State of Michigan
Department of Environmental Quality

HAZARDOUS WASTE MANAGEMENT FACILITY OPERATING LICENSE

NAME OF LICENSEE: Pharmacia & Upjohn Company, LLC

NAME OF FACILITY OWNER: Pharmacia & Upjohn Company, LLC

NAME OF FACILITY OPERATOR: Pharmacia & Upjohn Company, LLC

NAME OF TITLEHOLDER OF LAND: Pfizer, Incorporated

FACILITY NAME: Pharmacia & Upjohn Company, LLC

FACILITY LOCATION: 7171 Portage Road, Kalamazoo, Michigan

EPA IDENTIFICATION (ID) NUMBER: MID 000 820 381

EFFECTIVE DATE: December 14, 2012

REAPPLICATION DATE: June 17, 2022

EXPIRATION DATE: December 14, 2022

AUTHORIZED ACTIVITIES

Pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), being §§324.11101 to 324.11153 of the Michigan Compiled Laws, and the hazardous waste management administrative rules (hereafter called the "rules") promulgated there under, being R 299.9101 *et. seq.* of the Michigan Administrative Code, by the Michigan Department Environmental Quality (MDEQ), an operating license (hereafter called the "license") is issued to Pharmacia & Upjohn, LLC (hereafter called the "licensee") to operate a hazardous waste management facility (hereafter called the "facility") located at latitude 42°12'32" and longitude 85°33'10". The licensee is authorized to conduct the following hazardous waste management activities:

- ☒ STORAGE
  - ☒ Container
  - ☐ Tank
  - ☐ Waste Pile
  - ☐ Surface Impoundment
  - ☐ Drip Pad
- ☐ TREATMENT
  - ☐ Container
  - ☐ Tank
  - ☐ Surface Impoundment
  - ☐ Incinerator
  - ☐ Other:
- ☐ DISPOSAL
  - ☐ Landfill
  - ☐ Land Application
  - ☐ Surface Impoundment
- ☐ POSTCLOSURE
  - ☐ Tank
  - ☐ Surface Impoundment
  - ☐ Landfill
  - ☐ Waste Pile

APPLICABLE REGULATIONS AND LICENSE APPROVAL

The conditions of this license were developed in accordance with the applicable provisions of the rules, effective March 17, 2008. The licensee shall comply with all terms and conditions of this license. This license consists of the 17 pages of conditions attached hereto, as well as those in Attachments 1 through 10, and the applicable regulations contained in R 299.9101 through R 299.11008, as specified in the license. For purposes of compliance with this license, applicable rules are those that are in effect on the date of issuance of this license in accordance with R 299.9521(3)(a).

This license is based on the information in the license application submitted on September 28, 2010, and any subsequent amendments (hereafter referred to as the "application"). Pursuant to R 299.9519(11)(c), the license may be revoked if the licensee fails, in the application or during the license issuance process, to disclose fully all relevant facts or, at any time, misrepresents any relevant facts. As specified in R 299.9519(1), the facility shall be constructed, operated, and maintained in accordance with Part 111 of Act 451, the rules, and this license.

This license is effective on the date of issuance and shall remain in effect for 10 years from the date of issuance, unless revoked pursuant to R 299.9519 or continued in effect as provided by the Michigan Administrative Procedures Act, 1969 PA 306, as amended (Act 306).

Issued this 14 day of December, 2012

by Elizabeth M Browne

Elizabeth M. Browne, Chief
Office of Waste Management and Radiological Protection

HAZARDOUS WASTE MANAGEMENT FACILITY OPERATING LICENSE
FOR

PHARMACIA & UPJOHN CO, LLC
MID 000 820 381

TABLE OF CONTENTS

Page

PART I: STANDARD CONDITIONS

A. Terminology and References 1

B. Effect of License 1

C. Severability 1

D. Responsibilities 1

E. Submittal Deadlines 2

PART II: GENERAL OPERATING CONDITIONS

A. General Waste Analysis 3

B. Security 3

C. General Inspection Requirements 3

D. Personnel Training 3

E. Preparedness and Prevention 3

F. Contingency Plan 3

G. Duty to Mitigate 3

H. Manifest System 3

I. Record Keeping and Reporting 4

J. Closure 5

K. Financial Assurance for Closure 5

L. Financial Assurance for Corrective Action 5

M. Financial Responsibility for Liability Coverage 5

N. Waste Minimization 5

O. Land Disposal Restrictions 6

P. Air Emission Standards 6

Q. Documents to be Maintained at the Facility 6

R. Engineering Plans 6

PART III: CONTAINER STORAGE CONDITIONS

A. Coverage of License 7

B. Waste Identification and Quantity 7

C. Use and Management of Containers 7

D. Special Requirements for Storage of Ignitable or Reactive Wastes 7

E. Special Requirements for Storage of Incompatible Wastes or Materials 7

F. Disposition of Accumulated Liquids 8

PART IV: ENVIRONMENTAL MONITORING CONDITIONS

A. Groundwater Monitoring Program 9

PART V: CORRECTIVE ACTION CONDITIONS

A. Corrective Action at the Facility 13

B. Corrective Action Beyond the Facility Boundary 13

C. Identification of Waste Management Units 13

D. Corrective Action Investigation 14

E. Interim Measures 14

F. Determination of No Further Action 15

G. Corrective Measures Study 15

H. Corrective Measures Implementation Plan 16

I. Corrective Action Management Units 16

J. Temporary Units 16

K. Summary of Corrective Action Submittals 16

L. Corrective Action Documents Retention 17

LIST OF ATTACHMENTS

Attachment 1 Waste Analysis Plan

Attachment 2 Inspection Schedule

Attachment 3 Personnel Training Program

Attachment 4 Contingency Plan

Attachment 5 Closure Plan

Attachment 6 Engineering Plans

Attachment 7 List of Acceptable Wastes

Attachment 8 Preventative Procedures

Attachment 9 Groundwater Sampling and Analysis Plan

Attachment 10 Statistical Evaluation Program

PART I
STANDARD CONDITIONS

A. TERMINOLOGY AND REFERENCES

Throughout this license, the term "Office" means the Office of Waste Management and Radiological Protection within the MDEQ responsible for administering Part 111 of Act 451 and the rules. Throughout this license, "Director" means the Director of the MDEQ or the Director's duly authorized designee, such as the Office Chief. All of the provisions of Title 40 of the Code of Federal Regulations (CFR) referenced in this license are adopted by reference in R 299.11003.

B. EFFECT OF LICENSE

Except as otherwise provided by law, any treatment, storage, or disposal of hazardous waste not specifically authorized in this license is prohibited. Issuance of this license does not authorize any injury to persons or property, any invasion of other private rights, or any infringement of federal, state, or local law or regulations {R 299.9516(8)}; nor does it obviate the necessity of obtaining such permits or approvals from other units of government as may be required by law. Compliance with the terms of this license does not constitute a warranty or representation of any kind by the MDEQ, nor does the MDEQ intend that compliance with this license constitutes a defense to any order issued or any action brought under Act 451 or any other applicable state statute or §106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) {42 U.S.C. 9606(a)}, the Resource Conservation and Recovery Act of 1976, as amended (RCRA), and its rules, or any other applicable federal statute. The licensee, however, does not represent that it will not argue that compliance with the terms of this license may be a defense to such future regulatory actions. Each attachment to this license is a part of, and is incorporated into, this license and is deemed an enforceable part of the license.

C. SEVERABILITY

The provisions of this license are severable, and if any provision of this license, or the application of any provision of this license to any circumstance, is held invalid, the application of such provision to other circumstances and the remainder of this license shall not be affected thereby.

D. RESPONSIBILITIES

1. The licensee shall comply with Part 111 of Act 451, the rules, and all conditions of this license, except to the extent authorized by the MDEQ pursuant to the terms of an emergency operating license. Any license noncompliance, except to the extent authorized by the MDEQ pursuant to the terms of an emergency operating license, constitutes a violation of Part 111 of Act 451 and is grounds for enforcement action, license revocation, license modification, or denial of a license renewal application. {§§11148, 11150, and 11151, of Act 451 and R 299.9521(1)(a) and (c) and (3)(a) and (b) and 40 CFR §270.30(a)}

2. If the licensee wishes to continue an activity regulated by this license after the expiration date of this license, the licensee shall submit a complete application for a new license to the Office Chief at least 180 days before this license expires, June 17, 2022, unless an extension is granted pursuant to R 299.9510(5). To the extent the licensee makes a timely and sufficient application for renewal of this license, this license and all conditions herein will remain in effect beyond the license expiration date and shall not expire until a decision on the application is finally made by the MDEQ, or if the application is denied or the terms of the new license are limited, until the last day for applying for judicial review of the new license or a later date fixed

by order of the reviewing court consistent with §91(2) of Act 306. {R 299.9521(1)(a) and (c) and (3)(a) and 40 CFR §270.30(b)}

3. The licensee shall comply with the conditions specified in R 299.9521(1)(b)(i) to (iii) and 40 CFR §270.30(c) through (k), (l)(2), (3), (5), (7), and (11), and (m). {§§11123(3), 11146(1) and (2), and 11148(1) of Act 451 and R 299.9501(1), R 299.9516, R 299.9519, R 299.9521(1)(a) and (b) and (3)(a) and (b), R 299.9522, and R 299.9525}

4. The licensee shall give notice to the Office Chief as soon as possible prior to any planned physical alterations or additions to the licensed facility. {R 299.9519(1)}

E. SUBMITTAL DEADLINES

When the deadline for submittals required under this license falls on a weekend or legal state holiday, the deadline shall be extended to the next regular business day. This extension does not apply to the deadline for financial mechanisms and associated renewals, replacements, and extensions of financial mechanisms required under this license. The licensee may request extension of the deadlines for submittals required under this license. The licensee shall submit such requests at least five business days prior to the existing deadline for review and approval by the Office Chief. Written extension requests shall include justification for each extension. {R 299.9521(3)(a)}

PART II
GENERAL OPERATING CONDITIONS

A. GENERAL WASTE ANALYSIS

The licensee shall ensure that any waste managed at the facility has been properly characterized pursuant to R 299.9302 and comply with the procedures described in the attached Waste Analysis Plan, Attachment 1, of this license. {R 299.9605(1), and 40 CFR §264.13}

B. SECURITY

The licensee shall comply with the barrier, surveillance, and signage requirements of R 299.9605(1) and 40 CFR §264.14.

C. GENERAL INSPECTION REQUIREMENTS

The licensee shall inspect the facility in accordance with the Inspection Schedule, Attachment 2, of this license, and comply with the inspection requirements of R 299.9605(1) and 40 CFR §264.15.

D. PERSONNEL TRAINING

The licensee shall comply with the personnel training requirements of R 299.9605 and 40 CFR §264.16. The Personnel Training Program, Attachment 3, of this license shall, at a minimum, cover all items in R 299.9605 and 40 CFR §264.16.

E. PREPAREDNESS AND PREVENTION

The licensee shall comply with the preparedness and prevention requirements of R 299.9606 and 40 CFR Part 264, Subpart C.

F. CONTINGENCY PLAN

The licensee shall comply with the contingency plan requirements of R 299.9607 and 40 CFR Part 264, Subpart D. The Contingency Plan, Attachment 4, of this license and the prescribed emergency procedures shall be immediately implemented by the licensee whenever there is a fire, explosion, or other release of hazardous waste or hazardous waste constituents that threatens or could threaten human health or the environment, or if the licensee has knowledge that a spill has reached surface water or groundwater.

G. DUTY TO MITIGATE

Upon notification from the Office Chief or his or her designee that an activity at the facility may present an imminent and substantial endangerment to human health or the environment, the licensee shall immediately comply with an order issued by the Office Chief pursuant to §11148(1) of Act 451 to halt such activity and conduct other activities as required by the Office Chief to eliminate the said endangerment. The licensee shall not resume the halted activity without the prior written approval from the Office Chief. {§11148 of Act 451 and R 299.9521(3)(b)}

H. MANIFEST SYSTEM

The licensee shall comply with the manifest requirements of R 299.9304, R 299.9305, and R 299.9608.

I. RECORD KEEPING AND REPORTING

1. The licensee shall comply with the written operating record and monthly operating report (EQP 5142 form) requirements of R 299.9609 and 40 CFR §264.73 and Part 264, Appendix I, and R 299.9610(3), respectively. The monthly operating report shall be submitted on EQP 5142 form provided by the Office Chief, or an equivalent form that has been approved by the Office Chief.

2. The licensee shall comply with the biennial report requirements of R 299.9610. {R 299.9521(1)(a) and 40 CFR §270.30(l)(9)}

3. The licensee shall submit the results of all environmental monitoring required by this license, with the exception of the annual groundwater report, and any additional environmental sampling or analysis conducted beyond that required by this license, in the form of an Environmental Monitoring Report to the Office Chief within 60 days after any sample collection. {R 299.9521(1)(a) and R 299.9521(3)(b) and 40 CFR §270.30(l)(4)}

4. The licensee shall provide environmental monitoring information or data that is required pursuant to this license to an authorized representative of an environmental or emergency response department of the city of Portage or county of Kalamazoo who requests such information or data and that has jurisdiction over the facility. Such information or data shall be made available on the same day the licensee forwards this information to the Office Chief. {R 299.9521(3)(b)}

5. The licensee shall immediately report to the Office Chief any noncompliance with the license that may endanger human health or the environment by doing both of the following:

   a. The licensee shall immediately notify the Office Chief at 517-335-2690, if the noncompliance occurs Monday through Friday during the period of 8:00 a.m. to 5:00 p.m., except state holidays, or by calling the MDEQ Pollution Emergency Alerting System (PEAS) at 1-800-292-4706 during all other times. This notice shall include the following:

      (i) Information concerning the fire, explosion, release, or discharge of any hazardous waste or hazardous waste constituent that could threaten human health or the environment, that has reached surface water or groundwater, or that may endanger public drinking water supplies or the environment; and

      (ii) A description of the occurrence and its cause, including all of the information outlined in R 299.9607(2)(a)-(i).

   b. The licensee shall also follow up the verbal notice by providing a written report to the Office Chief within five days of the time the licensee becomes aware of the circumstances. The written report shall contain all of the information in Condition II.I.5.(a)(i)-(ii) of this license along with a description of the noncompliance and its cause; the periods of noncompliance (including exact dates and times); whether the noncompliance has been corrected and, if not, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance and when those activities occurred or will occur. The Office Chief may waive the 5-day written notice requirement in favor of submittal of a written report within 15 days of the time the licensee becomes aware of the circumstances.

   {R 299.9521(1)(a) and R 299.9607 and 40 CFR §270.30(l)(6)}

6. The licensee shall report all other instances of noncompliance with this license, Part 111 of Act 451, the rules, and any other applicable environmental laws or rules that apply to the licensed facility, at the time monitoring reports required by this license are submitted or within 30 days, whichever is sooner. The reports shall contain the information listed in Condition II.I.5. of this license. {R 299.9521(1)(a) and 40 CFR §270.30(l)(10)}

7. The licensee may make minor modifications to the forms contained in the attachments to this license. The modifications may include changing the format, updating existing references and information, adding necessary information, and changing certification and notification information in accordance with Part 111 of Act 451 and its rules and RCRA and its regulations. The licensee shall submit the modifications to the Office Chief prior to implementing the use of the modified form(s). If the Office Chief does not reject or require revision of the modified form(s) within 14 days of receipt, the licensee shall implement use of the modified form(s) and the form(s) shall be incorporated into this license as a replacement for the existing form(s).

J. CLOSURE

The licensee shall comply with the closure requirements of R 299.9613. The licensee shall close the facility in accordance with the Closure Plan, Attachment 5, of this license, all other applicable requirements of this license, and all other applicable laws. {R 299.9613 and 40 CFR Part 264, Subpart G, except 40 CFR §§264.112(d)(1), 264.115, and 264.120}

K. FINANCIAL ASSURANCE FOR CLOSURE

1. On the effective date of this license, the facility closure cost estimate is $140,000**.** The licensee shall keep this estimate current as required under R 299.9702 and 40 CFR §264.142.

2. The licensee shall continuously maintain financial assurance for the current closure cost estimate as required under R 299.9703.

L. FINANCIAL ASSURANCE FOR CORRECTIVE ACTION

The licensee shall continuously maintain financial assurance for correction action as required under R 299.9713.

M. FINANCIAL REPSONSIBILITY FOR LIABILITY COVERAGE

The licensee shall continuously maintain liability coverage for sudden and accidental occurrences, as required by R 299.9710.

N. WASTE MINIMIZATION

The licensee shall certify, at least annually, that the licensee has a hazardous waste minimization program in place. {R 299.9609(1)(a) and 40 CFR §264.73(b)(9) and §3005(h) of RCRA and 42 U.S.C. §6925(h)}

O. LAND DISPOSAL RESTRICTIONS

The licensee shall comply with all of the requirements of 40 CFR Part 268. {R 299.9627 and 40 CFR Part 268}

P. AIR EMISSION STANDARDS

1. The licensee shall comply with the requirements of 40 CFR Part 264, Subpart CC, regarding air emission standards for tanks, surface impoundments, and containers.

2. The licensee shall notify the Office Chief of any waste management units that become subject to the requirements of 40 CFR Part 264, Subparts AA, BB, and/or CC within 30 days of the start of the regulated activity.

{R 299.9630, R 299.9631, and R 299.9634 and 40 CFR Part 264, Subparts AA, BB, and CC}

Q. DOCUMENTS TO BE MAINTAINED AT THE FACILITY

The licensee shall maintain at the facility the following documents and amendments required by this license, until closure/postclosure is completed, certified by an independent registered professional engineer, and the facility is released from financial assurance requirements for closure/postclosure by the Director:

1. Waste Analysis Plan, including Quality Assurance/Quality Control (QA/QC) Plans.
2. Inspection Schedules and records.
3. Personnel Training Program documents and records.
4. Contingency Plan.
5. Closure Plan.
6. Cost estimates for facility closure and corrective action and copies of related financial assurance documents.
7. Operating record.
8. Site Security Plan.
9. Facility engineering plans and specifications.
10. Record keeping procedures.
11. Environmental monitoring plans, including Sampling and Analysis Plans and QA/QC Plans.
12. Environmental monitoring data and statistical records.
13. Preventative procedures (Personnel Protection Plan).
14. Hazardous waste minimization program certification.

{R 299.9521(3)(a)}

R. ENGINEERING PLANS

The licensee shall construct, operate, and maintain the facility in accordance with the Engineering Plans, Attachment 6, of this license and any modifications to those plans shall be made in accordance with this license

PART III
CONTAINER STORAGE CONDITIONS

A. COVERAGE OF LICENSE

The hazardous waste Building 388 container storage area at the facility shown in Drawing D-1 is covered by this license. Any expansion or enlargement beyond the facility boundary shown in Drawing D-1 or beyond the 15,400 gallon storage design capacity requires a new expansion license from the Office Chief. Drawing D-1 is incorporated into this license as part of Attachment 6. {R 299.9521(1)(b)}

B. WASTE IDENTIFICATION AND QUANTITY

The licensee may store no more than a total volume of 15,400 gallons of the hazardous wastes listed in Attachment 7 in containers at the facility, subject to the terms of this license. {R 299.9521(2)(d)}

C. USE AND MANAGEMENT OF CONTAINERS

1. The licensee shall manage all containers in compliance with R 299.9521(3)(b), R 299.9614, and R 299.9627 and 40 CFR §§264.171, 264.172, 264.173, and 268.50(a)(2)(i).

2. The licensee shall only place containers, stacked no greater than two high, into the hazardous waste container storage area referenced in Condition III.A. of this license in accordance with the configuration shown in Drawing D-1 in Attachment 6 of this license or an alternate configuration approved by the Office Chief. {R 299.9521(3)(b)}

3. The licensee shall operate and maintain the containment system in accordance with the requirements of R 299.9614 and 40 CFR §264.175, and the plans and specifications in Attachment 6 of this license.

D. SPECIAL REQUIREMENTS FOR STORAGE OF IGNITABLE OR REACTIVE WASTES

1. The licensee shall locate containers holding ignitable or reactive wastes in accordance with R 299.9614 and 40 CFR §264.176.

2. The licensee shall take precautions to prevent the accidental ignition or reaction of ignitable or reactive wastes by following the procedures specified in the Preventative Procedures, Attachment 8, of this license. The licensee shall document compliance with this condition and place this documentation in the operating record. {R 299.9605 and 40 CFR §264.17(a) and (c)}

E. SPECIAL REQUIREMENTS FOR STORAGE OF INCOMPATIBLE WASTES OR MATERIALS

1. The licensee is prohibited from placing incompatible wastes or incompatible wastes and materials in the same container. {R 299.9521(2)(d) and (3)(b)}

2. The licensee shall prevent the placement of hazardous waste in an unwashed container that previously held an incompatible waste or material. {R 299.9614 and 40 CFR §264.177(b)}

3. The licensee shall document compliance with Conditions III.E.1. and III.E.2. of this license and place this documentation in the operating record. {R 299.9605 and 40 CFR §264.17(c)}

4. The licensee shall separate containers of incompatible wastes as indicated in the procedures contained in the Preventative Procedures, Attachment 8, of this license. {R 299.9614 and 40 CFR §264.177(c)}

F. DISPOSITION OF ACCUMULATED LIQUIDS

The licensee shall remove all liquids accumulated in the containment system within 24 hours of detection and manage the liquids in accordance with the requirements of Part 111 of Act 451 and the rules. {R 299.9521(3)(b) and R 299.9614(1)(a) and 40 CFR §264.175(b)(5)}

PART IV
ENVIRONMENTAL MONITORING CONDITIONS

A. GROUNDWATER MONITORING PROGRAM

1. The licensee shall conduct a Corrective Action Detection (CAD) monitoring program and a Corrective Action Characterization Program (CAC) to monitor groundwater quality. Under these programs, the licensee shall operate and maintain a groundwater monitoring system consisting of monitoring wells labeled MW, OS, or W followed by a number, as shown in Tables 2 and 4, of the Groundwater Monitoring Program Sampling and Analysis Plan (SAP), Attachment 9, of this license. In addition, the licensee shall conduct a Corrective Action Water Level Monitoring Program (CAWL), which shall consist of the wells and piezometers shown in Attachment A, Table 6, of the SAP mentioned above. The CAD, CAC, and CAWL monitoring well and piezometer locations are shown on Figure 1, Attachment B, of the SAP. {R 299.9611(2)(a) and (b), R 299.9612, and R 299.9629 and 40 CFR Part 264, Subpart F, excluding 40 CFR §§264.94(a)(2) and (3), 264.94(b) and (c), 264.100, and 264.101}

2. The licensee shall sample the monitoring wells in accordance with the SAP, Attachment 9, of this license. {R 299.9521(3)(b)}

3. The licensee shall submit an annual groundwater report to the Office Chief no later than March 1st for the previous calendar year's activities. The report shall summarize the groundwater quality data collected during the previous calendar year and discuss any need to add parameters to the CAD monitoring well program. The report shall include time vs. concentration graphs for the CAC well parameters, quarterly static water level measurements from the upper and lower aquifers, quarterly groundwater contour maps for each aquifer, statistical evaluations, and identification of any statistically significant increases (and/or pH decreases) pursuant to Conditions IV.A.9. and IV.A.10. of this license. {R 299.9612(1) and 40 CFR §264.97(j), which is adopted by reference (ABR) in R 299.11003}
{R 299.9521(3)(b) and R 299.9612(1) and 40 CFR §264.97(j)}

4. The licensee shall establish background groundwater quality values for the CAD monitoring wells for the parameters specified in Table 6 of the SAP, Attachment 9, of this license. In the event that groundwater quality at the upgradient well(s) shows a significant change, a petition may be submitted to the Office Chief to reestablish background quality. Background values may be reestablished only upon written approval of the Office Chief. {R 299.9612(1)(c), (d), and (e) and 40 CFR §264.97(a) and (g)}

5. The licensee shall collect and analyze samples according to the schedule, parameters, and procedures specified in the SAP, Attachment 9, of this license. Data and evaluations must be submitted to the Office Chief in accordance with the time frame specified in Condition IV.A.3. of this license. Tables 1, 3, and 6 are included in the SAP, Attachment 9, of this license.
{R 299.9612 and R 299.9629}

6. The licensee shall take quarterly water level readings from the CAWL monitoring wells and piezometers listed in Table 1 according to the procedures specified in the SAP, Attachment 9, of this license. The results of these readings and the resultant groundwater contour maps shall be reported to the Office Chief along with the CAD and CAC monitoring data identified in Condition IV.A.3. of this license.

7. The licensee shall submit to the Office Chief monthly reports of the facility’s production wells, listing daily rates calculated from monthly flow volumes for each well. The reports are due within 15 calendar days of the end of the previous month. If pumping in the production wells extracts less than a monthly average of 12.4 million gallons per day, a monthly water level

monitoring program will be initiated and will continue until normal pumping rates resume. The licensee may submit a proposed revision of the monthly average pumping rate and supporting documentation to the Office Chief for review and approval. If approved, the revised monthly average pumping rate shall become part of this license. The Office Chief may also revise the monthly average pumping rate based on the results of environmental monitoring data or groundwater modeling data. Such a revision shall become part of this license.

8. CAC Monitoring Wells: The licensee shall plot time vs. concentration graphs for the organic monitoring parameters identified in Table 3 of the SAP, Attachment 9, of this license to evaluate parameter trends. The results of this analysis shall be submitted to the Office Chief as part of the annual groundwater monitoring report identified in Condition IV.A.3. of this license.

9. CAD Monitoring Wells - Organic Monitoring Parameters:

   a. Within 60 days of each sampling of each CAD monitoring well, the licensee shall determine if a statistically significant increase has occurred compared to background for each organic parameter listed in Table 6 of the SAP, Attachment 9, of this license. Any detection of an organic parameter above its laboratory detection limit shall be considered statistically significant. {R 299.9612(1)(e) and 40 CFR §264.97(h) and (i), which are ABR in R 299.11003}

   b. If a statistically significant increase is detected, the licensee shall notify the Office, Hazardous Waste Section (HWS), Permitting and Corrective Action Unit (PCAU) by telephone within one working day and arrange a resampling as soon as possible to confirm if a statistically significant increase exists. Resampling must include not less than four replicate samples at the affected well(s) for the organic parameter(s) in question. {R 299.9612 and 40 CFR §264.97(g), which is ABR in R 299.11003}

   c. If the licensee determines pursuant to Conditions IV.A.9.a. and IV.A.9.b. of this license that a statistically significant increase has occurred for an organic parameter, the licensee shall:
   {R 299.9612 and 40 CFR §264.98(f) and (g), which are ABR in R 299.11003}

      (i) Notify the Director within one working day by calling the Office Chief or the appropriate Office District Supervisor or, in the event of their unavailability, the MDEQ PEAS at 1-800-292-4706.

      (ii) Provide follow-up notification to the Office Chief in writing within 7 calendar days of the telephone call. The notification shall indicate what parameters or constituents have shown statistically significant changes and the well(s) in which the changes have occurred.

      (iii) As soon as possible, sample the groundwater monitoring wells within 1000 feet of the affected well for organic, inorganic, and other monitoring parameters and determine the concentration of all constituents identified in Appendix IX of 40 CFR Part 261 that are present in groundwater and for which approved analysis methods exist. The licensee shall also establish background values for Appendix IX constituents detected pursuant to R 299.9612 and 40 CFR §264.98(g)(3), which is ABR in R 299.11003.

      (iv) Immediately take steps to determine the cause of the contamination and eliminate the source of discharge.

d. Within 90 days of the determination, submit to the Office Chief an application for a license modification to establish a compliance monitoring and corrective action program meeting the requirements of R 299.9612. The application shall include the following information:

   (i) An identification of the concentration of all Appendix IX constituents found in the groundwater.

   (ii) Any proposed changes to the groundwater monitoring system at the facility necessary to meet the requirements of R 299.9612.

   (iii) Any proposed changes to the monitoring frequency, sampling and analysis procedures or methods, or statistical procedures used at the facility necessary to meet the requirements of R 299.9612.

e. Within 180 days, submit to the Office Chief a detailed description of corrective actions that shall achieve compliance with applicable laws and rules, including a schedule of implementation. Corrective action shall also meet the requirements of R 299.9629 and include a plan for a groundwater monitoring program that shall demonstrate the effectiveness of the corrective action. Such a groundwater monitoring program may be based on a compliance monitoring program developed to meet the requirements of 40 CFR §264.99, which is ABR in R 299.11003.

f. During the period prior to a license modification requiring a compliance monitoring and corrective action program, the licensee shall provide the Office Chief, or his or her designee, with weekly telephone updates and written reports every two weeks regarding the progress to date in determining the cause of contamination and eliminating the discharge. The licensee shall include in the written report the results of all samples from environmental monitoring conducted by the licensee.

g. If the licensee determines, pursuant to Conditions IV.A.9.a. and IV.A.9.b. of this license, that a statistically significant increase in hazardous constituents has occurred in groundwater, the licensee may demonstrate that a source other than the licensed facility caused the increase or that the increase resulted from error in sampling, analysis, or evaluation. While the licensee may make a demonstration under this condition in addition to, or in lieu of, submitting a license modification application within the time specified in Condition IV.A.9.d. of this license, the licensee is not relieved of the requirement to submit a license modification application within the time specified, unless the demonstration made under this condition successfully shows that a source other than the licensed facility caused the increase or that the increase resulted from an error in sampling, analysis, or evaluation. In making a demonstration under this condition, the licensee shall:

   (i) Notify the Office Chief within 7 days of the determination that it intends to make a demonstration under this condition.

   (ii) Within 90 days of the determination, submit a report to the Office Chief that demonstrates that a source other than the licensed facility solely caused the increase, or that the increase was caused by error in sampling, analysis, or evaluation.

(iii) Within 90 days of the determination, submit to the Office Chief an application for a license modification to make any appropriate changes to the groundwater monitoring program at the facility.

(iv) Continue to monitor groundwater in compliance with this license. {R 299.9612 and 40 CFR §264.98(g)(6), which is ABR in R 299.11003}

h. In the event that the Office Chief determines from the findings of Conditions IV.A.9.a. and IV.A.9.b. of this license that a statistically significant increase in hazardous constituents has occurred in the groundwater and the Office Chief finds, in accordance with Section 11148 of Act 451, that the increase may present an imminent and substantial hazard to the health of persons or to the natural resources, or is endangering or causing damage to public health or the environment, the licensee shall immediately cease waste receipt, storage, and treatment at the affected unit(s) until instructed by the Office Chief that operations may resume. {R 299.9612(1)(g)}

10. <u>CAD Monitoring Wells - Inorganic and Other Parameters</u>.

a. Within 60 days of each sampling of each CAD monitoring well, the licensee shall determine if a statistically significant increase (or change in pH) has occurred compared to background levels for each inorganic and other parameter, excluding temperature, listed in Table 6 of the SAP, Attachment 9, of this license. A significant increase (or change in pH) shall be determined using the groundwater statistical evaluation program specified in Statistical Evaluation Program, Attachment 10, of this license. {R 299.9612(1)(c)}

b. If the licensee determines pursuant to Condition IV.A.10.a. of this license that a statistically significant increase (or change in pH) has occurred for any inorganic or other parameter, the licensee shall:

(i) Notify the Director, within one working day, by calling the Office Chief or the appropriate Office District Supervisor.

(ii) Resample for organic, inorganic, and other parameters in the affected well(s), taking not less than four samples at each well.

(iii) Determine whether or not a statistically significant increase (or change in pH) has actually occurred for organic, inorganic, or other parameters (excluding temperature) and, within one working day, notify the Office Chief.

c. If confirmed, the licensee shall immediately take steps to determine the cause of contamination and eliminate the source of the discharge. A report that explains the chronology of events; investigative methods; and all lab analyses, calculations, field activities, and findings/conclusions related to this determination shall be submitted within 60 days of a statistically significant determination under Condition IV.A.10.a. of this license.

d. The licensee may demonstrate that a source other than the facility, or an error in sampling, analysis, or evaluation solely caused the increase. A report that contains the information set forth in Condition IV.A.10.c. of this license shall be submitted within 60 days of a statistically significant determination under Condition IV.A.10.a. of this license. {R 299.9612(1)(c)}

PART V
CORRECTIVE ACTION CONDITIONS

A. CORRECTIVE ACTION AT THE FACILITY

1. The licensee shall implement corrective action for all releases of a contaminant from any waste management unit (WMU) at the facility, regardless of when the contaminant may have been placed in or released from the WMU. For the purposes of this license, the term "corrective action" means an action determined by the Office Chief to be necessary to protect the public health, safety, welfare, or the environment, and includes, but is not limited to, investigation, evaluation, cleanup, removal, remediation, monitoring, containment, isolation, treatment, storage, management, temporary relocation of people, and provision of alternative water supplies, or any corrective action allowed under Title II of the federal Solid Waste Disposal Act, PL 89-272, as amended, or regulations promulgated pursuant to that act. For the purposes of this license, the process outlined in Part 111 of Act 451 and the environmental protection standards adopted in R 299.9629 shall be used to satisfy the corrective action obligations under this license. {§§11102 and 11115a of Act 451 and R 299.9629}

2. To the extent that a release of a hazardous substance, as defined in §20101(t) of Act 451, that is not also a contaminant, as defined in §11102(2) of Act 451, is discovered while performing corrective action under this license, the licensee shall take concurrent actions as necessary to address the Part 201, Environmental Remediation, of Act 451 remedial obligations for that release. {R 299.9521(3)(b)}

B. CORRECTIVE ACTION BEYOND THE FACILITY BOUNDARY

The licensee shall implement corrective action beyond the facility in accordance with §11115a of Act 451 and R 299.9629(2).

C. IDENTIFICATION OF WASTE MANAGEMENT UNITS

The WMUs at the facility are identified below.

1. The following WMUs do not require corrective action at this time:

   a. The following WMU is currently operating pursuant to the act and its rules with no evidence of a release of any contaminants. Corrective action may be required when the unit undergoes final closure.

WMU 19	Building 388 Container Storage

   b. The following WMU requires no further corrective action at this time. The determination that no further corrective action is required at this time is based on analytical data, investigatory work, and interim responses performed by the licensee during the RCRA Facility Investigation (RFI) confirming that interim measures are in place to address the contaminants.

WMU 1	Site-Wide Soil and Groundwater Contamination

{§§11102 and 11115a of Act 451 and R 299.9521(3)(b) and R 299.9629}

3. Within 30 days of discovery of a new WMU or a release of a contaminant from a new WMU, the licensee shall provide written notification to the Office Chief. The written notification shall include all of the following information:

   a. The location of the unit on the facility topographic map.

   b. The designation of the type of unit.

   c. The general dimensions and structural description, including any available drawings of the unit.

   d. The date the unit was operated.

   e. Specification of all waste(s) that have been managed in the unit.

   f. All available information pertaining to any release of a contaminant from the unit.

4. Based on a review of all of the information provided in Condition V.C.3 of this license, the Office Chief may require corrective action for the newly-identified WMU. The licensee shall submit a written Investigation Work Plan to the Office Chief within 60 days of written notification by the Office Chief that corrective action for the unit is required.

{§§11102 and 11115a of Act 451 and R 299.9504(1), R 299.9508(1)(b), and R 299.9629 and 40 CFR §270.14(d)}

D. CORRECTIVE ACTION INVESTIGATION

The licensee shall conduct a Corrective Action Investigation to determine if a release of a contaminant(s) from any of the WMUs identified in Condition V.C.3 of this license has occurred and, if a release(s) has occurred, evaluate the nature and extent of the release(s). The licensee shall submit a written Corrective Action Investigation Work Plan, Corrective Action Investigation Final Report documenting compliance with the approved Work Plan and supporting further corrective action at the facility, and Corrective Action Investigation progress reports to the Office Chief for review and approval in accordance with Condition V.K of this license. The Office Chief will approve, modify and approve, or provide a Notice of Deficiency (NOD) for the Work Plan and Final Report. Upon approval, the Work Plan and Final Report become enforceable conditions of this license. {§§11102 and 11115a of Act 451 and R 299.9629}

E. INTERIM MEASURES

The licensee shall conduct interim measures (IM) at the facility, if determined necessary by the licensee or the Office Chief, to cleanup or remove a released contaminant or to take other actions, prior to the implementation of corrective measures, as may be necessary to prevent, minimize, or mitigate injury to the public health, safety, or welfare, or to the environment. The licensee shall submit a written IM Work Plan, an IM Final Report documenting compliance with the approved Work Plan and supporting further corrective action at the facility, and IM progress reports to the Office Chief for review and approval in accordance with Condition V.K of this license. The Office Chief will approve, modify and approve, or provide an NOD for the Work Plan and Final Report. Upon approval, the Work Plan and Final Report become enforceable conditions of this license. {§§11102 and 11115a of Act 451 and R 299.9629}

F. DETERMINATION OF NO FURTHER ACTION

1. The licensee shall continue corrective action measures to the extent necessary to ensure that the applicable environmental protection standards adopted in Part 111 of Act 451 are met, if the limits are not less stringent than allowed pursuant to the provisions of RCRA.

2. Based on the results of the Corrective Action Investigation and other relevant information, the licensee shall submit a written request for a license minor modification to the Office Chief if the licensee wishes to terminate corrective action for a specific WMU identified in Condition V.C.3 of this license. The licensee must demonstrate that there have been no releases of a contaminant(s) from the WMU and that the WMU does not pose a threat to public health, safety, welfare, or the environment.

3. Based on the results of the Corrective Action Investigation and other relevant information, the licensee shall submit a written request for a license major modification to the Office Chief if the licensee wishes to terminate facility-wide corrective action. The licensee must conclusively demonstrate that there have been no releases of a contaminant(s) from any of the WMUs at the facility and that none of the WMUs pose a threat to public health, safety, welfare, or the environment.

4. If, based upon a review of the licensee's request for a license modification pursuant to Condition V.F.2. or V.F.3. of this license, the results of the completed Corrective Action Investigation, and other relevant information, the Office Chief determines that the release(s) or suspected release(s) of a contaminant(s) do not exist and that the WMU(s) do not pose a threat to public health, safety, welfare, or the environment, the Office Chief will approve the requested modification

5. A determination of no further action shall not preclude the Office Chief from requiring continued or periodic monitoring of air, soil, groundwater, or surface water, if necessary, to protect public health, safety, welfare, or the environment, when facility-specific circumstances indicate that potential or actual releases of a contaminant(s) may occur.

6. A determination of no further action shall not preclude the Office Chief from requiring further corrective action at a later date, if new information or subsequent analysis indicates that a release or potential release of a contaminant(s) from a WMU at the facility may pose a threat to public health, safety, welfare, or the environment. The Office Chief will initiate the necessary license modifications if further corrective action is required at a later date.

{§§11102 and 11115a of Act 451 and R 299.9629(2)}

G. CORRECTIVE MEASURES STUDY

If the Office Chief determines, based on the results of the Corrective Action Investigation and other relevant information, that remedial activities are necessary, the Office Chief will notify the licensee in writing that a Corrective Measures Study (CMS) is required. If required by the Office Chief, the licensee shall conduct a CMS to develop and evaluate the corrective measures alternative(s) necessary to address the release(s) of a contaminant(s) or hazardous substance(s) and the WMU(s) that are identified in the approved Corrective Action Investigation Final Report as requiring final remedial activities. The licensee shall submit a written CMS Work Plan, a CMS Final Report documenting compliance with the approved Work Plan and supporting further corrective action at the facility, and CMS progress reports to the Office Chief for review and approval in accordance with Condition V.K. of this license. The Office Chief will approve, modify and approve, or provide an NOD for the Work Plan and Final Report. Upon approval, the Work Plan and Final Report become enforceable conditions of this license. {§§11102 and 11115a of Act 451 and R 299.9629}

H. CORRECTIVE MEASURES IMPLEMENTATION PLAN

1. The licensee shall conduct final corrective measures based on the CMS Final Report approved by the Office Chief. The licensee shall submit a written Corrective Measures Implementation (CMI) Work Plan to the Office Chief for review and approval. The licensee shall also submit a written CMI Final Report documenting the compliance with the approved CMI Work Plan, providing justification that the corrective actions may cease, and CMI progress reports to the Office Chief for review and approval in accordance with Condition V.K. of this license. The Office Chief will approve, modify and approve, or provide an NOD for the Work Plan and Final Report. Upon approval, the Work Plan and Final Report become enforceable conditions of this license.

2. The Office will provide notice of its draft decision on the CMI Work Plan to persons on the facility mailing list and provide an opportunity for a public hearing.

3. The licensee shall implement the approved CMI Work Plan within 60 days of receipt of the Office Chief's written approval of the Work Plan.

{§§11102 and 11115a of Act 451 and R 299.9629}

I. CORRECTIVE ACTION MANAGEMENT UNITS

If applicable, the licensee shall comply with the requirements of R 299.9635 in order to designate an area at the facility as a corrective action management unit for implementation of corrective measures. {R 299.9521(3)(a)}

J. TEMPORARY UNITS

If applicable, the licensee shall comply with the requirements of R 299.9636 in order to designate tank or container storage units used for the treatment or storage of remediation wastes as temporary units for implementation of corrective measures. {R 299.9521(3)(a)}

K. SUMMARY OF CORRECTIVE ACTION SUBMITTALS

The licensee shall submit the required documents in accordance with Conditions V.D., V.E., V.G., and V.H. of this license and the schedule below.

Document	Submittal Deadline
Written notification of a new release of a contaminant from an existing WMU, a new WMU, or a release of a contaminant from a new WMU	Within 30 days of discovery
Corrective Action Investigation Work Plan for a newly-identified release of a contaminant from an existing WMU, a new WMU, or a release of a contaminant from a new WMU	Within 90 days of receipt of notification that an investigation is required
Revised Corrective Action Investigation Work Plan for WMUs and contaminant releases	Within 45 days of receipt of Work Plan NOD
Corrective Action Investigation progress reports	Within 60 days of initiation of the investigation and every 60 days thereafter, unless otherwise approved

Document	Submittal Deadline
Corrective Action Investigation Final Report for WMUs and contaminant releases	Within 60 days of completion of investigation
Revised Corrective Action Investigation Final Report for WMUs and contaminant releases	Within 45 days of receipt of Final Report NOD
IM Work Plan for WMUs and contaminant releases	Within 60 days of receipt of notification that Work Plan is required
Revised IM Work Plan for WMUs and contaminant releases	Within 45 days of receipt of Work Plan NOD
IM progress reports	Within 60 days of initiation of the IM and every 60 days thereafter, unless otherwise approved
IM Final Report for WMUs and contaminant releases	Within 60 days of completion of the IM
Revised IM Final Report for WMUs and contaminant releases	Within 45 days of receipt of Final Report NOD
CMS Work Plan for WMUs and contaminant releases	Within 120 days of receipt of notification that CMS is required
Revised CMS Work Plan for WMUs and contaminant releases	Within 45 days of receipt of Work Plan NOD
CMS progress reports	Within 60 days of initiation of the CMS and every 60 days thereafter, unless otherwise approved
CMS Final Report for WMUs and contaminant releases	Within 90 days of completion of the CMS
Revised CMS Final Report for WMUs and contaminant releases	Within 45 days of receipt of Final Report NOD
CMI Work Plan for WMUs and contaminant releases	Within 120 days of approval of the CMS Final Report
Revised CMI Work Plan for WMUs and contaminant releases	Within 45 days of receipt of Work Plan NOD
CMI progress reports	Within 60 days of implementation of the Work Plan and every 60 days thereafter, unless otherwise approved
CMI Final Report for remediated WMUs and contaminant releases	Within 90 days of the remedial actions have been completed and cleanup criteria have been met
Revised CMI Final Report for WMUs and contaminant releases	Within 45 days of receipt of Final Report NOD

L. CORRECTIVE ACTION DOCUMENTS RETENTION

The licensee shall maintain all corrective action documents required by this license at the facility. The documents shall be maintained for the operating life of the facility or until the facility is released from financial assurance requirements for corrective action by the Director, whichever is longer. The licensee shall offer such documents to the Office Chief prior to discarding those documents. {§§11102 and 11115a of Act 451 and R 299.9521(3)(b) and R 299.9629}

ATTACHMENT A3
WASTE ANALYSIS PLAN (WAP)

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), being R 299.9504, R 299.9508, and R 299.9605, and Title 40 of the Code of Federal Regulations (CFR) §§270.14(b)(3) and 264.13(b) and (c), establish requirements for WAPs for hazardous waste management facilities. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003.

This license application attachment addresses requirements for a WAP for the hazardous waste management units and the hazardous waste management facility for the *Pharmacia & Upjohn Company LLC, a subsidiary of Pfizer, Inc.* facility. All activities associated with the WAP will be conducted at the *Pharmacia & Upjohn Company LLC* facility.

A3.A WASTE ANALYSES
  A3.A.1 Initial Waste Characterization Requirements for Generators
    A3.A.1(a) Test Methods
    A3.A.1(b) Sampling Methods
    A3.A.1(c) Generator Waste Characterization Discrepancies
    A3.A.1(d) Subsequent Waste Shipment Procedures
  Figure A3.A.1 Example Facility Waste Profile Form
  A3.A.2 Waste Acceptance Procedures
    A3.A.2(a) Review Paperwork
    A3.A.2(b) Waste Screening/Fingerprinting
  A3.A.3 Procedures to Ensure Compliance with Land Disposal Restrictions (LDR) Requirements
    A3.A.3(a) Spent Solvent and Dioxin Wastes
    A3.A.3(b) Listed Wastes
    A3.A.3(c) Characteristic Wastes
    A3.A.3(d) Radioactive Mixed Waste
    A3.A.3(e) Leachates
    A3.A.3(f) Laboratory Packs
    A3.A.3(g) Contaminated Debris
    A3.A.3(h) Waste Mixtures and Wastes with Overlapping Requirements
    A3.A.3(i) Dilution and Aggregation of Wastes
A3.B NOTIFICATION, CERTIFICATION, AND RECORD KEEPING REQUIREMENTS
  A3.B.1 Retention of Generator Notices and Certifications
  A3.B.2 Waste Shipped to Subtitle C Facilities
  A3.B.3 Waste Shipped to Subtitle D Facilities
  A3.B.4 Recyclable Materials
  A3.B.5 Record Keeping
  A3.B.6 Required Notice

A3.A WASTE ANALYSES

Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc facility is a private facility that generates waste on site and receives wastes generated off site at other Pfizer, Inc facilities in the Kalamazoo, MI area. *Pharmacia & Upjohn Co LLC* has developed a WAP to ensure that its facility at *7171 Portage Rd in Kalamazoo, MI* will accept only wastes that it is authorized to accept. All hazardous waste received at the facility will be placed into storage upon receipt and sent off-site for treatment.

All analysis performed pursuant to this application will be consistent with the QA/QC Plan in accordance with *"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," U.S. Environmental Protection Agency (EPA) Publication No. SW-846, Third Edition, Chapter 1 (November 1986), and its updates*. All samples for the purpose of waste characterization will be collected, transported, stored, and disposed by trained and qualified individuals in accordance with the QA/QC Plan.

In accordance with R 299.9609 and 40 CFR §264.73 and Part 264, Appendix I, *Pharmacia & Upjohn Co* LLC will retain all records and results of waste determinations performed as specified in 40 CFR §§264.13, 264.17, 264.314, 264.1034, 24.1063, 264.1083, 268.4(a), and 268.7 in the facility operating record until closure of the facility.

A3.A.1 Initial Waste Characterization Requirements for Generators
[R 299.9605(1) and R 299.9504(1)(c) and 40 CFR §264.13(b)(5)]

Pharmacia & Upjohn Co LLC will require the following waste profile information for initial waste shipments from all generators (on-site and off-site) prior to shipment.

Pharmacia & Upjohn Co LLC will describe each waste's characteristics and composition based on knowledge of the process materials and their known physical properties. Whenever a new waste stream is generated or a waste has changed, the waste is profiled and characterized to determine the appropriate classification and disposal.

For hazardous waste, a waste profile is completed and certified by the generator of the waste with complete characterization of the waste stream. When the stream is a Pfizer, Inc product, the constituents of the waste are identified in the MSDS that is reviewed with the profile. If the waste stream is not a Pfizer, Inc product, generator knowledge of the constituents in the waste stream provided on the profile form is used to determine what analysis (if any) is necessary to properly classify the waste. The waste is classified assigning the appropriate hazardous waste code, and a profile number that describes the appropriate destination of the waste in compliance with all applicable permits governing the proper storage, transport and disposal of wastes.

The proper DOT container and labeling requirements will be determined, and an assessment will be made for the potential hazards in storing the material, if any, including compatibility with other wastes stored in the same area. Incompatible materials will be stored at B388 using portable containment pallets and appropriate isolation distances.

Upon receipt of materials in B388 the operator will inspect the integrity of the container and confirm proper labeling has been completed.

A3.A.1(a) Test Methods

The most recent Test Methods and detection limits for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, and all of its updates will be utilized to analyze constituents of concern at the time of analyses. SW-846 methods not available at the time will be developed and submitted to the MDEQ for approval.

Screening Parameter	Test Method
☒ Waste Code	SW-846
☒ Free Liquids	SW-846
☒ Ignitability	SW-846
☒ Reactivity	SW-846
☒ Land Disposal Restrictions	SW-846

A3.A.1(b) Sampling Methods

Methods of waste sampling will be conducted in accordance with Test Methods and detection limits for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, and all of its updates.

Container Type or Material	Sampling Method
Containerized Liquid	Coliwasa
Liquid Waste in Secondary Containment	Grab sample
Crushed or powdered material	ASTM D346-75
Extremely viscous material	ASTM D140-70
Soil-like material	ASTM D1452-65

A3.A.1(c) Generator Waste Characterization Discrepancies

[R 299.9605(1) and R 299.9504(1)(c) and 40 CFR §§264.13(a)(3) and (4), 264.13(b)(c), and 264.72]

The generating facility will be notified and an updated waste characterization will be required in the event the facility receives or has reason to believe that a waste received is not consistent with the waste characterization on file.

A3.A.1(d) Subsequent Waste Shipment Procedures

[R 299.9605(1) and R 299.9504(1)(c) and 40 CFR §§264.13(a)(3) and 264.13(b)(4)]

All re-occurring hazardous waste streams are re-certified upon a process change or triennial to verify the waste stream is still consistent with the information provided on the profile.

Figure A3.A.1 Example Facility Waste Profile Form

PFIZER KALAMAZOO

Waste Common Name: **Item #** **Profile #** **Last Reviewed**

Section 1 – Generator Information

Generator EPA ID #

Generator Name

Facility Address

City State Zip

County

Mailing/Billing Address

City State Zip

Generator Contact

Title

Phone Fax

Technical Contact

Phone Fax

Mobile Pager

E-mail

Section 2 – Shipping & Packaging Information

2.1) Estimated Shipping Volume: (include units)

2.2) Estimated Frequency: ☐ One Time Only ☐ Year ☐Quarter ☐ Month

2.3) DOT Shipping Name

2.4) Packaging **(check all that apply)**

☐ Bulk Solid (Yd$_3$ < 2000 lbs/yd$_3$) ☐ Bulk Solid (Ton >2000 lbs/yd$_3$) ☐ Bulk Liquids (Gallon)

☐ Totes, Size ☐ Cubic Yard Boxes/Bags ☐ Drums, Size

☐ Other (palletized, 5 gal. Pail, etc.):

2.5) Is this waste subject to regulation under 40 CFR, Part 63, Subpart DD or 40 CFR, Part 264, Subpart CC (RCRA)? ☐ Yes ☐ No

(Does the waste contain >500 ppm Volatile Organic Hazardous Air Pollutants – VOHAP’s or Volatile Organic Compounds – VOC’s?)

2.6) Personal Protective Equipment Requirements:

2.7) Comments:

Section 3 – Physical Characteristics

3.1) Color 3.2) Strong Odor: ☐No ☐Yes If Yes, describe:

3.3) Physical State at 70^{0}F: ☐ Solid ☐ Dust/Powder ☐ Liquid ☐ Sludge

3.4) Free Liquid Range: ☐ None ☐ 1 - 25% ☐ 26 - 50% ☐ 51-75% ☐ 76-99% ☐ 100%

3.5) Layers: ☐ Single ☐ Bi-layered ☐ Multi-layered

3.6) What is the pH of this waste? ☐ <2 ☐ 2.1-4.9 ☐ 5-10 ☐ 10.1-12.4 ☐ >12.5

3.7) What is the flash point of this waste? ☐ <900F ☐ 90-1400F ☐ 140-1990F ☐ >2000F

3.8) Does this waste contain? (check all that apply):

☐ None ☐ Water Reactive ☐ Oxidizer ☐ OSHA Carcinogen ☐ Infectious ☐ Shock Sensitive Waste

☐ Radioactive Waste ☐ Explosives ☐ Pyrophoric Waste ☐ Poison - Inhalation Hazard

☐ Asbestos – non-friable ☐ Asbestos – friable ☐ Dioxins ☐ Furans ☐ Debris ☐ Class I or Class II ODC

3.9) Are the containers empty as defined in R 299.9207 and/or 40 CFR 761.79? ☐ Yes ☐ No

3.10) Comments:

Section 4 – Waste Composition and Generating Process

4.1) Describe the physical and chemical composition of the waste (i.e., soil, water, PPE, debris, key chemical compounds, etc.):

4.2) Identify the constituents in the waste stream:

Composition Information				
Constituents	**CAS Number**	**Concentration**	**Data Source**	**HAP (check if yes)**
				☐
				☐
				☐
				☐
				☐
				☐

4.3) Provide a *detailed* description of the process generating this waste (attach flow diagram if available).

4.4) Is this waste generated from a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or MDEQ mandated cleanup?

☐ Yes ☐ No

Section 5 – Is This Hazardous Waste?

Determination	Yes	No	Codes	Comments / Regulatory Reference for Exclusions
Defined as Waste	☐	☐	N/A	
Excluded from Waste	☐	☐	N/A	
Excluded from Haz. Waste	☐	☐	N/A	
F-listed / Michigan F-listed	☐	☐		
K-listed / Michigan K-listed	☐	☐		
P-listed	☐	☐		
U-listed / Michigan U-listed	☐	☐		
Ignitable	☐	☐		
Corrosive	☐	☐		
Reactive	☐	☐		
Toxic (D004 – D043)	☐	☐		
Universal Waste	☐	☐		
Michigan Liquid Industrial Waste	☐	☐		
Toxic (Michigan S-list)	☐	☐		
Management Method				**Associated On-Site Routing**
Waste Codes Permitted to On-Site Routing	☐	☐	If no, which code(s)	If no, alternate solution

Based On: ☐ **Generator Knowledge** ☐ **Analysis*** ☐ **MSDS***. ***Please attach a copy.**

Section 6– Land Disposal Restriction

☐ LDR Not Applicable	LDR Treatability Group ☐ Wastewater ☐ Nonwastewater		Subcategory (as applicable)	
LDR "Significant" Waste Codes	Regulated Constituent	Specified Technology, Total Concentration, or TCLP	Underlying Hazardous Constituents (if applicable)	UHC Treatment Technology

Section 7– TSCA/FIFRA/NRC Information

7.1) What is the concentration of PCBs in the waste? ☐ None ☐ 0-5 ppm ☐ 6-49 ppm ☐ 50-499 ppm ☐ 500+ ppm

7.2) Does the waste contain PCB contamination from a source with a concentration > 50 ppm? ☐ Yes ☐ No

If you answered "no" to 7.1 and 7.2, please skip to Section 7.3.

7.2.1) Has this waste been processed into a non-liquid form? _ Yes _ No

If yes, what was the concentration of PCBs prior to processing? ☐ N/A ☐ 0-499 ppm ☐ 500+ ppm

7.2.2) Is the non-liquid PCB waste in the form of soil, rags, debris, or other contaminated media? ☐ Yes ☐ No

7.2.3) Are you a PCB capacitor manufacturer or a PCB equipment manufacturer? ☐ Yes ☐ No

7.2.4) Has the PCB Article (e.g., transformer, hydraulic machine, PCB-contaminated electrical equipment) been drained/flushed of all PCBs and decontaminated in accordance with 40 CFR 761.60(b)? ☐ N/A ☐ Yes ☐ No

7.3) Does this waste contain any of the following pesticides or herbicides:

☐Endrin ☐ Lindane ☐ Methoxychlor ☐ Toxaphene ☐ 2,4-D

☐ 2,4,5-TP (silvex) ☐ Chlordane ☐ Heptachlro (and its epoxide)

7.4) Does the waste contain concentrations of radioactive elements regulated by the Nuclear Regulatory Commission (NRC)? ☐ Yes ☐ No

Section 8– Certification

I certify that all information (including attachments) is complete and factual and is an accurate representation of the known and suspected hazards, pertaining to the waste described herein.

Generator Signature ______________________ Printed Name ______

Company ______________________ Title ______________________ Date ______

A3.A.2 Waste Acceptance Procedures

[R 299.9605(1) and R 299.9504(1)(c), and 40 CFR §§264.13(c), 264.72(a) and (b), and 264.73(b)]

Waste shipments arrive at the facility in the following containers:

☒ Drums
☒ Carboys
☐ Roll-off boxes
☒ Totes
☒ Wrangler box
☐ Vacuum trucks
☐ Tanker trucks
☐ Filter bags
☒ Other: *Cylinders*

Upon receipt of wastes from a generator, *Pharmacia & Upjohn Co LLC* will perform all of the following tasks:

- Review paperwork
- Visually inspect the waste
- Perform waste screening/Fingerprinting

These tasks are discussed below.

A3.A.2(a) Review Paperwork

[R 299.9605(1) and R 299.9504(1)(c), and 40 CFR §§264.13(c), 264.72(a) and (b), and 264.73(b)]

Pharmacia & Upjohn Co LLC will review all paperwork, including manifests and LDR notifications, before any wastes are accepted by the facility. *Pharmacia & Upjohn Co LLC* will review all paperwork for completeness. In addition, the manifest and LDR notification will be compared for consistency. The manifest will also be compared to the waste profile and analytical information provided by the generator and to the waste shipment to ensure the accuracy of information provided on shipment paperwork. The manifest will also be compared to the number of containers, the volume, and/or the weight of the waste in the shipment. If there is any manifest or labeling discrepancies, the facility that generated the waste will also be contacted and the manifest revised accordingly. If there is a problem with respect to container integrity, an appropriate method of handling the waste will be determined (e.g., overpacking a damaged drum or pumping its contents into an empty drum).

A3.A.2(b) Waste Screening/Fingerprinting

Only wastes generated and characterized at Pfizer, Inc facilities will be accepted at the facility; therefore no sampling will be performed upon receipt. These wastes include returned goods that are being sent off-site for treatment or disposal without being opened at the Pharmacia & Upjohn Co LLC facility.

A3.A.3 Procedures to Ensure Compliance with Land Disposal Restrictions (LDR) Requirements [R 299.9627 and 40 CFR, Part 268]

All shipments of wastes subject to LDR received at the facility will be accompanied by appropriate generator notification and LDR notification in accordance with R 299.9627 and 40 CFR §268.7. The LDR notification accompanying generator wastes will be reviewed, and any discrepancies in the LDR notification and the associated manifest, analytical records, or Waste Profile Form will require shipment rejection unless additional, satisfactory, clarifying information is provided by the generator.

All information obtained to document LDR compliance will be maintained in the facility operating record until closure of the facility.

All hazardous waste received at the facility will be placed into storage upon receipt and sent off-site for treatment. *Pharmacia & Upjohn Co LLC* will supply LDR notifications and certification, including appropriate analytical records to support the certification, to the receiving facility with each shipment of waste. The notifications and certifications will contain the information required under R 299.9627 and 40 CFR §268.7.

A3.A.3(a) Spent Solvent and Dioxin Wastes

[R 299.9627 and 40 CFR §§264.13(a)(1), 268.7, 268.30, 268.31, 268.40, 268.41, 268.42, and 268.43]

Spent solvent wastes (F001-F005) are generated at the facility. Generator process knowledge will be used to determine the presence of Spent solvent wastes (F001-F005). Generator process knowledge will be documented on the waste material profile report and LDR notification. The LDR notification will provide additional information regarding the appropriate treatment standards for the waste and whether it has already been treated to the appropriate standards.

A3.A.3(b) Listed Wastes

[R 299.9627, R 299.9213, and R 299.9214 and 40 CFR, Sections 264.13(a)(1), 268.7, 268.33, 268.34, 268.35, 268.36, 268.39, 268.40, 268.41, 268.42, and 268.43]

Generator process knowledge will be used to determine whether listed waste meets the applicable treatment standards or to demonstrate that the waste has been treated by the appropriate specified treatment technology. In accordance with R 299.9627 and 40 CFR §268.41, where treatment standards are based on concentrations in the waste extract, the facility will use TCLP to determine if wastes meet treatment standards.

Generator process knowledge will be documented on the waste material profile report and LDR notification.

A3.A.3(c) Characteristic Wastes

[R 299.9627, R 299.9208, and R 299.9212 and 40 CFR §261.3(d)(1), 264.13(a)(1), 268.7, 268.9, 268.37, 268.40, 268.41, 268.42, and 268.43 and Part 268, Appendix I and Appendix IX]

Generator process knowledge will be used to determine whether characteristic wastes meet the applicable treatment standards or to demonstrate that the waste has been treated by the appropriate specified treatment technology. In accordance with R 299.9627 and 40 CFR §268.41, where treatment standards are based on concentrations in the waste extract, the facility will determine if wastes meet treatment standards.

Characteristic D008 lead nonwastewaters will be analyzed using TCLP to determine compliance with treatment standards. If after treatment a hazardous waste displays a characteristic for the first time, the characteristic waste code will be added to the LDR notification and facility records. Wastes will be retreated, as appropriate, to meet the characteristic treatment standard prior to land disposal. In addition, the *Generator process knowledge* will be used to identify the underlying hazardous constituents that are expected to be present in D001 and D002 wastes. The *Generator process knowledge* will be documented on the waste material profile report and LDR notification.

A3.A.3(d) Radioactive Mixed Waste
[R 299.9627 and 40 CFR §§268.7, 268.35(c), 268.35(d), 268.36, and 268.42(d)]

☒ The facility does not generate or received radioactive mixed waste.

A3.A.3(e) Leachates
[R 299.9627 and 40 CFR §§260.10, 268.35(a), and 268.40]

☒ The facility does not generate or received single-source or multi-source F039 leachates.

A3.A.3(f) Laboratory Packs
[R 299.9627 and 40 CFR §268.7, 268.42(c) and Part 268, Appendix IV and Appendix V]

☒ The laboratory packs generated and received at the facility are not land disposed.

If a laboratory pack hazardous waste is combined with nonlaboratory pack hazardous waste prior to, or during, treatment, the entire mixture will be treated to meet the most stringent treatment standards for each waste constituent before being land disposed.

A3.A.3(g) Contaminated Debris
[R 299.9627 and 40 CFR §§268.2(g), 268.7, 268.9, 268.36, 268.45, and 270.13(n)]

☒ Hazardous debris generated or received at the facility that exhibits the characteristics of ignitability, corrosivity, or reactivity will be sent for treatment using one of the extraction, destruction, or immobilization technologies identified in Table 1 of 40 CFR §268.45.

A3.A.3(h) Waste Mixtures and Wastes with Overlapping Requirements
[R 299.9627 and 40 CFR §§264.13(a), 268.7, 268.41(b), 268.43(b), and 268.45(a)]

Generator process information and analytical data will be used to demonstrate that waste mixtures and wastes carrying multiple codes are properly characterized. Wastes that carry more than one characteristic will be identified with a number for each characteristic.

A3.A.3(i) Dilution and Aggregation of Wastes
[R 299.9627 and 40 CFR §268.3]

Listed wastes, if destined for land disposal, may not be diluted from the point of generation to the point of land disposal. Characteristic wastes may only be diluted if (1) the waste is managed in a CWA/CWA-equivalent surface unit or a Class I Safe Drinking Water Act injection well, (2) the waste has a concentration-based treatment standard or is treated using the DEACT technology-based treatment standard, and (3) the waste is not a D003 reactive waste.

The facility may not dilute or partially treat a listed waste to change its treatability category (i.e., from nonwastewater to wastewater), in order to comply with different treatment standards. If the wastes are all legitimately amenable to the same type of treatment to be performed, the facility may aggregate wastes for treatment.

A3.B NOTIFICATION, CERTIFICATION, AND RECORDKEEPING REQUIREMENTS

[R 299.9627 and R 299.9609 and 40 CFR §§264.73, 268.7, and 268.9(d)]

Pharmacia & Upjohn Co LLC will perform the following procedures for preparing and/or maintaining applicable notifications and certifications to comply with LDRs:

A3.B.1 Retention of Generator Notices and Certifications

[R 299.9627 and 40 CFR §268.7(a)(7)]

Pharmacia & Upjohn Co LLC will retain a copy of all notices, certifications, demonstrations, data, and other documentation associated with compliance to LDRs.

The following notices and certifications submitted by the initial generator of the waste will be reviewed and maintained:

- Notices of restricted wastes not meeting treatment standards or exceeding levels specified in RCRA §3004(d), including the information listed in R 299.9627 and 40 CFR §268.7(a)(1).
- Notices of restricted wastes meeting applicable treatment standards and prohibition levels, including the information in R 299.9627 and 40 CFR §268.7(a)(2).

A3.B.2 Waste Shipped to Subtitle C Facilities

[R 299.9627 and 40 CFR §§268.7(a) and 268.7(b)(6)]

☒ For restricted waste or waste treatment residues that will be further managed at a Subtitle C (hazardous waste management) facility, the facility will submit notifications and certifications in compliance with the notice and certification requirements applicable to generators under R 299.9627 and 40 CFR §268.7(a) and (b)(6).

A3.B.3 Waste Shipped to Subtitle D Facilities

[R 299.9627 and 40 CFR §§268.7(d) and 268.9(d)]

☒ The facility does not ship waste to Subtitle D facilities.

A3.B.4 Recyclable Materials

[R 299.9627 and 40 CFR §268.7(b)(7)]

☒ The facility does **not accept** recyclable materials used in a manner constituting disposal.

A3.B.5 Record Keeping

[R 299.9608(4), R 299.9609, R 299.9610(3), and R 299.9627 and
40 CFR §§264.72, 264.73, 268.7(a)(5), 268.7(a)(6), 268(a)(7), and 268.7(d)]

Pharmacia & Upjohn Co LLC maintains a facility operating log in accordance with R 299.9609 and 40 CFR §264.73. The operating log consists of *waste profiles, analytical data, inventory records, inspection records, LDR notifications, and manifests*.

Copies of all necessary notifications and certifications, as well as relevant inspection forms and monitoring data, are also maintained on file at the facility. Files will be maintained for a minimum of three years (for inspection records and LDR notification), or until facility closure (for inventory records).

If a significant manifest discrepancy is discovered (such as variation in one-piece count or misrepresentation of the type of waste or corrosive rather than flammable) that cannot be resolved with the generator or transporter within 15 days of receipt, facility personnel will submit to the Director and Regional Administrator a letter describing the discrepancy and all attempts to reconcile the discrepancy. The letter will include a copy of the discrepant manifest or shipping document.

Facilities managing a restricted waste that is excluded from the definition of a hazardous or solid waste or exempt from Subtitle C regulations*:* The facility will place a one-time notice in the facility files describing the generation, basis for exclusion or exemption, and disposal of the waste. For each shipment of treated debris, the facility will place a certification of compliance with applicable treatment standards in the facility's files.

A3.B.6 Required Notice

[R 299.9605(1) and 40 CFR §264.12(a) and (b))]

The facility will notify the Division Chief in writing at least four weeks before the date the facility expects to receive hazardous waste from a foreign source. Notice of subsequent shipments of the same waste from the same foreign source is not required. When receiving such hazardous waste, the facility will comply with applicable treaties or other agreements entered into between the country in which the foreign source is located and the United States.

When the facility is to receive hazardous waste from an off-site source, the facility will inform the generator in writing that the facility has the appropriate license for and will accept the waste the generator is shipping. The facility will keep a copy of this written notice in the operating record.

Attachment 2

Inspection Schedule

ATTACHMENT A5
INSPECTION REQUIREMENTS

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), being R 299.9504, R 299.9508, R 299.9605 and Title 40 of the Code of Federal Regulations (CFR) §§264.15 and 270.14(b)(5), establish requirements for inspections at hazardous waste management facilities. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003

This license application attachment addresses requirements for inspections at the following hazardous waste management facility: *Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc* in *Kalamazoo*, Michigan.

☒ Operating License applicant

☐ Construction Permit applicant

This attachment is organized as follows:

INTRODUCTION
A5.A WRITTEN SCHEDULE
A5.B INSPECTION LOG OR SUMMARY
    Table A5.B.1 Container Storage Area Inspection Log Example

INTRODUCTION

Pharmacia & Upjohn Co LLC will inspect the facility for malfunctions and deterioration, operator errors, and discharges that may be causing, or may lead to: (1) release of hazardous waste constituents into the environment or (2) a threat to human health. Pharmacia & Upjohn Co LLC will conduct these inspection often enough to identify problems in time to correct them before they harm human health or the environment [R 299.9605 and 40 CFR §264.15(a)].

A5.A WRITTEN SCHEDULE

Written Schedule *[R 299.9605 and 40 CFR §264.15(b)(1)]*	**Types of Problems** *[R 299.9605 and 40 CFR §264.15(b)(3)]*	**Frequency** *[R 299.9605 and 40 CFR §§264.15(b)(4), 264.174, 264.1086, 264.1088 and 264.1089, where applicable]*	**Remedy Schedule** *[R 299.9605 and 40 CFR §264.15(c)]*
Containment Structure	Presence of a release, water from eyewash/safety shower testing, rainwater, cracking of containment floor, and the deterioration of concrete.	*Daily*	*Immediate clean-up released material. Water from eye wash/safety shower testing or vehicle runoff will be removed as necessary to ensure containment capacity is maintained. Sumps will be emptied of water with 24-hrs when full. Within 24-hrs submit work orders to have containment repaired.*
Aisle Spacing	Narrow spacing or blocked isle ways.	*Weekly*	*Immediate remove/relocate material to maintain proper aisle spacing.*
Labels Intact	Labels not legible, visible or damage.	*Weekly*	*Immediately relocate, repair, or replace effected labels.*
Container Condition	Shell damaged/bulging, bungs missing, or container leaking	*Weekly*	*Immediate repair and/or overpack damaged containers*
Safety Shower, Eye Wash, and Alarm	Equipment damage, leaking, low flow, alarm malfunction	*Monthly*	*Within 24-hrs submit work orders to have equipment repaired and or replaced.*
Emergency Response Equipment	Equipment damaged or missing	*Yearly*	*Within 24-hrs submit work orders to have equipment repaired and or replaced.*

A5.B INSPECTION LOG OR SUMMARY

[R 299.9605 and 40 CFR §264.15(d)]

Copies of these records must be kept for at least three years from the date of inspection. At a minimum, these records must include the date and time of the inspection, the name of the inspector, a notation of the observations made, and the date and nature of any repairs or other remedial actions taken. An example inspection log is provided as Table A5.B.1.

Table A5.B.1 Container Storage Area Inspection Log Example

Daily				Weekly					
Date	**Time**	**Inspector (Full Name) Example: John Smith**	**Containment Structure (Free of liquid, good condition)**	**Aisle Spacing**	**Labels are clearly visible**	**Labels contain applicable waste codes**	**Containers are clearly dated**	**Container Condition (Shell, bungs, leaks, etc)**	**Comments/Repairs/ Remedial Actions**

ATTACHMENT A10
PERSONNEL TRAINING

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of the Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), R 299.9501, R 299.9605 and Title 40 Code of Federal Regulations (CFR) §§264.16 and 270.14(b)(12), establish requirements for personnel training programs at hazardous waste management facilities. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003.

This license application attachment addresses requirements for a personnel training program at the hazardous waste management facility for the Pharmacia and Upjohn Company LLC, a subsidiary of Pfizer Inc in Kalamazoo, Michigan. This attachment includes personnel training requirements for construction permits and operating license applications. The information included in the attachment demonstrates how the facility meets the personnel training requirements for hazardous waste management facilities.

(Check as appropriate)

Operating License Applicant:	Construction Permit Applicant:
☒ R 299.9605 Personnel Training Program	☐ R 299.9605 Personnel Training Program

This template is organized as follows:

A10.A CONTENT OF INTRODUCTORY AND CONTINUING EDUCATION PROGRAMS
  A10.A.1 Outline for Introductory Training Program
  A10.A.2 Outline for Continuing Education
A10.B PERSONNEL SUBJECT TO TRAINING REQUIREMENTS
  A10.B.1 Job Titles and Job Descriptions
  A10.B.2 Description of How Training is Designed to Meet Actual Job Tasks
A10.C FREQUENCY OF REQUIRED TRAINING
  A10.C.1 Initial Training
  A10.C.2 Continuing Education
A10.D TRAINING DIRECTOR
A10.E DOCUMENTATION AND RECORD KEEPING
  A10.E.1 Documentation
    A10.E.1(a) Job Titles
    A10.E.1(b) Written Job Descriptions
    A10.E.1(c) Written Description of Type and Amount of Training Given to Each Position
    A10.E.1(d) Documentation That Training Has Been Given to and Completed by Facility Personnel
  A10.E.2 Record Keeping

A10.A CONTENT OF INTRODUCTORY AND CONTINUING EDUCATION TRAINING PROGRAMS

[R 299.9605 and 40 CFR §264.16(a)]

A10.A.1 Outline for Introductory Training Program

[R 299.9605 and 40 CFR §§264.16(a)(1) and 264.16(d)(3)]

The goal of the personnel training program is to provide instructions for the proper management of hazardous waste and use of equipment involved in waste production/disposal and emergency response procedures. Training is scheduled and recorded electronically through a training database. Environmental professionals are responsible for developing and implementing initial and refresher training for employees at the facility. The training can be classroom training, computer based training, or on-the-job training.

The Environmental professional's training is supplemented by their attendance at outside technical seminars, conferences, webcasts, or other professional training.

Contractors directly involved with managing waste at the TSD are provided with training which includes the safe handling and management of hazardous waste and RCRA issues pertinent to contingency plan implementation. Specific requirements for the Pfizer Site Contingency Plan are provided by Pharmacia & Upjohn Co LLC.

A10.A.2 Outline for Continuing Education

[R 299.9605 and 40 CFR §§264.16(a)(1) and 264.16(d)(3)]

Personnel, Environmental professionals, and contractors directly involved with managing waste at the TSD are refreshed on the requirements for the proper management of hazardous waste, use of equipment involved in waste production/disposal, and emergency response procedures annually.

A10.B PERSONNEL SUBJECT TO TRAINING REQUIREMENTS

[R 299.9605 and 40 CFR §§264.16(a),(d)]

A10.B.1 Job Titles and Job Descriptions

[R 299.9605 and 40 CFR §§264.16(d)(1),(2)]

The job titles and job descriptions for each employee directly involved with the handling of hazardous waste are kept on file at the facility.

A10.B.2 Description of How Training is Designed to Meet Actual Job Tasks

[R 299.9605 and 40 CFR §§264.16(a)(1) and (d)(3)]

The RCRA training program includes an introduction for handling and managing hazardous waste and spill and fire response.

The annual refresher covers general hazardous waste management and updates as needed to reflect new regulatory requirements and to introduce changes in management procedures.

The training program described above is designed to ensure that personnel not only handle hazardous wastes in a safe manner, but also properly respond to emergency situations. The program trains hazardous waste handling/management personnel to maintain compliance under both normal operation conditions and emergency conditions. Training elements address both routine and emergency situations, including the following areas:

- Procedures for using, inspecting, and replacing facility emergency and monitoring equipment;
- Communications or alarm systems;
- Response to fire/explosions;
- Response to ground-water contamination incidents; and,
- Shutdown of operations.

Pharmacia & Upjohn Co LLC offers fire fighting classes to all Pharmacia & Upjohn Co LLC employees, including those working in waste management activities. This training is presented by the Pharmacia & Upjohn Co LLC firefighters to promote the knowledge of hazardous chemicals and to present appropriate fire fighting techniques for specific classes of chemicals used at Pharmacia & Upjohn Co LLC. Training includes information on the use of fire fighting equipment for response to chemical emergencies. This information is updated as needed to address new types of chemicals used at Pharmacia & Upjohn Co LLC and new emergency response equipment as it is obtained.

A10.C FREQUENCY OF REQUIRED TRAINING

[R 299.9605 and 40 CFR §§264.16(b), (c)]

A10.C.1 Initial Training

[R 299.9605 and 40 CFR §264.16(b)]

All new contractors who work at the TSD receive training prior to starting at the facility. Personnel and Environmental Professionals receive training within six months and do not work unsupervised until training is complete.

A10.C.2 Continuing Education

[R 299.9605 and 40 CFR §264.16(c)]

Personnel, Environmental professionals, and contractors directly involved with managing waste at the TSD are refreshed on the requirements for the proper management of hazardous waste, use of equipment involved in waste production/disposal, and emergency response procedures annually.

A10.D TRAINING DIRECTOR

[R 299.9605 and 40 CFR §264.16(a)(2)]

Environmental professionals are responsible for developing and providing initial and refresher training for employees at the facility.

A10.E DOCUMENTATION AND RECORD KEEPING REQUIREMENTS

[R 299.9605 and 40 CFR §§264.16(d) and (e)]

A10.E.1 (a-d) Documentation

[R 299.9605 and 40 CFR §264.16(d)]

The following documents will be maintained at each facility to fulfill RCRA requirements:

- Job titles and names of employees filling each job
- Written job descriptions
- Written description of type and amount of training given to each position
- Documentation that training has been given to and completed by facility personnel

A10.E.2 Record Keeping

[R 299.9605 and 40 CFR §264.16(e)]

The completion of appropriate RCRA training is tracked electronically. An environmental professional monitors the training database to ensure compliance with the RCRA training requirements. The training records are kept for current personnel until the closure of the facility and former personnel for at least three years.

Attachment 4

Contingency Plan

TSDF FACILITIES
PGM KALAMAZOO – WASTE CONTROL
RCRA CONTINGENCY PLAN
[R 299.9607, R299.9504(1)(C);
40 CFR 264 Subpart D, 270.14 (B)(7)]

Pharmacia & Upjohn LLC (subsidiary of Pfizer)
Kalamazoo, Michigan

TABLE OF CONTENTS

G.1 GENERAL INFORMATION 3
G.2 ENVIRONMENTAL EMERGENCY COORDINATORS 3
G.3 IMPLEMENTATION 3
G.4 EMERGENCY RESPONSE PROCEDURES 4
  G.4.1 First Responders 4
  G.4.2 Notification 4
  G.4.3 Identification of Hazardous Materials 5
  G.4.4 Assessment 5
  G.4.5 Control Procedures 6
  G.4.6 Prevention of Recurrence or Spread of Fires, Explosions, or Releases 6
  G.4.7 Storage and Treatment of Released Material 6
  G.4.8 Incompatible Wastes 6
  G.4.9 Post-Emergency Actions 6
  G.4.10 Container Spills and Leaks 6
G.5 EMERGENCY EQUIPMENT 7
  G.5.1 Spill Response Contractors 7
  G.5.2 Fire Extinguishing and Safety Equipment 7
G.6 COORDINATION AGREEMENTS 8
G.7 EVACUATION PLAN 8
G.8 REQUIRED REPORTS 8
G.9 AMENDMENTS TO CONTINGENCY PLAN 9

Tables

Table 1 Facility Response Equipment
Table 2 HazMat Vehicle Inventory

Figures

Figure 1 Site Location Aerial
Figure 2 Site Map
Figure 3 Waste Control
Figure 4 Waste Control – Building 388

PGM KALAMAZOO – WASTE CONTROL
RCRA CONTINGENCY PLAN

[R 299.9607, R299.9504(1)(C);
40 CFR 264 Subpart D, 270.14 (B)(7)]

(Permit reference Section G)

G.1 GENERAL INFORMATION

The Pharmacia & Upjohn Company LLC (P&U), a subsidiary of Pfizer Inc., is located at 7171 Portage Road, Kalamazoo, Michigan 49001, as shown in Figure 1. This facility is a major manufacturer of pharmaceuticals and fine chemical products which operates its own permitted Storage Facility, as part of the site's Waste Control operations, as shown in Figure 2. The Waste Control operations manage hazardous wastes in containers for off-site internment, as depicted in Figure 3.

G.2 ENVIRONMENTAL EMERGENCY COORDINATORS

The following personnel are designated as Environmental Emergency coordinators and are authorized to commit necessary resources to implement the Contingency Plan. They are thoroughly familiar with all operations and activities, characteristics of the waste materials handled, and the location of all records pertinent to the facility's operations. All environmental emergency coordinators are on call 24 hours a day.

Primary Emergency Coordinator

Michael S. Elkins

Phone Numbers:	Work (269) 833.5122 Cell (269) 720.0675 Home (269) 342.2364
Residence:	2809 Springbrook Parchment, MI 49004

Secondary Emergency Coordinators

James Miles

Phone Numbers:	Work (269) 833.5122 Cell (269) 720.5181 Home (269) 344.1524
Residence:	5251 Manana Parchment, MI 49004

G.3 IMPLEMENTATION

P&U maintains a comprehensive Emergency Plan for its Kalamazoo County operations. Personnel designated as Emergency Coordinators and Emergency Officers are responsible for coordinating environmental emergency activities. Personnel assigned to hazardous material areas in the facility have been trained in emergency response in accordance with R 299.9306 and 40 CFR 265 Subpart D.

G.4 EMERGENCY RESPONSE PROCEDURES

G.4.1 First Responders

First responders initiate response action and, based on the degree, nature and safety of the situation, attempt to take actions necessary to minimize the environmental effects of a fire, explosion, or release of hazardous waste or materials. Initial actions include:

1. Maintain a safe distance from the immediate danger.
2. Secure the area and notify unit management and nearby work areas which may be affected.
3. For emergency assistance call:
   - For Hazardous Materials spills: Call 3-3800.
   - For other emergencies (injury, fire, etc.): Call 1-2-3 or 833-4799 from an external line.
   - State the nature and location of the emergency.
4. Send someone to meet emergency personnel.

Subsequent initial response actions may require:

- Close or activate valves and devices that will stop the flow or release of liquids or gases.

- In the event of a fire or explosion, alert the P&U Fire Department by dialing 3-5122, 123, or 833-4799 from an external line on a nearby telephone, or by pulling a fire alarm box. Spills are reported to the P&U Dispatch Center Spill Team at 3-3800. In the event of a fire in early stage development, an attempt may be made by area personnel to extinguish using portable fire extinguishers.

- Contain the spill to prevent horizontal and vertical migration, as quickly as possible. Absorbent booms, sand bags, or earthen dikes may be utilized for containment.

G.4.2 Notification

When an emergency situation occurs, (i.e. fire, explosion or release of hazardous waste constituents that could threaten human health or the environment) the following Emergency Coordination is implemented:

- Internal facility alarms or communication systems are activated as applicable by the P&U Fire Department to notify facility personnel of the event. A more detailed discussion of the Evacuation Plan is provided in Section G.7.

- Requirements for regulatory agency notifications are assessed and notification to the appropriate authorities is made based on the situation involved.

G.4.3 Identification of Hazardous Materials

In the event of a release, fire or explosion, emergency coordination will identify the material, source, amount, and area extent of the release.

If the released material cannot be immediately identified, then Environmental will arrange to have samples collected for chemical analysis at the Company's laboratory or a contract laboratory. Other resources for identifying the release could include manifests, waste characterizations, records review, generator knowledge and/or operation logs.

G.4.4 Assessment

Emergency Coordination will assess possible hazards, both direct and indirect, to human health and the environment (e.g., toxicity, irritability, generation of asphyxiating gases, heat-induced explosions). Upon evaluation of the incident, appropriate actions will be followed to ensure containment and cleanup of the release.

If the Emergency Coordination assessment determines that the release, fire, or explosion could threaten human health or the environment outside the facility, the following will occur:

- If the assessment indicates that evacuation of local areas may be advisable, the Emergency Coordinator will notify the City of Portage and, if necessary, the Kalamazoo County Office of Emergency Management.

- Environmental will notify the National Response Center and MDEQ PEAS. Environmental will verbally provide:

    1. Name and telephone number of the reporter.
    2. Name and address of the facility including EPA I.D. No. MID 000 820 381.
    3. Date, time and type of incident.
    4. Name and quantity of material(s) involved.
    5. Extent of injuries, if any
    6. Estimated quantity and disposition of recovered material resulting from the incident.
    7. Potential hazards to human health and the environment outside the facility
    8. The initial response action taken.

- In addition, the following agencies will be notified, as required or if their assistance is necessary:

City of Portage Fire Department	269.329.4487 Emergency: 9-1-1
City of Portage Police Department	269.329.4567 Emergency: 9-1-1
Kalamazoo Department of Public Safety	269.337.8120
Kalamazoo County Office of Emergency Management	269.383.8743
City of Kalamazoo Water Reclamation Plant	269.337.8681

G.4.5 Control Procedures

Controls for designated hazardous waste areas are discussed in Section G.4.10, below.

G.4.6 Prevention of Recurrence or Spread of Fires, Explosions, or Releases

During an emergency, the Emergency Coordinator will take reasonable measures to ensure that fires, explosions and releases do not occur, recur, or spread to other hazardous waste management areas at the facility. This includes stopping processes and operations, collecting released waste, and recovering or isolating containers. Applicable employees are trained on specific actions to be taken in response to an emergency. In addition, if the facility stops operations during an emergency response, area supervision will be advised to monitor valves and other equipment for leaks, pressure buildup, gas generation, or ruptures.

G.4.7 Storage and Treatment of Released Material

As control is established, Environmental will make arrangements for treatment, storage, and disposal of recovered waste, contaminated soil, surface water or any other contaminated material as is appropriate based on its characteristics. Samples of contaminated material may be analyzed to determine its characteristics or composition for proper handling and disposal.

G.4.8 Incompatible Wastes

Environmental will assess the compatibility of released materials with activities or material storage within the impacted area.

G.4.9 Post-Emergency Actions

Federal, state and local authorities may develop a sampling plan for the collection of waste, groundwater, soil, ash, airborne dust, debris, surface water, and/or wipe samples as appropriate. Post event off-site sampling may not be necessary based on air monitoring data and lack of off-site migration or deposition. Based upon the results of the samples collected P&U will perform corrective actions as required.

Before operations are resumed at the facility, Environmental will notify appropriate federal, state and local authorities that the facility response and cleanup are complete in the affected areas, as required. Written report(s) on the incident will be submitted, as required (see Section G.8).

After an emergency event, emergency equipment is cleaned so that it is fit for use or it is replaced. Before operations resume, an inspection of safety equipment is conducted. Affected containment areas are effectively emptied and washed, capturing residuals and rinses for proper disposal.

If the incident required the activation of the Contingency Plan, Environmental will advise the operator in the area of the release to complete an incident investigation and assign appropriate corrective actions using the facility incident database.

G.4.10 Container Spills and Leaks

Routine inspections are conducted on the storage areas for contained wastes to ensure that the containers are in good condition. Prior to storage, all wastes in the permitted storage area (Building 388) are determined to be compatible with the drums in which they are contained and with other wastes in the storage area. Secondary containment is provided for the container storage area via co-located sumps.

If a spill is observed or a leak detected, sand bags or barriers of absorbent material may be used to contain the spilled liquid in the immediate vicinity of the affected container. The P&U Spill Dispatch Center will be notified at 3-3800, and they will in turn notify Environmental of the situation, provide status of initial actions and implement Emergency Coordination, as needed. Small amounts of spilled liquid may be captured using absorbents and shovels. Materials captured or contaminated absorbent(s) will be characterized, placed in an appropriate container, properly labeled, and shipped off site for proper disposal. Salvage drums are maintained in supply if needed to over pack leaking containers.

G.5 EMERGENCY EQUIPMENT

A list of emergency equipment available in the event of an accident or incident resulting in the release of hazardous waste to the environment is provided in Tables 1 and 2. Location of this equipment can be found in Figure 4, including the locations of spill kits available in proximity to the hazardous waste management area. Table 2 describes equipment that is maintained by the P&U HAZMAT Team response vehicle. Absorbent booms and pads are also available to be deployed at the outfalls from the P&U Pond, in the unlikely event of a spill reaching the outfall. Permanent booms are in place at both sites for containing spills. Spill residues contained in those surface waters would then be absorbed, vacuumed, or skimmed.

Telephones for internal and external communications are available near each hazardous waste management unit. Additionally, operations personnel routinely carry internal/external communication devices (e.g. 2-way radios, cell phones). Telephone communication with the P&U Fire Department would be the first step in activating facility alarms in case of an emergency. Fire alarm boxes that notify the Fire Department automatically are also located near many of the storage areas.

G.5.1 Spill Response Contractors

Pharmacia & Upjohn has retained the following spill response contractors who are available to respond to spills:

Valley City Environmental Services — Grand Rapids, MI
Business Telephone 616.235.1500

Terra I/S — Kalamazoo, MI
Business Telephone: 269.375.9595

The above emergency spill response contractors employ personnel specifically trained in handling hazardous materials. The contractors have a wide range of equipment, including absorbent material, oil booms, vacuum trucks and tankers, bulk tankers, dump trucks, excavation equipment, and mobile treatment and filtration systems.

G.5.2 Fire Extinguishing and Safety Equipment

First response personnel have the opportunity to be trained in portable fire extinguisher response and are capable of using extinguishing equipment as needed. These extinguishers are inspected monthly, serviced annually, and located so that travel distance to each extinguisher location is kept to a minimum. Additional fire extinguishing capability includes strategically located fire hoses. Figure 4 shows the location of fire alarms and portable fire suppression equipment in proximity to the hazardous waste management area.

The P&U Fire Department is responsible for primary response for the Portage facilities. The P&U Fire Department is located on site, with personnel specifically trained in industrial and chemical fires. The Portage Fire Department is the municipal fire department of this jurisdiction and responds to all alarms. P&U also play an active role as a member of the Kalamazoo County Local Emergency Planning Committee.

G.6 COORDINATION AGREEMENTS

Pursuant to R 299.9606 and 40 CFR 264.37, arrangements have been made with state and local emergency response groups to address and coordinate emergency response activities of incidents involving P&U. Copies of this emergency plan have been distributed to the organizations listed below. P&U will ensure that the following organizations receive the most current version of the Contingency Plan:

- Kalamazoo Department of Public Safety (for Fire & Police)
- Kalamazoo County Office of Emergency Management
- Portage Fire Department
- Portage Police Department
- Bronson Methodist Hospital
- Bronson Vicksburg Hospital
- City of Kalamazoo Water Reclamation Plant
- Valley City Environmental Services
- Terra I/S

P&U has provided these agencies, whose assistance may be needed, with opportunities and/or resource materials to familiarize them with the facility layout, properties and associated hazards of hazardous materials handled at the facility, location of facility personnel, entrances to and from roads inside the facility, and possible evacuation routes.

G.7 EVACUATION PLAN

The facility telephone system may be used to report an imminent emergency or event perceived as a threat. By dialing 1-2-3 or 833-4799 from an external line, an individual can report the incident to the 24-hour manned P&U Fire Department. An audible and strobe alert system is used to alert employees of an emergency and provide direction for actions to be taken. Employees are trained in the recognition of and response to emergency alerts.

The evacuation route, relative to the proximity of the hazardous waste management area, is shown in Figures 4.

