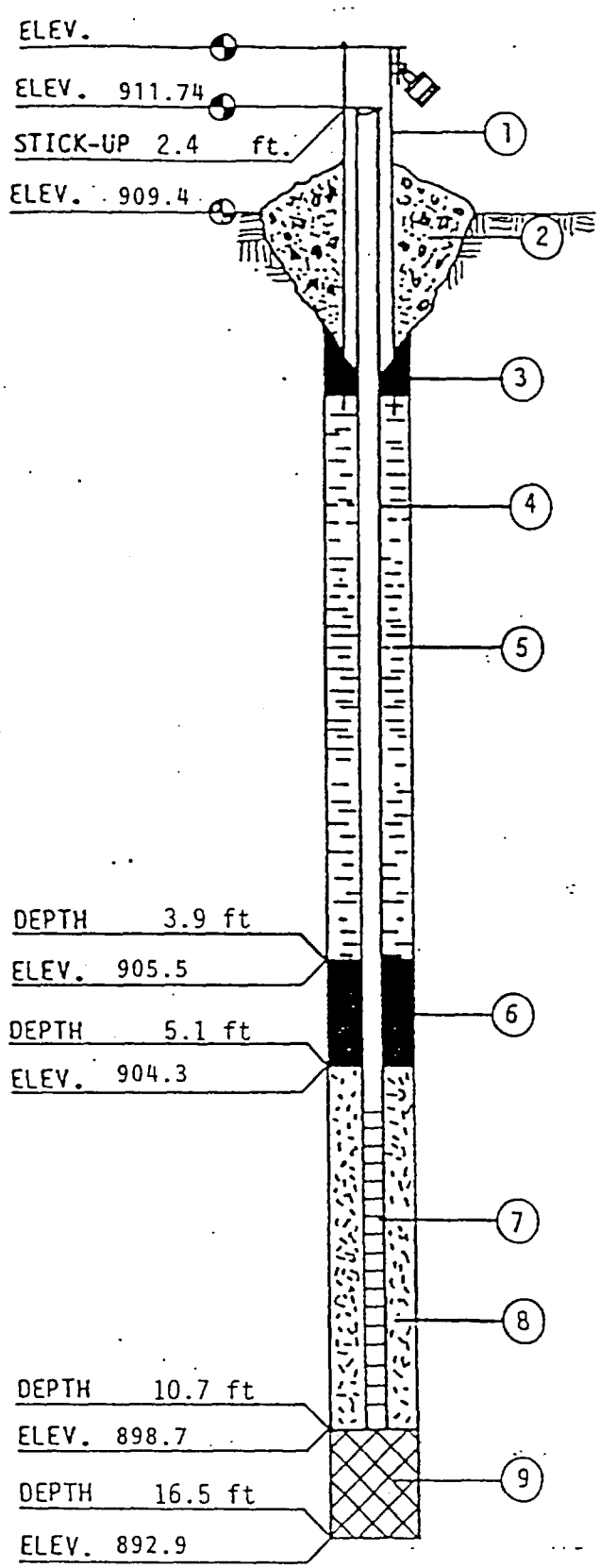
WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.5 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 7.03 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/6/89 End 8/6/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



WARZYN ENGINEERING INC

MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-09S

DATE August 6, 1989

CHIEF/UNIT Dave Ellis/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 7.7 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Granular Bentonite

   HOW INSTALLED - TREMIE
   FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Bentonite Pellets

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4 ft

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Sand

9. TYPE OF BACKFILL Natural Collapse

10. DRILLING METHOD 4.25 HSA

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 7.03 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW10D
Surface Elevation 912.2
Job No. 70051
Sheet 1 of 2

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNu	HCN	LEL
						Loose, Dark Brown, Sandy TOPSOIL.	0.0	0	
SS-01		20	M	8 18 24 26	5	Dense, Light Gray, C - F SAND, some C - F Gravel (SP).	0.0	0	
SS-02		12	W	6 8 9 11	10	Loose, Light Gray, C - F SAND, some C - F Gravel (SP).	0.0	0	
SS-03		14	W	4 8 7 18	15	Dense, Light Gray - Brown, C - F SAND, some C - F Gravel (SP).	0.0	0	
SS-04		18	W	2 6 13 15	20	Loose, Light Brown - Gray, C - F SAND, some C - F Gravel (SP).			
					25				
SS-05		0	W	14 34 37	30	No Recovery -- Blow-up.			
SS-06		4	W	7 10 13 10	35	Loose, Light Gray, C - F SAND and C - F GRAVEL (SP-GP).			
					40				

WATER LEVEL OBSERVATIONS

While Drilling ▽ 8.0 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 9.38 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/4/89 End 8/4/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA

WARZYN

LOG OF TEST BORING

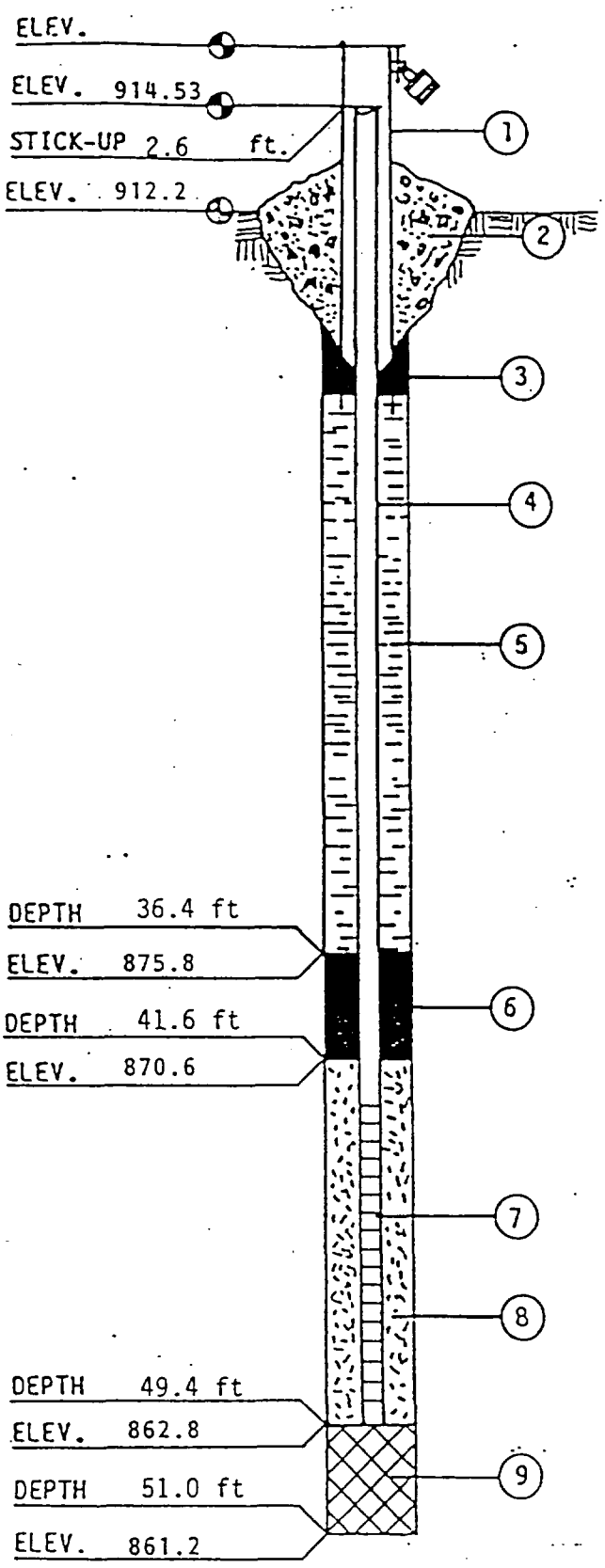
Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW10D
Surface Elevation 912.2
Job No. 70051
Sheet 2 of 2

41551 ELEVEN MILE ROAD, PO BOX 8012, NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES	Hnu	HCN	LEL
SS-07		6	W	9 13 7 17		Loose, Gray, C - F SAND and C - F Gravel (SP-GP).				
					45					
SS-08		18	W/M	8 44 72	50	Loose, Gray, C - F SAND and C - F Gravel (SP-GP).				
						Very Dense, Gray, Silty, C - F SAND, trace Gravel, some Clay (SM-ML).				
					55	End of Boring at 51.0'				
					60					
					65					
					70					
					75					
					80					
					85					



WARZYN ENGINEERING INC

MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-10D

DATE August 4, 1989

CHIEF/UNIT Dave Ellis/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 46.6 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Bentonite Slurry/ Granular Bentonite

   HOW INSTALLED - TREMIE FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Fine Silica Sand and Collapsed Natural Sand

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4 ft

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2.0 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Sand

9. TYPE OF BACKFILL None

10. DRILLING METHOD 4.25 HSA

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 9.38 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW10S
Surface Elevation 912.2
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, • NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES			
No.	TYPE	Rec (in.)	Moist	N	Depth			HNu	HCN	LEL
						Loose, Dark Brown, Sandy TOPSOIL.				
					5	Dense, Light Gray, C - F SAND, some C - F Gravel (SP).				
					10	Loose, Light Gray, C - F SAND, some C - F Gravel (SP).				
					15	End of Boring at 13.0' See Log of Soil Boring For MW10D				
					20					
					25					
					30					
					35					
					40					

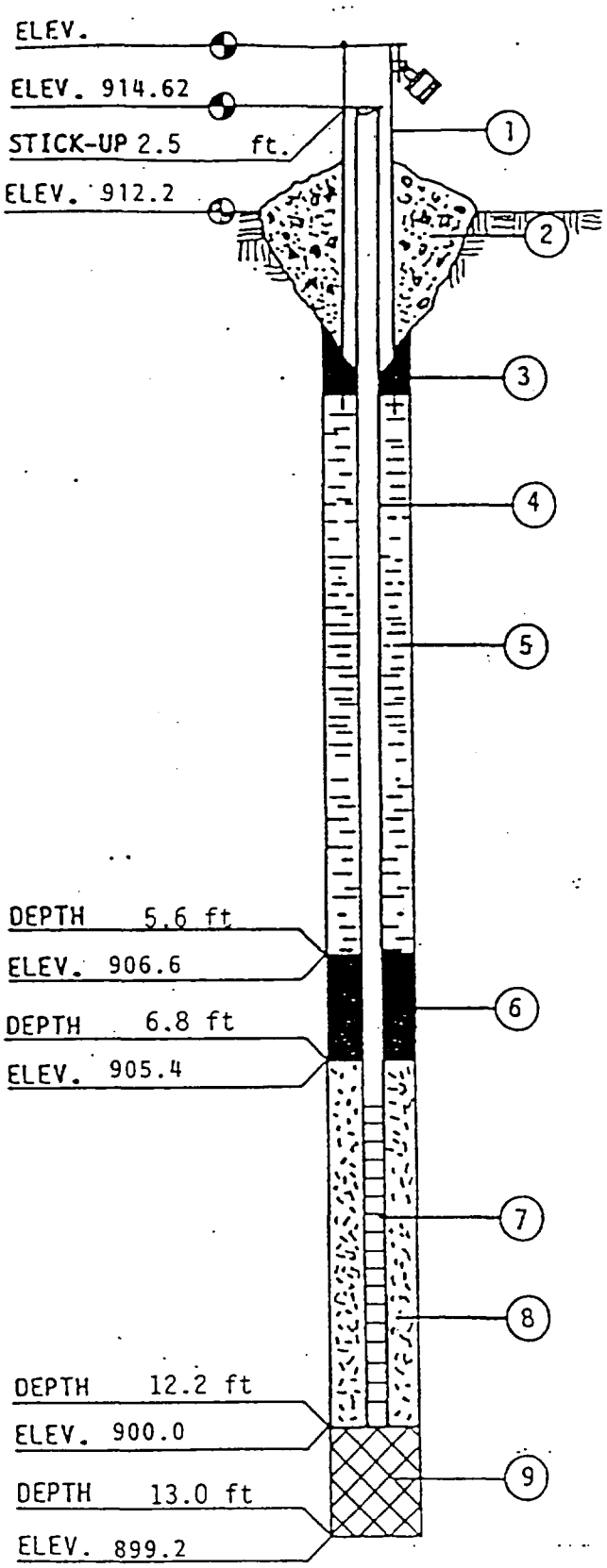
WATER LEVEL OBSERVATIONS

While Drilling ▽ 8.0 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 9.47 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/4/89 End 8/4/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



WARZYN ENGINEERING INC

MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-10S

DATE August 4, 1989/D-50

CHIEF/UNIT Dave Ellis/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 9.3 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Granular Bentonite

   HOW INSTALLED - TREMIE FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Bentonite Pellets

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4 ft

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2.0 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Silica Sand

9. TYPE OF BACKFILL Natural Collapse

10. DRILLING METHOD 4.25 HSA

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 9.47 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW11S
Surface Elevation 927.6
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	HNu	HCN	LEL
						Dark Brown, Silty, Sandy TOPSOIL.	0.0	0	
						Loose, C - F SAND, some C - F Gravel (SP).			
SS-01		16	M	3 9 3 15	5	Medium Dense, Light Brown, Silty, C - F SAND, some Clay, trace Gravel (SM-ML).	0.0	0	
SS-02		18	M/W	3 7 6 12	10	Medium Dense, Light Brown, Silty, C - F SAND, some Clay, trace Gravel (SM-ML).	0.0	0	
SS-03		18	M/W	3 5 5 8	15	Medium Dense, Light Gray, Silty, C - F SAND, some Clay, trace Gravel (SM-ML).			
ST-04		21	M/W			Pushed a Shelby tube from 17.0 to 19.1'.			
					20	End of Boring at 19.1'			
					25				
					30				
					35				
					40				

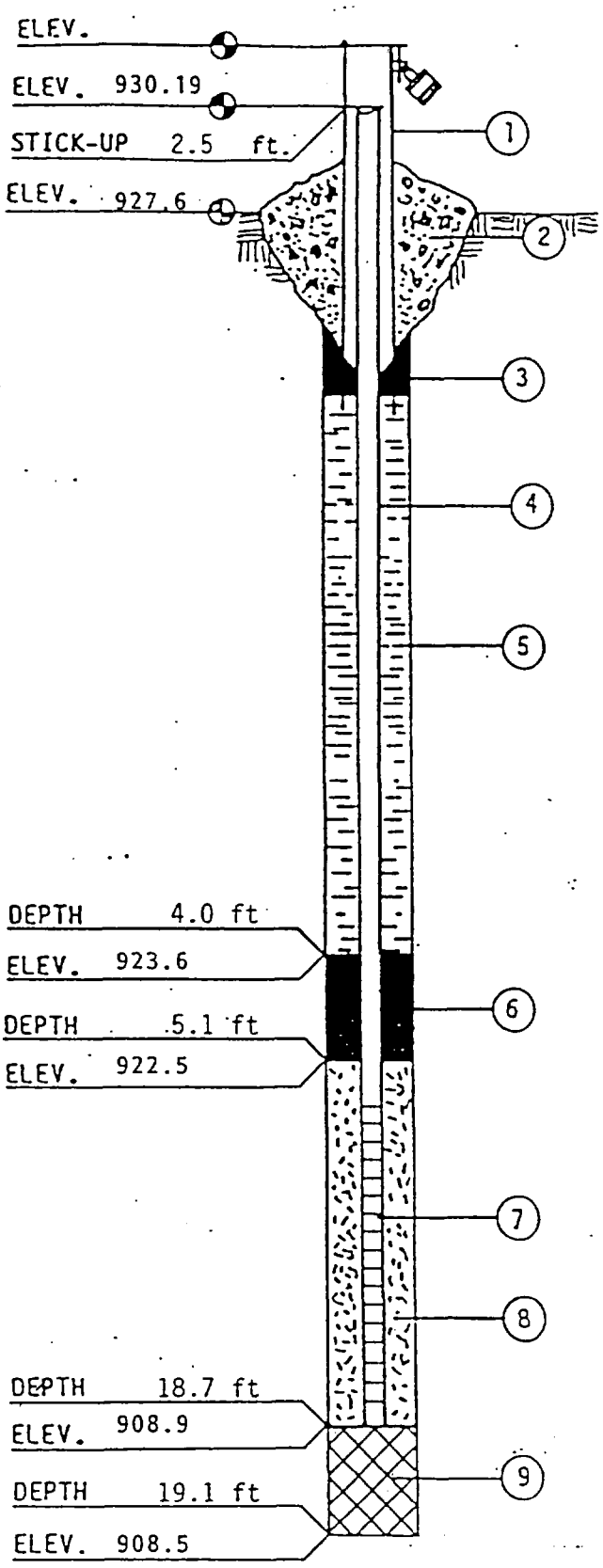
WATER LEVEL OBSERVATIONS

While Drilling ▽ 10.0 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 6.01 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/9/89 End 8/9/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-11S

DATE August 9, 1989

CHIEF/UNIT Dave Ellis/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Hole Plug

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 15.8 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Hole Plug

   HOW INSTALLED - TREMIE FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Bentonite Pellets

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Sand

9. TYPE OF BACKFILL Coarse Sand/Natural Collapse

10. DRILLING METHOD 4.25 HSA

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 6.01 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN ENGINEERING INC

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW12D
Surface Elevation 910.6
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNu	HCN	LEL
						Loose, Dark Brown, Silty, Sandy TOPSOIL. Diesel Fuel Odor -- Farmer possibly spraying it to kill insects or trees.	0.8	0	
SS-01		18	M	12 19 29 28	5	Dense, Light Brown - Gray, C - F SAND, 1" Thick green stain at 5.0', Solvent/Pesticide Odor (SP).	2.8	0	
							10.8	0	
SS-02		18	M/W	4 7 13 20	10	Loose, Light Gray, C - F SAND, some C - F Gravel, No Odor (SP).	0.0	0	
SS-03		20	W	5 11 17 20	15	Loose, Gray, C - F SAND, some C - F Gravel (SP). 2 inches of Clay at 16.5' in last 2 inches of Split-Spoon, must have been a seam because drillers didn't notice it.	0.0	0	
SS-04		12	W	7 12 18 21	20	Dense, Gray, C - F SAND, some C - F Gravel (SP). Gravel and Cobbles at 23.0'			
ST-05		12	M		25	Pushed a Shelby tube from 26 to 28' with 12" recovery. Very Stiff, Gray, M - F Sandy SILT, some Clay (ML).			
					30	End of Boring at 28.0'			
					35				
					40				

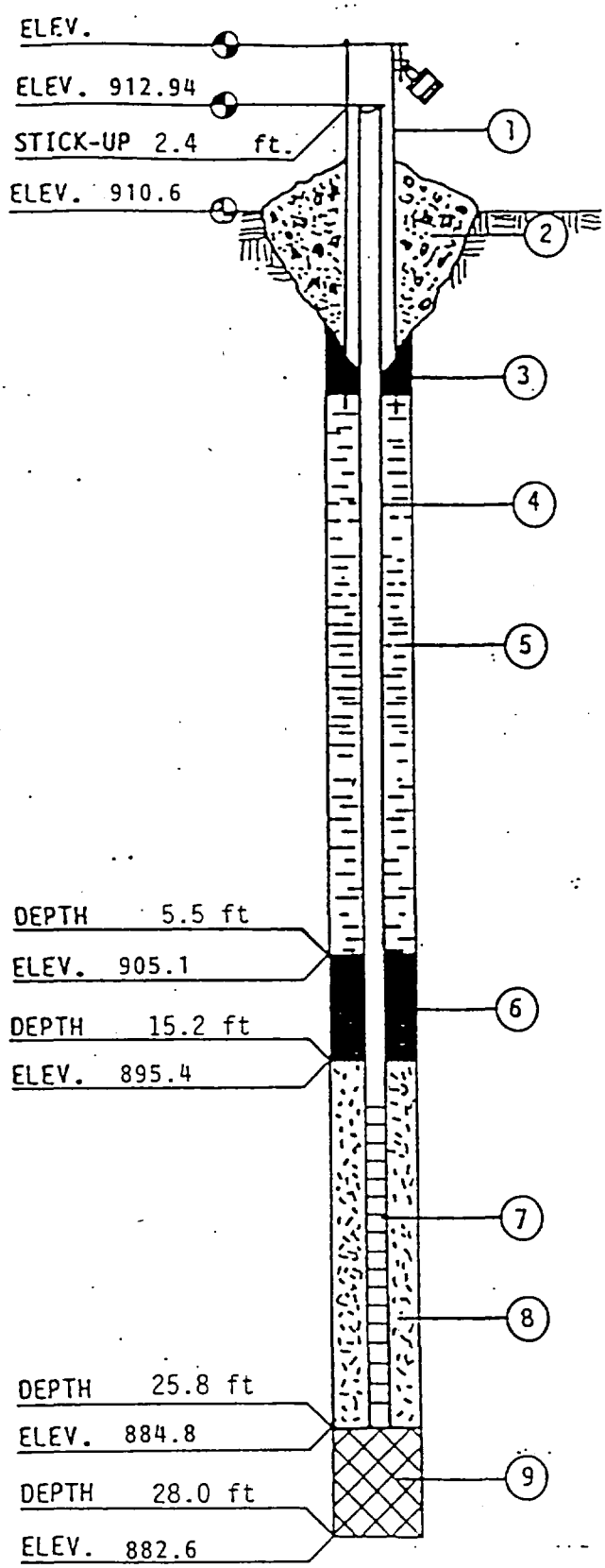
WATER LEVEL OBSERVATIONS

While Drilling ▽ 11.0 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 8.77 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/7/89 End 8/7/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-12 D

DATE August 7, 1989

CHIEF/UNIT Dave Ellis/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)

   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 22.8 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Hole Plug/Granular Bentonite

   HOW INSTALLED - TREMIE FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)

   Hole Plug-Rock Bentonite/and Natural Collapse

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN

   Coarse Sand/Natural Collapse

9. TYPE OF BACKFILL Natural Collapse/Coars Sand

10. DRILLING METHOD 4.25 HSA

11. ADDITIVES USED (IF ANY)

    None

WATER LEVEL 8.77 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN ENGINEERING INC

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW12S
Surface Elevation 910.3
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, • NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES			
No.	TYPE	Rec (in.)	Moist	N	Depth			HNu	HCN	LEL
						Loose, Dark Brown, Silty, Sandy TOPSOIL. Diesel Fuel Odor -- Farmer possibly spraying it to kill insects or trees.				
					5	Dense, Light Brown - Gray, C - F SAND, 1" Thick green stain at 5.0', Solvent/Pesticide Odor (SP).				
					10	Loose, Light Gray, C - F SAND, some C - F Gravel, No Odor (SP).				
						End of Boring at 13.0' See Log of Soil Boring for MW12D				
					15					
					20					
					25					
					30					
					35					
					40					

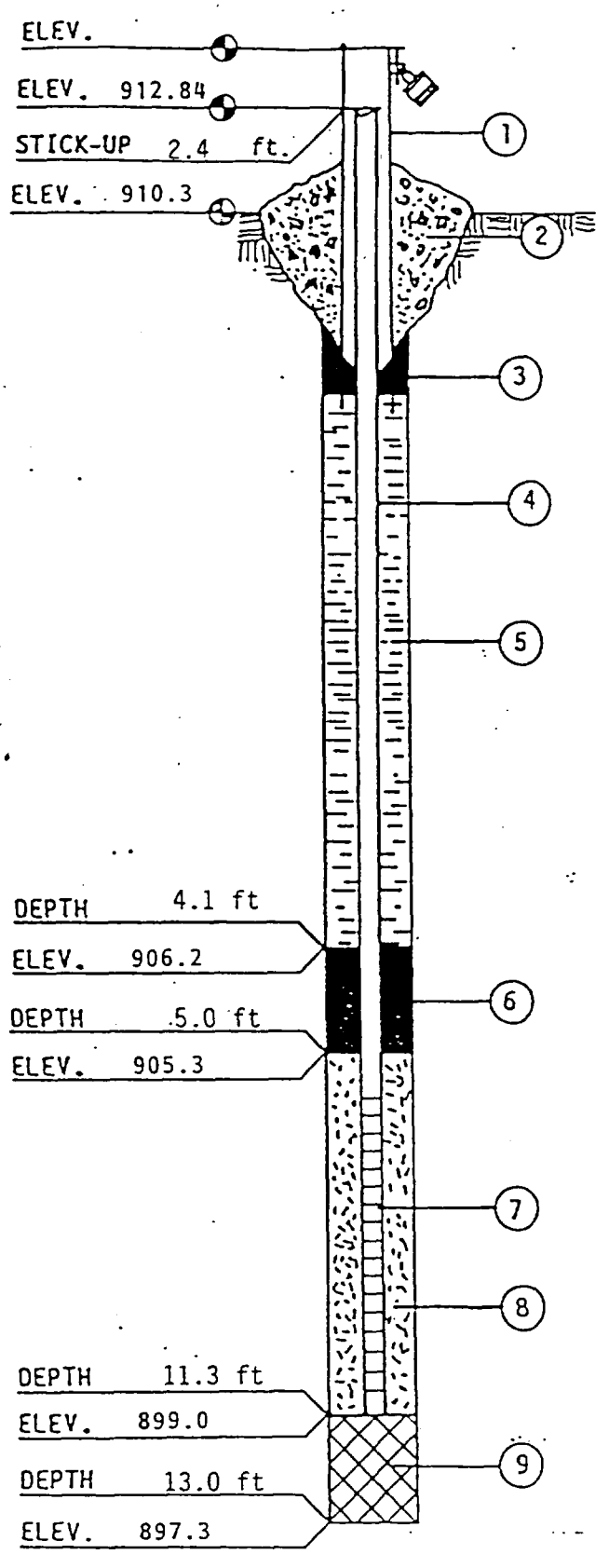
WATER LEVEL OBSERVATIONS

While Drilling ▽ 11.0 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 8.67 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/7/89 End 8/7/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-12S

DATE August 7, 1989

CHIEF/UNIT Dave Ellis/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 8.3 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Granular Bentonite

   HOW INSTALLED - TREMIE FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Bentonite Pellets

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Sand

9. TYPE OF BACKFILL Natural Collapse/Coarse Sand

10. DRILLING METHOD 4.25 HSA

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 8/67 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN ENGINEERING INC

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW13D
Surface Elevation 910.5
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, • NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	HNU	HCN	LEL
						Brown - Black, Silty, Sandy FILL.	0.0	0	
SS-01		14	M/W	3 3 10 12	5	Loose, Brown, M - F SAND, trace Silt, trace Gravel (SP).	0.0	0	
SS-02		2	W	8 10 12 14	10	Loose, Gray, C - F SAND, little C - F Gravel, trace Silt (SP).	0.0	0	
SS-03		18	W	8 10 12	15		0.0	0	
SS-04		18	W	6 12 14	20		0.0	0	
					25	Cobbles and Boulders from 23 to 26'.			
SS-05		18	M	7 10 18		Dense, Gray, Silty, C - F SAND, some Clay, little C - F Gravel (SM-ML).	0.0	0	
					30	End of Boring at 28.0'			
					35				
					40				

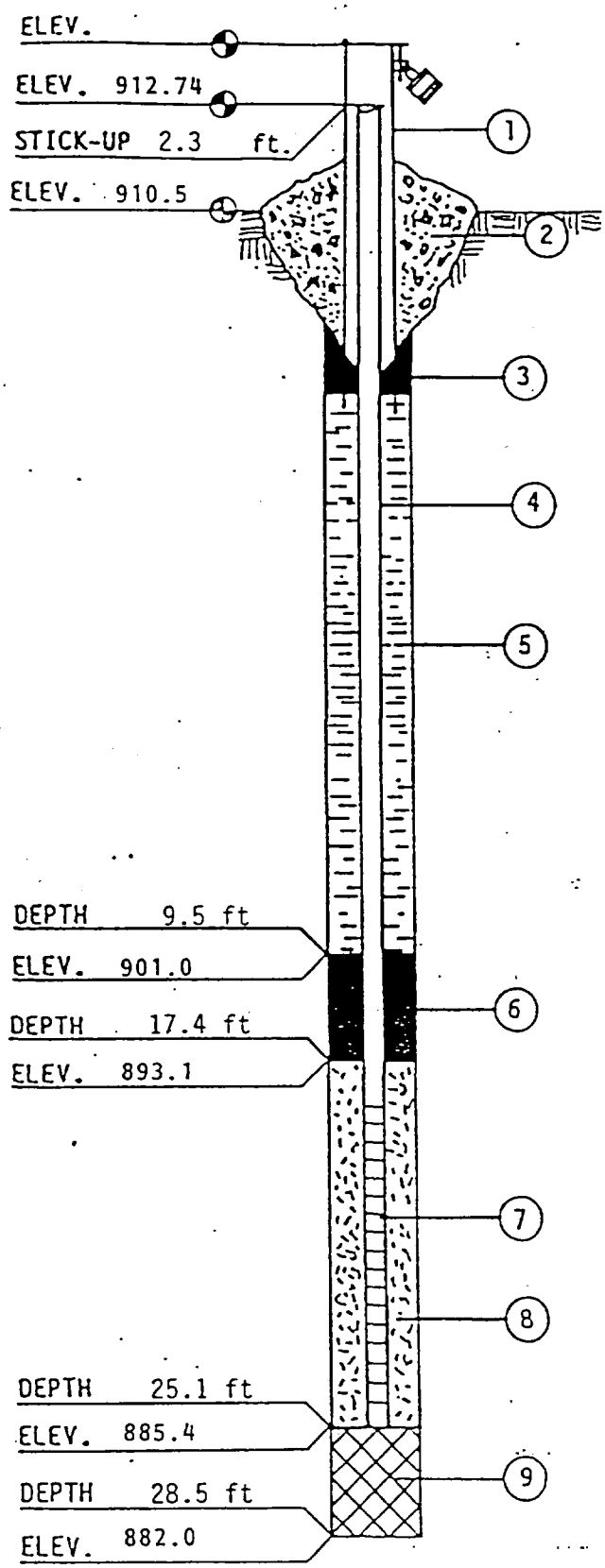
WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 7.97 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/2/89 End 8/2/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-13D

DATE August 2, 1989

CHIEF/UNIT Dave Ellis/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 22.0 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Dry Granular Bentonit and Bentonite Slurry

   HOW INSTALLED - TREMIE and FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Hole Plug Bentonite and Caved Sand

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Sand

9. TYPE OF BACKFILL Coarse Sand

10. DRILLING METHOD 4 1/4 in. HSA

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 7.97 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN ENGINEERING INC

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW13S
Surface Elevation 910.8
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, • NOVI, MI. 48376 • TEL. (313) 344-0205

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES			
No.	TYPE	Rec (in.)	Moist	N	Depth			HNu	HCN	LEL
						Brown - Black, Silty, Sandy FILL.				
					5	Loose, Brown, M - F SAND, trace Silt, trace Gravel (SP).				
					10	Loose, Gray, C - F SAND, little C - F Gravel, trace Silt (SP).				
					15	End of Boring at 14.0' See Log of Soil Boring for MW13D				
					20					
					25					
					30					
					35					
					40					

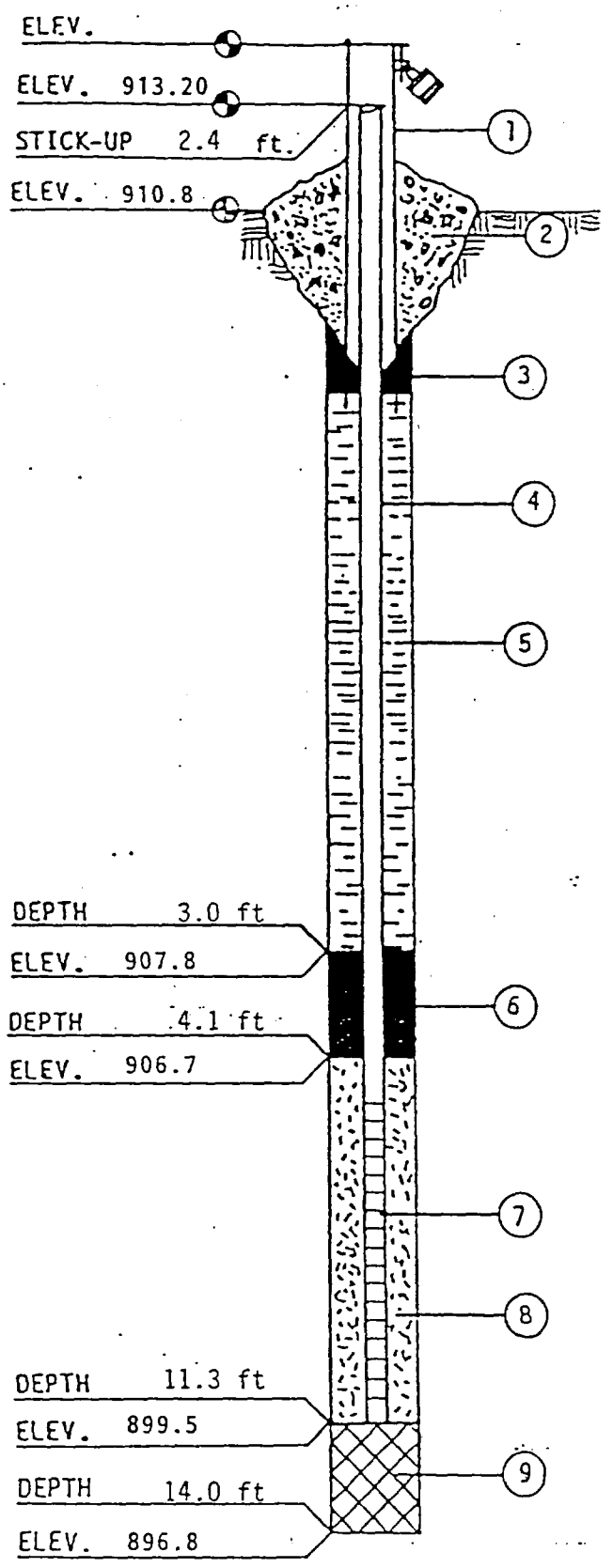
WATER LEVEL OBSERVATIONS

While Drilling ▽ 6.0 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 8.42 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/3/89 End 8/3/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-13S

DATE August 3, 1989

CHIEF/UNIT Dave Ellis/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)
   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 8.2 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Granular Bentonite

   HOW INSTALLED - TREMIE FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)
   Bentonite Pellets

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN
   Coarse Sand

9. TYPE OF BACKFILL Coarse Dand

10. DRILLING METHOD 4 1/4 in. HSA

11. ADDITIVES USED (IF ANY)
    None

WATER LEVEL 8.42 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN ENGINEERING INC

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. MW14S
Surface Elevation 912.3
Job No. 70051
Sheet 1 of 1

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNu	HCN	LEL
						Loose, Light Brown, Sandy TOPSOIL.	0.0	0	
SS-01		18	M	4 8 11 16	5	Loose, Light Brown, C - F SAND, some C - F Gravel (SP).	0.1	0	
SS-02		18	W	8 9 15 21	10	Loose, Light Brown - Gray, C - F SAND, some C - F Gravel, trace Silt (SP).	0.0	0	
SS-03		6	W	6 10 11 13	15	Loose, Gray, C - F SAND, some C - F Gravel, trace Silt (SP).	0.0	0	
						End of Boring at 16.5'			
					20				
					25				
					30				
					35				
					40				

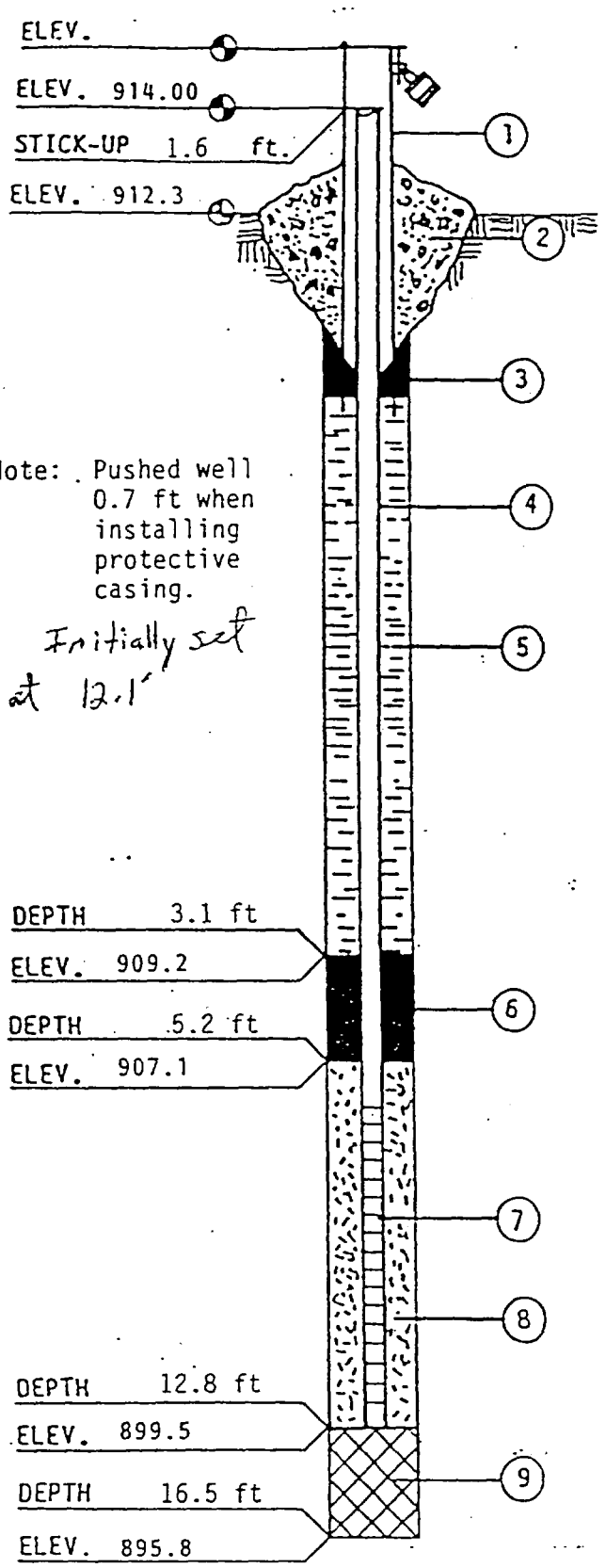
WATER LEVEL OBSERVATIONS

While Drilling ▽ 7.6 Upon Completion of Drilling _____
Time After Drilling 8/9/89 _____ _____ _____
Depth to Water 8.48 _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/6/89 End 8/6/89
Driller DE Chief GFP Rig D-50
Logger CSY Editor CSY
Drill Method 4.25" HSA



Note: Pushed well 0.7 ft when installing protective casing.

Initially set at 12.1'

MONITORING WELL CONSTRUCTION INFORMATION

JOB NO. 70051.45

BORING/WELL NO. MW-14 S

DATE August 6, 1989

CHIEF/UNIT Dave Ellis/D-50

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. TYPE OF SURFACE SEAL (IF INSTALLED)

   Granular Bentonite

4. SOLID PIPE TYPE Sch. 40 PVC

   SOLID PIPE LENGTH 9.0 ft.

   JOINT TYPE SLIP/GLUED THREADED

5. TYPE OF BACKFILL Granular Bentonite

   HOW INSTALLED - TREMIE FROM SURFACE

6. TYPE OF LOWER SEAL (IF INSTALLED)

   Bentonite Pellets

7. SCREEN TYPE Sch. 40 PVC

   SCREEN LENGTH 5.4

   #10 Slot

   SLOT-SIZE 0.010 LENGTH 4.5 ft.

   SCREEN DIAMETER 2 in.

8. TYPE OF BACKFILL AROUND SCREEN

   Coarse Sand

9. TYPE OF BACKFILL Natural Collapse/Coarse Sand

10. DRILLING METHOD 4.25 HSA

11. ADDITIVES USED (IF ANY)

    None

WATER LEVEL 8.48 DATE 08/09/89

*ALL DEPTHS MEASURED FROM GROUND SURFACE.

WARZYN ENGINEERING INC

LOG OF TEST BORING

WARZYN

Project: North Bronson RI/FS

Location: Bronson, Michigan

Boring No. MW19
Surface Elevation 913.0
Job No. 7005100/159
Sheet 1 of 2

One Science Court, P.O. Box 5385, Madison, WI 53705, TEL. (608) 231-4747

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
						Earth Drilled to 58.2 ft	
					5		
					10	- Sample intervals depict screened intervals for water sampling.	
1						- Soil types were determined by field observation of drill cuttings and soils identified in borings from the site area.	1.0 E7
					15		
2						Brown to Gray, Fine to Coarse SAND (SP) with Little to Some Coarse to Fine Gravel, and Trace Silt and Clay.	1.6 E8
					20		
3							7.5 E7
					25		
4							2.3 E8
					30		
5							6.6 E7
					35		
6							3.6 E6
					40		

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/12/91 End 11/12/91
Driller Mathes Chief CSY Rig CME-75
Logger CSY Editor SGW
Drill Method 4 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project: North Bronson RI/FS

Location: Bronson, Michigan

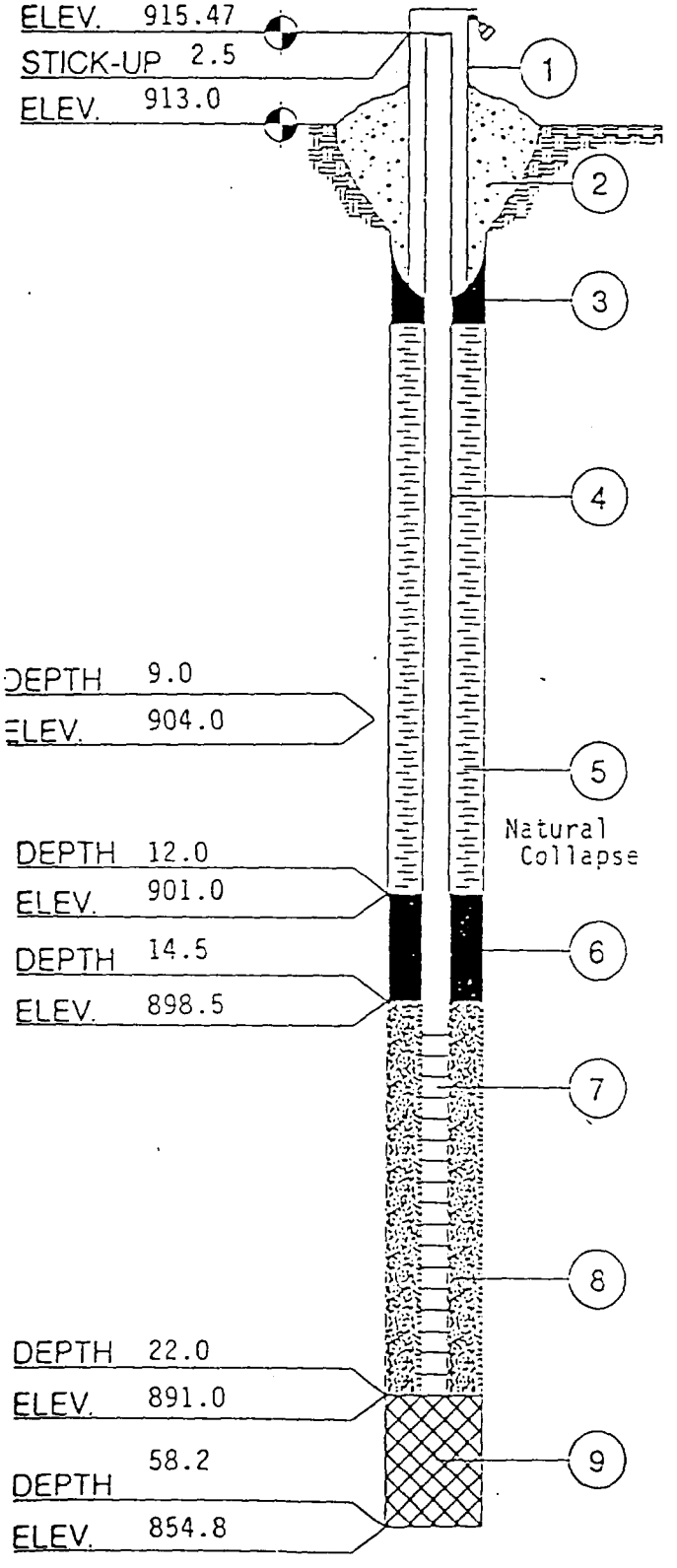
Boring No. MW19
Surface Elevation 913.0
Job No. 7005100/159
Sheet 2 of 2

One Science Court, P.O. Box 5385, Madison, WI 53705 TEL. (608) 231-4747

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
7							2.0 E6
					45		
8							6.3 E5
					50		
9							3.1 E5
					55		
					60	Dense, Gray Silty Fine to Coarse SAND (SM) with Some Clay and Trace to Little Fine Gravel	
						End of Boring at 58.2 ft	
					65		
					70		
					75		
					80		

WARZYN

Monitoring Well Construction Information (STICK-UP)



[pvk-301-28]

PROJECT North Bronson RI/FS

BORING/WELL NO. MW19

DATE 11/12/91

PROJECT NUMBER 70051.53

1. PROTECTIVE CASING 4 in. Steel

   LOCKING Yes (2002 Key)

2. CONCRETE SEAL None

3. TYPE OF SURFACE SEAL (IF INSTALLED)

   Fine Granular Bentonite

4. SOLID PIPE TYPE Stainless Steel

   SOLID PIPE LENGTH 19.3 ft

   JOINT TYPE Flush threaded with "O" rings

5. TYPE OF BACKFILL Fine Granular Bentonite

   BACKFILL INSTALLED from surface

6. TYPE OF LOWER SEAL (IF INSTALLED)

   3/4 in. Granular Bentonite

7. SCREEN TYPE Stainless Steel

   SCREEN LENGTH 5.15 ft

   SLOT SIZE 0.0060 in. (#6 slot)

   SLOTTED INTERVAL LENGTH 4.63 ft

   SCREEN DIAMETER 2.0 in. ID

8. TYPE OF BACKFILL AROUND SCREEN

   Natural Collapse

9. TYPE OF BACKFILL Natural Collapse

10. DRILLING METHOD 4.25 in. HSA

11. ADDITIVES USED (IF ANY)

    Clear Water

(ALL DEPTHS MEASURED FROM GROUND SURFACE)

Elevations based on USGS datum.

WARZYN

LOG OF TEST BORING

Project: North Bronson RI/FS

Location: Bronson, Michigan

Boring No. MW20
Surface Elevation 914.1
Job No. 7005100/159
Sheet 1 of 2

One Science Court, P.O. Box 5385, Madison, WI 53705, TEL. (608) 231-4747

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
						Earth Drilled to 56.5 ft	
					5		
					10	- Sample intervals depict screened intervals for water sampling.	
1						- Soil types were determined by field observation of drill cuttings and soils identified in borings from the site area.	1.0 E9
					15		
2						Brown to Gray, Fine to Coarse SAND (SP) with Little to Some Coarse to Fine Gravel, and Trace Silt and Clay.	2.0 E9
					20		
3							1.7 E6
					25		
4							1.1 E9
					30		
5							2.7 E8
					35		
6							1.5 E8
					40		

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/23/91 End 11/23/91
Driller Mathes Chief CSY Rig CME-75
Logger CSY Editor SGW
Drill Method 4 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project: North Bronson RI/FS

Location: Bronson, Michigan

Boring No. MW20
Surface Elevation 914.1
Job No. 7005100/159
Sheet 2 of 2

One Science Court, P.O. Box 5385, Madison, WI 53705 TEL. (608) 231-4747

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
7							1.0 E8
					45		
8							8.5 E7
					50		
9							N.D.
					55	Dense, Gray Silty Fine to Coarse SAND (SM) with Some Clay and Trace to Little Fine Gravel	
					60	End of Boring at 56.5 ft N.D. = Nothing Detected	
					65		
					70		
					75		
					80		

WARZYN

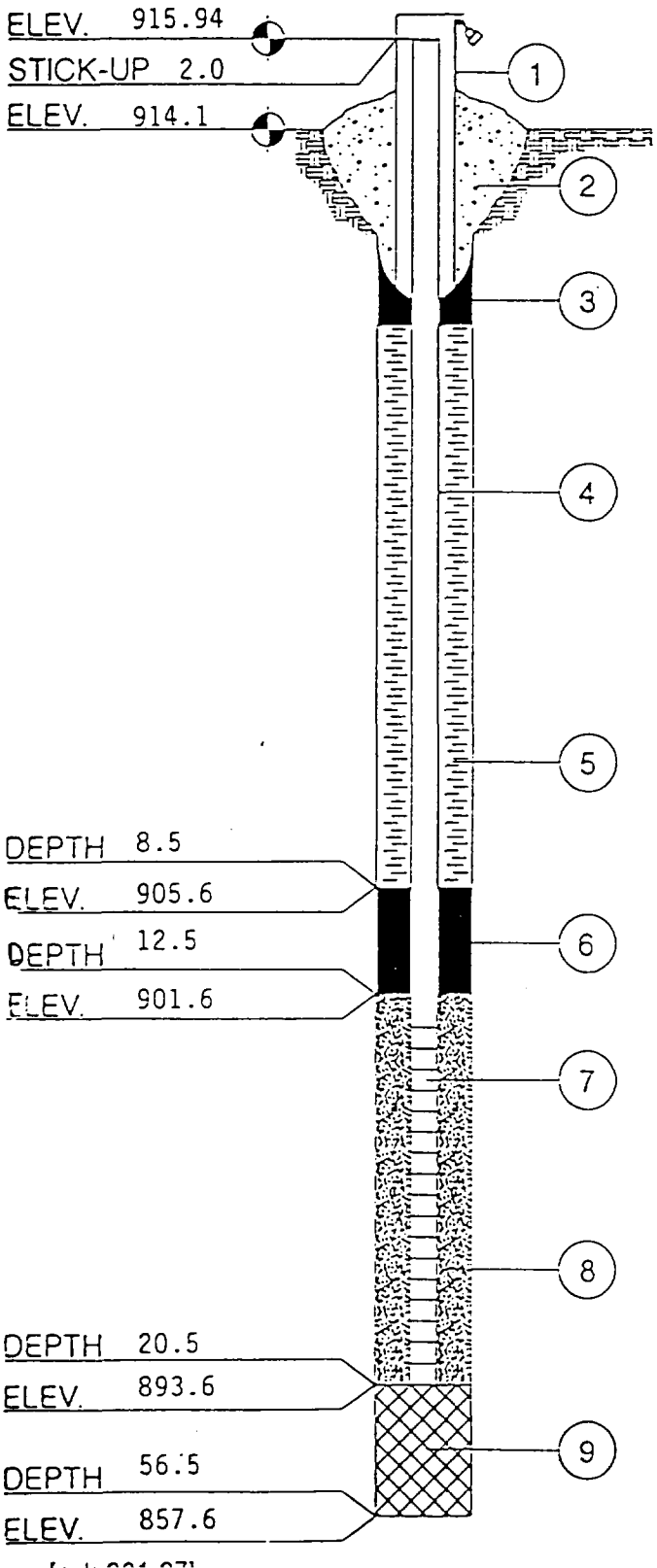
Monitoring Well Construction Information (STICK-UP)

PROJECT North Bronson RI/FS

BORING/WELL NO. MW20

DATE 11/24/91

PROJECT NUMBER 70051.53



1. PROTECTIVE CASING 4 in. Steel

   LOCKING Yes (2002 Key)

2. CONCRETE SEAL None

3. TYPE OF SURFACE SEAL (IF INSTALLED)

   Fine Granular Bentonite

4. SOLID PIPE TYPE Stainless Steel

   SOLID PIPE LENGTH 17.3 ft

   JOINT TYPE Flush threaded with "O" rings

5. TYPE OF BACKFILL Fine Granular Bentonite

   BACKFILL INSTALLED from surface

6. TYPE OF LOWER SEAL (IF INSTALLED)

   3/4 in. Granular Bentonite

7. SCREEN TYPE Stainless Steel

   SCREEN LENGTH 5.15 ft

   SLOT SIZE 0.0060 in. (#6 slot)

   SLOTTED INTERVAL LENGTH 4.63 ft

   SCREEN DIAMETER 2.0 in. ID

8. TYPE OF BACKFILL AROUND SCREEN

   Natural Collapse

9. TYPE OF BACKFILL Natural Collapse

10. DRILLING METHOD 4.25 in. HSA

11. ADDITIVES USED (IF ANY)

    None

(ALL DEPTHS MEASURED FROM GROUND SURFACE)

Elevations based on USGS datum.

LOG OF TEST BORING

WARZYN

Project: North Bronson RI/FS

Location: Bronson, Michigan

Boring No. MW21
Surface Elevation 916.6
Job No. 7005100/159
Sheet 1 of 2

One Science Court, P.O. Box 5385, Madison, WI 53705, TEL. (608) 231-4747

SAMPLE No.	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
					Earth Drilled to 58.0 ft	
				5		
				10	- Sample intervals depict screened intervals for water sampling.	
1					- Soil types were determined by field observation of drill cuttings and soils identified in borings from the site area.	1.5 E8
				15		
2					Brown to Gray, Fine to Coarse SAND (SP) with Little to Some Coarse to Fine Gravel, and Trace Silt and Clay.	6.5 E8
				20		
3						3.5 E8
				25		
4						2.7 E8
				30		
5						1.8 E8
				35		
6						2.6 E7
				40		

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/8/91 End 11/8/91
Driller Mathes Chief CSY Rig CME-75
Logger CSY Editor SGW
Drill Method 4 1/4" I.D. HSA

LOG OF TEST BORING

WARZYN

Project: North Bronson RI/FS

Location: Bronson, Michigan

Boring No. MW21
Surface Elevation 916.6
Job No. 7005100/159
Sheet 2 of 2

One Science Court, P.O. Box 5385, Madison, WI 53705 TEL. (608) 231-4747

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
7							8.7 E6
					45		
8							3.8 E6
					50		
9							1.3 E7
					55	Dense, Gray Silty Fine to Coarse SAND (SM) with Some Clay and Trace to Little Fine Gravel	
					60	End of Boring at 58.0 ft	
					65		
					70		
					75		
					80		

WARZYN

Monitoring Well Construction Information (STICK-UP)

PROJECT North Bronson RI/FS

BORING/WELL NO. MW21

DATE 11/09/91

PROJECT NUMBER 70051.53

1. PROTECTIVE CASING 4 in. Steel

   LOCKING Yes (2002 Key)

2. CONCRETE SEAL None

3. TYPE OF SURFACE SEAL (IF INSTALLED)

   Fine Granular Bentonite

4. SOLID PIPE TYPE Stainless Steel

   SOLID PIPE LENGTH 17.4 ft

   JOINT TYPE Flush threaded with "O" rings

5. TYPE OF BACKFILL Fine Granular Bentonite

   BACKFILL INSTALLED from surface

6. TYPE OF LOWER SEAL (IF INSTALLED)

   3/4 in. Coarse Granular Bentonite

7. SCREEN TYPE Stainless Steel

   SCREEN LENGTH 5.15 ft

   SLOT SIZE 0.0060 in. (#6 slot)

   SLOTTED INTERVAL LENGTH 4.63 ft

   SCREEN DIAMETER 2.0 in. ID

8. TYPE OF BACKFILL AROUND SCREEN

   Natural Collapse

9. TYPE OF BACKFILL Natural Collapse

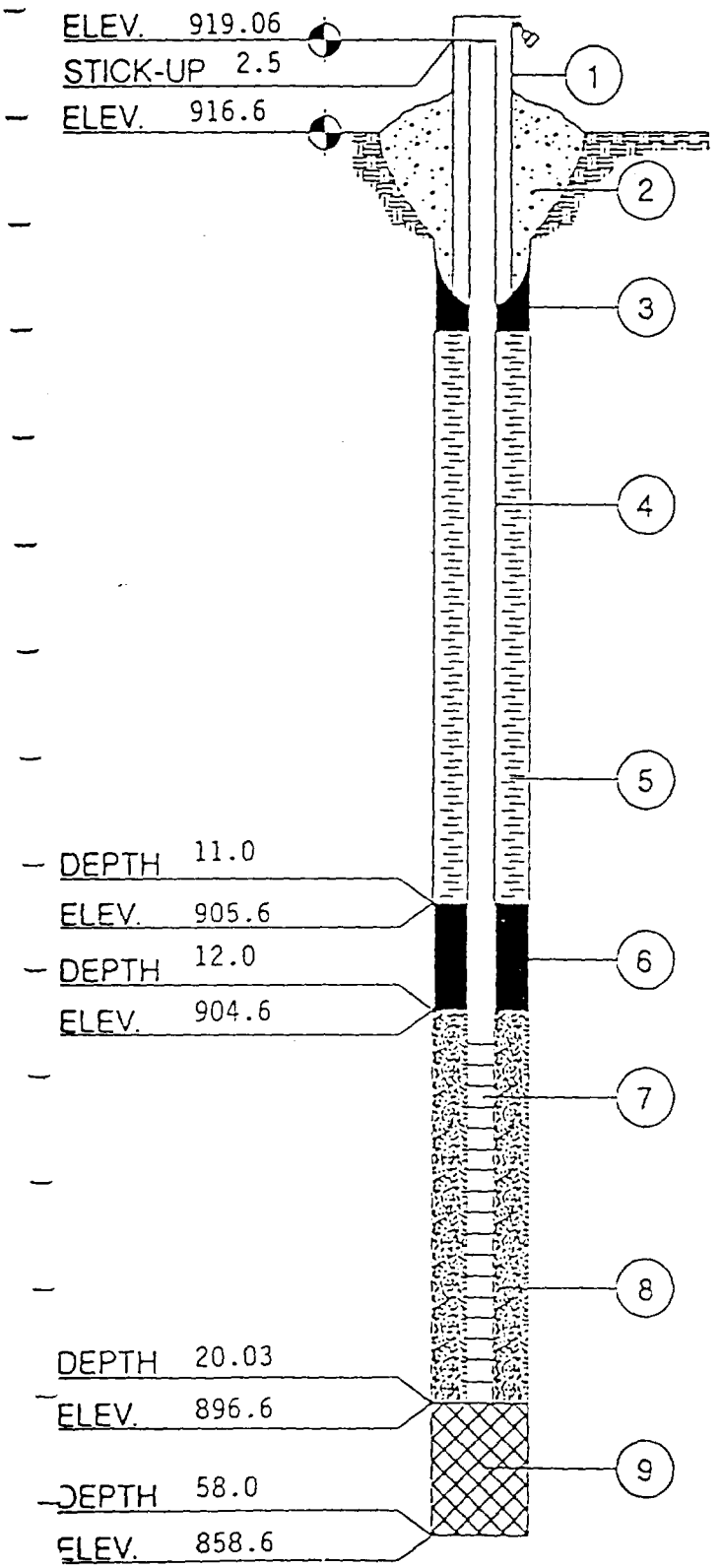
10. DRILLING METHOD 4.25 in. HSA

11. ADDITIVES USED (IF ANY)

    None

(ALL DEPTHS MEASURED FROM GROUND SURFACE)

Elevations based on USGS datum.



[pvk-301-26]

LOG OF TEST BORING

WARZYN

Project: North Bronson RI/FS

Location: Bronson, Michigan

Boring No. MW22
Surface Elevation 913.3
Job No. 7005100/159
Sheet 1 of 2

One Science Court, P.O. Box 5385, Madison, WI 53705, TEL. (608) 231-4747

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
						Earth Drilled to 64.0 ft	
					5		
					10	- Sample intervals depict screened intervals for water sampling.	
1						- Soil types were determined by field observation of drill cuttings and soils identified in borings from the site area.	6.0 E6
					15		
2						Brown to Gray, Fine to Coarse SAND (SP) with Little to Some Coarse to Fine Gravel, and Trace Silt and Clay.	3.5 E7
					20		
3							6.4 E7
					25		
4							1.1 E7
					30		
5							5.5 E5
					35		
6							2.4 E5
					40		

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/11/91 End 11/11/91
Driller Mathes Chief CSY Rig CME-75
Logger CSY Editor SGW
Drill Method 4 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project: North Bronson RI/FS

Location: Bronson, Michigan

Boring No. MW22
Surface Elevation 913.3
Job No. 7005100/159
Sheet 2 of 2

One Science Court, P.O. Box 5385, Madison, WI 53705 TEL. (608) 231-4747

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
7							N.D.
					45		
8							3.8 E5
					50		
9							1.6 E5
					55	Dense, Gray Silty Fine to Coarse SAND (SM) with Some Clay and Trace to Little Fine Gravel	
					60		
					65	End of Boring at 64.0 ft N.D. = Nothing Detected	
					70		
					75		
					80		

WARZYN

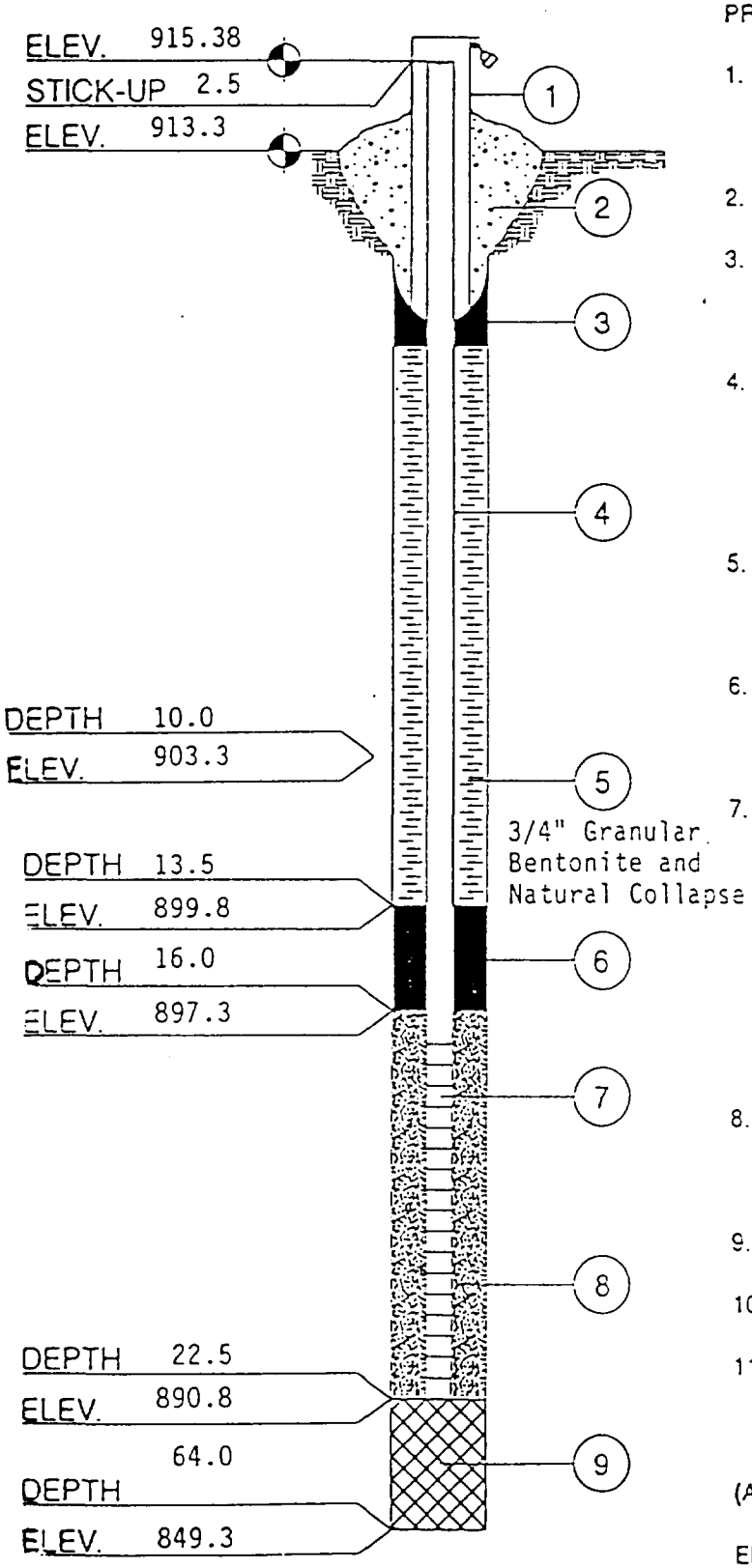
Monitoring Well Construction Information (STICK-UP)

PROJECT North Bronson RI/FS

BORING/WELL NO. MW22

DATE 11/11/91

PROJECT NUMBER 70051.53



1. PROTECTIVE CASING 4 in. Steel

   LOCKING Yes (2002 Key)

2. CONCRETE SEAL None

3. TYPE OF SURFACE SEAL (IF INSTALLED)

   Fine Granular Bentonite

4. SOLID PIPE TYPE Stainless Steel

   SOLID PIPE LENGTH 19.8 ft

   JOINT TYPE Flush threaded with "O" rings

5. TYPE OF BACKFILL Fine Granular Bentonite

   BACKFILL INSTALLED from surface

6. TYPE OF LOWER SEAL (IF INSTALLED)

   3/4 in. Granular Bentonite

7. SCREEN TYPE Stainless Steel

   SCREEN LENGTH 5.15 ft

   SLOT SIZE 0.0060 in. (#6 slot)

   SLOTTED INTERVAL LENGTH 4.63 ft

   SCREEN DIAMETER 2.0 in. ID

8. TYPE OF BACKFILL AROUND SCREEN

   Natural Collapse

9. TYPE OF BACKFILL Natural Collapse

10. DRILLING METHOD 4.25 in. HSA

11. ADDITIVES USED (IF ANY)

    None

(ALL DEPTHS MEASURED FROM GROUND SURFACE)

Elevations based on USGS datum.

