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1010300

FIELD AUDIT REPORT

GROUNDWATER AND SURFACE SOIL RESAMPLING PROGRAM

RCRA FACILITY INVESTIGATION

3M, CORDOVA, ILLINOIS, FACILITY

May 27, 1998

Prepared for:

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Introduction

During the period of May 4 through May 8, 1998, Daniel P. Claycomb, PG, of Environmental Standards, Inc. (Environmental Standards), conducted an audit of groundwater and surface soil sampling services being provided in the Waste Water Treatment Plant (WWTP) and the Sludge Incorporation Area (SIA) of Minnesota Mining and Manufacturing's (3M) Cordova, Illinois, facility. These activities, conducted by RUST Environment and Infrastructure (RUST) and supervised by AquAeTer, Inc. (AquAeTer) representatives Ms. Pam Hoover and Mr. Kevin Warren, were performed as part of the corrective action and further site characterization for the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI). This audit was performed in order to provide 3M with an indication of the quality of field sampling procedures that were performed during this investigation. The audit was also performed to fulfill requirements stipulated in the Work Plan for Corrective Action and Further Site Characterization for the RCRA Facility Investigation (Work Plan), the Quality Assurance Project Plan (QAPP), the Field Sampling Plan (FSP), and the standard operating procedures (SOPs). Additionally, the audit was executed to make recommendations and institute corrective action on a real-time basis.

In June, 1997, a Phase I Sampling Program was conducted to obtain soil and groundwater data to assess the presence or absence of regulated constituents at the WWTP and SIA. Assessment and validation of the data generated by this sampling event revealed that some of the data was not valid for decision-making purposes. Also, additional data would be needed for further characterization of chemical constituents in the WWTP and SIA. Consequently, a RFI Phase I resampling event was performed during the week of May 4, 1998.

During the week-long resampling event, groundwater sampling activities were conducted by RUST personnel at 12 monitoring well locations in the WWTP and five monitoring well locations in the SIA. Surface soil samples were collected at 20 sampling locations in the SIA and eight sampling locations in the control area. Details of the full scope of investigative activities are provided in the Work Plan.

Groundwater sampling activities were implemented utilizing a low-flow submersible pump. Low-flow purging and sampling methods were employed to minimize the disturbance of sediments in the wells and to reduce potential volatilization effects of standard purging and sampling techniques.

The audit performed by Environmental Standards focused on an evaluation of each aspect of the sampling activities being performed during the week of May 4, 1998. The following general headings were used to group the field audit activities:

1. Pre-Task Planning
2. Field Documentation/Records
3. Sampling Containers
4. Field Quality Control (QC) Samples
5. Soil Sampling

6. Field Measurements
7. Groundwater Sampling
8. Decontamination
9. Chain-of-Custody (COC)
10. Sample Packaging
11. Waste Management
12. Health & Safety

During the field audit, Environmental Standards personnel utilized a field audit checklist that was developed specifically for the RFI Phase I Resampling Program field activities. This checklist contained pertinent items under each of the above headings to provide guidelines for a comprehensive audit. Due to the nature of an audit, some critical statements will be presented in this report. These statements should not be regarded as an overall indication of RUST's qualifications; rather, they should represent areas for immediate corrective action and future improvement. This audit report has been prepared exclusively for 3M Environmental Technology and Services.

Audit Findings

During the course of the audit, the Environmental Standards auditor observed two sampling crews conducting groundwater purging and sampling activities as well as surface soil sampling activities. Observations of field procedures were compared to the specifications of the Work Plan. Notes and comments on adherences and inconsistencies relative to the Work Plan were recorded on the field audit checklist. The completed checklist is provided in Attachment 1.

During the field audit, interviews were conducted with the field team leaders and the field crews to ascertain their understanding of the project requirements. The following sections provide the findings of the audit and will follow the major headings presented in the checklist. Comments will be made and may be followed with recommendations that 3M should consider when conducting future groundwater and surface soil sampling programs and related field activities.

I. Pre-Task Planning

The auditor verified that proper planning had occurred to successfully implement the field program. To address the time and labor force constraints that where encountered during the June 1997 sampling event, RUST assigned two field crews to the project, one to implement the groundwater sampling program, the second to implement the surface soil sampling program. Mr. Jim Crowl and Mr. Chad Wurzer were designated as the groundwater sampling crew, and Mr. Jeff Groen and Mr. Jeff Hove were designated as the surface soil sampling crew. Throughout the week, Mr. Kevin Warren of AquAeTer accompanied the groundwater sampling crew while Ms. Pam Hoover of AquAeTer accompanied the surface water sampling crew.

Copies of the Work Plan, the FSP, the QAPP, the relevant groundwater and surface soil sampling SOPs, the Health and Safety Plan (HaSP), and the site diagram indicating monitoring well and surface soil sampling locations were kept on-site. Building No. 5 was used to store the sample containers and supplies necessary to conduct the sampling activities. This location was selected based on the anticipated absence of potential contaminants and available free space.

Adequate laboratory and data management coordination efforts were made so that sampling efforts were not delayed or jeopardized. Daily communication with the laboratory and 3M project managers provided an opportunity to update the laboratory and 3M on expected sample delivery volumes and to supplement missing or additional bottleware, cooler, and laboratory deionized water needs.

II. Field Documentation/Records

A hard bound field logbook was utilized for recording pertinent events. In response to last year's audit recommendation, a separate logbook was maintained by each field crew. Notes being logged by the field personnel were reviewed by the auditor following the first day of field activities. Several deficiencies were identified in each of the field crew's logbooks. For instance, blank lines were left between logbook entries and at the bottom of several pages. Additionally, there were no headers on the logbook pages, the logbook pages were not numbered, and the logbook pages were not initialed or dated.

Environmental Standards recommends that each page of the logbook have a header which includes the client name, the site location, the project number, the date, and the page number. Field notes should be recorded neatly with indelible ink. No blank lines should be left between entries. Each entry should be preceded with the time the entry occurred (times are typically recorded along the left hand side of the page). The pages of the logbook should be consecutively numbered, and no page or portion of a page should be left blank. The person making entries should initial and date the bottom of each page and should sign and date the last page of each day's entries. If an incorrect entry is made, it should be stricken with a single line, then initialed and dated. Any blank spaces or pages should also be stricken with a single line and initialed and dated.

With the assignment of a sufficient number of field personnel to the project, the field crews had time to utilize groundwater and soil sampling forms to record pertinent sampling information at the time of sample collection.

III. Sample Containers

Sample containers for analytical testing were supplied by Quanterra, Incorporated (Quanterra), located in North Canton, Ohio, which is the laboratory selected to perform the analytical testing for this phase of investigation. The laboratory supplied virgin sample bottleware pre-cleaned to US EPA specifications. Where appropriate, preservatives were placed in the sample containers by the field team prior to sample collection (with the exception of the volatile organic compound [VOC] vials which came pre-preserved from the laboratory).

Two sets of labels were placed on each of the sample containers. Adhesive labels were placed on the sample containers and covered with clear tape just prior to or immediately following sample collection. Once the samples were collected, tags with sample labels were also affixed around the top of the sample containers using plastic wire ties. The majority of sample information was pre-printed on the labels provided by the laboratory. The name of the sampler, the date, the time, and any revisions to the sample identification number were hand-written on the labels just prior to or immediately following sample collection.

The samples were stored in iced coolers in the field vehicles, and at the end of the day they were repacked for overnight shipment to the laboratory. The samples were delivered by one of the field teams to the local Federal Express office for overnight delivery to Quanterra. On several occasions, the samples which were collected very late in the day could not be included with the samples sent for overnight delivery due to time constraints.

Section 3.3.3.1 (pages 3-17 and 3-18) of the FSP states that samples will be transported to the laboratory via an overnight courier either at the end of the day or the following morning. The samples that were held by the field crews were kept overnight and shipped out with the samples that were collected the following day. Although this is a slight deviation from the FSP, the samples were kept in iced coolers, and the temperature of the cooler containing these samples was checked periodically (by use of a temperature blank) to confirm that proper temperature preservation was being maintained. The holding time of these samples was also checked to confirm that holding times were not being jeopardized by delaying their delivery to the laboratory. As long as the temperature preservation and holding time criteria were not being jeopardized, the auditor thought this deviation was acceptable for the purpose of allowing the project schedule (as presented in the Work Plan) to be maintained.

IV. Field QC Samples

The auditor verified that the proper field QC samples were being collected at the frequency specified in Tables 2-7, 2-8, 3-2, and 3-3 of the Work Plan. A field blank was collected each day per matrix for the analytical parameters collected that day. Field blanks were collected by

pouring laboratory-supplied deionized water into laboratory-supplied containers at a location where an investigative sample was collected.

An initial equipment blank was collected prior to commencing groundwater sampling activities to assess the condition of the pump and tubing as it was delivered to the site. Subsequent equipment blanks were collected at the appropriate frequency as identified in the Work Plan. The equipment blanks for groundwater were collected by pumping laboratory-supplied deionized water through the pump and tubing into laboratory-supplied sample containers. The equipment blanks for soil were collected by pouring laboratory-supplied deionized water over the bucket auger into the mixing bowl and then collecting it in laboratory-supplied sample containers.

Duplicate samples and matrix spike/matrix spike duplicates (MS/MSDs) for each analytical parameter were collected at the appropriate frequency as specified in the Work Plan.

Consistent with the Work Plan, a trip blank for VOC analysis accompanied the groundwater VOC sample collected from MW 8-90 on the last day of sampling (as well as the field blank, equipment blank, duplicate, and MS/MSD QC samples). Prior to initiating field activities on the first day of the sampling program, an equipment blank was collected on the pump to characterize it's condition. A VOC sample was collected as part of the equipment blank and, consequently, a trip blank had to accompany this sample. This trip blank was an addition to the Work Plan.

V. Soil Sampling

Soil sample locations were presented in Figure 2-1 of the Work Plan. These locations were selected by gridding the SIA zones and control area, eliminating the grid where soil samples where collected in June, 1997. Subsequently, a computer program was used to randomly select the locations. The number of soil sampling locations per zone or area was dependent on the size of the zone/area.

To transpose the soil sampling locations identified in Figure 2-1 to an actual sampling location in the field, the soil sampling crew employed the use of a Global Positioning System (GPS). The original plan was to obtain the sample location coordinates (using 3M's coordinate system) from Figure 2-1, then compute these into NAD 27 coordinates. Among other positioning systems (such as latitude/longitude and UTM coordinates), the GPS that was used was able to obtain corrected real-time NAD 27 data readouts. However, while taking coordinate readings at reference locations, it was discovered that the 3M coordinate system was rotated approximately 30 degrees from north, thus rendering the computed NAD 27 coordinates useless.

Consequently, for the first day of soil sampling activities, sample locations were identified in the field using a measuring tape and a Brunton Compass. Using the scale on the map and a northing

and easting from a known point, the samples were able to be located within the boundaries of the grid area presented in Figure 2-1.

While one member of the field team located (using the tape and compass method described above) and collected samples, the other recalculated NAD 27 coordinates, accounting for the difference in grid coordinate orientation. Samples collected on days two through five were located using GPS and the corrected coordinates.

To collect the samples, a decontaminated stainless steel, hand-held bucket auger was advanced to 12 inches, and the retrieved soil was placed in a decontaminated stainless steel mixing bowl. The soil was mixed with a decontaminated stainless steel spoon until well homogenized. The homogenized soil was quartered, and an aliquot from each quadrant was placed in the sample container(s) until the containers were full. Consistent with the Work Plan, the physical characteristics of the soil samples were recorded on a soil sampling form.

Sample labels were completed as the soil samples were collected. During the first day of the audit, the auditor observed that the field crew was labeling the soil samples as "composite" because they were being collected over a 12-inch interval. It was the auditor's opinion (as well as that of Ms. Hoover) that the samples were "grab" samples.

Composite sample collection typically refers to a sample comprised of several aliquots of soil collected from different sampling locations or depth intervals (spatially independent) or over time (selected time intervals over a specified duration). Since these samples were collected at a discrete location over a relatively limited and homogeneous depth interval (12 inches), it was recommended by the auditor that the samples be classified as grab samples. The sample labels were changed to reflect this, and subsequent samples were classified as grab samples.

VI. Field Measurements

RUST utilized individual instruments to measure the indicator parameters for groundwater purging and sampling. As specified in the Work Plan, the following instruments were used: a Fisher Scientific thermometer (which came from the supplier with a manufacturer's report of calibration and a registration form) was used to measure temperature, a LaMotte Turbidity Meter was used to measure turbidity, a Cole-Palmer pHTestr BNC™ was used to measure pH, a Hanna Instruments Multi-Range Conductivity Meter was used to measure specific conductivity, and a Solinst Water Level Meter was used to measure depth to groundwater. Each morning, prior to initiating sampling activities, the turbidity, pH, and conductivity meters were calibrated according to the manufacturer's instructions and in accordance with the site-specific SOPs. Calibration information was recorded in the field logbook.

The SOPs for pH, conductivity, and turbidity state that control samples or standards will be utilized as a quality control check for these field parameters. The SOPs require that one independently prepared control sample/standard be analyzed daily for each of these three field parameters. Control samples/standards (calibration standards cannot be used) were not provided to the field crew and, consequently, these analyses were not performed. However, the auditor recommended that a calibration check be performed on the field instruments at the end of each sampling day. With calibration procedures being conducted twice a day, ample quality control checks on the field instruments appears to have been obtained.

Water column measurements and calculations were recorded in the field logbook. Proper methods were used to determine the well volume and minimum purge volume. In accordance with the Work Plan, the submersible pump utilized to purge and sample a monitoring was placed in the middle of the saturated screened interval. The indicator parameters and depth to water measurements were obtained and recorded after each well volume was evacuated (once a proper flow rate was reached and maintained). Purging continued until four successive readings for each indicator parameter were achieved within the ranges presented in the FSP.

Following completion of sampling activities for the first monitoring well, the auditor noted that depth to water measurements during purging and immediately following sampling activities were not being obtained and recorded.

Recommendation: The SOP for groundwater sampling specifies that a final depth to water reading should be obtained following sampling and purging activities. The auditor also recommended that the other field parameters should be measured at this time as well. This procedure was implemented by the field crew.

VII. Groundwater Sampling

Groundwater sampling protocols were generally followed during the course of the sampling program. The Work Plan and appropriate SOPs were present and in use by the field team.

The Work Plan specifies that groundwater samples will be collected at a flowrate of 200 to 300 milliliters per minute (ml/min). It also states that if this flowrate cannot be achieved, the samples will be collected at the lowest pumping rate achievable. The primary pump that was delivered to the site for use in this groundwater sampling program was thought to be able to achieve the desired flowrate. However, the field crew was unable to get this pump, as well as the backup pump, to operate. A pump that was being used by another sampling crew from RUST who was on-site to conduct quarterly groundwater sampling (unrelated to this specific sampling event) was utilized for the duration of this sampling event. This pump was unable to achieve the desired flowrate for sampling. Typical purge flowrates ranged from approximately 880 to 1,800 ml/min,

and sample flowrates ranged from approximately 800 to 1,200 ml/min. The lower flowrate was achieved by manually compressing the discharge tubing from the pump.

Following sample collection, the sample container lids for the analytical fractions contained in plastic jars were taped closed with strapping tape. This procedure was reportedly requested by 3M as a result of a lid becoming unfastened on a plastic sample container during a previous sampling event. Label tags were then attached to each sample container, and each container was then placed in individual sealable plastic bags prior to being placed in an ice bath.

VIII. Decontamination

Sampling equipment was decontaminated according to the procedures outlined in the FSP. The outside of the pump was decontaminated using a detergent wash with deionized water and then rinsed with deionized water. The outside of the pump tubing was cleaned using a deionized water rinse and then wiped dry with a paper towel. The inside of the pump and tubing were decontaminated by pumping 5 gallons of deionized water through the pump and tubing.

Soil sampling equipment was decontaminated using the method described in Section 3.3.8 of the FSP. The decontamination steps included: a potable water and detergent wash, deionized water rinse, methanol rinse and air dry, deionized water rinse, nitric acid rinse, and deionized water rinse. The auditor observed that the field crew was not allowing sufficient time for the methanol rinse to air dry.

The decontamination procedure identified in Section 3.3.8 of the FSP identifies an air dry component of the methanol rinse step. Allowing the sampling equipment to air dry after the methanol rinse is a precautionary procedure aimed at allowing the methanol to evaporate to reduce the potential of cross-contamination of a sample or having VOCs from a sample be dissolved in any residual methanol that remains on the sampling equipment. It is the auditors' opinion that because methanol is very soluble in water, a thorough deionized water rinse (following the methanol rinse) should remove any residual methanol (whether or not the methanol had totally evaporated or not). However, the approved decontamination procedures outlined in the FSP states that the methanol will be allowed to air dry, so this procedure was enforced in the field.

IX. Chain-of-Custody

Either as the samples were collected (if time permitted) or upon completion of daily sample collection activities, a hand-written COC was completed. The information contained on the COC included sample identifications, analytical parameters, date and time of sample collection, sample matrix, number of containers, type of preservation (if applicable), client name and location,

laboratory name, site contact, and laboratory receipt signature information. COCs were signed by the field personnel to be relinquished to the laboratory.

The completed COC forms were reviewed daily by the auditor. The following deficiencies were identified, and the recommended procedures were employed by the field crews:

1. Some errors on the COC were crossed out with a double line and initialed.

   If errors are made on the COC they should be crossed out with a single line, initialed, and dated.

2. As established in the Work Plan, field duplicate samples were to be identified simply as "Field Duplicate" followed by a single digit number. This method of identification promotes the concept of a "blind" field duplicate to assist in deterring the laboratory from identifying the investigative sample with which the duplicate sample is associated. In an attempt to keep the sampling location of the field duplicate "blind", one of the field crews did not provide a time and a date of collection for a field duplicate.

   In order for the laboratory to make sure they are complying with holding times, the date and time of sample collection should be provided. The auditor agrees with the field crew's efforts to keep the sampling location of the field duplicates hidden from the laboratory, but with this project, the laboratory was provided a copy of the Work Plan that identifies field duplicate sampling locations. Consequently, most parties agreed that it was more important to provide the date and time of field duplicate sample collection so that the expiration of holding times could easily be determined by the laboratory.

3. A temperature blank was placed in each cooler to provide a means for checking cooler/sample temperatures. The temperature blank was not included on the COC.

   The COC should identify every piece of bottleware contained in a sample cooler. Temperature blanks should be identified on the COC as a temperature blank with a remark that it is for temperature use only. The auditor also recommended that the temperature of the cooler/samples be measured just prior to shipment and recorded on the COC.

X. Sample Packaging

Following sample collection activities at the site each day, the samples were typically transported outside the plant production area where repackaging activities were conducted. This area was located in the facility's main parking lot. On one rainy day, a tent shelter inside the plant was used as the location for repackaging activities.

Sample packaging consisted of first lining the bottom of each cooler with bubble wrap to reduce the potential of sample container breakage during shipment and handling. Each individual sample container had already been placed in a sealed Ziplock® plastic bag and, during repackaging procedures, the glass jars were also placed in bubble wrap bags. Double-bagged wet ice was placed in the coolers for temperature preservation. Upon completion of the appropriate signature, the COC was sealed in a plastic bag and was taped to the inside top of the cooler. Signed custody seals were placed on the coolers, which were then sealed shut using strapping tape.

XI. Waste Management

Purge water and pump decontamination water was collected in plastic containers and disposed through the facility's on-site waste water treatment system. Garbage and personal protective equipment (predominantly latex or nitrile gloves) were collected in plastic bags and disposed through the facility's solid waste collection system.

Waste from decontaminating soil sampling equipment comprised of deionized water and trace amounts of waste methanol and nitric acid was collected in a five-gallon metal container which accompanied the field crew throughout the week. A hazardous waste label (flammable liquid and corrosive) was placed on the container. Upon completion of sampling activities, the container was temporarily stored on a containment pallet system located north of Building 2 until proper disposal arrangements can be made by 3M.

XII. Health and Safety

The auditor observed general health and safety procedures during the field audit. A copy of the site HaSP accompanied the sampling team. Level D protective clothing was worn by the field personnel. General health and safety procedures appeared to be followed during the sampling event.

Conclusions

The overall performance of RUST personnel during the period of the field audit was very good. RUST personnel were very prepared and followed the procedures outlined in the Work Plan and applicable SOPs, with few to no exceptions. They were very conscientious and thorough in their work and quickly worked through any unexpected field conditions that were encountered (i.e. two pump failures and the rotation of the grid coordinates). Any necessary adjustments were typically made early on in the sampling program. The recommendations identified in this audit report were discussed with the RUST field crews at the time of occurrence and with the AquAeTer representatives. A line of communication was maintained with the 3M management staff to discuss project status and any changes or variances to the Work Plan.

Audit performed by:

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ATTACHMENT 1

FIELD AUDIT CHECKLIST

3M

CORDOVA, ILLINOIS

FIELD AUDIT CHECKLIST

RCRA FACILITY INVESTIGATION

FIELD RESAMPLING PROGRAM

Project Location: Cordova, Illinois

Environmental Standards' Job #: 95040129.A000

Date(s) of Field Audit: 5/4/98 (SUNNY 70'S): 0830-2030 / 5/5/98 (cldy-prtly sunny 60's-70's): 0740-1830 / 5/6/98: (cldy, rain 60's-70's) 0800-1800 / 5/7/98 (RAIN 60'S): 0810-1815 / 5/8/98 (SUNNY 60's-70'S): 0800-1315

Time(s) of Field Audit:

Environmental Standards' Auditor(s): DAN CLAYCOMB

Rust's Field Sampling Crew: JEFF GROEN, JEFF HOVE (SOIL); JIM CROUL, CHAD WURZER (GW), PAM HOOVER, KEVIN WARREN (AquaTec)

Audit Conducted on the Following:

- ✓ Pre-Task Planning
- ✓ Field Documentation/Records
- ✓ Sampling Containers
- ✓ Field QC Samples
- ✓ Soil Sampling
- ✓ Field Measurements
- ✓ Groundwater Sampling
- ✓ Decontamination
- ✓ Chain-of-Custody
- ✓ Sample Packaging
- ✓ Waste Management
- ✓ Health & Safety

Pre-Task Planning:	Y	N	N/A
- Personnel and responsibilities noted	✓		
- 3M project-specific SOPs present and in use	✓		
- Sampling location (on-site specific map) (3M grid rotated ≈30° from North - no clear benchmark)	✓		
- Location number (soil boring, etc.)	✓		
- Weather conditions	✓		
- Parameters to be sampled identified (WP/SAP)	✓		

3M (Cont.)

CORDOVA, ILLINOIS

FIELD AUDIT CHECKLIST

RCRA FACILITY INVESTIGATION

FIELD RESAMPLING PROGRAM

	Y	N	N/A
Field Documentation/Records:			
- Notebooks - bound-page, numbered, no missing pages	✓		
- Appropriate 3M field sampling records in use (Soil & GW)	✓		
- leaving blanks between entries (Jeff & Jim)			
- No page Header (both)			
- initial & date each page (both)			
	Y	N	N/A
Sample Containers:			
- Proper type and size	✓		
- Proper preservation	✓		
- Proper labeling	✓		
- Proper quantity	✓		
- Proper source of container	✓		
- Cooler	✓		
- Proper ice	✓		
- Proper packing material	✓		
- Proper custody seals (on coolers)	✓		
- Proper courier (Fed Ex)	✓		

3M (Cont.)

CORDOVA, ILLINOIS

FIELD AUDIT CHECKLIST

RCRA FACILITY INVESTIGATION

FIELD RESAMPLING PROGRAM

Field QC Samples: According to WP & QAPP	Y	N	N/A
- Proper frequency	✓		
- Proper field blank(s)	✓		
- Proper equipment blank(s)	✓		
- Proper trip blank(s)	✓		
- Proper duplicate sample(s)	✓		
- Proper matrix spike/matrix spike duplicate sample(s)	✓		
- Proper water source for blanks	✓		

Soil Sampling:	Y	N	N/A
- Locations agree with Work Plan	✓		
- Locations documented sufficiently (GPS & tape w/ Brunton)	✓		
- Sampling times, identifications, and descriptions noted	✓		
- Volatiles collected first			✓
- Sample bottles inspected	✓		
- Bottles labeled properly (initially labeled as composite on 1st day of sampling - changed to grab)	✓	✓	
- Proper containers/preservatives	✓		
- Proper sample volumes procured	✓		
- Proper ice or refrigeration after collection	✓		

3M (Cont.)

CORDOVA, ILLINOIS

FIELD AUDIT CHECKLIST

RCRA FACILITY INVESTIGATION

FIELD RESAMPLING PROGRAM

	Y	N	N/A
Soil Sampling (Continued):			
- Potential for cross-contamination exists		✓	
- Consistency of technique	✓		
- Samples collected at proper depths	✓		
- Samples screened with HNU			✓
- Description of material logged by J.H. on Soil Sampling Record	✓		
- Soils homogenized except for VOAs	✓		

	Y	N	N/A
Field Measurements:			
- Proper calibration of pH meter pH Tester BNC™	✓		
- Conductivity meter Hanna Inst. HI 9033 Multi-Range Cond. Meter	✓		
- Thermometer Certified, FS	✓		
Turbidity - LaMotte Model 2008 Turb. Mtr.			
- Proper standards of pH meter 4, 7, 10	✓		
- Conductivity meter 1445 @ 25°C	✓		
- Thermometer	✓		
Turbidity 0.5, 5.0, 40			

3M (Cont.)

CORDOVA, ILLINOIS

FIELD AUDIT CHECKLIST

RCRA FACILITY INVESTIGATION

FIELD RESAMPLING PROGRAM

	Y	N	N/A
Field Measurements (Cont.)			
- Proper units for pH SU	✓		
- Conductivity meter µS/CM	✓		
- Thermometer °C	✓		
Turbidity NTU	✓		
- Proper frequency of pH 1/volume	✓		
- Conductivity meter	✓		
- Thermometer	✓		
Turbidity	✓		
- Steady state achieved for pH 4 consecutive readings w/in range	✓		
- Conductivity	✓		
- Temperature	✓		
Turbidity	✓		
- Proper times/dates purged for pH	✓		
- Conductivity	✓		
- Thermometer	✓		
Turbidity	✓		
- Submersible pump positioned properly (½ saturated screen)	✓		
- Proper instrument for measuring indicator parameters	✓		
- Proper instrument for measuring headspace			✓

3M (Cont.)

CORDOVA, ILLINOIS

FIELD AUDIT CHECKLIST

RCRA FACILITY INVESTIGATION

FIELD RESAMPLING PROGRAM

	Y	N	N/A
Groundwater Sampling			
- Water volumes calculated properly	✓		
- Monitoring headspace in well			✓
- Interface probe for LNAPL/DNAPL			✓
- Pump properly positioned (MIDWAY SATURATED SCREEN)	✓		
- Correct purge rate 880-1800 ml/min - MINIMUM ACHIEVABLE	✓	✓	
- Drawdown less than 3 feet typically only 1/100th of a foot	✓		
- Appropriate disposal of purge water WWTP / grounds SIA	✓		
- Bailer and bail line dedicated to each well			✓
pg 3-18 FSP - Final readings			

	Y	N	N/A
Chain-of-Custody:			
- Client and location	✓		
- Sample identification numbers	✓		
- Date collected	✓		
- Time collected	✓		
- Matrix	✓		
- Number of containers	✓		
- Preservation technique	✓		

- ERRORS need to be ① single line crossed (some double lined)
  ② initialed & dated (no date)
- Note temperature blank on COC
- Field Duplicate (no time or date)

3M (Cont.)

CORDOVA, ILLINOIS

FIELD AUDIT CHECKLIST

RCRA FACILITY INVESTIGATION

FIELD RESAMPLING PROGRAM

	Y	N	N/A
Chain-of-Custody (Continued):			
- Blanks labeled (temp blank not on COC)	✓	✓	
- Proper transfer signatures	✓		
- Proper transfer time and date	✓		
- Proper continuity	✓		
- Sample travel time reasonable			✓
- Airbill and courier name	✓		

	Y	N	N/A
Decontamination:			
- Proper frequency	✓		
- Proper method(s) considering organic analytes (not allowing air dry after methanol)	✓	✓	
- Proper method(s) considering inorganic analytes	✓		
- Each device cleaned			
List 1) scoop	✓		
List 2) mixing bowl	✓		
List 3) hand auger	✓		
List 4) pump	✓		
List 5)			

3M (Cont.)

CORDOVA, ILLINOIS

FIELD AUDIT CHECKLIST

RCRA FACILITY INVESTIGATION

FIELD RESAMPLING PROGRAM

	Y	N	N/A
Decontamination (Continued):			
- Disposable equipment collected and removed for disposal	✓		
- Proper decontamination area used	✓		
- Dedicated equipment	✓		
- Clean plastic sheeting	✓		

	Y	N	N/A
Sample Packaging:			
- Samples packed to avoid breakage (bubble wrap each jar)	✓		
- Sufficient ice packs (wet ice)	✓		
- Absorbent material sufficient (none)		✓	✓
- Chain-of-Custody in Ziplock® in cooler	✓		
- Custody seals initialed and present (on cooler)	✓		
- Strapping tape adequate	✓		
- Cooler labels adequate	✓		

3M (Cont.)

CORDOVA, ILLINOIS

FIELD AUDIT CHECKLIST

RCRA FACILITY INVESTIGATION

FIELD RESAMPLING PROGRAM

	Y	N	N/A
Waste Management:			
- 3M waste source codes (HAZ waste only)	✓		✓
- Proper segregation stored north of bldg 2 on containment pallet system	✓		
- Proper container labels	✓		
- WASTE Methanol / nitric Acid - containerized flammable liquid & corrosive, HAZ waste labels shipping to 3M incinerator Cottage Grove, MN			
- SLA water on ground, WWTP water to Treatment Plant			

	Y	N	N/A
Health & Safety:			
- Proper level of protective clothing	✓		
- HASP plan on-site with emergency contacts	✓		
- Monitoring equipment present			✓
- First aid kit in field office (field vehicles)	✓		
- Contaminated PPE disposed of properly (on-site trash)	✓		

	Y	N	N/A
General:			
- Personnel conducting investigation professionally	✓		
- Project objectives understood by personnel	✓		
- Records taken in a clean and legible manner	✓		
- Field crew organized	✓		

3M (Cont.)

CORDOVA, ILLINOIS

FIELD AUDIT CHECKLIST

RCRA FACILITY INVESTIGATION

FIELD RESAMPLING PROGRAM

	Y	N	N/A
General (Continued):			
- Continuity in the process	✓		
- Weather conditions affecting sample quality		✓	
- Field office organized	✓		

Audit Summary and Comments:

- Well organized
- Prepared for sampling program well
- had to use Chad Brown's pump for All work
- rotated 3M coordinates ≈ 30°

Signed by: Daniel P. Claycomb Print: DANIEL P. CLAYCOMB

Date: MAY 8, 1998

Audit Documented dated 7-21-98

ENVIRONMENTAL STANDARDS

Setting the Standards for Innovative Environmental Solutions

July 21, 1997

John S. Hunter, III, P.E., Ph.D.
3M Environmental Technology and Services
Bldg. 41-01-05
879 East 7th Street
P.O. Box 33331
St. Paul, MN 55133-3331

Dear Dr. Hunter:

During the week of June 9, 1997, Environmental Standards personnel conducted an audit of groundwater and surface soil sampling activities being conducted by RUST Environment and Infrastructure at Minnesota Mining and Manufacturing's (3M) Cordova, Illinois, facility as part of the Resource Conservation and Recovery Act Facility Investigation Phase I Sampling Program. Sampling activities were conducted in the Waste Water Treatment Plant Area and the Sludge Incorporation Area. This audit was performed in order to provide 3M with an indication of the quality of the field investigative techniques and sample collection procedures that were being performed during this phase of investigation. The findings of the audit are presented herein.

If you have any questions or comments, please do not hesitate to call.

Sincerely,

Daniel P. Claycomb

Daniel P. Claycomb, PG
Technical Director of Consulting Geosciences

Concurred by,

Rock J. Vitale, CPC
Technical Director of Chemistry/
Principal

DPC:ck
Enc.

ENVIRONMENTAL STANDARDS, INC.
VALLEY FORGE, PA

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ENVIRONMENTAL STANDARDS

Setting the Standards for Innovative Environmental Solutions

May 27, 1998

John S. Hunter, III, P.E., Ph.D.
3M Environmental Technology and Services
Bldg. 42-2E-27
900 Bush Street
P.O. Box 33331
St. Paul, MN 55133-3331

Dear Dr. Hunter:

During the week of May 4, 1998, Environmental Standards personnel conducted an audit of groundwater and surface soil sampling activities being conducted by RUST Environment and Infrastructure at Minnesota Mining and Manufacturing's (3M) Cordova, Illinois, facility as part of the Resource Conservation and Recovery Act (RCRA) Facility Investigation Phase I Sampling Program.

Sampling activities were conducted in the Waste Water Treatment Plant Area (WWTP) and the Sludge Incorporation Area (SIA). This audit was performed in order to provide 3M with an indication of the quality of the field investigative techniques and sample collection procedures that were being performed during this phase of investigation. The findings of the audit are presented herein.

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If you have any questions or comments, please do not hesitate to call.

Sincerely,

Daniel P. Claycomb

Daniel P. Claycomb, PG
Technical Director of Consulting
Geosciences

Concurred by,

Rock J. Vitale, CPC
Technical Director of Chemistry/
Principal

Meg A. Clark

Meg A. Clark
Senior Quality Assurance Chemist II/
Project Manager

DPC:hb

Enc.

cc: Ms. Pam Hoover-AquAeTer, Inc.

ENVIRONMENTAL STANDARDS

Setting the Standards for Innovative Environmental Solutions

FIELD AUDIT REPORT

GROUNDWATER AND SURFACE SOIL SAMPLING PROGRAM

RCRA FACILITY INVESTIGATION

3M, CORDOVA, ILLINOIS, FACILITY

July 21, 1997

Prepared for:

3M ENVIRONMENTAL TECHNOLOGY AND SERVICES
879 East 7th Street
P.O. Box 33331
St. Paul, MN 55133-3331

Prepared by:

ENVIRONMENTAL STANDARDS, INC.
1140 Valley Forge Road
P.O. Box 911
Valley Forge, PA 19482-0911

Introduction

During the period of June 9 through June 13, 1997, Environmental Standards, Inc. (Environmental Standards) personnel, Daniel P. Claycomb, PG, conducted an audit of groundwater and surface soil sampling services being provided in the Waste Water Treatment Plant (WWTP) and the Sludge Incorporation Area (SIA) of Minnesota Mining and Manufacturing's (3M) Cordova, Illinois, facility. These activities, conducted by RUST Environment and Infrastructure (RUST) and supervised by AquAeTer, Inc. (AquAeTer) representative, Ms. Pam Hoover, were performed as part of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Phase I Sampling Program. This audit was performed in order to provide 3M with an indication of the quality of field sampling procedures that were performed during this investigation. The audit was also performed to fulfill requirements stipulated in the Quality Assurance Project Plan (QAPP), the Field Sampling Plan (FSP), and the standard operating procedures (SOPs), and to make recommendations and institute corrective action on a real-time basis.