G.8 REQUIRED REPORTS

The facility incident database will include the occurrence of incidents that required implementation of this Contingency Plan.

The Michigan Department of Environmental Quality will be notified in writing within 15 days of an emergency incident requiring notification of a hazardous waste release at the facility. The report will include:

1. Name, address and telephone number of the facility and owner or operator:
2. Date, time and type of incident;
3. Type and quantities of materials(s) involved;
4. Extent of injuries, if any;
5. Assessment of any hazards to human health or the environment, if applicable;
6. Estimated quantity of recovered material and its disposition.

G.9 AMENDMENTS TO CONTINGENCY PLAN

This plan will be reviewed and amended, as necessary, under any of the following circumstances:

- If applicable regulations are revised;
- Following an emergency;
- Whenever the facility changes its design, construction, operations, maintenance or other conditions in a way that increases the potential for fires, explosions, or releases of hazardous waste or hazardous waste constituents, or changes the response necessary in an emergency; or
- Whenever the list of Emergency Coordinators or emergency equipment changes.

Table 1: Facility Response Equipment

INDOOR EQUIPMENT LISTING

AVAILABLE EQUIPMENT	CAPABILITIES
Radios	communication
Fire Extinguisher, ABC	fire control
Fire hose	fire control
Eye Wash	rinse eyes
Face shield, regular splash shield	PPE
Safety Glasses	PPE
Safety Goggles	PPE
Gloves	PPE
Suit, Coveralls	PPE
Disposal Bags	waste containment
COMMON SPILL KIT CONTENTS	**CAPABILITIES**
Sorbent pads	spill absorption
Sorbent socks	spill absorption & containment

OUTDOOR EQUIPMENT LISTING

AVAILABLE EQUIPMENT	CAPABILITIES
Radios	communication
Fire Extinguishers ABC	fire control
Drain Plug	spill containment
COMMON SPILL KIT CONTENTS	**CAPABILITIES**
Plastic sheeting	spill containment
Sand bags	spill containment
Sorbent pads	spill absorption
Sorbent socks	spill absorption & containment

Table 2: HAZMAT VEHICLE INVENTORY

EQUIPMENT	CAPABILITIES
Radios	communication
Barricade, Orange	communication
NIOSH Guide	guidance
Resource Manuals	guidance
CHRIS (Condensed guide to Chemical Hazards)	guidance
Permeation Reference Manual	guidance
Emergency Action Guides	guidance
Matheson Gas Data Book	guidance
Fire Extinguishers ABC	fire control
Foam Fire Extinguisher	fire control
Fire hoses	fire control
EMS Medical Bag	basic medical treatment
SKED Stretcher	medical response
Chlorine Kit "A"	medical response
Chlorine Kit "B"	medical response
Stethoscope	medical response
Eye Wash	rinse eyes
Face shield, regular splash shield	PPE
Hard Hats	PPE
Respirators	PPE
Safety Glasses	PPE
Safety Goggles	PPE
Gloves	PPE
Suit, Coveralls	PPE
Ear Plugs	PPE
Suit, level B	PPE
Boots	PPE
Suit, level A	PPE
Air bottles	PPE
SCBA	PPE
Respirator cartridges	air filtration/purification
Decon Pool, Folding	decontamination
Decon Coveralls, brushes, bucket	decontamination
HAZMAT Vacuum Sample Kit	sample collection
Snoop Solution	leak detection
pH Test Paper	pH determination
Citric Acid Powder	neutralization
Sodium Bicarbonate	neutralization

Chlorine Bleach	neutralization
Base spill kit	neutralization and spill cleanup
Acid Spill Kit	neutralization and spill cleanup
Drum Bungs	drum closure
Drum Lifter	drum handling
Metal Drum Hoist	drum handling
Drum Dolly	drum handling
Grounding Cable with clamps	spark prevention
Sorbent pads	spill absorption
Sorbent socks/booms	spill absorption & containment
Hazmat Waste Disposal Bags	spill containment
Drum Liners	spill containment
Plugs	spill containment
Belly Patch Kit	spill containment

FIGURE 1: SITE LOCATION AERIAL
PHARMACIA & UPJOHN Co LLC
PORTAGE ROAD SITE

Figure 2 – Site Map

7171 Portage Road, Kalamazoo, Michigan

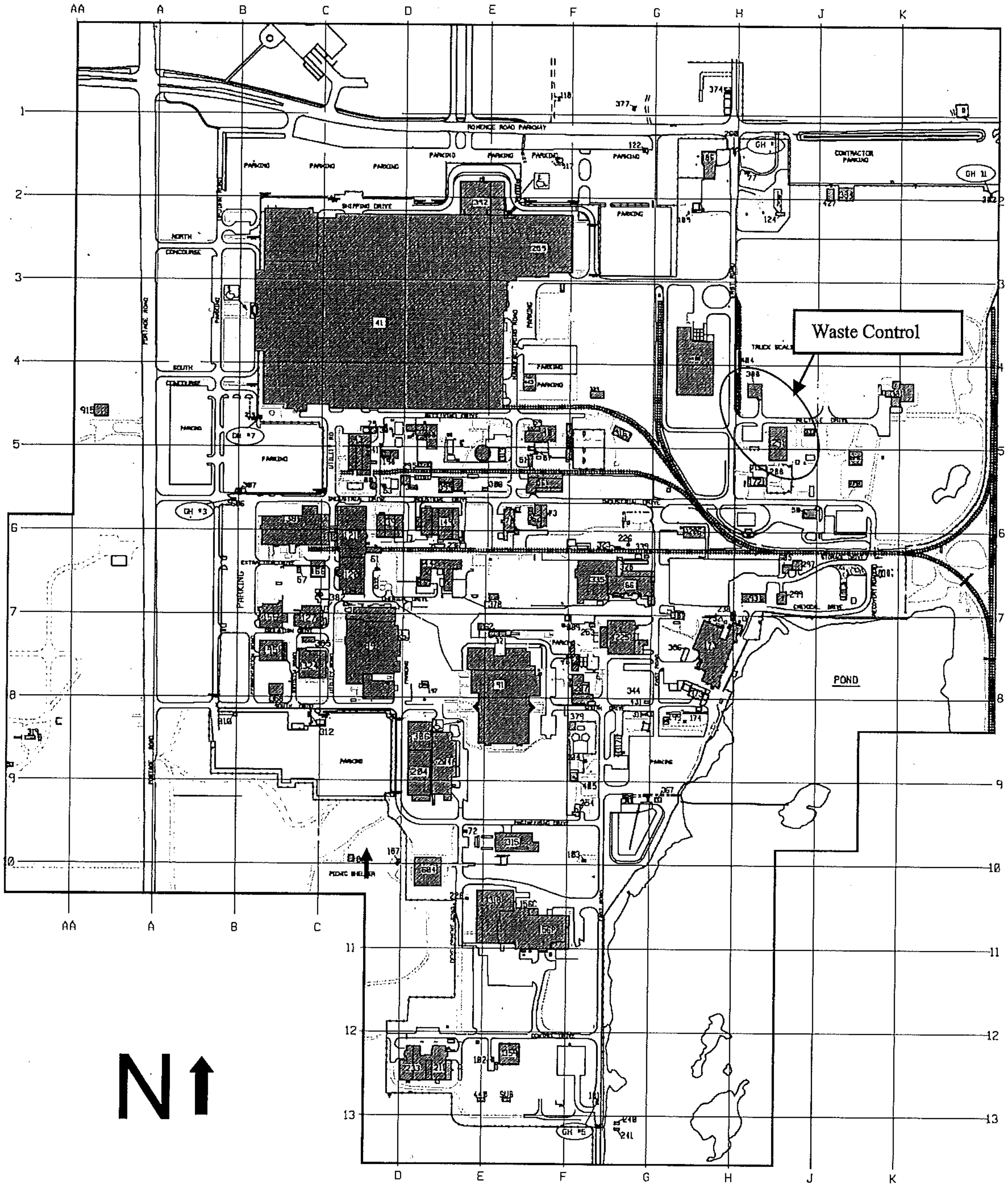


FIGURE 3: WASTE CONTROL HAZARDOUS WASTE PERMITTED STORAGE LOCATION

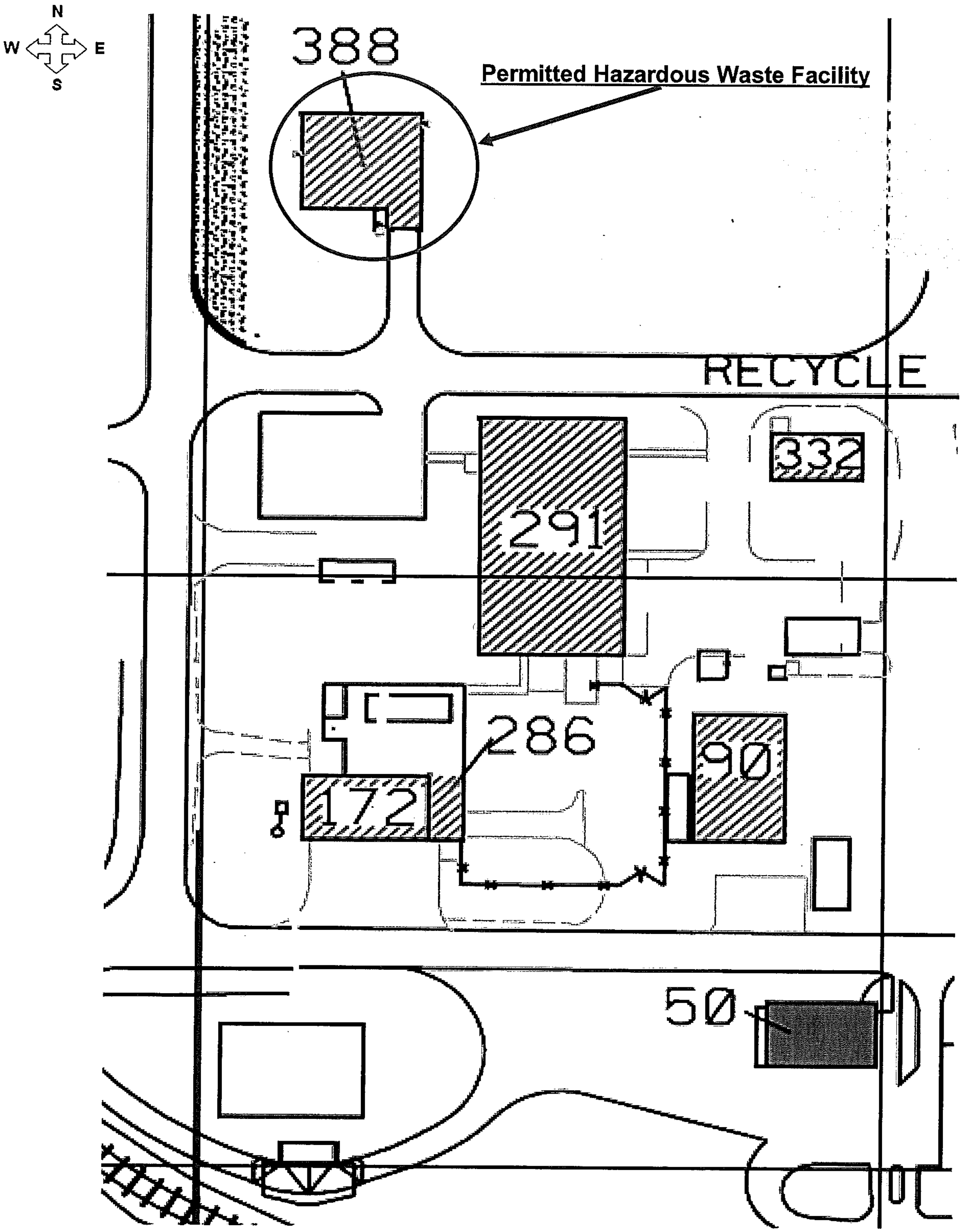
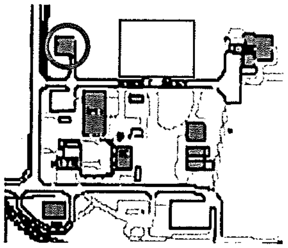
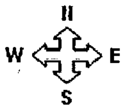
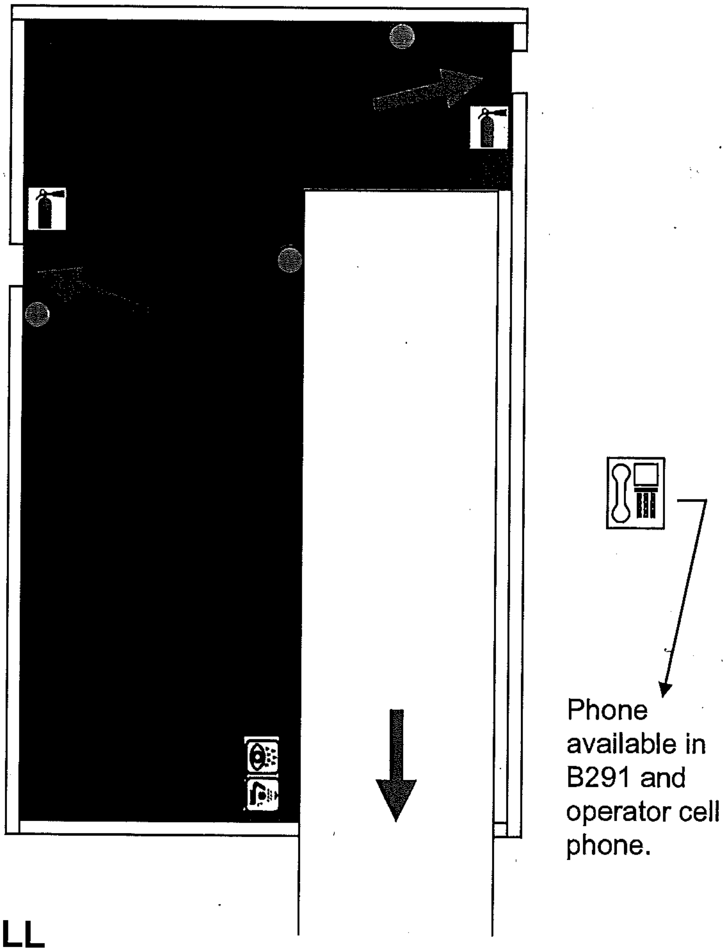


FIGURE 4: WASTE CONTROL - BUILDING 388 HAZARDOUS WASTE ACCUMULATION
with associated emergency equipment, and exit routing



Waste Control





Phone available in B291 and operator cell phone.

EMERGENCY CALL

Fire/Injury: 1-2-3

Spill/Release: 3-3800

EMERGENCY GUIDELINES

Familiarize yourself with all ➡ exit locations.

Know the location of fire, safety and spill equipment.

Evacuation – Follow public address announcement instructions.

Follow shutdown protocol.

Remain calm and orderly.

Do not use the elevators.

LEGEND

- ● Hazardous Waste Facility
- • Spill Kit
- Portable Fire Extinguisher
- ☎ Phone

Attachment 5

Closure Plan

ATTACHMENT A11
CLOSURE AND POSTCLOSURE CARE PLANS

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, (Act 451), R 299.9613 and Title 40 of the Code of Federal Regulations (CFR), Part 264, Subpart G, establishes requirements for the closure and, if necessary, postclosure care of hazardous waste management facilities. All references to 40 CFR citations specified herein are adopted by reference in R 299.11003. This license application attachment addresses requirements for the proper closure and, if necessary, postclosure care of the hazardous waste management units and the hazardous waste management facility for the *Pharmacia & Upjohn Co LLC, a subsidiary of Pfizer, Inc* in *Kalamazoo*, Michigan. The information provided in this attachment was used to prepare the closure and postclosure care cost estimate provided in Attachment A12, "Closure and Postclosure Care Cost Estimates."

This attachment is organized as follows:

- A11.A CLOSURE PLAN
  - A11.A.1 Closure Performance Standard
  - A11.A.2 Unit-Specific Information
  - Table A11.A.1 Hazardous Waste Management Unit Information
  - A11.A.3 Schedule of Final Facility Closure
  - A11.A.4 Notification and Time Allowed for Closure
    - A11A.4(a) Extensions for Closure Time
  - A11.A.5 Unit-Specific Closure Procedures
    - A11.A.5(a) Closure of Container Storage Areas
  - Table A11.A.2 Parameters to be Analyzed
  - A11.A.6 Certification of Closure
  - A11.A.7 Postclosure Notices Filed
- A11.B POSTCLOSURE CARE PLAN
  - A11.B.1 Applicability

A11.A CLOSURE PLAN

A11.A.1 Closure Performance Standard
[R 299.9613 and 40 CFR §264.111]

This Closure Plan is designed to ensure that the facility will be closed in a manner that achieves the following:

a. Minimizes the need for further maintenance; and

b. Controls, minimizes, or eliminates, to the extent necessary to protect human health and the environment, postclosure escape of hazardous wastes, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition byproducts to the groundwater, surface water, or atmosphere; and, as applicable

c. Complies with the unit-specific closure requirements for each of the following units:

(Check as appropriate)

☒ Use and management of containers	R 299.9614 and 40 CFR §264.178
☐ Tank systems	R 299.9615 and 40 CFR §264.197
☐ Surface impoundments	R 299.9616 and 40 CFR §264.228
☐ Waste piles	R 299.9617 and 40 CFR §264.258
☐ Land treatment[a]	R 299.9618 and 40 CFR §264.280
☐ Landfill	R 299.9619 and 40 CFR §264.310
☐ Incinerators	R 299.9620 and 40 CFR §264.351
☐ Drip pads[b]	R 299.9621 and 40 CFR §264.575
☐ Miscellaneous units	R 299.9623 and 40 CFR §§264.601-603
☐ Hazardous waste munitions and explosive storage[b]	R 299.9637 and 40 CFR §264.1202
☐ Boilers and industrial furnances	R 299.9808 and 40 CFR §266.102(e)(11)

[a] Not included in the attachment
[b] *Not yet included in 40 CFR §264.111; therefore not considered*

Unit-specific closure procedures are discussed in Section A11.A.5 of this attachment for each unit type indicated above.

A11.A.2 Unit-Specific Information
[R 299.9613 and 40 CFR §§264.112(b)(3) and (6)]

Table A11.A.1 Hazardous Waste Management Units Information

The following table identifies each hazardous waste management unit at the *Pharmacia & Upjohn Co LLC* facility subject to the closure requirements of this hazardous waste management facility operating license. The table also includes: each unit's maximum licensed hazardous waste inventory, a list of the waste codes managed in the unit, the anticipated date of closure (if known), and the estimated duration of closure activities once closure begins. Unit-specific methods for closure and detailed schedules are discussed in Section 11A.5 of this attachment.

Unit Designation	Maximum Inventory (Include Units)	Waste Codes of Hazardous Wastes Managed	Scheduled Closure Date	Estimated Duration of Closure
B388	280 55-gallon drum equivalents	Refer to section XIV.		

A11.A.3 Schedule of Final Facility Closure
[R 299.9613 and 40 CFR §264.112(b)(6)]

The *Pharmacia & Upjohn Co LLC* facility:

(Check as appropriate)

☐ Anticipates completing final closure of the entire facility by *[insert estimated date]*

☒ Has not determined when the facility will close and does not anticipate completing final closure of the entire facility prior to expiration of the facility's hazardous waste operating license.

Detailed Closure Schedule for Facility Closure

Closure Activity	Time Completed
Inventory Removal & Disposal	7-8 weeks
Decontamination of Equipment	5-6 weeks
Sampling and Analysis	8-10 weeks
Certification of Closure	2 weeks

A11.A.4 Notification and Time Allowed for Closure
[R 299.9613 and 40 CFR §§264.112(d)(2) and 264.113(a) and (b)]

Final closure activities will be initiated within 90 days of receipt of the final volume of hazardous wastes and completed within 180 days of receipt of the final volume of waste. The tasks and estimated time required for partial closure shall follow the schedule specified in Section 11A.3. The Director will be notified by *Pharmacia & Upjohn Co LLC* facility 60 days before final closure begins. Final closure will be certified by both Pharmacia & Upjohn Co LLC facility and an independent, qualified, registered professional engineer of the state of Michigan.

A11.A.4(a) Extensions for Closure Time
[R 299.9613 and 40 CFR §264.113(a) and (b)]

In the event that an extension for closure for the facility or any unit is necessary, the Pharmacia & Upjohn Co LLC facility will request an extension in accordance with the requirements of 40 CFR §264.113(a).

A11.A.5 Unit-Specific Closure Procedures

Unit-specific closure procedures are provided for each unit identified in Section A11.A.2 of this attachment.

🕮 GUIDANCE/REFERENCES

- Part 201, Environmental Remediation, of Act 451. September 1996.
- Test Methods for Evaluating Solid Waste: Physical/Chemical Methods SW 846, Update III plus Variations. December 1996. EPA

A11.A.5(a) Closure of Container Storage Areas
[R 299.9614 and 40 CFR §264.178]

This section describes the procedures for closure of *B388*. The general closure requirement and specific closure procedures are discussed below.

A. General Closure Requirement

At closure, all hazardous waste and hazardous waste residues will be removed from the containment system. Remaining containers, liners, bases, and soil containing or contaminated with hazardous waste or hazardous waste residues will be decontaminated or removed.

B. Specific Closure Procedures

Specific procedures for inventory management, unit inspection, decontamination, sampling and analysis, and additional waste management are discussed below.

1. Inventory and Remedial Waste Management Procedures

It is anticipated that the unit will continue to receive hazardous waste during and following the closure activities; therefore the building will be divided into two sections. The closure activities will be conducted through completion in one section prior to beginning closure activities in the other section. Once closure activities are completed in one section, it will be returned to service as Generator status hazardous waste container storage area according to Part 3 of the Rules and will resume receiving hazardous waste while the other section undergoes closure activities. The shipping and receiving dock area in the building will need to have closure activities conducted separately from the two storage area sections as it will continue to be used during the closure activities for those sections. Once the closure activities are completed for the two storage sections, closure activities will commence for the shipping and receiving dock area. Shipping and receiving activities will be discontinued while closure activities are being conducted in the shipping and receiving dock area.

All hazardous wastes stored in the section of the building undergoing closure will either be moved to the portion of the building that is not undergoing closure activities or will be manifested and shipped by a licensed hazardous waste transporter to an off-site licensed hazardous waste facility.

2. Unit Inspection Procedures

Once the waste inventory has been removed from a section of the building, an independent registered professional engineer will inspect the concrete floor, collection sump, and secondary containment area for the presence of cracks. Should cracks be noted at the time of closure, their exact location will be documented for further investigation. Prior to any decontaminating of surfaces, cracks will be sealed with mastic to ensure that potentially contaminated rinse water does not impact underlying soils.

3. Decontamination Procedures

The concrete floor, collection sump, pallets with their own individualized secondary containment and secondary containment curb will be decontaminated by pressure washing with tap water. The wash water and rinse water will be collected in a licensed hazardous waste vacuum tank truck and disposed of through the local POTW via the facilities sewer system and/or sent off-site to a licensed hazardous waste treatment facility in accordance with all applicable local, state and federal regulations.

To ensure complete decontamination, a composite sample of wash water and rinse water, and a sample of the final rinse, will be collected and analyzed for the parameters indicated in Table A11.A.2. In addition to these samples, an equipment blank sample will be prepared by collecting a sample of the tap water from its source directly into a laboratory-supplied container. The equipment blank will be analyzed for the parameters listed in Table A11.A.2.

The applicant must state whether decontamination solutions will be discharged to the facility sewer and waste water treatment plant, the local publicly-owned treatment works, or collected and characterized for disposal as specified in Subsection 5, below.

4. Sampling and Analysis Procedures

Upon closure of all section of the unit, the following activities will be conducted at the B388 Container Storage Area:

- If cracks are found, the soil under the cracks will be observed for visible signs of contamination and examined with a portable organic vapor analyzer (OVA), which measures the total concentration of volatile organic compound vapors. Soil samples for OVA screening will be taken using an appropriate core drilling device to retrieve undisturbed samples for analysis at a depth of one foot.

- Upon collection of each sample, the soil recovery shall be measured, and general soil type, color, and moisture content noted and recorded on a field log. During the field testing, three undisturbed samples will be split into two samples. The first portion will be placed in two 40-mL septum top vials for laboratory analysis. This sample will be immediately preserved with Methanol in accordance with SW846, Method 5035 and will be analyzed for the organics listed in Table A11.A.2. The second portion, for field examination, will be placed in a virgin eight-ounce glass jar, aluminum foil placed on the mouth, and the jar sealed with the lid and labeled. After a minimum of 30 minutes, the lid will be removed and an OVA probe inserted through the aluminum foil into the glass jar, and the vapor concentration measured in the headspace of the jar. The maximum level measured will be recorded for each sample.

- The sample screened for OVA readings will be submitted for laboratory analysis for the metal parameters listed in Table A11.A.2. In addition, a perimeter soil sample will be obtained for analysis for the parameters listed in Table A11.A.2.

- A soil sample for laboratory analysis will be obtained from a depth of approximately one foot beneath the sumps in the containment area. Soil samples beneath the sumps will be collected by cutting through the sump floor or the containment area concrete floor using a diamond bit drill, to remove a concrete core. If drilling through the containment area, the hole will be cut at an appropriate angle to ensure advancement of the coring device to a depth approximately one foot beneath the sump where an undisturbed core soil sample will be collected. Upon completion of the sample analysis, and providing that the soil sample indicates no contamination, the borehole will be filled with clean material. The surface location of the angle boring will be determined at the time of unit closure. In addition, if any cracks are found in the containment surfaces, the concrete will be penetrated and underlying soil samples for laboratory analysis will be collected and analyzed as described above.

- Between samples, the sampling device will be either used once and disposed, or decontaminated with a non-sudsing detergent and water solution, followed by a tap water rinse and a double rinse with distilled water. All rinse water will be collected and placed in drums for proper disposal.

- The laboratory analytical results of the soil sampling will be statistically compared to the soil background concentrations that have been determined in conjunction with the current closure activities and the Pharmacia & Upjohn Co LLC facility. The statistical comparison will use the mean plus three times the standard deviation to identify soils potentially impacted by spills. For organic constituents stored in Building 388, (Table A11.A.2) concentrations above the level of detection for each constituent will be considered contamination.

- In the event that contamination above statistical background is found, a sampling plan will be developed and implemented to determine the extent of the contamination.

- When the extent of contamination has been determined, the soil will either be remediated during closure activities if B388 will be demolished or be handled as part of the site-wide corrective action program due to the buildings structural interference if B388 will continue to be utilized.

- If any contamination is detected that is not caused by hazardous waste operations, it will be handled as part of the site-wide corrective action program.

Table A11.A.2 Parameters to be Analyzed

Parameter	Method of Analysis		Detection Limits	
	Solids	Water	Solids µg/kg	Water µg/L
Inorganic Compounds				
Barium	Note 1	Note 1	Note 1	Note 1
Cadmium	Note 1	Note 1	Note 1	Note 1
Chromium	Note 1	Note 1	Note 1	Note 1
Cyanides	Note 1	Note 1	Note 1	Note 1
Lead	Note 1	Note 1	Note 1	Note 1
Mercury	Note 1	Note 1	Note 1	Note 1
Nickel	Note 1	Note 1	Note 1	Note 1
Silver	Note 1	Note 1	Note 1	Note 1
Zinc	Note 1	Note 1	Note 1	Note 1
Organic Compounds				
Acetone (2-Propanone)	Note 1	Note 1	Note 1	Note 1
Acetonitrile	Note 1	Note 1	Note 1	Note 1
Benzyl Chloride	Note 1	Note 1	Note 1	Note 1
Bromobenzene	Note 1	Note 1	Note 1	Note 1
t-Butanol	Note 1	Note 1	Note 1	Note 1
Carbon Tetrachloride	Note 1	Note 1	Note 1	Note 1
Chlorobenzene	Note 1	Note 1	Note 1	Note 1
Chloroform (Trichloromethane)	Note 1	Note 1	Note 1	Note 1
Dichlorodifluoromethane	Note 1	Note 1	Note 1	Note 1
Ethyl Acetate	Note 1	Note 1	Note 1	Note 1
Ethyl Benzene	Note 1	Note 1	Note 1	Note 1
Formaldehyde	Note 1	Note 1	Note 1	Note 1
Heptane	Note 1	Note 1	Note 1	Note 1
Hexane	Note 1	Note 1	Note 1	Note 1
Hydrazine	Note 1	Note 1	Note 1	Note 1

Iodomethane (Methyl Iodide)	Note 1	Note 1	Note 1	Note 1
Lithium and compounds	Note 1	Note 1	Note 1	Note 1
Methanol	Note 1	Note 1	Note 1	Note 1
Methyl Chloride (Chloromethane)	Note 1	Note 1	Note 1	Note 1
Methyl Ethyl Ketone	Note 1	Note 1	Note 1	Note 1
Methyl t-Butyl Ether	Note 1	Note 1	Note 1	Note 1
Methylene Chloride (Dichloromethane)	Note 1	Note 1	Note 1	Note 1
Naphthalene	Note 1	Note 1	Note 1	Note 1
Pyridine	Note 1	Note 1	Note 1	Note 1
Styrene	Note 1	Note 1	Note 1	Note 1
Tetrahydrofuran	Note 1	Note 1	Note 1	Note 1
Toluene	Note 1	Note 1	Note 1	Note 1
o-Toluidine	Note 1	Note 1	Note 1	Note 1
Trichlorofluoromethane	Note 1	Note 1	Note 1	Note 1
1,2,4-Trimethylbenzene	Note 1	Note 1	Note 1	Note 1
1,3,5-Trimethylbenzene	Note 1	Note 1	Note 1	Note 1
Xylene (Dimethylbenzene)	Note 1	Note 1	Note 1	Note 1

Note 1: The most recent Test Methods and detection limits for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, and all of its updates will be utilized to analyze these constituents at the time of closure. SW-846 methods not available at the time of closure will be developed and submitted to the MDEQ for approval.

A11.A.6 Certification of Closure
[R 299.9613]

Within 60 days of completion of closure Pharmacia & Upjohn Co LLC will submit to the Director, by registered mail, a certification that the hazardous waste management unit or facility, as applicable, has been closed in accordance with the specifications in the approved closure plan. The certification will be signed by the Pharmacia & Upjohn Co LLC and by an independent registered professional engineer. Documentation supporting the independent registered engineer's certification will be furnished to the Director in accordance with R 299.9613(3), including:

1. The results of all sampling and analysis;
2. Sampling and analysis procedures;
3. A map showing the location where samples were obtained;
4. Any statistical evaluations of sampling data;

5. A summary of waste types and quantities removed from the site and the destination of these wastes; and
6. If soil has been excavated, the final depth and elevation of the excavation and a description of the fill material used.

The *Pharmacia & Upjohn Co LLC* facility will maintain financial assurance for closure until the Director releases the *Pharmacia & Upjohn Co LLC* facility from the financial assurance requirements for closure under R 299.9703.

The certification must be worded as follows:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A11.A.7 Postclosure Notices Filed

[R 299.9504(1)(c) and R 299.9508(1)(b) and 40 CFR, Section 270.14(b)(14)]

The applicant must provide documentation that the postclosure notices required under 40 CFR §264.119 have been filed for hazardous waste disposal units that have been closed at the facility.

A11.B POSTCLOSURE PLAN

[R 299.9613 and 40 CFR, Section 264.118]

A11.B.1 Applicability

(Check as appropriate)

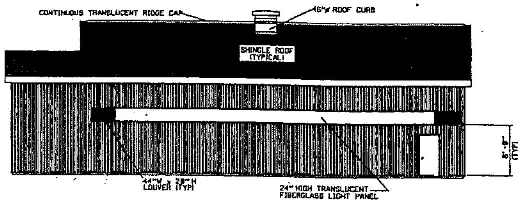
☒ **Not applicable**: Hazardous waste will not be left behind at closure. A survey plat, postclosure care, postclosure certifications, and other notices are not required.

☐ **Applicable**:

- ☐ Contingent plan
- ☐ Landfill unit

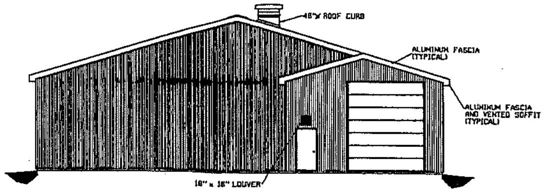
Attachment 6

Engineering Plans



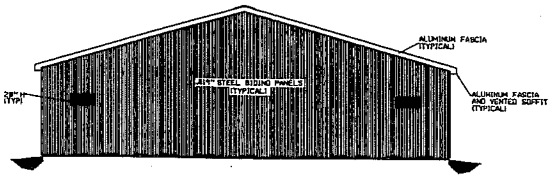
EAST ELEVATION

SCALE: ¼" = 1'-0



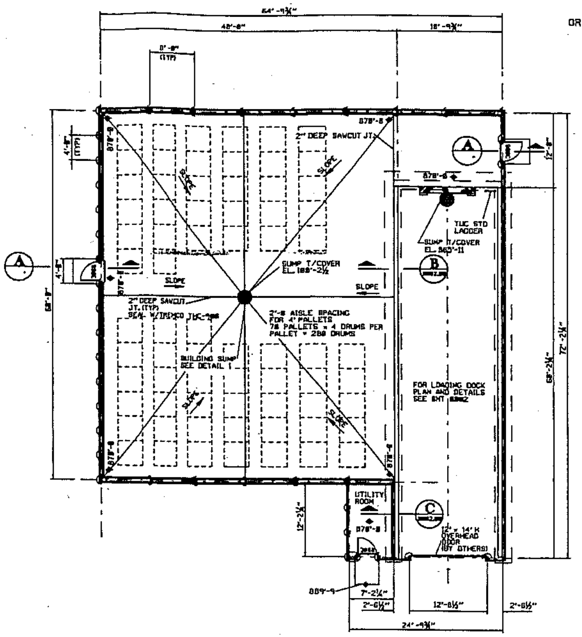
SOUTH ELEVATION

SCALE: ¼" = 1'-0



NORTH ELEVATION

SCALE: ¼" = 1'-0



ORIENTATION

FLOOR PLAN

SCALE: ¼" = 1'-0

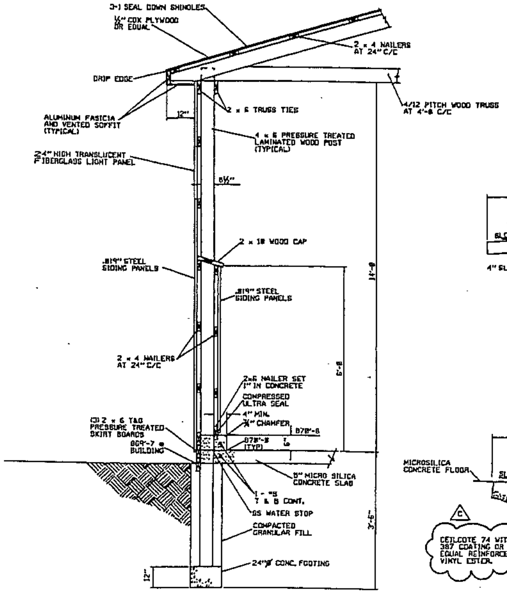
FACILITY SPILL CAPACITY:

BLDG FLOOR & SUMP = 1,865± gal.
TRUCK DOCK & SUMP = 10,840 gal.

TOTAL CAPACITY BEFORE
GROUND CONTACT = 12,705 gal.

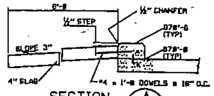
DRY FIT FIRE PROTECTION: (BY OTHERS)

30 NOZZLE SYSTEM
EACH NOZZLE DISPLACES 25 GPM
TOTAL SYSTEM WORSE CASE 750 GPM
EACH NOZZLE ACTIVATES INDEPENDENT
OF EACH OTHER



WALL DETAIL

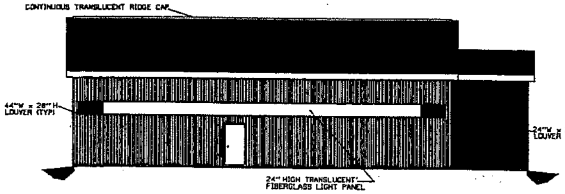
NO SCALE



SECTION A

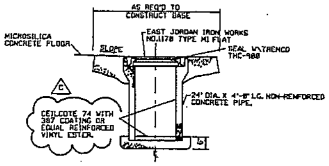
SCALE: NTS

TYPICAL SECTION @ DOORS

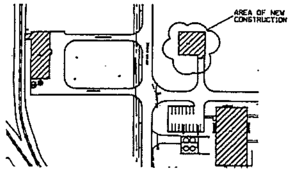


WEST ELEVATION

SCALE: ¼" = 1'-0



DETAIL 1



KEYPLAN

TITLE:	ACT 64 DWG. NO.	CADD INFORMATION
PLAN AND SECTIONS, BUILDING 388 CONTAINER STORAGE AREA	D-1	LOCAL FILE NAME: PLOTTED BY: PLOT DATE: 12-02-2009 / 16:31:42

SYM.	DATE	REVISION	BY	APPROV.
C	12/2/09	AS-BUILT FOR GCR2009-4K401-0013	DMP	AMD
B	8/16/94	ISSUED FOR CONSTRUCTION - SITE WORK AND BUILDING CONSTRUCTION		HZD
A	7/28/94	ISSUED FOR BIDS - SITE WORK AND BUILDING CONSTRUCTION	HZD	HZD

CAPITAL REQUEST NO. *3-4850
RELEASED FOR CONSTRUCTION
PROJ. ENG. ________ DATE: ________

SCALE: AS NOTED
DATE DRAWN 2/14/94
DRAWN BY / DESIGNER GL DAVISSON
CHECKED BY
DATE
APPROVED BY GLD
DATE 7/28/94

Pfizer

TITLE: HAZARDOUS WASTE
STORAGE BUILDING
FLOOR PLAN, ELEVATIONS
AND DETAILS

BLDG 388

PROJECT NUMBER E X 6 ~~0~~ 1 ~~9~~
JOB NO.
LOCATION ~~0 0~~ B
CATEGORY _ _ B 3 8 8 -
SECTION _ _ 4 7 -
FLOOR 0 1
DISCIPLINE 0 2 -
SEQUENTIAL NUMBER 0 0 0 1 . 0 0
ISSUE C

Attachment 7

List of Acceptable Wastes

A2.A WASTE DESCRIPTION

[R 299.9504(1)(c) and 40 CFR §270.14(b)(2)]

A2.A.1 Waste Description (generate on-site wastes)

[R 299.9504(1)(c) and 40 CFR §270.14(b)(2)]

The following are the chemical and physical characterizations of hazardous wastes to be handled at the Pharmacia & Upjohn Co LLC facility. These characterizations contain all the information that must be known to properly treat, store, and dispose of the waste. Wastes for container storage may be liquids, semi-solids, solids or compressed gases. The specific identification numbers of the waste types to be stored in containers can be found in Table A2-1.

These materials consist primarily of spent solvents; expired or off-specification raw materials, products, returned goods and pharmaceutical raw materials; process filter cakes; and laboratory chemicals. Incompatible materials will be segregated with containment pallets according to the 49 CFR Part 177.848, Segregation Table for Hazardous Material.

A2.A.2 Waste Description (receive wastes from off-site generators)

[R 299.9504(1)(c) and 40 CFR §270.14(b)(2)]

Pharmacia & Upjohn Co LLC is a subsidiary of Pfizer, Inc. Only waste generated by Pfizer, Inc owned facilities will be accepted for storage. The characteristic of the waste from off-site generators will be the same as those generated on-site and described above.

A2.A.2(a) Procedures for Obtaining Chemical and Physical Analyses from Off-Site Generators

Refer to Attachment A3 - Waste Analyses Plan

Table A2.A.1 Hazardous Waste Accepted at the Facility (page 4)

A2.B CONTAINERIZED WASTE

[R 299.9504(1)(c) and 40 CFR §264.172]

A2.B.1 Wastes Compatible with Container

Refer to Attachment C1.C - Use and Management of Containers

TABLE A2-1 HAZARDOUS WASTE ACCEPTED AT THE FACILITY

Hazardous Waste Code	Waste Description	Hazardous Waste Characteristics	Basis for Hazardous Designation	Hazardous Waste Management Unit
D001	Flammable Liquids	Ignitability	Generator Knowledge	B388
D001	Oxidizers	Ignitability	Generator Knowledge	B388
D001	Flammable Solids	Ignitability	Generator Knowledge	B388
D001	Ignitable Compressed Gas	Ignitability	Generator Knowledge	B388
D002	Corrosive Liquid (base)	Corrosivity	Generator Knowledge	B388
D002	Corrosive Liquid (acid)	Corrosivity	Generator Knowledge	B388
D002	Corrosive Solid	Corrosivity	Generator Knowledge	B388
D003	Water reactive	Reactivity	Generator Knowledge	B388
D003	Cyanide Waste	Reactivity	Generator Knowledge	B388
D003	Sulfide Waste	Reactivity	Generator Knowledge	B388
D003	Unstable Waste readily undergoes violent change without detonation	Reactivity	Generator Knowledge	B388
D004	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D005	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D006	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D007	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D007	Production Waste	Toxicity	Generator Knowledge	B388
D008	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D008	Maintenance Waste	Toxicity	Generator Knowledge	B388
D009	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D009	Production Waste	Toxicity	Generator Knowledge	B388
D010	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D011	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D019	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D020	Lab Pack Waste	Toxicity	Generator Knowledge	B388

D021	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D022	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D023	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D023	Production Waste	Toxicity	Generator Knowledge	B388
D024	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D024	Production Waste	Toxicity	Generator Knowledge	B388
D025	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D025	Production Waste	Toxicity	Generator Knowledge	B388
D026	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D026	Production Waste	Toxicity	Generator Knowledge	B388
D027	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D028	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D029	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D030	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D032	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D033	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D034	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D035	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D036	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D037	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D038	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D039	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D040	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D041	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D042	Lab Pack Waste	Toxicity	Generator Knowledge	B388
D043	Lab Pack Waste	Toxicity	Generator Knowledge	B388
P003	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P004	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P010	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P011	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P012	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P013	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P014	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P017	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388

P018	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P022	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P023	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P024	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P028	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P029	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P030	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P037	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P042	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P043	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P047	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P051	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P059	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P063	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P064	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P067	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P068	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P074	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P075	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P076	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P077	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P087	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P088	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P089	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P093	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P095	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P098	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P101	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P102	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P103	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P104	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P105	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P106	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P108	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388

P113	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P115	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P116	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P121	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
P123	Lab Pack Waste	Acutely Hazardous	Generator Knowledge	B388
U001	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U002	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U003	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U004	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U006	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic, Corrosive, and Reactive	Generator Knowledge	B388
U007	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U008	Discarded Commercial	Toxic and	Generator Knowledge	B388

	Chemical Product; Off-specification species; container residues; and spill residues	Ignitability		
U009	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U012	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U019	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U021	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U029	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U031	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U032	Discarded Commercial Chemical Product; Off-	Toxic	Generator Knowledge	B388

	specification species; container residues; and spill residues			
U034	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U036	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U037	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U039	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U041	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U043	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U044	Discarded Commercial Chemical Product; Off-specification species;	Toxic	Generator Knowledge	B388

	container residues; and spill residues			
U045	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U046	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U052	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U053	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U056	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U057	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U061	Discarded Commercial Chemical Product; Off-specification species; container residues; and	Toxic	Generator Knowledge	B388

	spill residues			
U067	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U068	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U070	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U071	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U072	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U073	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U076	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388

U077	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U080	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U081	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U082	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U083	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U088	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U092	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U097	Discarded Commercial	Toxic	Generator Knowledge	B388

	Chemical Product; Off-specification species; container residues; and spill residues			
U098	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U099	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U101	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U102	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U103	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U105	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U106	Discarded Commercial Chemical Product; Off-	Toxic	Generator Knowledge	B388

	specification species; container residues; and spill residues			
U107	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U108	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U109	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U110	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U112	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U113	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U115	Discarded Commercial Chemical Product; Off-specification species;	Toxic and Ignitability	Generator Knowledge	B388

	container residues; and spill residues			
U117	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U118	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U119	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U120	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U122	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Corrosivity	Generator Knowledge	B388
U123	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U124	Discarded Commercial Chemical Product; Off-specification species; container residues; and	Toxic	Generator Knowledge	B388

	spill residues			
U127	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U128	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U131	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U132	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U133	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Reactivity	Generator Knowledge	B388
U134	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Corrosivity	Generator Knowledge	B388
U135	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388

U136	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U138	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U140	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U144	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U145	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U147	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U148	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U149	Discarded Commercial	Toxic	Generator Knowledge	B388

	Chemical Product; Off-specification species; container residues; and spill residues			
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U154	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U156	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U157	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U159	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U160	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U161	Discarded Commercial Chemical Product; Off-	Toxic	Generator Knowledge	B388

	specification species; container residues; and spill residues			
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U163	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
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U170	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U171	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U181	Discarded Commercial Chemical Product; Off-specification species;	Toxic	Generator Knowledge	B388

	container residues; and spill residues			
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U184	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U185	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U186	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U188	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U189	Discarded Commercial Chemical Product; Off-specification species; container residues; and	Toxic and Reactivity	Generator Knowledge	B388

	spill residues			
U196	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U197	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U200	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U201	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U202	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U203	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U204	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388

U206	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U207	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
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U210	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U211	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U213	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U214	Discarded Commercial	Toxic	Generator Knowledge	B388

	Chemical Product; Off-specification species; container residues; and spill residues			
U215	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U217	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U218	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U219	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U220	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U222	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U223	Discarded Commercial Chemical Product; Off-	Toxic and Reactivity	Generator Knowledge	B388

	specification species; container residues; and spill residues			
U225	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U226	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U227	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U228	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U234	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U236	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U237	Discarded Commercial Chemical Product; Off-specification species;	Toxic	Generator Knowledge	B388

	container residues; and spill residues			
U238	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U239	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic and Ignitability	Generator Knowledge	B388
U240	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U244	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
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U328	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
U353	Discarded Commercial Chemical Product; Off-specification species; container residues; and	Toxic	Generator Knowledge	B388

	spill residues			
U358	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388
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	Chemical Product; Off-specification species; container residues; and spill residues			
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	container residues; and spill residues			
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	spill residues			
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065U	Discarded Commercial	Toxic	Generator Knowledge	B388

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	specification species; container residues; and spill residues			
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	container residues; and spill residues			
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	spill residues			
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	container residues; and spill residues			
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	spill residues			
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167U	Discarded Commercial Chemical Product; Off-	Toxic	Generator Knowledge	B388

	specification species; container residues; and spill residues			
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171U	Discarded Commercial Chemical Product; Off-specification species; container residues; and spill residues	Toxic	Generator Knowledge	B388

Attachment 8

Preventative Procedures

A6.E IGNITABLE AND REACTIVE WASTES
[R 299.9504(1)(c) and 40 CFR §270.14(b)(9)]

The storage of all ignitable wastes in the container storage building takes place more than 50 feet away from the facilities fence lines. The labeling, sealing, handling, stacking of these containers is done in a manner that minimizes the possibility of these wastes experiencing any fires, explosions or reactions.

The company policy prohibits smoking on facility property. "No Smoking" signs are prominently displayed within the plant and wherever ignitable wastes in containers are stored. The wastes are also separated or protected from sources of ignition, such as open flames, smoking, cutting and welding, hot surfaces, frictional heat, sparks, spontaneous ignition, and radiant heat. If any type of work is to be done in the container storage area, a "safe work permit" must first be obtained from the facility manager to ensure that all work within the storage area conforms to these necessary hazard prevention procedures.

The only reactive wastes expected to be handled at the facility are chemicals that are not explosive or shock sensitive. Inspections are performed as described in Attachment A5 to ensure that containers bearing reactive wastes retain their integrity and that the contents do not come into contact with air or moisture.

Attachment 9

Groundwater Sampling and Analysis Plan

PHARMACIA & UPJOHN HAZARDOUS WASTE OPERATING LICENSE APPLICATION; MID 000820381

GROUNDWATER SAMPLING AND ANALYSIS PLAN

Provided For:

Pharmacia and Upjohn Company LLC
Portage Road Facility
Kalamazoo, Michigan

Prepared By:

American Hydrogeology Corporation
6869 South Sprinkle Road
Portage, Michigan 49002

JUL 20 2012
DEQ
RESOURCE MANAGEMENT DIVISION

JULY 18, 2012

TABLE OF CONTENTS

1.0 GROUNDWATER SAMPLING AND ANALYSIS PLAN 1

2.0 CORRECTIVE ACTION CHARACTERIZATION (CAC) MONITORING PROGRAM 1

2.1 CAC MONITORING WELL NETWORK 2
2.2 GROUNDWATER CAC MONITORING PARAMETERS AND FREQUENCY 2

3.0 CORRECTIVE ACTION DETECTION (CAD) MONITORING PROGRAM 2

3.1 CAD MONITORING WELL NETWORK 2
3.2 GROUNDWATER CAD MONITORING PARAMETERS AND FREQUENCY 3

4.0 CORRECTIVE ACTION WATER LEVEL (CAWL) MONITORING PROGRAM 3

4.1 CAWL MONITORING WELL NETWORK 3
4.2 GROUNDWATER CAWL MONITORING FREQUENCY 3

5.0 GROUNDWATER SAMPLING AND ANALYSIS 4

5.1 SAMPLING COLLECTION METHODS 4
5.1.1 Groundwater Measurement Techniques 5
5.1.2 Well Purging Techniques 6
5.1.3 Groundwater Sample Collection 7
5.2 SAMPLING EQUIPMENT 9
5.3 STANDARD OPERATING PROCEDURES 9
5.3.1 Turbidity Observations of Water Samples 9
5.3.2 Temperature Measurements 9
5.3.3 pH Measurements 10
5.3.4 Specific Conductance Measurements 11
5.3.5 Groundwater Field-Filtration 11
5.3.6 Sampling With a Dedicated Teflon™ Bailer 12
5.3.7 Portable Submersible Pump 13
5.3.8 Purging and Sampling Wells With a 2-Inch Dedicated Submersible Pump 15
5.4 DECONTAMINATION PROCEDURES 15
5.5 SAMPLE HANDLING 17
5.6 SAMPLE ANALYSIS 18
5.7 QUALITY ASSURANCE/QUALITY CONTROL 18
5.8 CHAIN-OF-CUSTODY PROCEDURES 19

6.0 STATISTICAL DATA EVALUATION 20

ATTACHMENTS

ATTACHMENT A .... TABLES
ATTACHMENT B .... FIGURE
ATTACHMENT C .... WELL BORING LOGS AND WELL CONSTRUCTION LOGS
ATTACHMENT D .... ENVIRONMENTAL LABORATORY QUALITY ASSURANCE MANUAL
ATTACHMENT E .... STATISTICAL EVALUATION PROGRAM

1.0 GROUNDWATER SAMPLING AND ANALYSIS PLAN

The Groundwater Sampling and Analysis Plan (GSAP) is implemented in three corrective action programs implemented by the Pharmacia and Upjohn Company LLC (P&U):

- Corrective Action Characterization (CAC) monitoring program;
- Corrective Action Detection (CAD) monitoring program; and,
- Corrective Action Water Level (CAWL) monitoring program.

The objective of each the corrective action programs are discussed below. Other aspects of the GSAP are described in the following sections of this document.

The CAC monitoring program is intended to provide data to measure the effectiveness of existing corrective actions managed by P&U to remediate groundwater.

The CAD monitoring program is intended to provide data to measure the vertical and horizontal extent of the groundwater plume and control it to comply with Act 451 R 299.9612. Furthermore, the CAD monitoring program provides data that is evaluated to alert P&U of other potential changes in groundwater quality beneath the facility.

The CAWL monitoring program is intended to provide data to measure the hydraulic control that production wells at the facility exert upon the two aquifers present beneath the site.

Implementation of all of the above programs by P&U ensures effective control of the groundwater plume at the facility.

Information concerning the installation, physical characteristics, and elevational data for the wells referenced in the GSAP is included in Table 1 in Attachment A. The locations of the wells are depicted on Figure 1 in Attachment B, and boring logs and well construction diagrams are included as Attachment C.

2.0 CORRECTIVE ACTION CHARACTERIZATION MONITORING PROGRAM

The Corrective Action Characterization (CAC) Monitoring Program monitors the effectiveness of three upper aquifer pumping wells and two lower aquifer production wells. The lower aquifer CAC and other production wells are used provide hydraulic containment of contaminated groundwater beneath the facility.

2.1 CAC Monitoring Well Network

Five wells (Table 2 in Attachment A) were selected for the purpose of characterizing the corrective action effectiveness. This network allows for identification and characterization of remediation effectiveness by measuring the constituent concentrations in the groundwater.

Well OS-2 is located upgradient and southeast of the South Tank Farm. Well OS-5 is located downgradient from the SRD, at the tank farm next to Building 44. Well OS-6b is located west of the main facility, southwest of Building 195. Production well W-19 is located north of the main facility, and is generally downgradient from production and chemical storage locations. Production well W-46 is located next to OS-6b along the western edge of the P&U manufacturing facility.

2.2 Groundwater CAC Monitoring Parameters and Frequency

Chemical characterization of the groundwater is performed quarterly by analyzing samples from each of the CAC wells. These wells will be sampled quarterly for the parameters listed in Table 3 of this GSAP.

After 4 quarters of non-detections of constituents from samples collected from a CAC well(s), a request may be made to reduce sampling parameters, frequency, or to terminate sampling activities from the subject well(s).

3.0 CORRECTIVE ACTION DETECTION (CAD) MONITORING PROGRAM

The wells in the CAD network surrounding the P&U property were selected to verify that no detections of constituents of concern have occurred in both the upper and the lower aquifers beyond the boundaries of the Corrective Action regulated units. Ten upper aquifer and eight lower aquifer monitoring wells comprise the CAD network.

3.1 CAD Monitoring Well Network

The CAD monitoring wells are listed on Table 4 in Attachment A, and were selected for the purpose of detecting statistically-based changes of constituent concentrations in the two aquifers present beneath the facility. The locations of these wells are depicted on Figure 1 in Attachment B. The CAD wells are situated along the perimeter of areas of manufacturing and material storage to allow for detection of potential release of constituents from areas within the facility.

Two upper aquifer and two lower aquifer wells were selected as background wells. These 4 CAD background wells (MW-111, MW-112, MW-115A, and MW-116) will be sampled to establish and verify upgradient concentrations of constituents in the groundwater beneath the facility. The background levels of the constituents will not be used in the statistical evaluation of sampling data. However, these data will alert P&U to the presence of organic and inorganic contamination that may migrate onto the P&U facility from off-site sources.

3.2 Groundwater CAD Monitoring Parameters and Frequency

The primary CAD monitoring parameters were selected from a partial list of constituents currently utilized in P&U manufacturing processes. A sub-set of the primary CAD parameter list was also developed. The parameters on this list are high use volume solvents and chromium and thus represent constituents that are most likely to indicate an undetected release.

Groundwater from the CAD monitoring wells is tested on an annual and quarterly basis for parameters listed in Table 5. Primary CAD parameters will be analyzed annually and the sub-set parameters analyzed only during the remaining three quarterly sampling events.

4.0 CORRECTIVE ACTION WATER LEVEL MONITORING PROGRAM

The constituent characterization and detection programs are complemented by the Corrective Action Water Level Monitoring Program (CAWL) which monitors the hydraulic control created by the Corrective Action program. The CAWL network wells are selected to evaluate the potential changes in groundwater flow due to natural conditions or from the influence of production well operation.

4.1 CAWL Monitoring Well Network

The CAWL network consists of 54 wells. These wells are largely located at the P&U facility, but also include wells located outside the boundaries of the site. The location of these wells allows measurement of water level responses to short-term and/or long-term variations from natural conditions and from facility production well pumping activities. A list of the CAWL wells is provided in Table 6 in Attachment A, and their locations are depicted on Figure 1 in Attachment B. The CAWL network is comprised of 33 upper aquifer and 21 lower aquifer wells.

4.2 Groundwater CAWL Monitoring Frequency

A quarterly monitoring program is implemented for the CAWL wells under which water levels are collected from the wells. The quarterly monitoring is complemented by monthly reporting of P&U production well discharges. If pumping rates should significantly vary from regular operations, a monthly water level monitoring review may then be considered until normal activities are resumed. Potentiometric maps are constructed from the quarterly water level data to assess the effectiveness of hydraulic control at the facility.

5.0 GROUNDWATER SAMPLING AND ANALYSIS

The groundwater sampling and analysis plan was developed to direct the efforts of groundwater monitoring personnel. The sampling and analysis plan includes sampling methods, chain-of-custody procedures, and field and laboratory quality control and quality assurance procedures. It describes sampling to be conducted for long-term groundwater monitoring at the facility. These sampling and analysis programs were derived from the RCRA groundwater monitoring Technical Enforcement Guidance Document (TEGD) and meet the requirements of 40 CFR 264.97 and Act 451 R 299.9612.

Well groundwater sampling and chain-of-custody templates are included in Table 7 and Table 8 in Attachment A. Standard operating and decontamination procedures for field equipment such as, field water quality analyzers, pumps, and bailers, are included in subsections Section 5.3 and Section 5.4 of this GSAP.

5.1 Sampling Collection Methods

Prior to initiating a sampling event, the senior member of the field team will ensure that the team members have the appropriate equipment and documents to complete the task. As the Quality Assurance officer (QAO), the senior team member will contact the appropriate contract laboratories at least two weeks prior to sample collection to obtain bottles and schedule the analyses. During sampling, the QAO will contact the laboratory manager at least every other day to confirm sample collection and shipments. In the event samples are to be delivered on a Friday, the QAO will ensure that the laboratory will be able to complete any required preservations or preparations.

Prior to departure for the sampling site, each member of the field team will have become familiar with the sampling and analysis plan for the facility. Prior to and during the sampling event, the field personnel will complete the sampling task by following these minimum procedures:

- Obtain site map, names of contacts, and access keys.
- Assemble necessary sampling and monitoring equipment, sample bottles and preservatives, trip blanks and coolers, and documentation.
- Decontaminate sampling and measuring equipment.
- Measure water levels in wells and determine volume of water in casing. If wells are to be sampled on multiple days, all water levels will be measured prior to conducting sampling in as short a period as possible.

- Inspect wells and note well condition during each sampling round.

- Collect samples and place in cooler. Collect QA/QC samples.

- Measure field parameters and record data on sampling logs.

- Complete sample labels and logs. Portions of labels and logs may have been completed earlier in preparation for sampling. However, all other information, such as sampling date and time, must be completed immediately prior to sampling. Completed sampling logs will include well identification, well depth, water level, presence of immiscible layer, purging methods, volume purged, sample withdrawal method, containers, preservatives, field measurements, sample disposition, and chain-of-custody record number, and other pertinent information such as the condition of the well and dedicated sampling equipment.

- Filter and preserve samples, as required.

- Decontaminate field sampling and measuring equipment.

- Complete chain-of-custody record.

- Pack and ship samples.

5.1.1 Groundwater Measurement Techniques

A number of measurement techniques may be used to determine groundwater elevations, total depth of wells, and product measurements. These techniques are described in this section.

Water levels are measured to determine groundwater flow patterns, water level fluctuations, and to calculate the volume of water in each monitor well purge prior to sampling. Water levels are measured with electronic water level measuring equipment.

When using electrical measuring equipment the cables are graduated in increments of hundredths of feet on Teflon™-coated tapes. The electrical sounding instrument, with attached probe, is lowered into the well until the probe is in contact with the water surface. When the tape is in contact with the water, the electrical circuit closes, and a signal is produced. These signals include audible buzzers, lights, and meters, or combinations thereof. The electrical measuring instrument is held to the surveyed measuring point (usually the top-of-casing) of the well, and the reading is recorded to the nearest 0.01 foot. The water level elevation is calculated by subtracting the depth to water from the surveyed elevation of the measuring point.

The total depth of a well is measured by lowering the measuring instrument into the well until a weight change is detected. The depth to the bottom of the well is directly read from the instrument tape at the measuring point after the slack has been removed from the tape. Comparison of the measured depth of the well and the depth shown on well construction records provides the basis for determining casing continuity and possible sediment accumulation in wells. However, wells with packers are precluded from total depth measurement, as discussed below.

Each well where water level data is collected will be re-surveyed every ten years to validate the correct value for its top-of-casing elevation. If quarterly data demonstrate that a change in well elevation may have occurred, the subject well will be re-surveyed to establish a corrected top-of-casing elevation.

5.1.2 Well Purging Techniques

Purging removes stagnant and stratified water from the well and ensures that samples are representative of the aquifer water. Well purging occurs after the measurement of the static water level, and measurement of the well depth (if appropriate).

Purging equipment includes various types of bailers and well pumping equipment. Pumping is preferred, providing that there is an adequate amount of water in the well.

Table 9 in Attachment A lists the means of sample collection for each of the CAC and CAD wells. In the wells without packers and without a dedicated system, if a pump is used the pump intake must be immersed within the water column. For wells with packer(s) or when the pump remains outside the well a suction tube is lowered in the well and through the packer opening, where appropriate. As the water level drops, the pump intake or suction tube may need to be lowered so that the water column in the well casing is completely and efficiently removed. For non-dedicated systems, the intake tube is removed before suction has been discontinued.

To avoid fuel contamination, gasoline is added to the fuel tank of the generator at a location away from the sampling equipment, wells, and samples. In addition after equipment fueling and maintenance activities, sampling personnel will perform appropriate self-decontamination procedures to prevent contamination to the collected samples.

Some 2-inch wells will be evacuated with dedicated or disposable bailers designed for that purpose. Bailers used for well purging can be constructed of polyvinyl chloride (PVC), polyethylene, Teflon™, or stainless steel. Most bailers are equipped with a check-valve and are lowered by hand into the well with polypropylene rope or Teflon™-coated stainless steel cord. These are attached to the bailer with stainless steel or Teflon™-coated fittings or tied directly to the bottom-discharging bailer.

To maintain continuity during a long-term sampling program, consistency is necessary for well evacuation methods and procedures. If possible, three to five casing volumes are purged from a well before sampling occurs. The volume of water to be purged is calculated using the following equation:

$$V = A \pi r^2 h n$$

where A = conversion factor (7.48 = conversion to gallons)
V = volume of water to be purged (gallons)
π = pi (mathematical constant)
r = radius of well casing (feet)
h = height of standing water (feet)
n = number of casing volumes to be purged

The time at which the required volume of water has been purged from the well can be determined by directly measuring the amount of water discharged into a container of known volume, or by measuring the time of pumping with a calibrated pump.

Temperature, pH, and specific conductance are measured in the purge water and purging will continue, if possible, until these parameters have stabilized. Purge water from wells previously uncontaminated for four quarters is disposed of at the well location. The purge water is disposed of in the facility's sanitary sewer for water in which organic constituents have been detected, or inorganic constituent detections exceeding MDEQ Part 201 criteria.

In low-yielding wells (where the full three casing volumes cannot be obtained before the well is purged dry), purging operations use the following standard guideline. If the well recovery is greater than 75 percent of the minimum purge volume within 15 minutes after the well is purged dry, the purging prior to sampling continues until three to five casing volumes are removed. If the recovery after purging is less than 75 percent after 15 minutes, sampling is initiated with the next appearance of water.

All purging equipment is decontaminated using the specified decontamination procedures in Section 5.4. Careful consideration is given when using pumps to purge wells which are excessively contaminated with constituents, since it may be difficult to adequately decontaminate severely contaminated pumps under field conditions. When such wells are encountered, alternative purging methods, such as dedicated or disposable bailers, are used.

5.1.3 Groundwater Sample Collection

Samples are withdrawn using either a double check-valve bottom-discharging bailer or a dedicated stainless steel/Teflon™ QED bladder pump, or equivalent. The sampling pump is designed so that only Teflon™ and stainless steel parts are in contact with the water sample. These materials are the most chemically-inert materials available for sampling the variety of organic and inorganic compounds monitored at the site. Other suitable materials meeting these requirements may be used. Cords or tubing attached to bailers or pumps shall be new, decontaminated, or dedicated. All groundwater samples are gently poured into the appropriate sample containers.

Parameter stabilization parameters are collected and recorded at each well casing volume to obtain measurements of pH, temperature, and specific conductance. Comparison of succeeding measurements provides a basis for collection of samples representing ambient groundwater. Prior to obtaining these measurements, the field instrumentation is properly calibrated with reference standards in accordance with the manufacturer's recommendations and procedures. The field measurements are recorded on the sampling log along with the time and date of the groundwater sample collection. If a slowly recharging well is encountered, samples are collected as soon as feasible. The sample jars are filled in the following order: volatile organic and purgeable organic compounds, semi-volatile compounds, dissolved metals, and any remaining inorganic parameters.

Organic samples are collected and placed in glass volatile organic analysis (VOA) containers with Teflon™-lined Septa□ caps. All sample containers are provided by the laboratory. The containers are pre-cleaned and meet USEPA SW-846 protocol. The VOA containers are filled to zero headspace. The samples are prepared and preserved in accordance with the requirements of SW-846.

Hydrochloric acid (HCl) will be used to treat the samples to be analyzed for aromatic hydrocarbons if analysis cannot be performed within seven days of collection. This treatment conforms with USEPA 8000 methodology for chemical analysis of water and wastes. If the sample bottles already contain preservatives, care will be taken to avoid washing preservatives out of the container. Contact between the preservative and body or clothing is avoided. After the VOA samples are collected, the next sample bottles filled are for other organic parameters.

The samples collected for dissolved metals analyses are filtered through a 0.45-micron filter to remove sediment prior to acidification. Preferably, filtration is done at the sampling location, but laboratory filtration is also acceptable if done on the same day as the sample is collected. The water sample is pumped through the filtering device and filtered into another clean sample container, also supplied by the laboratory. Filtering must occur before preservatives are added to the sample. The SOP described in Section 5.3.5 will be followed. Decontamination procedures for filtering equipment are also followed. Sample labels include the well number, collector identification, date, and time of collection. Once the samples are collected, they are placed on ice in a cooler, or refrigerated until delivery to the laboratory.

5.2 Sampling Equipment

Sampling equipment to be used in this groundwater monitoring program includes the following:

- Field thermometer in Celsius (integrated or discrete) ;
- pH meter (integrated or discrete);
- Conductance meter (integrated or discrete);
- Hand pump;
- In-line 0.45-micron filter;
- Double check-valve bottom-discharging Teflon™ bailer;
- Portable submersible pump (similar to the QED bladder pump); and,
- Teflon™ pump hose.

5.3 Standard Operating Procedures

5.3.1 Turbidity Observations of Water Samples

Comment will be made on the turbidity (fine materials in suspension such as, clay, rust, fine sand, etc.) of the samples at the time of collection. A clear bottle of the groundwater is held up to the sun or another bright source of natural light for observations of turbidity.

5.3.2 Temperature Measurements

Temperature measurements are collected in the field during purging and immediately before sample collection using an instrument possessing a thermal sensor integrated with other water quality sensors. In lieu of this temperature measurement technique, a mercury thermometer may be used. Temperature measurements are taken in a container other than the sample bottle:

The following procedure is used to conduct field measurements using a thermometer integrated with other instrumentation:

1. Rinse the instrument sensor thoroughly with de-ionized water.

2. Immerse the sensor in a freshly collected sample.

3. Wait for the temperature to equilibrate (no more than 30 seconds).

4. Set the instrument to temperature mode and read and record the temperature to the nearest 0.1 degree Celsius while the sensor is immersed in the sample.

5. After completion of all parameter measurements, rinse the sensor with de-ionized water, and place it back into its protective sleeve.

The following procedure is used to conduct field measurements with a standard mercury thermometer:

1. Rinse the thermometer thoroughly with de-ionized water.

2. Immerse the thermometer in a freshly collected sample.

3. Wait for the temperature to equilibrate (no more than 1 minute).

4. Read and record the temperature to the nearest 0.5 degree Celsius while the thermometer is immersed in the sample. Do not pull the thermometer out of the sample to read it.

5. Rinse the thermometer with de-ionized water, and place it back into its protective sleeve.

5.3.3 pH Measurements

The pH of the sample is measured in the field during purging and immediately prior to collecting the water sample. pH measurements are collected using an instrument possessing a pH electrode integrated with other water quality parameter sensors. In lieu of this pH measurement technique, a discrete pH meter may be used. pH measurements are taken in a container other than ones used for sample collection according to the following procedure:

1. Set up and calibrate the pH meter according to the manufacturer's specifications to cover the expected range of values, e.g. at two pH calibration points of 5 and 9. The temperature of the buffers and the sample need to be within 5 degrees Celsius of each other.

2. Rinse the electrode thoroughly with de-ionized water.

3. Immerse the electrode in the sample.

4. Wait for the reading to stabilize, but no longer than 2 minutes.

5. Read and record the pH to the nearest 0.01 units.

6. Remove the electrode from the sample and rinse it with de-ionized water.

7. Store the electrode in the buffer solution between sample measurements. Never leave the electrode remain outside of a solution for an extended period of time.

8. Recalibrate no less frequently than every four readings.

9. When pH monitoring is completed, replace the cap over the electrode. Check that the cap contains a moist piece of cotton inside to protect the electrode from drying out.

5.3.4 Specific Conductance Measurements

Specific conductance is measured in the field during purging and immediately prior to collecting the water sample. Specific conductance measurements are collected using an instrument possessing a conductivity sensor integrated with other water quality sensors. In lieu of this specific conductance measurement technique, a discrete conductivity meter may be used. Specific conductance measurements are taken in a container other than the sample bottle:

Specific conductance measurements are taken in a different container than the sample bottle according to the following procedure:

1. Set up and calibrate the conductivity meter according to the manufacturer's specifications.

2. Set the dial to the desired range of values for measurement (example: X 100 µmhos/cm).

3. Calibrate the meter if applicable for temperature corrections. If the instrument is incapable of performing temperature corrections, correct the measurement to 25 degrees Celsius using the equation supplied by the manufacturer.

4. Rinse the probe in the sample and rotate the cell several times until the reading stabilizes.

5. Record the measurement and the temperature.

6. Rinse the probe and thermometer thoroughly with de-ionized water.

5.3.5 Groundwater Field-Filtration

The following procedure is used in filtering water for inorganic analysis with a hand pump:

1. Set up the pump as described in the manufacturer's specifications. Flush a minimum of 500 ml of de-ionized water through the line before filtering the sample.

2. Connect an appropriate length of new or fully decontaminated Teflon™ tubing to the pump. Ensure that the tubing is of a sufficient length to be submerged in the well or other location to be sampled at one end and to reach easily the filter and/or sample jar at the other.

3. Insert the long end of the tubing into a container holding a small amount of de-ionized or distilled water. Start pumping. Check that water is being pumped in the correct direction, i.e., that water is pumped out of, rather than into, the well.

4. Put a 0.45-micron filter on the pump outlet line. Let approximately 100 ml of reagent water run through the line before the sample is collected.

5. After running reagent water through the tubing, making sure that the pump is running in the correct direction and that the in-line filter cartridge is attached. Insert the long end of the tubing into the well or other location from which the sample will be filtered. Do not let it come in contact with the ground or other sources of possible cross-contamination. Attach the short end to the in-line filter or filter holder to discharge into appropriate sample bottles or into an approved receptacle prior to placement in the sample bottles.

6. When finished with filtering, remove the tubing from the well or other receptacle, and decontaminate exposed portions of the pump and tubing using a non-phosphate soap and water, a tap water rinse, and a final analytically pure water rinse.

5.3.6 Sampling With a Dedicated Teflon™ Bailer

The following procedure is used to sample monitor wells with a double check-valve, bottom-discharging Teflon™ bailer:

1. Open the top of the well and pull the bailer cord up off of the hook located just below the top of the casing. Spread a plastic sheet on the ground to prevent the bailer or bailer cord from coming in contact with the ground. Check the cord to be sure that it isn't worn, frayed or tangled. If the cord is worn or frayed, replace it with a new, clean cord of the appropriate length. Check the bailer for any visible damage. Make sure that both check-ball assemblies are functional and that the cord is tied securely to the top of the bailer. If the free movement of the

bottom check-valve is impeded by silt or clay, disassemble and rinse the bailer components with de-ionized water.

2. Lower the bailer slowly to the top of the groundwater table and slowly immerse it in the water. Let it fill approximately half-way with water and then pull it up out of the well slowly. Check this first bailer of water for the presence of free product. If free product is present, measure the apparent thickness of the layer and obtain a sample of the product if possible.

3. Lower the bailer again into the well in the same manner. However, this time, allow it to fill completely with water. When removing the bailer from the well, be sure not to let the cord come in contact with the ground or other potential sources of cross-contamination.

4. After removing bailer from the well, decant the water into an appropriate sample jar or vial. To do so, push the bottom emptying tube up into the bailer and allow the water to run out into the sample container.

5. Repeat Steps 3 and 4 until a sufficient volume of sample has been obtained.

6. When sampling is complete, coil the bailer cord and hang it on the hook located inside the well casing. No decontamination is necessary when using disposable or dedicated bailers.

7. If the bailer requires cleaning or a non-dedicated bailer is used, wash the bailer thoroughly using de-ionized water and a non-phosphate soap. If possible, unscrew the ends of the bailer and wash the interior of the bailer thoroughly. Rinse the bailer with de-ionized water until free of soap. Finally, rinse the bailer twice with de-ionized water. Inspect the check-ball and when re-assembling the bailer, checking to ensure its proper working order. Dispose of all wash water in the manner referenced in Section 5.1.2. Whenever cleaning equipment, review the area for the presence of airborne contaminants that may contaminate the bailer.

5.3.7 Portable Submersible Pump

The following operating and decontamination procedure is used in purging, sampling and filtering water with a Keck submersible pump, or equivalent:

1. Remove the pump from the case and assemble it according to the manufacturer's specifications.

2. To decontaminate the pump, place the entire pump and reel assembly into a shallow tub. Take three four-gallon containers and fill one with an appropriate

detergent/potable water mixture, one with potable water, and one with analytically tested de-ionized distilled water. Place the pump unit into the detergent/water solution and pump the solution out of the container through the discharge pipe into a bucket. Refer to Steps 5 through 8 for pump operating procedures. Pour the discharged detergent/water solution over the coiled line and brush off any soil or other visible contaminants. Repeat the process using the potable, and then the distilled water. After finishing with the distilled water rinse, reverse the pumping direction and draw out the remaining water in the tubing. Dispose of the rinsate as specified in the work plan. DO NOT RUN THE PUMP DRY.

3. Check the well for plumbness before putting the pump down the hole by inserting a Teflon™ bailer down to the groundwater level inside the casing to be sure that the pump will not hang up in the well. If the bailer hangs up in the well, do not insert the pump.

4. Check the water level in the well. Remove the discharge tubing from the hose barb at the top of the pump and submerge the pump so that the unit is vertical and the water level is at a minimum of six inches above the hose barb. Carefully lower the pump into the well to keep it fully vertical. If allowed to come out of plumb, the pump may become stuck in the well casing. Allow the pump to sit in the water for at least five minutes without running to equalize in temperature.

5. Connect the power cable to the power supply. Turn the voltage/current meter to "ON - VOLTAGE". If the display reads between 13 and 14 volts, turn the voltage/current meter to "AMPS" and the pump control switch to "FORWARD". Watch the current level while you do this. Turn the control off immediately if the current exceeds 10.0 amps or the meter blanks out (the current exceeds 20.0 amps).

6. If the current display from Step 4 reads greater than 10.0 amps or blanks out, the pump may be blocked with sediment. Flip the forward/reverse switch back and forth from "FORWARD" to "REVERSE" four to eight times. If this does not cause the current display to drop below 10 amps, refer to the manufacturer's specifications for other stabilization procedures. If the current display from Step 4 reads less than 10.0 amps, let the pump run until the current stabilizes between 4 and 7 amps. The pump is then ready for operation.

7. Withdraw the pump to the top of the casing and attach the discharge hose to the hose barb at the top of the pump. Replace the pump in the well, taking care to keep the pump vertical.

8. Monitor the amperage carefully while operating the pump. A sudden increase in amperage may indicate an increase in percent solids of the flow stream, restricted

tubing, sand-locking of the stator and/or rotor, or an inadequate voltage or power supply. If the amperage rises abruptly, check these parameters and refer to the manufacturer's specifications for appropriate action to address the situation.

9. Check for sufficiency of power since operation of the pump for periods of over 30 minutes at a time requires a continuous 13 to 14 volt DC power source rated at 15 amps.

5.3.8 Purging and Sampling Wells With a 2-Inch Dedicated Submersible Pump

The following procedure is used in purging and sampling water with a dedicated QED bladder pump, or equivalent:

1. Attach the compressor supply line to the pump controller. Attach the controller supply line to the air-line fitting on the well.

2. Attach the dedicated pump discharge line to the discharge fitting on the well.

3. Start the compressor to supply air to the bladder pump.

4. Begin purging the well with the pump controller set at minimum settings for bladder refill and discharge. Adjust the refill and discharge settings so that the bladder fills completely, and discharges the entire bladder volume during each cycle.

5. After purging is complete, adjust the controller to minimum settings to achieve a lower pumping rate acceptable for sampling.

6. After completing the sampling, disconnect all fittings and return the dedicated discharge line to its receptacle on the well cap.

5.4 Decontamination Procedures

Equipment used for monitoring and sampling are properly decontaminated prior to use at each location. Decontamination effectively eliminates the potential for cross-contamination between sampling locations and is conducted using the appropriate materials so as to prevent the introduction of external contaminants (such as, phosphate from detergents, aromatic hydrocarbons from motor vehicles, or oil and grease from dirty hands). The decontamination procedures specified in this section are used by all sampling personnel to decontaminate sampling, and other field equipment.

- Laboratory Detergent and Cleaning Solvent. For laboratory detergent used in equipment decontamination, use a standard brand of phosphate-free laboratory detergent such as, Alconox™, Liquinox™, or Micro™. The use of any other detergent or solvent must be approved by the senior member of the sampling team, and its use must be documented in the field logbooks.

- Cleaning Water. Tap water from any municipal water supply may be used for initial equipment rinses and steam-cleaning prior to decontamination. The use of an untreated potable water supply is not an acceptable substitute for tap water. Use analytically tested distilled and de-ionized water to prepare soap solutions and to complete final rinses during field equipment cleaning. Do not reuse the laboratory detergent and rinse water used to clean equipment.

- Location of Decontamination Process. When possible, decontaminate equipment in batches at a central staging area. When necessary, conduct decontamination of water sampling equipment at a designated location. Contain liquids generated at the sampling sites during equipment decontamination in accordance with relevant regulations.

- Required Decontamination Procedures. The different pieces of equipment that are used have varying degrees of contact with the sample media. Primary equipment are used to contain and handle the sample and are in direct contact with the portion of the sample that will be analyzed in a quantitative fashion by the laboratory. Decontaminate all primary sampling equipment such as, Teflon™ bailers, filtering equipment, glass bowls, split-spoons, stainless steel scoops, and spoons using the following procedure:

- Rinse equipment thoroughly with de-ionized or distilled water in the field as soon as possible after use.

- Wash equipment thoroughly with laboratory detergent and de-ionized water using a brush to remove particulate matter or surface film.

- Rinse equipment thoroughly with analytically tested de-ionized water.

- Air dry.

- Wrap equipment completely in aluminum foil to prevent contamination during storage and/or transport to the field.

- Secondary Equipment Cleaning Procedures. Secondary equipment, such as, bailers or submersible pumps used to purge wells, pH and specific conductivity probes, thermometers, and steel tapes, come in contact with the sample media. However, this equipment does not contact the sample that will be analyzed in the laboratory.

- Decontaminate secondary equipment that is not grossly contaminated by rinsing liberally with de-ionized water. Decontaminate grossly contaminated secondary equipment using laboratory detergent and wash water, followed by rinses of de-ionized water.

- Clean non-dedicated pumps, used to purge water from monitoring wells prior to sampling, with non-phosphate detergents followed by potable water flushes of at least 15 minutes each. Complete a final rinse with 500 ml of analytically tested de-ionized distilled water. If the pump must be transported, wrap it in plastic to prevent contact with road dirt and motor vehicle exhaust fumes.

- Equipment Storage. Store all decontaminated field and sampling equipment in covered containers or wrap them in aluminum foil to minimize contamination. Clearly identify decontaminated equipment by labeling the wrapping material.

- Quality Control Procedures for Cleaning Operations. Monitor the effectiveness of field-cleaning procedures during the groundwater sampling round by collecting equipment blanks (Section 5.7). However, sources of potential contamination could include the chemical preservatives and the sample bottles used during the investigations as well as laboratory sample handling procedures. Additional quality control samples (field blanks) may be analyzed to help evaluate all sources of potential contamination (Section 5.7).

5.5 Sample Handling

Immediately following collection, each water sample is transferred to laboratory-supplied, properly labeled, new, clean, sample containers compatible with the analyses to be performed. Water samples submitted for inorganic analyses are placed in appropriately sized plastic sample bottles; water samples submitted for organic analyses are placed in appropriately sized glass sample bottles. Water samples submitted for volatile organic analyses completely fill the sample container to minimize sample jar headspace following USEPA SW-846 protocols.

Water sample containers are placed in separate plastic bags, and stored in a clean, insulated cooler containing ice or frozen blue-ice packs for refrigeration with appropriate packing. Preservation techniques, other than storage in an insulated cooler, are not necessary. At the completion of each day, the water samples are shipped by overnight delivery in the insulated cooler to the analytical laboratory.

Sample collection documentation is recorded in indelible ink on the field sampling logs used in the monitoring program. An individual sampling log is created for each well that is sampled. The samplers initial each page of the field sampling logs. The information recorded on the field sampling logs consists of the following:

- The names of the samplers, and a general description of the sampling event;

- The date and time of sample collection;
- Field observations regarding weather conditions.
- Sample identification and location;
- Purging information including purge volumes and parameter stabilization measurements;

5.6 Sample Analysis

Table 3 lists the parameters that are monitored quarterly in the CAC wells. After four consecutive monitoring events showing non-detections of the constituent, the constituent may be considered for removal from the list of parameters monitored quarterly.

The CAD wells are monitored quarterly for the parameters listed on Table 5 in Attachment A.

All analyses are performed in conformance with SW-846 requirements for detection limits, holding times, container, filtering and preservation. Constituents not included in SW-846 are analyzed according to SW-846 requirements as applicable.

5.7 Quality Assurance/Quality Control

To evaluate the reliability and validity of the field and analytical laboratory data, a Quality Assurance/Quality Control (QA/QC) program has been developed. The following is a description of QA/QC programs to be used in the field portion of the groundwater monitoring program. These measures are also described in the USEPA groundwater monitoring Technical Enforcement Guidance Document (TEGD).

- Trip Blank - Submit one trip blank with the water samples collected each day during the quarterly sampling. The trip blank is provided by the analytical laboratory, and accompanies the sample containers during the sampling event and the shipment. Submit the trip blank to the laboratory for analysis of the organic constituents listed in Table 5.
- Rinsewater Blank - Submit one rinsewater blank for each batch and each source (e.g., P&U Reverse Osmosis facility) of the distilled de-ionized rinsewater at time of use. The rinsewater blank is intended to verify the analytical purity of the water used in the decontamination procedures for final rinse of the equipment and for soap/cleaning mixtures. Submit the rinsewater blank along with the sample containers to the laboratory for analysis of the organic constituents listed in Table 5.

- Equipment Blank - Prepare one equipment blank for each sampling event by exposing to analytically pure water the water sampling equipment after its decontamination. Submit the equipment blank to the laboratory for analysis of the parameters listed in Table 5. Document the information regarding equipment blank preparation and identification in the water monitoring field logbook.

- Field Blank - Submit one field blank with the water samples collected for each sampling event. The field blank is provided by the analytical laboratory, is exposed to atmospheric conditions during the sampling event, and accompanies the sample containers during shipment. Submit the field blank to the laboratory for analysis of the organic constituents listed in Table 5.

- Field Duplicate - To validate sampling methods and laboratory analytical methods, analyze twice 10 percent of all wells sampled. Label the second sample in a manner to distinguish the duplicate from the original well sample, e.g., the duplicate samples from MW-104 would be labeled AW-201, and the origin of the sample recorded on the Water Sampling Log. If the duplicate does not show reasonable correlation with its split, re-evaluate the sampling and analysis methods.

All laboratory analyses conform to SW-846 QA/QC requirements. Any inorganic analyses which do not have a designated test method under SW-846 are performed following "Standard Methods for the Examination of Water and Wastewater, 1985".

P&U has selected KAR Laboratories, Inc. (KAR) of Kalamazoo, Michigan, to perform analyses of groundwater samples collected during this monitoring program. The KAR's laboratory QA/QC manual is included as Attachment D. Other laboratories may be considered for analytical services, pursuant to MDEQ approval.

5.8 Chain-of-Custody Procedures

Sample custody is a vital aspect of site investigations. Samples must be traceable from the time of sample collection through analysis. Samples are considered in custody if the following conditions are not violated:

- The responsible person maintains possession;

- After the samples are received, they remain in the view of, or in the physical possession of, the responsible person;

- Samples are locked so that no one can tamper with them; and,

- Samples are maintained in a secured area, restricted to authorized personnel.

All samples are maintained in the custody of the sampling personnel. At the end of each sampling day and prior to the transfer of the samples off-site, a chain-of-custody record is completed. Upon transfer of custody, the chain-of-custody record is signed and dated by the sample team leader. When samples are shipped, forms are placed in the cooler in a plastic bag and a signed, dated, custody seal is placed over the lid opening of the sample cooler. Chain-of-custody records sent to the laboratory must be signed and dated by the senior staff member assigned to the field team.

The chain-of-custody records include sample number and well identification, signature of collector, date and time of collection, sample type, number of containers, parameter analysis request, and signatures of those in the chain of possession. The forms accompany the samples to the laboratory. All packages are delivered personally by field technicians, or via overnight courier to the laboratory for analysis.

Upon receipt of the samples at the laboratory, the laboratory sample custodian notes the condition of each sample received. The laboratory sample custodian also initiates the laboratory sample-tracking record that follows each sample through all stages of laboratory processing. The sample tracking records document sample removal from storage, and the date and time of sample extraction or preparation, and sample analysis.

6.0 STATISTICAL DATA EVALUATION

The Statistical Evaluation Program (SEP) is presented in Attachment E. Statistical evaluations of groundwater monitoring data collected from CAD wells are performed quarterly. The quarterly evaluations are presented annually in the Operating License Annual Groundwater Monitoring Report. The statistical methods used in the SEP will be re-evaluated periodically to confirm the validity of the statistical models utilized. At that time other methods may be proposed and new background constituent levels may be established based on the preceding sixteen quarters of data.