[pyk-301-25]

LOG OF TEST BORING

WARZYN

Project: North Bronson RI/FS

Location: Bronson, Michigan

Boring No. MW23
Surface Elevation 911.5
Job No. 7005100/159
Sheet 1 of 1

One Science Court, P.O. Box 5385, Madison, WI 53705, TEL. (608) 231-4747

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
						Earth Drilled to 35.0 ft	
					5		
1					10	- Sample intervals depict screened intervals for water sampling.	1.9 E6
2						- Soil types were determined by field observation of drill cuttings and soils identified in borings from the site area.	1.3 E6
					15		
3						Brown to Gray, Fine to Coarse SAND (SP) with Little to Some Coarse to Fine Gravel, and Trace Silt and Clay.	1.1 E5
					20		
4							1.1 E6
					25		
5							3.1 E6
					30		
						Dense, Gray Silty Fine to Coarse SAND (SM) with Some Clay and Trace to Little Fine Gravel	
					35		
						End of Boring at 35.0 ft	
					40		

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/13/91 End 11/13/91
Driller Mathes Chief CSY Rig CME-75
Logger CSY Editor SGW
Drill Method 4 1/4" I.D. HSA

WARZYN

Monitoring Well Construction Information (STICK-UP)

PROJECT North Bronson RI/FS

BORING/WELL NO. MW23

DATE 11/13/91

PROJECT NUMBER 70051.53

1. PROTECTIVE CASING 4 in. Steel

   LOCKING Yes (2002 Key)

2. CONCRETE SEAL None

3. TYPE OF SURFACE SEAL (IF INSTALLED)

   Fine Granular Bentonite

4. SOLID PIPE TYPE Stainless Steel

   SOLID PIPE LENGTH 12.3 ft

   JOINT TYPE Flush threaded with "O" rings

5. TYPE OF BACKFILL Fine Granular Bentonite

   BACKFILL INSTALLED from surface

6. TYPE OF LOWER SEAL (IF INSTALLED)

   3/4 in. Granular Bentonite

7. SCREEN TYPE Stainless Steel

   SCREEN LENGTH 5.15 ft

   SLOT SIZE 0.0060 in. (#6 slot)

   SLOTTED INTERVAL LENGTH 4.63 ft

   SCREEN DIAMETER 2.0 in. ID

8. TYPE OF BACKFILL AROUND SCREEN

   Natural Collapse

9. TYPE OF BACKFILL Natural Collapse

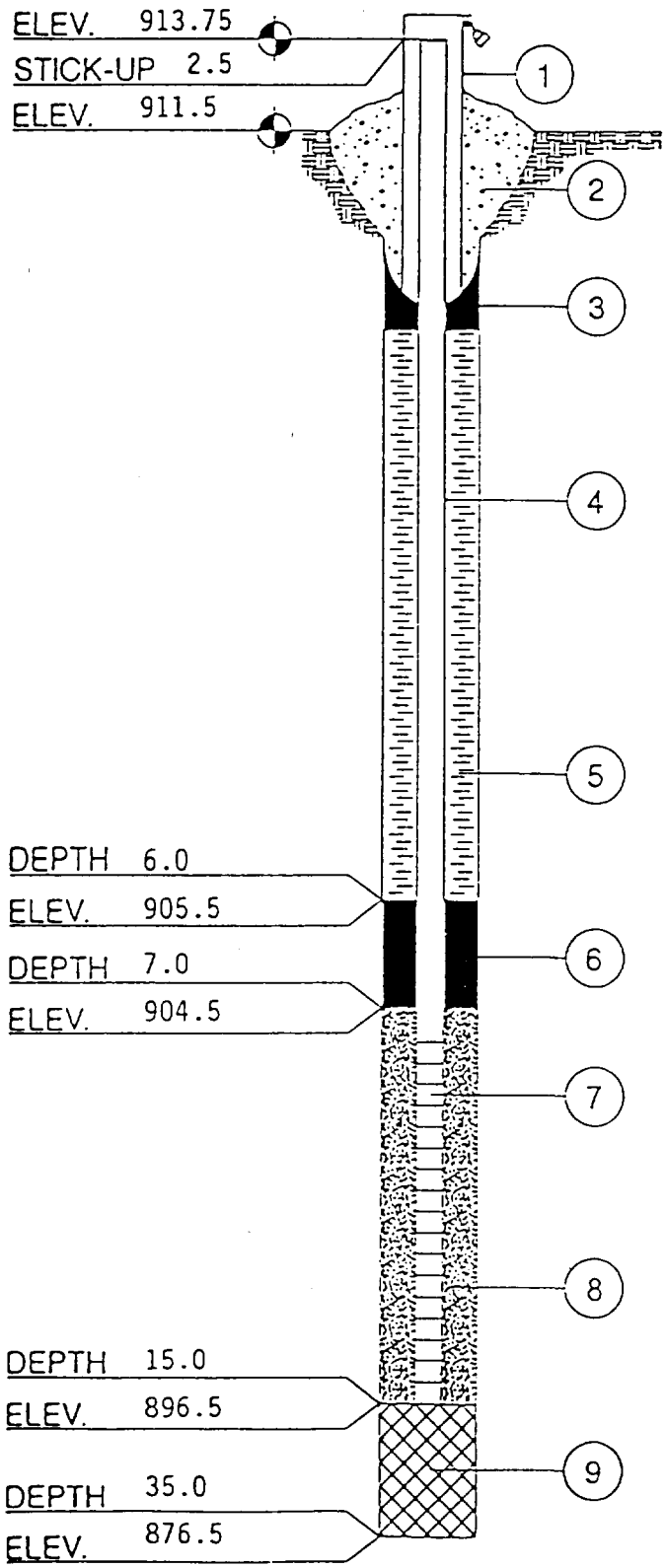
10. DRILLING METHOD 4.25 in. HSA

11. ADDITIVES USED (IF ANY)

    None

(ALL DEPTHS MEASURED FROM GROUND SURFACE)

Elevations based on USGS datum.



LOG OF TEST BORING

WARZYN

Project: North Bronson RI/FS

Location: Bronson, Michigan

Boring No. MW24
Surface Elevation 911.6
Job No. 7005100/159
Sheet 1 of 2

One Science Court, P.O. Box 5385, Madison, WI 53705, TEL. (608) 231-4747

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
						Earth Drilled to 51.5 ft	
					5		
					10	- Sample intervals depict screened intervals for water sampling.	
1						- Soil types were determined by field observation of drill cuttings and soils identified in borings from the site area.	3.0 E7
					15		
2						Brown to Gray, Fine to Coarse SAND (SP) with Little to Some Coarse to Fine Gravel, and Trace Silt and Clay.	6.0 E7
					20		
3							9.4 E7
					25		
4							1.8 E8
					30		
5							3.2 E7
					35		
6							1.6 E8
					40		

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/23/91 End 11/23/91
Driller Mathes Chief CSY Rig CME-75
Logger CSY Editor SGW
Drill Method 4 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project: North Bronson RI/FS

Location: Bronson, Michigan

Boring No. MW24
Surface Elevation 911.6
Job No. 7005100/159
Sheet 2 of 2

One Science Court, P.O. Box 5385, Madison, WI 53705 TEL. (608) 231-4747

SAMPLE No.	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
7				45		5.9 E7
8				50		3.7 E7
					Dense, Gray Silty Fine to Coarse SAND (SM) with Some Clay and Trace to Little Fine Gravel	
					End of Boring at 51.5 ft	
				55		
				60		
				65		
				70		
				75		
				80		

WARZYN

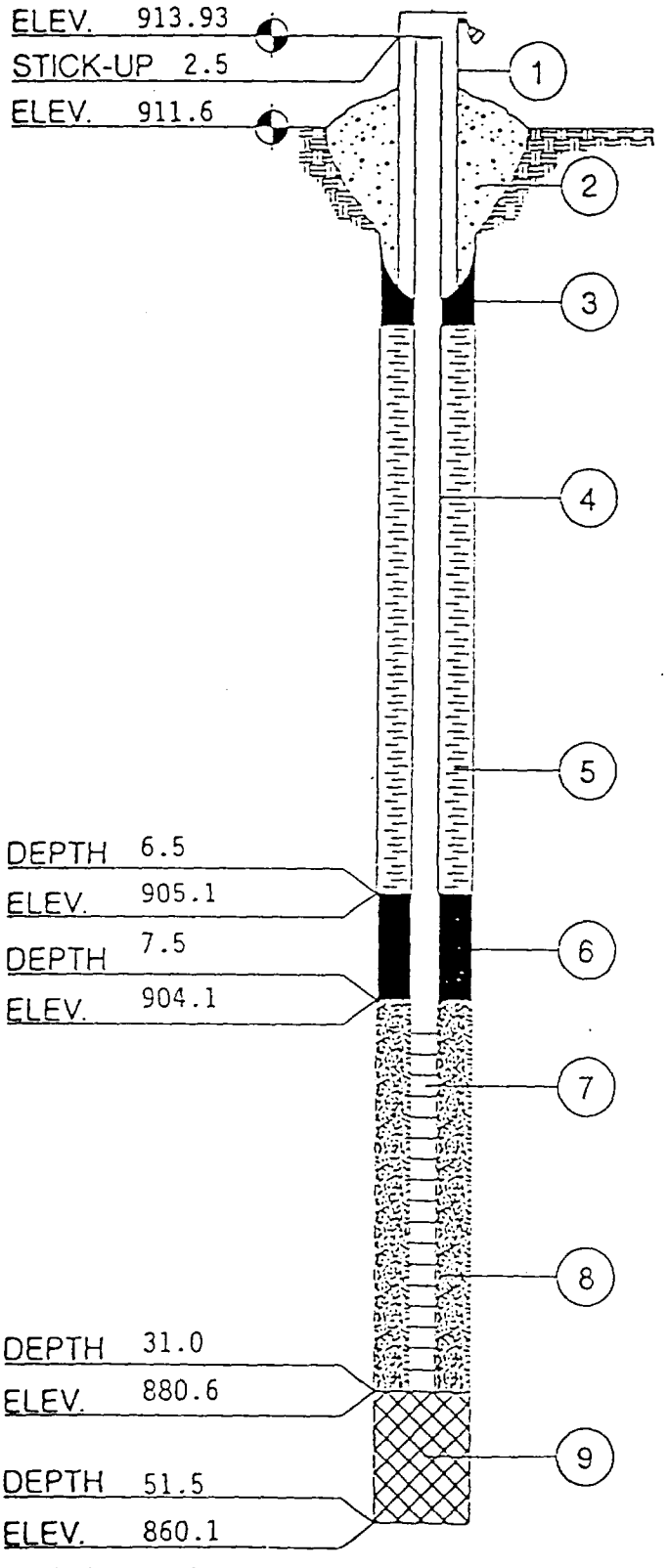
Monitoring Well Construction Information (STICK-UP)

PROJECT North Bronson RI/FS

BORING/WELL NO. MW24

DATE 11/23/91

PROJECT NUMBER 70051.53



[pvk-301-23]

1. PROTECTIVE CASING 4 in. Steel

   LOCKING Yes (2002 Key)

2. CONCRETE SEAL None

3. TYPE OF SURFACE SEAL (IF INSTALLED)

   Fine Granular Bentonite

4. SOLID PIPE TYPE Stainless Steel

   SOLID PIPE LENGTH 28.3 ft

   JOINT TYPE Flush threaded with "O" rings

5. TYPE OF BACKFILL Fine Granular Bentonite

   BACKFILL INSTALLED from surface

6. TYPE OF LOWER SEAL (IF INSTALLED)

   3/4 in. Granular Bentonite

7. SCREEN TYPE Stainless Steel

   SCREEN LENGTH 5.15 ft

   SLOT SIZE 0.0060 in. (#6 slot)

   SLOTTED INTERVAL LENGTH 4.63 ft

   SCREEN DIAMETER 2.0 in. ID

8. TYPE OF BACKFILL AROUND SCREEN

   Natural Collapse

9. TYPE OF BACKFILL Natural Collapse

10. DRILLING METHOD 4.25 in. HSA

11. ADDITIVES USED (IF ANY)

    None

(ALL DEPTHS MEASURED FROM GROUND SURFACE)

Elevations based on USGS datum.

LOG OF TEST BORING

WARZYN

Project: North Bronson RI/FS

Location: Bronson, Michigan

Boring No. MW25
Surface Elevation 909.0
Job No. 7005100/159
Sheet 1 of 1

One Science Court, P.O. Box 5385, Madison, WI 53705, TEL. (608) 231-4747

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
						Earth Drilled to 30.0 ft	
					5		
1							8.5 E5
					10	- Sample intervals depict screened intervals for water sampling.	
2						- Soil types were determined by field observation of drill cuttings and soils identified in borings from the site area.	1.2 E6
					15		
3						Brown to Gray, Fine to Coarse SAND (SP) with Little to Some Coarse to Fine Gravel, and Trace Silt and Clay.	1.0 E6
					20		
4							N.D.
					25	Dense, Gray Silty Fine to Coarse SAND (SM) with Some Clay and Trace to Little Fine Gravel	
					30		
						End of Boring at 30.0 ft	
						N.D. = Nothing Detected	
					35		
					40		

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/21/91 End 11/21/91
Driller Mathes Chief CSY Rig CME-75
Logger CSY Editor SGW
Drill Method 4 1/4" I.D. HSA

WARZYN

Monitoring Well Construction Information (STICK-UP)

PROJECT North Bronson RI/FS

BORING/WELL NO. MW25

DATE 11/21/91

PROJECT NUMBER 70051.53

1. PROTECTIVE CASING 4 in. Steel

   LOCKING Yes (2002 Key)

2. CONCRETE SEAL None

3. TYPE OF SURFACE SEAL (IF INSTALLED)

   Fine Granular Bentonite

4. SOLID PIPE TYPE Stainless Steel

   SOLID PIPE LENGTH 14.3 ft

   JOINT TYPE Flush threaded with "O" rings

5. TYPE OF BACKFILL Fine Granular Bentonite

   BACKFILL INSTALLED from surface

6. TYPE OF LOWER SEAL (IF INSTALLED)

   3/4 in. Granular Bentonite

7. SCREEN TYPE Stainless Steel

   SCREEN LENGTH 5.15 ft

   SLOT SIZE 0.0060 in. (#6 slot)

   SLOTTED INTERVAL LENGTH 4.63 ft

   SCREEN DIAMETER 2.0 in. ID

8. TYPE OF BACKFILL AROUND SCREEN

   Natural Collapse

9. TYPE OF BACKFILL Natural Collapse

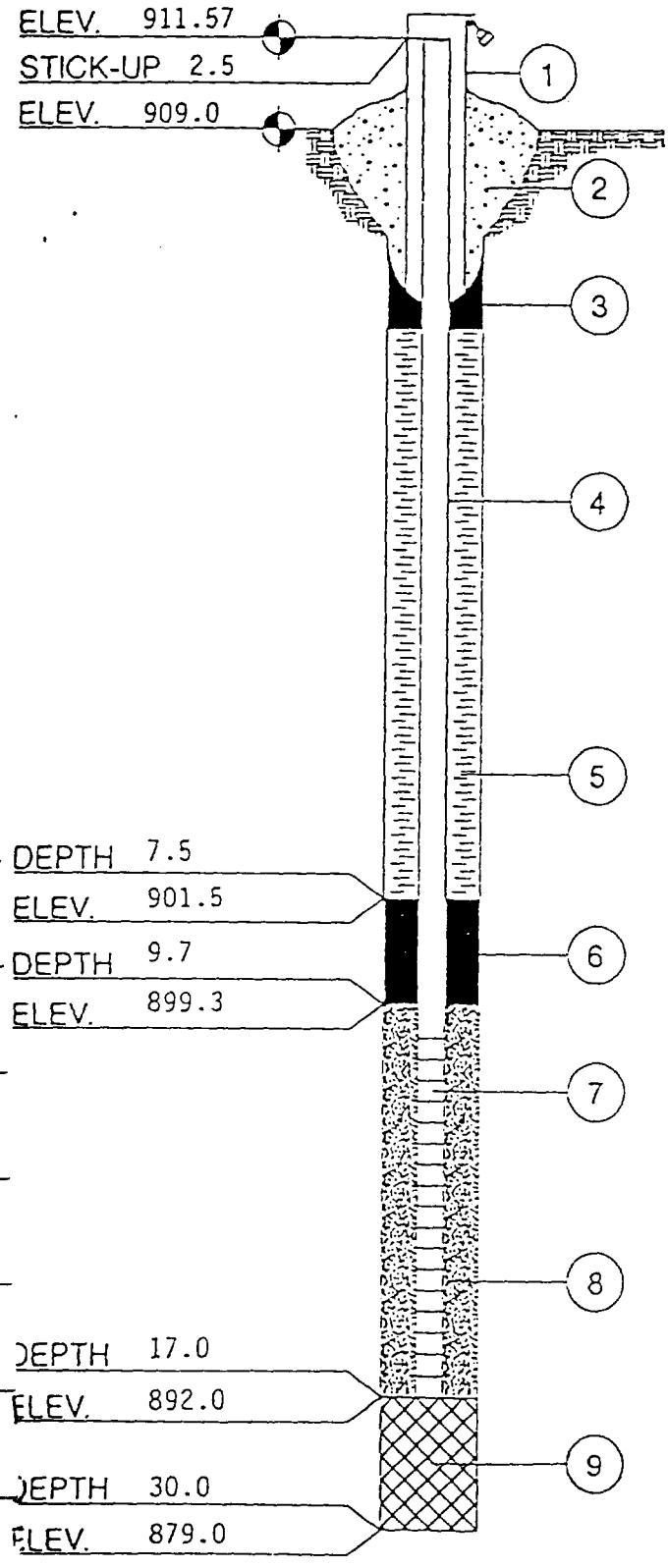
10. DRILLING METHOD 4.25 in. HSA

11. ADDITIVES USED (IF ANY)

    None

(ALL DEPTHS MEASURED FROM GROUND SURFACE)

Elevations based on USGS datum.



[pvk-301-22]

WARZYN

LOG OF TEST BORING

Project: North Bronson RI/FS

Location: Bronson, Michigan

Boring No. MW26
Surface Elevation 909.5
Job No. 7005100/159
Sheet 1 of 1

One Science Court, P.O. Box 5385, Madison, WI 53705, TEL. (608) 231-4747

SAMPLE No.	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
					Earth Drilled to 31.0 ft	
				5		
				10	- Sample intervals depict screened intervals for water sampling.	
1					- Soil types were determined by field observation of drill cuttings and soils identified in borings from the site area.	3.5 E8
				15		
2					Brown to Gray, Fine to Coarse SAND (SP) with Little to Some Coarse to Fine Gravel, and Trace Silt and Clay.	N.D.
				20		
3						2.0 E8
				25		
				30	Dense, Gray Silty Fine to Coarse SAND (SM) with Some Clay and Trace to Little Fine Gravel	
				35	End of Boring at 31.0 ft N.D. = Nothing Detected	
				40		

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

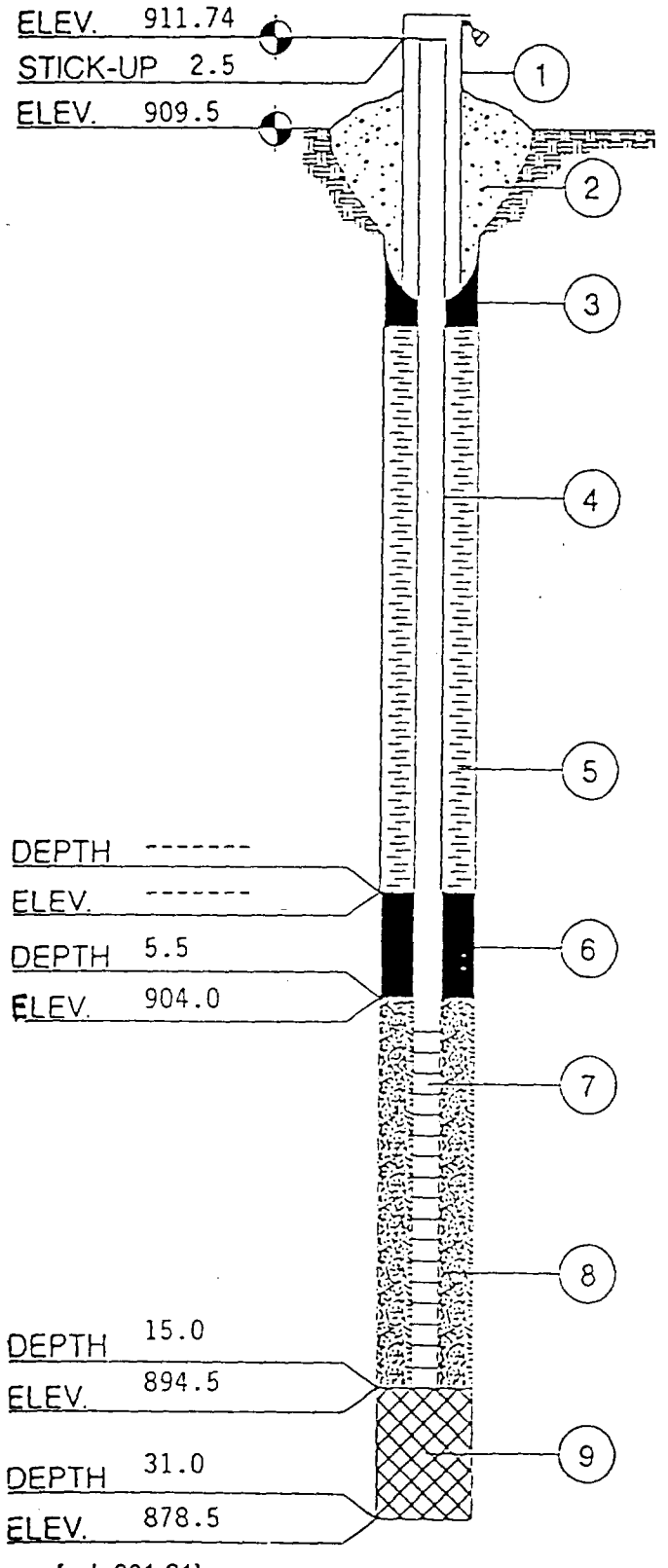
The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/25/91 End 11/25/91
Driller Mathes Chief CSY Rig CME-75
Logger CSY Editor SGW
Drill Method 4 1/4" I.D. HSA

WARZYN

Monitoring Well Construction Information (STICK-UP)



[pvk-301-21]

PROJECT North Bronson RI/FS

BORING/WELL NO. MW26

DATE 11/26/91

PROJECT NUMBER 70051.53

1. PROTECTIVE CASING 4 in. Steel

   LOCKING Yes (2002 Key)

2. CONCRETE SEAL None

3. TYPE OF SURFACE SEAL (IF INSTALLED)

   Fine Granular Bentonite

4. SOLID PIPE TYPE Stainless Steel

   SOLID PIPE LENGTH 12.3 ft

   JOINT TYPE Flush threaded with "O" rings

5. TYPE OF BACKFILL Fine Granular Bentonite

   BACKFILL INSTALLED from surface

6. TYPE OF LOWER SEAL (IF INSTALLED)

   None

7. SCREEN TYPE Stainless Steel

   SCREEN LENGTH 5.15 ft

   SLOT SIZE 0.0060 in. (#6 slot)

   SLOTTED INTERVAL LENGTH 4.63 ft

   SCREEN DIAMETER 2.0 in. ID

8. TYPE OF BACKFILL AROUND SCREEN

   Natural Collapse

9. TYPE OF BACKFILL Natural Collapse

10. DRILLING METHOD 4.25 in. HSA

11. ADDITIVES USED (IF ANY)

    None

(ALL DEPTHS MEASURED FROM GROUND SURFACE)

Elevations based on USGS datum.

WARZYN

LOG OF TEST BORING

Project: North Bronson RI/FS

Location: Bronson, Michigan

Boring No. MW27
Surface Elevation 910.8
Job No. 7005100/159
Sheet 1 of 2

One Science Court, P.O. Box 5385, Madison, WI 53705, TEL. (608) 231-4747

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
						Earth Drilled to 60.0 ft	
					5		
					10	- Sample intervals depict screened intervals for water sampling.	
1						- Soil types were determined by field observation of drill cuttings and soils identified in borings from the site area.	N.D.
					15		
2						Brown to Gray, Fine to Coarse SAND (SP) with Little to Some Coarse to Fine Gravel, and Trace Silt and Clay.	2.5 E5
					20		
3							N.D.
					25		
4							N.D.
					30		
5							3.2 E6
					35		
6							6.3 E4
					40		

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____ _____ _____ _____
Depth to Water _____ _____ _____ _____ ▼
Depth to Cave in _____ _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/24/91 End 11/24/91
Driller Mathes Chief CSY Rig CME-75
Logger CSY Editor SGW
Drill Method 4 1/4" I.D. HSA

WARZYN

LOG OF TEST BORING

Project: North Bronson RI/FS

Location: Bronson, Michigan

Boring No. MW27
Surface Elevation 910.8
Job No. 7005100/159
Sheet 2 of 2

One Science Court, P.O. Box 5385, Madison, WI 53705 TEL. (608) 231-4747

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
7							2.4 E7
					45		
8							4.7 E7
					50		
9							6.7 E6
					55	Dense, Gray Silty Fine to Coarse SAND (SM) with Some Clay and Trace to Little Fine Gravel	
					60	End of Boring at 60.0 ft N.D. = Nothing Detected	
					65		
					70		
					75		
					80		

WARZYN

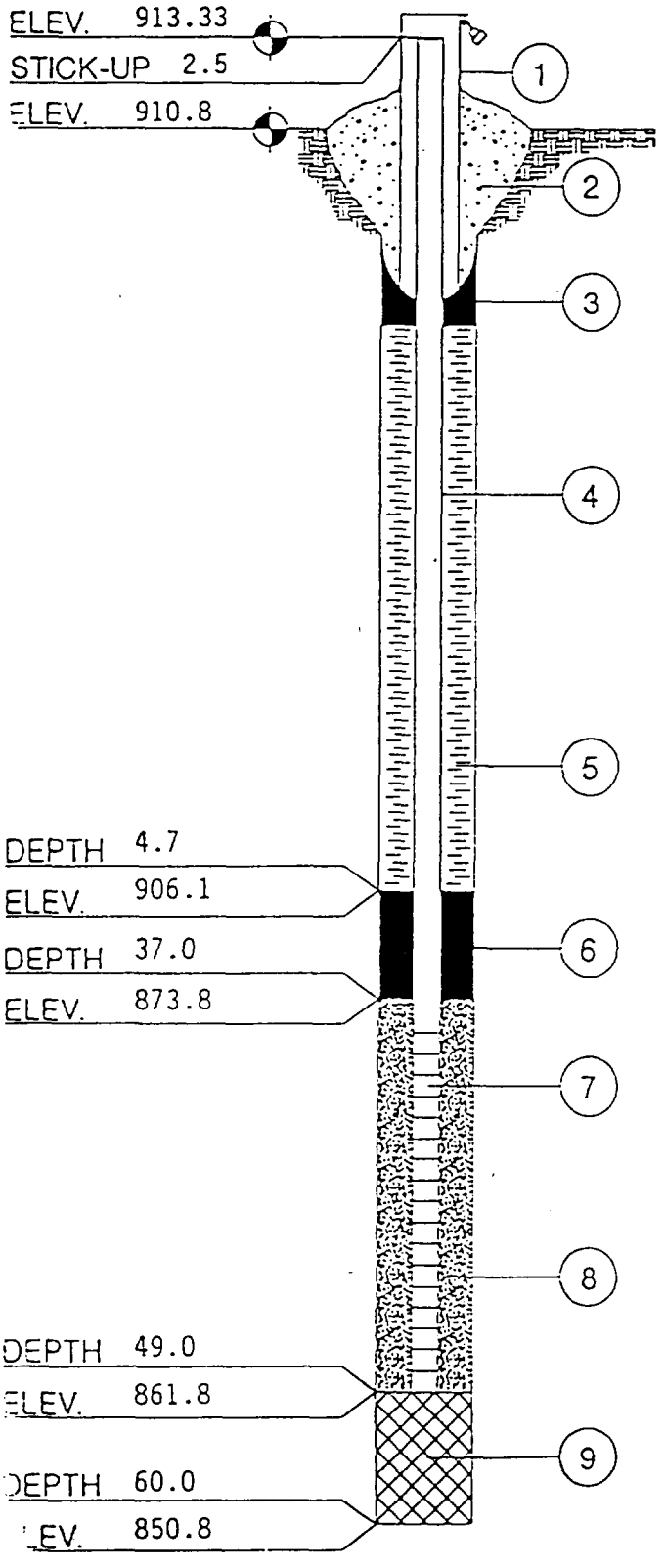
Monitoring Well Construction Information (STICK-UP)

PROJECT North Bronson RI/FS

BORING/WELL NO. MW27

DATE 11/25/91

PROJECT NUMBER 70051.53



1. PROTECTIVE CASING 4 in. Steel

   LOCKING Yes (2002 Key)

2. CONCRETE SEAL None

3. TYPE OF SURFACE SEAL (IF INSTALLED)

   Fine Granular Bentonite

4. SOLID PIPE TYPE Stainless Steel

   SOLID PIPE LENGTH 46.3 ft

   JOINT TYPE Flush threaded with "O" rings

5. TYPE OF BACKFILL Fine Granular Bentonite

   BACKFILL INSTALLED from surface

6. TYPE OF LOWER SEAL (IF INSTALLED)

   Natural collapse and Bentonite Slurry

7. SCREEN TYPE Stainless Steel

   SCREEN LENGTH 5.15 ft

   SLOT SIZE 0.0060 in. (#6 slot)

   SLOTTED INTERVAL LENGTH 4.63 ft

   SCREEN DIAMETER 2.0 in. ID

8. TYPE OF BACKFILL AROUND SCREEN

   Natural Collapse

9. TYPE OF BACKFILL Natural Collapse

10. DRILLING METHOD 4.25 in. HSA

11. ADDITIVES USED (IF ANY)

    None

(ALL DEPTHS MEASURED GROUND SURFACE)

Elevations based on USGS datum.

WARZYN

LOG OF TEST BORING

Project: North Bronson RI/FS

Location: Bronson, Michigan

Boring No. MW28
Surface Elevation 908.0
Job No. 7005100/159
Sheet 1 of 1

One Science Court, P.O. Box 5385, Madison, WI 53705, TEL. (608) 231-4747

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
						Earth Drilled to 25.0 ft	
					5		
					10	- Sample intervals depict screened intervals for water sampling.	
1						- Soil types were determined by field observation of drill cuttings and soils identified in borings from the site area.	7.1 E7
					15		
2						Brown to Gray, Fine to Coarse SAND (SP) with Little to Some Coarse to Fine Gravel, and Trace Silt and Clay.	N.D.
					20		
						Dense, Gray Silty Fine to Coarse SAND (SM) with Some Clay and Trace to Little Fine Gravel	
					25		
						End of Boring at 25.0 ft	
						N.D. = Nothing Detected	
					30		
					35		
					40		

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/26/91 End 11/26/91
Driller Mathes Chief CSY Rig CME-75
Logger CSY Editor SGW
Drill Method 4 1/4" I.D. HSA

WARZYN

Monitoring Well Construction Information (STICK-UP)

PROJECT North Bronson RI/FS

BORING/WELL NO. MW28

DATE 11/26/91

PROJECT NUMBER 70051.53

1. PROTECTIVE CASING 4 in. Steel

   LOCKING Yes (2002 Key)

2. CONCRETE SEAL None

3. TYPE OF SURFACE SEAL (IF INSTALLED)

   Fine Granular Bentonite

4. SOLID PIPE TYPE Stainless Steel

   SOLID PIPE LENGTH 12.4 ft

   JOINT TYPE Flush threaded with "O" rings

5. TYPE OF BACKFILL Fine Granular Bentonite

   BACKFILL INSTALLED from surface

6. TYPE OF LOWER SEAL (IF INSTALLED)

   None (fine granular Bentonite)

7. SCREEN TYPE Stainless Steel

   SCREEN LENGTH 5.15 ft

   SLOT SIZE 0.0060 in. (#6 slot)

   SLOTTED INTERVAL LENGTH 4.63 ft

   SCREEN DIAMETER 2.0 in. ID

8. TYPE OF BACKFILL AROUND SCREEN

   Natural Collapse

9. TYPE OF BACKFILL Natural Collapse

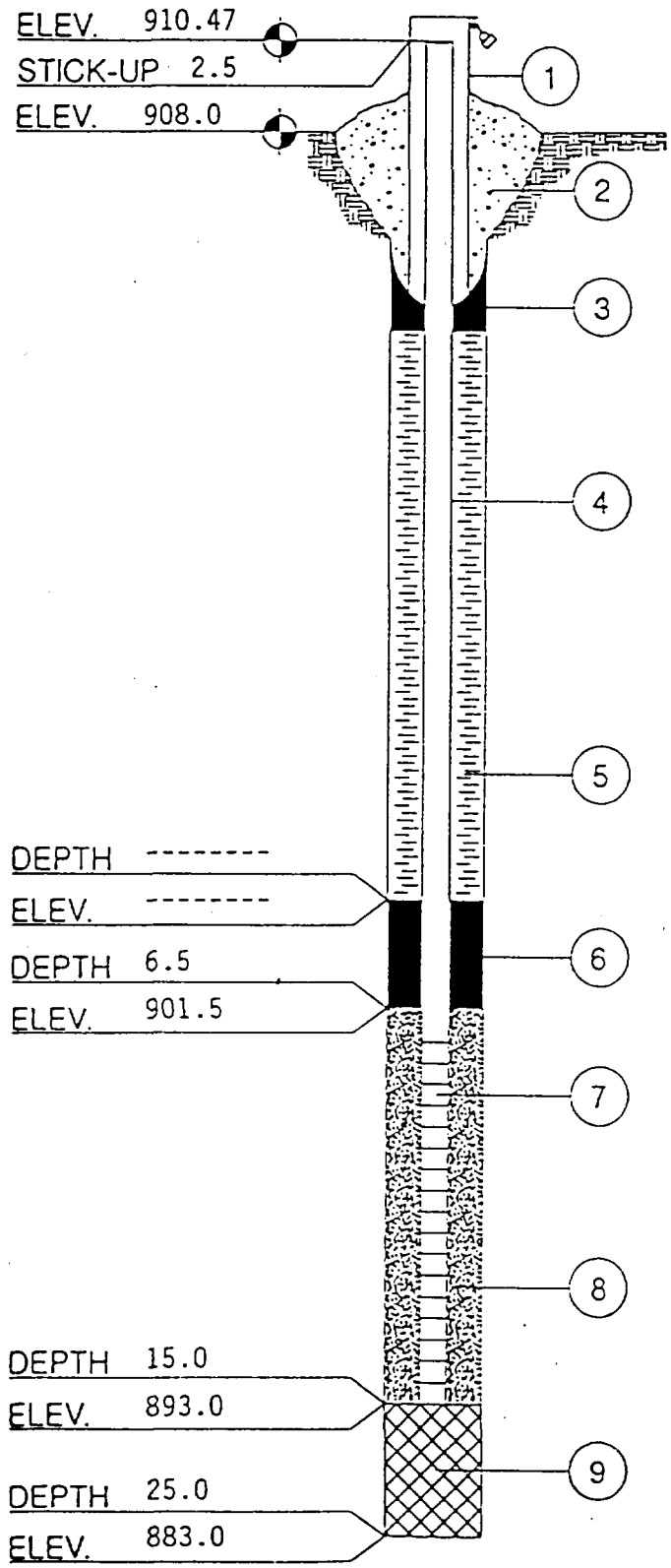
10. DRILLING METHOD 4.25 in. HSA

11. ADDITIVES USED (IF ANY)

    None

(ALL DEPTHS MEASURED FROM GROUND SURFACE)

Elevations based on USGS datum.



[pvk-301-19]

LOG OF TEST BORING

WARZYN

Project: North Bronson RI/FS

Location: Bronson, Michigan

Boring No. MW29
Surface Elevation 914.2
Job No. 7005100/159
Sheet 1 of 2

One Science Court, P.O. Box 5385, Madison, WI 53705, TEL. (608) 231-4747

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
						Earth Drilled to 61.0 ft	
					5		
					10	- Sample intervals depict screened intervals for water sampling.	
1						- Soil types were determined by field observation of drill cuttings and soils identified in borings from the site area.	9.9 E5
					15		
					20	Brown to Gray, Fine to Coarse SAND (SP) with Little to Some Coarse to Fine Gravel, and Trace Silt and Clay.	
2							N.D.
					25		
					30		
3							1.7 E5
					35		
					40		

WATER LEVEL OBSERVATIONS

While Drilling ▽ _____ Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/27/91 End 11/27/91
Driller Mathes Chief CSY Rig CME-75
Logger CSY Editor SGW
Drill Method 4 1/4" I.D. HSA

LOG OF TEST BORING

WARZYN

Project: North Bronson RI/FS

Location: Bronson, Michigan

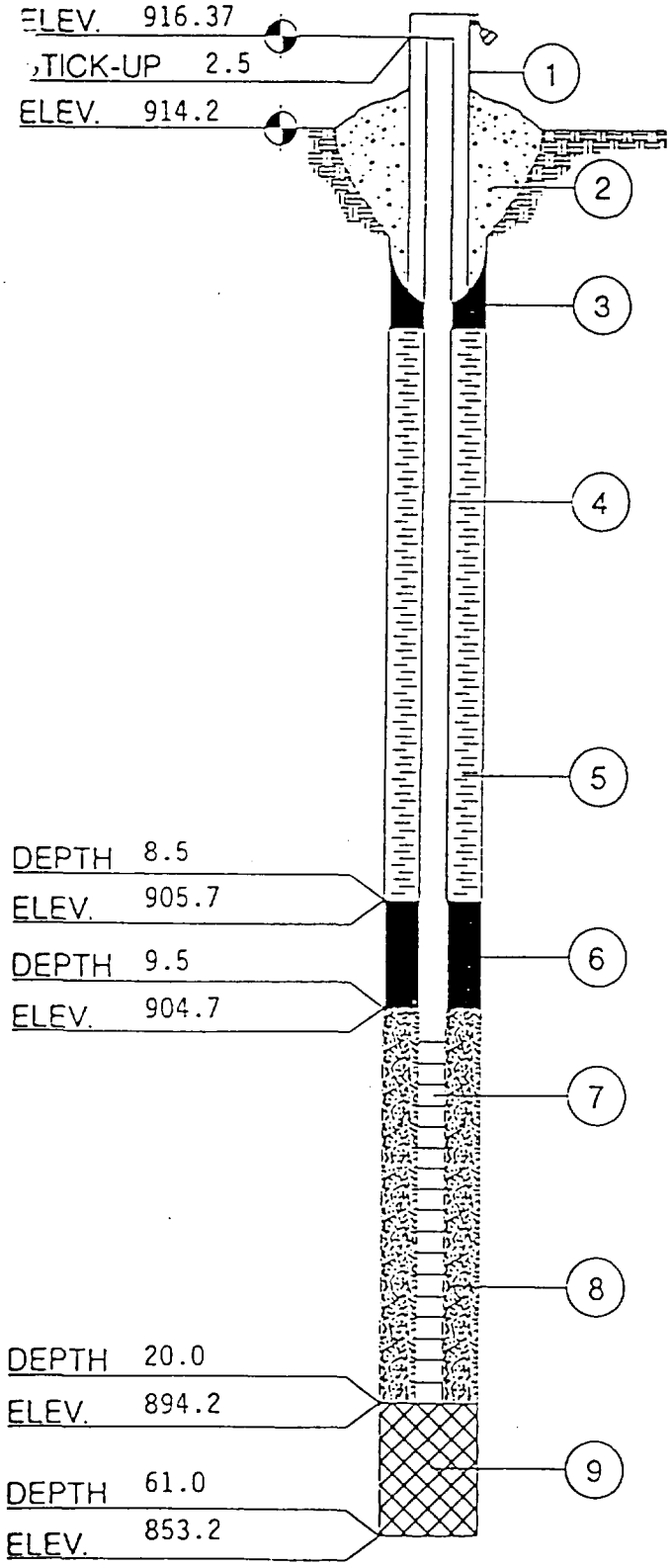
Boring No. MW29
Surface Elevation 914.2
Job No. 7005100/159
Sheet 2 of 2

One Science Court, P.O. Box 5385, Madison, WI 53705 TEL. (608) 231-4747

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	FIELD GC Total VOCs - Area Count
4							1.8 E7
					45		
					50		
5							1.3 E5
					55		
					60	Dense, Gray Silty Fine to Coarse SAND (SM) with Some Clay and Trace to Little Fine Gravel	
					65	End of Boring at 61.0 ft N.D. = Nothing Detected	
					70		
					75		
					80		

WARZYN

Monitoring Well Construction Information (STICK-UP)



[pvk-301-18]

PROJECT North Bronson RI/FS

BORING/WELL NO. MW29

DATE 11/27/91

PROJECT NUMBER 70051.53

1. PROTECTIVE CASING 4 in. Steel

   LOCKING Yes (2002 Key)

2. CONCRETE SEAL None

3. TYPE OF SURFACE SEAL (IF INSTALLED)

   Fine Granular Bentonite

4. SOLID PIPE TYPE Stainless Steel

   SOLID PIPE LENGTH 17.3 ft

   JOINT TYPE Flush threaded with "O" rings

5. TYPE OF BACKFILL Fine Granular Bentonite

   BACKFILL INSTALLED from surface

6. TYPE OF LOWER SEAL (IF INSTALLED)

   3/4 in. Granular Bentonite

7. SCREEN TYPE Stainless Steel

   SCREEN LENGTH 5.15 ft

   SLOT SIZE 0.0060 in. (#6 slot)

   SLOTTED INTERVAL LENGTH 4.63 ft

   SCREEN DIAMETER 2.0 in. ID

8. TYPE OF BACKFILL AROUND SCREEN

   Natural Collapse

9. TYPE OF BACKFILL Natural Collapse

10. DRILLING METHOD 4.25 in. HSA

11. ADDITIVES USED (IF ANY)

    None

(ALL DEPTHS MEASURED FROM GROUND SURFACE)

Elevations based on USGS datum.

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

Boring No. PZ1S,D
Surface Elevation 913.7
Job No. 70051
Sheet 1 of 2

41551 ELEVEN MILE ROAD, PO BOX 8012, · NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES HNu	HCN	LEL
SS-01		20	M	3 3 6 9	5	Medium Dense, Dark Brown to Brown, C - F SAND, some C - F Gravel and Clay (SP). This may be fill material.	0.0	0	0
SS-02		20	M/W	3 6 7 7	10	Medium Dense, Brown and Dark Brown, C - F Gravelly, C - F SAND (SP-GP).	0.0	0	0
						Medium Dense, Dark Brown to Brown, C - F SAND, little Fine Gravel (SP).			
SS-03		24	W	2 4 6 6	15	Medium Dense, Brown to Tan, C - F SAND, trace to some C - F Gravel (SP).	0.0	0	0
SS-04		24	W	3 5 13 20	20	Medium Dense, Brown to Tan, C - F SAND, trace Fine Gravel (SP).	0.0	0	0
SS-05		24	W	5 6 12 15	30	Medium Dense to Dense, Brown to Tan, C - F SAND, some C - F Gravel, trace Silt (SP).	0.0	0	
SS-06		0	W	2 7 9 15	40	No Sample Recovery. Split-spoon was filled with "blow in" Material consisting	0.0	0	

WATER LEVEL OBSERVATIONS

While Drilling ▽ 9.0 Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 11/6/91 End 11/6/91
Driller MATHES Chief CSY Rig CME -75
Logger CSY Editor CSY
Drill Method 4.25" HSA

WARZYN

LOG OF TEST BORING

Project NORTH BRONSON RI/FS

Location BRONSON, MI

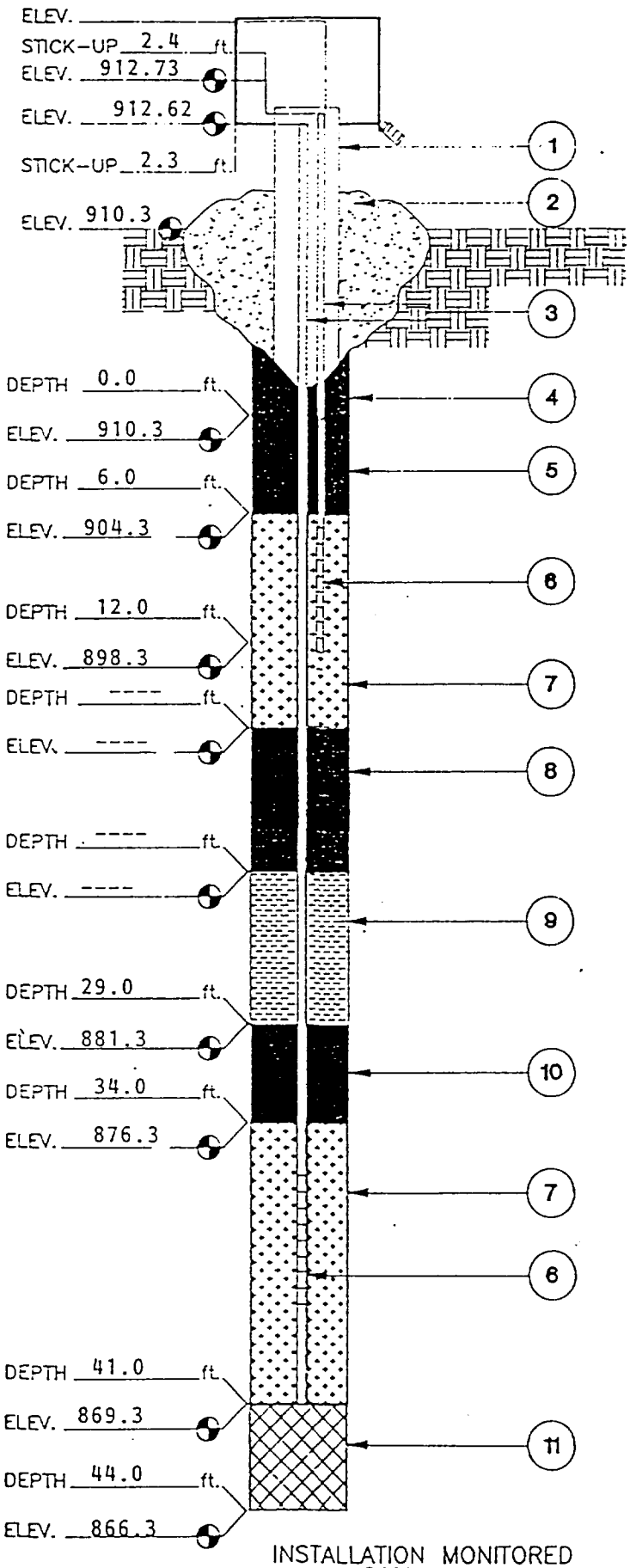
Boring No. PZ7S,D
Surface Elevation 910.3
Job No. 70051
Sheet 2 of 2

41551 ELEVEN MILE ROAD, PO BOX 8012, NOVI, MI. 48376 · TEL. (313) 344-0205

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES			
No.	TYPE	Rec (in.)	Moist	N	Depth			Hnu	KCN	LEL
						trace Clay (SP-GP).				
-1		10	W/M							
-07		12	M	4 9 10 12		Medium Dense to Stiff, Gray, Silty, C - F SAND, some Clay, little C - F Gravel (SM).				
					45					
						End of Boring at 44.0'				
					50					
					55					
					60					
					65					
					70					
					75					
					80					
					85					

WARZYN

NESTED PIEZOMETER DETAIL SHEET



INSTALLATION MONITORED BY: CSY

PROJECT North Bronson RI/FS

PROJECT NO. 70051.53

BORING/WELL NO. PZ7 S&D

DATE 11/25/91

CHIEF/UNIT Mathes/CME75

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. CONCRETE SEAL YES NO

3. SOLID PIPE TYPE 1" Schedule 80 PVC

   SOLID PIPE LENGTH SHALLOW PZ 11.4 ft

   DEEP PZ 43.3 ft.

   JOINT TYPE ~~SLIP/GLUE OR~~ THREADED

4. TYPE OF SURFACE SEAL (IF INSTALLED)

   Fine granular Bentonite

5. TYPE OF SEAL Fine granular Bentonite

6. SCREEN TYPE 1" Schedule 80 PVC

   SCREEN LENGTH 2.95 ft.

   SLOT SIZE #6 slot/0.0060 in.

   SLOTTED INTERVAL LENGTH 2.73 f

   SCREEN DIAMETER 1.0 in.

7. TYPE OF BACKFILL AROUND SCREEN

   Natural collapse

8. TYPE OF SEAL None

9. TYPE OF BACKFILL Natural collapse

10. TYPE OF LOWER SEAL 3/4" granular ~~Bentonite~~

11. TYPE OF BACKFILL Natural collapse

12. DRILLING METHOD 4.25" HSA

13. ADDITIVES USED (IF ANY) Clean water

ALL DEPTHS MEASURED FROM GROUND SURFACE

C2

RESIDENTIAL WELL LOGS

GEOLOGICAL SURVEY SAMPLE No.

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

11-3

SE 11-2

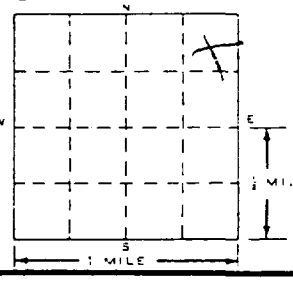
1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	~~NE NE~~ NE	11	7 ☒ S.	8 ☒ W.

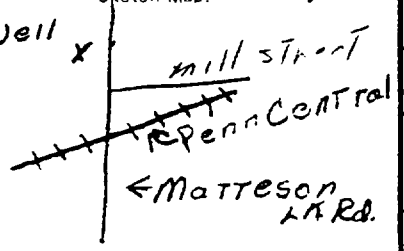
Distance And Direction from Road Intersections: 60 Ft West of Matteson Lk. Rd. RR No 3 ¼ Mile North of Penn Central

Street Address & City of Well Location: 216 S. Matteson Lk Rd Bronson Michigan

Locate with "X" in section below



Sketch Map:



3 OWNER OF WELL: Ray Borgert

Address: 216 S Matteson Lk. Rd. Bronson Michigan

4 WELL DEPTH: (completed) 81 ft. Date of Completion: April 13, 1972

5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐

6 USE: ☒ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☐

7 CASING: Threaded ☒ Welded ☐ Diam. 4 in. to 78 ft. Depth; ___ in. to ___ ft. Depth

Height: Above/~~Below~~ Surface 1 ft. Weight 11 lbs./ft. Drive Shoe? Yes ☒ No ☐

2 FORMATION

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Sandy Brown Clay	20	20
coarse gravel with very muddy clay made some water	7	27
Clay large rocks some gravel	21	48
Very Sandy Clay no gravel	21	69
Large Clay & gravel	8	77
Gravel & Large Rocks (Water Bearing)	4	81

ADDED WHEN DRILLER, ITEM No.

USE A 2ND SHEET IF NEEDED

8 SCREEN: Type: Johnson Red Brass Dia.: 4" Slot/Gauze 18 Length 3 Set between 81 ft. and 78 ft. Fittings: closed Bottom 1' Blank at Top with Self Sealing Packer

9 STATIC WATER LEVEL 15 ft. below land surface

10 PUMPING LEVEL below land surface 25 ft. after 2 hrs. pumping 13 g.p.m. ___ ft. after ___ hrs. pumping ___ g.p.m.

11 WATER QUALITY in Parts Per Million: Iron (Fe) ___ Chlorides (Cl) ___ Hardness ___ Other ___

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☒ Pitless Adapter ☐ 12" Above Grade

13 Well Grouted? ☐ Yes ☒ No ☐ Neat Cement ☐ Bentonite ☐ ___ Depth: From ___ ft. to ___ ft.

14 Nearest Source of possible contamination: 60 feet West Direction Septic Type. Well disinfected upon completion ☒ Yes ☐ No

15 PUMP: ☐ Not installed. Manufacturer's Name: Red Jacket. Model Number: 5 BC HP ¼ Volts 115. Length of Drop Pipe 42 ft. capacity 10 G.P.M. Type: ☒ Submersible ☐ Jet ☐ Reciprocating

16 Remarks, elevation, source of data, etc.

Screened at 27 Ft. but to much clay would not allow water to come through screen Would make 4gpm

17 WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Griffin Well Drlg — REGISTERED BUSINESS NAME; 1039 — REGISTRATION NO.

Address: Box 113 RR No 6 Coldwater

Signed: Clifford W. Griffin — AUTHORIZED REPRESENTATIVE; Date: 4-22-72

D67d 100M (Rev. 12-68)

8

GEOLOGICAL SURVEY COPY

GEOLOGICAL SURVEY NO.

MICHIGAN DEPARTMENT OF PUBLIC HEALTH
WATER WELL AND PUMP RECORD

PERMIT NUMBER

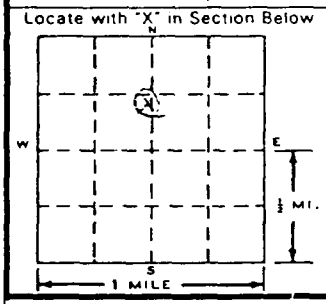
1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	NE¼ SE¼ NW¼	12	7 S	8 W

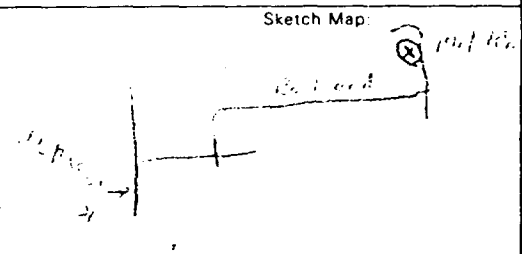
Distance And Direction From Road Intersection: Lots 41 & 42 Matilda St

Street Address & City of Well Location

Locate with "X" in Section Below



Sketch Map:



3 OWNER OF WELL: Chuck Buckley

Address: 127 W Corey, Bronson

Address Same As Well Location? ☐ Yes ☒ No

4 WELL DEPTH (completed): 25 ft. Date of Completion: 5-28-88

5 ☐ Cable tool ☐ Rotary ☑ Driven ☐ Dug ☐ Hollow rod ☐ Auger ☐ Jetted ☐ ____

6 USE: ☑ Domestic ☐ Type I Public ☐ Type III Public ☐ Irrigation ☐ Type IIa Public ☐ Heat pump ☐ Test Well ☐ Type IIb Public ☐ ____

7 CASING: Diameter ☑ Steel ☐ Threaded ☐ Plastic ☐ Welded

1¼ in. to 25 ft. depth

____ in. to ____ ft. depth

Grouted Drill Hole Diameter

____ in. to ____ ft. depth

____ in. to ____ ft. depth

Height: Above/Below Surface ____ ft.

Weight ____ lbs./ft.

Drive Shoe ☐ Yes ☐ No

8 SCREEN: Point ☐ Not Installed

Type ____ Diameter 2½

Slot/Gauze ____ Length 4

Set between ____ ft. and ____ ft.

FITTINGS: ☐ K-Packer ☐ Lead Packer ☐ Bremer Check

☐ Blank above screen ____ ft. Other ____

9 STATIC WATER LEVEL: 7' ft. below land surface ☐ Flow

10 PUMPING LEVEL: below land surface

____ ft. after ____ hrs. pumping at ____ G.P.M.

____ ft. after ____ hrs. pumping at ____ G.P.M.

11 WELL HEAD COMPLETION: ☐ Pitless adapter ☑ 12" above grade ☐ Basement offset ☐ Approved pit

12 WELL GROUTED? ☑ No ☐ Yes From ____ to ____ ft.

☐ Neat cement ☐ Bentonite ☐ Other ____

No. of bags of cement ____ Additives ____

13 Nearest source of possible contamination

Type NITRITES FIELD Distance 200 ft Direction EAST

Well disinfected upon completion? ☑ Yes ☐ No

14 PUMP ☐ Not Installed ☐ Pump Installation Only

Manufacturer's name WAYNE

Model number SW 550 HP ½ Volts 110

Length of Drop Pipe 25 ft. capacity ____ G.P.M.

TYPE: ☐ Submersible ☑ Jet ____

PRESSURE TANK

Manufacturer's name WAYNE

Model number 43986T Capacity 30 Gallons

2 FORMATION DESCRIPTION

FORMATION DESCRIPTION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM

USE A 2ND SHEET IF NEEDED

15. Remarks, elevation, source of data, etc.

W.P. # 9851

RECEIVED JUN 6 1988

16. WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

[illegible] installed

REGISTERED BUSINESS NAME REGISTRATION NO.

Address ____

Signed ____ Date ____

AUTHORIZED REPRESENTATIVE

D67d 2/84

Authority: Act 368 PA 1978
Completion: Required
Penalty: Conviction of a violation of any provision is a misdemeanor.

LOCAL HEALTH DEPT COPY

GEOLOGICAL SURVEY NO.

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

WATER WELL AND PUMP RECORD

PERMIT NUMBER

1 LOCATION OF WELL

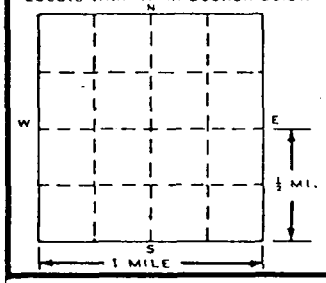
County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	¼ ¼ ¼	11	N/S	E/W

Distance And Direction From Road Intersection: 200 ft W of Albers on N side of 12

Street Address & City of Well Location

Locate with "X" in Section Below

Sketch Map:



3 OWNER OF WELL

Craig Crabill

Address

Address Same As Well Location? ☐ Yes ☐ No

4 WELL DEPTH:

24 FT.

Date Completed: MO DAY YEAR

☒ New Well ☐ Replacement Well

5

☐ Cable tool ☐ Rotary ☒ Driven ☐ Dug ☐ Hollow rod ☐ Auger ☐ Jetted ☐ ____

6 USE

☐ Domestic ☐ Type I Public ☒ Type III Public ☐ Irrigation ☐ Type IIa Public ☐ Heat pump ☐ Test Well ☐ Type IIb Public ☐ ____

7 CASING

Diameter: ☒ Steel ☒ Threaded ☐ Plastic ☐ Welded

2 in. to 25 ft. depth

____ in. to ____ ft. depth

Grouted Drill Hole Diameter

____ in. to ____ ft. depth

____ in. to ____ ft. depth

Height: Above/Below

Surface 1 ft.

Weight ____ lbs./ft.

Drive Shoe ☐ Yes ☐ No

2 FORMATION DESCRIPTION

FORMATION DESCRIPTION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Bowlby Adapter Installed		

USE A 2ND SHEET IF NEEDED

RECEIVED JAN 30 1992

8 SCREEN

☐ Not Installed

Type Johnson Diameter 2"

Slot/~~Gauze~~ 10 Length 36"

Set between 25 ft. and 28 ft.

FITTINGS: ☐ K-Packer ☐ Lead Packer ☐ Bremer Check ☐ Blank above screen ____ ft. Other ____

9 STATIC WATER LEVEL

11 ft. below land surface ☐ Flow

10 PUMPING LEVEL below land surface

10 ft. after 1 hrs. pumping at 10 G.P.M.

____ ft. after ____ hrs. pumping at ____ G.P.M.

11 WELL HEAD COMPLETION

☐ Pitless adapter ☒ 12" above grade ☐ Basement offset ☐ Approved pit

12 WELL GROUTED?

☐ No ☒ Yes From ____ to ____ ft.

☐ Neat cement ☒ Bentonite ☐ Other ____

No. of bags of cement 2 Additives ____

13 Nearest source of possible contamination

Type Septic Distance 78 ft. Direction S

Well disinfected upon completion? ☒ Yes ☐ No

Was old well plugged? ☐ Yes ☐ No

14 PUMP

☒ Not Installed ☐ Pump Installation Only

Manufacturer's name ____

Model number ____ HP ____ Volts ____

Length of Drop Pipe 10 ft. capacity ____ G.P.M.

TYPE: ☐ Submersible ☐ Jet ____

PRESSURE TANK

Manufacturer's name ____

Model number ____ Capacity ____ Gallons

15. Remarks, elevation, source of data, etc.

16. WATER WELL CONTRACTOR'S CERTIFICATION

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Branch Well Pumps 1581

REGISTERED BUSINESS NAME REGISTRATION NO.

Address Coldwater

Signed [signature] Date 1-30-92

AUTHORIZED REPRESENTATIVE

17. Rig Operator's Name:

D67d 2/89

Authority: Act 368 PA 1978
Completion: Required
Penalty: Conviction of a violation of any provision is a misdemeanor.

LOCAL HEALTH DEPT. COPY

GEOLOGICAL SURVEY SAMPLE No.

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

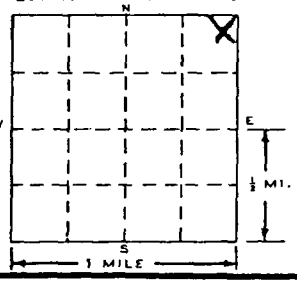
1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
BRANCH	BRONSON	NE¼NE¼NE¼	11	7 N/S.	8 E/W.

Distance And Direction from Road Intersections: 2/3 mi N of US12 on W side of Matt. Lk. Rd

Street address & City of Well Location: 212 Matteson Lk. Rd.

Locate with "X" in section below



Sketch Map:

3 OWNER OF WELL: ROY FINLEY

Address: 212 MATTESON LAKE RD BRONSON, MI 49028

4 WELL DEPTH: (completed) 83' ft. Date of Completion 8/10/77

5 ☐ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☒ Jetted ☐ Bored ☐

6 USE: ☒ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☐

7 CASING: Threaded ☒ Welded ☐ Diam. 4 in. to 79 ft. Depth; ___ in. to ___ ft. Depth

Height: Above/Below Surface ___ ft. Weight 11 lbs./ft. Drive Shoe? Yes ☒ No ☐

2 FORMATION

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Sand, Gravel	30	30
Clay	45	75
Vein	8	83

USE A 2ND SHEET IF NEEDED

8 SCREEN:

Type: Stainless steel Dia.: 3 7/8"

Slot/Gauge 12 Length 48"

Set between 79 ft. and 83 ft.

Fittings: 4 x 3 K-packer, 3" x 36" stem

9 STATIC WATER LEVEL

13 ft. below land surface

10 PUMPING LEVEL below land surface

___ ft. after ___ hrs. pumping ___ g.p.m.

NA ft. after ___ hrs. pumping ___ g.p.m.

11 WATER QUALITY in Parts Per Million:

Iron (Fe) ___ Chlorides (Cl) ___

Hardness NA Other ___

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☒ Pitless Adapter ☐ 12" Above Grade

13 Well Grouted? ☐ Yes ☒ No ☐ Neat Cement ☐ Bentonite ☐ ___

Depth: From ___ ft. to ___ ft.

14 Nearest Source of possible contamination

50 feet from any direction septic Type

Well disinfected upon completion ☒ Yes ☐ No

15 PUMP: ☐ Not installed

Manufacturer's Name Flint & Walling

Model Number TBK7 HP 3/4 Volts 220

Length of Drop Pipe 35 ft. capacity 19 G.P.M.

Type: ☒ Submersible ☐ Jet ☐ Reciprocating

16 Remarks, elevation, source of data, etc.

17 WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

GEO. P. REID & SON — REGISTERED BUSINESS NAME

0369 — REGISTRATION NO.

Address Box 5 Howe, IN 46746

Signed [signature] — AUTHORIZED REPRESENTATIVE

Date 8/22/77

D67d 100M (Rev. 12-68)

LOCAL HEALTH DEPT COPY

well permit #1850

E .OGICAL SURVEY SAMPLE No.

UG 0 7 1978

2

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

LOCATION OF WELL

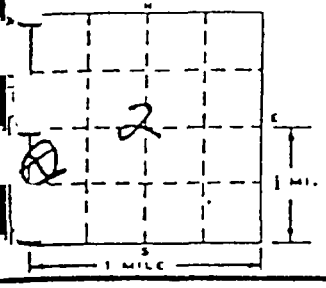
County	Township Name	Fraction	Section Number	Town Number	Range Number
BRANCH	BRONSON	SW NW SW	2	7 N(S)	8 E(W)

Distance And Direction from Road Intersections

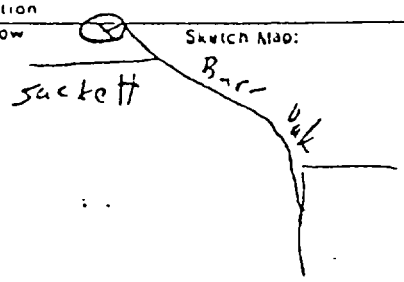
879 Burr Oak Rd

Street address & City of Well Location

Locate with "X" in section below



Sketch Map:



3 OWNER OF WELL:

Address J.K. Gerda 879 Burr Oak Rd. Bronson

4 WELL DEPTH: (completed) 43 ft. Date of Completion 6/21/78

5 ☐ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☒ Jetted ☐ Bored ☐

6 USE: ☒ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☐

7 CASING: Threaded ☒ Welded ☐ Diam. 2 in. to 39½ ft. Depth; in. to ft. Depth

Height: Above/Below Surface ft. Weight 3.75 lbs./ft. Drive Shoe? Yes ☒ No ☐

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Sand	15	15
sand	15	30
Clay & sand	8	38
and	~~XX~~ 2	40
vein	3	43

8 SCREEN:

Type: Stainless Dia.: 1¼"

Slot ~~XXXX~~ 10 Length 42"

Set between 39½ ft. and 43 ft.

Fittings: K-packer, bremer 2' stem X 1¼"

9 STATIC WATER LEVEL

13 ft. below land surface

10 PUMPING LEVEL below land surface

ft. after hrs. pumping g.p.m.

ft. after hrs. pumping 900 GPH g.p.m.

11 WATER QUALITY in Parts Per Million:

Iron (Fe) Chlorides (Cl)

Hardness NA Other

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☒ Pitless Adapter ☐ 12" Above Grade

13 Well Grouted? ☐ Yes ☒ No ☐ Neat Cement ☐ Bentonite ☐

Depth: From ft. to ft.

14 Nearest Source of possible contamination

50 feet ~~from~~ Direction ~~any~~ ~~septic~~ Type

Well disinfected upon completion ☒ Yes ☐ No

15 PUMP: ~~☒ Not installed~~ inst. his pump

Manufacturer's Name Myers

Model Number HJ 505 HP ½ Volts 110

Length of Drop Pipe 21 ft. capacity G.P.M.

Type: ☐ Submersible ☒ Jet ☐ Reciprocating

ADDED INFO BY DRILLER, ITEM NO.

CORRECTED BY

ADDITION BY

ELEVATION

DEPTH TO ROCK

USE A 2ND SHEET IF NEEDED

Remarks, elevation, source of data, etc.