The objective of the Phase I Sampling Program was to obtain soil and groundwater data to assess the presence or absence of regulated constituents at the WWTP and SIA. During the week-long sampling program, groundwater sampling activities were conducted by RUST personnel at 12 monitoring well locations in the WWTP and 5 monitoring well locations in the SIA. Surface soil samples were collected at 7 sampling locations in the SIA. Details of the full scope of investigative activities are provided in the RFI Work Plan dated, November 1996.

Groundwater sampling activities were implemented utilizing a low-flow submersible pump. Low-flow purging and sampling methods were employed to minimize the disturbance of sediments in the wells and to reduce potential volatilization effects of standard purging and sampling techniques.

The audit performed by Environmental Standards focused on an evaluation of each aspect of the sampling activities being performed during the week of June 9, 1997. The following general headings were used to group the field audit activities:

1. Pre-Task Planning
2. Field Documentation/Records
3. Sampling Containers
4. Field Quality Control (QC) Samples
5. Soil Sampling
6. Field Measurements
7. Groundwater Sampling
8. Decontamination
9. Chain-of-Custody (COC)
10. Sample Packaging
11. Waste Management
12. Health & Safety

During the field audit, Environmental Standards personnel utilized a field audit checklist that was developed specifically for the RFI Phase I Sampling Program field activities. This checklist contained pertinent items, under each of the above headings, to provide guidelines for a comprehensive audit. Due to the nature of an audit, some critical statements will be presented in this report. These statements should not be regarded as an overall indication of RUST's qualifications but, rather, represent areas for immediate corrective action and areas for future improvement. This audit report has been prepared exclusively for 3M.

Audit Findings

During the course of the audit, the Environmental Standards auditor observed the sampling team conduct groundwater purging and sampling activities, as well as surface soil sampling activities. Observations of field procedures were compared to the specifications of the Work Plan. Notes and comments on adherences and inconsistencies relative to the Work Plan were recorded on the field audit checklist. The completed checklist is provided in Attachment 1. A list of nine accepted and approved (by each field party and 3M) minor variances to the Work Plan are listed separately in Table 1. Because these variances were considered minor and were previously approved through 3M, they are not discussed in greater detail in this report.

During the field audit, interviews were conducted with the field team leader and the field crew to ascertain their understanding of the project requirements. The following sections provide the findings of the audit and will follow the major headings presented in the checklist. Comments will be made and may be followed with recommendations that 3M should consider when conducting future groundwater and surface soil sampling programs and related field activities.

I. Pre-Task Planning

The auditor verified that proper planning had occurred to successfully implement the field program. RUST designated a field team leader, Mr. Jeff Lowenberg, to organize, manage, coordinate, conduct, and schedule field activities. He was assisted with sampling activities on various days by Mr. Chad Brown (June 9, 10, and 13, 1997), Mr. Joe Eiffler (June 12 and 13, 1997), and Ms. Kathy Larson (June 13, 1997).

Copies of the RFI Work Plan, the FSP, the QAPP, the relevant groundwater and surface soil sampling SOPs, the Health and Safety Plan (HaSP), and the site diagram indicating monitoring well and surface soil sampling locations were kept on-site. Building No. 5 was used to store the sample containers and supplies necessary to conduct the sampling activities. This location was selected based on the anticipated absence of potential contaminants and available free space.

Adequate laboratory and data management coordination efforts were made such that sampling efforts were not delayed or jeopardized. Daily communication with the laboratory provided an

opportunity to update the laboratory on expected sample delivery volumes and to supplement missing or additional bottleware, cooler, and laboratory deionized water needs.

Labor management and assignment of appropriate personnel is a pre-planning task that is critical to the success of a sampling program. The personnel assigned to the project were a "good fit." Everyone's familiarity with the site and the type of sampling being conducted were key factors in the successful implementation of the sampling program. However, the labor force was short-handed on some occasions considering the program had an aggressive schedule. These factors caused the auditor to perceive the program's implementation as being somewhat "rushed."

Recommendation: A full-time third field team member should have been assigned to a sampling program of this magnitude and duration. With the addition of a third field person, one person's (preferably the field team leader or a senior field person) primary responsibility could have been to maintain field documentation (i.e., keeping the field logbook up-to-date with pertinent field events, recording sampling data on the sampling forms, completing sample labels, keeping field instrument calibration records, and maintaining the COC records).

II. Field Documentation/Records

A hard bound field logbook was utilized for recording pertinent events. Notes being logged by the field personnel were in sufficient detail to meet minimum documentation requirements relative to the activities being performed.

Recommendation: As noted above, the field notes met minimum documentation requirements, but as much documentation as possible being recorded is preferred. As mentioned in the previous section of this report, the addition of a full-time third field team member would have allowed a better opportunity for further documentation of field events.

The RUST field crews also utilized groundwater and soil sampling forms to record pertinent sampling information. However, these forms (for the most part) were filled out subsequent to the completion of field activities.

Recommendation: The sampling forms should have been filled out as sampling activities occur such that the recorder of the information is prompted to complete all requested information. Completing the forms at a later time using memory and information contained in the field logbook introduces an increased possibility of transcription errors, missing the notation of key observations and/or specific field conditions at the time of sampling, and false recollection of sampling events not recorded in the field logbook.

On the final day of sampling activities (June 13, 1997), RUST's field team consisted of four members (for a portion of the day). The team split up into two crews such that one crew could

continue groundwater sampling activities and the other crew could conduct soil sampling activities. The crew conducting soil sampling activities did not have a field logbook and kept notes on loose-leaf paper. These notes were later transcribed into the groundwater sampling crews field logbook.

Recommendation: Each field crew should have a field logbook in which to record notes regarding their sampling activities. It may not have been anticipated that two crews would be at the site, but a backup field logbook should be kept in the field for instances such as this or if the original becomes full or misplaced.

III. Sample Containers

Sample containers for analytical testing were supplied by the laboratory selected to perform the analytical testing for this phase of investigation, Quanterra, Incorporated (Quanterra) located in North Canton, Ohio. The laboratory supplied virgin sample bottleware precleaned to US EPA specifications. Where appropriate, preservatives were placed in the sample containers by the field team prior to sample collection (with the exception of the volatile organic compound [VOC] vials which came pre-preserved from the laboratory).

Two sets of labels were placed on each of the sample containers. Adhesive labels were placed on the sample containers and covered with clear tape immediately prior to sample collection. Once the samples were collected, tags with sample labels were also affixed around the top of the sample containers using plastic wire ties. The majority of sample information was pre-printed on the labels provided by the laboratory. The name of the sampler, the date, the time, and an addition to the sample identification number were hand-written on the labels immediately prior to sample collection.

The samples were stored in iced coolers in a field vehicle, and at the end of the day they were repacked for overnight shipment to the laboratory. With the exception of the final day of sampling, the samples were delivered by the field team to the local Federal Express office for overnight delivery to Quanterra. The samples from the final day of sampling (June 13, 1997) were held on ice overnight and were reportedly transported to RUST's Minneapolis, Minnesota, office on Saturday (June 14, 1997) and placed in a refrigerated unit. According to the information provided, the samples were repackaged and shipped for overnight delivery to the laboratory the following Monday (June 16, 1997).

IV. Field QC Samples

The auditor verified that the proper field QC samples were being collected at the frequency specified in the Work Plan. Field blanks were collected each day in each area (WWTP or SIA) for each parameter collected that day (with the exception of dissolved metals which would have required pumping the water through the filter, making it an equipment blank). Field blanks were

collected by pouring laboratory-supplied deionized water into laboratory-supplied containers at a location where an investigative sample was collected.

An initial equipment blank was collected prior to commencing sampling activities to assess the condition of the pump and tubing as it was delivered to the site. Subsequent equipment blanks were collected at the appropriate frequency as identified in the FSP. The equipment blanks for groundwater were collected by pumping laboratory-supplied deionized water through the pump, tubing, and filter (for dissolved metals only) into laboratory-supplied sample containers. The equipment blanks for soil were collected by pouring laboratory-supplied deionized water over the bucket auger into the mixing bowl and then collecting it in laboratory-supplied sample containers.

Duplicate samples and matrix spike/matrix spike duplicates (MS/MSDs) for each analytical parameter were collected at the appropriate frequency as specified in the FSP. Following the suggestion of the auditor, the duplicate and MS/MSD samples for groundwater were collected by filling a sample vial for the investigative sample and then filling a sample vial for the quality assurance (QA)/QC sample(s). This was repeated until all of the vials were filled. The remaining sample containers were first filled halfway (for one analytical fraction at a time), beginning with the investigative sample then the QA/QC sample container(s); then the second half was filled, again beginning with the investigative sample then the QA/QC sample container(s). The auditor recommended the following criteria for selecting the location of duplicate and MS/MSD samples.

Recommendation: The duplicate sample should be collected from a monitoring well thought to have measurable (but not significant) concentrations of chemical constituents so that there are constituent levels to compare. The MS/MSD samples should be collected from a monitoring well thought to contain low concentrations of chemical constituents so that a realistic assessment of matrix interferences can be made without the introduction of significant chemical/analytical interferences.

Consistent with the FSP, a daily trip blank for VOC analysis accompanied the groundwater VOC samples which were placed in a single cooler.

V. Soil Sampling

Soil sampling activities were conducted on the final day of the sampling program at the SIA. Several months prior to conducting the sampling program, the sampling locations were identified and marked by surrounding the sampling area with fencing. The soil sampling points were located utilizing the global positioning system (GPS).

Prior to sample collection, plants and other debris were removed from the surface of the sampling location by hand (gloved) and/or utilizing sampling equipment. A decontaminated stainless steel, hand-held bucket auger was advanced to 12 inches and the retrieved soil sample was placed in a decontaminated stainless steel mixing bowl. The VOC sample was collected first, and the

remaining volume of soil was assessed as to whether sufficient volume remained to collect the remaining parameters. If not, additional volume was obtained by augering to 12 inches adjacent to the initial location.

The soil was mixed with a decontaminated stainless steel spoon until well homogenized. At this point, the material was to be quartered and sampled.

Recommendation: Initially, the sampling crew did not quarter the homogenized soil and collect an aliquot from each quadrant, as specified in the soil sampling SOP and the FSP. The auditor informed the sampling team of this requirement and corrective action was implemented to incorporate this specified procedure into soil sampling activities.

Although not specifically requested in the project control documents, logging the soil characteristics of the soil samples is a good procedure for sampling teams to adopt. This soil information can prove to be quite valuable when assessing analytical data.

Recommendation: Upon collection of the samples, the auditor recommended that a brief description of the soil characteristics (i.e., soil type, color, compactness, etc.) of the samples should be recorded in the field logbook.

As noted earlier, the soil sampling field crew did not posses a field logbook in which to record field notes. Notes kept on paper were later transcribed into the groundwater sampling crews field logbook. Upon review of a copy of the field logbook notes and the Soils Data Forms, the auditor observed that soil characteristics were not recorded despite the recommendation.

As previously mentioned, soil sampling activities were conducted on Friday, June 13, 1997 (the last day of the sampling event), and were not completed in time for delivery of the samples to the overnight courier. The samples were stored in iced coolers overnight in a secure hotel room and were transported to RUST's office on Saturday, June 14, 1997, by field staff. The samples were stored in a refrigerator at RUST's office until they were packaged for shipment on Monday, June 16, 1997. After this time, it was discovered that a trip blank did not accompany the soil samples prior to being placed in the refrigerator at RUST's office. A trip blank did accompany the soil VOC samples from that point on.

Recommendations: Although general QA/QC sampling procedures do not always require a trip blank to accompany soil VOC samples, the Work Plan for this project specified that a trip blank should accompany the soil VOC samples. Sampling teams for future sampling events should be aware that this may be a requirement.

VI. Field Measurements

RUST utilized individual instruments to measure the indicator parameters for groundwater purging and sampling. As specified in the Work Plan, the following instruments were used: a Fisher Scientific thermometer (which came from the supplier with a manufacturer's report of calibration and a registration form) was used to measure temperature, a LaMotte Turbidity Meter was used to measure turbidity, a Cole-Palmer pH Wand was used to measure pH, a Hanna Instruments Conductivity Meter was used to measure specific conductivity, and a Solinst Water Level Meter was used to measure depth to groundwater. Each morning, prior to initiating sampling activities, the turbidity, pH, and conductivity meters were calibrated according to the manufacturer's instructions and in accordance with the site-specific SOPs. Calibration information was recorded in the field logbook and later onto Instrument Calibration Logs.

Recommendation: In addition to the calibration information being recorded in the field logbook, it is suggested that, for each instrument, an on-going calibration logbook be maintained such that any trends or deviations in calibration readings can be evaluated to assess the need for maintenance, recalibration, or replacement of the instrument.

Water column measurements and calculations were recorded in the field logbook. Proper methods were used in determining the well volume and minimum purge volume. The indicator parameters were measured and recorded after each well volume was evacuated (once a proper flow rate was reached and maintained). Purging continued until four successive readings for each indicator parameter were achieved within the ranges presented in the Work Plan (Section 3 - FSP).

The FSP specifies that the submersible pump utilized to purge and sample a monitoring well be "placed in the water column above the screened interval... ." Generally, this was not possible, because the top of the water table was located within the screened portion of the well. Typically, the intake of the pump was positioned approximately 2.0 feet below the top of the water surface.

Recommendation: This acceptable deviation should be noted as a deviation from the FSP.

Following completion of sampling activities for the first monitoring well, it was noted by the auditor that depth to water measurements during purging and immediately following sampling activities were not being obtained and recorded.

Recommendation: The SOP for groundwater sampling specifies that a final depth to water reading be obtained to assess drawdown in the well during purging and sampling activities. It was recommended by the auditor that depth to water measurements also be obtained and recorded during purging activities to assess drawdown conditions such that changes to the purge rate and/or pump position can be made if necessary. This procedure was implemented by the field crew.

VII. Groundwater Sampling

Groundwater sampling protocols were generally followed (with the exceptions noted below) during the course of the sampling program. The FSP and appropriate SOPs were present and in use by the field team.

During collection of the first groundwater sample on the first day of sampling activities, the auditor observed that the analytical fractions were not collected in the order specified in the FSP, and that, once collected, the samples were not immediately placed in an iced cooler. These issues were addressed, corrective action was taken, and each subsequent sample was collected according to the following recommended procedures.

Recommendation: Although the volatile fractions were collected first, in compliance with the sampling order presented in the FSP, the field team was not initially following the remaining order of volatilization sensitivity presented in the FSP. Subsequent samples were collected in the following order, as specified in the FSP: volatile organics, semivolatile organics, PCBs, metals, and water quality parameters.

Immediately following collection, sample containers should be placed in an iced cooler, or, as recommended by the auditor and adapted by the field team, samples should be placed in an ice bath. This reduces the possibility of a mishap occurring to the sample containers placed on the ground or in a field vehicle after collection and will reduce the potential for volatilization, especially during sampling events occurring during warm weather.

Following sample collection, the sample container lids for the analytical fractions contained in plastic jars were taped closed with strapping tape. This procedure was reportedly requested by 3M as a result of a lid becoming unfastened on a plastic sample container during a previous sampling event. Label tags were then attached to each sample container, and each container was then placed in individual sealable plastic bags prior to being placed in an ice bath.

VIII. Decontamination

Sampling equipment was decontaminated according to the procedures outlined in the FSP. The outside of the pump was decontaminated using a detergent wash with deionized water and then rinsed with deionized water. The outside of the pump tubing was cleaned using a deionized water rinse and then paper towel wiped dry. The inside of the pump and tubing was decontaminated by pumping 5 gallons of deionized water through the pump and tubing. The only exception to the decontamination procedures outlined in the FSP is referenced in Table 1: the water level meter was not decontaminated using methanol and nitric acid rinses, but with a deionized water rinse and paper towel wipe. This variance was reportedly agreed to at a meeting between 3M and RUST prior to commencing field work.

Soil sampling equipment was decontaminated using the method described in Section 3.3.8 of the FSP. The decontamination steps included: a potable water and detergent wash, deionized water rinse (an upgrade from a potable water rinse specified in the FSP), methanol rinse and air dry, deionized water rinse, nitric acid rinse, and deionized water rinse.

IX. Chain-of-Custody

Upon completion of daily sample collection activities, a partially pre-printed, partially hand-written COC was completed. The information contained on the COC included sample location identifications, analytical parameters, date and time of sample collection, sample matrix, number of containers, type of preservation (if applicable), client name and location, laboratory name and contact, and laboratory receipt signature information. COCs were signed by the field personnel to be relinquished to the laboratory.

Recommendation: Portions of the COC contained pre-printed sample information. When this information was printed, the first two rows were left blank. The auditor suggested that these two blank rows be stricken with a single line, initialed, and dated. As a general rule, there should be no blank rows above the first sample entry. Also, any changes made on the COC should be stricken with a single line, initialed, and dated.

X. Sample Packaging

Following sample collection activities at the site each day, the samples were transported to the field team's hotel by the sampling team where the samples and coolers were brought into one of the rooms and repackaged. The amount of time the field team could spend on site was limited because of operational procedures, so the hotel was selected as a controlled environment where final sample packaging procedures could be completed.

First, the bottom of each cooler was lined with bubble wrap to reduce the potential of sample container breakage during shipment and handling. Each individual sample container had already been placed in a sealed Ziplock® plastic bag and, during repackaging procedures, the glass jars were also placed in bubble wrap bags. Double-bagged wet ice was placed in the coolers for temperature preservation. Upon completion of the appropriate signature, the COC was sealed in a plastic bag and was taped to the inside top of the cooler. Signed custody seals were placed on the coolers which were then sealed shut using strapping tape.

XI. Waste Management

Decontamination waste, comprised almost entirely of deionized water (with minimal amounts of tap water, detergent and trace amounts of waste methanol and nitric acid on June 13, 1997, only), was

collected in plastic containers and disposed through the facility's on-site waste water treatment system.

Purge water was also collected in plastic containers and disposed through the facility's on-site waste water treatment system. Garbage and personal protective equipment (predominantly latex or nitrile gloves) were collected in plastic bags and disposed through the facility's solid waste collection system.

XII. Health and Safety

The auditor observed general health and safety procedures during the field audit. A copy of the site HaSP accompanied the sampling team. Level D protective clothing was worn by the field personnel. General health and safety procedures appeared to be followed during the sampling event.

Conclusions

The overall performance of RUST personnel during the period of the field audit was good. RUST personnel followed the procedures outlined in the Work Plan and applicable SOPs, with few to no exceptions, and were very conscientious and thorough in their work. Any necessary adjustments were made early on in the sampling program. The recommendations identified in this audit report were discussed with the RUST field team leader at the time of occurrence and with Ms. Hoover, the AquAeTer representative. Ms. Hoover maintained a line of communication with the 3M management staff to discuss project status and any changes or variances to the Work Plan.

Audit performed by:

Daniel P. Claycomb

Daniel P. Claycomb, PG
Technical Director of Geosciences

Report reviewed and approved by:

Meg A. Clark

Meg A. Clark
Senior Quality Assurance Chemist II

Rock J. Vitale, CPC
Technical Director of Chemistry/
Principal-in-Charge

Date: 7/21/97

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TABLE 1

RFI FIELD VARIANCES

1. The sample identification number on the sample labels and tags did not indicate 3M coded sample numbers, so they were assigned in the field.

2. The equipment was decontaminated adjacent to the sample collection location instead of moving a separate decontamination location.

3. An initial equipment blank was added to the QC samples to provide data on the condition of the pump and tubing as it was brought on-site. This sample was collected by running laboratory-prepared deionized water through the pump and tubing and capturing the discharge in containers.

4. The pump flow rate was estimated as 1,000 ml/min for the dissolved metals sample collection (through the in-line filter) and 600 ml/min for remaining analytical parameters. The flow rate of 200 ml/min specified in the Work Plan was not achievable in the field.

5. The water level indicator was decontaminated by rinsing with DI water instead of rinsing with methanol and nitric acid.

6. A dissolved metals sample was not collected for field blanks because the type of filter used in the field required that the sample be run through the pump, making it an equipment blank.

7. If the well water was turbid, the pump rate was increased until the turbidity approached 5 μmhos/cm and the pump rate was lowered to approximately 600 ml/min for the rest of the purging steps. The purging procedure was modified for highly turbid wells after MW2-90 was purged and found to be highly turbid.

8. Some of the samples were not provided tags and were shipped to the laboratory with only labels.

9. On June 13, 1997, the sample collection team split into two groups. Ms. Kathy Larson came to the site to assist Mr. Jeff Lowenburg in collection of Sludge Incorporation Area groundwater samples. Mr. Chad Brown and Mr. Joe Eiffler collected soil samples from the Sludge Incorporation Area. Ms. Pam Hoover worked with the groundwater collection crew. Mr. Dan Claycomb provided oversight of both soil sample collection activities and groundwater sample collection activities.

ATTACHMENT 1

FIELD AUDIT CHECKLIST

3M

CORDOVA, ILLINOIS

FIELD AUDIT CHECKLIST

RCRA FACILITY INVESTIGATION

FIELD SAMPLING PROGRAM

Project Location: Cordova, Illinois

Environmental Standards' Job #: _____

Date(s) of Field Audit: 6/9/97 through

Time(s) of Field Audit: 7:00-18:30 (6/9) 7:00-

Environmental Standards' Auditor(s): DAN CLAYCOMB

Rust's Field Sampling Crew: Chadd Brown, JEFF LOWENBERG

Audit Conducted on the Following:

- ✓ Pre-Task Planning
- ✓ Field Documentation/Records
- ✓ Sampling Containers
- ✓ Field QC Samples
- ✓ Soil Sampling
- ✓ Field Measurements
- ✓ Groundwater Sampling
- ✓ Decontamination
- ✓ Chain-of-Custody
- ✓ Sample Packaging
- ✓ Waste Management
- ✓ Health & Safety

Pre-Task Planning:

	Y	N	N/A
- Personnel and responsibilities noted	✓		
- 3M project-specific SOPs present and in use	✓		
- Sampling location (on-site specific map)	✓		
- Location number (soil boring, etc.)	✓		
- Weather conditions 6/9/97 - sunny 60's - 70's;	✓		
- Parameters to be sampled identified (IN WORK PLAN)	✓		
- Additional pre-sampling observation (if applicable)			

3M (Cont.)

CORDOVA, ILLINOIS

FIELD AUDIT CHECKLIST

RCRA FACILITY INVESTIGATION

FIELD SAMPLING PROGRAM

	Y	N	N/A
Field Documentation/Records:			
- Notebooks - bound-page, numbered, no missing pages			
- Appropriate 3M field sampling records in use well purging & sampling record	✓		

	Y	N	N/A
Sample Containers:			
- Proper type and size - supplied by lab (quantezza)	✓		
- Proper preservation - field preserved except for VOAs	✓		
- Proper labeling - tagged and on bottle	✓		
- Proper quantity	✓		
- Proper source of container	✓		
- Cooler	✓		
- Proper ice (double bagged)	✓		
- Proper packing material (bubble wrap for glass)	✓		
- Proper custody seals (signed & dated)	✓		
- Proper courier (Fed Ex)	✓		

Discuss

✓ - ICING upon collection

✓ - PARAMETER ORDER - 3-17 of WP

✓ - range of indicator parameters

✓ - DTW while purging

✓ - Measure pump level ~~mid-screen~~ above screen

3M (Cont.)

CORDOVA, ILLINOIS

FIELD AUDIT CHECKLIST

RCRA FACILITY INVESTIGATION

FIELD SAMPLING PROGRAM

FB daily (per AREA)
TB daily (1 per VOA cooler - usually put VOAs in 1 cooler)
E.B. 1 - at beginning
1 - WWTP 90 wells
1 - WWTP 94 wells
1 - SIA water
1 - SIA soil

Field QC Samples:	Y	N	N/A
- Proper frequency	✓		
SIA soil - > Proper field blank(s)	✓		
NOT BECAUSE SIA WATER COOLED - Proper equipment blank(s)	✓		
- Proper trip blank(s)	✓		
- Proper duplicate sample(s)	✓		
- Proper matrix spike/matrix spike duplicate sample(s)	✓		
- Proper water source for blanks (lab supplied ultrapure di)	✓		

Soil Sampling:	Y	N	N/A
- Locations agree with Work Plan	✓		
- Locations documented sufficiently (GPS) area fenced in location staked)	✓		
- Sampling times, identifications, and descriptions noted ↳ didn't have log book	✓	✓	
- Volatiles collected first	✓		
- Sample bottles inspected	✓		
- Bottles labeled properly labeled & tagged	✓		
- Proper containers/preservatives - blank (equip) only	✓		
- Proper sample volumes procured	✓		
- Proper ice or refrigeration after collection (ice bath)	✓		

- need to quarter & collect from each quadrant

RUST ENVIRONMENT & INFRASTRUCTURE

TECHNICAL MEMORANDUM

May 21, 1998

TO: John S. Hunter, III, P.E., Ph.D., 3M

FROM: Cathy Larson, Rust

SUBJECT: Internal Field Audit
3M Cordova RFI Sampling

An internal audit was conducted for ground water and soil sampling performed from May 4 through May 8, 1998 at the 3M Cordova Facility . A separate Field Audit Checklist was completed for both the soil and ground water sampling activities and these are attached. The audit included a review of the following documentation:

- The field log books (one each for soil and ground water sampling activities)
- Well purging and sample collection forms
- Soil data forms
- Instrument calibration forms
- Chain-of-custody forms

Overall, documentation met the requirements of the "Work Plan for Corrective Action and Further Site Characterization for the RCRA Facility Investigation". However, some discrepancies were observed. These are listed below along with either a response to the comment or a corrective action taken. Any changes to the field notes, due to the following comments, were initialed and dated.

1. Custody seal numbers were not on the chain-of-custodies (COCs) for ground water samples.

   Response: The COCs included in the auditor's documentation package were photocopied before the custody seal numbers had been added. The documentation package has been corrected to include copies of COCs which document the custody seal numbers.

2. The turbidity measurements did not meet the Work Plan's stabilization criteria of "±10 percent or 1 turbidity unit, whichever is greater" for successive readings, as follows:

Well No.	Final NTU Measurement	NTU difference[a]
MW1-88	3.52	1.29
MW6-90	3.96	1.38
MW8-90	4.00	2.20
MW9-90	4.85	2.00
MW1-94	4.93	2.07
MW2-94	2.60	1.60
MW3-94	4.42	2.38
MW4-94	4.38	4.64
MW5-94	3.30	3.65
MW6-94	4.60	7.05
MW7-94	3.72	1.24

a - The difference calculated between the two final measurements.

Response: The field crew interpreted a separate section of the Work Plan as requiring a final NTU of less than five. The standard of less than 5 NTUs is commonly used in the industry and may be a more appropriate standard due to the precision which can be achieved by the turbidity meter. As specified in Appendix 3 of the Quality Assurance Project Plan, the control limit for duplicate turbidity measurements is within 10 percent. Thus, the stabilization criteria specified in the Work Plan is within the margin of error inherent in the turbidity meter. In all cases, wells were stabilized to a turbidity of less than 5 NTUs. The change in stabilization criteria should not affect sample results.

3. No temperature, at the time of shipment, was listed on one COC for ground water samples.

   Response: This measurement was not required by the Work Plan. It was added at the request of the Environmental Standards representative and implemented for all but the first shipment of samples.

4. Descriptions of soil sample locations and soil characteristics were included on the Soils Data Form but not in the field log book.

   Response: Due to the amount of text, the information was not written twice. The information was included on the Soils Data Form for easier readability and referencing.

5. The line "Sheet ___ of ___" was not completed for the Soils Data Form.

Response: Information added.

for Steve Pettit, Rust Auditor

Cathy Larson, Rust Project Manager

3M CORDOVA SITE
RCRA FACILITY INVESTIGATION WORK PLAN

REVISED NOVEMBER 1996

MINNESOTA MINING and MANUFACTURING (3M)

CORDOVA, ILLINOIS

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EXECUTIVE SUMMARY

The Resource Conservation and Recovery Act (RCRA) Part B Permit granted to the facility and effective on March 24, 1995 includes Hazardous and Solid Waste Amendment (HSWA) requirements for corrective action. Specifically, 3M must conduct an investigation to determine whether a release of hazardous waste or hazardous waste constituents has occurred from the Sludge Incorporation Area (SIA) and the Wastewater Treatment Plant (WWTP). The RCRA Facility Investigation (RFI) will be conducted following review and approval of this RFI Work Plan by the U.S. Environmental Protection Agency (USEPA), Region 5. A copy of the RCRA Part B Permit is provided in the Quality Assurance Project Plan (QAPP) which has been submitted under separate cover. 3M provided USEPA, Region 5, with documentation on the design and operation of the WWTP and SIA (Permit Standard Condition II. F.1.a) on May 21, 1995.

The wastewater treatment system consists of a variety of tanks and surface impoundments connected with piping to process wastewaters and sludges by gravity flow or through pumping. The surface impoundments are lined with either concrete or synthetic liners. The wastewater treatment operations produce two sludges which are land incorporated on site in the SIA. One is an inorganic sludge produced by a physical/chemical treatment process and one is a biological sludge produced by an activated sludge treatment process.

Land incorporation of these sludges has been conducted since 1975 in the areas east of Highway 84 and south of the main manufacturing facilities. A new area just east of the plant and west of Highway 84 and the railroad known as Zone 12 was added in the spring of 1994. The SIA is operated in accordance with Illinois Environmental Protection Agency (IEPA) Sludge Incorporation Permit No. 1995-SC-3408 (effective date June 12, 1995)

This RFI Work Plan describes background information, sample collecting procedures, health and safety procedures, and data management procedures for conducting the RFI. The QAPP has been submitted to USEPA, Region 5, under separate cover. The RFI will include collecting samples from surface soil locations in the SIA and groundwater monitoring wells located in the WWTP and the SIA. The parameter list the groundwater monitoring wells were specified in Attachment 1, Task A, Section 4 of the RCRA Part B Permit. Dissolved metals and polychlorinated biphenyl (PCB) analyses has been added to the parameter list. The surface soil samples will be analyzed for the same parameters as the groundwater samples collected from the SIA, except for dissolved metals.

Following the procedures described in this RFI Work Plan will ensure that the investigation will satisfy the requirements specified in the RCRA Part B Permit for determining if a release or hazardous wastes or hazardous waste constituents has occurred within the designated WWTP and/or SIA Solid Waste Management Units (SWMUs).

SECTION 1

FACILITY BACKGROUND

1.1 INTRODUCTION

The Resource Conservation and Recovery Act (RCRA) Part B Permit granted to the facility and effective on March 24, 1995 includes Hazardous and Solid Waste Amendment (HSWA) requirements for corrective action. Specifically, 3M must conduct an investigation to determine whether a release of hazardous waste or hazardous waste constituents has occurred from the Sludge Incorporation Area (SIA) and the Wastewater Treatment Plant (WWTP). 3M is submitting this RCRA Facility Investigation (RFI) Work Plan as specified in the RCRA Part B Permit. A copy of the RCRA Part B Permit is presented as Appendix 1 in the Quality Assurance Project Plan (QAPP) which has been submitted under separate cover.

3M provided the U.S. Environmental Protection Agency (USEPA), Region 5, with documentation on the design and operation of the WWTP and SIA on May 21, 1995 (Permit Standard Condition II. F.1.a).

3M has operated the production facility at 22614 Route 84 N, Cordova, Illinois, 61242 since 1970. The plant location is shown in Figures 1-1 and 1-2. The facility is located on the east bank of the Mississippi River in the northern portion of Rock Island County. Manufacturing occurs on an approximate 100-acre, triangle portion of the site, near the river and west of Illinois Route 84 as shown in Figure 1-3. The remainder of the property is used for land incorporation of the sludges produced by the facility's WWTP. A high capacity, alluvial well field that supplies the 3M facility with water is located in the 280-acre portion of the site located east of Illinois Route 84.