ATTACHMENT A

TABLES

Table 1
CAC, CAD, and CAWL Well Installation, Elevation, and Construction Data
Pharmacia and Upjohn Company LLC, Kalamazoo, Michigan

Well ID	Well Class	Coordinates	Installation Date	Installed By	TOC	Casing Diameter	Casing Material	Screen Length	Screen Diameter	Screen Material	Screen Slot Size	Aquifer	Top of Screen	Bottom of Screen	Ground Elevation
CW 28	CAWL	N6542.00, E14659.50	NA	ODC	868.49	2.0	Galvanized Steel	3.0	2.0	Stainless Steel	0.01	Upper	826.4	823.4	865.0
CW 29	CAWL	N5971.50, E14667.00	NA	ODC	876.01	2.0	Galvanized Steel	3.0	2.0	Stainless Steel	0.01	Upper	835.8	832.8	872.9
CW 30A	CAWL	N8428.0, E14538.5	NA	ODC	864.97	2.0	Galvanized Steel	3.0	2.0	Stainless Steel	NA	Upper	833.9	830.9	862.2
CW 31	CAWL	N9093.5, E14539.5	NA	ODC	871.66	2.0	Galvanized Steel	3.0	2.0	Stainless Steel	0.01	Upper	837.9	834.9	869.1
CW 35	CAWL	N7311.50, E15058.00	Jun/19/1989	ODC	863.51	2.0	Galvanized Steel	5.0	2.0	Stainless Steel	0.01	Upper	831.7	826.7	861.4
CW 37	CAWL	N8891.0, E12200.5	Jan/09/1990	ODC	871.90	2.0	Galvanized Steel	3.0	2.0	Stainless Steel	NA	Upper	834.1	831.1	870.1
DF 4	CAWL	N10129.0, E11350.0	Mar/07/1989	ODC	871.96	2.0	Galvanized Steel	3.0	2.0	Stainless Steel	0.01	Upper	828.0	825.0	868.5
DF 17	CAWL	N4567.00, E12224.50	May/03/1983	ODC	866.68	2.0	Steel	3.5	2.0	Stainless Steel	NA	Upper	842.6	838.6	864.8
DF 18	CAWL	N4065.0, E12233.5	May/04/1983	ODC	873.21	2.0	Steel	3.5	2.0	Stainless Steel	NA	Upper	846.1	842.6	871.6
DF 20	CAWL	N7294.5, E7869.5	Nov/01/1983	ODC	855.29	2.0	Steel	3.0	2.0	Stainless Steel	NA	Upper	820.2	817.2	852.9
DF 26	CAWL	N4625.0, E8749.5	Nov/21/1983	ODC	859.22	2.0	Steel	3.5	2.0	Stainless Steel	NA	Upper	830.0	826.5	858.8
LA 01	CAWL	N7993.5, E11047.0	Dec/09/1986	ODC	872.47	3.0	Steel	3.0	3.0	Stainless Steel	NA	Lower	714.9	711.9	871.8
MW 17	CAWL/CAD	N8381.5, E10805.0	Dec/30/1993	ETI	871.05	2.0	PVC	5.0	2.0	PVC	0.01	Upper	821.4	816.4	871.4
MW 101A	CAWL/CAD	N94849.5, E10090.0	Oct/19/1990	STS	870.23	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	807.9	802.9	870.5
MW 104	CAWL/CAD	N9831.0, E10072.0	Nov/07/1990	ODC	870.25	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	643.5	638.5	870.6
MW 108R	CAWL/CAD	N10057.3, E12120.7	Oct/03/2000	AHC	869.28	2.0	Stainless Steel	15.0	2.0	Stainless Steel	0.01	Upper	834.2	819.3	857.7
MW 109R	CAWL/CAD	N10063.6, E13194.8	Oct/03/2000	AHC	872.17	2.0	Stainless Steel	10.0	2.0	Stainless Steel	0.01	Upper	831.6	821.7	869.6
MW 110	CAWL/CAD	N9416.00, E13838.00	Jul/04/1990	STS	873.55	2.0	Stainless Steel	10.0	2.0	Stainless Steel	0.01	Upper	849.0	839.0	872.0
MW 111	CAWL/CAD	N7923.50, E13909.50	Jul/09/1990	STS	867.06	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	854.3	849.3	864.4
MW 112	CAWL/CAD	N7923.00, E13909.50	Nov/05/1990	STS	867.27	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	620.8	615.8	865.1
MW 114	CAWL	N5888.50, E13852.00	Jul/01/1990	STS	874.63	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	853.2	848.2	872.1
MW 115A	CAWL/CAD	N4995.50, E13885.00	Oct/29/1990	ODC	869.24	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	831.8	826.8	866.9
MW 116	CAWL/CAD	N5089.0, E13782.5	Oct/09/1990	STS	868.67	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	690.5	685.5	866.7
MW 117	CAWL	N4731.00, E10079.00	Jul/09/1990	STS	866.03	2.0	Stainless Steel	10.0	2.0	Stainless Steel	0.01	Upper	839.0	829.0	863.9
MW 119	CAWL	N4780.00, E10080.50	Oct/14/1990	ODC	865.49	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	720.5	715.5	863.9
MW 122	CAWL	N6026.50, E10344.50	Sep/10/1990	STS	871.15	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	831.2	826.2	869.6
MW 129A	CAWL	N8170.50, E12896.00	Oct/17/1990	STS	873.60	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	824.9	819.9	871.1
MW 131	CAWL	N8143.50, E12854.00	Nov/28/1990	ODC	873.46	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	670.5	665.5	871.4
MW 133	CAWL/CAD	N5129.00, E12208.00	Jul/11/1990	STS	862.26	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	850.9	845.9	860.2

CAC: Corrective Action Characterization Network
CAD: Corrective Action Detection Network
CAWL: Corrective Action Water Level Network
NA: Not Available
TOC and Ground Elevation from 2006 survey

Table 1
CAC, CAD, and CAWL Well Installation, Elevation, and Construction Data
Pharmacia and Upjohn Company LLC, Kalamazoo, Michigan

Well ID	Well Class	Coordinates	Installation Date	Installed By	TOC	Casing Diameter	Casing Material	Screen Length	Screen Diameter	Screen Material	Screen Slot Size	Aquifer	Top of Screen	Bottom of Screen	Ground Elevation
MW-134	CAWL	N4746.50, E11195.50	Aug/21/1990	STS	870.07	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	840.0	835.0	866.8
MW 135	CAWL	N7911.5, E9191.0	Nov/29/1990	STS	867.34	2.0	Stainless Steel	10.0	2.0	Stainless Steel	0.01	Upper	825.3	815.3	865.2
MW 136	CAWL	N7900.0, E9217.0	Jan/22/1991	STS	868.20	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	731.2	726.2	865.0
MW 139	CAWL	N7114.0, E9037.0	Jan/13/1991	STS	863.35	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	725.4	720.4	860.7
MW 141	CAWL/CAD	N7548.50, E8813.00	Dec/06/1990	STS	860.50	2.0	Stainless Steel	10.0	2.0	Stainless Steel	0.01	Upper	823.5	813.5	858.4
MW 142	CAWL/CAD	N7542.50, E8801.00	Dec/19/1990	STS	860.51	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	728.5	723.5	858.4
MW 144	CAWL	N6404.0, E9918.5	Mar/06/1991	STS	874.35	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	741.3	736.3	871.7
MW 146	CAWL	N5917.00, E10334.50	Feb/08/1991	STS	873.64	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	743.0	738.0	871.3
MW 148	CAWL	N9954.00, E13498.00	Feb/03/1991	STS	872.00	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	740.1	735.1	871.8
MW 149	CAWL/CAD	N9891.50, E13545.50	Jan/31/1991	STS	868.52	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	653.8	648.8	869.0
MW 151	CAWL	N10389.50, E11474.00	Feb/03/1991	STS	872.16	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	737.9	732.9	869.7
MW 152	CAWL/CAD	N10335.00, E11524.00	Jan/24/1991	STS	870.58	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	706.6	701.6	868.7
MW 153	CAWL/CAD	N11026.00, E12664.50	Apr/04/1991	STS	869.34	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	730.2	725.2	866.7
MW 158	CAWL/CAD	N6305.39, E9282.70	Dec/18/1992	AHC	862.64	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Lower	727.7	722.7	860.3
MW 161R	CAWL/CAD	N6488.0, E9846.3	Mar/27/1995	ETI	874.05	2.0	Stainless Steel	5.0	2.0	Stainless Steel	0.01	Upper	814.1	809.1	872.4
OS 2	CAC	N8073.50, E13233.00	Nov/20/1984	ODC	868.72	8.0	Stainless Steel	10.0	8.0	Stainless Steel	0.02	Upper	839.9	829.9	NA
OS-5	CAC	N7990.5, E11045.5	Mar/02/1988	ODC	873.76	10.0	Stainless Steel	25.0	10.0	Stainless Steel	0.06	Upper	850.2	825.2	NA
OS-6B	CAC	N7524.00, E10376.00	May/17/1990	ODC	877.57	16.0	Stainless Steel	33.0	16.0	Stainless Steel	0.05	Upper	823.6	790.6	NA
PZ 1A	CAWL	N7144.0, E12517.0	Jun/30/1990	STS	862.32	1.0	PVC	5.0	1.0	PVC	0.01	Upper	846.2	841.2	862.5
PZ 1B	CAWL	N7168.00, E12477.00	Jun/30/1990	STS	862.90	1.0	PVC	5.0	1.0	PVC	0.01	Upper	847.9	842.9	863.2
PZ 1C	CAWL	N7190.5, E12435.0	Jun/30/1990	STS	863.64	1.0	PVC	5.0	1.0	PVC	0.01	Upper	848.6	843.6	863.8
PZ 2B	CAWL	N6046.50, E12018.00	Jun/30/1990	STS	862.09	1.0	PVC	5.0	1.0	PVC	0.01	Upper	848.1	843.1	860.8
PZ 3A	CAWL	N59717.00, E13714.50	Jul/02/1990	STS	874.07	1.0	PVC	5.0	1.0	PVC	0.01	Upper	852.0	847.0	872.5
PZ 3B	CAWL	N5908.5, E13774.5	Jul/02/1990	STS	877.14	1.0	PVC	5.0	1.0	PVC	0.01	Upper	853.4	848.4	876.5
PZ 4A	CAWL	N7486.5, E10361.5	Aug/24/1990	STS	879.17	1.0	PVC	5.0	1.0	PVC	0.01	Lower	696.1	691.1	877.2
PZ 4B	CAWL	N7468.0, E10342.0	Sep/12/1990	STS	881.39	1.0	PVC	5.0	1.0	PVC	0.01	Lower	699.4	694.4	878.3
PZ 4C	CAWL	N7503.0, E10305.0	Sep/19/1990	STS	878.27	1.0	PVC	5.0	1.0	PVC	0.01	Lower	698.0	693.0	878.6
PZ 8	CAWL	N6576.63, E11825.34	Jan/01/1992	AHC	866.65	2.0	PVC	5.0	2.0	PVC	0.01	Lower	754.8	749.8	864.6
W 19	CAC	N9900.00, E12249.00	Aug/20/1958	ODC	871.19	16.0	Steel	25.0	14.5	Bronze	0.07	Lower	677.3	652.3	NA
W-46	CAC	N7504.00, E10376.50	Mar/31/1989	ODC	878.74	16.0	Steel	25.0	16.0	Stainless Steel	0.10	Lower	717.8	692.8	NA

CAC: Corrective Action Characterization Network
CAD: Corrective Action Detection Network
CAWL: Corrective Action Water Level Network
NA: Not Available
TOC and Ground Elevation from 2006 survey

Table 2

Corrective Action Characterization (CAC) Well Network, Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

Well Designation/ Number	Well Depth (ft bgs)	Screen Length (ft)
OS-2	37	10
OS-5	47	25
OS-6B	87	33
W-19	219	25
W-46	186	25

Revised 07/16/12

Table 3

CAC Groundwater Monitoring Parameters, Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

OS-2	
Organic Constituents	**Field Parameters**
Benzene	pH
Chlorobenzene	Temperature
Cyclohexane	Specific Conductance
Methyl cyclopentane	
Toluene	
Xylenes	

W-19	
Organic Constituents	**Field Parameters**
Chloroform	pH
	Temperature
	Specific Conductance

OS-5 & W-46	
Organic Constituents	**Field Parameters**
t-Butanol	pH
	Temperature
	Specific Conductance

Table 3 Continued

CAC Groundwater Monitoring Parameters, Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

OS-6B	
Organic Constituents	**Field Parameters**
t-Butanol	pH
Chlorobenzene	Temperature
	Specific Conductance

Table 4

Corrective Action Detection (CAD) Well Network, Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

Lower Aquifer

Well Designation/ Number	Well Depth (ft bgs)	Screen Length (ft)
MW-104	232	5
MW-112	77.4	5
MW-116	181.4	5
MW-142	130.1	5
MW-149	219.9	5
MW-152	167.3	5
MW-153	141.0	5
MW-158	140.0	5

Upper Aquifer

Well Designation/ Number	Well Depth (ft bgs)	Screen Length (ft)
MW-17	55.0	5
MW-101A	67.6	5
MW-108R	48.5	15
MW-109R	48.4	10
MW-110	32.0	10
MW-111	15.3	5
MW-115A	39.9	5
MW-133	14.7	5
MW-141	45.1	10
MW-161R	65.7	5

Revised 07/16/12

Table 5

CAD Groundwater Monitoring Parameters, Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

Organic Constituents	Inorganic Constituents	Field Parameters
Annual Sampling Event (3rd Quarter)		
Acetone	Chromium	pH
t-Butanol	Copper	Temperature
Chlorobenzene	Zinc	Specific Conductance
Ethyl benzene		
Hexane		
Methylene chloride		
Methyl cyclopentane		
Methyl t-butyl ether		
Tetrahydrofuran		
Toluene		
Xylenes		

Organic Constituents	Inorganic Constituents	Field Parameters
Quarterly Sampling Events (1st, 2nd and 4th Quarters)		
Acetone	Chromium	pH
Methylene chloride		Temperature
Tetrahydrofuran		Specific Conductance
Toluene		

Revised 07/16/12

Table 6

Corrective Action Water Level (CAWL) Well Network, Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

Lower Aquifer

Well Designation/ Number	Well Depth (ft bgs)	Screen Length (ft)
LA-01	160.0	3
MW-104	232.0	5
MW-112	77.4	5
MW-116	181.4	5
MW-119	147.9	5
MW-131	206.2	5
MW-136	138.6	5
MW-139	140.4	5
MW-142	130.1	5
MW-144	135.2	5
MW-146	133.1	5
MW-148	134.1	5
MW-149	219.9	5
MW-151	136.6	5
MW-152	167.3	5
MW-153	141.0	5
MW-158	140.0	5
PZ-4A	185.6	5
PZ-4B	183.9	5
PZ-4C	185.2	5
PZ-8	117.0	5

Table 6 Continued

Corrective Action Water Level (CAWL) Well Network, Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

Upper Aquifer

Well Designation/ Number	Well Depth (ft bgs)	Screen Length (ft)
CW-28	41.4	3
CW-29	37.0	3
CW-30A	36.0	3
CW-31	34.0	3
CW-35	37.0	5
CW-37	39.0	3
DF-4	43.0	3
DF-17	28.0	3.5
DF-18	30.0	3.5
DF-20	36.0	3
DF-26	30.5	3.5
MW-17	55.0	5
MW-101A	67.6	5
MW-108R	48.5	15
MW-109R	48.4	10
MW-110	32.0	10
MW-111	15.3	5
MW-114	23.4	5
MW-115A	39.9	5
MW-117	34.6	10
MW-122	43.1	5
MW-129A	51.2	5
MW-133	14.7	5
MW-134	31.7	5
MW-135	50.1	10
MW-141	45.1	10
MW-161R	65.7	5
PZ-1A	21.3	5
PZ-1B	20.0	5
PZ-1C	20.0	5
PZ-2B	17.3	5
PZ-3A	25.4	5
PZ-3B	26.7	5

Table 7

Groundwater Sampling Log
Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

PHARMACIA GROUNDWATER SAMPLING LOG 226-1534

PROJECT: **RCRA QUARTERLY MONITORING**

WELL ID: **MW-17**

DATE:

SAMPLER:

WEATHER: °,

TIME BEGAN:

PRESSURE OF PACKER AT START: **NA**

TIME COMPLETED:

PRESSURE OF PACKER AT END: **NA**

PUMP INFORMATION: **DEDICATED BLADDER PUMP**

OPTIMIZATION SETTINGS FOR BLADDER PUMPS: **NA**

PURGING INFORMATION

PACKER: INSTALLED

RADIUS (**r**) OF WELL (FEET): **0.083**

DEPTH TO PACKER (FEET): **NA**

AREA OF WELL CASING (FEET^2): **0.022**
3.14 x r^2 =

DEPTH TO WATER (FEET):

DEPTH OF WELL (FEET): **55.0**

LENGTH OF WATER COLUMN (FEET):
(DEPTH OF WELL - DEPTH TO WATER) OR
(DEPTH OF WELL - DEPTH TO PACKER = **h**)

VOLUME OF WATER IN WELL (FEET^3): 0.022 x 7.48 x **h** = 0.165 x **h** = **Gallons**
[LENGTH OF WATER COLUMN x (3.14 x r^2)](MULTIPLY BY 7.48 FOR GALLONS)

DEPTH TO PLUG (FEET): **46.0**

MINIMUM PURGE VOLUME: **Gallons**
(VOLUME OF WATER IN WELL x 3)

PARAMETER MONITORING WHILE PURGING

pH:

CONDUCTIVITY (µS):

TEMPERATURE (°C):

ACTUAL PURGE VOLUME: **Gallons**

COMMENTS: pH, temperature, and conductivity taken after gallons had been purged.

SAMPLING

TURBIDITY:

ODOR:

pH:

CONDUCTIVITY:

TEMPERATURE:

ANALYSIS	BOTTLE TYPE & VOL.	FILTERED	PRESERVATIVE
VOA	**x 40 ml**	**N**	**HCl**
PHARMACIA HL	**x 950 ml**	**N**	**-----**
SULFIDE	**x 250 ml**	**N**	**NaOH/ZnAc**
METALS	**x 250 ml**	**Y**	**Nitric**

COMMENTS:

PHARMACIA GROUNDWATER SAMPLING LOG 226-1534

PROJECT: **RCRA CAC QUARTERLY MONITORING**

WELL ID: **OS-2**

DATE:

SAMPLER:

WEATHER: °,

TIME BEGAN:

PRESSURE OF PACKER AT START: **NA**

TIME COMPLETED:

PRESSURE OF PACKER AT END: **NA**

PUMP INFORMATION: **TURBINE PUMP**

OPTIMIZATION SETTINGS FOR BLADDER PUMPS: **NA**

PURGING INFORMATION

PACKER: INSTALLED

DEPTH TO PACKER (FEET): **NA**

RADIUS (r) OF WELL (FEET): **0.417**

AREA OF WELL CASING (FEET^2): **0.5**
$3.14 \times r^2 =$

DEPTH TO WATER (FEET):

DEPTH OF WELL (FEET): **NA**

PARAMETER MONITORING WHILE PURGING

pH:

CONDUCTIVITY (µS):

TEMPERATURE (°C):

SAMPLING

TURBIDITY:

ODOR:

pH:

CONDUCTIVITY:

TEMPERATURE:

ANALYSIS	BOTTLE TYPE & VOL.	FILTERED	PRESERVATIVE
VOA	**2 x 40 ml**	**N**	**HCl**

COMMENTS:

Table 8

Chain-of-Custody Record
Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

AMERICAN HYDROGEOLOGY CORPORATION

6869 S. Sprinkle Road ortage, Michigan 49002
(269) 329-1600 • FAX (269) 329-2494

CHAIN OF CUSTODY RECORD

Project Name:

Project No.:

Laboratory/Lab Quote No.

AHC Purchase Order No.:

Sampled By:

State Collected From:

Sample Location	Sample Type			Date Taken	Time Taken	No. of Bottles & Type	Analyses Requested										MDL Requested	
	S	W	O *														MDEQ Part 201/Part 213	Other

REQUIRED TURNAROUND TIME: ☐ STANDARD ☐ RUSH: _________ DAYS

Attention Laboratory: Project deadlines require that reports of these analyses be received by American Hydrogeology Corporation not later than ________________. If this deadline cannot be met, contact AHC immediately.

Comments:____

*** Describe:**____

Relinquished By (Name, Firm)	Date	Time	Received By (Name, Firm)	Date	Time
1)					
2)					
3)					
4)					

Form COC-1

WHITE AND YELLOW: LABORATORY PINK: AHC PROJECT FILE

Revised 11/13/96

Table 9

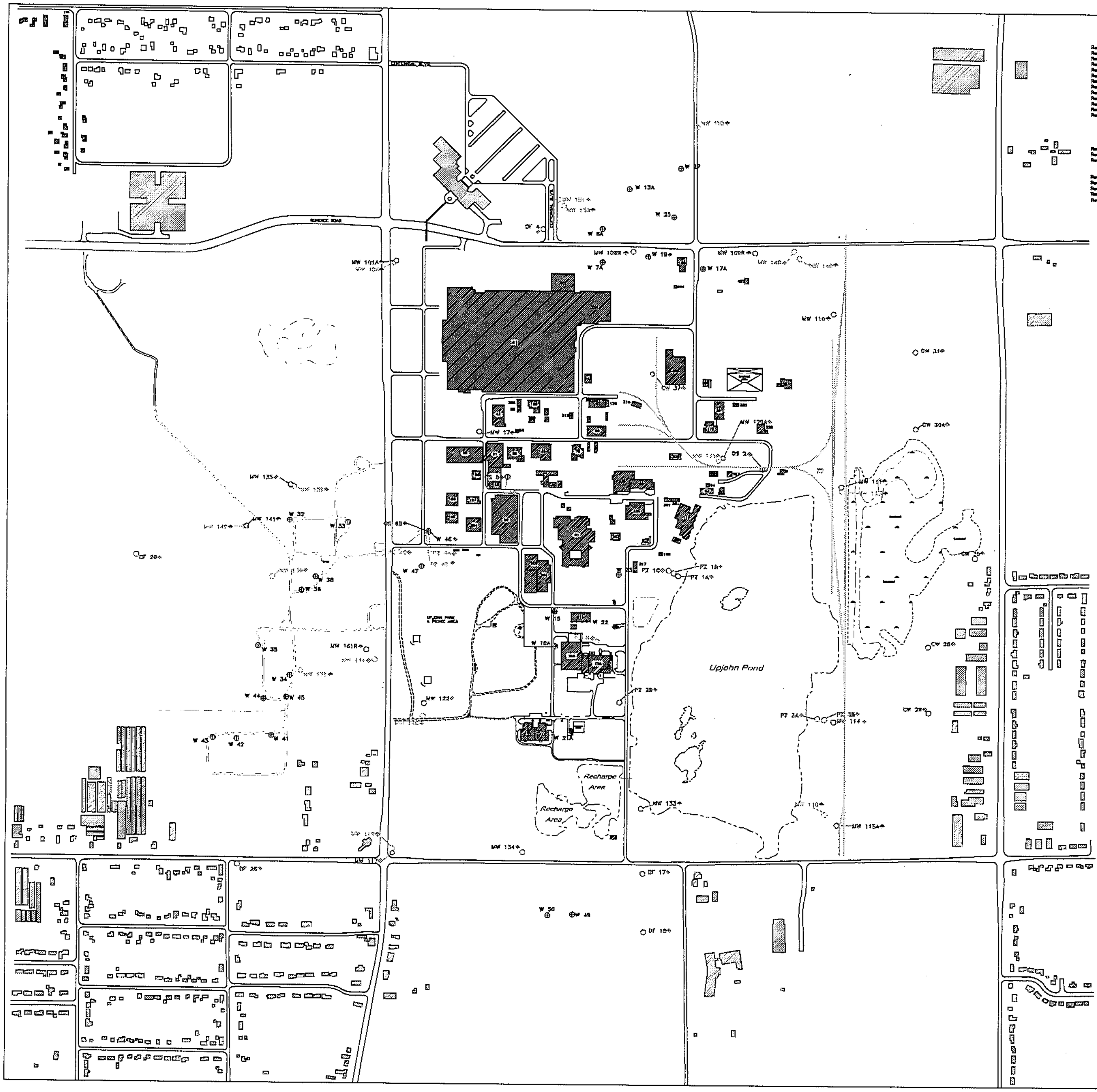
CAD/CAC Well Network – Purge Methods
Pharmacia & Upjohn Company LLC, Kalamazoo, Michigan

Well ID/Class	Dedicated/ Non-dedicated	Bailer (B)/ Bladder Pump (BP)	Packer (P)/ No Packer (NP)
MW-17 (CAD)	Dedicated	BP	NP
MW-101A (CAD)	Dedicated	B	NP
MW-104 (CAD)	Dedicated	BP	P
MW-108R (CAD)	Dedicated	B/BP	NP
MW-109R (CAD)	Dedicated	BP	NP
MW-110 (CAD)	Dedicated	B	NP
MW-111 (CAD)	Dedicated	B	NP
MW-112 (CAD)	Dedicated	BP	NP
MW-115A (CAD)	Dedicated	BP	P
MW-116 (CAD)	Dedicated	BP	P
MW-133 (CAD)	Dedicated	B	NP
MW-141 (CAD)	Dedicated	BP	NP
MW-142 (CAD)	Dedicated	BP	P
MW-149 (CAD)	Dedicated	BP	P
MW-152 (CAD)	Dedicated	BP	P
MW-153 (CAD)	Dedicated	BP	P
MW-158 (CAD)	Dedicated	BP	P
MW-161R (CAD)	Dedicated	BP	NP
OS-2 (CAC)	Dedicated	VTP	NP
OS-5 (CAC)	Dedicated	VTP	NP
OS-6B (CAC)	Dedicated	VTP	NP
W-19 (CAC)	Dedicated	VTP	NP
W-46 (CAC)	Dedicated	VTP	NP

NOTES:
BP = Bladder Pump, B = Bailer, VTP = Vertical Turbine Pump
NP = No Packer, P = Packer
CAC = Corrective Action Characterization well sampled quarterly.
CAD = Corrective Action Detection well sampled quarterly.
Some wells have a BP/B designation indicating that a dedicated bailer and bladder pump have both been assigned to that well.

ATTACHMENT B

FIGURE



Revision Notes

Revision 15 (6/18/02): Added Wells PZ-12, 13, 14, & 15, MW 134A, & W-50; Renamed W21 to W21A and W40 to W40A; Fixed MW-14 & W-48 colors.
Revision 16 (6/21/02): Changed W-46 to DS Layer – W-46 is not a Production well per BH.
Revision 17 (10/7/02): Added Monitor Wells 180, 181, 182, 183.
Revision 18 (11/29/02): Updated Romence & Portage Rd. Intersection, Roads South of Bldg. 88, and Recharge Area Near E. Road; Added MWs 176–179, 1e & 1d; Changed W 7 & 8 to W 7A & 8A.
Revision 19 (5/5/03): Removed USGS 2; MD-3,4,7,8; OCD-1; MDNR-9B,9C; OMW-1,2,3,4; AMW-1,8; W-28 Cooling Tower Well. Added MW-184.
Revision 20 (8/22/03): Removed MD-7 and MD-8.
Revision 21 (11/24/03): Added PZ-16, Moved PZ-13.
Revision 22 (4/20/04): Moved MW-111A & 112; Removed CAD designation from MW-113; Added CAD/CAWL designation to MW-112.
Revision 23 (5/12/04): Added MW-185 & MW-186.
Revision 24 (7/13/04): Added MW-187 & MW-188.
Revision 25 (12/23/04): Removed HEP-E.
Revision 26 (6/30/05): Building 158 Removed(BH H.to Advise Date).
Revision 27 (1/18/06): Removed Wells MW-5a&b, MW-6a,b,&c, MW-7a,b,&c, MW-8a,b,&c, MW-10a&b, Nob#1 & Sab#1 (Pershing Well Field).
Abandoned Wells W-26 & 30 (January 2006) and W-37 (Date Unknown).
Removed Trailers 337,338,350,354,365,366,368,384,386,397,398,409,413,&419.
Removed Buildings 45,63,68/69,70,88(and Surrounded Driveways,Access Roads),90&Associated Buildings,92&Adjacent,162,163,222,230,257 (and Portions of Access Road),287,& 3 Kuzma Buildings (Near MWs 187&188).
Modified/Removed Parking Area South of Central Drive (Near Security Gate).
Revision 28 (3/17/06): Abandoned Wells W-39 & W-40A
Revision 29 (3/19/06): Abandoned Purge Well 05-1
Revision 30 (4/2/08): Added Buildings 313,384,427,432,433,434,435,436,437,443,444,480,&604
Adjusted Size and Location of Buildings 40/50
Labeled Buildings 186 & 438
Revision 31 (7/22/08): Removed Buildings 208,432,&433
Revision 32 (4/7/09): Removed Buildings 275&Adjacents,436,&437
Revision 32 (3/19/10): Removed Wells W-26, W-30, W-38 & W-40A
Revision 34 (6/4/10): Removed Buildings 87, 181, 434, 435; Removed Wells EW-11, W-37, Pershing Well #1 & #2
Revision 35 (7/16/12): Removed Buildings 384, 398, 438, & 604

LEGEND

- ▨ BLUE COLOR DENOTES UPPER AQUIFER MONITOR WELLS
- ▨ BLUE–GREEN COLOR DENOTES LOWER AQUIFER MONITOR WELLS
- ○ MW, DF, CW, LA – MONITORING WELL
- ○ PZ – PIEZOMETER
- ⊕ PURGE WELL
- ⊕ W – PRODUCTION WELL
- ◆ CAD WELL
- ⌃ CAWL WELL
- ✦ CAD–CAWL WELL
- ◆ CAC WELL
- ‐‐‐ EDGE OF SURFACE WATER
- ⌃ LOWLAND

N

0 400 800 Feet

Base Map Adopted From Abrams Aerial Survey Corporation Map
Date Of Photography March 20, 1990

SITE WELL LOCATIONS
PHARMACIA & UPJOHN COMPANY, LLC
PORTAGE FACILITY
Section 14, T. 3 S., R. 11 W.
City Of Portage
Kalamazoo County, Michigan

1534

AHC

Last Updated: July 16, 2012

ATTACHMENT C

WELL BORING LOGS AND WELL CONSTRUCTION LOGS

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR The Upjohn Company - Kalamazoo, Michigan HOLE NO. CW-28

DRILLED BY Dwain Hanson DRILLER COMPLETED 19

LOCATION

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
5 ft.	Topsoil	5 ft.		
6 ft.	Sand, Stones & Clay	11 ft.		
6 ft.	Fine Sand & Clay	17 ft.		
5 ft.	Sand, Stones & Clay	22 ft.		
6 ft.	Sand, Stones & Clay	28 ft.		
7 ft.	Sand, Little Gravel & Clay	35 ft.		
6 ft.	Sand, Little Gravel & Clay	41 ft.		
6 ft.	Sand, Stones & Clay	47 ft.		
1 ft.	Clay	48 ft.		

Static water level - 14' 10"

Set 2" stainless steel #10 slot screen from 38' 4" to 41' 4" on 2" galvanized pipe and cap.

10 feet of 8" casing set over the 2" and cemented into the ground.

THE OHIO DRILLING CO.
INCORPORATED
MASSILLON, OHIO

ED FOR The Upjohn Company - Kalamazoo, Michigan HOLE NO. CW- 29

DRILLED BY Dwain Hanson DRILLER COMPLETED 19

LOCATION

HICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
6 ft.	Topsoil	6 ft.		
5 ft.	Sand, Stones & Clay	11 ft.		
7 ft.	Fine Sand, Stones & Clay	18 ft.		
7 ft.	Sand, Stones & Clay	25 ft.		
6 ft.	Sand & Clay	31 ft.		
6 ft.	Sand, Little Gravel & Clay	37 ft.		
5 ft.	Sand & Clay	42 ft.		
1 ft.	Clay	43 ft.		

Static water level - 21' 10½"

Set 2" stainless steel, #10 slot screen from 34 to 37 feet on 2" galvanized pipe and cap.

10 feet of 8" casing set over the 2" and cemented into the ground.

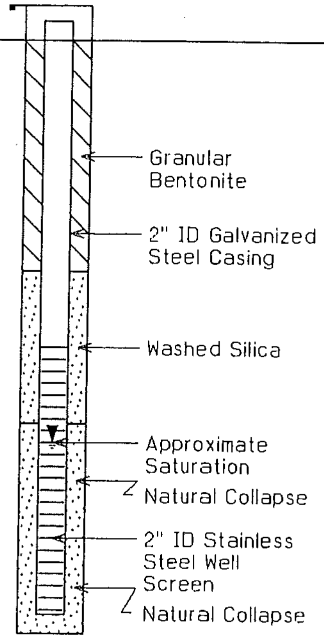
AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: Upjohn Monitoring
L[illegible]n: South side of northeast field north of lowland
Date (s) Drilled: May 18, 1994
Logged By: Michael T. Janeczko
Drilling Co.: Stearns
Weather Conditions: Sunny

Well/Boring ID: CW-30A
Page: 1 of 1
Boring Depth: 15.5'
Boring Diameter: 8.25"
Drilling Method: Hollow Stem Auger
Drilling Equipment: CME-55
Top of Slots: 8.0' b.g.l.
Bottom of Slots: 15.0' b.g.l.

DEPTH feet (bgl)	SAMPLE			PID	STRATA	DESCRIPTION	ELEV. (feet)
	DEPTH	BLOWS COUNTS	RECOVERY				
						SAND-fine to medium grained, subangular to subrounded, trace Clay, slightly cohesive, dry, dark brown.	
						SAND-fine to medium grained, subangular to subrounded, trace fine Gravel, loose, dry, brown.	
5							857.2
						SAND-medium to coarse grained, subangular to rounded, some fine to medium subangular to rounded Gravel, poorly sorted, loose, dry, gray.	
10		3 2 2 3	1.0'	ND		SAND-fine to medium grained, subangular to subrounded, well sorted, loose, saturated at ≈10.5' bgl, gray.	852.2
		3 2 2 2	1.5'	ND			
15		2 1 1 2 2 4	1.2'	ND			847.2
20							842.2
25							837.2
30							832.2
3							827.2

WELL CONSTRUCTION DETAIL



Notes:

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR The Upjohn Company - Kalamazoo, Michigan HOLE NO CW- 3

DRILLED BY Dwain Hanson DRILLER COMPLETED 19

LOCATION

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
3 ft.	Topsoil	3 ft.		
3 ft.	Red Sand	6 ft.		
4 ft.	Red Sand, Little Gravel & Clay	10 ft.		
3 ft.	Fine Sand, Stones & Clay	13 ft.		
5 ft .	Fine Sand & Clay	18 ft.		
2 ft.	Sand, Little Gravel & Clay (hard)	20 ft.		
11 ft.	Sand, Stones & Clay (hard)	31 ft.		
3 ft.	Sand, Little Gravel & Clay (hard)	34 ft.		
[illegible]	Clay	35 ft.		
	Static water level - 22' 5"			
	Set 2" stainless steel, #10 slot screen from 31 to 34 feet on 2" galvanized pipe and cap.			
	10 feet of 8" casing set over the 2" and cemented into the ground.			

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR The Upjohn Company - Kalamazoo, Michigan HOLE NO. CW35

DRILLED BY Dwain Hanson DRILLER COMPLETED June 19, 19 89

LOCATION

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
1 ft.	Brown Silty Loam	1 ft.		
4 ft.	Brown Fine Sand & Clay (dry)	5 ft.		
2 ft.	Brown Fine Sand & Clay (moist)	7 ft.		
1 ft.	Brown Medium Sand & Clay (moist)	8 ft.		
3 ft.	Gray Medium Sand & Little Clay (wet)	11 ft.		
3 ft.	Gray Coarse Sand, Gravel & Little Clay	14 ft.		
10 ft.	Gray Medium Sand, Fine Gravel & Little Clay	24 ft.		
13 ft.	Gray Medium Sand, Fine Gravel, Little Clay & Some Stones	37 ft.		
8 ft.	Gray Clay, Sand & Stones (tight, dry)	45 ft.		
3 ft.	Clayey Sand, Interstratified with Fine Sand	48 ft.	yes	

First static water level - 7.09 feet at a depth of 12 feet

Second static water level - 9.76 feet at a depth of 48 feet

Set 2" stainless steel #10 slot screen from 32 to 37 feet on 2" galvanized pipe and cap.

Permeameter tests run at 13 to 16 feet.

Hole test pumped at 13 to 16 feet.

Q = 5.75 gpm Q/s = 3.21 gpm per ft.

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR The Upjohn Company - Kalamazoo, Michigan HOLE NO. CW 37

DRILLED BY George Fahrni DRILLER COMPLETED January 9, 19 90

LOCATION Near railroad tracks at spill area

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
7 ft.	Fine Sand & Clay	7 ft.		
6 ft.	Sand & Clay	13 ft.		
14 ft.	Sand, Gravel & Clay	27 ft.		
7 ft.	Fine Sand, Little Gravel & Clay	34 ft.		31 ft.
7 ft.	Fine Sand, Clay & Stones	41 ft.		31 ft.
7 ft.	Fine Sand & Clay	48 ft.		31 ft.

Set 2" stainless steel screen from 36 to 39 feet on 2" galvanized pipe and cap. Pipe is 2' 2" above ground surface.

Hole was pumped for a water sample at a depth of 34 feet.

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR The Upjohn Company - Kalamazoo, M ichigan HOLE NO. DF-4

Monitoring Well

DRILLED BY Dwain Hanson DRILLER

COMPLETED March 7, 19 89

LOCATION

ICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
2 ft.	Backfill	2 ft.		
3 ft.	Sand & Stones	5 ft.		
6 ft.	Sand & Stones	11 ft.		
5 ft.	Fine Sand	16 ft.		
6 ft.	Fine Sand	22 ft.		
2 ft.	Sand, Little Gravel & Stones	24 ft.		
7 ft.	Sand, Little Gravel & Stones	31 ft.		
6 ft.	Sand, Little Gravel & Stones	37 ft.		

Static water level - 29' 1"

Set 2" stainless steel #10 slot screen from 40 to 43 feet on 2" galvanized pipe and cap.

10 feet of 8" casing set over the 2" and cemented into the ground.

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR Upjohn Company - Kalamazoo, Michigan HOLE NO. DF-17
3" Test Hole

DRILLED BY George Fahrni DRILLER COMPLETED May 3, 19 83

5430S 2220E

LOCATION 468 ft. south of No. DF-15 Elevation = 866.55

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
3 ft.	Clay & Loam	3 ft.		
5 ft.	Clay, Sand & Gravel	8 ft.		
10 ft.	Gravel, Sand & Clay	18 ft.		
7 ft.	Sand, Little Gravel & Clay	25 ft.		14 ft.
3 ft.	Sand & Clay	28 ft.		14 ft.
	Set well point - 42"			
	Set 2" pipe - 27 ft.			
	2 ft. above ground			
	Pumped well between 25 - 28 ft.			

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR Upjohn Company - Kalamazoo, Michigan HOLE NO. DF-18

3" Test Hole

DRILLED BY George Fahrni DRILLER COMPLETED May 4, 19 83

6030 S 2220 E

LOCATION 600 ft. south of No. DF-17 Elevation = 873.09

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
2 ft.	Clay & Loan	2 ft.		
3 ft.	Sand & Clay	5 ft.		
3 ft.	Sand, Gravel & Clay	8 ft.		
9 ft.	Gravel, Sand & Clay	17 ft.		
10 ft.	Sand, Gravel & Clay	27 ft.		2 ft.
3 ft.	Sand, Gravel & Clay	30 ft.		2 ft.
	Set well point - 42"			
	Set 2" pipe - 29 ft.			
	2 ft. above ground			
	Pumped between 27 - 30 ft.			

MASSILLON, OHIO

DRILLED FOR The Upjohn Company - Kalamazoo, Michigan

HOLE NO. DF-20

3" Test Hole

DRILLED BY George Fahrni DRILLER

COMPLETED Nov. 1, 19 83

LOCATION Elevation = 855.25 2700'S 2130W

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
1 ft.	Muck	1 ft.		
7 ft.	Clay & Fine Sand	8 ft.		
9 ft.	Sand & Clay	17 ft.		
10 ft.	Sand, Gravel & Clay	27 ft.		
6 ft.	Gravel, Sand & Clay	33 ft.		18 ft.
3 ft.	Gravel, Sand, Clay & Stones	36 ft.		18 ft.
	Pumped well between 33 - 36 ft.			
	Set 3 ft. of Clayton Mark screen			
	Set 33 ft. of 2" pipe			
	Set 2 ft. of 2" pipe above ground			

INCORPORATED
MASSILLON, OHIO

LED FOR The Upjohn Company - Kalamazoo, Michigan
HOLE NO. DF-26
3" Test Hole

DRILLED BY George Fahrni DRILLER
COMPLETED Nov. 21, 1983

LOCATION

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
4 ft.	Sand & Clay	4 ft.		
6 ft.	Clay & Sand	10 ft.		
10 ft.	Sand & Clay	20 ft.		
5 ft.	Gravel, Sand & Clay	25 ft.		17 ft.
5 ft.	Sand & Clay	30 ft.		17 ft.
6 ft.	Fine Sand & Clay	36 ft.		
1 ft.	Clay & Fine Sand	37 ft.		
	Pull back to 27 ft.			
	Pumped well between 27 - 30 ft.			
	Set 42 in. Clayton Mark screen			
	Set 27 ft. of 2" pipe			
	Set 2 ft. of 2" pipe above ground			

THE OHIO DRILLING Co.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR The Upjohn Company - Kalamazoo, Michigan HOLE NO. LA 1

3" Test Hole

DRILLED BY George Fahrni DRILLER COMPLETED December 9, 19 86

LOCATION 11 ft. south of well No. 5

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	REAMED	WATER FROM SURFACE
6 ft.	Sand & Clay	6 ft.		
4 ft.	Clay, Sand & Gravel	10 ft.		
10 ft.	Clay & Sand	20 ft.		
6 ft.	Sand & Clay	26 ft.		
6 ft.	Sand & Clay	32 ft.		
6 ft.	Sand, Gravel & Little Clay	38 ft.		20 ft.
6 ft.	Sand, Gravel & Little Clay	44 ft.		25 ft.
7 ft.	Fine Sand, Little Gravel & Clay	51 ft.		
5 ft.	Sand, Gravel & Little Clay	56 ft.		38 ft.
4 ft.	Sand, Little Gravel & Little Clay	60 ft.		
7 ft.	Clay & Sand	67 ft.		
10 ft.	Sand, Little Gravel & Clay	77 ft.		28 ft.
7 ft.	Sand, Little Gravel & Clay	84 ft.		31 ft.
7 ft.	Sand, Gravel & Clay	91 ft.		32 ft.
7 ft.	Sand & Clay	98 ft.		32 ft.
7 ft.	Sand & Clay	105 ft.		32 ft.
8 ft.	Sand & Little Clay	113 ft.		32 ft.
7 ft.	Sand	120 ft.		32 ft.
7 ft.	Sand & Little Gravel	127 ft.		32 ft.
7 ft.	Sand & Gravel	134 ft.		32 ft.
5 ft.	Sand & Little Gravel	139 ft.		32 ft.
4 ft.	Clay & Sand	143 ft.		
4 ft.	Clay, Sand & Gravel	147 ft.		
5 ft.	Sand, Little Gravel & Clay (tight	152 ft.		36 ft. 6 in.
5 ft.	Sand, Little Gravel & Clay (tight	157 ft.		36 ft. 6 in.
3 ft.	Sand & Clay (tight)	160 ft.		36 ft. 6 in.
1 ft.	Clay & Fine Sand	161 ft.		
	Pumped for water samples at:	70 ft.		
		100 ft.		
		130 ft.		
		160 ft.		
	Converted to a permanent sample well - screened 157 - 160 ft.			
	Set 157' 9" of 3" pipe			
	1 - 3" pipe cap			

ENVIROLOGIC TECHNOLOGIES, INC.
2960 INTERSTATE PARKWAY
KALAMAZOO, MI 49001
(616) 342-1100

LOG OF MW-17

SHEET 1 of 2

CLIENT: THE UPJOHN COMPANY - 930142

LOCATION: PORTAGE, MICHIGAN

ELEVATIONS:

SURFACE: 871.56 TOP OF CASING: 871.17

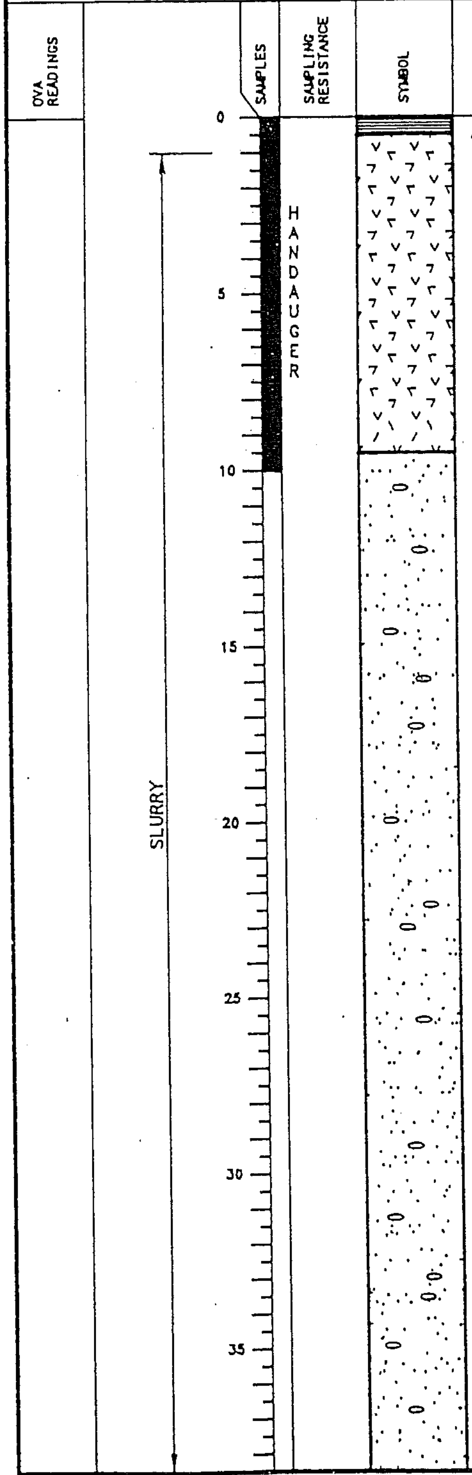
STATIC WATER LEVEL:

DRILLING CO: ED&S

START DATE: 12/30/93 10:30 AM

GEOLOGIST: KRS

COMPLETION DATE: 12/30/94 3:30 PM



DESCRIPTION

ASPHALT

FILL
Sand and gravel.

NO SPLIT-BARREL SAMPLES UNTIL 55 FEET.
(Please refer to the Work Plan.)

SAND
Light brown, medium to coarse grained, some fine to medium gravel, damp.

▨	GRAVEL	▥	SILT	⁘	ORGANIC	▤	SHALE	⁒	MISC. FILL	▽	SATURATION LEVEL AT TIME OF DRILLING
⁘	SAND	▧	CLAY	≈	TILL	▩	ROCK	∿	TOPSOIL	▼	STATIC WATER LEVEL
										N.D.	NOT DETECTED BY Hnu OR OVA

ENVIROLOGIC
TECHNOLOGIES, INC.
2960 INTERSTATE PARKWAY
KALAMAZOO, MI 49001
(616) 342-1100

LOG OF MW-17

SHEET 2 of 2

CLIENT: THE UPJOHN COMPANY - 930142

LOCATION: PORTAGE, MICHIGAN

ELEVATIONS:

SURFACE: 871.56 TOP OF CASING: 871.17

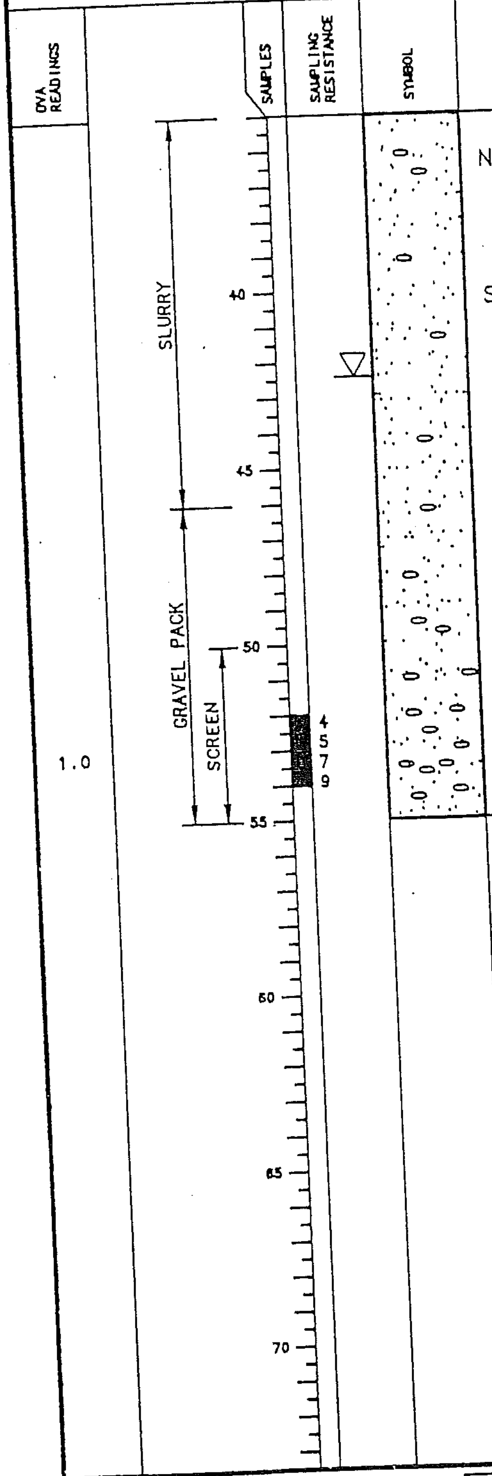
STATIC WATER LEVEL:

DRILLING CO: ED&S

GEOLOGIST: KRS

START DATE: 12/30/93 10:30 AM

COMPLETION DATE: 12/30/93 3:30 PM



DESCRIPTION

NO SPLIT-BARREL SAMPLES UNTIL 55 FEET.
(Please refer to the Work Plan.)

SAND
Brown, medium to coarse grained, some fine to medium gravel, wet.

SAND
Gray, fine to medium grained, with fine gravel, wet.

EOB

▨ GRAVEL
▒ SAND
SILT
CLAY
ORGANIC
TILL
SHALE
ROCK
MISC. FILL
TOPSOIL
▽ SATURATION LEVEL AT TIME OF DRILLING
▼ STATIC WATER LEVEL
N.D. NOT DETECTED BY Hnu OR OVA

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER **MW-101A**

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

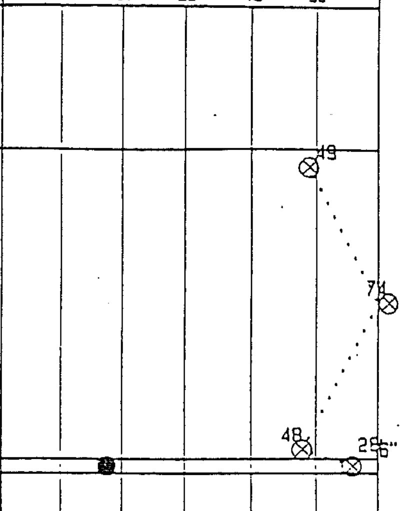
PLASTIC LIMIT % × - - - - WATER CONTENT % ● - - - - LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

UNIT DRY WT. LBS./FT.^{3}

SURFACE ELEVATION 870.6

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL
			AB			Boring advanced without sampling to 60.0'. See MW-101 and MW-105 borings logs for soil classification.
60.0		1	SS			Fine to medium sand, trace silt, gravel and coarse sand - gray - dense to very dense. (SP)
			AB			
65.0		2	SS			
			AB			
70.0		3	SS			
71.5		3A	SS			Silty sand, little clay, trace fine gravel - brownish gray - very dense. (SM)



END OF BORING

Boring advanced to 70.0' with washed rotary drilling techniques.
10.0' of 4.0" temporary casing.

Monitoring well installed. See well installation diagram.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL WS OR WD
BCR ACR
WL

BORING STARTED 10/19/90
BORING COMPLETED 10/19/90
RIG/FOREMAN 8-61/TT

STS OFFICE Lansing-07
ENTERED BY TJM
SHEET NO. 1 OF 1
APP'D BY AMM
STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-104

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

-○- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 870.7	UNIT DRY WT. LBS./FT.^{3}
			CT			Boring advanced without sampling to 230.0'. See MW-101, MW-105, and MW-106 for soil classifications.	
230.0						END OF BORING	

Boring advanced to 230.0' using cable tool drilling techniques.
24.0' of 16.0" temporary casing;
156.0' of 12.0" temporary casing;
230.0' of 8.0" temporary casing.
A 200 foot 5" permanent casing with 30 feet of stainless steel screen was installed for a temporary pumping well.
77.0' of 8.0" permanent casing.

Monitoring well installed within 5.0" permanent casing. See well installation diagram.

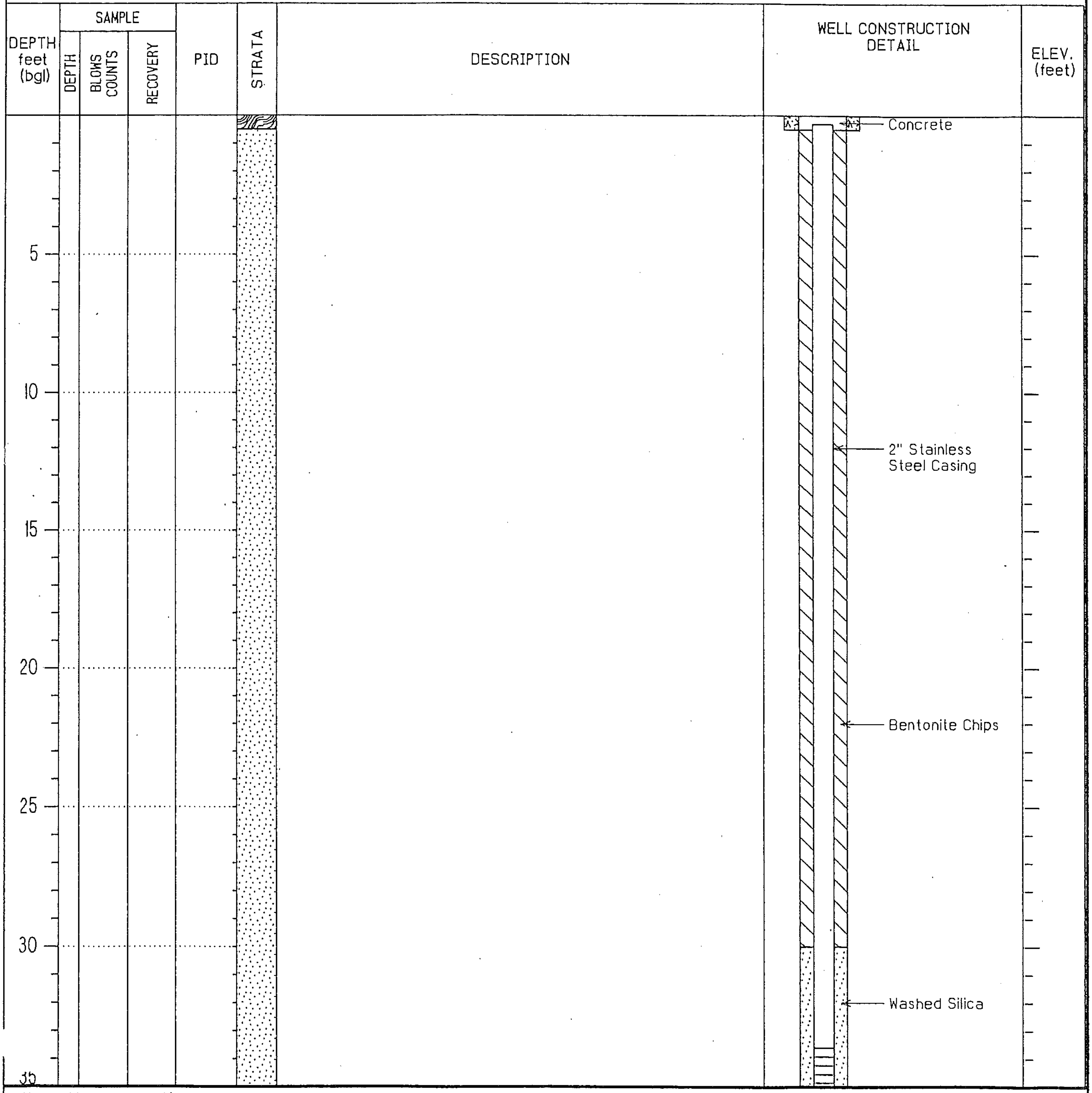
The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL	WS OR WD	BORING STARTED 08/30/90	STS OFFICE Lansing-07	
BCR	ACR	BORING COMPLETED 09/11/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL		RIG/FOREMAN OHIO/JK	APP'D BY AMM	STS JOB NO. 71840

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: Pharmacia Corporation
tion: Former MW 108 location
Date (s) Drilled: 10/3/00
Logged By: William K. Hunsberger
Drilling Co.: Cook Drilling
Weather Conditions: Partly cloudy ~70°

Well/Boring ID: MW 108R
Page: 1 of 2
Boring Depth: 52.0'
Boring Diameter: 8.5"
Drilling Method: 4.25" Hollow Stem Auger
Drilling Equipment: Diedrich D-50
Top of Slots: 33.6' bgs
Bottom of Slots: 48.5' bgs



Notes: Lithology 0-40' from STS log of MW 108.

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

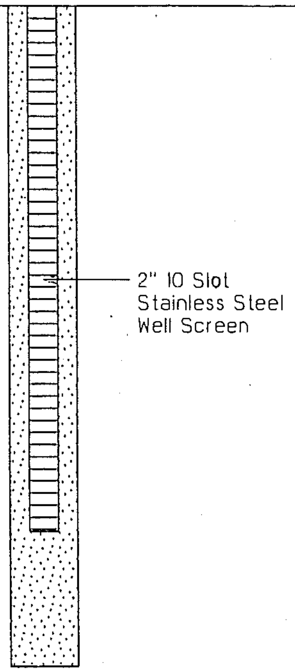
Project: Pharmacia Corporation

Well/Boring ID: MW 108R

Page: 2 of 2

DEPTH feet (bgl)	SAMPLE DEPTH	SAMPLE BLOWS COUNTS	SAMPLE RECOVERY	PID	STRATA	DESCRIPTION	ELEV. (feet)
40							
		8 10 12 12	1.0'	<1		Medium dense gray-brown fine to medium SAND, little coarse Sand, trace fine to medium Gravel, trace Silt. Sand subrounded to subangular, Gravel subangular. Slightly moist.	
45		9 13 16 18	1.8'	<1		Dense brown-gray fine to medium SAND, some Clay, little coarse Sand, trace Silt. Sand subrounded to subangular. Slightly moist.	
		18 19 27 31	1.6'	<1 <1		Dense gray-brown fine to medium SAND, little Clay, little Silt. Sand subrounded to subangular. Moist. Dense gray-brown fine SAND, little medium to coarse Sand, some Clay, trace fine to medium Grave. Sand subrounded to subangular, Gravel subangular. Slightly moist.	
		16 18 29 30	1.4'	<1			
50		12 12 14 21	1.7'	<1		Firm gray-brown CLAY & SILT. Medium plasticity. Slightly moist.	
55							
60							
65							
70							
75							

WELL CONSTRUCTION DETAIL

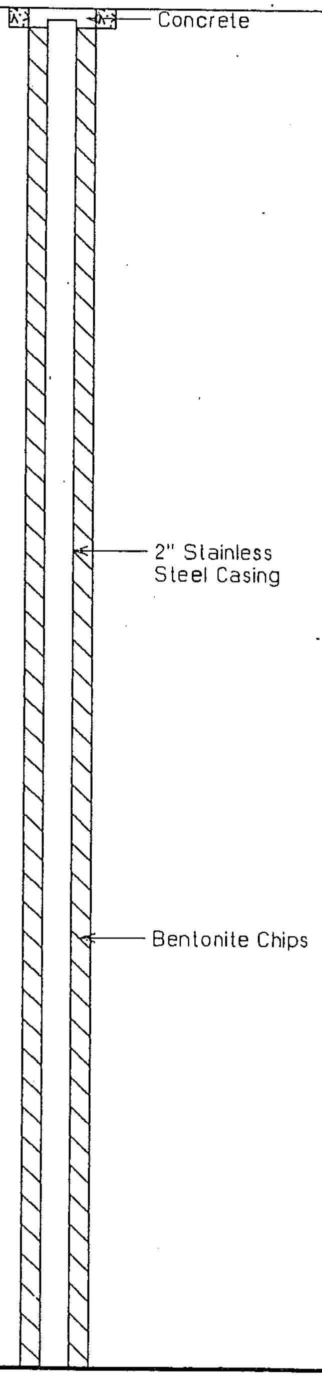


Notes: Lithology 0-40' from STS log of MW 108.

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

ject:	Pharmacia Corporation	Well/Boring ID:	MW 109R Page: 1 of 2
tion:	Approximately 20'E, 10'S of former MW 109 location	Boring Depth:	49.5'
Date (s) Drilled:	10/3/00 and 10/6/00	Boring Diameter:	8.5"
Logged By:	William K. Hunsberger	Drilling Method:	4.25" Hollow Stem Auger
Drilling Co.:	Cook Drilling	Drilling Equipment:	Diedrich D-50
Weather Conditions:	Partly cloudy ~70˚ , Partly cloudy ~50˚	Top of Slots:	38.5' bgs Bottom of Slots: 48.4' bgs

DEPTH feet (bgl)	SAMPLE			PID	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEV. (feet)
	DEPTH	BLOWS COUNTS	RECOVERY					
5								
10								
15								
20								
25								
30								
35								

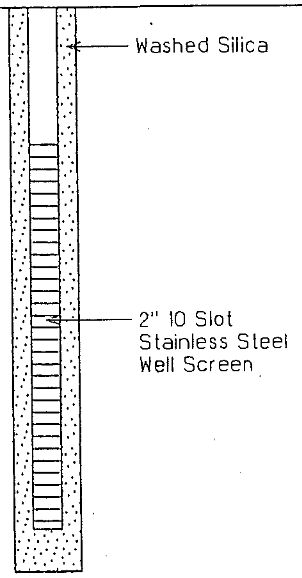


Notes: Lithology 0-48' from STS log of MW 109.

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

lect: Pharmacia Corporation
Well/Boring ID: MW 109R
Page: 2 of 2

DEPTH feet (bgl)	SAMPLE			PID	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEV. (feet)
	DEPTH	BLOWS COUNTS	RECOVERY					
40								
45								
	☒	39 48 53	1.5'	<1 <1		Very firm medium gray CLAY, some Silt, little fine to coarse Sand, trace fine to medium Gravel. Medium plasticity. Slightly moist.		
50						Very dense medium gray-brown fine to medium SAND, little Clay & Silt. Sand subangular. Very moist.		
55								
60								
65								
70								
75								



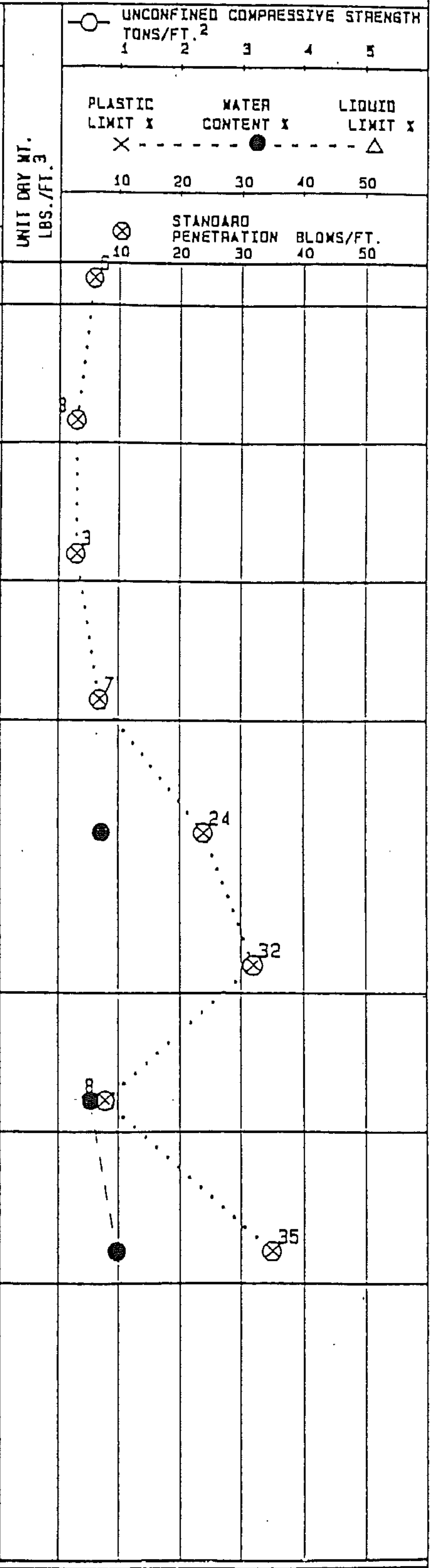
Notes: Lithology 0-48' from STS log of MW 109.

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-110
	PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 870.9

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL
		1	SS	Silty fine sand and topsoil, trace gravel, coarse sand and roots - brown - loose. (TOPSOIL)
			HS	Fine to medium sand, little coarse sand, trace silt and gravel - brown - very loose - moist. (SW)
5.0		2	SS	
			HS	Fine to medium sand, trace coarse sand - brown - very loose - moist. (SP)
10.0		3	SS	
			HS	Fine sand - light brown - loose - moist. (SP)
15.0		4	SS	
			HS	Fine to medium sand, some silt, little fine to medium gravel and coarse sand, trace clay - light brown - medium dense to dense - moist. (SM)
20.0		5	SS	
			HS	
25.0		6	SS	
			HS	Gravelly medium to coarse sand, little fine sand, trace silt - loose - saturated. (SP-GP) Note: Obstruction encountered at 26.5 feet borehole offset 6.0' Northeast, and continued. Saturated at 29.6'.
30.0		7	SS	
			HS	Fine to medium sand, little coarse sand and fine to medium gravel, trace silt - gray - dense - saturated. (SW)
35.0		8	PL×	
37.0				
				END OF BORING Boring advanced to 35.0' with 4.25" hollow stem auger. Monitoring well installed. See well installation diagram. Note: PL× indicates 3.0" plastic liner.



The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL WS OR WD	BORING STARTED 07/04/90	STS OFFICE Lansing-07	
BCR ACR	BORING COMPLETED 07/04/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL 28.7 875 hrs AB	RIG/FOREMAN CME-550/JS	APP'D BY AMM	STS JOB NO. 71840

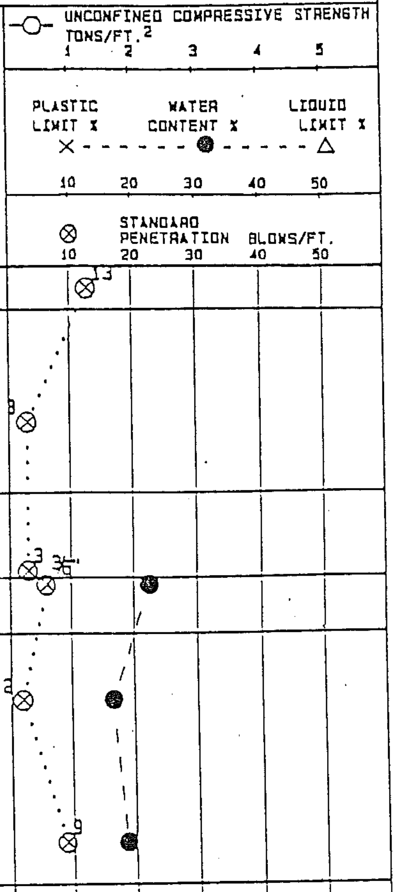
STS Consultants Ltd.

OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-111
PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER

E LOCATION
TAGE, MICHIGAN

SURFACE ELEVATION 864.4

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
		1	SS			Fine to medium sand and topsoil, little silt and clay, trace gravel and roots - medium dense - moist. (TOPSOIL)	
			HS			Fine to medium sand, little silt and clay, trace gravel - brown - very loose - moist. (SC-SM)	
5.0		2	SS				
			HS				
			HS			Peat - black - loose - moist. (PT)	
10.0		3	SS				
		3A	SS			Clayey sand, some silt, trace medium sand - gray - loose - moist to saturated. (SC-SM)	
			HS				
			HS			Saturated at 13.8'.	
15.0		4	SS			Fine to medium sand, trace silt, clay and coarse sand - gray - loose to very loose - saturated. (SP)	
			HS				
20.0		5	PL*				



END OF BORING

Boring advanced to 20.0' with 4.25" hollow stem auger.
Monitoring well installed. See well installation diagram.

Note: PL* indicates 3" plastic liner.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

13.8' WS OR WD WD	BORING STARTED 07/09/90	STS OFFICE Lansing-01	
BCR 12.7' ACR	BORING COMPLETED 07/09/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL 11.9' @24 hrs AB	RIG/FOREMAN CME-550/JS	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-113

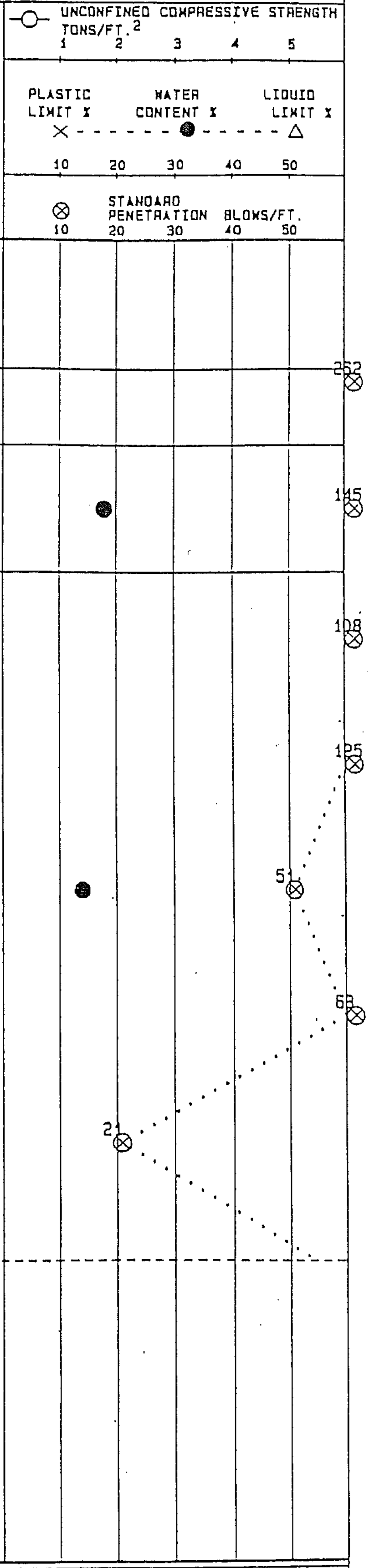
PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 864.3

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	STANDARD PENETRATION BLOWS/FT.
			RB			Boring advanced without sampling to 65.0'. See MW-111 and MW-112 for soil classifications.		
65.0		1	PL			Fine to medium sand, little silt - brown - extremely dense. (SM)		252
			RB					
			RB			Silt, some sand - gray - extremely dense - moist. (ML)		
70.0		2	SS				.2/0	145
			RB					
			RB			Fine to medium sand, trace silt, gravel and coarse sand - brown - medium dense to extremely dense - moist to wet. (SP)		
75.0		3	SS				0/0	108
			RB					
80.0		4	SS				0/0	125
			RB					
85.0		5	PL				0/0	51
			RB					
90.0		6	SS				0/0	68
			RB					
95.0		7	SS					21
			RB					
100.0								



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 7

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

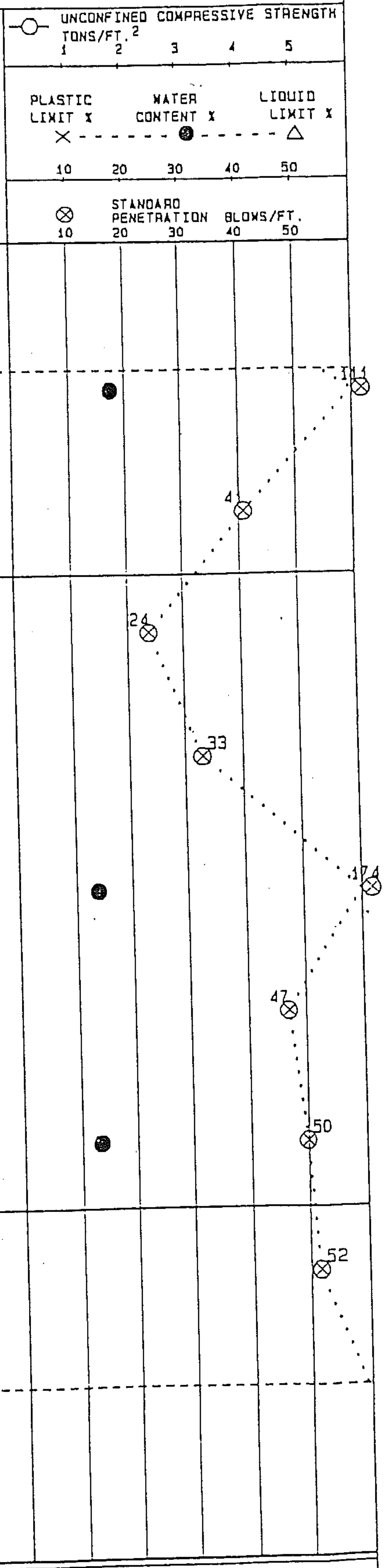
PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

LOG OF BORING NUMBER MW-113

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
100.0		8	PL×			Fine to medium sand, trace silt, gravel and coarse sand - brown - medium dense to extremely dense - moist to wet. (SP)	
			RB				
105.0		9	SS				
			RB				
			RB			Fine to medium sand, little to trace gravel, trace silt and coarse sand - brown - medium dense to extremely dense - wet. (SP)	
110.0		10	SS				
			RB				
115.0		11	SS				
			RB				
120.0		12	PL×				
			RB				
125.0		13	SS				
			RB				
130.0		14	SS				
			RB				
			RB			Fine to medium sand, little gravel, little to trace silt and coarse sand - brown - very dense to extremely dense - wet. (SP-SM)	
135.0		15	SS				
			RB				
140.0							
						... continued	



The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 2 OF 7

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-113

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

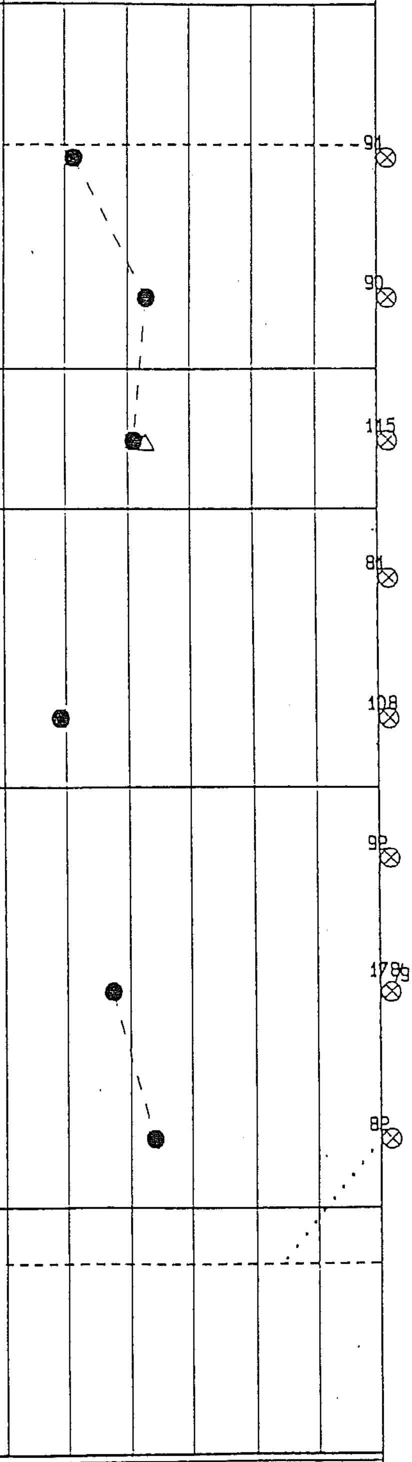
FIELD PHOTO-IONIZATION DETECTOR READING (PPM)

○ UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION
						Continued from previous page
140.0		16	SS			Fine to medium sand, little gravel, little to trace silt and coarse sand - brown - very dense to extremely dense - wet. (SP-SM)
			RB			
145.0		17	SS			
			RB			
			RB			Silty clay, little fine sand, trace gravel - gray - extremely dense. (CL-ML)
150.0		18	PL×			
			RB			
			RB			Fine to coarse sand and fine to medium gravel, trace silt - brown - extremely dense - wet. (SP-GP)
155.0		19	SS			
			RB			
160.0		20	SS			
			RB			
			RB			Fine sandy silt, some to little clay, trace fine gravel - gray - extremely dense - saturated. (ML-SM)
165.0		21	SS			
			RB			
170.0		22	PL×			
			RB			
175.0		23	SS			
			RB			
			RB			Silty clay, little to trace sand, trace gravel - gray - dense to extremely dense. (ML-CL)
180.0						



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 3 OF 7

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

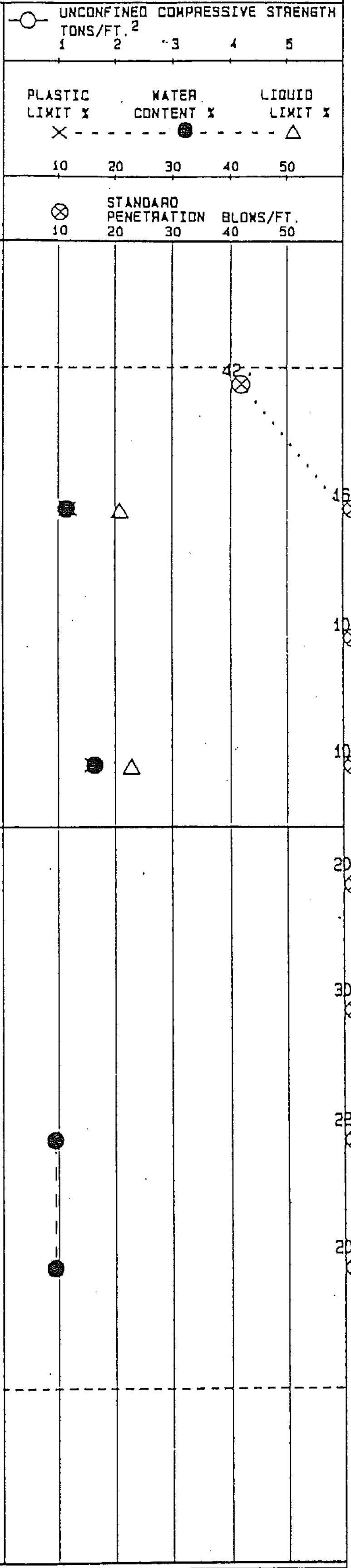
LOG OF BORING NUMBER **MW-113**

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
☒						SURFACE ELEVATION	
						Continued from previous page	
180.0							
		24	SS			Silty clay, little to trace sand, trace gravel - gray - dense to extremely dense. (ML-CL)	
			RB				
185.0							
		25	PLX				
			RB				
190.0							
		26	SS				
			RB				
195.0							
		27	SS				
			RB				
			RB			Fine to coarse sand, some to little silt, trace clay and gravel - brown - extremely dense - moist to wet. (SM)	
200.0							
		28	SS				
			RB				
205.0							
		29	PLX				
			RB				
210.0							
		30	SS				
			RB				
215.0							
		31	SS				
			RB				
220.0							
						... continued	



The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 4 OF 7

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER **MW-113**

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

FIELD PHOTO-IONIZATION DETECTOR READING (PPM)

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % ✕ WATER CONTENT % ● LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL SURFACE ELEVATION	STANDARD PENETRATION BLOWS/FT.
			Continued from previous page	
220.0	32	SS	Fine to coarse sand, some to little silt, trace clay and gravel - brown - extremely dense - moist to wet. (SM)	154
		RB		
		RB	Fine to medium sand, little silt, trace gravel and coarse sand - brownish gray - extremely dense. (SP-SM)	
225.0	33	PL		300/3"
		RB		
230.0	34	SS		315/6"
		RB		
		RB	Fine to medium sand, trace silt and coarse sand and gravel - brown - extremely dense - wet. (SP)	
235.0	35	SS		121/6"
		RB		
240.0	36	PL		300/3"
		RB		
245.0	37	SS		277/6"
		RB		
250.0	38	SS		287/3"
		RB		
		RB	Silty clay, trace fine to coarse sand - gray. (CL)	
255.0	39	SS		90
		RB		
260.0				

... continued

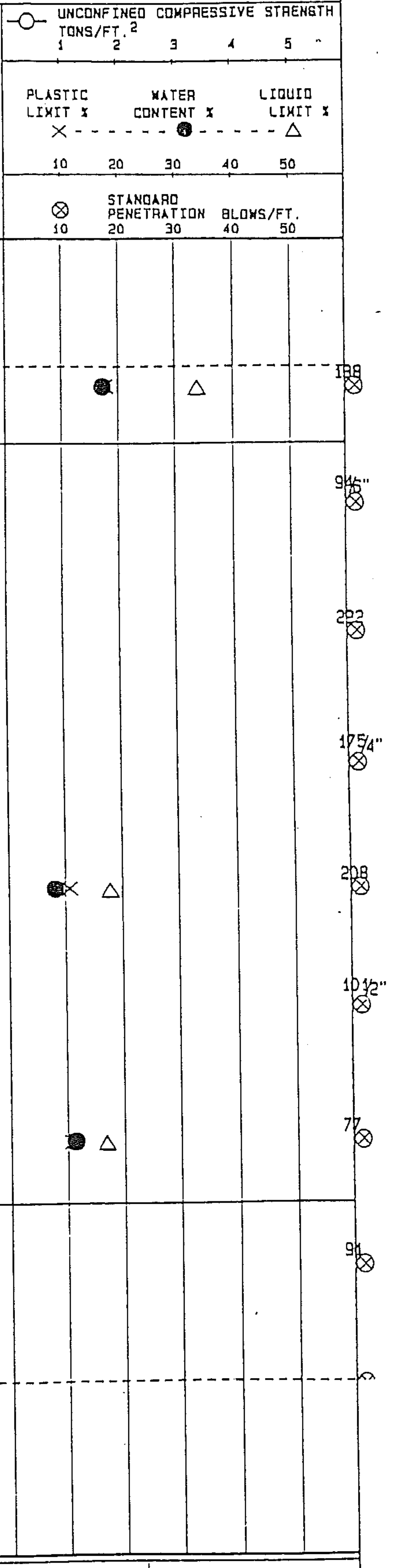
The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 5 OF 7

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-113
	PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER
SITE LOCATION PORTAGE, MICHIGAN		

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
260.0		40	PL			Silty clay, trace fine to coarse sand - gray. (CL)	
			AB				
			AB			Silty clay, some fine sand, little to trace medium sand, trace fine gravel and coarse sand. (ML-CL)	
265.0		41	SS				
			AB				
270.0		42	SS				
			AB			Driller's observation: Cobbles encountered at 283.0'.	
275.0		43	SS				
			AB				
280.0		44	PL				
			AB				
285.0		45	SS				
			AB				
290.0		46	SS				
			AB				
			AB			Fine sand, some silt, trace medium to coarse sand - gray - extremely dense - wet. (SM)	
295.0		47	SS				
			AB				
300.0							
						... continued	



The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.	STS JOB NO. 71840	SHEET NO. 6 OF 7

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-113

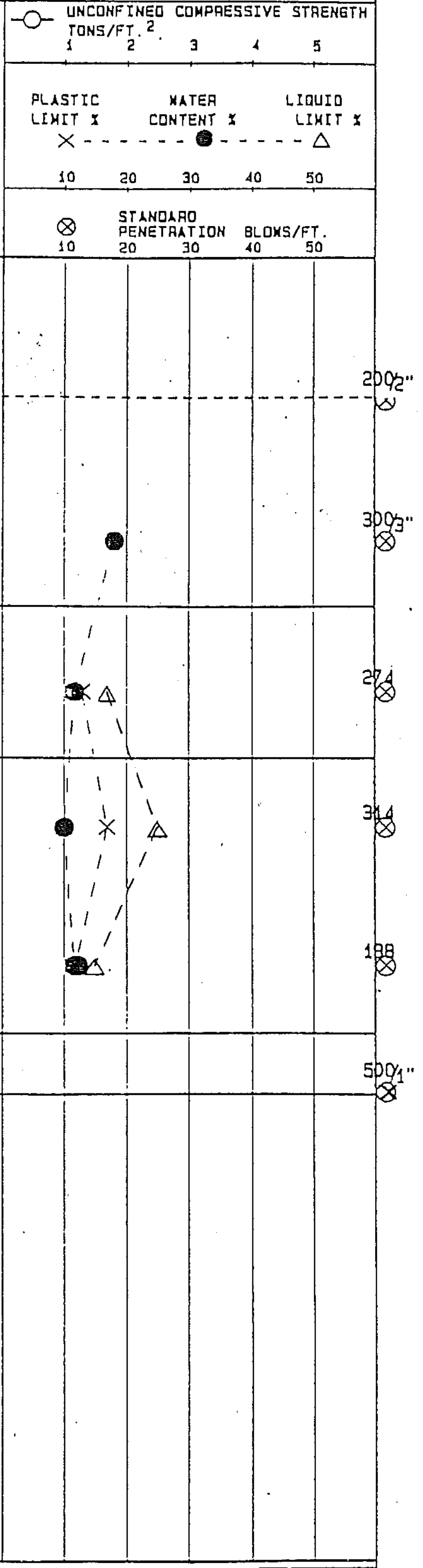
PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	STANDARD PENETRATION BLOWS/FT.
						Continued from previous page		
300.0						Fine sand, some silt, trace medium to coarse sand - gray - extremely dense - wet. (SM)		200/2"
			RB					
305.0		49	PL*					300/3"
			RB					
			RB			Silty clay and fine sand, trace medium to coarse sand - gray - extremely dense. (CL-ML)		
310.0		50	SS					274
			RB					
			RB			Silty clay, little fine sand, trace fine gravel and medium to coarse sand - gray. (CL-ML)		
315.0		51	PL*					314
			RB					
320.0		52	PL*					188
			RB					
			RB			Driller's observation: Split spoon refusal; bedrock.		
3[illegible]		53	SS					500/1"



END OF BORING

Boring advanced to 325.20' with washed rotary drilling techniques.
60.0' of 8.0" permanent casing.
70.0' of 6.0" temporary casing.
200.0' of 4.0" temporary casing.

Borehole grouted from 250.0' to 325.2' with cement grout.

Monitoring well installed. See well installation diagram.

Note: PL* indicates 3.0" plastic liner.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL	WS OR WD	BORING STARTED 10/24/90	STS OFFICE Lansing-07	
WL	BCR ACR	BORING COMPLETED 11/03/90	ENTERED BY TJM	SHEET NO. 7 OF 7
WL		RIG/FOREMAN B-61/OG	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

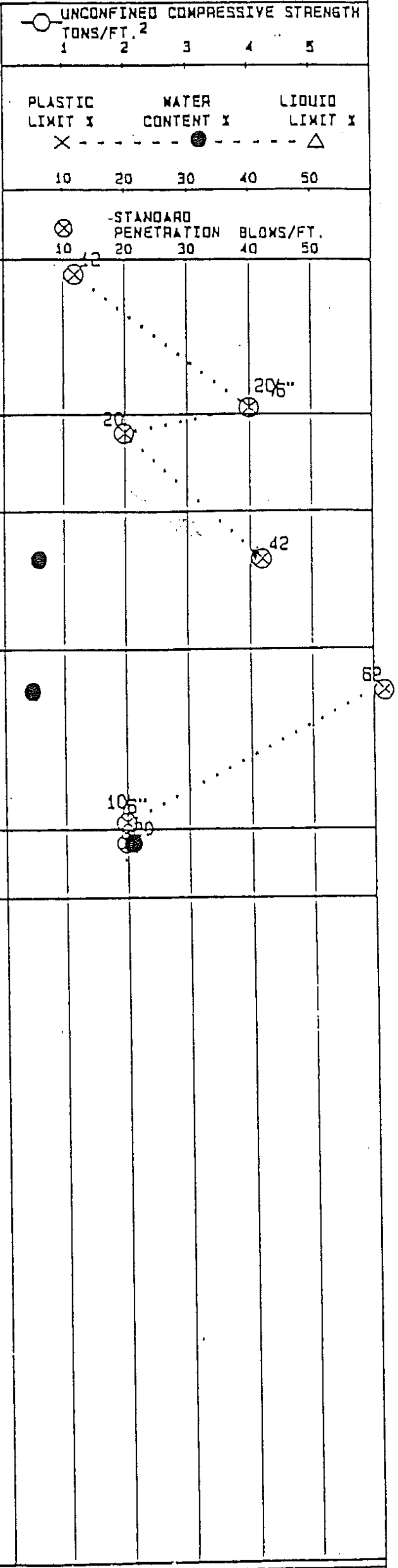
LOG OF BORING NUMBER MW-114

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
				SURFACE ELEVATION 871.6	
		1	SS	Fill - medium dense to dense. (FILL) Driller's observation: Glass, steel and brick rubble in boring.	
			HS		
5.0		2	SS		
		2A	SS	Silty sand and fill - grayish brown - medium dense - moist. (FILL)	
			HS		
10.0			HS	Medium gravel, little fine gravel and fine to coarse sand, trace silt - brown - dense - moist. (GP)	
		3	SS		
		3A	AS		
15.0			HS	Fine to coarse sand, little to some medium to coarse gravel, trace silt - brown - medium dense to very dense - moist to saturated. (SW-GW) Saturated at 20.0'.	
		4	SS		
			HS		
20.0		5	SS		
		5A	SS	Fine sand, trace silt and medium sand, light brown to yellowish - medium dense - saturated. (SP)	
		6	PL*		
23.0					



END OF BORING

Boring advanced to 23.0' with 3.25" hollow stem auger.
Note: An obstruction was encountered at 21.5', boring was offset 3.0' and continued.
Monitoring well installed. See well installation diagram.

Note: PL* indicates 3.0" plastic liner.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 20.0'	WS OR WD WS	BORING STARTED 07/01/90	STS OFFICE Lansing-07	
BCR 18.9	ACR .16 HR	BORING COMPLETED 07/01/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL 18.75' @1.5 hrs AB		RIG/FOREMAN D-50/SB	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-115A

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

—○— UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
☒						SURFACE ELEVATION 866.8	
			CT			Boring advanced without sampling to 39.0'. See MW-115 and MW-116 boring logs for soil classification.	
40.0		1	BAI			Fine to medium sand, little coarse sand and fine gravel, trace silt and clay. (SP)	
			CT				
		2	BAI			Clayey sand, little coarse sand - gray. (SC)	
			CT				
44.0		3	BAI			Gravel and coarse sand. (GP-SP)	

END OF BORING

Boring advanced to 44.0' with cable tool drilling techniques.
15.0' of 16.0" temporary casing.
44.0' of 8.0" temporary casing.

Monitoring well installed. See well installation diagram.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL WS OR WD	BORING STARTED 10/26/90	STS OFFICE Lansing-07	
BCR ACR	BORING COMPLETED 10/29/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL	RIG/FOREMAN OHIO/JH	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-117

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

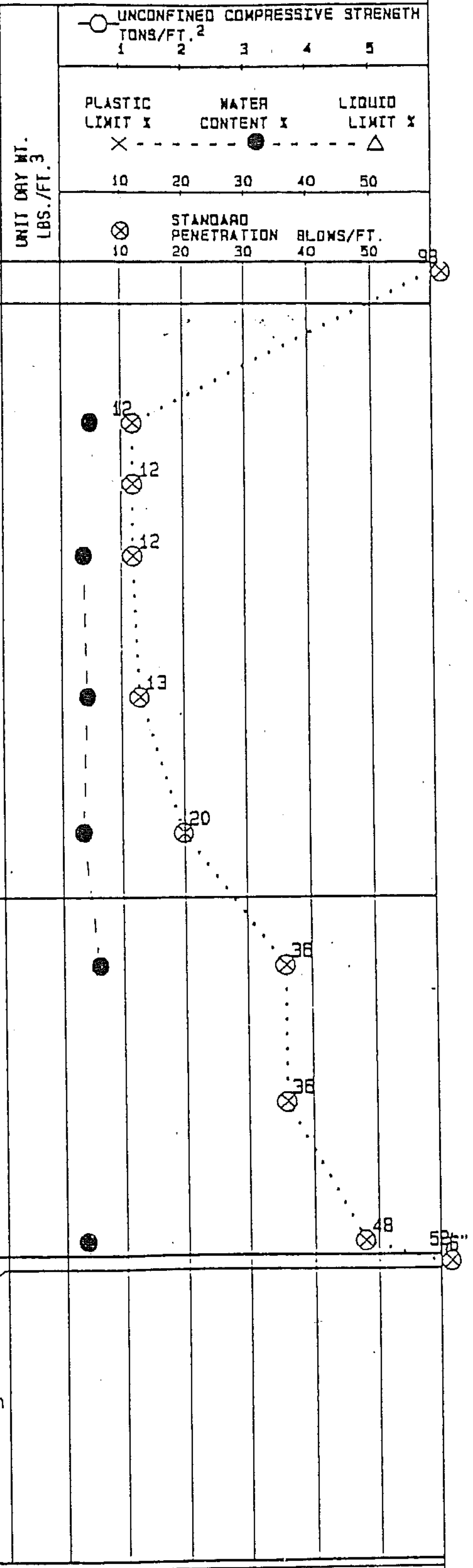
SURFACE ELEVATION 863.6

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL
		1	SS			Sandy topsoil, little silt, trace clay - brown - extremely dense - moist. (TOPSOIL)
			HS			Fine to medium sand, little to trace fine to medium gravel, trace coarse sand and silt - light brown - medium dense - moist. (SW)
5.0		2	SS			
			HS			
		2A	SS			
			HS			
10.0		3	SS			
			HS			
15.0		4	SS			
			HS			
20.0		5	SS			
			HS			
			HS			Medium to coarse sand, some gravel, trace fine sand and silt - brown - dense - wet to saturated. (SW) Saturated at 27.0'.
25.0		6	SS			
			HS			
30.0		7	SS			
			HS			
35.0		8	PL*			
36.5		8A	PL*			Geologist's observation: Silty clay - gray. (CL)

END OF BORING

Boring advanced to 35.0' with 4.25" hollow stem auger.
Monitoring well installed. See well installation diagram.

Note: PL* indicates 3.0" plastic liner.



The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 27.0' WS OR WD WD
BCR ACR
WL
BORING STARTED 07/10/90
BORING COMPLETED 07/10/90
RIG/FOREMAN B-61/DG
STS OFFICE Lansing-07
ENTERED BY TJM
APP'D BY AMM
SHEET NO. 1 OF 1
STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER **MW-119**

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - WATER CONTENT % ● - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
						SURFACE ELEVATION 863.6	
			CT			Boring advanced with out sampling to 140.0'. See MW-117, MW-118, and MW-121 soil borings for soil classification.	
140.0		1	BA			Medium to coarse sand, some silt, little clay, trace gravel. (SM)	
145.0			CT			Medium to coarse sand and fine to medium gravel, trace silt. (SP-GP)	
150.0		2	BA				

END OF BORING

Boring advanced to 150.0' with cable tool drilling tecnniques.
48.0' of 8" permanent casing.
150.0' of 5.0" temporary casing.