W-P- #3414

17 WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

GEO. P. REID & SON — REGISTERED BUSINESS NAME

035 9 — REGISTRATION NO.

Address Box 5 Fowe, IN 46746

Signed Wm. T. Reid — AUTHORIZED REPRESENTATIVE

Date 6/29/78

100M (Rev. 12-68)

GEOLOGICAL SURVEY SAMPLE No.

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

1 LOCATION OF WELL

County	Twp.	Fraction	Section No.	Town	Range
Branch	Bronson	NW¼ NW¼ SE¼	12	7 N/S.	8 E/W.

Distance And Direction from Road Intersections: 20 Rods North of end of Matilda St

OWNER No.

Street address & City of Well Location

3 OWNER OF WELL: G.W. Jeffery

Address: 430 W Chicago, Bronson

2 FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Sandy Loam	2	2
Dry gravel, Coarse	10	12
Fine gravel	26	38

4 WELL DEPTH: (completed) 38 ft. Date of Completion 4-5-68

5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐ ___

6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☒ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☐ ___

7 CASING: Diam. ___ in. to ___ ft. Depth; ___ in. to ___ ft. Depth. Threaded ☒ Welded ☐. Height: Above/~~Below~~ surface 1 ft. Weight 25 lbs/ft. Drive Shoe? Yes ☒ No ☐

8 SCREEN: Type: Brass Dia.: 8 in. Slot/Gauze 25 Length 15' Set between ___ ft. and ___ ft. Fittings: Std.

9 STATIC WATER LEVEL ___ ft. below land surface

10 PUMPING LEVEL below land surface: 16 ft. after 1 hrs. pumping 430 g.p.m.; 20' ft. after 1 hrs. pumping 500 g.p.m.

11 WATER QUALITY in Parts Per Million: Iron (Fe) ~~[illegible]~~ Chlorides (Cl) 1; Hardness ~~[illegible]~~ ~~[illegible]~~ ~~[illegible]~~

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☐ Pitless Adapter ☐ 12" Above Grade

13 GROUTING: Well Grouted? ☐ Yes ☒ No. Material: ☐ Neat Cement ☐ ___ Depth: From ___ ft. to ___ ft.

14 SANITARY: Nearest Source of possible contamination 1000 feet S Direction Sewer Type. Well disinfected upon completion ☒ Yes ☐ No

15 PUMP: Manufacturer's Name By owner. Model Number ___ HP ___. Length of Drop Pipe ___ ft. capacity ___ G.P.M. Type: ☐ Submersible ☐ ___ ☐ Jet ☐ Reciprocating

16 Remarks, elevation, source of data, etc.

17 WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

W E Downer & Son — REGISTERED BUSINESS NAME

0641 — REGISTRATION NO.

Address: Quincy Mich

Signed: W E Downer — AUTHORIZED REPRESENTATIVE

Date: 4-10-68

D67D 100M 6-66

LOCAL HEALTH DEPT. COPY

-3

OLOGICAL SURVEY SAMPLE No. [ ] [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][4]

JUL 16 1973

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

SW SW SW

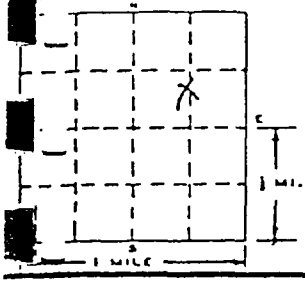
LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
Tuscola	Brenzer	~~SW NW~~	1	7 N/S.	8 E/W.

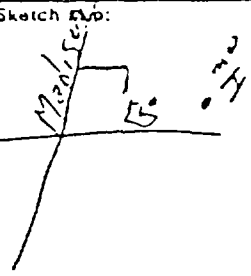
Distance And Direction from Road Intersections: the line of Montgomery Lake rd 4 2/5 12 with one mile then right 90 ft

Street address & City of Well Location

Circle with "X" in section below



Sketch Map:



3 OWNER OF WELL: Schaffer Farm's

Address: R.F.D. Brenzer, Mich.

4 WELL DEPTH: (completed) 82 ft. Date of Completion Oct. 2-72

5 [X] Cable tool [ ] Rotary [ ] Driven [ ] Dug [ ] Hollow rod [ ] Jetted [ ] Bored [ ] ____

6 USE: [X] Domestic [ ] Public Supply [ ] Industry [ ] Irrigation [ ] Air Conditioning [X] Commercial [ ] Test Well [ ] ____

7 CASING: Threaded [X] Welded [ ]
Diam. 4 in. to ____ ft. Depth
____ in. to ____ ft. Depth
Height: Above/Below Surface 12 ft.
Weight 11 lbs./ft.
Drive Shoe? Yes [X] No [ ]

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Yellow Clay	72	72
Sand & Gravel	10	82

8 SCREEN:
Type: Cook Dia.: 4
Slot/Gauze 20 Length 10'
Set between 72 ft. and 82 ft.
Fittings: Std.

9 STATIC WATER LEVEL
35-4" ft. below land surface

10 PUMPING LEVEL below land surface
____ ft. after ____ hrs. pumping ____ g.p.m.
None
____ ft. after ____ hrs. pumping ____ g.p.m.

11 WATER QUALITY in Parts Per Million:
Iron (Fe) ____ Chlorides (Cl) ____
Not tested
Hardness ____ Other ____

Well N/E

12 WELL HEAD COMPLETION: [ ] In Approved Pit [X] Pitless Adapter [ ] 12" Above Grade

13 Well Grouted? [X] Yes [ ] No
[ ] Neat Cement [ ] Bentonite [ ] Sand
Depth: From ____ ft. to ____ ft.

14 Nearest Source of possible contamination
200 feet E Direction Cattle lot Type
Well disinfected upon completion [X] Yes [ ] No

15 PUMP: [ ] Not installed
Manufacturer's Name Fairbanks
Model Number ____ HP 1 Volts 220
Length of Drop Pipe 70 ft. capacity 20 G.P.M.
Type: [X] Submersible [ ] Jet [ ] Reciprocating

USE A 2ND SHEET IF NECESSARY

16 Remarks, elevation, source of data, etc.
No. of Drillers Contract Well Nos.
CORRECTED
ADDITION

17 WATER WELL CONTRACTOR'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Kenneth Hill Drilling — 0483
REGISTERED BUSINESS NAME — REGISTRATION NO.

Address P.O. Box 303

Signed [signature] Date Oct. 2-72

GEOLOGICAL SURVEY SAMPLE No. [ ] [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][5]

JUL 16 1973

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

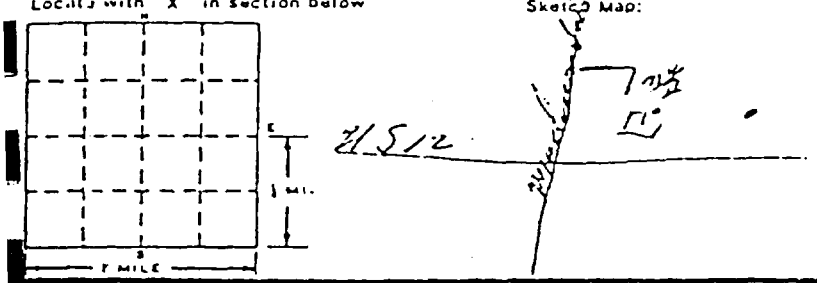
1 LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	SW. SW. SW.	1	7 N.S.	8 E/W.

Distance And Direction from Road Intersections: Intersection 21 S 12 E meadow lake rd. go north joining town right in front to the cattle barn

Street Address & City of Well Location

Location with "X" in section below — Sketch Map:



3 OWNER OF WELL:

Schiffer Farms

Address: R#1 Bronson Mich

4 WELL DEPTH: (completed) 82 ft. Date of Completion: Oct. 16-72

5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐ ____

6 USE: ☒ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☒ Commercial ☐ Test Well ☐

7 CASING: Threaded ☒ Welded ☐

Diam. 4 in. to ____ ft. Depth

____ in. to ____ ft. Depth

Height: Above/Below Surface 1 2 ft.

Weight 11 lbs/ft.

Drive Shoe? Yes ☒ No ☐

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Yellow Clay	72	72
Sand & Gravel	10	82

8 SCREEN:

Type: Cook Dia.: 4"

Slot/Gauze 20 Length 10

Set between 72 ft. and 82 ft.

Fittings: [illegible]

9 STATIC WATER LEVEL

33-2 ft. below land surface

10 PUMPING LEVEL below land surface

____ ft. after ____ hrs. pumping ____ g.p.m.

____ ft. after ____ hrs. pumping ____ g.p.m.

11 WATER QUALITY in Parts Per Million:

Iron (Fe) ____ Chlorides (Cl) ____

Hardness ____ Other ____

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☒ Pitless Adapter ☐ 12" Above Grade

13 Well Grouted? ☒ Yes ☐ No

☐ Neat Cement ☐ Bentonite ☐ sand

Depth: From ____ ft. to ____ ft.

14 Nearest Source of possible contamination

300 feet E Direction Cattle-Lot Type

Well disinfected upon completion ☒ Yes ☐ No

15 PUMP: ☐ Not installed

Manufacturer's Name F&W

Model Number ____ HP 1 Volts 220

Length of Drop Pipe 70 ft. capacity 24 G.P.M.

Type: ☒ Submersible ☐ Jet ☐ Reciprocating

USE A 2ND SHEET IF NEEDED

Remarks, elevation, source of data, etc.

Sec Info. of [illegible]

CORRECTED [illegible]

ADDITION [illegible]

17 WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

[illegible] Drilling — 0183

REGISTERED BUSINESS NAME — REGISTRATION NO.

Address R#6 Box 303

OLOGICAL SURVEY SAMPLE No.

MAR 05 1974

3

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	NE ¼	2	7 N/S	8 E/W

Distance And Direction from Road Intersections: Intersection of 12 & Maddison rd north on Maddison rd 3/4 of mile on west side of rd.

Street address & City of Well Location

Locate with "X" in section below

Sketch Map: 2 S Bronson 12 E Mattison? Maddison well W N

1 MILE

3 OWNER OF WELL: Ralph Schaffer Jr.

Address R# Bronson Mich.

4 WELL DEPTH: (completed) 109 ft. Date of Completion June 11-73

5 ☒ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☐ Bored ☐

6 USE: ☒ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☐

7 CASING: Threaded ☐ Welded ☐ Diam. 4 in. to ___ ft. Depth; ___ in. to ___ ft. Depth

Height: Above/Below Surface 12 ___ Weight 11 lbs/ft. Drive Shoe? Yes ☒ No ☐

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Red Clay & Stones	91	91
Blue Clay	12	103
Sand & Gravel	6	109

USE A 2ND SHEET IF NEEDED

8 SCREEN: Type: Cook Dia.: 4" Slot/Gauze 12 Length 6' Set between 103 ft. and 109 ft. Fittings: Std.

9 STATIC WATER LEVEL 42 ft. below land surface

10 PUMPING LEVEL below land surface 42 ft. after 4 hrs. pumping 30 g.p.m. ___ ft. after ___ hrs. pumping ___ g.p.m.

11 WATER QUALITY in Parts Per Million: Iron (Fe) ___ Chlorides (Cl) ___ Hardness ___ Other ___

12 WELL HEAD COMPLETION: ☐ In Approved Pit ☒ Pitless Adapter ☐ 12" Above Grade

13 Well Grouted? ☒ Yes ☐ No ☐ Neat Cement ☐ Bentonite ☐ mud Depth: From ___ ft. to ___ ft.

14 Nearest Source of possible contamination 55 feet N.E. Direction Sept. Tank Type

Well disinfected upon completion ☒ Yes ☐ No

15 PUMP: ☐ Not installed

Manufacturer's Name F & W

Model Number ___ HP 3/4 Volts 220

Length of Drop Pipe 60 ft. capacity 30 G.P.M.

Type: ☒ Submersible ☐ Jet ☐ Reciprocating

Remarks, elevation, source of data, etc.

ADDED INFO BY DRILLER, ITEM NO.

*CORRECTED BY

**ADDITION BY

ELEVATION

17 WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Joseph Neff Drilling 0453

REGISTERED BUSINESS NAME REGISTRATION NO.

Address R#6 Box 303

[signature] Date June 11-73

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

GEOLOGICAL SURVEY NO.

WATER WELL AND PUMP RECORD

PERMIT NUMBER

PART 127 ACT 368, P.A. 1978

1. LOCATION OF WELL

County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	NW 1/4 NE 1/4 SE 1/4	11	7 S	8 W

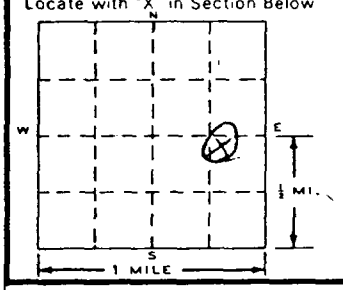
Distance And Direction From Road Intersection

~~243 E State St.~~ 143 State ST

Street Address & City of Well Location

Locate with "X" in Section Below

Sketch Map:



2. FORMATION DESCRIPTION

FORMATION DESCRIPTION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Sand - Gravel	12	
Hard pan Red	10	
Sand + Gravel	15	

USE A 2ND SHEET IF NEEDED

3. OWNER OF WELL

Smoker Estate

Address ~~243 State St.~~ 143 State ST.

Bronson

Address Same As Well Location? [X] Yes [ ] No

4. WELL DEPTH (completed)

37 ft.

Date of Completion

5.

[X] Cable tool [ ] Rotary [ ] Driven [ ] Dug

[ ] Hollow rod [ ] Auger [X] Jetted [ ] ____

6. USE

[X] Domestic [ ] Type I Public [ ] Type III Public

[ ] Irrigation [ ] Type IIa Public [ ] Heat pump

[ ] Test Well [ ] Type IIb Public [ ] ____

7. CASING

Diameter [X] Steel [X] Threaded

[ ] Plastic [ ] Welded

____ in to ____ ft. depth

____ in to ____ ft. depth

Grouted Drill Hole Diameter

____ in to ____ ft. depth

____ in to ____ ft. depth

Height Above/Below Surface 1' ft.

Weight ____ lbs /ft

Drive Shoe [X] Yes [ ] No

8. SCREEN

[ ] Not Installed

Type SS Diameter 1 1/4

Slot/Gauze 10 Length 26"

Set between 34 ft. and 37 ft.

FITTINGS [ ] K-Packer [ ] Lead Packer [X] Bremer Check

[ ] Blank above screen 3 ft. Other ____

9. STATIC WATER LEVEL

12 ft. below land surface [ ] Flow

10. PUMPING LEVEL below land surface

16 ft. after 1/2 hrs. pumping at 15 G.P.M.

____ ft. after ____ hrs. pumping at ____ G.P.M.

11. WELL HEAD COMPLETION

[X] Pitless adapter [X] 12" above grade

[ ] Basement offset [ ] Approved pit

12. WELL GROUTED?

[X] No [ ] Yes From ____ to ____ ft

[ ] Neat cement [ ] Bentonite [ ] Other ____

No. of bags of cement ____ Additives ____

13. Nearest source of possible contamination

Type Livestock Distance 40 ft Direction N.

Well disinfected upon completion? [ ] Yes [X] No

14. PUMP

[X] Not Installed [ ] Pump Installation Only

Manufacturer's name ____

Model number ____ HP ____ Volts ____

Length of Drop Pipe ____ ft. capacity ____ G.P.M.

TYPE [ ] Submersible [ ] Jet ____

PRESSURE TANK

Manufacturer's name ____

Model number ____ Capacity ____ Gallons

15. Remarks, elevation, source of data, etc.

W.P. #6333

16. WATER WELL CONTRACTOR'S CERTIFICATION

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Wendell Services 0853

REGISTERED BUSINESS NAME REGISTRATION NO.

Address RR Box 141 Hutchins Road

Signed [illegible] Date 12-22-82

AUTHORIZED REPRESENTATIVE

D67d (Rev. 10-80)

LOCAL HEALTH DEPT. COPY Rec. 12-27-82

C3

PUBLIC WELL NO. 3 BORING LOG

LAYNE-NORTHERN COMPANY

Incorporated

MISHAWAKA, INDIANA

☐ TEST

☒ PERMANENT

Job No. _____

WELL LOG No. 3 CITY Bronson County Branch

Owner City of Bronson Township Bronson

Section _____

Location State Michigan

From Land Description _____ ft. East and _____ ft. North of SW Corner of Section.

From Street or Road Washington St.

FORMATION FOUND — DESCRIBE FULLY	FROM NATURAL GROUND LEVEL			
	Depth to Top of Stratum	Depth to Bottom of Stratum	Thickness of Stratum	Static Water Level
Top Soil	0	7	7	
Sand & Gravel	7	57	50	
Clay	57	74	17	
Gravel	74	97	23	10'
18' of Johnson #40 Screen 79' to 97' Pumped 700 GPM RT				
54' Pumping Level				

RECEIVED FEB 17 1993 ERD-SUPERFUND

12 inch diameter hole drilled by ☒ Cable Tool ☐ Rotary ☐ Jetting

Pipe left in hole

C4

PRE RI WESTERN LAGOON AREA BORING LOGS AND SKETCHES

(STERLING DRILLING CO.)

Pre RI MW1

Sterling Drilling Co.

6236 W. GRAND RIVER – BRIGHTON, MICHIGAN 48116
Telephone (517) 546-3981

Scott Fetzer Corp.
Douglas Division
Bronson, MI 49028

JOB NO. _____ LOG OF SOIL BORING NO. Well 78-1
pg 1 of 1

PROJECT _____

Re: Plant No. 2

LOCATION 6½' N. of S. Property Line Fence
51' W. of 6' High Chain Link Fence,
W. Side Entrance Drive

DATE 16, 17 Aug SURFACE ELEV. _____

County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	NE ¼ NE ¼	11	7 S	8 W

Sample Depth	Legend	SOIL DESCRIPTION
1, 2		Black 50% By Vol. Muck, Sand
3, 4		Variegated Yellow & Tan 5% Silty, 20% Clay, 25% Gravelly, 50% Sand
5, 6		Tan, trace silt, 5% Clayey, Gravelly, Sand 20% 1/8-3/8"; 20% 3/8-3/4"
7		Tan Gray Gravel, 85% Sand, 10% 1/8-3/8 5% 3/8-3/
8		Gray Gravelly, Sand, 10% 1/8-3/8"; 5% 3/8-3/4
9, 10		Gray Fine-30% Med. Sand-Clean
11		Gray Gravelly, 50% Fine-15% Med.-15% Coarse (Sand, 15% 1/8-3/8; 5% 3/8-3/4
2, 3, 4, 5, 6, 7, 8, 9, 0		

End of test 11'

W.L. 5½'

Pre RI MW1

GEOLOGICAL SURVEY SAMPLE No.

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

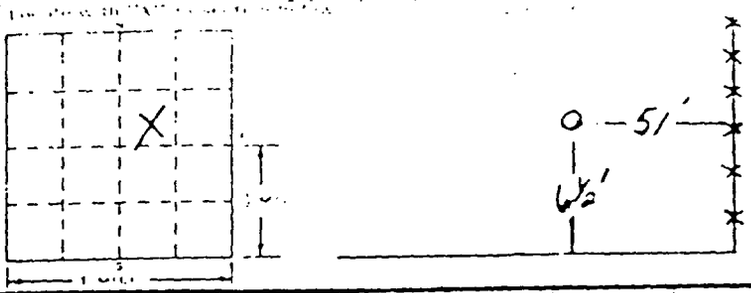
LOCATION OF WELL 78-1

County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	NE, NE	11	7 X S.	8 X W.

Distance And Direction from Road Intersections

6½' N. of South Property Line Fence
51' W. of 6' High Chain Link Fence, W. Sdie of Entrance Drive

Street address & City of Area location



Scott Fetzer Corp.
Douglas Division
Bronson, MI 49028

11 17 August 78

Driven Dug Bored

Public Supply Industry Air Conditioning Commercial Test Well X Monitoring Well

Height Above/Below XXX Surface 1.18 ft.

Weight lbs./ft.

Drive Shoe? Yes No X

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Black Muck, Sand	2'	2'
Variegated Yellow & Tan Silty, Clayey, Gravelly, Sand	2'	4'
[illegible]n Silty, Clayey, Gravelly, Sand	2'	6'
[illegible]nish Gray Gravelly, Sand	1'	7'
Gray Gravelly, Sand	1'	8'
Gray Fine, Med., Sand	2½'	10½'
Gray Gravelly, Fine, Med., Coarse Sand	6"	11'

8 SCREEN

Midwest Dia. 2"
XXX 60 Length 30"
8½ 11
Threaded

5½ ft. below land surface

Slug test 15 gpm fails to fill to top of 2" pipe

Threaded

Bronson Sewage Treatment Plant

N/A

Glenn Miller, Consulting Geologist

Sterling Drilling Company 0666

[illegible] W. Grand Rv. Brighton, MI 48116

Pre RI MW1

Sterling Drilling Company

6236 WEST GRAND RIVER • BRIGHTON, MICHIGAN 48116

TELEPHONE (517) 546-3981

OBSERVATION WELL DATA

Location 78-1 16 August 78

30" - #60 Guaze Brass Jacket, Flush Point Strainer
Trade # 121, Midwest

9.2' - 2" Galv. pipe to top of strainer openings

1 - 2" x 1¼" reducing coupling

11.90' to inside of bottom of 2" pipe

Top of 2" pipe sticks up 1.18' above ground surface

Slug test - 15 gpm fails to fill to top of 2" pipe

14:00-14:45 - Capacity test 5 gal in 13½ seconds with Gould 2.25 H.P. S.W. centrifugal 1½" x 1½" pump with 20" hg vacuum and 10 psi throttle pressure

Thursday, 17 August 78

14:03 - Water Level 6.01' below top of 2" pipe

Saturday, 19 August 78

13:35 - Water Level 6.05' below top of 2" pipe

Pre RI MW2

Sterling Drilling Co.

6236 W. GRAND RIVER – BRIGHTON, MICHIGAN 48116
Telephone (517) 546-3981

Scott Fetzer Corp.
Douglas Division
Bronson, MI 49028

Re: Plant No. 2

JOB NO. _____ LOG OF SOIL BORING NO. Well 78-2
pg 1 of 1

PROJECT _____

LOCATION 7' N. of S. Property Line Fence
234' W. of 6' High Chain Link Fence,
W. Side of Entrance Drive

DATE 17 Aug. 78 SURFACE ELEV. _____

County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	NE ¼ NE ¼	11	7 S	8 W

Sample Depth	Legend	SOIL DESCRIPTION
1		Dark Brown 10% Gravelly, 10% Muck, 10% Silt, Sand Fill
2, 3		Orangish Tan 5% Gravelly, 10% Clayey, 10% Silty, Sand Fill
4, 5		Blackish Brown 50% By Vol. Muck Sand
6		Tannish Gray 10% Marl, 10% Silty, 10% Gravel, 30% Clayey, 40% Sand
7, 8		Dark Tan 10% Clayey, 10% Silty, Gravelly 65% Sand, 5% 1/8-1/4"; 5% 1/4-3/8"; 5% 3/8-3/4"
9, 10, 11, 12, 13		Grayish Tan 5% Clayey, Gravelly, Sand, 15% Fine-25% Med.-20% Coarse, 25% 1/8-1/4"; 5% 1/4-3/8"; 5% 3/8-3/4"
4, 5, 6, 7, 8, 9, 0		

End of test 13'

W.L. 6½'

Pre RI MW2

GEOLOGICAL SURVEY SAMPLE No.

WATER WELL RECORD

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

LOCATION OF WELL 78-2

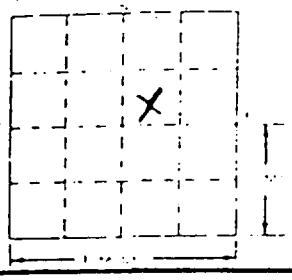
County: Branch | Township: Bronson | NE NE | 11 | 7 X | 8 X

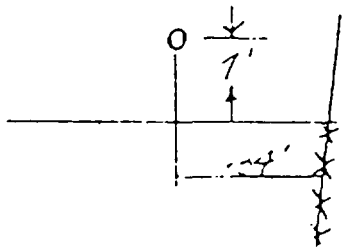
Distance And Direction from Road Intersections

7' N. of South Property Line Fence
234' W. of 6' High Chain Link Fence, W. Side of Entrance Drive

Street address & City of Well Location

Locate with "X" in section below





Scott Fetzer Corp.
Bouglas Division
Bronson, MI 49028

13 17 August 78

X

X Montioring Well
X XXXX
9"

X

FORMATION		
Dark Brown Gravelly, Muck, Silty, Sand Fill	1½'	1½'
Orangish Tan Gravelly, Clayey, Silty, Sand Fill	2'	3½'
ackish Brown Muck, Sand	1½'	5'
Tannish Gray Marl, Silty, Gravelly, Clayey, Sand	1'	6'
Dark Tan Clayey, Silty, Gravelly, Sand	2'	8'
Grayish Tan Clayey, Gravelly, Sand	5'	13'

Johnson 2"
XXXX 20 30"
10½ 13
Threaded

6½

Slug test 15 gpm fails to fill 2" pipe

Threaded

XX

Bronson Sewage Treatment Plant

N/A

Glenn Miller, Consulting Geologist

Sterling Drilling Company 0666

6236 W. Grand River Brighton, MI 48116

D67d

Sterling Drilling Company

6236 WEST GRAND RIVER • BRIGHTON, MICHIGAN 48116

TELEPHONE (517) 546-3981

OBSERVATION WELL DATA

Location 78-2 17 August 78

30" - #20 Slot Johnson Red Head Strainer, Trade # 121

11.45' - 2" Galv. pipe to top of strainer openings

13.88' to inside bottom of strainer

Top of 2" pipe sticks up 9" above ground surface 3' to north

Slug test - 17:00 17 Aug. 78 = 15 gpm fails to fill 2" pipe

Water Level - 17:03 17 Aug. 78 = 7.95' below top of 2" pipe

Saturday, 19 August 78

13:40 Water Level 8.00' below top of 2" pipe

13:52-14:02 - Capacity test 30 gpm with 17" Hg vacuum and 12 psi throttle pressure with Gould 2.25 H.P. 1½" x 1½" S.W. centrifugal pump

Pre RI MW3

Sterling Drilling Co.

6236 W. GRAND RIVER – BRIGHTON, MICHIGAN 48116
Telephone (517) 546-3981

Scott Fetzer Corp.
Douglas Division
Bronson, MI 49028

Re: Plant No. 2

JOB NO _____ LOG OF SOIL BORING NO Well 78-3
pg 1 of 1

PROJECT _____

LOCATION 11' N. of S. Property Line Fence
14' E. of W. Property Line Fence =
621' W. of 6' High Chain Link Fenc
W. Side of Entrance Drive

DATE 17, 18 Aug. SURFACE ELEV. _____

County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	NE ¼ NE ¼	11	7 s	8 w

Sample Depth	Legend	SOIL DESCRIPTION
		Blackish Brown 20% Clayey, 20% Muck Sand Fill
1, 2		Mixed Blackish Brown & Tan 50% By Vol. Muck Sand Fill
3		Mixed Whitish Tan & Tan 10% Clayey, 10% Silty 10% Gravelly, Sand Fill
4		Orangish Tan 10% Clayey, 10% Silty, 10% Gravelly, 70% Sand
		Blackish Tan 20% By Vol. Muck, Tan Sand
5, 6		Tan 5% Silty, 10% Clayey, 75% Fine Sand, 10% Gravelly
7, 8, 9, 10		Tan 5% Clayey, 5% Silty, Gravelly, 60% Sand 15% 1/8-3/8"; 10% 3/8-3/4"; 5% 3/4-1"
11, 12		Grayish Tan Fine Gravelly, 5% Clayey, 80% Sand 10% 1/8-3/8"; 5% 3/8-3/4"
13, 14, 15, 16		Gray 80% Fine-10% Med.-10% Coarse Sand
		Gray 30% Silty, 35% Sandy, 35% Clay
7, 8, 9, 0		

End of test 16½'

W.L. 9'

Pre RI MW3

GEOLOGICAL SURVEY SAMPLE No.

WATER WELL RECORD

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

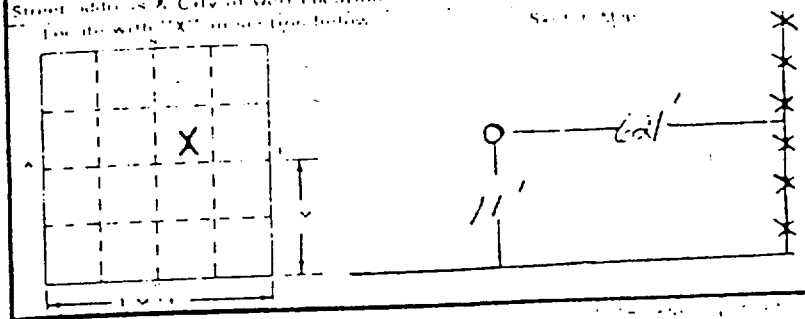
1 LOCATION OF WELL 78-3

Branch | Bronson | NE | NE | 11 | 7 X | 8 X

Distance And Direction From Road Intersection

11' N. of South Property Line Fence
621' W. of 6' High Schain Link Fence, W. Side of Entrance Drive

Street Address & City of Well Location



Scott Fetzer Corp.
Douglas Division
Bronson, MI 49028

16½ | 18 August 78

X

X Monitoring Well

X | XXXX | 1.5

2 FORMATION

Blackish Brown Clayey, Sand Fill	6"	6"
Mixed Blackish Brown & Tan Muck, Sand Fill	1½'	2'
Mixed Whitish Tan & Tan Clayey, Silty, Gravelly, Sand Fill	1'	3'
Orangish Tan Clayey, Silty, Gravel, Sand	1'	4'
Blackish Tan Muck, Tan Sand	6"	4½'
Tan Silty, Clayey, Gravelly, Fine Sand	2'	6½'
Tan Clayey, Silty, Gravelly, Sand	3½'	10'
Grayish Tan Fine Gravelly, Clayey, Sand	2'	12'
Gray Fine Med. Coarse Sand	4'	16'
Gray Silty, Sandy, Clay	6"	16½'

Midwest | 2"
XXXX | 60 | 30"
13 | 16½
Threaded

9

Slug test 6 gpm fails to fill 2" pipe

Threaded

XX

Bronson Sewage Treatment Plant

N/A

10 Remarks (Elevation, source of information, etc.)

Glenn Miller, Consulting Geologist

Sterling Drilling Company 0666

6236 W. Grand Rv. Brighton, MI 48116

067d FORM (Rev. 12-64)

Sterling Drilling Company

6236 WEST GRAND RIVER • BRIGHTON, MICHIGAN 48116

TELEPHONE (517) 546-3981

OBSERVATION WELL DATA

Location 78-3 17 August 78

30" - #60 Guaze Brass Jacket, Flush Point Midwest Strainer, Trade # 121

13.50' - 2" Galv. pipe to top of strainer openings

16.12' to inside of bottom of strainer

1 - 2" x 1¼" reducing coupling

Top of 2" pipe sticks up 1.5' above ground surface

Water Level - 09:12 Friday 18 Aug. 78 = 10.10 below top of 2" pipe

Slug test - 09:15 Friday 18 Aug. 78 = 6 gpm fails to fill 2" pipe

Water Level - 09:22 Friday 18 Aug. 78 = 10.05' below top of 2" pipe

Saturday, 19 August 78

14:02 Water Level 10.13' below top of 2" pipe

14:18-14:40 - Capacity test 20 gpm with 26.2" Hg Vac. and 5 psi throttle pressure with Gould 2.25 H.P. 1½" x 1½" S.W. centrifugal pump

Pre RI MW4

Sterling Drilling Co.

6236 W. GRAND RIVER – BRIGHTON, MICHIGAN 48116

Telephone (517) 546-3981

Scott Fetzer Corp.
Douglas Division
Bronson, MI 49028

Re: Plant No. 2

JOB NO. _____ LOG OF SOIL BORING NO. Well 78-4
pg 1 of 1

PROJECT _____

LOCATION 9.25' S. of N. Property Line Fence
11.5' E. of W. Property Line Fence
624' W. of 6' High Chain Link Fence
W. Side of Entrance Drive

DATE 18 Aug. 78 SURFACE ELEV. _____

County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	NE¼NE¼	11	7 S	8 W

Sample Depth	Legend	SOIL DESCRIPTION
		Whitish 15% Gravel, Sand Fill
1, 2, 3		Black 50% By Vol. Muck, Sand
4		Whitish Tan, trace Silty, 5% Clayey, Fine Sand
5		Tan 5% Clayey, 5% Silty, Trace Fine Gravel, 70% Fine-10% Med.-10% Coarse Sand
6, 7		Tannish Gray 5% Clayey, 95% Fine Sand
8, 9, 10		Gray 60% Sand, Gravel, Clean 20% 1/8-1/4"; 10% 1/4-3/8"; 10% 3/8-3/4"
1, 2, 3, 4, 5, 6, 7, 8, 9, 0		

End of test 10'

W.L. 4½'

Pre RI MW4

GEOLOGICAL SURVEY SAMPLE No.

WATER WELL RECORD

ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

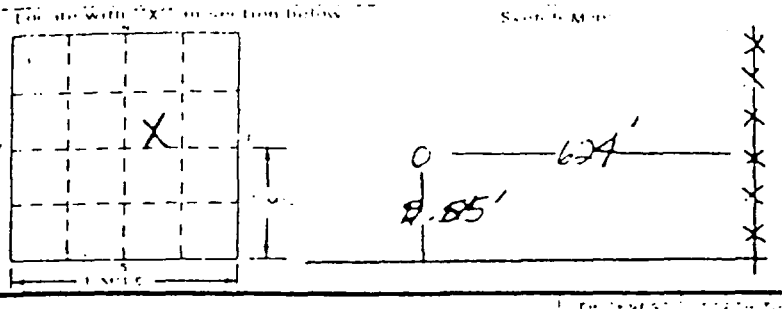
1 LOCATION OF WELL 78-4

County: Branch | Township Name: Bronson | Fraction: NE NE | 11 | 7 X | 8 X

Distance And Direction from Road Intersection:
9.25' S. of North Property Line Fence
624' W. of 6' High ~~Sch~~ Chain Link Fence, W. Side of Entrance Drive

Street address & City of Well Location

Locate with "X" in section below



Scott Fetzer Corp.
Douglas Division
Bronson, MI 49028

10 18 August 78

XX

X Montioring Well

X XXXX

1.33

X

2 FORMATION

Whitish Gravel, Sand Fill	6"	6"
Black Muck, Sand	2½'	3'
Whitish Tan Silty, Clayey, Fine Sand	1'	4'
an Clayey, Silty, Fine Gravel, Sand	1½'	5½'
Tannish Gray Clayey, Fine Sand	1½'	7'
Gray Sand, Gravel	3'	10'

Midwest 2"

XX 60 30"

7½ 10

Threaded

4½

Slug test 6 gpm fails to fill 2" pipe

Threaded

Bronson Sewage Treatment Plant

N/A

16 Remarks, elevation, source of data, etc.

Glenn Miller, Consulting Geologist

WATER WELL CONTRACTOR'S CERTIFICATION

Sterling Drilling Company 0666

6236 W. Grand Rv. Brighton, MI 48116

D67d 100M (Rev. 12-68)

Sterling Drilling Company

6236 WEST GRAND RIVER • BRIGHTON, MICHIGAN 48116

TELEPHONE (517) 546-3981

OBSERVATION WELL DATA

Location 78-4 18 August 78

30" - #60 Guaze Brass Jacket, Flush Point Midwest Strainer, Trade # 121

8.48' - 2" Galv. pipe to top of strainer openings

11.04' to inside bottom of strainer

1 - 2" x 1¼" reducing coupling

Top of 2" pipe sticks up 1'4" = 1.33' above ground surface

Water Level - 11:32 Friday 18 August 78 = 6.25' below top of 2" pipe

Slug test - 11:33 Friday 18 August 78 = 6 gpm fails to fill to top of 2" pipe

Water Level - 11:38 Friday 18 August 78 = 6.15' below top of 2" pipe

<u>Saturday, 19 August 78</u>

14:47 Water Level 6.21' below top of 2" pipe

14:53-15:05 - Capacity test 15 gpm with 23.5" Hg Vac. and 6 psi throttle pressure with Gould 1½" x 1½" 2.25 H.P. gas engine driven S.W. centrifugal pump

Sterling Drilling Co.

6236 W. GRAND RIVER – BRIGHTON, MICHIGAN 48116
Telephone (517) 546-3981

Scott Petzer Corp.
Douglas Division
Bronson, MI 49028

Re: Plant No. 2

JOB NO _____ LOG OF SOIL BORING NO Well 78-5
pg 1 of 1

PROJECT _____

LOCATION 10' S. of N. Property Line Fence
216' W. of 6' High Chain Link Fence, W. Side of Entrance Drive

DATE 18 Aug. 78 SURFACE ELEV. _____

County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	NE ¼NE ¼	11	7 S	8 W

Sample Depth	Legend	SOIL DESCRIPTION
		Gray 10% Silty, 20% Clayey, 20% Gravel 50% Sand
1, 2		Black 50% By Vol. Muck, Sand
3, 4, 5		Black Muck
6		Yellowish Tan 5% Gravelly, 15% Silty, 15% Marly, 15% Gravelly, 50% Sand
7		Variegated Whitish Tan & Tan 15% Silty, 20% Marly, 15% Gravelly, 50% Sand
8, 9		Lt. Tan 5% Clayey, 5% Silty, 5% Fine Gravel, 85% Fine Sand
10, 11, 12, 13, 14		Gray Gravelly, 45% Fine-25% Med.-15% Coarse Sand, 10% 1/8-1/4"; 5% 1/4-1/8"
15, 16		Gray 5% Gravelly, 30% Sandy, 30% Silty, 35% Clay
7, 8, 9, 0		

End of test 16' W.L. 8'

Pre RI MW5

GEOLOGICAL SURVEY SAMPLE No.

WATER WELL RECORD
ACT 294 PA 1965

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

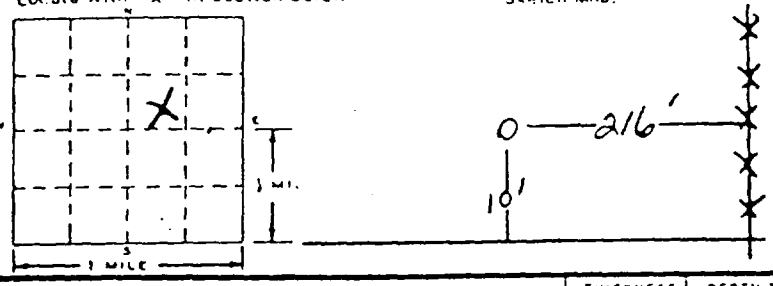
1 LOCATION OF WELL 73-3

County	Township Name	Fraction	Section Number	Town Number	Range Number
Berrien	Bronson	¼ ¼ ¼	11	7 S.	8 W.

Distance And Direction from Road Intersections: 10' S. of North Property Line Fence 216' W. of 6' High Chain Link Fence, W. Side of Entrance Drive

Street Address & City of Well Location

Locate with "X" in section below — Sketch Map:



3 OWNER OF WELL: Scott Fetzer Corp.
Address: Bronson, MI
Douglas Division

4 WELL DEPTH: (completed) 16 ft. Date of Completion: 18 August 78

5 ☐ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☒ Bored ☐ ____

6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring Well

7 CASING: Threaded ☒ Welded ☐ Height: Above/Below Surface 2.25 ft.
Diam. ____ in. to ____ ft. Depth
____ in. to ____ ft. Depth
Weight ____ lbs./ft.
Drive Shoe? Yes ☐ No ☒

2 FORMATION

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Gray Silty, Clayey, Gravelly, Sand	6"	6"
Black Muck, Sand	1½'	2'
Black Muck	3'	5'
Yellowish Tan Gravelly, Silty, Marl Clayey, Sand	1'	6'
Variegated Whitish Tan & Tan, Silty, Marl, Gravely, Sand	1'	7'
Lt. tan Clayey, Silty, Fine Gravel, Fine Sand	2'	9'
Gray Gravelly, Fine Med Coarse Sand	5'	14'
Gray Gravelly, Sand, Silty, Clay	2'	16'

USE A 2ND SHEET IF NEEDED

8 SCREEN: Type: Midwest Dia.: 2" Gauze 60 Length 30" Set between 13½' ft. and 16 ft.
Fittings: Threaded

9 STATIC WATER LEVEL 8 ft. below land surface

10 PUMPING LEVEL below land surface
____ ft. after ____ hrs. pumping ____ g.p.m.
Slug test 5 gpm falls to top of 2" pipe
____ ft. after ____ hrs. pumping ____ g.p.m.

11 WATER QUALITY in Parts Per Million:
Iron (Fe) ____ Chlorides (Cl) ____
Hardness ____ Other ____

12 WELL HEAD COMPLETION: Threaded ☐ In Approved Pit ☐ Pitless Adapter ☐ 12" Above Grade

13 Well Grouted? ☐ Yes ☒ No
☐ Neat Cement ☐ Bentonite ☐ ____
Depth: From ____ ft. to ____ ft.

14 Nearest Source of possible contamination: Bronson Sewage Treatment Plant
____ feet ____ Direction ____ Type
Well disinfected upon completion ☐ Yes ☐ No

15 PUMP: N/A ☐ Not installed
Manufacturer's Name ____
Model Number ____ HP ____ Volts ____
Length of Drop Pipe ____ ft. capacity ____ G.P.M.
Type: ☐ Submersible ☐ Jet ☐ Reciprocating

16 Remarks, elevation, source of data, etc.

Glenn Miller, Consulting Geologist

17 WATER WELL CONTRACTOR'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Sterling Drilling Company — REGISTERED BUSINESS NAME
0666 — REGISTRATION NO.

Address: 6236 W. Grand Rv. Brighton, MI 48116

Signed ____ AUTHORIZED REPRESENTATIVE Date ____

D67d 100M (Rev. 12-68)

Sterling Drilling Company

6236 WEST GRAND RIVER • BRIGHTON, MICHIGAN 48116

TELEPHONE (517) 546-3981

OBSERVATION WELL DATA

Location 78-5 18 August 78

30" - #60 Guaze Brass Jacket, Flush Point, Midwest Strainer, Trade # 121

15.28' - 2" Galv. pipe to top of strainer openings

17.82' to bottom of 2" pipe

Top of 2" pipe sticks up 2.25' above ground surface

Slug test - 15:23 18 Aug. 78 = 5 gpm fills to top of 2" pipe

Water Level - 15:33 18 Aug. 78 = 9.77' below top of 2" pipe

" " " " - 15:38 18 Aug. 78 = 9.83' below top of 2" pipe

" " " " - 15:45 18 Aug. 78 = 9.84' below top of 2" pipe

Saturday 19 August 78

15:45 Water Level 9.84' below top of 2" pipe

15:50-16:10 Capacity test 5 gpm with 23.9" Hg Vac. and 4 psi throttle pressure with Goulds 1½" x 1½" 2.25 H.P. gas engine driven s.w. centrifugal pump

Pre RI MW6

Sterling Drilling Co.

6236 W. GRAND RIVER – BRIGHTON, MICHIGAN 48116
Telephone (517) 546-3981

Scott Fetzer Corp.
Douglas Division
Bronson, MI 49028

Re: Plant No. 2

JOB NO. _____ LOG OF SOIL BORING NO. Well 78-6
pg 1 of 1

PROJECT _____

LOCATION 9' S.of N. Property Line Fence
52' W. of 6' High Chain Link Fence. W. Side of Entrance Drive

DATE 18 Aug. 78 SURFACE ELEV. _____

County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	NE ¼ NE ¼	11	7 S	8 W

Sample Depth	Legend	SOIL DESCRIPTION
1, 2		Black 5% Gravelly, 30% By Vol. Muck, Sand
3		White & Tan 20% Marl, 20% Silty, 20% Clayey, 10% Gravelly, 30% Sand
4		Tan, trace Silt, trace Gravel, 5% Clayey, 95% Sand
5, 6, 7, 8		Gray trace Clay, Gravelly, 80% Sand, 15% 1/8-1/4"; 5% 1/4-1"
9, 10		Gray 5% Clayey, Gravelly, 55% Sand, 10% 1/8-3/8"; 10% 3/8-3/4"; 10% 3/4-1" 10% 1-1½"

End of test 10'

W.L. 4'

GEOLOGICAL SURVEY SAMPLE NO.

WATER WELL RECORD

ACT 294 PA 1965

Pre RI MW6

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

1 LOCATION OF WELL 78-6

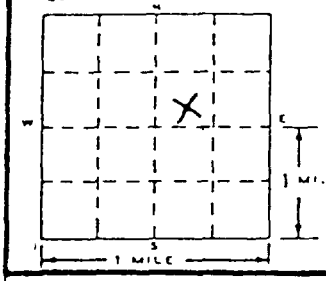
County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	NE ¼ NE ¼	11	7 S.	8 W.

Distance And Direction from Road Intersections

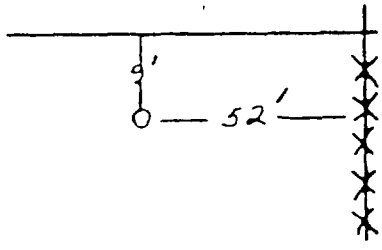
9' S. of North Property Line Fence
52' W. of 6' High Chain Link Fence, W. Side of

Street address & City of Well Location Entrance Drive

Locate with "X" in section below



Sketch Map:



3 OWNER OF WELL: Scott Fetzer Corp.

Address: Douglas Division, Bronson, MI 49028

4 WELL DEPTH (completed) 10 ft. Date of Completion 18 August 78

5 ☐ Cable tool ☐ Rotary ☐ Driven ☐ Dug ☐ Hollow rod ☐ Jetted ☒ Bored ☐ ____

6 USE: ☐ Domestic ☐ Public Supply ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitoring Well

7 CASING: Threaded ☒ Welded ☐ Diam. ___ in. to ___ ft. Depth; ___ in. to ___ ft. Depth

Height Above Surface 2.25' ft. Weight ___ lbs./ft. Drive Shoe? Yes ☐ No ☒

8 SCREEN: Type: Midwest Dia.: 2" Gauze 60 Length 30" Set between 8½ ft. and 10 ft.

Fittings: Threaded

9 STATIC WATER LEVEL 4 ft. below land surface

10 PUMPING LEVEL below land surface

___ ft. after ___ hrs. pumping ___ g.p.m.

Slug test 5 gpm fills to top of 2" pipe

___ ft. after ___ hrs. pumping ___ g.p.m.

11 WATER QUALITY in Parts Per Million: Iron (Fe) ___ Chlorides (Cl) ___ Hardness ___ Other ___

12 WELL HEAD COMPLETION: Threaded ☐ In Approved Pit ☐ Fittings Adapter ☐ 12" Above Grade

13 Well Grouted? ☐ Yes ☒ No ☐ Neat Cement ☐ Bentonite ☐ ____ Depths: from ___ ft. to ___ ft.

14 Nearest Source of Possible Contamination: Bronson Sewage Treatment Plant Type: ___ Well disinfected upon completion ☐ Yes ☐ No

15 PUMP N/A ☐ Not installed

Manufacturer's Name ___ Model Number ___ HP ___ Volts ___ Length of Drop Pipe ___ ft. capacity ___ G.P.M.

Type: ☐ Submersible ☐ Jet ☐ Reciprocating

2 FORMATION

FORMATION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Black Gravelly, Muck, Sand	2'	2'
White, Tan, Marl, Silty, Clayey, Gravelly, Sand	1'	3'
Tan Silt, Gravel, Clayey, Sand	1½'	4½'
Gray Clay, Gravelly, Sand	3½'	8'
Gray Clayey, Gravelly, Sand	2'	10'

USE A 2ND SHEET IF NEEDED

16 Remarks, elevation, source of data, etc.

Glenn Miller, Consulting Geologist

17 WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Starling Drilling Company — REGISTERED BUSINESS NAME; 0666 — REGISTRATION NO.

Address 6236 N. Grand Rv. Brighton, MI 48116

Signed ___ AUTHORIZED REPRESENTATIVE Date ___

D67d 100M (Rev. 12-68)

GEOLOGICAL SURVEY COPY

Pre RI MW6

Sterling Drilling Company

6236 WEST GRAND RIVER • BRIGHTON, MICHIGAN 48116

TELEPHONE (517) 546-3981

OBSERVATION WELL DATA

Location 78-6 18 August 78

30" - #60 Guaze Brass Jacket, Flush Point, Strainer, Midwest, Trade # 121

9.70' - 2" Galv. pipe to top of strainer openings

12.25' to inside bottom of strainer

Top of 2" pipe sticksup 2.25' above ground surface

Slug test - 17:20 Fri. 18 Aug. 78 = 5 gpm fills to to of 2" pipe

Water Level - 17:19 18 Aug. 78 = 7.39 below top of 2" pipe

" " " " - 17:30 18 Aug. 78 = 6.02 below top of 2" pipe

" " " " - 17:35 18 Aug. 78 = 6.04 below top of 2" pipe

<u>Saturday, 19 August 78</u>

15:15 Water Level 6.05' below top of 2" pipe

15:24-15:40 - Capaicty test 1 gal/23 sec. with 23" Hg Vac. and 4 psi throttle pressure with Gould 1½" x 1½" 2.25 H.P. gas engine driven S.W. centrifugal pump

Sterling Drilling Co.

6236 W. GRAND RIVER – BRIGHTON, MICHIGAN 48116
Telephone (517) 546-3981

Scott Fetzer Corp.
Douglas Division
Bronson, MI 49028

Re: Plant No. 2

JOB NO. _____ LOG OF SOIL BORING NO. Test Hole 78-7
pg 1 of 1

PROJECT _____

LOCATION 46' N. of S. Property Line Fence
530' W. of 6' High Chain Link Fence=
W. Side of Entrance Drive

DATE 19 Aug. 78 SURFACE ELEV. _____

County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	NE ¼ NE ¼	11	7 s	8 w

Sample Depth	Legend	SOIL DESCRIPTION
1		Tan 5% Silty, 10% Clayey, Gravelly, 75% Sand 5% 1/8-3/8"; 5% 3/8-3/4"
		Reddish Brown Wood Decaysed
2, 3, 4		Lt. Tan 5% Clayey, 5% Silty, Gravelly, 80% Sand, 5% 1/8-3/8"; 5% 3/8-3/4"
5		Tan 10% Clayey, 10% Silty, 55% Sand, Gravel 10% 1/8-3/8"; 10% 3/8-3/4"; 5% 3/4-1"
6		Black Muck
7		White & Tan 5% Marl 10% Silt 30% Clay 55% San
8, 9		Tan trace Silt, 5% Gravelly, 10% Clayey, 85% Sand
10, 11, 12, 13		Tannish Gray 70% Fine-20% Med.-10% Coarse Sand
4, 5, 6, 7, 8, 9, 0		

End of test 13'

W.L. 8½'

Sterling Drilling Co.

6236 W. GRAND RIVER – BRIGHTON, MICHIGAN 48116
Telephone (517) 546-3981

Scott Fetzer Corp.
Douglas Division
Bronson, MI 49028

Re: Plant No. 2

JOB NO _____ LOG OF SOIL BORING NO Test Hole 78-
pg 1 of 1

PROJECT _____

LOCATION 130' N. of S. Property Line Fence
436' W. of 6' High Chain Link Fenc, W.
Side of Entrance Drive

DATE 19 Aug. 78 SURFACE ELEV. _____

County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	NE ¼ NE ¼	11	7 s	8 w

Sample Depth	Legend	SOIL DESCRIPTION
1, 2, 3		Blackish Brown Mixed, 10% Muck, 10% Marl, 10% Silty, 10% Gravelly, 60% Sand
4		Whitish Tan 5% Clayey, 10% Fine Gravelly, 85% Sand
5, 6, 7		Blackish Tan 10% Muck, 10% Silty, 5% Clayey Gravelly, 50% Sand, 10% 1/8-3/8"; 10% 3/8-3/4 5% 3/4-1"
		Tan 85% Fine-15% Med. Sand
8		Black Muck
9, 10		Tan 20% Clayey, 20% Silty, 30% Sand, Gravel 10% 1/8-3/8"; 10% 3/8-3/4";10% 3/4-1"
11		Dk. Gray 10% Clay, 10% Silt, Gravel, 60% Sand
12, 13		Tannish Gray (10% 1/8-3/8" 5% 3/8-3/4" 5% 3/4-1" 5% Clayey, Fine Gravelly, 75% Fine-15% Med. Sand, 5% 1/8-3/8"
4, 5, 6, 7, 8, 9, 0		

End of test 13'

W.L. 10½'

Sterling Drilling Co.

6236 W. GRAND RIVER – BRIGHTON, MICHIGAN 48116
Telephone (517) 546-3981

Scott Fetzer Corp.
Douglas Division
Bronson, MI 49028

Re: Plant No. 2

JOB NO _____ LOG OF SOIL BORING NO Test Hole 78-9
pg 1 of 1

PROJECT _____

LOCATION 117' N. of S. Property Line Fence
260' W. of 6' High Chain Link Fence, W. Side of Entrance Drive

DATE 19 Aug. 78 SURFACE ELEV. _____

County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	NE ¼ NE¼	11	7 S	8 W

Sample Depth	Legend	SOIL DESCRIPTION
1, 2		Blackish Brown Mixed 10% Marl, 15% Silty, 50% Sand, Gravelly, 5% 1/8-3/8" 10% 3/8-3/4" 10% 3/4-1½"
3		Pale Tan 5% Clayey, Gravelly, 80% Sand, 10% 1/8-3/8"; 5% 3/8-1½"
4		Blackish Brown Mixed 10% Muck 10% Clayey, 10% Silty, 10% Gravelly, 60% Gravelly
5		Tan 5% Clayey, 5% Silty, Gravelly, 70% Sand, 10% 1/8-3/8"; 10% 3/8-3/4"
6, 7		Black Mixed 10% Muck, 5% Silty, Gravelly, 55% Sand, 15% 1/8-3/8"; 10% 3/8-3/4"; 5% 3/4-1"
8, 9		Black Muck
10		Tan 10% Clayey, 10% Silty, 50% Sand, Gravel 15% 1/8-3/8"; 10% 3/8-3/4"; 5% 3/4-1½"
11, 12		Yellowish Tan 10% Clayey, 10% Silty, 40% Sand, Gravel, 20% 1/8-3/8"; 10% 3/8-3/4" 10% 3/4-1½"
13, 14, 15		Gray 20% Fine-60% Med.-20% Coarse Sand, Clean
16		Gray Gravelly, 65% Sand-Clean 20% 1/8-1/4"; 10% 1/4-3/8"; 5% 3/8-3/4"
17		Gray Fine Med. Sand
18		Gray Fine Me.d Sand Cobbles
9, 0		

End of test 18' W.L. 11'

70051-M-1

Pre RI Test Boring #10

Sterling Drilling Co.

6236 W. GRAND RIVER – BRIGHTON, MICHIGAN 48116

Telephone (517) 546-3981

Scott Fetzer Corp.
Douglas Division
Bronson, MI 49028

Re: Plant No. 2

JOB NO. _____ LOG OF SOIL BORING NO. Test Hole 78
pg 1 of 1

PROJECT _____

LOCATION 45' S. of N. Property Line Fence
151' W. of 6' High Chain Link Fence,
W. Side of Entrance Drive

DATE 19 Aug 78 SURFACE ELEV. _____

County	Township Name	Fraction	Section Number	Town Number	Range Number
Branch	Bronson	NE¼ NE¼	11	7	8

Sample Depth	Legend	SOIL DESCRIPTION
1		Dark Gray 10% Marly, 15% Silty, 15% Gravelly 60% Sand
2, 3		Blackish Gray 5% Silty, 10% Clayey, 15% Gravelly, 70% Sand
		Black 50% By Vol. Muck, 5% Silt 10% Clay Sand
4, 5, 6, 7		Tan 5% Clayey, Fine Gravelly, 80% Sand 10% 1/8-3/8"; 5% 3/8-3/4
8, 9, 10		Black Muck
11		Grayish Tan 10% Clayey, 10% Silty, Gravelly 50% Sand, 10% 1/8-3/8"; 10% 3/8-3/4"; 10% 3/4-1")
12, 13, 14		Gray 10% Fine Gravelly, 55% Fine-20% Med.-15% Coarse Sand-Clean
15, 16		Gray 5% Clayey, Fine Gravelly, 20% 1/8-1/4" 5% 1/4-3/8"; 30% Fine-20% Med.-20% Coarse Sand Cobbles 16½'-17½'
17, 18		Gray 5% Silty, 10% Clayey, Gravelly, 55% Sand 15% 1/8-1/4"; 5% 1/4-3/8"; 10% 3/8-1½"
9, 0		

End of test 18'

W.L. 9'4"

BRONSON, MICHIGAN

SITE MAP

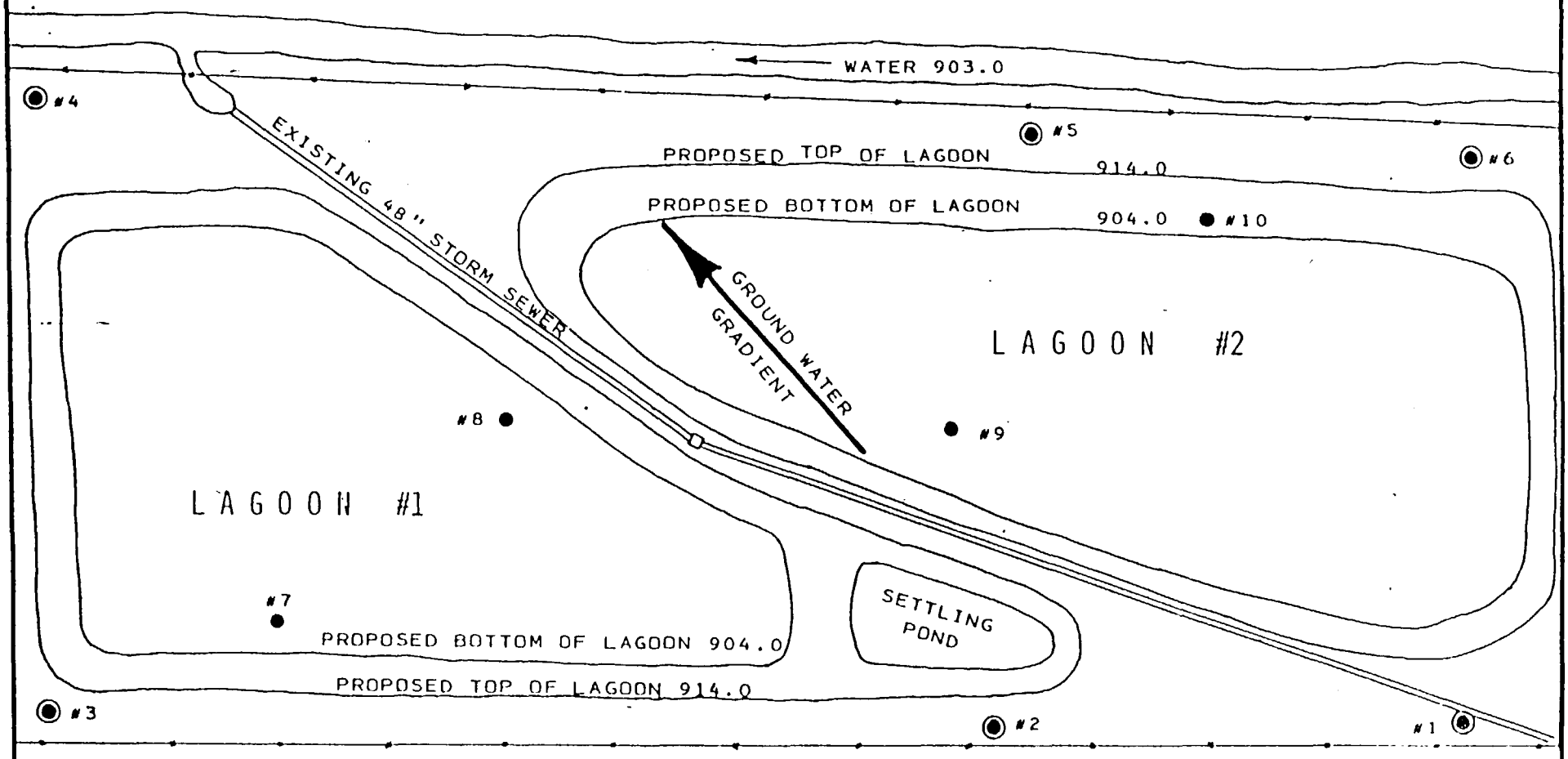


Figure taken from Hyrdrogeolic Evaluation for Douglas Division - Scott & Fetzer Co., prepared by McNamee, Porter & Seeley, Consulting Engineers (November 1978)

SCALE 1" = 60'

MONITOR WELL

TEST BORING

PLATE 1

Figure taken from Hydrogeologic Evaluation for Douglas Division - Scott & Fetzer Co., prepared by McNamee, Porter & Seeley, Consulting Engineers (November 1978)

DOUGLAS DIVISION - SCOTT & FETZER CO.

BRONSON, MICHIGAN

CROSS SECTION

C5

PRE RI BRONSON PLATING WELL LOGS

(KECK CONSULTING SERVICES, INC.)