Revision: 2
Date: November 1996

FIGURE 1-1
LOCATION MAP

Revision: 2
Date: November 1996

N

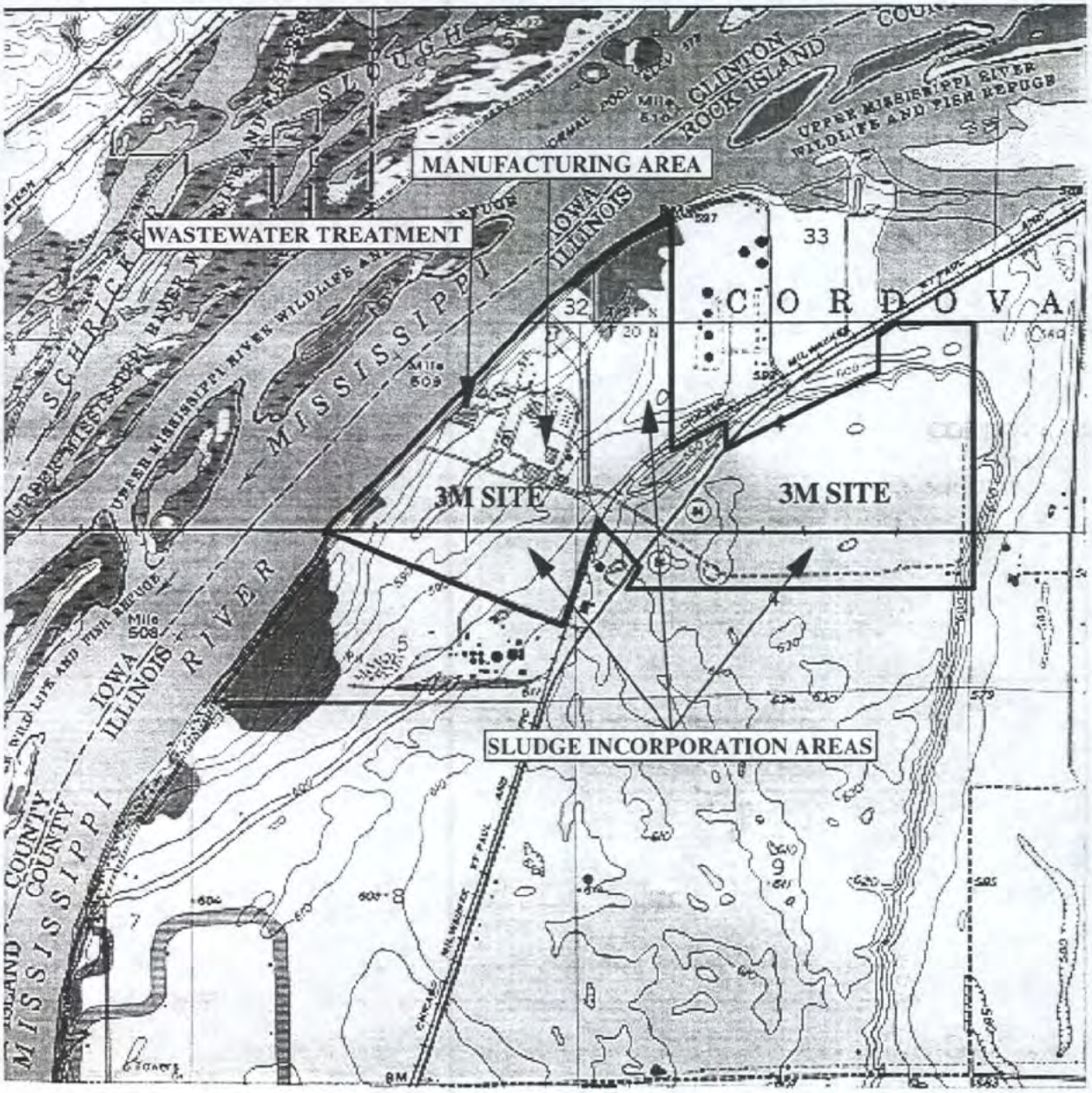


FIGURE 1-2

3M CORDOVA, ILLINOIS PLANT SITE WITH AREA TOPOGRAPHY

Revision: 2
Date: November 1996
Revised November 1996

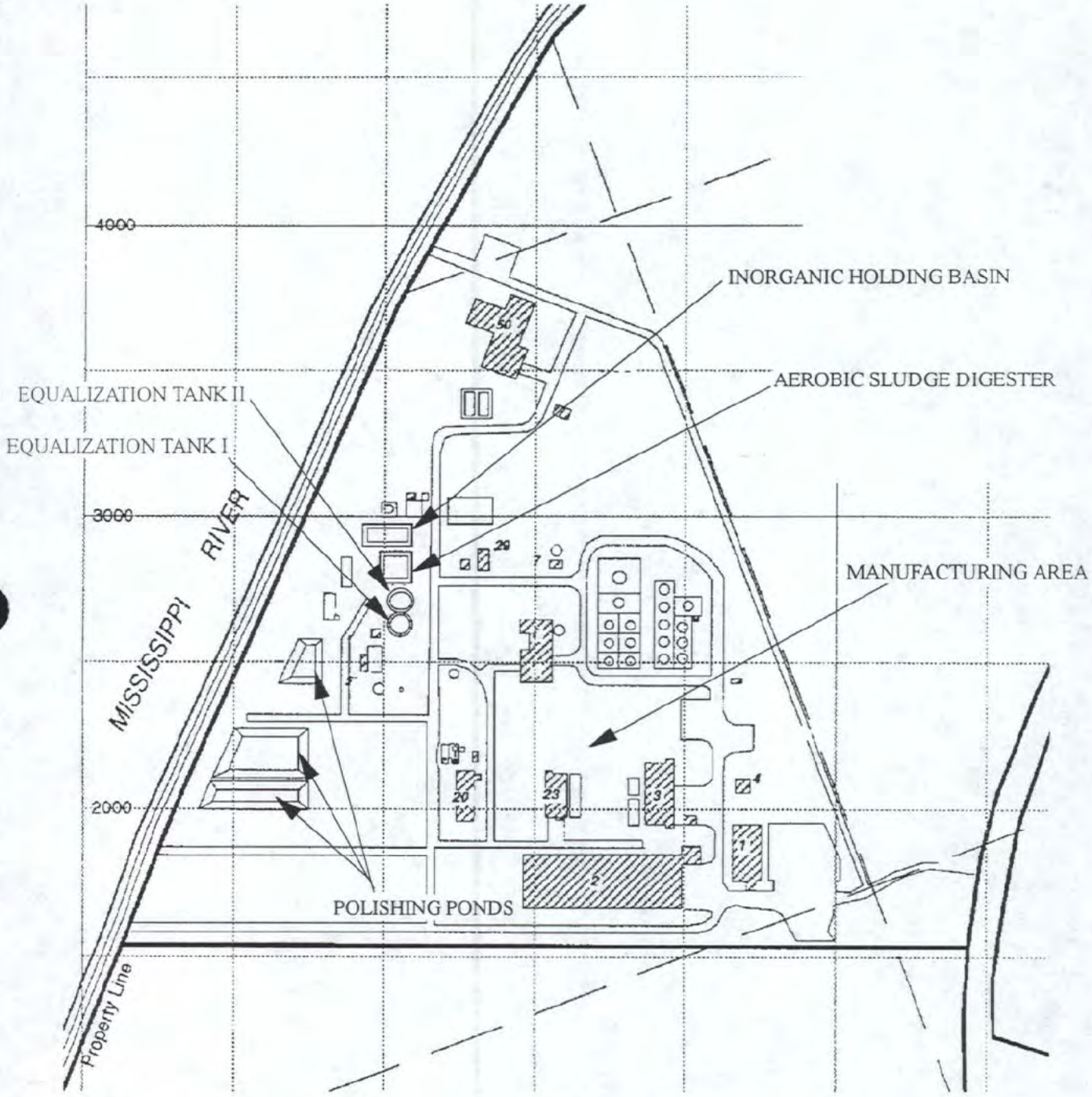


FIGURE 1-3
PLANT LAYOUT

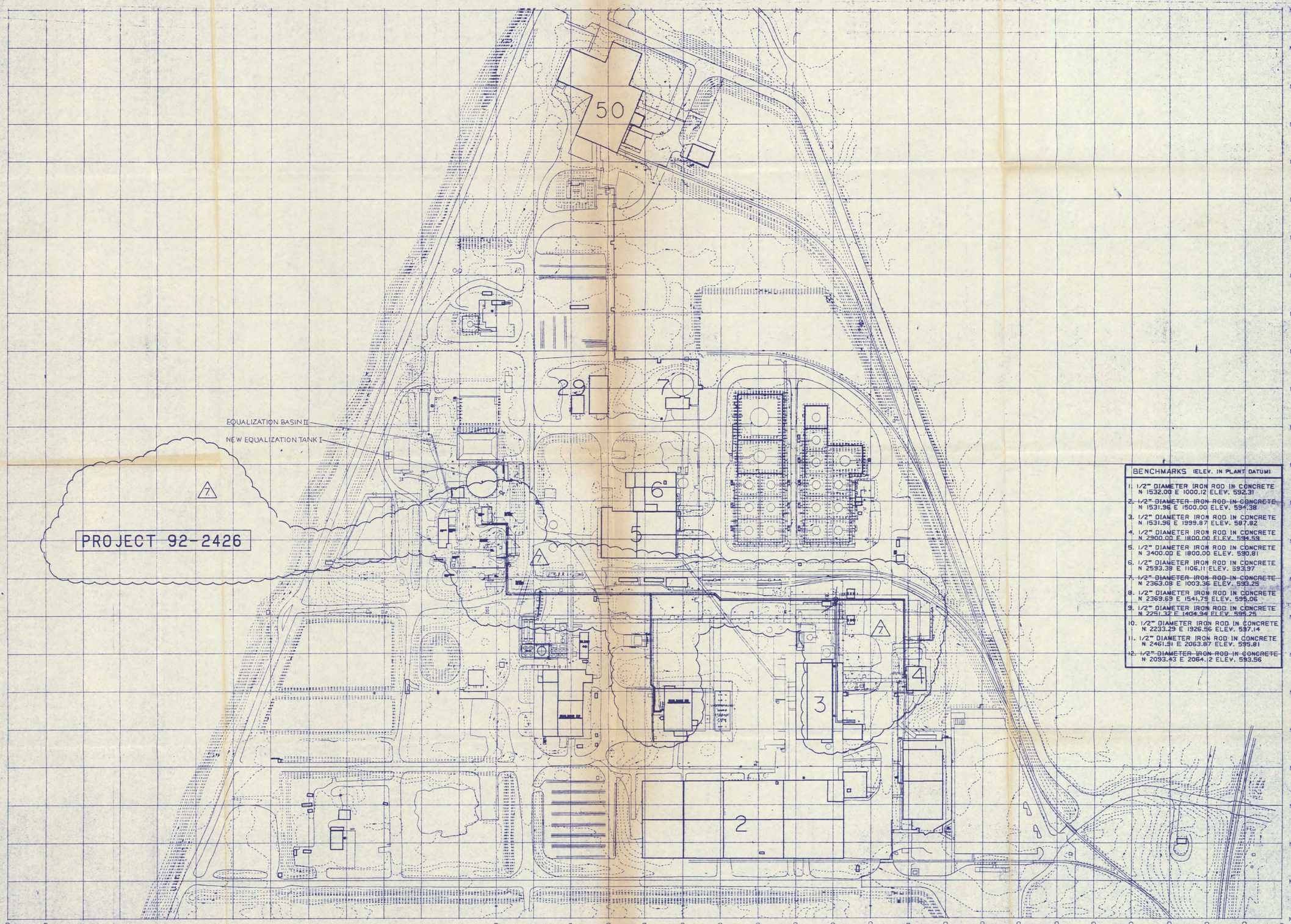
Two 3M operating divisions currently have facilities at the site, the 3M Audio and Video Technology Division (AVTD) and the Specialty Materials Division (SMD). The primary SIC codes for this facility are 2899 (chemical preparations), 2821 (resins), and 2816 (inorganic pigments). The AVTD produces iron oxide for magnetic recording tapes. Only small quantities of hazardous wastes are generated by this Division in production quality control laboratories. The SMD produces a variety of specialty chemicals, primarily for use as feedstocks at other 3M manufacturing facilities, including adhesives, polymers, resins, and fluorochemicals. The hazardous wastes generated by the two divisions are stored in tanks and containers and shipped off-site for treatment and disposal.

1.1.1 Surrounding Land-Use

The surrounding properties are mainly agricultural. However, the 3M site is a part of an industrial park. The area located south of the 3M site and east and adjacent to the Mississippi River has included a fertilizer manufacturer in the past and currently includes a food product manufacturer and a nuclear power generating facility. A sand and gravel mining operation is also located to the south of 3M. A fertilizer storage and distribution facility is located to the north of 3M.

1.1.2 Historical Property Usage

3M has operated manufacturing operations at the Cordova site since 1970. Prior to 3M's presence at the site, the area was used for agricultural purposes.



BENCHMARKS (ELEV. IN PLANT DATUM)

1. 1/2" DIAMETER IRON ROD IN CONCRETE N 1532.00 E 1000.12 ELEV. 592.31
2. 1/2" DIAMETER IRON ROD IN CONCRETE N 1531.96 E 1500.00 ELEV. 594.38
3. 1/2" DIAMETER IRON ROD IN CONCRETE N 1531.96 E 1999.87 ELEV. 587.82
4. 1/2" DIAMETER IRON ROD IN CONCRETE N 2900.00 E 1800.00 ELEV. 594.59
5. 1/2" DIAMETER IRON ROD IN CONCRETE N 3400.00 E 1800.00 ELEV. 590.81
6. 1/2" DIAMETER IRON ROD IN CONCRETE N 2593.38 E 1106.11 ELEV. 593.97
7. 1/2" DIAMETER IRON ROD IN CONCRETE N 2363.08 E 1003.36 ELEV. 593.25
8. 1/2" DIAMETER IRON ROD IN CONCRETE N 2369.69 E 1541.79 ELEV. 595.06
9. 1/2" DIAMETER IRON ROD IN CONCRETE N 2251.32 E 1404.94 ELEV. 595.25
10. 1/2" DIAMETER IRON ROD IN CONCRETE N 2233.29 E 1926.56 ELEV. 597.14
11. 1/2" DIAMETER IRON ROD IN CONCRETE N 2461.91 E 2063.87 ELEV. 595.81
12. 1/2" DIAMETER IRON ROD IN CONCRETE N 2093.43 E 2064.2 ELEV. 593.56

6	5-31-93	LHJ	STORM SEWER PROJECT	46035 10-7301	1	3-31-88	RAL	ORIGINAL ISSUE 23762 87-5976
7	7-09-93	LHJ	ISSUED FOR FIBERGLASS PIPE BIDS	50686 21-2426	2	4-20-88	KL	ISSUED FOR TANK FARM DIKING 87-5984
					3	4-29-89	RAL	RE-ISSUE BID SET PROJ. 87-5976
					4	6-22-89	KL	WASTE TREATMENT AREA STORM DRAINAGE #1 POND LINER 89-1488 89-1847
					5	5-12-93	PDK	CHEMICAL SEWER PROJECT 50686 92-2426

SCALE 1" = 100' M.F.NO. 12,77,81,100,101
DR. R.A. LEPISTO DATE 3-31-88
CK. P.J. MCGRANN DATE 3-31-8
APP. R.L. MOORE DATE 3-31-88

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3M

OVERALL SITE GRADING & DRAINAGE PLAN (MIDDLE AREA)

CORDOVA ILLINOIS

CAD PART NAME LOC.CORD.888.C.200B
FLOOR ELEVATION
PROJECT NO. 87-5976
FILE OR SHT.NO. CORD-888-C-200B

IBM TITLE SITE GRADING / DRAIN PLAN

MF AUG 20 1993

FIGURE 1-4

OVERALL SITE GRADING
AND DRAINAGE PLAN (MIDDLE AREA)
DRAWING #CORD-888-C-200B

1.1.3 Location and Physiography

The Cordova facility is located adjacent to the Mississippi River in the northern portion of Rock Island County as shown in Figure 1-2. The site property boundaries and area topography are also depicted on this figure. The plant site consists of 566 acres and is bisected by Illinois Route 84 and the CMSP&P Railroad.

1.1.4 Topography and Drainage

Normal pool elevation for the Mississippi River in the vicinity of the 3M Cordova facility is 572 feet National Vertical Geodetic Datum of 1929 (NVGD). The plant manufacturing facilities are at an elevation of 588 and 598 feet NVGD. The highest elevation on the site is about 630 feet NVGD, east of Illinois Route 84, near the well field buildings. Surface drainage is generally from east to west with culverts and road ditches directing most precipitation runoff from the surrounding agricultural area to the river. Overall site grading is shown in Figure 1-4. The Army Corps of Engineers (COE) estimates that the 100-year crest at Cordova will be at 588.5 feet NVGD and the 200-year flood crest at 589.5 feet NVGD. Natural mounding and river front road maintenance have raised the levee area near the river above flood elevation.

1.1.5 Climate

Rock Island County is situated in a continental climate zone typical of the north central United States. Temperatures range from average summer highs in the 90°F range to winter lows in

the teens to below zero. Annual precipitation averages about 33 inches. Snowfall averages about 28 inches with an average water content of one inch of water per ten inches of snow.

1.1.6 Soils

The United States Department of Agriculture (USDA), Soil Conservation Service (SCS), General Soil Map for Rock Island County indicated that the 3M Cordova site is situated in the Sparta-Dickinson-Coyne (35 percent-15 percent-15 percent) association. The soil map for Rock Island County is presented in Figure 1-5. These soils are nearly level to strongly sloping, well drained to excessively drained, and mainly formed in sandy material on terraces. The remaining 35 percent of soils are minor occurrences.

Sparta soils consist of very dark, grayish-brown sand to a depth of about 28 inches and a subsoil of dark yellowish-brown sand about 8 inches thick. The underlying material is yellowish-brown loose sand.

Dickinson soils consist of dark grayish-brown sandy loam about 13 inches thick and a subsoil layer about 22 inches thick consisting of dark-brown sandy loam and a dark yellowish-brown loamy sand. The underlying material is yellowish-brown loose sand.

Coyne soils consist of a 5-inch layer of very dark gray fine sandy loam, a 14-inch layer of brown fine sandy loam, and a 13-inch layer of reddish-brown silty clay loam. The underlying material is brown to dark-brown sand and fine gravel.

The general soil profile from soil borings west of Illinois Route 84 consists of 1 to 3.5 feet of topsoil underlain by 2 feet of loose sandy silt and a one foot layer of clayey silt. Below this

Revision: 2
Date: November 1996

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ILLINOIS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
ROCK ISLAND COUNTY, ILLINOIS

Scale 1:253,440
1 0 1 2 3 4 Miles

SOIL ASSOCIATIONS

1 Fayette-Sylvan-Hickory association: Gently sloping to very steep, well drained and moderately well drained soils formed in loess or loamy glacial till; on uplands

2 Muscatine-Tama association: Nearly level to strongly sloping, somewhat poorly drained and well drained soils formed in loess; on uplands

3 Hickory-High Gap association: Moderately steep to very steep, well drained and moderately well drained soils formed in loamy glacial till or in loamy glacial till and in the underlying weathered shale; on uplands

4 Seaton-Oakville-Lamont association: Gently sloping to very steep, well-drained soils formed in loess or sandy material; on uplands

5 Seaton-Port Byron-Timula association: Nearly level to steep, well drained and moderately well drained soils formed in loess; on uplands

6 Sawmill-Coffeen-Mixed alluvial land association: Nearly level, well drained to poorly drained soils formed mainly in silty material; on bottom lands

7 Sparta-Dickinson-Coyne association: Nearly level to strongly sloping, well drained to excessively drained soils formed mainly in sandy material; on terraces

8 Raddle-Joslin association: Nearly level to moderately sloping, well drained and moderately well drained soils formed mainly in silty material; on terraces

Compiled 1975

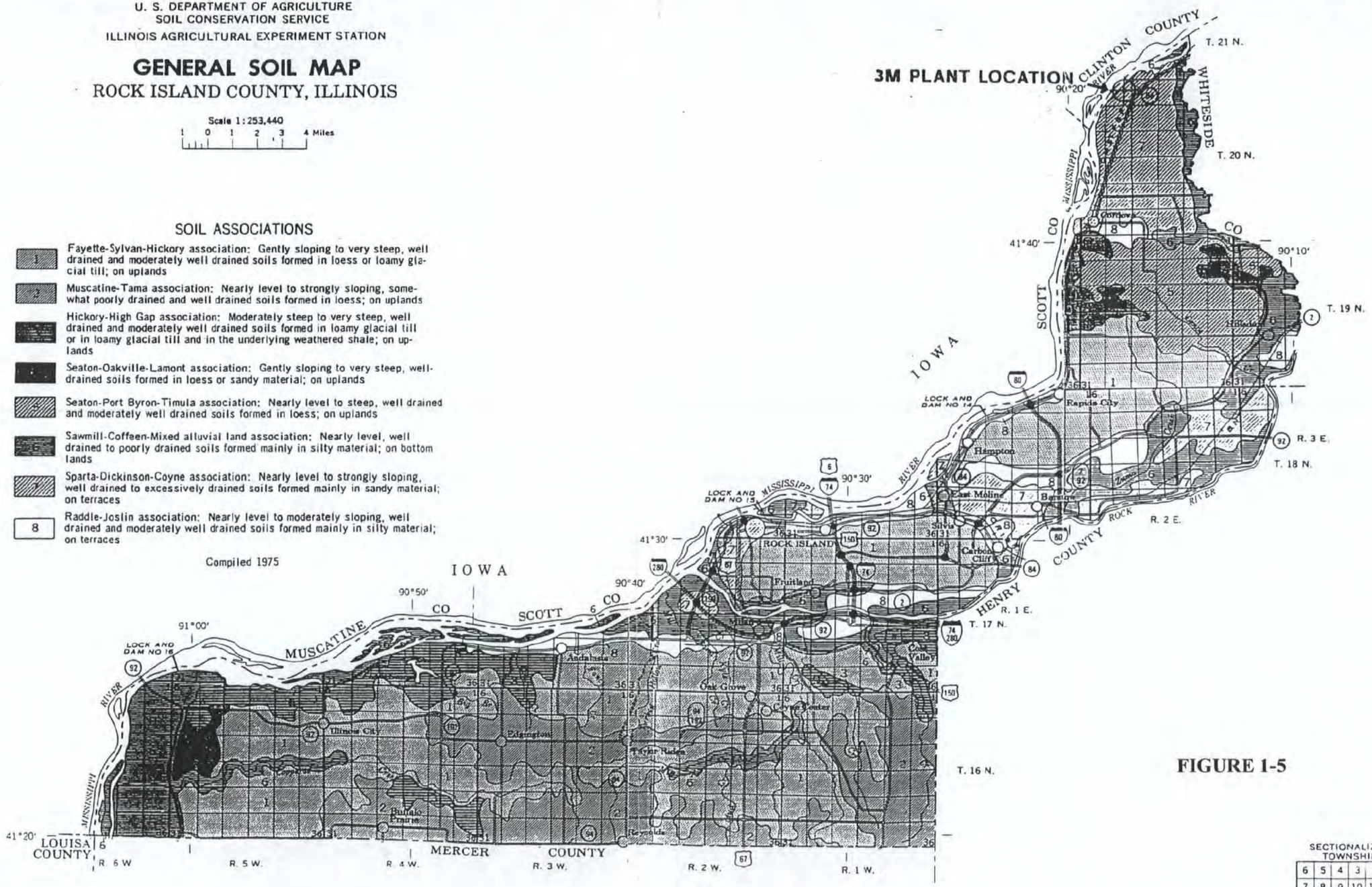

FIGURE 1-5

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

clayey silt layer is loose fine to coarse sand to 10 feet in depth and medium dense sands to 50 feet in depth. The general soil profile from soil borings east of Illinois Route 84 consists of 1 to 2.5 feet of topsoil underlain by loose sand to fine gravel to a depth of 15 feet. Below this sand and gravel layer is medium dense sand to 50 feet in depth.

1.1.7 Bedrock and Hydrogeology

Rock Island County and the 3M Cordova plant site are located at the northwestern edge of the Illinois Basin. Silurian dolomites subcrop below the 60 to greater than 100-foot thick alluvium cover on the 3M site. These same dolomites outcrop further south toward Port Byron and further north toward Savanna at the Mississippi Palisades north of the Plum River fault and the Savanna anticline.

The 3M site is located north of the Rock River confluence with the Mississippi on alluvial terrace deposits in the northwestern extreme on the Illinois Till Plain. Desiccation, meandering, and alluvial deposition along the Mississippi and Rock Rivers has formed an alluvial landscape locally with wave formed terraces and alluvial valleys. The site is bounded on the east by the steep slope of a former channel of the Mississippi River.

Alluvium depth averages over 50 feet at the 3M site. A compilation of depth to bedrock data was compiled using 3M well records and original Layne-Western Company Cordova Industrial Park reports. A bedrock contour map compiling this data is presented in Figure 1-6. An east-west cross section of the site showing near surface stratigraphy is presented in Figure 1-7.

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Bedrock Contour Map
August, 1990

SE= 627 - Surface Elevation
-158 - Depth to Bedrock
BE= 469 - Bedrock Elevation (Sea Level Datum)

■ - Existing Production Well

⊗ - Previous Bedrock Well or Boring Data Point

- Bedrock Contour (Dashed where inferred) (5 Ft. Contour Interval)

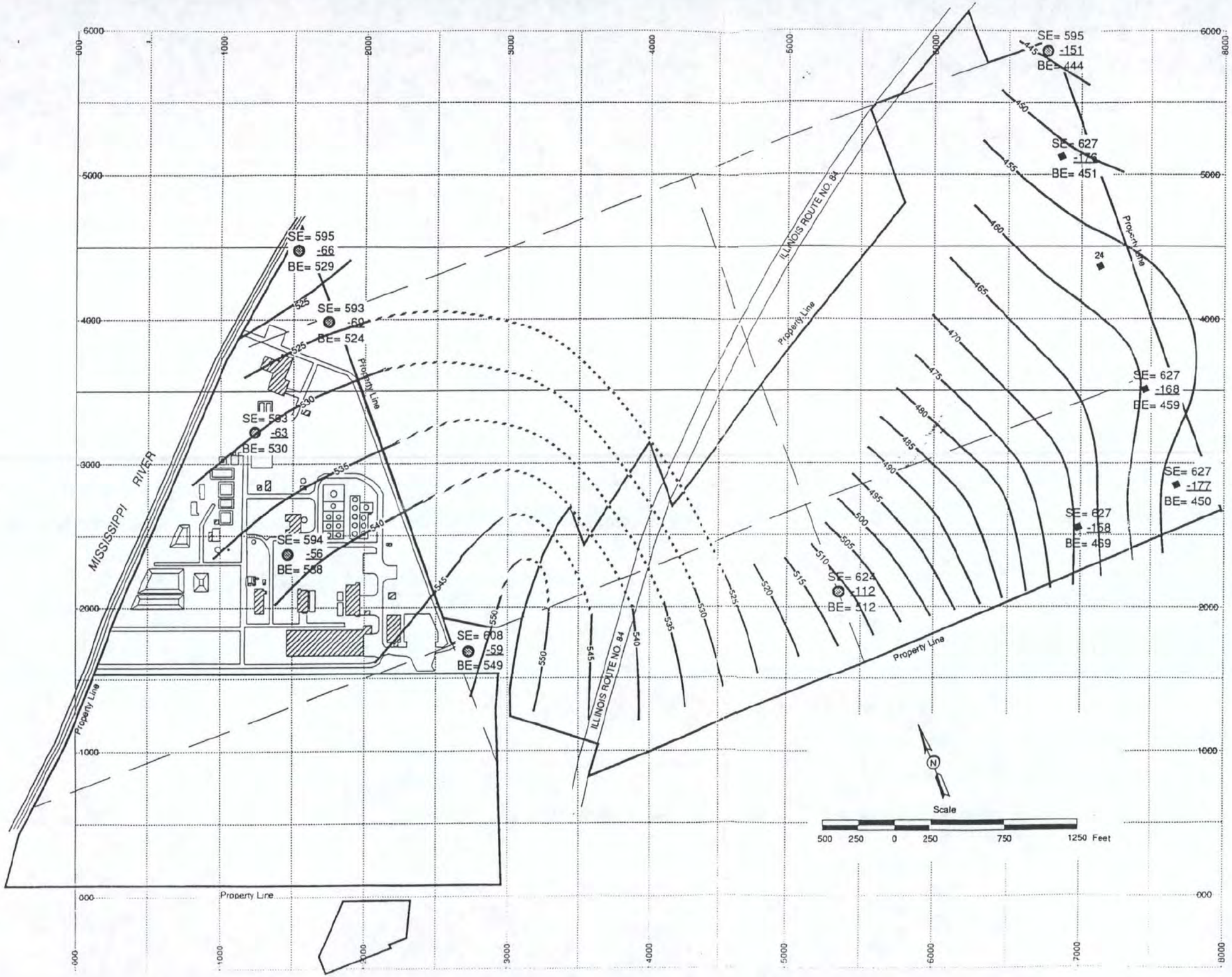

FIGURE 1-6

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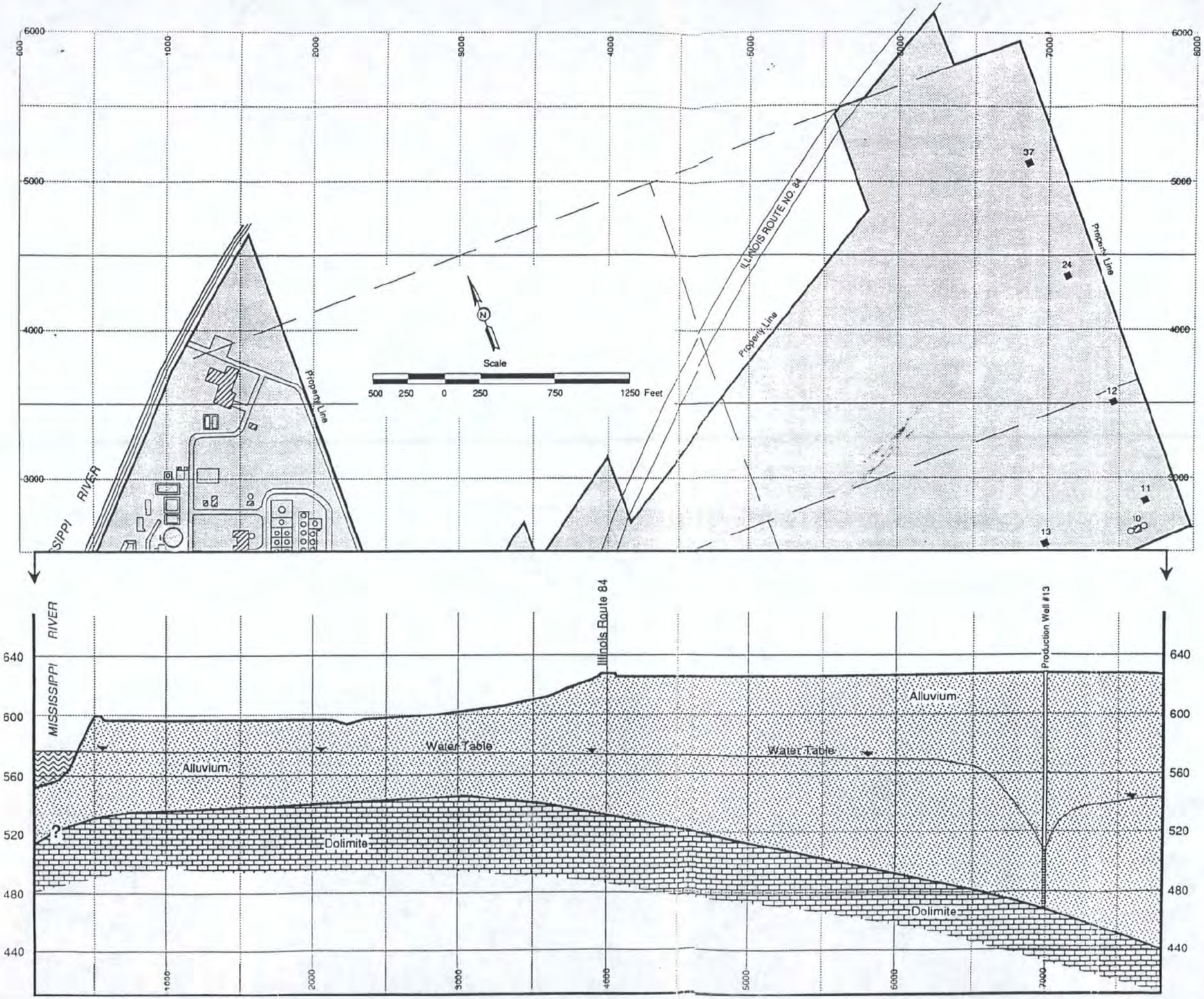
East-West Vertical Section

Showing
Near Surface
Stratigraphy
and
Water Table



■ - Production Wells

ELEVATION IN FEET
(VERTICAL DATUM: MEAN SEA LEVEL)

FIGURE 1-7

Potable water aquifers in the vicinity of the 3M site include surficial sand and gravel deposits (20 to 180 feet deep) generally used for agricultural irrigation and residential use; creviced, Niagran series (Silurian) dolomites, clays and siltstones (20 to 400 feet deep) for low volume residential and agricultural use; and deep (400 feet to 1,600 feet deep) Ordovician and Cambrian dolomites, shales, and sandstones used primarily for municipal, utility, and industrial needs.

1.1.8 Groundwater

The water supply at the 3M facility is obtained from five alluvial groundwater wells located on the eastern edge of the plant property. These wells are within the influence of a buried, former channel of the Mississippi River and withdraw water from a depth of 150 to 180 feet below the surface. Each well has a design capacity of 1,000 to 1,200 gallons per minute. Considering well field interference, well field capacity is about 80 percent of the total capacity of the five individual wells. Water is conveyed from a single transmission line from the well field and is then distributed for various uses within the plant. Water table contours prepared in the fall of 1978 are presented in Figure 1-8. These contours show that the groundwater flow was from west to east toward the well field over the entire site. However, contours drawn for the WWTP Area show that groundwater flow direction may change during the year in that area.

The groundwater flow direction in the WWTP Area has been investigated as part of the interim status groundwater monitoring program for the Equalization Basin II. The information on groundwater flow has been presented to USEPA, Region 5, in the Groundwater Assessment Plan Annual Report for 1993 and 1994. The location of groundwater monitoring wells is shown in Figure

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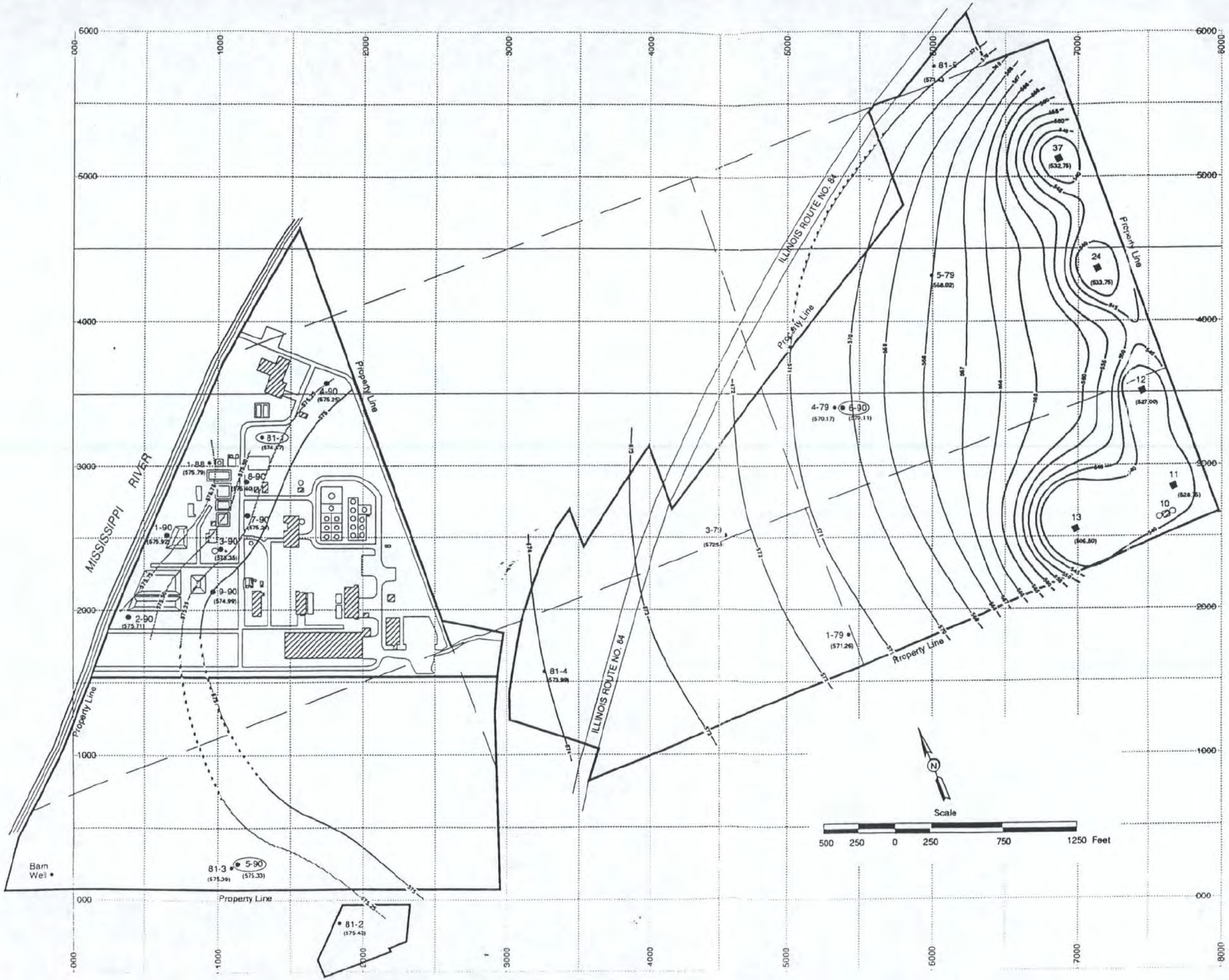
CORDOVA

Water Table Contour Map
August, 1990



(564.11) - Water Elevation (Sea Level Datum)
● - 1990 Monitor Well Location
• - pre-1990 Monitor Well Location
■ - Production Wells
- Ground Water Contour (Dashed where inferred) (1.0 Ft. Contour Interval)
- Ground Water Contour (0.25 Ft. Contour Interval)
- Ground Water Contour (5 Ft. Contour Interval)
○ - Circled Well Location indicates water level known but not used for contouring at this location due to screen interval differences

WELL NUMBER	WATER ELEVATION
MW-1-88	575.79
MW-1-90	575.92
MW-2-90	575.71
MW-3-90	575.35
MW-4-90	575.25
MW-5-90	575.33
MW-6-90	570.11
MW-7-90	575.27
MW-8-90	575.40
MW-9-90	574.99
MW-81-1	574.87
MW-81-2	575.43
MW-81-3	575.39
MW-81-4	573.99
MW-81-5	571.43
MW-1-79	571.26
MW-3-79	572.58
MW-4-79	570.17
MW-5-79	568.02
PW-11	528.75
PW-12	527.00
PW-13	506.50
PW-24	533.75
PW-37	532.75

FIGURE 1-8

1-9. An evaluation of the 1994 groundwater level data shows that, during 1994, the groundwater flow direction in the vicinity of Equalization Basin II was from the Mississippi River to the east. Also, it appears that the Mississippi River influenced the flow in May, July, and October, 1994. The evaluation of the data is presented in Appendix 1.