Monitoring well installed. See well installation diagram.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL WS OR WD	BORING STARTED 10/09/90	STS OFFICE Lansing-07	
BCR ACR	BORING COMPLETED 10/19/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL	RIG/FOREMAN OHIO/JH	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

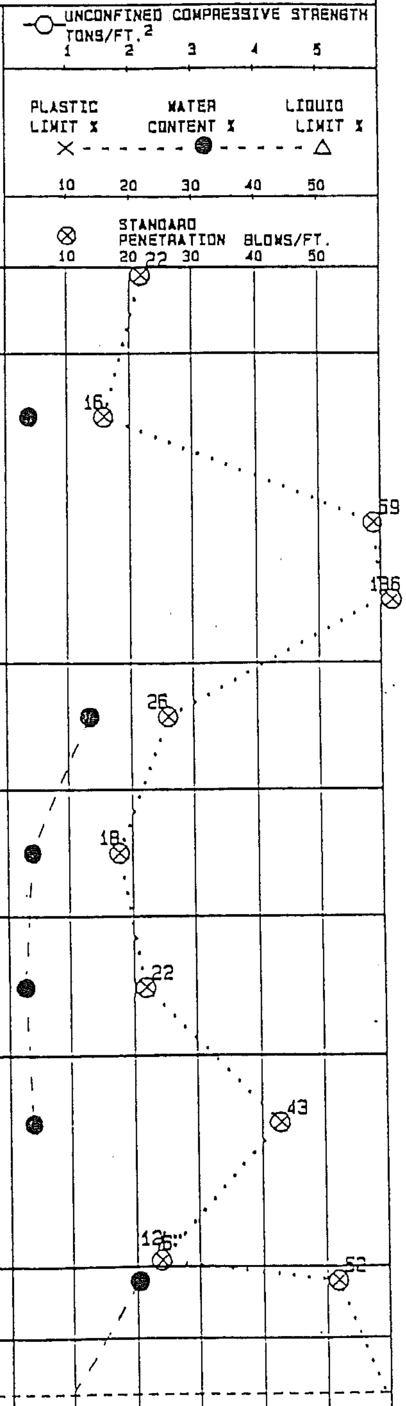
LOG OF BORING NUMBER MW-122

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 869.4	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
		1	SS			Silty sand, little gravel and organics, trace clay - brown - medium dense - moist. (SM)	0/0
			HS				
			HS			Medium to coarse sand and fine to medium gravel, little fine sand, trace silt - brown - medium dense to extremely dense - moist. (SP-GP)	
5.0		2	SS				0/0
			HS				
10.0		3	SS				
		3A	SS				0/0
			HS				
15.0			HS			Fine sand, some silt, trace medium to coarse sand - brown - medium dense - moist. (SM)	
		4	SS				0/0
			HS				
			HS			Fine sand, trace silt and medium sand - brown - medium dense - moist. (SP)	
20.0		5	SS				0/0
			HS				
			HS			Fine to medium sand, trace silt, coarse sand and fine gravel - brown - medium dense - moist. (SP)	
25.0		6	SS				0/0
			HS				
			HS			Gravelly sand, trace silt - brown - medium dense to dense - moist. (SW-GW)	
30.0		7	SS				0/0
			HS				
35.0		8	SS				0/0
		8A	SS			Fine sand, some silt, trace medium to coarse sand and clay - gray - very dense - moist. (SM)	
			HS				
			HS			Silty sand, little fine gravel - brownish gray - very dense - moist to wet. (SM)	
40.0							



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 2

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

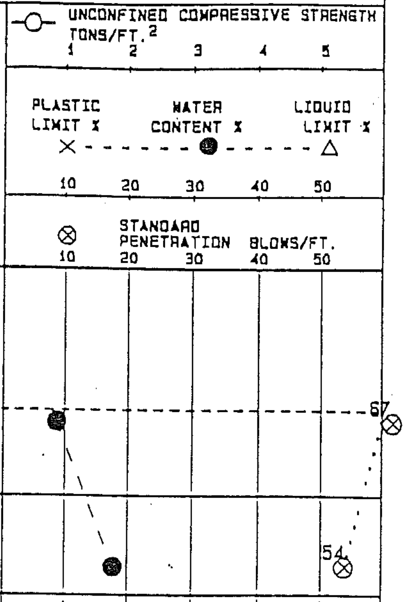
LOG OF BORING NUMBER **MW-122**

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						SURFACE ELEVATION	
						Continued from previous page	
40.0		9	SS			Silty sand, little fine gravel - brownish gray - very dense - moist to wet. (SM)	0/0
			HS				
			HS			Fine sand, trace medium to coarse sand, silt and fine gravel - brownish gray - very dense - moist to wet. (SP)	
45.0		10	PL*				0/0
46.5							



END OF BORING

Boring advanced to 45.0' with 4.25" hollow stem auger.

Monitoring well installed. See well installation diagram.

Note: PL* indicates 3.0" plastic liner.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 41.0'	WS OR WD WS	BORING STARTED 07/09/90	STS OFFICE Lansing-07	
BCR	ACR	BORING COMPLETED 07/10/90	ENTERED BY TJM	SHEET NO. 2 OF 2
WL		RIG/FOREMAN B-61/DG	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-129A
	PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER

ITE LOCATION
ORTAGE, MICHIGAN

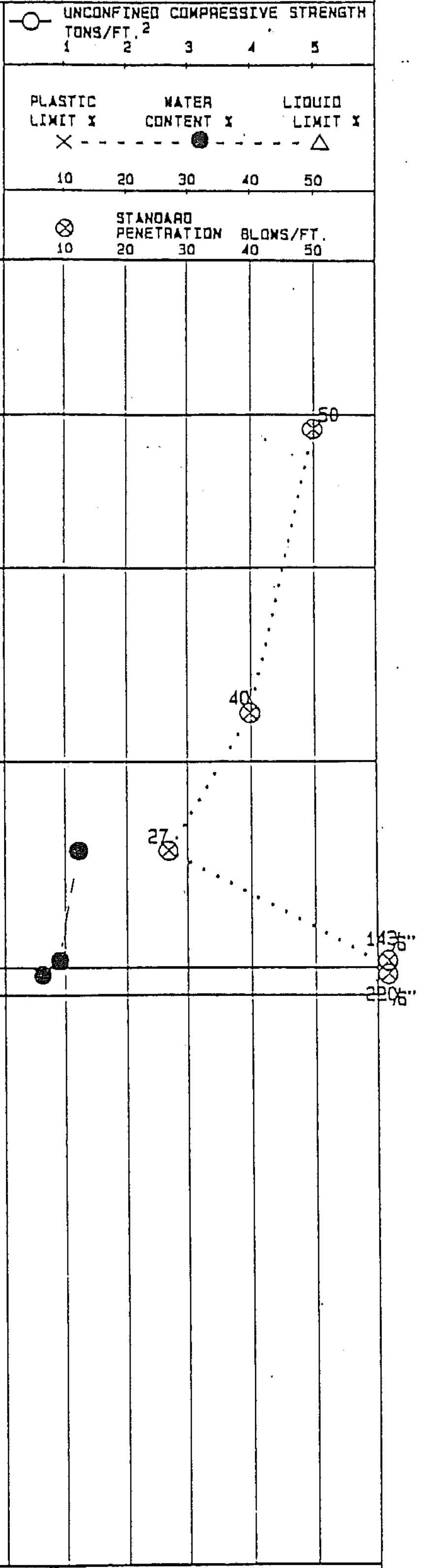
SURFACE ELEVATION 871.1

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.3
			HS			Boring advanced without sampling to 30.5'. See MW-129 boring logs for soil classification.	
30.0							
		1	PL*			Fine to coarse sand - gray - very dense - saturated. (SP)	
35.0			HS				
			HS			Fine sand, little medium to coarse sand - grayisn brown - dense - saturated. (SP)	
40.0		2	SS				
			HS				
45.0			HS			Fine sand, little fine to medium gravel and medium to coarse sand - grayish brown - medium dense to extremely dense. (SP)	
		3	SS				
			HS				
50.0		4	SS				
51.5		4A	SS			Fine to medium sand, some clay, little silt and coarse sand, trace fine gravel - gray - extremely dense. (SC)	

END OF BORING

Boring advanced to 50.0' with 4.25" hollow stem auger.
Monitoring well installed. See well installation diagram.

Note: PL* indicates 3.0" plastic liner.



The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

25.0'	WS OR WD WD	BORING STARTED 10/17/90	STS OFFICE Lansing-07	
BCR 25.35'	ACR	BORING COMPLETED 10/17/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL		RIG/FOREMAN CME-550/BP	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-131
	PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER
SITE LOCATION PORTAGE, MICHIGAN		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} — 1 2 3 4 5

PLASTIC LIMIT % × - - - - WATER CONTENT % ● - - - - LIQUID LIMIT % △ — 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. — 10 20 30 40 50

SURFACE ELEVATION 871.6

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}	WATER CONTENT %
			CT			Boring advanced without sampling to 170.0'. See MW-129 and MW-132 boring logs for soil classification.		
170.0		1	BA	I		Fine sand, trace medium sand - gray. (SP)		
			CT					
175.0		2	BA	I				
			CT					
			CT			Medium to coarse sand, little fine sand, trace gravel, silt and cobbles. (SW)		
180.0		3	BA	I				
			CT					
			CT			Fine sand, little medium sand, trace fine gravel, silt, and coarse sand - gray. (SP)		
185.0		4	BA	I				●
			CT					
190.0		5	BA	I				
			CT					
195.0		6	BA	I				●
			CT					
200.0		7	BA	I				
			CT					
205.0								

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 2

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-131

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - WATER CONTENT % ● - - - LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	UNIT DRY WT. LBS./FT.^{3}
						Continued from previous page	
205.0		8	BAI			Fine sand, little medium sand, trace fine gravel, silt, and coarse sand - gray. (SP)	
			CT				
210.0		9	BAI				
			CT				
215.0							
216.0		10	BAI				

END OF BORING

Boring advanced to 216.0' with cable tool drilling methods.
19.0' of 20.0" temporary casing;
19.0' of 16.0" temporary casing;
173.0' of 12.0" temporary casing;
215.0' of 8.0" temporary casing.
55.0' of 8.0" permanent casing.

Monitoring well installed. See well installation diagram.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WS OR WD	BORING STARTED 10/08/90	STS OFFICE Lansing-07	
BCR ACR	BORING COMPLETED 11/26/90	ENTERED BY TJM	SHEET NO. 2 OF 2
WL	RIG/FOREMAN OHIO/JK	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-133
	PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

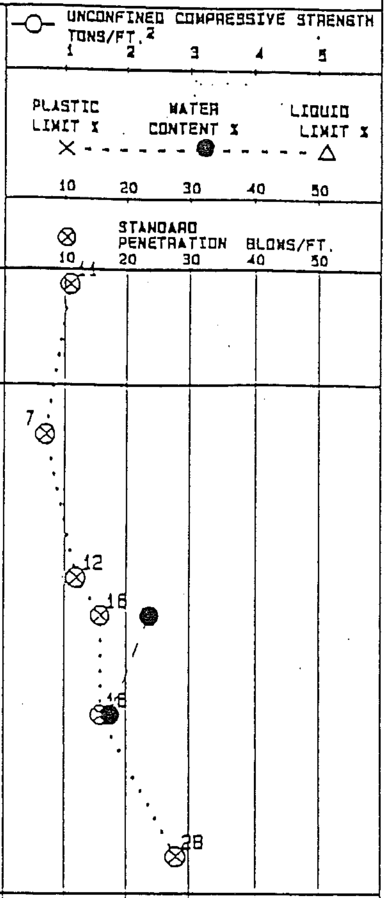
SURFACE ELEVATION 860.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL
	1	SS	Gravelly fine sand, little medium to coarse sand, trace roots - brown - medium dense - desiccated. (SP-GP)
		HS	
5.0		HS	Fine to medium sand, trace silt, fine gravel and coarse sand - light brown - loose to medium dense - wet. (SP)
	2	SS	
		HS	
10.0	3	SS	
	3A	SS	
		HS	
15.0	4	SS	
		HS	
20.0	5	SS*	

END OF BORING

Boring advanced to 20.0' with 4.25" hollow stem auger.
Monitoring well installed. See well installation diagram.

Note: SS* indicates 3.0" split spoon.



UNIT DRY WT. LBS./FT.³

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL WS OR WD	BORING STARTED 07/11/90	STS OFFICE Lansing-07	
BCR 16.1' ACR 11.55	BORING COMPLETED 07/11/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL	RIG/FOREMAN CME-550/JS	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-134

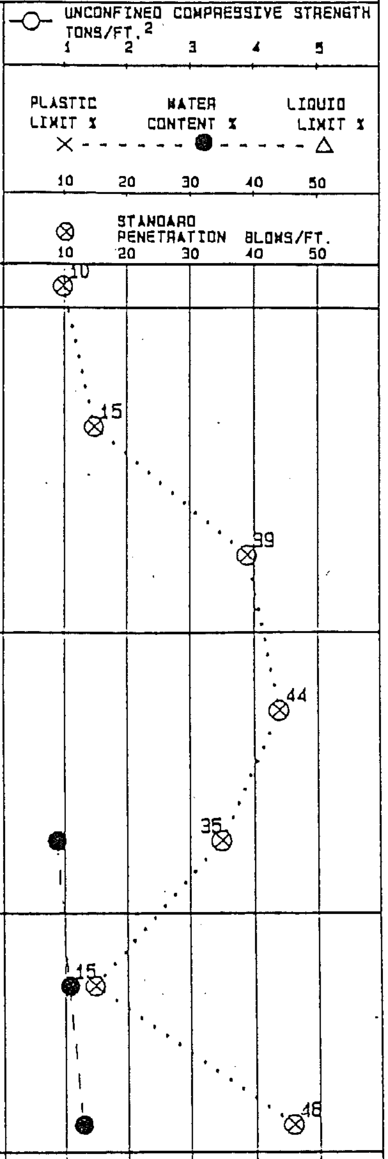
PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 866.8

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	STANDARD PENETRATION BLOWS/FT.
	1	SS	Fine topsoil, trace roots - brown - medium dense - moist. (TOPSOIL)	0/0	10
		HS	Medium to coarse sand, trace gravel - brown - medium dense to dense - moist. (SP)		
5.0	2	SS		0/0	15
		HS			
10.0	3	SS		0/0	39
		HS			
		HS	Fine to medium sand, some silt, trace coarse sand - brown - dense - moist. (SM)		
15.0	4	SS			44
		HS			
20.0	5	SS		0/0	35
		HS			
		HS	Fine to medium sand, trace silt, coarse sand and fine gravel - light brown - medium dense to dense - saturated. (SP)		
25.0	6	SS		0/0	15
		HS			
30.0	7	SS		0/0	48
31.5					



END OF BORING

Boring advanced to 30.0' with 4.25" hollow stem auger.
Monitoring well installed with screen set from 22.0 to 27.0' on 7-11-90. Boring abandoned on 8-21-90. See well abandonment form.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 25.0'	WS OR WD .WS	BORING STARTED 07/11/90	STS OFFICE Lansing-07
BCR	ACR	BORING COMPLETED 07/11/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL		RIG/FOREMAN B-61/DG	APP'D BY AMM	STS JOB NO. 71840

WELL/DRILLHOLE ABANDONMENT
Form 3300-5 Rev. 6-87

(1) GENERAL INFORMATION

Well/Drillhole Location: MW-134
County: Kalamazoo

___ 1/4 of ___ 1/4 of Sec. ___; T. ___ N; R. ___ ☐ E ☐ W
(If applicable)

___ Gov't Lot ___ Grid Number

Civil Town Name:

Street Address of Well: 7171 Portage Road

City, Village: Kalamazoo, MI 49002

Date of Abandonment: 08-21-90

(2) FACILITY NAME

Original Well Owner (If Known): The UpJohn Company

Present Well Owner: The UpJohn Company

Street or Route: 7171 Portage Road

City, State, Zip Code: Kalamazoo, MI 49002

Well Number and/or Name (If Applicable): MW-134

Reason For Abandonment:

WELL/DRILLHOLE INFORMATION

(3) Original Well/Drillhole Construction Completed on (Date) 07-11-90

☒ Monitoring Well
☐ Water Well ☐ Drillhole

Construction Report Available? ☐ Yes ☐ No

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ___

Well Type:
☒ Unconsolidated Formation Well ☐ Bedrock Well

Total Well Depth (ft.) 31.5' Casing Diameter (ins.) 2"

Casing Depth (ft.) 26.5'

Was Well Annular Space Grouted? ☒ Yes ☐ No ☐ Unknown
If Yes, To What Depth? 31.5' Feet

(4) Depth to Water (Feet) 25 Feet

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☒ Yes ☐ No ☐ Not Applicable
Casing Left in Place? ☐ Yes ☒ No
If No, Explain ___

Was Casing Cut Off Below Surface? ☐ Yes ☐ No NA
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Drillhole Retopped? ☐ Yes ☐ No

(5) Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☒ Conductor Pipe-Pumped
☐ Dump Bailer ☐ Other (Explain) ___

(6) Acceptable Sealing Materials
Neat Cement Grout; Concrete Grout; Concrete; Clay Slurry; Sodium Bentonite Slurry

(7)

Kind of Sealing Material	From (Ft.)	To (Ft.)	No. Yards or Sacks Sealant	Mix Ratio or Mud Weight
BENTONITE/CEMENT GROUT	Surface	31.5'	200 Gallons	

(8) Comments:

(9) Name of Person or Firm Doing Sealing Work: STS CONSULTANTS, LTD.

Signature of Person Doing Work:
Date Signed:

Street or Route: 3340 RANGER ROAD
Telephone Number: (517) 321-4964

City, State, Zip Code: LANSING, MI 48906

STS Consultants Ltd.

PROJECT: THE UPJOHN COMPAN

TITLE: HYDROGEOLOGIC
STUDY WORK PLAN

DATE: 12-12-90

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-134A

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
× - - - - - - ● - - - - - - △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 866.8	UNIT DRY WT. LBS./FT.^{3}
30.0 32.0			HS			Note: Boring advanced without sampling to 32.0'. See MW-134 for soil classification.	
						END OF BORING Boring advanced to 32.0' with 4.25" hollow stem auger. Monitoring well installed. See well installation diagram.	

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL WS OR WD	BORING STARTED 08/21/90	STS OFFICE Lansing-07	
BCR ACR	BORING COMPLETED 08/21/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL	RIG/FOREMAN 8-61/DG	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-135

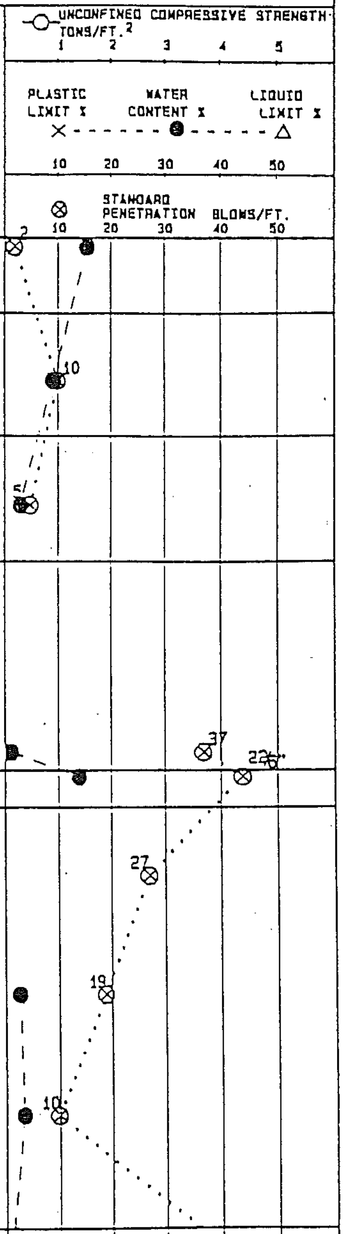
PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 865.4

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
	1	SS	Fine to medium sand, little silt and clay, trace roots, coarse sand and fine gravel - brown - very loose - moist. (Topsoil)	TR/0
		HS		
		HS	Fine to medium sand, little to trace silt, gravel and coarse sand - light brown - medium dense - moist. (SP-SM)	
5.0	2	SS		0/0
		HS		
		HS	Fine to medium sand, trace silt - light brown - loose - moist. (SP)	
10.0	3	SS		0/0
		HS		
		HS	Fine to medium sand, trace coarse sand, silt and gravel - light brown - medium dense - moist. (SP)	
15.0	4	SS		0/0
		HS		
20.0	5	PLX		
	5A	PLX	Fine to medium sand, little silt, trace coarse sand and fine gravel - brown - dense - moist. (SM)	
		HS		
		HS	Fine to coarse sand, some gravel, trace silt and cobbles - brown - medium dense - moist. (SW)	
25.0	6	SS		0/0
		HS		
30.0	7	SS		0/0
		HS		
35.0	8	SS		0/0
		HS		
40.0				



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO.71840

SHEET NO. 1 OF 2

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-135

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² 1 2 3 4 5 PLASTIC LIMIT % ✕ - - - WATER CONTENT % ● - - - LIQUID LIMIT % △ 10 20 30 40 50 ⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50
						Continued from previous page		
40.0		9	PL*			Fine to medium sand, trace coarse sand, fine gravel and silt - brown - medium dense - moist. (SP)		39
			HS					
			HS			Fine sand, little medium sand, little to trace silt, trace clay - gray - dense - moist to saturated. (SP-SM)		
45.0		10	SS				TR/0	35
			HS					
			HS			Fine to medium sand, little gravel, trace coarse sand and silt - gray - medium dense - saturated. (SP)		
50.0		11	SS				0/0	18
51.5								

END OF BORING

Boring advanced to 50.0' with 4.25" hollow stem auger.
Monitoring well installed. See monitoring well installation diagram.

PL* indicates 3" plastic liner

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 45.0 WS OR WD WS	BORING STARTED 11/28/90	STS OFFICE Lansing-07	
WL BCR 44.8 ACR	BORING COMPLETED 11/29/90	ENTERED BY DOS	SHEET NO. 2 OF 2
WL	RIG/FOREMAN CME-550/DH	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-136

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

○ UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × WATER CONTENT % ● LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

SURFACE ELEVATION 864.8

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}	PLOT
			RB			Boring advanced without sampling to 80.0'. See MW-135 and MW-137 boring logs for soil classification.		
80.0		1	PL×			Fine to medium sand, trace silt, coarse sand and gravel - gray - extremely dense - saturated. (SP)		● ⊗ 186
			RB					
85.0						Boring advanced without sampling from 81.5 to 138.0 See MW-137 boring log for soil classification from samples. Field observation: Fine to medium sand - gray - saturated.		
90.0								
95.0								
100.0			RB					
105.0								
110.0								
115.0								

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 2

STS Consultants Ltd.	OWNER **THE UPJOHN COMPANY**	LOG OF BORING NUMBER **MW-136**
	PROJECT NAME **HYDROGEOLOGIC STUDY**	ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	UNIT DRY WT. LBS./FT.^{3}	Water content	Standard penetration
						Continued from previous page			
115.0									
						Field observation: Sandy medium to coarse gravel - brown - saturated.			
			RB						
120.0									
						Fine to medium sand, trace coarse sand, fine gravel and silt - brown - extremely dense - saturated. (SP)			
125.0									
130.0			RB						
135.0									
		2	PL*					●	242 ⊗
140.0			RB						
						END OF BORING Boring advanced to 140.0' using washed rotary drilling techniques. Monitoring well installed. See well installation diagram. 70.0' of 8.0" permanent casing 80.0' of 6.0" temporary casing Note: PL* indicated 3.0" plastic liner			

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 40.5	WS OR WD WD	BORING STARTED 01/20/91	STS OFFICE Lansing-07
BCR	ACR	BORING COMPLETED 01/21/91	ENTERED BY DDS — SHEET NO. 2 OF 2
WL		RIG/FOREMAN B-61/JL	APP'D BY AMM — STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-139

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

ITE LOCATION
ORTAGE, MICHIGAN

SURFACE ELEVATION 860.7

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}	PLASTIC LIMIT % × — WATER CONTENT % ● — LIQUID LIMIT % △	⊗ STANDARD PENETRATION BLOWS/FT.
			RB			Boring advanced without sampling to 140 ft. See MW-138 and MW-140 boring logs for soil classification.				
140.0 141.0		1	PL*			Fine to medium gravel, some fine to coarse sand, little cobbles, trace silt - grayish brown - extremely dense - saturated. (GP)			●	100

END OF BORING

Boring advanced to 140.0' using washed rotary drilling techniques.
Monitoring well installed. See well installation diagram.

Drillers observation: Boulders and cobbles encountered from 120 to 140 ft.

70' of 6" permanent casing

Note: PL* indicates 3" plastic liner

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

42.0	WS OR WD WD	BORING STARTED 01/11/91	STS OFFICE Lansing-07	
WL BCR	ACR	BORING COMPLETED 01/13/91	ENTERED BY DOS	SHEET NO. 1 OF 1
WL		RIG/FOREMAN B-61/DG	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-141

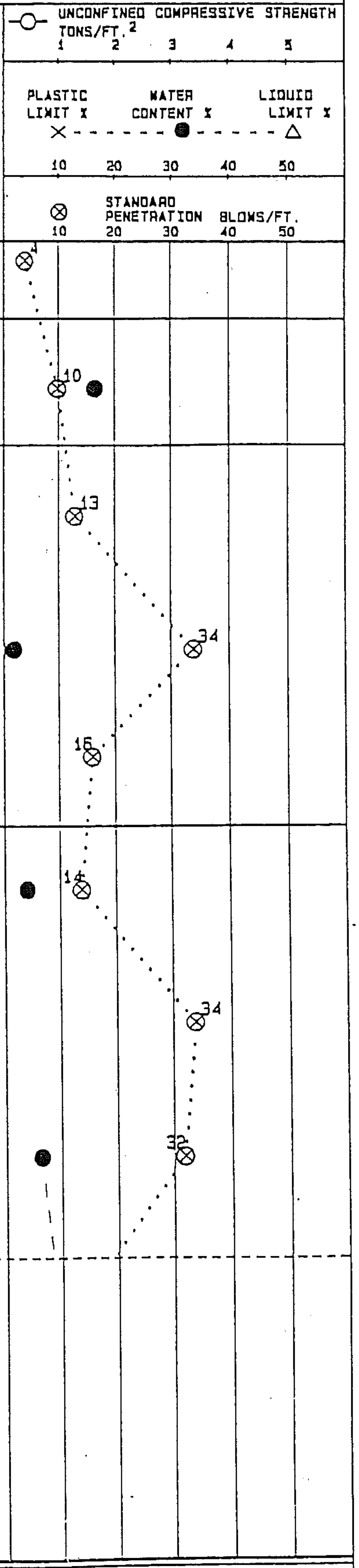
PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 858.6

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
		1	SS			Clayey fine sand, some silt, trace organics - brown - loose - moist. (TOPSOIL)	0/0
			HS				
			HS			Fine sandy silt, trace medium to coarse sand, and fine gravel - brownish gray - medium dense - wet. (ML)	
5.0		2	SS				0/0
			HS				
			HS			Fine to medium sand, trace silt, clay and gravel - brown - medium dense - moist. (SP)	
10.0		3	SS				0/0
			HS				
15.0		4	PL*				
			HS				
20.0		5	SS				0/0
			HS				
			HS			Fine to coarse sand, some to little gravel, little to trace silt - brownish gray - medium dense to dense - moist to saturated. (SP-SM)	
25.0		6	SS				0/0
			HS				
30.0		7	SS				0/0
			HS				
35.0		8	PL*				
			HS				
40.0							



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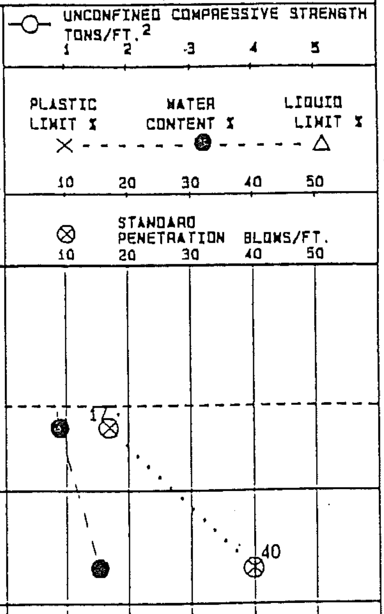
The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 2

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-141
	PROJECT NAME HYDROGEOLOGIC STUDY	ARCHITECT-ENGINEER
	SITE LOCATION PORTAGE, MICHIGAN	

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
40.0		9	SS			Fine to coarse sand, some to little gravel, little to trace silt - brownish gray - medium dense to dense - moist to saturated. (SP-SM)	0/0
			HS				
			HS			Fine to medium sand, trace coarse sand and silt - brownish gray - dense - saturated. (SP)	
45.0		10	SS				0/0
47.0							



END OF BORING

Boring advanced to 45.0' with 4.25" hollow stem auger.
Monitoring well installed. See well installation diagram.

Note: PL* indicates 3" plastic liner

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 40.0 WS OR WD WS	BORING STARTED 12/06/90	STS OFFICE Lansing-07	
BCR ACR 38.0	BORING COMPLETED 12/06/90	ENTERED BY DGS	SHEET NO. 2 OF 2
WL	RIG/FOREMAN CME-550/BP	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-142

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

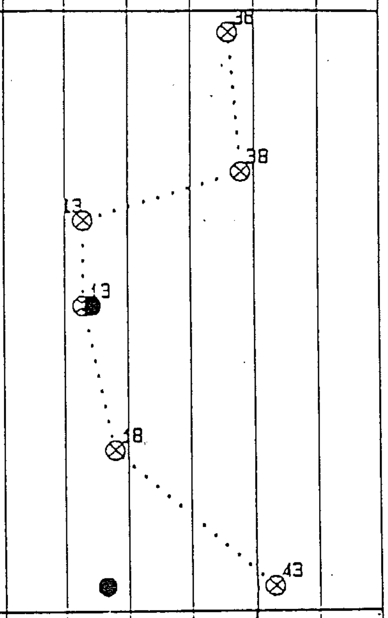
UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × — WATER CONTENT % ● — LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

SURFACE ELEVATION 858.6

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
			HS			Boring advanced without sampling to 50.0 ft. See MW-141 boring log for soil classification.	
50.0		1	SS			Fine to medium sand, little to trace fine to medium gravel, trace coarse sand and silt - brown - medium dense to dense - saturated. (SP)	0/0
			HS				
55.0		2	SS				0/0
		3	SS				0/0
			HS				
60.0		4	PL×				
			HS				
65.0		5	SS				0/0
			HS				
70.0		6	PL×				
75.0 80.0 85.0			AB			Boring advanced without sampling from 71.5 to 138.0'. See MW-143 boring log for soil classification from samples. Field observation: Silty fine sand - gray.	



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-142

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

TE LOCATION
PORTAGE, MICHIGAN

-○- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % ✕ - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
85.0						Boring advanced without sampling from 71.5 to 138.0'. See MW-143 boring log for soil classification from samples. Field observation: Silty fine sand - gray.	
90.0							
95.0						Field observation: Silty fine to coarse sand - gray.	
0.0							
105.0							
110.0			RB				
115.0							
120.0							
125.0							

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 2 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-142

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

FIELD PHOTO-IONIZATION DETECTOR READING (PPM)

SURFACE ELEVATION

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL
						Continued from previous page
25.0						Field observation: Silty fine to coarse sand - gray.
30.0			RB			Field observation: Silty fine to coarse sand, some fine gravel - gray.
35.0						
40.0		7	PL*			Fine to coarse sand, some fine to medium gravel, trace silt - brown - medium dense - saturated. (SW)

END OF BORING

Boring advanced to 70.0' with 4.25" hollow stem auger.
Boring advanced from 70.0 to 140.0' using washed rotary drilling techniques.
Monitoring well installed. See well installation diagram.

60.0' of 6" permanent casing

Note: PL* indicates 3" plastic liner.

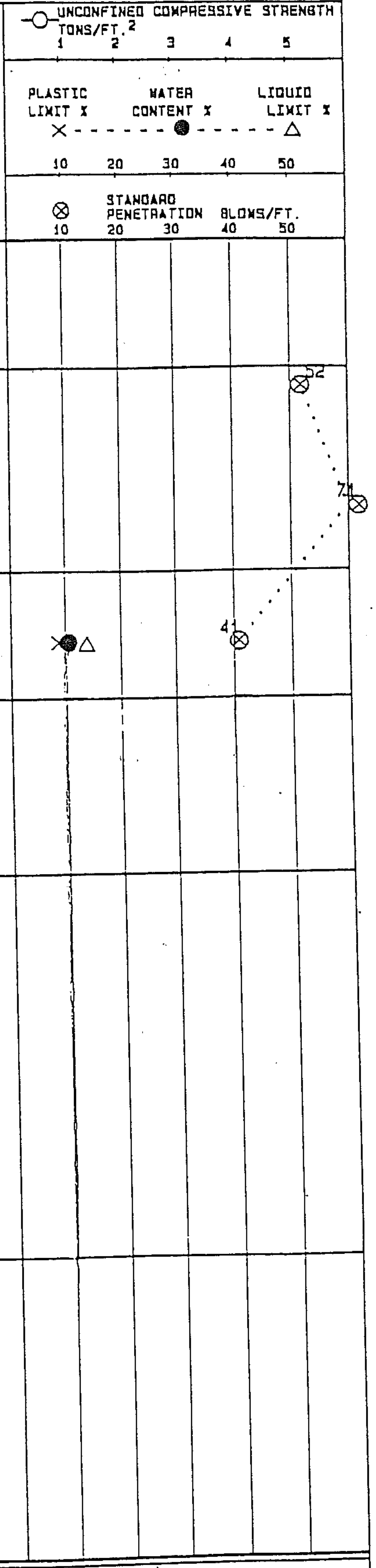
The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

33.5 WS OR WD WD	BORING STARTED 12/04/90	STS OFFICE Lansing-07	
WL BCR ACR	BORING COMPLETED 12/14/90	ENTERED BY DOS	SHEET NO. 3 OF 3
WL	RIG/FOREMAN CME-550/BP	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY
	PROJECT NAME HYDROGEOLOGIC STUDY
LOG OF BORING NUMBER	MW-144
ARCHITECT-ENGINEER	
TTE LOCATION ORTAGE, MICHIGAN	

SURFACE ELEVATION 871.6

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
			HS			Boring advanced without sampling to 40.0'. See MW-145 boring log for soil classification.	
40.0		1	SS			Fine to coarse sand, little fine gravel, trace silt - brown - very dense - moist. (SW)	0/0
			HS				
45.0		2	SS				0/0
			HS				
			HS			Fine sand and silty clay, trace medium to coarse sand and fine gravel - gray - dense - moist. (SC; CL-ML)	
50.0		3	PL×				0/0
			RB				
55.0			RB			Boring advanced without sampling from 53.0 to 130.0'. See MW-145 boring log for soil classification from samples. Field observation: Clayey fine sand - gray.	
60.0 65.0 70.0			RB			Field observation: Fine to coarse sand - brown.	
75.0							



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840 SHEET NO. 1 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER **MW-144**

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

TE LOCATION
ORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5 PLASTIC LIMIT % ✕ - - - - WATER CONTENT % ● - - - - LIQUID LIMIT % △ 10 20 30 40 50 ⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50
☒								
						Continued from previous page		
75.0						Field observation: Fine to coarse sand - brown.		
80.0								
85.0								
90.0								
95.0			AB					
100.0								
105.0								
110.0								
115.0								
						... continued		

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 2 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

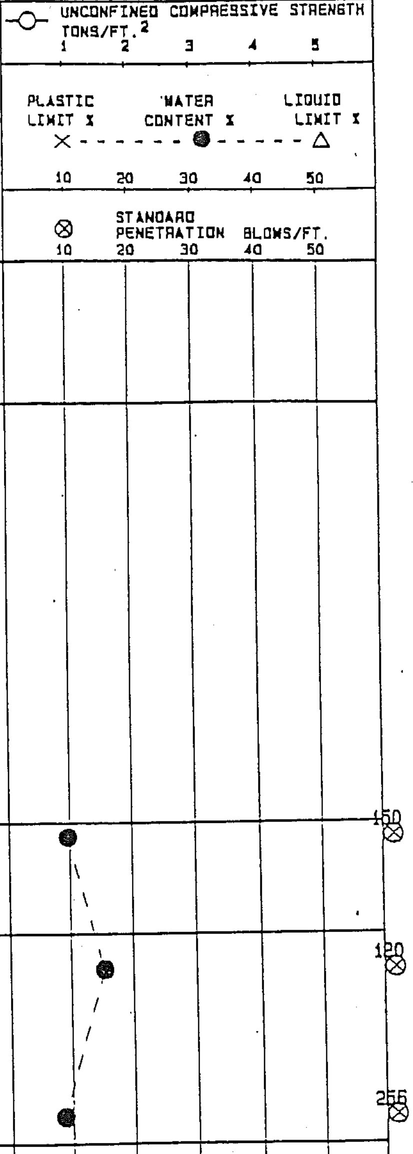
LOG OF BORING NUMBER MW-144

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	STANDARD PENETRATION BLOWS/FT.
						Continued from previous page		
115.0						Field observation: Fine to coarse sand - brown.		
120.0								
			AB					
125.0								
130.0		4	PL*			Gravelly fine to coarse sand, trace silt - brown - very dense - saturated. (SP-GP)		150
			AB					
135.0			AB			Fine to coarse sand, little fine to medium gravel and silt - brown to gray - very dense to extremely dense - saturated. (SM)		
		5	PL*					120
			AB					
140.0		6	PL*					255
141.5						END OF BORING		



END OF BORING

Boring advanced to 50.0' with 4.25" hollow stem auger.
Boring advanced from 50.0 to 140.0' using washed rotary drilling techniques.
Boring backfilled from 135.0 to 141.5' with filter sand.
Monitoring well installed. See well installation diagram.

55' of 6" permanent casing

Note: PL* indicates 3" plastic liner

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

49.0	WS OR WD WD	BORING STARTED 02/28/91	STS OFFICE Lansing-07
BCR	ACR	BORING COMPLETED 03/06/91	ENTERED BY DOS
			SHEET NO. 3 OF 3
WL		RIG/FOREMAN CME-550/DR	APP'D BY AMM
			STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-146

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

○ UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % ✕ - - - - WATER CONTENT % ● - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 871.4	UNIT DRY WT. LBS./FT.^{3}	PLASTIC LIMIT ✕ / WATER CONTENT ● / LIQUID LIMIT △	STANDARD PENETRATION ⊗
			HS			Boring advanced without sampling to 41.0'. See MW-147 boring log for soil classification.			
40.0									
		1	PL	✕		Sandy clay, little silt, trace to little gravel - gray. (CL)		✕ △	105 ⊗
						Boring advanced without sampling from 43.0' to 135.0'. See MW-145 boring log for soil classification from samples.			
45.0									
50.0									
55.0									
60.0									
65.0									
70.0									
75.0									

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840 SHEET NO. 1 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-146

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % X - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	UNIT DRY WT. LBS./FT.^{3}
						Continued from previous page	
75.0						Boring advanced without sampling from 43.0' to 135.0'. See MW-145 boring log for soil classification from samples.	
			RB				
80.0							
85.0							
90.0							
95.0							
100.0							
105.0							
110.0							
115.0							

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual

STS JOB NO. 71840

SHEET NO. 2 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-146

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

—○— UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % × - - - - WATER CONTENT % ● - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	UNIT DRY WT. LBS./FT.^{3}	WATER CONTENT %	STANDARD PENETRATION BLOWS/FT.
						Continued from previous page			
115.0						Boring advanced without sampling from 43.0' to 135.0'. See MW-145 boring log for soil classification from samples.			
120.0									
125.0			RB						
130.0									
135.0		2	PLX			Silt, little clay and fine sand, trace medium to coarse sand - brownish gray - dense - moist to wet. (ML)		●	85 ⊗
136.5									

END OF BORING

Boring advanced to 40.0' with 4.25" hollow stem auger.
Boring advanced from 40.0' to 135.0' using washed rotary drilling techniques.
Boring backfilled from 133.0 to 136.5' with filter sand.
Monitoring well installed. See well installation diagram.

40' of 6" permanent casing.

PLX indicates 3" plastic liner.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 40.0 WS OR WD WD	BORING STARTED 02/07/91	STS OFFICE Lansing-07	
WL BCR ACR	BORING COMPLETED 02/08/91	ENTERED BY DOS	SHEET NO. 3 OF 3
WL	RIG/FOREMAN B-61/JL	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-148

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

-○- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % ✕ - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

SURFACE ELEVATION 869.2

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	
			HS		Boring advanced without sampling to 60.0'. See MW-149 boring log for soil classification.		
60.0			HS		Silty clay, trace fine sand - gray. (CL-ML) Drillers observation: 6" layer of cobbles at 63'		
		1	SS			0/0	●✕ △
			AB				
65.0		1A	SS		Silty sand, little clay, trace fine gravel - brown - very dense - saturated. (SM)	0/0	⊗ 57
			AB				
70.0					Boring advanced without sampling from 66.5 to 130.0'. See MW-147 boring log for soil classification from samples.		
75.0							
80.0			AB				
85.0							
90.0							
					Field observation: Fine to coarse sand - brown.		
95.0							

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-148

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5 PLASTIC LIMIT % × - - - WATER CONTENT % ● - - - LIQUID LIMIT % △ 10 20 30 40 50 ⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50
						Continued from previous page		
95.0						Field observation: Fine to coarse sand - brown.		
100.0								
105.0								
110.0			RB					
115.0								
120.0								
125.0								
130.0		2	SS			Fine to medium sand, little coarse sand, trace silt, clay and fine gravel - brownish gray - extremely dense - saturated. (SP)	0/0	● ⊗ 112
			RB					
135.0								
						... continued		

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 2 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

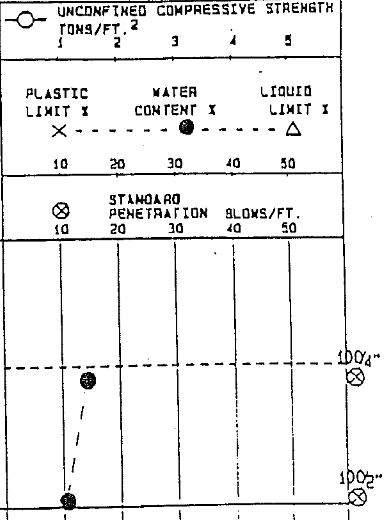
PROJECT NAME
HYDROGEOLOGIC STUDY

LOG OF BORING NUMBER MW-148

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
135.0		3	SS			Fine to medium sand, little coarse sand, trace silt, clay and fine gravel - brownish gray - extremely dense - saturated. (SP)	0/0
			RB				
140.0							0/0
140.5							



END OF BORING

Boring advanced to 60.0' with 4.25" hollow stem auger.
Boring advanced from 60.0 to 140.5' using washed rotary drilling techniques.
Boring backfilled from 135.0 to 140.5' with filter sand.
Monitoring well installed. See well installation diagram.

68' of 6" permanent casing

Note: PL* indicates 3" plastic liner

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 26.0 WS OR WD WD	BORING STARTED 02/01/91	STS OFFICE Lansing-07	
WL BCR ACR	BORING COMPLETED 02/03791	ENTERED BY DDS	SHEET NO. 3 OF 3
WL	RIG/FOREMAN 8-61/JL	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-149

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

ITE LOCATION
ORTAGE, MICHIGAN

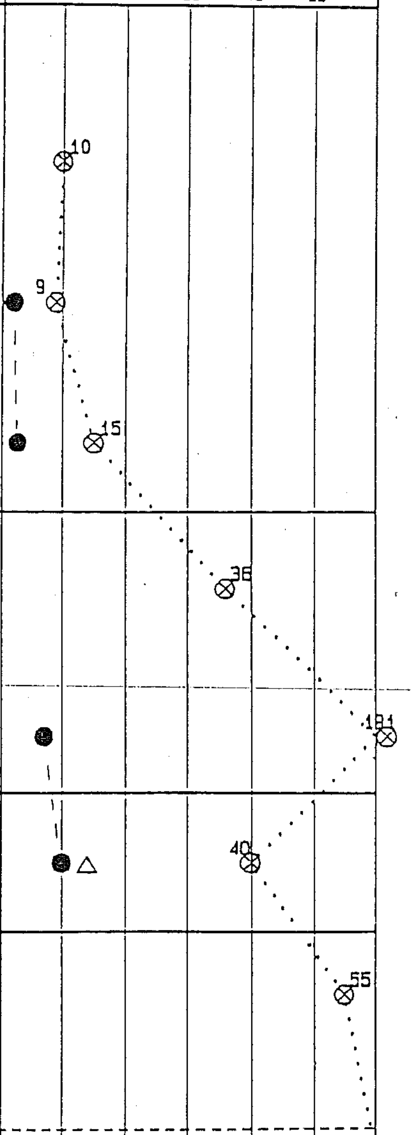
UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

SURFACE ELEVATION 869.1

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	STANDARD PENETRATION BLOWS/FT.
			HS			Fine to medium sand, trace silt and coarse sand - brown - loose to medium dense - moist. (SP)		
5.0		1	SS				0/0	10
			HS					
10.0		2	SS				0/0	9
			HS					
15.0		3	SS				0/0	15
			HS					
			HS			Fine to medium sand, some silt, little coarse sand, little to trace gravel, trace clay - brownish gray - dense to extremely dense - moist (SM)		
20.0		4	SS				0/0	36
			HS					
25.0		5	PL×					101
			HS					
			HS			Sandy silt, some clay - brown - dense - moist to wet. (ML-CL)		
30.0		6	SS				0/0	40
			RB					
			RB			Silty fine sand, little clay, little fine gravel, trace medium to coarse sand - gray - very dense - saturated. (SM)		
35.0		7	SS				0/0	55
			RB					
40.0								



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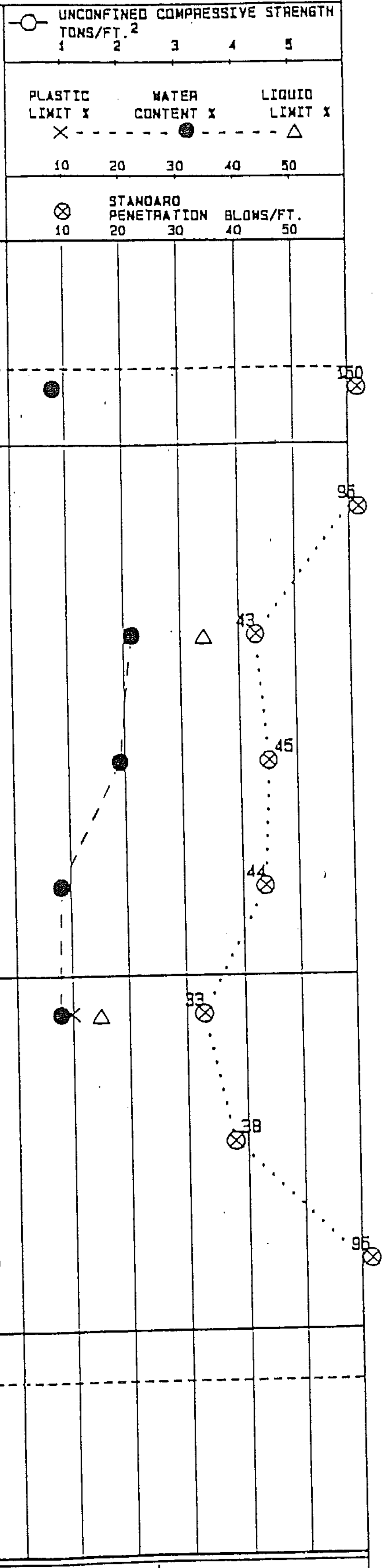
The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 6

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY
	PROJECT NAME HYDROGEOLOGIC STUDY
LOG OF BORING NUMBER	MW-149
ARCHITECT-ENGINEER	
SITE LOCATION	PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
40.0		8	PL×			Silty fine sand, little clay, little fine gravel, trace medium to coarse sand - gray - very dense - saturated. (SM)	
			AB				
			AB			Fine sandy silt, trace fine gravel, and medium to coarse sand - gray - medium dense to extremely dense - saturated. (ML)	
45.0		9	SS				0/0
			AB				
50.0		10	SS				0/0
			AB				
55.0		11	SS				0/0
			AB				
60.0		12	PL×				
			AB				
			AB			Silty clay, little to some sand, trace gravel - gray. (CL-ML)	
65.0		13	SS				0/0
			AB				
70.0		14	SS				0/0
			AB				
75.0		15	SS				0/0
			AB				
			AB			Silty fine sand, and clay, trace medium to coarse sand - brownish gray - very dense to extremely dense - saturated. (SM)	
80.0							



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 2 OF 6

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

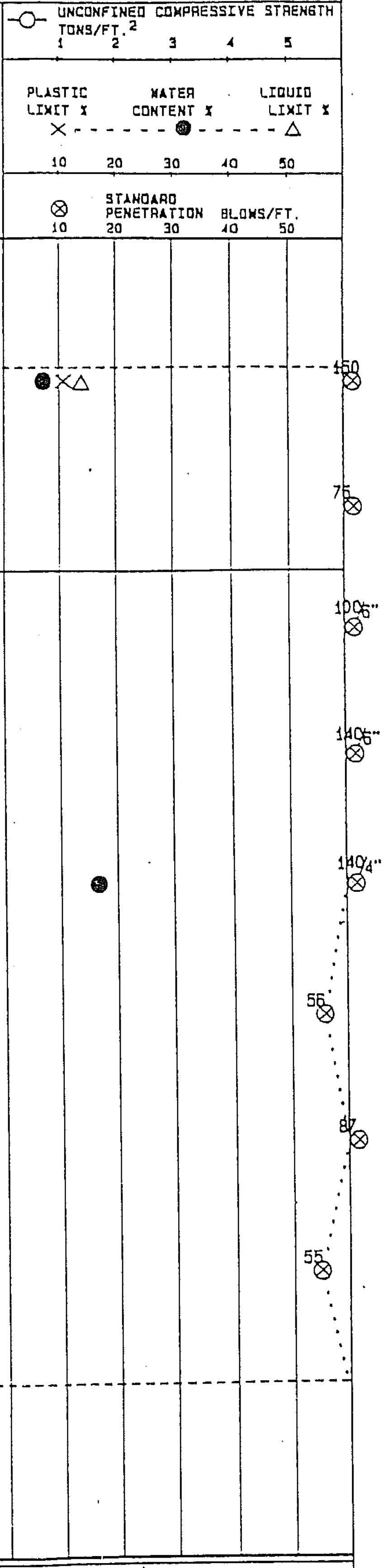
LOG OF BORING NUMBER MW-149

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	STANDARD PENETRATION BLOWS/FT.
						Continued from previous page		
80.0		16	PL×			Silty fine sand, and clay, trace medium to coarse sand - brownish gray - very dense to extremely dense - saturated. (SM)		150
			RB					
85.0		17	SS				0/0	75
			RB					
			RB			Gravelly fine to coarse sand, trace silt and clay - brownish gray - dense to extremely dense - saturated. (SP)		
90.0		18	SS				0/0	100/6"
			RB					
95.0		19	SS				0/0	140/6"
			RB					
100.0		20	PL×					140/4"
			RB					
105.0		21	SS				0/0	56
			RB					
110.0		22	SS				0/0	87
			RB					
115.0		23	SS				0/0	55
			RB					
120.0								



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 3 OF 6

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-149

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × – – – WATER CONTENT % ● – – – LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

SURFACE ELEVATION

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	STANDARD PENETRATION BLOWS/FT.
						Continued from previous page		
20.0		24	PL*			Gravelly fine to coarse sand, trace silt and clay - brownish gray - dense to extremely dense - saturated. (SP)		150
			RB					
25.0		25	SS				0/0	110
			RB					
30.0		26	SS				0/0	107/6"
			RB					
35.0		27	SS				0/0	100/4"
			RB					
40.0		28	SS*				0/0	118
			RB					
45.0		29	PL*					119
			RB					
50.0		30	SS				0/0	44
			RB					
55.0		31	SS				0/0	53
			RB					
60.0								

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 4 OF 6

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-149

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

ITE LOCATION
ORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % ✕ - - - WATER CONTENT % ● - - - LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

SURFACE ELEVATION

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	WATER CONTENT %	STANDARD PENETRATION BLOWS/FT.
				Continued from previous page			
160.0		32	SS	Gravelly fine to coarse sand, trace silt and clay - brownish gray - dense to extremely dense - saturated. (SP)	0/0		52
			RB				
165.0		33	PL✕			●	119
			RB				
			RB	Fine to medium sand, little gravel, trace silt and coarse sand - brownish gray - extremely dense - saturated. (SP)			
170.0		34	SS		0/0		104 6"
			RB				
175.0		35	SS		0/0		103
			RB				
180.0		36	PL✕			●	150 3"
			RB				
185.0		37	SS		0/0		95 6"
			RB				
190.0		38	SS		0/0		100 6"
			RB				
195.0		39	SS		0/0		105 4"
			RB				
200.0							

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840 SHEET NO. 5 OF 6

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-149

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

○ UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - WATER CONTENT % ● - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	STANDARD PENETRATION BLOWS/FT.
						SURFACE ELEVATION		
						Continued from previous page		
200.0		40	PL*			Fine to medium sand, little gravel, trace silt and coarse sand - brownish gray - extremely dense - saturated. (SP)		163/5" ⊗
			RB					
205.0		41	SS				0/0	147/6" ⊗
			RB					
210.0		42	SS				0/0	100/3" ⊗
			RB					
215.0		43	SS				0/0	100/3" ⊗
			RB					
220.0		44	PL*					80/3"* ⊗
221.0								

END OF BORING

Boring advanced to 30.0' using 4.25" hollow stem augers.
Boring advanced from 30.0 to 221.0' using washed rotary drilling techniques.
Monitoring well installed. See well installation diagram.

65' of 6" permanent casing.

Note: PL* indicates 3" plastic liner.
Note: ⊗* indicates 300 lb. hammer used.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 32.0 WS OR WD WD	BORING STARTED 01/23/91	STS OFFICE Lansing-07	
BCR ACR	BORING COMPLETED 01/30/91	ENTERED BY COS	SHEET NO. 6 OF 6
WL	RIG/FOREMAN B-61/JL	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-151

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 869.5

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
			HS			Boring advanced without sampling to 50.0 ft. See MW-152 boring log for soil classification.	
50.0		1	SS			Silty fine sand, trace clay - brownish gray - medium dense - saturated. (SM)	0/0
			RB				
			RB			Fine to medium sand, little to trace silt, trace coarse sand and fine gravel - brown - extremely dense - saturated. (SP-SM)	
55.0		2	PL				
			RB				
60.0		3	PL				
			RB				
65.0						Boring advanced without sampling from 61.5' to 138.0'. See MW-152 boring log for soil classification.	
70.0							
75.0							
80.0							
85.0							

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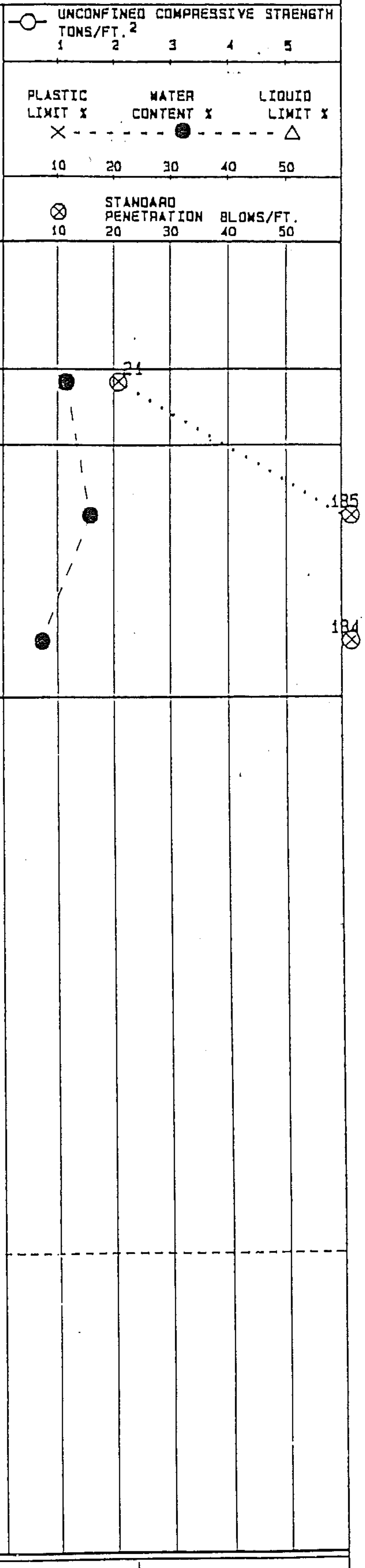


The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER **MW-151**

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

-O- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
85.0						Boring advanced without sampling from 61.5' to 138.0'. See MW-152 boring log for soil classification.	
90.0							
95.0			A8				
100.0							
105.0							
110.0							
115.0							
120.0							
125.0							

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 2 OF 3

STS Consultants Ltd.

OWNER **THE UPJOHN COMPANY**	LOG OF BORING NUMBER **MW-151**
PROJECT NAME **HYDROGEOLOGIC STUDY**	ARCHITECT-ENGINEER
SITE LOCATION **PORTAGE, MICHIGAN**	

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	―○― UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5 PLASTIC LIMIT % × - - - WATER CONTENT % ● - - - LIQUID LIMIT % △ 10 20 30 40 50 ⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50
125.0						Continued from previous page		
130.0			RB			Boring advanced without sampling from 61.5' to 138.0'. See MW-152 boring log for soil classification.		
135.0			RB			Drillers observation: Gravel and cobble strata; Water loss occured while drilling.		
140.0		4	PL*			Sandy silt, trace coarse sand - gray - dense - saturated. (ML)		● 88 ⊗

END OF BORING

Boring advanced to 50.0' with 4.25" hollow stem auger.
Boring advanced from 50.0 to 140.0' using washed rotary drilling techniques.
Boring backfilled from 137.0 to 140.0' with filter sand.
Monitoring well installed. See well installation diagram.

60.0' of 6" permanent casing

Note: PL* indicates 3" plastic liner.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 38.3 WS OR WD WD	BORING STARTED 02/02/91	STS OFFICE Lansing-07	
BCR ACR	BORING COMPLETED 02/03/91	ENTERED BY DDS	SHEET NO. 3 OF 3
WL	RIG/FOREMAN B-61/DG	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

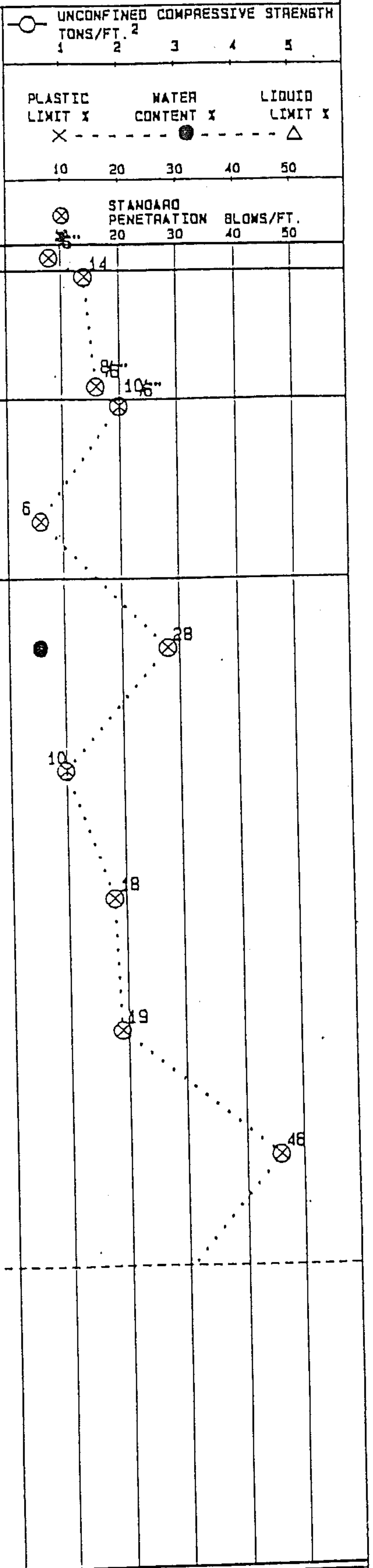
LOG OF BORING NUMBER MW-152

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						SURFACE ELEVATION 868.9	
		1	SS			Clayey sand, trace organics and silt - dark brown - loose - moist. (TOPSOIL)	
		1A	SS			Clayey sand, trace silt - brown - medium dense - moist. (SC)	0/0
			HS				
5.0		2	SS				0/0
		2A	SS			Sandy clay, trace silt and fine gravel - brown - (CL)	0/0
			HS				
10.0		3	SS				0/0
			HS				
			HS			Fine to medium sand, trace to some fine to medium gravel and coarse sand, trace silt - dark to light brown - medium dense to dense - moist to saturated. (SP-GP)	
15.0		4	PL				
			HS				
20.0		5	SS				0/0
			HS				
25.0		6	SS				0/0
			HS				
30.0		7	SS				0/0
			HS				
35.0		8	PL				
			HS				
40.0							



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 5

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

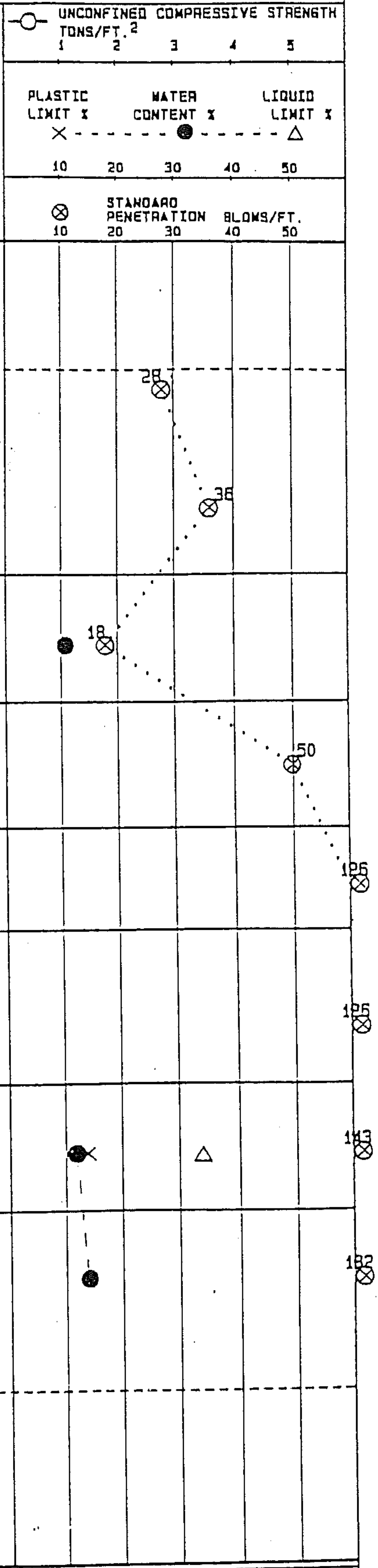
LOG OF BORING NUMBER MW-152

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	STANDARD PENETRATION BLOWS/FT.
			SURFACE ELEVATION		
			Continued from previous page		
40.0	9	SS	Fine to medium sand, trace to some fine to medium gravel and coarse sand, trace silt - dark to light brown - medium dense to dense - moist to saturated. (SP-GP)	0/0	28
		HS			
45.0	10	SS		0/0	36
		RB			
		RB	Silty fine sand, trace medium to coarse sand, fine gravel and clay - gray - medium dense - saturated. (SM)		
50.0	11	SS		0/0	18
		RB			
		RB	Fine to medium sand, trace silt - brownish gray - very dense - saturated. (SP)		
55.0	12	PL			50
		RB			
		RB	Silty clay, little fine to coarse sand and fine gravel - grayish brown. (CL)		
60.0	13	SS		0/0	126
		RB			
		RB	Fine to medium sand, trace silt, clay and fine gravel - grayish brown - extremely dense - saturated. (SP)		
65.0	14	SS		0/0	125
		RB			
		RB	Silty clay, little fine to coarse sand and fine gravel - grayish brown. (CL)		
70.0	15	SS		0/0	143
		RB			
		RB	Fine to medium sand, trace silt and fine gravel - brown - very dense to extremely dense - saturated. (SP) Geologist observation: Black peat lenses from 110 to 111 ft.		
75.0	16	PL			132
		RB			
80.0					



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 2 OF 5

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-152

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × WATER CONTENT % ● LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

SURFACE ELEVATION

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	WATER CONTENT %	STANDARD PENETRATION BLOWS/FT.
						Continued from previous page			
80.0		17	SS			Fine to medium sand, trace silt and fine gravel - brown - very dense to extremely dense - saturated. (SP) Geologist observation: Black peat lenses from 110 to 111 ft.	0/0		88
			AB						
85.0		18	SS				0/0		84
			AB						
90.0		19	SS				0/0		68
			AB						
95.0		20	PL×					●	104
			AB						
100.0		21	SS				0/0		97
			AB						
105.0		22	SS				0/0		77
			AB						
110.0		23	SS				0/0		86
			AB						
115.0		24	PL×					●	120/6"
			AB						
120.0									

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 3 OF 5

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-152
	PROJECT NAME HYDROGEOLOGIC STUDY	ARCHITECT-ENGINEER
SITE LOCATION PORTAGE, MICHIGAN		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} ○ 1 2 3 4 5

PLASTIC LIMIT % × WATER CONTENT % ● LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	WATER CONTENT %	STANDARD PENETRATION BLOWS/FT.
				Continued from previous page			
120.0		25	SS	Fine to medium sand, trace silt and fine gravel - brown - very dense to extremely dense - saturated. (SP)	0/0		186
			AB				
125.0		26	SS		0/0		88
			AB				
130.0		27	SS		0/0		181
			AB				
135.0		28	SS		0/0		146
			AB				
			AB	Sandy silt, trace clay - gray - extremely dense - saturated. (ML)			
140.0		29	PLX			●	125/6"
			AB				
			AB	Fine to coarse sand, trace to little silt and fine to medium gravel - brown - extremely dense. saturated. (SP-SM)			
145.0		30	SS		0/0		124/6"
			AB				
150.0		31	SS		0/0		124/6"
			AB				
155.0		32	SS		0/0		180/6"
			AB				
160.0							

... continued

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.	STS JOB NO. 71840	SHEET NO. 4 OF 5

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-152

PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × WATER CONTENT % ● LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)	STANDARD PENETRATION BLOWS/FT.
						SURFACE ELEVATION		
						Continued from previous page		
160.0		33	PL*			Fine to coarse sand, trace to little silt and fine to medium gravel - brown - extremely dense-saturated. (SP-SM)		1606"
			RB					
165.0		34	SS				0/0	956"
			RB					
170.0		35	SS				0/0	746"
			RB					
175.0		36	SS				0/0	145
			RB					
180.0								1986"
180.5		37	PL*					

END OF BORING

Boring advanced to 45.0' with 4.25" hollow stem auger.
Boring advanced from 45.0 to 180.5' using washed rotary drilling techniques.
Boring backfilled from 170.0 to 180.5' with filter sand.
Monitoring well installed. See well installation diagram.

60.0' of 6" permanent casing.

Note: PL* indicates 3" plastic liner.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 36.0	WS OR WD WS	BORING STARTED 01/22/91	STS OFFICE Lansing-07
BCR	ACR	BORING COMPLETED 01/25/91	ENTERED BY DDS — SHEET NO. 5 OF 5
WL		RIG/FOREMAN B-61/DG	APP'D BY AMM — STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-153

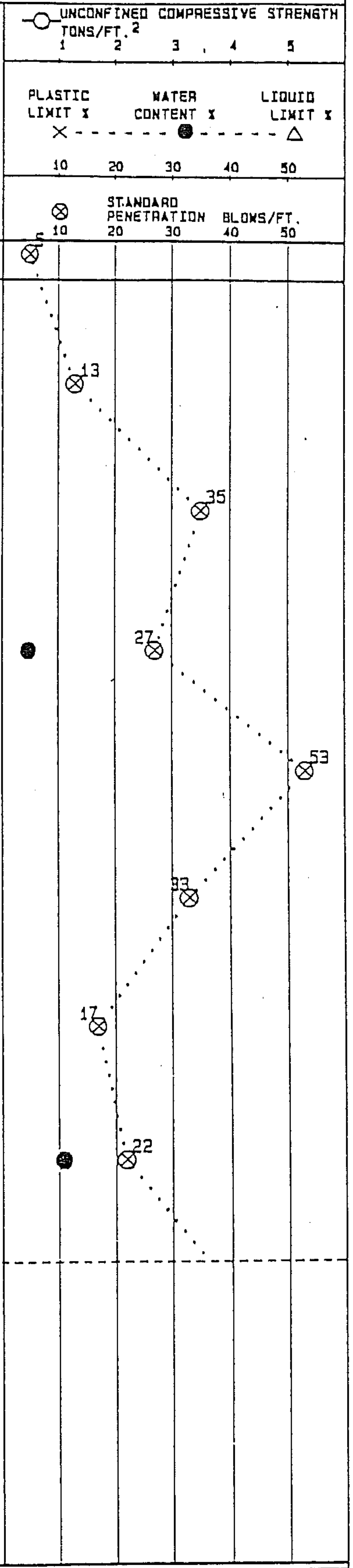
PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 866.2

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
		1	SS			Sandy clay, little silt and organics, trace fine gravel - dark brown - loose - moist. (TOPSOIL)	0/0
			HS			Fine to medium sand, little to trace silt, trace coarse sand and fine gravel - brown - medium dense to very dense - moist to saturated. (SP-SM)	
5.0		2	SS				0/0
			HS				
10.0		3	SS				0/0
			HS				
15.0		4	PL*				
			HS				
20.0		5	SS				0/0
			HS				
25.0		6	SS				0/0
			HS				
30.0		7	SS				0/0
			HS				
35.0		8	PL*				
			HS				
40.0							



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840

SHEET NO. 1 OF 4

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-153

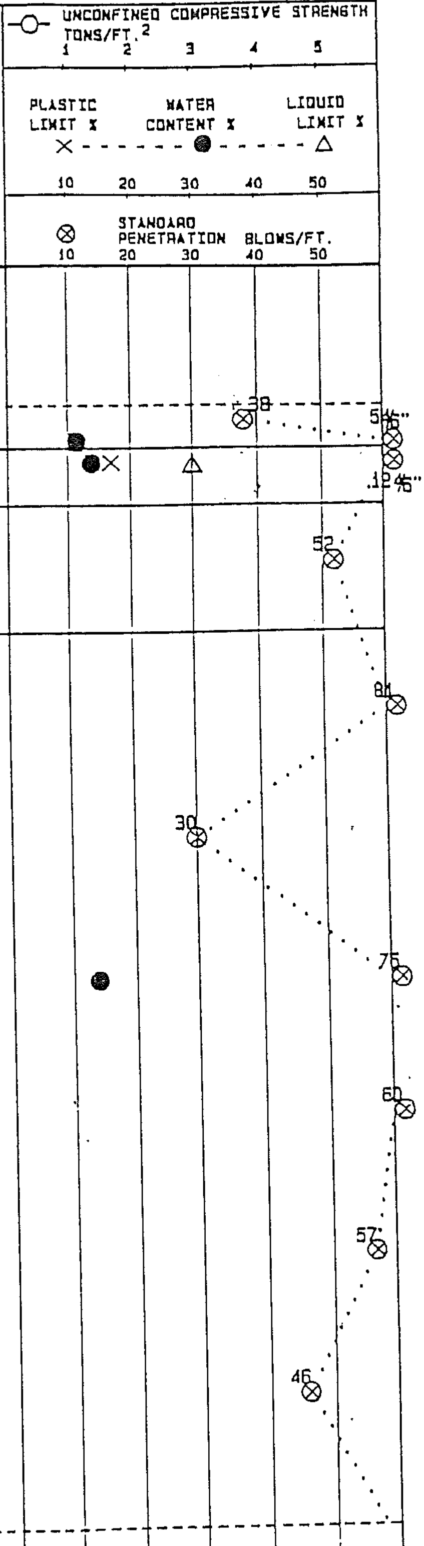
PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
40.0		9	SS			Fine to medium sand, little to trace silt, trace coarse sand and fine gravel - brown - medium dense to very dense - moist to saturated. (SP-SM)	0/0
		10	PL				
		10A	PL				
			AB				
			AB			Silty clay, some fine sand, trace fine gravel and medium to coarse sand - gray. (CL)	
45.0		11	SS			Silty fine sand, trace medium sand - gray - very dense - saturated. (SM)	0/0
			AB				
			AB			Fine to medium sand, little coarse sand, trace fine gravel, silt and clay - brown - dense to extremely dense - saturated. (SP-SW)	
50.0		12	SS				0/0
			AB				
55.0		13	SS				0/0
			AB				
60.0		14	PL				
			AB				
65.0		15	SS				0/0
			AB				
70.0		16	SS				0/0
			AB				
75.0		17	SS				0/0
			AB				
80.0							



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

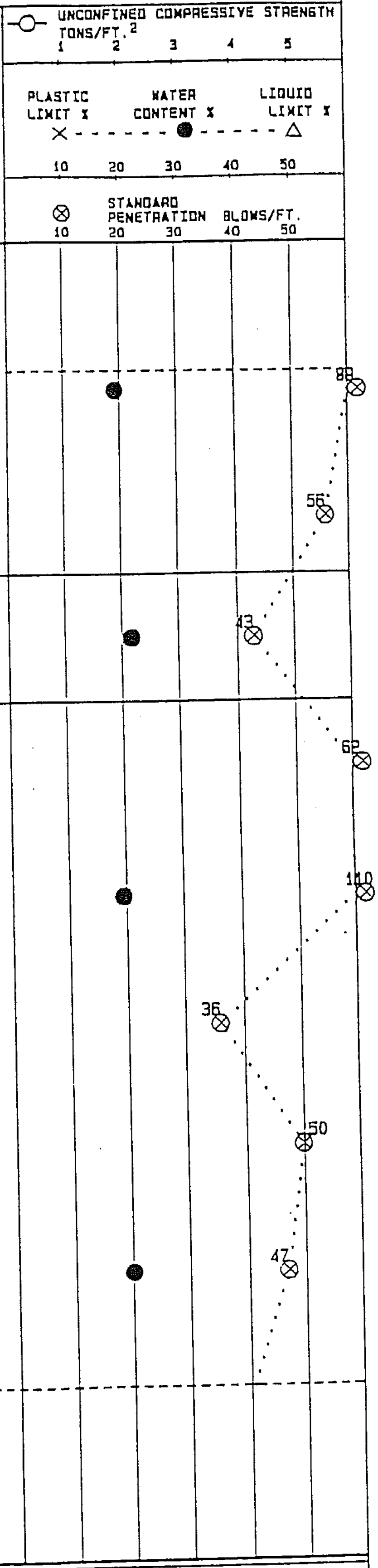
STS JOB NO. 71840

SHEET NO. 2 OF 4

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER MW-153
	PROJECT NAME HYDROGEOLOGIC STUDY	ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
80.0		18	PL			Fine to medium sand, little coarse sand, trace fine gravel, silt and clay - brown - dense to extremely dense - saturated. (SP-SW)	
			RB				
85.0		19	SS				0/0
			RB				
			RB			Fine to medium sand, some silt, trace coarse sand - brownish gray - dense - saturated. (SM)	
90.0		20	SS				0/0
			RB				
			RB			Fine sand, trace medium to coarse sand, fine gravel and silt - brown - dense to extremely dense - saturated. (SP)	
95.0		21	SS				0/0
			RB				
100.0		22	PL				
			RB				
105.0		23	SS				0/0
			RB				
110.0		24	SS				0/0
			RB				
115.0		25	SS				0/0
			RB				
120.0							



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71840 SHEET NO. 3 OF 4

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER MW-153

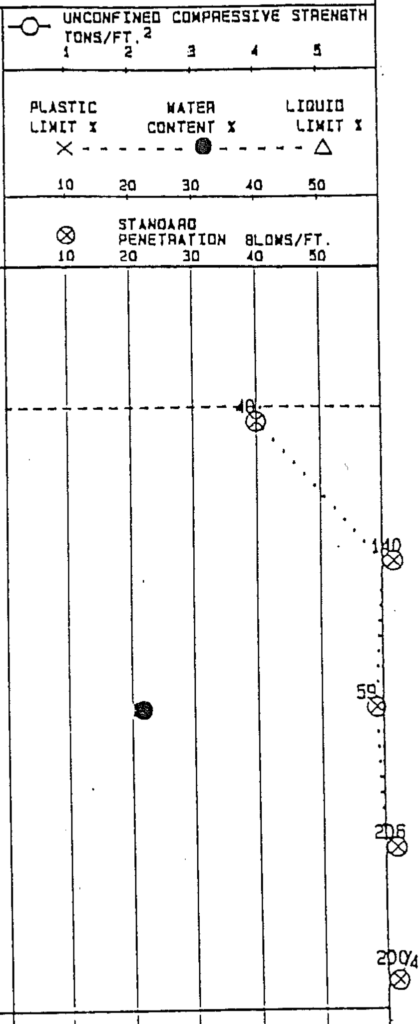
PROJECT NAME
HYDROGEOLOGIC STUDY

ARCHITECT-ENGINEER

ITE LOCATION
ORTAGE, MICHIGAN

SURFACE ELEVATION

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
120.0		26	PL*			Fine sand, trace medium to coarse sand, fine gravel and silt - brown - dense to extremely dense - saturated. (SP)	
			RB				
125.0		27	SS				0/0
			RB				
130.0		28	SS				0/0
			RB				
135.0		29	SS				0/0
			RB				
140.0		30	PL*				
141.5							



END OF BORING

Boring advanced to 50.0' with 4.25" hollow stem auger.
Boring advanced from 50.0 to 141.0' using washed rotary drilling techniques.
Monitoring well installed. See well installation diagram.

47' of 6" permanent casing

PL* indicates 3" plastic liner

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 31.0	WS OR WD WS	BORING STARTED 03/28/91	STS OFFICE Lansing-07
BCR	ACR	BORING COMPLETED 04/04/91	ENTERED BY DDS / SHEET NO. 4 OF 4
WL		RIG/FOREMAN CME-550/BP	APP'D BY AMM / STS JOB NO. 71840

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: The Upjohn Company

[illegible]: Approx. 150' East of Production Well W-34

[illegible]s) Drilled: 12-16-92 and 12-18-92

Logged By: Michael Janeczko

Drilling Co.: Environmental Drilling and Services

Weather Conditions: Cold

Well/Boring ID: MW-158

Page: 1 of 4

Boring Depth: 140'

Boring Diameter: 16.25"

Drilling Method: 12.25" and 4.25" Hollow Stem Auger

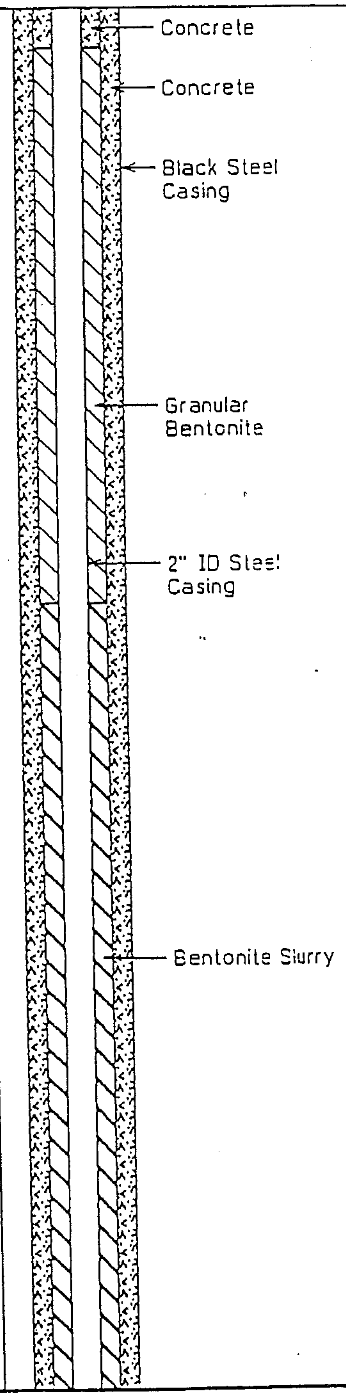
Drilling Equipment: Mobile/Failing Drill Rig

Top of Slots: 135' b.g.l.

Bottom of Slots: 140' b.g.l.

DEPTH feet (bgl)	SAMPLE			PID	STRATA	DESCRIPTION	ELEV. (feet)
	DEPTH	BLOWS COUNTS	RECOVERY				
						TOPSOIL.	
						SAND-fine, some clay, subangular to subrounded, well sorted, medium dense, slightly moist, reddish-brown.	
5							
						SAND-fine to medium, subangular to subrounded, well sorted, medium dense, dry, brown.	
10		4 5 6 5	1.2'	ND			
15							
						COBBLE SEAM.	
						SAND-medium, some fine to medium gravel, subangular to rounded, moderately sorted, loose, dry, brown.	
20		8 11 14 14	1.2'	ND			
25							
						GRAVELLY SAND-coarse, subangular to rounded, poorly sorted, loose, slightly moist, brown.	
30		30 60 70 50	0.5'	ND			
35							

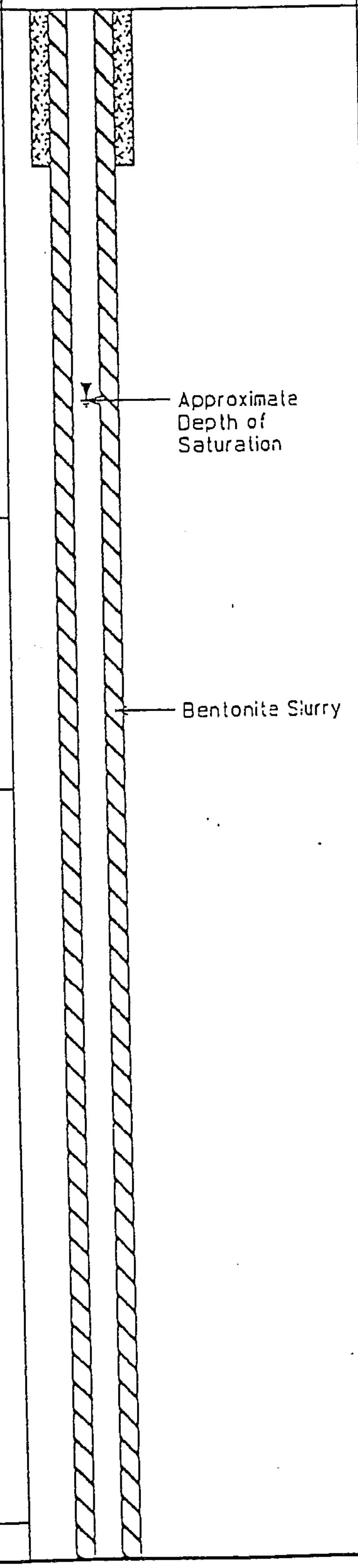
WELL CONSTRUCTION DETAIL



Notes: Interpretation between split-spoon samples done by auger cutting and driller observations.

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: The Upjohn Company
Well/Boring ID: MW-158
Page: 2 of 4

feet (bgl)	SAMPLE			PID	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEV. (feet)
	DEPTH	BLOWS COUNTS	RECOVERY					
		11 15 17 19	1.4'	ND		CLAY-fine to medium, trace fine to coarse gravel, subrounded, moderately sorted, medium stiff, dry to saturated at about 44' bgl, gray.		
		11 14 16 18	1.8'	ND				
40								
45								
						CLAYEY SAND.		
50								
55						GRAVELLY SAND-medium to coarse, subrounded, poorly sorted, very loose, saturated, brown.		
60		8 13 18 19	1.0'	ND				
65								
70								
						SAND- (see next page)		
75								

Notes: Interpretation between split-spoon samples done by auger cutting and driller observations.

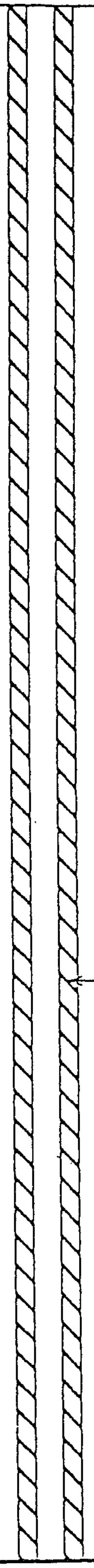
AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: The Upjohn Company

Well/Boring ID: MW-158

Page: 3 of 4

feet (bgl)	SAMPLE			PID	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEV. (feet)
	DEPTH	BLOWS COUNTS	RECOVERY					
						SAND-fine to medium, some fine gravel, subangular, moderately sorted, loose, saturated, brown.		
80	☒	32 20 10 15	1.0'	ND				
85								
90								
95								
100	☒	1 4 3 5	1.0'	ND			Bentonite Slurry	
105								
110						COBBLE SEAM.		
						SAND-fine to coarse, trace fine to medium gravel, subangular, poorly sorted, loose, saturated, brown.		
115								

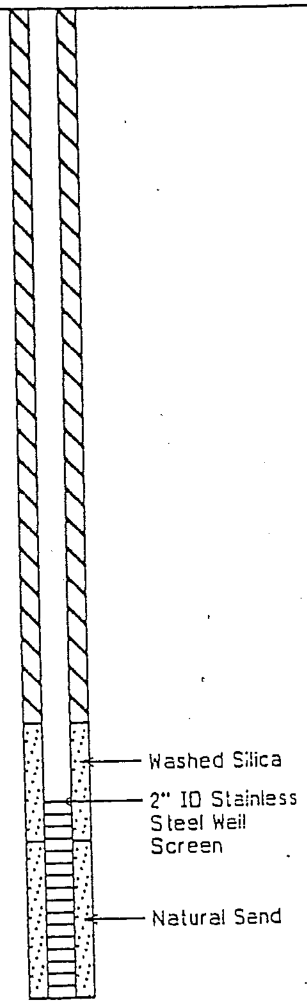


Notes: Interpretation between split-spoon samples done by auger cutting and driller observations.

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: The Upjohn Company Well/Boring ID: MW-158 Page: 4 of 4

feet (bgl)	SAMPLE DEPTH	SAMPLE BLOWS COUNTS	SAMPLE RECOVERY	PID	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEV. (feet)
						SAND-fine to coarse, trace fine to medium gravel, subangular, poorly sorted, loose, saturated, brown.		
120	☒	60 80 60 70	-	ND				
125	☒	2 4 7 8	1.2'	ND				
130	☒	3 8 11 10	1.2'	ND				
135	☒	60 80 50 45	-	ND				
140	☒	50 70 80 50	-	ND				
145								
150								
155								



Notes: Interpretation between split-spoon samples done by auger cutting and driller observations.

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR Upjohn Company - Kalamazoo, Michigan HOLE NO. OS-2

DRILLED BY George Fahrni DRILLER COMPLETED November 20, 1984

Elevation = 867 1910' S of Bishop + 3240' E of Portage

LOCATION West of East service road along tracks by old incinterator

CKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
6' 0"	Sand and clay	6' 0"		
6' 0"	Sand, gravel & clay	12' 0"		
5' 0"	Sand, gravel & clay	17' 0"		
6' 0"	Sand and clay	23' 0"		
4' 0"	Sand, gravel and clay	27' 0"		16' 0"
5' 0"	Gravel, sand and clay	32' 0"		16' 0"
2' 0"	Fine sand, gravel and clay	34' 0"		
3' 0"	Fine sand and clay	37' 0"		

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR Upjohn Company - Kalamazoo, Michigan HOLE NO. OS-3

8" Test Hole

DRILLED BY George Fahrni DRILLER COMPLETED 19

LOCATION

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
3 ft.	Sand & Clay	4 ft.		
11 ft.	Clay & Sand	14 ft.		
5 ft.	Sand & Clay	19 ft.		
9 ft.	Sand & Clay	28 ft.		
4 ft.	Sand & Little Gravel	32 ft.		
4 ft.	Sand & Little Gravel	36 ft.		
6 ft.	Gravel & Sand	42 ft.		
2 ft.	Clay & Fine Sand	44 ft.		

THE OHIO DRILLING CO.