BORING NUMBER B-2/MW 2s & d TOTAL DEPTH 44' S.W.L.(BGL) s = 5.99 d = 6.03

Sample Number	From 0 to 44 Feet	Lithologic Description
	0 - 2	Sandy clay topsoil w/med organics, dark brown
1 composite	4 - 40	Sand: unsorted w/fn. gravel becoming coarser w/depth;
		brown turning gray @ 10', sat. @ approx. 6'
2 composite	40 - 44	Clay Till w/gravel; gray, tight, unsaturated
		H_2O Sample Analysis
		Sample / Depth / Temp. °C / Conductivity µmhos
		1 / 9-14' / 15.5 / 850
		2 / 19-25' / 14.0 / 925
		3 / 29-35' / 13.0 / 3500
		(Pre RI MW16S/16D)

Piezometer: ☐ Screen 2' slotted Pipe s = 10' d = 40' PVC Total Depth (BGL) s = 9.19 d = 38.40

BORING NUMBER B-3/MW 3 s & d TOTAL DEPTH 29' S.W.L.(BGL) s = 4.11 d = 4.10

Sample Number	From 0 to 29 Feet	Lithologic Description
	0 - 1	Sandy clay topsoil w/med. organics, dark brown
1 composite	1 - 24	Sand: med.w/fn. gravel, becomes coarse w/increased
		gravel @ 15', sat. @ approx. 4'
2 composite	24 - 29	Clay Till w/gravel; gray, tight, unsaturated
		H_2O Sample Analysis
		Sample / Depth / Temp. °C / Conductivity µmhos
		1 / 9-14' / 13.5 / 1100
		2 / 19-24' / 12.5 / 1100
		(Pre RI MW17S/17D)

BORING NUMBER B4/MW-4 TOTAL DEPTH 19' S.W.L.(BGL) 5.09

Sample Number	From 0 to 19 Feet	Lithologic Description
	0 - 4	Sandy clay topsoil w/med. organics, dark brown
1 composite	4 - 15	Sand: coarse w/fn-med. gravel, gray; sat, @ approx. 5'
N.S. Pieces on bit	15 - 19	Clay Till: gray, tight
		H_2O Sample Analysis
		Sample / Depth / Temp. °C / Conductivity MHOS
		1 / 9-14' / 13.0 / 1050
		(Pre RI MW18)

Piezometer: ☐ Screen 2' slotted PVC Pipe 15' PVC Total Depth (BGL) 13.41

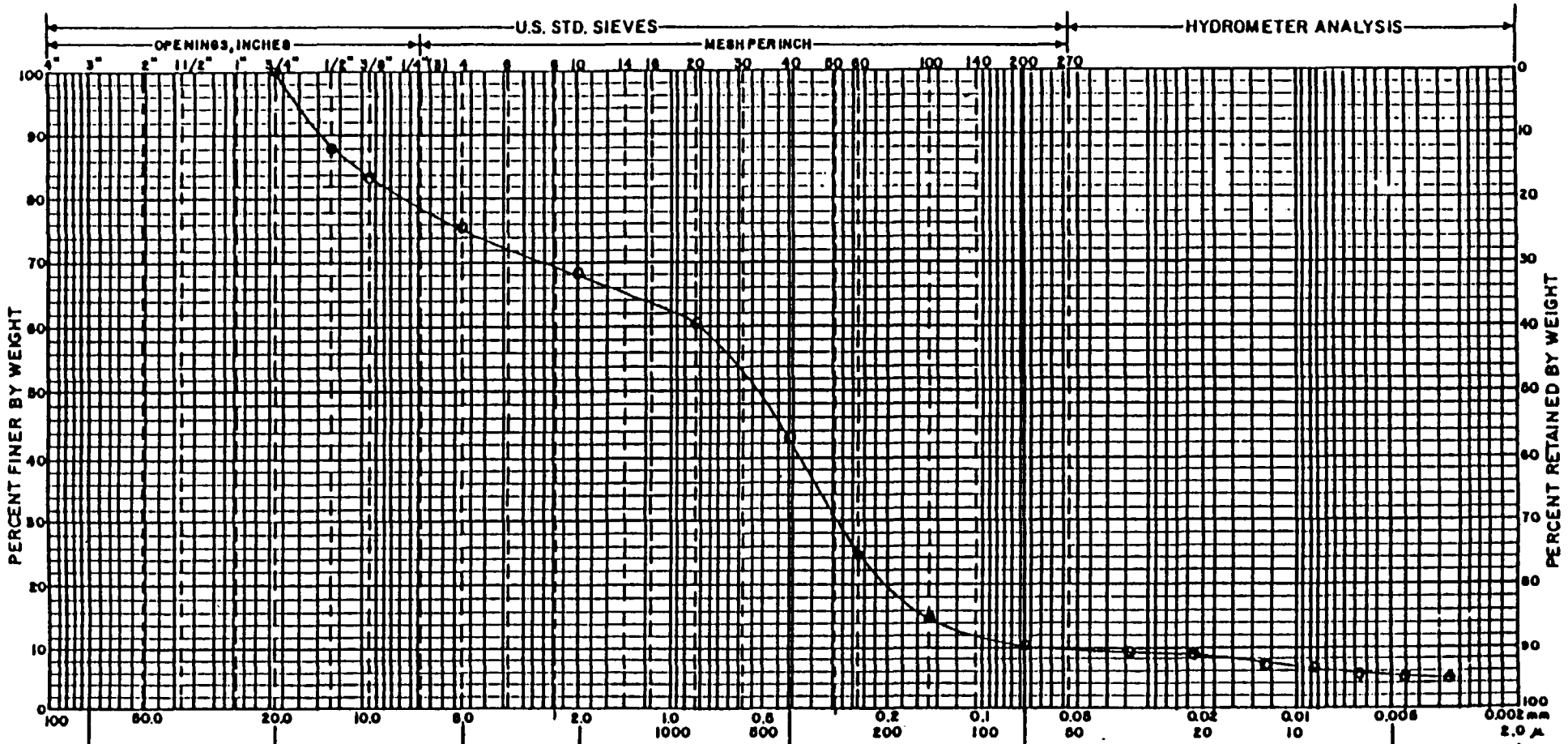
BORING NUMBER _____ TOTAL DEPTH _____ S.W.L.(BGL) _____

Sample Number	From ___ to ___ Feet	Lithologic Description

D

GRAIN SIZE ANALYSIS

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT	CLAY
		24.3%	65.5%			5.2%	5.0%

SAMPLE INFORMATION: SAS #4834E 17 SB1 - 2 ft

Fine gravelly, C-F SAND, little silt and clay

(sp - gp)

☒ Insufficient Sample Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC

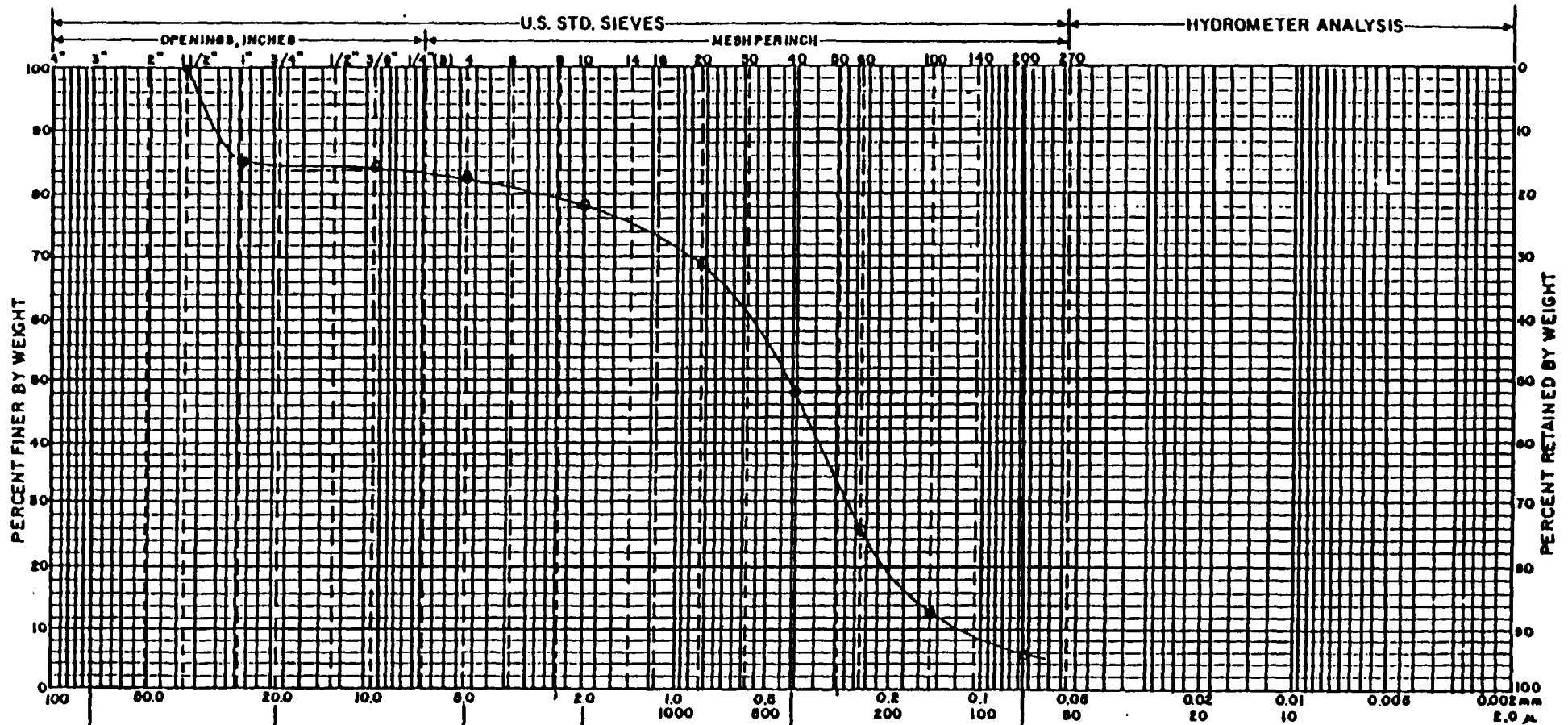
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: JFC	CK'D. JFC	DATE: Sept. '89	PROJ. NO. C019.001

153.018

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
	17.4%		76.8%			5.8%

SAMPLE INFORMATION: SAS #4834E 18 SB1 - 6 ft

C-F SAND, some C-F gravel, little silt or clay

(sp)

[X] Insufficient Sample Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC

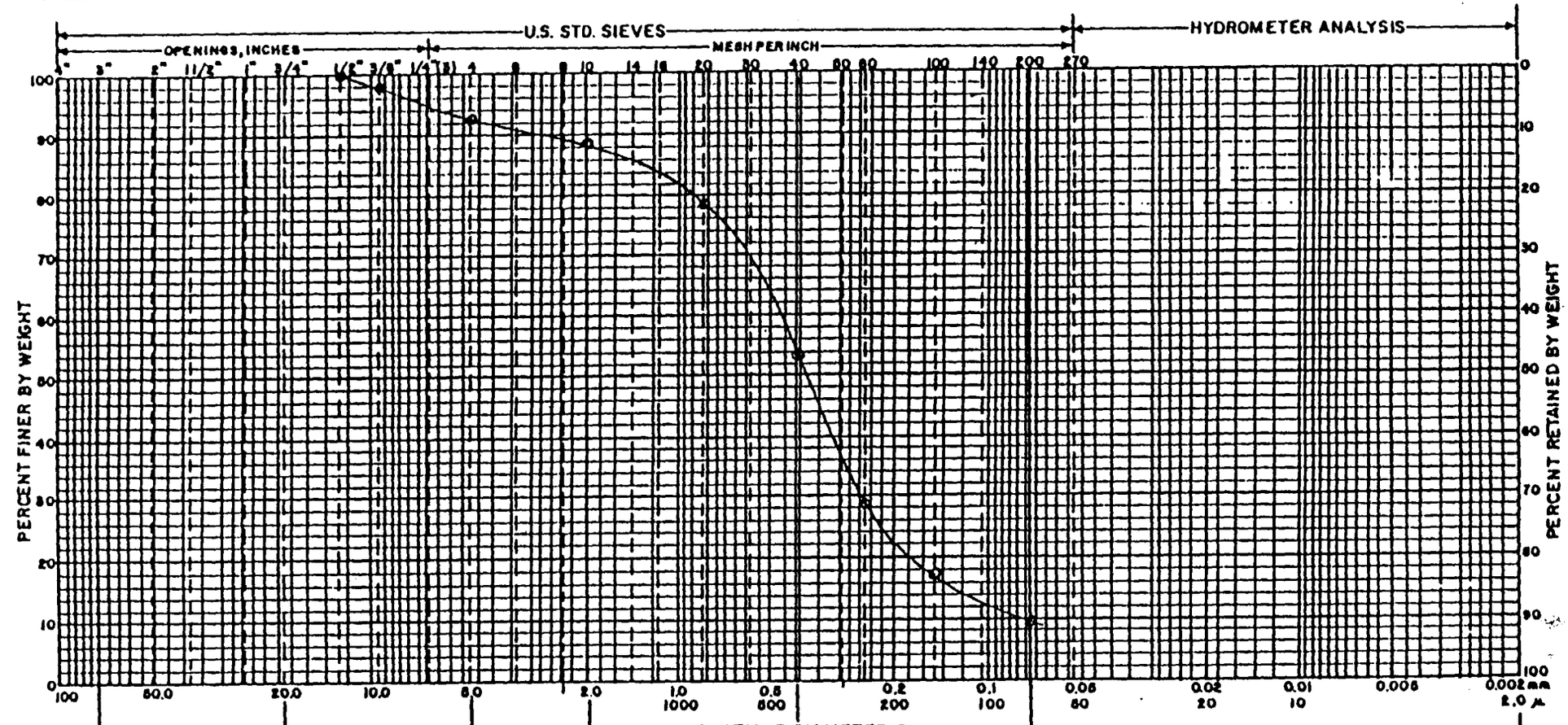
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: NS	CK'D. JFC	DATE: Sept. '89	PROJ. NO. C019.001

153.019

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
		6.3%	83.9%			9.8%

SAMPLE INFORMATION: SAS #4834E 19 SB1 - 8 ft

C-F SAND, little fine gravel, silt and clay

(sp)

[X] Insufficient Sample Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC.

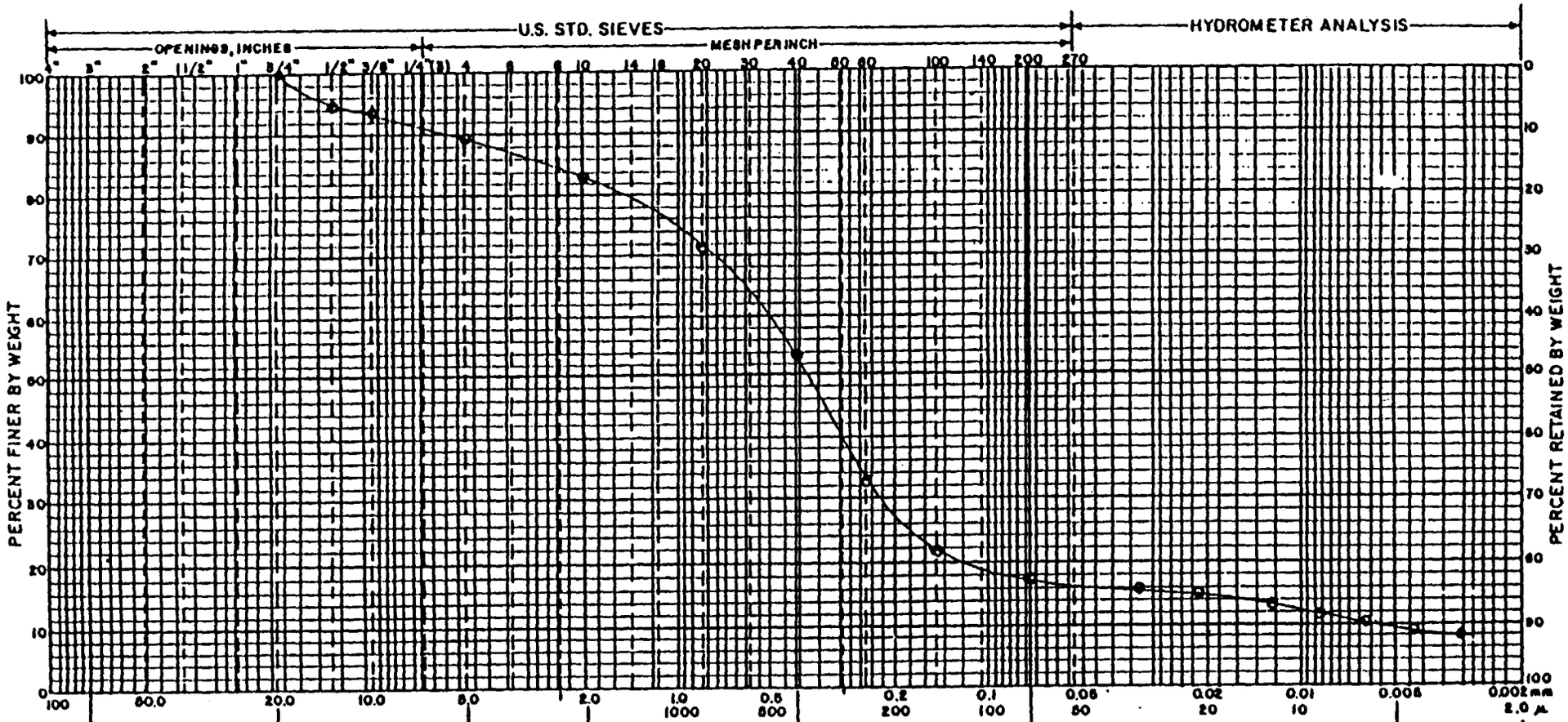
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: NS	CK'D. JFC	DATE: Sept. '89	PROJ. NO. C019.001

153.020

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT BR CLAY	CLAY
		10.8%		72.0%		8.0%	9.2%

SAMPLE INFORMATION: SAS #4834E 20 SB1 - 10 ft

C-F SAND, little fine gravel, silt and clay

(sp - sm)

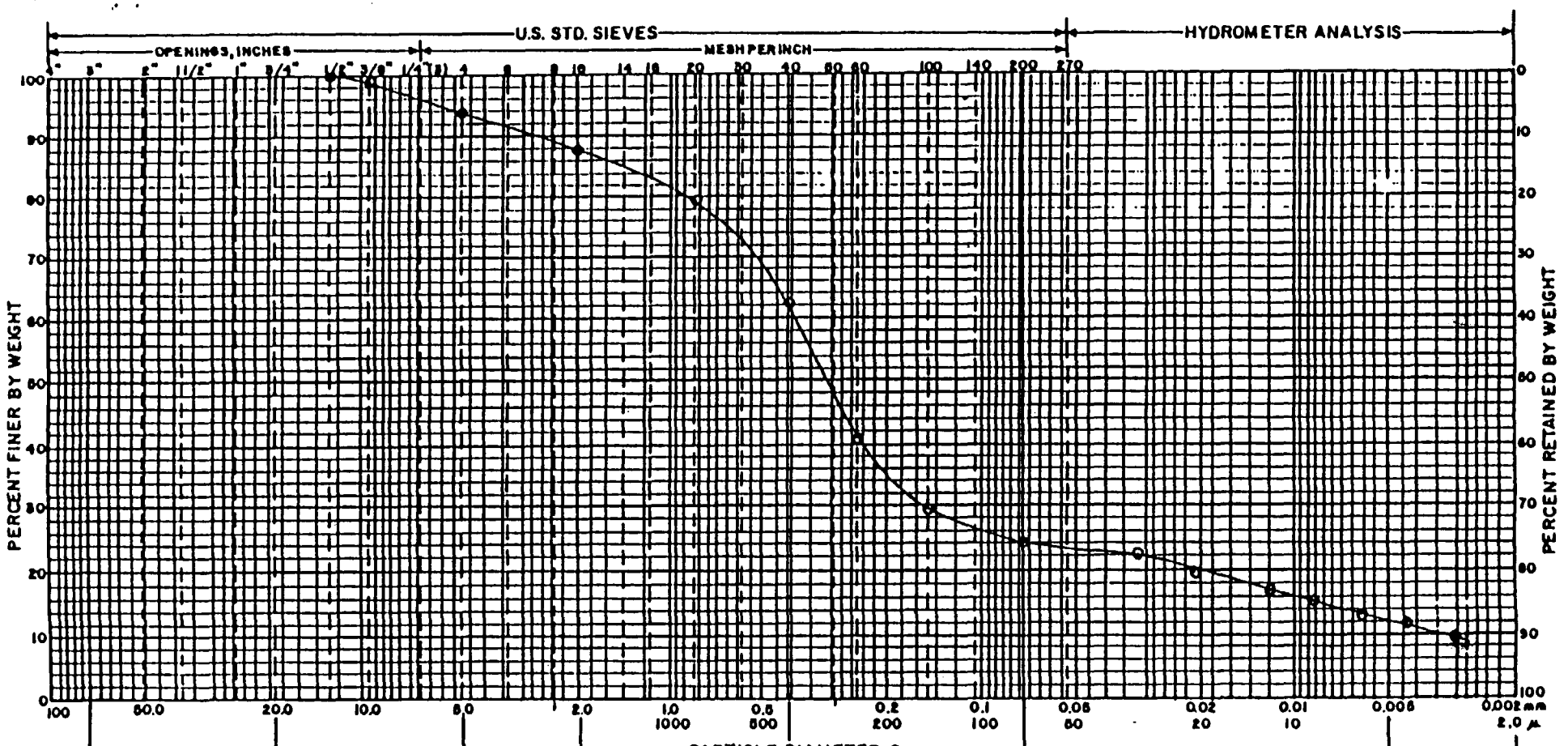
EMPIRE SOILS INVESTIGATIONS INC.

PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: | CK'D | DATE: | PROJ. NO. GO[illegible] 001

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT	CLAY
		6.3%	69.6%			12.1%	12.0%

SAMPLE INFORMATION: SAS #4834E 21 SB2 - 2 ft

C-F SAND, some silt and clay, little fine gravel

(sp - sm)

☒ Insufficient Sample Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC

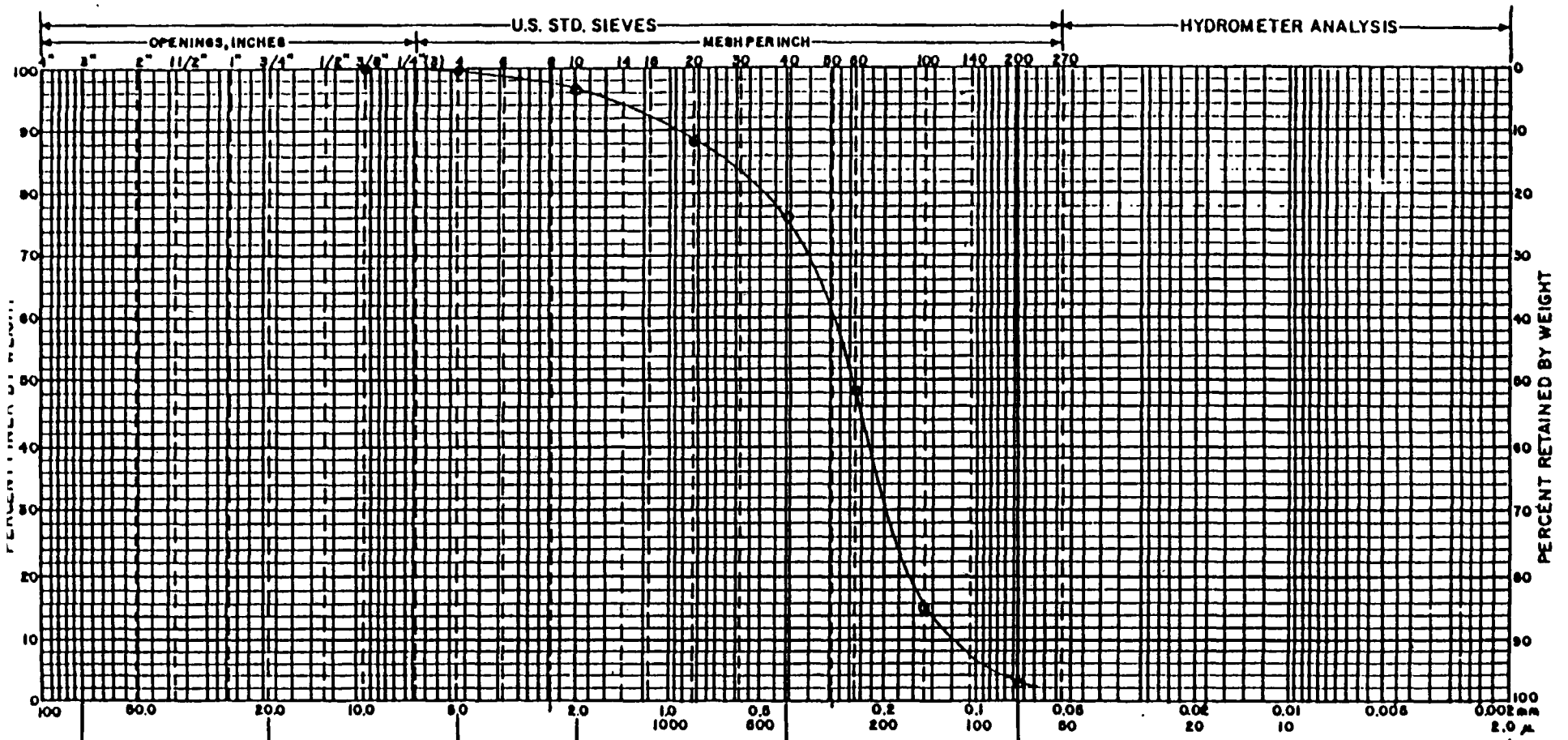
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: JFC	CK'D. JFC	DATE: Sept. '89	PROJ. NO. G019.001

15? ?2

PARTICLE SIZE DISTRIBUTION CURVE



lied Soil sification STM 487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
		0.1%		97.2%		2.7%

SAMPLE INFORMATION: SAS #4834E 22 SB2 - 15 ft

C-F SAND, trace fine gravel, silt and clay

(sp)

[X] Insufficient Sample Size per ASTM D 422

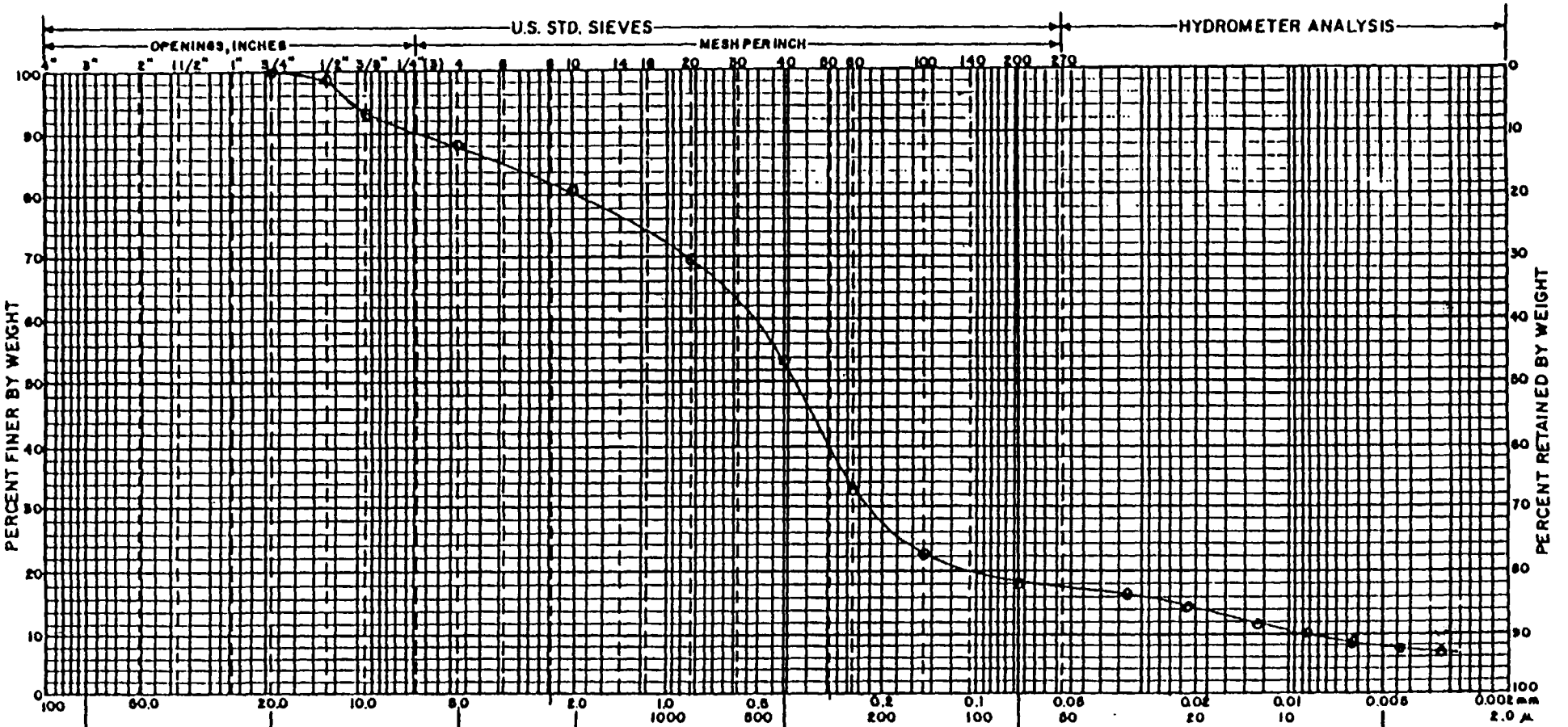
EMPIRE SOILS INVESTIGATIONS INC.

PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: JFC | CK'D. JFC | DATE: Sept. '86 | PROJ. NO. C019.001

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT	CLAY
		11.8%	70.2%			10.0%	8.0%

SAMPLE INFORMATION: SAS #4834E 23 SB3 - 2 ft

C-F SAND, little fine gravel, silt and clay

(sp - sm)

[X] Insufficient Sample Size per ASTM D 422

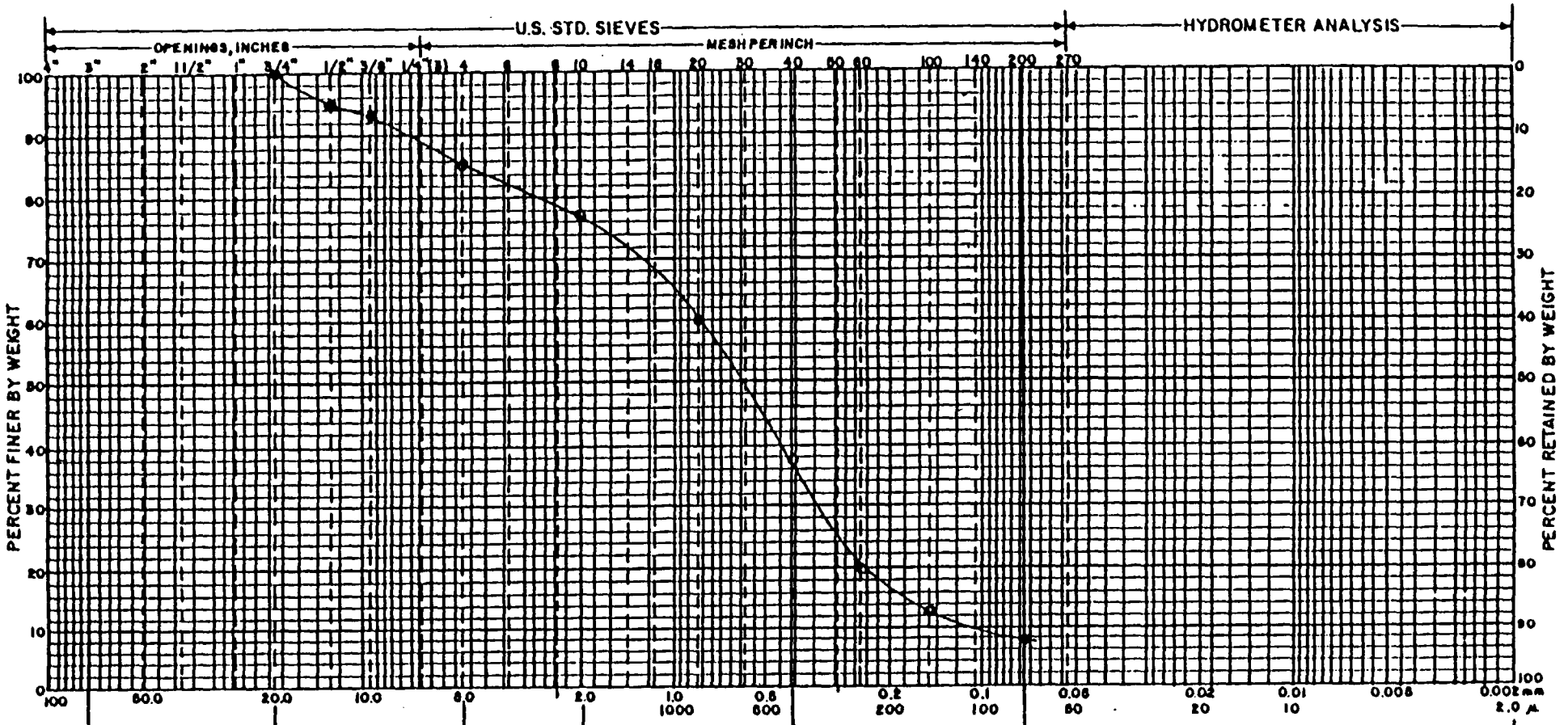
EMPIRE SOILS INVESTIGATIONS INC.

PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: JFC	CK'D. JFC	DATE: Sept. '89	PROJ. NO. C019.001

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
		14.5%	77.8%			7.7%

SAMPLE INFORMATION: SAS #4834E 24 SB3 - 8 ft

C-F SAND, some fine gravel, trace to little silt and clay

(sp)

[X] Insufficient Sample Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC.

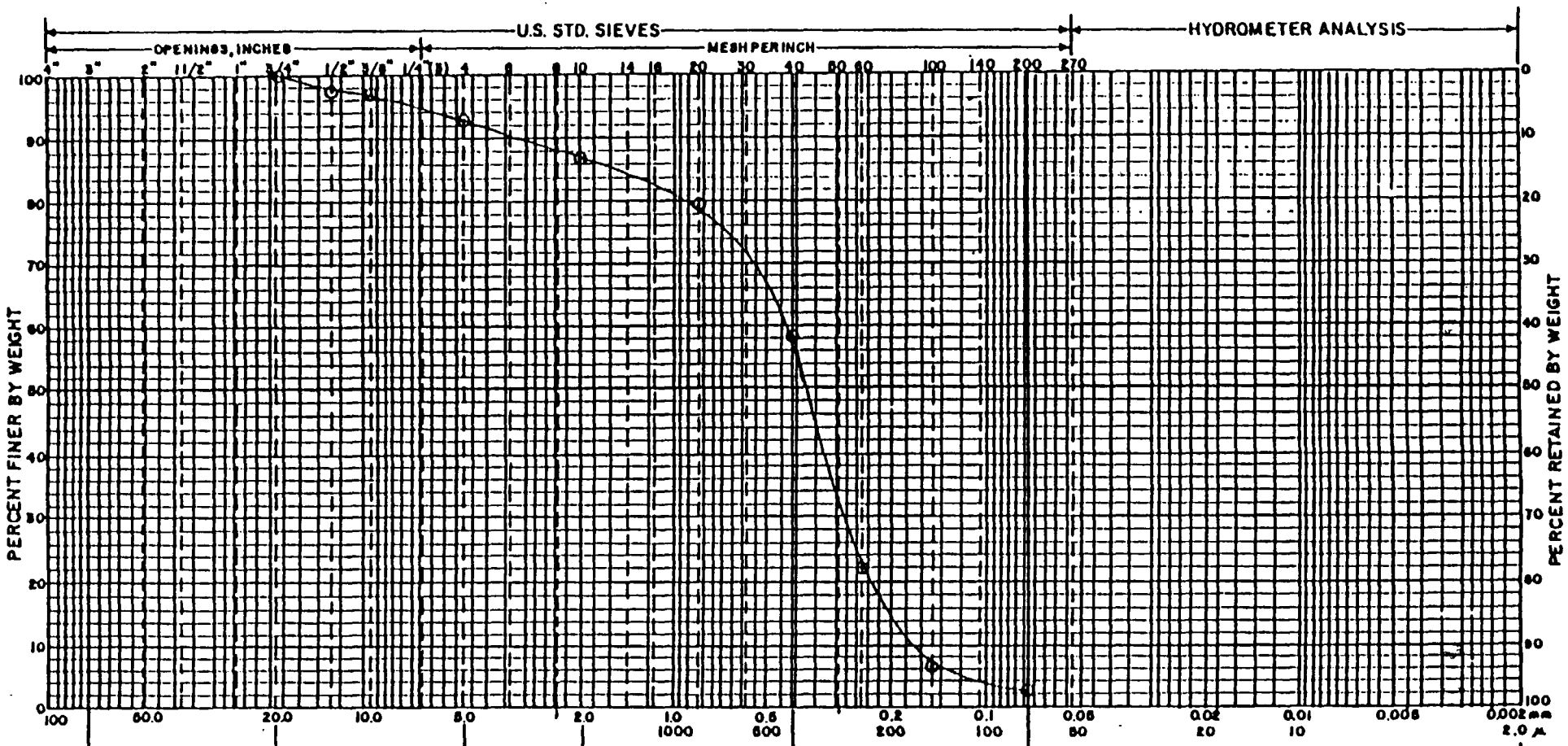
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: JFC	CK'D. JFC	DATE: Sept. '89	PROJ. NO. G019.001

153.001

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
		7.2%	90.4%			2.4%

SAMPLE INFORMATION: SAS #4834E 01 MWIS-15 ft

C-F SAND, little fine gravel, trace silt and clay

(sp)

[X] Insufficient Sample Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC.

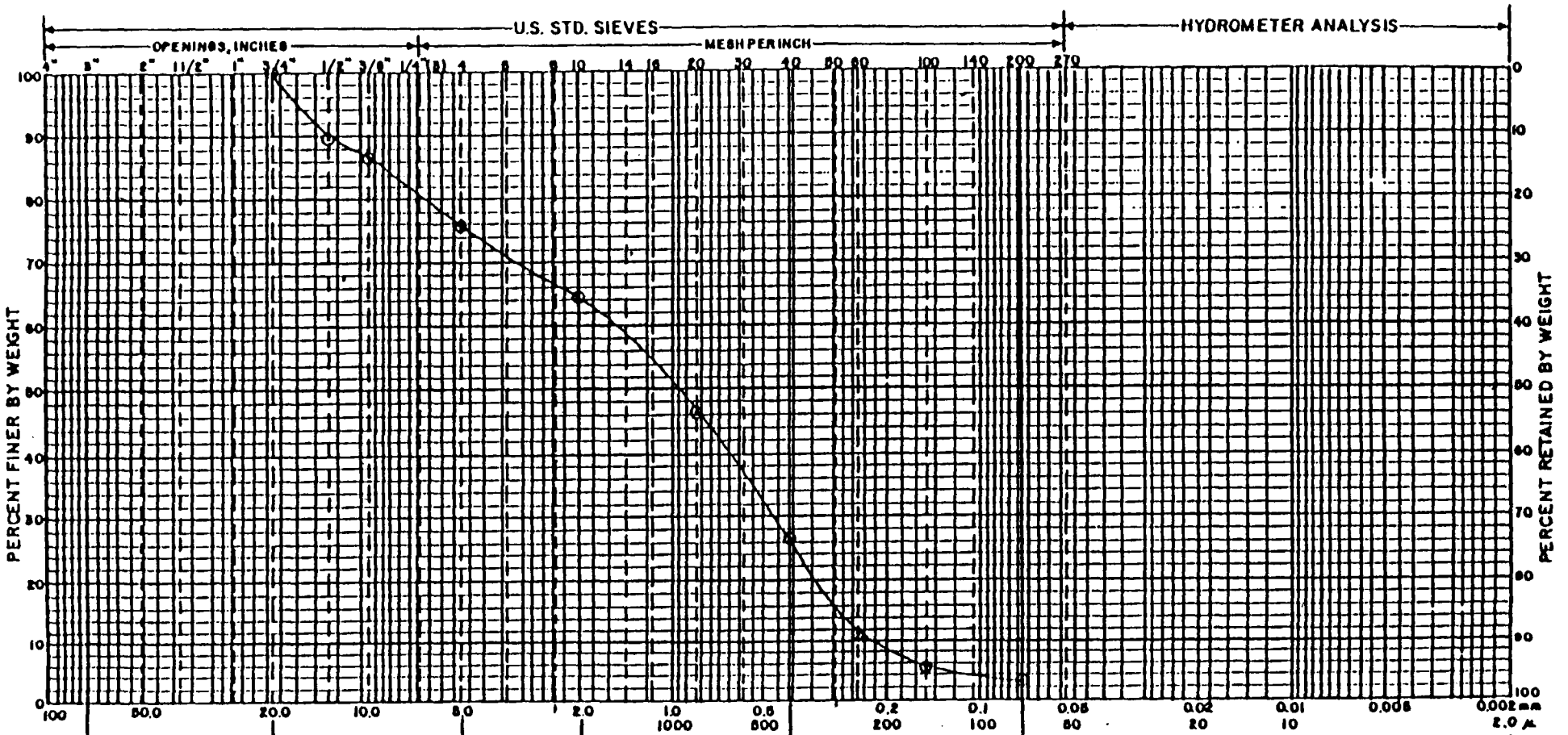
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: NS	CK'D. JRC	DATE: Sept. '89	PROJ. NO. 019.001

153.013

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
	24.2%		73.0%			2.8%

SAMPLE INFORMATION: SAS #4834E 13 MW2S - 10 ft

Fine gravelly, C-F SAND, trace silt and clay

(sp - gp)

[X] Insufficient Sample Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC.

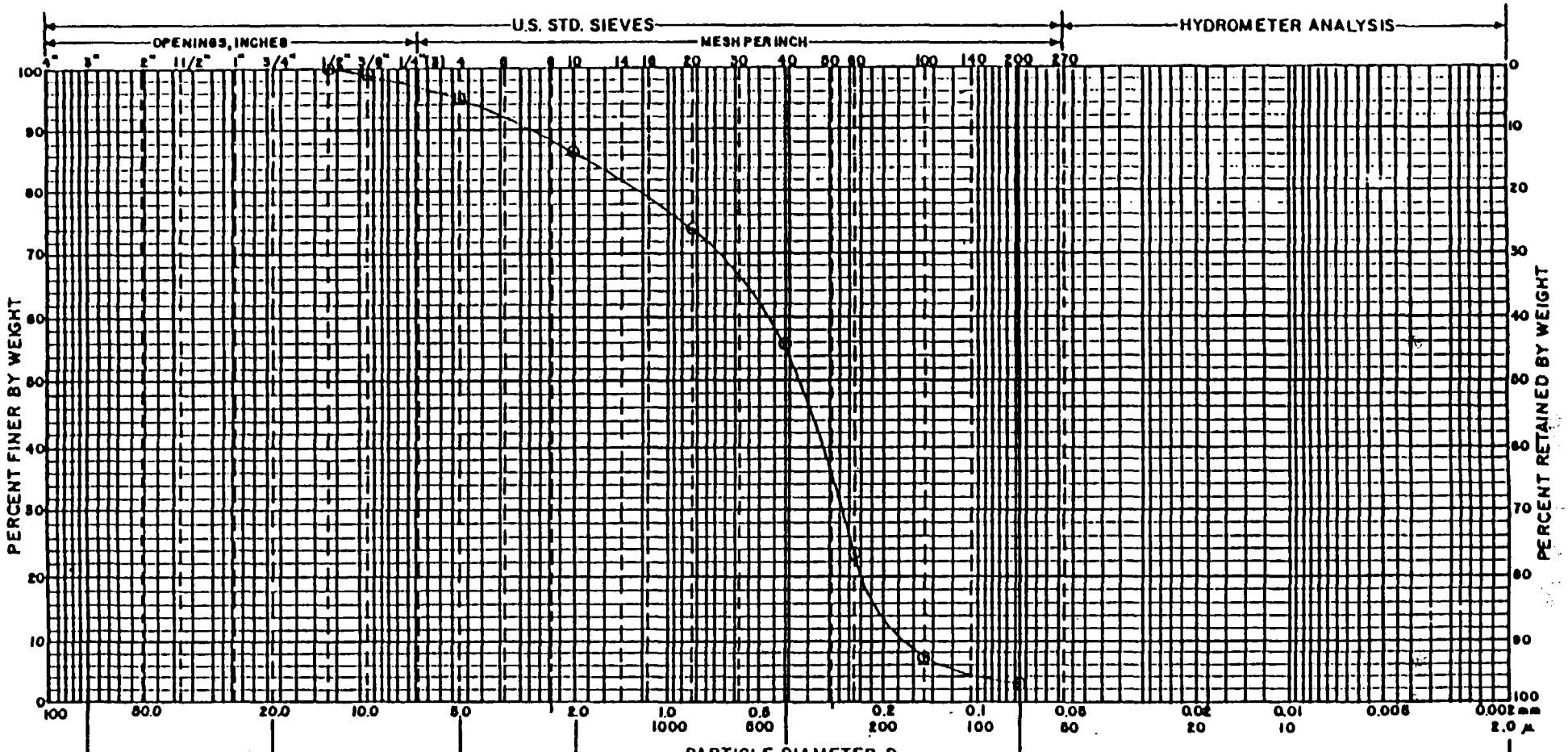
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: NS	CK'D. JFC	DATE Sept. '89	PROJ. NO. G019.001

153.012

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
	4.8%		92.4%			2.8%

SAMPLE INFORMATION: SAS #4834E 12 MW3S - 15 ft

C-F SAND, trace fine gravel, silt and clay

(sp)

[X] Insufficient Sample Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC

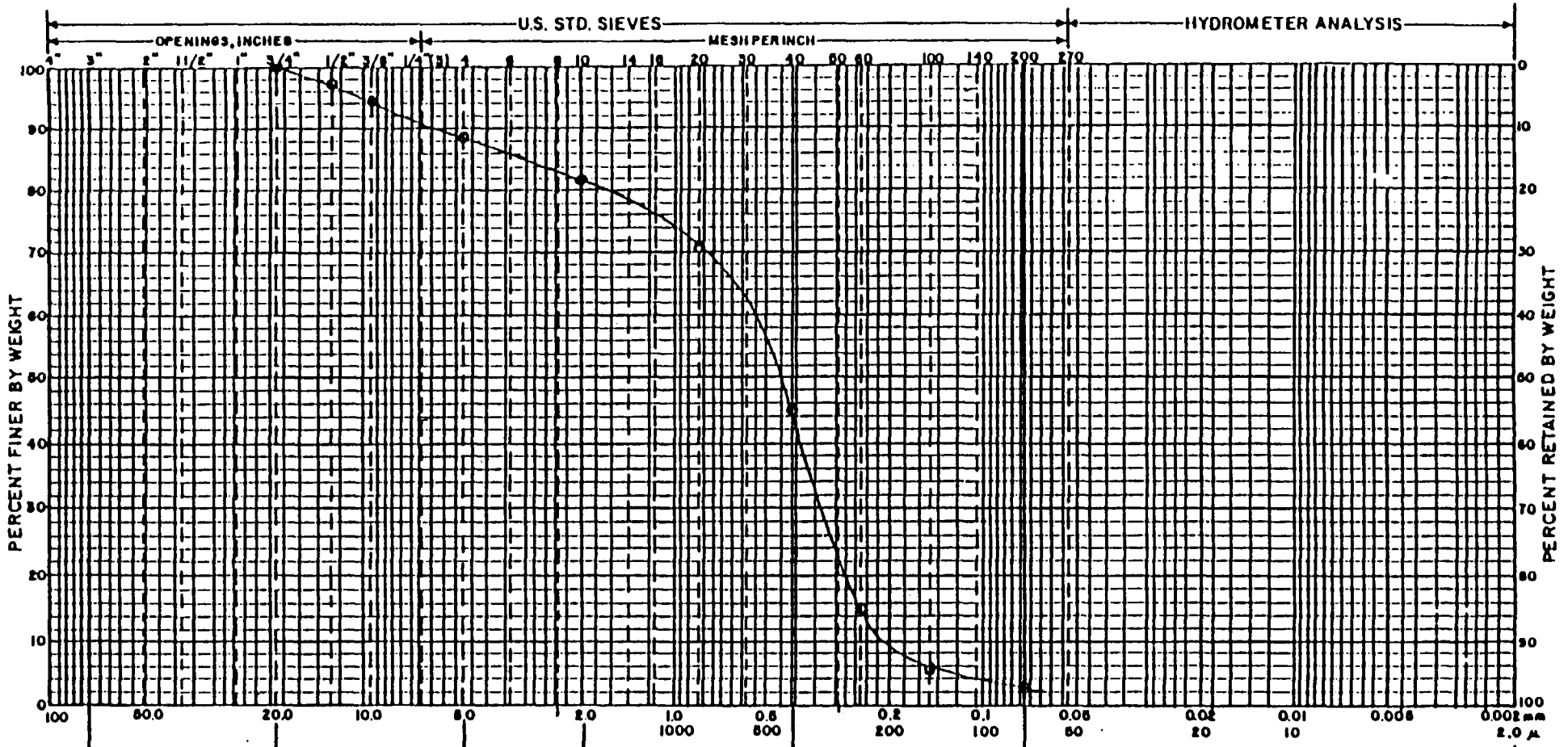
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: JFC	CK'D. JFC	DATE: Sept. '89	PROJ. NO. C019.001

153.011

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
		11.3%	86.2%			2.5%

SAMPLE INFORMATION: SAS #4834E 11 MW4S - 15 ft

C-F SAND, little gravel, trace silt and clay

(sp)

[X] Insufficient Sample Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC.

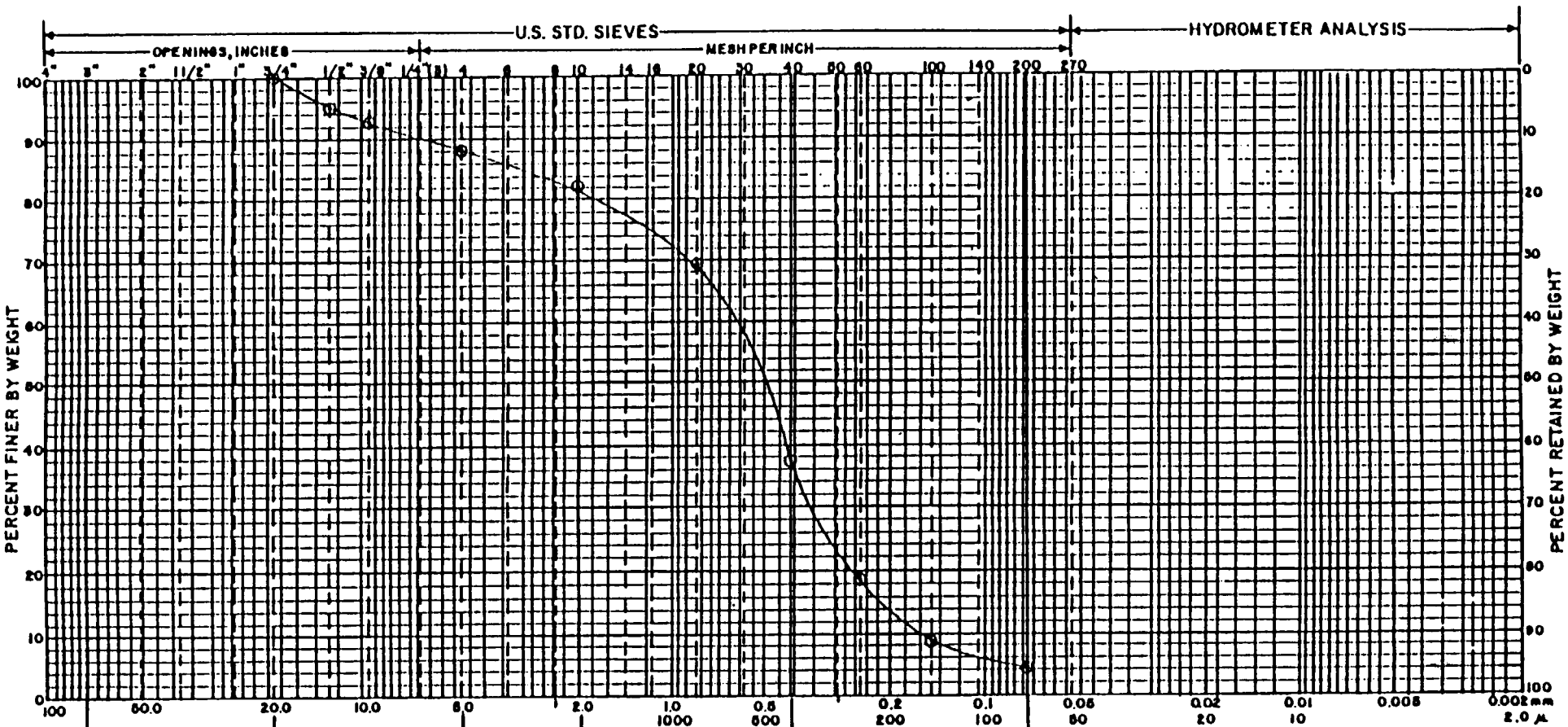
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: [illegible] | CK'D. IFC | DATE: Sept '89 | PROJ. NO. C019.001

153.009

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
		11.9%		83.9%		4.2%

SAMPLE INFORMATION: SAS #4834E 09 MW5D - 15 ft

C-F SAND, little to some fine gravel, trace silt and clay

(sp)

[X] Insufficient Sample Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC.

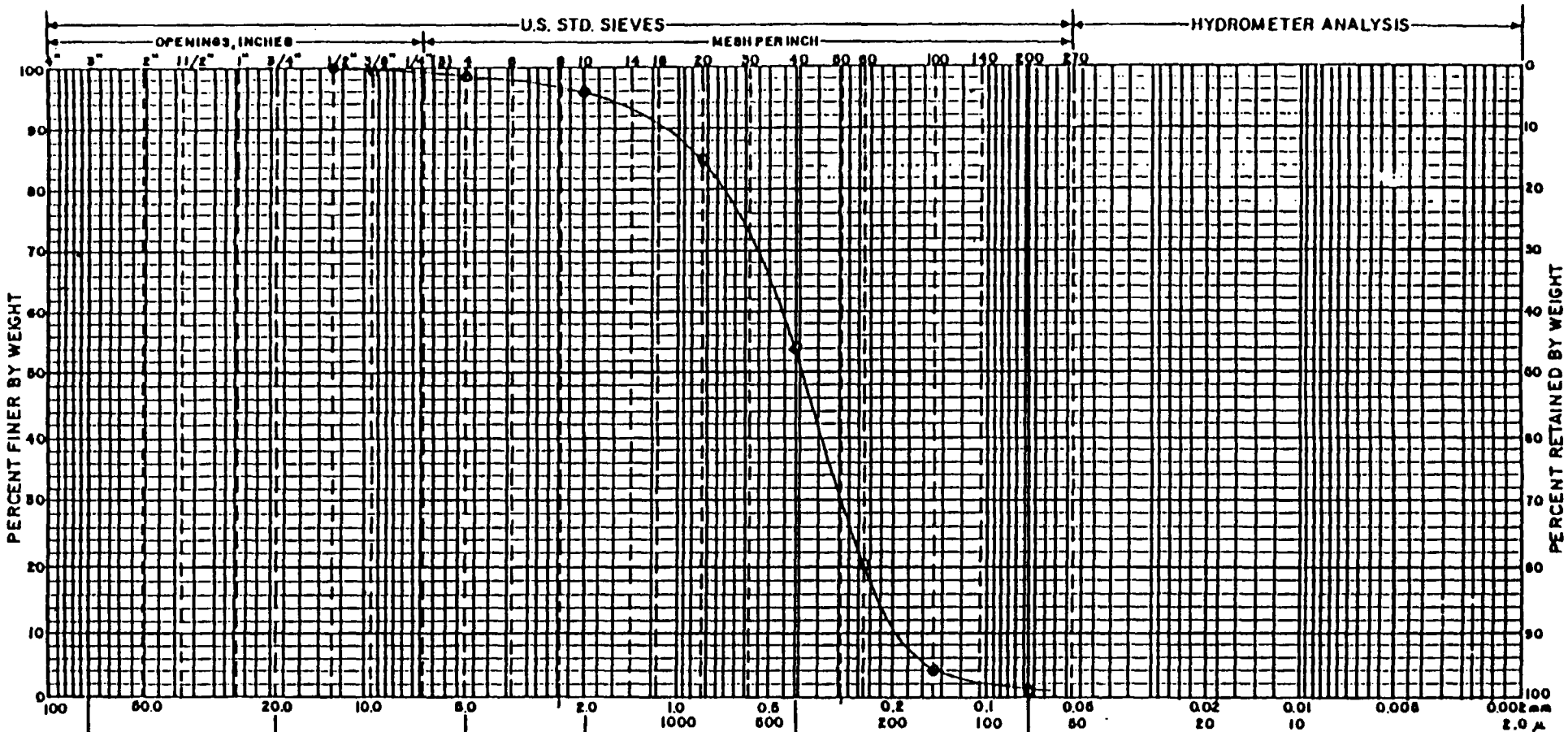
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: NS	CK'D. JFC	DATE: Sept. '89	PROJ. NO. 6019.001

153.010

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
		1.3%		97.7%		1.0%

SAMPLE INFORMATION: SAS #4834E 10 MW5D - 40 ft

C-F SAND, trace fine gravel, silt and clay

(sp)

EMPIRE SOILS INVESTIGATIONS INC.

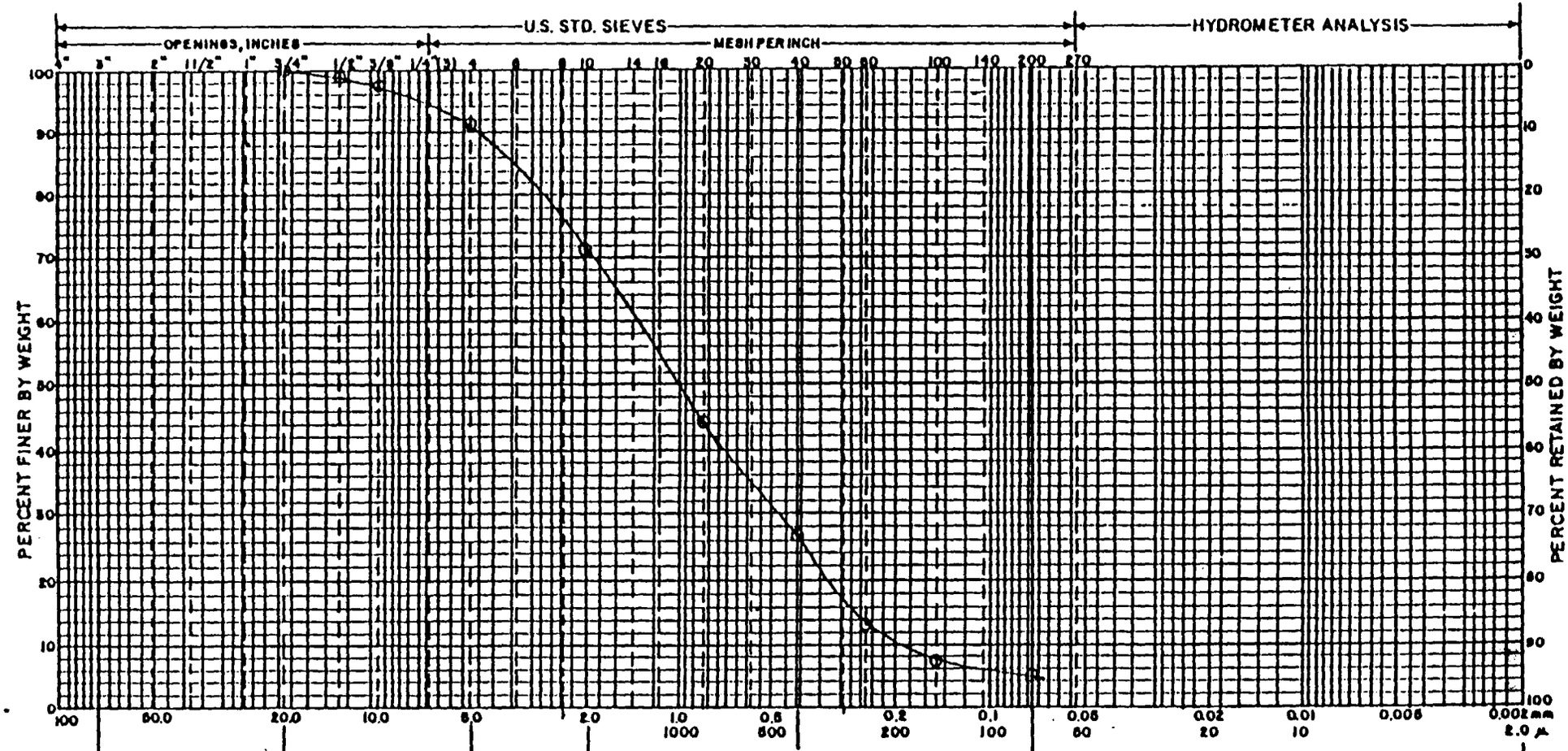
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

[illegible] 1F/[illegible] [illegible] '89 [illegible] NO. [illegible]019.00[illegible]

153.016

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
	8.6%		86.6%			4.8%

SAMPLE INFORMATION: SAS #4834E 16 MW6D* - 5 ft

* now known as MW6S - 5 ft

C-F SAND, little fine gravel, trace silt and clay

(sp)

[X] Insufficient Sample Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC

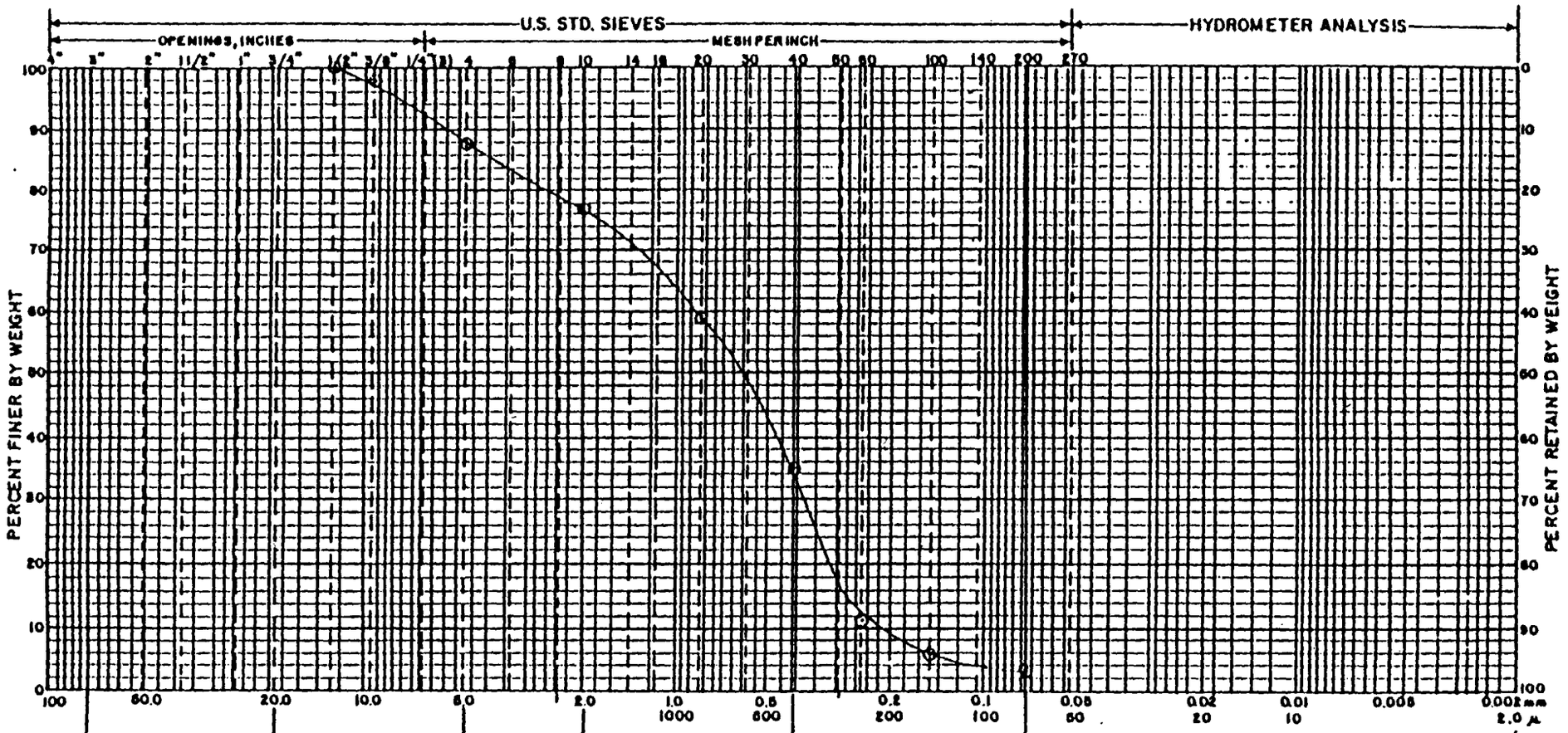
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: NS	CK'D. JFC	DATE: Sept. '89	PROJ. NO. G019.001

153.003

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-64	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
		12.1%	84.6%			3.3%

SAMPLE INFORMATION: SAS #4834E 03 MW7D* - 10 ft

* now known as MW7S - 10 ft

C-F SAND, some fine gravel, trace silt and clay

(sp)

ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC.