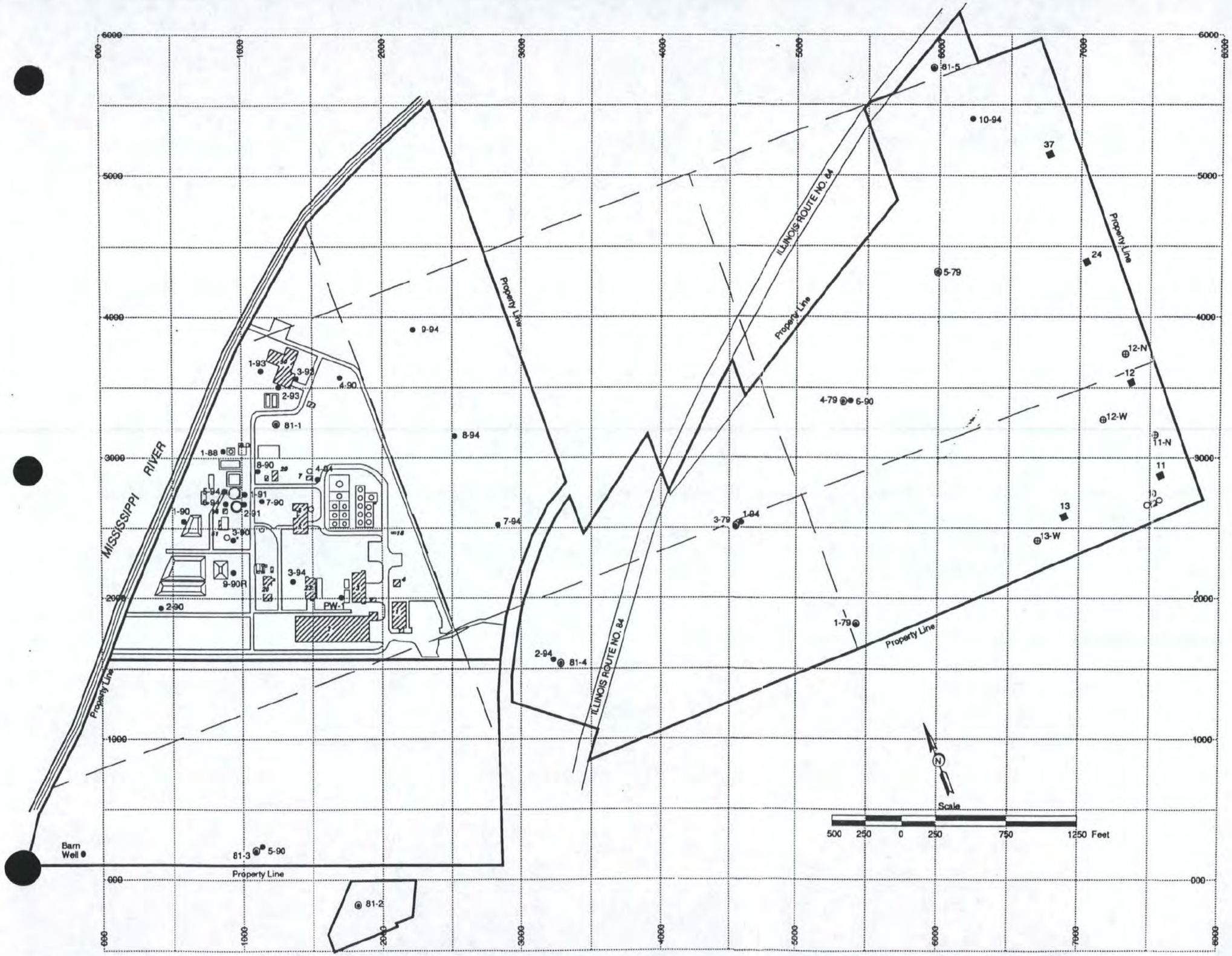
1.2 WASTEWATER TREATMENT PLANT

A detailed description of the WWTP has previously been submitted to the USEPA, Region 5, on May 21, 1995 in accordance with Permit condition II.F.1.a. The following is a summary of the wastewaters treated in the facility.

1.2.1 General Description

Wastewater treatment facilities were provided at the time that the initial manufacturing facilities were constructed. Additions to the wastewater treatment facilities have been made to meet the needs of various plant expansions or changes in environmental requirements. A diagram of the wastewater treatment system is presented in Figure 1-10. The plant is currently operating under National Pollutant Discharge Elimination System (NPDES) Permit No. IL0003140. The wastewater treatment system consists of a variety of tanks and surface impoundments connected with piping to process wastewaters and sludges by gravity flow or through pumping. The surface impoundments are lined with either concrete or synthetic liners as shown in Figure 1-10.

The wastewater treatment operations produce two sludges which are land incorporated on-site. One is an inorganic sludge produced by a physical/chemical treatment process and one is a



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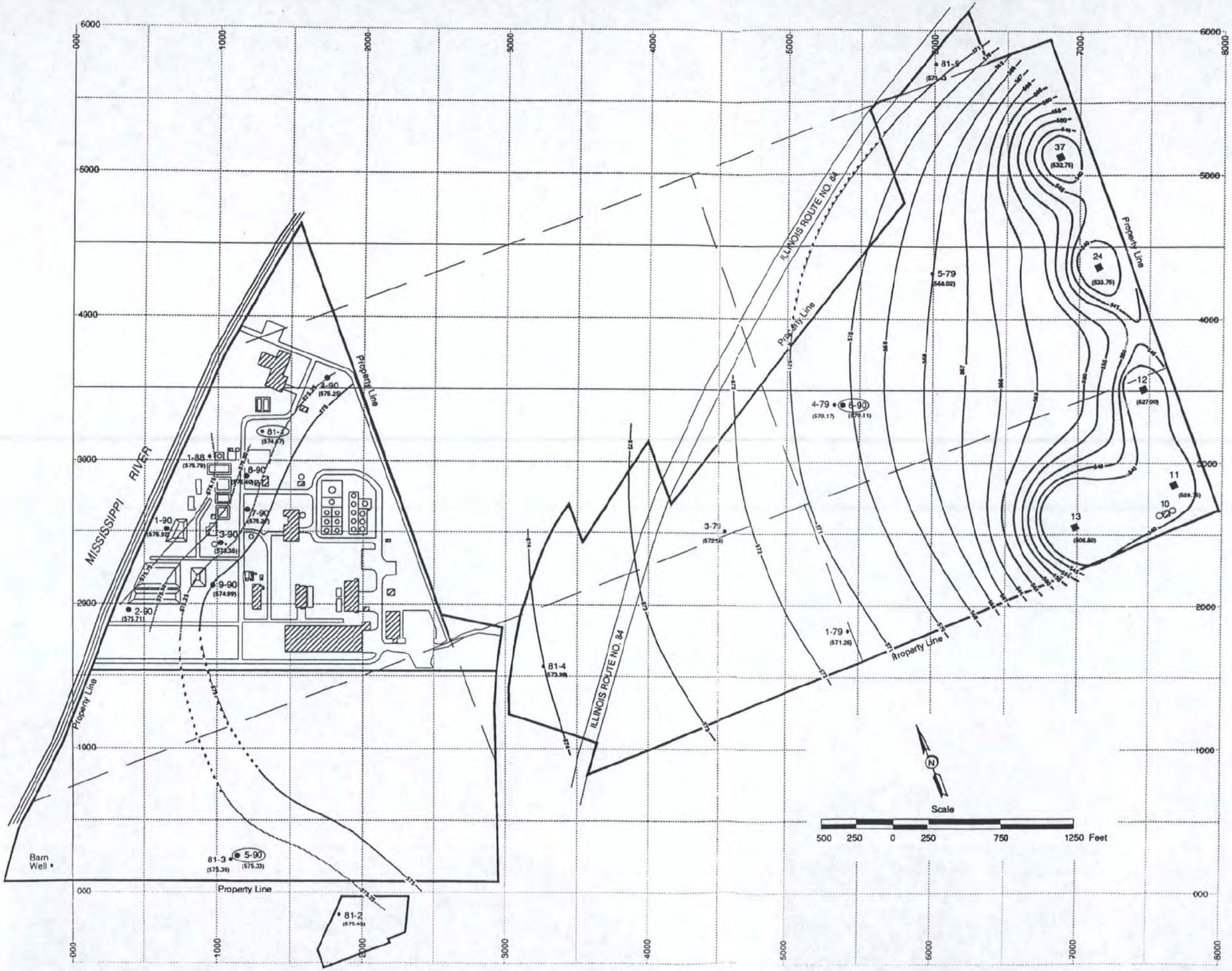
Monitor Well Locations

- 1988-90-91-93-94 2" Dia. Monitor Wells
- 1979-81 5" Dia. Monitor Wells
- Production Wells
- 8" Dia. Observation Wells

FIGURE 1-9

Revised November 1996



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Water Table Contour Map

August, 1990

(564.11) - Water Elevation (Sea Level Datum)

● - 1990 Monitor Well Location

● - pre-1990 Monitor Well Location

■ - Production Wells

- Ground Water Contour (Dashed where inferred) (1.0 Ft. Contour Interval)

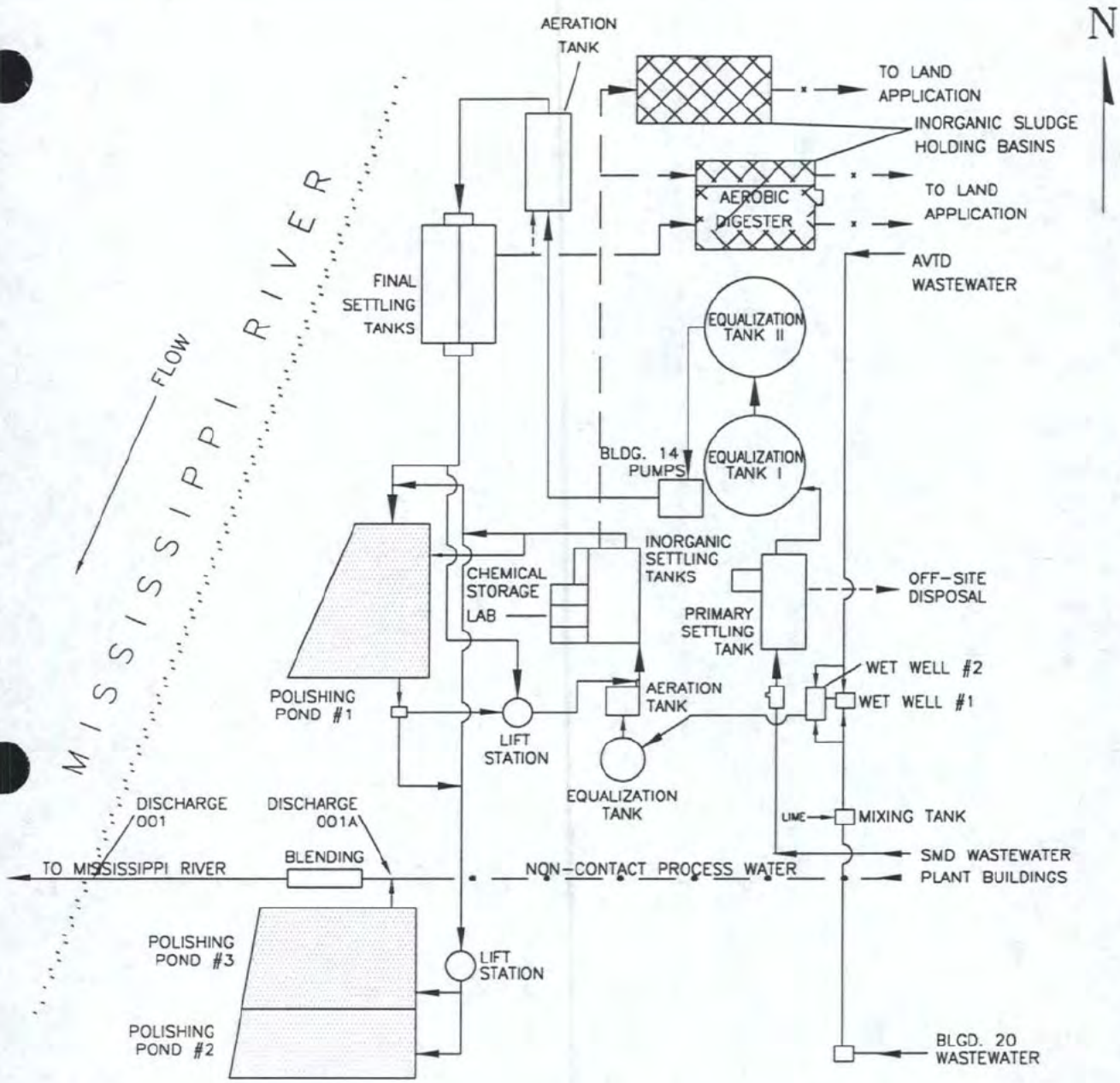
- Ground Water Contour (0.25 Ft. Contour Interval)

- Ground Water Contour (5 Ft. Contour Interval)

- Circled Well Location indicates water level known but not used for contouring at this location due to screen interval differences

WELL NUMBER	WATER ELEVATION
MW-1-88	575.79
MW-1-90	575.92
MW-2-90	575.71
MW-3-90	575.35
MW-4-90	575.25
MW-5-90	575.33
MW-6-90	570.11
MW-7-90	575.27
MW-8-90	575.40
MW-9-90	574.99
MW-81-1	574.87
MW-81-2	575.43
MW-81-3	575.39
MW-81-4	573.99
MW-81-5	571.43
MW-1-79	571.26
MW-3-79	572.58
MW-4-79	570.17
MW-5-79	568.02
PW-11	528.75
PW-12	527.00
PW-13	506.50
PW-24	533.75
PW-37	532.75

FIGURE 1-8



LEGEND

AVTD = Audio and Video Technology Division
SMD = Specialty Materials Division

Concrete Tank
Concrete Liner
Synthetic Liner

Settled Solids Sludge
Wastewater
Non-Contact Process Water
Sludge
Not Currently in Use

FIGURE 1-10
WASTEWATER TREATMENT FACILITY
3M COMPANY – CORDOVA, ILLINOIS

biological sludge produced by an activated sludge treatment process. Land incorporation of these sludges has been conducted since 1975 in the areas east of Highway 84 and south of the main manufacturing facilities. A new area just east of the plant and west of Highway 84 and the railroad was added in the spring of 1994. Illinois Environmental Protection Agency (IEPA) Sludge Incorporation Permit prescribes how the SIA is managed by 3M.

1.2.2 Waste Streams

Wastewaters produced at the plant fall into five general groups and are blended after intermediate treatment steps and combined into a single discharge to the Mississippi River. The five wastewater groups and generalized treatment descriptions are provided below.

1.2.2.1 Audio and Video Technology Division (AVTD) Wastewaters. AVTD manufactures iron oxide used in magnetic recording tapes. Wastewaters from these facilities contain high concentrations of iron which must be removed prior to discharge. Wastewater from this location is pumped to an on-ground equalization tank and metered into an aeration tank where soluble ferrous iron is converted to insoluble ferric oxide. Alum is added to coagulate the ferric oxide. Polymers are added to promote flocculation and settling. Settling occurs in the Inorganic Settling Tank. Treated wastewater from this tank is pumped to Polishing Pond 1, flows by gravity through Pond 2 and Pond 3, and then is discharged to the Mississippi River. Sludge removed from the Inorganic Settling Tank is pumped to the Inorganic Sludge Holding Basins where the sludge further consolidates. Supernatant from the Inorganic Sludge Holding Basins is returned to the AVTD sewer. The consolidated sludge is periodically transferred to the sludge incorporation areas for disposal.

1.2.2.2 Building 20 Wastewater. Fluorochemical products are manufactured in Building 20. Wastewaters from this area contain fluoride and nickel which must be treated with lime to produce insoluble calcium fluoride and nickel hydroxide. Wastewaters flow continuously through a mixing tank where lime is added. From the mix pit, this water flows into the AVTD wastewater lift station and combines with AVTD wastewaters prior to the AVTD equalization tank. The wastewater continues through the system mixed with the AVTD wastewater.

1.2.2.3 Special Materials Division (SMD) Wastewaters. SMD produces a variety of organic chemical products and intermediates which are used as feedstocks at other 3M facilities. Wastewaters from several of these processes have a high chemical oxygen demand (COD) which is treated in a biological treatment system. Settleable and floating materials are first removed in a Primary Settling Tank. The settled solids and floating materials are collected and disposed off-site. Wastewater from the Primary Settling Tank discharges into Equalization Tank I.

Wastewater in Equalization Tank I is pumped into the Aeration Tank and seeded with return activated sludge from the Final Settling Tanks. In this process, organic constituents are converted to carbon dioxide, water, and cell mass. The cell mass is removed as biological sludge using the Final Settling Tanks.

Treated wastewater from the Final Settling Tank can flow directly into Polishing Pond 1 or it can first be diverted into the influent of the AVTD Inorganic Settling Tank then into Pond 1. Wastewater from Pond 1 undergoes further polishing in Polishing Ponds 2 and 3 before being blended with non-contact process wastewater and discharged into the Mississippi River.

Excess biomass from the biological treatment system is removed at the Final Settling Tank and is metered into the Aerobic Sludge Digester, where it is further digested for stabilization and volume reduction. Before the periodic removal of sludge from the Aerobic Sludge Digester, the diffusers in the digester are shut off. After the sludge has settled, supernatant is removed and returned to the Organic WWTP. The sludge is transferred to the SIA for disposal.

In the past, Equalization Basin II was the first basin in a two basin series with Equalization Basin I. In August 1993, Equalization Basin I was replaced with an aboveground tank, Equalization Tank I. In May 1994, Equalization Basin II was taken out of service for RCRA closure. The wastewater was removed, the sludge was removed and shipped off-site for disposal, the walls were cleaned using hydroblasting with water and steam, and samples were collected for analysis to demonstrate clean closure. A closure report and certification was submitted on January 10, 1995 to USEPA, Region 5. USEPA, Region 5, approved clean closure on March 15, 1995. The basin has been replaced with an aboveground tank (Equalization Tank II)

1.2.2.4 Non-Contact Process Waters. Much of the water used in the production areas is not contaminated with process residues. To reduce the volume of wastewater being discharged to the SMD, Building 20, and AVTD sewers, these wastewaters are segregated and discharged through separate sewers. These wastewaters will contain only those constituents which are already present in the facility's groundwater supply. Non-contact process waters are blended with all other wastewaters at the outlet of Polishing Pond 3 and then discharged to the Mississippi River as specified in the NPDES Permit.

1.2.2.5 Sanitary Wastewaters. Sanitary wastewaters are mixed with chemical wastewaters in Equalization Tank I. These wastes are then processed in conjunction with the other chemical wastes and undergo biological treatment as well as settling prior to blending and discharge.

1.3 SLUDGE INCORPORATION AREA

A detailed description of the SIA and the sludges applied for incorporation has previously been submitted to the USEPA, Region 5, on May 21, 1995 in accordance with Permit Condition II. F.1. a. The following is additional information as specified in Attachment 1 of the facility RCRA Part B permit. The application of sludge to the SIA is permitted by IEPA, Division of Water Pollution (Land Application of Sludge Permit No. 1995-SC-3408, effective date June 12, 1995).

1.3.1 Area Characteristics

1.3.1.1 Location. 3M Cordova utilizes land incorporation to dispose of the two sludges generated by the plant wastewater treatment system. Corn is planted, harvested, and sold annually. The locations of the land incorporation areas are shown in Figure 1-11. These areas include a 93-acre track west of Highway 84 and a 182-acre area, including a control plot, west of Highway 84. A total of 257 acres is used for land incorporation. An additional 92-acre piece of land located just north of the manufacturing buildings and west of Highway 84, known as Zone 12, was bought by 3M as an addition to the SIA in 1993. The Land Application of Sludge Permit was modified effective March 7, 1994 to include the new area.

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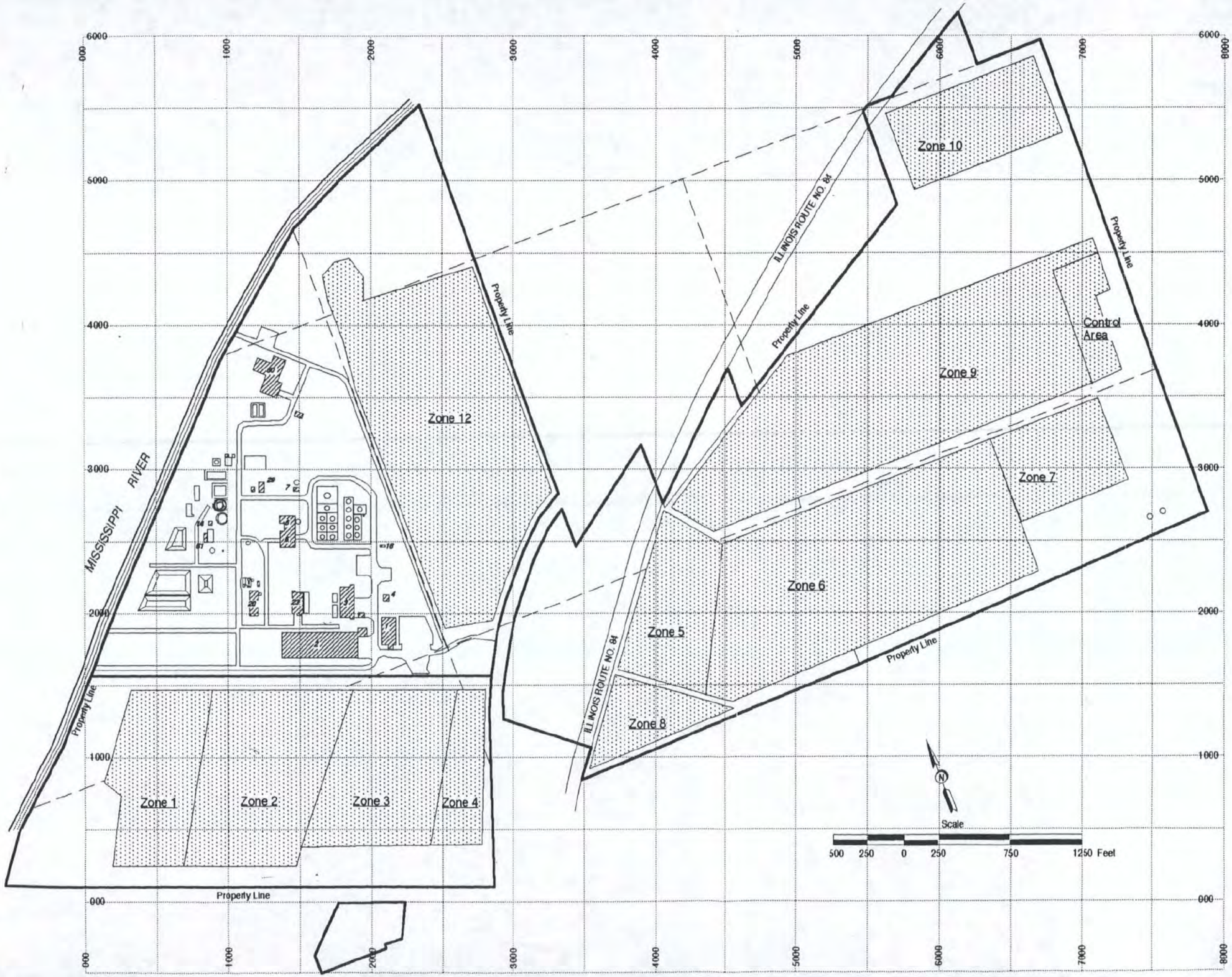
Date: November 1996



3M
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Sludge Incorporation Zones

FIGURE 1-11

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1.3.1.2 Type of Unit/Disposal Unit Sludges from the inorganic sludge surface impoundment and the aerobic digester surface impoundment are applied to the SIA for disposal. In this practice, the sludges are incorporated with soil material in the manner of fertilizer or manure. The land incorporation areas are managed through the use of a number of zones. The zones and the control area are shown in Figure 1-11.

1.3.2 Design Features

1.3.2.1 Soil Characteristics. An important factor in the design of land incorporation systems is the ability of soil to hold heavy metal constituents as measured by the cation exchange capacity (CEC). The CEC is regularly determined from the soil samples collected from the SIA.

Lime is incorporated into the soil to prevent the solubilization and transport of metals. Finely crushed limestone is purchased from a local agriculture and supply firm and this same firm applies the lime to the land using its own equipment. The calculation procedure that is used to determine the amount of lime to be incorporated into the soil is described in Methods of Soil Analysis, Part II - Chemical and Microbiological Properties, second edition, 1982.

1.3.2.2 Stormwater Run-on and Run-off. The flow direction of stormwater is illustrated in Figures 1-12, 1-13, and 1-14. The soils underlying the 3M property are highly sandy and porous and the land is relatively flat. The slope is generally from the east to the west towards the Mississippi River. For the most part, the water volume from small rainwater events soaks directly into the ground. For large rain events, the eastern and new field property drain to the drainage ditch

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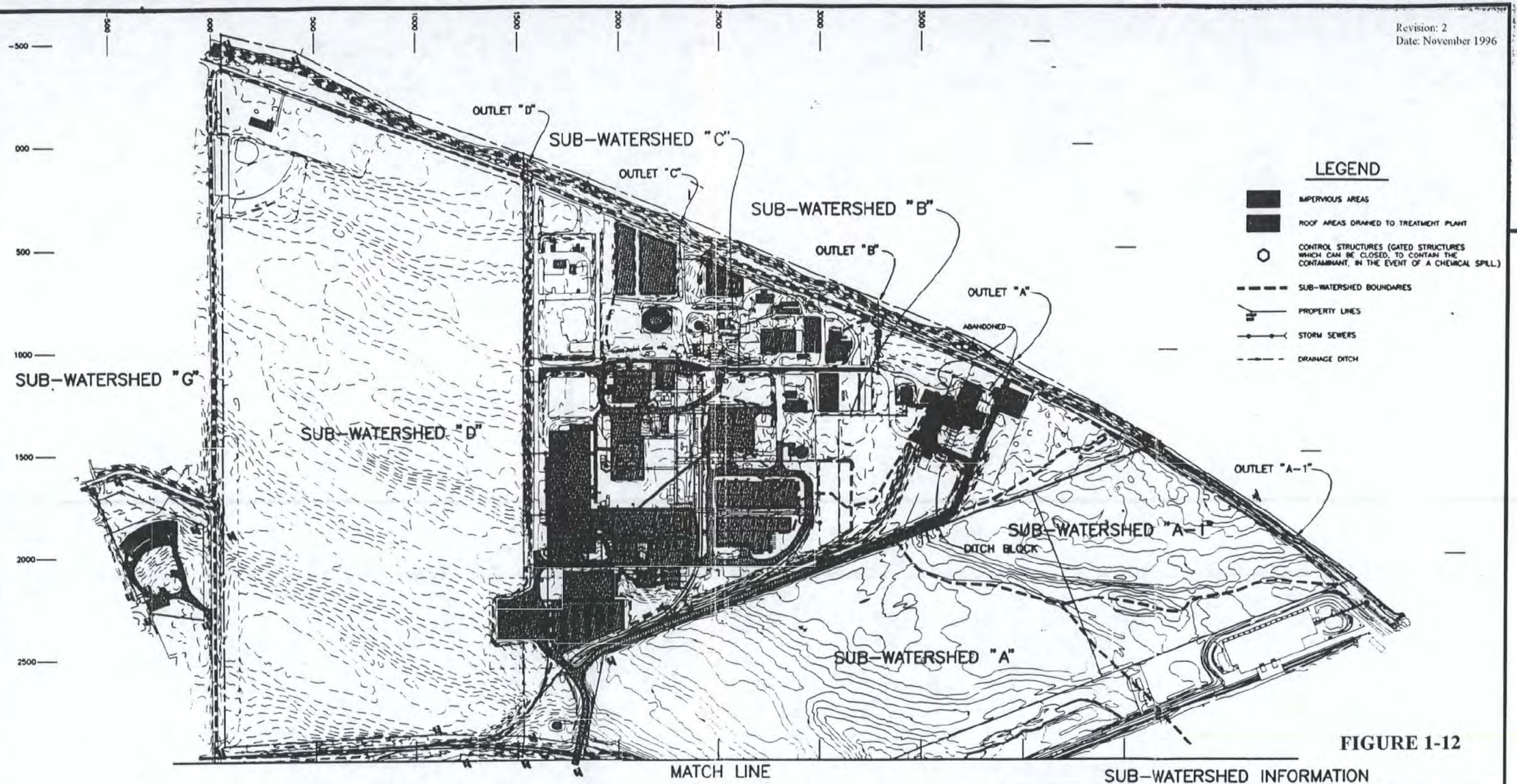

FIGURE 1-12

SUB-WATERSHED INFORMATION

SUB-WATERSHED	DRAINAGE TOTAL AREA	DRAINAGE AREA 3M PROPERTY	IMPERVIOUS AREA 3M PROPERTY	OUTFALL
A	109.5 (AC)	89.1 (AC)	7.6 (AC)	PIPE TO MISSISSIPPI RIVER
A-1	22.3 (AC)	22.3 (AC)	0.1 (AC)	OUTLET TO MISSISSIPPI RIVER
B	14.5 (AC)	14.5 (AC)	1.4 (AC)	PIPE TO MISSISSIPPI RIVER
C	13.5 (AC)	13.5 (AC)	4.3 (AC)	PIPE TO MISSISSIPPI RIVER
D	145.7 (AC)	140.6 (AC)	22.3 (AC)	PIPE TO MISSISSIPPI RIVER
E	N.A.	52.5 (AC)	0.0 (AC)	OVERLAND RUNOFF TO NON-3M PROP.
F	N.A.	229.3 (AC)	0.0 (AC)	OVERLAND RUNOFF TO NON-3M PROP.
G	N.A.	4.9 (AC)	1.4 (AC)	OVERLAND RUNOFF TO NON-3M PROP.

NOTE: DITCHES AND DIKES ARE USED THROUGHOUT THE PLANT SITE, TO ISOLATE STORMWATER RUNOFF FROM POTENTIAL CONTAMINATION AREAS. ADDITIONALLY, THE STORMSEWER SYSTEM IS PROVIDED WITH GATED CONTROL STRUCTURES, WHICH CAN BE CLOSED, TO CONTAIN THE CONTAMINANT, IN THE EVENT OF A CHEMICAL SPILL.