INCORPORATED

MASSILLON, OHIO

DRILLED FOR The Upjohn Company - Kalamazoo, Michigan HOLE NO. OS-5
3" Test Hole

DRILLED BY Dwain Hanson DRILLER COMPLETED March 10, 19 88

LOCATION Near LA1

THICKNESS OF STRATA	STRATA	TOTAL DEPTH	HEAVED	WATER FROM SURFACE
3 ft.	Backfill, Sand & Gravel	3 ft.		
3 ft.	Fine Sand	6 ft.		
16 ft.	Sand & Gravel	22 ft.		
6 ft.	Fine Sand & Little Gravel	28 ft.		
6 ft.	Coarse Sand (red)	34 ft.		
2 ft.	Coarse Sand (red)	36 ft.		35' 0"
4 ft.	Coarse Sand (gray)	40 ft.		
4 ft.	Sand, Gravel & Stones	44 ft.		
1 ft.	Clay, Sand, Gravel & Stones	45 ft.		36' 2"

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

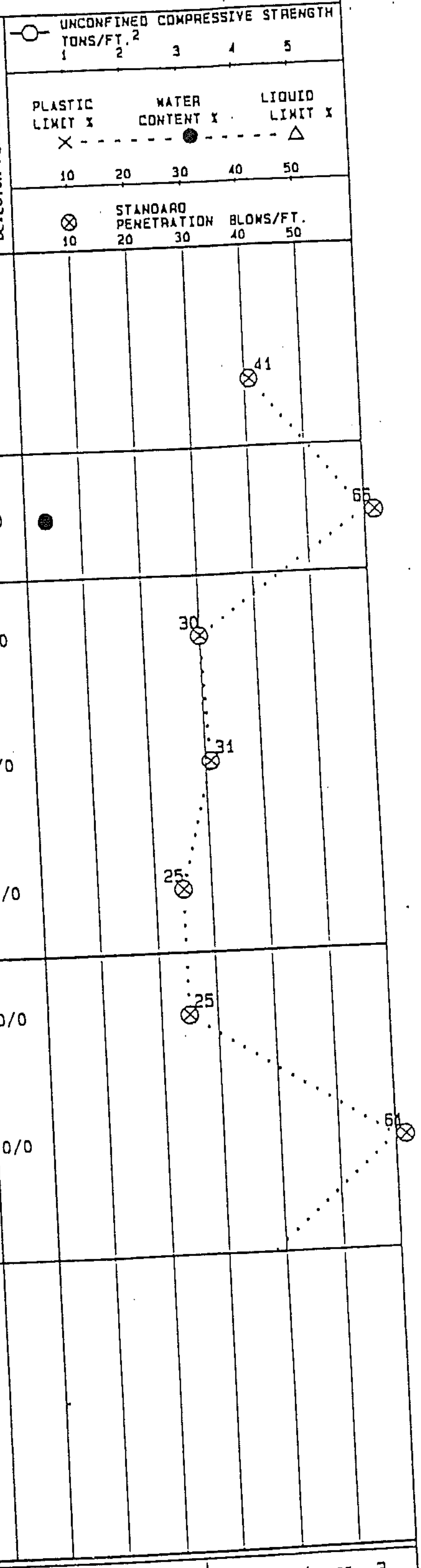
PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

LOG OF BORING NUMBER OS-6B

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						SURFACE ELEVATION	
			CT			Fine to coarse sand, trace silt - brown - dense - moist. (SP)	0/0
5.0		2	SS				
			CT				
			CT			Fine to medium sand, little gravel and coarse sand, trace silt - light brown - very dense - moist. (SW)	0/0
10.0		3	PL				
			CT				
			CT			Fine to medium sand, little coarse sand, trace silt and gravel - brown - medium dense to dense - moist. (SP)	0/0
15.0		4	PL				
			CT				0/0
20.0		5	PL				
			CT				0/0
25.0		6	PL				
			CT				
			CT			Medium sand, little fine to coarse sand and gravel, trace silt - brown - medium dense to very dense - moist to saturated. (SP)	0/0
30.0		7	PL				
			CT				0/0
35.0		8	PL			Saturated at 38.6'.	
			CT				
40.0							



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71797

SHEET NO. 1 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

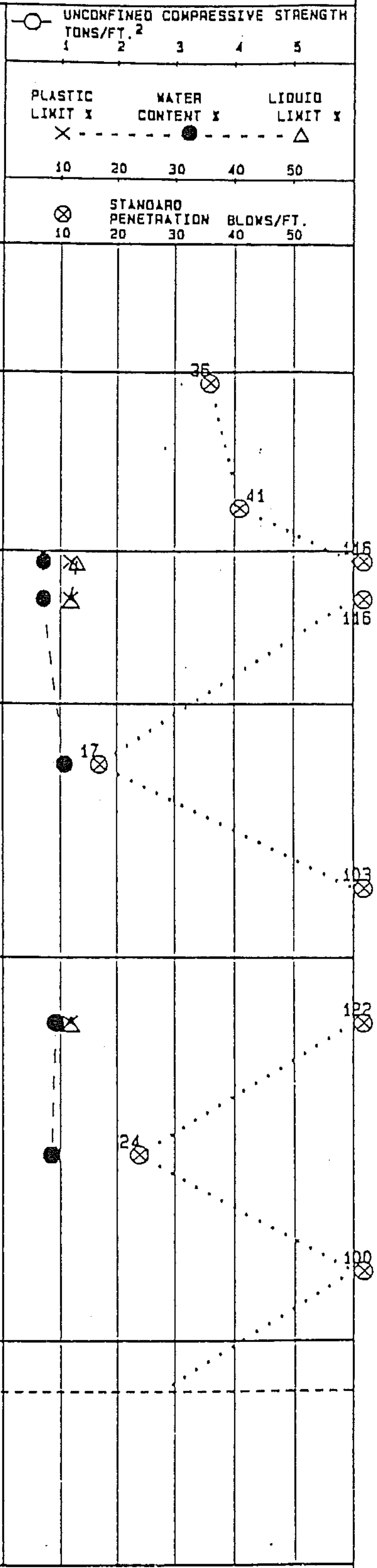
LOG OF BORING NUMBER OS-68

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READINGS (PPM)
						Continued from previous page	
40.0		9	PL			Medium sand, little fine to coarse sand and gravel, trace silt - brown - medium dense to very dense - saturated. (SP) Driller's observation small cobbles encountered from 45.0' to 46.0'.	0/0
			CT				
45.0		10	PL				0/0
			CT				
		11	PL			Fine to coarse sand, little fine gravel and silt, trace clay - gray - extremely dense - saturated. (SM)	0/0
		12	PL				0/0
50.0			CT				
			CT			Fine to medium sand, little coarse sand, trace silt - brown - medium dense to extremely dense - saturated. (SP)	
55.0		13	PL				0/0
			CT				
60.0		14	PL				0/0
			CT				
			CT			Fine medium sand, little silt, trace coarse sand, clay and gravel - brown - medium dense to extremely dense - saturated. (SM) Driller's observation: Strata is interbedded with thin layers of gray silty clay with little sand and gravel. (CL)	
65.0		15	PL				0/0
			CT				
70.0		16	PL				0/0
			CT				
75.0		17	PL				0/0
			CT				
			CT			Fine to medium sand, little coarse sand, trace silt, clay and fine sand - brown - medium dense to dense - saturated. (SW)	
80.0							



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The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

STS JOB NO. 71797

SHEET NO. 2 OF 3

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER OS-68

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

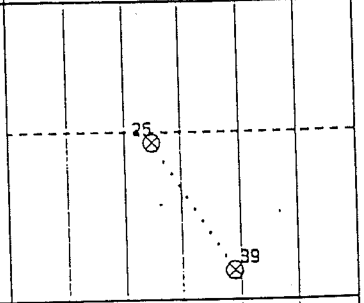
SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	FIELD PHOTO-IONIZATION DETECTOR READING (PPM)
						Continued from previous page	
80.0		18	PL			Fine to medium sand, little coarse sand, trace silt, clay and fine sand - brown - medium dense to dense - saturated. (SW)	0/0
			CT				
85.0		19	PL				0/0
86.5						END OF BORING	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × WATER CONTENT % ● LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50



END OF BORING

Boring advanced to 86.5' with cable tool drilling methods using:

85.0' of 4.5" casing

Boring backfilled from 0 to 86.5' with soil cuttings.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 38.6'	WS OR WD WD	BORING STARTED 03/20/90	STS OFFICE LANSING - 07
BCR 49.0'	ACR	BORING COMPLETED 03/20/90	ENTERED BY TJM / SHEET NO. 3 OF 3
		RIG/FOREMAN 6-F/CT	APP'D BY AMM / STS JOB NO. 71797

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER PZ-1A

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

—○— UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}	
☒						SURFACE ELEVATION 862.6		
			HS			Boring advanced without sampling to 20.0'		
20.0		1	SS			Medium to coarse sand, some fine sand, trace gravel and silt - gray - dense. (SP)		● ⊗ 47
21.5								

END OF BORING

Boring advanced to 20.0' with 3.25" hollow stem auger.
Piezometer installed. See piezometer installation diagram.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL WS OR WD	BORING STARTED 06/30/90	STS OFFICE Lansing-07
BCR ACR	BORING COMPLETED / /	ENTERED BY TJM — SHEET NO. 1 OF 1
WL 14.0' 8.5 hrs AB	RIG/FOREMAN D-50/SB	APP'D BY AMM — STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER PZ-18

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 863.2	UNIT DRY WT. LBS./FT.^{3}	─○─ UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5 PLASTIC LIMIT % × - - - WATER CONTENT % ● - - - LIQUID LIMIT % △ 10 20 30 40 50 ⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50
			HS			Boring advanced without sampling to 20.0'.		
20.0 21.5		1	SS			Fine to medium sand, trace coarse sand, fine gravel, and silt - brownish gray - medium dense. (SP)		⊗ ● 11

END OF BORING

Boring advanced to 20.0' with 3.25" hollow stem auger.
Piezometer installed. See piezometer installation diagram.

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WS OR WD	BORING STARTED 06/30/90	STS OFFICE Lansing-07	
WL BCR ACR	BORING COMPLETED / /	ENTERED BY TJM	SHEET NO. 1 OF 1
WL 14.9' 8.5 hrs AB	RIG/FOREMAN D-50/SB	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER PZ-1C

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

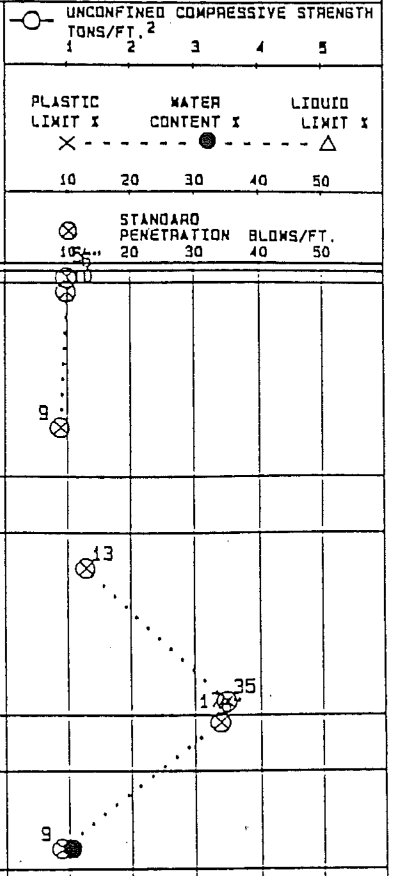
SITE LOCATION
PORTAGE, MICHIGAN

SURFACE ELEVATION 863.8

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
		1	SS			Drillers' observation: Asphalt.	
		1A	SS			Gravelly sand, trace silt - brown - medium dense - desiccated. (FILL)	
			HS			Driller's observation: Road base.	
5.0		2	SS			Fine to medium sand, some to little clay, trace silt, gravel and coarse sand - brown - loose to medium dense - moist. (SC)	
			HS				
		2A	AS			Fine to medium sand, little to trace silt, trace clay and coarse sand - black - moist. (SP-SM)	
		2B	AS				
10.0			HS			Fine to medium sand, trace silt, gravel and coarse sand - brown - medium dense to dense - moist to wet. (SP)	
		3	SS				
			HS				
15.0		4A	SS				
		4B	SS			Fine sand, trace silt - light brown - dense - moist. (SP)	
			HS				
			HS			Medium to coarse sand, some fine to medium gravel, little fine sand, trace silt - brown - loose - saturated. (SW)	
20.0		5	SS				
21.5							

END OF BORING

Boring advanced to 20.0' with 3.25" hollow stem auger.
Piezometer installed. See piezometer installation diagram.



The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 15.0'	WS OR WD WS	BORING STARTED 06/30/90	STS OFFICE Lansing-07		
WL BCR	ACR	BORING COMPLETED 06/30/90	ENTERED BY TJM	SHEET NO. 1	OF 1
WL		RIG/FOREMAN 0-50/SB	APP'D BY AMM	STS JOB NO. 71840	

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER PZ-28
	PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER

ITE LOCATION
PORTAGE, MICHIGAN

-○- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - WATER CONTENT % ● - - - - LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 860.4	UNIT DRY WT. LBS./FT.^{3}	
			HS			Boring advanced without sampling to 15.0'.		
15.0		1	SS			Fine sand, trace silt and medium sand - gray - medium dense - moist. (SP)		⊗●
17.0						END OF BORING Boring advanced to 15.0' with 3.25" hollow stem auger. Piezometer installed. See piezometer installation diagram.		

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WS OR WD DRY	BORING STARTED 06/30/90	STS OFFICE Lansing-07	
BCR ACR	BORING COMPLETED 06/30/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL	RIG/FOREMAN D-50/SB	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.	OWNER THE UPJOHN COMPANY	LOG OF BORING NUMBER PZ-3A
	PROJECT NAME HYDROGEOLOGIC STUDY WORK PLAN	ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

○ UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 872.5	UNIT DRY WT. LBS./FT.^{3}	
			HS			Boring advanced without sampling to 25.0'.		
25.0		1	SS			Fine to medium sand, little coarse sand, trace gravel and silt - brown - dense. (SP)		● ⊗40
27.0						END OF BORING Boring advanced to 25.0' with 4.25" hollow stem auger. Piezometer installed. See piezometer installation diagram.		

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

L 20.2' WS OR WD WD	BORING STARTED 07/01/90	STS OFFICE Lansing-07	
WL BCR ACR	BORING COMPLETED 07/02/90	ENTERED BY TJM	SHEET NO. 1 OF 1
WL 19.2' @.5 hrs AB	RIG/FOREMAN D-50/SB	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

LOG OF BORING NUMBER PZ-38

ARCHITECT-ENGINEER

SITE LOCATION
PORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5

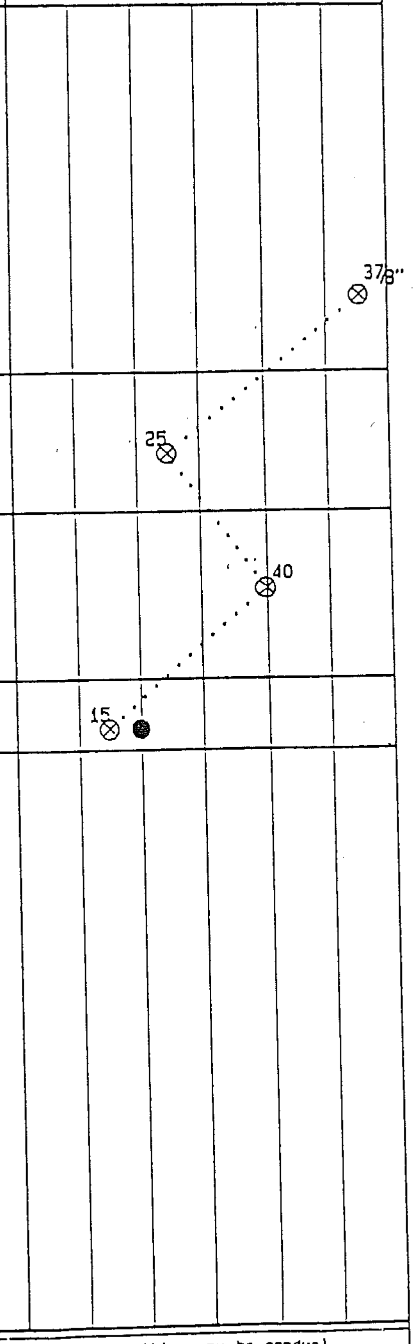
PLASTIC LIMIT % × - - - - WATER CONTENT % ● - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
						SURFACE ELEVATION 875.2	
		1	AS			Gravelly sand, little to trace silt and clay - brown and grayish brown - very dense - moist. (FILL) Driller's observation: Rubble and cobbles.	
5.0			HS				
10.0		2	SS				
			HS				
			HS			Fine to medium sand, little clay and gravel, trace coarse sand- brown - medium dense - moist. (SC)	
15.0		3	SS				
			HS				
			HS			Gravelly medium to coarse sand, trace silt - light brown - dense - desiccated. (SP-GP) Driller's observation: Cobbles and broken gravel.	
20.0		4	SS				
			HS				
25.0			HS			Fine sand - trace medium to coarse sand and silt - brown - medium dense - saturated. (SP)	
25.5		5	SS			Saturated at 24.0'.	

END OF BORING

Boring advanced to 25.0' with 4.25" hollow stem auger.
Piezometer installed. See piezometer installation diagram.



The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 24.0'	WS OR WD WD	BORING STARTED 07/02/90	STS OFFICE Lansing-07
WL BCR	ACR	BORING COMPLETED 07/02/90	ENTERED BY TJM · SHEET NO. 1 OF 1
WL 22.3' @ 25 hrs AB		RIG/FOREMAN D-50/SB	APP'D BY AMM · STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER PZ-4A

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

TE LOCATION
ORTAGE, MICHIGAN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % ✕ - - - - - - WATER CONTENT % ● - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 876.8	UNIT DRY WT. LBS./FT.^{3}
			AB			Boring advanced without sampling to 186.0'.	
186.0						END OF BORING Boring advanced to 10.0' with hollow stem auger. Boring advanced from 10.0' to 186.0' with washed rotary drilling techniques. Piezometer installed. See piezometer installation diagram.	

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WS OR WD	BORING STARTED 08/24/90	STS OFFICE Lansing-07	
BCR ACR	BORING COMPLETED / /	ENTERED BY TJM	SHEET NO. 1 OF 1
WL	RIG/FOREMAN B-61/DG	APP'D BY AMM	STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

LOG OF BORING NUMBER PZ-48

ARCHITECT-ENGINEER

ITE LOCATION
PORTAGE, MICHIGAN

○ UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}
1 2 3 4 5

PLASTIC LIMIT % × - - - - - - WATER CONTENT % ● - - - - - - LIQUID LIMIT % △
10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
☒						SURFACE ELEVATION 878.3	
			AB			Boring advanced without sampling to 186.0'.	
185.0 186.0						END OF BORING Boring advanced to 186.0' with wash rotary drilling techniques. Piezometer installed. See piezometer installation diagram.	

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WS OR WD
WL BCR ACR
WL 23.0' AB

BORING STARTED 09/09/90
BORING COMPLETED / /
RIG/FOREMAN B-61/BP

STS OFFICE Lansing-07
ENTERED BY TJM
SHEET NO. 1 OF 1
APP'D BY AMM
STS JOB NO. 71840

STS Consultants Ltd.

OWNER
THE UPJOHN COMPANY

LOG OF BORING NUMBER PZ-4C

PROJECT NAME
HYDROGEOLOGIC STUDY WORK PLAN

ARCHITECT-ENGINEER

ITE LOCATION
PORTAGE, MICHIGAN

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION 878.6	UNIT DRY WT. LBS./FT.^{3}	—○— UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} 1 2 3 4 5 PLASTIC LIMIT % × - - - WATER CONTENT % ● - - - LIQUID LIMIT % △ 10 20 30 40 50 ⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50
			RB			Boring advanced without sampling to 185.0'.		
185.0								
						END OF BORING Boring advanced to 55.0' with hollow stem auger. Boring advanced from 55.0' to 185.0' with washed rotary drilling techniques. 65.0' of 4.0" permanent casing. Piezometer installed. See piezometer installation diagram.		

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

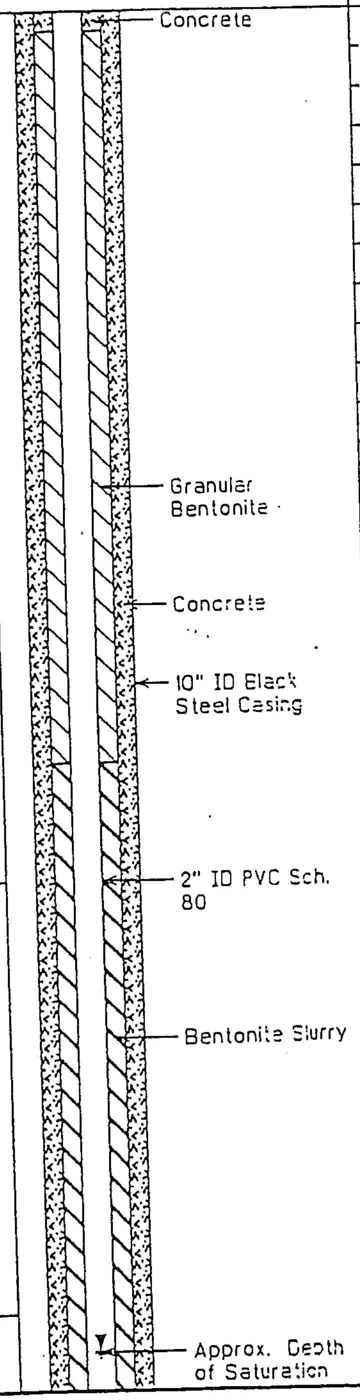
55.0 WS OR WD WD	BORING STARTED 09/17/90	STS OFFICE Lansing-07		
WL BCR 21.0 ACR	BORING COMPLETED 09/20/90	ENTERED BY PSB	SHEET NO. 1 OF 1	
WL	RIG/FOREMAN B-61/BP	APP'D BY AMM	STS JOB NO. 71840	

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: The Upjohn Company
Well/Boring ID: PZ-8
Page: 1 of 4
[illegible]on: Grass field north of building 318.
Boring Depth: 120'
[illegible]ate (s) Drilled: 12-17-92 and 12-21-92
Boring Diameter: 18.25"
Logged By: Michael Janeczko
Drilling Method: 12.25" and 4.25" Hollow Stem Auger
Drilling Co.: Environmental Drilling and Services
Drilling Equipment: Mobile/Failing Drill Rig
Weather Conditions: Cold
Top of Slots: 112' b.g.l.
Bottom of Slots: 117' b.g.l.

DEPTH feet (bgl)	SAMPLE			PID	STRATA	DESCRIPTION	ELEV. (feet)
	DEPTH	BLOWS COUNTS	RECOVERY				
						Sandy Topsoil	
						Sandy Clay-fine to medium, subrounded, moderately sorted, medium stiff, dry, dark brown.	
						Gravelly Sand-coarse, subangular to rounded, poorly sorted, loose, dry, brown.	
5							
10	☒	16 17 18 29	1.0'	ND			
15							
						Sand-fine to medium, subrounded to rounded, well sorted, medium dense, slighty moist, gray-brown.	
20	☒	5 12 13 11	1.2'	ND			
						Silt-fine, subrounded, well sorted, loose, slightly moist, gray-brown.	
25							
30							
						Sand-fine to medium, trace fine gravel, subrounded, moderately sorted, loose, moist to saturated at 34' b.g.l, gray-brown.	
35							

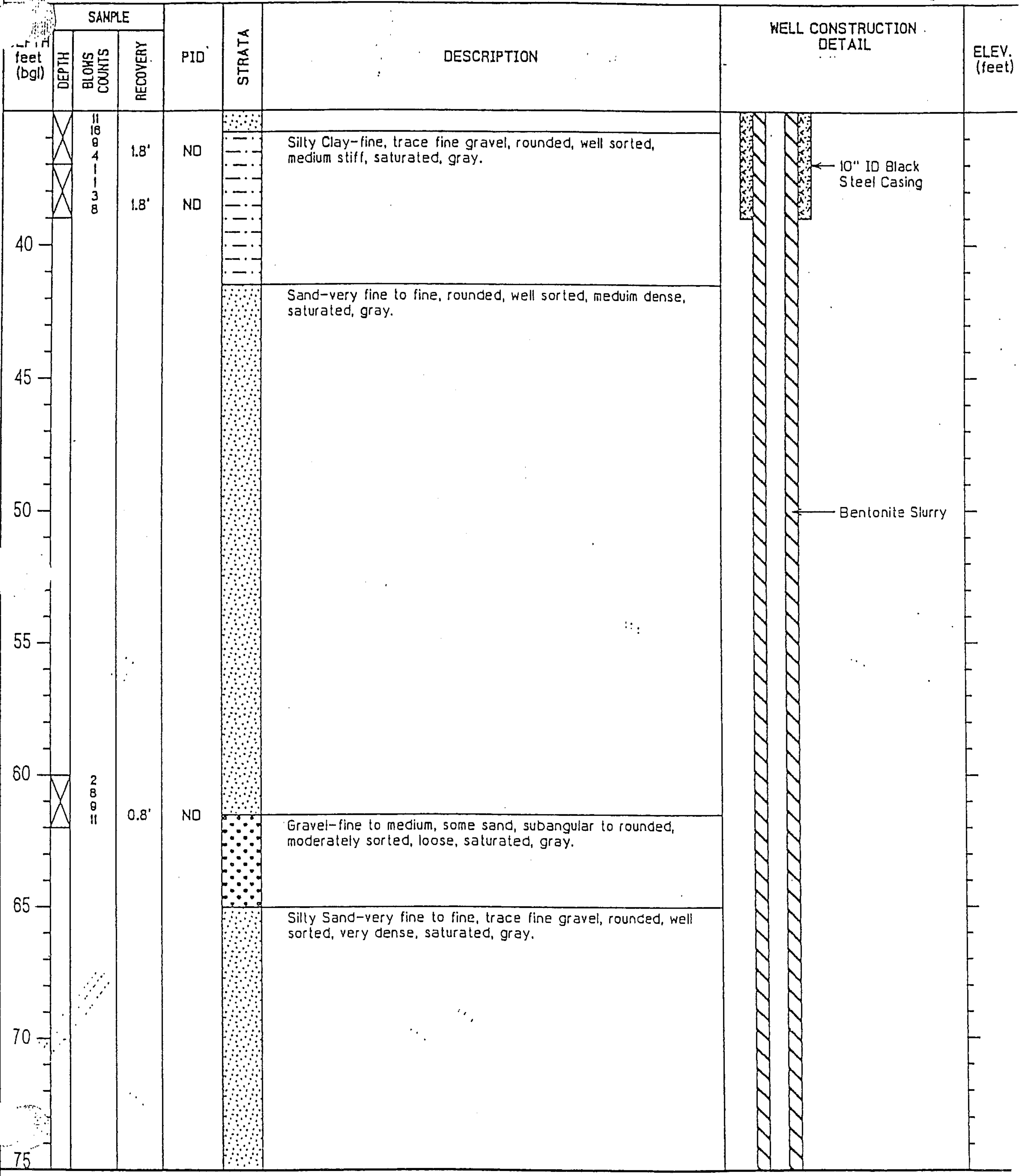
WELL CONSTRUCTION DETAIL



Notes: Interpretation between split-spoon samples done by auger cuttings and drillers observations.

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: The Upjohn Company
Well/Boring ID: PZ-8
Page: 2 of 4



Silty Clay-fine, trace fine gravel, rounded, well sorted, medium stiff, saturated, gray.

Sand-very fine to fine, rounded, well sorted, meduim dense, saturated, gray.

Gravel-fine to medium, some sand, subangular to rounded, moderately sorted, loose, saturated, gray.

Silty Sand-very fine to fine, trace fine gravel, rounded, well sorted, very dense, saturated, gray.

Notes: Interpretation between split-spoon samples done by auger cuttings and drillers observations.

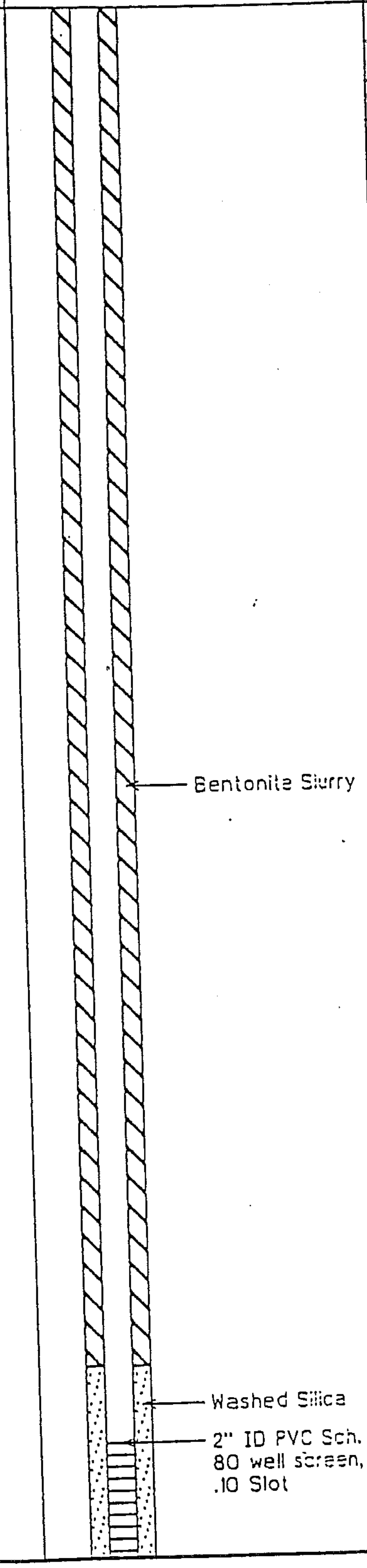
AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

Project: The Upjohn Company

Well/Boring ID: PZ-8

Page: 3 of 4

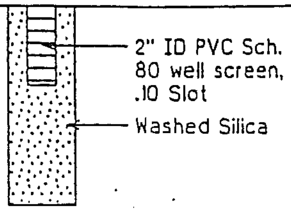
feet (bgl)	SAMPLE			PID	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEV. (feet)
	DEPTH	BLOWS COUNTS	RECOVERY					
80		17 60 13 22	0.8'	ND				
		22 25 27 29	2.0'	ND				
85								
90								
95							Bentonite Slurry	
100		7 5 5 6	1.3'	ND				
105								
110							Washed Silica 2" ID PVC Sch. 80 well screen, .10 Slot	
115								



Notes: Interpretation between split-spoon samples done by auger cuttings and drillers observations.

AMERICAN HYDROGEOLOGY CORPORATION
WELL/BORING LOG
PROJECT #: 226-1534

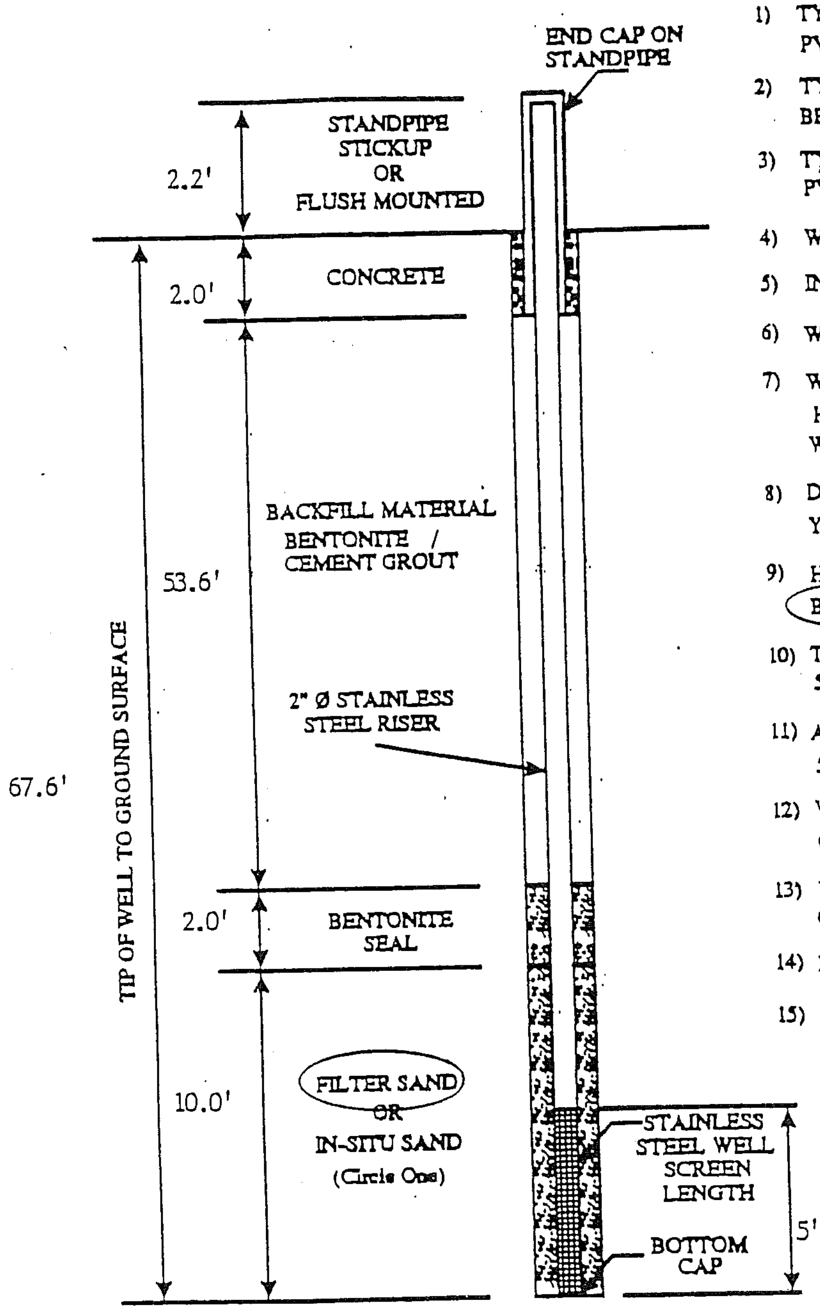
Project: The Upjohn Company
Well/Boring ID: PZ-8
Page: 4 of 4



[illegible]TH feet (bgl)	SAMPLE DEPTH	SAMPLE BLOWS COUNTS	SAMPLE RECOVERY	PID	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEV. (feet)
120	☒	3 3 8 5	1.2'	ND		Garvel-fine to medium, some coarse sand, subrounded, moderately sorted, very loose, saturated, gray.		
125								
130								
135								
140								
145								
150								
155								

Notes: Interpretation between split-spoon samples done by auger cuttings and drillers observations.

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS], OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED], OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED [✓ STAINLESS], OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? YES
HOLLOW STEM AUGER, [✓ ROTARY], CABLE TOOL,
WATER, REVERT [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 10-22-90
5 MIN., 15 MIN, 30 MIN, OTHER 2 Hours

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 85 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID], OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID], OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY
1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
42.10' FT OR DRY
2) OTHER MEASUREMENTS:
DATE 10-31-90 , 42.58 FT FROM T. ST. PIPE
DATE 11-04-90 , 42.48 FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE

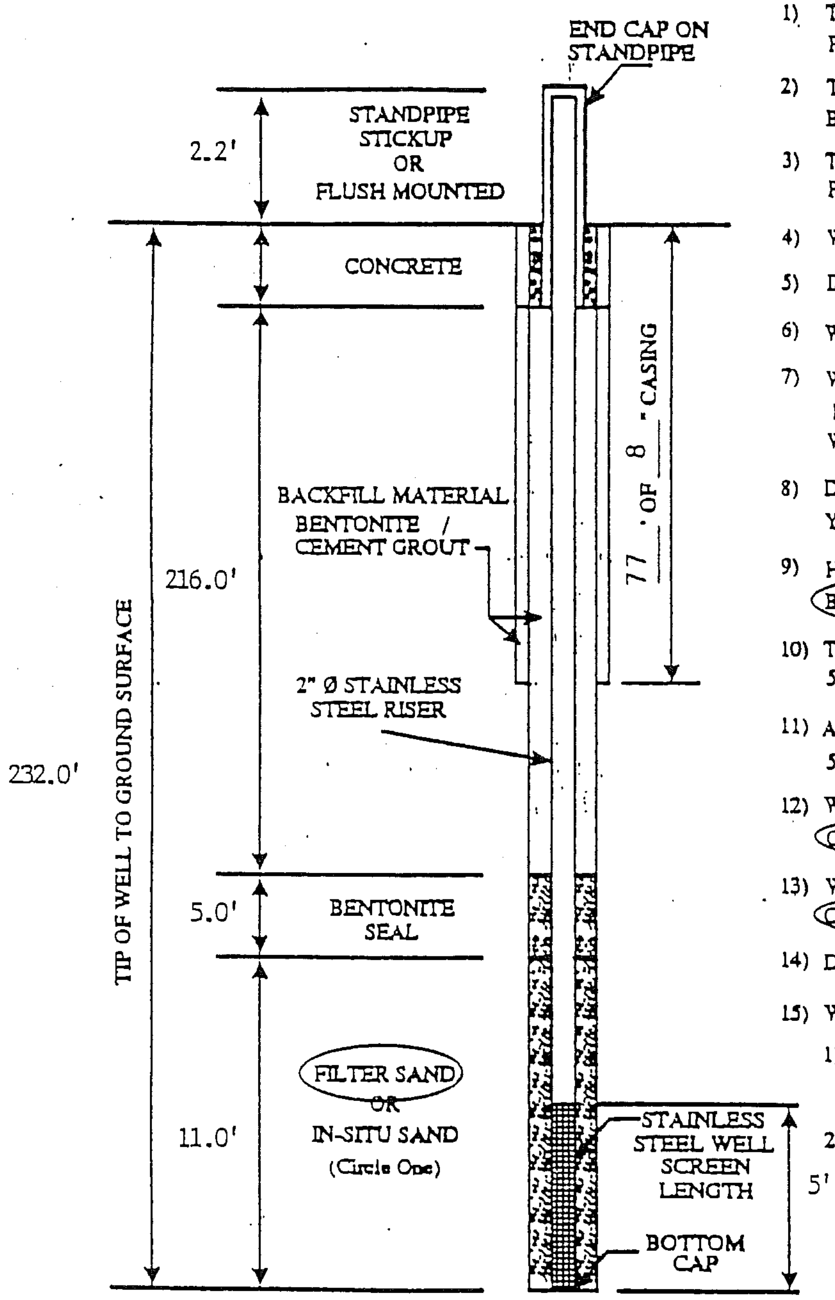
WELL NO. MW-101A DATE INSTALLED 10-19-90 DRILL RIG MOBILE B-61

DRILLER TT DRILL CREW DP

JOB/CLIENT The UpJohn Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
HOLLOW STEM AUGER, [✓ ROTARY], CABLE TOOL,
WATER, REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING], PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 11-09-90
5 MIN., 15 MIN, 30 MIN, OTHER 2½ Hours

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 92 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT? 41.80 FT OR DRY

2) OTHER MEASUREMENTS:

DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE

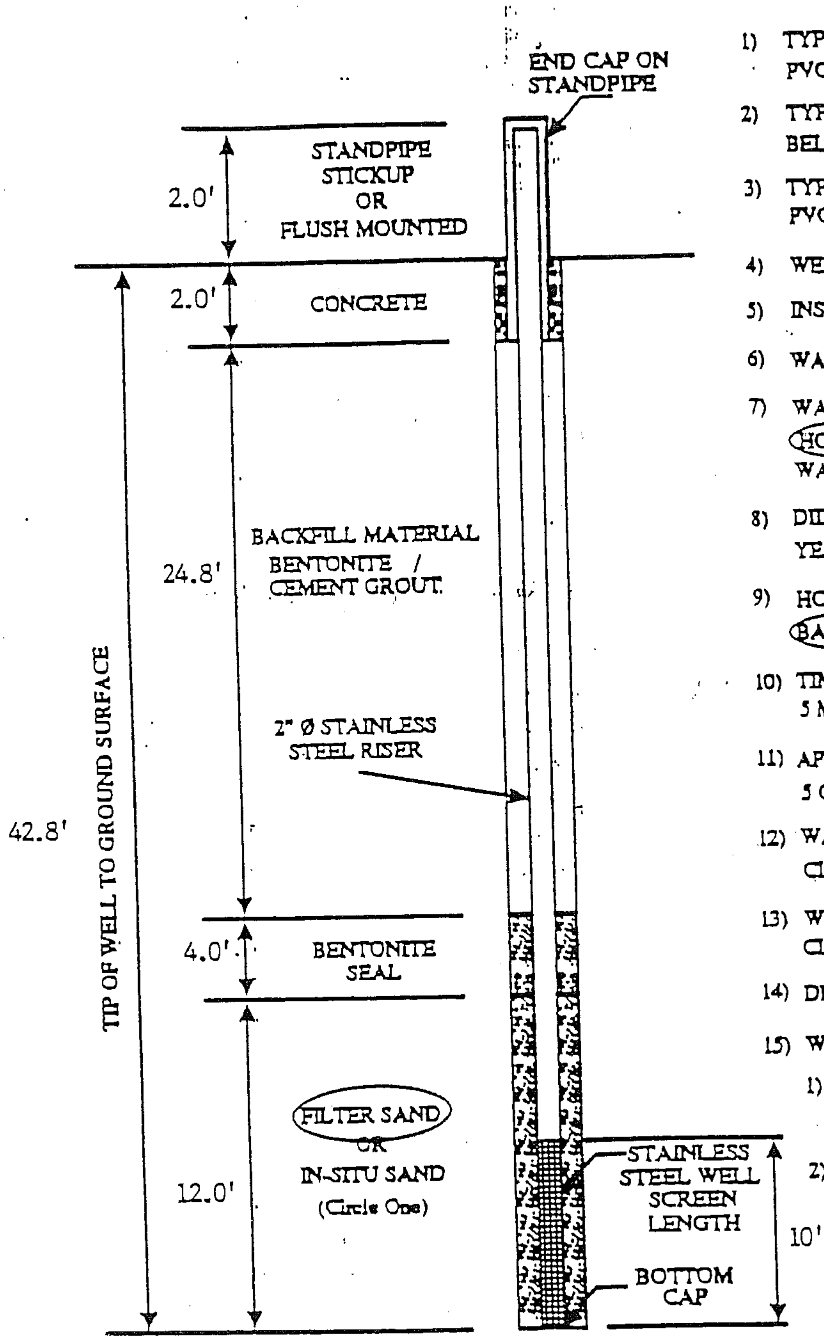
WELL NO. MW-104 DATE INSTALLED 11-07-90 DRILL RIG Cable Tool CME-550

DRILLER JH/ODC/DB DRILL CREW RP and DB

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? NO
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 07-30-90
5 MIN., 15 MIN., [✓ 30 MIN] OTHER ________

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 30 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT.
CLEAR, TURBID, [✓ OPAQUE]

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
38.17 FT OR DRY

2) OTHER MEASUREMENTS:

DATE 08-26-90	39.05	FT FROM T. ST. PIPE
DATE 10-09-90	40.13	FT FROM T. ST. PIPE
DATE 10-31-90	40.53	FT FROM T. ST. PIPE
DATE ________	________	FT FROM T. ST. PIPE

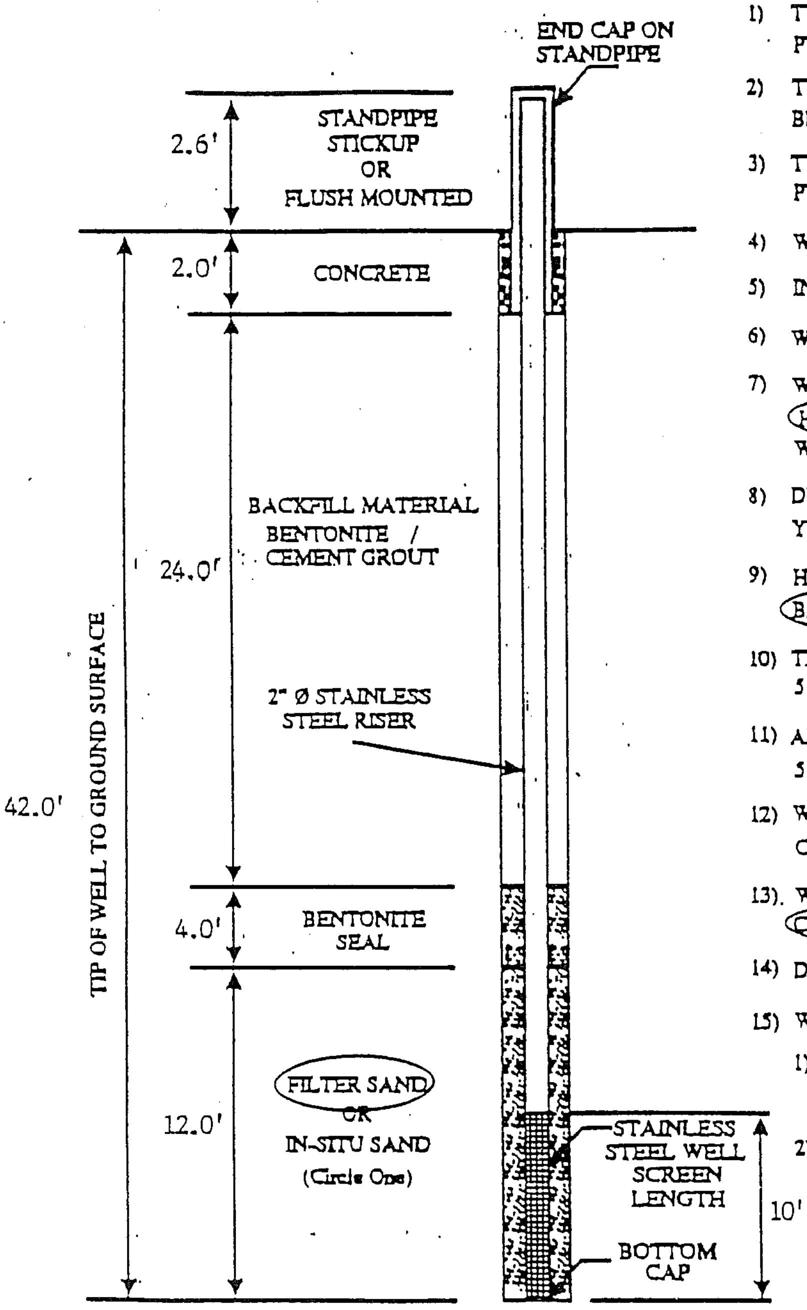
WELL NO. MW-107 DATE INSTALLED 07-02-90 DRILL RIG CME-550

DRILLER JS DRILL CREW DH

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS,] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS,] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? NO
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL,
WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 07-30-90
5 MIN., 15 MIN, 30 MIN, OTHER 1 Hour

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 20 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID,] OPAQUE

13). WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR,] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
35.17' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 08-26-90, 36.51 FT FROM T. ST. PIPE
DATE 10-09-90, 37.40 FT FROM T. ST. PIPE
DATE 10-31-90, 37.52 FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE

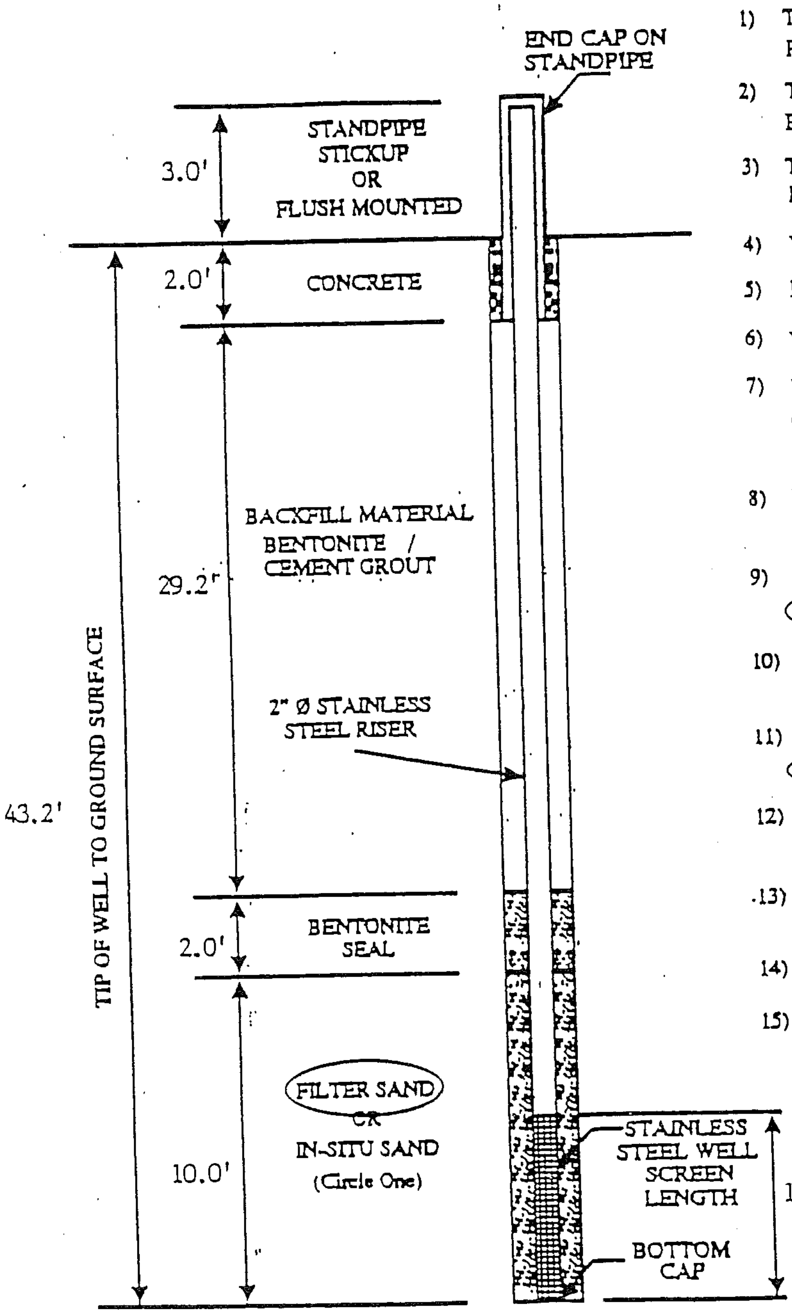
WELL NO. MW-108 DATE INSTALLED 07-03-90 DRILL RIG CME-550

DRILLER JS DRILL CREW DH

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? NO
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 07-30-90
5 MIN., 15 MIN., [✓ 30 MIN] OTHER ________

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
[✓ 5 GAL] 10 GAL, 15 GAL, OTHER ________

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
37.33' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 08-26-90, 39.22 FT FROM T. ST. PIPE
DATE 10-09-90, 40.57 FT FROM T. ST. PIPE
DATE 10-31-90, 40.83 FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE

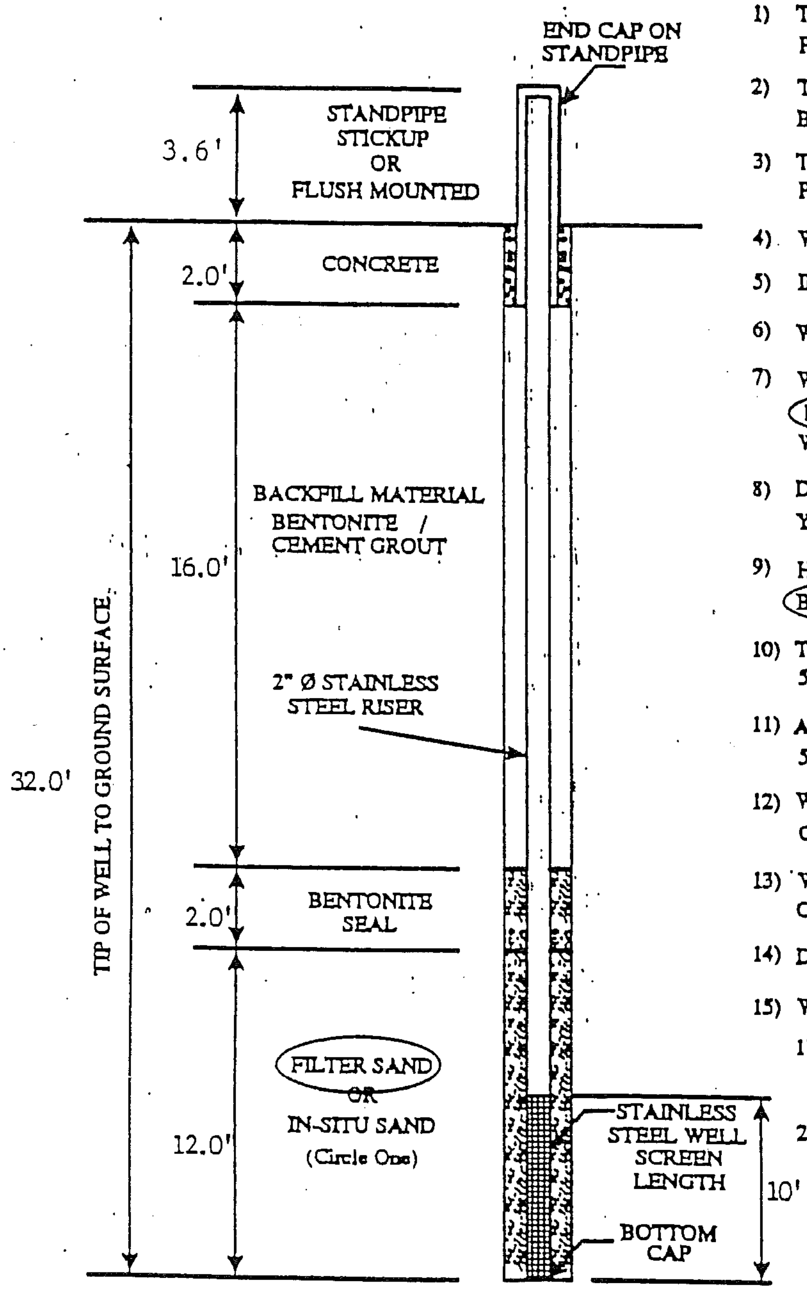
WELL NO. MW-109 DATE INSTALLED 07-29-90 DRILL RIG Mobile B-61

DRILLER DG DRILL CREW CC

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 07-31-90
5 MIN., 15 MIN., 30 MIN., OTHER 1 Hour

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 30 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
29.25 FT OR DRY

2) OTHER MEASUREMENTS:

DATE 08-26-90, 24.69 FT FROM T. ST. PIPE
DATE 10-31-90, 30.24 FT FROM T. ST. PIPE
DATE 11-04-90, 30.28 FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE

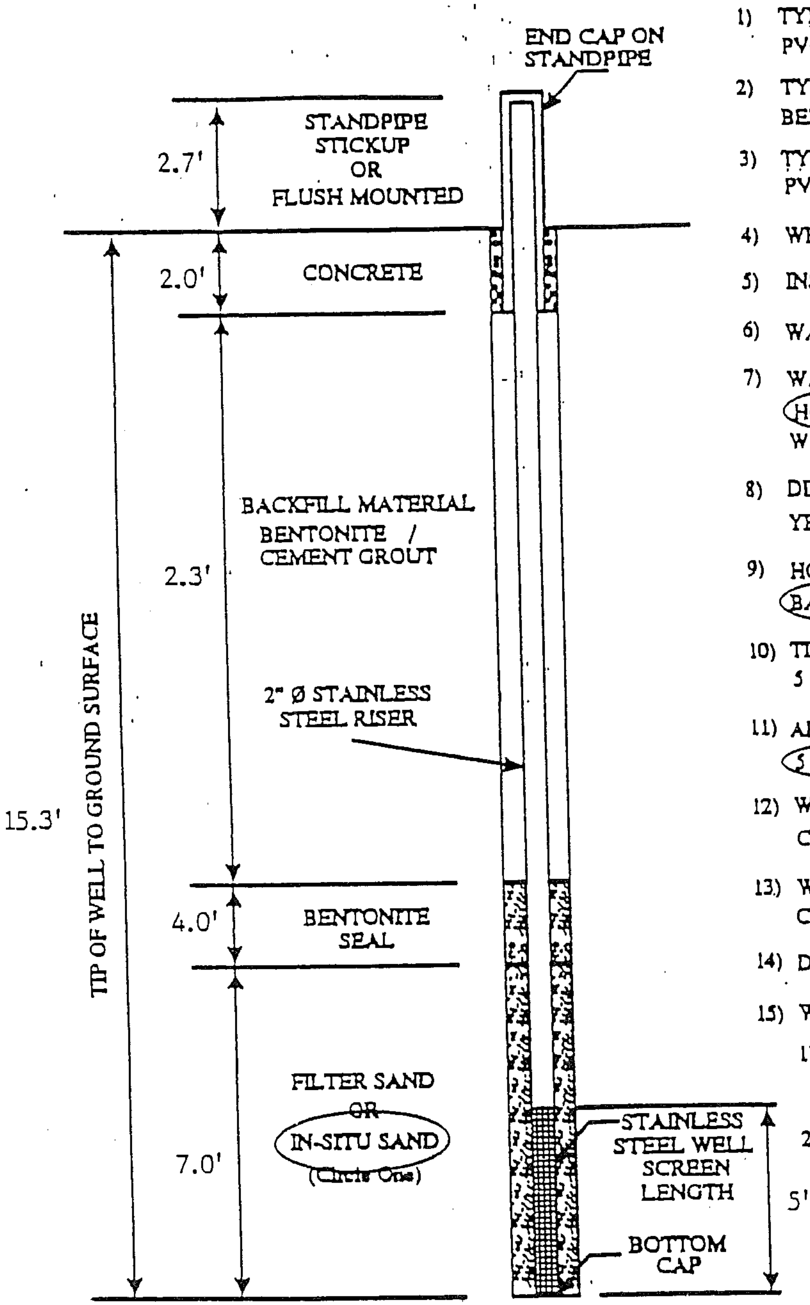
WELL NO. MW-110 DATE INSTALLED 07-04-90 DRILL RIG CME-550

DRILLER JS DRILL CREW DH

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - MI1DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 10-31-90
5 MIN., 15 MIN, [✓ 30 MIN] OTHER ____________

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
[✓ 5 GAL] 10 GAL, 15 GAL, OTHER ____________

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
15.34 ' FT OR DRY

2) OTHER MEASUREMENTS:
DATE 11-04-90, 15.06 FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE

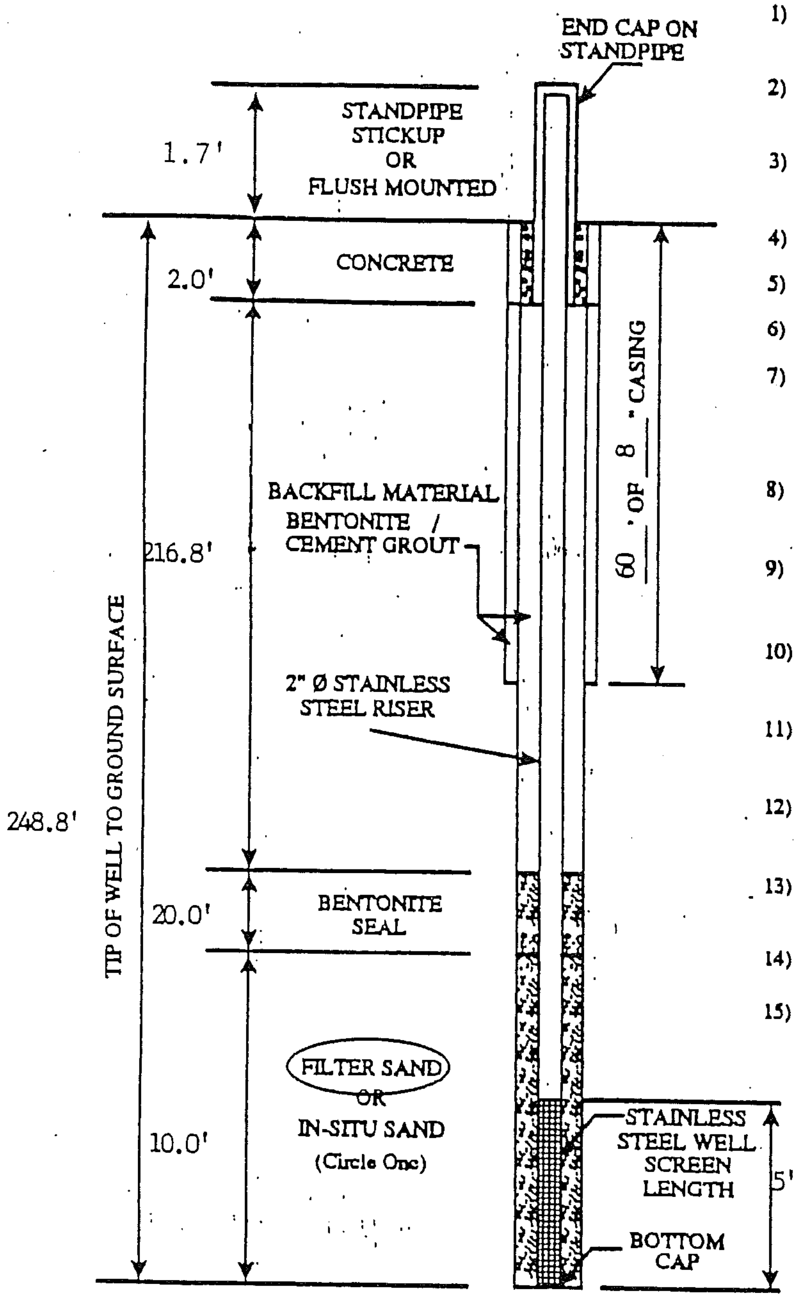
WELL NO. MW-111 DATE INSTALLED 07-09-90 DRILL RIG CME-550

DRILLER JS DRILL CREW DH

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
HOLLOW STEM AUGER, [✓ ROTARY] CABLE TOOL,
WATER, REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 11/10/90
5 MIN., 15 MIN, 30 MIN, OTHER 3 Hours

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 250 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
22.43' FT OR DRY

2) OTHER MEASUREMENTS:

DATE ______, ______ FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE

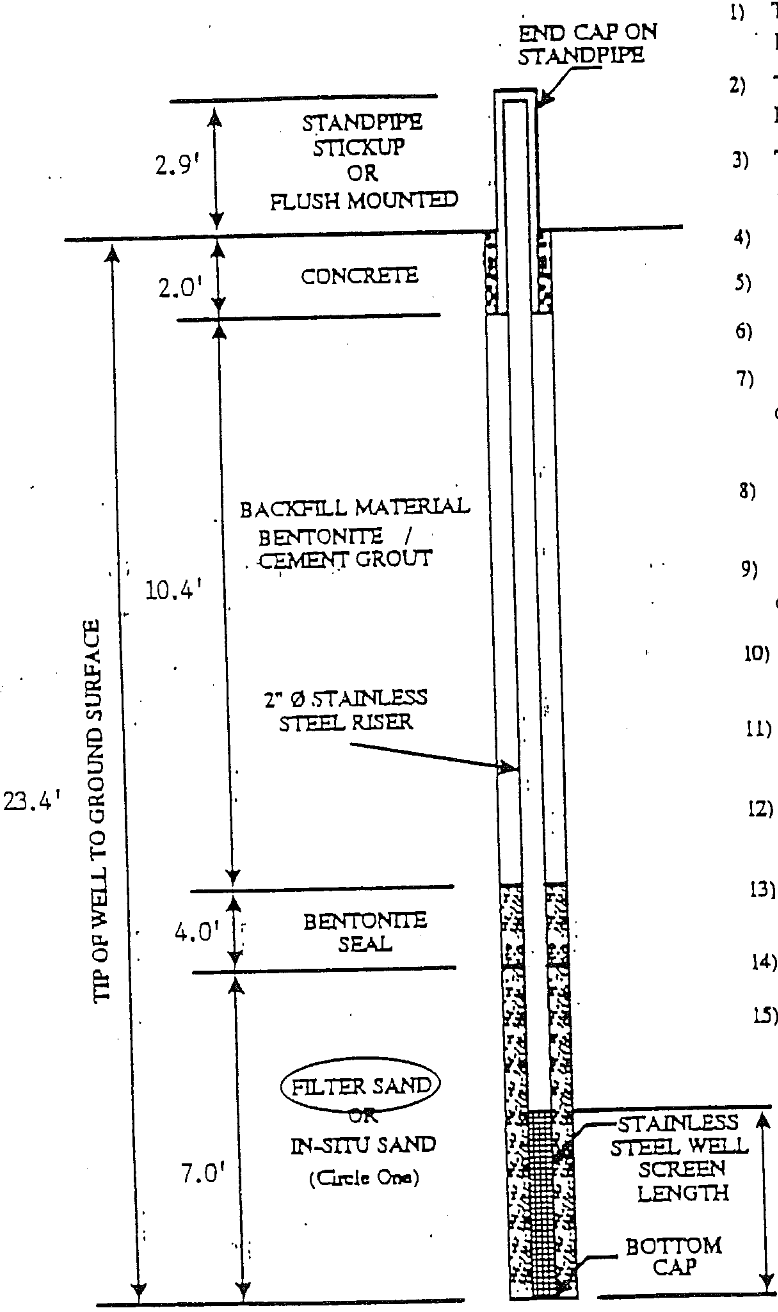
WELL NO. MW-113 DATE INSTALLED 11-05-90 DRILL RIG MOBILE B-61

DRILLER DG DRILL CREW CC

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? NO
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 07-31-90
5 MIN., 15 MIN., 30 MIN., OTHER 1 Hour

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, [✓ 15 GAL] OTHER ____

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY
1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
22.17' FT OR DRY
2) OTHER MEASUREMENTS:
DATE 08-26-90 , 19.65 FT FROM T. ST. PIPE
DATE 10-09-90 , 19.65 FT FROM T. ST. PIPE
DATE 11-04-90 , 22.18 FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE

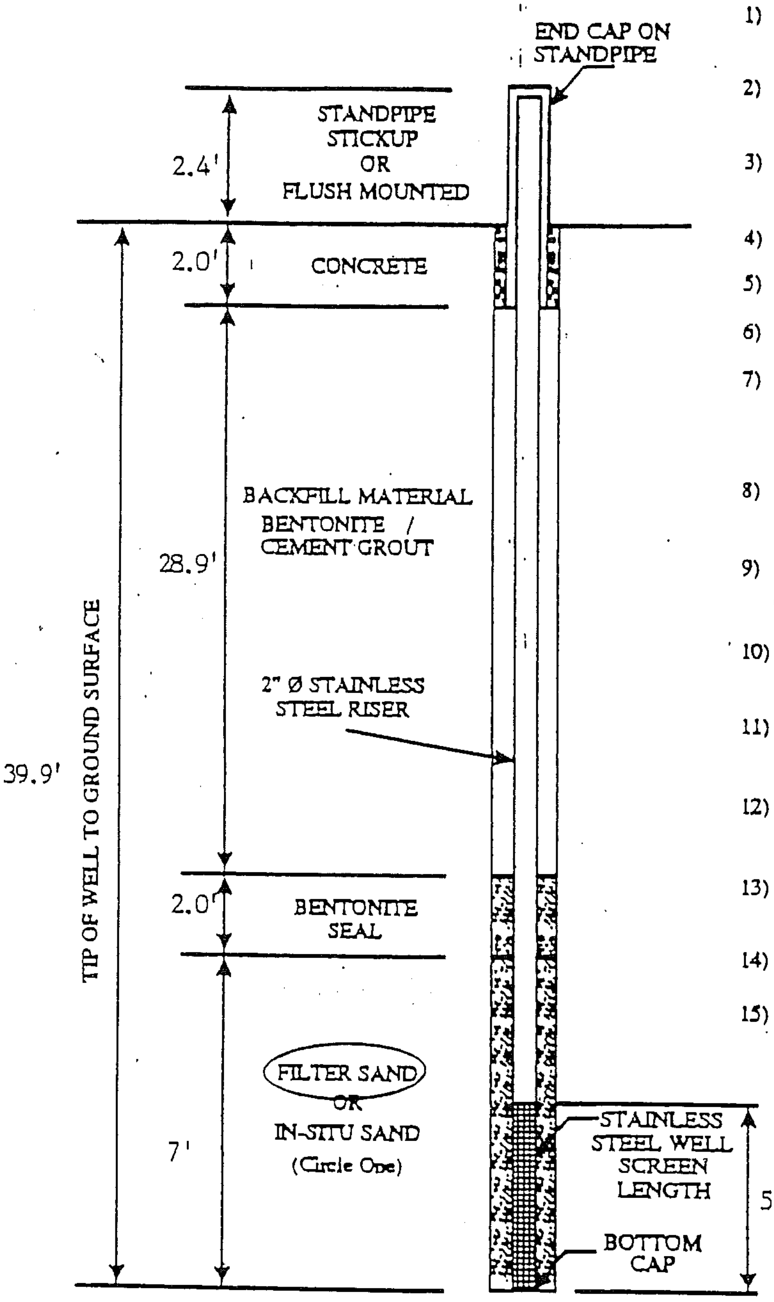
WELL NO. MW-114 DATE INSTALLED 07-01-90 DRILL RIG D-50/CME 550

DRILLER SB/JS DRILL CREW DZ/DH

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
HOLLOW STEM AUGER, ROTARY [✓ CABLE TOOL,]
[✓ WATER] REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT
5 MIN., 15 MIN, 30 MIN, OTHER 1 Hour

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 50 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
18.0 ' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 10-31-90 , 18.10 FT FROM T. ST. PIPE
DATE 11-04-90 , 18.08 FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE

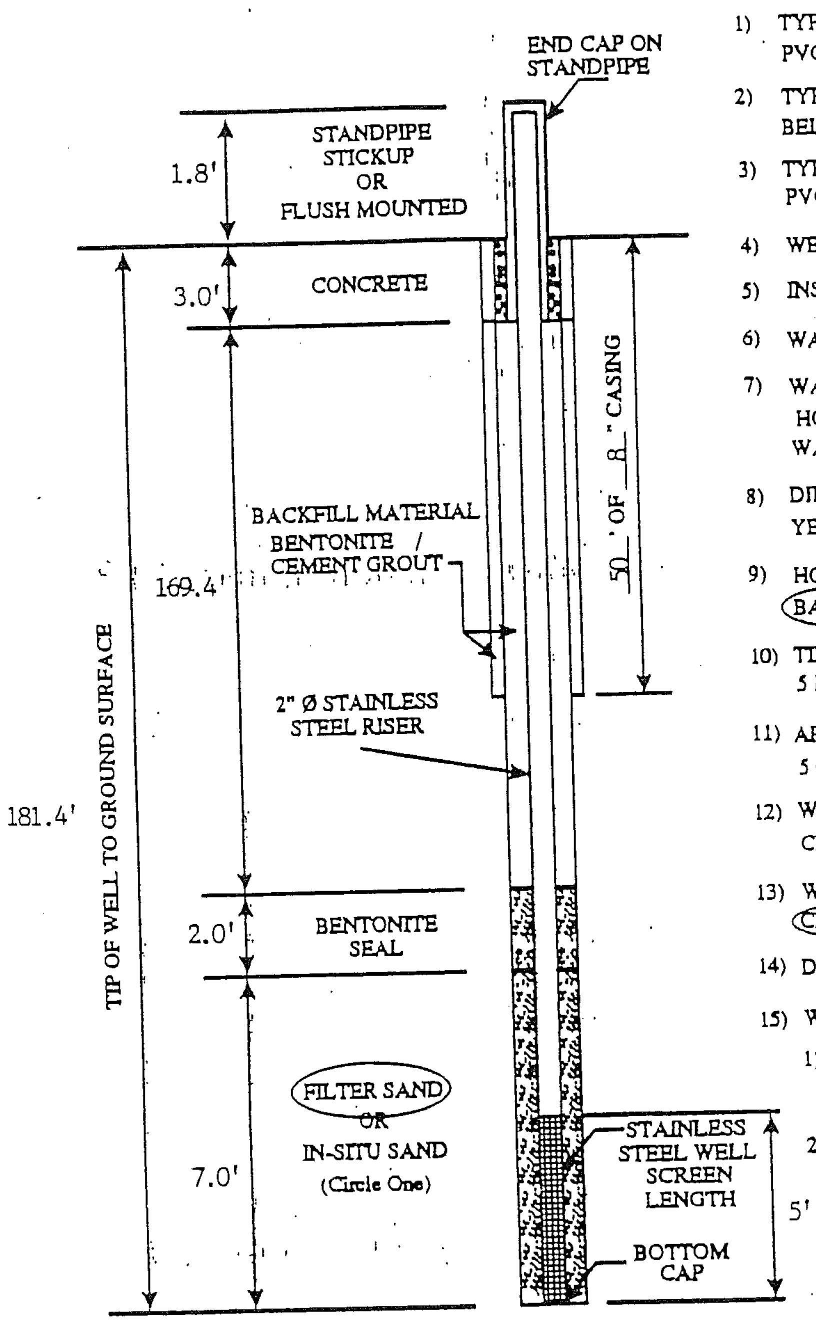
WELL NO. MW-115A DATE INSTALLED 10-29-90 DRILL RIG CABLE TOOL

DRILLER JH/ODC DRILL CREW DB

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED?
HOLLOW STEM AUGER, [✓ ROTARY], CABLE TOOL,
WATER, REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING], PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 10-23-90
5 MIN., 15 MIN, 30 MIN, OTHER 2 Hours

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 170 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR], TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
22.83' FT OR DRY

2) OTHER MEASUREMENTS:
DATE 10-31-90 , 22.23 FT FROM T. ST. PIPE
DATE 11-04-90 , 22.65 FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE

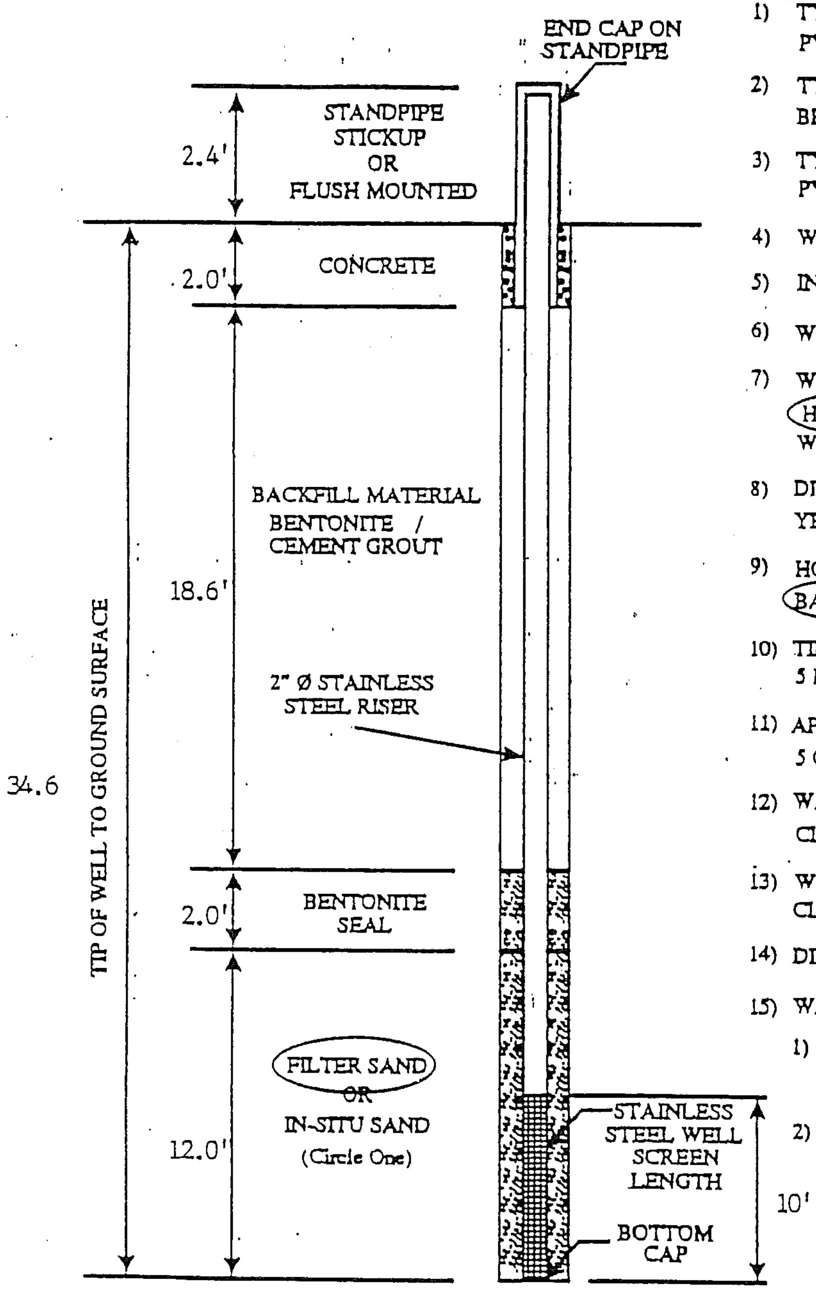
WELL NO. MW-116 DATE INSTALLED 10-09-90 DRILL RIG MOBILE B-61

DRILLER TT DRILL CREW DP

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 10-23-90
5 MIN., 15 MIN, [✓ 30 MIN] OTHER ____________

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 20 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
31.25' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 10-31-90, 32.36 FT FROM T. ST. PIPE
DATE 11-04-90, 37.00 FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE

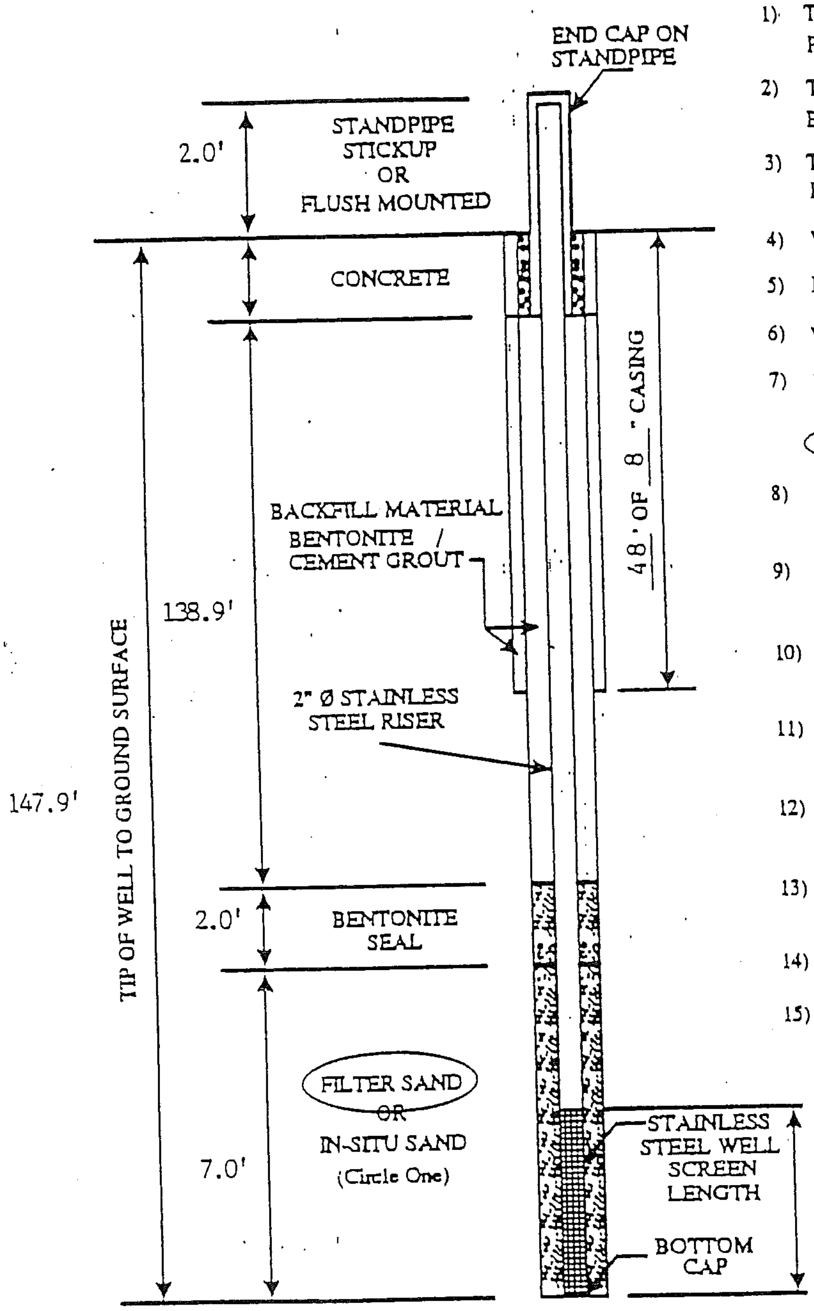
WELL NO. MW-117 DATE INSTALLED 07-09-90 DRILL RIG Mobile B-61

DRILLER DG DRILL CREW CC

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - MI1DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
HOLLOW STEM AUGER, ROTARY, [✓ CABLE TOOL], [✓ WATER], REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING], SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 10-24-90
5 MIN., 15 MIN, 30 MIN, OTHER 3 Hours

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 260 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID], OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID], OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
35.25' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 10-31-90 , 34.12 FT FROM T. ST. PIPE
DATE 11-04-90 , 34.56 FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE

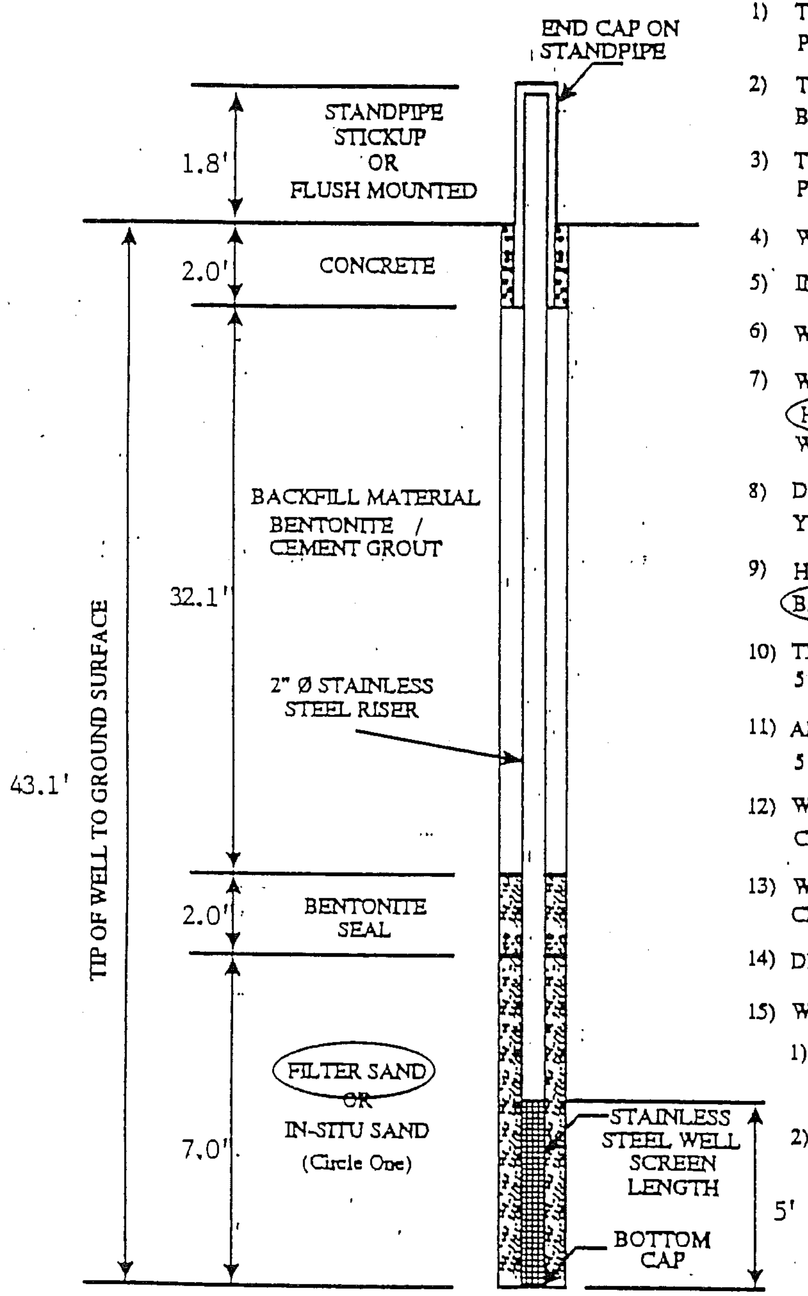
WELL NO. MW-119 DATE INSTALLED 10-14-90 DRILL RIG CABLE TOOL

DRILLER JH/ODC- DRILL CREW DB

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 01-01-90
5 MIN., 15 MIN, 30 MIN, OTHER 1 Hour

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 32 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
42.4' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 08-26-90	43.27	FT FROM T. ST. PIPE
DATE 10-31-90	44.05	FT FROM T. ST. PIPE
DATE 11-04-90	44.25	FT FROM T. ST. PIPE
DATE		FT FROM T. ST. PIPE

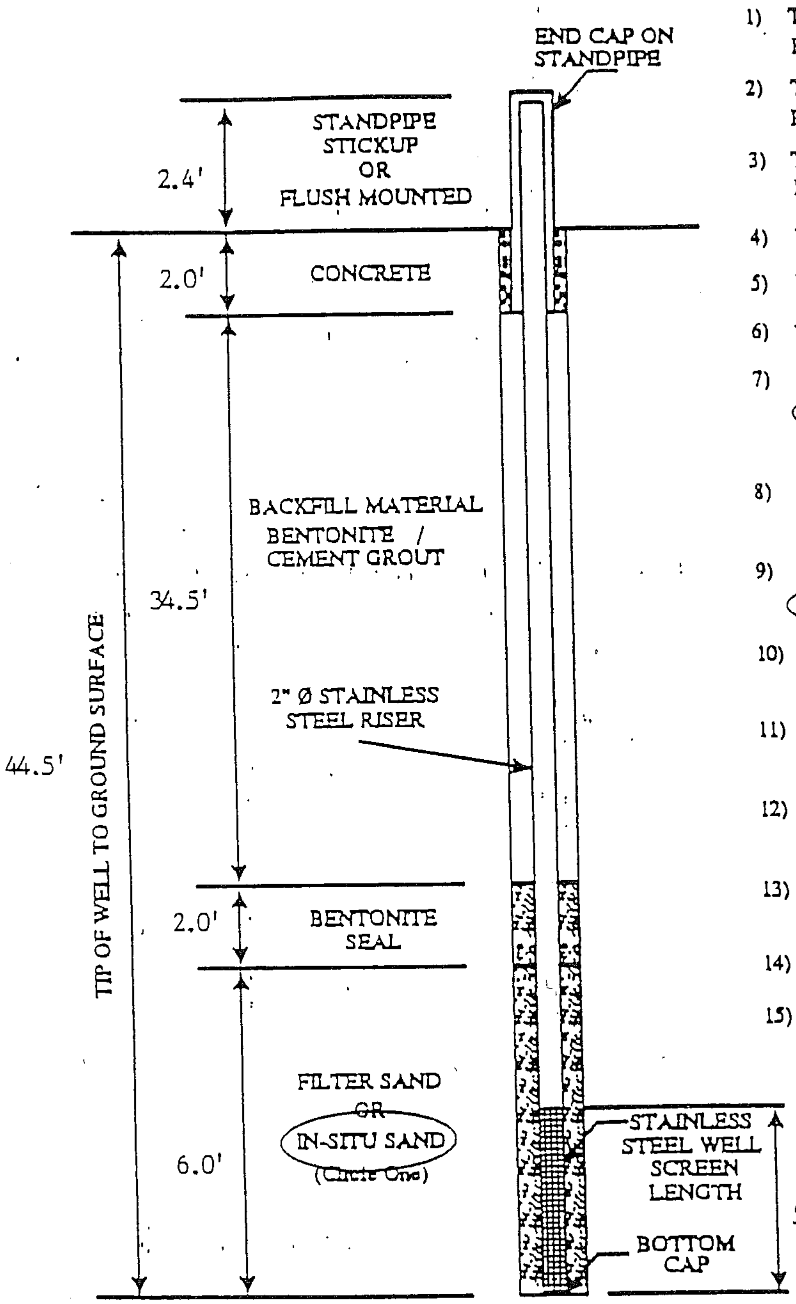
WELL NO. MW-122 DATE INSTALLED 07-10-90 DRILL RIG MOBILE B-61

DRILLER DG DRILL CREW CC

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 08-02-90
5 MIN., 15 MIN, [✓ 30 MIN] OTHER ______

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 20 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
44.8' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 08-26-90 , 45.30 FT FROM T. ST. PIPE
DATE 10-09-90 , 46.99 FT FROM T. ST. PIPE
DATE 10-31-90 , 46.45 FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE

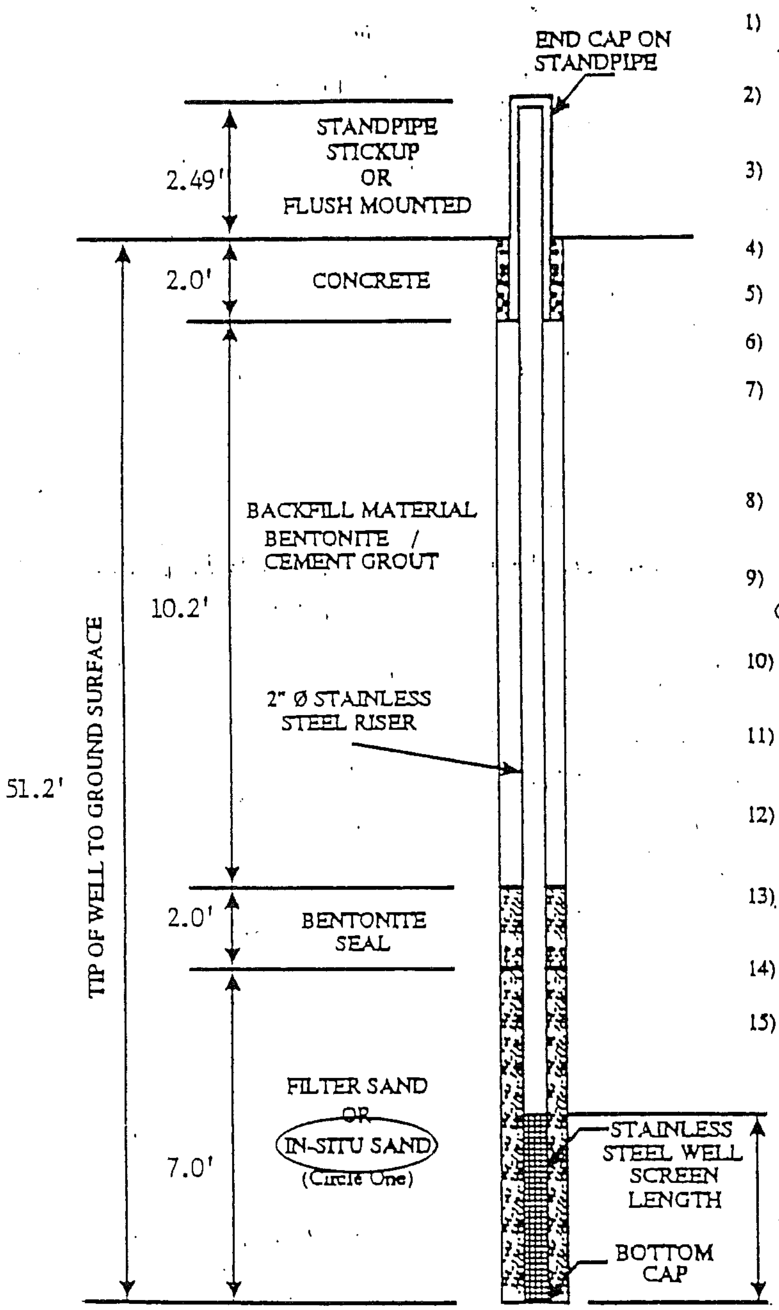
WELL NO. MW-128 DATE INSTALLED 07-12-90 DRILL RIG CME-550

DRILLER JS DRILL CREW DH

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? NO
[✓ HOLLOW STEM AUGER], ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 10-23-90
5 MIN., 15 MIN, 30 MIN, OTHER 1 Hour

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 125 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? [✓ YES] OR NO

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
28.5' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 10-31-90, 38.39 FT FROM T. ST. PIPE
DATE 11-04-90, 27.20 FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE

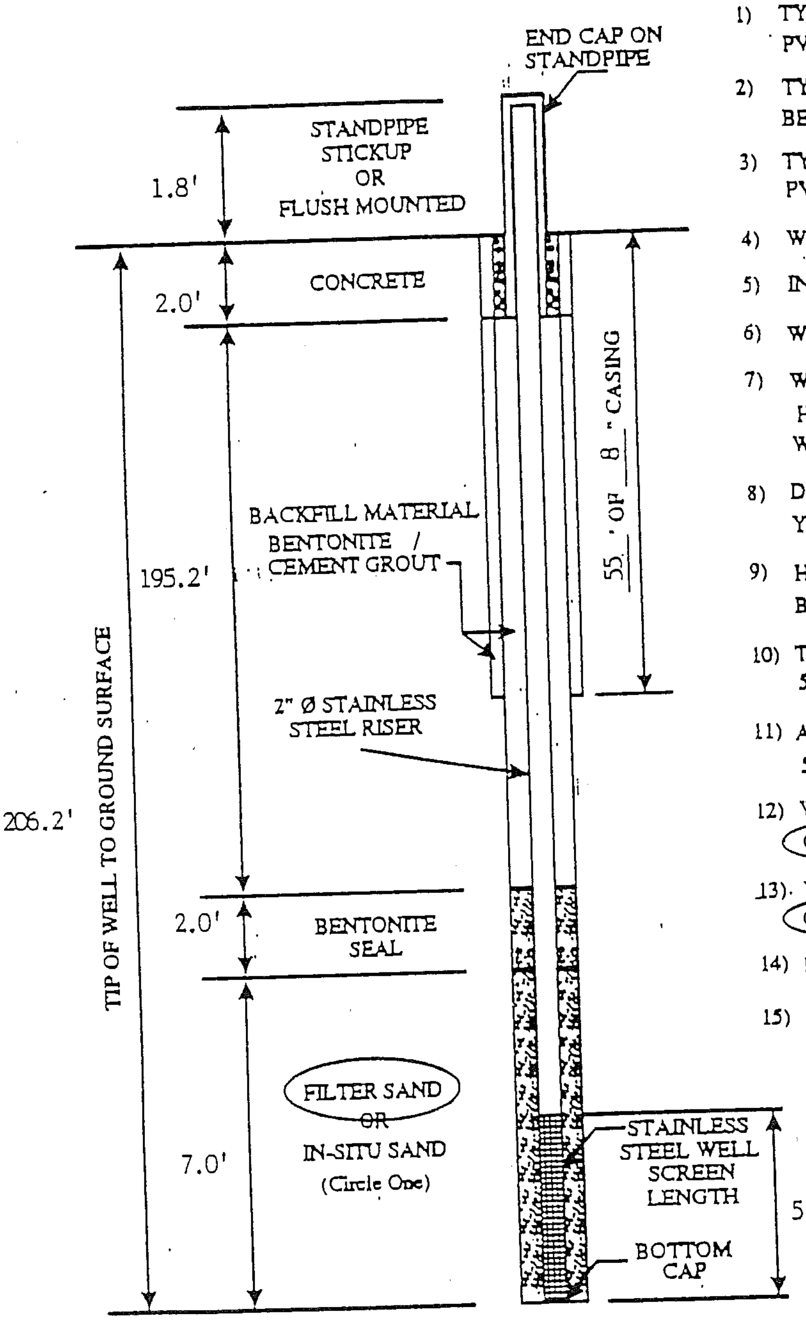
WELL NO. MW-129A DATE INSTALLED 10-17-90 DRILL RIG CME 550

DRILLER BP DRILL CREW DH

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - MI1DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS], OTHER ____

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? NO
HOLLOW STEM AUGER, ROTARY, [✓ CABLE TOOL]
WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING], SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 11-28-90
5 MIN., 15 MIN., 30 MIN., OTHER 2½ Hours

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 90 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
38.10' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 3-17-91 , 37.52' FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE

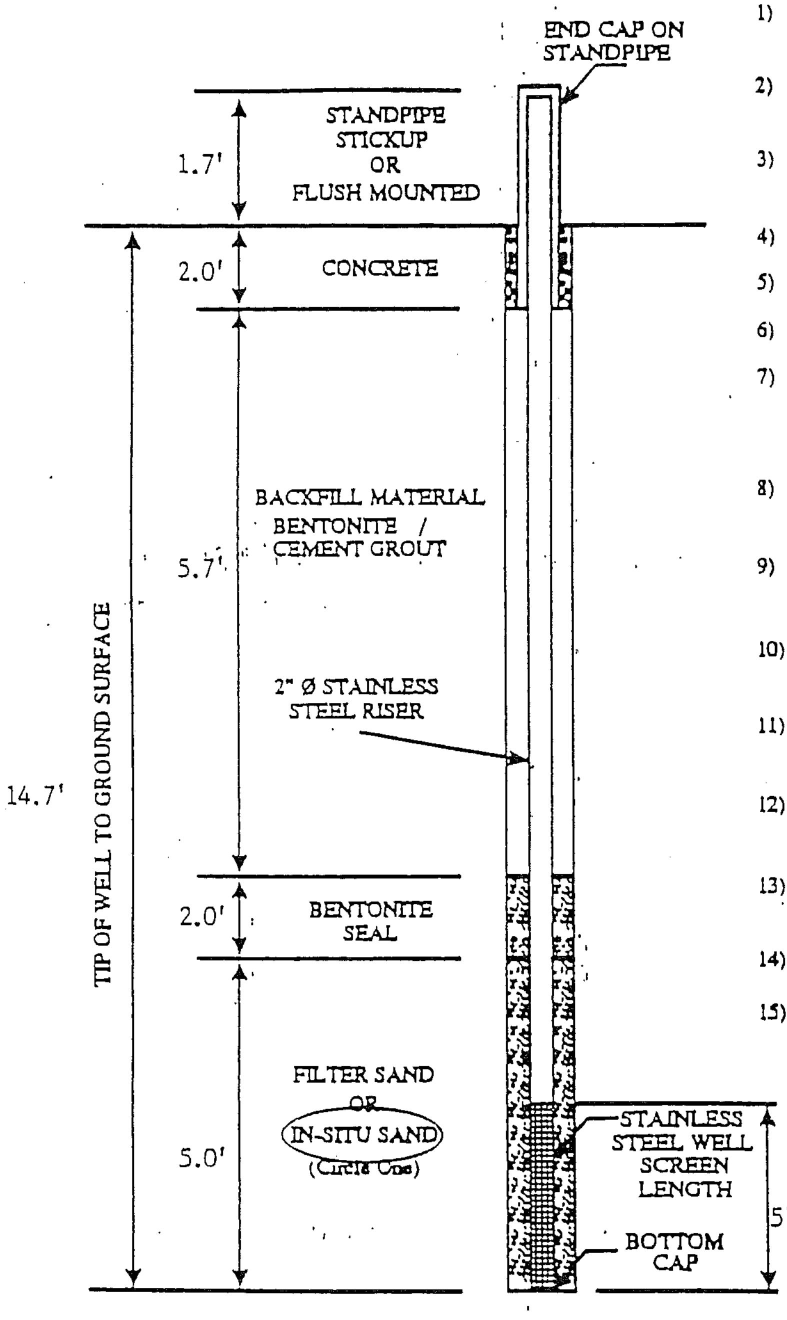
WELL NO. MW-131 DATE INSTALLED 11-28-90 DRILL RIG CABLE TOOL

DRILLER JK/ODC DRILL CREW DB

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? NO
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 07-31-90
5 MIN., 15 MIN, [✓ 30 MIN] OTHER ________

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, [✓ 15 GAL] OTHER ________

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
14.0' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 07-19-90, 13.07 FT FROM T. ST. PIPE
DATE 08-26-90, 9.60 FT FROM T. ST. PIPE
DATE 10-31-90, 14.33 FT FROM T. ST. PIPE
DATE 11-04-90, 13.16 FT FROM T. ST. PIPE

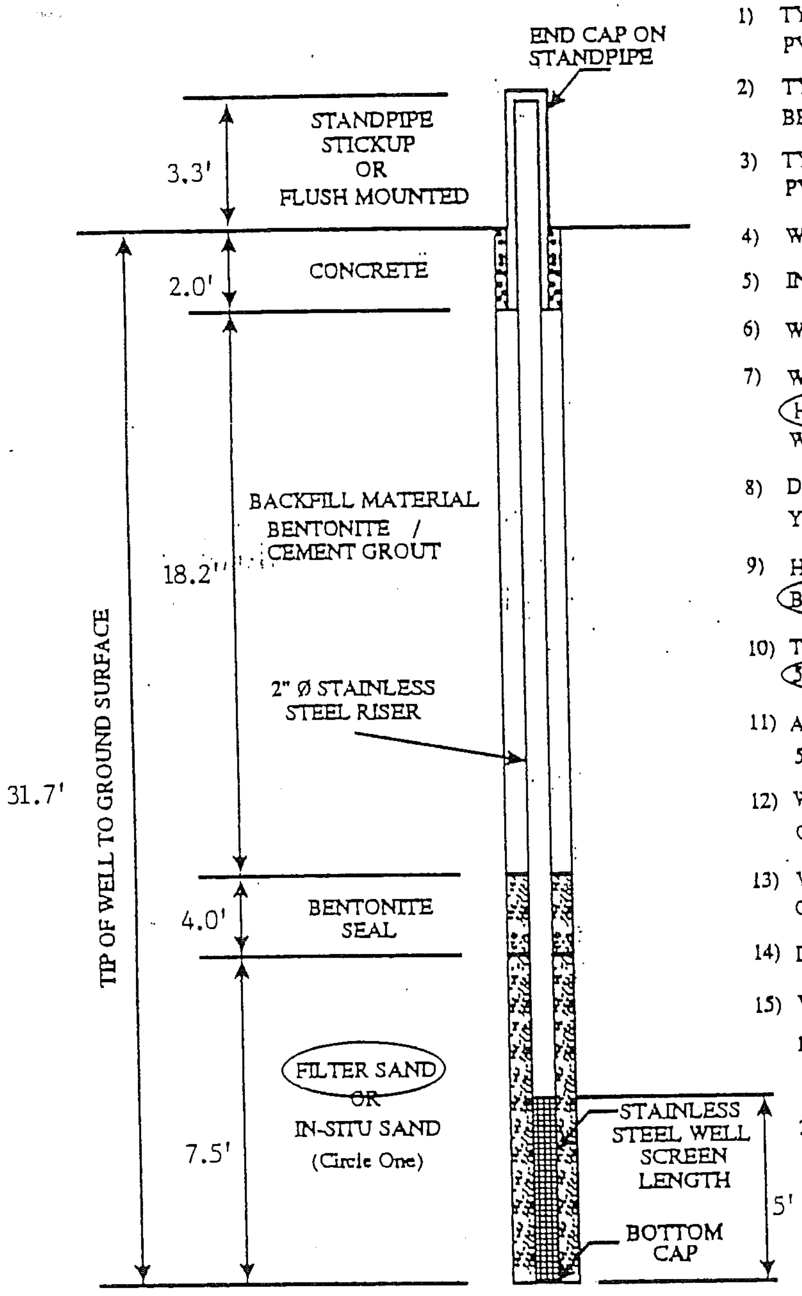
WELL NO. MW-133 DATE INSTALLED 07-11-90 DRILL RIG CME-550

DRILLER JS DRILL CREW DH

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL,
WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 10-04-90
[✓ 5 MIN.] 15 MIN, 30 MIN, OTHER ______

11) APPROXIMATE WATER VOLUME [✓ REMOVED] OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 1 Gallon

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
30.0' FT OR DRY

2) OTHER MEASUREMENTS:
DATE 10-31-90, 31.61 FT FROM T. ST. PIPE
DATE 11-04-90, 31.76 FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE

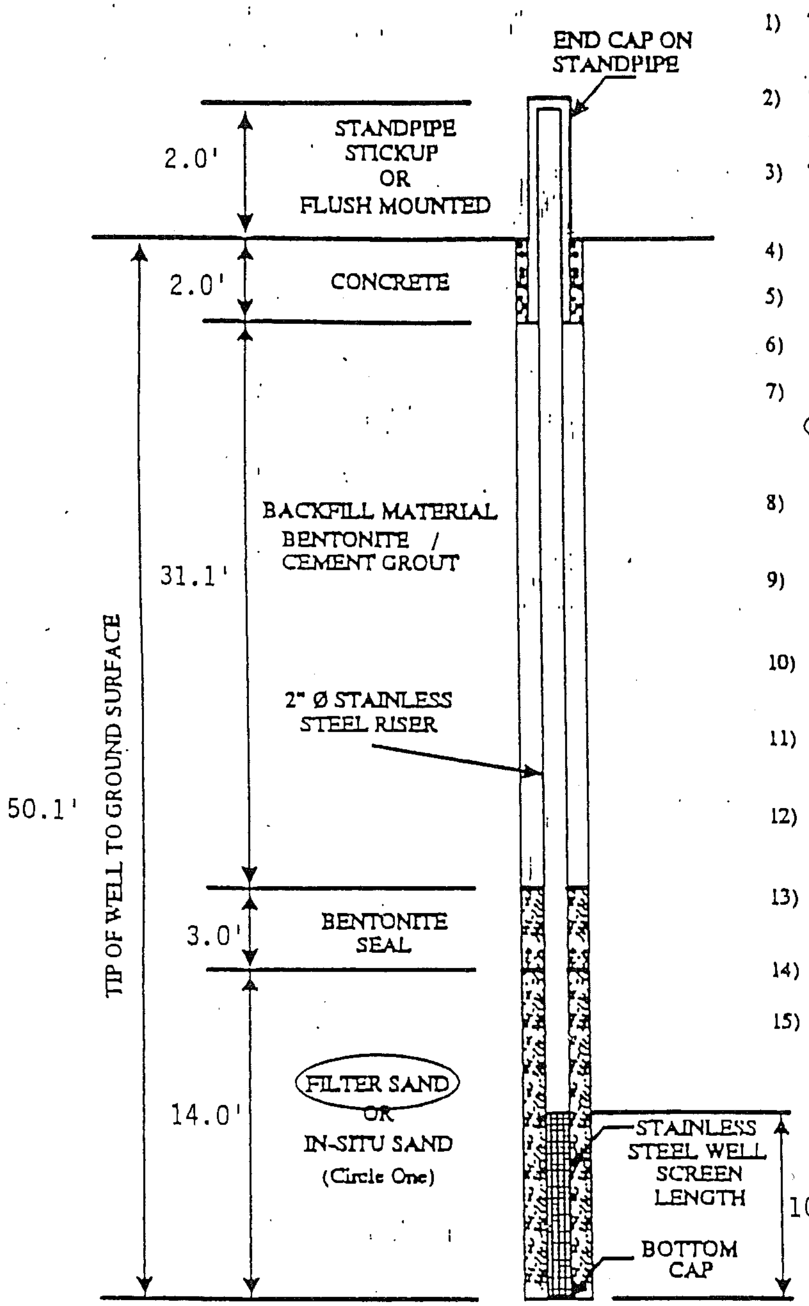
WELL NO. MW-134A DATE INSTALLED 08-21-90 DRILL RIG MOBILE B-61

DRILLER DG DRILL CREW CC

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? NO
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL,
WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING], [✓ SURGING], COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 12-6-91
5 MIN., 15 MIN, 30 MIN, OTHER 3 hrs. 25 min.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 75 gal. Removed

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE Clear to Slightly Turbid

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE Clear to Slightly Turbid

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY
1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
46.7' FT OR DRY
2) OTHER MEASUREMENTS:
DATE 12-6-90 , 49.65 FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE
DATE ______ , ______ FT FROM T. ST. PIPE

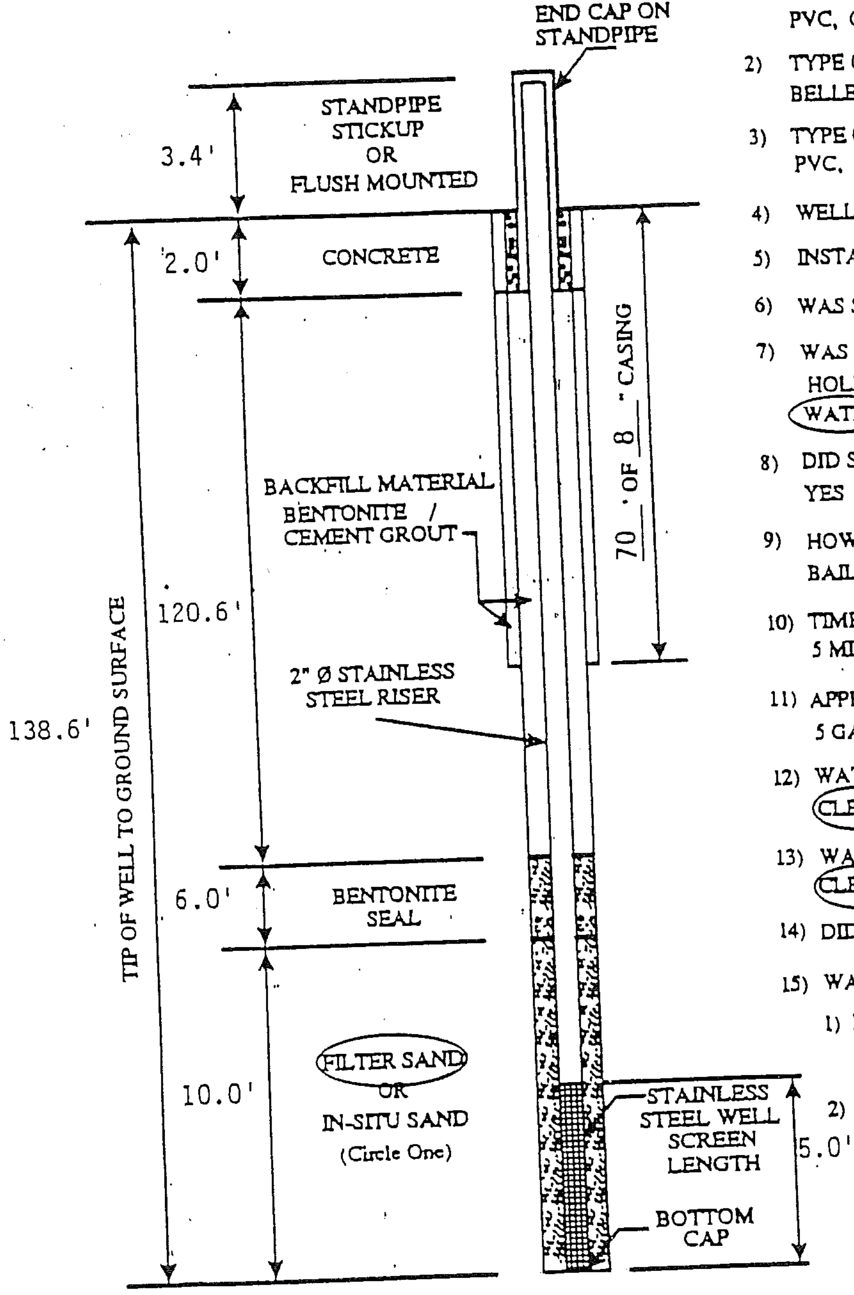
WELL NO. MW - 135 DATE INSTALLED 11-29-90 DRILL RIG CME - 550

DRILLER B.P. DRILL CREW E.R.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
HOLLOW STEM AUGER, [✓ ROTARY] CABLE TOOL, [✓ WATER] REVERT [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] [✓ SURGING] COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 1-29-91
5 MIN., 15 MIN, 30 MIN, OTHER 3 hrs. 15 min.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 350 gal. Removed

12) WATER CLARITY BEFORE DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

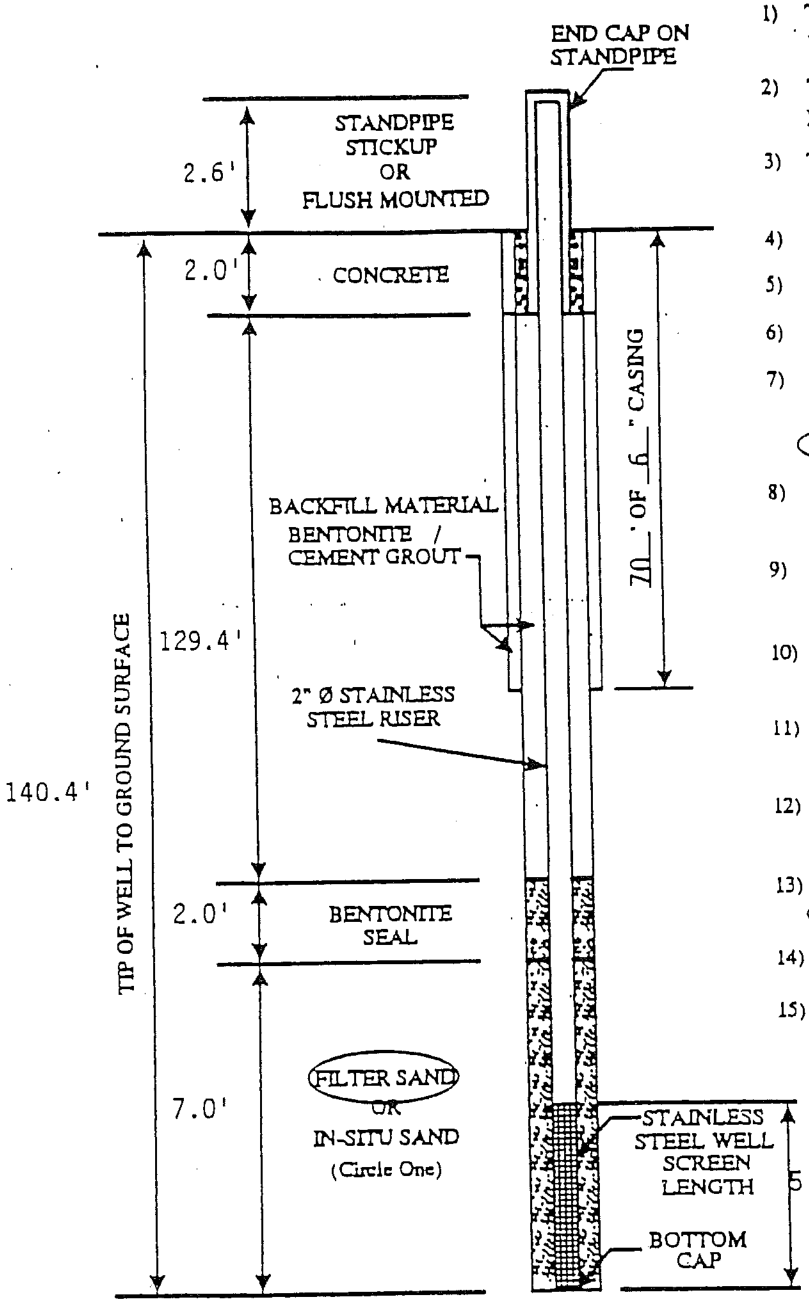
14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY
1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
______ FT OR DRY
2) OTHER MEASUREMENTS:
DATE 2-29-91, 45.35 FT FROM T. ST. PIPE
DATE 2-17-91, 43.35 FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE

WELL NO. MW-136 DATE INSTALLED 1-22-91 DRILL RIG Mobile B-61
DRILLER J.L. DRILL CREW D.T.
JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10(0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? YES
HOLLOW STEM AUGER, [✓ ROTARY] CABLE TOOL,
[✓ WATER] REVERT [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] [✓ SURGING] COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT
5 MIN., 15 MIN, 30 MIN, OTHER 2 ½ Hr.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 200 Gal.

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY
1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
________ FT OR DRY
2) OTHER MEASUREMENTS:
DATE 2-17-91 , 44.46 FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE

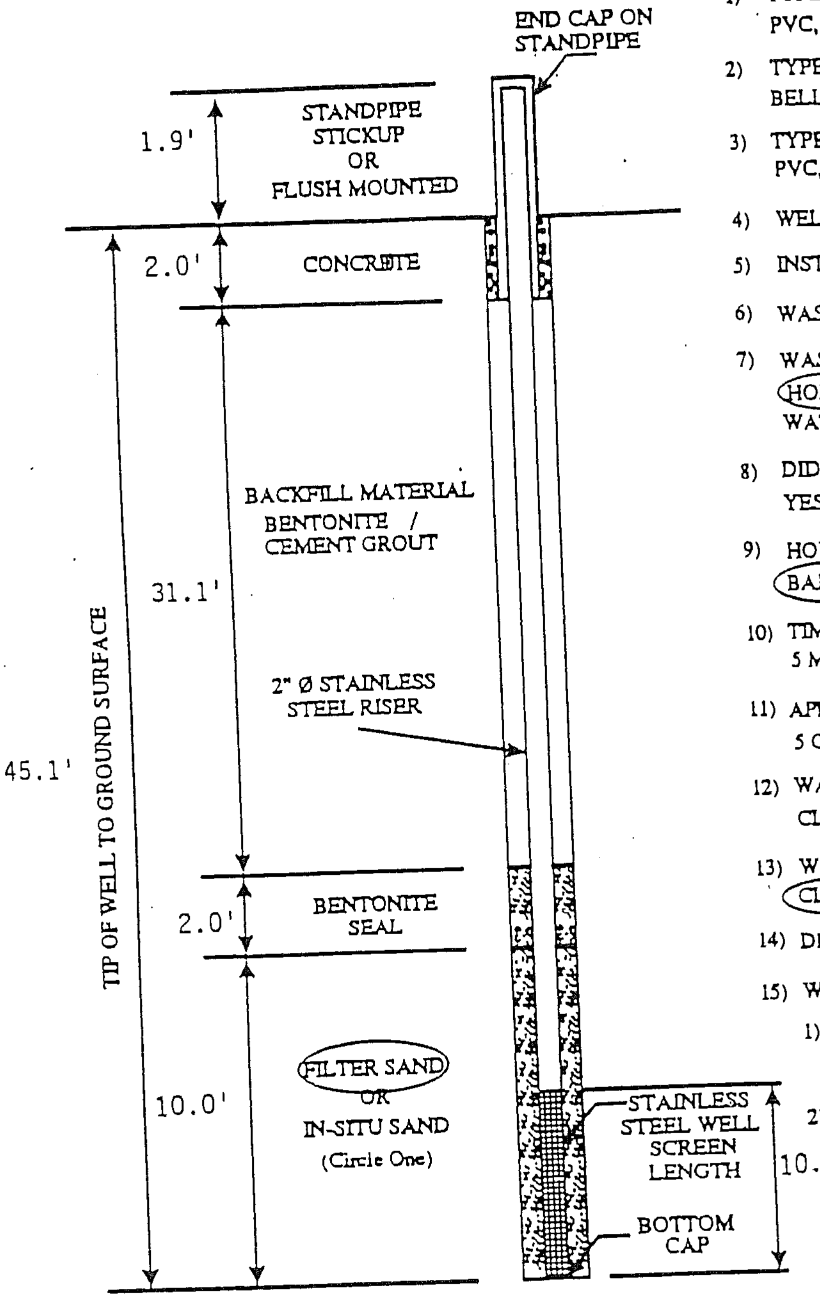
WELL NO. M W- 139 DATE INSTALLED 1-13-91 DRILL RIG Mobile B-61

DRILLER DG DRILL CREW P.P.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
[✓ BAILING] PUMPING, [✓ SURGING] COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT
5 MIN., 15 MIN [✓ 30 MIN] OTHER ____

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 10 Gal.

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
____ FT OR DRY

2) OTHER MEASUREMENTS:
DATE 3-17-91, 37.10' FT FROM T. ST. PIPE
DATE ____, ____ FT FROM T. ST. PIPE
DATE ____, ____ FT FROM T. ST. PIPE
DATE ____, ____ FT FROM T. ST. PIPE

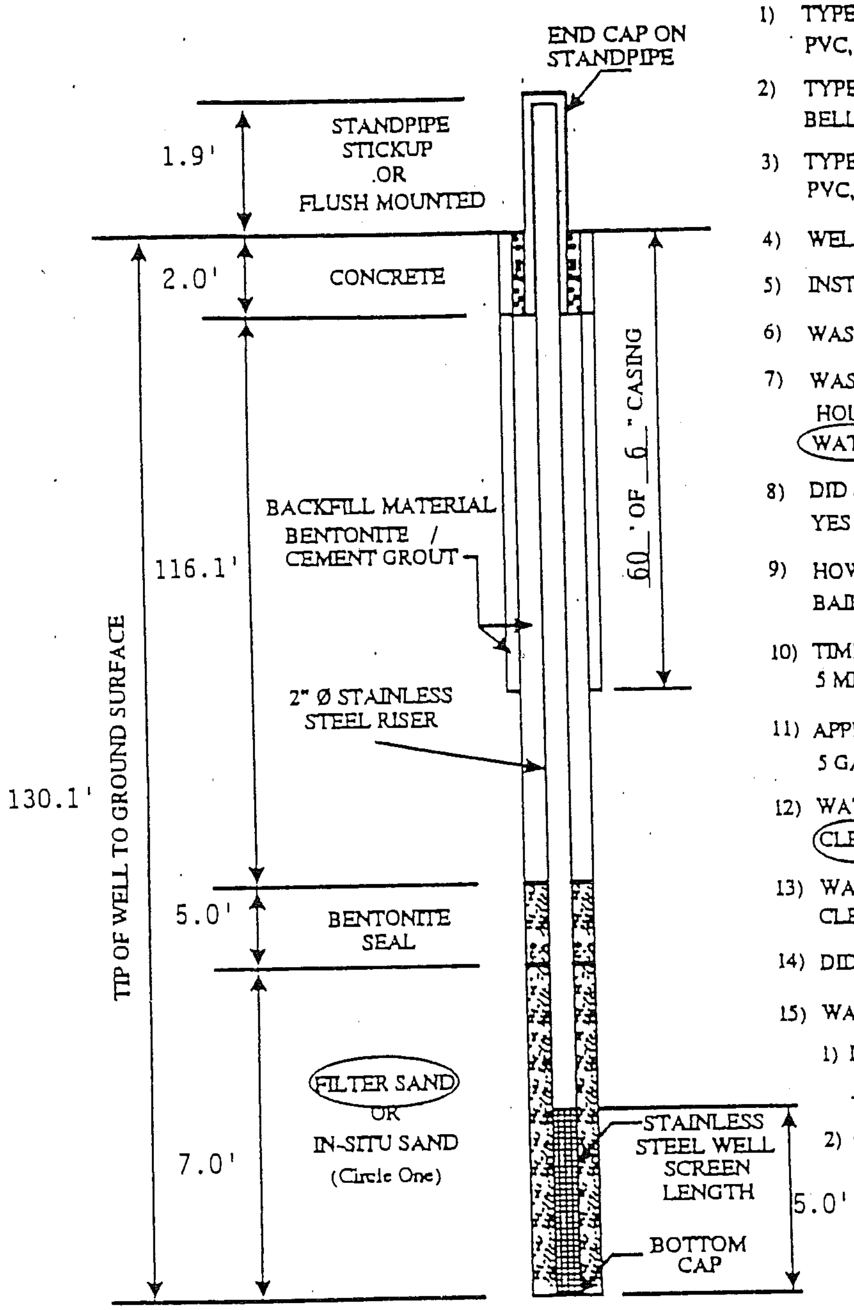
WELL NO. M W -141 DATE INSTALLED 12-6-90 DRILL RIG CME 63-550

DRILLER BP DRILL CREW D H

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____________

4) WELL SCREEN SLOT SIZE NO. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
HOLLOW STEM AUGER, [✓ ROTARY], CABLE TOOL,
[✓ WATER], REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING], [✓ SURGING], COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 1-28-91
5 MIN., 15 MIN, 30 MIN, OTHER 6 hrs

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 45 gal. Removed

12) WATER CLARITY BEFORE DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID] OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
____________ FT OR DRY

2) OTHER MEASUREMENTS:

DATE 1-28-91 , 45.30 FT FROM T. ST. PIPE
DATE 2-17-91 , 35.76 FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE

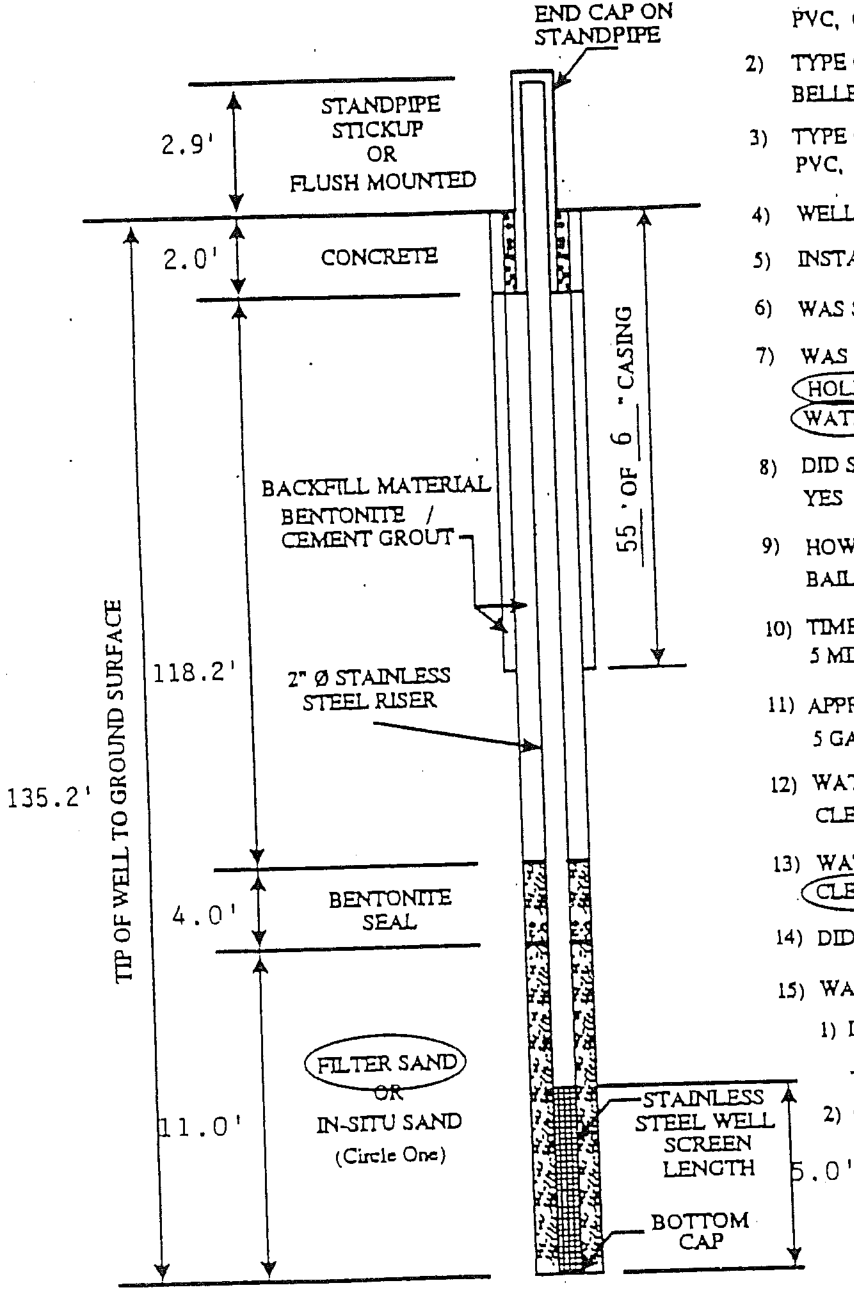
WELL NO. MW-142 DATE INSTALLED 12-19-90 DRILL RIG CME 63-550

DRILLER B.P. DRILL CREW E.H.R.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

4) WELL SCREEN SLOT SIZE No. 10(0.01')

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
[✓ HOLLOW STEM AUGER] [✓ ROTARY] CABLE TOOL,
[✓ WATER] REVERT [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING [✓ PUMPING] [✓ SURGING] COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT
5 MIN., 15 MIN, 30 MIN, OTHER 45 Min.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 250 Gal.

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR [✓ TURBID] OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY
1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
____ FT OR DRY
2) OTHER MEASUREMENTS:
DATE 3-15-91 , 51.18' FT FROM T. ST. PIPE
DATE 3-17-91 , 51.07' FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE

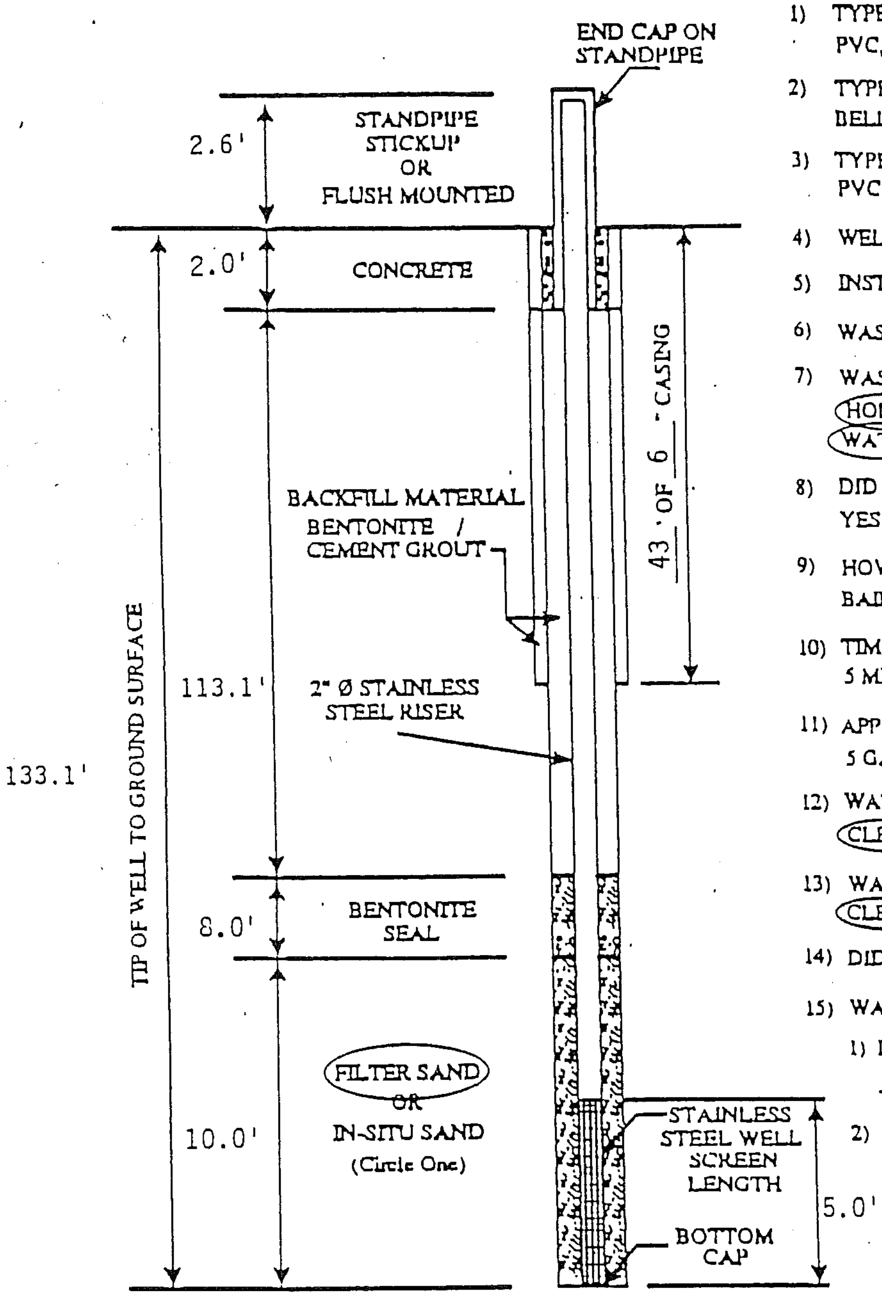
WELL NO MW-144 DATE INSTALLED 3-6-91 DRILL RIG B-61

DRILLER B.P. DRILL CREW R.H.D.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840XA

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
[✓ HOLLOW STEM AUGER] [✓ ROTARY] CABLE TOOL,
[✓ WATER] REVERT [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING [✓ PUMPING] [✓ SURGING] COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT
5 MIN., 15 MIN, 30 MIN, OTHER 1.25 hr.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 200 Gal.

12) WATER CLARITY BEFORE DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
____ FT OR DRY

2) OTHER MEASUREMENTS:
DATE 3-17-91 , 44.23' FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE

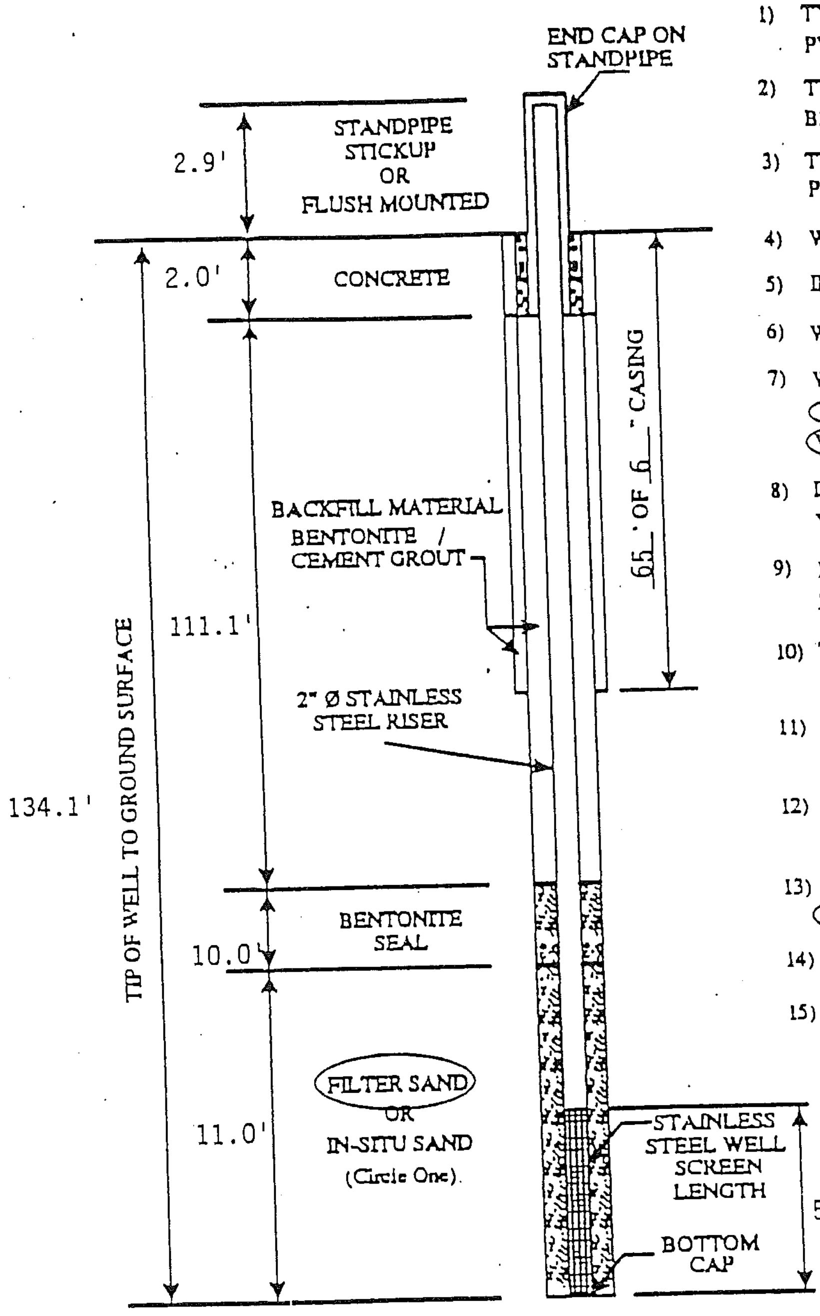
WELL NO. MW - 146 DATE INSTALLED 2-8-91 DRILL RIG Mobile B-61

DRILLER J.L. DRILL CREW D.T.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01 ")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? YES
[✓ HOLLOW STEM AUGER] [✓ ROTARY] CABLE TOOL,
[✓ WATER] REVERT [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 2-5-91
5 MIN., 15 MIN, 30 MIN, OTHER 2.5 hrs.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 175 gal. Removed

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE Slightly Turbid

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
________ FT OR DRY

2) OTHER MEASUREMENTS:
DATE 2-5-91 , 28.20 FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE

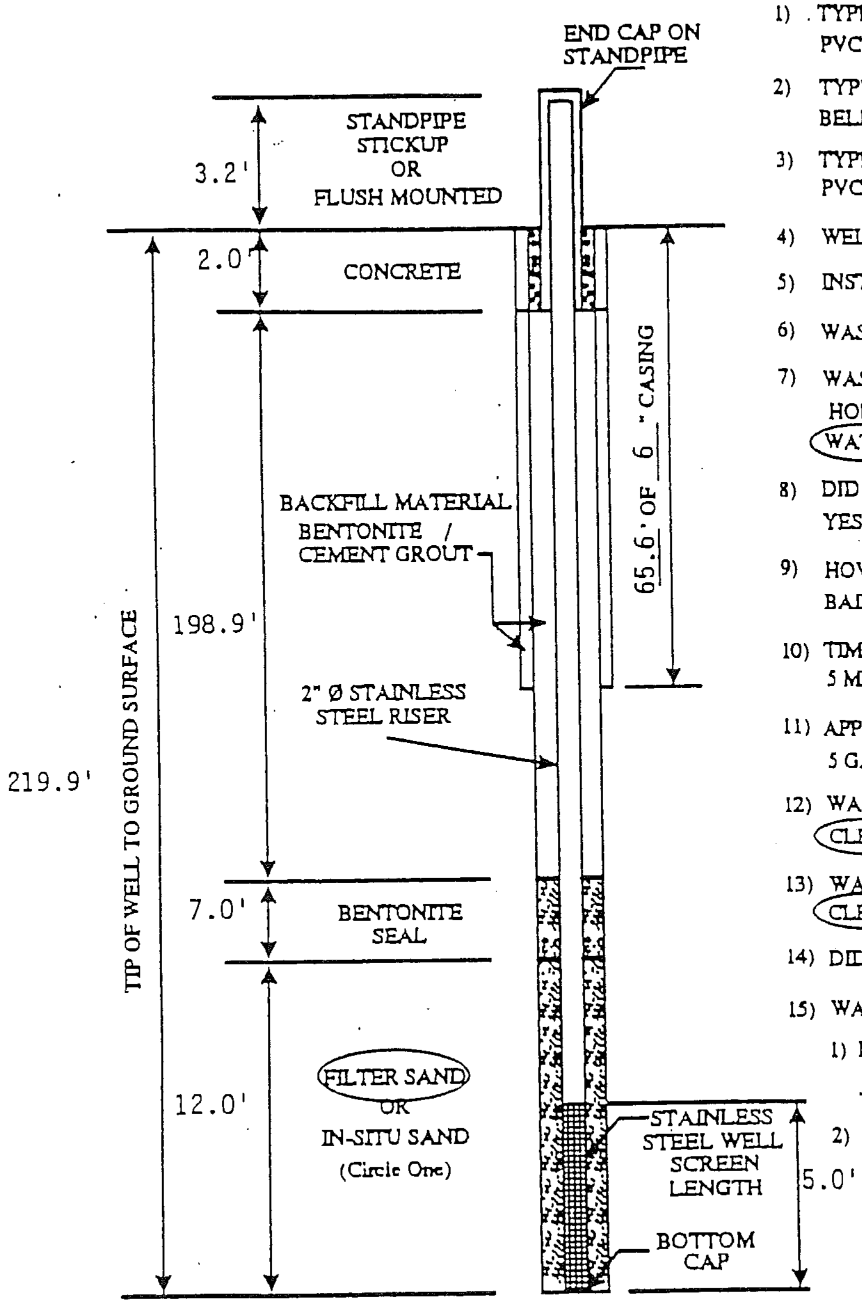
WELL NO. MW - 148 DATE INSTALLED 2-3-91 DRILL RIG Mobile B-61

DRILLER J.L. DRILL CREW D.T.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ______

4) WELL SCREEN SLOT SIZE No. 10(0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
HOLLOW STEM AUGER, [✓ ROTARY] CABLE TOOL,
[✓ WATER] REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] [✓ SURGING] COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT
5 MIN., 15 MIN, 30 MIN, OTHER 2 ½ Hr.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 250 Gal.

12) WATER CLARITY BEFORE DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR] TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
______ FT OR DRY

2) OTHER MEASUREMENTS:
DATE 2-17-91, 34.59 FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE
DATE ______, ______ FT FROM T. ST. PIPE

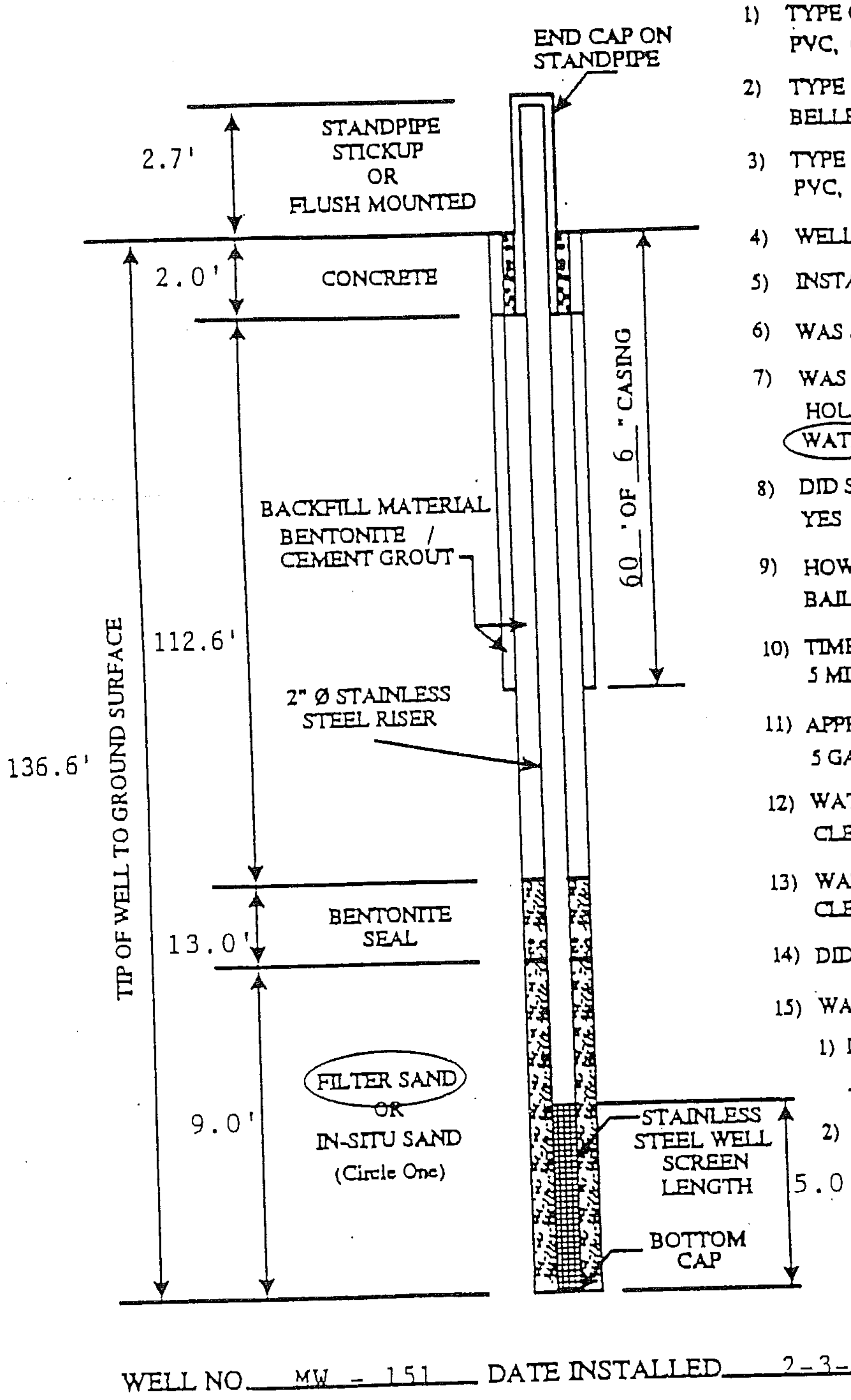
WELL NO. MW -149 DATE INSTALLED 1-31-91 DRILL RIG Mobile B-61

DRILLER J.L. DRILL CREW D.T.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ____

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ____

4) WELL SCREEN SLOT SIZE No. 10 (0.10")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
HOLLOW STEM AUGER, [✓ ROTARY], CABLE TOOL, [✓ WATER], REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING], [✓ SURGING], COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 2-5-91
5 MIN., 15 MIN, 30 MIN, OTHER 5 hrs.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 175 gal. Removed

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID], OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, [✓ OPAQUE]

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
____ FT OR DRY

2) OTHER MEASUREMENTS:
DATE 2-5-90 , 38.60 FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE
DATE ____ , ____ FT FROM T. ST. PIPE

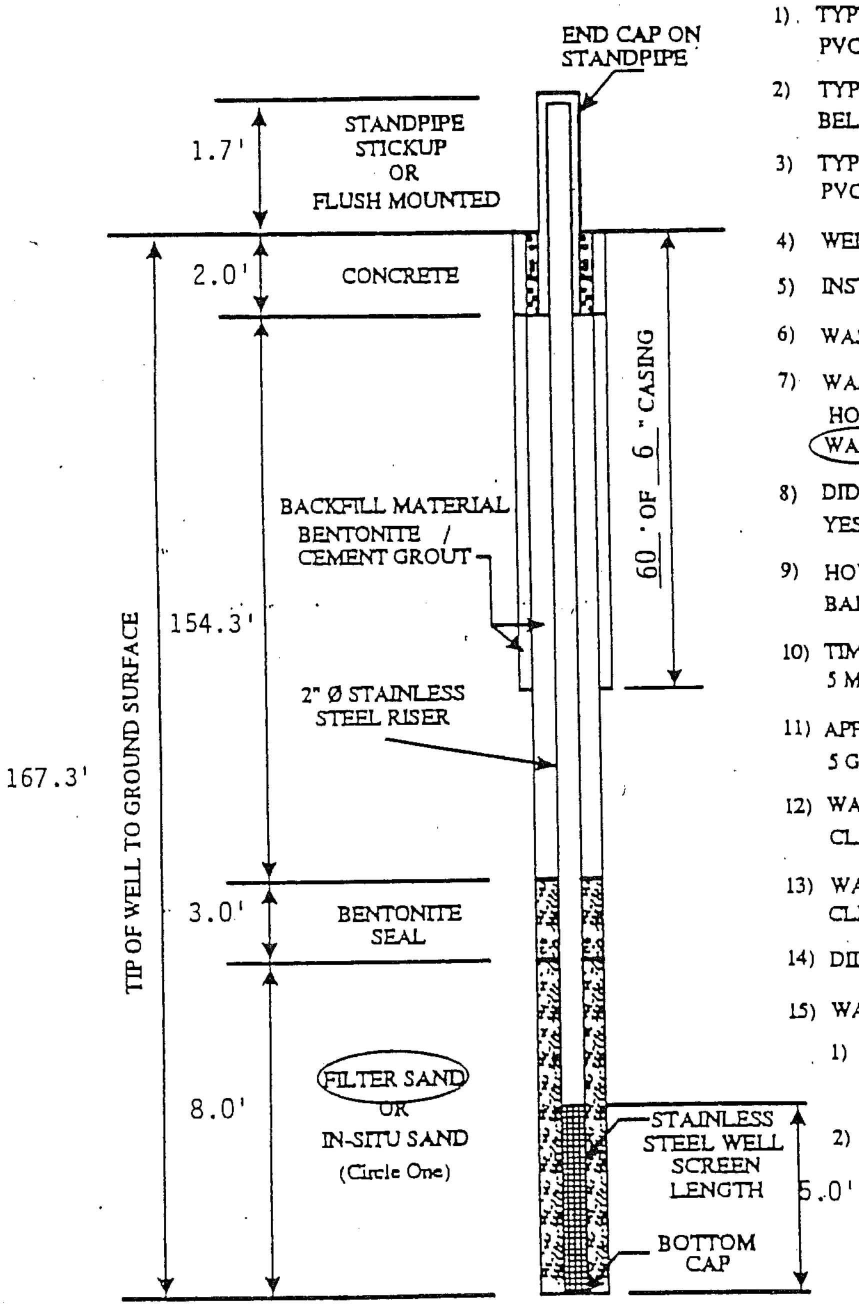
WELL NO. MW - 151 DATE INSTALLED 2-3-91 DRILL RIG Mobile B-61

DRILLER D.G. DRILL CREW P.B.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
HOLLOW STEM AUGER, [✓ ROTARY], CABLE TOOL, [✓ WATER] REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING], [✓ SURGING], COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 1-31-91
5 MIN., 15 MIN, 30 MIN, OTHER 4 hrs.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 225 gal. Removed

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID], OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, [✓ TURBID], OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
________ FT OR DRY

2) OTHER MEASUREMENTS:
DATE 1-31-91 , 38.60 FT FROM T. ST. PIPE
DATE 2-17-91 , 38.60 FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE

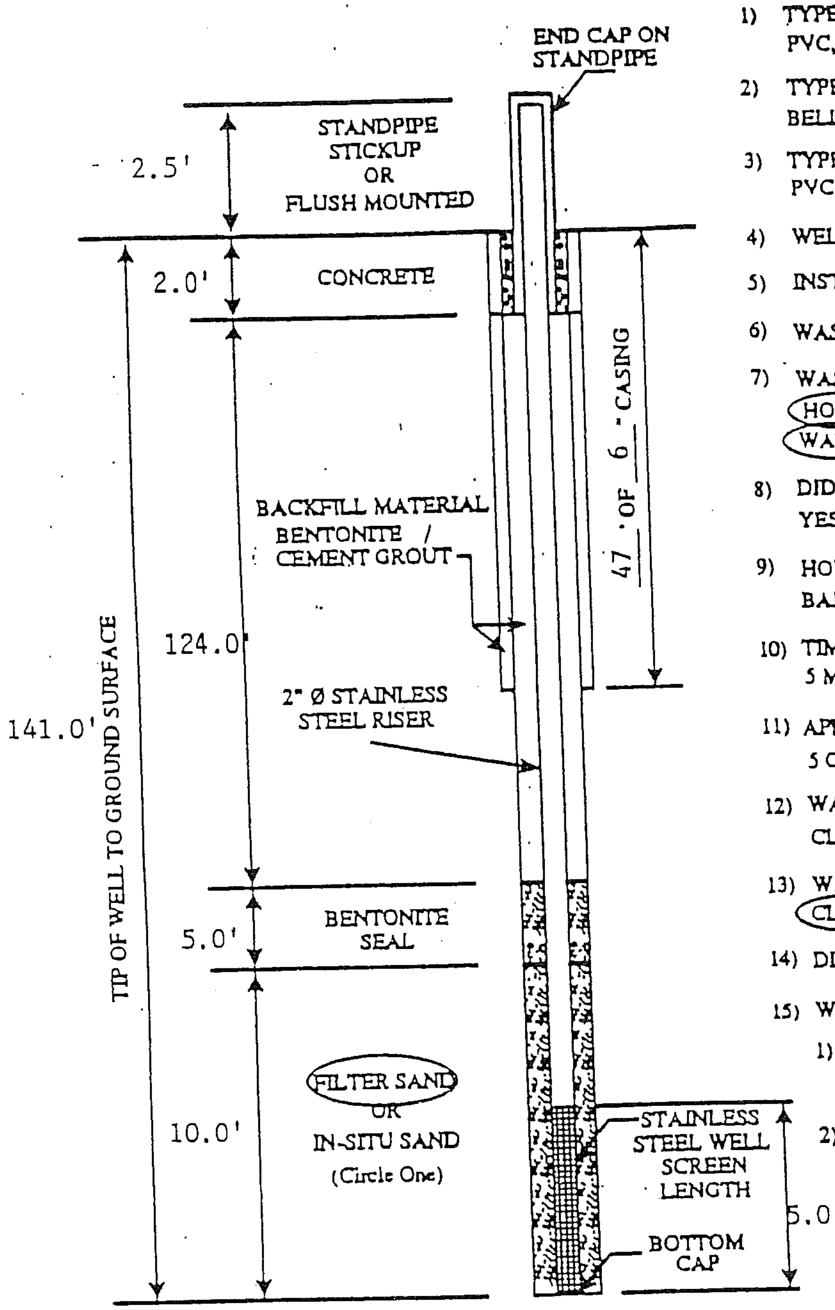
WELL NO. MW-152 DATE INSTALLED 1-24-91 DRILL RIG Mobile B-61

DRILLER D.G. DRILL CREW P.P.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Well Installation Diagram



1) TYPE OF PIPE
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, [✓ STAINLESS] OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? Yes
[✓ HOLLOW STEM AUGER], [✓ ROTARY], CABLE TOOL, [✓ WATER], REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING], [✓ SURGING], COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT
5 MIN., 15 MIN, 30 MIN, OTHER 45 Min.

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 200 Gal.

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, [✓ TURBID], OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
[✓ CLEAR], TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY
1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
________ FT OR DRY
2) OTHER MEASUREMENTS:
DATE 4-10-91, 37.75' FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE

WELL NO. MW-153 DATE INSTALLED 4-4-91 DRILL RIG Mobile B-61

DRILLER B.P. DRILL CREW D.R.

JOB/CLIENT The Upjohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

ENVIROLOGIC
TECHNOLOGIES, INC.
2960 INTERSTATE PARKWAY
KALAMAZOO, MI 49001
(616) 342-1100

LOG OF MW-161R

SHEET 1 of 2

CLIENT: UPJOHN - 950013

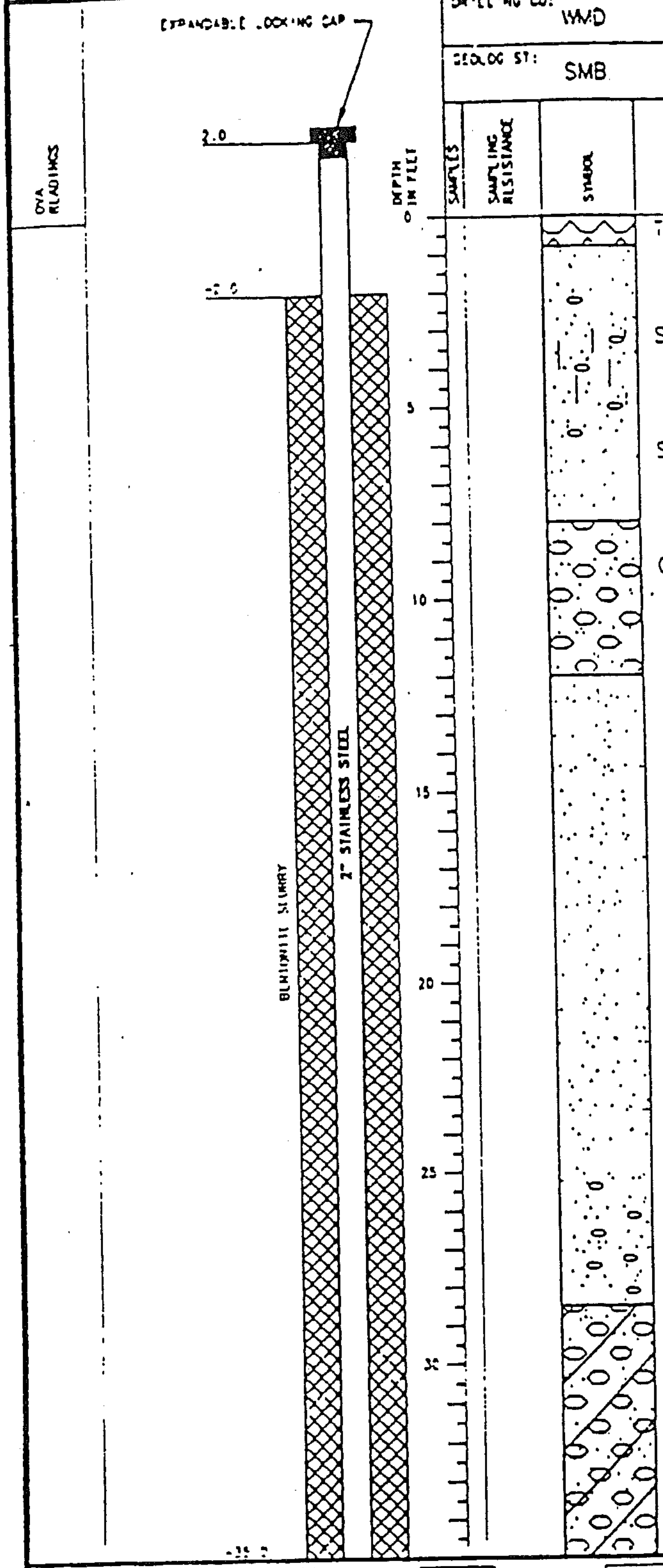
LOCATION: FIELD WEST OF PORTAGE ROAD

DRILLING CO: WMD

START DATE: 3/27/95

GEOLOGIST: SMB

COMPLETION DATE: 3/27/95



DESCRIPTION

TOPSOIL 8"
Light brown, sandy.

SAND
Dark reddish brown, medium grained, well sorted, some medium gravel, trace silt.

SAND
Light brown, medium to coarse grained, poorly sorted with medium and coarse gravel.

GRAVEL
Medium to coarse, poorly sorted, some medium to coarse grained sand, trace cobbles, dry.

SAND
Tan, fine grained, well sorted, dry.

GRAVEL
Fine to coarse, with coarse grained sand, poorly sorted, dry.

GRAVEL
SAND
SILT
CLAY
ORGANIC
TILL
SHALE
ROCK
MISC. FILL
TOPSOIL
▽ SATURATION LEVEL AT TIME OF DRILLING
▼ STATIC WATER LEVEL
N.D. NOT DETECTED BY HNU OR OVA

ENVIROLOGIC
TECHNOLOGIES, INC.
2960 INTERSTATE PARKWAY
KALAMAZOO, MI 49001
(616) 342-1100

LOG OF MW-161R

SHEET 2 of 2

CLIENT: UPJOHN - 950013

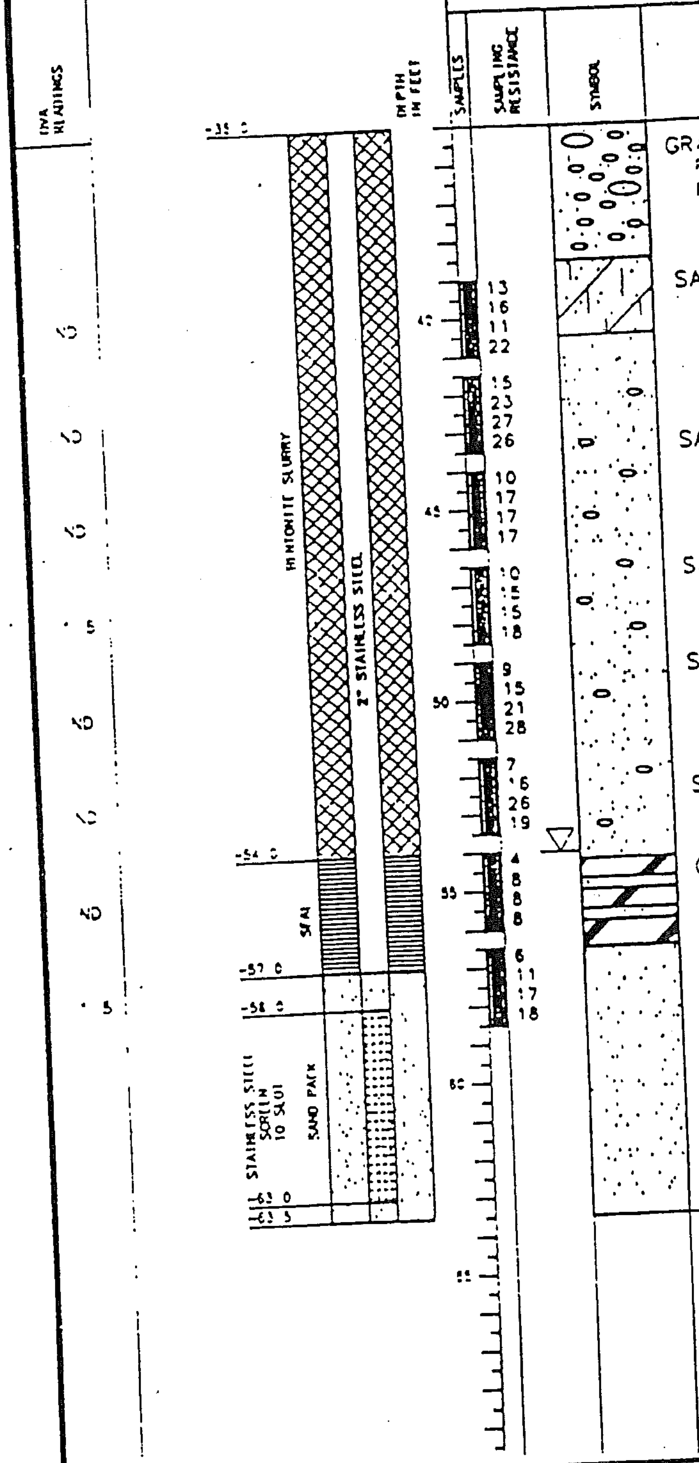
LOCATION: FIELD WEST OF PORTAGE ROAD

START DATE: 3/27/95

DRILLING CO: WMD

COMPLETION DATE: 3/27/95

GEOLOGIST: SMB



DESCRIPTION

GRAVEL
Fine to medium, with medium and coarse grained sand. Fine to medium, poorly sorted, trace cobbles, dry.

SAND
Grayish brown, fine grained, with silt, some clay, trace gravel, damp.

SAND
Brown, coarse grained, moderately sorted, some gravel, dry.

SAND
Brown, coarse and medium grained, some gravel, poorly sorted, dry.

SAND
Tan, fine grained, well sorted, trace fine gravel, dry.

SAND
Orangish brown, medium grained, poorly sorted, trace gravel, dry.

CLAY AND SAND
Clay: Gray, cohesive, non-plastic, damp.
Sand: Brown, fine grained, well sorted, wet.
6" clay layers and 3" sand seams, intermittent

SAND
Brown, medium grained, moderately sorted, wet

Total depth = 63.5 feet

GRAVEL	SILT	ORGANIC	SHALE	MISC FILL	▽	SATURATION LEVEL AT TIME OF DRILLING
SAND	CLAY	TILL	ROCK	TOPSOIL	▼	STATIC WATER LEVEL
					N.D.	NOT DETECTED BY HNU OR OVA

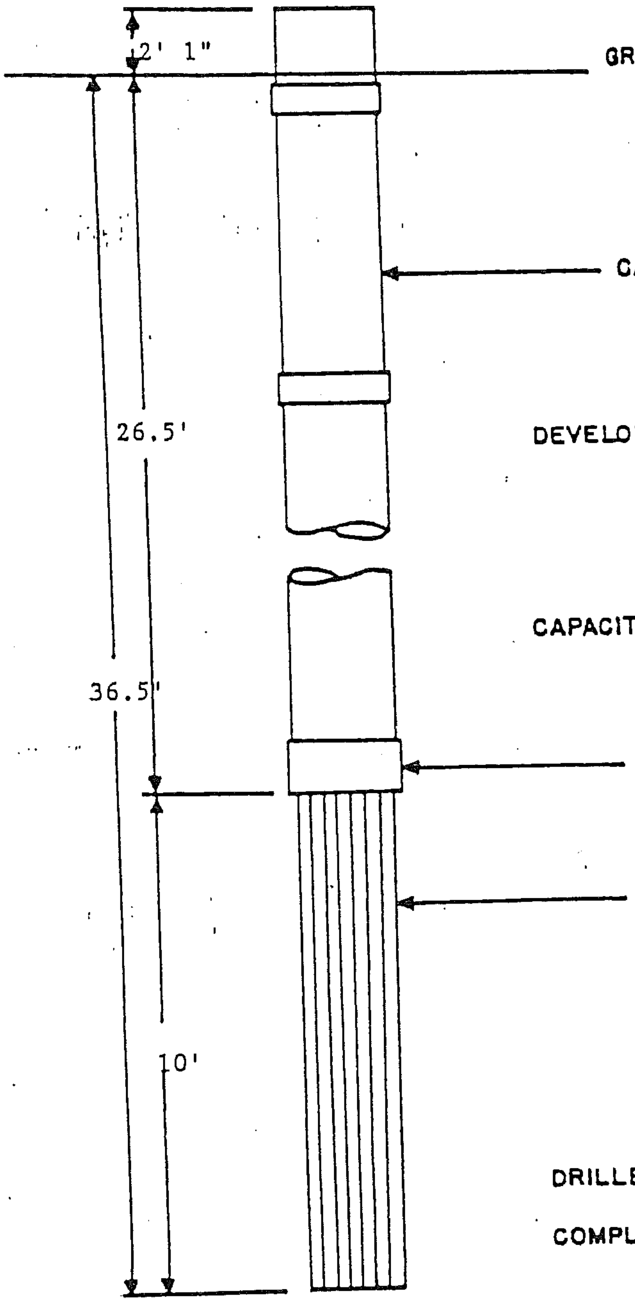
THE OHIO DRILLING COMPANY

MASSILLON, OHIO

The Upjohn Company

Kalamazoo, Michigan

Test hole No. OS-2



GROUND SURFACE

CASING
8" diameter with welded and banded joints.

DEVELOPMENT

Swabbed and bailed -
Treated with glassy phosphates and chlorine.

CAPACITY

Approximately 250 gpm

DRIVE SHOE

Steel shoe, 8" long

SCREEN

Stainless steel -
- Top 2 feet - 20 slot
- Middle 5 feet - 40 slot
- Bottom 3 feet - 20 slot

DRILLED BY: George Fahrni

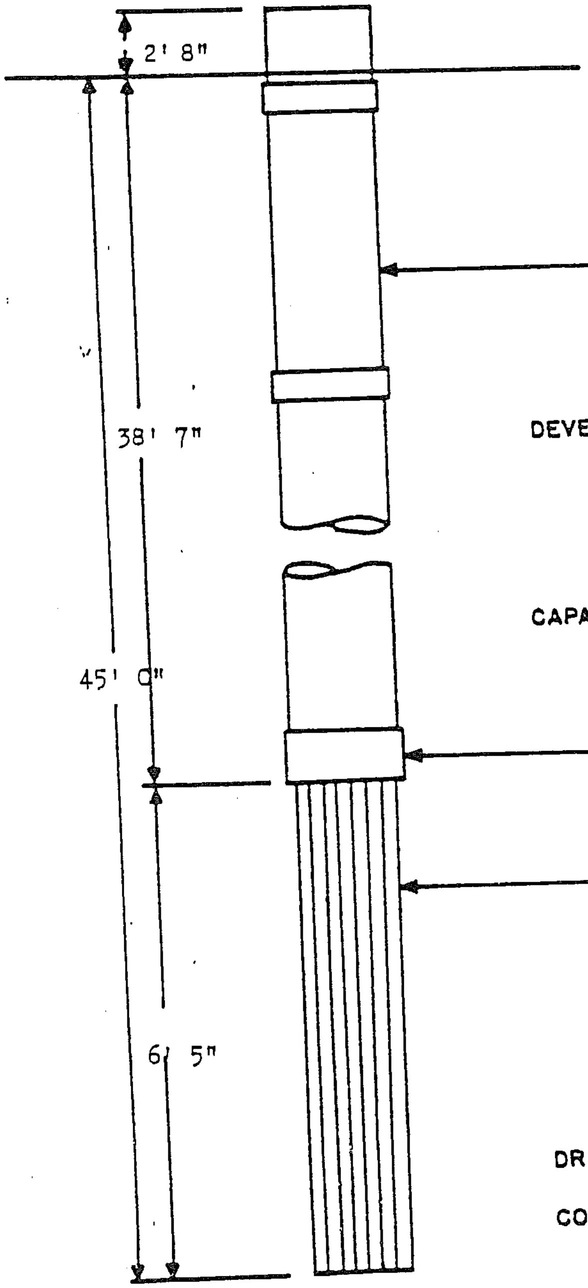
COMPLETED: November 20, 1984

THE OHIO DRILLING COMPANY

MASSILLON, OHIO

The Upjohn Company
Kalamazoo, Michigan

Well No. OS-3



GROUND SURFACE

CASING 8" steel

DEVELOPMENT Swab and bail, 7' 6" of sand removed

CAPACITY 140 gpm

DRIVE SHOE Steel

SCREEN Johnson stainless steel, Top 2 ft. 40 slot, Bottom 5 ft. 60 slot, Lead packer top & plate bottom

DRILLED BY: George Fahrni

COMPLETED: June 16, 1986

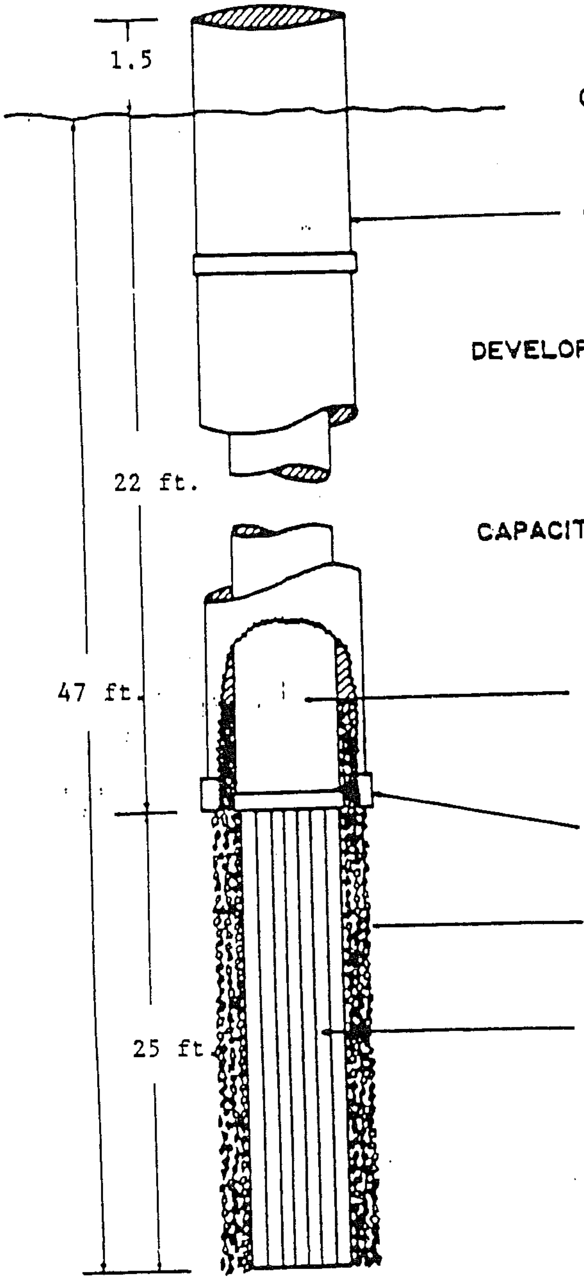
Static water level - 34' 8"

THE OHIO DRILLING COMPANY

MASSILLON, OHIO

The Upjohn Company
Kalamazoo, Michigan

Well OS-5



GROUND SURFACE

OUTER CASING
20" diameter with banded & welded joints

DEVELOPMENT
Treated with glassy phosphates and chlorine, swabbed & bailed, pumped & backwashed

CAPACITY Approximately 150 gpm

INNER CASING 10" steel with banded & welded joints

DRIVE SHOE
5" x 1" steel

GRAVEL PACK
Rounded silica gravel

SCREEN
Johnson, stainless steel, 10" pipe size, 60 slot

DRILLED BY: Dwain Hanson

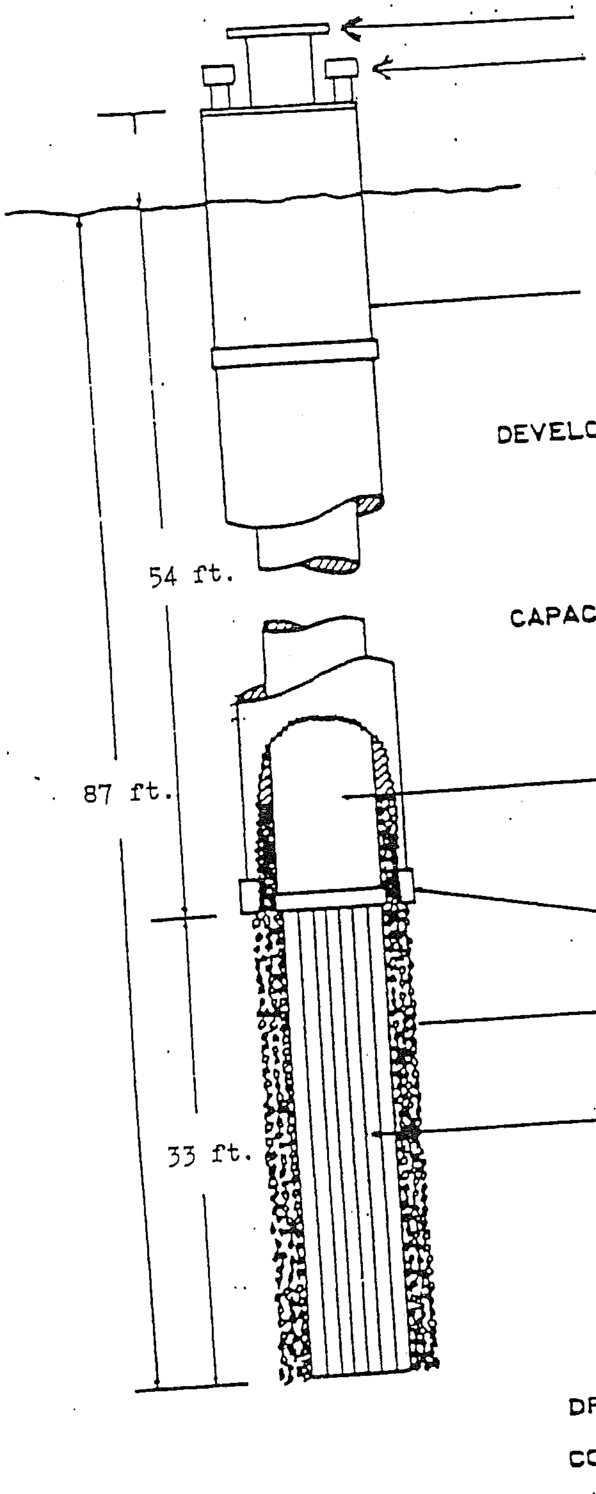
COMPLETED: March 2, 1988

THE OHIO DRILLING COMPANY

MASSILLON, OHIO

Well OS-6B

The Upjohn Company - Kalamazoo, Michigan



Pump Discharge Base

Gravel Fill Tube - 3" dia. with threaded cap

GROUND SURFACE

OUTER CASING

24" diameter with welded & banded joints. Casing grouted to a depth of 30 feet

DEVELOPMENT

Treated with phosphates & chlorine, swabbed & bailed, pumped, backwashed & air surged

CAPACITY

Tested at 470 gpm with 7.40 feet of drawdown.

Static water level - 50.08 feet

INNER CASING

16" diameter with welded & banded joints

DRIVE SHOE

5" long steel

GRAVEL PACK

Rounded silica gravel, .125" to .0625" diameter. Top of gravel - 38 ft.