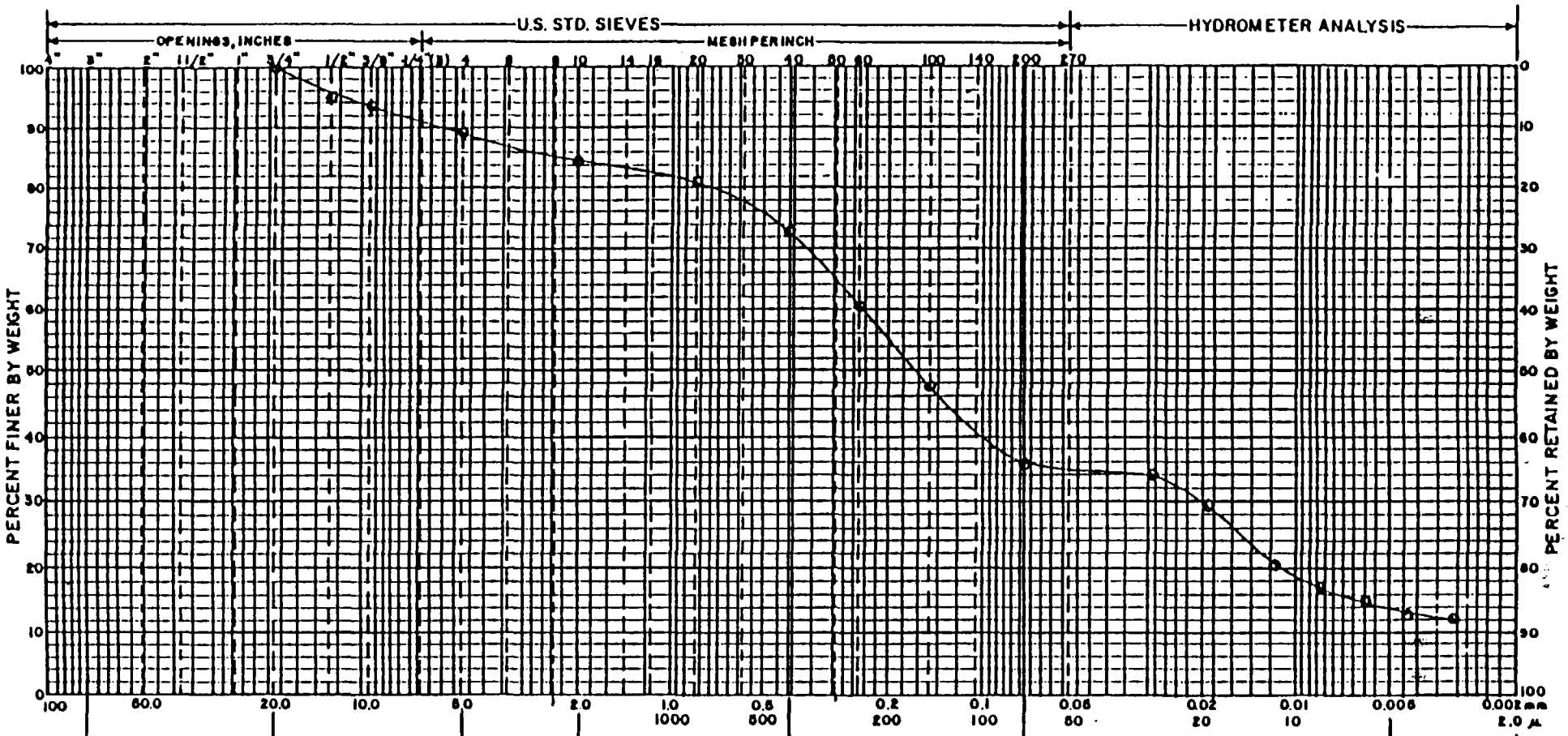
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: NS | CK'D. JFC | DATE: Sept. '89 | PROJ. NO. C019.001

153.004

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY	CLAY
		10.8%	53.5%			21.7%	14.0%

SAMPLE INFORMATION: SAS #4834E 04 MW8S* 20 ft

* now known as MW8D - 20 ft

Silty, C-F SAND, some clay, little fine gravel

(sm)

[X] Insufficient Sample Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC

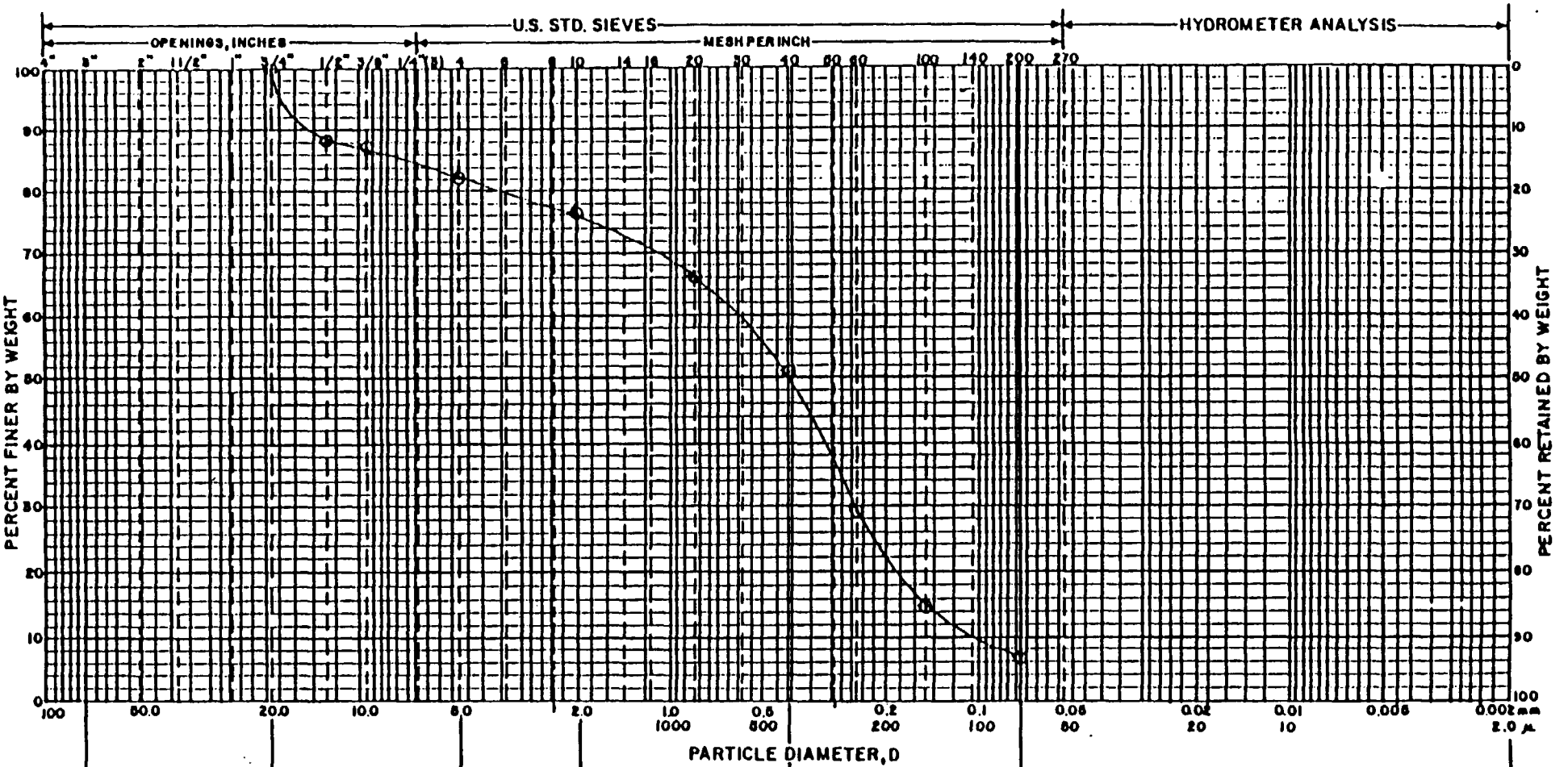
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: JFC	CK'D. JFC	DATE: Sept. '89	PROJ. NO. 6019.001

153.005

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-64	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
		17.8%	75.7%			6.5%

SAMPLE INFORMATION: SAS #4834E 05 MW8S* 22 ft

* now known as MW8D - 22 ft

C-F SAND, some fine gravel, trace silt and clay

(sp)

☒ Insufficient Sample Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC

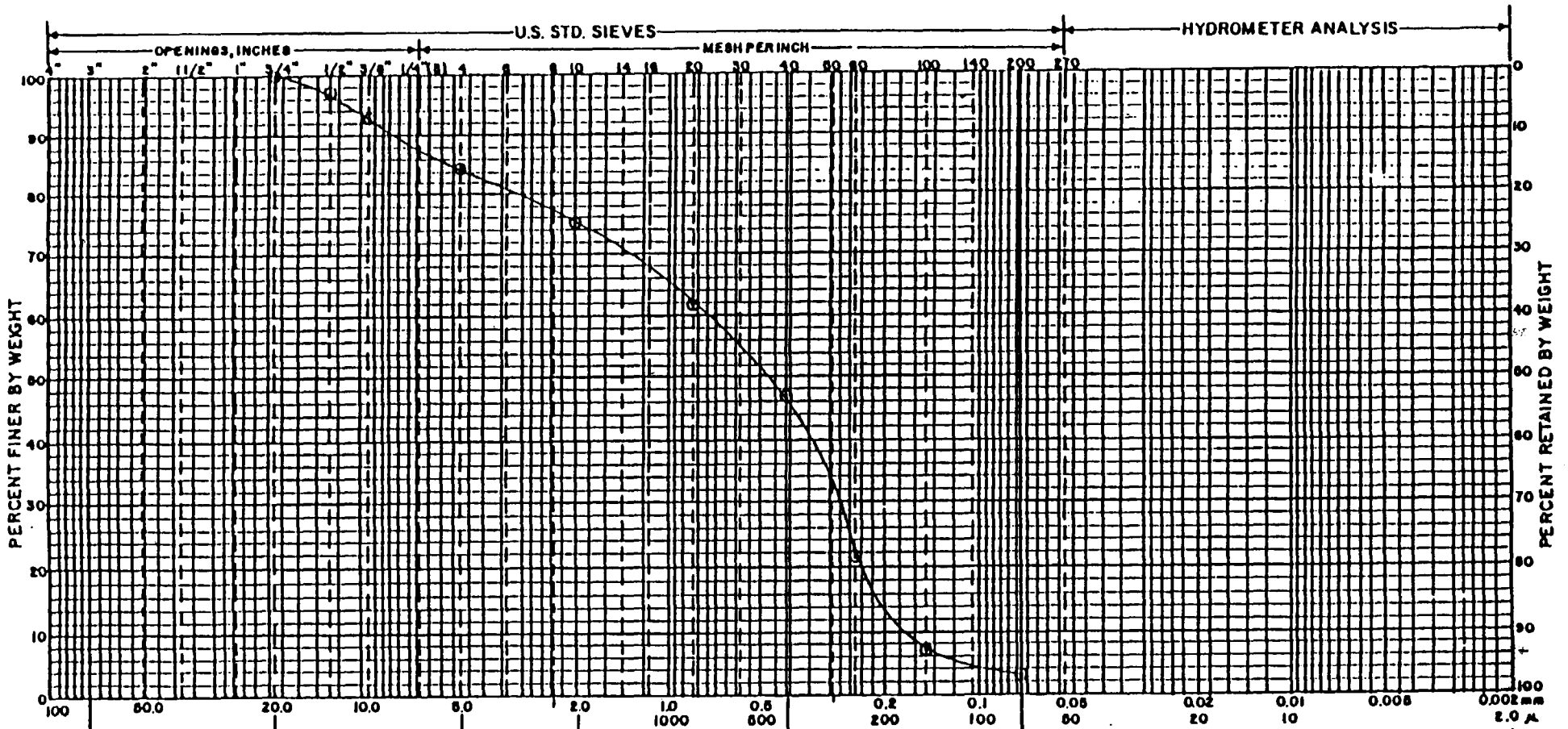
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: NS	CK'D. JFC	DATE: Sept. '89	PROJ. NO. G019.001

153.01f

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
		15.5%	81.4%			3.1%

SAMPLE INFORMATION: SAS #4834E 14 MW9S - 10 ft

C-F SAND, some fine gravel, trace silt and clay

(sp)

[X] Insufficient Sample Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC.

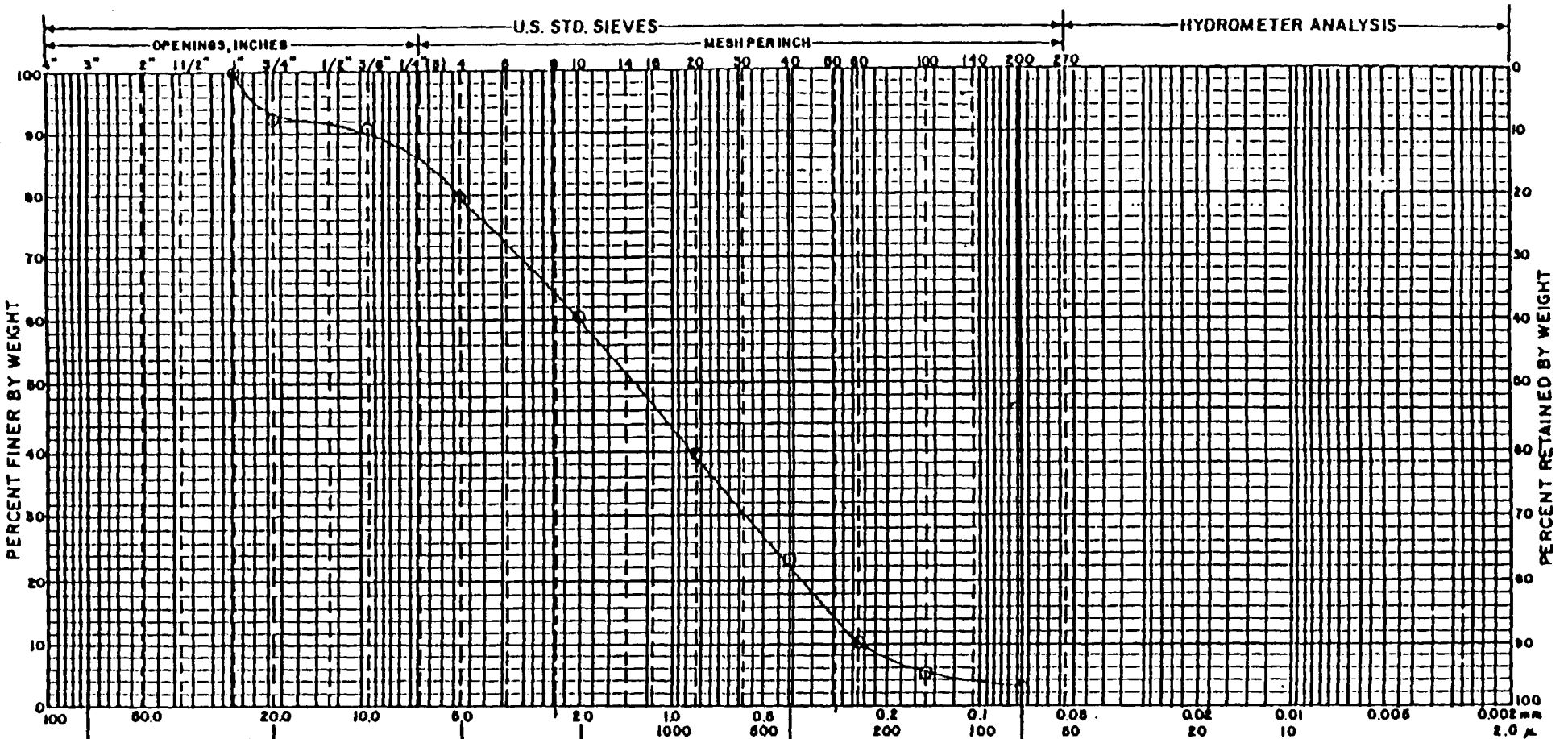
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: NS	CK'D. JFC	DATE: Sept. '89	PROJ. NO. G019.001

153.006

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-64	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
		20.1%		77.1%		2.8%

SAMPLE INFORMATION: SAS #4834E 06 MW10D - 10 ft

C-F Gravelly, C-F SAND, trace silt and clay

(sp - gp)

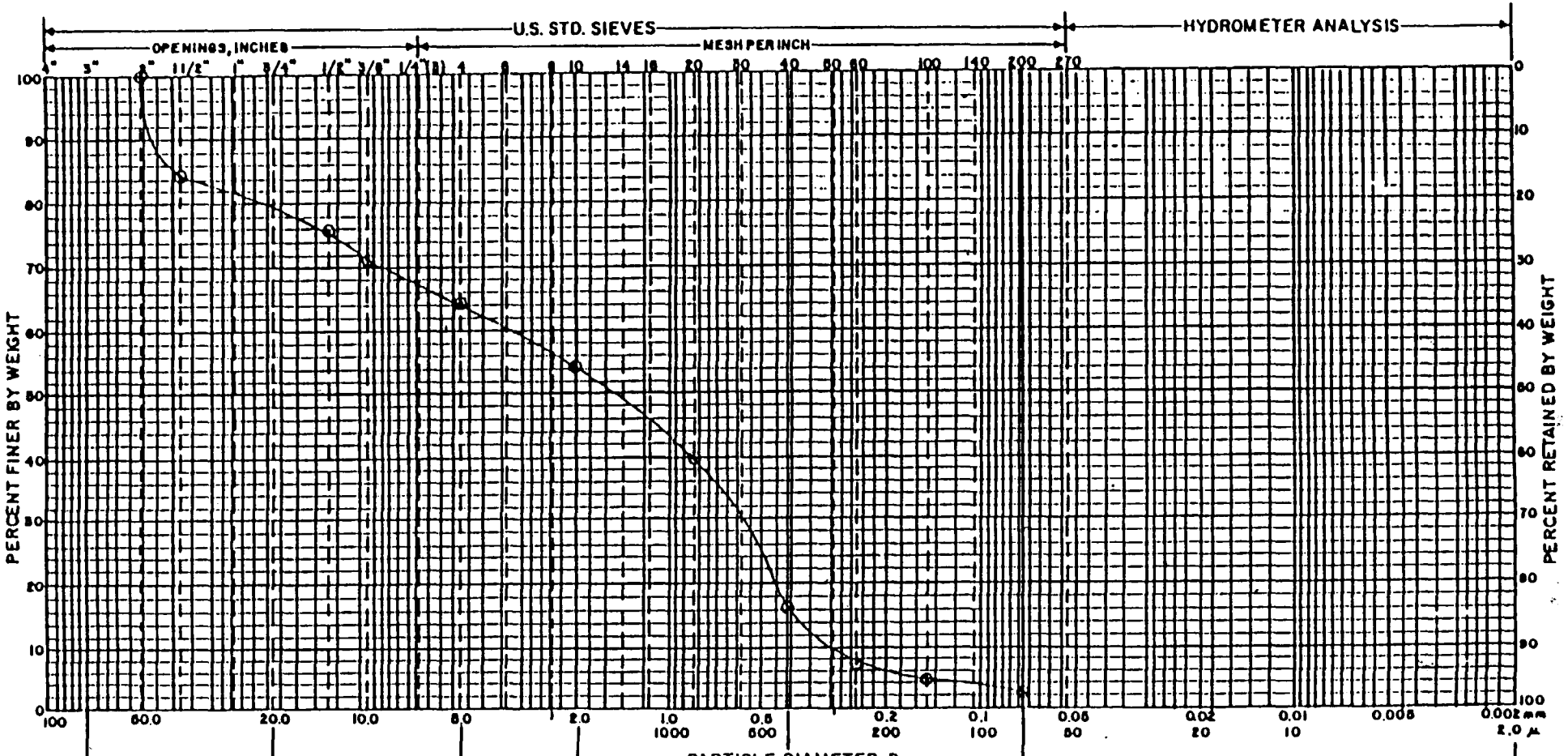
EMPIRE SOILS INVESTIGATIONS INC

PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

153.007

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
	35.5%		62.2%			2.3%

SAMPLE INFORMATION: SAS #4834E 07 MW10D - 40 ft

C-F SAND and C-F GRAVEL, trace silt and clay

(sp - gp)

☒ Insufficient Sample Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC.

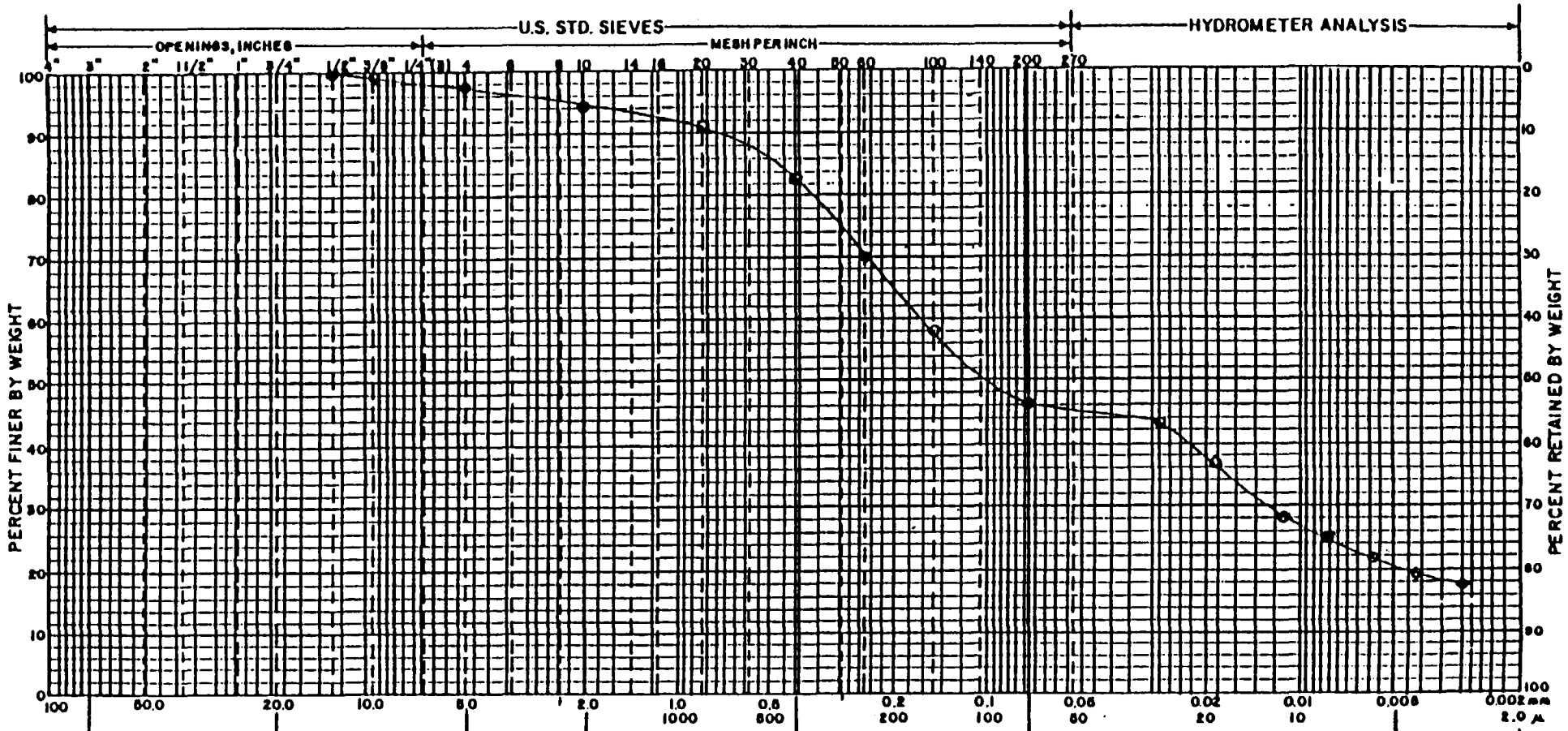
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: NS	CK'D. JFC	DATE: Sept. '89	PROJ. NO. G019.001

153.008

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT	CLAY
		2.3%		51.5%		25.7%	20.5%

SAMPLE INFORMATION: SAS #4834E 08 MW10D - 50 ft

Silty, Clayey, C-F SAND, trace fine gravel

(sm -sc)

☐ Insufficient Sample Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC.

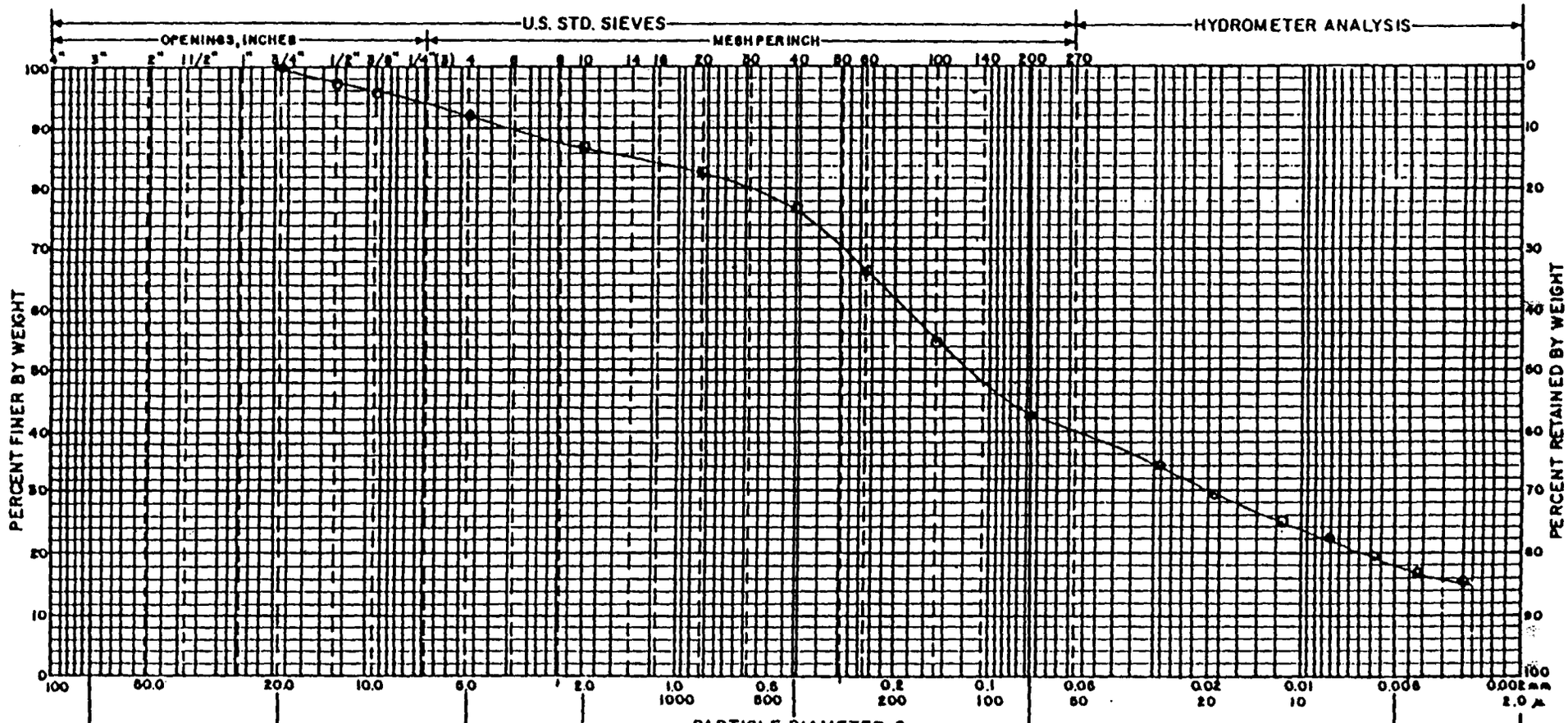
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: JFC	CK'D. JFC	DATE: Sept. '89	PROJ. NO. C019.001

12.5

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT ~~OR COLLOIDS~~	CLAY
		7.9%	49.6%			24.5%	18.0%

SAMPLE INFORMATION: SAS #4834E 25 MW11D*- 15 ft

*now known as MW11S - 15 ft

Silty, C-F SAND, some clay, little fine gravel

(sm)

[X] Insufficient Sample Size per ASTM D 422

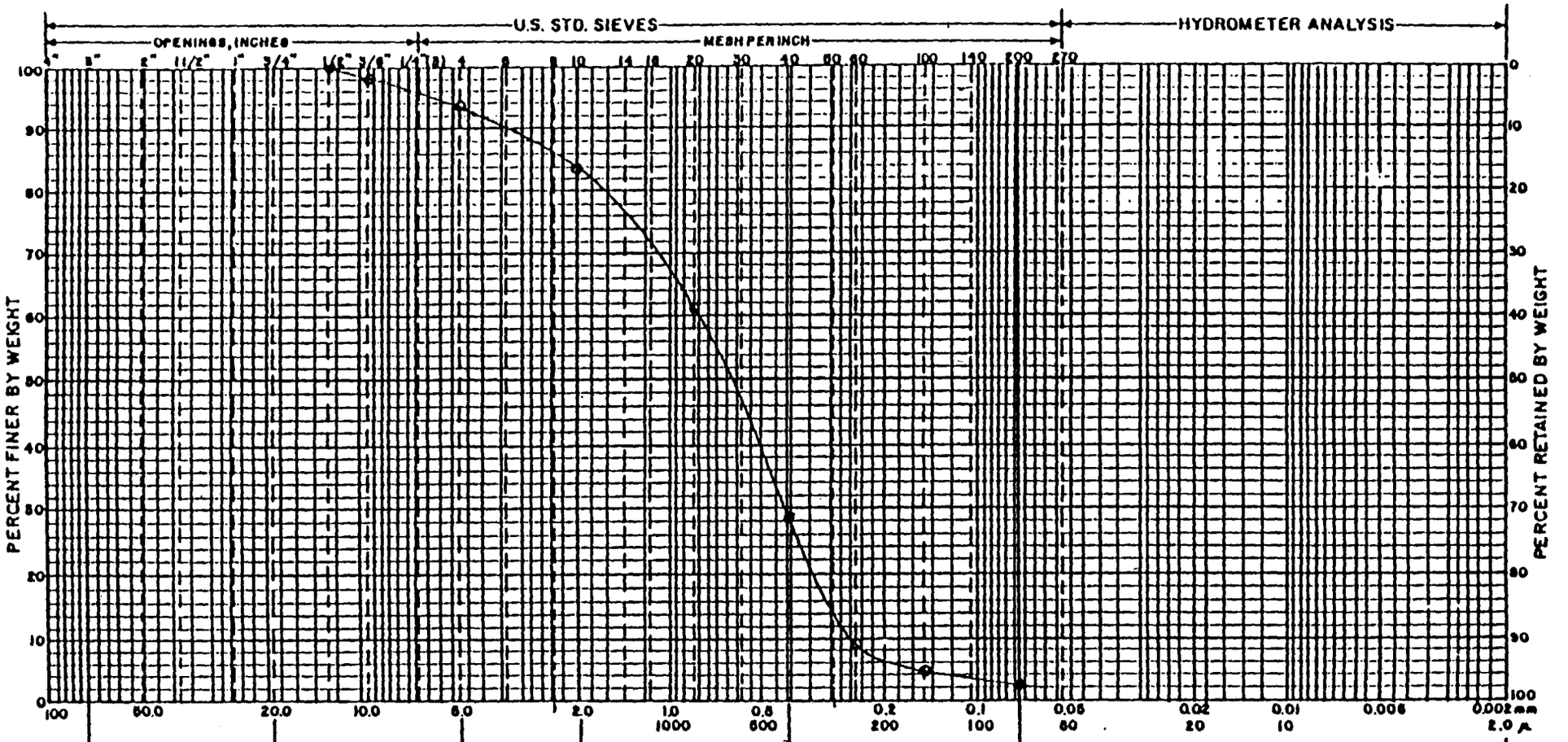
EMPIRE SOILS INVESTIGATIONS INC.

PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: JFC	CK'D. JFC	DATE: Sept. '89	PROJ. NO. G019.001

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-84	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT OR CLAY
		6.4%	91.3%			2.3%

SAMPLE INFORMATION: SAS #4834E 15 MW12D - 20 ft

C-F SAND, little fine gravel, trace silt and clay

(sp)

Particle Size per ASTM D 422

EMPIRE SOILS INVESTIGATIONS INC

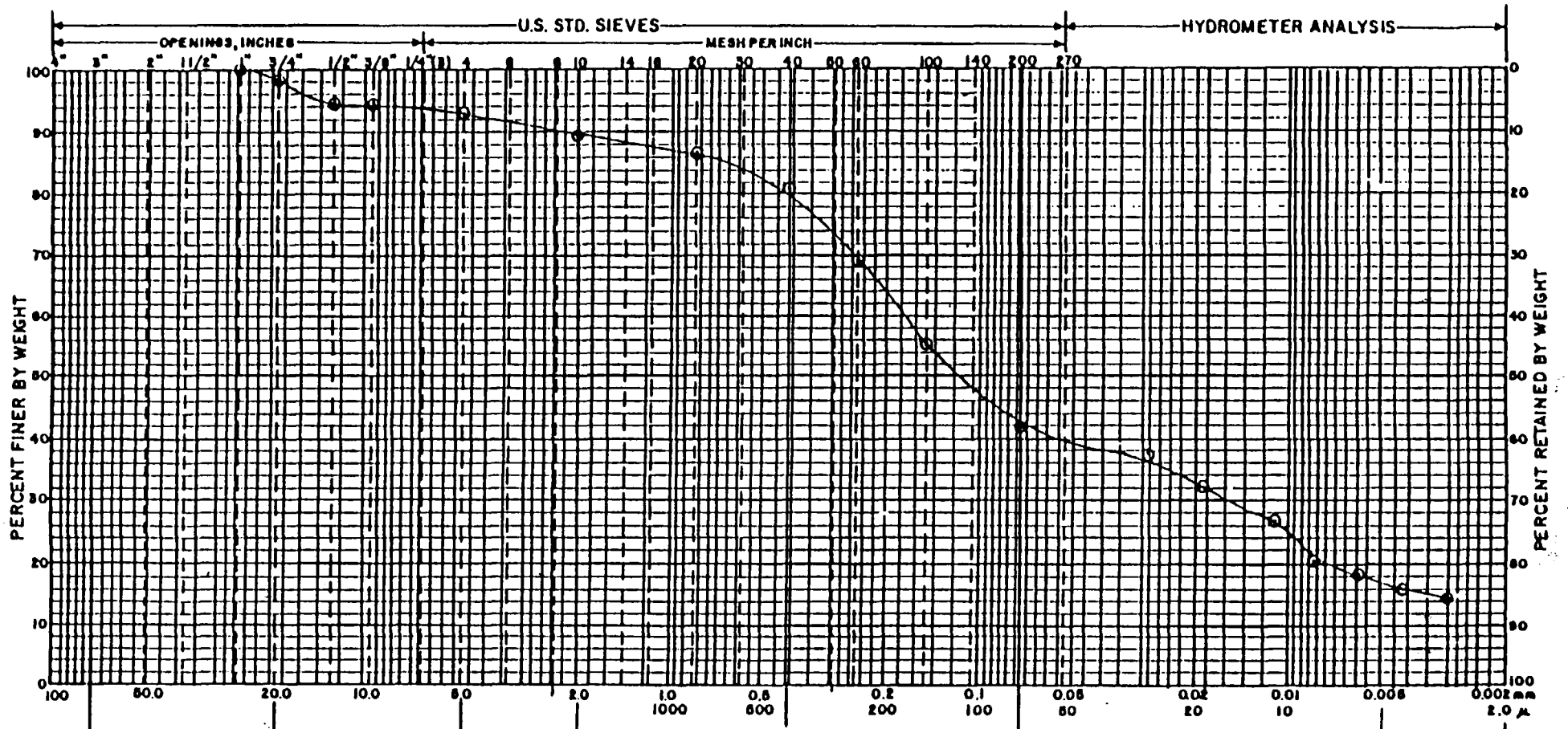
PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: JFC | CK'D. JFC | DATE: Sept. '89 | PROJ. NO. C019.001

153.002

PARTICLE SIZE DISTRIBUTION CURVE



Unified Soil Classification ASTM D 2487-64	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT ~~OR CLAY~~	CLAY
		7.1%		51.0%		24.9%	17.0%

SAMPLE INFORMATION: SAS #4834E 02 MW13D - 27 ft

Silty, C-F SAND, some clay, little C-F gravel

(sm)

(X) Insufficient Sample Size per ASTM D 422

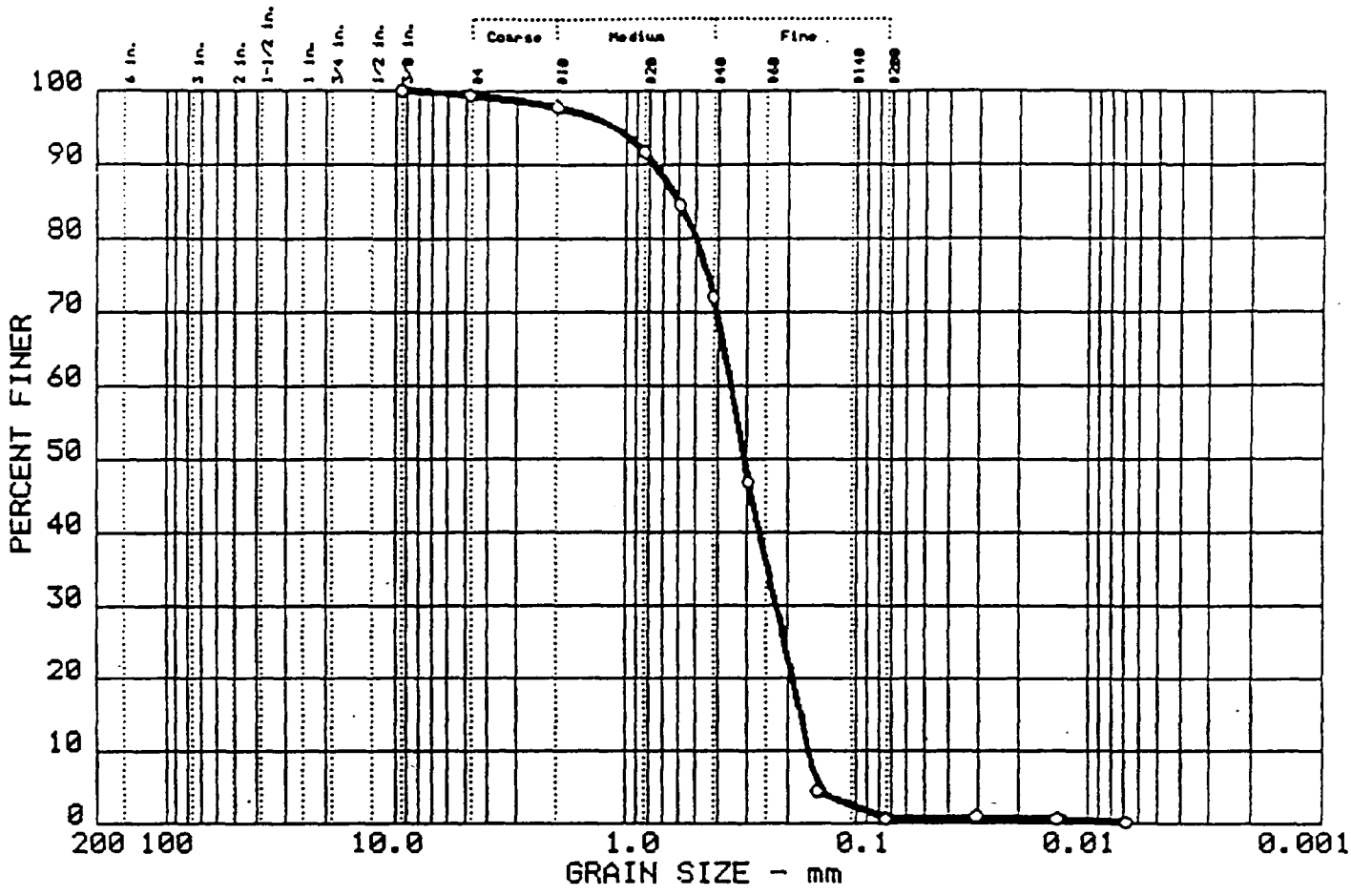
EMPIRE SOILS INVESTIGATIONS INC.

PARTICLE SIZE ANALYSIS

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
US ENVIRONMENTAL PROTECTION AGENCY

DR. BY: NS	CK'D. JFC	DATE: Sept. '89	PROJ. NO. C019.001

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
o	0.0	0.6	98.7	0.7	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	----	----	0.60	0.35	0.31	0.226	0.1768	0.1631	0.89	2.1

MATERIAL DESCRIPTION	USCS
o Brown Fine-Coarse SAND, Trace Silt & Gravel	SP

Project No.: 70051.53
Project: NORTH BRONSON RI/FS, Bronson, MI
o Sample: MB-SB/PZ 1 @ 15.0 FT

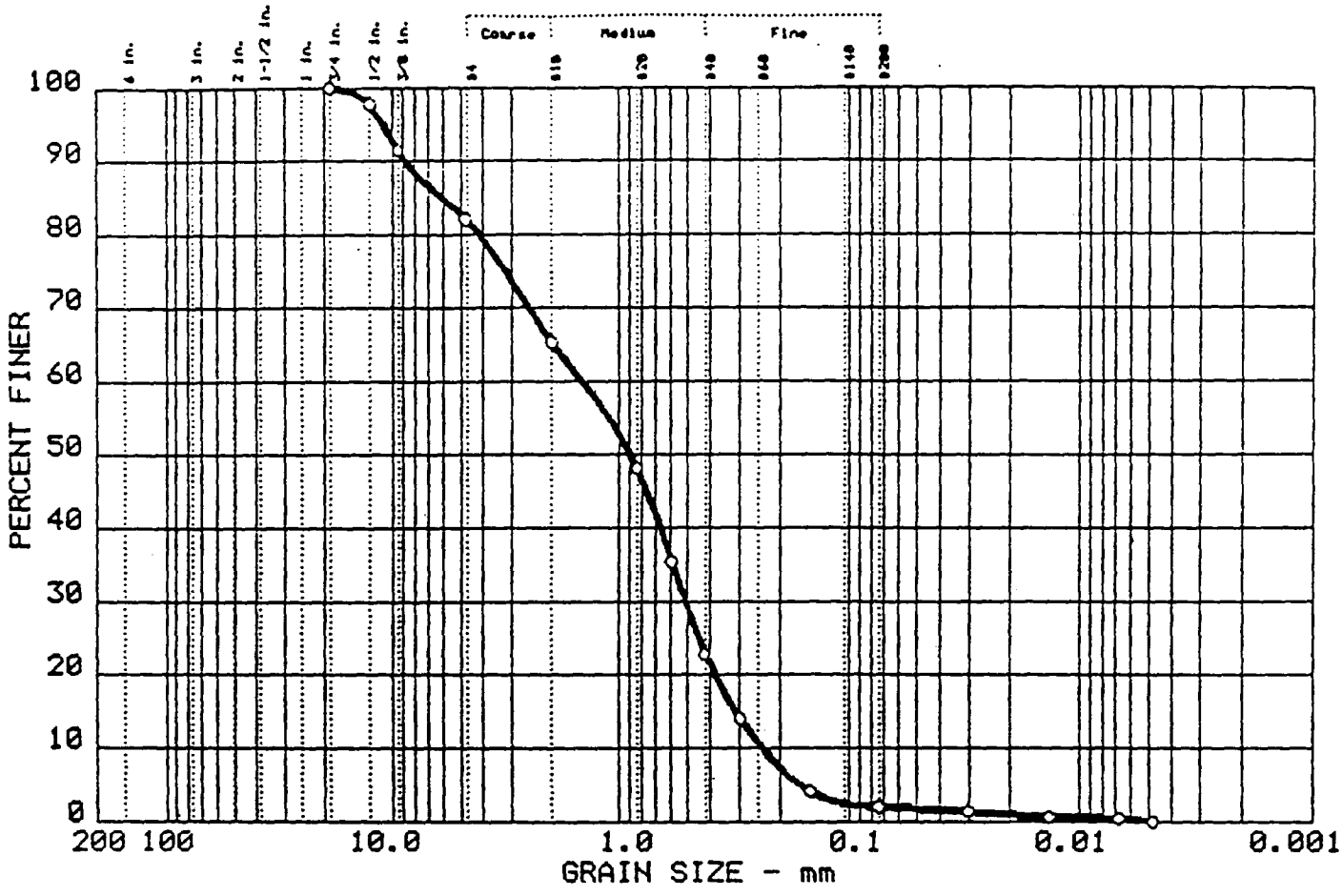
Date: 11/21/91

Remarks:
TESTED BY DWA/RWP
CHECKED BY
APPROVED BY
11-26-91

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN, INC.

Sheet No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
o	0.0	17.8	80.1	1.9	0.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	----	----	5.96	1.46	0.90	0.511	0.3080	0.2363	0.76	6.2

MATERIAL DESCRIPTION	USCS
o Brown Fine-Coarse SAND, Some Gravel, Trace Silt	SR

Project No.: 70051.53
Project: NORTH BRONSON RI/FS, Bronson, MI
o Sample: MB-SB/PZ 1 @ 30.0 FT

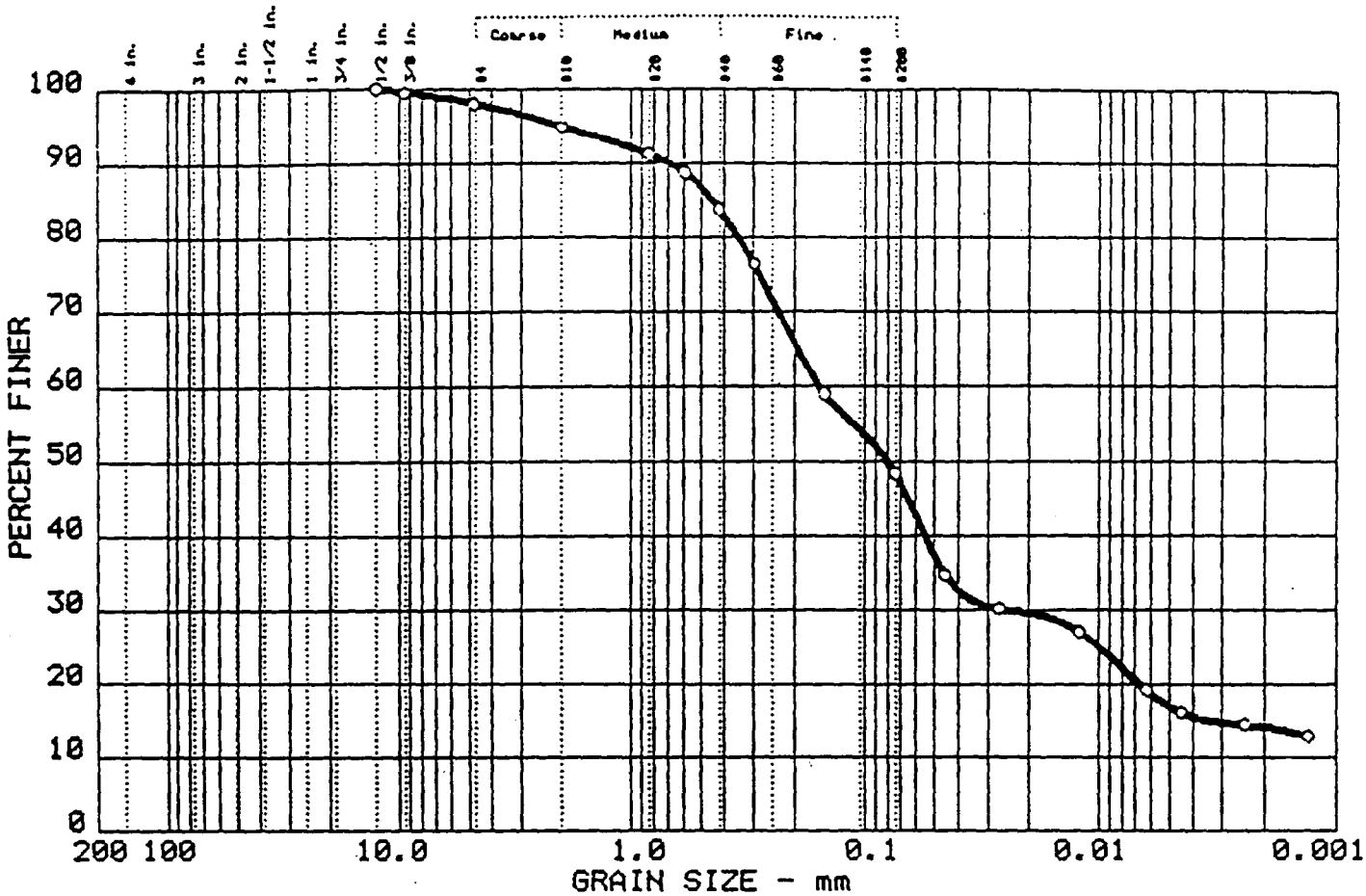
Date: 11/21/91

Remarks:
TESTED BY DWA/RWP
CHECKED BY
APPROVED BY
11.26.91

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN, INC.

Sheet No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
o	0.0	2.0	49.6	31.6	16.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	----	----	0.45	0.16	0.08	0.024	0.0035			

MATERIAL DESCRIPTION	USCS
o Brown Fine-Coarse SAND, Some ~~Silt & Clay~~ Silty, Trace Gravel	SM

Project No.: 70051.53
Project: NORTH BRONSON RI/FS, Bronson, MI
o Sample: MB-SB/PZ 1 @ 61.0 FT

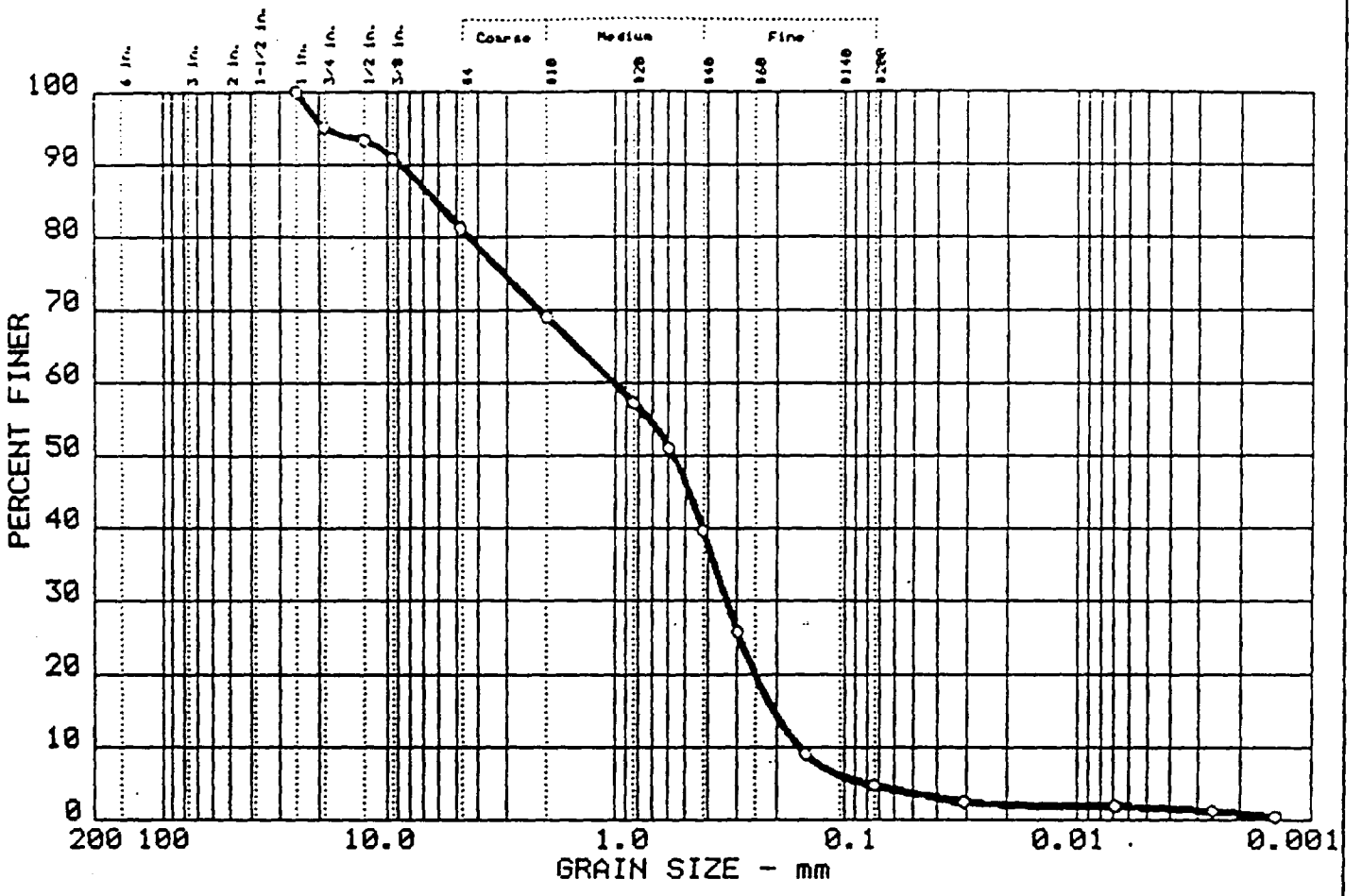
Date: 11/21/91

Remarks:
TESTED BY DWA/RWP
CHECKED BY DWA
APPROVED BY
11-26-91

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN, INC.

Sheet No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
o	0.0	18.7	76.5	3.0	1.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	----	----	6.10	1.01	0.56	0.331	0.2063	0.1583	0.68	6.4

MATERIAL DESCRIPTION	USCS
o Brown Fine-Coarse SAND, Some Gravel, Trace Silt & Clay	SP

Project No.: 70051.53
Project: NORTH BRONSON RI/FS, Bronson MI.
o Sample: MB-PZ6S @ 8.0-10.0 FT

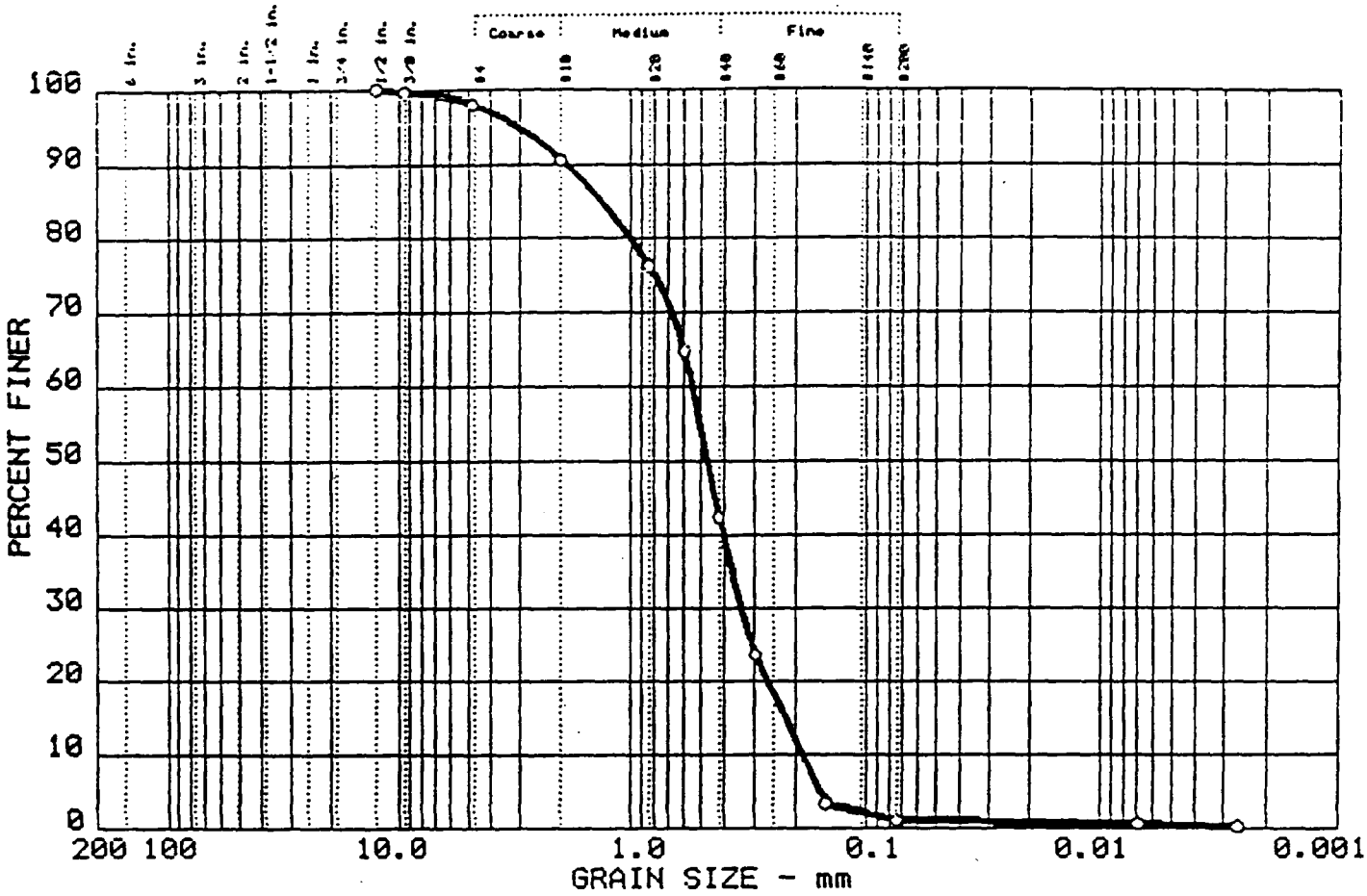
Date: 12/4/91

Remarks:
TESTED BY DWA/RWP
CHECKED BY DWA
APPROVED BY LR
12.5.91

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN, INC.

Sheet No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
o	0.0	2.0	96.9	0.6	0.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	----	----	1.33	0.54	0.47	0.338	0.2205	0.1856	1.13	2.9

MATERIAL DESCRIPTION	USCS
o Brown Fine-Coarse SAND, Trace Gravel, Silt & Clay	SP

Project No.: 70051.53
Project: NORTH BRONSON RI/FS, Bronson MI.
o Sample: MB-PZ8S @ 48.0-50.0 FT

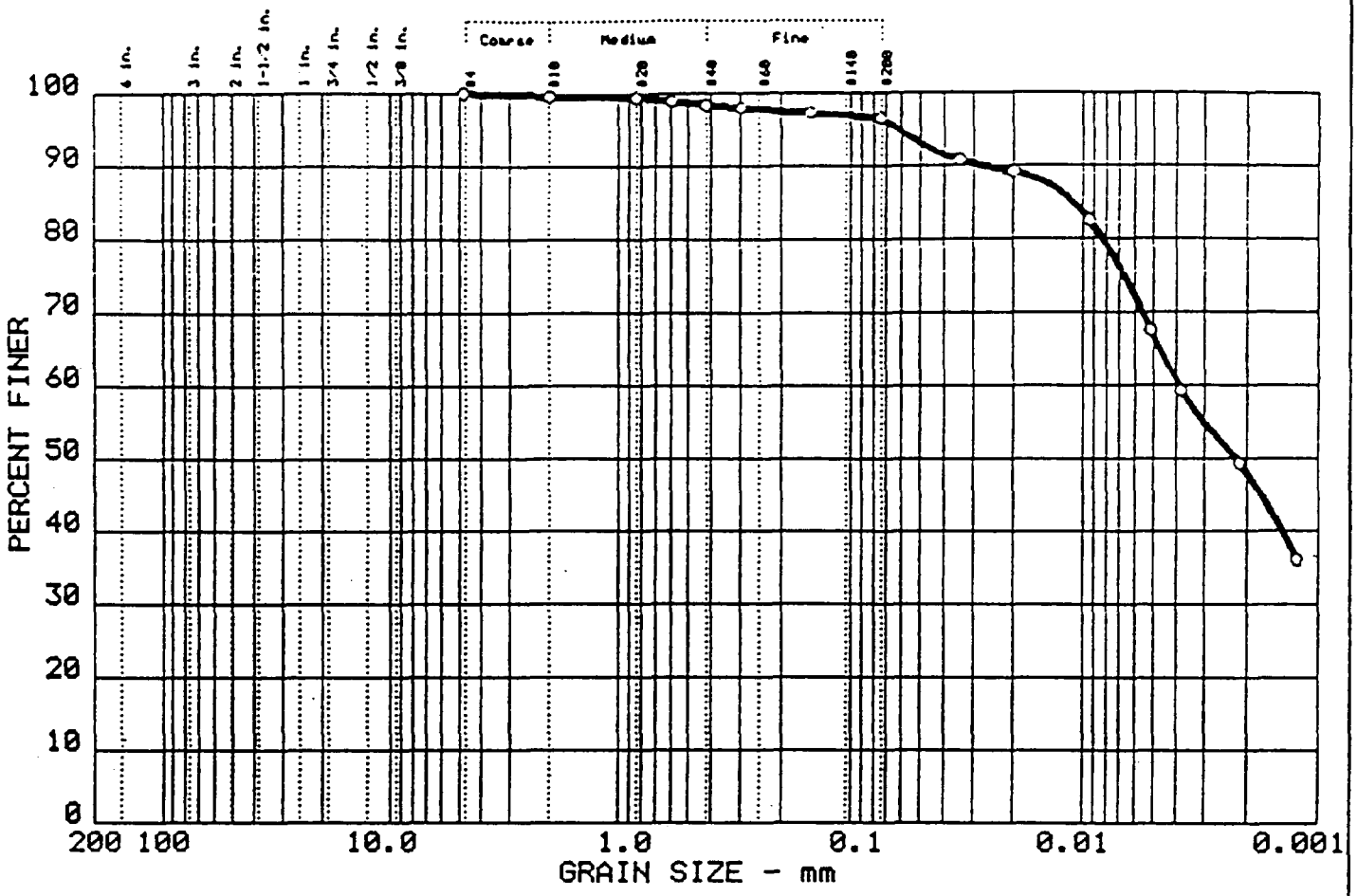
Date: 12/4/91

Remarks:
TESTED BY DWA/RWP
CHECKED BY DWA
APPROVED BY CR
12.5.91

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN, INC.

Sheet No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
o	0.0	0.0	3.5	29.8	66.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	----	----			0.00					

MATERIAL DESCRIPTION	USCS
o Gray Lean CLAY, Trace Sand	CL

Project No.: 70051.53
Project: NORTH BRONSON RI/FS, Bronson MI.
o Sample: MB-PZ6S @ 69.0-71.0 FT

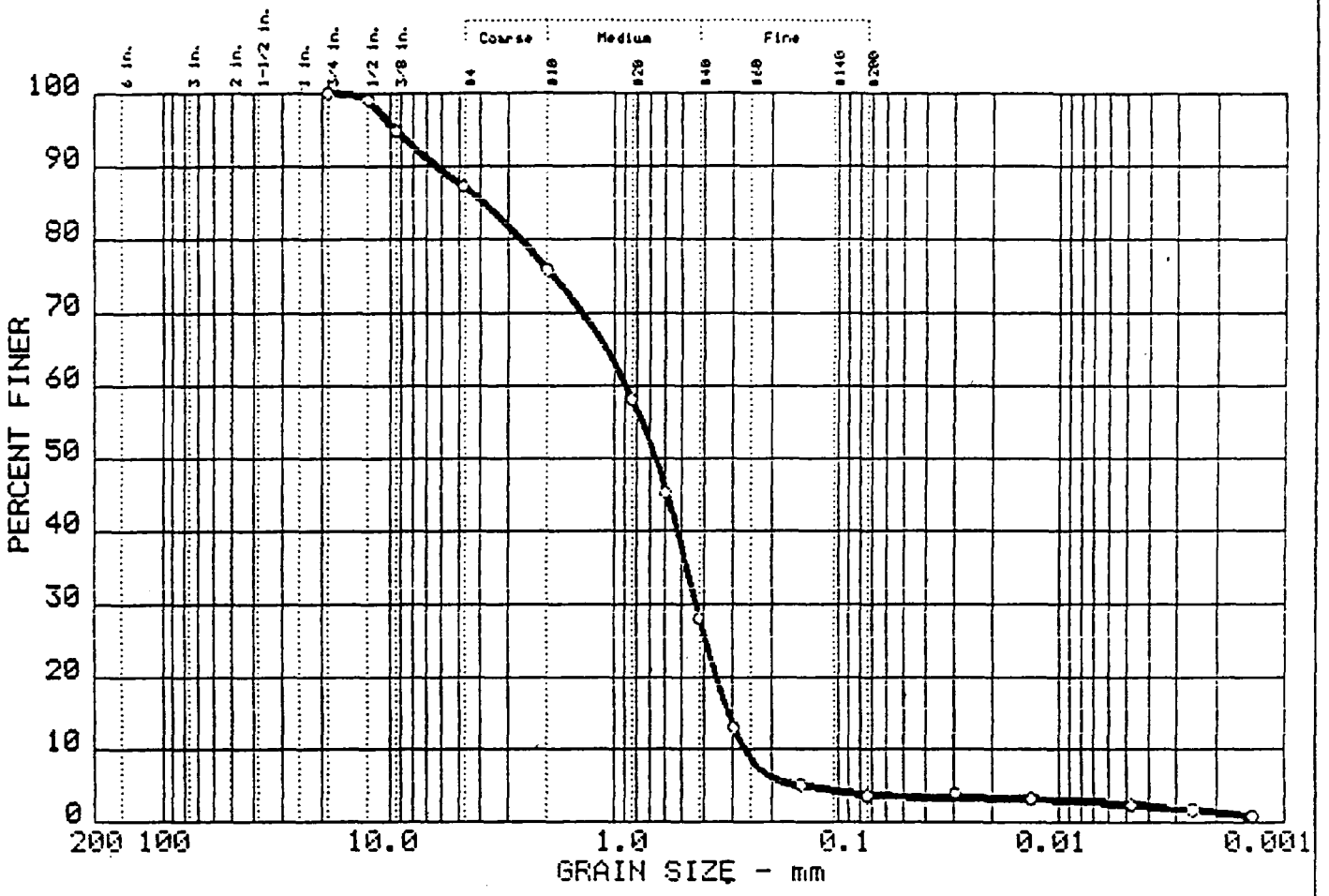
Date: 12/4/91

Remarks:
TESTED BY DWA/RWP
CHECKED BY DWA
APPROVED BY LR
12-5-91

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN, INC.

Sheet No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
o	0.0	12.8	83.7	1.1	2.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	----	----	3.85	0.89	0.66	0.436	0.3144	0.2645	0.80	3.4

MATERIAL DESCRIPTION	USCS
o Brown Fine-Coarse SAND, Some Gravel, Trace Silt & Clay	SP

Project No.: 70051.53
Project: NORTH BRONSON RI/FS,Bronson MI.
o Sample: MB PZ7S @ 8.0-10.0 FT

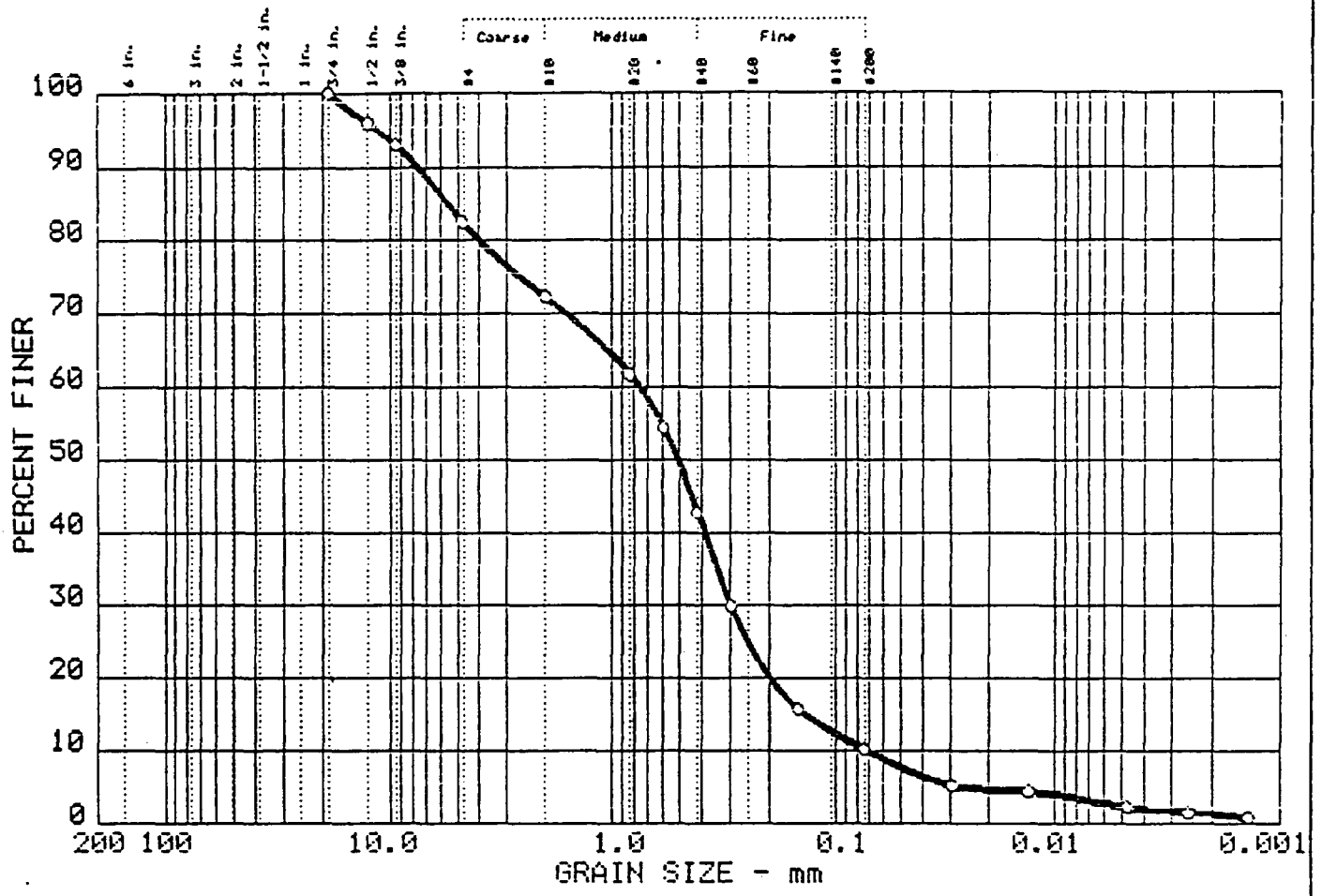
Date: 12/17/91

Remarks:
TESTED BY DWA/RWP
CHECKED BY
APPROVED BY VJR

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN, INC.