3M TITLE SITE DRAINAGE MAP A

1	8-15-92	TKDA	ORIGINAL ISSUE	PROJ. NO. 10-7901
2	12-7-94	TKDA	REVISE BOUNDARIES	PROJ. NO. 10-7901

SCALE 1"=200'-0"
DR. TKDA
CK. TKDA
APP.
512.077.061.100
DATE SEPT., 1992
DATE SEPT., 1992
DATE

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900 BUSH AVENUE
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ST. PAUL, MN 55133

3M

MAIN PLANT AREA
SITE DRAINAGE MAP A

CORDOVA ILLINOIS

CADD PART NAME
FLOOR ELEVATION
PROJECT NO. 10-7901
FILE OR SHT. NO. CORD-888-C-911

Revision: 2
Date: November 1996

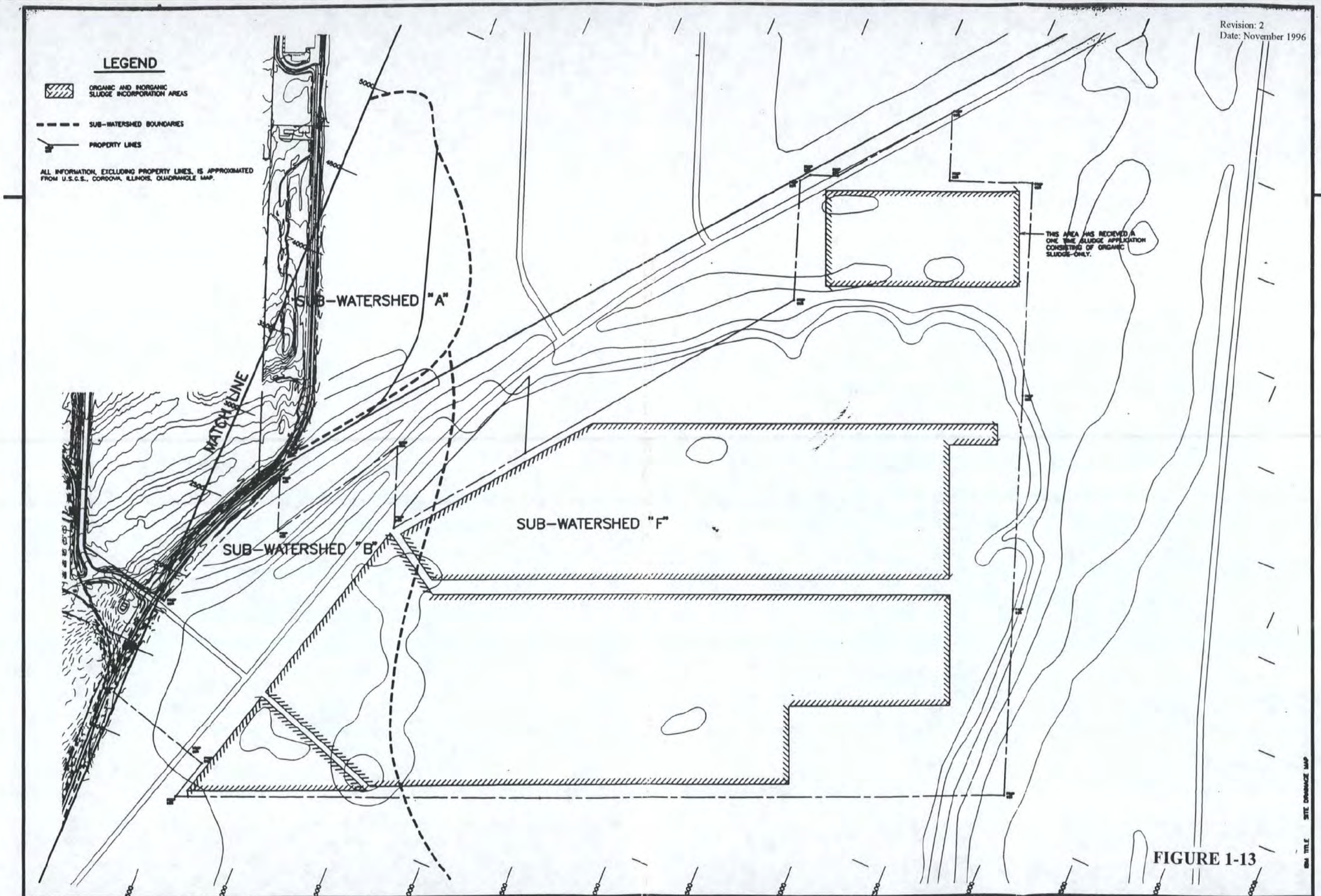

FIGURE 1-13

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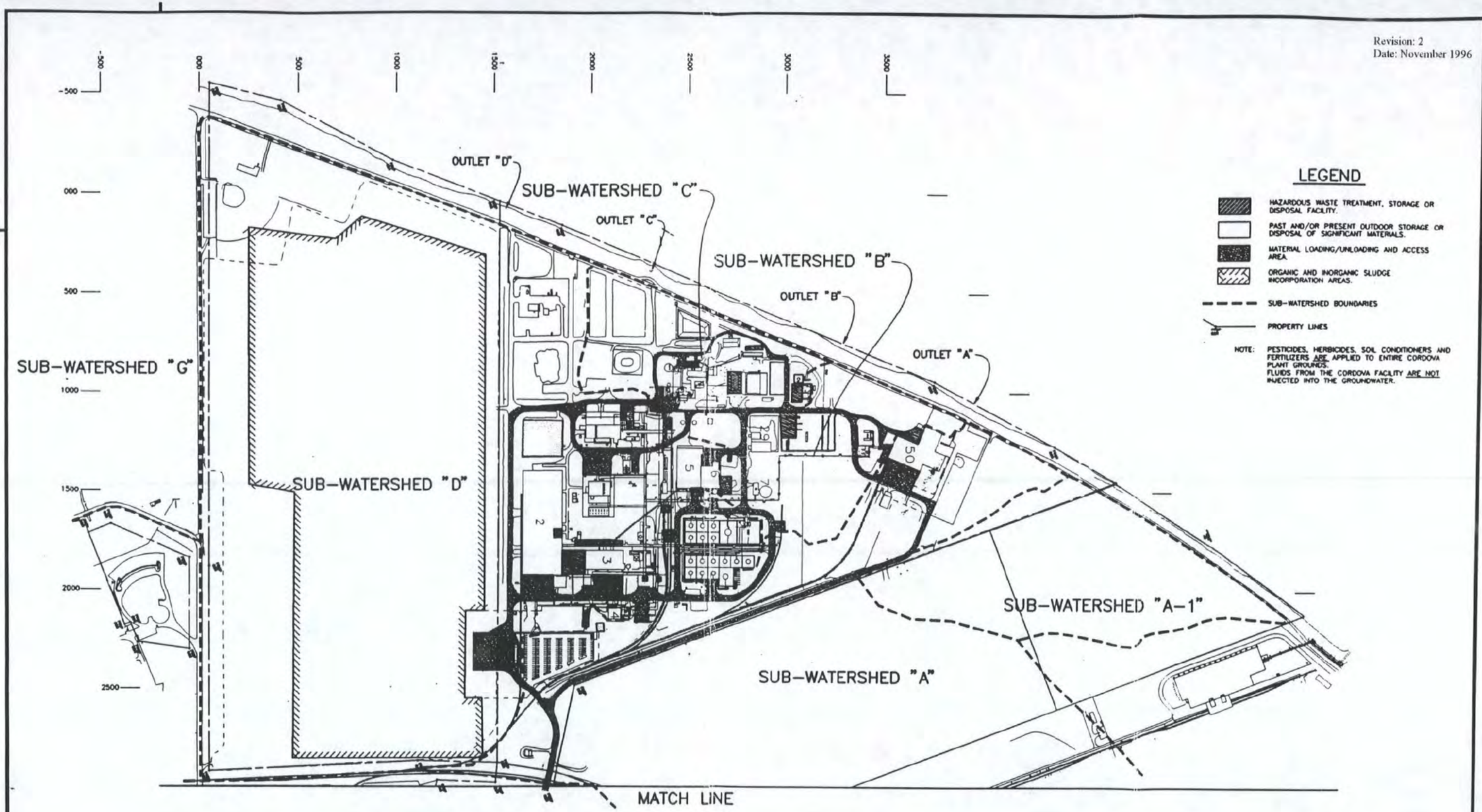

FIGURE 1-14

IBM TITLE SITE DRAINAGE MAP B

1	8-15-92	TKDA	ORIGINAL ISSUE
2	12-7-94	TKDA	REVISE BOUNDARIES

SCALE 1"=200'-0"
DR. TKDA
CK. TKDA
APP.
DATE SEPT. 1992
DATE SEPT. 1992
DATE

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MAIN PLANT AREA
SITE DRAINAGE MAP B

CADD PART NAME
FLOOR ELEVATION
PROJECT NO. 10-7901
FILE OR SHT.NO. CORD-888-C-915

along the highway. Run-off from the southern field flow in a southwest direction towards the Mississippi River.

1.3.2.3 Operating Practices. Approximately 400,000 gallons of aerobically digested sludge (3.8 percent solids) and 700,000 gallons of inorganic sludge (17 percent solids) are incorporated each year.

Sludge application is typically conducted in "campaigns" when either the aerobic sludge digester or the inorganic sludge holding basins become filled. Spreading rates are based on agronomic requirements (nitrogen content) and have averaged about 8,000 gallons per acre per year. Land application zones are rotated to provide for uniform distribution. The inorganic sludge is typically spread on the surface followed by incorporation with a plow. Inorganic sludge is applied by using modified dump trucks. The truck drives across the field with the rear slide gate open leaving a strip of sludge behind. A contract farmer disks the inorganic sludge into the soil. Aerobic digester sludge is typically applied by knife injection.

3M calculates the application rates each time sludge is incorporated and instructs the contractor as to how many loads can be applied to each zone. Based on past experience, the contractor judges how best to evenly apply the sludge. Sludge is not land applied in the winter when the ground is frozen.

Annual application rates are kept less than the agronomic utilization rate for nitrogen in order to protect the groundwater. This utilization rate is calculated using the procedures given in the IEPA document Design Criteria for Municipal Sludge Utilization on Agricultural Land. It is recognized that the application of sludges will enrich the soil with heavy metals. Limitations on application

rates specified in the IEPA permit and continued monitoring ensure that concentrations in soil, ground water, and crops contain acceptable levels of these constituents. Sludge application rates must not exceed the maximum allowable total cumulative heavy metal loadings of 1,000 pounds Pb per acre, 500 pounds Zn per acre, 250 pounds Cu per acre, 200 pounds Ni per acre, 10 pounds Cd per acre, 900 pounds Mn per acre, 3,500 pounds $Cr+^3$ per acre, and 440 pounds $Cr+^6$ per acre.

1.3.2.4 Monitoring Requirements. All monitoring wells are sampled on a semiannual basis and soil samples are taken once per year as specified in the Land Application of Sludge Permit.

1.3.2.5 Period of Operation. Land application typically occurs from March through November, as permitted by prevailing weather conditions. A portion of the land application areas is usually left open for application during the summer. After fall harvest, the sludges are again land applied over the entire area.

1.3.2.6 Age. Zones 1 through 11 have been operated under permits from the IEPA since 1975. The cuurent IEPA Sludge Incorporation Permit for land application of sludge was approved in early June, 1995. Zone 12 has been operated since 1994.

1.3.2.7 General Physical Conditions. The portions of land used for sludge incorporation are depicted in Figure 1-11 and occupy a total area of 257 acres at the 3M site. The slope of the land is fairly uniform. The surface water drainage is towards the Mississippi River to the west. The soils that exist in the SIA were previously discussed in section 1.1.7. The drainage and grading of the site is depicted in Figure 1-4.

1.3.3 Waste Characteristics

Detailed information on the sludge applied to the sludge incorporation area is found in the May 21, 1995 submittal to USEPA, Region 5. The sludge applied to the SIA is not RCRA hazardous waste as defined in 40 CFR 261.

1.3.4 Migration Pathway Data

1.3.4.1 Soil Sampling Data. Soil samples are analyzed annually. Surface samples have been taken from the top six inches at 44 locations, including three within the control plot. Beginning in 1993, these samples have been taken from 8 to 12 inches from the surface. Each surface sample consists of a composite of five discrete samples taken in the area surrounding the sample point. At six locations, including one in the control plot, samples are also taken at depths of 2.5 and 5 feet. Each of these samples is a discrete sample taken near the prescribed sample point. Soil samples are analyzed for both extractable and total metals. The soil sampling data shows elevated concentrations of nickel, cobalt, and zinc in the upper layers of the soil. However, the concentrations are reduced to background levels at the background depth, indicating the metals are being held by the top layer of soil and are not migrating downward.

Additional sampling was conducted in October 1989 as part of the abbreviated RFI. 3M collected surface samples and six samples each at the 2.5 and 5.0 ft depths from the sampling locations as shown in Figure 1-9. This would provide information on concentrations both within and at the base of the incorporation zone.

Analytical sample results showed that there were no volatile organics (624), semi-volatile organics (625), organochlorine pesticides/PCBs (608), or herbicides (615) present in any of the samples tested. With the exception of sample location 14 at 2.5 feet, none of the samples collected had above background concentrations of any other constituents. The concentrations of a number of constituents (As, Ba, Co, Cr-total, Pb, Sr, Vd, Zn) in location 14 were slightly elevated above background. The sample taken at location 14 at 5.0 feet does not show values above background for any of these constituents.

1.3.4.2 Groundwater Monitoring Data. A number of wells were drilled on the Cordova plant site for the purpose of monitoring the groundwater quality in the SIA. In 1979 and 1981, a network of 5-inch diameter, mild-steel cased wells with a short (3-foot) section of stainless steel screen were placed about 20 to 30 feet below the top of the water table. These wells are designated on Figure 1-11 as MW 1-79, MW 3-79, MW 5-79, MW 81-1, MW 81-2, MW 81-3, MW 81-4, MW 81-5, and the Barn. The Barn is a water well located in the plant recreational area. Well 81-1 is located within the manufacturing area of the site and is considered to be upgradient from the SIA.

As part of the abbreviated RFI, 3M installed two new monitoring wells that meet RCRA design requirements in the SIA (MW 5-90 and MW 6-90). Existing monitoring wells at the site were used in this study as piezometers. These older wells were not constructed to current RCRA specifications. They were typically screened beneath the ground water table and constructed of materials other than stainless steel or Teflon®. The location of the new wells are coincident with two existing wells, screened at deep intervals which would provide information on the vertical gradient in these areas. One upgradient well was installed at the center of the site to provide

background ground water quality information. Five wells were placed in the wastewater treatment facility area to provide down-gradient water quality information.

The two RCRA wells were sampled and analyzed in October 1989 for 40 CFR 265, Appendix IX, constituents except dioxins and furans. Data was also obtained on aluminum, alkalinity, hardness, boron, calcium, chloride, fluoride, iron, magnesium, manganese, nitrate, potassium, silica, sodium, strontium, and sulfates. Sampling and analyses were conducted with Contract Laboratory Procedures (CLP). Samples were taken with appropriate tools and stored in appropriate containers. Required preservatives were used, samples were shipped in accordance with requirements, and analyses were conducted within the specified holding times. Full Chain-of-Custody documentation was prepared. Both field duplicates and laboratory duplicates were collected and analyzed. Method spikes and travel blanks were also collected. Precautions were taken to avoid cross contamination. Wells were stabilized and samples of ground water were filtered in the field as appropriate.

With the exception of nitrate, the source of which is believed to be releases from a fertilizer plant in the area, neither Well 5-90 nor Well 6-90 showed elevated concentrations of any hazardous constituent or water quality parameter.

1.3.4.3 Crop Data. Feed corn is the only agricultural crop currently harvested from the Sludge Incorporation Area. Corn samples are taken at the end of each growing season at approximately twelve locations. The number of sampling locations is dependent on the size of the harvest. Each sample consists of five ears of corn taken from within the sampling locations. These locations typically include two from the control areas, one from zone 10, and the remaining locations

are selected randomly from around the planted fields. These samples are composited and analyzed for heavy metals and the yield is recorded. The results are submitted to IEPA and indicate that no sludge constituent has transferred into the crops.

1.3.4.4 Summary of Migration Pathway Data. Hazardous constituents as defined by 40 CFR 264, Appendix IX, have been found to be present in samples collected from the sludges applied to the SIA. However, migration of these constituents through the soil into the groundwater or crops has not occurred.

SECTION 2

PROJECT MANAGEMENT PLAN

2.1 INTRODUCTION

The purpose of the Project Management Plan is to document the overall management approach to the RFI, including implementation of the detailed site investigation. This plan includes a discussion of both the technical approach and schedule of activities for the RFI. In addition, personnel organization, job description, and qualifications of those conducting or directing the RFI are discussed.

2.2 TECHNICAL APPROACH

The goal of the RFI is to determine whether there has been a release of any hazardous waste or hazardous constituent from these units to the environment. The technical approach to be used for the facility investigation is detailed in the RCRA Part B Permit (Attachment 1 of the Permit) and guided by data generated during previous sampling events. Based upon the information set forth in the permit, the site investigation will examine two SWMUs at the Cordova facility: **1)** the WWTP Area; and **2)** the SIA. A summary of the sampling and analyses to be conducted is also provided in the Field Sampling Plan (Section 3 of this Work Plan).

2.2.1 WWTP SWMU

The WWTP Area contains twelve monitoring wells (MW 1-88, MW 1-90, MW 2-90, MW 3-90, MW 4-90, MW 7-90, MW 8-90, MW 9-90, MW 3-94, MW 4-94, MW 5-94, and MW 6-94),

as shown in Section 3 of the FSP. The wells will be sampled and analyzed for the following list of parameters as specified in Attachment 1 of the Permit:

1. 40 CFR 264, Appendix IX, Volatile Organics;
2. 40 CFR 264, Appendix IX, Total and Dissolved Metals;
3. Water Quality Characteristics (alkalinity, hardness, chloride, cyanide, fluoride, nitrate, nitrite, sulfate, and sulfide); and
4. Total and Dissolved Water Quality Metals (Al, B, Ca, Fe, Mg, Mn, K, Na, and Sr).

A list of 40 CFR 264, Appendix IX, constituents (except pesticides, dioxins, and furans) is provided in the FSP. The Permit does not specify total or dissolved metals analyses. 3M has elected to have both conducted. Furthermore, 3M has added polychlorinated biphenyls (PCBs) to the target parameter list.

2.2.2. SIA SWMU

The SIA currently contains four groundwater monitoring wells (MW 5-90, MW 6-90, MW 1-94, and MW 2-94) that meet RCRA construction requirements, as shown in the FSP. In addition, 3M will collect a groundwater sample from the monitoring well (MW 7-94) installed in the new sludge incorporation area known as Zone 12. This well also meets RCRA construction requirements. All five wells will be sampled and analyzed for 40 CFR 264, Appendix IX, constituents (except pesticides, dioxins, and furans), as shown in the FSP. Since the Permit does not specify total or dissolved metals analysis, 3M has elected to perform both. Furthermore, PCBs will be added to the target parameter list.

In addition to collecting groundwater samples in the SIA, soil samples will be collected in the SIA. Soil sampling has been added to the RFI upon the recommendation of USEPA, Region 5. Seven surface samples (0 to 12 in) will be collected. The soil samples will be analyzed for the same constituents as the SIA groundwater samples including PCBs (dissolved metals not withstanding).

2.3 PROJECT SCHEDULE

Based upon the technical approach outlined in the previous section, a schedule has been created that allows 3M Company to complete all testing and analysis in compliance with regulatory time constraints. A time line illustrating the projected schedule of RFI activities is presented in Figure 2-1. The completion time scheduled is adequately conservative to account for unforeseen schedule changes

The site investigation will commence within 45 days after work plan approval or when soil conditions allow sample collection. Soil sample collection will not occur when the ground is frozen. It is estimated that field work for the WWTP Area will require approximately four to five days to complete and that field work for the SIA will require approximately four to five days. It should also be noted that work will be discontinued if the wind chill index drops below 0°F as specified in the Health and Safety Plan (Section 6 of the Work Plan). Laboratory analysis of groundwater and soil samples will be completed in six to eight weeks for both SWMUs. The Draft RFI Phase I Report will be submitted no later than 12 months after the RFI Work Plan is approved by USEPA, Region 5.

FIGURE 2-1. TIMELINE FOR 3M COMPANY RFI PHASE I ACTIVITIES

SAMPLING EVENTS		TIME LINE	REGULATIONS AND REPORTS	
EVENT	DATE		DATE	DESCRIPTION
			0 days	Approval of RFI Work Plan
			45 days *	Implementation of RFI Phase I * of Approval of Work Plan or when soil conditions allow sample collection
Collect 12 groundwater samples from monitoring wells in Wastewater Treatment Plant Area	60 days			
Collect 5 groundwater samples from monitoring wells in Sludge Incorporation Area	65 days			
Collect 7 soil samples from the Sludge Incorporation Area	67 days			
Laboratory Analytical Results of groundwater and soil samples from Wastewater Treatment Plant Area Area and Sludge Incorporation Area	120 days			
Conduct Data Validation	150 days			
Any resampling that may be required.	160 days			
Laboratory Analytical Results of samples collected during resampling, if necessary	180 days			
Conduct Data Validation for resampling event, if necessary	210 days			
			275 days	Compile Draft RFI Phase I Report
			12 months	Draft RFI Phase I Report Submission
			45 days after receipt of the Regional Administrator's comments on Draft RFI Phase I Report	Final RFI Phase I Report Submission

2.4 PERSONNEL QUALIFICATIONS

This project will require a well-coordinated team effort involving 3M Company, its subcontractors, and regulatory agencies. The regulatory body governing the project is USEPA, Region 5, in Chicago, Illinois. The project management team will consist of several levels of expertise. All personnel involved with any aspect of the facility investigation will be duly qualified and will have received appropriate training. The organization for this project is described in detail in the QAPP submitted to USEPA, Region 5, under separate cover.

SECTION 3

FIELD SAMPLING PLAN

3.1 INTRODUCTION

This FSP has been prepared to address field sampling activities conducted as part of the RFI Phase I sampling program. The FSP contains a statement of sampling objectives, analyses of interest, sample media, sample locations and frequency, and schedule. The FSP will be used to determine if any hazardous waste or hazardous waste constituents have been released to the environment from the two SWMUs located at 3M's Cordova facility: **1)** the WWTP and **2)** the SIA. Certain specific details of the sampling program, such as quality assurance and quality control (QA/QC) procedures and equipment, are found in the QAPP.

3M provided USEPA, Region 5, with a description of historical sampling events and monitoring data in a background information report entitled, "Revised Background Information on Wastewater Treatment Plant" (August 1995). This background information report summarizes the findings of the historical groundwater, soil, and sludge sampling events and monitoring data. Data contained in this background information report were used in the formulation of this FSP. The background information report and this FSP divide the historic investigations and monitoring programs into two categories: **1)** Not RFI-related data; and **2)** RFI-related data. Analytical data of samples with detectable constituent levels are consolidated into two tables in the background information report, which have been included in the QAPP as Appendix 14. A list of analytical parameters and the associated concentrations which have been detected in groundwater samples

collected during previous studies is provided in Table 7-4 in Section 7 of this QAPP. The following is a description of the studies which were included in the August 1995 background information report.

3.1.1 Not RFI-Related Data

From 1975 to the present, metals and other inorganic parameters have been monitored in the sludges, groundwater, soil, and crops at the 3M Cordova site, in accordance with the IEPA SIA permit, to demonstrate that metals are being adsorbed by the surficial layer of soil in the SIA and are not migrating downward.

Samples of the sludges being land-applied are collected and analyzed on a semi-annual basis. The sludge samples are analyzed for percent total solids, total Kjeldahl nitrogen (TKN), pH, ammonia nitrogen, nitrate nitrogen, phosphorus, total iron, total copper, total nickel, total zinc, total lead, total cadmium, total cobalt, total manganese, trivalent chromium, and hexavalent chromium using the methods described in 40 CFR 136. Results from the sampling indicate that copper, cobalt, nickel, and zinc are present in the aerobic digester sludge. The results also indicate that cobalt, chromium, copper, nickel, zinc, and occasionally, lead are present in the inorganic sludge.

Groundwater monitoring wells are sampled and analyzed on a semiannual basis. IEPA's groundwater monitoring requirements have focused on hazardous constituents which are present in the sludges at elevated concentrations or are of particular concern in soil environments. Samples were analyzed for total chromium, cobalt, copper, lead, and nickel from 1976 to 1987. Although not

required by the IEPA SIA permit, 3M began including analyses for soluble metals in 1988. Prior to 1992, soluble nickel and lead had been detected in a few groundwater samples, at or near the method detection limit. Chromium and copper were added to the parameter list in 1992. Since 1992, soluble chromium, soluble cobalt, soluble copper, and soluble lead have not been detected in any groundwater samples. Soluble nickel was detected in groundwater samples collected in October 1994. Surface soil (top 6 inches until 1993 and 8 to 12 inches since 1993) samples are collected once per year and analyzed for total metals. The soil sampling data have shown elevated concentrations of nickel, cobalt, and zinc in the upper levels of the soil. Corn samples are taken at the end of each growing season at approximately 12 locations. These samples are composited and analyzed for heavy metals. The results indicate that the uptake of sludge constituents is minimal to non-existent.

In December 1981, samples from the Aerobic Sludge Digester and Inorganic Sludge Holding Basins and monitoring wells in the SIA were collected and analyzed for the USEPA Priority Pollutant list using USEPA Methods 624, 625, and 608 and "Methods for Chemical Analysis of Water and Wastes" (USEPA, EMSL - Cincinnati, Ohio, March 1979). Results indicated the presence of antimony, chromium, copper, lead, mercury, nickel, silver, zinc, cyanide, phenols, *delta*-BHC, heptachlor, Aroclor 1254, toluene, anthracene, bis(2-ethylhexyl)phthalate, chrysene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene in one or both of the sludges. Methylene chloride and chloroform were routinely found in the groundwater samples, but were considered to be probable laboratory contaminants. No cyanide, phenols, or pesticides were detected

in the monitoring wells. No volatile or semivolatile organic compounds were detected except toluene and di-*n*-butylphthalate. Zinc, lead, copper, nickel, and selenium were detected in some of the groundwater samples.

In December 1986, samples from the Aerobic Sludge Digester and Inorganic Sludge Holding Basins were taken and analyzed for volatile and semivolatile organic compounds using USEPA Methods 624 and 625. Only low levels of toluene and phenol were detected in the Aerobic Digester sludge. No volatile or semivolatile organic constituents were detected in the inorganic sludge.

In 1991, 3M began a program to collect and analyze samples of wastewater entering the WWTP Equalization Basin II from the Primary Settler for benzene in response to the Toxicity Characteristic (TC) Rule, promulgated on March 29, 1990. With the construction of the Equalization Tank 1 in 1994, the effluent sample collection point was moved from the Primary Settler to the Equalization Tank 1. Benzene was detected in the wastewater from July 1991 through April 1992 at levels less than the TC level of 0.5 mg/L, but has not been detected since. Equalization Basin II has been replaced with an aboveground tank (Equalization Tank II).

In February and April 1991, samples from the Aerobic Sludge Digester and Inorganic Sludge Holding Basins were collected and analyzed for the characteristic of toxicity using the toxicity characteristic leaching procedure (TCLP). The two constituents detected, barium and methyl ethyl ketone, were at least three orders of magnitude less than the TCLP regulatory limit for determining hazardous wastes. Thus, the sludges are not considered hazardous wastes.

From March 1992 to the present, treated effluent has been collected and analyzed for USEPA Priority Pollutants and other compounds as part of a special studies provision of the NPDES permit. Generally, the constituents methylene chloride, phenanthrene, toluene, benzene, bis(2-ethylhexyl)phthalate, chloromethane, chloroethane, acetone, isopropanol, tetrahydrofuran, *tert*-butanol, ethyl ether, total xylenes, ethanol, and naphthalene have been detected a number of times and have been detected in the most recent monitoring events. Most of these compounds were detected at trace levels. In addition, 2,4-dimethylphenol; ethylbenzene; anthracene; isophorone; diethylphthalate; 1,1-dichloroethane; 1,2-diphenylhydrazine; benzidine; 2-butanone; 2-methylphenol; carbazole; 1,3,5-trimethylbenzene; 1,2,4-trimethylbenzene; 1,2-dichlorobenzene; dimethyl disulfide; 4-methyl-2-pentanone; and *n*-butanol have either only been detected once or only a few times several years ago.

In March 1993, wastewater samples were collected from the three WWTP polishing ponds and analyzed under a special program to evaluate the ponds with respect to the Universal Treatment Standards promulgated on September 19, 1994. Initial grab and 24-hour composite samples were collected and analyzed for hazardous waste code F039 constituents and general organics using SW846 methods. Acetone was detected in the initial grab, but not in the composite samples. Cresol was detected in two composite samples. Acetophenone, barium, and zinc were detected in one composite sample. Nickel was detected in three composite samples.

In 1994, Equalization Basin II was closed in accordance with a RCRA Closure Plan approved by USEPA, Region 5, and has since been demolished and replaced by an aboveground tank.

USEPA, Region 5, approved clean closure of the Equalization Basin II on March 15, 1995, upon review of the Closure Report and Certification. As part of the closure activities, samples from four monitoring wells (MW 7-90, MW 1-91, MW 2-91, and MW 4-90) and the facility water system were collected for laboratory analysis. Additional closure activities included removing wastewater from Equalization Basin II, removing and disposing of sludge, cleaning the basin walls, and collecting wall rinsate samples. Sludge samples were collected and analyzed using SW846 methods. Acetone, acetonitrile, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, methylene chloride, ethylbenzene, lead, mercury, nickel, Aroclor 1242, Aroclor 1260, propionitrile, thallium, toluene, vanadium, total xylenes, and zinc were detected in the sludge samples collected from the bottom of Equalization Basin II. The groundwater samples were analyzed for the 40 CFR 264, Appendix IX, constituents (except pesticides, dioxins, and furans) using "Test Methods for Evaluating Solid Waste" (third edition) methods. Assessment of the analytical results indicated that no 40 CFR 264, Appendix IX, compounds were detected in the groundwater samples collected from the monitoring wells, with the exception of total xylenes which were detected at a level of 8.1 μg/L in MW 1-91. This level is several orders of magnitude less than the USEPA, Region 5, Data Quality Level (DQL) of 1,400 μg/L. Therefore, no further investigative or remedial action was required.

3.1.2 RFI-Related Data

In May 1987, sludge samples were collected from the WWTP Polishing Ponds #1 and #2, the Aerobic Sludge Digester, and the Inorganic Sludge Holding Basin and analyzed for the 40 CFR,

Appendix VIII, organic constituents, additional organics (in accordance with SW846), and inorganic constituents (in accordance with SW846 and 40 CFR 136). Acetaldehyde, carbon disulfide, fluoride, benzene, ethylbenzene, toluene, total xylenes, bis(2-ethylhexyl)phthalate, fluoranthene, fluorene, phenanthrene, pyrene, and phenol were each detected in at least one of the sludge samples.

In the fall of 1989, 3M initiated a site investigation to provide specific monitoring data which would be used to adequately define the need for and scope of a future RFI. Groundwater, soil, and sludge samples were collected from the WWTP and SIA SWMUs. A total of nine monitoring wells were installed: **1)** six in the WWTP; **2)** two in the SIA; **3)** and one upgradient of these areas at the northwest corner of the 3M property. Groundwater, soil, and sludge samples were analyzed for the 40 CFR 264, Appendix IX, constituents (except dioxins and furans). In addition, data were obtained on water quality parameters. Assessment of the analytical results indicated that no 40 CFR 264, Appendix IX, volatile organics (Method 624), semivolatile organics (Method 625), organochlorine pesticides/PCBs (Method 608), or herbicides (Method 615) were detected in any of the groundwater or soil samples. The groundwater sample collected from one well in the WWTP had an above background concentration of cobalt. The groundwater samples collected from several of the wells in the WWTP had low concentrations of barium, strontium, nickel, zinc, iron, manganese, fluoride, and cyanide. Assessment of the levels of barium and strontium indicated they were near natural background levels. The concentrations of nickel, zinc, iron, and manganese were only slightly above the detection limits. Fluoride concentrations were slightly above background levels in two wells and, in one well, slightly above the maximum contaminant level (MCL) of 4.0 mg/L. All of the total

cyanide concentrations were below proposed drinking water MCL and maximum contaminant level goal (MCLG) of 0.2 mg/L. In the majority of the monitoring wells, elevated concentrations of nitrate were detected, likely the result of the migration of nitrates from a fertilizer plant located south/upgradient of the 3M site. Soil and groundwater samples collected in the SIA had concentrations below background levels for all inorganic hazardous constituents, including heavy metals, with the exception of one soil sample.

3.2 SAMPLING OBJECTIVES

The objective of the RFI Phase I Sampling is to obtain samples for the purpose of determining the presence or absence of hazardous waste(s) or hazardous waste constituents (at or above the PRLs specified in Table 7-1 in the QAPP) which may have been released to the environment from the two SWMUs located at the 3M Cordova facility. Appendix IX pesticides, PCBs, dioxins, and furans were expressly deleted from the parameter list by language included in Attachment 3 of the RCRA Part B Permit because these compounds have not been used as raw materials on the site and have not been products, nor been contained in products produced on the site. Since trace levels of compounds that are, or appear to be, PCBs have been detected on site, 3M has elected to add PCBs to the parameter list.

Phase I sampling and analysis includes resampling and reanalysis of those samples for which analytical data does not meet quality assurance and quality control objectives and are consequently not usable for decision making purposes. The list of analytical parameters for any subsequent

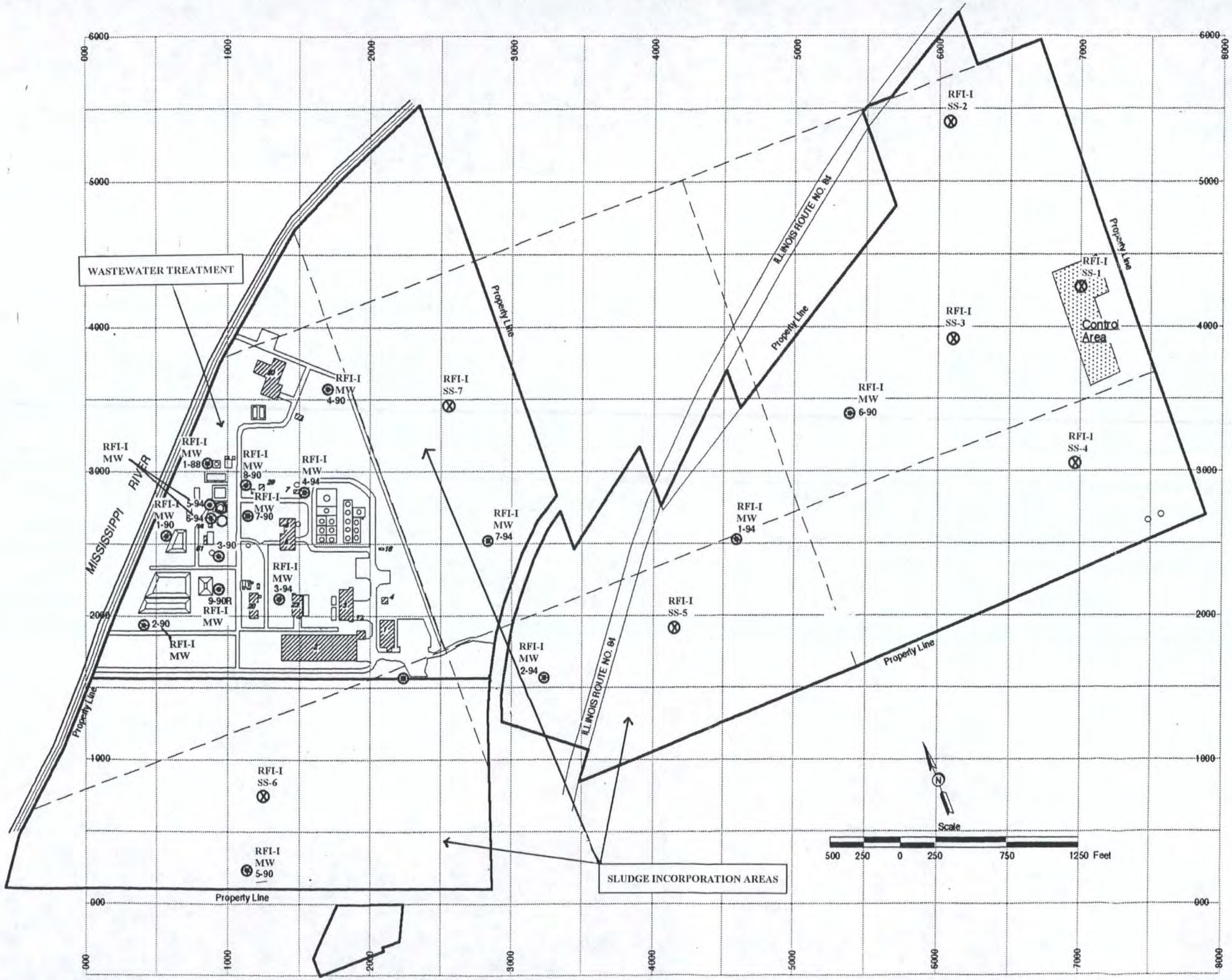
sampling round(s) will be based on results of the rigorous data review of the first round of sampling and analysis discussed in the project QAPP. The validated Phase I sample analytical results will be compiled, as presented in the Data Management Plan (Section 5 of the RFI Work Plan), and submitted to the USEPA Regional Administrator for review.