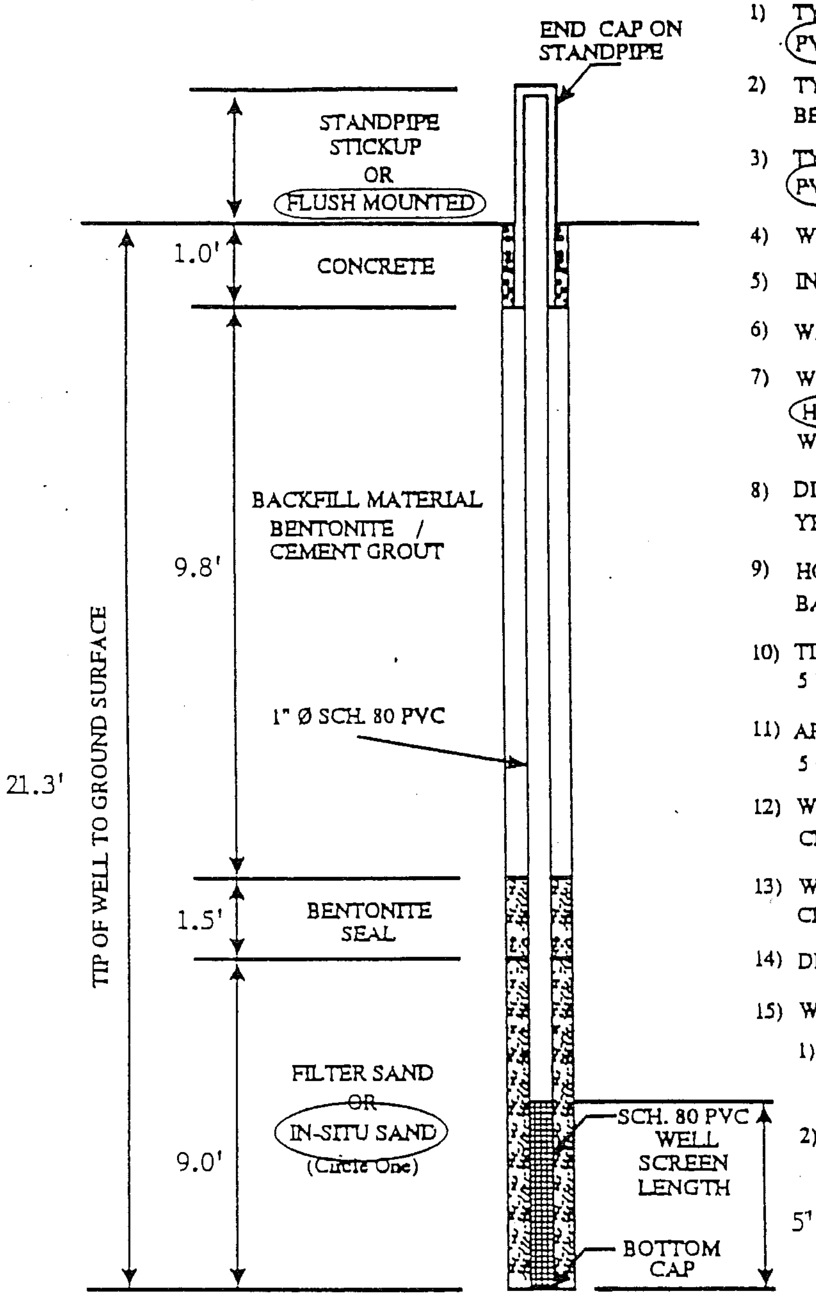
SCREEN

Johnson stainless steel, 50 slot

DRILLED BY: Jonathon Hofacre

COMPLETED: May 17, 1990

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC] GALVANIZED, STAINLESS, OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
[✓ PVC] GALVANIZED, STAINLESS, OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 06-30-90
5 MIN., [✓ 15 MIN] 30 MIN, OTHER ______

11) APPROXIMATE WATER VOLUME REMOVED OR [✓ ADDED?]
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID; OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
11.25' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 08-26-90, 11.25 FT FROM T. ST. PIPE
DATE 10-09-90, 12.60 FT FROM T. ST. PIPE
DATE 10-31-90, 12.92 FT FROM T. ST. PIPE
DATE 11-04-90, 12.88 FT FROM T. ST. PIPE

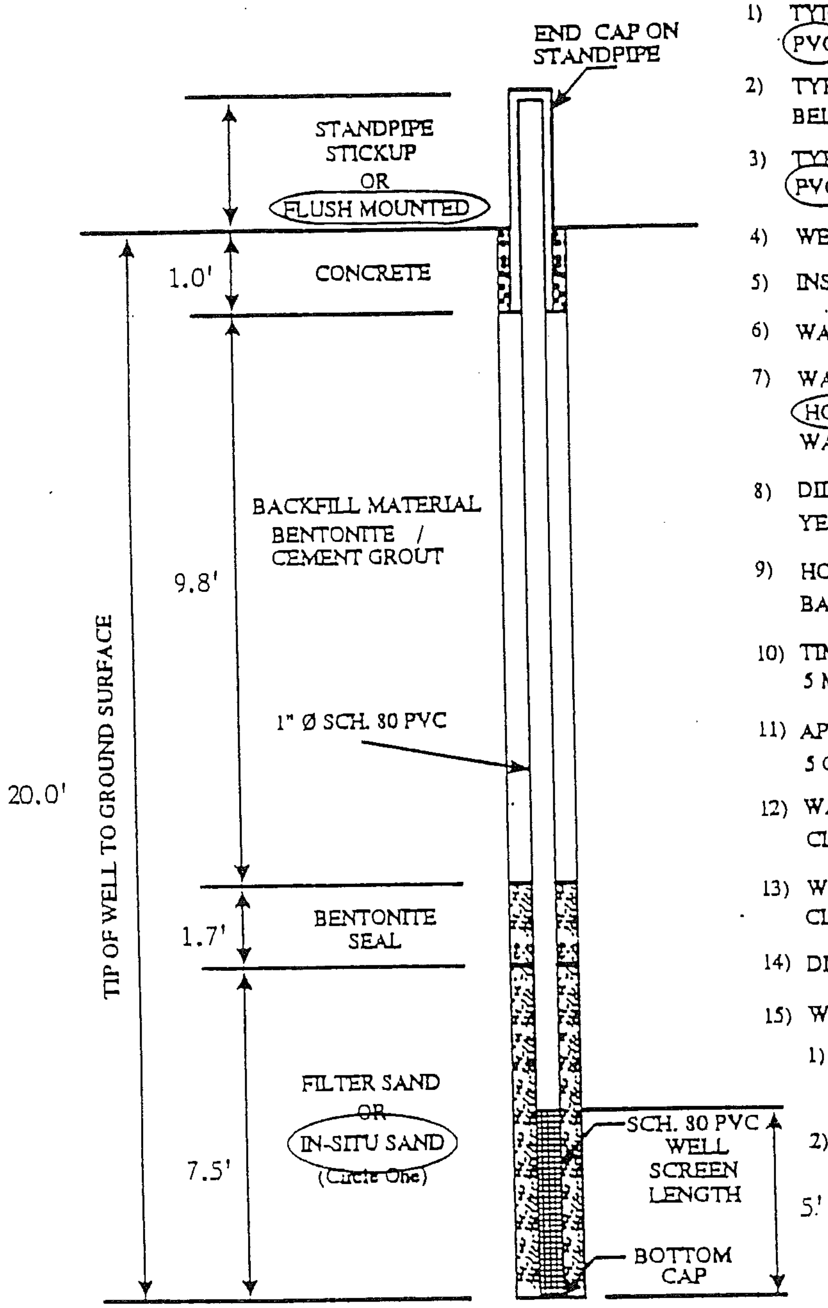
WELL NO. Pz-1a DATE INSTALLED 06-30-90 DRILL RIG DEIDRICH D-50

DRILLER SB DRILL CREW DZ

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC] GALVANIZED, STAINLESS, OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
[✓ PVC] GALVANIZED, STAINLESS, OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 06-30-90
5 MIN., 15 MIN, [✓ 30 MIN,] OTHER ________

11) APPROXIMATE WATER VOLUME REMOVED OR [✓ ADDED?]
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
12.24' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 08-26-90, 12.24 FT FROM T. ST. PIPE
DATE 10-09-90, 13.60 FT FROM T. ST. PIPE
DATE 10-31-90, 14.30 FT FROM T. ST. PIPE
DATE 11-04-90, 13.85 FT FROM T. ST. PIPE

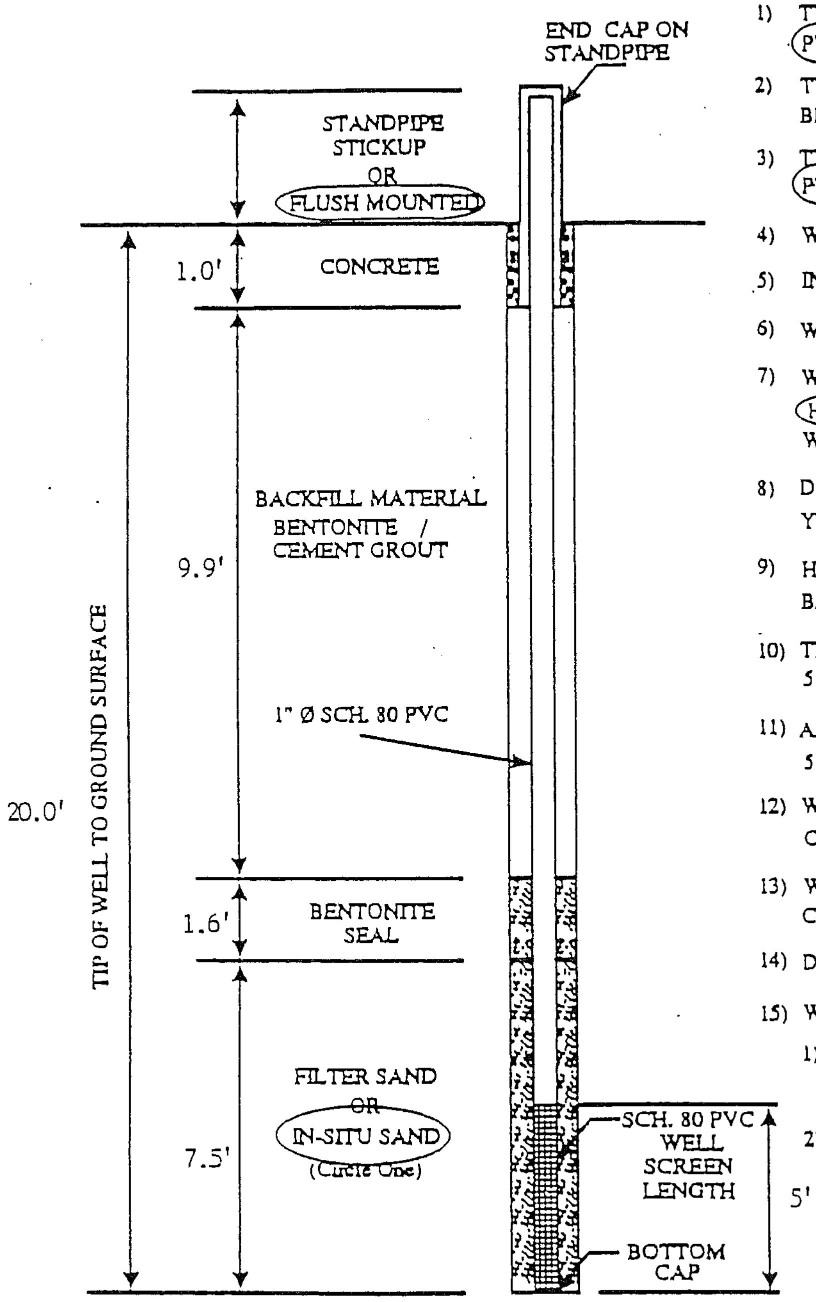
WELL NO. Pz-1b DATE INSTALLED 06-30-90 DRILL RIG DEIDRICH D-50

DRILLER SB DRILL CREW DZ

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC] GALVANIZED, STAINLESS, OTHER ______

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ______

3) TYPE OF WELL SCREEN
[✓ PVC] GALVANIZED, STAINLESS, OTHER ______

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 06-30-90
5 MIN., [✓ 15 MIN] 30 MIN, OTHER ______

11) APPROXIMATE WATER VOLUME REMOVED OR [✓ ADDED?]
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
13.50' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 08-26-90, 13.50 FT FROM T. ST. PIPE
DATE 10-09-90, 14.90 FT FROM T. ST. PIPE
DATE 10-31-90, 15.12 FT FROM T. ST. PIPE
DATE 11-04-90, 14.95 FT FROM T. ST. PIPE

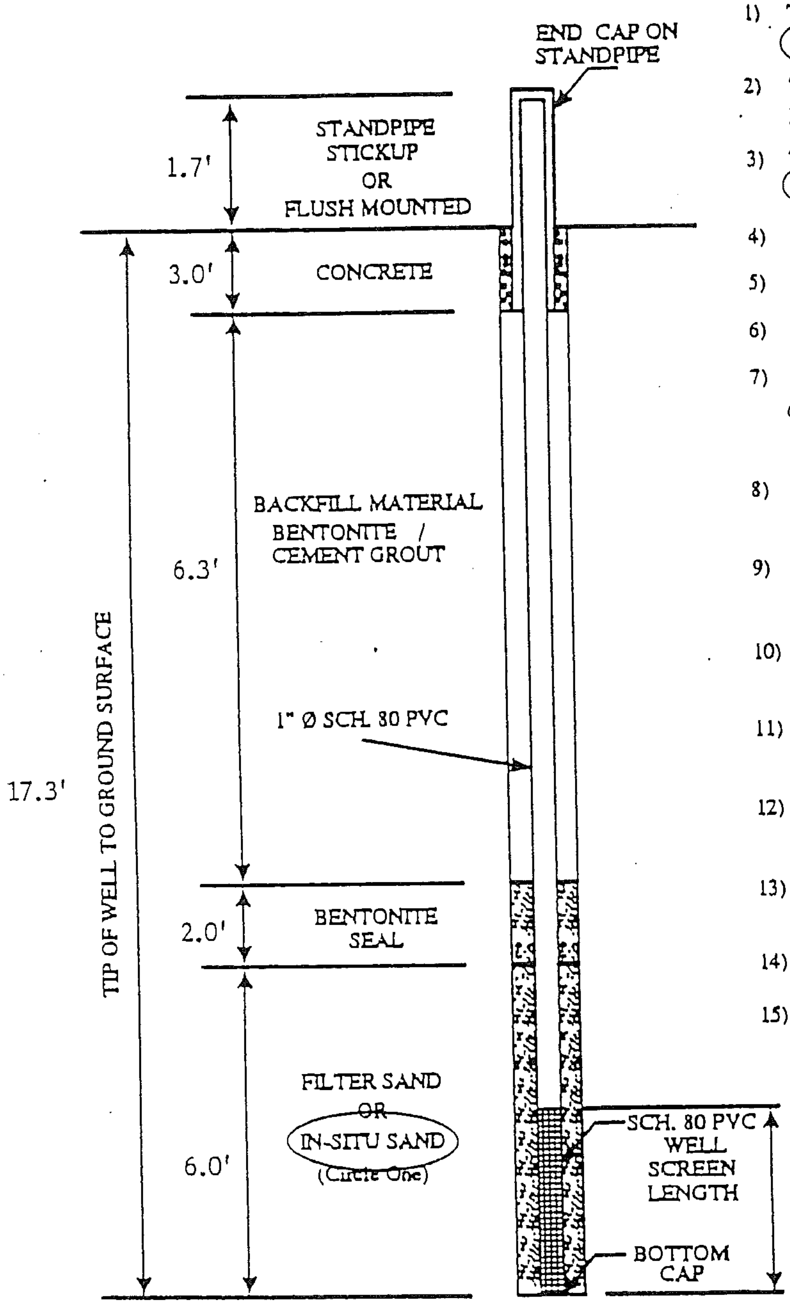
WELL NO. Pz-1c DATE INSTALLED 06-30-90 DRILL RIG DEIDRICH D-50

DRILLER SB DRILL CREW DZ

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC] GALVANIZED, STAINLESS, OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
[✓ PVC] GALVANIZED, STAINLESS, OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 06-30-90
5 MIN., [✓ 15 MIN] 30 MIN, OTHER ________

11) APPROXIMATE WATER VOLUME REMOVED OR [✓ ADDED]?
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
13.01' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 08-26-90, 13.01 FT FROM T. ST. PIPE
DATE 10-09-90, 13.70 FT FROM T. ST. PIPE
DATE 10-31-90, 15.30 FT FROM T. ST. PIPE
DATE 11-04-90, 15.01 FT FROM T. ST. PIPE

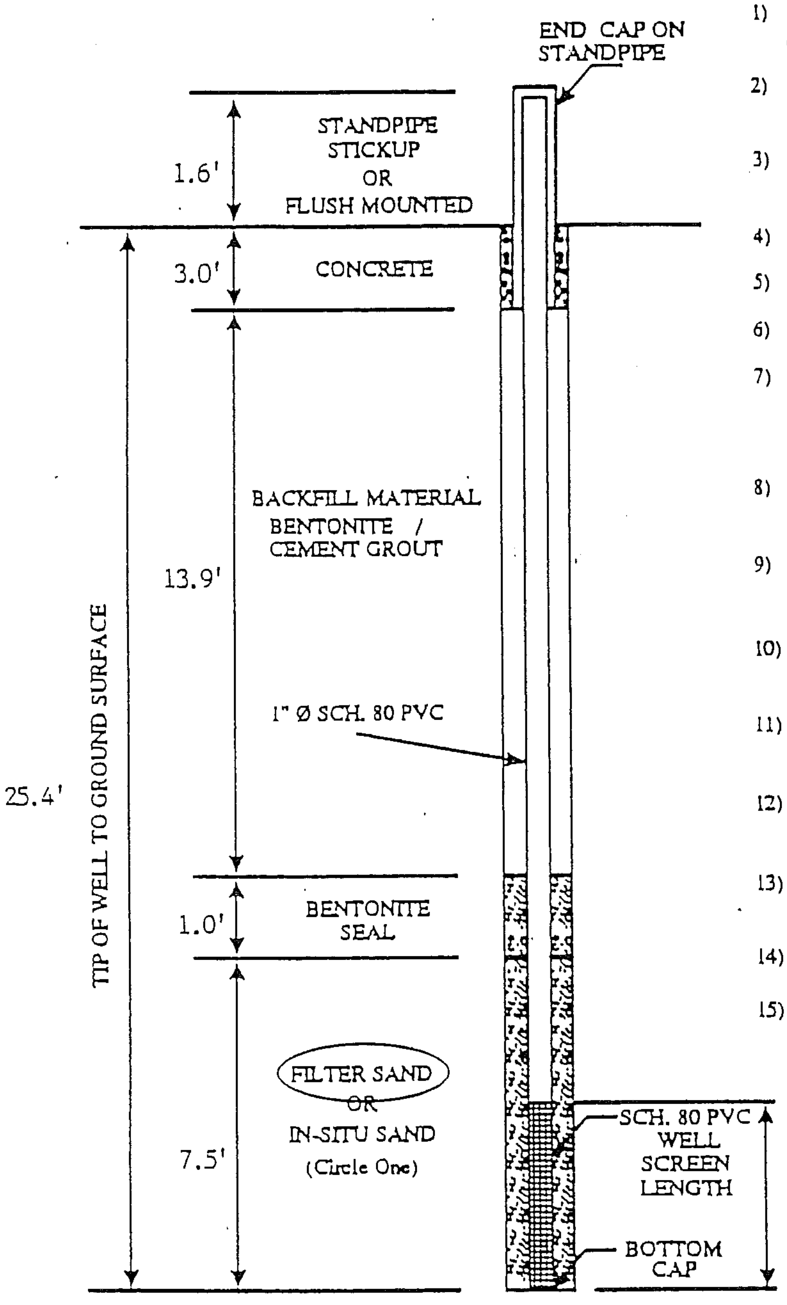
WELL NO. Pz-2b DATE INSTALLED 06-30-90 DRILL RIG DEIDRICH D-50

DRILLER SB DRILL CREW DZ

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC], GALVANIZED, STAINLESS, OTHER __________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER __________

3) TYPE OF WELL SCREEN
[✓ PVC], GALVANIZED, STAINLESS, OTHER __________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER], ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING], SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 07-02-90
5 MIN., [✓ 15 MIN], 30 MIN, OTHER __________

11) APPROXIMATE WATER VOLUME REMOVED OR [✓ ADDED]?
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
18.05' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 08-26-90,	18.05	FT FROM T. ST. PIPE
5' DATE 10-09-90,	20.60	FT FROM T. ST. PIPE
DATE 10-31-90,	21.30	FT FROM T. ST. PIPE
DATE 11-04-90,	21.31	FT FROM T. ST. PIPE

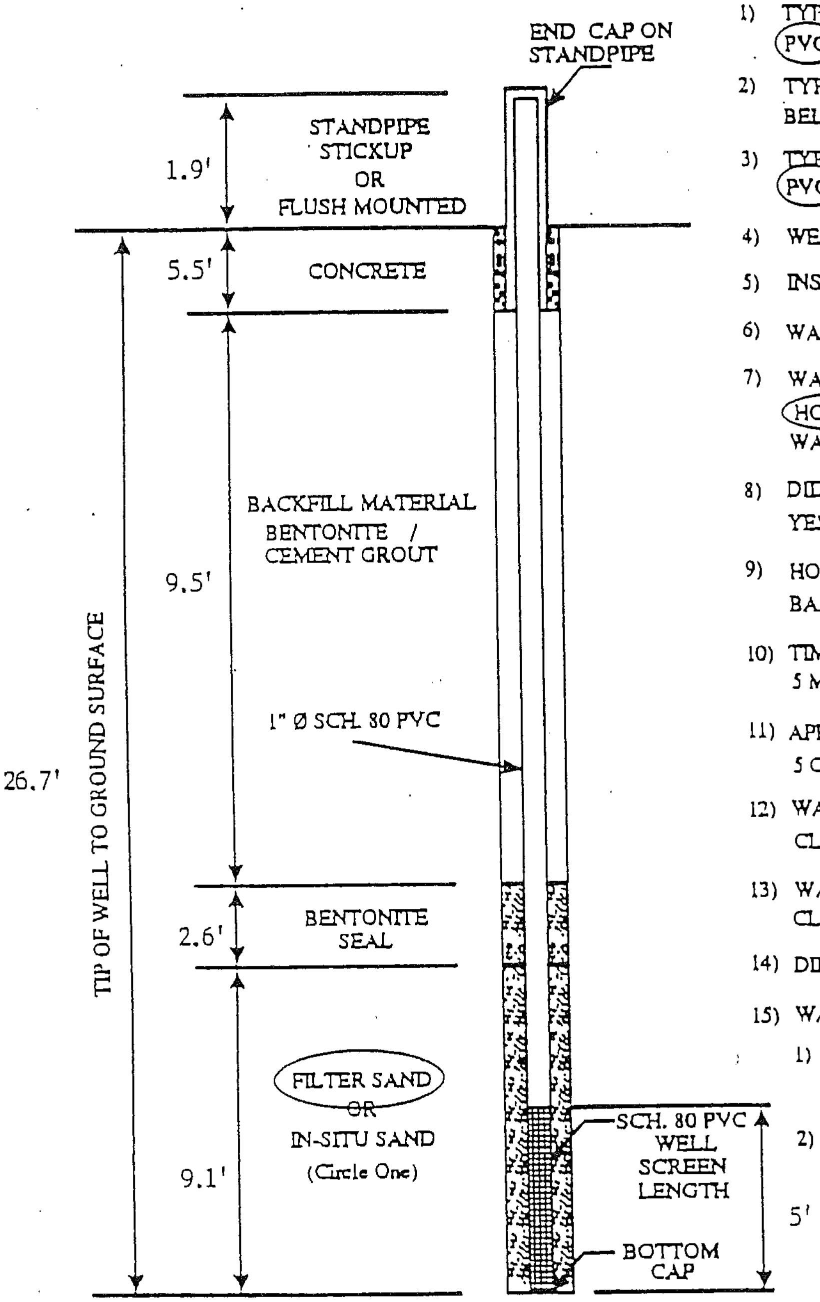
WELL NO. Pz-3a DATE INSTALLED 07-02-90 DRILL RIG DEIDRICH D-50

DRILLER SB DRILL CREW DZ

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC] GALVANIZED, STAINLESS, OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
[✓ PVC] GALVANIZED, STAINLESS, OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 07-02-90
5 MIN., [✓ 15 MIN] 30 MIN, OTHER ________

11) APPROXIMATE WATER VOLUME REMOVED OR [✓ ADDED?]
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
22.00' FT OR DRY

2) OTHER MEASUREMENTS:
DATE 08-26-90 , 22.00 FT FROM T. ST. PIPE
DATE 10-09-90 , 24.30 FT FROM T. ST. PIPE
DATE 10-31-90 , 25.06 FT FROM T. ST. PIPE
DATE 11-04-90 , 24.46 FT FROM T. ST. PIPE

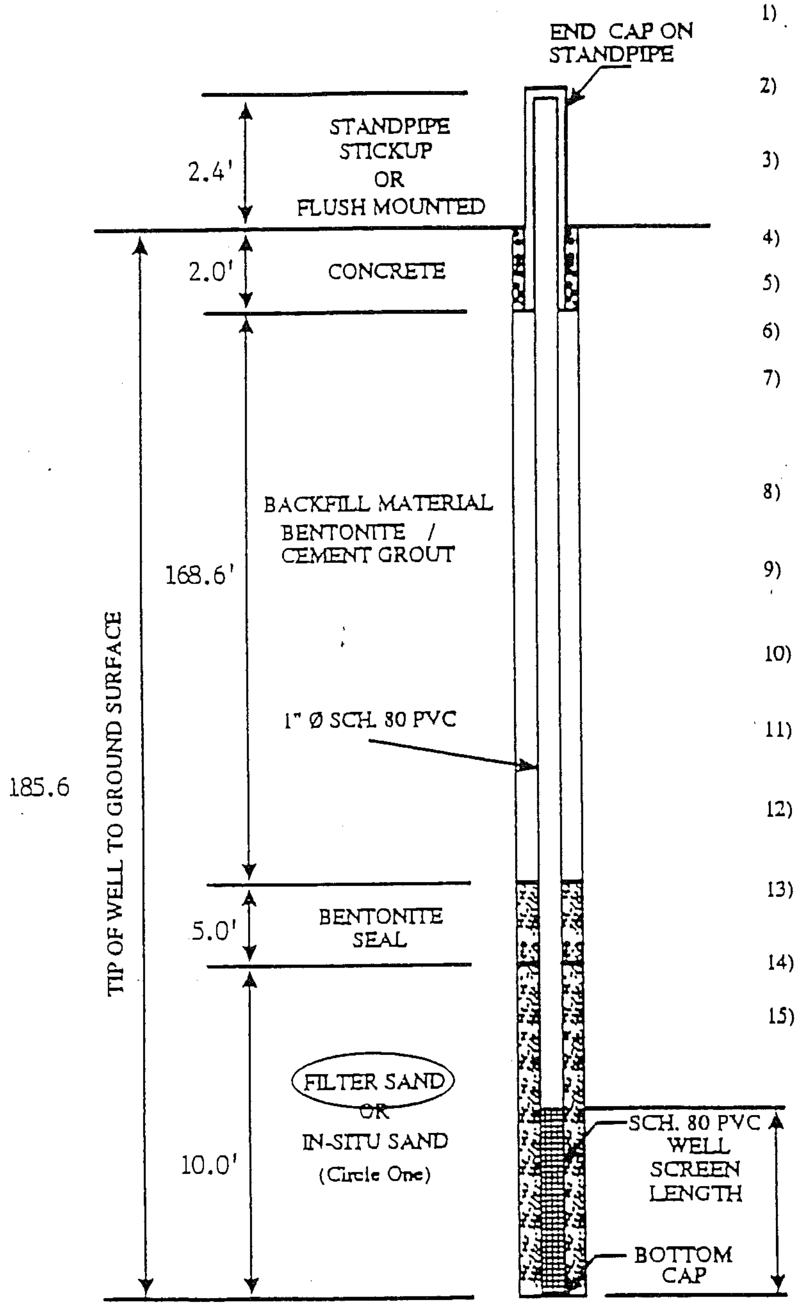
WELL NO. Pz-3b DATE INSTALLED 07-02-90 DRILL RIG DEIDRICH D-50

DRILLER SB DRILL CREW DZ

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC] GALVANIZED, STAINLESS, OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
[✓ PVC] GALVANIZED, STAINLESS, OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? YES
[✓ HOLLOW STEM AUGER] [✓ ROTARY] CABLE TOOL,
WATER, REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 08-24-90
5 MIN., [✓ 15 MIN] 30 MIN, OTHER ________

11) APPROXIMATE WATER VOLUME REMOVED OR [✓ ADDED?]
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
81.20' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 10-09-90	81.20	FT FROM T. ST. PIPE
DATE 10-14-90	73.03	FT FROM T. ST. PIPE
DATE 10-31-90	54.65	FT FROM T. ST. PIPE
DATE 11-04-90	56.48	FT FROM T. ST. PIPE

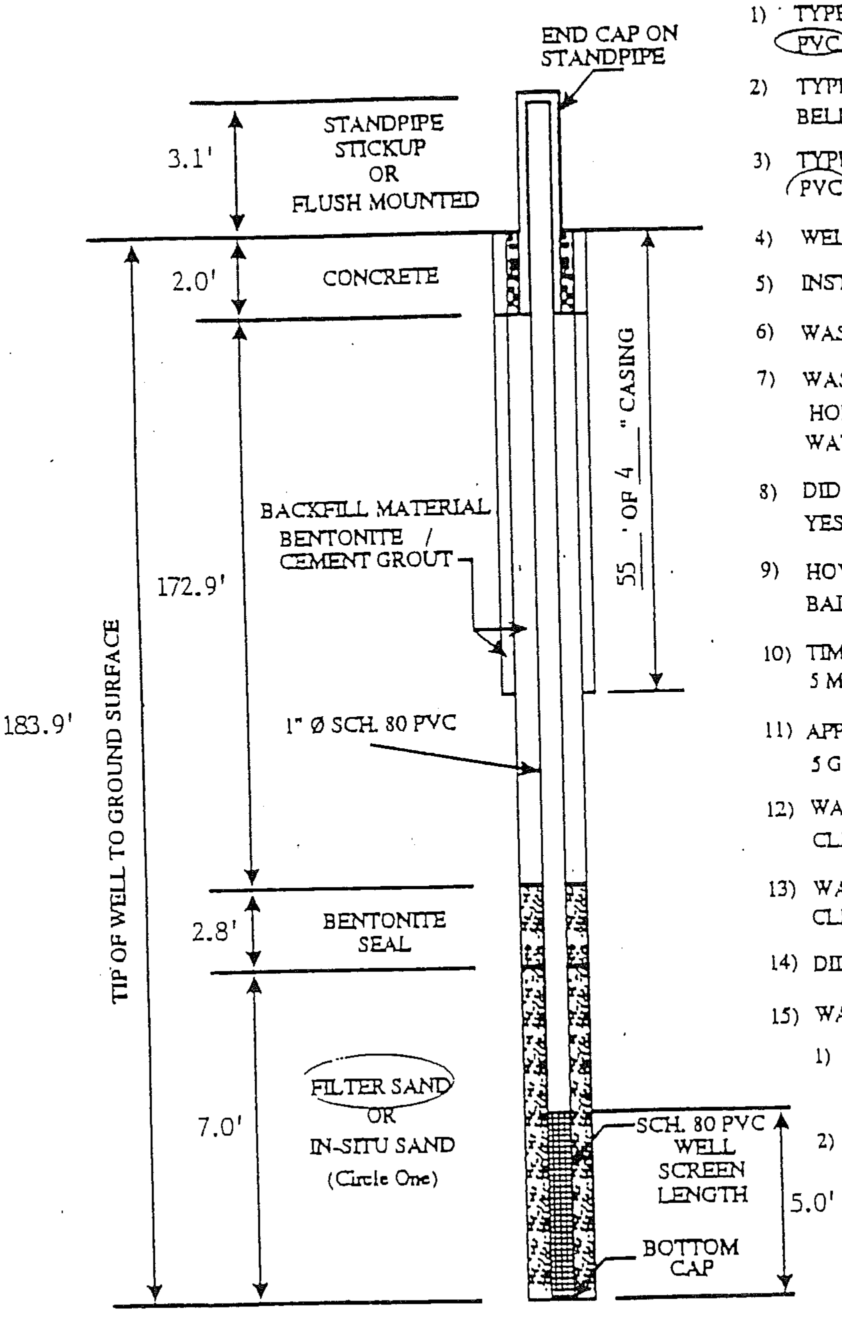
WELL NO. Pz-4a DATE INSTALLED 08-24-90 DRILL RIG MOBILE B-61

DRILLER DG DRILL CREW CC

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC] GALVANIZED, STAINLESS, OTHER ____________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED], OTHER ____________

3) TYPE OF WELL SCREEN
[✓ PVC], GALVANIZED, STAINLESS, OTHER ____________

4) WELL SCREEN SLOT SIZE No. 10 (0.01)

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? YES
HOLLOW STEM AUGER, [✓ ROTARY], CABLE TOOL, WATER, REVERT, [✓ BENTONITE]

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING], SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 09-12-90
5 MIN., [✓ 15 MIN], 30 MIN, OTHER ____________

11) APPROXIMATE WATER VOLUME REMOVED OR ADDED?
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
63.75' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 10-31-90 , 63.75 FT FROM T. ST. PIPE
DATE 11-03-90 , 63.92 FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE
DATE ________ , ________ FT FROM T. ST. PIPE

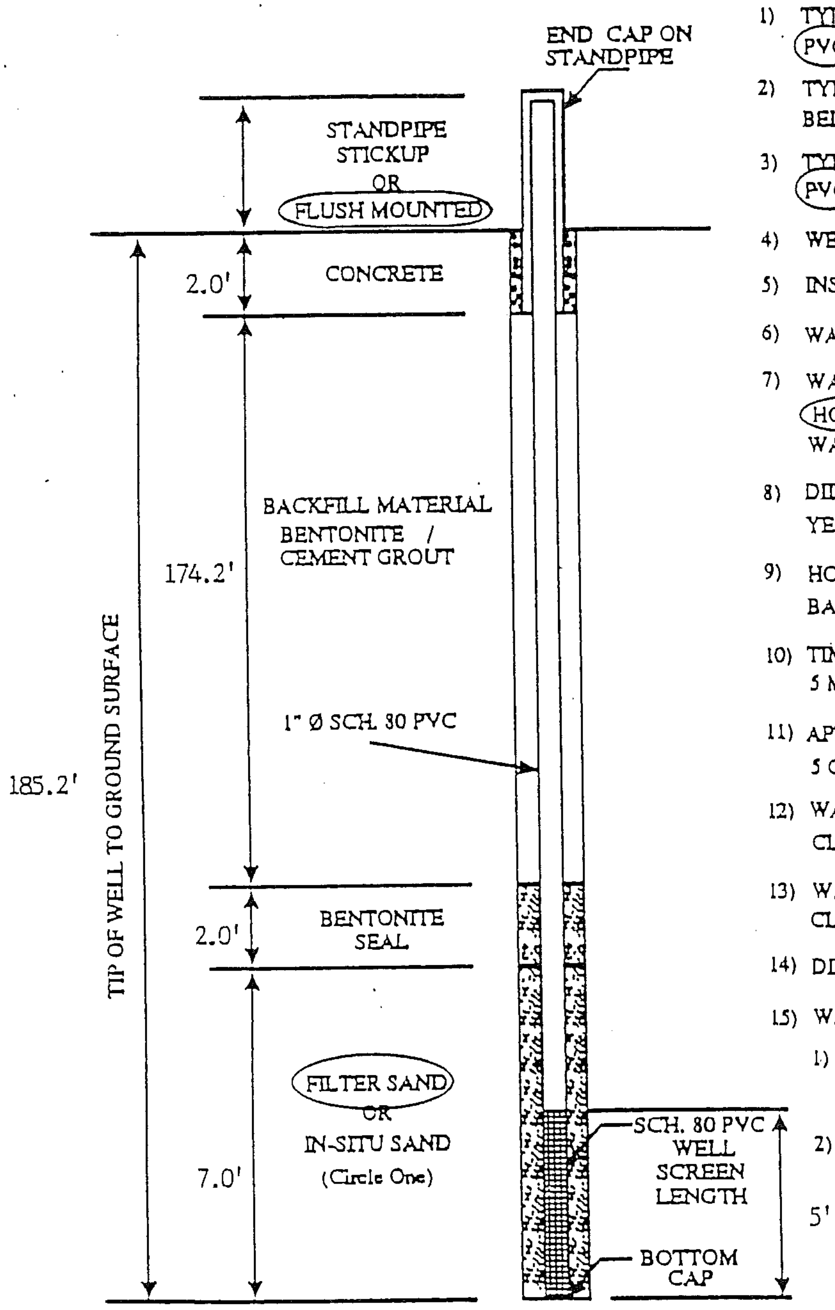
WELL NO. Pz-4b DATE INSTALLED 09-12-90 DRILL RIG MOBILE B-61

DRILLER BP DRILL CREW DH

JOB/CLIENT The UpJohn Company Portage Facility STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

STS Piezometer Installation Diagram



1) TYPE OF PIPE
[✓ PVC] GALVANIZED, STAINLESS, OTHER ________

2) TYPE OF PIPE JOINTS
BELLED, COUPLINGS, [✓ THREADED] OTHER ________

3) TYPE OF WELL SCREEN
[✓ PVC] GALVANIZED, STAINLESS, OTHER ________

4) WELL SCREEN SLOT SIZE No. 10 (0.01")

5) INSTALLED PROTECTOR PIPE W/LOCK? [✓ YES] OR NO

6) WAS SOLVENT USED? YES OR [✓ NO]

7) WAS DRILLING MUD USED? No
[✓ HOLLOW STEM AUGER] ROTARY, CABLE TOOL, WATER, REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR [✓ NO]

9) HOW WAS WELL DEVELOPED?
BAILING, [✓ PUMPING] SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT 09-19-90
5 MIN., [✓ 15 MIN] 30 MIN, OTHER ________

11) APPROXIMATE WATER VOLUME REMOVED OR [✓ ADDED]?
5 GAL, 10 GAL, 15 GAL, OTHER 100 Gallons

12) WATER CLARITY BEFORE DEVELOPMENT
CLEAR, TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
CLEAR, TURBID, OPAQUE

14) DID THE WATER HAVE AN ODOR? YES OR [✓ NO]

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
69.80' FT OR DRY

2) OTHER MEASUREMENTS:

DATE 10-14-90, 69.80 FT FROM T. ST. PIPE
DATE 10-31-90, 62.56 FT FROM T. ST. PIPE
DATE 11-03-90, 60.79 FT FROM T. ST. PIPE
DATE ________, ________ FT FROM T. ST. PIPE

WELL NO. Pz-4c DATE INSTALLED 09-19-90 DRILL RIG MOBILE B-61

DRILLER BP DRILL CREW DH

JOB/CLIENT The UpJohn Company STS PROJECT NO. 71840

(VERSION 1: 11/90 - M11DRAW)

THE OHIO DRILLING COMPANY

MASSILLON, OHIO

W-7
TH-31

. 7 - 16" Water Well located
at No. 31 test hole

~~Enclosed~~ well for:

Upjohn Company
Portage Road Plant
Kalamazoo, Michigan

16" OD, 3/8" wall welded joints
Pipe size & description

Note - Temporary 26" casing ran
to 28 ft. and temporary 20" to 101 ft.

Lee Hofacre - Driller
Completed - June 5, 1951.

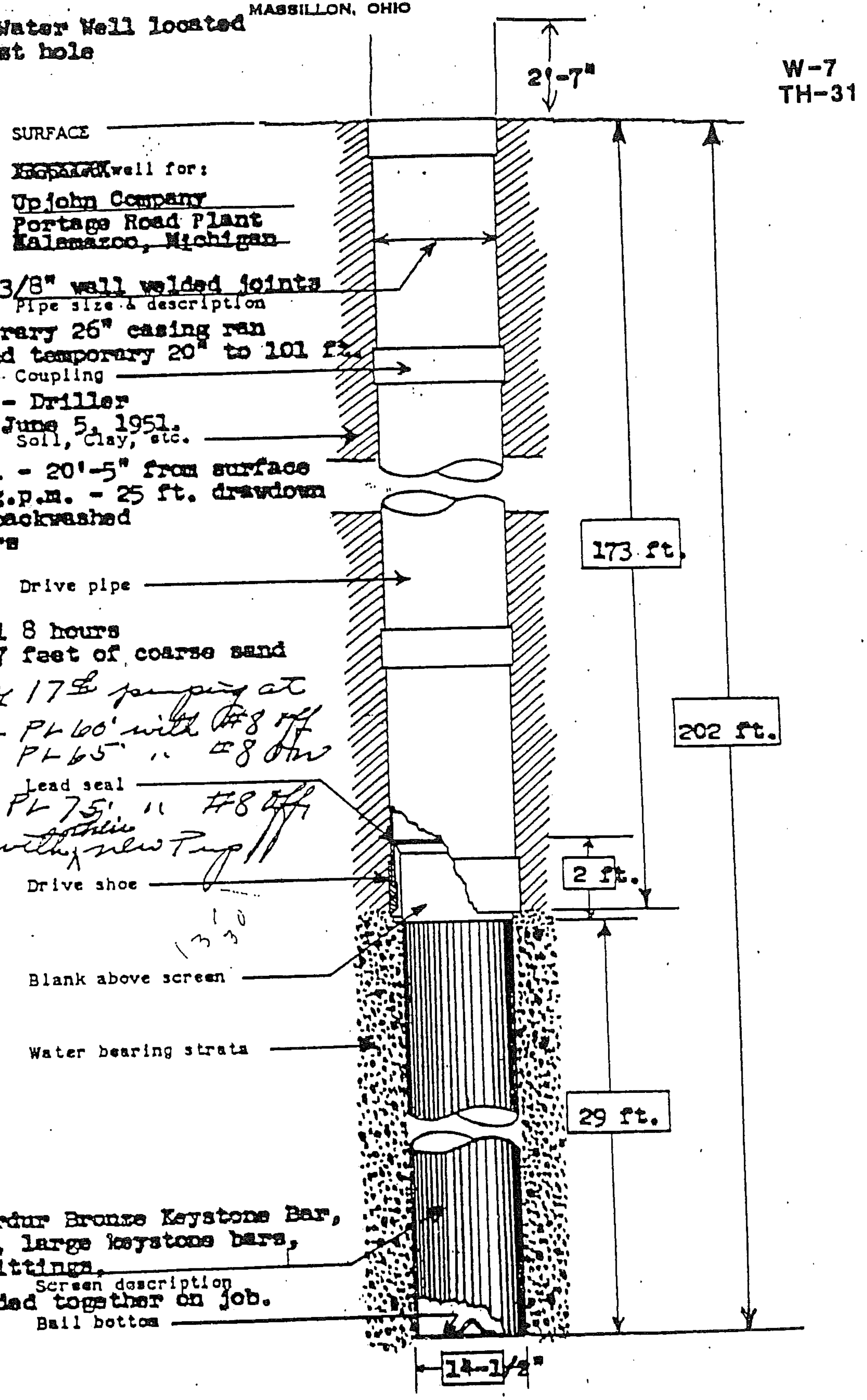
Static level - 20'-5" from surface
Yield 1200 g.p.m. - 25 ft. drawdown
Pumped and backwashed
well 28 hours

Swabbed well 8 hours
Swabbed in 7 feet of coarse sand

n July 17th pumping at
1600 GPM - PL 60' with #8 off
" " PL 65' " #8 on
1400 " PL 75' " #8 off
This test with gasoline new Pump

10
\33

Type H Everdur Bronze Keystone Bar,
No.70 Slot, large keystone bars,
Standard fittings.
Screen description
Screen welded together on job.

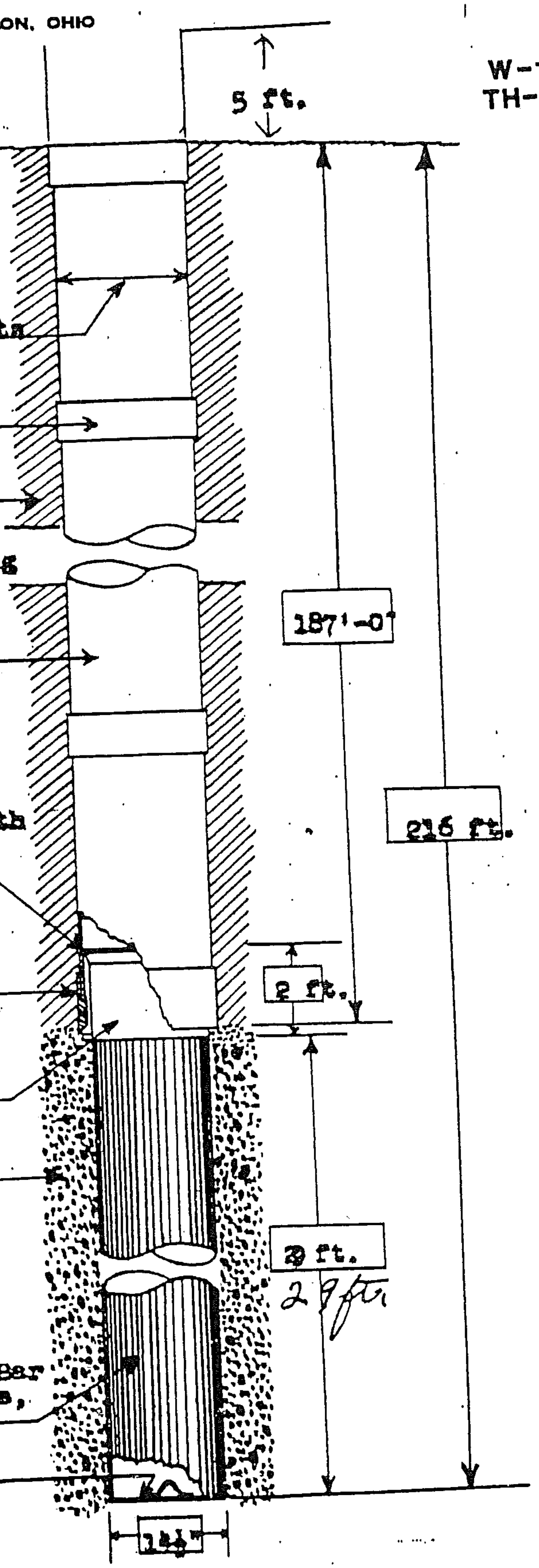


THE OHIO DRILLING COMPANY

MASSILLON, OHIO

W-13
TH-35

No. 13 - 16" Well located
at No. 35 test hole



~~XXXXXXX~~ well for:
Upjohn Company
Portage Road Plant
Kalamazoo, Michigan

16" OD, 3/8" wall, welded joints
Pipe size & description

Completed December 7, 1951
Driller, Lee Hofacre

NOTE: Temporary 26" casing to 52 ft. and temporary 20" casing 108 ft.

Static level 15 ft. from surface with Nos. 7 and 8 shut down and 18 ft. with Nos. 7 and 8 in operation
Yield 1065 gpm -55 ft. drawdown with Nos. 7 and 8 operating. With No. 7 idle, 1090 gpm at 48 ft. drawdown.

Pumped and backwashed well 30 hours.

Swabbed well 1-1/2 days, swabbed in 78 ft. of sand.

Note: The top of the 16" pipe is now 866.01', and the finished Concrete Base will be 865.69'

Type H Everdur Bronze Keystone Bar No. 70 Slot, large keystone bars, standard ~~fittings~~.
Screen welded together on job

THE OHIO DRILLING COMPANY
MASSILLON, OHIO

W-17
TH-49

No. 17 - 16" Well located
at No. 49 test well, Portage
Road Plant

~~Proposed~~ well for:
Upjohn Company
Kalamazoo, Michigan

16" - 65# steel, welded joints
Pipe size & description

Lee Hofacre, Driller
Completed - May 3, 1954

Temporary 26" casing to 37 ft. and
20" casing to 92 ft. and removed.

tatic level 29 ft. from surface.
eld 875 g.p.m. - 55 ft. drawdown

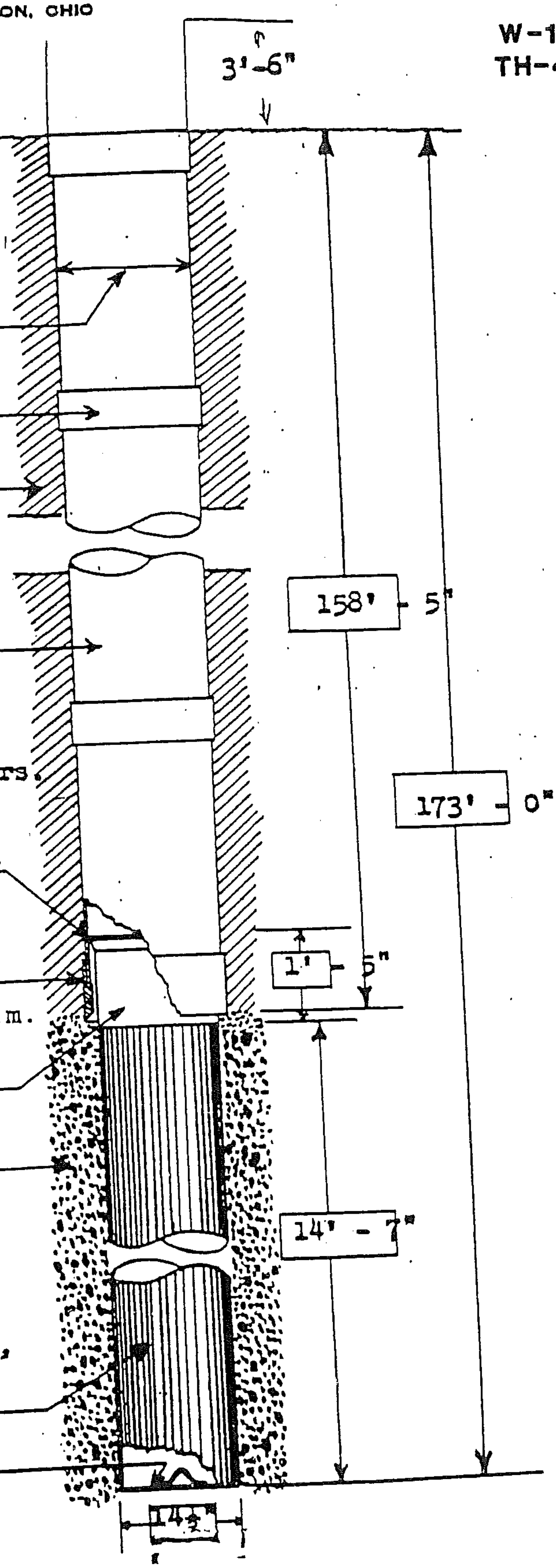
Pumped well for approximately 25 hrs.
Record of pumping test attached.

Swabbed 2 hours - 34 ft. of sand

Permanent pump Peerless, 1300 g.p.m.
257 ft. total head. Column pipe
120 ft. of 10" and 12".

Pump bowl, 4 stage 12" MA.
Suction 10 ft. of 8".

Type H Everdur Bronze Keystone Bar,
large keystone bars, No. 70 slot,
standard fitting.
Screen description



W-19
TH-53

THE OHIO DRILLING COMPANY

MASSILLON, OHIO

No. 19 - 16" Well at
No. 53 Test Hole.

SURFACE

well for:
The Upjohn Company
Kalamazoo, Michigan

16" - 65 lb. Steel, Welded Joints
Pipe size & description

Coupling

Tevella Hofacre, Driller.
Completed - August 20, 1958.

Soil, Clay, etc.

Note: 26" temporary casing to 55 ft., and 20" temporary casing to 110 ft. All removed.

Drive pipe

Static level - 31 ft. from surface.
Yield - 1000 GPM - 7½ ft. Drawdown, with wells 7 and 17 idle.
Yield - 1000 GPM - 10½ ft. Drawdown with wells 7 and 17 operating.
Pumped well 22 hours.

Lead seal

Swabbed well 2 hrs. - 1 ft. coarse sand.

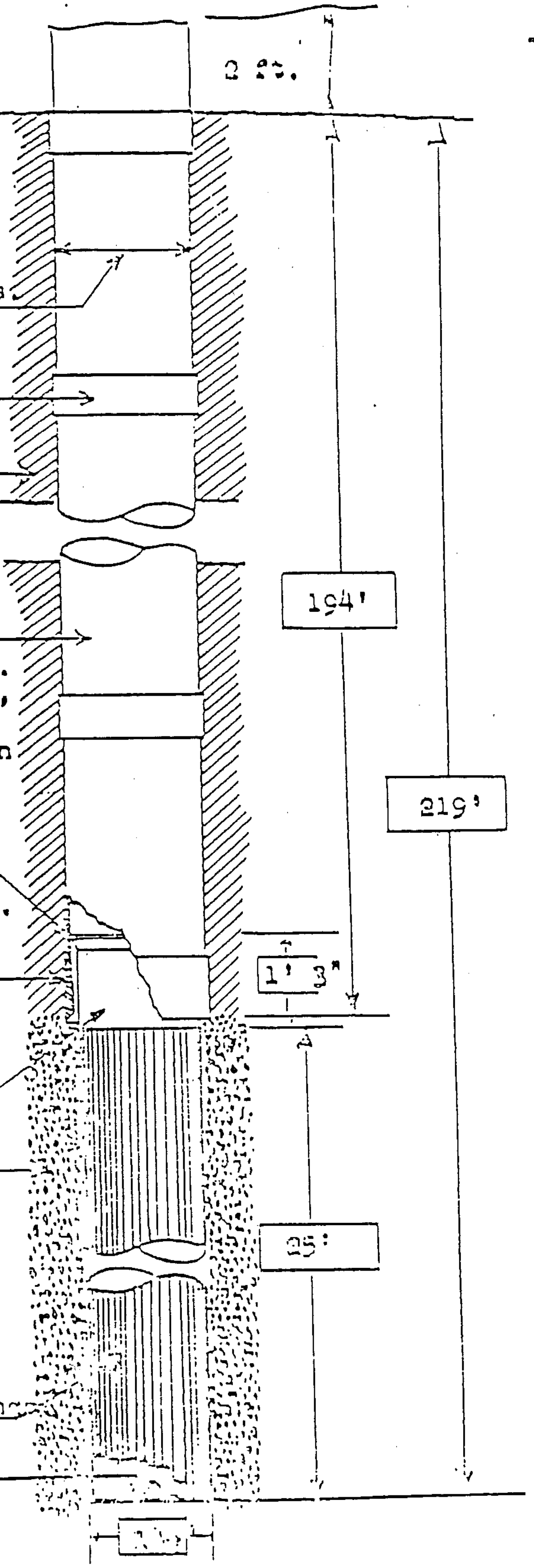
Drive shoe

Blank above screen

Water bearing strata

Type H Everdur Bronze Keystone Pip, No. 70 Slots, standard fittings
Screen description

Bail bottom

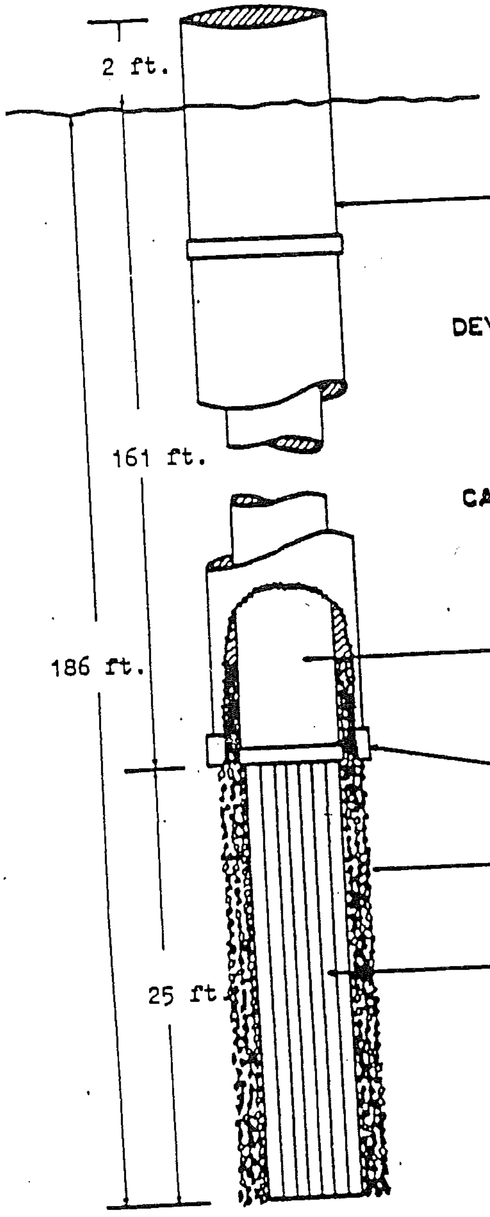


W-46
TH-203

THE OHIO DRILLING COMPANY

MASSILLON, OHIO

Well No. 46 - The Upjohn Company
Kalamazoo, Michigan



GROUND SURFACE

OUTER CASING

24" dia. steel casing with banded & welded joints, upper 30 ft. of well grouted as work pipe was pulled

DEVELOPMENT

Surged, backwashed, air surged, swabbed, bailed, treated with glassy phosphates and chlorine

CAPACITY

1210 gpm with 8.75 feet of drawdown
Specific capacity - 138 gpm per ft. of drawdown

INNER CASING

16" diameter with banded & welded joints

DRIVE SHOE

1/2" thick x 5" long steel

GRAVEL PACK

.125" to .250" rounded silica gravel.
Top of gravel - 142 ft.

SCREEN

Johnson stainless steel, 16" pipe size, screen slot size - .100 inch

DRILLED BY: John King

COMPLETED: March 31, 1989

Static water level - 49.42 feet

ATTACHMENT D

ENVIRONMENTAL LABORATORY QUALITY ASSURANCE MANUAL

KAR *Laboratories, Inc.*

• • • • • • • • • • • • • • • • • •

ENVIRONMENTAL LABORATORY QUALITY ASSURANCE MANUAL

April 30, 2009

KAR Laboratories, Inc.
4425 Manchester Road
Kalamazoo, MI 49001
269-381-9666
Fax: 269-381-9698
email: info@karlabs.com
Internet: http://www.karlabs.com

Environmental Laboratory
Quality Assurance Manual

Company Vision: Be a Top Performing Environmental Laboratory

Mission: Focus on the following key areas

Clients	*All resources are applied to satisfy or exceed clients' needs*
Employees	*The work environment provides a high degree of worker satisfaction*
Ethics	*All company and employee actions are legal and ethical*
Image	*KAR's image accurately reflects the company's commitment to excellence*
Profits	*KAR Laboratories is profitable for its shareholders and employees*
Quality	*Superior quality is provided in all aspects of performance*

Date of Issue: April 30, 2009

Approval:

Laboratory Manager: David R. Alkema Date: 30 April 2009
David R. Alkema

Quality Assurance Manager: Linda M. Felcyn Date: april 30, 2009
Linda M. Felcyn

KAR Laboratories President: Date: 4-30-2009
William G. Rauch

TABLE OF CONTENTS

1. INTRODUCTION
   - 1.1 Corporate Core Values
   - 1.2 Quality Control and Quality Assurance Programs
   - 1.3 Quality Assurance Manager
   - 1.4 Laboratory Manager
   - 1.5 The Laboratory Information Management System (LIMS)
   - 1.6 Report Options

2. SAMPLE COLLECTION
   - 2.1 The Importance of Proper Sample Collection
   - 2.2 Elements of the Sampling Plan

3. SAMPLE RECEIPT AND HANDLING WITHIN THE LABORATORY
   - 3.1 Sample Receipt
   - 3.2 Sample Handling
   - 3.3 Chain-of-Custody

4. LABORATORY SUPPLIES, CHEMICALS AND EQUIPMENT
   - 4.1 Laboratory Glassware
   - 4.2 Chemicals and Reagents
   - 4.3 Equipment/Instrument Calibration Checks

5. ANALYTICAL METHODOLOGY
   - 5.1 Analytical Methods
   - 5.2 Standard Operating Procedures (SOP)
   - 5.3 Auditing Performance
   - 5.4 Method Validation

6. INSTRUMENT PERFORMANCE
    6.1 Sensitivity, Specificity, Stability
    6.2 Monitoring Performance
    6.3 Calibration
    6.4 Maintenance

7. DATA HANDLING AND RECORD KEEPING
    7.1 What Records to Keep and How Long
    7.2 Protocols and Forms
    7.3 Important Aspects of Documentation and Qualifying Data
    7.4 Reporting Results

8. DATA INTEGRITY, CONFIDENTIALITY, CHALLENGES, AND DATA CORRECTION
    8.1 Data Integrity
    8.2 Confidentiality Agreement
    8.3 Data Challenges and Auditing Data Validity
    8.4 Data Correction and Notification Procedures
    8.5 Laboratory Corrective Action

9. PERSONNEL
    9.1 Training
    9.2 Safety

INTRODUCTION

1.1 Corporate Core Values

1.1.1 Clients

- Provide a wide range of services
- Keep promises, meet commitments
- Maintain high quality
- Charge reasonable fees
- Promote open & timely communication (client focus, client-driven)

1.1.2 Employees

- Promote employee involvement and empowerment
- Provide a generous, comprehensive benefit package
- Seek employee input, comments & criticisms
- Provide continuing education and training
- Encourage teamwork and cooperation
- Provide opportunity for advancement
- Recognize & acknowledge contributions of all employees

1.1.3 Ethics

- Treat all individuals with dignity and respect
- Ethical waste management: disposal, recycling, reuse, & minimization
- Be fair when billing for services
- Accept work only when we can provide something of value to our client
- Follow established SOPs and current approved methods
- Report complete and accurate data
- Pursue knowledge of environmental laws and regulations

1.1.4 Corporate Responsibility

- Act in a professional and responsible manner
- Support charitable causes and community programs

- Maintain a high level of involvement in professional associations
- Market, advertise, and promote KAR Labs appropriately
- Build relationships and reputation with Government officials/regulators
- Promote environmental awareness

1.1.5 Profits

- Make KAR a good investment for shareholders
- Provide substantial profit sharing to employees
- Provide stability and security for employees
- Minimize expenses wherever possible
- Increase efficiency/effectiveness
- Maximize revenue: expand client base, increase range of services offered

1.1.6 Quality

- Provide a high quality product (report) and high quality services
- Satisfy client requirements for timeliness
- Innovate: stay abreast of improvements in technology (leading edge)
- Provide a high level of service, client focus, and expertise
- Practice continuous improvement
- Adequately maintain building, laboratories, and grounds

1.2 Quality Control and Quality Assurance Programs

1.2.1 This manual is intended to be a general overview of the quality assurance program at KAR Laboratories, Inc. for the environmental testing area. Detailed, step-by-step procedures regarding Quality Control can be found in the appropriate Standard Operating Procedure (SOP).

1.2.2 **Definition of Laboratory Quality Assurance**: A program of techniques and procedures to ensure that the facilities, equipment, personnel, methods, practices, records, and controls are in compliance with regulations set forth by the Environmental Protection Agency (EPA).

1.2.3 **Definition of Laboratory Quality Control**: The techniques whereby the variables of the analytical processes are monitored and maintained within an established limit.

1.3 Quality Assurance Manager

It is the responsibility of the Quality Assurance Manager to design, implement, manage, and enforce the laboratory's overall Quality Assurance Program that ensures that laboratory data are produced and evaluated in compliance with quality standards. Assessments of the overall laboratory compliance are performed through periodic reviews of the facilities, systems, and processes. The Quality Assurance Manager maintains the Quality Assurance Manual and is responsible for its biennial review and update.

To ensure that QA Manager has adequate authority, the individual shall be a manager who has an independent reporting structure unrelated to laboratory managers and supervisors on the Organization Chart. The QA Manager is appointed by the president of the company.

1.4 Laboratory Manager

It is the responsibility of the Laboratory Manager to manage the overall operations of the environmental laboratory and supervise senior laboratory staff. The Laboratory Manager ensures compliance with federal, state, and local regulations, corporate policies, and technical SOPs as well as to ensure that there is complete and accurate analytical documentation on all projects. The Laboratory Manager reviews and validates all laboratory results and signs the laboratory reports.

1.5 Laboratory Information Management System (LIMS)

The computerized LIMS system is at the center of storage, management and retrieval of KAR's QC information. The statistical nature and volume of QC data favors a computerized system. All information regarding samples and the associated quality information is immediately and easily available because every staff member has access to LIMS through a networked computer at their desk.

Every step of quality is tracked, and QC control charts are automatically generated and displayed during data entry. LIMS assists quality by providing:

- Printed sample labels
- Work lists that can be customized by the department supervisor
- Automatic uploading of instrumental data for Matrix Spikes and Matrix Spike Duplicates, calculations of Relative Percent Difference and Percent Recovery and comparison to method-specific limits
- Validation routines
- Report generation by several formats via hardcopy or electronic media
- Minimum and maximum values are assigned to data fields and format limited to mo/da/yr for consistency
- Extensive use of "Lookup" tables to provide exactly the same naming in Client information, test names, units, qualification codes and sample types and other areas as well
- Automatic data-entry validity checks for completeness (all of the following: concentration, units, date analyzed, analyst)
- Correct units for the sample type
- Denies impossible concentration for the units specified (example <0% or >100%)
- Rounding, concentration/dilution factoring and significant figure manipulations for instrumental data uploads
- Spike and Duplicate data must be within statistically-based QC limits for the matrix type with required "Reason for QC Failure" documentation upon acceptance of data which falls outside of QC limits
- Quality Control Charting is available for the parameter by pressing one key
- Automatic Validation Checks:
    - Missing units
    - Concentration outside the range for the units

- Concentration outside the likely range for the test
- Missing digit preceding a decimal point
- Holding time exceeded
- Missing comma separator on numbers >9999
- "Dissolved" concentrations greater than "Total"
- Unlikely relative BOD, COD and/or TOC relationships
- Hexavalent Chromium exceeding Total Chromium
- Printed copy of test results sorted via "test" (a proofreading aid)
- Printed copy of complete Ion Balance calculations with anion/cation listing, measured Solids vs. calculated Dissolved Solids agreement and measured Conductivity vs. calculated Conductivity agreement
- Printed copy of all client correspondence, additions, deletions and changes that relate to the project

1.6 Report Options

Upon completion of a project, KAR Labs issues a Standard Analytical Report which generally does not contain QC data (KAR SOP KG032). If QC data is desired, a "QC Analytical Report" should be requested. This report contains spiked sample, duplicate sample, and analytical batch data with statistical calculations, instrument detection limits, sample analysis date, analyst, method used, and other data. All quality requests and inquiries should be directed to the Laboratory Manager.

If a client requires special or unique data quality objectives, those objectives must be addressed prior to the sampling event.

2. SAMPLE COLLECTION

2.1 Importance of Proper Sample Collection

Sampling is considered to be the single most important factor in an analytical scheme because all subsequent steps in data generation can only be a reflection of the sample that was submitted for analysis. For this reason, it is imperative that no analytical program be conducted without an adequate Sampling Plan that ensures representative samples will be collected and that the integrity of those samples will not be compromised.

2.2 Elements of the Sampling Plan

A Sampling Plan must be designed by an individual who is familiar with both the various sampling devices and the analytical requirements. This familiarity is essential because (1) certain sampling devices are made of materials that may contaminate the sample, (2) cross contamination of samples may occur if the sampling device is not cleaned properly, (3) routine sampling methods may not be applicable to a sample that is to be analyzed for a unique parameter, and (4) the method of employing the sampling device may affect the integrity of the sample.

Whether the sampling responsibility lies with the client or KAR Laboratories, the following items must be in place to ensure the reliability of the data:

2.2.1 A properly designed Sampling Plan.

2.2.2 Sampling containers that have been properly cleaned and labeled for their intended use.

2.2.3 Containers that satisfy requirements for sample size which will likely include provisions for field duplicates and field blanks.

2.2.4 Containers that optimize conditions necessary for replication of results and preservation of the chemical integrity of the sample.

2.2.5 Chemical preservatives or refrigeration to satisfy the requirements of the analytical method and/or regulatory requirements.

2.2.6 Special provisions for project-specific data quality objectives.

3. SAMPLE RECEIPT AND HANDLING WITHIN THE LABORATORY

3.1 Sample Receipt (KAR SOP KC020)

Sample integrity can be seriously compromised if samples are not preserved and stored in a proper and timely manner after they are received, or if samples are not analyzed in a timely manner because the record of time sampled and/or time of arrival has not been adequately documented.

It is the responsibility of the Client Services Department to completely record (input) all necessary information about a sample or sample set (KAR calls this a "Project") into the computerized Laboratory Information Management System (LIMS). This must be done as soon as possible (typically the same day that the samples were received). Because all staff members have their own networked personal computer at their desk, the sample information is immediately available to the entire staff including the analyst responsible for the test. Management and clerical staff utilizes the LIMS to track work progress to ensure that no sample or test is overlooked.

Subsampling is often necessary because of varying preservation requirements. Such subdivisions are performed at sample login by a member of the sample login team to ensure the identity and integrity of sub-portions without deterioration or contamination.

Preservation, storage, and holding times are observed in accordance with EPA guidelines. These are automatically tracked by the Laboratory Information Management System (LIMS), and violations are automatically flagged on internal and final reports. Long-term storage of samples depends upon several factors which include the clients' request, expiration of holding time, hazardous properties, legal evidence (or possibility of legal evidence), and sample amount. Samples are always maintained for at least two weeks after the analytical report has been mailed or after a specified holding time has expired, whichever is longer.

3.2 Sample Handling

This procedure outlines the elements and steps involved in the handling of samples received for analysis at KAR Laboratories.

3.2.1 Samples are received directly from the client or from contracted carriers. Sample Receipts and Chain-of-Custody (KAR SOP KC020) documents are prepared at this time. Indelible, reproducible ink must be used for all recordings.

3.2.2 The project is activated by logging the project into the computerized Laboratory Information Management System (LIMS). The LIMS assigns a Project Number which is entered into the master projects data base (KAR SOP KC030). The established format must be followed by entering all requested information.

3.2.3 Each sample is assigned a unique identification number. This is a numerical or sometimes alphabetical suffix separated from the Project Number by a hyphen (example 891234-01). The assigned identification number shall be printed onto the LIMS-generated sample label or written onto the sample or sample container in ink or other permanent marker.

3.2.4 All pertinent information provided with the sample is then entered into the LIMS and is peer-reviewed for accuracy as a final check.

3.2.5 Samples are preserved and/or subsampled by Client Services. Samples are then routed to the proper laboratory for storage. The type of environment chosen for sample storage will be consistent with method protocol. All sample and subsample labels include a minimum of the KAR Laboratories Project Code # and the chemical preservative used, if any. Computer-generated labels are used whenever possible.

3.2.6 Analyses are carried out according to specified analytical procedures.

3.2.7 After all testing is complete, samples are returned to their respective storage areas and retained for a period of time consistent with approved holding times for the tests.

3.3 Chain-of-Custody

To ensure that the necessary chain-of-custody procedures are in place for the various requirements of its clients, KAR Laboratories implements one of several systems.

All samples received for analysis must use at least a KAR Laboratories Sample Receipt/Chain-of-Custody Record (KAR SOP KC020). Some clients may prefer to use their own chain-of-custody form. This is considered supplemental to the KAR Chain-of-Custody Record.

KAR Laboratories has tamper-proof custody seals which can be used on sample containers. These custody seals are made of a special adhesive foil, and once installed at the bottle-cap interface, they cannot be removed without clearly indicating that the container was opened.

Upon request, a sample custodian may be assigned the responsibility of safeguarding the samples and ensuring that the chain-of-custody is maintained. To achieve this end, a locked storage receptacle accessible only to the sample custodian is used.

4. LABORATORY SUPPLIES, CHEMICALS AND EQUIPMENT

Glassware, chemicals, and equipment used at KAR Laboratories are selected to conform to the specifications defined in the method of analysis. Items not specifically mentioned in a particular method of analysis should conform to Good Laboratory Practices. For example, Class A volumetric glassware is usually used for measurements that require a volume determination. If an item is available in a disposable configuration, then that option is sometimes preferred to avoid cross-contamination or introduction of other contaminants to a sample. Once it has been established that a particular supplier or manufacturer has a good record of supplying an item of suitable utility, ordering that item from a different source should be avoided.

4.1 Laboratory Glassware

4.1.1 **Cleaning Procedures**

4.1.1.1 General labware washing will include (at a minimum) a detergent wash in hot water, two rinses with ASTM Type II reagent water (also known at KAR as deionized [DI] water). The labware is then inverted and suspended to dry. An automated dishwashing system is available for routine glassware washing (KAR SOP KQ070).

4.1.1.2 Labware for trace metals analysis includes a detergent wash in hot water, tap water rinses, one acid rinse followed by two rinses with ASTM Type II reagent water (KAR SOP KM010).

4.1.1.3 Purgeable hydrocarbon labware consists of cleaning as outlined in 4.1.1.1.

4.1.1.4 Pesticides and acid/base-neutral extractables labware incorporates the cleaning outlined in 4.1.1.1 followed by one rinse using pesticide-grade acetone and one rinse using pesticide-grade methylene chloride. The containers are then inverted and suspended to dry (KAR SOP KO005).

4.1.1.5 In all cases the sample bottle cleaning recommendations of the appropriate method and/or SOP should be followed.

4.1.2 **Testing for Contamination.** Contamination is monitored on a routine basis by the analysis of Laboratory Method Blanks (LMB). Reagent water is carried through all steps of an analysis parallel to the samples being analyzed. In this manner, any laboratory-borne contamination introduced by reagents, labware or the laboratory environment should be detected. A systematic troubleshooting scheme is implemented when an LMB fails.

The LMB is used throughout the laboratory. Most wet chemical methods include an LMB as part of the Standard Operating Procedure. Volatile organic instrumental analysis includes an LMB after every calibration standard, and as a means of verification that sample component carry-over from a previous high-level sample has not occurred.

4.1.3 **Storage.** KAR Laboratories has adequate storage capability and, therefore, has greater flexibility in providing an appropriate environment for special applications. Labware for everyday use is stored at a location isolated from potential contaminants. Specially cleaned labware such as those designated for the Organic Laboratory are stored separately in the Organic Preparation Lab in a covered enclosure. Labware designated for trace metals analysis are stored in the Trace Metals Laboratory in a covered cabinet to avoid potential dust contamination. Light, heat, and/or moisture sensitive items are stored in a special room intended for this use. Other items not demanding any special storage considerations are stored to provide the most efficient retrieval of the item.

4.2 Chemicals and Reagents

4.2.1 **Purity Specifications -** All chemical reagents and gases are selected to meet or exceed the specifications defined in the method of analysis.

4.2.2 **Receipt procedures -** All chemicals, reagents, gases, and other expendables are labeled upon receipt with the date received. Upon opening, the date is recorded on the label. An expiration date is assigned to each chemical/reagent based on the manufacturer's recommendation or on KAR Laboratories' dating practices (KAR SOP KG034).

4.2.3 **Shelf Life -** Most reagents/chemicals have a limited shelf life. Purchased chemicals are labeled with the date received, the date it was opened, the expiration date, and the storage conditions. Reagents are labeled with the date it was prepared, the name or initials of the analyst who prepared it, the storage conditions, and the expiration date. Some laboratory Standard Operating Procedures require that associated reagents be prepared fresh daily at the time the assay is being performed. Other reagents such as prepared standard solutions and calibration compounds for atomic absorption and gas chromatography are replaced on an expiration basis. (KAR SOP KG066).

4.2.4 **Laboratory Reagent Water -** ASTM Type II reagent water (also called RO water, DI water, or D-H_2O) is supplied by an on-site Reverse Osmosis system with an on-demand high capacity storage tank. This system is centrally plumbed to provide reagent water to all laboratories. Reagent water purity (conductivity) is continually monitored and recorded daily. Monthly, all common parameters including organics, trace metals, general water quality, and microbiology are analyzed. If the concentration of any contaminant approaches the laboratory's reporting limits, reporting of that parameter to external clients must be suspended until the problem is corrected (KAR SOP KQ230).

4.2.5 **Documentation -** To document traceability of chemicals and reagents, the SOP number, date, and analyst's initials are recorded as part of the laboratory assay preparation.

4.3 Equipment/Instrument Calibration Checks

4.3.1 All repeating pipettes are calibrated weekly (KAR SOP KQ062).

4.3.2 Balances are checked daily and calibrated semi-annualy by in-house staff with certified Class S weights. All completed calibration sheets are reviewed and available for inspection. In addition, balances are calibrated annually by an external contractor (KAR SOP KG018).

4.3.3 Analytical instrumentation's calibration is checked through the use of surrogates, spikes, blanks and calibration standards.

4.3.4 The temperature of all sample refrigerators, freezers, and BOD incubators is checked daily (KAR SOP KG010). Microbiology incubators are checked twice daily (KAR SOP KB050). All completed Log Sheets are forwarded to QA. Thermometers and thermocouples are checked annually against an NIST-traceable source (KAR SOP KQ010).

5. ANALYTICAL METHODOLOGY

5.1 Analytical Methods

The most current sources for analytical procedures are used as references to develop KAR Laboratories' analytical SOPs. The SOPs are controlled and followed throughout the laboratories and are based on methods from:

5.1.1 <u>Standard Methods for the Examination of Water and Wastewater</u>, American Public Health Association, American Water Works Association, Water Environment Federation.

5.1.2 Methods for Chemical Analysis of Water and Wastes, U.S.EPA.

5.1.3 Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, U.S.EPA.

5.1.4 Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, U.S.EPA.

5.2 Standard Operating Procedures (SOP)

KAR Laboratories maintains SOP manuals which contain analytical SOPs of test procedures routinely performed in each laboratory and appropriate general procedures (KAR SOP KG023). Analytical SOPs supercede general SOPs. All new SOPs or revisions to existing SOPs are approved, tracked and controlled by QA.

5.3 Auditing Performance

Method performance is checked in the following ways (KAR SOP KG035):

5.3.1 KAR uses two standard deviations from the mean (95% confidence) for warning limits and three standard deviations from the mean (99% confidence) for control limits.

If the maximum allowable range is set by regulation, then the statistical range may not exceed the regulated maximum.

When statistical data is unavailable then ± 20% can be used (although this may be parameter specific) unless a regulation exists that is more restrictive.

Values which are out of control will be investigated. Data that has failed QC limits (out of control) will be qualified (flagged as failing QC) on the final report to the client.

5.3.2 Duplicate analyses are performed at least on one in every ten samples. If the difference between duplicate sample results exceeds that specified in the SOP, then the cause must be determined and the samples may have to be reanalyzed. Duplicate measurements are automatically tracked and charted by LIMS.

5.3.3 Spiked samples are analyzed one in every ten samples. If the recovery falls outside the range specified in the SOP, then the cause must be determined and the sample reanalyzed if necessary. Spike measurements are automatically tracked and charted by LIMS.

5.3.4 KAR Laboratories subscribes to a commercially available QC check sample program for wastewater and Priority Pollutants on a semi-annual basis.

5.3.5 Performance Evaluation Samples (also called proficiency testing samples) are analyzed and the results are submitted to either the EPA (for certain drinking water parameters) or to other oversight bodies on a semi-annual basis.

5.3.6 Surrogate compounds are used routinely in organic analyses to monitor recovery.

5.3.7 Internal audits are performed periodically by the QA department to build laboratory strengths and to detect and eliminate deficiencies (KAR SOP K022).

5.4 Method Validation

In most cases method and/or operator verification/validation will be established by the successful completion of a Method Detection Limit Study (MDL). This study establishes the accuracy, precision and minimum detectable level on reagent water.

This is true for EPA methods and Standard Methods which comprise the vast majority of methods used at KAR Laboratories (KAR SOP KQ020).

In cases where a written validated method is unavailable, whatever method development or modification is undertaken shall be done so in a context that concludes with at least an informal method validation study. Most commonly this will involve a combination of spiked samples, replicate samples, linearity study, and confirmation of positive results by at least one other method or technique.

6. INSTRUMENT PERFORMANCE

6.1 Sensitivity, Specificity, and Stability

The acceptable performance of an instrument with respect to sensitivity, accuracy, and precision is demonstrated before analyzing samples.

Some sample matrices will not allow a low Limit of Detection to be achieved. Samples of this type are noted as such on the analytical report along with the estimated Limit of Detection. In all cases sensitivity must be maintained to meet regulatory requirements. All acceptable cleanup procedures should be employed when necessary. Unnecessary or arbitrary sample dilutions are not allowed.

6.2 Monitoring Performance

6.2.1 **Monitoring Performance for General Parameters.** Instrument performance is monitored in several ways. Problems may appear during the daily calibration. When such problems arise, it will become apparent whether the instrument can achieve the necessary performance. Quality control check samples are used frequently. Blanks monitor for contamination. Replicate samples and spike samples are used at a frequency of approximately one in ten samples. Any QC sample that is out of control according to the control chart must be investigated and documented. If, after investigation, the measurement continues to be out of control, the data must be qualified accordingly on the final report. If the statistical QC acceptance criteria for relative percent difference (RPD) between duplicate samples is less than 5%, then a value of 5 will be used for acceptance.

6.2.2 **Monitoring Performance for Trace Metals**

Parameters	ICV	CCV	LCS	ICB/ CCB	Dup. RPD	Spike Recovery
Furnace	90-110%	85-115%	85-115%	<RL	20%	80-120%
ICP and Flame	DW 90-110% Others 90-110%	90-110%	85-115%	<RL	20%	75-125%
Mercury	DW 95-105% Others 90-110%	DW 90-110% Others 80-120%	85-115%	<RL	20%	aq 75-125% non 70-130%

QC Requirements

- Correlation coefficient must be $\geq$ 0.995
- ICV (from different source) immediately after calibration must be within 90-110% of true value
- ICB immediately after ICV must be < RL
- CCV and CCB after every 10 analyses
- One matrix spike and one duplicate analysis every 10 samples
- One LMB and one LCS for every preparation batch
- Spike recoveries and duplicate RPD must meet established performance limits
- ICP/MS must have acceptable internal standard recovery

Codes:

- DW	Drinking Water
- ICV	Initial Calibration Verification
- ICB	Initial Calibration Blank
- CCV	Continuing Calibration Verification

- CCB	Continuing Calibration Blank
- LMB	Laboratory Method Blank
- LCS	Laboratory Control Standard
- RPD	Relative Percent Difference
- RL	Reporting Limit
- ICP/MS	Inductively Coupled Plasma/Mass Spectroscopy

Notes:

- Data is invalidated by unacceptable ICV, ICB, CCV, CCB, or IS results.
- Unacceptable spike, duplicate, LMB, or LCS results are investigated before validating data.
- Spike and duplicate limits are generally based on the method's observed performance with real samples.

6.2.3 **Monitoring Performance for Gas Chromatography.** Method performance requirements are written into the SOP. In most cases this will result in one matrix spike/matrix spike duplicate analysis for each analytical batch.

6.3 Calibration

Instruments are calibrated prior to each day's use in accordance with the method used or the SOP and repeated periodically throughout the day as required. The usual procedure is first to establish a linearity graph consisting of a blank and at least three standards. This establishes the linear working range for the instrument. When the linear range has been established and documented, the calibration is checked daily with at least two points, a blank and a standard. If the results of this daily calibration check demonstrate agreement with the established calibration curve, then it may not be necessary to run additional standards. These calibration procedures will vary from method to method and in all cases the appropriate Standard Operating Procedure should be consulted.

6.4 Maintenance

Instruments are installed and maintained to maximize their usefulness and to minimize downtime. Every analytical instrument system has a log book to record maintenance procedures, recurring or intermittent problems which may not allow immediate repair, and troubleshooting incidents (KAR SOPs KG023 and KB050). All factors that may affect the system are to be recorded. Each entry is dated and signed, and any suggestions or recommendations are also included. All balances are checked and serviced annually by an outside contractor (KAR SOP KG018).

7. DATA HANDLING AND RECORD KEEPING

Record keeping is essential to all laboratory activities. Only by properly maintaining permanent records using indelible ink and contemporaneous documentation can it be determined that the analytical data generated is reliable. If appropriate records are not made, final results may not be useable.

7.1 What Records to Keep and How Long

It is the responsibility of each individual employed by KAR Laboratories to maintain complete records of their work in the detail and format prescribed by the department supervisor and/or SOP. The minimum requirement shall be that all experimental work be recorded at the time performed and be described in sufficient detail to make it understandable to one familiar with analytical chemistry yet not directly connected with the work. All such records (termed raw data) will be retained for a minimum of seven years, then destroyed. All records associated with quality control systems (e.g., SOPs, audit reports, training files) will be retained at KAR Laboratories for a minimum of seven years (KAR SOP KG040).

7.2 Protocol and Forms

All experimental data will be recorded in indelible ink, usually in a bound laboratory notebook. The name of the analyst shall be clearly indicated on all work so that there is no question who is responsible. All numerical data shall comply with the following format: (1) a digit must always precede a decimal point, and (2) a comma separator shall be used for all numbers five digits or larger.

Entry errors, deletions, or corrections shall be indicated as such by drawing one single line through the text, table, drawing, or graph that is to be canceled. These errors are further notated by the date and initials of the person responsible for the changes. Erasures and use of correction fluid is not permitted. <u>Transcriptions shall be avoided whenever possible</u>.

All laboratory record books are the property of KAR Laboratories and may not be removed from the premises without proper authorization. Individuals who wish to maintain other records may do so, after supervisory approval, but records shall be in addition to the complete and permanent records mentioned above. Any notation intended to indicate the same value (such as "ditto" marks, arrows, etc.) is acceptable except for recording direct measurements (e.g., sample weights). Each direct measurement is individually recorded contemporaneously; that is, recorded at the time the measurement is performed.

Data in the form of charts, instrument recordings, and printouts will be given suitable identification and maintained in a manner similar to written records.

All analytical results, when entered into the LIMS system, shall include the date analyzed and the analyst's name or initials. Any other information relevant to the test should be included in the comments field.

All LIMS data is hardcopied and filed on a project basis. All electronic data is backed-up daily onto magnetic tape and kept for seven years, then destroyed.

7.3 Important Aspects of Documentation and Qualifying Data

In view of the possible legal implications that accompany the generation of analytical data, all data shall be recorded in such a way as to preclude its discrediting at any time. Any deviation from the method protocol that may affect the results should be reported on the analysis report. This includes such items as expired holding times or improperly collected samples.

7.4 Reporting Results

7.4.1 **Significant Figures.** KAR Laboratories uses "significant figures" when reporting results. This means that all digits in a reported result are expected to be known definitely except for the last digit which may be in doubt. If more than a single doubtful digit is carried, then the extra digits are not significant and, therefore, should not be reported (see section 7.4.2). Analysts shall report only such figures that are justified by the accuracy of the work. Rounding and significant figures apply only to the final, reported results. Intermediate calculations necessary to arrive at a final result shall not be rounded.

7.4.2 **Rounding.** Digits that are not significant will not be reported. To round a number to the reported value, the digits 6, 7, 8, or 9 that follow the significant digit will round the reported value up by one unit. If the digit 0, 1, 2, 3, or 4 follows the significant value, the reported value is not altered. If the digit 5 (and no other additional digits are included) follows the significant value, the reported value is rounded to the nearest even number (e.g. 114.5 rounds to 114 and 115.5 rounds to 116). If the digit 5 has additional digits following it that are non-zero, the reported value should be rounded up. Exceptions to this rule may be necessary depending on software that accompanies analytical instrumentation or used for report generation.

7.4.3 **Format.** Values which contain a decimal point shall always be preceded by an integer or zero (e.g., 0.31). Units shall always accompany a result except in cases where units do not apply.

7.4.4 **Detection Limits.** A "less than" sign (<) will precede the detection or quantitation limit in cases where the analyte is not detected or quantitated. Calculated values less than these limits shall be stated as such without rounding. For example, a calculated final results of 0.98 for a test that has a detection limit of 1 shall be reported as "<1" and not rounded up to 1.

8. DATA INTEGRITY, CONFIDENTIALITY, CHALLENGES, AND DATA CORRECTION

8.1 Data Integrity

Data integrity is established through the use of data review, assay training, pre-employment agreements, secure data storage, and the backing up of electronic records. Data is either generated from validated systems or goes through review processes to ensure that reported tests reflect laboratory results. All QC results in support of tests are reviewed to make sure they are within established acceptance criteria and that all required quality control samples were analyzed. Each analyst has been shown to be proficient in their assigned assay (see Section 9.1) and have documented training on policies and procedures that support the laboratory. Data is stored in secure locations with limited access. Electronic data, after capture, is protected against erasure and tampering, as well as backed-up and stored off-site per internal standard operating procedures.

8.2 Confidentiality Agreement

Each employee is required to sign an agreement that ensures that all data and client information is kept confidential. Only laboratory supervision or higher are permitted to discuss laboratory results or client-specific information outside of KAR Laboratories unless otherwise instructed. Clients may view their sample results through the internet. This access is granted only through approval by KAR management. Clients are issued passwords and specific "rights" that allow only client-owned data to be viewed.

Terms of employment regarding non-disclosure agreements are further discussed in the KAR Employee Manual. Any employee or ex-employee who discloses trade secrets or confidential business information will be subject to disciplinary action. All outside jobs held by employees must be reported to KAR Laboratories' President in advance for approval. These restrictions avoid any activities that could diminish employee competence, impartiality, and integrity.

8.3 Data Challenges and Auditing Data Validity

End-users (clients) of laboratory data are encouraged to challenge any data that does not fit their expectations by requesting a data review from Quality Assurance or the Project Manager (KAR SOP KG026). All information shall be recorded on the KAR QC Review Form. Similarly, laboratory staff who suspect that data may be incorrect or inaccurate for any reason must immediately report the incident. The request will then be routed directly to the supervisor. In the event that the supervisor is unavailable and the review cannot wait, then the group leader of the area is consulted. The supervisor will then be notified of the request via e-mail or other means, but in no case should the supervisor go unaware of a data change/inquiry request. This is necessary to allow the supervisor to monitor system and analyst performance and ensure that corrective actions are taken.

8.4 Data Correction and Notification Procedures

It is the laboratory's responsibility to contact the client immediately of an error or, in the case of a review initiated by the client, within eight working hours. The telephone call is then followed up with a printed Revised Report mailed to the client if a review uncovers a reporting error. If a systematic or other long-term condition is found which could affect data quality and/or accuracy, an attempt must be made to ensure that all reported data that might be affected be handled in the manner specified above.

8.5 Laboratory Corrective Action

Each laboratory supervisor is responsible for the initiation of all corrective action processes performed within their section. Documentation includes the nature of the problem, the name and affiliation of any person contacted regarding the problem, and the action taken to correct the problem. QA may review the details regarding the outcome of any corrective action/problem resolution and initiate any procedural changes deemed necessary.

In the case of instrument failure or procedural problems, the analyst is responsible for terminating the analytical run and contacting the laboratory supervisor. The problem may be evaluated through consultation with QA and the appropriate corrective action taken. Analyses will resume when proper operation of the instrument is confirmed.

As part of the data evaluation process, the Laboratory Manager will initiate corrective actions when reported results exceed acceptance limits or when the QC requirements for a given analysis are not satisfied.

When the deviation is known to have a definite effect on data quality, the data will automatically be rejected. The appropriate laboratory personnel are notified. In some cases, QA may confer with the client's project manager to help determine the effect of the deviation on data usage. The project manager notifies the appropriate personnel of the situation. A decision on the corrective action is made along with the necessary steps to be taken. Data qualified as approximate will be reported as such, and the deviation will be described in the report.

9. PERSONNEL

9.1 Training

The training for specific tasks is performed under the guidance of a laboratory supervisor or an experienced analyst in conjunction with written Standard Operating Procedures. In all cases, an analyst must first demonstrate competency for any assigned test by successfully meeting precision, accuracy, and detection limit requirements defined in the SOP or the Method. Appropriate method detection limits (MDLs) are entered into the database and tracked by LIMS, and documented using the Initial Demonstration of Capability (IDC) Form which is placed in the individual's training folder located in the quality assurance office (KAR SOP KG024). Employees (temporary or otherwise) without formal laboratory training and/or experience will not be assigned any analytical tasks unless approved by Quality Assurance. This includes (but is not limited to) measuring samples, labeling samples, and filtering.

Formal educational backgrounds for technicians include a minimum of an associates degree or equivalent. Chemists and microbiologists require a four year science degree or three years of experience. Continuing education is encouraged for all employees, the expense of which is covered by KAR Laboratories according to current company policy.

9.2 Safety

KAR Laboratories maintains an active safety program which includes a designated Safety Officer. The facility operates in a manner that is safe for both the employees and the environment (KAR SOP KG055). Protective equipment is worn and wastes generated in the lab are disposed in a safe and environmentally sound manner. All chemicals are appropriately labeled and Material Safety Data Sheets are maintained on the property, easily accessible to all employees.

Employees are instructed to avoid working in the laboratory with hazardous chemicals or processes unless someone else is on the premises. This includes procedures where personnel are handling large glassware, flammable or explosive substances, chemically hazardous samples, or large amounts of solvents, acids, bases, or strong oxidizers.

Any time an employee is in a situation that requires the use of protective gloves, the selected glove must be appropriate to guard against the possible exposure in the laboratory. Several types of gloves are available which are specifically targeted to prevent exposure to certain chemical, biological, or environmental contact. After using any type of glove, all analysts are instructed to thoroughly wash their hands.

Microbiolgy laboratory surfaces and any other laboratory surfaces, as needed, are decontaminated by either exposing the surface to a 10% chlorine bleach solution (prepared within 24 hours) or a dilute Vesphene solution. The surface must be in contact with the decontamination solution for at least 10 minutes.

Attachment 10

Statistical Evaluation Program

ATTACHMENT E

STATISTICAL EVALUATION PROGRAM
FOR
PHARMACIA & UPJOHN COMPANY, LLC
HAZARDOUS WASTE FACILITY
OPERATING LICENSE

Application MID: 000820381

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FINAL REPORT

August 24, 2012

TABLE OF CONTENTS

1.0 INTRODUCTION 1
- 1.1 Purpose of the SEP 1
- 1.2 Downgradient Wells 1
- 1.3 Upgradient Wells 2
- 1.4 Use of Historic IntraWell Background Data As A Control 2
- 1.5 Monitoring Data Evaluation Methods 3

2.0 ESTABLISHMENT OF BACKGROUND CONCENTRATIONS FOR INTRAWELL EVALUATIONS 4
- 2.1 Historic Intrawell Background Data 4
- 2.2 Background Intrawell Sample Sizes 9

3.0 CLASSIFICATION AND FREQUENCY OF SAMPLING OF SITE PARAMETERS 10
- 3.1 Classification and Frequency of Sampling of Organic Parameters 10
- 3.2 Classification and Frequency of Sampling of Field Parameters 11
- 3.3 Classification and Frequency of Sampling of Inorganic Parameters 11

4.0 STATISTICAL EVALUATIONS APPLIED TO THE FOREGROUND DATA 14

5.0 STATISTICAL EVALUATION OF THE ORGANIC PARAMETERS 15

6.0 GRAPHICAL EVALUATION OF THE FIELD PARAMETERS 17

7.0 STATISTICAL EVALUATION OF THE INORGANIC PARAMETERS 18

8.0 PROCEDURES FOR MAKING CHANGES TO THE SEP 20

9.0 REPORTING PROCEDURES 21
- 9.1 Protocol for Quarterly Reports Through 2016 21

10.0 REFERENCES 22

11.0 APPENDIX SECTION 23
- Appendix A pH Parameter Data Listings by Well: 1992 - 2012
- Appendix B Specific Conductance Parameter Data Listings by Well: 1992 - 2012
- Appendix C Temperature Parameter Data Listings by Well: 1992 - 2012

1.0 INTRODUCTION

This Statistical Evaluation Program (SEP) describes the methodology to be used for the statistical evaluation of Corrective Action Detection (CAD) monitoring wells at the Pharmacia & Upjohn Company, LLC (P&U) Hazardous Waste Facility in Portage, Michigan. This program was developed in accordance with the P&U Hazardous Waste Management Facility Operating License (Operating License), and recommendations provided in the U.S. EPA guidance documents entitled *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities: Interim Final Guidance* (February 1989) and *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities: Addendum to Interim Final Guidance* (July 1992).

1.1 Purpose of the SEP

The purpose of the SEP is to evaluate if storage and/or treatment activities at the hazardous waste facility have impacted downgradient groundwater quality. Groundwater monitoring data will be collected on a quarterly basis from the site to obtain data to make this evaluation.

The specific details outlining the collection of quarterly monitoring data from the Corrective Action Detection (CAD) wells located at the facility are described in the facility Groundwater Sampling and Analysis Plan (GSAP) of the Operating License. In the GSAP it is stated that: "The wells in the CAD network surrounding the P&U property were selected to verify that no detections of constituents of concern have occurred in both the upper and lower aquifers beyond the boundaries of the Corrective Action regulated units."

In the GSAP it furthers states that: "The CAD monitoring wells were selected for the purpose of detecting statistically-based changes of constituent concentrations in the two aquifers present beneath the facility." It is further stated in this section that: "The CAD wells are situated along the perimeter of areas of manufacturing and material storage to allow for detection of potential release of constituents from these areas within the facility."

The GSAP also states: "Two upper aquifer and two lower aquifer wells were selected as background wells". The purpose of the background wells is: "to establish and verify upgradient concentrations of constituents in the groundwater beneath the facility". The data collected from these upgradient wells will be used to: "alert P&U to the presence of organic and inorganic contamination that may migrate onto the P&U facility from off-site sources".

1.2 Downgradient Wells

The GSAP designates wells MW-104, MW-142, MW-149, MW-152, MW-153, and MW-158 as downgradient wells for the lower aquifer, and wells MW-17, MW-101A, MW-108R, MW-109R, MW-110, MW-133, MW-141, and MW-161R as downgradient wells for the upper aquifer.

As referenced in Section 2.1, monitor wells MW-17 and MW-101A were designated as CAD wells, and were first sampled during the Fourth Quarter of 2000.

The "R" designations refer to replacement wells. Well MW-108 has been replaced by MW-108R, and well MW-109 has been replaced with MW-109R. Since the installation of wells MW-108 and MW-109 in 1990, these wells frequently failed to possess sufficient groundwater to allow for sampling. Due to this condition, these two wells were replaced with monitoring wells MW-108R and MW-109R in October, 2000. The replacement wells are located within a few feet of the original wells, and are slightly deeper to permit continuous sampling.

It is assumed that groundwater samples collected from the replacement wells will be representative of samples collected from the pre-existing wells, and will provide a continuous record of the groundwater quality at these locations. Specifically, it is assumed that the groundwater samples collected from the replacement wells MW-108R and MW-109R will provide water quality data representative of that collected from MW-108 and MW-109.

Downgradient wells will be monitored quarterly as part of the groundwater monitoring program. If trends or changing conditions are documented in groundwater within either aquifer downgradient of the hazardous waste facility, P&U may petition the Michigan Department of Environmental Quality (MDEQ) to install additional downgradient wells for incorporation into future evaluations.

1.3 Upgradient Wells

The GSAP section of the Operating License designates wells MW-112 and MW-116 as upgradient wells for the lower aquifer, and wells MW-111 and MW-115A as upgradient wells for the upper aquifer.

As referenced in Section 2.1, monitor wells MW-112 and MW-116 were designated as CAD wells in October 2003 and October 2000, respectively. The sampling history for MW-112 includes the Second Quarter of 1992 and Fourth Quarter 2003 through the present. The sampling history for MW-116 includes the Second Quarter of 1992 and Fourth Quarter of 2000 through the present.

Upgradient wells will be monitored quarterly as part of the groundwater monitoring program. If trends or changing conditions are documented in groundwater within either aquifer upgradient of the hazardous waste facility, P&U may petition the MDEQ to install additional upgradient wells within the affected aquifer for incorporation into future evaluations.