Sheet No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
o	0.0	17.5	72.3	7.8	2.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	----	----	5.56	0.75	0.51	0.297	0.1373	0.0712	1.65	10.5

MATERIAL DESCRIPTION	USCS
o Brown Fine-Coarse SAND, Some Gravel, Little Silt, Trace Clay	SW-SM

Project No.: 70051.53
Project: NORTH BRONSON RI/FS, Bronson MI.
o Sample: MB PZ7S @ 38.0-40.0 FT

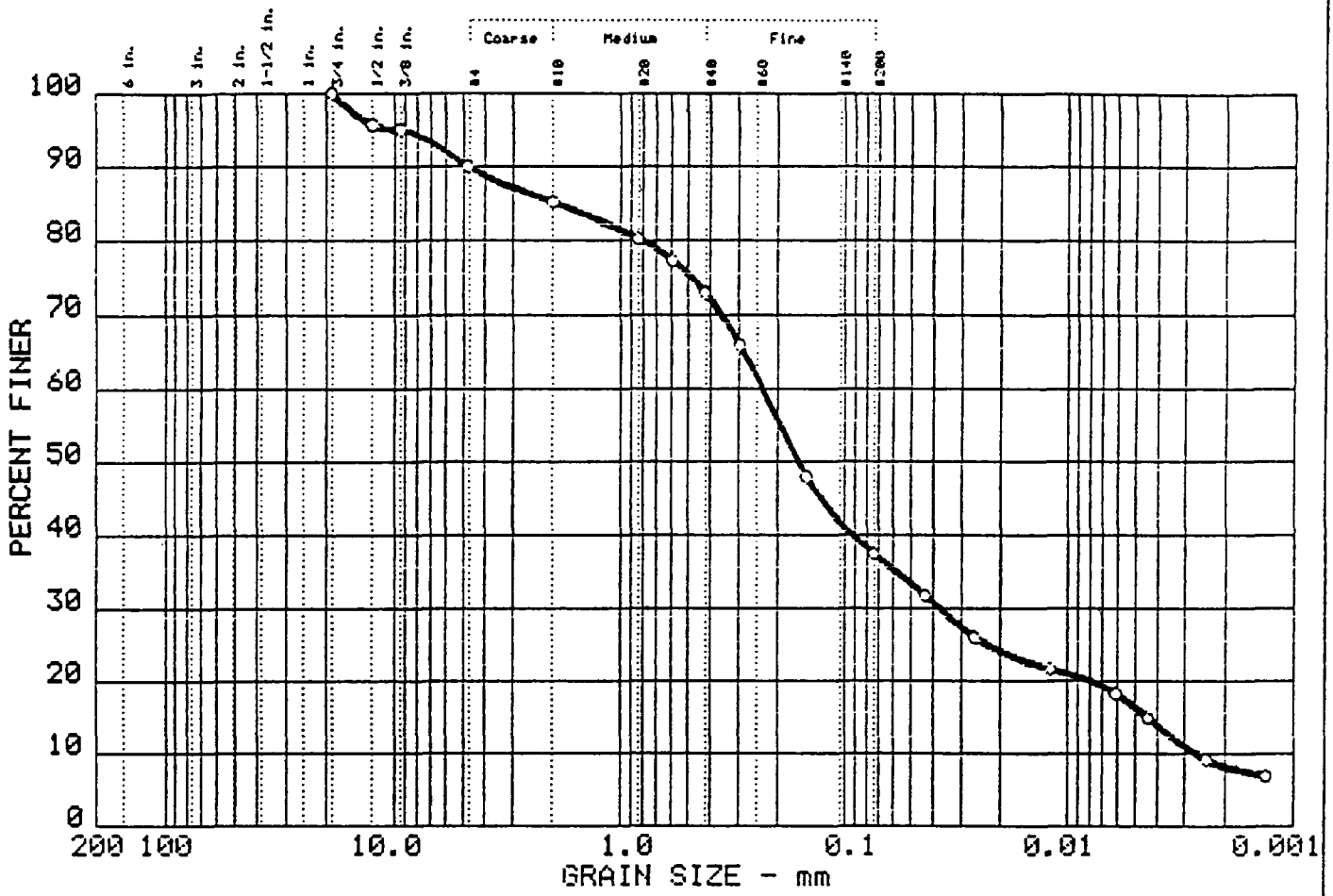
Date: 12/17/91

Remarks:
TESTED BY DWA/RWP
CHECKED BY DWA
APPROVED BY KJR

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN, INC.

Sheet No.

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	10.0	52.6	21.1	16.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	----	----	1.93	0.24	0.16	0.037	0.0044	0.0027	2.16	88.1

MATERIAL DESCRIPTION	USCS
○ Brown Silty Fine-Coarse SAND, Some Clay, Little Gravel	SM

Project No.: 70051.53
Project: NORTH BRONSON RI/FS, Bronson MI.
○ Sample: MB PZ7S @ 42.0-44.0 FT

Date: 12/17/91

Remarks:
TESTED BY DWA/RWP
CHECKED BY
APPROVED BY

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN, INC.

Sheet No.

E

PERMEABILITY TEST RESULTS

Job No. 70051
Date: 12/17/91

FALLING HEAD PERMEABILITY TEST

Warzyn Inc., 1 Science Court, Madison, WI 53711 Phone: (608) 231-6955 or 231-4747

PROJECT	NORTH BRONSON RI/FS
LOCATION	Bronson MI.
SAMPLE (a)	MB PZ1S
DEPTH (ft)	58.0-58.8 FT
SOIL DESCRIPTION (b)	Gray-Brown Fine-Coarse SAND, Some Silt & Clay, Little Gravel (SM)
SAMPLE DIAMETER (cm)	7.3
SAMPLE AREA, A(cm^2)	42.0

	INITIAL	FINAL
SAMPLE LENGTH, L(cm)	16.3	16.5
MOISTURE CONTENT, %	9.8	9.9
DRY DENSITY (lb/cu ft)	134.3	132.3

RUN	COEFFICIENT OF PERMEABILITY, k(cm/sec)
1	3.1E-08
2	2.1E-08
3	1.0E-08
4	6.4E-09
5	7.1E-09
6	6.4E-09
7	8.6E-09
8	9.3E-09
9	1.0E-08
10	8.6E-09

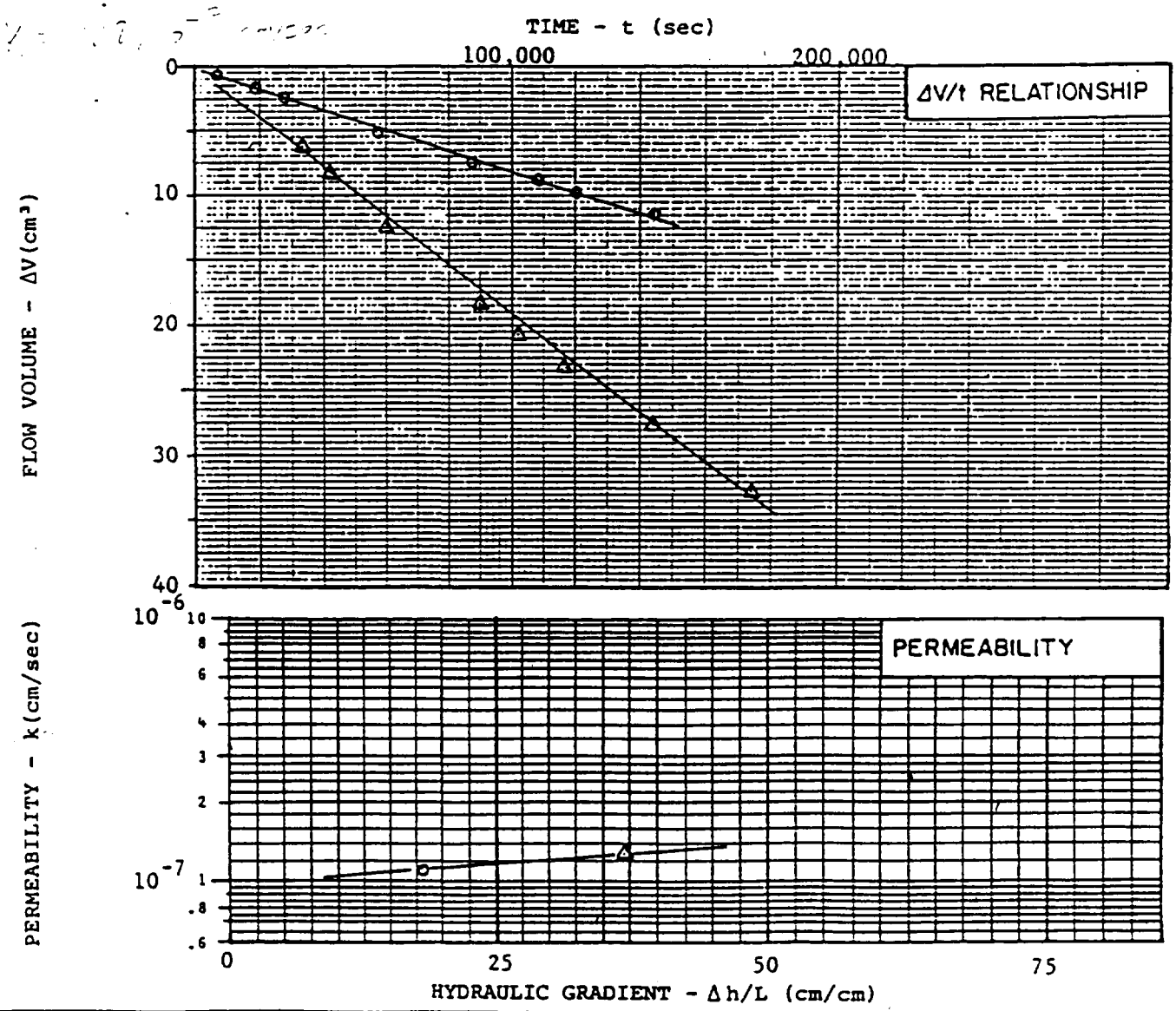
AVERAGE COEFFICIENT OF PERMEABILITY = 9.3E-09 cm/sec
(Based on run numbers 8 through 10)

FORMULA: $k = \frac{2.3aL}{At} \log_{10} \frac{h_0}{h_1}$, Where a = cross-sectional area of standpipe,
t = time for water level to fall from initial height, h_0, to final height, h_1
(All other terms are defined above)

FOOTNOTES: (a) This permeability test was performed on a relatively undisturbed 3-inch diameter Shelby tube sample.
(b) Soil description is based on visual observation only.

CHECKED BY: [illegible] DATE: 12/30/91 APPROVED BY: VJR DATE: 12-31-91

TEST DATA:			SAMPLE DATA:
Specimen Height (cm):		7.80	Sample Identification:
Specimen Diameter (cm):		7.18	Sample No. SAS #4834E 40 MW12D-28
Dry Unit Weight (pcf):		134.7	Visual Description: Brownish grey sand,
Moisture Content Before Test (%):		8.6	some silt, little fine to med. gravel.
Moisture Content After Test (%):		8.9	Remarks: Test conducted in accord with
Cell Confining Pressure (psi):		60.0	EM 1110-2-1906, App. VII (7).
Test Pressure (psi):	51.8	54.0	Maximum Dry Density
Back Pressure (psi):	50.1	50.1	(ASTM D ____) (pcf):
Differential Head (psi):	1.7	3.9	Optimum Moisture Content (%):
Flow Rate (ΔV/t) (cm³/sec)	O 7.99×10^{-5}	Δ 1.90×10^{-4}	Percent Compaction:
Permeability (cm/sec):	O 1.09×10^{-7}	Δ 1.27×10^{-7}	Permeameter Type: Flexible Wall

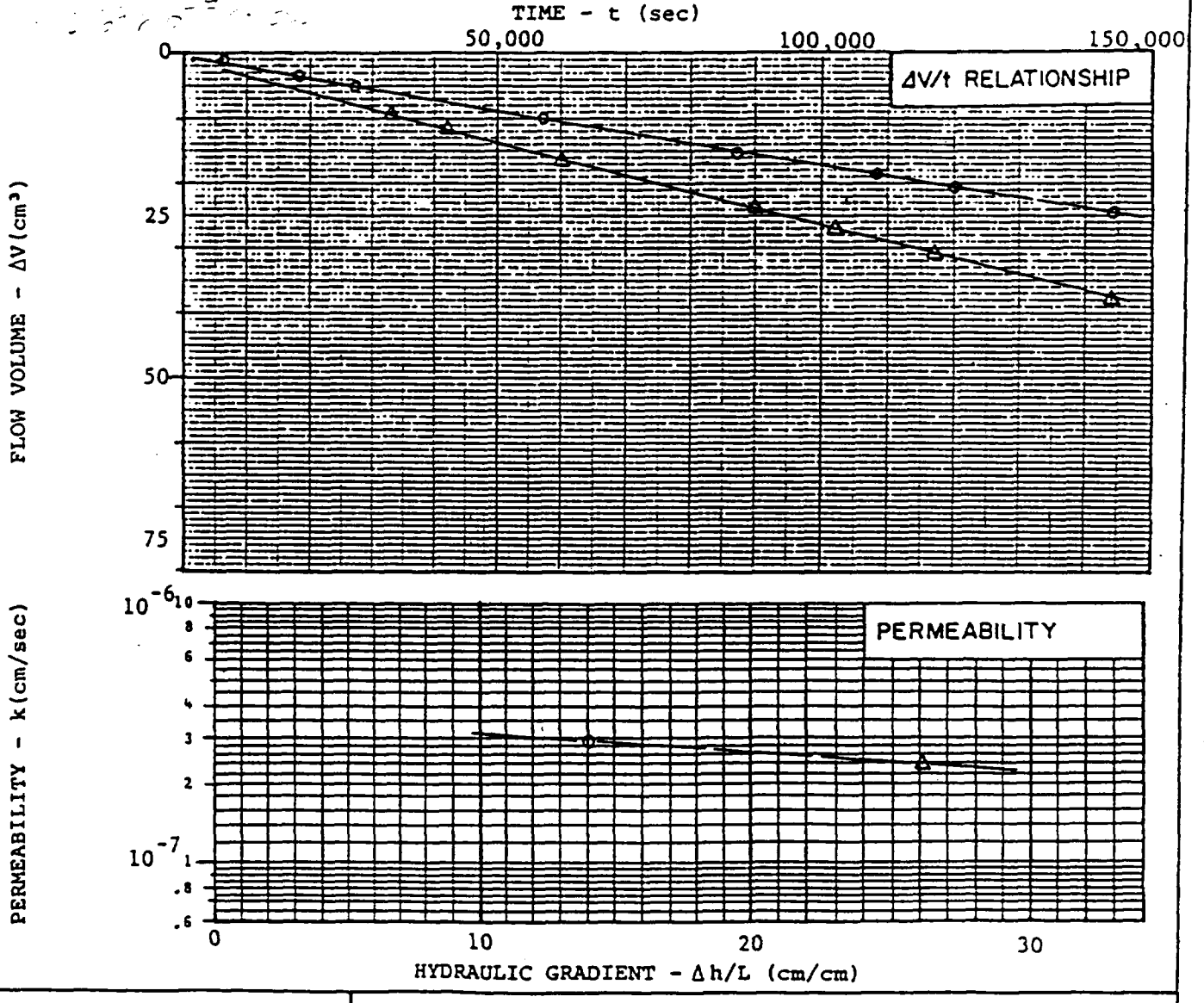


EMPIRE SOILS INVESTIGATIONS INC

PERMEABILITY TEST REPORT

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
U.S. ENVIRONMENTAL PROTECTION AGENCY

TEST DATA:			SAMPLE DATA:
Specimen Height (cm):		10.78	Sample Identification:
Specimen Diameter (cm):		7.25	Sample No. SAS #4834E 41 MW6D-15ft
Dry Unit Weight (pcf):		136.0	Visual Description: now known as MW6S-15ft Grey brown sand,
Moisture Content Before Test (%):		9.2	some silt, little fine gravel.
Moisture Content After Test (%):		8.8	Remarks: Thin inclined seams of med.
Cell Confining Pressure (psi):		60.0	brown sand in specimen.
Test Pressure (psi):	51.9	54.0	Maximum Dry Density EM 1110-2-1906, App. VII (7)
Back Pressure (psi):	50.0	50.1	(ASTM D ____) (pcf):
Differential Head (psi):	1.9	3.9	Optimum Moisture Content (%):
Flow Rate ($\Delta V/t$) (cm^3/sec)	O 1.67×10^{-4}	Δ 2.56×10^{-4}	Percent Compaction:
Permeability (cm/sec):	O 2.90×10^{-7}	Δ 2.37×10^{-7}	Permeameter Type: Flexible Wall



EMPIRE SOILS INVESTIGATIONS INC

PERMEABILITY TEST REPORT

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
U.S. ENVIRONMENTAL PROTECTION AGENCY

153.

TEST DATA:

Specimen Height (cm):		9.43
Specimen Diameter (cm):		7.22
Dry Unit Weight (pcf):		136.1
Moisture Content Before Test (%):		10.1
Moisture Content After Test (%):		9.4
Cell Confining Pressure (psi):		60.0
Test Pressure (psi):	52.0	54.0
Back Pressure (psi):	50.1	50.1
Differential Head (psi):	1.9	3.9
Flow Rate ($\Delta V/t$) (cm^3/sec)	O 5.52×10^{-5}	Δ 1.06×10^{-4}
Permeability (cm/sec):	O 8.36×10^{-8}	Δ 8.49×10^{-8}

SAMPLE DATA:

Sample Identification:

Sample No. SAS #4834E 42 MW11S-19

Visual Description: Grey brown sand & silt, little fine gravel.

Remarks: Test conducted in accord with EM 1110-2-1906, App. VII (7).

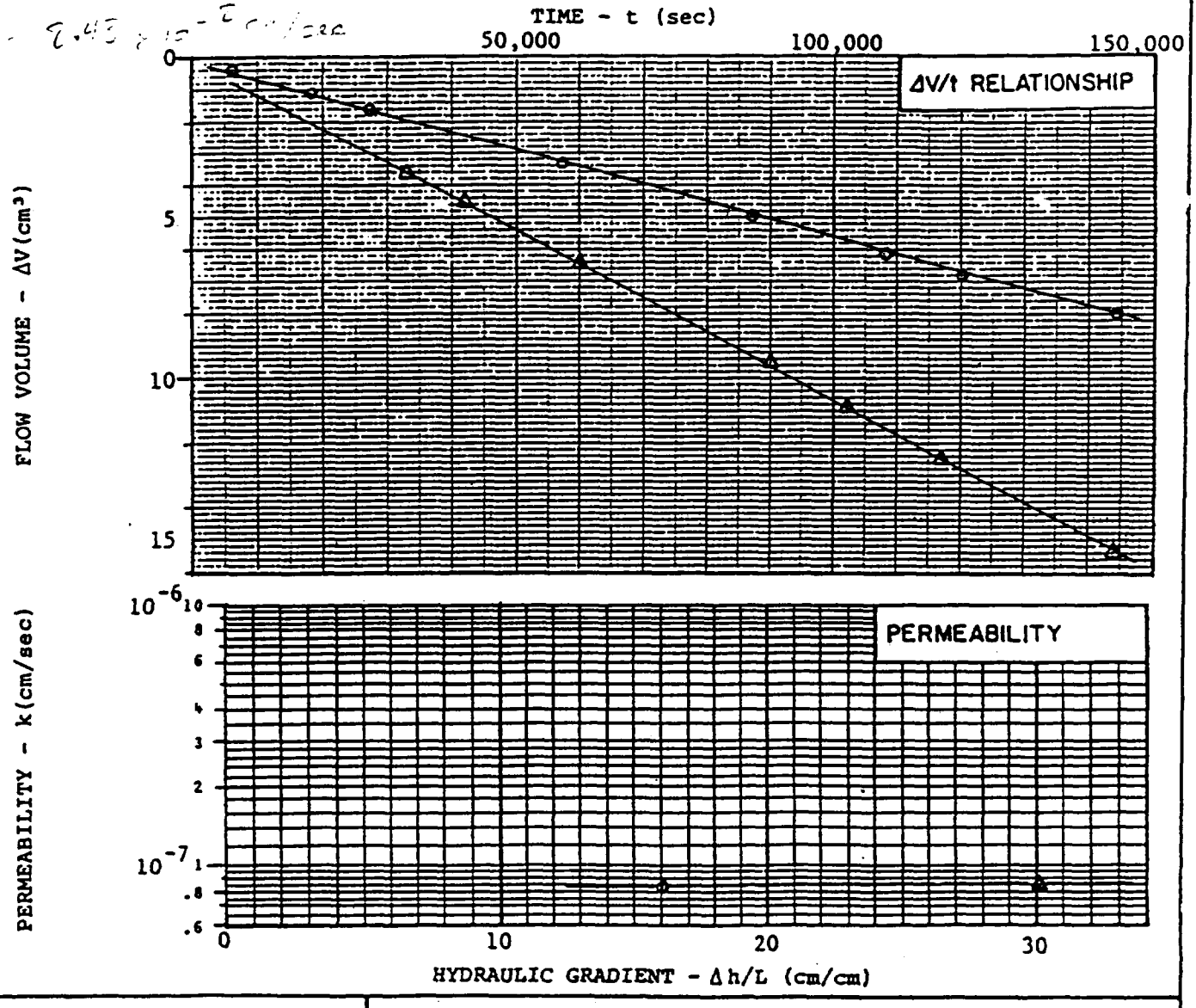
Maximum Dry Density (ASTM D ____) (pcf):

Optimum Moisture Content (%):

Percent Compaction:

Permeameter Type: Flexible Wall

k - 8.43 x 10^-8 cm/sec



EMPIRE SOILS INVESTIGATIONS INC

PERMEABILITY TEST REPORT

SAS #4834E
CLP SAMPLE MANAGEMENT OFFICE
U.S. ENVIRONMENTAL PROTECTION AGENCY

Job No. 70051
Date: 12/17/91

FALLING HEAD PERMEABILITY TEST

Warzyn Inc., 1 Science Court, Madison, WI 53711 Phone: (608) 231-6355 or 231-4747

PROJECT	NORTH BRONSON RI/FS
LOCATION	Bronson MI.
SAMPLE (a)	MB PZ6S
DEPTH (ft)	68.0-68.8 FT
SOIL DESCRIPTION (b)	Gray-Brown Lean CLAY, Little Sand (CL)
SAMPLE DIAMETER (cm)	7.3
SAMPLE AREA, A(cm^2)	42.0

	INITIAL	FINAL
SAMPLE LENGTH, L(cm)	4.4	4.4
MOISTURE CONTENT, %	20.9	20.9
DRY DENSITY (lb/cu ft)	118.5	118.5

RUN	COEFFICIENT OF PERMEABILITY, k(cm/sec)
1	1.1E-08
2	6.1E-09
3	2.7E-09
4	1.8E-09
5	2.1E-09
6	2.0E-09
7	2.1E-09
8	2.3E-09
9	2.3E-09
10	2.5E-09

AVERAGE COEFFICIENT OF PERMEABILITY = 2.4E-09 cm/sec
(Based on run numbers 8 through 10)

FORMULA: $k = \frac{2.3aL}{At} \log_{10} \frac{h_0}{h_1}$, Where a = cross-sectional area of standpipe,
t = time for water level to fall from initial height, h_0, to final height, h_1
(All other terms are defined above)

FOOTNOTES: (a) This permeability test was performed on a relatively undisturbed 3-inch diameter Shelby tube sample.

(b) This soil description is based on visual observation only.

CHECKED BY: DWA DATE: 12/30/91 APPROVED BY: VJR DATE: 12-31-91

Job No. 70051
Date: 12/17/91

FALLING HEAD PERMEABILITY TEST

Warzyn Inc., 1 Science Court, Madison, WI 53711 Phone: (608) 231-6955 or 231-4747

PROJECT	NORTH BRONSON RI/FS
LOCATION	Bronson MI.
SAMPLE (a)	MB PZ7S
DEPTH (ft)	42.0-42.8 FT
SOIL DESCRIPTION (b)	Gray-Brown Fine-Coarse SAND, Some Silt & Clay, Little Gravel (SM)
SAMPLE DIAMETER (cm)	7.3
SAMPLE AREA, A(cm^2)	42.0

	INITIAL	FINAL
SAMPLE LENGTH, L(cm)	18.3	18.3
MOISTURE CONTENT, %	8.9	9.1
DRY DENSITY (lb/cu ft)	134.1	134.1

RUN	COEFFICIENT OF PERMEABILITY, k(cm/sec)
1	6.6E-07
2	4.0E-07
3	3.3E-07
4	3.2E-07
5	3.2E-07
6	3.3E-07
7	3.2E-07
8	3.2E-07
9	3.2E-07
10	3.1E-07

AVERAGE COEFFICIENT OF PERMEABILITY = 3.2E-07 cm/sec
(Based on run numbers 8 through 10)

FORMULA: $k = \frac{2.3aL}{At} \log_{10} \frac{h_0}{h_1}$, Where a = cross-sectional area of standpipe,
t = time for water level to fall from initial height, h_0, to final height, h_1
(All other terms are defined above)

FOOTNOTES: (a) This permeability test was performed on a relatively undisturbed 3-inch diameter Shelby tube sample.
(b) Soil description is based on visual observation only.

CHECKED BY: [signature] DATE: 12/30/91 APPROVED BY: VJR DATE: 12-31-91

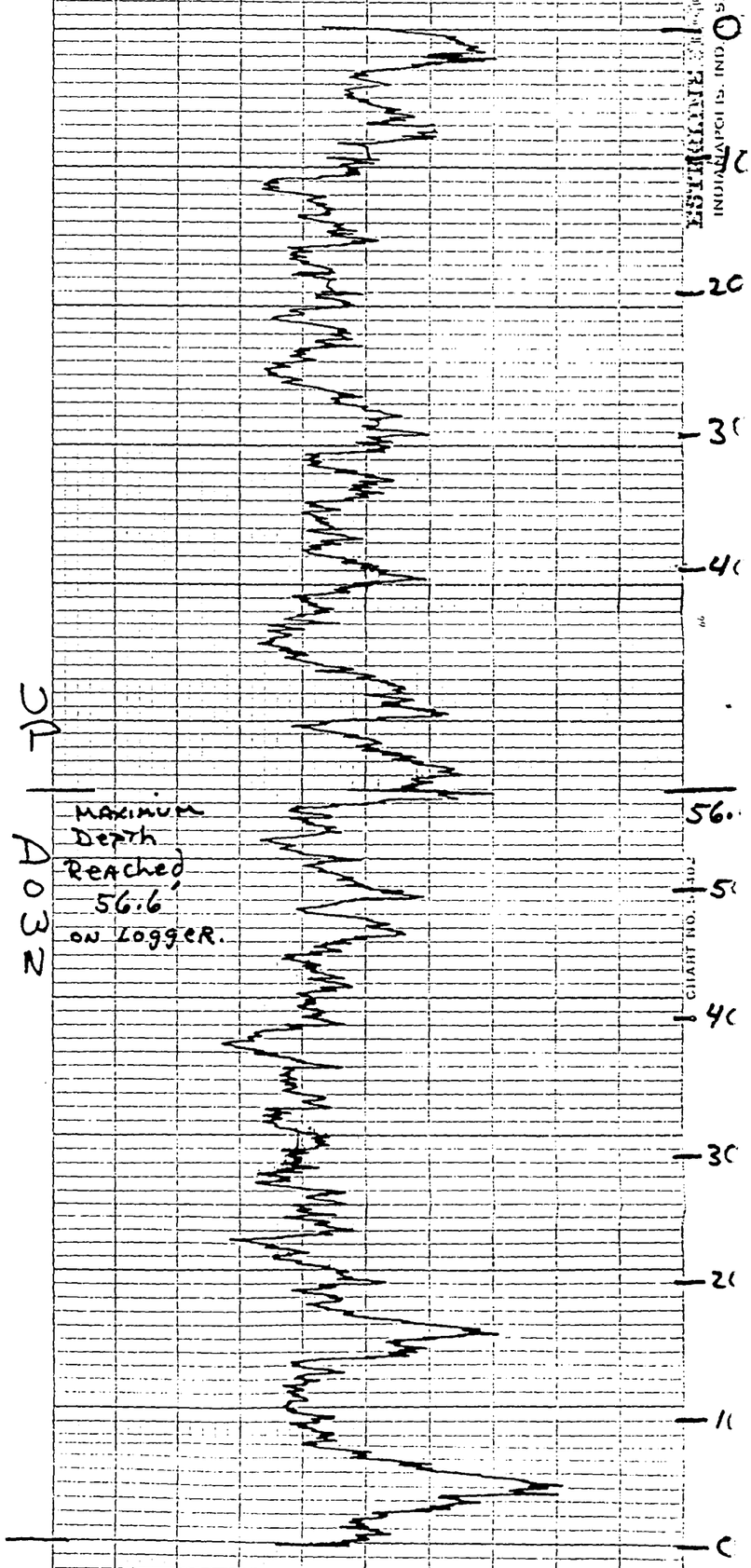
F

GAMMA LOGS

MW-19

11-12-91

END of RUN AT SURFACE



Begining at Surface.

Chart Speed: 10

Sensitivity : .1

MW19

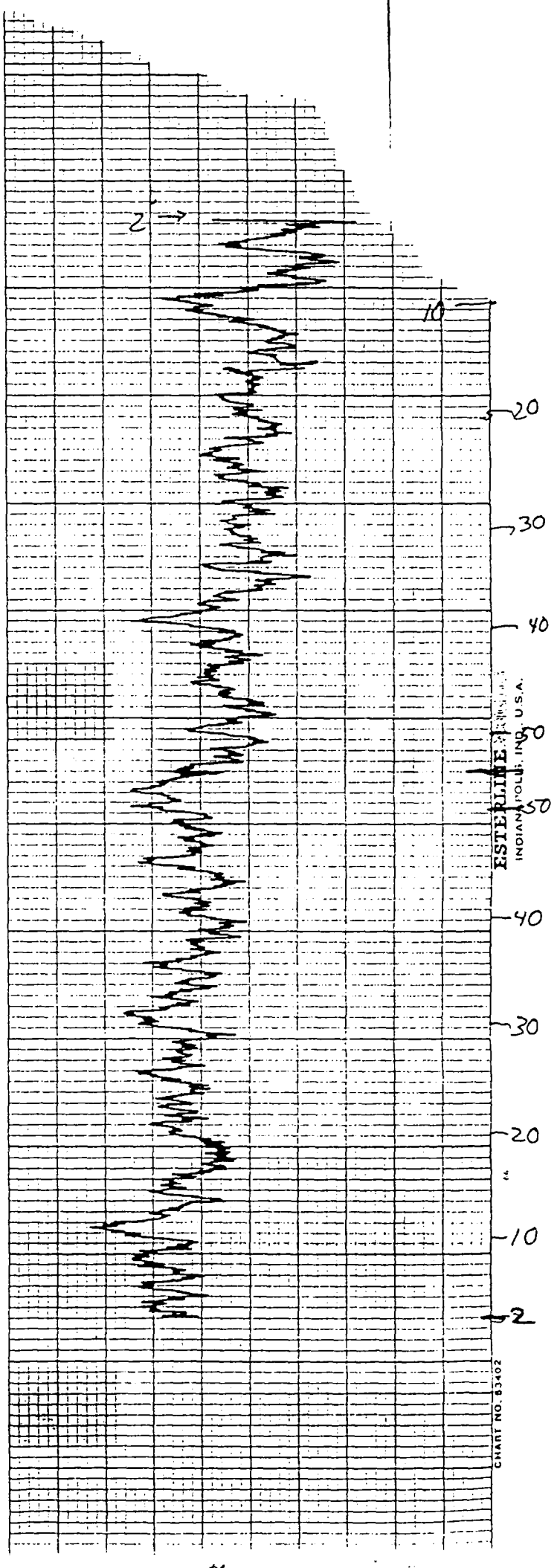
N. BRONSON
MW-20

Depth counter
R+D .4 AT Top
NOT 0.

Clay @ ?
Possible ≈ 53'

Chart
Sens. .1
Speed 10

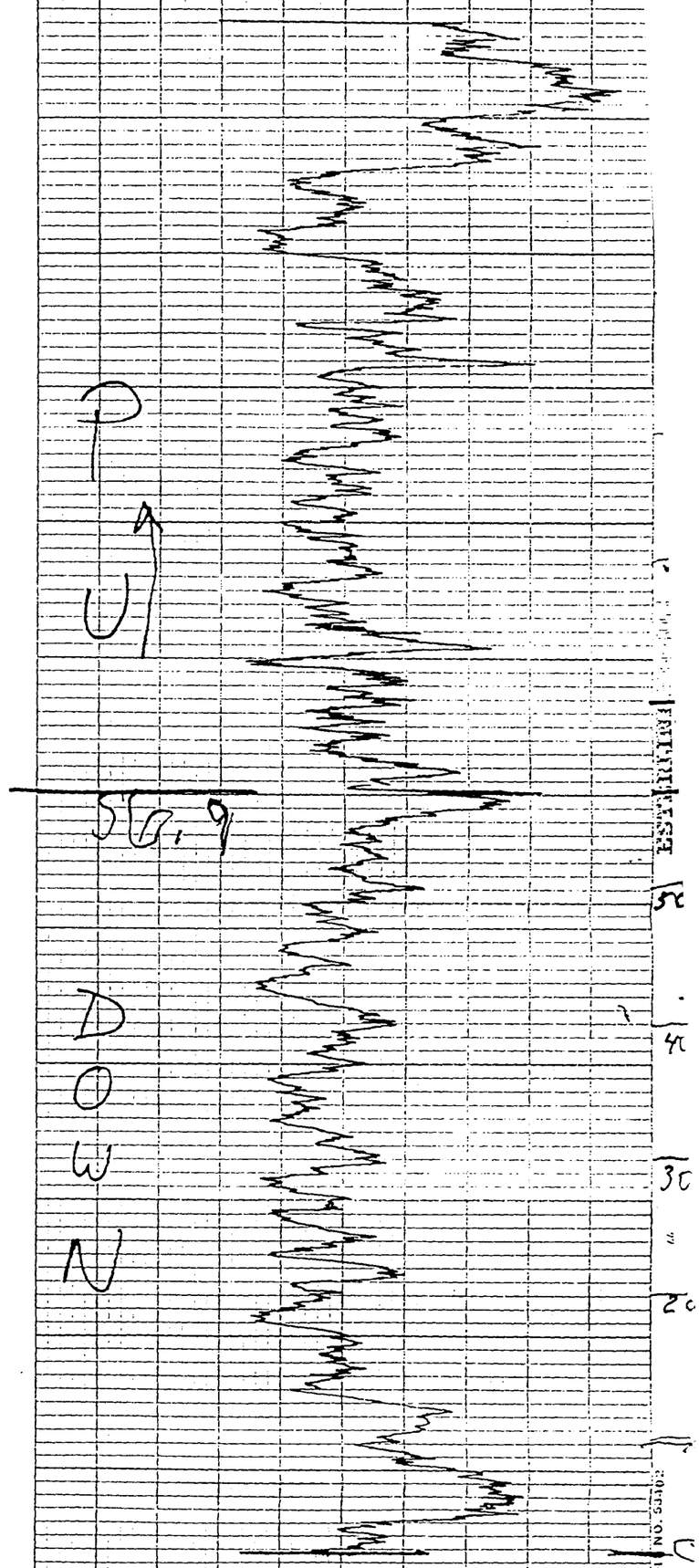
G.R.
T.C. 10
Sens. 1K



MW 20

11-4-91

16:00 WsBolio



MW21

MW-21

GAMMA RAY

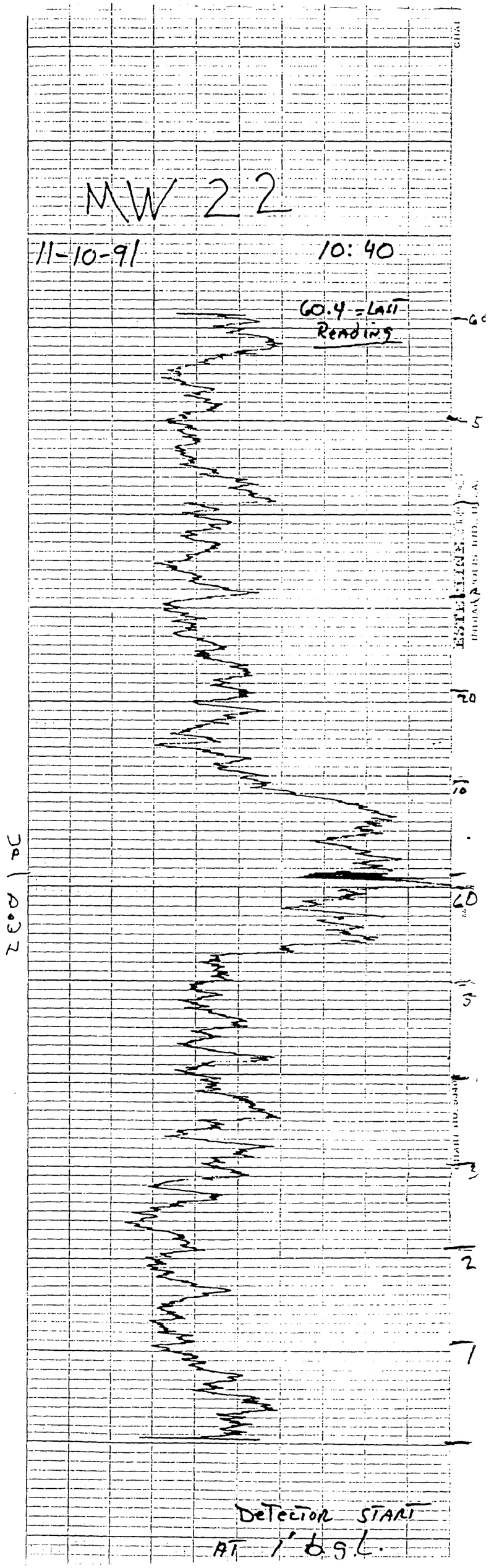
Time Constant ~~#~~ 10

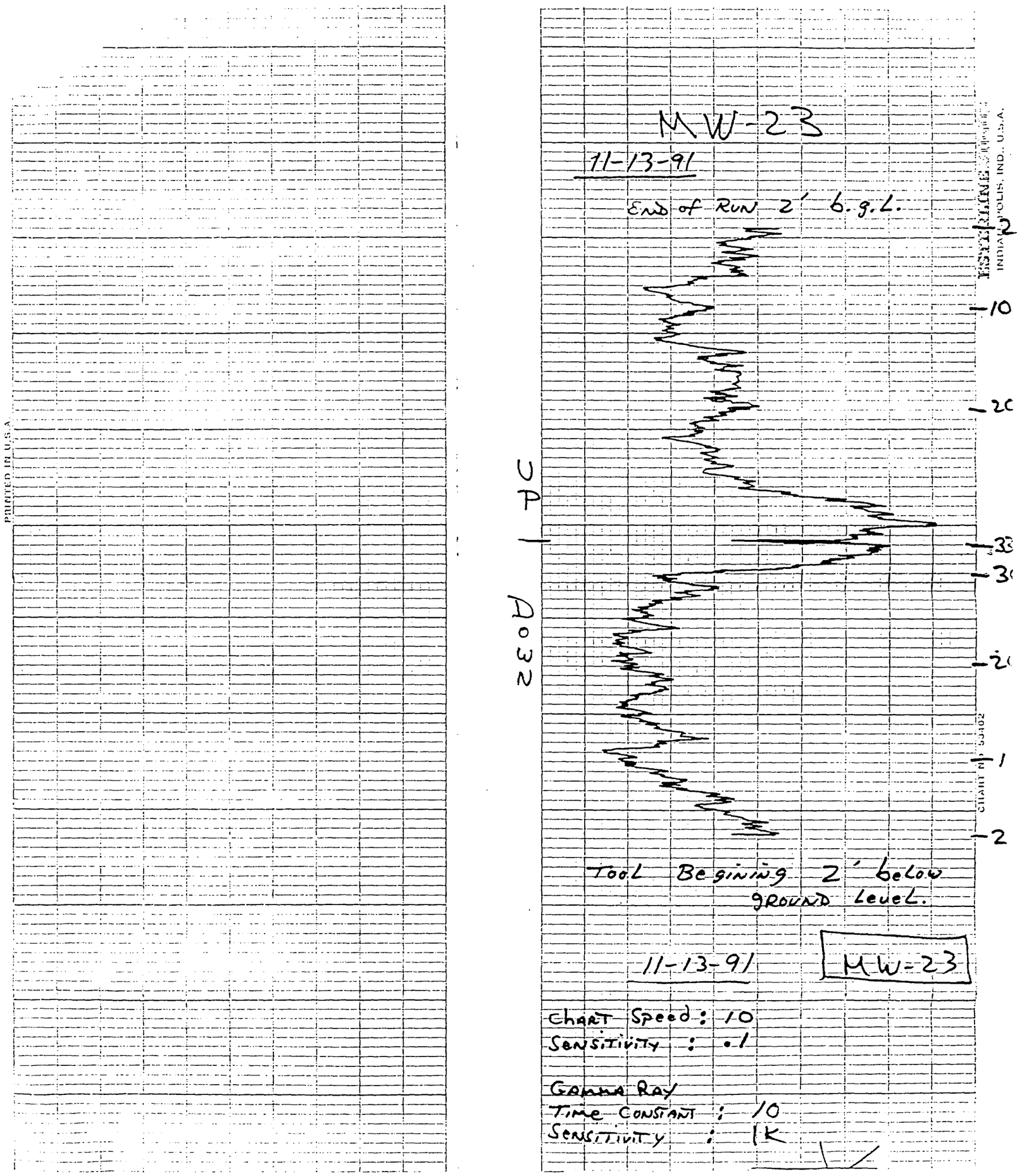
Sensitivity 1K

GAMMA RECORDER
SENSITIVITY 1K
TIME CONST. 10

RIGHT CHANNEL
CHART SPEED 10
SENSITIVITY .1

MW22




MW-23
11-13-91
End of Run 2' b.g.L.
UP
Down
2
10
20
33
30
20
1
2
Tool Begining 2' below ground Level.
11-13-91
MW-23
Chart Speed : 10
Sensitivity : .1
Gamma Ray
Time Constant : 10
Sensitivity : 1K
PRINTED IN U.S.A.
ESTERLINE
INDIANAPOLIS, IND., U.S.A.

MW23

N. BRONSON

MW-24

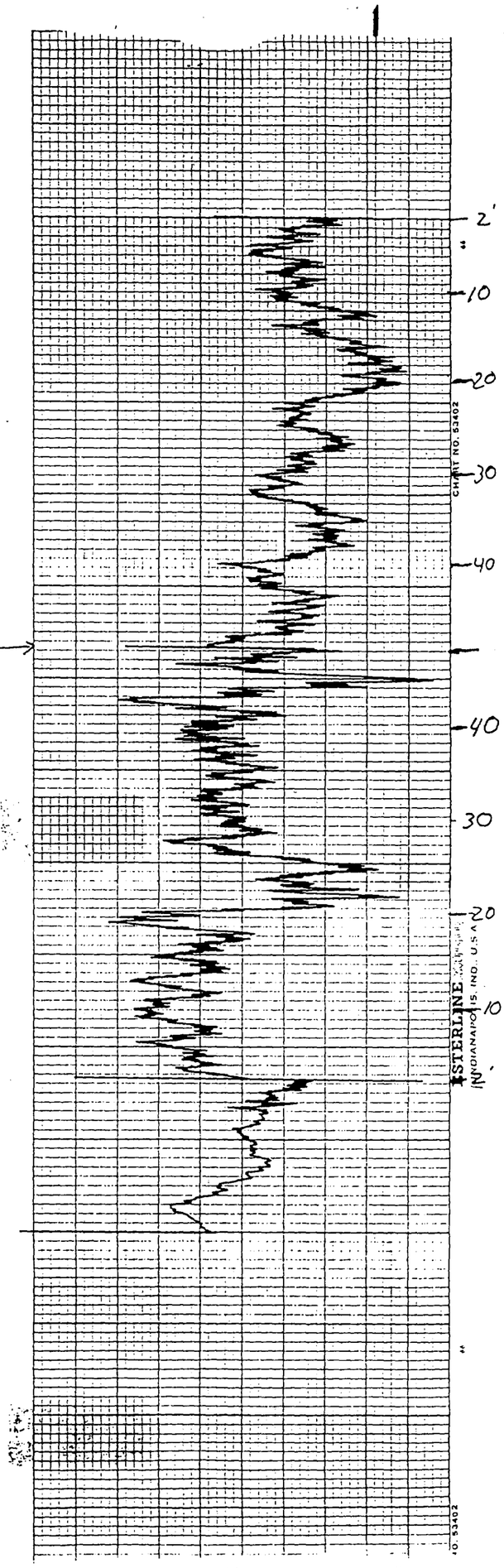
STOP @ 46.9

+2' CORRECTION = 48.9'

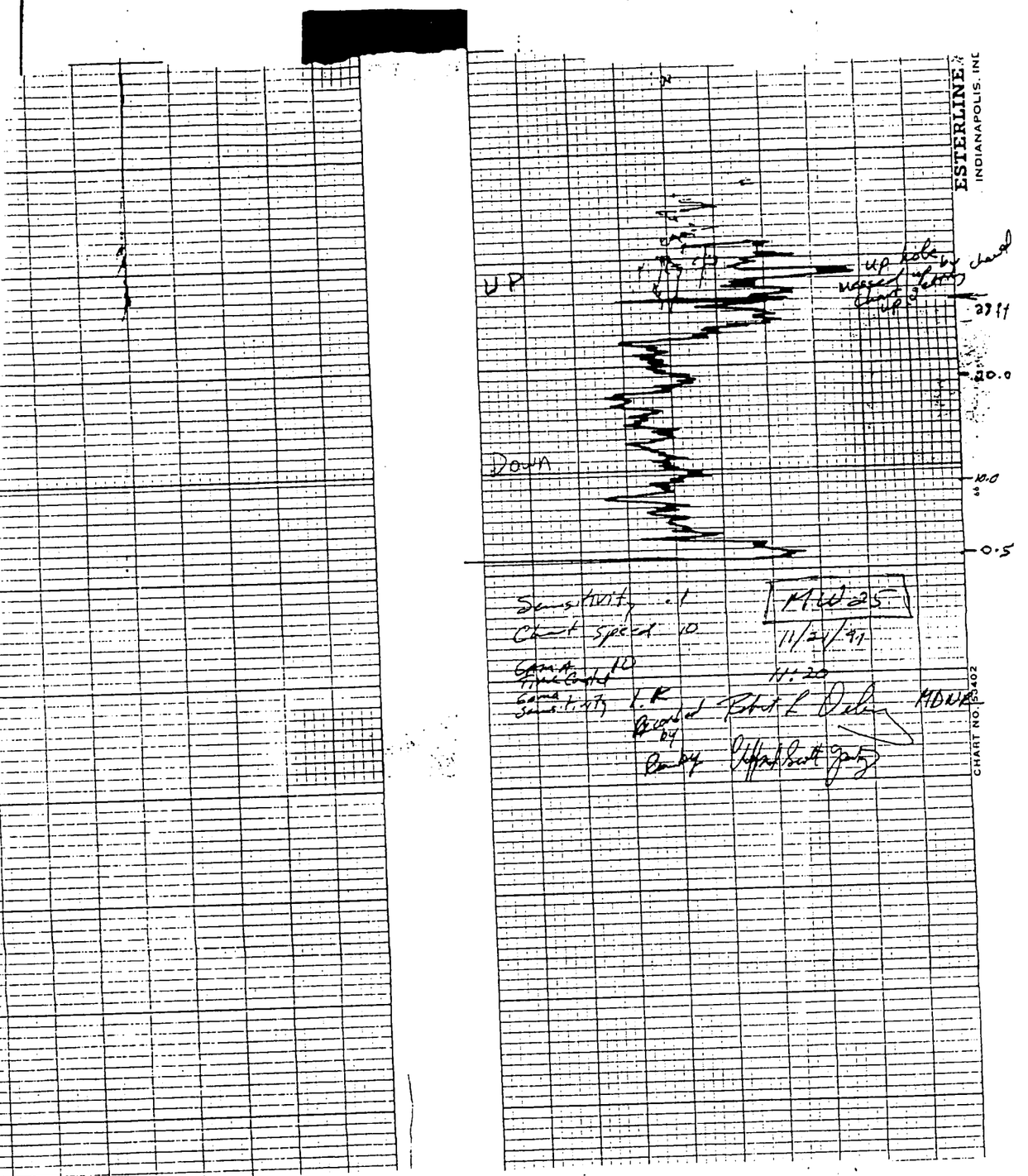
CLAY ≈ 43'

CHART		G.R.	
SENSITIVITY	.1	T.C. =	10
CHART SPEED	10	SENSITIVITY	10K

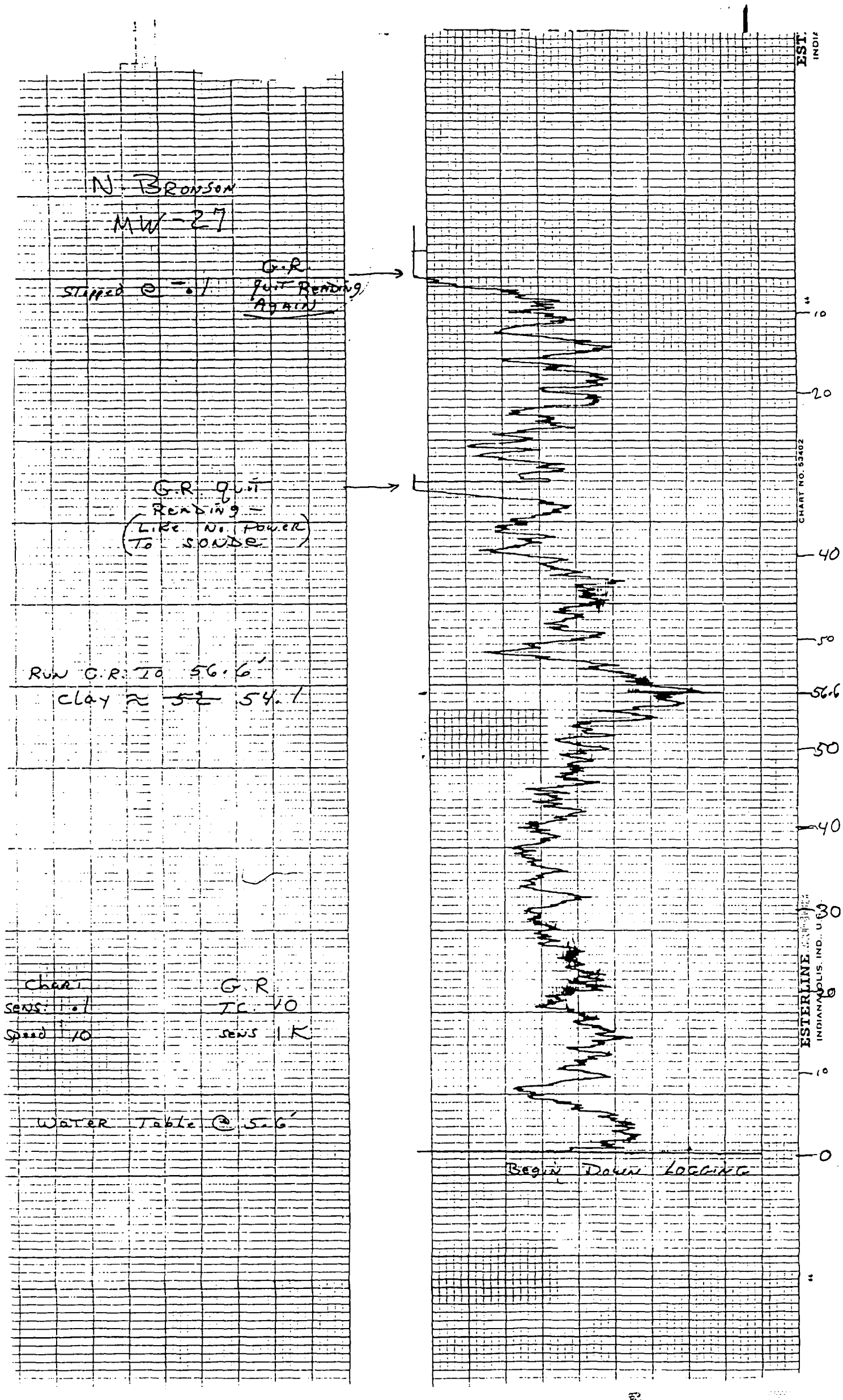
Begin Log
(Logging Down)
0700
11-23-91



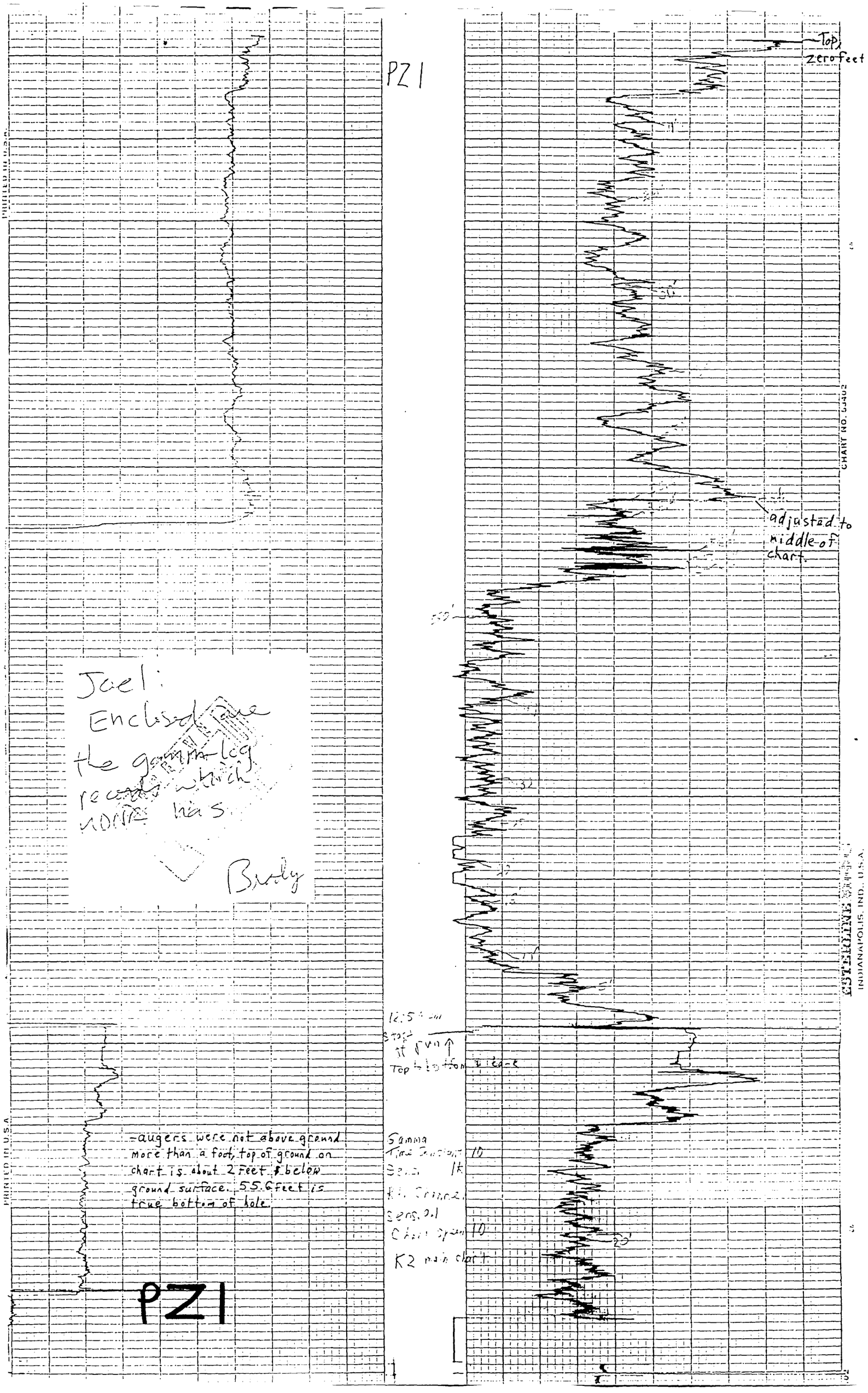
MW24

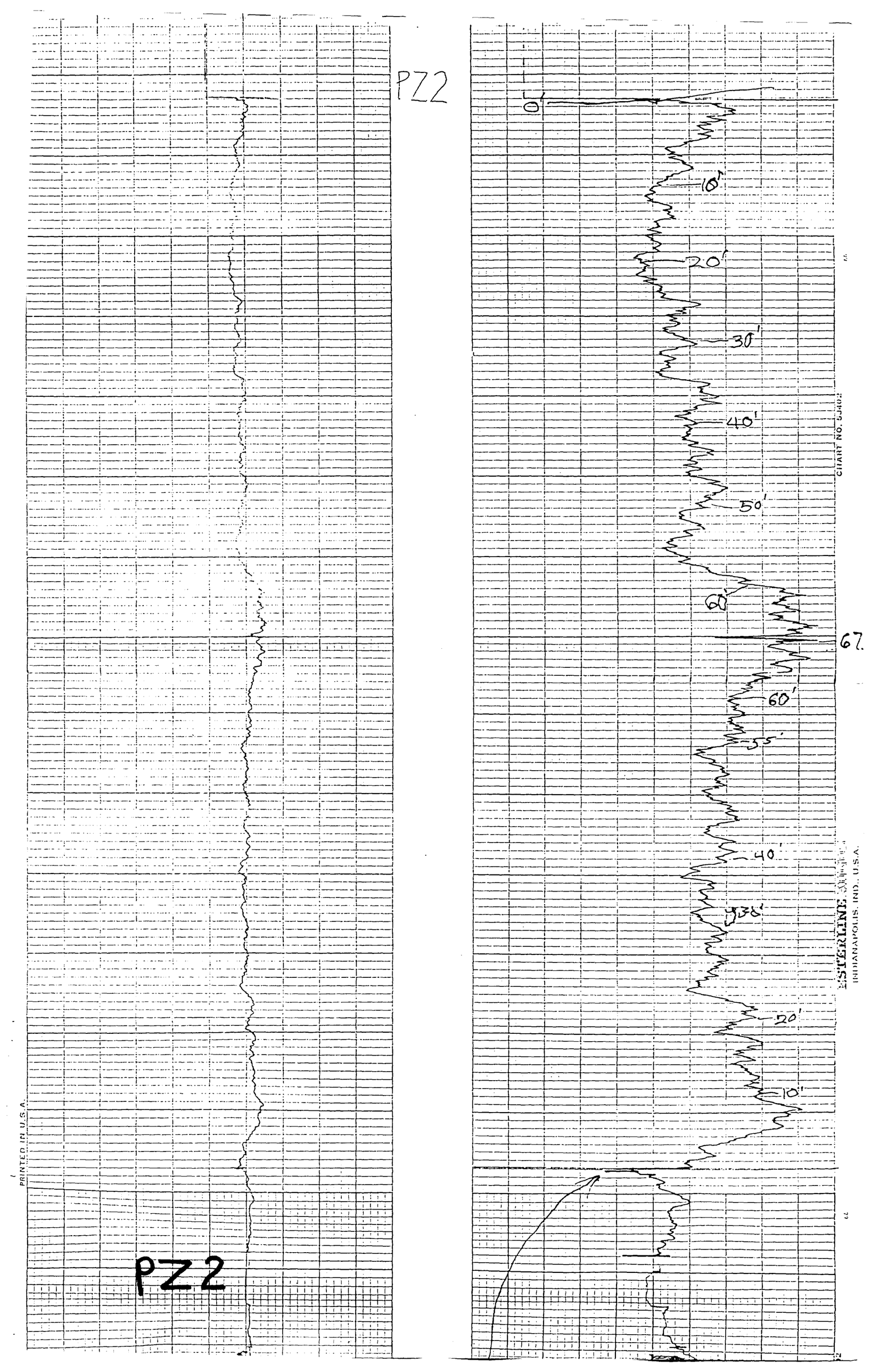

ESTERLINE
INDIANAPOLIS, INC
UP
Down
20.0
10.0
0.5
MW25
11/21/97
11:20
CHART NO. 95402

MW25


N. BRONSON
MW-27
STARTED @ -.1
G.R. QUIT READING AGAIN
G.R. QUIT READING — (LIKE NO POWER TO SONDE)
RUN G.R. TO 56.6'
CLAY ≈ ~~52~~ 54.1
CHART SENS: .1
SPEED 10
G.R. TC 10
SENS 1K
WATER TABLE @ 5.6'
BEGIN DOWN LOGGING
EST.
INDIA
CHART NO. 53402
ESTERLINE
INDIANAPOLIS, IND.
10
20
40
50
56.6
50
40
30
20
10
0

MW27


PZ1
Top, zero feet
adjusted to middle of chart.
Joel:
Enclosed are the gamma log records which none has.
Brady
-augers were not above ground more than a foot, top of ground on chart is about 2 feet below ground surface. 55.6 feet is true bottom of hole.
Gamma
K2 main chart
PZ1
CHART NO. 53402
ESTERLINE
INDIANAPOLIS, IND., U.S.A.
PRINTED IN U.S.A.


PZ2
0'
10'
20'
30'
40'
50'
60'
67.
60'
55'
40'
30'
20'
10'
PZ2
PRINTED IN U.S.A.
CHART NO. 53402
ESTERLINE
INDIANAPOLIS, IND., U.S.A.

G

Sample Identification And Control Information

G

SAMPLE IDENTIFICATION AND CONTROL INFORMATION

The same sample identification and control system was used during the entire RI investigation.

SAMPLE DESIGNATION

A sample numbering system was used to identify each sample, including duplicates and blanks. Each sample identifier has three components: a project code; a sample type and and identifier code; and a numerical code indicating sampling event. A listing of sample identification was maintained in a log book kept by the sampling team leader. The samples were taken from the field to the on-site trailer, where they were identified with U.S. EPA sample tags, and logged on chain of custody forms and traffic report forms.

SAMPLE IDENTIFICATION SYSTEM

Project Identifier

A two-letter designation was used to identify the investigation site. The project identifier has a two-letter prefix: "M" for Michigan (state-lead project) followed by "B" for the North Bronson Industrial Area Site.

Sample Type and Location Code

A sample type and location code follow the project identifier. Each sample collected is identified by an alpha code corresponding to the type of sample. The alpha codes, which can be used in combination, are as follows:

- FB - field blank
- GW - groundwater sample
- LW - lagoon water sample
- MW - monitoring well sample
- OF - outfall sample
- PW - private well sample
- PZ - piezometer sample
- S - sludge sample, Phase I

- SB - soil boring sample
- SD - sediment sample
- SDS - sludge sample, Phase II
- SS - surface soil sample
- SSMW - soil boring sample (at given depth)
- SW - surface water sample
- TB - trip blank

Each sample type code is associated with a sample identifier code. The sample identifier is a numeric or alpha-numeric code consisting of a one-, two- or three-digits and an letter if appropriate. Surface water samples, sediment samples, surface soil samples, lagoon water samples, outfall samples, field blanks, and trip blanks use a consecutive numbering system, starting with 1. For groundwater samples from monitoring and private wells, sample location codes corresponded with designated well numbers (see examples below).

Sampling Event

Groundwater (monitoring wells and private/city wells), surface water, sediment, outfall, and surficial soil samples have an identifier to indicate the sampling event ("01", "02", etc.). Duplicate samples are identified by "91" for the first sampling event and "92" for the second sampling event. The designation for soil samples obtained from soil borings and sludge samples end with the depth of the bottom of the sampled interval. Duplicate soil samples have a "D" or "Dup" following the depth.

EXAMPLE OF SAMPLE NUMBERS

Examples of sample numbers are listed below:

MB-GWMW9S-01	-	MDNR-lead, North Bronson Industrial Area Site, groundwater sample from Monitoring Well MW9S, Round 1 sampling.
MB-GWMW8D-91	-	MDNR-lead, North Bronson Industrial Area Site, groundwater sample from Monitoring Well MW8D, duplicate sample, Round 1 sampling.
MB-SSMW2S-10	-	MDNR-lead, North Bronson Industrial Area Site, soil boring sample from Monitoring Well MW2S, taken at depth of 10 ft.

MB-SSMW2S-10-D	-	MDNR-lead, North Bronson Industrial Area Site, soil boring sample from Monitoring Well MW2S, taken at a depth of 10 ft, duplicate sample.
MB-SD10-01	-	MDNR-lead, North Bronson Industrial Area Site, sediment sample from sampling location No. 10, Round 1 sampling.
MB-SD10-91	-	Duplicate of above sample, Round 1 sampling.
MB-FB04-02	-	MDNR-lead, North Bronson Industrial Area Site, field blank No. 4, Round 2 sampling.

U.S. EPA SAMPLE NUMBER

Each sample had a U.S. EPA Central Regional Laboratory (CRL) sample number. The CRL sample number consisted of nine alpha-numeric characters.

Ex.	88	M	B	01	S	01
	a	b	c	d	e	f

The characters are described as follows:

a - fiscal year (1988)
b - contractor code (MDNR - "M")
c - site name (North Bronson Industrial Area Site = "B")
d - CRL numbers [01(1-99), 02(101-199)]
e - sample type
  S = sample
  D = duplicate
  R = field blank
f - sample number

The sample identification number(s) were recorded in the field log book and were cross-referenced with the chain-of-custody and shipping documents.

SAMPLE CONTROL

Surface soil, sludge, subsurface soil, sediment, and water (monitoring well, private well, lagoon water, and surface water) samples were collected, preserved, packaged, and shipped by the field team.

While awaiting shipping, samples were stored on ice in coolers and kept at a temperature of approximately 4°C. Samples were filtered, when necessary, and preserved and shipped on the same day that they were collected. Coolers were shipped via overnight carrier to the Contract Laboratory Program (CLP) or CRL laboratory designated by the Sample Management Office (SMO). The SMO was notified by phone of each sample shipment, including airbill number(s), either by close of the business on the day that the samples were collected and shipped, or by 9:00 a.m. the following day if a late shipment was made. If samples were scheduled but not sent, the SMO was notified as soon as possible of the change in sample shipment size.