3.3 SAMPLING PROCEDURES

Through evaluation of the results obtained from previous investigations at the site, groundwater has been determined to be the medium of concern for this RFI. In order to provide additional data for use in evaluating the impact or potential impact, if any, of sludge incorporation activities on groundwater, surface soil samples from the SIA will also be collected and analyzed for the same parameters as the groundwater samples collected in the SIA. The sampling procedures developed for this RFI are consistent with these objectives and the requirements of the RCRA Part B Permit. The groundwater monitoring well and surface soil locations for this investigation are shown in Figure 3-1.

3.3.1 Groundwater Monitoring Well Installation

In January 1994, four additional groundwater monitoring wells were installed in the WWTP Area, and two additional wells were installed in the SIA, as required by the RCRA Part B Permit. These wells will be used in conjunction with the ten previously existing wells to evaluate if a release of hazardous waste or hazardous waste constituents has occurred from the SWMUs.



3M

CORDOVA

Monitor Well And Soil Sampling Locations To Be Used In RFI

⊗ Monitor Well Location

⊗ Soil Sampling Location

FIGURE 3-1

Revised November 1996

In addition to the SIA Zones noted in the RCRA Part B Permit, a new zone (Zone 12) has been permitted by IEPA. Well MW 7-94, located in the southern portion of Zone 12, has been added to this RFI as a monitoring well.

The new groundwater monitoring wells, including MW 7-94 in the new sludge application zone, were installed in the same, approved method used for the previous wells. Boring logs are provided in Appendix 2 of the RFI Work Plan. The monitoring wells are constructed of two-inch nominal I.D. 316 screen and 304 stainless steel, flush-jointed well casing. A 10 or 15-foot section of nominal 0.01-inch manufactured 316 stainless steel slotted screen was installed at the bottom of the boreholes. The screen interval was positioned to intersect the apparent groundwater table encountered while drilling. A 2-inch I.D. solid 304 stainless steel riser pipe was attached to each screen and extended to approximately three feet above the existing ground surface.

The borehole annulus was backfilled with #3 Muscatine gravel pack to a point approximately two feet above the slotted screen interval. An approximate two foot layer of bentonite pellets was placed in the annulus above the gravel pack and hydrated with potable water. The remaining annulus was filled with a cement/bentonite grout. A 316 stainless steel plug and top cap were installed at each well. A lockable steel protector cover was placed over each well casing. The protector cover extends below ground surface and is imbedded in concrete. Four inch nominal diameter steel protective bollards were imbedded outside a concrete splash pad measuring approximately three square feet by four inches in thickness. Each well is secured with a padlock.

3.3.1.1 Well Development

The monitoring wells were developed after installation. Groundwater was removed utilizing a two-inch submersible pump until pH, specific conductance, and temperature readings in each well were reasonably stabilized.

3.3.1.2 Well Surveying

The top of casing (TOC) elevations of the monitoring wells were measured relative to the TOC of existing monitoring wells. Elevations were measured with a surveyor's level, monitoring well locations were measured with a tape, and angles were estimated. The locations and elevations should be considered accurate only to the degree implied by the methods used.

3.3.2 Groundwater Monitoring Well and Surface Soil Sampling Equipment

The equipment selected to collect groundwater samples is a function of the type and size of monitoring well, pumping level and rate requirements, type of potential constituent, analytical equipment, and presence or absence of permanent or dedicated pumping fixtures. Ideally, groundwater sample withdrawal mechanisms will be: **1)** completely inert; **2)** easily decontaminated, cleaned and reused; **3)** able to operate at remote sites in the absence of external power sources; and **4)** capable of delivering continuous flow for purging. A specifically-designed pump (Keck Model SP84, or equivalent, capable of purging from 100 mL/minute to 3 gallons/minute) will be used to collect samples. Disposable fluorocarbon resin (Teflon®) sample bailers will be available as a backup.

Ideally, surface soil sample withdrawal mechanisms will be: **1)** completely inert; **2)** easily decontaminated, cleaned and reused; and **3)** able to operate at remote sites in the absence of external power sources. A stainless steel bucket auger, stainless steel spoon, and stainless steel bowl will be used to collect soil samples.

The sampling devices will be carefully cleaned before they are used. It is important to thoroughly clean sampling equipment and instrumentation in order to minimize the potential for introducing external contaminants to the samples and aquifer. Cleaning procedures outlined in the decontamination procedures will be followed. Spent solutions will be collected and disposed through the WWTP.

3.3.3 Groundwater and Surface Soil Sampling Procedures

A substantial portion of the sampling procedure consists of gathering and cleaning equipment, collecting and labeling sample containers, and completing necessary forms, such as Chain-of-Custody forms. Preparation prior to entering the field is a prerequisite to an orderly and complete sampling schedule. The sampling procedure will be facilitated by first organizing required equipment and supplies. The appropriate containers and preservatives required for each sample should be prepared, labeled, and ready upon initiation of sample collection. Additional sample containers and the required preservatives will be available in the event that the previously prepared containers are broken or inadvertently contaminated. The following discussion describes the sampling methodologies to be followed when obtaining the sample.

3.3.3.1 Groundwater Sampling Procedures

The following procedures have been developed in order to obtain investigative and quality control (QC) samples that provide representative groundwater quality information from the monitoring wells in the sampling network.

1. Identify the well and record its number on a water sampling data sheet and log book. Sample the wells beginning with the well having water which is least likely to contain target parameters as shown in Table 3-1.
2. Clean the top of the well with a clean rag to prevent loose particulate matter from falling into the well during sampling. Place a clean plastic sheeting around the well to provide a clean work area for sampling the well.
3. Measure and record the depth to water from an established datum to the nearest 0.01-foot using a clean electronic water level meter. Measure and record the total well depth from the established datum.
4. Compute the volume of standing water in the monitoring well.
5. Remove the standing water in the well using a submersible pump at a rate which does not exceed the groundwater recovery rate in the well. This will be determined by obtaining a depth to water (DTW) measurement immediately prior to starting the pump. DTW measurements will be obtained periodically to assess well drawdown. Changes will be made to the pumping rate as necessary to minimize the drawdown of the water column. After each well volume is removed, measure and record the

TABLE 3-1. THE ORDER OF MONITORING WELL SAMPLE COLLECTION

SEQUENCE (1), (2)	MONITORING WELL	PREVIOUSLY DETECTED CONSTITUENT
WASTEWATER TREATMENT PLANT AREA		
1	RFI - I MW 4-90	
2	RFI - I MW 2-90	
3	RFI - I MW 1-90	CN
4	RFI - I MW 5-94	
5	RFI - I MW 6-94	
6	RFI - I MW 3-90	CN
7	RFI - I MW 9-90	CN
8	RFI - I MW 3-94	
9	RFI - I MW 7-90	CN
10	RFI - I MW 4-94	
11	RFI - I MW 1-88	Ni, Zn, Co, CN
12	RFI - I MW 8-90	Ni, Zn, F, CN
SLUDGE INCORPORATION AREA		
1	RFI - I MW 5-90	
2	RFI - I MW 7-94	
3	RFI - I MW 2-94	
4	RFI - I MW 6-90	
5	RFI - I MW 1-94	

NOTES:

(1) The monitoring well sample collection sequence was selected so that the wells that are least likely to be contaminated are sampled first (based on previous results and groundwater flow direction).

(2) In the wells for which there are no previous detections, the sampling sequence may be changed in the field based on field conditions.

temperature, pH, specific conductance at 25°C (specific conductance), and turbidity of the groundwater, as described in Section 3.3.3.5 of this FSP. Continue purging the well until these parameters have stabilized. Stabilization is reached when four replicate measurements have been recorded (as defined in the acceptable ranges presented in Section 3.3.3.5). An extremely slow recovery well will be allowed to recover sufficiently for further water removal and then pumped again to depletion prior to sample collection. This procedure will best ensure that the well volume and the water volume in the screen filter pack have been purged and evacuated so that the groundwater that recharges the well is representative of the *in-situ* formation conditions. The well purging procedure is described in detail in Section 3.3.3.4 of this FSP.

6. Upon completion of well purging activities, the well will be allowed to fully recharge. Sampling activities will be conducted after the well is fully recharged and within two hours of the completion of purging activities. In the event that full recovery time exceeds two hours, the samples will be collected as soon as sufficient volumes are available to collect a sample for each parameter. Regardless of well recharge rates, samples destined for volatile organic analysis will be withdrawn from the well within one hour of purging, as described in the next step.

7. Sample bottles will be filled in the order of the volatilization sensitivity of the parameters. As samples are collected, sample containers will be filled in the

following order: **1)** volatile organics (collected within one hour of well purging); **2)** extractable organics; **3)** inorganic constituents; and **4)** water quality parameters. All sample containers, particularly those which are to be used for organic analyses, will be filled to the top to eliminate any headspace and a possible change in volatile constituents. Gently fill sample containers with the water to minimize the volatilization of organic compounds.

- QC Field Duplicate and matrix spike and matrix spike duplicate (MS/MSD) sample containers for organic constituents will be filled before any sample containers for inorganic constituents. When collecting QC Field Duplicate and MS/MSD samples, fill each QC constituent container immediately after filling the original sample constituent container.
- For filtered samples for the dissolved metals analysis, an in-line filter is attached directly to the discharge line on the pump. The samples will be collected using the pump at a flow rate of 200 to 300 mL/min. This rate is similar to the groundwater flow rate.
- Collect equipment blank sample as described in Item 11.
- Prepare trip blank as described in Item 12.

8. After each sample container is filled, the sample tag is completed, the lid is taped to provide an additional seal, and the sample container is placed on ice. All samples will be placed in a shuttle for shipment with proper documentation and will be

transferred to the laboratory as soon as possible for analysis. Samples will be transported to the laboratory by an overnight courier (i.e., Federal Express) either at the end of each day's sampling or the following morning.

9. Measure and record the final water elevation in the well after sampling is complete.

10. Decontaminate the sampling equipment between successive monitoring well locations as described in Section 3.3.8 of this FSP. When collecting an Equipment Blank, run organic-free water which has been provided by the laboratory through the decontaminated pump tubing or over other equipment. Collect the rinsate in the appropriate sample bottles.

11. Organic-free water will be provided by the laboratory in sealed containers and poured into the appropriate sample containers in the field to prepare any required field blanks. In addition, trip blanks consisting of distilled water will be poured into volatile organic compound (VOC) vials at the laboratory and included along with each cooler that contains aqueous VOC samples. The trip blank will remain in the cooler during shipment from the laboratory to the site, while it is stored at the site (if necessary), and during shipment back to the laboratory. The trip blank is only removed from the cooler for labeling with a sample tag. Trip blanks will be prepared by the project laboratory, but labeled in the field.

3.3.3.2 Surface Soil Sampling Procedures

The following generalized procedures have been developed in order to obtain investigative and QC samples that provide representative surface soil quality information from the locations in the sampling network. Surface soil sampling must be scheduled for a time when the ground is not frozen.

Sampling points will be documented as to their exact location for purposes of future sampling. Return to the original sample location will also be aided by surrounding each sample location with temporary fencing. Sample locations will be determined through the use of a global positioning system (GPS) or alternatively, through the use of a monument, measuring tape, and compass. GPS works by using the satellites orbiting the Earth. When the GPS receiver locks on to at least three satellites it can provide latitude and longitude information. As the receiver locks on to each satellite, it calculates the distance from the satellite by measuring the length of time it takes the radio signal to reach it.

The GPS used will be capable of accuracy to approximately three meters. This accuracy, however, is subject to manipulation by the U.S. Department of Defense which can alter information by 100 meters. To adjust for this manipulation, differential correction is needed for "real time" positioning. There is a differential GPS station in East Moline, Illinois which can be used. A GPS receiver and a Differential GPS receiver will be used to obtain readings of latitude and longitude for each soil sampling location.

If, for some reason (e.g., weather or distance) the differential correction signal does not reach the Cordova facility, the "real time" accuracy for GPS is approximately 100 meters and would not be sufficient to allow using the GPS to return the original sampling location. In this situation, the monument, measuring tape and compass method would be used to locate sample locations. A monument will act as a stationary reference point from which all sampling points can be measured using a compass and measuring tape. If a building or other stationary structure exists, its corner may act as this reference point. If no such monument already exists, one will be created by hammering a piece of wood (approximately 2 × 2 inches) into the ground to almost ground level, making it difficult to remove and thus assuring its permanence. The stake will then be marked with flagging tape or fluorescent paint. Standing at the monument, facing the sampling point, use the compass hairlines to determine degree of direction. The line of sight should run from the monument through both hairline needles on the compass, to the sampling point.

When establishing a sample point, the following procedures will be used.

1. Locate the sample point using GPS or the monument, measuring tape, and compass.
   - Identify the location.
   - Record the identification number.
2. Remove plants and other debris from the surface of the location to be sampled.
3. Advance the Stainless Steel Bucket Auger to 12 inches.
4. Immediately place the sample in the auger bucket into a decontaminated stainless steel bowl.

5. Immediately fill sample bottle(s) for volatile organics analysis with soil representative of the 0-12 inch depth also, fill any QC VOC Field duplicate and MS/MSD sample containers. After each sample container is filled, the sample tag is completed, the lid is taped to provide an additional seal, the sample container is placed in a sealable plastic bag and the sample container is placed on ice. All samples will be placed in shuttles for shipment with proper documentation and will be transferred tot he laboratory as soon as possible for analysis. Samples will be transported to the laboratory by an overnight courier (i.e., Federal Express) either at the end of each day's sampling or the following morning.

6. Determine if sufficient volume remains to fill all other sample containers. If not, obtain additional volume by auguring to 12 inches in a location next to the original sample location. Add this soil to the stainless steel bowl. Repeat this process until enough soil is in the bowl to fill all required sample containers.

7. Mix the soil sample with a stainless steel spoon until a homogenous mixture is obtained. Spread the resultant mixed soil evenly in the bottom of the bowl. The soil is quartered into four quadrants, and a small sample is taken from each quadrant and placed in the bottles identified on Table 3-1. When collecting QC Field Duplicate and MS/MSD samples, fill each QC constituent container immediately after filling the original sample constituent container.

8. Organic-free water will be provided by the laboratory in sealed containers and poured into the appropriate sample containers in the field to prepare any required field blanks. In addition, trip blanks consisting of distilled water will be poured into VOC vials at the laboratory and included along with each cooler that contains aqueous VOC samples. The trip blank will remain in the cooler during shipment from the laboratory to the site, while it is stored at the site (if necessary), and during shipment back to the laboratory. The trip blank is only removed from the cooler for labeling with a sample tag. Trip blanks will be prepared by the project laboratory, but labeled in the field.

3.3.3.3 Field Observations

Upon arrival at each groundwater monitoring well and surface soil location, field personnel will note the general well and site conditions on an appropriate field parameter form. For example, general comments about the weather conditions for each sampling date will be recorded. Specific comments on each of the wells will then be made. Typical notations will include, but will not be limited to, location with respect to flooded areas, the presence of nearby desiccation cracks, and missing well locks or caps. Observations related to the physical condition of the well will be recorded if it appears that the well has been damaged (for example, from being vandalized or struck by a vehicle). It will be the responsibility of the field personnel to submit written well maintenance requests to the appropriate party.

3.3.3.4 Well Purging

The water standing in a well casing prior to sampling may not be representative of the *in-situ* groundwater quality. Therefore, each monitoring well will be evacuated and sufficiently purged so that standing water in the well and filter packing may be replaced with formation water. The standard purging protocol is to remove the volume of water in the annular section of the monitoring well. Both industry and regulatory agency guidance recommendations describe three to five well casing volumes as the minimum amount of water to evacuate from the well in order to obtain a representative sample of the in-situ aquifer characteristics. As stated in Section 3.3.3.1, General Groundwater Sampling Procedures, a minimum of four well casings will be purged for this project. The well will be purged following the initial measurements of static water level.

Initially, the water volume in the casing must be calculated to determine the appropriate amount of water to be removed. This volume is ascertained by measuring the water column inside the casing using a water level indicator and determining the total depth of the well and height of the water column. These parameters are used in the following equation to calculate the water volume of the casing.

$$v = \frac{\pi \ x \ (d/12)^2}{4} * h * c \qquad \textbf{(Eq. 1)}$$

Where,

V	=	volume, gallons
π	=	3.142
d	=	inside diameter of well casing, inches
h	=	height of water column, feet
c	=	7.48 gallons/ft^3

The total depth of the well should be known from the monitoring well construction details. It is important, however, to measure the total depth during each sampling event in order to evaluate the monitoring well integrity. The measurement can be used to determine if the screen has collapsed, the casing has failed, or sediment has accumulated in the well.

In instances where field calculation is impractical, the field person may determine the purging volume by using the conversion factors of 0.16, 0.37, 0.65, 1.02, and 1.47 gallons per foot of water in well for 2, 3, 4, 5, and 6 inch diameter wells, respectively. For example, given a 2-inch well with 40 feet of standing fluid, the casing volume is calculated as follows.

Example 1.

40 ft. × 0.16 gals/ft = 6.4 gal per casing volume

Therefore, a minimum of 25.6 gallons of fluid (4 casing volumes) would need to be evacuated before collecting the samples. The sampling personnel will note observations of the purged water on the field parameter form (e.g., odor and color).

Once the required volume of water to be removed from the well has been determined, the selected pumping equipment can be placed into the well casing. The pumping equipment will be cleaned and decontaminated prior to insertion into the casing and also between sampling locations.

In a high yield formation, such as found at the 3M Cordova site, a pump will be placed in the water column above the screened interval to allow fresh water from the surrounding formation to enter and move up the well casing. This will permit complete replacement of standing water. The removal volume can be determined by measuring actual volume or by using a removal rate. The removal rate can be determined by measuring the flow into a graduated cylinder or bucket over a certain time interval. When this removal rate (measured in gal/min) is determined, it can be divided into the casing volume to calculate the time necessary to remove each casing volume. The minimum time required to properly purge the well may be calculated using the following equation.

$$t = V/q \ (x) \qquad \text{(Eq. 2)}$$

Where,

t	=	time required to pump x volumes, minutes
x	=	number of volumes to purge (typically 3 to 5)
V	=	volume, gallons from Equation 1
q	=	constant flow rate, gallons/minute

Two conditions exist where it may be necessary to purge the monitoring well with a bailer rather than the pump. First, the hydrogeologic characteristics of the saturated zone may preclude the standard equipment requirements for well purging and evacuation if the monitoring well exhibits a low water yield. Second, the pump used to purge the well could fail in the field. Under either of these circumstances, the well will be bailed to remove four well casings, as described for purging

with a pump. When not in use, both the bailers and the reels will be stored in sealed and labeled plastic bags in a secure location protected from contamination. The potential for cross-contamination is negligible with this procedure. Well evacuation will be performed by gently lowering the bailer into the well to prevent de-gassing of the fluid column and disturbing any sediment. The bailer will be allowed to fill and then be retrieved from the well.

Purged water will be saved in containers placed adjacent to the wells located in the WWTP. After the casing evacuations have been performed, the collected water will be disposed through the WWTP. Purged water collected from the SIA groundwater monitoring wells will be disposed on the surrounding grounds since no contamination has previously been noted in these wells.

In the case of poorly yielding wells where four casing evacuations cannot be made, the well will be allowed to recover until enough sample volume can be removed for the necessary analyses. This situation may require returning to a well to obtain the sample several hours after it was initially bailed to dryness or returning the following day. This situation is not expected to arise based on past experience at this site.

3.3.3.5 Groundwater Sample Field Parameter Analysis

3M groundwater sampling protocol specifies that samples are collected after temperature, pH, and specific conductivity have stabilized in the water being pumped from the purged well. Measurement of turbidity, reduction - oxidation potential (redox), and dissolved oxygen (DO) concentrations were considered as additional parameters to determine whether the groundwater quality is stable and representative. Experience shows that redox is a difficult parameter to measure

because it is not stable. Also, measuring DO until it is stable is very time consuming. However, turbidity is an acceptable parameter for measurement and will be added to the list of groundwater measurements for each well.

After the well is purged, samples will be collected to measure the parameters that will show that the groundwater quality is stable. The criteria for successive readings is the following:

1. pH: ± 0.1 S.U.;
2. Temperature: ± 0.5 °C;
3. Specific Conductivity: ±10 percent; and
4. Turbidity: ± 10 percent or 1 turbidity unit, whichever is greater.

3.3.4 Obtaining Contaminant-Free Sample Containers

The sample containers will be received by the sampling team directly from the analytical laboratory. The laboratory receives pre-cleaned bottles from their supplier. The sample container supplier provides a certificate of analysis to verify that the bottles have been cleaned according to the USEPA wash procedures set forth in the USEPA Statement-of-Work "Specifications and Guidance for Obtaining Contaminant-Free Sample Containers." The supplier also certifies that the containers have been tested and found to comply with the USEPA specifications as set forth in the USEPA Statement-of-Work "Superfund Analytical Methods for Low Concentration Water for Organics Analysis 6/91" and "The Superfund Analytical Method for Low Concentration Water for Inorganic Analysis 10/91," as applicable.

3.3.5 Groundwater and Surface Soil Sampling Equipment Decontamination

The sample collection pump and tubing and other sampling equipment will be thoroughly cleaned before being used, in order to minimize the potential for introducing contaminants to sampled medium. The in-line filter to collect filtered samples for dissolved metals analysis is disposable and will not require decontamination. The equipment will be decontaminated between successive sampling locations, as described in Section 3.3.8 of this Field Sampling Plan.

3.3.6 Sampling Order

In order to minimize cross-contamination between groundwater samples, the wells of each SWMU will be sampled in the order of least contaminated to most contaminated as shown in Table 3-1. Background wells will be sampled first, and those wells historically showing contamination will be sampled last. Surface soil samples will be collected separately from the collection of groundwater samples.

3.3.7 Sample Numbering

Samples will be designated using a pre-determined 3M Lab Request Number which is unique to this RFI, followed by a consecutive number which is unique for each well and QA/QC sample. The unique identifiers for the various monitoring wells and surface soil samples are listed on Table 3-1. Bottles will also be labeled with a description of the sample location, date, time, name, and preservative used.

3.3.8 Decontamination Procedures

The basic procedure that will be used for cleaning equipment, such as the water level indicator and the stainless steel bucket auger, is as follows:

1. Clean with potable water and laboratory grade detergent solution using dedicated brush;
2. Rinse with potable water;
3. Rinse with methanol (pesticide grade purity), as necessary for equipment used for organic analysis sample collection, and air dry;
4. Rinse with deionized water;
5. Rinse with dilute (5 percent) nitric acid (trace metal grade), as necessary for equipment used for inorganics sample collection; and
6. Rinse with deionized water.

The decontamination procedure for the pump is the following:

1. Rinse the outside of the tubing with deionized water and wipe with a paper towel;
2. Wash the outside of the pump with soap solution;
3. Rinse pump with tap water through the pump, then rinse three times with deionized water; and
4. Run five gallons of deionized water through the pump tubing.

3.4 SPECIFICATION OF EQUIPMENT

3.4.1 Sampling Equipment.

The equipment selected to collect groundwater samples is a function of the type and size of monitoring well, pumping level and rate requirements, type of potential constituent, analytical equipment, and presence or absence of permanent or dedicated pumping fixtures. Ideally, groundwater sample withdrawal mechanisms will be: **1)** completely inert; **2)** easily decontaminated, cleaned, and reused; **3)** able to operate at remote sites in the absence of external power sources; and **4)** capable of delivering continuous flow for purging. A specifically-designed pump (Keck Model SP84 or equivalent capable of purging from 100 mL/minute to 3 gallons/minute) will be used to collect samples. Disposable fluorocarbon resin (Teflon®) sample bailers will be available as a backup.

Ideally, surface soil sample withdrawal mechanisms will be: **1)** completely inert; **2)** easily contaminated, cleaned, and reused; and **3)** able to operate at remote sites in the absence of external power sources. A stainless steel spoon, stainless steel bowl, and stainless steel bucket auger will be used to collect soil samples.

The non-dedicated sample collection pump and other sampling devices will be carefully cleaned before they are used. It is important to thoroughly clean sampling equipment and instrumentation in order to minimize the potential for introducing external contaminants to the samples, soil, and aquifer. Cleaning procedures outlined in Section 3.3.8 of this FSP will be followed.

3.4.2 Personal Protective Equipment

Personal protective equipment (PPE) will be used and worn while sampling the SIA soil and groundwater monitoring wells. Sampling personnel will wear Level D PPE, which includes surgical gloves, steel-toe boots, hard hats, and protective eyewear. A first aid kit and eyewash will be available at all times.

3.4.3 Sample Containers

The sample container to be used is dictated by the analysis required. In general, sample containers for organic analyses are glass bottles with Teflon®-lined caps. Samples requiring volatile organic analyses are small glass vials with Teflon® septa. Samples for inorganic metal and general chemistry analyses are collected in either glass or plastic containers. A list of standard sample containers, preservatives, and holding times to be used is provided in Table 3-2.

3.4.4 Decontamination Equipment

Decontamination equipment is necessary to perform the procedure described in Section 3.3.8 of this FSP. Equipment includes laboratory-grade detergent, dedicated brush, bucket, wash tub, and deionized water.

3.4.5 Field Equipment Checklist

A predetermined equipment checklist will provide assurance that equipment and materials are collected, prepared, and are functioning properly. An example of a field equipment checklist

TABLE 3-2. GROUND[illegible]D SURFACE SOIL SAMPLE COLLECTION INFORMATION

Surface Soil/ Monitoring Wells Identification	Constituents To Be Monitored (1)	Number of Field Blanks (2)	Number of Trip Blanks (3)	Number of Equipment Blanks (4)	Number of Field Duplicates (5)	Number of MS/MSD (6)	CONTAINERS (7) Quantity	Size	Type	Preservative	Holding Time (8)	Analytical Method	Parameter
Wastewater Treatment Plant Area (WWTPA)													
Existing Wells: RFI-I MW1-88 RFI-I MW1-90	40 CFR 264 Appendix IX Volatile Organics &	1	1	1	1	1	3	40 mL	glass vial with teflon-lined septa and no headspace	HCl, pH <2 Cool, 4 C	14 days	8260A	Appendix IX volatiles
RFI-I MW2-90 RFI-I MW3-90	Hexachlorobenzene, PCBs & Total & Dissolved	1	0	1	1	1	2	1 L	amber glass with teflon-lined lid	Cool, 4 C	7 days (extraction) 40 days (analysis)	8080A	Appendix IX PCBs/ Hexachlorobenzene
RFI-I MW4-90 RFI-I MW7-90	Metals, Total & Dissolved	1	0	1	1	1	1	1 L	high density polyethylene	HNO3, pH <2	6 months	6010A (trace)	total Appendix IX & water quality metals except mercury
RFI-I MW8-90	Water Quality										28 days	7470A	total mercury
RFI-I MW9-90	Metals & Water Quality Characteristics	1	0	1	1	1	1	1 L	high density polyethylene	Field filtered through 0.45 um filter then: HNO3, pH <2	6 months	6010A (trace)	dissolved Appendix IX & water quality metals except mercury
											28 days	7470A	dissolved mercury
		1	0	1	1	1	1	250 mL	high density polyethylene	HNO3, pH <2 Cool, 4 C	6 months	130.2	total hardness
		1	0	1	1	1	2	1 L	high density polyethylene	Cool, 4 C	14 days	310.1	alkalinity
											28 days	325.3/9252A	chloride
											28 days	340.2	fluoride
											28 days	375.4	sulfate
		1	0	1	1	1	1	250 mL	glass	H2SO4, pH < 2 Cool, 4 C	28 days	353.2	total nitrate/nitrite nitrogen
		1	0	1	1	1	1	250 mL	high density polyethylene	NaOH, pH >12 Cool, 4 C	14 days	9012	total cyanide
		1	0	1	1	1	1	1 L	high density polyethylene	NaOH, Zn Acetate pH >9, Cool, 4 C	7 days	376.1/9030A	sulfide
Newly Installed Wells: RFI-I MW3-94	40 CFR 264 Appendix IX Organic Constituents	1	1	0	1	0	3	40 mL	glass vial with teflon-lined septa and no headspace	HCl, pH <2 Cool, 4 C	14 days	8260A	Appendix IX volatiles
RFI-I MW4-94 RFI-I MW5-94	(except pesticides, dioxins, & furans)	1	0	0	1	0	1	1 L	high density polyethylene	HNO3, pH <2	6 months	6010A (trace)	total Appendix IX metals except mercury
RFI-I MW6-94	& 40 CFR 264										28 days	7470A	total mercury
	Appendix IX Total & Dissolved Metals	1	0	0	1	0	1	1 L	high density polyethylene	Field filtered through 0.45 um filter then: HNO3, pH <2	6 months	6010A (trace)	dissolved Appendix IX metals except mercury
											28 days	7470A	dissolved mercury
		1	0	0	1	0	1	250 mL	high density polyethylene	NaOH, pH >12 Cool, 4 C	14 days	9012	total cyanide
		1	0	0	1	0	1	1 L	high density polyethylene	NaOH, Zn Acetate pH >9, Cool, 4 C	7 days	376.1/9030A	sulfide
		1	0	1	1	0	2	1 L	amber glass with teflon-lined lid	Cool, 4 C	7 days (extraction) 40 days (analysis)	8270B	Appendix IX semivolatile organics
		1	0	0	1	0	2	1 L	amber glass with teflon-lined lid	Cool, 4 C	7 days (extraction) 40 days (analysis)	8080A	Appendix IX PCBs/ Hexachlorobenzene
		1	0	1	1	0	2	1 L	amber glass with teflon-lined lid	Cool, 4 C	7 days (extraction) 40 days (analysis)	8150B	Appendix IX herbicides
Sludge Incorporation Area (SIA)													
Wells: RFI-I MW5-90 RFI-I MW6-90	40 CFR 264 Appendix IX Organic Constituents	1	1	1	1	1	3	40 mL	glass vial with teflon-lined septa and no headspace	HCl, pH <2 Cool, 4 C	14 days	8260A	Appendix IX volatiles
RFI-I MW1-94 RFI-I MW2-94	(except pesticides, dioxins, & furans)	1	0	1	1	1	1	1 L	high density polyethylene	HNO3, pH <2	6 months	6010A (trace)	total Appendix IX metals except mercury
RFI-I MW7-94	& 40 CFR 264										28 days	7470A	total mercury
	Appendix IX Total & Dissolved Metals	1	0	1	1	1	1	1 L	high density polyethylene	Field filtered through 0.45 um filter then: HNO3, pH <2	6 months	6010A (trace)	dissolved Appendix IX metals except mercury
											28 days	7470A	dissolved mercury

TABLE 3-2. GROUNI [illegible] D SURFACE SOIL SAMPLE COLLECTION INFORMATION

Surface Soil/ Monitoring Wells Identification	Constituents To Be Monitored (1)	Number of Field Blanks (2)	Number of Trip Blanks (3)	Number of Equipment Blanks (4)	Number of Field Duplicates (5)	Number of MS/MSD (6)	CONTAINERS (7) Quantity	Size	Type	Preservative	Holding Time (8)	Analytical Method	Parameter
Sludge Incorporation Area (SIA) (Continued)													
Wells (Continued)		1	0	1	1	1	1	250 mL	high density polyethylene	NaOH, pH >12 Cool, 4 C	14 days	9012	total cyanide
		1	0	1	1	1	1	1 L	high density polyethylene	NaOH, Zn Acetate pH >9, Cool, 4 C	7 days	376.1/9030A	sulfide
		1	0	1	1	1	2	1 L	amber glass with teflon-lined lid	Cool, 4 C	7 days (extraction) 40 days (analysis)	8270B	Appendix IX semivolatile organics
		1	0	1	1	1	2	1 L	amber glass with teflon-lined lid	Cool, 4 C	7 days (extraction) 40 days (analysis)	8080A	Appendix IX PCBs/ Hexachlorobenzene
		1	0	1	1	1	2	1 L	amber glass with teflon-lined lid	Cool, 4 C	7 days (extraction) 40 days (analysis)	8150B	Appendix IX herbicides
Surface Soil: RFI-I SS1 RFI-I SS2 RFI-I SS3 RFI-I SS4 RFI-I SS5 RFI-I SS6 RFI-I SS7	40 CFR 264 Appendix IX Organic Constituents (except pesticides, dioxins, & furans) & 40 CFR 264 Appendix IX Total Metals	1	1	1	1	1	2	60 mL	glass jar with teflon-lined lid	Cool, 4 C	14 days	8260A	Appendix IX volatiles
		1	0	1	1	1	3	120 mL	glass with teflon-lined lid	Cool, 4 C	6 months	6010A (trace)	Appendix IX metals except mercury
											28 days	7471A	mercury
											14 days	9012	total cyanide
											7 days	376.1/9030A	sulfide
											14 days (extraction) 40 days (analysis)	8270B	Appendix IX semivolatile organics
											14 days (extraction) 40 days (analysis)	8080A	Appendix IX PCBs
											14 days (extraction) 40 days (analysis)	8150B	Appendix IX herbicides

TABLE 3-1 NOTES:

(1) After each monitoring well is purged, a sample will be collected and measured for pH, temperature, specific conductivity, and turbidity in the field.

(2) A field blank consists of contaminant-free deionized distilled water placed into sample container(s) (same quantity, size, type, and preservative as for investigative aqueous samples) in the field and packaged and shipped with the associated samples.
Field blanks will be collected at a frequency of once per day and are to be analyzed for all parameters requested for analysis in the samples collected that day.

(3) A trip blank consists of two preserved VOA vials with no headspace containing organic-free water which accompany the sample bottles during collection and shipment to the laboratory and are stored with the associated samples.
A trip blank will be included in each shuttle containing samples for volatile organics analysis.
Four trip blanks have been included on this table, although the actual number of trip blanks will depend on the actual number of shuttles necessary for transporting the samples for volatiles analysis for this sampling event.