1.4 Use of Historic IntraWell Background Data As A Control

Quarterly groundwater monitoring data have been collected continuously at the site beginning in 1992. As of the end of the 2012 Second Quarter sampling, eighty-one quarterly monitoring events have been conducted at the site. Due to absence of groundwater in some of the monitor wells and modifications to the CAD network, individual wells possess from thirty-six to eighty-one data sets in this period.

As discussed in Sections 2.0 and Section 5.0, due to the differing groundwater chemistry between CAD monitoring wells, it was determined that naturally occurring parameters in downgradient monitoring wells should be evaluated using historic intrawell background data.

It is proposed that the accumulated data collected in the period: 1992 – 2012 will be used to construct an intrawell set of background data for each downgradient and upgradient well in each of the two aquifers at the site. This background data will be referred to as the 1992 – 2012 background monitoring data in this SEP. The background data in this SEP specifically will consist of the eighty-one monitoring events conducted at the site starting with the 1992 Second Quarter sampling, and ending with the 2012 Second Quarter sampling.

Monitoring data for each upgradient and downgradient well at the site starting with the Fourth Quarter 2012 sampling will be evaluated by comparison to the historic intrawell 1992 – 2012 background monitoring data collected at the individual well, if possible.

1.5 Monitoring Data Evaluation Methods

Monitoring data for the CAD groundwater monitoring parameters will be evaluated for evidence of statistically significant increases and/or decreases by comparing the current levels to intrawell background data for each CAD downgradient monitoring well. Upper and lower aquifer wells will be evaluated separately throughout the SEP.

Monitoring data for each upgradient well will also be evaluated. The purpose of the upgradient well evaluations is to provide a control for downgradient evaluations, although no statistical comparisons are recommended to compare upgradient and downgradient concentration levels.

Section 2.0 of the SEP contains a description of the development and characteristics of the intra-well background groundwater monitoring data at the site. Section 3.0 contains the description of the classification of the parameters into three groups of parameters for the purpose of statistical evaluation.

Sections 4.0 – 7.0 contain the statistical and graphical procedures which will be used to evaluate for increases and/or decreases in concentrations of monitoring parameters at the downgradient wells, as well as the basis for selection of these statistical procedures.

Section 8.0 describes procedures and circumstances for changing or modifying the SEP.

Section 9.0 describes the reporting procedures to be followed as part of the SEP.

2.0 ESTABLISHMENT OF BACKGROUND CONCENTRATIONS FOR INTRAWELL EVALUATIONS

Background parameter concentrations or detection limit standards for each of the CAD groundwater monitoring events are presented in the GSAP. The CAD monitoring wells and CAD groundwater monitoring parameters are listed in Tables 4 and 5 of the GSAP.

A historic intrawell background set of monitoring data was used to establish background concentrations as described in Section 2.1. The characteristics of this intrawell background data set are used in Section 3.0 to classify each parameter into one of three groups of parameters in each aquifer.

2.1 Historic Intrawell Background Data

Historic intrawell background data is comprised of a maximum of eighty-one consecutive quarterly sampling events of monitoring data that have been collected at each well during the period starting with the 1992 Second Quarter sampling data and ending with the 2012 Second Quarter sampling data. Some wells have a shorter sampling history due either to dry well occurrences or being newly designated as a CAD well.

Tables A and B contain background data collection summaries of the quarterly sampling events collected at each well currently designated as a CAD well, starting with the 1992 Second Quarter and ending with the 2012 Second Quarter sampling data. Table A contains the background data collection summary for the six lower aquifer downgradient wells: MW-104, MW-142, MW-149, MW-152, MW-153, and MW-158, and the two lower aquifer upgradient wells: MW-112 and MW-116. Table B contains the quarterly background data collection summary for the eight upper aquifer downgradient wells: MW-17, MW-101A, MW-108R, MW-109R, MW-110, MW-133, MW-141, and MW-161R, and the two upper aquifer upgradient wells: MW-111 and MW-115A.

Table A: Quarterly Data Collection Summary For The Lower Aquifer Wells For The Background Period:

1992 Second Quarter - 2012 Second Quarter

Lower Aquifer	Year					Well Type
	1992	1993	1994	1995	1996	
	2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	
MW-104	x x x	x x x x	x x x x	x x x x	x x x x	D
MW-142	x x x	x x x x	x x x x	x x x x	x x x x	D
MW-149	x x x	x x x x	x x x x	x x x x	x x x x	D
MW-152	N x x	x x x x	x x x x	x x x x	x x x x	D
MW-153	x x x	x x x x	x x x x	x x x x	x x x x	D
MW-158	N N N	x x x x	x x x x	x x x x	x x x x	D
MW-112	x N N	N N N N	N N N N	N N N N	N N N N	U
MW-116	x N N	N N N N	N N N N	N N N N	N N N N	U

Lower Aquifer	Year					Well Type
	1997	1998	1999	2000	2001	
	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	
MW-104	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-142	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-149	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-152	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-153	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-158	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-112	N N N N	N N N N	N N N N	N N N N	N N N N	U
MW-116	N N N N	N N N N	N N N N	N N N x	x x x x	U

Lower Aquifer	Year					Well Type
	2002	2003	2004	2005	2006	
	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	
MW-104	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-142	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-149	x x x x	x x d x	x x x x	x x x x	x x x x	D
MW-152	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-153	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-158	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-112	N N N N	N N N x	x x x x	x x x x	x x x x	U
MW-116	x x x x	x x x x	x x x x	x x x x	x x x x	U

Table A: Quarterly Data Collection Summary For The Lower Aquifer Wells For The Background Period:

1992 Second Quarter - 2012 Second Quarter

	Year																				
Lower	2007				2008				2009				2010				2011				Well
Aquifer	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	Type
MW-104	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-142	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-149	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	NS	x	D
MW-152	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-153	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-158	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-112	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U
MW-116	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U

	Year		
Lower	2012		Well
Aquifer	1	2	Type
MW-104	x	x	D
MW-142	x	x	D
MW-149	x	x	D
MW-152	x	x	D
MW-153	x	x	D
MW-158	x	x	D
MW-112	x	x	U
MW-116	x	x	U

Data Code	Description	Well Type Code
x	data collected and available	U = upgradient background well
d	dry well encountered in sampling	D = downgradient background well
N	not part of the CAD network	
NS	CAD well could not be sampled	

Table B: **Quarterly Data Collection Summary For The Upper Aquifer Wells For The Background Period:**

1992 Second Quarter - 2012 Second Quarter

	Year					
Upper	1992	1993	1994	1995	1996	Well
Aquifer	2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	Type
MW-17	N N N	N N N N	N N N N	N N N N	N N N N	D
MW-101A	N N N	N N N N	N N N N	N N N N	N N N N	D
MW-108R	N x x	x x x x	x x x x	x x x x	x x x x	D
MW-109R	x x x	x x x x	x x x x	x x x d	d x d d	D
MW-110	x x x	x x x x	d x x x	x x x x	x x x x	D
MW-133	x x d	x x x x	x x x x	x x x x	x d d x	D
MW-141	x x x	x x x x	x x x x	x x x x	x x x x	D
MW-161R	N N N	N N N N	N N N N	N x x x	x x x x	D
MW-111	N x d	x x x x	d x x d	x x d d	x x x d	U
MW-115A	x x x	x x x x	x x x x	x x x x	x x x x	U

	Year					
Upper	1997	1998	1999	2000	2001	Well
Aquifer	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	Type
MW-17	N N N N	N N N N	N N N N	N N N x	x x x x	D
MW-101A	N N N N	N N N N	N N N N	N N N x	x x x x	D
MW-108R	d x x x	x d d d	d d d d	x d d x	x x x x	D
MW-109R	d x x x	x x d d	d x d d	d d d x	x x x x	D
MW-110	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-133	x x x x	x x x d	x x x x	d x x x	x x x x	D
MW-141	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-161R	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-111	d d d d	x x x x	x x d x	x x x x	d d d x	U
MW-115A	x x x x	x x x x	x x x x	x x x x	x x x x	U

	Year					
Upper	2002	2003	2004	2005	2006	Well
Aquifer	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	Type
MW-17	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-101A	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-108R	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-109R	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-110	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-133	x x x x	x x x d	x x x x	x x x d	x x x x	D
MW-141	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-161R	x x x x	x x x x	x x x x	x x x x	x x x x	D
MW-111	d x d d	d x d d	d d d d	x d d d	x d d x	U
MW-115A	x x x x	x x x x	x x x x	x x x x	x x x x	U

Table B: Quarterly Data Collection Summary For The Upper Aquifer Wells For The Background Period:

1992 Second Quarter - 2012 Second Quarter

	Year																				
	2007				2008				2009				2010				2011				
Upper Aquifer	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	Well Type
MW-17	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-101A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-108R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-109R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-110	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-133	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-141	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-161R	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	D
MW-111	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	d	x	x	x	U
MW-115A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	U

	Year		
	2012		
Upper Aquifer	1	2	Well Type
MW-17	x	x	D
MW-101A	x	x	D
MW-108R	x	x	D
MW-109R	x	x	D
MW-110	x	x	D
MW-133	x	x	D
MW-141	x	x	D
MW-161R	x	x	D
MW-111	x	x	U
MW-115A	x	x	U

Data Code	Description	Well Type Code
x	data collected and available	U = upgradient background well
d	dry well encountered in sampling	D = downgradient background well
N	not part of the CAD network	
NS	CAD well could not be sampled	

2.2 Background Intrawell Sample Sizes

Tables A and B are used to determine the number of samples available for calculation of background for each CAD well over the 1992 – 2012 background period for the lower and upper aquifers, respectively.

The numbers of samples for calculation of background are tabulated in Table C for each of the eighteen wells, and are observed to range from 36 to 81 samples. Background data were collected from the two downgradient wells: MW-17 and MW-101A beginning with the Fourth Quarter 2000 sampling. This yields a total of 47 data values for background calculations for each of these two wells. Background data were collected at the upgradient well: MW-116 in the Second Quarter sampling of 1992, and not again until sampling was resumed with the Fourth Quarter sampling in 2000. This yields a total of 48 data values for background calculations for the MW-116 well. Background data were collected at the upgradient well: MW-112 in the Second Quarter sampling of 1992, and not again until sampling was resumed with the Fourth Quarter sampling in 2003. This yields a total of 36 data values for background calculations for the MW-112 well.

Table C: Number of Samples For Calculation Of Background By Well For The Background Period:

1992 Second Quarter – 2012 Second Quarter

Lower Aquifer Wells	Number of Samples For Calculation Of Background	Upper Aquifer Wells	Number of Samples For Calculation Of Background
Downgradient		**Downgradient**	
MW-104	81	MW-17	47
MW-142	81	MW-101A	47
MW-149	79	MW-108R	70
MW-152	80	MW-109R	68
MW-153	81	MW-110	80
MW-158	78	MW-133	74
		MW-141	81
		MW-161R	69
Upgradient		**Upgradient**	
MW-112	36	MW-111	50
MW-116	48	MW-115A	81

3.0 CLASSIFICATION AND FREQUENCY OF SAMPLING OF SITE PARAMETERS

The site parameters and frequency of monitoring are listed in Table 5 of the GSAP. Each parameter is classified into one of the three categories: Organic Parameters, Inorganic Parameters, and Field Parameters

3.1 Classification and Frequency of Sampling of Organic Parameters

There are eleven parameters classified as Organic Parameters. They are listed in Table 5 of the GSAP and below in Table D.

Historic Intrawell Organic Parameter Data

Sampling data were regularly collected from each CAD well during the 1992 – 2012 background period for Organic Parameters according to the quarterly data collection summary listed in Tables A and B. Only two of the eleven Organic Parameters (t-Butanol and tetrahydrofuran) have been detected (above the detection limit) in any of the downgradient or upgradient wells in either aquifer over the entire 1992 – 2012 background period.

Frequency of Sampling of Organic Parameters

The frequency of groundwater sampling and analysis for the eleven Organic Parameters is given in Table 5 of the GSAP and in Table D below. The monitoring frequencies of the eleven Organic Parameters are specified in the GSAP as either quarterly or annually. The GSAP specifies that four of the Organic Parameters are to be analyzed and evaluated on a quarterly basis, as specified in Table D below. The GSAP specifies that seven of the Organic Parameters are to be analyzed and evaluated on an annual basis only (in conjunction with regular Quarter Three sampling), as specified in Table D below.

Table D: Eleven Organic Parameters and Frequency of Sampling

Parameter	Frequency of Sampling
Acetone	Quarterly
t-Butanol	Annual (Quarter 3 only)
Chlorobenzene	Annual (Quarter 3 only)
Ethylbenzene	Annual (Quarter 3 only)
Hexane	Annual (Quarter 3 only)
Methylene chloride	Quarterly
Methyl cyclopentane	Annual (Quarter 3 only)
Methyl-t-butyl ether	Annual (Quarter 3 only)
Tetrahydrofuran	Quarterly
Toluene	Quarterly
Xylenes	Annual (Quarter 3 only)

3.2 Classification and Frequency of Sampling of Field Parameters

Three site parameters are classified as Field Parameters and are listed on Table 5 of the GSAP and below in Table E. These three Field Parameters are pH, specific conductance, and temperature.

Field (Conventional) Parameters are defined in this SEP as those parameters which are detected in more than 50% of the samples from all CAD monitoring wells within an aquifer over the entire 1992 – 2012 background period. The parameters: pH, specific conductance, and temperature were observed to satisfy this requirement over the 1992 – 2012 background period. Historic intrawell background data will not be statistically analyzed for the Field Parameters: pH, specific conductance, and temperature.

Frequency of Sampling of Field Parameters

Table 5 of the GSAP specifies that the three Field Parameters are to be sampled on a quarterly basis, as shown in Table E below.

Table E: Field Parameters and Frequency of Sampling

Parameter	Frequency of Sampling
pH	Quarterly
Specific Conductance	Quarterly
Temperature	Quarterly

3.3 Classification and Frequency of Sampling of Inorganic Parameters

Three site parameters were classified as Inorganic Parameters in Table 5 of the GSAP, and are given in Table F below. The three Inorganic Parameters are chromium, copper, and zinc.

Inorganic Parameters (Infrequently Detected Inorganic Parameters) are defined in this SEP as those parameters which are detected in fewer than 50% of the samples from all CAD monitoring wells within an aquifer over the entire 1992 – 2012 background period. Determinations of the Inorganic Parameters were made individually for each of the CAD wells incorporating data collected in the background period defined in Section 2.1 as the 1992 Second Quarter through the 2012 Second Quarter. The parameters chromium, copper, and zinc were detected in fewer than 50% of the samples over the 1992 – 2012 background sampling period in both the upper and lower aquifers at the site.

Frequency of Sampling of Inorganic Parameters

The GSAP specifies that the single Inorganic Parameter: chromium is to be sampled and evaluated on a quarterly basis and that two of the Inorganic Parameters: copper and zinc are to be sampled and evaluated on an annual basis only (in conjunction with regular Quarter Three sampling).

The Inorganic Parameters frequencies of sampling are listed below in Table F.

Table F: Three Inorganic Parameters and Frequency of Sampling

Parameter	Frequency of Sampling
Chromium	Quarterly
Copper	Annual (Quarter 3 only)
Zinc	Annual (Quarter 3 only)

Non-Parametric Upper Tolerance Interval Limits Based on Background Data

As described in Section 7.0, a Non-Parametric Tolerance Interval statistical method will be used to evaluate the three Inorganic Parameters due to the high level of censoring (proportion of data falling below the detection limit). This method requires large numbers of background samples to ensure a reasonable Type I (false positive) error rate. Therefore, beginning with the 2012 Fourth Quarter sampling, Inorganic Parameters at each well will be compared to the maximum historic intrawell parameter value observed at the well in the 1992 – 2012 background period.

Table G contains a tabulation of the maximal parameter values detected in the 1992 – 2012 background samples for each of the Inorganic Parameters at each CAD well. These maximal tolerance interval (TI) values will be used as the non-parametric Upper TI limits, as described in Section 7.0. Each Upper TI value tabulated in Table G is based on a total of eighty-one possible samples from the 1992 – 2012 background data.

The Upper TI values reported in Table G are unchanged from those reported in the previous SEP, with one exception. A copper exceedance of 0.072 mg/L was reported at MW-109R in the Fourth Quarter (October 17, 2011) sampling which exceeded the upper TI of 0.020 mg/L.

> *According to the SEP protocol, four separate re-samples were collected from MW-109R on December 20, 2011. No copper exceedances were found in any of the four re-samples and each of the four copper re-sampled results were reported as non-detect (<0.02 mg/L). In accordance with the SEP (January 23, 2007), the foreground copper concentration at MW-109R is consistent with background and is not classified as a statistically significant increase.*

The updated Upper TI value of copper for MW-109R in Table G is reported as: 0.072 mg/L.

Table G: Non-Parametric Upper Tolerance Interval (Upper TI) Limits For The Infrequently Detected Inorganic Parameters For The Background Period:

1992 Second Quarter – 2012 Second Quarter

Lower Aquifer

Well	Well Type	Chromium (mg/L)	Copper (mg/L)	Zinc (mg/L)
MW-104	D	<0.025	<0.02	0.03
MW-112	U	<0.025	<0.02	0.15
MW-116	U	<0.025	<0.02	<0.02
MW-142	D	<0.025	0.05	0.02
MW-149	D	<0.025	0.02	0.01
MW-152	D	<0.025	0.02	0.06
MW-153	D	<0.025	<0.02	0.02
MW-158	D	<0.025	<0.02	0.03

Upper Aquifer

Well	Well Type	Chromium (mg/L)	Copper (mg/L)	Zinc (mg/L)
MW-17	D	<0.025	<0.02	0.03
MW-101A	D	<0.025	<0.02	0.07
MW-108R	D	<0.025	0.05	0.19
MW-109R	D	<0.025	0.072	0.13
MW-110	D	<0.025	0.03	0.05
MW-111	U	<0.025	<0.02	0.90
MW-115A	U	<0.025	<0.02	0.03
MW-133	D	<0.025	<0.02	0.14
MW-141	D	<0.025	<0.02	1.09
MW-161R	D	<0.025	0.02	0.07

Well Type Code:

D = Downgradient
U = Upgradient

4.0 STATISTICAL EVALUATIONS APPLIED TO THE FOREGROUND DATA

Foreground Data

In accordance with this SEP, all new data collected from CAD wells at the facility (which may be affected by the facility), beginning with the Fourth Quarter 2012 sampling, will be referred to as the "foreground data". The foreground data will be evaluated on a regular quarterly or annual basis starting with the Fourth Quarter 2012 sampling.

Statistical Evaluation of the Organic Parameters

An exceedance occurs if any quarterly-evaluated foreground Organic Parameter or any annually-evaluated foreground Organic Parameter is detected above the applicable detection limit. Details describing the statistical evaluation of the Organic Parameters are given in Section 5.0.

Graphical Evaluation of the Field Parameters

Foreground concentrations of Field Parameters in downgradient wells will be evaluated and compared to intrawell background concentrations using graphical procedures. Details describing the graphical evaluation of the Field Parameters are given in Section 6.0.

Statistical Evaluation of the Inorganic Parameters

A statistical evaluation method will be used to determine if a foreground sample concentration of an Inorganic Parameter is to be reported as a statistically significant increase.

An exceedance occurs if any quarterly-evaluated foreground sample of the three Inorganic Parameters or any annually-evaluated foreground sample of the single Inorganic Parameter is detected above the applicable Non-Parametric Upper TI Limit given in Table G (determined from the 1992 – 2012 background data). Details describing the statistical evaluation of the Inorganic Parameters are given in Section 7.0.

5.0 STATISTICAL EVALUATION OF THE ORGANIC PARAMETERS

None of the eleven Organic Parameters listed in Table D were detected above their respective detection limits in any of the 1992 – 2012 background samplings at the site.

Quarterly-Sampling Statistical Evaluation of Organic Parameters

Foreground concentrations of the four quarterly-evaluated Organic Parameters listed in Table D will be evaluated by comparison to the detection limit used in the groundwater chemistry measurement process. A statistically significant increase at an upgradient or downgradient CAD well will be noted if at least one of the four quarterly-evaluated Organic Parameters listed in Table D is reported above the individual parameter's detection limit.

If each of the four foreground concentrations of the quarterly-evaluated Organic Parameters is reported below the detection limit, then concentrations at the well will be considered not in exceedance, and therefore, compliant. However, if at least one of the four foreground concentrations of the quarterly-evaluated Organic Parameters equals or exceeds its detection limit, the Organic Parameter concentration at the well will be deemed as higher than background. The well will then be re-sampled in quadruplicate as soon as practical for the detected Organic Parameter in that well to confirm the exceedance.

Annual-Sampling Statistical Evaluation of Organic Parameters

Foreground concentrations of the seven annually-evaluated Organic Parameters listed in Table D will be evaluated by comparison to the detection limit used in the groundwater chemistry measurement process. A statistically significant increase at an upgradient or downgradient CAD well will be noted if at least one of the seven annually-evaluated Organic Parameters listed in Table D is reported above the individual parameter's detection limit.

If each of the seven foreground concentrations of the annually-evaluated Organic Parameters is reported below the detection limit, then concentrations at the CAD well will be considered not in exceedance, and therefore, compliant. However, if at least one of the seven foreground concentrations of the annually-evaluated Organic Parameters equals or exceeds its detection limit, the Organic Parameter concentration at the CAD well will be deemed as higher than background. The CAD well will then be re-sampled in quadruplicate as soon as practical for the detected Organic Parameter in that well to confirm the exceedance.

Quadruplicate Re-Sampling Procedure for Quarterly and Annual Evaluations

The analytic results of the quadruplicate re-sampling will be evaluated as soon as practical.

If any Organic Parameter from the quadruplicate quarterly or annual re-sampling exceeds a detection limit, foreground concentrations of the individual parameter in the affected CAD well will be declared in exceedance. In this event procedures in accordance with Part VI of the Operating License will be performed.

However, it may be demonstrated that a source other than the facility caused the observed exceedance in the Organic Parameter concentration, by using procedures described in the Operating License. If it is determined that the facility is not the source of the detected parameter the P&U Company will propose to the MDEQ one of the following:

(1) exclude the subject Organic Parameter at the affected CAD well from statistical evaluation until the non-facility influence no longer exists, or

(2) removal of the affected well from the CAD network and substitution of another suitable non-affected monitor well into the CAD network.

6.0 GRAPHICAL EVALUATION OF THE FIELD PARAMETERS

The procedures to be used to evaluate the Field Parameters: pH, specific conductance, and temperature are graphical procedures. A graph will be produced after each quarterly sampling including all three Field Parameters for each of the eighteen CAD wells. Each graph produced will include all data from the 1992 – 2012 background period and all historic foreground data collected after the 2012 Third Quarter sampling, including the most recent quarterly data collected at the well. The method of evaluation is inspection of the graphs for excessively large values of pH, conductivity, and temperature, and for excessively small values of pH and temperature only.

Quarterly listings of the Field Parameters: pH, specific conductance and temperature (Centigrade) are given in Appendices A, B, and C, respectively. It is noted that temperatures were reported in Fahrenheit degrees for all quarterly listings up to and including the Third Quarter of 1999. All quarterly temperatures were reported in Centigrade degrees starting with the Fourth Quarter of 1999. For consistency, all quarterly Fahrenheit temperatures are reported in Centigrade degrees in the Appendix C listings.

7.0 STATISTICAL EVALUATION OF THE INORGANIC PARAMETERS

Foreground concentrations of the Inorganic Parameters (identified in Section 3.0) will be compared to historic intrawell background concentrations using Non-Parametric Upper Tolerance Interval (TI) Limits.

Nonparametric tolerance intervals are recommended in the U.S. EPA Guidance (July 1992; p. 54) for use in evaluating groundwater monitoring data when "the assumptions of normality and lognormality cannot be justified, especially when a significant portion of the samples are non-detect". According to U.S. EPA guidance, non-parametric intervals are sensitive to the actual magnitudes of the concentrations. Because non-parametric tolerance intervals may be established as the maximum detected concentration in background, they allow for an accurate representation of background when high levels of censoring are present in background data sets.

The choice of the use of the non-parametric tolerance intervals for the analysis of the Inorganic Parameters is the result of the high number of non-detect data observed in the background data for these parameters, as noted in Section 3.3.

Establishment of Non-Parametric Upper Tolerance Interval Limits for Inorganic Parameters

Non-parametric upper tolerance limits have been established based on the historic 1992 –2012 intrawell background data for each Inorganic Parameter in each downgradient and upgradient CAD monitoring well at the facility.

Table G in Section 3.3 contains a tabulation of the maximal parameter values detected in the 1992 – 2012 background samples for all Inorganic Parameters at each well. These maximal tolerance interval (Upper TI) values will be used as the non-parametric upper tolerance interval limits. For Inorganic Parameters detected above current detection limits in the 1992 – 2012 intrawell background data, the maximal tolerance interval (Upper TI) value in Table G is the maximum detected concentration in the 1992 – 2012 intrawell background history. For Inorganic Parameters not detected above current detection limits in the 1992 – 2012 intrawell background data set, the maximal tolerance interval (Upper TI) is the detection limit itself.

Each maximal tolerance interval (Upper TI) value tabulated in Table G is based on a possible total of 81 possible samples from the 1992 – 2012 background data set. U.S. EPA Guidance (July 1992; p. 76) recommends that a minimum of eight samples be used to characterize background concentrations. Statistical evaluation of the Inorganic Parameters for each of the eighteen wells listed in Table C may continue because at least eight background samples are available from each well.

Statistical Evaluation Procedure using the Non-Parametric Upper Tolerance Interval

Foreground data for each Inorganic Parameter in an individual well will be evaluated by comparing detected concentrations to the maximal detected concentration upper TI limit observed in the 1992 – 2012 period for the well. The following notation is introduced:

x_i = individual foreground concentration at sampling event i

Upper TI = maximum concentration over the entire1992–2012 background period, which is tabulated in Table G

Foreground Concentrations Consistent with the 1992 –2012 Background Concentrations

If the foreground concentration of a particular Inorganic Parameter in a well is less than the Upper TI :

x_i < Upper TI,

or if the foreground concentration is below the detection limit (regardless of the detection limit employed), it will be considered consistent with background.

Foreground Concentrations in Exceedance of the 1992 –2012 Background Concentrations

If a foreground concentration of a particular Inorganic Parameter in a well exceeds the Upper TI:

x_i > Upper TI,

it will be classified as greater than background concentrations, and the concentration will be classified as a statistically significant increase or an exceedance.

Implementation of the Non-Parametric Tolerance Interval Evaluation Method

The Upper TI values in Table G will be used for all evaluations of the Inorganic Parameters for all foreground data collected in the Fourth Quarter 2012 – Fourth Quarter 2016 period of this SEP. Foreground Inorganic Parameter data will be compared to the maximal historic intrawell parameter value (Upper TI) observed at the well in the 1992-2012 background period.

The non-parametric tolerance interval evaluation method will be utilized on a quarterly-basis for the chromium Inorganic Parameter and on an annual basis (at the Third Quarter sampling only) for the copper and zinc Inorganic Parameters (as listed in Table F).

If an exceedance of the upper TI limit occurs for any Inorganic Parameter, samples will be collected in quadruplicate from the well as soon as practical to confirm the exceedance for the parameter. If at least three of the subsequent detected concentrations fall below the Upper TI value, foreground concentrations will be considered consistent with background. However, if two or more of the subsequent detected concentrations exceed the Upper TI value, foreground concentrations of the individual Inorganic Parameter in the affected well will be considered significantly greater than background, and the steps in accordance with Part VI of the Operating License will be performed.

8.0 PROCEDURES FOR MAKING CHANGES TO THE SEP

P&U may submit a petition to the MDEQ to re-evaluate and modify, as necessary, the statistical procedures included in the 2012 SEP resulting from documented evidence of changes in the groundwater chemistry at the site.

P&U may review any new and improved statistical methods as they are developed, and propose modifications to the SEP accordingly, upon approval by the MDEQ. In addition, P&U may request a modification of the CAD groundwater parameters monitored at the site from the MDEQ. Finally, P&U may request from the MDEQ that new site CAD wells be added or existing site CAD wells be deleted from the SEP.

9.0 REPORTING PROCEDURES

The statistical evaluation of the quarterly or annual groundwater sampling analytical results from the CAD wells will be performed and documented in quarterly statistical reports. The MDEQ will receive notifications of exceedances as specified in the Operating License. These quarterly reports and the Annual Statistical Summary Report will be submitted to the MDEQ as attachments to the Annual Groundwater Monitoring Report.

9.1 Protocol for Quarterly Reports Through 2016

The quarterly monitoring data collected at each of the CAD wells in the 1992-2012 period will be used as an intrawell background for each round of quarterly data collected at each CAD well starting with the Fourth Quarter 2012 sampling. This set of background intrawell data will be used as a background for all quarterly monitoring data collected at the CAD well over the four-year period: Fourth Quarter 2012 – Fourth Quarter 2016.

Seventeen quarterly reports will be produced over this Fourth Quarter 2012 – Fourth Quarter 2016 period starting with the Fourth Quarter 2012 sampling and ending with the Fourth Quarter 2016 sampling. The same background intrawell data sets will be used as the background control at each individual CAD well and parameter for each of these seventeen evaluations and reports.

The background intrawell data will not be updated quarterly as new data are collected during the Fourth Quarter 2012 – Fourth Quarter 2016 period.

A thorough statistical review will be completed after the Fourth Quarter 2016 sampling, and consideration will be given to updating the background data used for intrawell evaluations on monitoring data collected on and after the First Quarter 2017 sampling.

10.0 REFERENCES

U.S. Environmental Protection Agency (U.S. EPA) (1992; July) *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities – Addendum to Interim Final Guidance*. Office of Solid Waste, Permits & State Programs Division.

U.S. EPA (1989; April) *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities – Interim Final Guidance*. Office of Solid Waste, Permits & State Programs Division.

11.0 APPENDIX SECTION

Appendix A	pH Parameter Data Listings by Well: 1992 - 2012
Appendix B	Specific Conductance Parameter Data Listings by Well: 1992 - 2012
Appendix C	Temperature Parameter Data Listings by Well: 1992 - 2012

Appendix A

pH Parameter Data Listings by Well: 1992-2012

CAD Groundwater Monitoring - pH
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 1 of 10)

Well ID	4/25-5/7/92	7/27-30/92	10/26-28/92	1/19-21/93	4/21-22/93	7/13-15/92	10/20-21/93	1/13/94	1/24-31/94	4/21-22/94	7/20-21/94	10/20/94
MW-17	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	8.60	7.99	7.23	7.89	8.15	8.43	7.80	8.16	----	7.70	7.34	7.76
MW-108R	7.47	6.98	7.30	6.83	7.54	7.77	7.25	----	7.30	7.10	6.39	6.86
MW-109R	7.47	7.68	7.03	7.07	8.68	7.39	7.52	----	7.10	7.40	6.67	6.99
MW-110	8.54	7.23	7.69	7.10	7.90	7.93	7.63	----	----	7.50	6.75	7.30
MW-111	----	6.91	----	6.42	7.98	7.56	6.79	----	----	7.20	7.11	----
MW-112	7.57	----	----	----	----	----	----	----	----	----	----	----
MW-115A	7.70	7.74	----	7.58	8.77	7.91	7.61	----	7.97	7.60	7.16	7.59
MW-116	8.72	----	----	----	----	----	----	----	----	----	----	----
MW-133	7.86	7.63	----	7.38	8.75	7.71	7.98	----	8.45	7.80	7.27	7.47
MW-141	7.28	7.14	7.33	6.82	8.12	8.14	8.95	7.53	----	7.60	6.71	7.11
MW-142	7.66	7.62	7.63	7.64	8.44	8.97	8.04	8.04	----	7.90	7.42	7.76
MW-149	7.96	7.78	8.34	8.22	8.59	8.56	7.58	----	8.56	7.90	7.35	7.75
MW-152	----	8.42	7.95	8.26	9.06	9.09	8.59	----	8.77	7.80	7.10	7.70
MW-153	7.15	7.40	7.55	7.10	8.08	8.40	7.81	----	7.42	7.60	6.90	7.39
MW-158	----	----	----	7.49	8.42	8.60	7.74	8.37	----	7.80	7.31	7.01
MW-161R	----	----	----	----	----	----	----	----	----	----	----	----

CAD Groundwater Monitoring - pH
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 2 of 10)

Well ID	1/18-19/95	1/26/95	4/24/95	7/20-21/95	7/27/95	10/19-20/95	10/27/95	1/17-18/96	1/24-25/96	4/18-19/96	7/18-19/96	10/17-18/96
MW-17	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	7.89	----	7.87	7.83	----	7.50	----	----	7.92	8.18	7.33	7.47
MW-108R	6.98	----	7.04	6.99	----	7.40	----	6.50	----	6.79	6.31	7.11
MW-109R	6.70	----	7.22	7.41	----	----	----	----	----	7.28	----	----
MW-110	7.58	----	7.60	7.30	----	7.10	----	7.08	----	7.49	8.02	6.96
MW-111	7.41	----	7.37	----	----	----	----	6.86	----	6.91	7.09	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	7.76	----	7.75	7.81	----	7.30	----	7.38	----	7.43	7.62	7.37
MW-116	----	----	----	----	----	----	----	----	----	----	----	----
MW-133	7.75	----	7.83	7.40	----	7.40	----	----	7.77	----	----	7.26
MW-141	----	7.24	7.31	----	7.20	7.40	----	7.44	----	7.54	7.04	6.70
MW-142	----	7.81	7.97	----	7.82	8.20	----	8.07	----	8.17	10.05	7.20
MW-149	8.18	----	8.10	7.90	----	7.70	----	----	8.08	8.16	8.09	6.27
MW-152	7.71	----	7.87	----	7.59	----	8.30	7.63	----	7.73	5.65	7.20
MW-153	7.41	----	7.73	----	7.58	7.40	----	7.71	----	7.84	7.25	7.30
MW-158	7.50	----	7.81	----	7.45	7.90	----	----	7.51	7.82	7.49	7.32
MW-161R	----	----	7.40	7.51	----	7.30	----	7.47	----	7.49	6.59	7.22

CAD Groundwater Monitoring - pH
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 3 of 10)

Well ID	1/23-24/97	4/22-24/97	7/15-17/97	10/15-16/97	1/21-23/98	4/23-24/98	7/14-15/98	10/22-23/98	1/25-29/99	2/1/99	4/26-29/99	7/22-23/99
MW-17	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	8.19	7.65	7.41	7.89	7.97	7.90	8.07	7.85	7.77	----	7.41	7.43
MW-108R	----	7.21	6.93	7.28	6.70	6.65	----	----	----	----	----	----
MW-109R	----	7.37	7.22	7.84	6.65	7.34	----	----	----	----	6.87	----
MW-110	7.61	7.36	7.14	7.55	7.56	7.43	7.98	8.23	----	7.28	6.97	7.30
MW-111	----	----	----	----	7.46	7.27	6.40	6.58	6.62	----	6.52	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	7.65	7.34	7.27	7.49	7.62	7.65	7.39	7.68	7.42	----	7.40	7.29
MW-116	----	----	----	----	----	----	----	----	----	----	----	----
MW-133	7.70	7.70	7.60	7.57	7.70	7.73	7.59	----	7.07	----	7.22	7.40
MW-141	7.33	6.74	7.22	7.47	7.36	7.16	7.18	6.86	6.73	----	7.12	7.18
MW-142	7.90	7.31	7.57	7.92	8.12	8.06	8.23	7.72	7.94	----	7.29	7.80
MW-149	9.80	8.98	8.41	8.87	8.65	8.42	7.80	8.18	8.71	----	7.72	7.52
MW-152	7.52	7.41	7.35	7.67	7.89	7.51	8.05	7.94	7.68	----	7.37	7.26
MW-153	7.63	7.46	7.46	7.69	7.64	7.55	7.79	7.90	7.38	----	7.29	7.16
MW-158	7.77	7.43	7.52	7.92	7.88	7.69	7.75	7.61	7.61	----	7.22	7.33
MW-161R	7.36	7.12	7.01	7.43	7.36	7.22	6.90	7.43	7.10	----	6.95	6.85

CAD Groundwater Monitoring - pH
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 4 of 10)

Well ID	10/12-14/99	1/18-21/00	4/19-21/00	7/26/28/00	10/17-19/00	1/24-26/01	2/20/01	4/26-27/01	5/25/01	6/20/01	7/24-27/01	9/21/01
MW-17	----	----	----	----	6.84	7.00	----	6.90	----	----	7.01	----
MW-101A	----	----	----	----	7.06	7.04	----	6.99	----	----	6.70	----
MW-104	7.47	7.59	7.55	7.35	7.60	7.72	----	7.40	----	----	7.05	----
MW-108R	----	6.38	----	----	6.91	7.12	7.07	7.06	----	----	6.87	----
MW-109R	----	----	----	----	7.42	7.38	----	7.76	----	7.60	7.18	----
MW-110	7.23	7.41	7.28	7.57	7.72	8.05	----	7.43	----	----	7.65	----
MW-111	6.78	6.70	6.90	6.88	6.75	----	----	----	----	----	----	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	7.33	7.50	7.46	7.69	7.59	7.82	----	7.66	7.31	----	7.30	----
MW-116	----	----	----	----	8.00	8.14	----	8.05	----	----	7.82	----
MW-133	7.28	----	7.62	7.62	7.31	7.57	----	7.67	----	----	7.25	----
MW-141	7.02	7.26	7.15	7.07	7.25	7.36	----	7.37	----	6.98	7.02	----
MW-142	7.45	7.56	7.61	7.40	7.63	7.83	----	7.63	----	----	7.43	----
MW-149	7.53	7.75	8.77	8.00	7.62	7.80	----	8.34	----	----	9.15	----
MW-152	7.40	7.48	7.42	7.71	7.41	7.60	----	7.29	----	----	6.95	----
MW-153	7.21	7.41	7.16	7.52	7.12	7.41	----	7.22	----	----	6.88	----
MW-158	7.37	7.52	7.44	7.36	7.54	7.71	----	7.54	----	----	6.97	----
MW-161R	6.93	7.22	7.14	6.81	7.05	7.21	----	7.13	----	7.05	6.77	7.12

CAD Groundwater Monitoring - pH
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 5 of 10)

Well ID	10/23-25/01	12/19/01	1/21-23/02	3/22/02	4/1/02	4/22-25/02	5/3/02	6/14/02	7/23-25/02	9/30/02	10/21-23/02	12/5/02
MW-17	7.01	----	6.95	----	----	7.01	----	----	6.65	----	6.58	----
MW-101A	6.95	----	6.88	----	----	6.99	----	----	6.65	----	6.46	----
MW-104	7.50	----	7.81	----	----	7.82	----	----	7.52	7.24	7.32	7.57
MW-108R	7.06	----	7.24	----	----	7.24	----	----	6.96	----	6.09	----
MW-109R	7.68	----	7.28	7.58	----	7.50	----	----	7.18	----	6.92	7.12
MW-110	7.59	----	7.93	----	----	7.89	----	----	7.60	----	7.80	----
MW-111	7.15	----	----	----	----	7.31	----	----	----	----	----	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	7.60	----	7.63	----	----	7.80	----	----	7.52	----	7.10	----
MW-116	8.02	----	8.06	----	----	8.17	----	----	7.80	----	7.55	----
MW-133	7.52	----	7.78	----	----	7.72	----	----	7.49	----	7.04	----
MW-141	7.29	----	7.45	----	----	7.40	----	----	7.22	----	6.89	----
MW-142	7.84	----	7.82	----	----	7.74	----	----	7.59	----	7.37	----
MW-149	8.50	----	8.09	----	8.08	----	7.70	8.02	7.78	7.71	7.80	7.92
MW-152	7.59	----	7.47	----	----	7.74	----	----	7.33	----	7.16	----
MW-153	7.56	----	7.54	----	----	7.68	----	----	7.19	----	7.08	----
MW-158	7.70	----	7.70	----	----	7.78	----	----	7.41	----	7.23	----
MW-161R	7.23	7.12	7.14	----	----	7.29	----	----	6.95	6.76	6.65	6.89

CAD Groundwater Monitoring - pH
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 6 of 10)

Well ID	1/13-15/03	3/17-18/03	4/14-16/03	6/18-20/03	7/28-30/03	9/23/03	10/20-22/03	12/1-3/03	12/9/03	1/19-23/04	3/15-16/04	4/19-23/04
MW-17	7.69	----	6.70	----	6.72	----	7.04	----	----	6.83	----	6.81
MW-101A	7.62	----	6.48	----	6.53	----	6.80	----	----	6.87	----	6.79
MW-104	8.30	7.62	7.23	7.46	7.58	7.77	7.76	7.65	----	7.73	7.63	7.81
MW-108R	7.26	----	6.18	6.38	6.26	----	6.53	----	6.56	6.68	6.70	6.94
MW-109R	7.95	7.28	7.24	----	7.14	----	7.43	7.44	----	7.12	7.26	7.24
MW-110	8.17	----	7.12	----	7.87	----	7.78	----	----	7.38	----	7.39
MW-111	----	----	6.84	----	----	----	----	----	----	----	----	----
MW-112	----	----	----	----	----	----	7.45	----	----	7.32	----	7.64
MW-115A	8.12	----	7.22	----	7.36	----	7.56	----	----	7.52	----	7.59
MW-116	8.52	----	7.43	----	7.72	----	8.05	----	----	8.07	----	8.09
MW-133	7.76	----	7.24	----	7.28	----	----	----	----	7.85	----	7.81
MW-141	7.42	----	6.87	----	6.95	----	7.28	----	----	7.38	----	7.36
MW-142	7.76	----	7.27	----	7.41	----	7.73	----	----	7.82	----	7.88
MW-149	8.59	9.71	8.88	8.39	----	----	7.54	7.78	----	7.85	----	7.63
MW-152	8.16	----	7.07	----	7.26	----	7.53	----	----	7.52	----	7.48
MW-153	8.06	----	7.06	----	7.23	----	7.51	----	----	7.55	----	7.46
MW-158	7.38	----	7.24	----	7.10	----	7.64	----	----	7.64	----	7.60
MW-161R	7.73	6.98	6.71	6.46	6.86	7.16	7.04	7.10	----	7.21	7.08	7.01

CAD Groundwater Monitoring - pH
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 7 of 10)

Well ID	6/9-10/04	7/19-21/04	9/8-10/04	10/18-19/04	12/9/04	12/14/04	1/17-20/05	3/16/05	4/11-14/05	5/25-26/05	7/18-20/05	9/9/05
MW-17	----	7.06	----	6.83	----	----	6.87	----	6.79	----	6.76	----
MW-101A	----	6.79	----	6.77	----	----	6.80	----	6.84	----	6.82	----
MW-104	7.79	7.58	7.76	7.72	7.84	----	7.51	7.65	7.67	7.62	7.69	7.69
MW-108R	----	7.15	----	6.85	----	----	6.95	----	6.83	----	6.76	----
MW-109R	7.42	7.56	7.19	7.15	7.37	----	7.33	7.35	7.34	7.46	7.46	7.37
MW-110	----	7.47	----	7.32	----	----	7.27	----	7.46	----	7.32	----
MW-111	----	----	----	----	----	----	7.15	----	----	----	----	----
MW-112	----	7.60	----	7.44	----	----	7.33	----	7.34	----	7.34	----
MW-115A	----	7.88	----	7.54	----	----	7.40	----	7.48	----	7.60	----
MW-116	----	8.20	----	8.07	----	----	7.88	----	7.99	----	7.98	----
MW-133	----	7.13	----	7.49	----	----	7.84	----	7.42	----	7.57	----
MW-141	----	7.34	----	7.37	----	----	7.22	----	7.36	----	7.33	----
MW-142	----	7.73	----	7.84	----	----	7.64	----	7.78	----	7.79	----
MW-149	7.66	7.57	7.66	7.68	----	7.72	7.62	7.69	7.71	7.47	7.70	7.70
MW-152	----	7.28	7.46	7.53	----	----	7.40	----	7.43	----	7.50	----
MW-153	----	7.45	----	7.54	7.64	----	7.58	7.48	7.43	7.44	7.52	----
MW-158	----	7.53	----	7.59	----	----	7.45	----	7.50	7.44	7.48	7.68
MW-161R	7.21	7.06	7.01	7.19	7.19	----	7.06	7.15	7.08	6.89	7.16	7.23

CAD Groundwater Monitoring - pH
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 8 of 10)

Well ID	10/17-19/05	12/12-16/05	1/23-25/06	3/20-21/06	5/1-5/06	6/13/06	7/17-20/06	8/28-31/06	10/16-18/06	11/28/06	1/22-25/07	4/16-18/07
MW-17	6.88	----	6.90	----	6.83	----	6.89	----	6.79	----	6.83	6.92
MW-101A	6.80	----	6.92	----	6.88	----	6.88	----	6.95	----	6.83	6.97
MW-104	7.84	7.48	7.89	7.72	7.78	7.72	7.80	7.78	8.01	----	7.90	7.92
MW-108R	6.89	----	6.73	----	6.81	----	6.83	----	6.66	----	6.71	6.81
MW-109R	7.41	7.21	7.48	7.29	7.27	7.34	7.24	7.01	7.21	7.12	7.21	7.25
MW-110	7.49	----	7.56	----	7.34	----	7.46	----	7.26	----	7.25	7.52
MW-111	----	----	7.40	----	----	----	----	----	7.25	----	7.58	7.35
MW-112	7.45	----	7.46	----	7.51	----	7.47	----	7.52	----	7.46	7.55
MW-115A	7.50	----	7.53	----	7.56	----	7.69	----	7.70	----	7.51	7.63
MW-116	8.06	----	8.09	----	7.73	----	8.09	----	8.18	----	7.96	8.04
MW-133	----	----	7.69	----	7.87	----	7.66	----	7.70	----	7.99	8.20
MW-141	7.34	----	7.35	----	7.19	----	7.33	----	7.55	----	7.46	7.51
MW-142	7.96	----	7.78	----	7.64	7.78	7.86	7.82	8.05	----	7.98	7.96
MW-149	7.79	7.37	7.70	7.81	7.73	7.75	7.66	7.73	8.00	7.77	7.83	7.91
MW-152	7.56	----	7.55	----	7.52	----	7.54	----	7.71	----	7.62	7.53
MW-153	7.58	7.27	7.70	7.49	7.57	7.55	7.59	7.58	7.58	----	7.70	7.27
MW-158	7.68	7.40	7.53	7.69	7.56	7.65	7.68	7.63	7.76	----	7.81	7.65
MW-161R	7.17	----	7.18	----	7.30	----	7.12	----	7.39	----	7.32	7.40

CAD Groundwater Monitoring - pH
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 9 of 10)

Well ID	7/16-18/07	7/31/07	10/22-24/07	1/14-18/08	4/14-16/08	7/15-17/08	10/13-15/08	1/28-2/3/09	4/13-16/09	7/13-17/09	10/14-16/09	11/6/09
MW-17	6.94	----	6.84	6.80	6.77	7.24	7.01	7.05	7.07	7.15	----	7.09
MW-101A	6.97	----	6.84	7.00	6.75	7.04	6.92	6.95	6.90	6.93	6.83	----
MW-104	8.00	----	7.80	7.86	7.74	7.99	7.76	8.00	8.00	7.99	7.89	----
MW-108R	6.88	----	6.79	6.72	6.69	7.12	6.83	6.82	6.93	6.98	6.79	----
MW-109R	7.08	----	7.12	7.10	7.12	7.69	7.33	7.50	7.55	7.60	7.39	----
MW-110	7.48	----	7.38	7.46	7.36	7.69	7.39	7.68	7.90	7.75	7.63	----
MW-111	7.45	----	6.95	7.21	7.19	7.36	6.99	7.10	7.30	7.40	7.28	----
MW-112	7.50	----	7.45	7.61	7.49	7.70	7.45	7.59	7.71	7.60	7.48	----
MW-115A	7.78	----	7.62	7.59	7.47	7.75	7.50	7.67	7.73	7.57	7.62	----
MW-116	8.19	----	7.98	8.10	7.90	8.12	7.87	8.13	8.18	8.03	8.02	----
MW-133	7.75	----	7.48	7.55	7.73	7.73	7.52	8.06	7.98	7.78	7.75	----
MW-141	7.51	----	7.36	7.15	7.24	7.44	7.36	7.34	7.38	7.30	7.41	----
MW-142	8.06	7.65	7.90	7.68	7.82	7.90	7.72	7.97	7.96	7.69	7.86	----
MW-149	7.95	----	7.74	7.44	7.66	8.00	7.75	7.95	7.94	7.94	7.83	----
MW-152	7.74	----	7.61	7.47	7.39	7.81	7.44	7.71	7.63	7.76	7.59	----
MW-153	7.75	----	7.58	7.68	7.49	7.85	7.49	7.70	7.67	7.64	7.55	----
MW-158	7.79	7.30	7.60	7.47	7.60	7.91	7.58	7.83	7.74	7.81	7.68	----
MW-161R	7.25	----	7.21	7.06	7.18	7.42	7.27	7.26	7.25	7.03	7.18	----

CAD Groundwater Monitoring - pH
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 10 of 10)

Well ID	1/12-18/10	4/20-22/10	7/21-23/10	10/19-25/10	1/19-25/11	4/21-29/11	7/18-25/11	10/17-26/11	12/20/11	1/18-25/12	4/26-5/1/12	7/18-23/12
MW-17	7.09	7.17	7.23	7.29	7.24	7.51	7.14	7.05	----	7.13	7.16	7.64
MW-101A	6.88	6.97	7.03	7.10	7.09	7.30	7.13	7.08	----	7.19	7.19	6.67
MW-104	8.06	8.07	8.08	8.06	8.01	8.27	8.02	7.80	----	7.58	7.89	7.26
MW-108R	6.85	6.95	6.93	7.05	7.06	7.15	----	6.99	----	7.12	6.98	7.25
MW-109R	7.35	7.54	7.56	7.40	7.32	7.94	7.50	7.44	7.39	7.52	7.49	7.07
MW-110	7.83	7.84	7.84	7.90	7.98	8.35	7.75	7.89	----	7.95	7.70	8.83
MW-111	7.55	7.37	7.40	7.35	----	7.33	7.19	7.15	----	7.14	7.20	6.83
MW-112	7.66	7.70	7.64	7.69	7.62	7.85	7.53	7.51	----	7.62	7.44	7.21
MW-115A	7.60	7.81	7.89	7.88	7.62	7.91	7.78	7.75	----	7.63	7.53	7.18
MW-116	8.16	8.25	8.23	8.17	8.06	8.38	8.10	8.00	----	8.04	7.91	7.45
MW-133	7.71	7.99	7.84	7.59	7.65	8.16	7.67	7.70	----	8.26	7.83	7.67
MW-141	7.35	7.54	7.64	7.61	7.52	7.68	7.49	7.41	----	7.45	7.41	6.83
MW-142	7.89	8.02	7.88	7.79	7.79	7.98	7.81	7.65	----	7.88	7.63	7.28
MW-149	7.86	8.09	8.00	7.96	7.98	8.39	----	8.04	----	7.97	7.90	7.31
MW-152	7.74	7.82	7.79	7.60	7.77	7.94	7.85	7.68	----	7.69	7.38	7.15
MW-153	7.68	7.65	7.71	7.67	7.71	7.79	7.61	7.44	----	7.62	7.40	7.87
MW-158	7.77	7.83	7.65	7.65	7.69	8.05	7.42	7.82	----	7.71	7.34	9.15
MW-161R	7.29	7.35	7.37	7.37	7.32	7.40	7.44	7.48	----	7.41	7.37	6.78

CAD Groundwater Monitoring - pH
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 10 of 10)

Well ID	1/12-18/10	4/20-22/10	7/21-23/10	10/19-25/10	1/19-25/11	4/21-29/11	7/18-25/11	10/17-26/11	12/20/11	1/18-25/12	4/26-5/1/12
MW-17	7.09	7.17	7.23	7.29	7.24	7.51	7.14	7.05	----	7.13	7.16
MW-101A	6.88	6.97	7.03	7.10	7.09	7.30	7.13	7.08	----	7.19	7.19
MW-104	8.06	8.07	8.08	8.06	8.01	8.27	8.02	7.80	----	7.58	7.89
MW-108R	6.85	6.95	6.93	7.05	7.06	7.15	----	6.99	----	7.12	6.98
MW-109R	7.35	7.54	7.56	7.40	7.32	7.94	7.50	7.44	7.39	7.52	7.49
MW-110	7.83	7.84	7.84	7.90	7.98	8.35	7.75	7.89	----	7.95	7.70
MW-111	7.55	7.37	7.40	7.35	----	7.33	7.19	7.15	----	7.14	7.20
MW-112	7.66	7.70	7.64	7.69	7.62	7.85	7.53	7.51	----	7.62	7.44
MW-115A	7.60	7.81	7.89	7.88	7.62	7.91	7.78	7.75	----	7.63	7.53
MW-116	8.16	8.25	8.23	8.17	8.06	8.38	8.10	8.00	----	8.04	7.91
MW-133	7.71	7.99	7.84	7.59	7.65	8.16	7.67	7.70	----	8.26	7.83
MW-141	7.35	7.54	7.64	7.61	7.52	7.68	7.49	7.41	----	7.45	7.41
MW-142	7.89	8.02	7.88	7.79	7.79	7.98	7.81	7.65	----	7.88	7.63
MW-149	7.86	8.09	8.00	7.96	7.98	8.39	----	8.04	----	7.97	7.90
MW-152	7.74	7.82	7.79	7.60	7.77	7.94	7.85	7.68	----	7.69	7.38
MW-153	7.68	7.65	7.71	7.67	7.71	7.79	7.61	7.44	----	7.62	7.40
MW-158	7.77	7.83	7.65	7.65	7.69	8.05	7.42	7.82	----	7.71	7.34
MW-161R	7.29	7.35	7.37	7.37	7.32	7.40	7.44	7.48	----	7.41	7.37

Appendix B

Conductivity Data Listings by Parameter and Well: 1992-2012

CAD Groundwater Monitoring - Conductivity
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 1 of 10)

Well ID	4/25-5/7/92	7/27-30/92	10/26-28/92	1/19-21/93	4/21-22/93	7/13-15/92	10/20-21/93	1/13/94	1/24-31/94	4/21-22/94	7/20-21/94	10/20/94	1/18-19/95
MW-17	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	630	598	574	600	544	506	502	527	----	585	715	628	648
MW-108R	1,490	1,567	1,425	1,461	978	1,125	1,537	----	2,017	2,140	2,180	1,970	2,183
MW-109R	1,359	734	812	1,038	505	908	1,320	----	1,372	959	1,690	1,561	213
MW-110	1,012	793	502	616	634	662	1,007	----	----	988	2,020	2,880	1,905
MW-111	----	908	----	981	738	728	748	----	----	925	926	----	1,273
MW-112	766	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	603	522	500	599	568	450	537	----	595	638	703	584	635
MW-116	308	----	----	----	----	----	----	----	----	----	----	----	----
MW-133	700	384	----	625	550	502	520	----	671	570	580	634	711
MW-141	1,182	957	946	942	938	928	1,120	1,030	----	970	1,130	1,019	----
MW-142	581	437	426	456	407	429	418	388	----	431	543	466	----
MW-149	480	475	329	495	650	477	365	----	460	501	582	482	537
MW-152	----	985	730	981	872	761	879	----	725	941	1,236	917	1,088
MW-153	795	939	661	906	736	742	684	----	694	652	428	669	676
MW-158	----	----	----	553	474	604	532	503	----	510	634	518	568
MW-161R	----	----	----	----	----	----	----	----	----	----	----	----	----

CAD Groundwater Monitoring - Conductivity
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 2 of 10)

Well ID	1/26/95	4/24/95	7/20-21/95	7/27/95	10/19-20/95	10/27/95	1/17-18/96	1/24-25/96	4/18-19/96	7/18-19/96	10/17-18/96	1/23-24/97	4/22-24/97
MW-17	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	----	581	567	----	542	----	----	651	477	484	587	479	543
MW-108R	----	2,310	2,630	----	2,510	----	3,180	----	2,660	2,780	2,180	----	1,620
MW-109R	----	2,300	2,450	----	----	----	----	----	1,990	----	----	----	1,220
MW-110	----	1,040	1,260	----	1,908	----	1,347	----	1,067	1,042	1,317	1,162	1,259
MW-111	----	1,090	----	----	----	----	895	----	888	758	----	----	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	----	645	590	----	568	----	438	----	568	539	613	583	652
MW-116	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-133	----	661	516	----	759	----	----	649	----	----	604	572	638
MW-141	1,037	1,013	----	1,010	900	----	699	----	844	872	1,028	968	1,529
MW-142	478	462	----	477	390	----	331	----	416	394	489	438	515
MW-149	----	599	552	----	505	----	----	550	923	570	577	1,023	482
MW-152	----	1,040	----	985	----	800	717	----	881	915	1,131	992	1,124
MW-153	----	618	----	611	905	----	399	----	489	485	613	509	603
MW-158	----	553	----	575	490	----	----	580	483	540	676	549	658
MW-161R	----	885	805	----	823	----	697	----	768	764	836	761	1,206

CAD Groundwater Monitoring - Conductivity
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 3 of 10)

Well ID	7/15-17/97	10/15-16/97	1/21-23/98	4/23-24/98	7/14-15/98	10/22-23/98	1/25-29/99	2/1/99	4/26-29/99	7/22-23/99	10/12-14/99	1/18-21/00	4/19-21/00
MW-17	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	496	415	496	483	481	454	507	----	557	590	495	669	668
MW-108R	2,330	1,980	429	----	----	----	----	----	----	----	----	3,900	----
MW-109R	1,398	885	310	1,013	----	----	----	----	1,142	----	----	----	----
MW-110	1,348	938	1,219	822	1,302	1,212	----	1,142	1,058	1,160	828	1,217	1,102
MW-111	----	----	981	344	658	593	829	----	661	----	676	920	837
MW-112	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	557	498	683	602	536	584	689	----	548	586	479	665	638
MW-116	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-133	510	484	677	524	543	----	652	----	568	571	475	----	658
MW-141	713	823	1,148	1,111	1,064	1,140	1,363	----	865	925	767	1,036	1,032
MW-142	497	420	508	499	510	512	483	----	455	470	378	495	491
MW-149	470	395	935	524	513	470	500	----	552	555	417	940	724
MW-152	1,138	879	1,143	1,084	982	978	961	----	820	889	679	954	891
MW-153	581	485	589	563	572	568	567	----	558	626	469	614	745
MW-158	606	504	596	569	562	558	552	----	543	603	480	666	667
MW-161R	1,023	847	1,052	896	1,096	922	909	----	1,105	1,240	1,198	1,101	1,391

CAD Groundwater Monitoring - Conductivity
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 4 of 10)

Well ID	7/26/28/00	10/17-19/00	1/24-26/01	2/20/01	4/26-27/01	5/25/01	6/20/01	7/24-27/01	9/21/01	10/23-25/01	12/19/01	1/21-23/02	3/22/02
MW-17	----	2,410	1,647	----	2,430	----	----	1,935	----	1,453	----	1,856	----
MW-101A	----	2,430	1,960	----	2,320	----	----	2,440	----	2,189	----	1,680	----
MW-104	618	603	453	----	509	----	----	467	----	401	----	338	----
MW-108R	----	2,290	2,360	1,917	1,823	----	----	1,752	----	1,810	----	1,250	----
MW-109R	----	1,090	2,540	----	1,755	----	1,199	1,492	----	809	----	2,992	2,800
MW-110	1,022	950	792	----	999	----	----	1,028	----	971	----	800	----
MW-111	702	848	----	----	----	----	----	----	----	709	----	----	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	482	691	622	----	624	602	----	597	----	501	----	573	----
MW-116	----	352	319	----	352	----	----	347	----	311	----	314	----
MW-133	480	682	635	----	660	----	----	677	----	579	----	515	----
MW-141	1,010	1,114	934	----	914	----	1,053	1,111	----	905	----	705	----
MW-142	497	491	432	----	488	----	----	491	----	439	----	397	----
MW-149	441	559	762	----	833	----	----	618	----	445	----	3,580	----
MW-152	742	1,005	813	----	1,050	----	----	876	----	742	----	774	----
MW-153	475	622	552	----	609	----	----	607	----	488	----	462	----
MW-158	592	589	534	----	593	----	----	571	----	472	----	450	----
MW-161R	1,812	1,086	1,093	----	1,142	----	1,058	1,263	1,037	823	780	790	----

CAD Groundwater Monitoring - Conductivity
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 5 of 10)

Well ID	4/1/02	4/22-25/02	5/3/02	6/14/02	7/23-25/02	9/30/02	10/21-23/02	12/5/02	1/13-15/03	3/17-18/03	4/14-16/03	6/18-20/03	7/28-30/03
MW-17	----	2,320	----	----	2,950	----	2,470	----	1,512	----	2,810	----	1,988
MW-101A	----	2,570	----	----	2,460	----	2,940	----	1,769	----	2,900	----	2,720
MW-104	----	428	----	----	441	422	425	388	357	488	446	376	390
MW-108R	----	1,454	----	----	2,830	----	3,650	----	3,380	----	3,420	3,340	3,290
MW-109R	----	2,420	----	----	1,708	----	4,110	5,080	4,230	3,930	2,690	----	2,540
MW-110	----	914	----	----	871	----	864	----	746	----	1,020	----	790
MW-111	----	639	----	----	----	----	----	----	----	----	794	----	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	----	675	----	----	581	----	583	----	509	----	695	----	620
MW-116	----	331	----	----	338	----	308	----	265	----	327	----	312
MW-133	----	569	----	----	540	----	581	----	533	----	669	----	547
MW-141	----	890	----	----	962	----	1,068	----	708	----	990	----	895
MW-142	----	447	----	----	454	----	441	----	375	----	467	----	422
MW-149	859	----	662	691	510	665	741	539	3,100	3,800	2,370	897	----
MW-152	----	786	----	----	755	----	787	----	550	----	850	----	901
MW-153	----	591	----	----	604	----	555	----	464	----	588	----	555
MW-158	----	541	----	----	571	----	550	----	466	----	628	----	588
MW-161R	----	1,276	----	----	1,714	1,636	1,499	997	852	1,170	1,140	1,240	1,064

CAD Groundwater Monitoring - Conductivity
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 6 of 10)

Well ID	9/23/03	10/20-22/03	12/1-3/03	12/9/03	1/19-23/04	3/15-16/04	3/23/04	4/19-23/04	6/9-10/04	7/19-21/04	9/8-10/04	10/18-19/04	12/9/04
MW-17	----	1,995	----	----	955	----	----	3,570	----	877	----	2,580	----
MW-101A	----	2,510	----	----	981	----	----	2,770	----	1,594	----	2,680	----
MW-104	445	436	485	----	345	463	----	457	400	453	449	429	361
MW-108R	----	3,240	----	2,290	2,310	2,410	----	1,748	----	935	----	1,599	----
MW-109R	----	1,531	1,204	----	1,289	4,270	----	4,880	2,650	960	2,960	3,460	1,635
MW-110	----	952	----	----	679	----	----	1,254	----	788	----	1,776	----
MW-111	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-112	----	565	----	----	435	----	----	669	----	640	----	588	----
MW-115A	----	604	----	----	443	----	----	702	----	610	----	555	----
MW-116	----	329	----	----	272	----	----	344	----	365	----	310	----
MW-133	----	----	----	----	526	----	----	715	----	644	----	584	----
MW-141	----	961	----	----	593	----	----	922	----	758	----	905	----
MW-142	----	455	----	----	363	----	----	482	----	439	----	442	----
MW-149	----	600	674	----	496	----	518	535	497	470	552	513	----
MW-152	----	867	----	----	555	----	----	946	----	974	1,374	989	----
MW-153	----	600	----	----	422	----	----	603	----	511	----	547	480
MW-158	----	646	----	----	476	----	----	702	----	517	----	616	----
MW-161R	1,080	1,286	938	----	794	1,223	----	1,514	940	774	1,569	1,112	896

CAD Groundwater Monitoring - Conductivity
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 7 of 10)

Well ID	12/14/04	1/17-20/05	3/16/05	4/11-14/05	5/25-26/05	7/18-20/05	9/9/05	10/17-19/05	12/12-16/05	1/23-25/06	3/20-21/06	5/1-5/06	6/13/06
MW-17	----	1,789	----	1,212	----	1,163	----	1,502	----	2,340	----	2,650	----
MW-101A	----	1,452	----	1,002	----	808	----	1,492	----	1,280	----	3,120	----
MW-104	----	430	493	412	336	182	608	452	516	453	349	506	470
MW-108R	----	1,360	----	999	----	1,297	----	1,697	----	2,420	----	2,500	----
MW-109R	----	1,788	1,726	1,280	947	1,318	2,880	2,840	1,095	1,192	1,391	3,440	3,430
MW-110	----	818	----	805	----	957	----	1,007	----	898	----	1,769	----
MW-111	----	472	----	----	----	----	----	----	----	821	----	----	----
MW-112	----	441	----	635	----	520	----	570	----	559	----	605	----
MW-115A	----	430	----	642	----	495	----	545	----	609	----	679	----
MW-116	----	267	----	352	----	323	----	371	----	368	----	297	----
MW-133	----	504	----	486	----	394	----	----	----	643	----	638	----
MW-141	----	587	----	584	----	562	----	817	----	813	----	943	----
MW-142	----	345	----	182	----	361	----	443	----	436	----	474	426
MW-149	578	420	833	629	477	532	810	613	487	563	400	585	494
MW-152	----	643	----	721	----	665	----	850	----	1,045	----	1,099	----
MW-153	----	570	608	510	424	470	----	568	663	535	401	602	530
MW-158	----	421	----	605	420	502	840	625	654	656	434	696	619
MW-161R	----	690	876	837	514	572	1,115	797	----	875	----	882	----

CAD Groundwater Monitoring - Conductivity
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 8 of 10)

Well ID	7/17-20/06	8/28-31/06	10/16-18/06	11/28/06	1/22-25/07
MW-17	3,000	----	1,201	----	1,442
MW-101A	328	----	815	----	1,378
MW-104	494	447	285	----	459
MW-108R	2,430	----	1,296	----	1,663
MW-109R	3,900	3,490	980	3,180	1,490
MW-110	1,633	----	740	----	684
MW-111	----	----	453	----	663
MW-112	622	----	375	----	633
MW-115A	611	----	359	----	642
MW-116	376	----	273	----	421
MW-133	564	----	343	----	644
MW-141	896	----	451	----	794
MW-142	427	425	273	----	435
MW-149	530	500	296	580	495
MW-152	970	----	498	----	864
MW-153	607	530	442	----	562
MW-158	692	591	362	----	588
MW-161R	854	----	555	----	736

CAD Groundwater Monitoring - Conductivity
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 9 of 10)

Well ID	4/16-18/07	7/16-18/07	7/31/07	10/22-24/07	1/14-18/08	4/14-16/08	7/15-17/08	10/13-15/08	1/28-2/3/09	4/13-16/09	7/13-17/09	10/14-16/09	11/6/09
MW-17	3,220	2,520	----	3,280	3,500	3,610	2,520	2,110	2,500	2,390	2,390	----	2,500
MW-101A	1,873	2,520	----	3,290	3,190	3,650	3,300	2,450	3,760	3,360	1,146	3,280	----
MW-104	437	500	----	450	524	486	545	499	428	410	365	467	----
MW-108R	1,880	1,975	----	2,660	2,950	2,900	2,740	2,680	4,390	4,240	4,640	5,040	----
MW-109R	3,230	3,310	----	3,580	3,030	2,940	2,270	1,674	1,950	1,893	1,776	1,834	----
MW-110	701	957	----	1,380	1,019	1,093	1,270	601	918	1,189	968	1,230	----
MW-111	563	620	----	617	724	598	712	1,340	1,150	804	587	747	----
MW-112	505	643	----	633	713	650	772	560	642	655	543	680	----
MW-115A	580	625	----	638	769	787	877	494	646	674	560	674	----
MW-116	344	438	----	430	478	457	544	366	445	453	403	478	----
MW-133	545	634	----	664	748	784	668	645	695	718	613	660	----
MW-141	674	821	----	986	1,186	1,278	1,265	1,118	1,305	1,034	792	945	----
MW-142	360	424	406	424	517	582	695	770	688	646	580	664	----
MW-149	4,010	1,029	----	903	989	770	762	647	610	634	535	589	----
MW-152	744	734	----	841	830	1,324	1,013	793	877	876	810	1,052	----
MW-153	500	586	----	611	689	730	748	636	678	745	587	854	----
MW-158	531	650	609	642	673	594	642	712	662	660	553	746	----
MW-161R	730	859	----	1,129	882	783	959	941	930	1,061	840	921	----

CAD Groundwater Monitoring - Conductivity
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 10 of 10)

Well ID	1/12-18/10	4/20-22/10	7/21-23/10	10/19-25/10	1/19-25/11	4/21-29/11	7/18-25/11	10/17-26/11	12/20/11	1/18-25/12	4/26-5/1/12
MW-17	1,711	1,657	1,913	1,700	1,841	1,320	2,270	5,650	----	6,800	5,640
MW-101A	3,420	3,620	3,520	3,220	2,690	2,770	3,080	3,220	----	3,010	3,130
MW-104	413	367	495	447	461	405	379	462	----	417	413
MW-108R	4,340	4,540	4,000	3,890	3,870	3,000	3,140	3,330	----	3,200	3,080
MW-109R	1,694	1,398	1,697	2,600	1,950	1,710	2,000	2,240	1,995	1,589	1,641
MW-110	998	760	807	1,005	1,040	593	779	910	----	764	560
MW-111	718	582	763	661	----	735	590	817	----	1,054	830
MW-112	613	568	718	665	710	712	536	725	----	625	624
MW-115A	604	618	718	672	711	739	529	749	----	639	693
MW-116	420	379	477	431	479	486	363	484	----	418	419
MW-133	640	634	647	678	740	709	584	711	----	749	611
MW-141	962	866	930	799	1,048	1,068	928	1,182	----	975	734
MW-142	645	563	710	694	880	816	512	698	----	575	572
MW-149	535	463	573	539	588	580	----	595	----	484	481
MW-152	643	570	734	681	772	581	758	773	----	800	595
MW-153	587	585	740	708	772	651	835	895	----	815	738
MW-158	689	560	798	715	860	633	560	661	----	572	600
MW-161R	794	635	922	791	888	959	673	861	----	768	773

Appendix C

Temperature(C°) Data Listings by Well: 1992-2012

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 1 of 10)

Well ID	4/25-5/7/92	7/27-30/92	10/26-28/92	1/19-21/93	4/21-22/93	7/13-15/92	10/20-21/93	1/13/94	1/24-31/94	4/21-22/94	7/20-21/94	10/20/94	1/18-19/95
MW-17	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	10.0	14.1	12.7	13.2	13.0	17.9	12.1	11.8	----	11.7	12.8	13.6	10.6
MW-108R	8.4	19.4	13.0	11.5	11.1	14.6	10.1	----	10.5	10.2	14.2	12.4	8.4
MW-109R	11.0	14.0	9.2	8.3	9.6	11.8	10.8	----	8.5	10.7	13.9	11.9	6.8
MW-110	11.4	13.3	13.1	12.9	10.0	11.8	11.3	----	----	11.0	15.5	12.8	9.8
MW-111	----	14.6	----	10.0	7.5	12.0	15.1	----	----	10.8	15.3	----	8.6
MW-112	17.8	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	14.9	10.6	11.2	12.4	7.1	19.8	7.4	----	9.8	10.1	10.3	12.3	11.9
MW-116	17.8	----	----	----	----	----	----	----	----	----	----	----	----
MW-133	14.3	14.1	----	0.8	8.3	18.9	12.8	----	-0.7	3.1	24.6	16.3	0.8
MW-141	9.7	10.8	10.1	9.9	8.9	10.0	8.4	9.1	----	8.1	8.6	10.1	----
MW-142	11.7	11.1	9.9	9.8	9.3	10.0	8.7	8.8	----	8.3	9.0	10.5	----
MW-149	17.3	12.0	10.1	10.4	9.9	15.5	9.6	----	7.3	9.5	10.4	11.1	8.2
MW-152	----	11.9	10.2	10.4	10.0	15.4	9.4	----	8.9	8.9	10.0	11.0	7.7
MW-153	15.0	11.4	10.4	9.8	9.5	11.4	8.9	----	7.5	8.7	10.8	10.7	7.2
MW-158	----	----	----	11.5	10.7	12.2	9.7	9.6	----	9.4	10.4	11.4	7.9
MW-161R	----	----	----	----	----	----	----	----	----	----	----	----	----

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 2 of 10)

Well ID	1/26/95	4/24/95	7/20-21/95	7/27/95	10/19-20/95	10/27/95	1/17-18/96	1/24-25/96	4/18-19/96	7/18-19/96	10/17-18/96	1/23-24/97	4/22-24/97
MW-17	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	----	10.7	10.8	----	14.7	----	----	10.9	10.2	10.0	9.9	12.0	12.7
MW-108R	----	9.4	10.8	----	12.3	----	8.6	----	10.4	11.9	10.2	----	9.9
MW-109R	----	8.7	14.1	----	----	----	----	----	8.9	----	----	----	13.4
MW-110	----	10.2	11.8	----	13.8	----	9.3	----	11.2	11.4	10.1	11.9	11.8
MW-111	----	7.3	----	----	----	----	11.1	----	4.2	12.5	----	----	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	----	10.6	8.2	----	13.3	----	5.7	----	2.2	3.5	10.7	3.9	5.6
MW-116	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-133	----	4.6	19.1	----	20.1	----	----	1.1	----	----	14.1	2.7	6.6
MW-141	7.1	7.6	----	7.3	9.8	----	6.2	----	7.3	8.7	11.2	9.4	9.6
MW-142	7.2	7.5	----	7.6	10.0	----	6.8	----	6.9	8.5	11.6	8.0	9.4
MW-149	----	8.8	9.0	----	12.4	----	----	4.7	8.1	8.9	12.2	10.1	12.3
MW-152	----	8.4	----	8.8	----	11.8	7.8	----	7.9	8.1	8.1	9.2	11.7
MW-153	----	8.0	----	8.7	11.8	----	7.2	----	7.6	7.8	7.4	9.7	10.0
MW-158	----	9.0	----	8.9	11.1	----	----	7.8	10.6	10.1	10.3	11.1	12.2
MW-161R	----	9.8	10.1	----	12.6	----	7.5	----	9.7	9.7	11.4	10.0	10.9

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 3 of 10)

Well ID	7/15-17/97	10/15-16/97	1/21-23/98	4/23-24/98	7/14-15/98	10/22-23/98	1/25-29/99	2/1/99	4/26-29/99	7/22-23/99	10/12-14/99	1/18-21/00	4/19-21/00
MW-17	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-101A	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-104	13.4	12.4	9.9	12.8	15.5	13.0	10.8	----	12.4	16.2	12.1	9.3	11.1
MW-108R	14.6	11.4	3.2	15.7	----	----	----	----	----	----	----	1.4	----
MW-109R	20.5	11.0	5.0	13.7	----	----	----	----	12.7	----	----	----	----
MW-110	14.3	12.4	10.0	12.9	17.0	12.1	----	12.7	14.4	17.2	13.0	6.4	11.2
MW-111	----	----	4.7	11.4	15.9	14.1	8.8	----	14.1	----	17.6	8.6	7.1
MW-112	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	9.6	16.7	4.9	9.0	21.3	20.4	19.1	----	11.4	22.4	17.5	11.6	10.6
MW-116	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-133	19.8	17.3	3.3	11.4	25.1	----	10.0	----	10.2	23.4	18.7	----	10.2
MW-141	10.6	9.3	6.8	10.5	12.8	9.6	9.6	----	10.7	11.0	9.8	8.1	9.8
MW-142	10.8	9.8	6.4	11.0	11.3	10.0	9.7	----	11.1	10.9	10.5	9.5	9.6
MW-149	14.5	11.5	9.8	12.1	15.4	11.3	9.9	----	11.5	15.0	11.3	10.2	10.6
MW-152	15.0	11.2	5.8	12.6	14.5	11.6	9.8	----	12.3	13.9	11.5	9.7	11.5
MW-153	14.2	10.1	8.8	11.9	14.2	10.3	8.9	----	11.9	12.0	10.3	9.3	10.8
MW-158	13.0	11.3	9.6	12.0	13.1	11.5	10.7	----	12.7	13.3	11.2	9.6	10.5
MW-161R	11.9	10.8	8.1	11.1	12.2	10.7	10.1	----	11.6	13.6	11.4	8.7	11.4

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 4 of 10)

Well ID	7/26/28/00	10/17-19/00	1/24-26/01	2/20/01	4/26-27/01	5/25/01	6/20/01	7/24-27/01	9/21/01	10/23-25/01	12/19/01	1/21-23/02	3/22/02
MW-17	----	15.3	13.3	----	15.6	----	----	16.3	----	15.6	----	13.5	----
MW-101A	----	12.8	9.7	----	13.1	----	----	14.1	----	13.6	----	11.5	----
MW-104	14.0	12.3	10.2	----	12.5	----	----	13.0	----	12.6	----	11.3	----
MW-108R	----	13.2	6.2	10.7	11.8	----	----	16.2	----	14.2	----	9.9	----
MW-109R	----	13.2	11.1	----	12.8	----	13.3	14.3	----	14.1	----	13.7	11.5
MW-110	14.4	12.3	6.4	----	11.0	----	----	12.2	----	12.3	----	9.9	----
MW-111	18.3	19.0	----	----	----	----	----	----	----	15.7	----	----	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	20.7	17.6	4.5	----	8.7	10.7	----	21.1	----	16.4	----	13.4	----
MW-116	----	14.7	8.6	----	10.5	----	----	15.0	----	13.9	----	11.6	----
MW-133	20.9	17.3	8.4	----	6.8	----	----	20.2	----	17.2	----	3.5	----
MW-141	11.3	10.6	8.3	----	10.9	----	10.7	10.4	----	9.3	----	10.3	----
MW-142	10.7	10.7	6.9	----	11.0	----	----	10.6	----	9.9	----	10.1	----
MW-149	13.2	12.8	9.6	----	12.1	----	----	17.6	----	13.6	----	10.6	----
MW-152	12.6	11.7	8.5	----	12.4	----	----	12.8	----	10.6	----	11.3	----
MW-153	11.1	10.9	7.9	----	11.5	----	----	12.2	----	9.9	----	10.5	----
MW-158	14.2	11.8	8.8	----	12.0	----	----	12.9	----	10.9	----	11.2	----
MW-161R	12.8	11.4	9.4	----	11.6	----	12.3	11.8	12.2	12.2	10.9	11.3	----

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 5 of 10)

Well ID	4/1/02	4/22-25/02	5/3/02	6/14/02	7/23-25/02	9/30/02	10/21-23/02	12/5/02	1/13-15/03	3/17-18/03	4/14-16/03	6/18-20/03	7/28-30/03
MW-17	----	16.0	----	----	18.0	----	14.9	----	13.3	----	17.3	----	16.5
MW-101A	----	12.0	----	----	13.2	----	12.2	----	11.2	----	13.1	----	12.5
MW-104	----	11.4	----	----	13.6	13.9	11.7	10.9	9.5	13.5	12.8	13.8	12.4
MW-108R	----	12.3	----	----	14.2	----	13.1	----	8.3	----	16.4	16.6	14.9
MW-109R	----	13.3	----	----	13.7	----	12.9	12.3	12.3	13.8	14.0	----	13.0
MW-110	----	10.9	----	----	14.1	----	12.3	----	6.8	----	15.4	----	14.6
MW-111	----	11.7	----	----	----	----	----	----	----	----	18.1	----	----
MW-112	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-115A	----	13.7	----	----	12.1	----	15.2	----	15.8	----	13.9	----	12.0
MW-116	----	12.7	----	----	12.8	----	13.5	----	12.0	----	11.7	----	13.0
MW-133	----	9.0	----	----	19.6	----	21.4	----	2.6	----	7.4	----	24.3
MW-141	----	10.0	----	----	10.7	----	9.8	----	7.5	----	10.7	----	10.0
MW-142	----	10.4	----	----	11.0	----	10.2	----	9.3	----	10.8	----	10.4
MW-149	10.1	----	11.5	12.9	13.2	13.2	11.2	10.1	8.8	10.9	14.0	16.2	----
MW-152	----	11.3	----	----	13.0	----	12.0	----	10.7	----	13.8	----	12.7
MW-153	----	10.2	----	----	11.4	----	10.7	----	9.7	----	11.4	----	11.5
MW-158	----	12.4	----	----	13.6	----	11.3	----	8.8	----	12.3	----	12.8
MW-161R	----	12.6	----	----	14.6	13.8	11.7	10.9	10.2	13.4	13.7	15.6	14.6

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 6 of 10)

Well ID	9/23/03	10/20-22/03	12/1-3/03	12/9/03	1/19-23/04	3/15-16/04	3/23/04	4/19-23/04	6/9-10/04	7/19-21/04	9/8-10/04	10/18-19/04	12/9/04
MW-17	----	16.6	----	----	12.7	----	----	16.1	----	17.8	----	14.6	----
MW-101A	----	11.8	----	----	9.9	----	----	12.0	----	13.3	----	11.8	----
MW-104	11.9	11.1	10.4	----	9.5	10.9	----	11.3	11.6	13.1	13.4	11.2	12.2
MW-108R	----	14.1	----	8.5	8.9	11.6	----	14.2	----	14.3	----	12.3	----
MW-109R	----	12.5	12.0	----	10.6	12.8	----	13.1	12.9	14.5	14.3	12.8	14.4
MW-110	----	13.5	----	----	8.3	----	----	11.4	----	13.0	----	11.0	----
MW-111	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-112	----	13.9	----	----	14.5	----	----	15.0	----	16.9	----	14.5	----
MW-115A	----	15.3	----	----	12.6	----	----	14.2	----	13.3	----	13.3	----
MW-116	----	12.8	----	----	10.2	----	----	11.5	----	13.9	----	13.3	----
MW-133	----	----	----	----	1.7	----	----	6.3	----	19.3	----	19.8	----
MW-141	----	9.5	----	----	7.2	----	----	10.1	----	10.8	----	10.1	----
MW-142	----	9.8	----	----	7.8	----	----	10.4	----	11.7	----	10.4	----
MW-149	----	10.5	9.5	----	8.0	----	9.8	11.3	13.0	11.5	12.9	11.3	----
MW-152	----	11.6	----	----	10.1	----	----	11.3	----	14.5	13.7	11.5	----
MW-153	----	10.4	----	----	8.0	----	----	10.5	----	12.7	----	10.6	11.4
MW-158	----	11.4	----	----	8.2	----	----	11.5	----	13.4	----	11.4	----
MW-161R	13.0	11.6	10.6	----	8.1	11.2	----	12.5	14.0	14.9	15.0	11.8	12.0

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 7 of 10)

Well ID	12/14/04	1/17-20/05	3/16/05	4/11-14/05	5/25-26/05	7/18-20/05	9/9/05	10/17-19/05	12/12-16/05	1/23-25/06	3/20-21/06	5/1-5/06	6/13/06
MW-17	----	12.7	----	15.2	----	19.3	----	15.0	----	13.1	----	19.4	----
MW-101A	----	10.0	----	11.9	----	14.6	----	11.5	----	10.6	----	12.5	----
MW-104	----	9.0	11.5	11.4	12.6	14.5	12.4	11.7	10.0	10.0	10.1	11.9	13.8
MW-108R	----	11.2	----	14.0	----	15.4	----	12.1	----	12.6	----	15.2	----
MW-109R	----	12.1	12.2	13.5	14.6	15.8	13.9	12.3	11.3	11.8	10.4	13.1	14.7
MW-110	----	9.9	----	11.6	----	12.9	----	11.0	----	10.1	----	13.1	----
MW-111	----	7.0	----	----	----	----	----	----	----	9.0	----	----	----
MW-112	----	13.3	----	14.7	----	16.5	----	13.9	----	13.0	----	16.2	----
MW-115A	----	12.6	----	13.9	----	11.9	----	12.6	----	14.9	----	14.6	----
MW-116	----	11.9	----	11.9	----	13.4	----	13.2	----	11.5	----	13.2	----
MW-133	----	2.2	----	6.3	----	19.0	----	----	----	8.9	----	7.1	----
MW-141	----	9.4	----	10.4	----	11.4	----	9.6	----	9.4	----	12.3	----
MW-142	----	9.0	----	10.7	----	12.3	----	10.0	----	9.0	----	12.6	12.6
MW-149	9.9	9.7	11.7	11.5	13.2	13.9	12.8	10.9	9.3	9.3	10.1	11.7	14.4
MW-152	----	9.2	----	11.2	----	14.2	----	11.6	----	10.4	----	11.9	----
MW-153	----	8.8	10.8	10.6	11.9	12.7	----	10.8	9.2	9.5	9.1	10.8	13.5
MW-158	----	8.5	----	11.5	12.3	13.1	12.5	10.5	8.3	9.4	9.7	12.9	13.1
MW-161R	----	9.5	11.6	12.2	13.7	14.0	11.7	11.3	----	9.0	----	11.0	----

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 8 of 10)

Well ID	7/17-20/06	8/28-31/06	10/16-18/06	11/28/06	1/22-25/07
MW-17	19.0	----	16.0	----	15.6
MW-101A	14.2	----	12.7	----	11.7
MW-104	12.8	12.6	12.7	----	10.5
MW-108R	14.4	----	13.6	----	13.2
MW-109R	14.3	13.7	13.3	14.8	13.0
MW-110	13.1	----	12.6	----	12.0
MW-111	----	----	15.7	----	9.6
MW-112	15.4	----	14.4	----	13.2
MW-115A	11.9	----	14.4	----	16.0
MW-116	13.3	----	14.1	----	12.6
MW-133	17.3	----	23.7	----	5.4
MW-141	11.0	----	11.1	----	10.5
MW-142	11.8	11.9	11.3	----	10.3
MW-149	13.3	13.4	12.5	13.4	11.2
MW-152	13.6	----	12.5	----	11.3
MW-153	12.9	11.8	11.3	----	10.4
MW-158	12.7	12.4	11.6	----	9.4
MW-161R	11.5	----	11.5	----	10.3

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 9 of 10)

Well ID	4/16-18/07	7/16-18/07	7/31/07	10/22-24/07	1/14-18/08	4/14-16/08	7/15-17/08	10/13-15/08	1/28-2/3/09	4/13-16/09	7/13-17/09	10/14-16/09	11/6/09
MW-17	17.3	17.0	----	15.6	14.7	15.7	16.9	20.1	16.5	17.1	18.0	----	15.0
MW-101A	13.5	13.3	----	11.9	11.2	12.2	13.1	14.1	12.3	14.0	14.5	13.5	----
MW-104	13.4	12.9	----	11.5	10.8	11.9	13.1	13.5	11.2	13.4	13.9	13.2	----
MW-108R	14.9	13.7	----	13.4	12.9	13.6	13.0	16.4	14.6	14.5	14.6	14.6	----
MW-109R	14.5	14.1	----	12.9	13.6	13.6	14.6	16.0	13.8	14.4	15.6	14.4	----
MW-110	13.6	15.8	----	12.7	9.9	11.9	13.0	19.0	10.5	11.9	14.7	13.5	----
MW-111	11.8	14.6	----	15.6	10.8	9.1	14.5	NA	11.9	10.3	14.7	16.7	----
MW-112	15.1	14.4	----	13.1	12.5	13.6	14.9	NA	14.3	14.7	15.4	15.0	----
MW-115A	17.2	15.1	----	13.3	14.7	15.4	16.4	13.5	12.8	15.6	16.3	14.8	----
MW-116	13.8	13.3	----	13.4	12.9	13.6	13.8	NA	14.4	14.2	14.4	15.0	----
MW-133	6.0	18.9	----	22.7	10.1	5.1	17.6	22.1	3.4	5.6	19.1	16.4	----
MW-141	11.7	11.2	----	10.2	10.8	10.7	10.9	12.1	11.0	12.2	11.9	11.5	----
MW-142	11.9	11.7	12.1	10.5	10.7	10.8	11.2	12.7	11.1	12.6	12.5	12.2	----
MW-149	12.9	13.1	----	11.4	10.8	11.5	12.9	13.5	11.3	12.7	14.9	13.1	----
MW-152	13.2	13.3	----	11.8	12.2	11.9	12.7	15.0	12.7	13.6	14.7	13.3	----
MW-153	12.3	12.3	----	11.0	9.4	11.1	12.0	14.0	11.0	12.5	13.6	12.6	----
MW-158	12.4	12.7	12.1	10.2	9.0	10.7	12.4	12.7	10.9	12.5	13.1	11.7	----
MW-161R	12.1	12.0	----	10.6	10.7	10.4	11.0	12.6	11.1	12.3	13.0	12.9	----

CAD Groundwater Monitoring - Temperature
Pharmacia & Upjohn Co., L.L.C. (#226-1534)
Portage, Michigan
(Page 10 of 10)

Well ID	1/12-18/10	4/20-22/10	7/21-23/10	10/19-25/10	1/19-25/11	4/21-29/11	7/18-25/11	10/17-26/11	12/20/11	1/18-25/12	4/26-5/1/12
MW-17	16.7	15.8	16.5	15.2	14.1	17.1	16.8	15.1	----	16.8	17.1
MW-101A	13.4	12.7	13.7	12.2	11.4	14.2	13.6	12.2	----	14.0	14.1
MW-104	12.5	12.1	12.7	11.6	10.5	13.5	12.6	11.6	----	11.3	13.4
MW-108R	14.4	13.3	12.9	13.2	13.0	15.2	14.8	12.9	----	15.2	14.8
MW-109R	14.0	13.7	14.4	12.9	12.4	15.6	14.4	12.9	15.0	13.5	14.7
MW-110	11.0	12.0	14.4	12.2	9.8	12.4	14.3	12.2	----	13.0	13.4
MW-111	10.2	11.2	16.3	15.5	----	12.0	14.9	15.4	----	12.6	12.9
MW-112	14.3	13.8	14.7	13.6	12.4	15.4	14.9	13.0	----	14.7	15.6
MW-115A	14.0	14.6	15.1	13.4	13.9	17.5	14.9	12.9	----	16.2	17.2
MW-116	14.9	14.6	12.9	14.2	11.5	14.4	12.7	13.4	----	14.5	14.6
MW-133	13.7	8.2	19.9	20.8	11.0	8.7	27.0	17.7	----	3.1	14.9
MW-141	11.6	10.5	11.2	10.6	8.8	12.9	11.0	10.3	----	12.6	12.3
MW-142	11.4	10.7	11.6	11.4	9.9	12.9	11.4	10.8	----	12.1	12.3
MW-149	12.4	11.9	13.6	11.8	10.1	13.6	----	11.7	----	12.6	13.0
MW-152	12.8	12.3	12.8	11.5	9.0	12.9	12.8	11.6	----	13.3	13.3
MW-153	11.9	11.1	11.9	11.1	10.0	13.1	12.5	11.5	----	12.5	13.0
MW-158	9.3	11.4	12.6	11.3	9.2	12.2	11.9	10.8	----	12.4	12.6
MW-161R	12.7	11.9	12.2	12.1	10.9	14.4	12.8	12.1	----	13.8	14.1