SAMPLE DOCUMENTATION

Samples were collected under CLP chain of custody procedures using U.S. EPA protocols. Standard forms including sample tags, traffic report forms, chain of custody forms, and custody seals used for CLP sample tracking were maintained. Pertinent information regarding the samples was recorded in the site log book maintained by the team leader, and in logs maintained by each sampling crew. The information included sampling time, location, tag numbers, designation, suppliers, and sampling equipment. HNu readings, weather conditions, and field modifications of sampling strategy were also recorded. The log book was maintained in ink unless weather conditions dictated otherwise. Photographs with the time, date, and location noted in the photographic log book were taken (as possible) at sampling locations.

Copies of the multiple-copy forms accompanied samples to the laboratory. The other copies were sent to the Sampling Coordinator immediately following sample shipment.

The following paperwork protocols were employed:

<u>Chain of Custody Form</u>

- One form per shipping container (cooler).
- Carrier service did not need to sign form if custody seals remained intact.
- Used for all samples.

Chain of Custody Seals

- Two seals per shipping container to secure the lid and provide evidence that samples were not tampered with.
- Seals were covered with clear tape.
- Seal numbers were recorded on chain of custody form.
- Used for all samples.

Traffic Report Forms

- One form per shipping container (cooler).
- Used for all samples.

Sample Tags

- Each sample container had a Sample Tag affixed to it with string or wire.
- Sample Tag numbers were recorded on the chain of custody forms.
- Used for all samples.

Sample Identification Record Form

- Provided a means of recording crucial sample shipping and tracking information, and included:
  - Project Number
  - Sample Number
  - Sample Matrix
  - Site Number
  - Sample Location Code
  - Sample Round
  - Sample Type (blank, replicate)
  - Number of Bottles
  - Chain of Custody Number
  - Laboratory Code
  - Date Sampled
  - Date Shipped
  - Airbill Number

- Sample Tag Number

This form was maintained for each sample shipment and was forwarded to the Sampling Coordinator upon sample shipment.

Paperwork accompanying the samples shipped to the laboratory was sealed in a plastic bag and taped to the inside of the cooler lid. Copies of the chain of custody forms and other paperwork were retained for the field files.

Two sample seals were placed on opposite sides of the lid, extending down the sides of the cooler. Seals were covered with clear tape. The lid was securely taped shut prior to shipment.

SGW/ccf/JMK
[mad-605-67b]
7005100/159

H

HYDRAULIC CONDUCTIVITY TEST RESULTS

BAILDOWN HYDRAULIC CONDUCTIVITY TEST METHODS

The purpose of a baildown test is to measure in-situ saturated hydraulic conductivity of subsurface materials. Baildown tests measure the saturated hydraulic conductivity of undisturbed, in-place aquifer material, whereas laboratory tests require removal of a sample from its natural environment.

The general procedure for conducting a baildown test is to instantaneously change the head in the well and measure the rate at which the water in the well returns to its static level. The change in head in the well must be "instantaneous" relative to the time required for the head to return to static conditions (e.g. <5% of total time). The hydraulic conductivity of the aquifer material is a function of the rate of water level rise and the well geometry. In permeable aquifer material, the location of the well screen with respect to the water table and the base of the aquifer are important. The configuration of a typical baildown test is illustrated in Figure A.

The procedure for changing head in a well depends on the type of well being analyzed. Head can be changed in a water table well or piezometer by physically removing or displacing a volume of water using a bailer or slug bomb. Air pressure can also be used to displace water in a piezometer, provided the well is screened in relatively high permeability material such as sand and gravel.

DATA REDUCTION

Several methods are available to interpret the water level versus time data that are obtained from a baildown test. These include Hvorslev (1951), NAVFAC (1971), Papadopulos, et al. (1973), Bouwer and Rice (1976) and Bouwer (1989). The first three references use an analytical solution to a well fully penetrating a confined aquifer. The method by Bouwer and Rice (1976) as modified in Bouwer (1989) utilizes an analog model of both fully and partially penetrating wells to aid in solution of the modified Thiem equation. The Bouwer and Rice (1976) method as modified in Bouwer (1989) was selected because of its ability to incorporate the effects on recovery rate due to a partially penetrating well.

The Bouwer and Rice (1976) method is based on solution of a modified Thiem equation for radial flow to a pumped well as shown in Equation 1.

$$Q = 2\pi\ (KLy)/(\ln(R_e/r_w)) \quad \text{.....} \quad (1)$$

Where :

- Q = flow into the well (L^3/T)
- K = hydraulic conductivity of the aquifer (L/T)
- L = open length of open interval in the well (L)
- y = difference between the water level in the well and the equilibrium level in the aquifer (L)
- R_e = radius of influence of the well (L)
- r_w = effective well radius (L)

In a single well test, the value of R_e is unknown. Values of R_e, in terms of the $\ln(R_e/r_w)$ were determined by Bouwer and Rice (1976) with an electric analog model of a homogeneous isotropic aquifer. The analog model was used to analyze the effects of the aquifer and well geometry. Results of the study for a partially penetrating well are shown in Equation 2 using Equation 3 to determine the value of $\ln(R_e/r_w)$.

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L} \quad \frac{1}{t} \cdot \ln\left(\frac{y_o}{y_t}\right) \quad \text{.....} \quad (2)$$

Where:

- r_c = radius of the well casing (L)
- t = time (T)
- y_o, y_t = difference between the water level in the well and the equilibrium level in the aquifer at times 0 and t

$$\ln(R_e/r_w) = \left[\frac{1.1}{\ln(H/r_w)} + \frac{A + B\ln(D-H)/r_w)}{L/r_w}\right]^{-1} \quad \text{.....} \quad (3)$$

Where:

- A, B = constants obtained from Figure B
- H = depth to the bottom of the screen from the water table
- D = thickness of the aquifer

As noted by Bouwer and Rice, a plot of log (y_o/y_t) versus time (t) (on the linear scale) should yield a straight line.

The commercially available software AQTESOLV (Duffield and Rumbaugh, 1989) was used to reduce the baildown field test data. The software combines statistical parameter estimation methods with graphical curve-matching techniques for analysis of the test data.

In water table wells, recovery of the water level in the well after bailing is affected by the water in the gravel pack. To "subtract" this effect on the test results, two modifications are generally made.

First, as described by Bouwer (1989), the program input parameter "radius of well casing" is increased to account for the water level rising in the well screen and gravel pack using the following equation;

$$r_s = \sqrt{r_c^2 + (r_w^2 - r_c^2)n}$$

where;

r_s = effective screen radius
r_c = radius of the casing (screen)
r_w = radius of the borehole
n = porosity of the gravel pack (decimal)

Second, where appropriate, the line of log (y_o/y_t) versus time used to calculate hydraulic conductivity is visually matched to data points occurring after effects of gravel pack water on water level recovery have diminished (Figure C).

Together these modifications allow for more accurate estimation of the formation's hydraulic conductivity.

Input data for each test is listed in the following pages. Output from the test analysis follows the input data. Results of the tests are summarized and discussed in the text.

REFERENCES CITED

Bouwer, H. and R.C. Rice. 1976. A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research, Vol. 12, No. 3, p. 423-428.

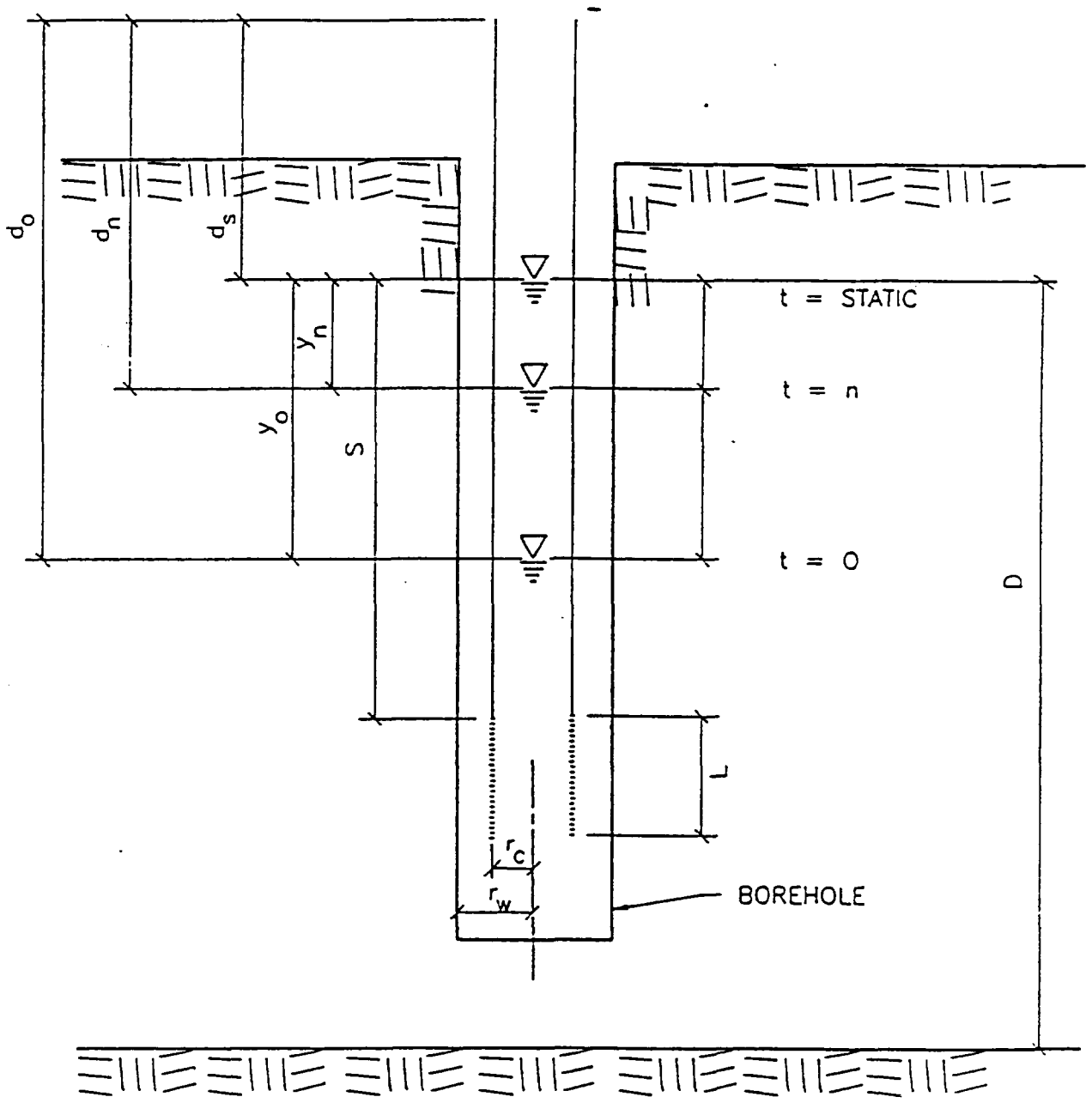
Bouwer, H., 1989. The Bouwer and Rice Slug Test - An Update, Groundwater, Vol. 27, No. 3, May-June, 1989, pp. 304-309.

Duffield, G.M. and J.O. Rumbaugh, III, AQTESOLV, Aquifer Test Solver, version 1.00, October 1989.

Hvorslev, M.J. 1951. Time Lag and Soil Permeability in Groundwater Observations. U.S. Army Corps of Engineers, Waterways Exp. Sta. Bull. 36, Vicksburg, MS.

Papadopulos, S.S., et. al. 1973. On the Analysis of 'Slug Test' Data. Water Resources Research, Vol. 9, No. 4. p. 1087-1089.

United States Department of the Navy. 1971. Design Manual: Soil Mechanics, Foundations, Earth Structures, NAVFAK DM-F, March 1971. p. 7-4-9.



d_s – DEPTH TO STATIC LEVEL

d_o – DEPTH TO WATER AT t=0

d_n – DEPTH TO WATER AT t=n

y_o – RELATIVE DRAWDOWN AT t=0 ($d_o - d_s$)

y_n – RELATIVE DRAWDOWN AT t=n ($d_n - d_s$)

S – DEPTH TO TOP OF SCREEN BELOW WATER TABLE

D – AQUIFER THICKNESS

L – LENGTH OF WELL SCREEN

r_c – RADIUS OF WELL CASING

r_w – RADIUS OF WELL (INCLUDING GRAVEL PACK)

FIGURE A- BAILDOWN TEST CONFIGURATION

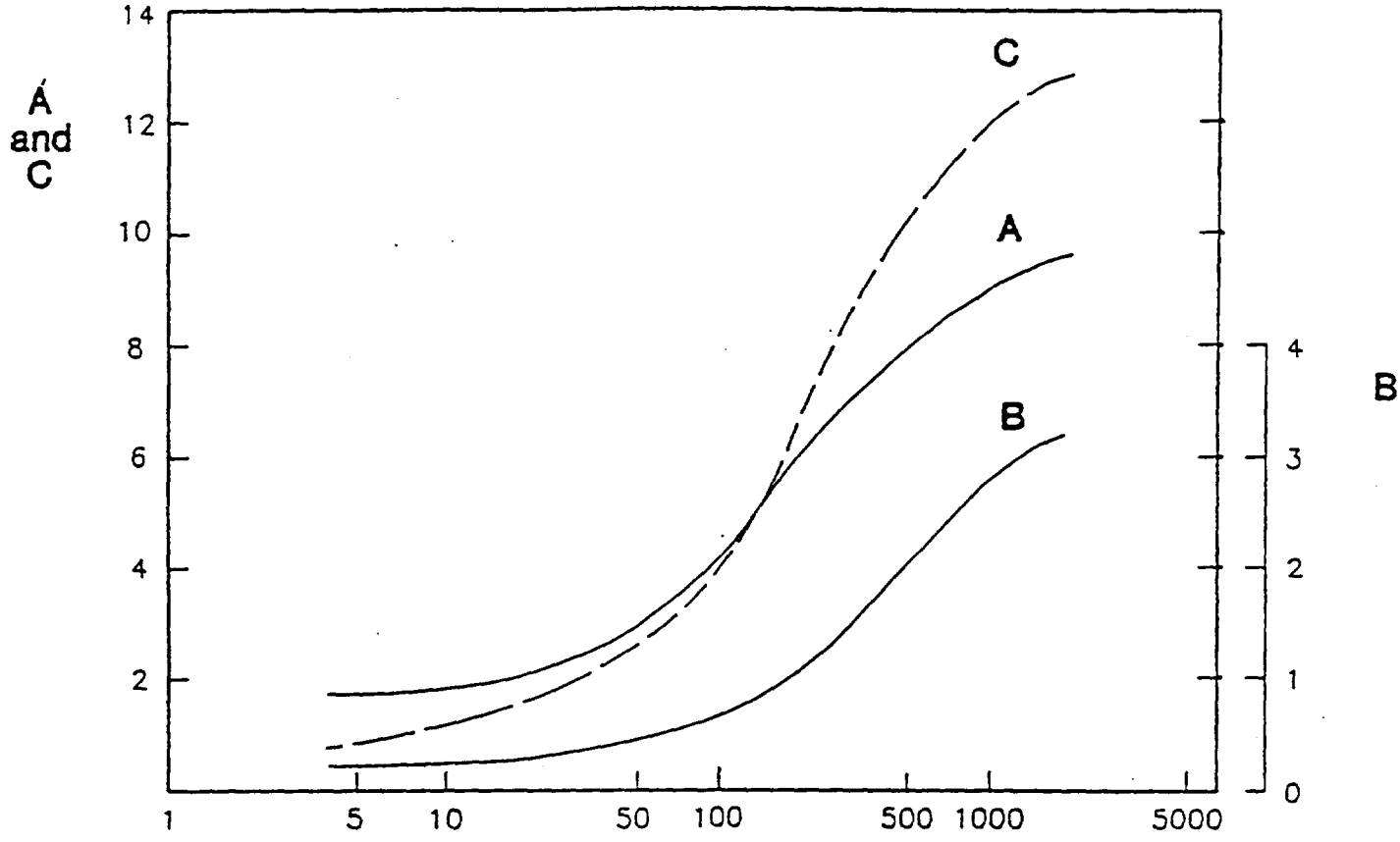


FIGURE B – CURVES RELATING A, B AND C TO L/r_w
(FROM BOUWER AND RICE, 1976).

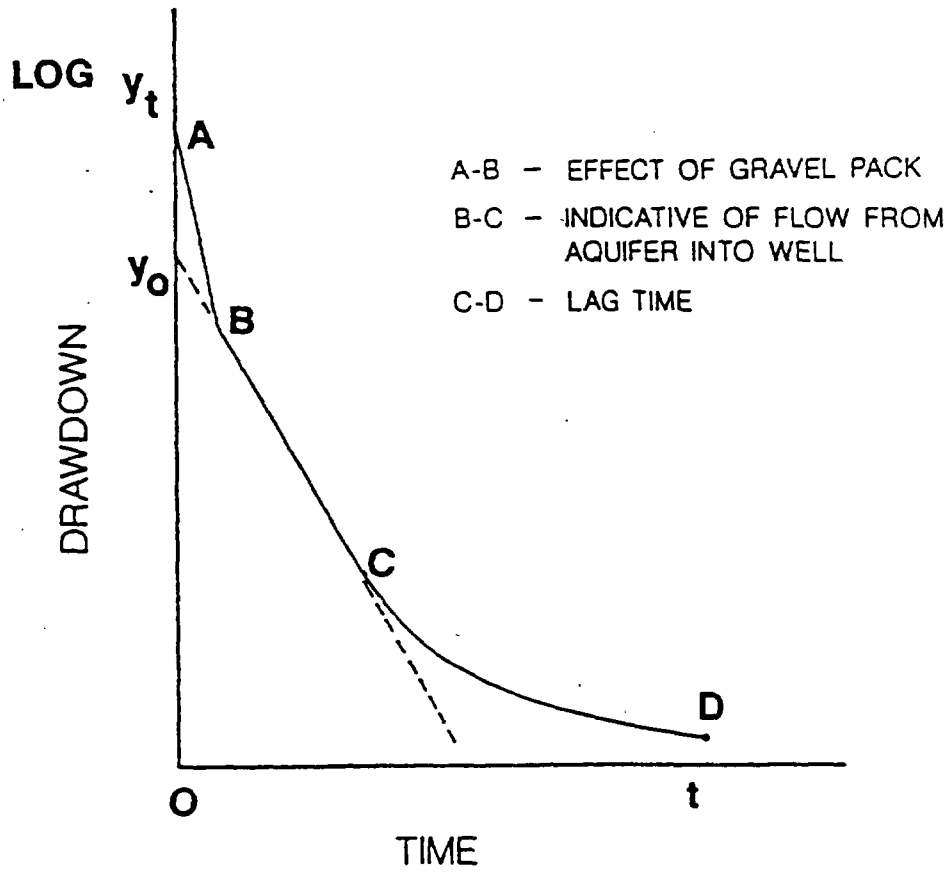
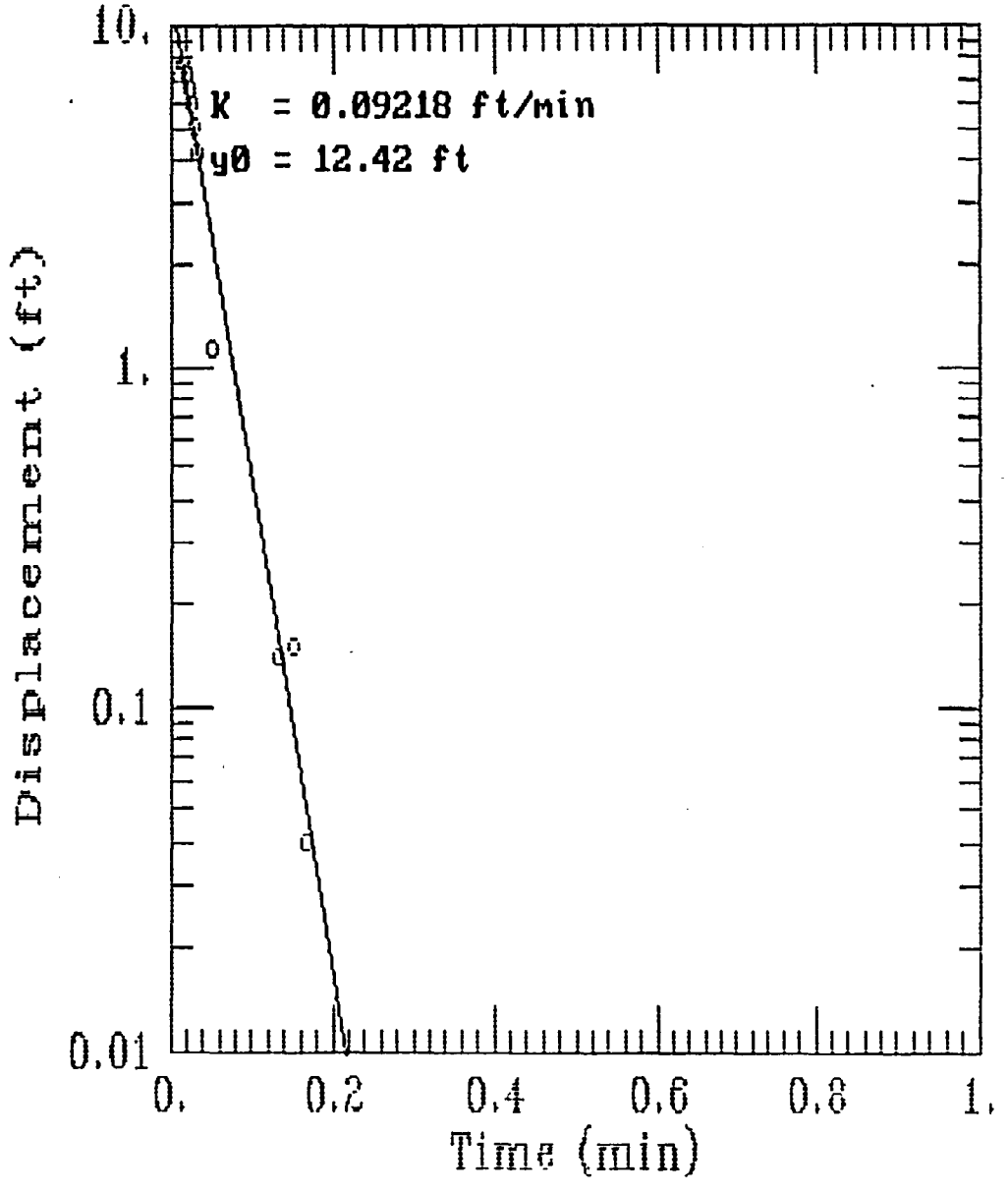


FIGURE C - SCHEMATIC OF DOUBLE STRAIGHT LINE EFFECT CAUSED BY HIGH PERMEABILITY OF GRAVEL PACK AROUND THE WELL. (AFTER BOUWER, 1989)

```
B:\>type nbmw5d.prn
North Bronson RI/FS - SLUG TEST for MW5D
slugt1
   7.65
0.083333
0.083333
slugt2
    45
   4.5
 40.24
tsdata
  0.0166    7.65     1
    0.02    7.23     1
  0.0233    6.58     1
  0.0266    5.99     1
    0.03    5.05     1
  0.0333    4.24     1
    0.05    1.14     1
  0.0666   -0.28     1
  0.0833   -0.58     1
     0.1   -0.39     1
  0.1166   -0.05     1
  0.1333    0.14     1
    0.15    0.15     1
  0.1666    0.04     1
  0.1833   -0.05     1
     0.2    -0.1     1
  0.2166   -0.08     1
  0.2333   -0.04     1
    0.25       0     1
  0.2666       0     1
  0.2833   -0.02     1
     0.3   -0.04     1
  0.3166   -0.04     1
  0.3333   -0.04     1
  0.4167   -0.02     1
     0.5   -0.02     1
  0.5833   -0.02     1
  0.6667   -0.02     1
    0.75   -0.02     1
  0.8333   -0.02     1
  0.9167   -0.02     1
       1   -0.02     1
  1.0833   -0.02     1
  1.1667   -0.02     1
    1.25   -0.02     1
  1.3333   -0.02     1
  1.4166   -0.02     1
     1.5   -0.02     1
  1.5833       0     1
  1.6667   -0.02     1
    1.75   -0.02     1
  1.8333   -0.02     1
  1.9167       0     1
       2       0     1
     2.5   -0.02     1
```

North Bronson RI/FS - SLUG TEST/MW5D



North Bronson RI/FS - Slug test MW6S

slugt1

0.42

0.083333

0.083333

slugt2

8.5

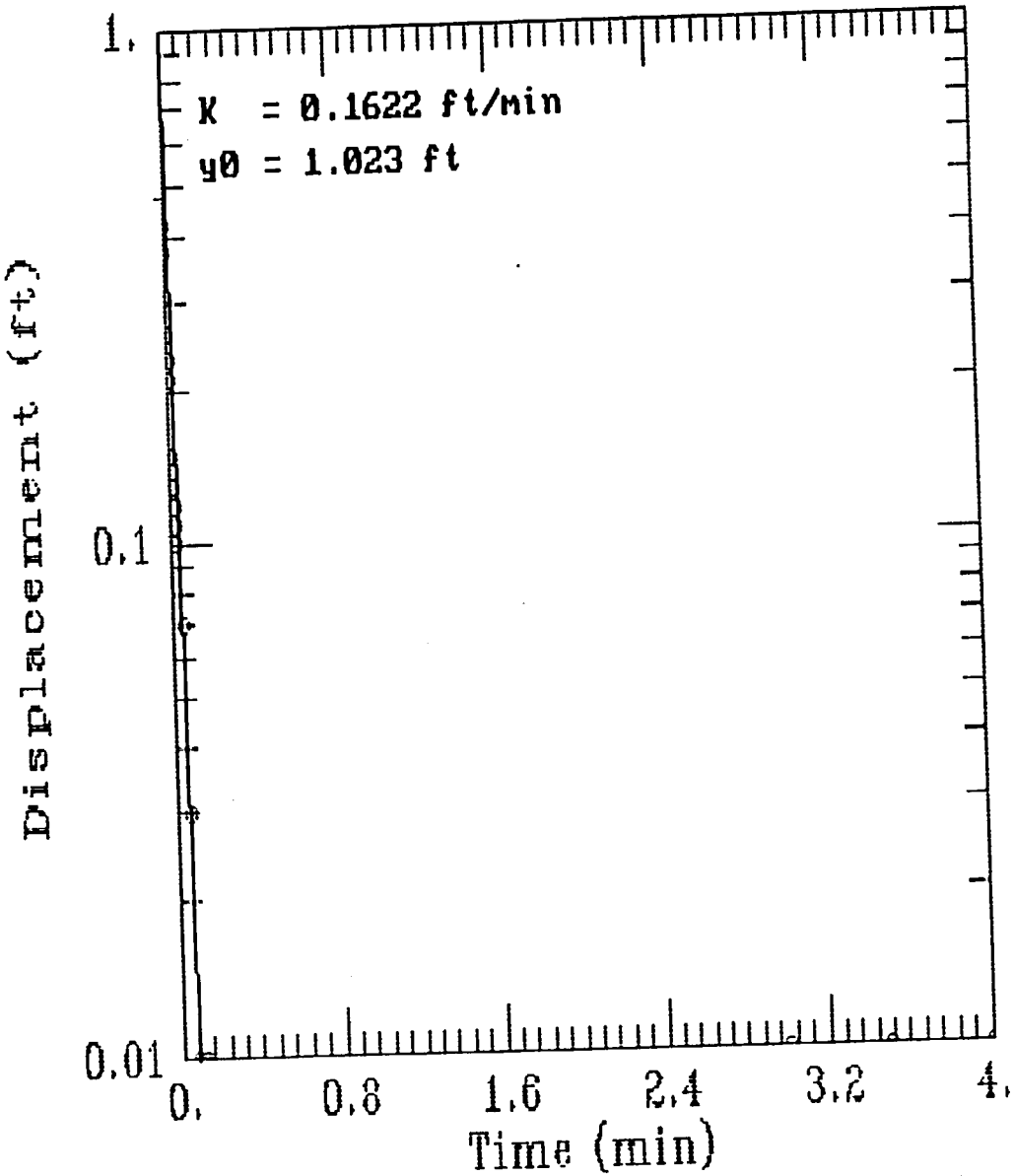
4.5

8.5

tsdata

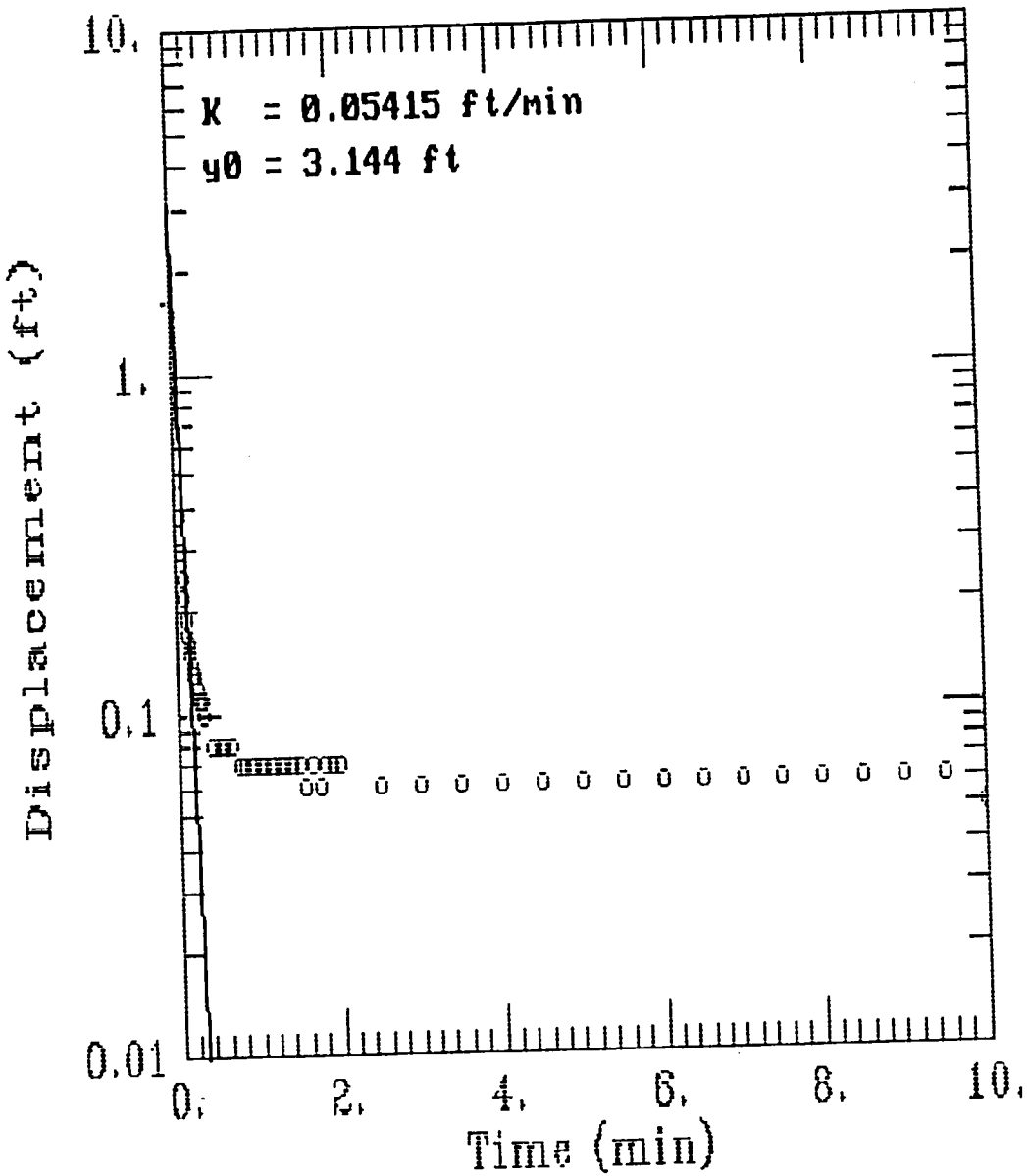
0	0.42	1
0.0033	0.37	1
0.0066	0.31	1
0.0099	0.26	1
0.0133	0.23	1
0.0166	0.21	1
0.02	0.15	1
0.0233	0.13	1
0.0266	0.12	1
0.03	0.11	1
0.0333	0.1	1
0.05	0.07	1
0.0666	0.03	1
0.0833	0.01	1
0.1	0.01	1
0.1166	0.01	1
0.1333	0	1
0.15	0	1
0.1666	0	1
0.1833	0	1
0.2	0	1
0.2166	0	1
0.2333	0	1
0.25	0	1
0.2666	0	1
0.2833	0	1
0.3	0	1
0.3166	0	1
0.3333	0	1
0.4167	0	1
0.5	0	1
0.5833	0	1
0.6667	0	1
0.75	0	1
0.8333	0	1
0.9167	0	1
1	0	1
1.0833	0	1
1.1667	0	1
1.25	0	1
1.3333	0	1
1.4166	0	1
1.5	0	1
1.5833	0	1
1.6667	0	1
1.75	0	1
1.8333	0	1
1.9167	0	1
2	0	1
2.5	0	1
3	0.01	1
3.5	0.01	1
4	0.01	1

North Bronson RI/FS - Slug test MW6S



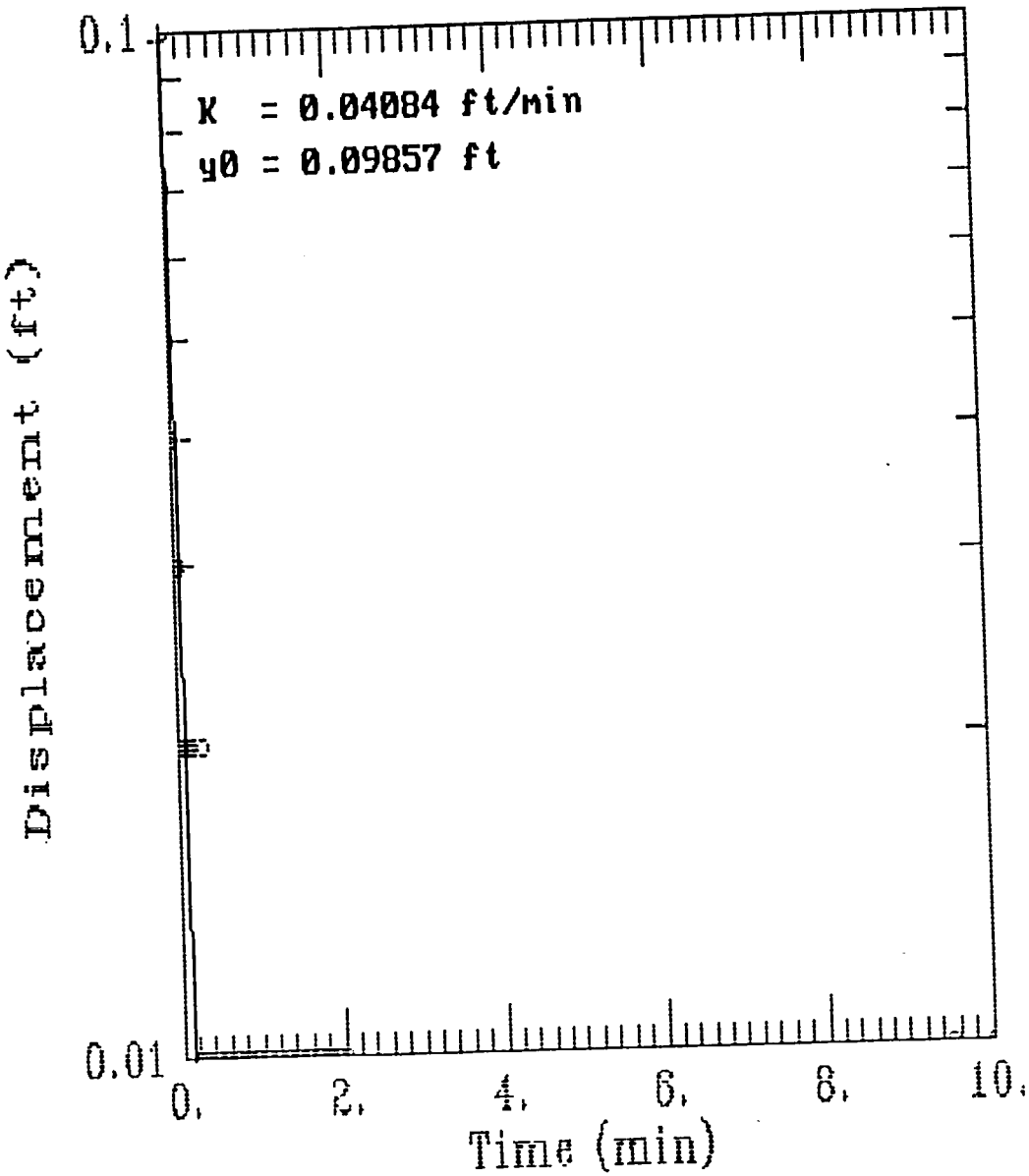
```
type nbmw8d.prn
North Bronson RI/FS - Slug test MW8D
slugt1
    1.49
0.083333
0.083333
slugt2
      27
     4.5
      22
tsdata
       0      1.49        1
  0.0033      1.36        1
  0.0066      1.24        1
  0.0099      1.14        1
  0.0133      1.06        1
  0.0166      0.98        1
    0.02      0.92        1
  0.0233      0.85        1
  0.0266      0.78        1
    0.03      0.74        1
  0.0333      0.68        1
    0.05      0.49        1
  0.0666      0.38        1
  0.0833       0.3        1
     0.1      0.25        1
  0.1166      0.22        1
  0.1333      0.19        1
    0.15      0.17        1
  0.1666      0.16        1
  0.1833      0.15        1
     0.2      0.14        1
  0.2166      0.13        1
  0.2333      0.13        1
    0.25      0.12        1
  0.2666      0.11        1
  0.2833      0.11        1
     0.3      0.11        1
  0.3166      0.11        1
  0.3333       0.1        1
  0.4167      0.08        1
     0.5      0.08        1
  0.5833      0.08        1
  0.6667      0.08        1
    0.75      0.07        1
  0.8333      0.07        1
  0.9167      0.07        1
       1      0.07        1
  1.0833      0.07        1
  1.1667      0.07        1
    1.25      0.07        1
  1.3333      0.07        1
  1.4166      0.07        1
     1.5      0.07        1
  1.5833      0.06        1
  1.6667      0.07        1
    1.75      0.06        1
  1.8333      0.07        1
  1.9167      0.07        1
       2      0.07        1
     2.5      0.06        1
       3      0.06        1
     3.5      0.06        1
       4      0.06        1
     4.5      0.06        1
       5      0.06        1
     5.5      0.06        1
       6      0.06        1
     6.5      0.06        1
       7      0.06        1
     7.5      0.06        1
       8      0.06        1
     8.5      0.06        1
       9      0.06        1
     9.5      0.06        1
      10      0.05        1
```

North Bronson RI/FS - Slug test MW8D



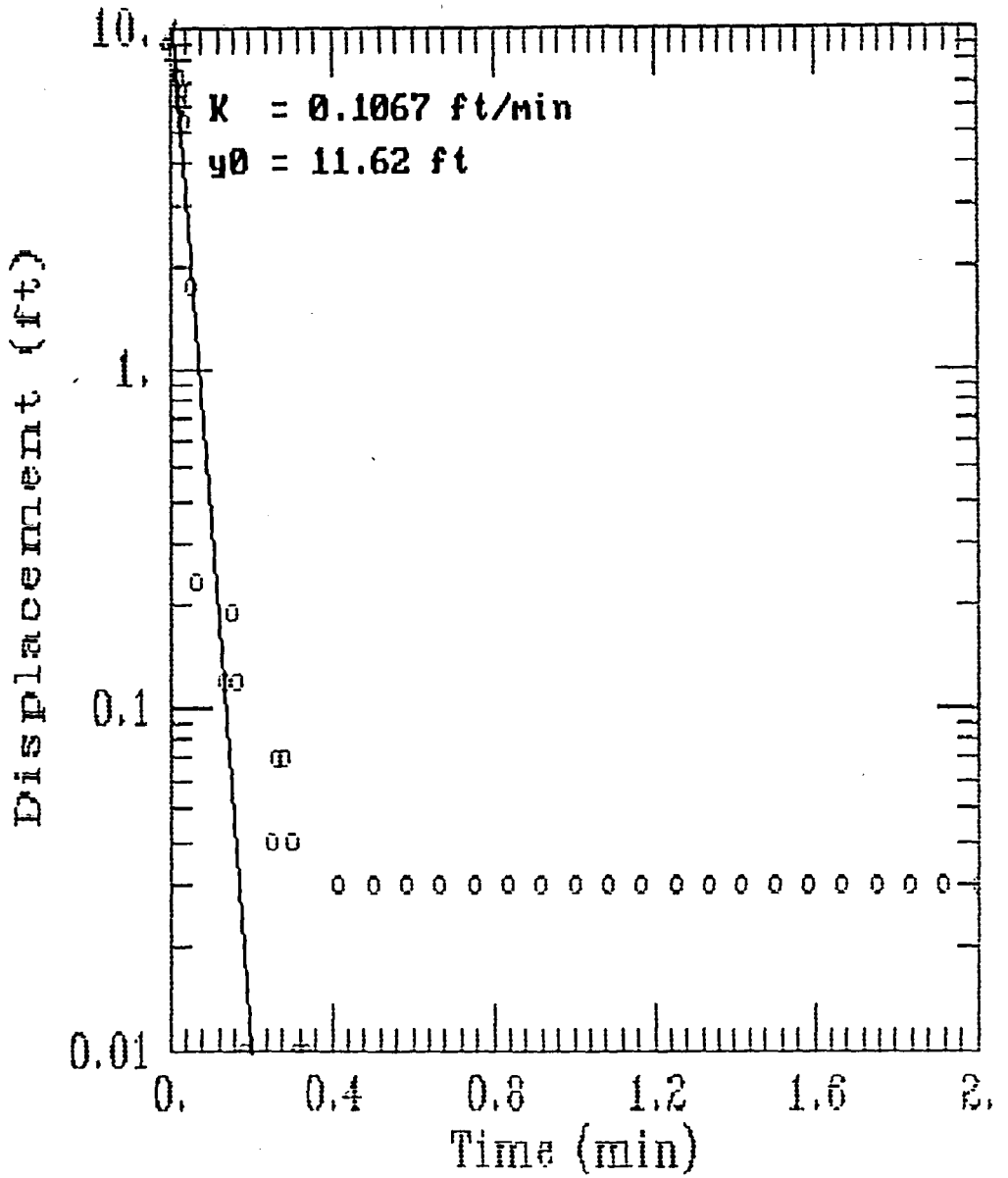
```
type nbmw8s.prn
North Bronson RI/FS - Slug Test MW8S
slugt1
    0.07
0.083333
0.083333
slugt2
      13
     4.5
       7
tsdata
       0      0.07        1
  0.0033      0.05        1
  0.0066      0.05        1
  0.0099      0.04        1
  0.0133      0.03        1
  0.0166      0.04        1
    0.02      0.03        1
  0.0233      0.03        1
  0.0266      0.03        1
    0.03      0.03        1
  0.0333      0.03        1
    0.05       0.1        1
  0.0666      0.03        1
  0.0833      0.02        1
     0.1      0.02        1
  0.1166      0.02        1
  0.1333      0.02        1
    0.15      0.02        1
  0.1666      0.02        1
  0.1833      0.02        1
     0.2      0.02        1
  0.2166      0.01        1
  0.2333      0.01        1
    0.25      0.01        1
  0.2666      0.01        1
  0.2833      0.01        1
     0.3      0.01        1
  0.3166      0.01        1
  0.3333      0.02        1
  0.4167      0.01        1
     0.5      0.01        1
  0.5833      0.01        1
  0.6667      0.01        1
    0.75      0.01        1
  0.8333      0.01        1
  0.9167      0.01        1
       1      0.01        1
  1.0833      0.01        1
  1.1667      0.01        1
    1.25      0.01        1
  1.3333      0.01        1
  1.4166      0.01        1
     1.5      0.01        1
  1.5833      0.01        1
  1.6667      0.01        1
    1.75      0.01        1
  1.8333      0.01        1
  1.9167      0.01        1
       2      0.01        1
     2.5         0        1
       3         0        1
     3.5         0        1
       4         0        1
     4.5         0        1
       5         0        1
     5.5         0        1
       6         0        1
     6.5         0        1
       7         0        1
     7.5         0        1
       8         0        1
     8.5         0        1
       9         0        1
     9.5      0.01        1
      10      0.01        1
     5.5     -6.98        1
       6     -6.98        1
     6.5     -6.98        1
       7     -6.98        1
     7.5     -6.98        1
       8     -6.98        1
     8.5     -6.98        1
       9     -6.98        1
     9.5     -6.98        1
      10     -6.99        1
```

North Bronson RI/FS - Slug Test MW8S

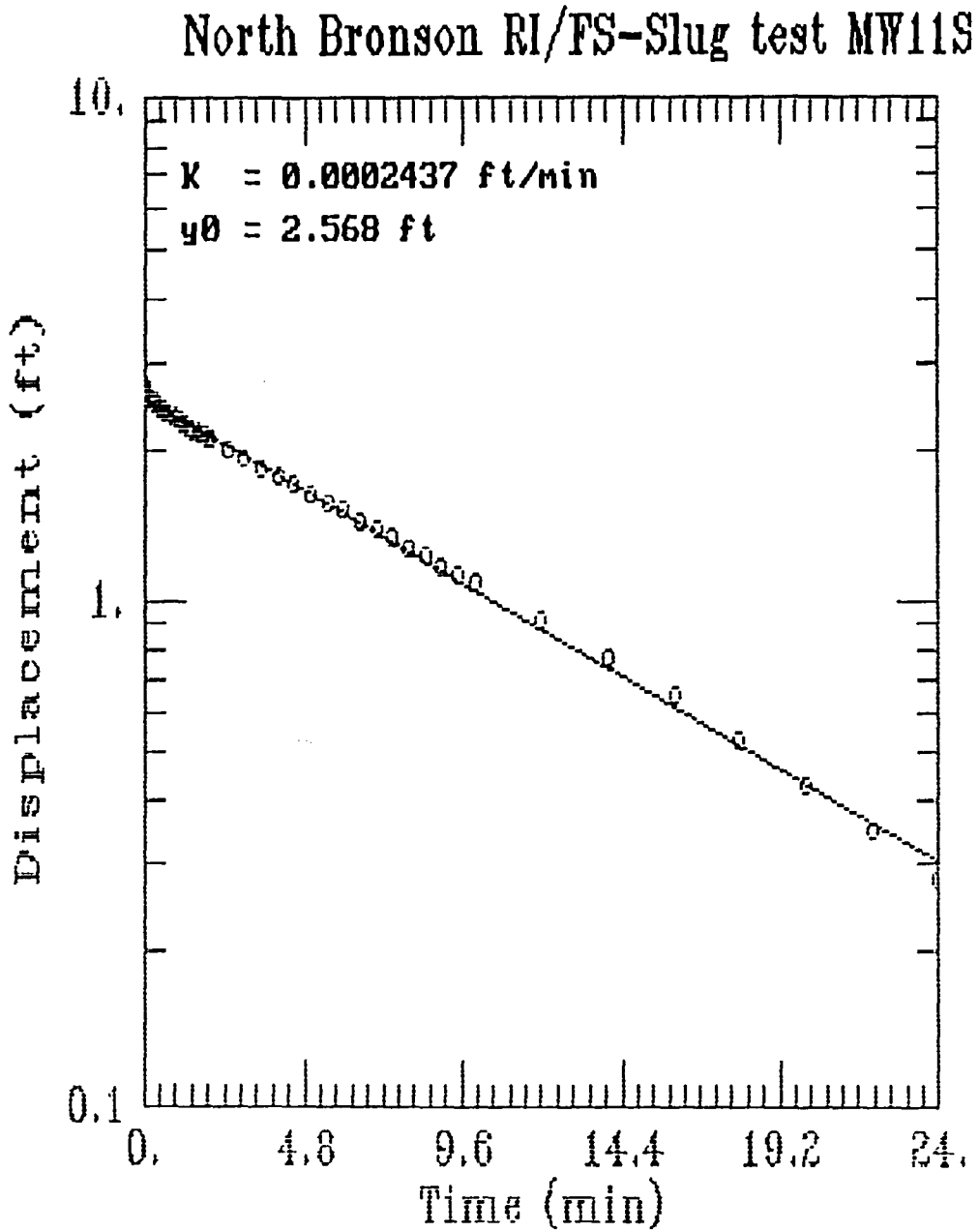


```
B:\>type nbmw10d.prn
North Bronson RI/FS - SLUG TEST MW10D
slugt1
   7.27
0.083333
0.083333
slugt2
    43
   4.5
 42.44
tsdata
   0.02     7.27      1
 0.0233     7.09      1
 0.0266     6.64      1
   0.03     6.04      1
 0.0333     5.34      1
   0.05     1.76      1
 0.0666     0.23      1
 0.0833    -0.23      1
    0.1    -0.21      1
 0.1166    -0.04      1
 0.1333     0.12      1
   0.15     0.19      1
 0.1666     0.12      1
 0.1833     0.01      1
    0.2    -0.05      1
 0.2166    -0.07      1
 0.2333        0      1
   0.25     0.04      1
 0.2666     0.07      1
 0.2833     0.07      1
    0.3     0.04      1
 0.3166     0.01      1
 0.3333     0.01      1
 0.4167     0.03      1
    0.5     0.03      1
 0.5833     0.03      1
 0.6667     0.03      1
   0.75     0.03      1
 0.8333     0.03      1
 0.9167     0.03      1
      1     0.03      1
 1.0833     0.03      1
 1.1667     0.03      1
   1.25     0.03      1
 1.3333     0.03      1
 1.4166     0.03      1
    1.5     0.03      1
 1.5833     0.03      1
 1.6667     0.03      1
   1.75     0.03      1
 1.8333     0.03      1
 1.9167     0.03      1
      2     0.03      1
```

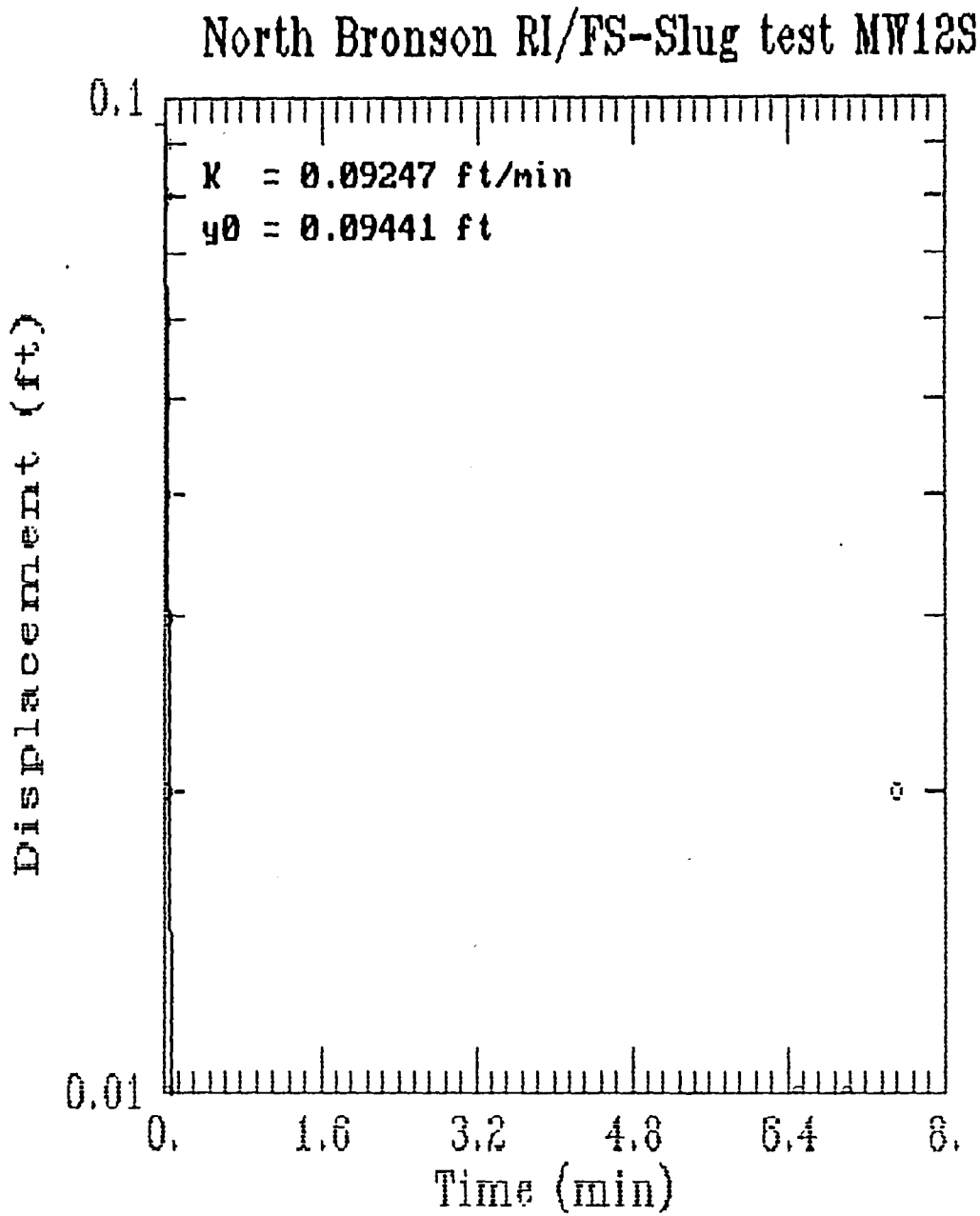
North Bronson RI/FS - SLUG TEST/MW10D



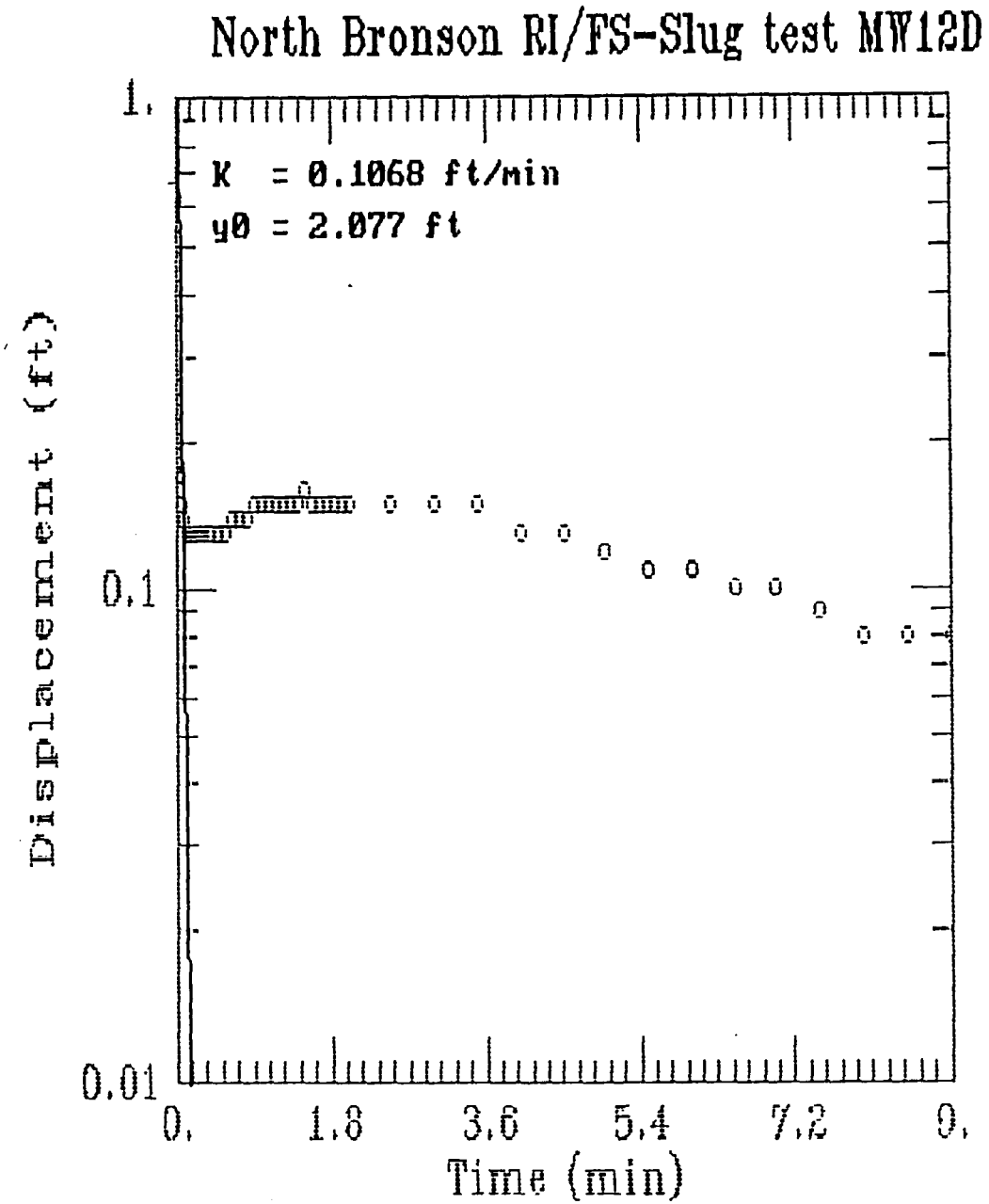
```
type nbmw11s.prn
North Bronson RI/FS-Slug test MW11S
slugt1
    2.61
0.083333
0.083333
slugt2
      18
     4.5
    17.5
tsdata
       0      2.61        1
  0.0033      2.62        1
  0.0066      2.67        1
  0.0099      2.65        1
  0.0133      2.61        1
  0.0166      2.62        1
    0.02      2.64        1
  0.0233      2.62        1
  0.0266      2.61        1
    0.03      2.62        1
  0.0333      2.62        1
    0.05       2.6        1
  0.0666      2.59        1
  0.0833      2.59        1
     0.1      2.57        1
  0.1166      2.57        1
  0.1333      2.56        1
    0.15      2.55        1
  0.1666      2.54        1
  0.1833      2.54        1
     0.2      2.53        1
  0.2166      2.52        1
  0.2333      2.52        1
    0.25      2.51        1
  0.2666       2.5        1
  0.2833       2.5        1
     0.3      2.49        1
  0.3166      2.49        1
  0.3333      2.48        1
  0.4167      2.45        1
     0.5      2.43        1
  0.5833       2.4        1
  0.6667      2.38        1
    0.75      2.37        1
  0.8333      2.35        1
  0.9167      2.32        1
       1       2.3        1
  1.0833      2.28        1
  1.1667      2.26        1
    1.25      2.25        1
  1.3333      2.23        1
  1.4166      2.21        1
     1.5       2.2        1
  1.5833      2.18        1
  1.6667      2.16        1
    1.75      2.14        1
  1.8333      2.13        1
  1.9167      2.11        1
       2      2.09        1
     2.5      2.01        1
       3      1.92        1
     3.5      1.84        1
       4      1.77        1
     4.5       1.7        1
       5      1.63        1
     5.5      1.57        1
       6      1.51        1
     6.5      1.44        1
       7      1.39        1
     7.5      1.34        1
       8      1.28        1
     8.5      1.23        1
       9      1.18        1
     9.5      1.14        1
      10      1.09        1
      12      0.92        1
      14      0.77        1
      16      0.65        1
      18      0.53        1
      20      0.43        1
      22      0.35        1
      24      0.28        1
```


North Bronson RI/FS-Slug test MW11S
K = 0.0002437 ft/min
y0 = 2.568 ft
10.
1.
0.1
Displacement (ft)
0.
4.8
9.6
14.4
19.2
24.
Time (min)

```
type nbmw12s.prn
North Bronson RI/FS-Slug test MW12S
slugt1
    0.09
0.083333
0.083333
slugt2
      21
     4.5
    19.5
tsdata
        0      0.09         1
   0.0033      0.08         1
   0.0066      0.06         1
   0.0099      0.05         1
   0.0133      0.05         1
   0.0166      0.04         1
     0.02      0.03         1
   0.0233      0.03         1
   0.0266      0.03         1
     0.03      0.03         1
   0.0333      0.02         1
     0.05      0.01         1
   0.0666      0.01         1
   0.0833         0         1
      0.1         0         1
   0.1166         0         1
   0.1333     -0.01         1
     0.15     -0.01         1
   0.1666     -0.01         1
   0.1833     -0.01         1
      0.2     -0.01         1
   0.2166     -0.01         1
   0.2333     -0.01         1
     0.25     -0.01         1
   0.2666     -0.01         1
   0.2833     -0.01         1
      0.3     -0.01         1
   0.3166     -0.01         1
   0.3333     -0.01         1
   0.4167     -0.01         1
      0.5     -0.01         1
   0.5833     -0.01         1
   0.6667     -0.01         1
     0.75     -0.01         1
   0.8333     -0.01         1
   0.9167     -0.01         1
        1     -0.01         1
   1.0833     -0.01         1
   1.1667         0         1
     1.25         0         1
   1.3333         0         1
   1.4166         0         1
      1.5         0         1
   1.5833         0         1
   1.6667         0         1
     1.75         0         1
   1.8333         0         1
   1.9167         0         1
        2         0         1
      2.5         0         1
        3     -0.01         1
      3.5         0         1
        4         0         1
      4.5         0         1
        5         0         1
      5.5         0         1
        6         0         1
      6.5      0.01         1
        7      0.01         1
      7.5      0.02         1
```

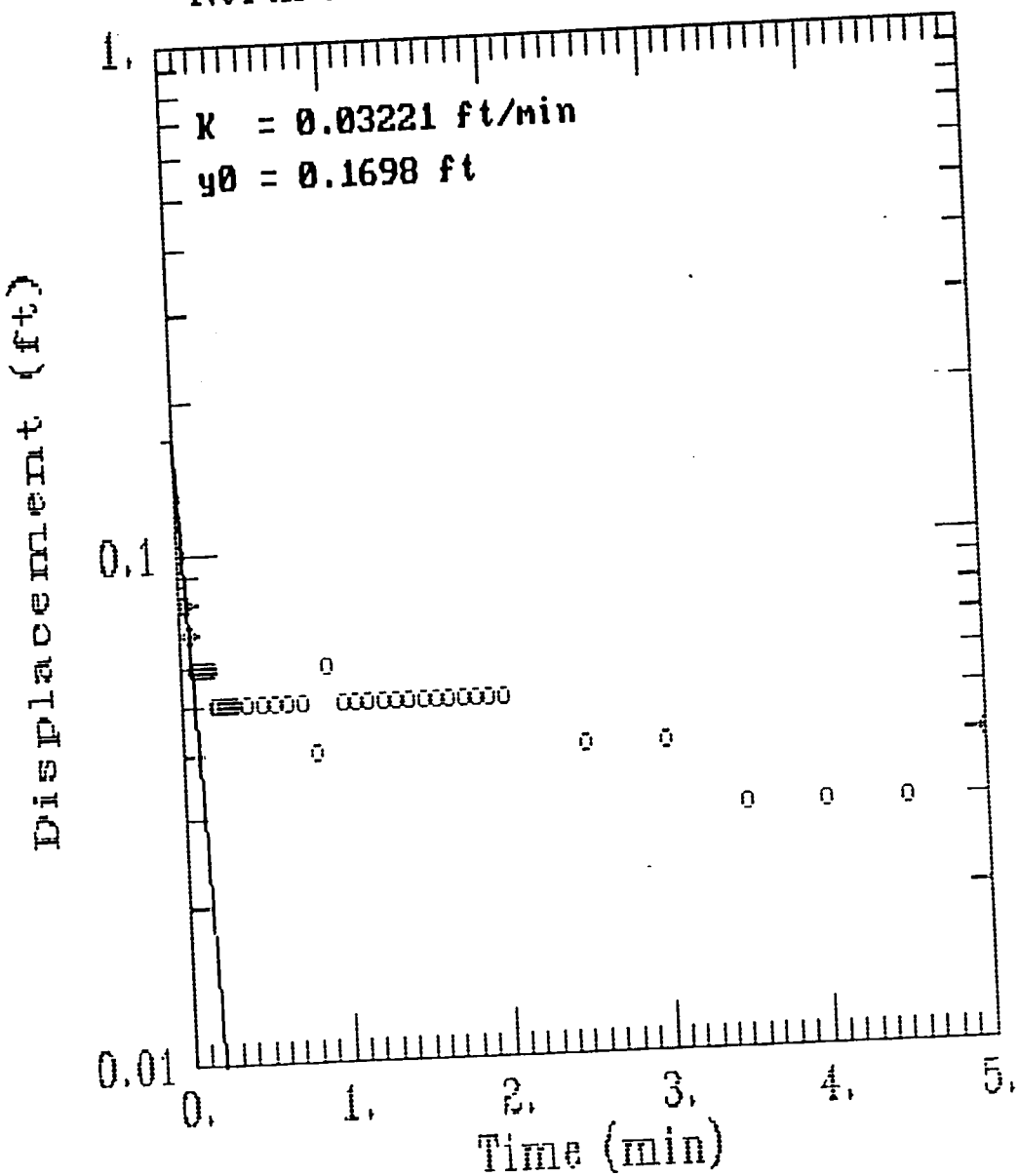

North Bronson RI/FS-Slug test MW12S
K = 0.09247 ft/min
y0 = 0.09441 ft
0.1
0.01
Displacement (ft)
0.
1.6
3.2
4.8
6.4
8.
Time (min)

```
type nbmw12d.prn
North Bronson RI/FS-Slug test MW12D
slugt1
    0.63
0.083333
0.083333
slugt2
      21
     4.5
    19.5
tsdata
       0      0.63        1
  0.0033      0.55        1
  0.0066      0.47        1
  0.0099      0.41        1
  0.0133      0.35        1
  0.0166      0.29        1
    0.02      0.26        1
  0.0233      0.23        1
  0.0266       0.2        1
    0.03      0.18        1
  0.0333      0.17        1
    0.05      0.14        1
  0.0666      0.15        1
  0.0833      0.15        1
     0.1      0.14        1
  0.1166      0.13        1
  0.1333      0.13        1
    0.15      0.13        1
  0.1666      0.13        1
  0.1833      0.13        1
     0.2      0.13        1
  0.2166      0.13        1
  0.2333      0.13        1
    0.25      0.13        1
  0.2666      0.13        1
  0.2833      0.13        1
     0.3      0.13        1
  0.3166      0.13        1
  0.3333      0.13        1
  0.4167      0.13        1
     0.5      0.13        1
  0.5833      0.13        1
  0.6667      0.14        1
    0.75      0.14        1
  0.8333      0.14        1
  0.9167      0.15        1
       1      0.15        1
  1.0833      0.15        1
  1.1667      0.15        1
    1.25      0.15        1
  1.3333      0.15        1
  1.4166      0.15        1
     1.5      0.16        1
  1.5833      0.15        1
  1.6667      0.15        1
    1.75      0.15        1
  1.8333      0.15        1
  1.9167      0.15        1
       2      0.15        1
     2.5      0.15        1
       3      0.15        1
     3.5      0.15        1
       4      0.13        1
     4.5      0.13        1
       5      0.12        1
     5.5      0.11        1
       6      0.11        1
     6.5       0.1        1
       7       0.1        1
     7.5      0.09        1
       8      0.08        1
     8.5      0.08        1
       9      0.08        1
```