(4) An equipment blank is a field blank which has also been run through the sampling equipment before it is placed into the sample containers.
An equipment blank will be taken after sample collection is completed for each sample matrix at each SWMU (WWTPA and SIA).
Each equipment blank will be analyzed for all parameters requested for analysis in any of the samples of the same matrix in the associated SWMU.

(5) A field duplicate consists of additional container(s) (same quantity, size, type and preservative as the original sample) of an investigative sample which are labelled with an unique identifier.
Field duplicates will be collected for each parameter list for the WWTPA and SIA SWMUs (i.e., one existing and one newly installed well in the WWTPA and one well and one soil location in the SIA).
Field duplicates will be collected from three of the 17 wells and one of the soil locations which exceeds the standard goal of one field duplicate for every 20 samples of a similar matrix.

(6) Matrix spike/matrix spike duplicates
Extra containers for a sample (2 extra volumes of the same quantity, size, type, and preservative as the original sample) to be collected at a frequency to meet the analytical method requirements of one "MS/MSD" set per 20 samples of the same matrix.
The number of MS/MSDs collected will match the number indicated on the table; however, the SWMU from which the samples are collected may vary.

(7) The table indicates the number of containers necessary for the analysis of a sample from each location indicated. Additional containers will be necessary for any required quality control samples.

(8) The holding times specified are from date of sample collection to the date of analysis unless otherwise specified.

(9) Sample containers will be combined for a total quantity of 3 120 mL glass jars for the following six fractions: Appendix IX metals, total cyanide, sulfide, Appendix IX semivolatiles, Appendix IX PCBs, and Appendix IX herbicides.

is provided as Appendix 2 of the RFI Work Plan. Additions to the checklist will be made as necessary.

3.5 ANALYSES OF INTEREST

Analysis of data from the groundwater and soil samples described in this RFI Work Plan will make it possible to determine if a release of hazardous waste or hazardous waste constituents has occurred at either of the Cordova site SWMUs. The RCRA Part B Permit for 3M Cordova (Permit Attachment 1, Task A, Section 4) specifies 16 monitoring well locations in the WWTP Area and the SIA from which the groundwater samples are to be collected and parameters for which the samples are to be analyzed.

In addition to the monitoring well locations specified by the Permit, a groundwater monitoring well (MW 7-94) located in the southern portion of a new sludge incorporation zone of the SIA SWMU (Zone 12) has been added to the RFI. This monitoring well is currently used for obtaining groundwater monitoring data, as required under the state sludge incorporation permit. 3M has added MW 7-94 to the list of wells to be sampled for the RFI because it is desirable to include a monitoring well that is located in Zone 12, which is somewhat separated from the other sludge incorporation zones. The sample from monitoring well MW 7-94 will be collected and analyzed in the same manner as the other SIA groundwater monitoring wells.

Pesticides, PCBs, dioxins, and furans were expressly deleted from the parameter list by language included in Attachment 3 of the Part B permit, because these compounds have not been used as raw materials on the site and have not been products, nor been contained in products

produced on the site. Since trace quantities of compounds that are, or appear to be, PCB compounds have been detected on site, 3M has elected to add PCBs to the parameter list for the 17 monitoring wells. Furthermore, in addition to the required total metals analyses, 3M has elected to analyze the groundwater samples for dissolved target metals. 3M believes that sediment can, and often does, get into groundwater samples and causes elevated levels of metals which can be inappropriately assumed to be representative of the groundwater. 3M believes that groundwater is naturally filtered as it moves through an aquifer and that filtered samples provide a more accurate indication of true water quality (e.g., soluble metals).

Furthermore, 3M has added the sampling and analysis of surface soil (0 to 12 inches) samples which represent the zones in which sludge incorporation activities take place from the SIA SWMU to the RFI. Surface soil samples will be collected from a total of seven locations throughout the SIA to obtain the broadest possible representation of the entire SIA SWMU for the RFI. Six of the locations are within zones used for sludge incorporation, including newly added Zone 12, and one of the locations is within the "control zone." The "control zone" is within the SIA and therefore, it has the same soil characteristics, is exposed to the same weather conditions, and is subjected to the same agricultural activities as the rest of the SIA. However, no sludge has ever been incorporated in the "control zone." The surface soil samples will be analyzed for the same set of parameters as the groundwater samples taken from the SIA monitoring wells. This will allow for the best evaluation of the impact or potential impact, if any, of the sludge incorporation activities on the groundwater.

The identifications and analyses for the monitoring wells specified in the Permit, monitoring well MW 7-94, and the surface soil samples are presented in Table 3-2 of this FSP. The monitoring well locations are presented in Figure 3-1 of the FSP.

3.5.1 Wastewater Treatment Plant Area

The WWTP area contains eight previously existing monitoring wells (MW 1-88, MW 1-90, MW 2-90, MW 3-90, MW 4-90, MW 7-90, MW 8-90, and MW 9-90), as shown in Figure 3-1. These wells will be sampled and analyzed for the following parameters (as specified in Attachment 3 to the RCRA Part B Permit plus the analysis for PCBs and for both total and dissolved metals):

1. 40 CFR 264, Appendix IX, volatile organics;
2. 40 CFR 264, Appendix IX, PCBs;
3. 40 CFR 264, Appendix IX, total and dissolved metals;
4. Water Quality Characteristics (alkalinity, hardness, chloride, cyanide, fluoride, nitrate, nitrite, sulfate, and sulfide); and
5. Total and Dissolved Water Quality Metals (Al, B, Ca, Fe, Mg, Mn, K, Na, and Sr).

Four additional groundwater monitoring wells (MW 3-94, MW 4-94, MW 5-94, and MW 6-94) were installed in January 1994. These four wells will be sampled and tested for all 40 CFR 264, Appendix IX, constituents (excluding pesticides, dioxins, and furans) as specified in Attachment 3 to the RCRA Part B Permit plus the analysis for PCBs and for both total and dissolved metals.

3.5.2 Sludge Incorporation Area

The SIA contains two previously existing groundwater monitoring wells (MW 5-90 and MW 6-90), as shown in Figure 3-1. Two additional monitoring wells (MW 1-94 and MW 2-94) were installed in January 1994. One additional well (MW 7-94) was installed in March 1994 in the new SIA zone (Zone 12). All five wells will be sampled and analyzed for all 40 CFR 264, Appendix IX, constituents (excluding pesticides, dioxins, and furans) as specified in Attachment 3 to the RCRA Part B Permit plus the analysis for PCBs and for both total and dissolved metals.

Surface soil samples will be collected from a total of seven locations throughout the SIA. Six of the locations are within zones used for sludge incorporation, including newly added Zone 12 and one of the locations is within the "control zone." The surface soil samples will be analyzed for the same set of parameters as the groundwater samples taken from the SIA monitoring wells (all 40 CFR 264, Appendix IX, constituents (excluding pesticides, dioxins, and furans).

3.5.3 Analytical Methods

The samples collected as part of this RFI will be analyzed using methods specified in SW846 (Third Revision, 1986, and updates, as applicable) Methods for Chemical Analysis of Water and Waste (March 1983) and Standard Methods for the Examination of Water and Waste (17th and 18th edition). A list of all parameters and associated laboratory methods are presented in Table 3-1. Detailed information on the analytical and data validation procedures is provided in the QAPP.

3.6 SAMPLE TYPES, LOCATIONS, AND FREQUENCY

The objective of the Phase I Sampling is to determine if any hazardous wastes or hazardous waste constituents have been released from the 3M Cordova facility SWMUs. During Phase I Sampling, all sample types will be grab samples. A grab sample is defined as an individual sample collected from a single location at a specific time or period of time, generally not exceeding 15 minutes.

The sampling locations were chosen with an effort to provide representative data. Groundwater in the WWTP Area will be monitored in 12 locations, as shown in Figure 3-1. Groundwater in the SIA will be monitored in five locations, as shown in Figure 3-1. Surface soil in the SIA will be monitored in seven locations, also as shown in Figure 3-1. The wells and surface soils will be sampled once during Phase I of the RI and analyzed for the constituents listed in the preceding section, as specified in Attachment 3 of the RCRA Part B Permit.

If any of the data generated from the Phase 1 sampling and analysis activities do not meet the data quality objectives (DQO) and are not usable for decision-making purposes, resampling and reanalysis may be performed upon evaluation of the data, as outlined in the QAPP. If resampling and reanalysis is necessary, it will be subject to approval by USEPA, Region 5. 3M will notify USEPA, Region 5, of any proposal to delete parameters from the analyses previously conducted. The presence of hazardous wastes or hazardous waste constituents in any Phase I sample will be reported to the USEPA, Region 5.

3.7 QUALITY ASSURANCE

The overall quality assurance objective is to ensure that the data are of known and acceptable quality. To achieve the overall DQO, proper sample handling, analysis, and data management procedures will be followed. These procedures are described in the QAPP which has been submitted to the USEPA, Region 5. The field QA procedures are described below.

3.7.1 Field Blank Collection.

Organic-free water will be provided by the laboratory in sealed containers and poured into the appropriate sample containers in the field to prepare a field blank. This will determine if any contaminants present in the area may have an effect on the sample integrity. One field blank will be collected each day of field work and per matrix.

3.7.2 Field Duplicate Collection.

The duplicate samples will be assigned a unique number and collected and handled in a manner identical to the original sample. Two groundwater field duplicate samples will be collected from the WWTP Area, and one groundwater field duplicate sample and one surface soil field duplicate sample will be collected from the SIA. Any difference in the results between the duplicate and the original may be attributed to: **1)** laboratory error; **2)** analytical uncertainty; or **3)** field or laboratory sampling or processing errors.

3.7.3 Trip Blank Preparation.

Trip blanks will be analyzed for VOCs. They will be used to monitor volatile organic migration during sample shipment and storage. One trip blank consisting of distilled water will be poured into VOC vials at the laboratory and included along with each cooler that contains aqueous or soil VOC samples. The trip blank sample is collected at a frequency of one per matrix per shipping cooler of VOC samples.

The trip blank will remain in the cooler during shipment from the laboratory to the site, while it is stored at the site (if necessary), and during shipment back to the laboratory. The trip blank is only removed from the cooler for labeling. Trip blanks will be prepared by the project laboratory, but labeled in the field.

3.7.4 Matrix Spike/Matrix Spike Duplicate Collection.

Samples will be collected in the field, as directed by the laboratory for the MS/MSD analysis. Field personnel will collect these samples in the same manner as all other groundwater and surface soil samples.

3.7.5 Equipment Blank

One equipment blank will be collected during the sampling of the WWTP Area, one during groundwater sampling of the SIA, and one during surface soil sampling of the SIA. The equipment blank for groundwater samples will be collected by running organic-free water, which has been

provided by the laboratory, through the pump tubing and into the sample container. The equipment blank for surface soil samples will be collected by pouring organic-free water, which has been provided by the laboratory, over the stainless steel spoon and auger, then into the stainless steel bowl (except for volatiles), and finally into the sample containers.

3.7.6 Logbook

A bound-page logbook will be used to record field activities. Each page will be numbered and dated. Information to be recorded includes site conditions, sample number, *in-situ* measurements, personnel, and health and safety activities. In addition, variances from the approved QAPP will be noted. Minor variances will have to be approved by the 3M Project Manager. Major variances will have to be approved by USEPA, Region 5.

3.8 SCHEDULE

As required by the Part B Permit, 3M plans to initiate field sampling activities within 45 days of the Work Plan and QAPP approval by USEPA, Region 5. However, at the time the Permit was drafted and issued, it was not anticipated that soil samples would be required. The soil samples will be taken to be representative of the top 12 inches of soil in the SIA. It is quite typical that this layer of soil at this site is frozen during the winter months. It is anticipated that it will be very difficult to obtain and properly containerize soil samples, particularly for volatile organics, if the soil is

frozen. In order to prevent this problem from occurring, 3M will adhere to the following plan of action.

1. Soil and groundwater sampling will be performed concurrently to ensure data is comparable from one medium to another.
2. 3M will initiate field sampling within 45 days of Work Plan and QAPP approval as required by the Part B Permit. However, if it is found that the soil in the SIA is frozen, sampling will be suspended. It should be noted that, as specified in the HASP, activities will be discontinued if the wind chill is less than 0°F.
3. If it is not possible to commence soil sampling before the soil freezes in the winter, field sampling will commence in the spring as soon as possible and no longer than 45 days after the soil has thawed. The date that the soil has thawed will be determined by testing the soil with a spade starting the first week of March. The soil will be tested weekly and will be considered thawed when it can be easily spaded and worked down to the designated sampling depth of 12 inches.
4. Any resampling that may be required will also be scheduled for a time when the soil is not frozen.

3M will still be required to submit the RFI Phase I Report no later than 12 months after final approval has been received for the Work Plan and QAPP, as required in Task D, Item 4, on page 23 of the RCRA Part B Permit. Thus, any delay in sampling will not adversely affect the overall schedule contained in the Part B Permit.

A schedule has been created that allows 3M to complete all testing and analysis in compliance with regulatory time constraints. A time line illustrating the projected schedule of RFI activities is presented in Figure 1-3 of the QAPP. The completion time scheduled is adequately conservative to account for unforeseen schedule changes. It is estimated that the field work for the WWTP Area will require approximately four to five days to complete and that field work for the SIA will require approximately four to five days. Laboratory analysis of groundwater and surface soil samples will be completed in approximately six weeks for both SWMUs. The Draft RFI Phase I Report will be submitted no later than 12 months after the RFI Work Plan is approved by USEPA, Region 5.

SECTION 4

QUALITY ASSURANCE PROJECT PLAN

The QAPP for the RFI described in this Work Plan has been submitted for review to USEPA, Region 5, under separate cover.

SECTION 5

DATA MANAGEMENT PLAN

5.1 OBJECTIVE

The objective of the Data Management Plan is to provide a means for organizing the vast quantities of data accumulated as part of the RFI investigation. A data management plan has been prepared using the RCRA (Resource Conservation and Recovery Act) Facility Investigation (RFI) Guidance, Volumes 1 - 4 and the requirements set forth in the RCRA Part B Permit issued to 3M by USEPA, Region 5 (effective date March 24, 1995). The Data Management Plan describes the procedure for presenting all data and information collected as part of this facility investigation.

5.2 DATA RECORD

The 3M Environmental Lab Status Report summarizes information from the analytical laboratory reports. The Status Report will serve as the data record and will include the following information:

1. Unique sampling or field measurement code;
2. Sampling or field measurement location and type;
3. Sampling date;
4. Sampling or field measurement raw data;
5. Laboratory analysis ID number;

6. Property or component measured; and

7. Result of analysis (i.e., concentration, detection limits, units).

In addition to the information contained in the data record, field logs will be maintained during sampling activities to document environmental conditions, procedures, geographical and physical conditions, and personnel involved in that particular investigative component. The field personnel will record the sample number in the logbook so field notes can be linked to the analytical data. Also, the Analytical Laboratory will provide data information in the Laboratory Results Report submitted to 3M.

5.3 TABULAR DISPLAYS

Data will be compiled in both sorted and raw tabular forms to best illustrate the trends and interpretations of the data. Raw data will consist of information that is used as backup and validation and will be presented in a simple spreadsheet form. Examples of raw data to be collected are analytical laboratory reports and field notes. Sorted data tables will be presented in a manner that best represents and illustrates the purpose and results (parameter analyzed, sample location, and analytical result). Summary tables of data and conclusions obtained as part of this investigation will further serve to present data in its most useful format. Tables will be prepared to present the following data:

1. Sample Analytical Results; and

2. QA/QC Sample Analytical Results.

5.4 GRAPHICAL DISPLAYS

In addition to analytical and sampling information which will be presented in a tabular form, often data presented in a graphic format will best present conclusions and illustrate trends. Presentations using site or topographic maps may best illustrate the areas of contamination or concern. Some graphic formats which may be utilized are bar, line, or x - y graphs, constituent or concentration overlays on site or topographical maps, isopleth plots, and aerial maps. The following data shall be presented in a graphic format:

1. Sampling locations;
2. Level(s) of contamination at each sampling location; and
3. Groundwater flow contours.

5.5 DATA REDUCTION

All data will be reported according to accepted QA/QC practices. Duplicate sample results will be presented as separate sample results in the QA/QC and the sample result discussion. Analytical values which are determined to be below the PRL will be reported as not detected (ND). Additionally, the analytical method used, and the appropriate PRL, and units will be noted and recorded as part of the data record.

5.6 PROJECT REPORTING PROCEDURES

3M will follow the requirements for reporting set forth in the Submission Summary in the RCRA Part B Permit. Any emergency or priority situations which could possibly require interim corrective measures will be reported to the regulatory agency immediately. A progress report will be submitted every two months and will contain the following information:

1. A description and estimate of the percentage of the RFI completed;
2. A summary of all findings;
3. Summaries and rationale for changes made in the Work Plan during the reporting period;
4. Summaries of all contacts with representatives of the local community, public interest groups, or government representatives during the reporting period;
5. Summaries of all problems or potential problems encountered during the reporting period;
6. Actions being taken to rectify problems;
7. Changes in personnel during the reporting period;
8. Projected work for the next reporting period; and
9. Copies of daily reports, inspection reports, and laboratory and monitoring data.

SECTION 6

HEALTH AND SAFETY PLAN

6.1 INTRODUCTION

Protecting the health and safety of the investigative team, as well as the general public, is a high priority during the RFI of the 3M facility located in Cordova, Illinois. This Health and Safety Plan (HASP) has been prepared as an addendum to the facility HASP to specifically cover the RFI activities. The RFI HASP is intended to be used in conjunction with the already as established health and safety practices at the facility. The RFI HASP establishes requirements for protecting the health and safety of the investigative team, facility workers, and the general public throughout the investigation.

The specific activities comprising the RFI are collecting samples from seventeen groundwater monitoring wells as specified in Standard Condition II.F and Attachment 1 of the RCRA Part B Permit. Twelve wells are located in the vicinity of the WWTP, and five wells are located in the SIA and soil samples from the SIA. In addition, seven soil samples will be collected from the SIA.

6.2 FACILITY DESCRIPTION

3M has operated the production facilities at 22614 Route 84 N, Cordova, Illinois, 61242 since 1970. The facility is located adjacent to the Mississippi River in the northern portion of Rock Island County. The plant site consists of 566 acres and is bisected by Illinois Route 84 and the

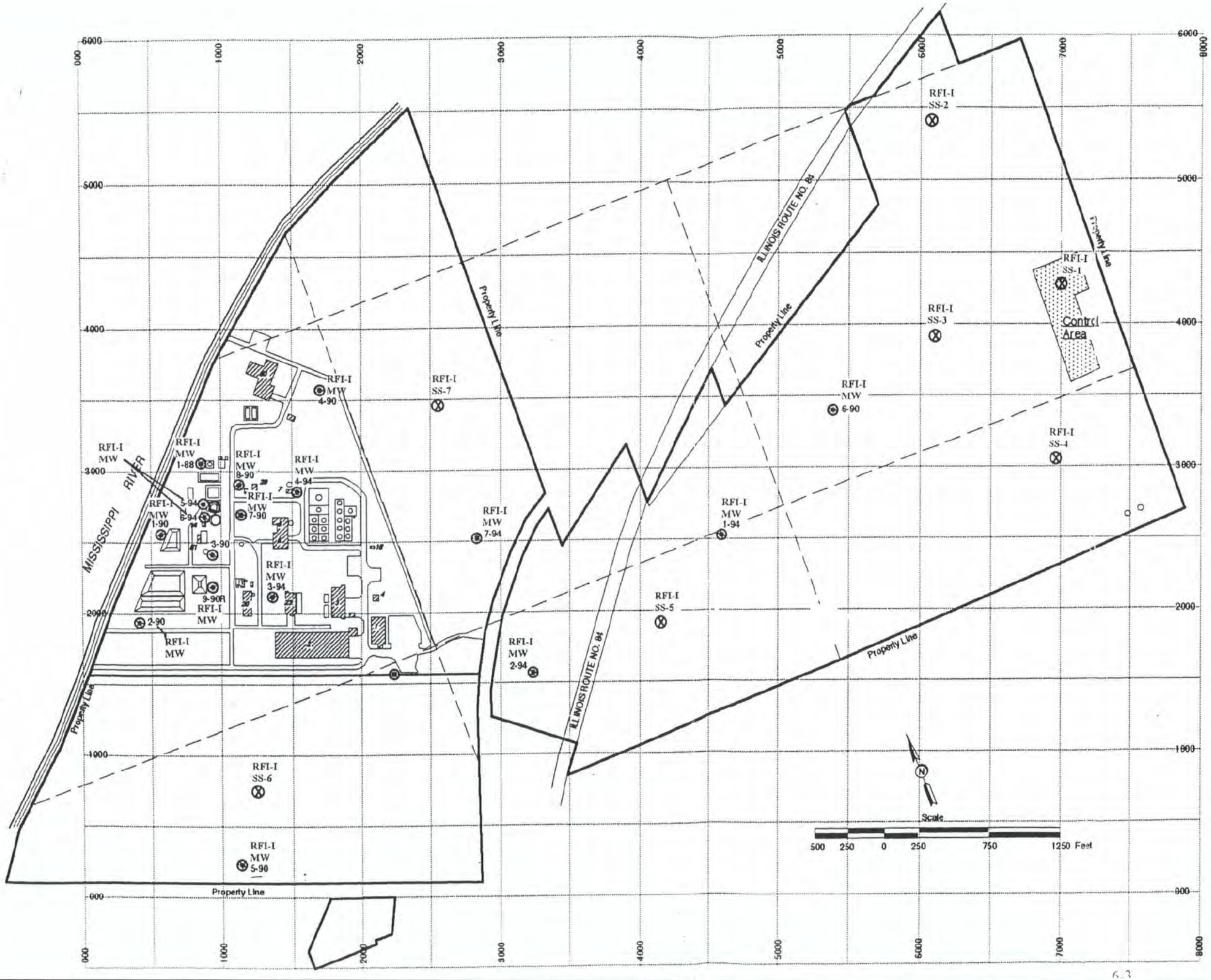
CMSP&P Railroad. Manufacturing only occurs on an approximate 100-acre, triangular portion of the site, near the river and west of Illinois Route 84. The remainder of the property is used for land incorporation of the sludges produced by the WWTP. A high capacity, alluvial well field that supplies the 3M facility with water is located in the 280-acre portion of the site located east of Illinois Route 84. A site map is presented as Figure 6-1 and shows the facility and State roads. The facility is equipped with internal and external communications by telephone.

6.3 KNOWN HAZARDS

A site characterization and analysis of each task and operation planned for this RFI has been conducted. The potential hazards and controls are shown in Table 6-1. The RFI involves collecting groundwater monitoring samples from wells located in the WWTP Area and the SIA. The potential hazards for these activities are contact with hazardous constituents that may be present in the groundwater; and soil, contact with decontamination fluids, and potential physical hazards resulting from working on the site. The risk posed by these potential hazards is low.

6.4 KEY PERSONNEL

The contract personnel on site during the RFI activities will follow the facility health and safety plan. The contract Health and Safety Officer will be the contact for information and will be accessible to the contract Project Manager at any time. The contract Project Manager will be on-site during the field activities conducting day-to-day supervision of all activities and will be in charge



3M

CORDOVA

Monitor Well And Soil Sampling Locations To Be Used In RFI

⊗ Monitor Well Location

⊗ Soil Sampling Location

FIGURE 6-1

Revised November 1996

TABLE 6-1. POTENTIAL HAZARDS AND CONTROLS DURING THE RFI

ACTIVITY	POTENTIAL HAZARDS	CONTROLS
Collect groundwater samples	Contact with hazardous constituents	1. Wear safety glasses and gloves
Collect soil samples	Contact with hazardous constituents	1. Wear safety glasses and gloves
Decontaminate sampling equipment	Contact with decontamination fluids	1. Wear safety glasses and gloves
Working in the facility	Physical hazards	1. Wear a hardhat, safety glasses, and steel-toe footwear 2. Work only in assigned area 3. Adhere to all 3M safety procedures

of all site decisions, including health and safety issues related to the RFI activities. The contract Project Manager has received OSHA 8-hour Supervisory Training in order to oversee health and safety activities during the project. Contractors and visitors onsite for the RFI will be required to follow the facility and RFI health and safety plan. Contractors and visitors to the RFI site will receive the facility and RFI health and safety training.

In the event of an emergency, the facility Major Disaster Control Plan will be implemented by the Plant Manager as appropriate. The plant has an Emergency Squad on call at all times to respond to emergencies. Key elements of the Plan are provided in Appendix 5 of this Work Plan. The RFI project team will follow the directions of 3M personnel should an emergency occur.

6.5 WORK AREA

The work area is divided into two areas: **1)** wells located in the WWTP Area; and **2)** wells and soil sample locations located in the SIA. A drawing of the area showing well locations is included in Figure 6-1.

6.6 PERSONAL SAFETY

While in the work area, all personnel will obey all Work Practices outlined in the facility and RFI HASP. Personnel will not be allowed to eat, drink, or smoke onsite except in designated areas.

6.7 PROTECTIVE CLOTHING

When conducting groundwater and soil sampling activities, personnel will wear gloves to minimize the potential for contact with hazardous constituents. Gloves will be changed between each sampling to ensure glove integrity and to minimize cross-contamination of samples between wells. In addition to wearing gloves, the RFI team and visitors will wear steel-toe footwear, safety glasses, and a hard hat. Eyewash and first-aid materials will be available to the site workers at all times.

Self-contained breathing apparatus (SCBAs) are not necessary for the sampling activities conducted during the RFI. In the event that conditions arise requiring SCBA or additional protective clothing, work will cease until the proper protective equipment can be put into use.

6.8 SITE CONTROL

Appropriate site control procedures have been implemented to control employee and public exposure to hazardous substances. The 3M facility property is enclosed by fencing and a security guard is on-site 24 hours per day. All personnel and visitors are required to register with the security guard before entering the Plant site and the SIA. Special site security for the RFI sampling will not be required because current plant security practices will be sufficient.

6.9 DECONTAMINATION

The groundwater well and soil sampling activities comprising the RFI will cause minimal risk of exposure to the sampling team. It is possible that groundwater and soil may come into contact with the hands of the samplers; however, this is the only possibility for direct contact. Therefore, the team will wear gloves during the sampling activities. The gloves will be disposed after each well or soil location is sampled. This will ensure that samples are not contaminated, as well as decrease the chance of exposure to the sampling team due to breakthrough or damage to the gloves. No additional decontamination procedures will be necessary for the RFI activities.

6.10 SITE EMERGENCY PROCEDURES

In any situation, planning and practice are the most useful tools in minimization of injury to human health or the environment. Contract personnel will receive training on the facility emergency procedures. The contract Project Manager and the other contract personnel will follow the emergency procedures set forth by in the Plant Contingency Plan presented in Appendix 5 of this Work Plan.

Emergencies resulting during groundwater and soil sampling are not anticipated. While working at the WWTP Area, the RFI team members will have access to emergency phones and fire extinguishers. The part of the RFI conducted in the SIA will occur on 3M property, but not within the plant gate. The contract Project Manger will carry a copy of the necessary emergency information during RFI field activities in the SIA. This will ensure that information is available

during the RFI sampling in the event of an emergency. Should an emergency arise during sampling in the SIA, the sampling team will proceed to the Guard House to receive instructions.

For all groundwater and soil sampling activities, the following safety precautions will be executed prior to and during sampling:

1. The Contract Project Manager will carry a list of all emergency telephone numbers to the well locations. Emergency telephone numbers are also posted near facility telephones;
2. A map detailing the best route to emergency medical facilities will be carried by the Contract Project Manager;
3. Emergency medical facilities will be notified in advance of potential hazards present at the site;
4. Emergency medical facilities will be notified when a patient is in route and of the extent of injury or exposure;
5. A source of communication will always be available during activities conducted in the facility; and
6. All emergency operations will follow the designated chain of command detailed in the Contingency Plan.

6.11 EMERGENCY MEDICAL CARE

6.11.1 Injuries

The contract field team will carry a first aid kit during the RFI. Any RFI team member suffering from an injury or symptom of exposure to hazardous substances will be taken promptly to the facility for referral to the appropriate medical service.

6.11.2 Toxicology

Material Safety Data Sheets (MSDSs) for all materials used during the facility investigation will be provided to the RFI team members as part of the safety training. The contract Project Manager will familiarize all sampling team members to the types of materials present, the potential hazards, and toxicological information, including exposure limits and health hazards. In addition, MSDSs for the 3M facility are kept throughout the plant and will be available to all personnel at all times. These MSDSs have been forwarded to all emergency facilities in the area to familiarize them with the potential chemical hazards present at the facility.

6.12 ENVIRONMENTAL SURVEILLANCE PROGRAM

Air monitoring is required whenever there is the possibility for employee exposure to hazardous substances, as required in 29 CFR 1910.120. There is a large database of groundwater and soil sample data which shows that the potential for exposure to hazardous constituents is minimal to nonexistent. Field sampling activities will not generate dust, minimizing the potential

for exposure due to inhalation. Therefore, no air monitoring will be necessary during the RFI activities.

6.13 TRAINING

6.13.1 Required Training

All RFI personnel will receive the following training:

1. General;
2. Facility; and
3. RFI.

The general training will require all persons involved in sampling to receive 40-hour training for hazardous waste operators. This training will be in accordance with 29 CFR 1910.120 as required by the Occupational Health and Safety Agency (OSHA) for persons who face potential exposure to hazardous substances. Documentation of training will be maintained to verify compliance of USEPA and OSHA guidelines. All contractors are required to receive facility safety training prior to working on-site. Facility training will meet all the requirements set forth by the 3M plant site. The training will include subjects specific to the 3M facility.

Employees will then be given RFI-specific training to become familiar with the particular hazards and safety procedures set forth in the HASP contained in the RFI Work Plan. In order to provide personnel with the knowledge and skills necessary to perform the facility investigation with minimal risk to health and safety, all persons engaged in the facility investigations will be trained in the following areas:

1. Use of appropriate Personal Protective Equipment (PPE);
2. Safe Work Practices;
3. Medical Monitoring Procedure; and
4. General Safety and Health Hazards.

In addition, every morning before work begins, the RFI team members will attend a safety meeting (tailgate meeting) conducted by the contract Project Manager. Team members will be briefed on important aspects of the HASP and issues of interest, such as:

1. PPE changes;
2. Work practices to minimize risks from work associated hazards;
3. Plant hazards to watch for according to the area where work is being conducted; and
4. Any changes in emergency response.

6.13.2 Other Training

The use of respirators and entry into confined spaces are not anticipated, therefore such training will not required.

6.14 WEATHER-RELATED CONCERNS

Weather-related concerns are not expected to be encountered during the RFI. If the sampling is conducted in the spring, summer or fall, it is expected that there will be a minimal risk for heat stress. The average high temperatures for the Cordova area are in the 90 °F range. Work conditions will not be strenuous (considered to be one arm, light work as shown on the table included in

Appendix 6), and since the sampling will be conducted in Level D protection, it is not anticipated that the RFI team will be subjected to heat stress. The recommended heat stress exposure limits show that a worker doing non-continuous, light, one arm work will be safe from heat stress at temperatures encountered at Cordova, as shown in Appendix 6 of this Work Plan.

If the sampling occurs during cold weather, activities will be discontinued if the Wind Chill Index drops below 0°F. Therefore, the risk of cold stress will be minimized. A wind chill chart is provided in Appendix 6 of this Work Plan.

6.15 FACILITY HEALTH AND SAFETY PLAN

The 3M Cordova Plant has prepared and implemented a HASP that is in accordance with:

1. NIOSH Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (1985);
2. EPA Order 1440.1 - Respiratory Protection;
3. EPA Order 1440.3 - Health and Safety Requirements for Employees Engaged in Field Activities;
4. Facility Contingency Plan;
5. EPA Standard Operating Safety Guide (1984);
6. OSHA regulations, particularly in 29 CFR 1910 and 1926;
7. State and local regulations; and
8. Other applicable USEPA guidance.

The facility Health and Safety Plan is located in the facility health and safety office and is easily accessible at other locations throughout the site.

APPENDIX 1

EVALUATION OF GROUNDWATER FLOW FOR 1994

GROUNDWATER LEVEL ANALYSIS DISCUSSION

Introduction

The following discussion, figures and tables summarize efforts to characterize the hydrogeology at the 3M Cordova facility for the purpose of this Groundwater Assessment Plan report.

Figure 1-1 shows the location of the monitor wells pertaining to this groundwater assessment study. Figure A1-1 shows these wells and all nearby, plant area monitor wells used in this analysis. Figures A1-2 to A1-5 are contour plots of static groundwater elevations for the four sampling periods of concern in this analysis. Table A1-1 is a spreadsheet summary of all Cordova site monitor well groundwater elevation data from January to December, 1994. Table A1-2 are the 1994 pool elevations for the COE Princeton gaging station. This station is located across the river from the Cordova plant. In addition, Figures A1-6 to A1-9 are hydrographs of the Assessment Plan wells (1-91,2-91,7-90 and 4-90) showing data for 1994. Figures A1-10 to A1-25 are hydrographs of all plant area wells for the period March 1990 to December 1994 where data exists.

Table A1-3 is a schedule of the 19 plant area monitor wells shown in Figure A1-1. All site monitoring wells have been surveyed by a licenced and state certified land surveyor in the state of Illinois (Shive-Hattery & Associates). Elevation data is referenced to mean sea level datum with the measuring point for each well marked with a scribe mark on the north side of the innermost casing with the inner well cap removed. All casing collar elevations are measured to 1/100 foot. Horizontal coordinates are plant grid coordinates transferrable if required to state plane or UTM coordinate systems and represent the location of the center of the innermost well casing.

Discussion

With the exception of January 1994 where no data exists for most of the plant monitor wells, contour plots of static groundwater elevation data for 1994 (Figures A1-2 to A1-5)

show a consistent trend of groundwater flow in the uppermost aquifer toward the east, away from the river. Some alteration in this trend is evident on the north end of the plant where equal elevation contours show a localized turning of groundwater flow direction toward the north.