North Bronson RI/FS-Slug test MW12D
K = 0.1068 ft/min
y0 = 2.077 ft
Displacement (ft)
1.
0.1
0.01
0.
1.8
3.6
5.4
7.2
9.
Time (min)

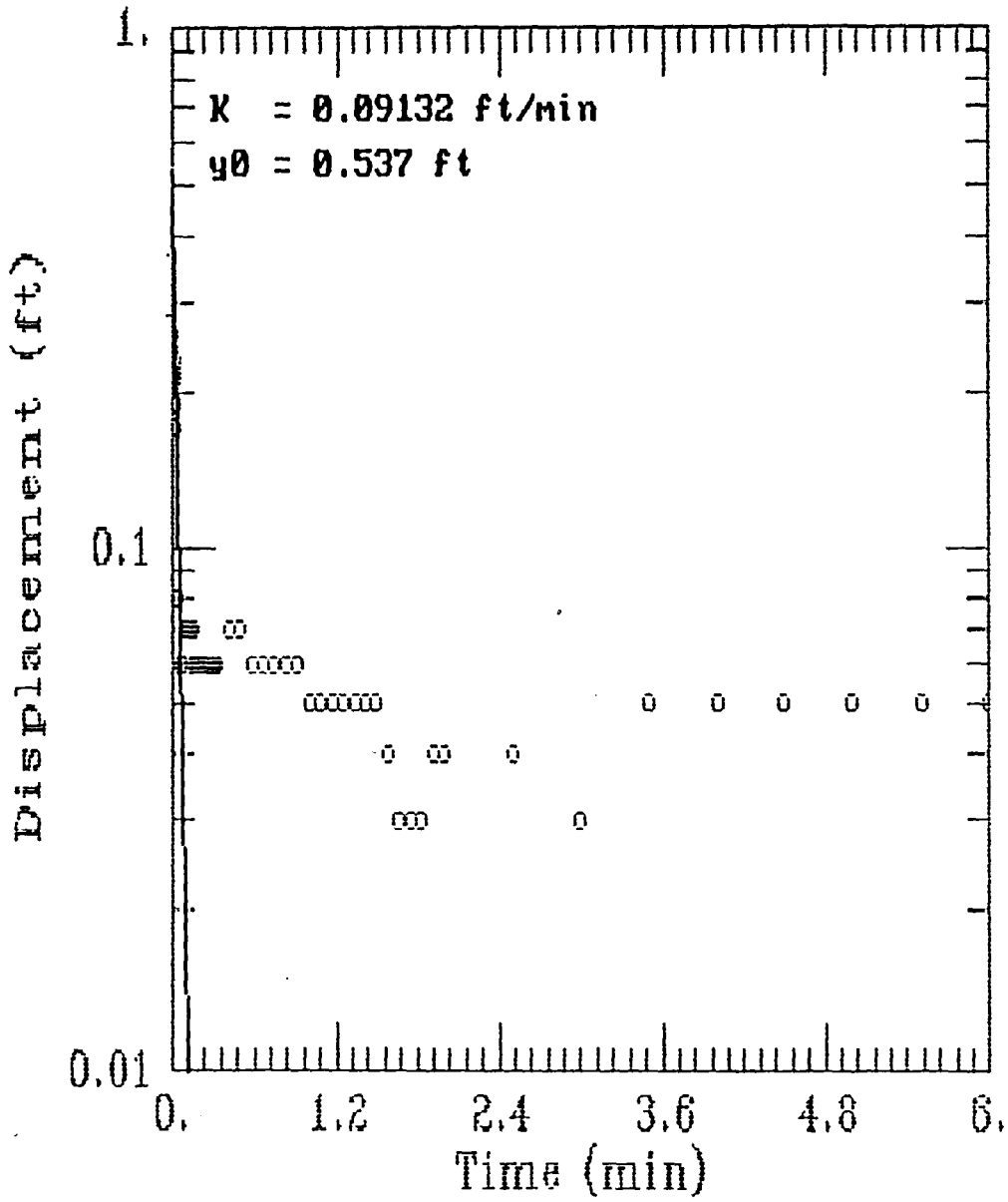
```
type nbmw13s.prn
North Bronson RI/FS-Slug test MW13S
slugt1
    0.12
0.083333
0.083333
slugt2
      20
     4.5
     5.5
tsdata
       0      0.12        1
  0.0033      0.13        1
  0.0066      0.12        1
  0.0099      0.11        1
  0.0133       0.1        1
  0.0166       0.1        1
    0.02      0.09        1
  0.0233      0.09        1
  0.0266      0.09        1
    0.03      0.09        1
  0.0333      0.08        1
    0.05      0.08        1
  0.0666      0.07        1
  0.0833      0.06        1
     0.1      0.06        1
  0.1166      0.06        1
  0.1333      0.06        1
    0.15      0.06        1
  0.1666      0.06        1
  0.1833      0.06        1
     0.2      0.06        1
  0.2166      0.05        1
  0.2333      0.05        1
    0.25      0.05        1
  0.2666      0.05        1
  0.2833      0.05        1
     0.3      0.05        1
  0.3166      0.05        1
  0.3333      0.05        1
  0.4167      0.05        1
     0.5      0.05        1
  0.5833      0.05        1
  0.6667      0.05        1
    0.75      0.05        1
  0.8333      0.04        1
  0.9167      0.06        1
       1      0.05        1
  1.0833      0.05        1
  1.1667      0.05        1
    1.25      0.05        1
  1.3333      0.05        1
  1.4166      0.05        1
     1.5      0.05        1
  1.5833      0.05        1
  1.6667      0.05        1
    1.75      0.05        1
  1.8333      0.05        1
  1.9167      0.05        1
       2      0.05        1
     2.5      0.04        1
       3      0.04        1
     3.5      0.03        1
       4      0.03        1
     4.5      0.03        1
       5      0.04        1
```

North Bronson RI/FS-Slug test MW13S



```
type nbmw13d.prn
North Bronson RI/FS-Slug test MW13D
slugt1
    0.26
0.083333
0.083333
slugt2
      20
     4.5
      19
tsdata
       0      0.26        1
  0.0033      0.24        1
  0.0066      0.22        1
  0.0099      0.21        1
  0.0133      0.21        1
  0.0166      0.22        1
    0.02      0.23        1
  0.0233      0.22        1
  0.0266      0.21        1
    0.03      0.19        1
  0.0333      0.17        1
    0.05      0.08        1
  0.0666      0.06        1
  0.0833      0.06        1
     0.1      0.07        1
  0.1166      0.07        1
  0.1333      0.07        1
    0.15      0.07        1
  0.1666      0.06        1
  0.1833      0.06        1
     0.2      0.06        1
  0.2166      0.06        1
  0.2333      0.06        1
    0.25      0.06        1
  0.2666      0.06        1
  0.2833      0.06        1
     0.3      0.06        1
  0.3166      0.06        1
  0.3333      0.06        1
  0.4167      0.07        1
     0.5      0.07        1
  0.5833      0.06        1
  0.6667      0.06        1
    0.75      0.06        1
  0.8333      0.06        1
  0.9167      0.06        1
       1      0.05        1
  1.0833      0.05        1
  1.1667      0.05        1
    1.25      0.05        1
  1.3333      0.05        1
  1.4166      0.05        1
     1.5      0.05        1
  1.5833      0.04        1
  1.6667      0.03        1
    1.75      0.03        1
  1.8333      0.03        1
  1.9167      0.04        1
       2      0.04        1
     2.5      0.04        1
       3      0.03        1
     3.5      0.05        1
       4      0.05        1
     4.5      0.05        1
       5      0.05        1
     5.5      0.05        1
       6      0.05        1
```

North Bronson RI/FS-Slug test MW13D



North Bronson RI/FS - Slug Test for MW19

slugt1

3.33

0.083333

0.083333

slugt2

49

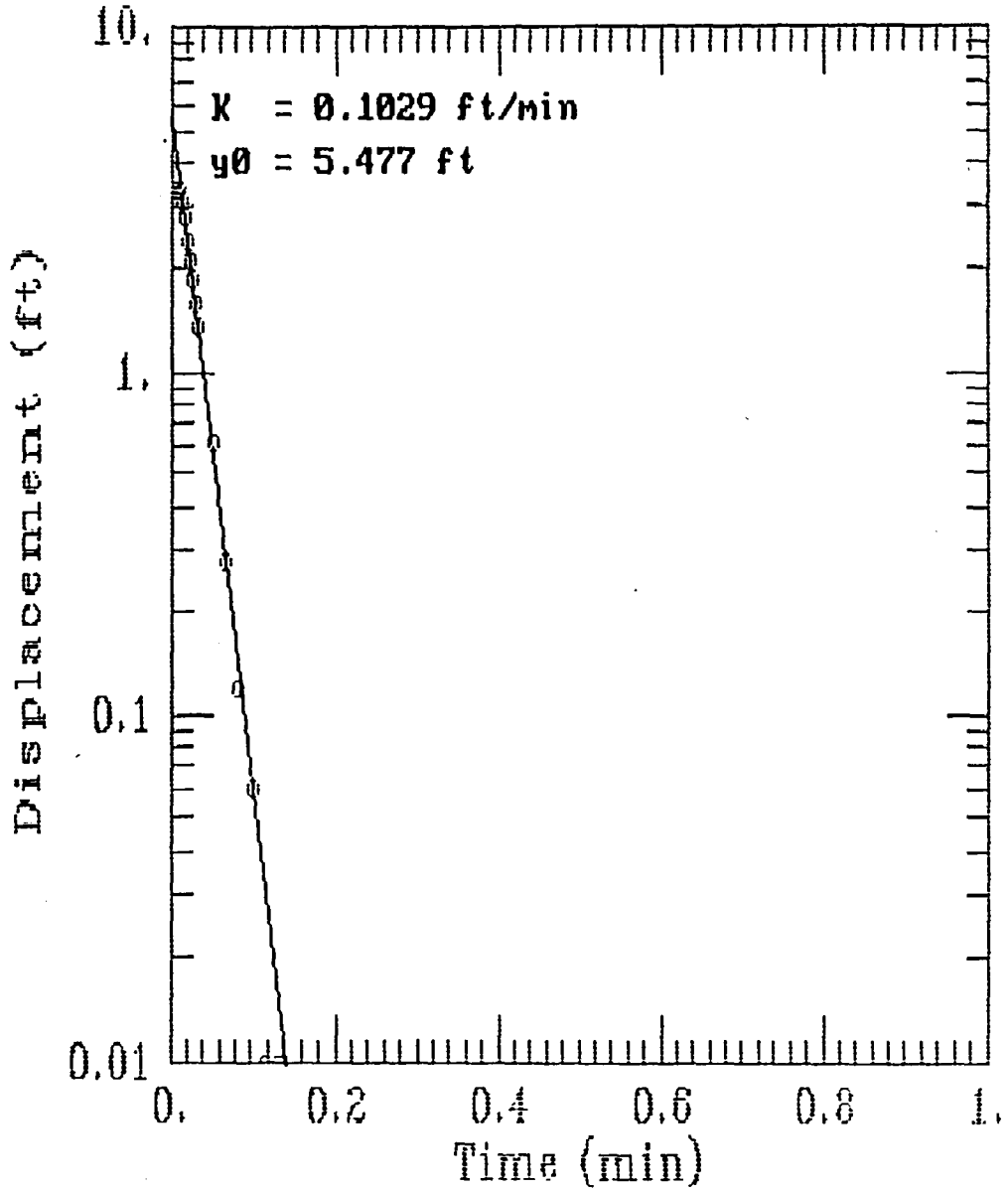
4.63

14.44

tsdata

0.0099	3.33	1
0.0133	3.12	1
0.0166	2.77	1
0.02	2.42	1
0.0233	2.1	1
0.0266	1.83	1
0.03	1.57	1
0.0333	1.35	1
0.05	0.63	1
0.0666	0.28	1
0.0833	0.12	1
0.1	0.06	1
0.1166	0.01	1
0.1333	0.01	1
0.15	0	1
0.1666	0	1
0.1833	0	1
0.2	0	1
0.2166	0	1
0.2333	0	1
0.25	0	1
0.2666	0	1
0.2833	0	1
0.3	0	1
0.3166	0	1
0.3333	0	1
0.4167	0	1
0.5	0	1
0.5833	0	1
0.6667	0	1
0.75	0	1
0.8333	0	1
0.9167	0	1
1	0	1
1.0833	0	1
1.1667	0	1
1.25	0	1
1.3333	0	1
1.4166	0	1
1.5	0	1
1.5833	0	1
1.6667	0	1
1.75	0	1
1.8333	0	1
1.9167	0	1
2	0	1
2.5	0	1
3	0	1

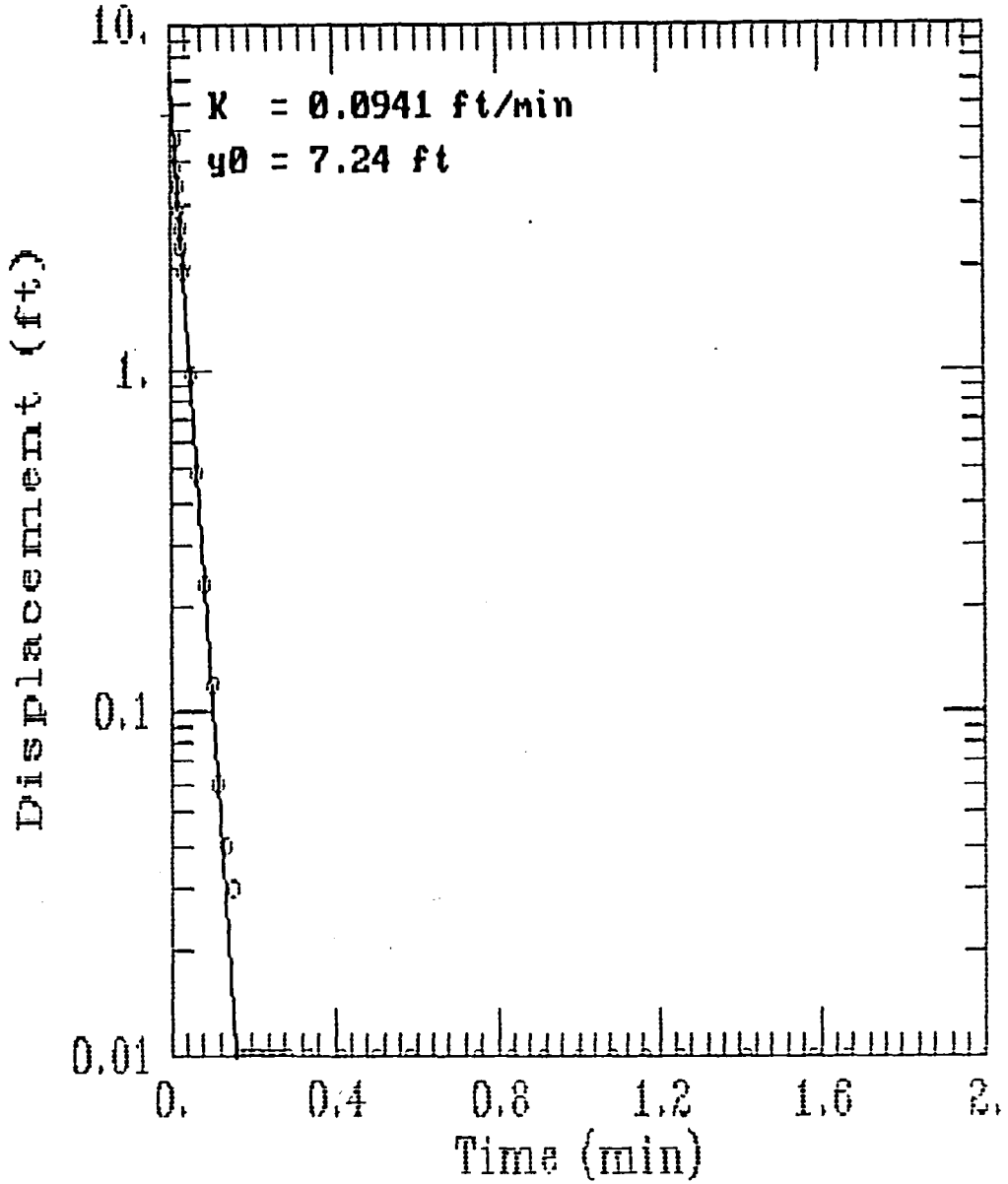
North Bronson RI/FS - SLUG TEST/MW19



```
B:\>type mbmw20.prn
North Bronson RI/FS - Slug Test for mw20
slugt1
   4.65
0.083333
0.083333
slugt2
     45
   4.63
  11.67
tsdata
  0.0133    4.65     1
  0.0166    3.95     1
    0.02    3.41     1
  0.0233    2.98     1
  0.0266    2.59     1
    0.03    2.26     1
  0.0333    1.97     1
    0.05    0.98     1
  0.0666    0.49     1
  0.0833    0.23     1
     0.1    0.12     1
  0.1166    0.06     1
  0.1333    0.04     1
    0.15    0.03     1
  0.1666    0.01     1
  0.1833    0.01     1
     0.2    0.01     1
  0.2166    0.01     1
  0.2333    0.01     1
    0.25    0.01     1
  0.2666    0.01     1
  0.2833    0.01     1
     0.3       0     1
  0.3166       0     1
  0.3333    0.01     1
  0.4167    0.01     1
     0.5    0.01     1
  0.5833    0.01     1
  0.6667       0     1
    0.75    0.01     1
  0.8333    0.01     1
  0.9167    0.01     1
       1    0.01     1
  1.0833    0.01     1
  1.1667    0.01     1
    1.25    0.01     1
  1.3333       0     1
  1.4166    0.01     1
     1.5       0     1
  1.5833    0.01     1
  1.6667    0.01     1
    1.75       0     1
  1.8333       0     1
  1.9167       0     1
       2    0.01     1
     2.5       0     1
       3       0     1

B:\>typenbbmw21.prn
```

North Bronson RI/FS - SLUG TEST/MW20



North Bronson RI/FS - Slug Test for MW21

slugt1

1.49

0.083333

0.083333

slugt2

43

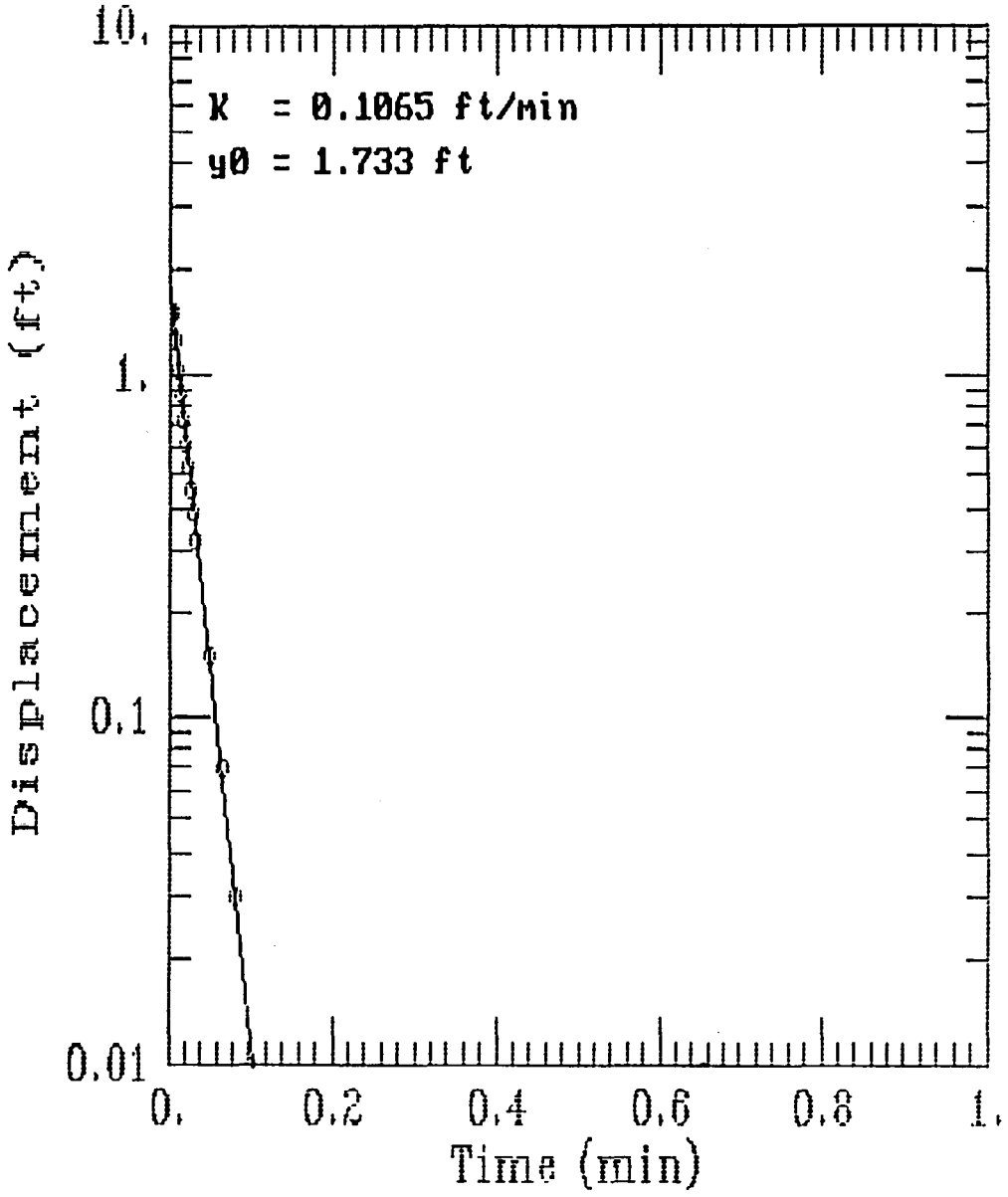
4.63

8.66

tsdata

0.0033	1.49	1
0.0066	1.24	1
0.0099	1.03	1
0.0133	0.87	1
0.0166	0.73	1
0.02	0.63	1
0.0233	0.54	1
0.0266	0.46	1
0.03	0.39	1
0.0333	0.33	1
0.05	0.15	1
0.0666	0.07	1
0.0833	0.03	1
0.1	0.01	1
0.1166	0	1
0.1333	0	1
0.15	0	1
0.1666	0	1
0.1833	0	1
0.2	0	1
0.2166	0	1
0.2333	0	1
0.25	-0.02	1
0.2666	0	1
0.2833	0	1
0.3	0	1
0.3166	0	1
0.3333	0	1
0.4167	0	1
0.5	-0.02	1
0.5833	0	1
0.6667	0	1
0.75	0	1
0.8333	0	1
0.9167	0	1
1	0	1
1.0833	0	1
1.1667	0	1
1.25	0	1
1.3333	-0.02	1
1.4166	0	1
1.5	-0.02	1
1.5833	0	1
1.6667	0	1
1.75	0	1
1.8333	0	1
1.9167	0	1
2	0	1
2.5	0	1

North Bronson RI/FS - SLUG TEST/MW21



B:\>type nbmw22.prn

North Bronson RI/FS - SLUG TEST for MW22

slugt1

8.57

0.083333

0.083333

slugt2

48

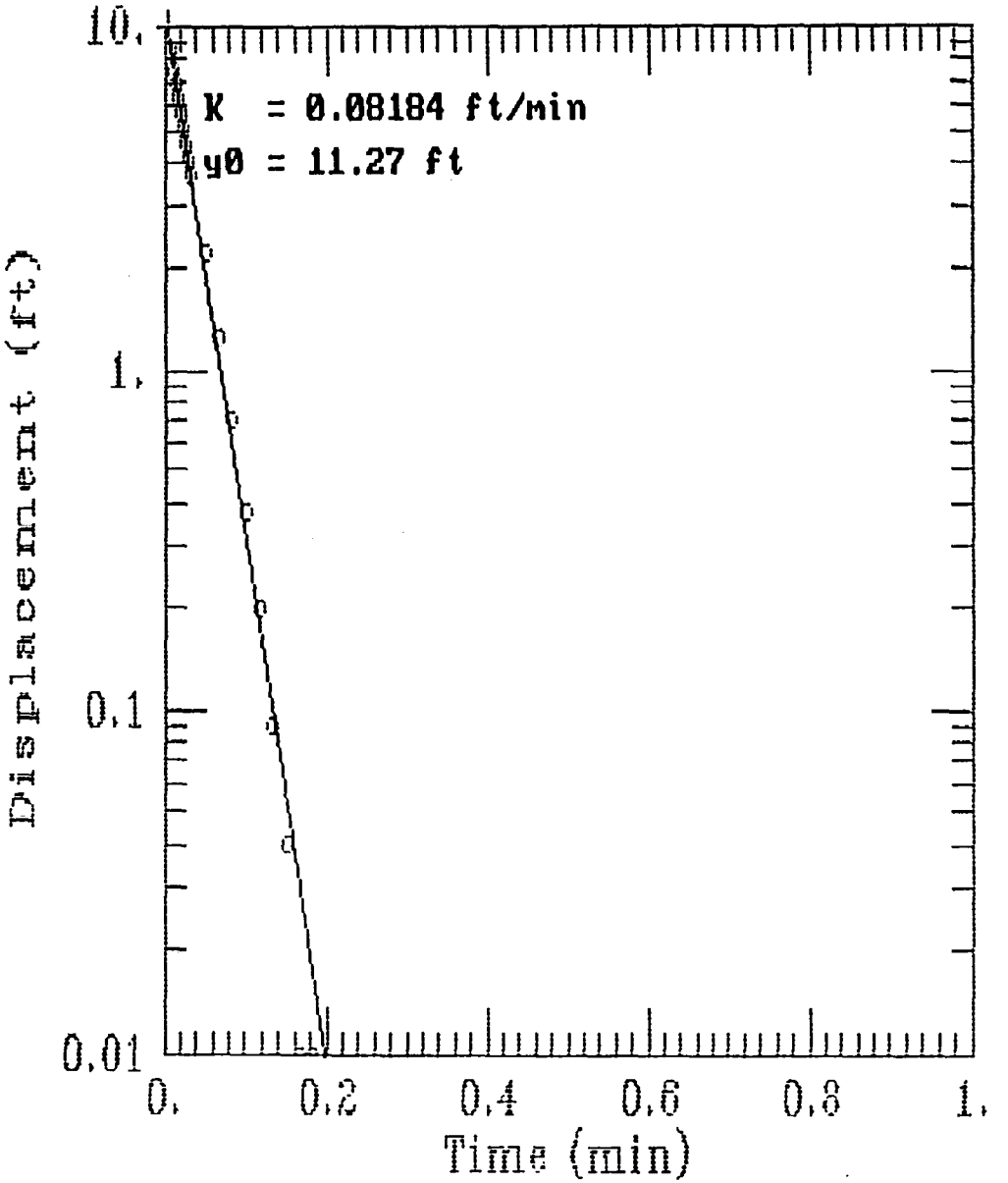
4.63

15.18

tsdata

0.0066	8.57	1	3.5	-0.02	1
0.0099	7.57	1	4	-0.02	1
0.0133	6.88	1	4.5	0	1
0.0166	6.23	1	5	0	1
0.02	5.64	1	5.5	-0.02	1
0.0233	5.1	1	6	0	1
0.0266	4.6	1	6.5	0	1
0.03	4.16	1			
0.0333	3.74	1			
0.05	2.2	1			
0.0666	1.25	1			
0.0833	0.7	1			
0.1	0.38	1			
0.1166	0.2	1			
0.1333	0.09	1			
0.15	0.04	1			
0.1666	0.01	1			
0.1833	0.01	1			
0.2	0	1			
0.2166	0	1			
0.2333	-0.02	1			
0.25	-0.02	1			
0.2666	-0.02	1			
0.2833	-0.02	1			
0.3	-0.02	1			
0.3166	-0.02	1			
0.3333	-0.02	1			
0.4167	-0.02	1			
0.5	-0.02	1			
0.5833	-0.02	1			
0.6667	-0.02	1			
0.75	0	1			
0.8333	0	1			
0.9167	0	1			
1	-0.02	1			
1.0833	0	1			
1.1667	0	1			
1.25	0	1			
1.3333	-0.02	1			
1.4166	0	1			
1.5	0	1			
1.5833	0	1			
1.6667	0	1			
1.75	0	1			
1.8333	0	1			
1.9167	0	1			
2	-0.02	1			
2.5	0	1			
3	0	1			

North Bronson RI/FS - SLUG TEST/MW22



B:\>type nbmw23.prn

North Bronson RI/FS - SLUG TEST for MW23

slugt1

3.68

0.083333

0.083333

slugt2

25

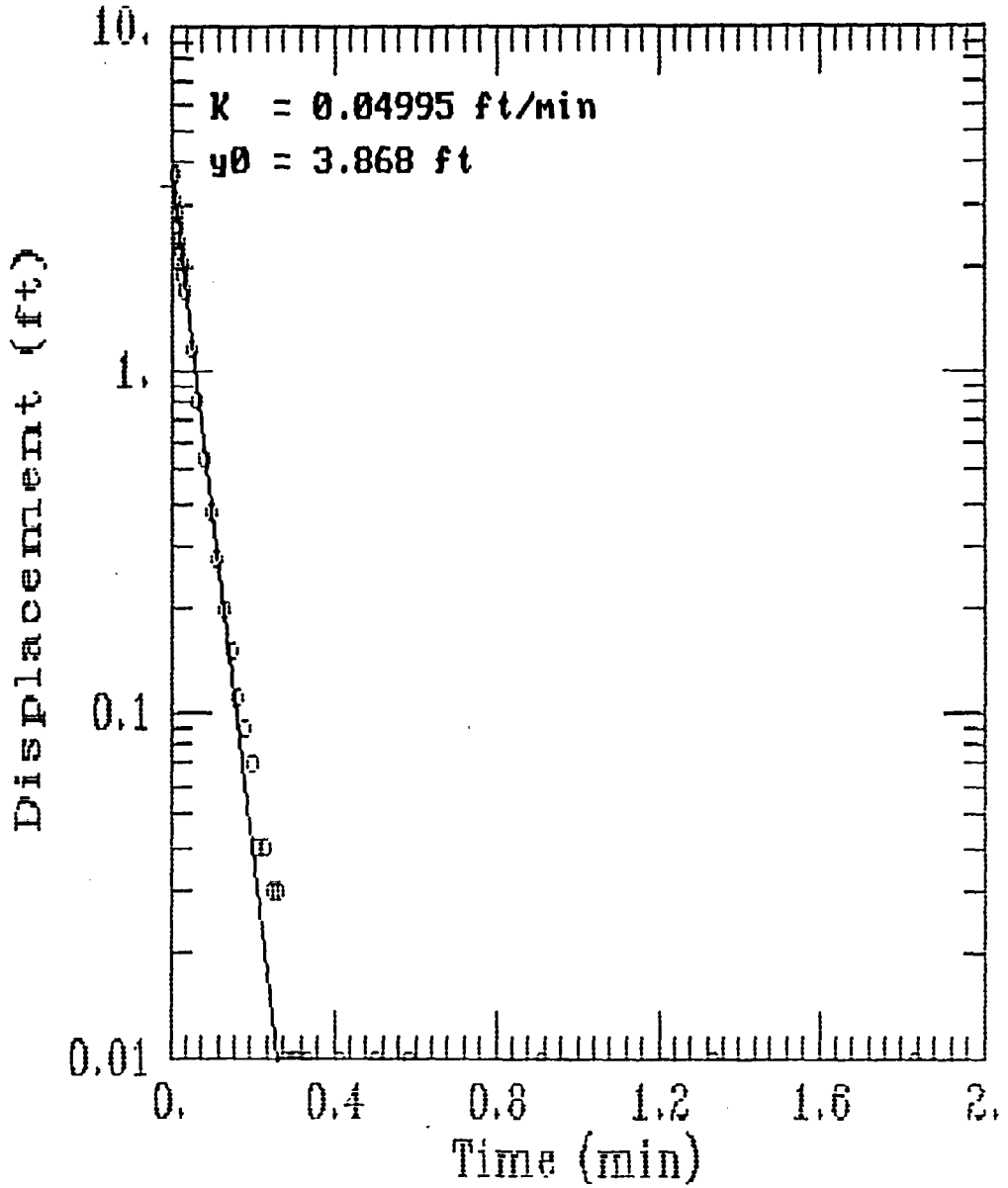
4.63

8.77

tsdata

0.0066	3.68	1
0.0099	3.1	1
0.0133	2.85	1
0.0166	2.63	1
0.02	2.4	1
0.0233	2.23	1
0.0266	2.05	1
0.03	1.89	1
0.0333	1.73	1
0.05	1.17	1
0.0666	0.81	1
0.0833	0.55	1
0.1	0.38	1
0.1166	0.28	1
0.1333	0.2	1
0.15	0.15	1
0.1666	0.11	1
0.1833	0.09	1
0.2	0.07	1
0.2166	0.04	1
0.2333	0.04	1
0.25	0.03	1
0.2666	0.03	1
0.2833	0.01	1
0.3	0.01	1
0.3166	0.01	1
0.3333	0.01	1
0.4167	0.01	1
0.5	0.01	1
0.5833	0.01	1
0.6667	0	1
0.75	0	1
0.8333	0	1
0.9167	0.01	1
1	0	1
1.0833	0	1
1.1667	0	1
1.25	0	1
1.3333	0.01	1
1.4166	0	1
1.5	0	1
1.5833	0	1
1.6667	0	1
1.75	0	1
1.8333	0.01	1
1.9167	0	1
2	0	1
2.5	0	1

North Bronson RI/FS - SLUG TEST/MW23



North Bronson RI/FS - SLUG TEST for MW24

slugt1

5.43

0.083333

0.083333

slugt2

43

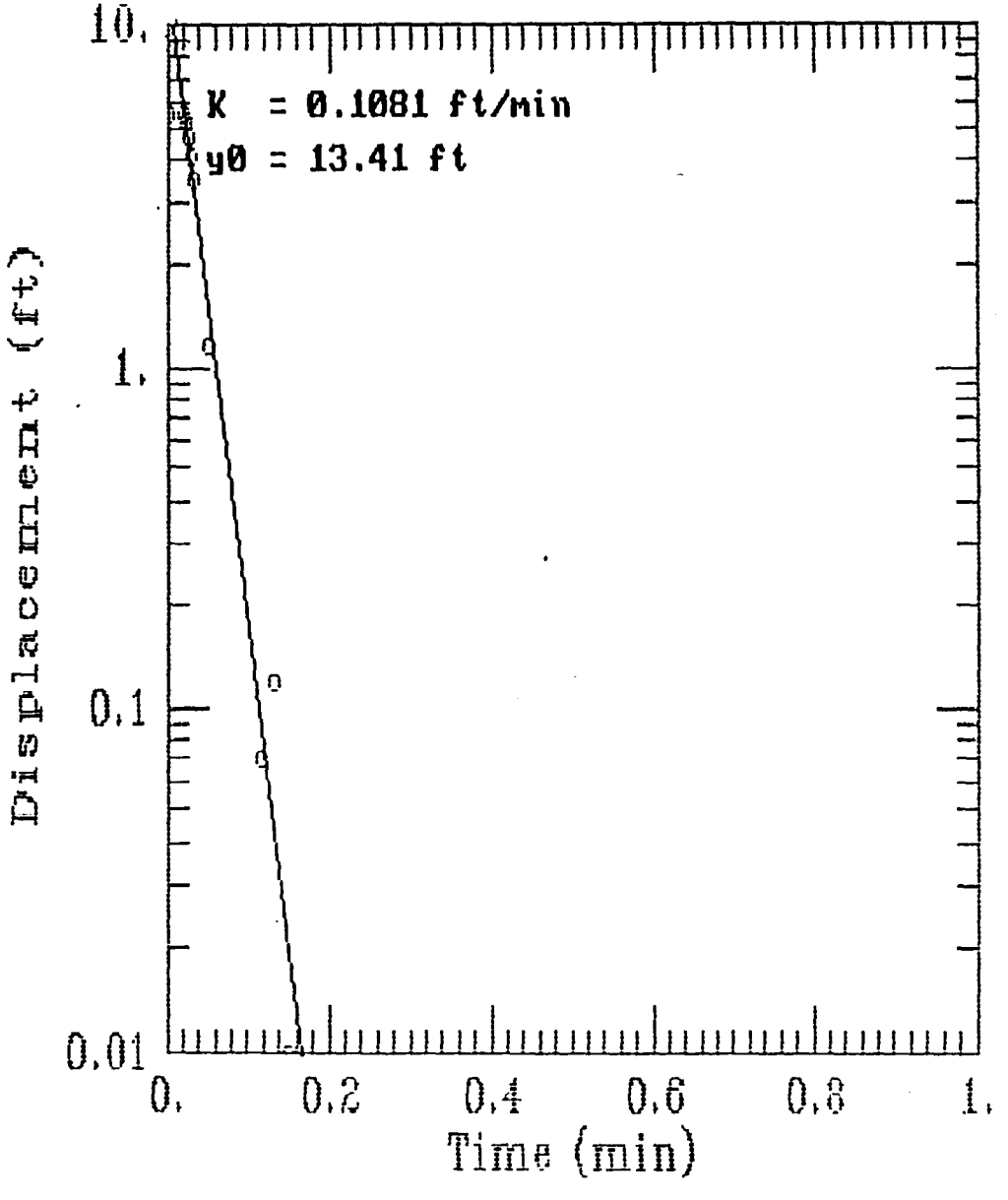
4.63

24.86

tsdata

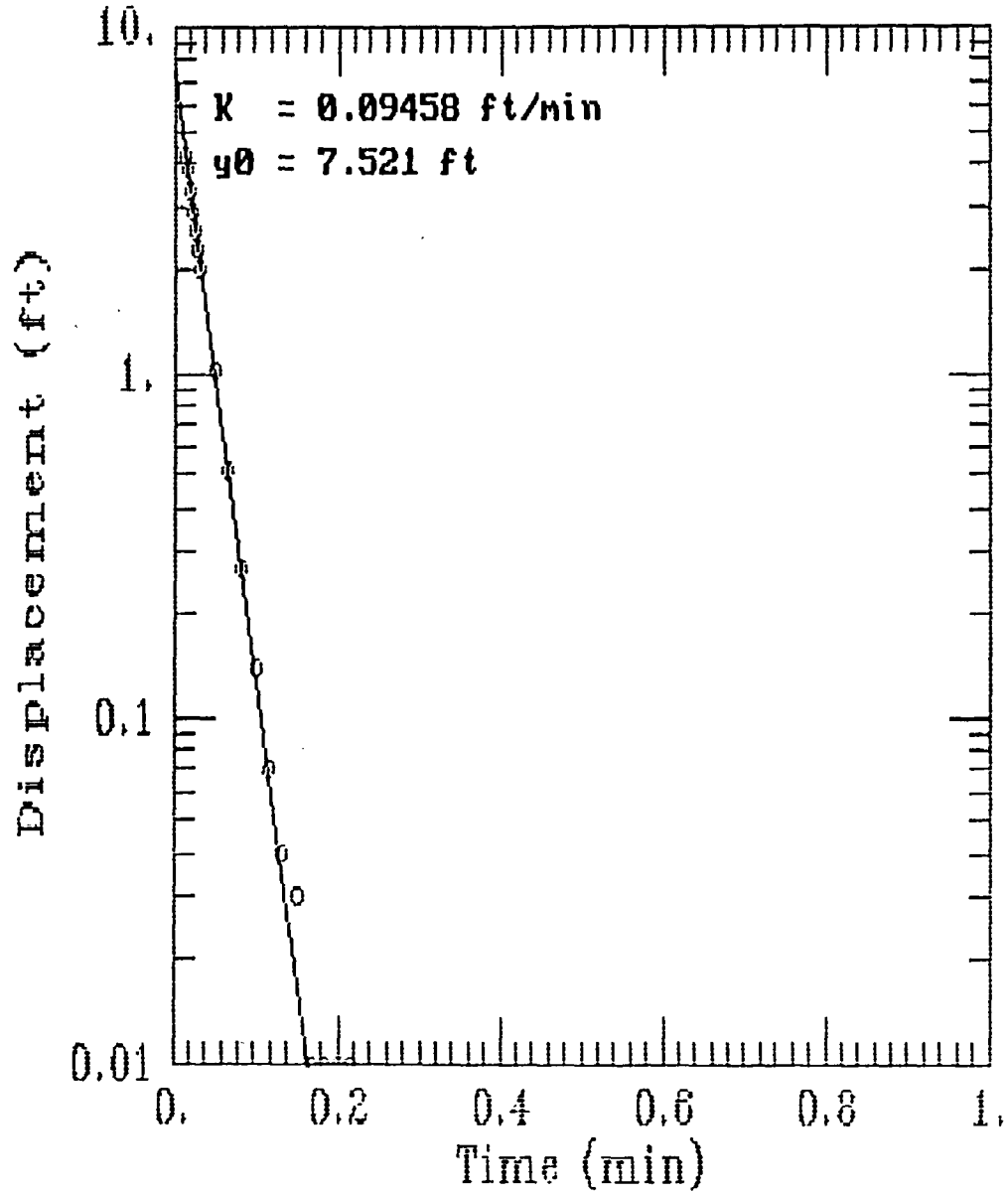
0.02	5.43	1
0.0233	5.16	1
0.0266	4.65	1
0.03	4.11	1
0.0333	3.52	1
0.05	1.16	1
0.0666	-0.12	1
0.0833	-0.53	1
0.1	-0.26	1
0.1166	0.07	1
0.1333	0.12	1
0.15	0.01	1
0.1666	-0.07	1
0.1833	-0.07	1
0.2	-0.04	1
0.2166	0	1
0.2333	-0.02	1
0.25	-0.02	1
0.2666	-0.04	1
0.2833	-0.04	1
0.3	-0.02	1
0.3166	-0.02	1
0.3333	-0.02	1
0.4167	-0.02	1
0.5	-0.02	1
0.5833	-0.02	1
0.6667	-0.02	1
0.75	-0.02	1
0.8333	-0.02	1
0.9167	-0.02	1
1	-0.02	1
1.0833	-0.02	1
1.1667	-0.02	1
1.25	-0.02	1
1.3333	-0.02	1
1.4166	-0.02	1
1.5	-0.02	1
1.5833	-0.02	1
1.6667	0	1
1.75	-0.02	1
1.8333	-0.02	1
1.9167	-0.02	1
2	-0.02	1
2.5	0	1
3	-0.02	1
3.5	-0.02	1
4	-0.02	1
4.5	-0.02	1
5	-0.02	1
5.5	-0.02	1
6	-0.02	1
6.5	-0.02	1
7	-0.02	1
7.5	-0.02	1
8	-0.02	1
8.5	-0.02	1
9	0	1
9.5	-0.02	1

North Bronson RI/FS - SLUG TEST/MW24



```
B:\>type nbmw25.prn
North Bronson RI/FS - SLUG TEST for MW25
slugt1
   4.25
0.083333
0.083333
slugt2
    20
   4.63
  12.21
tsdata
  0.0133    4.25     1
  0.0166    3.89     1
    0.02    3.39     1
  0.0233    2.96     1
  0.0266    2.59     1
    0.03    2.26     1
  0.0333    1.99     1
    0.05    1.02     1
  0.0666    0.52     1
  0.0833    0.27     1
     0.1    0.14     1
  0.1166    0.07     1
  0.1333    0.04     1
    0.15    0.03     1
  0.1666    0.01     1
  0.1833    0.01     1
     0.2    0.01     1
  0.2166    0.01     1
  0.2333       0     1
    0.25       0     1
  0.2666       0     1
  0.2833       0     1
     0.3       0     1
  0.3166       0     1
  0.3333       0     1
  0.4167       0     1
     0.5       0     1
  0.5833       0     1
  0.6667       0     1
    0.75       0     1
  0.8333       0     1
  0.9167       0     1
       1       0     1
  1.0833       0     1
  1.1667       0     1
    1.25       0     1
  1.3333       0     1
  1.4166       0     1
     1.5       0     1
  1.5833       0     1
  1.6667       0     1
    1.75       0     1
  1.8333       0     1
  1.9167       0     1
       2       0     1
     2.5       0     1
```

North Bronson RI/FS - SLUG TEST/MW25



North Bronson RI/FS - SLUG TEST for MW26

slugt1

3.71

0.083333

0.083333

slugt2

23

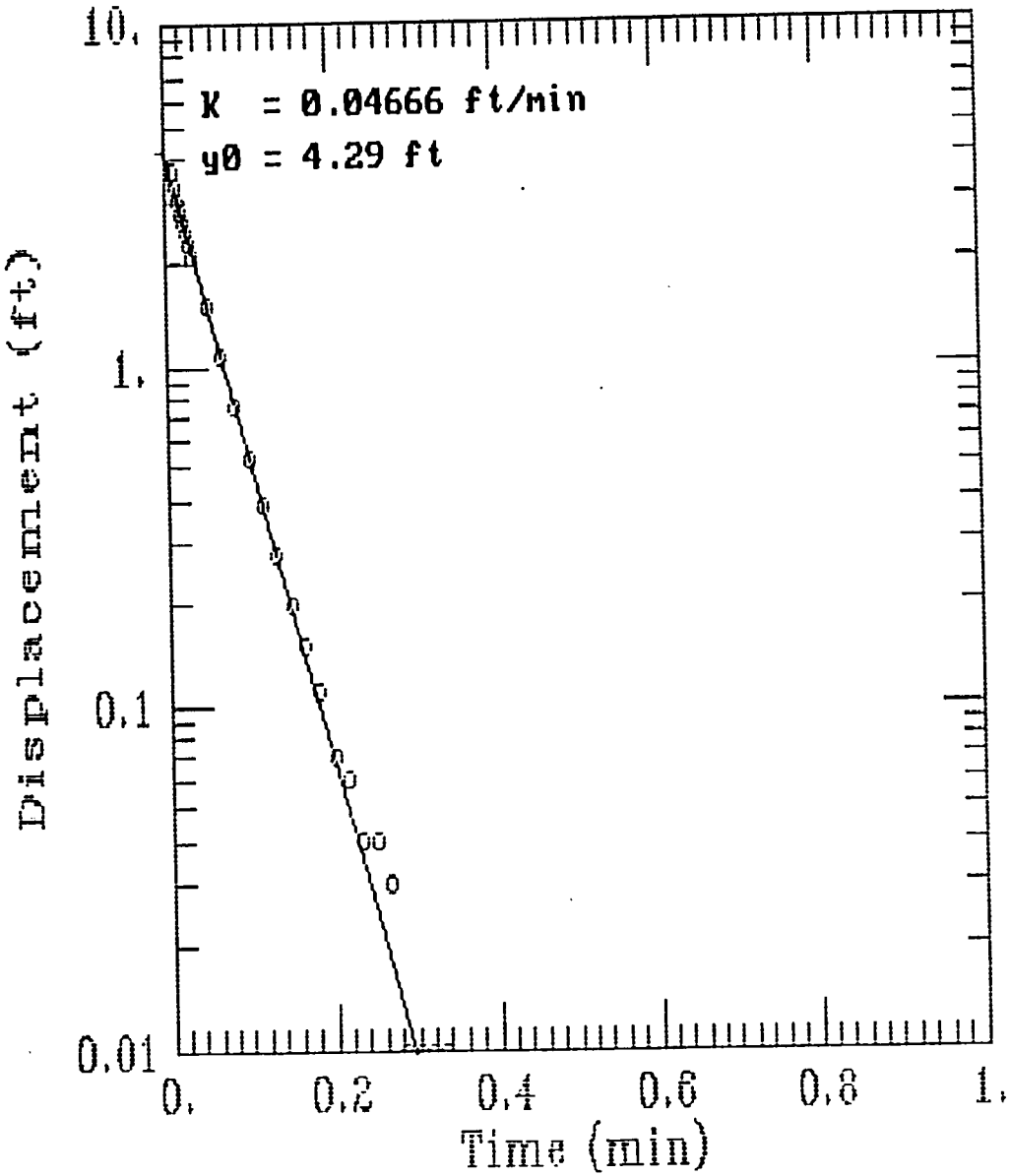
4.63

10.41

tsdata

0.0099	3.71	1
0.0133	3.34	1
0.0166	3.06	1
0.02	2.83	1
0.0233	2.63	1
0.0266	2.43	1
0.03	2.26	1
0.0333	2.1	1
0.05	1.49	1
0.0666	1.06	1
0.0833	0.76	1
0.1	0.54	1
0.1166	0.39	1
0.1333	0.28	1
0.15	0.2	1
0.1666	0.15	1
0.1833	0.11	1
0.2	0.07	1
0.2166	0.06	1
0.2333	0.04	1
0.25	0.04	1
0.2666	0.03	1
0.2833	0.01	1
0.3	0.01	1
0.3166	0.01	1
0.3333	0.01	1
0.4167	0	1
0.5	0	1
0.5833	0	1
0.6667	0	1
0.75	0	1
0.8333	0	1
0.9167	0	1
1	0	1
1.0833	0	1
1.1667	0	1
1.25	0	1
1.3333	0	1
1.4166	0	1
1.5	0	1
1.5833	0	1
1.6667	0	1
1.75	0	1
1.8333	0	1
1.9167	0	1
2	0	1
2.5	0	1
3	0	1

North Bronson RI/FS - SLUG TEST/MW26



B:\>type nbmw27.prn

North Bronson RI/FS - SLUG TEST for MW27

slugt1

12.75

0.083333

0.083333

slugt2

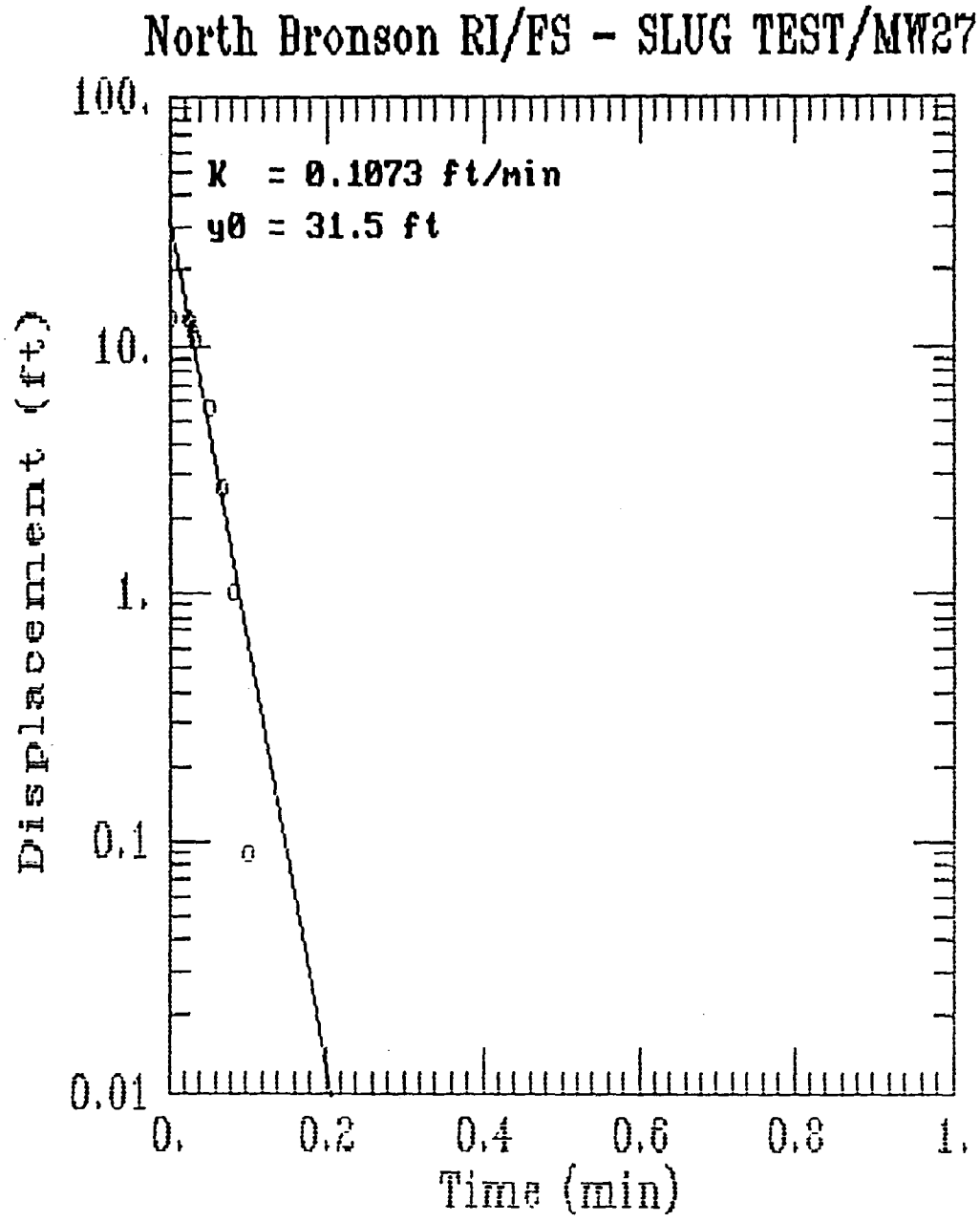
49

4.63

42.93

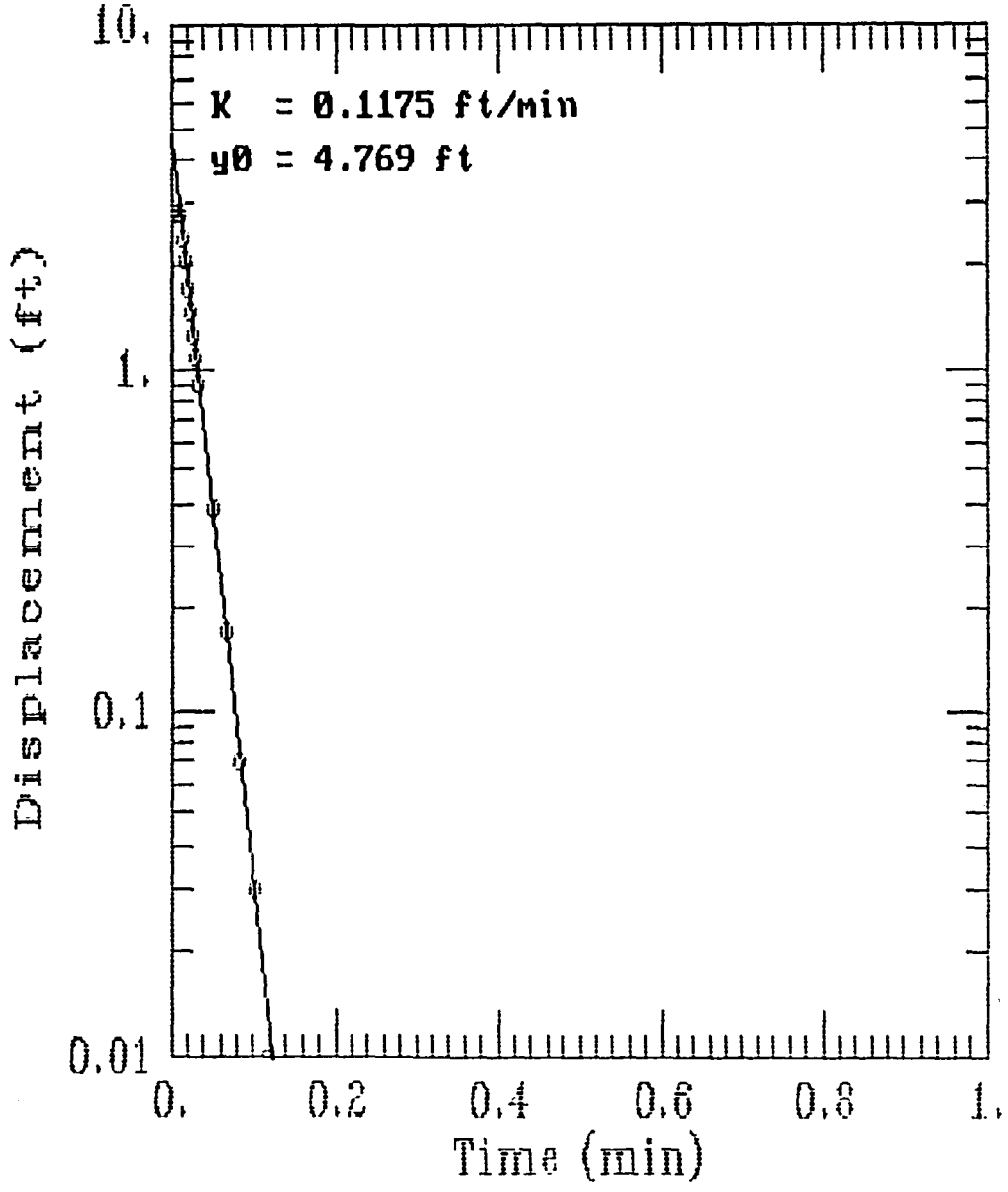
tsdata

0.0233	12.75	1
0.0266	12.31	1
0.03	11.46	1
0.0333	10.44	1
0.05	5.56	1
0.0666	2.64	1
0.0833	1	1
0.1	0.09	1
0.1166	-0.28	1
0.1333	-0.32	1
0.15	-0.24	1
0.1666	-0.15	1
0.1833	-0.08	1
0.2	-0.07	1
0.2166	-0.07	1
0.2333	-0.08	1
0.25	-0.1	1
0.2666	-0.12	1
0.2833	-0.12	1
0.3	-0.12	1
0.3166	-0.1	1
0.3333	-0.1	1
0.4167	-0.1	1
0.5	-0.1	1
0.5833	-0.08	1
0.6667	-0.08	1
0.75	-0.08	1
0.8333	-0.08	1
0.9167	-0.08	1
1	-0.08	1
1.0833	-0.08	1
1.1667	-0.08	1
1.25	-0.08	1
1.3333	-0.07	1
1.4166	-0.07	1
1.5	-0.07	1
1.5833	-0.07	1
1.6667	-0.07	1
1.75	-0.07	1
1.8333	-0.07	1
1.9167	-0.07	1
2	-0.07	1
2.5	-0.07	1
3	-0.07	1
3.5	-0.07	1


North Bronson RI/FS - SLUG TEST/MW27
K = 0.1073 ft/min
y0 = 31.5 ft
100.
10.
1.
0.1
0.01
Displacement (ft)
0.
0.2
0.4
0.6
0.8
1.
Time (min)

```
>type nbmw28.prn
North Bronson RI/FS - SLUG TEST for 28
slugt1
    2.83
0.083333
0.083333
slugt2
      16
    4.63
    10.1
tsdata
  0.0066     2.83       1
  0.0099      2.8       1
  0.0133     2.39       1
  0.0166     2.04       1
    0.02     1.73       1
  0.0233     1.48       1
  0.0266     1.25       1
    0.03     1.06       1
  0.0333      0.9       1
    0.05     0.39       1
  0.0666     0.17       1
  0.0833     0.07       1
     0.1     0.03       1
  0.1166     0.01       1
  0.1333        0       1
    0.15        0       1
  0.1666        0       1
  0.1833        0       1
     0.2        0       1
  0.2166        0       1
  0.2333        0       1
    0.25        0       1
  0.2666        0       1
  0.2833        0       1
     0.3        0       1
  0.3166        0       1
  0.3333        0       1
  0.4167        0       1
     0.5        0       1
  0.5833        0       1
  0.6667        0       1
    0.75        0       1
  0.8333        0       1
  0.9167        0       1
       1        0       1
  1.0833        0       1
  1.1667        0       1
    1.25        0       1
  1.3333        0       1
  1.4166        0       1
     1.5        0       1
  1.5833        0       1
  1.6667        0       1
    1.75        0       1
  1.8333        0       1
  1.9167        0       1
       2        0       1
     2.5        0       1
       3        0       1
```

North Bronson RI/FS - SLUG TEST/MW28



B:\>type nbmw29.prn

North Bronson RI/FS - SLUG TEST for MW29

slugt1

4.73

0.083333

0.083333

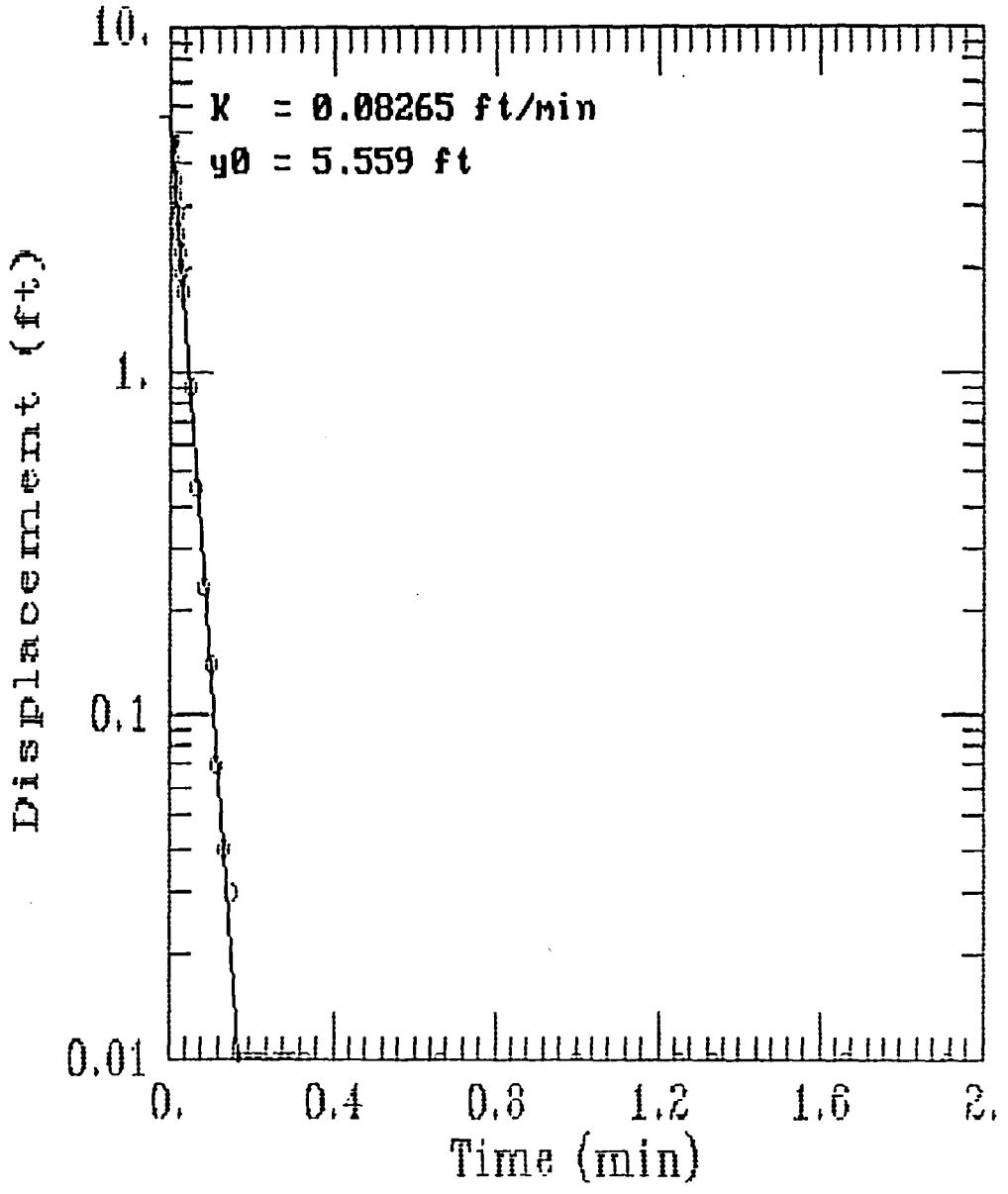
slugt2

47

4.63

9.89

tsdata

0.0066	4.73	1
0.0099	4.17	1
0.0133	3.66	1
0.0166	3.25	1
0.02	2.85	1
0.0233	2.51	1
0.0266	2.21	1
0.03	1.94	1
0.0333	1.7	1
0.05	0.89	1
0.0666	0.46	1
0.0833	0.23	1
0.1	0.14	1
0.1166	0.07	1
0.1333	0.04	1
0.15	0.03	1
0.1666	0.01	1
0.1833	0.01	1
0.2	0.01	1
0.2166	0.01	1
0.2333	0.01	1
0.25	0	1
0.2666	0.01	1
0.2833	0.01	1
0.3	0.01	1
0.3166	0	1
0.3333	0.01	1
0.4167	0	1
0.5	0	1
0.5833	0	1
0.6667	0.01	1
0.75	0	1
0.8333	0	1
0.9167	0	1
1	0.01	1
1.0833	0	1
1.1667	0	1
1.25	0.01	1
1.3333	0.01	1
1.4166	0	1
1.5	0	1
1.5833	0	1
1.6667	0.01	1
1.75	0	1
1.8333	0	1
1.9167	0.01	1
2	0	1
2.5	0	1
3	0	1
3.5	0	1
4	0	1
4.5	0	1
5	0	1
5.5	0	1
6	0	1
6.5	0	1
7	0	1
7.5	0	1
8	0	1
8.5	0	1
9	0	1
9.5	0	1
10	0	1
12	-0.02	1

North Bronson RI/FS - SLUG TEST/MW29