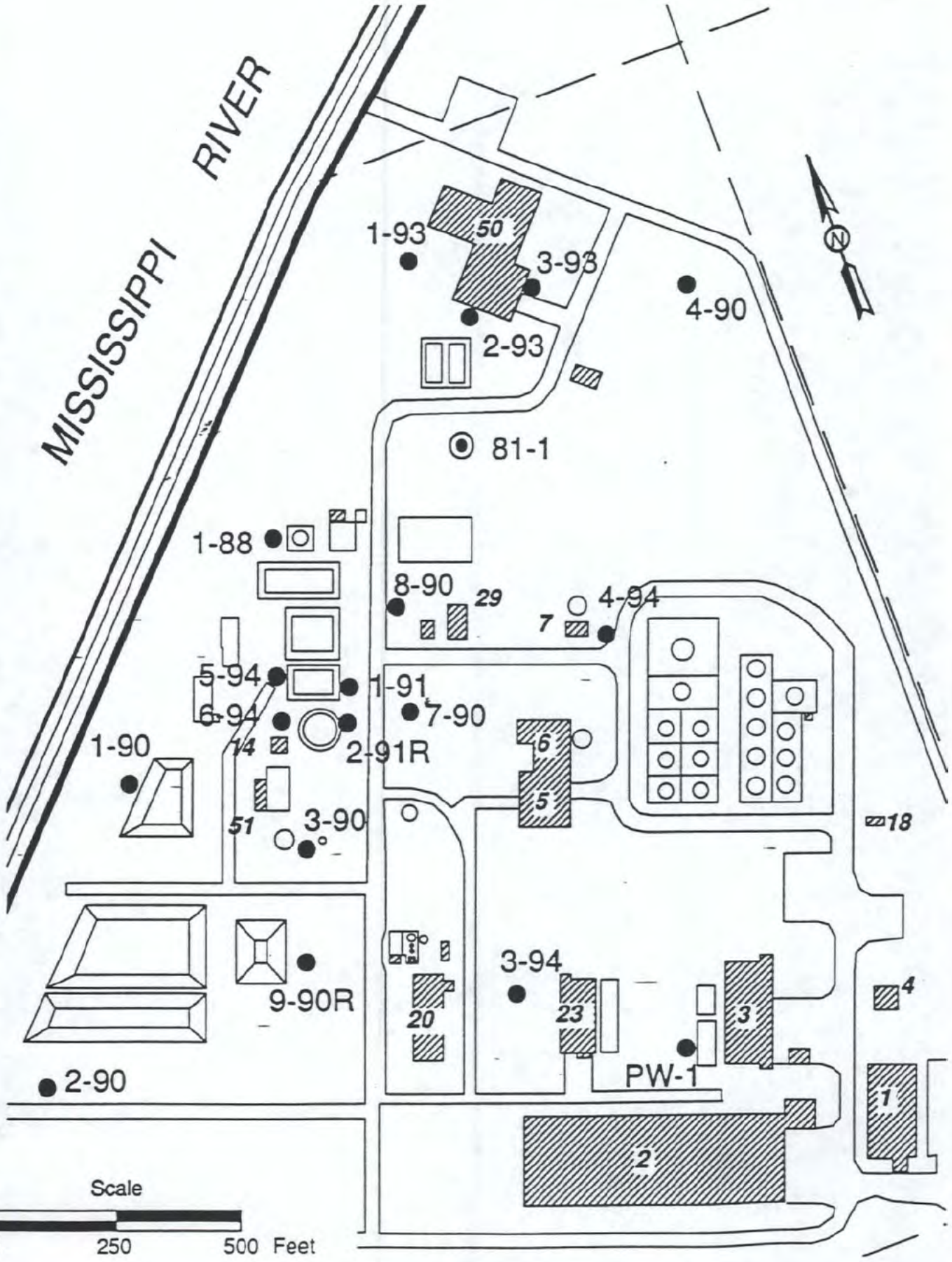
For the time period reviewed in this study, Mississippi river pool elevations are consistently higher than the adjacent static groundwater elevations in the uppermost aquifer. This correlation indicates the river may be adding to up-gradient recharge of the alluvial aquifer directly or indirectly through an alluvial-glacial-fluvial filled channel.

Conclusion

In summary, for the area of the Equalization Basin, the static groundwater level contour plots for the May, July and October data show a gradient development with flow trending away from the river toward the east. This is consistent with the original well location criteria defined in the regulation (40 CFR 265.91 (a). Monitoring data from the 3M well system developed for this assessment plan (MW 1-91, MW-2-91, and MW-7-91) should be considered a valid sample of down-gradient conditions in the surficial aquifer for the purpose of this study.

Bruce W. Kramer
Certified Professional Geologist
AIPG CER.#4450

FIGURE A1-1. 3M CORDOVA, ILLINOIS PLANT AREA MONITOR WELLS



3M CORDOVA, ILLINOIS
PLANT AREA MONITOR WELLS

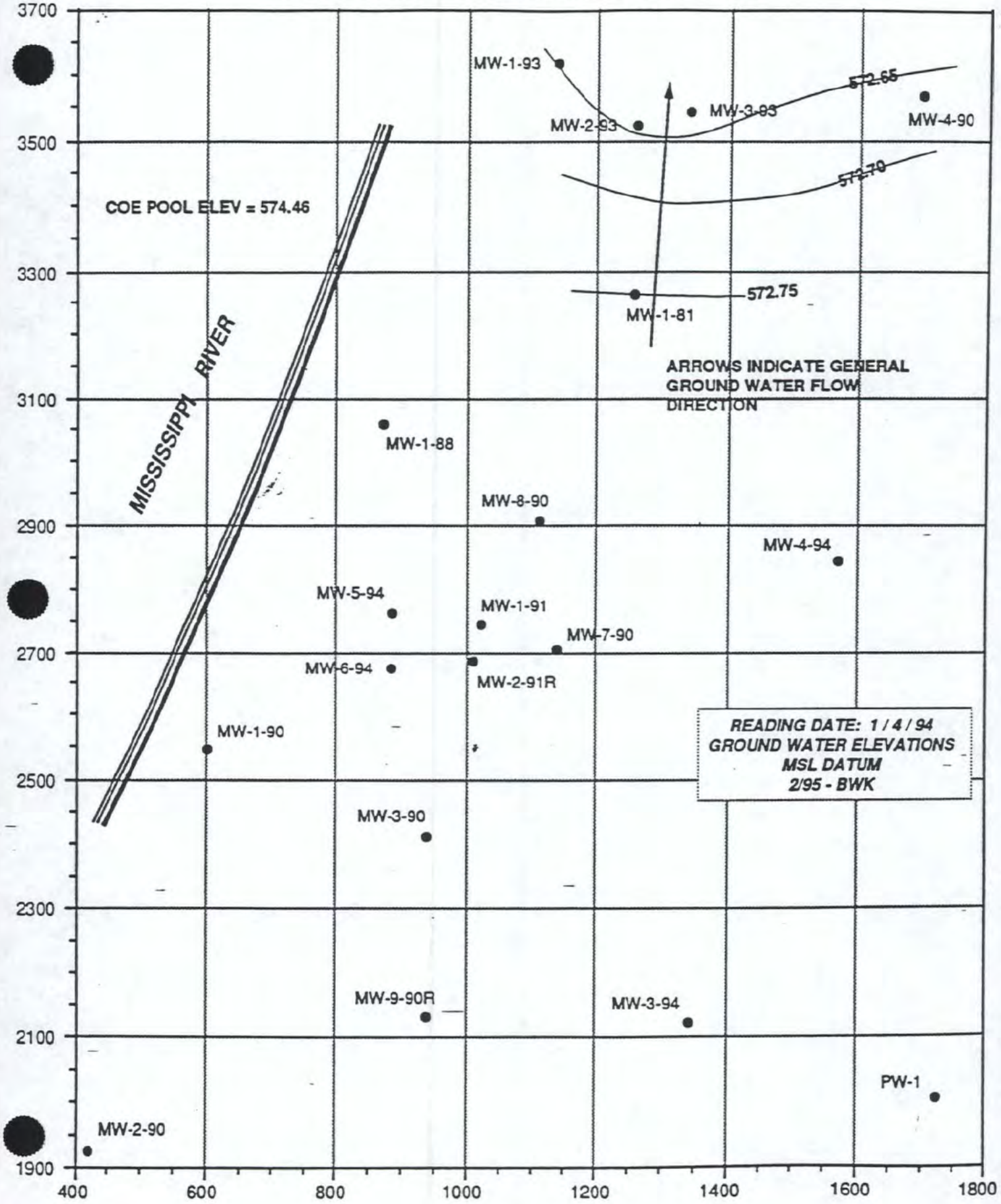


FIGURE A1-2

3M CORDOVA, ILLINOIS
PLANT AREA MONITOR WELLS

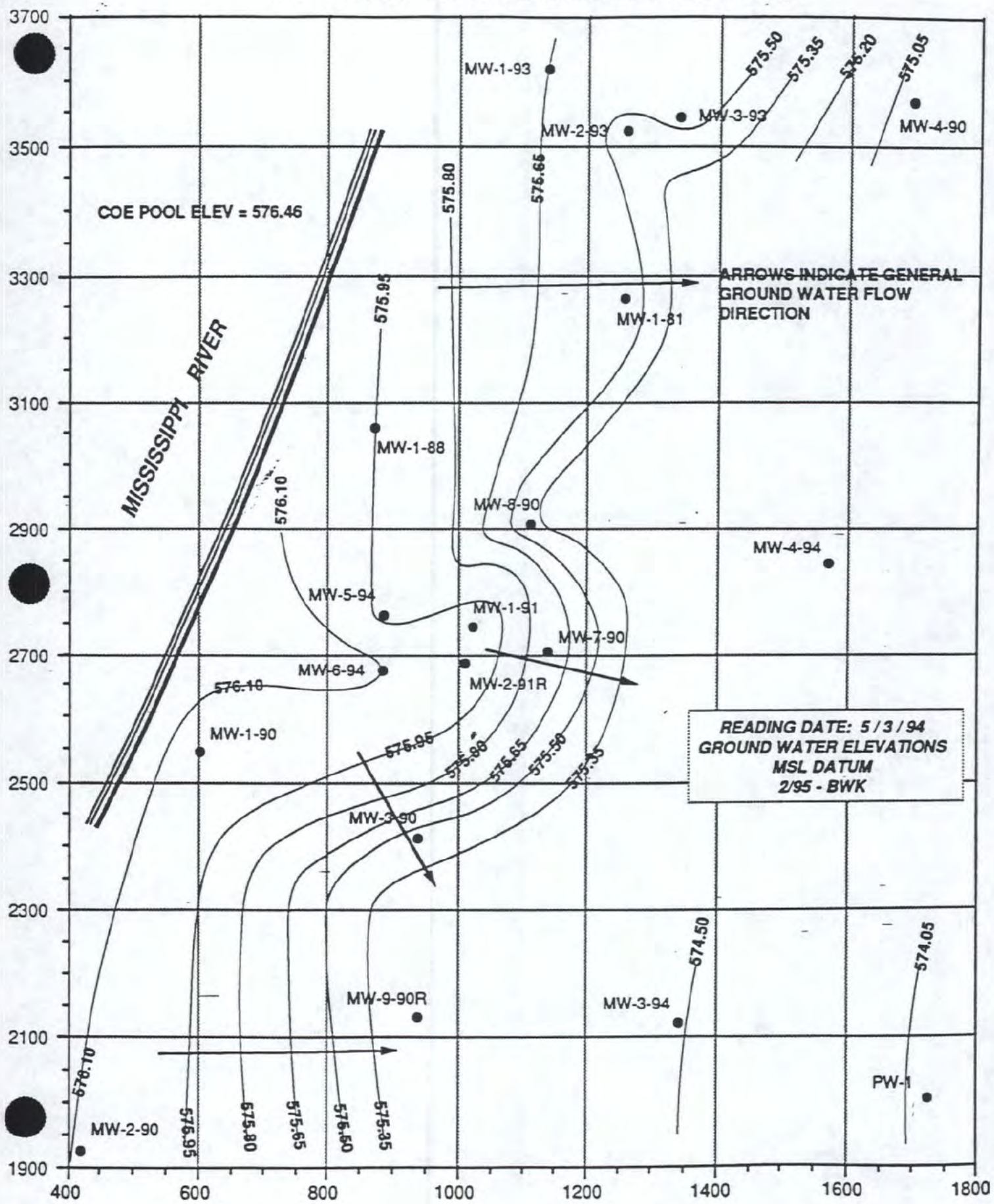


FIGURE A1-3

3M CORDOVA, ILLINOIS
PLANT AREA MONITOR WELLS

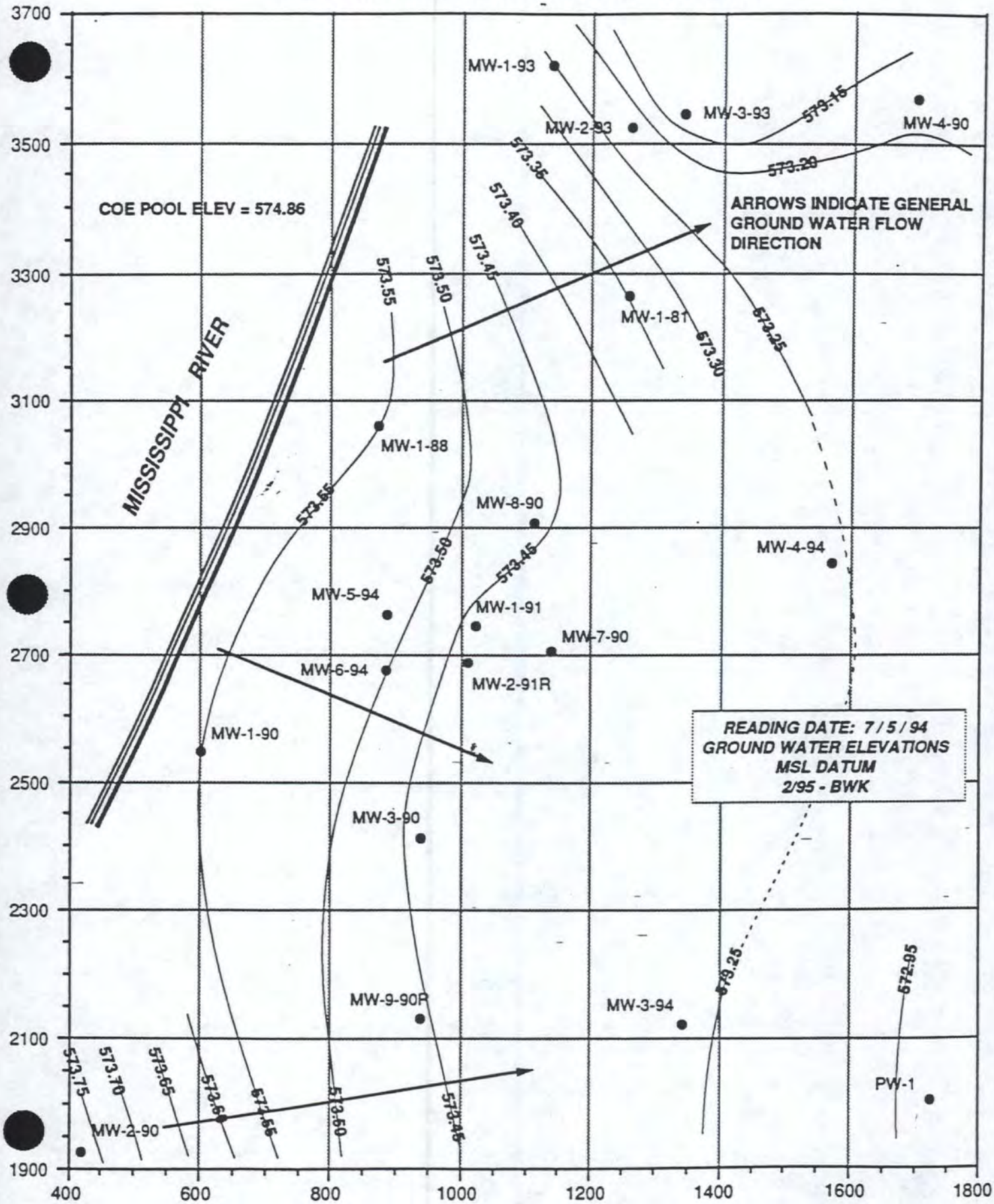


FIGURE A1-4

3M CORDOVA, ILLINOIS
PLANT AREA MONITOR WELLS

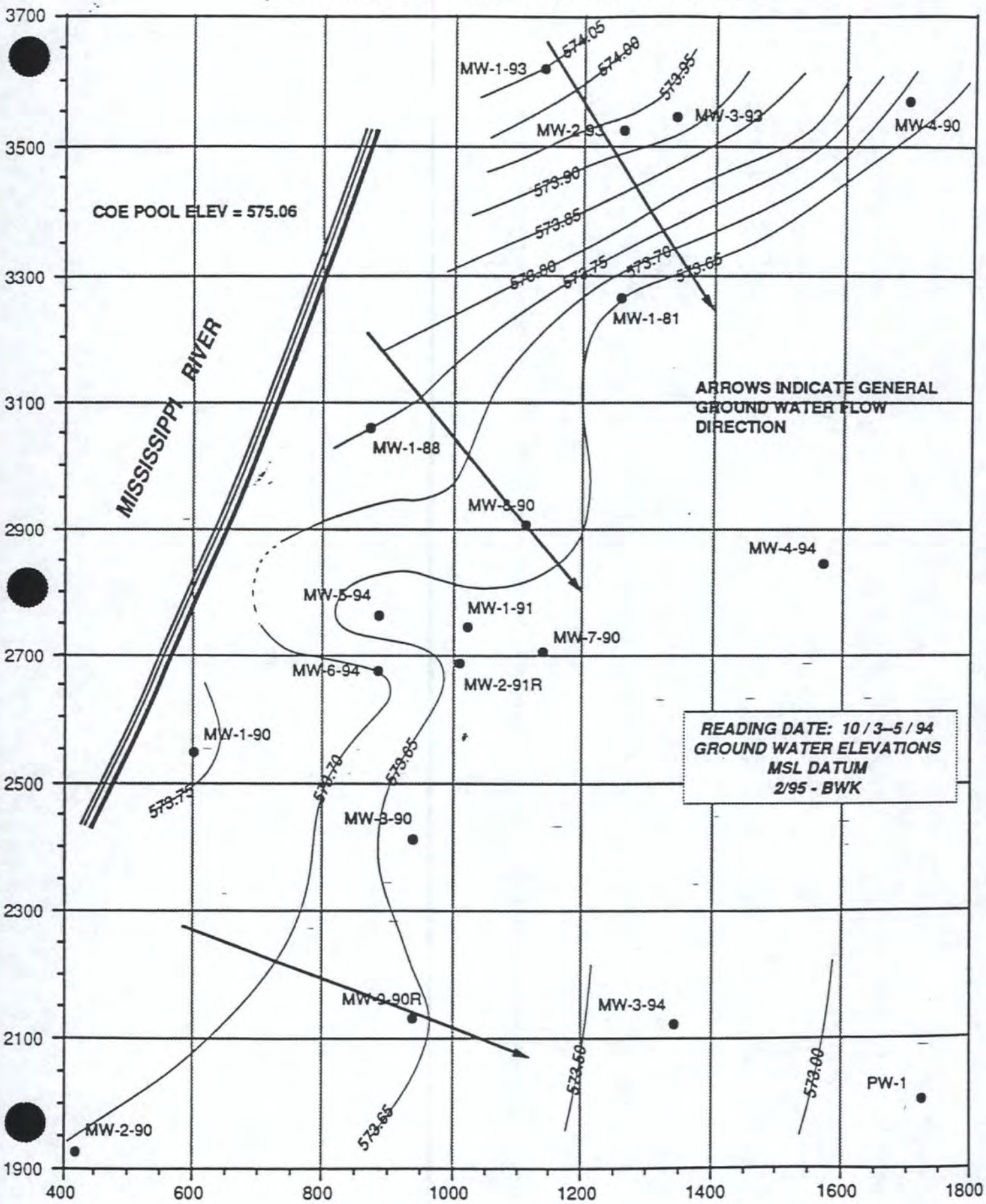


FIGURE A1-5

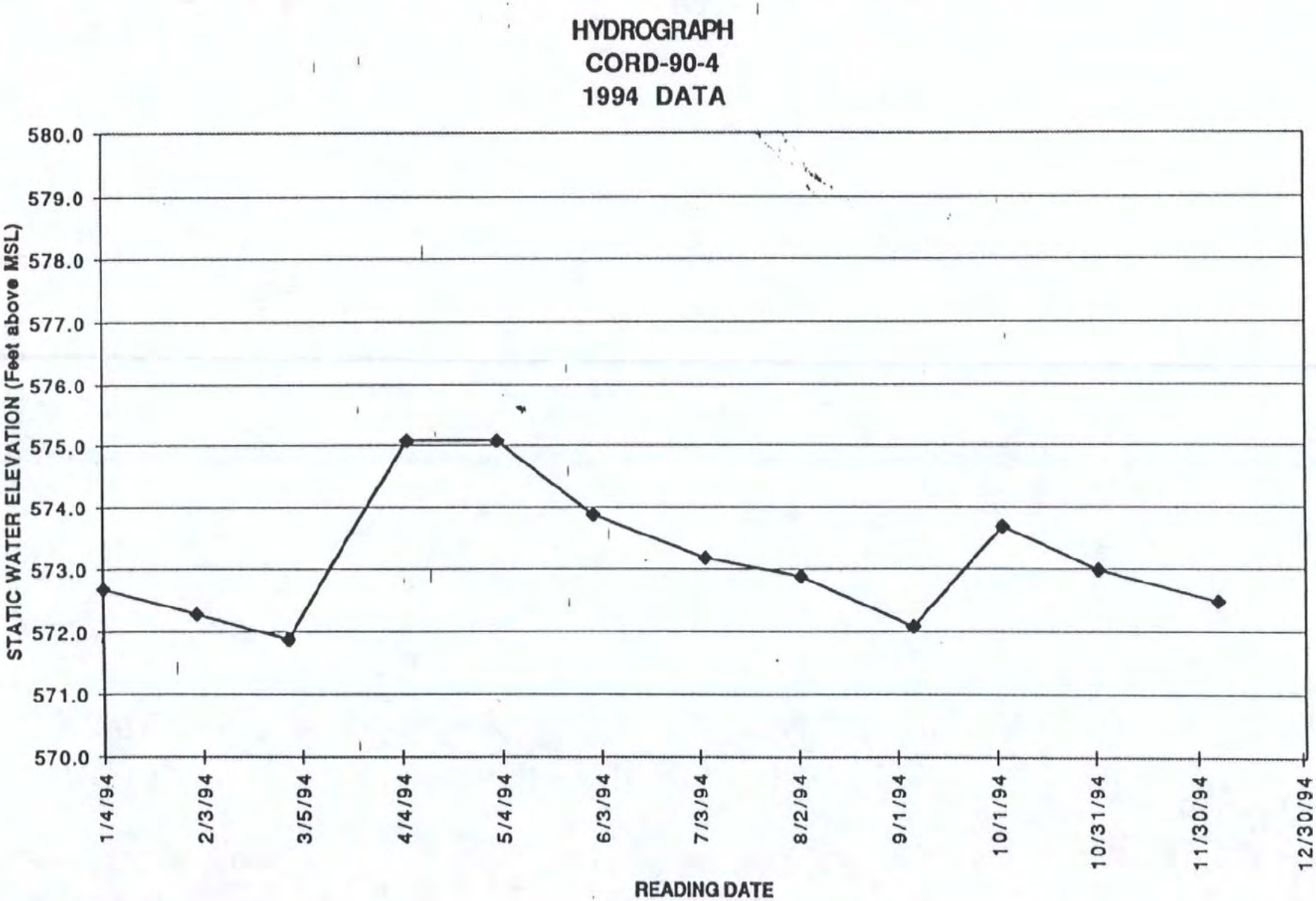


Figure A1-6

3M:GEOLOGY: BWK
CORD-90-4 94 HYDGPH
2/28/95

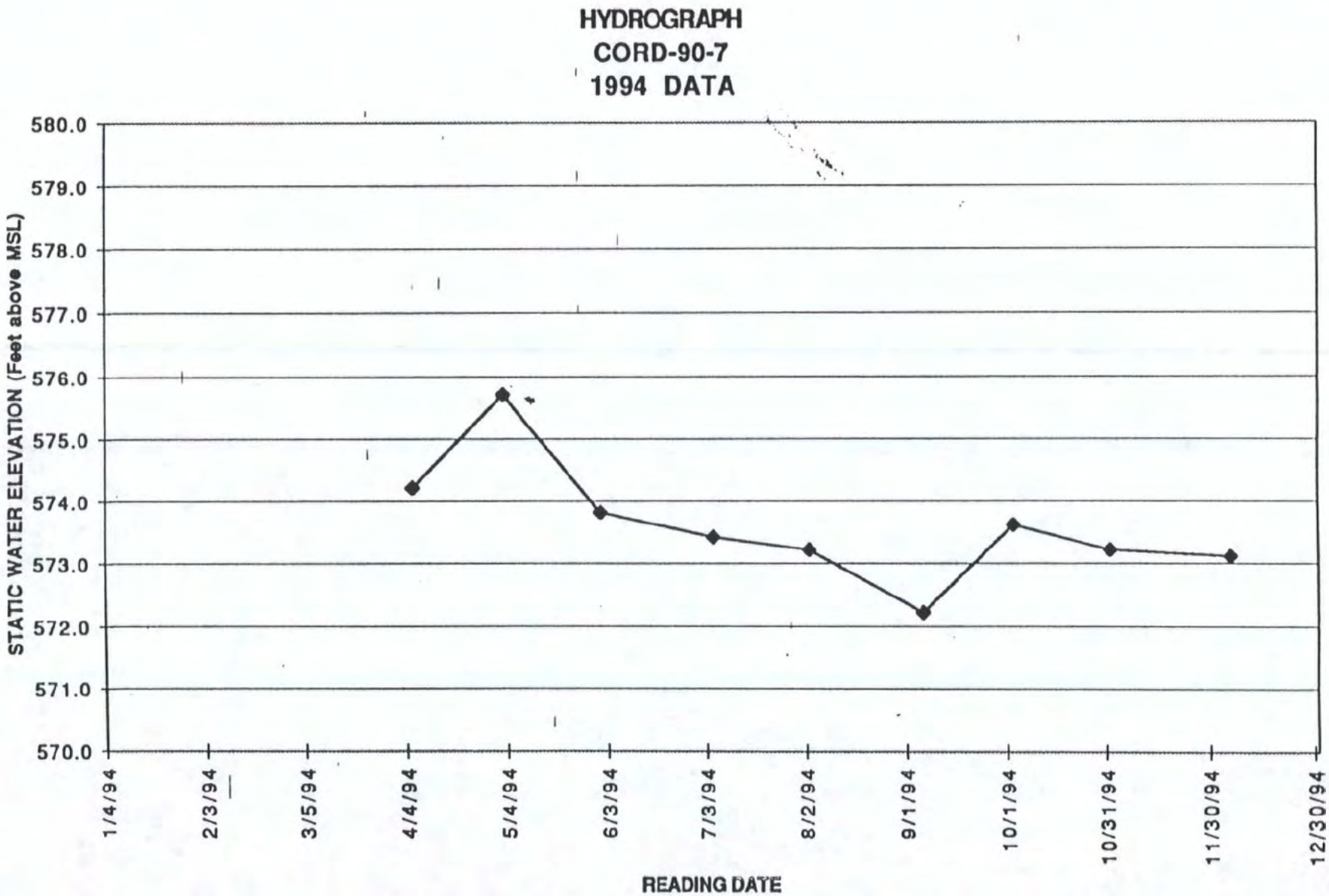


Figure A1-7

3M:GEOLOGY: BWK
CORD-90-7 94 HYDGPH
2/28/95

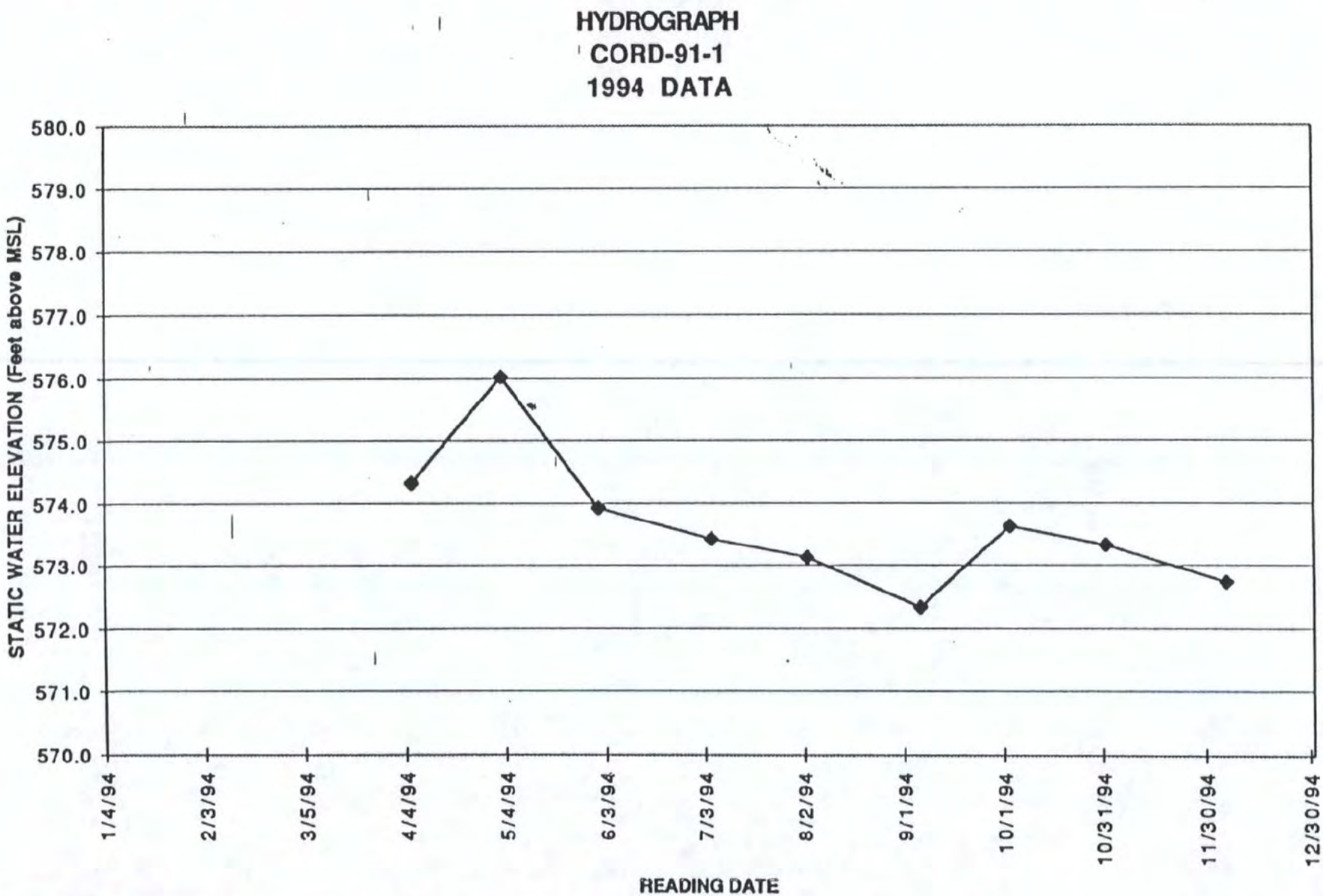


Figure A1-8

3M:GEOLOGY: BWK
CORD-91-1 94 HYDGPH
2/28/95

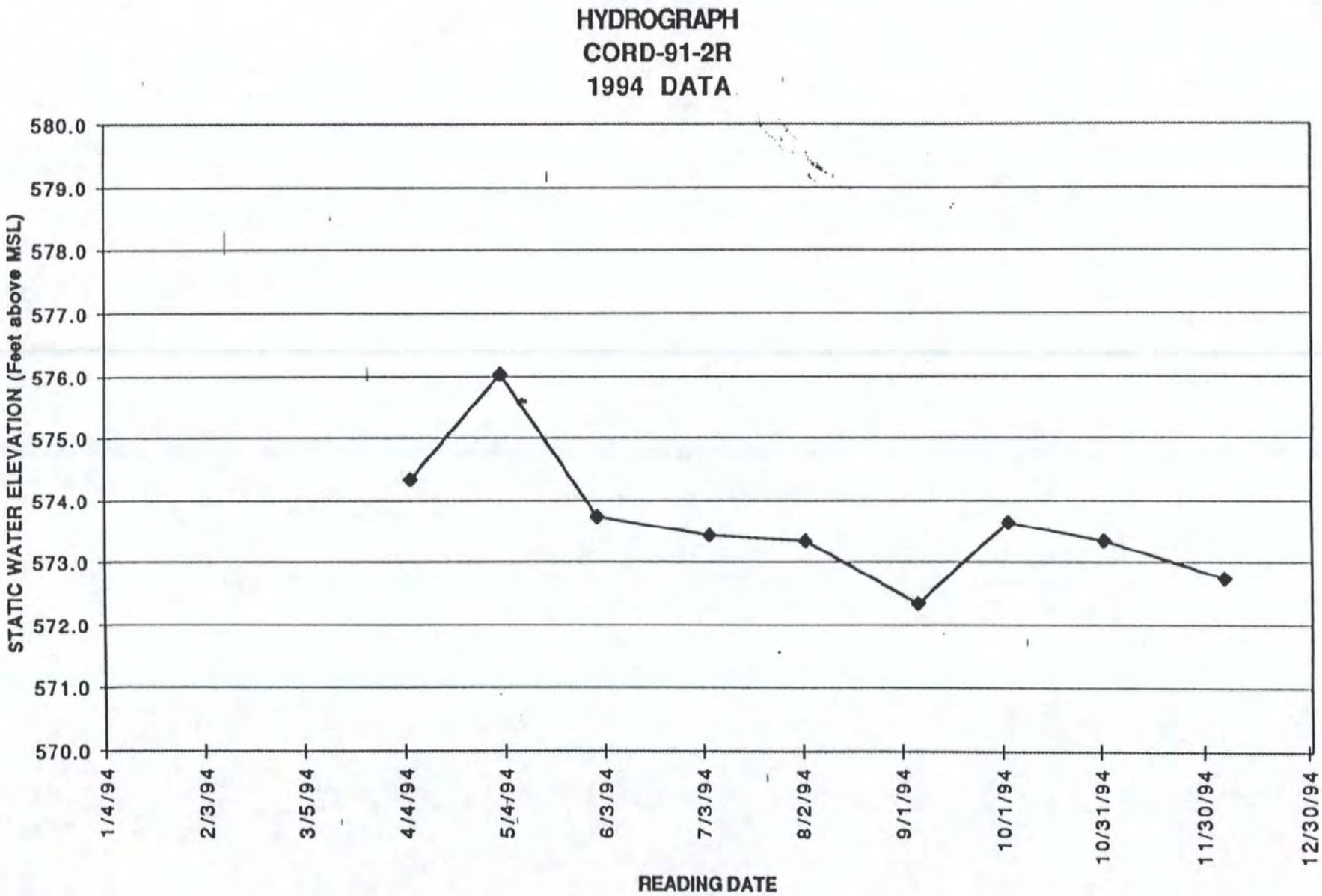


Figure A1-9

3M:GEOLOGY: BWK
CORD-91-2R 94 HYDGPH
2/28/95

HYDROGRAPH
CORD-81-1

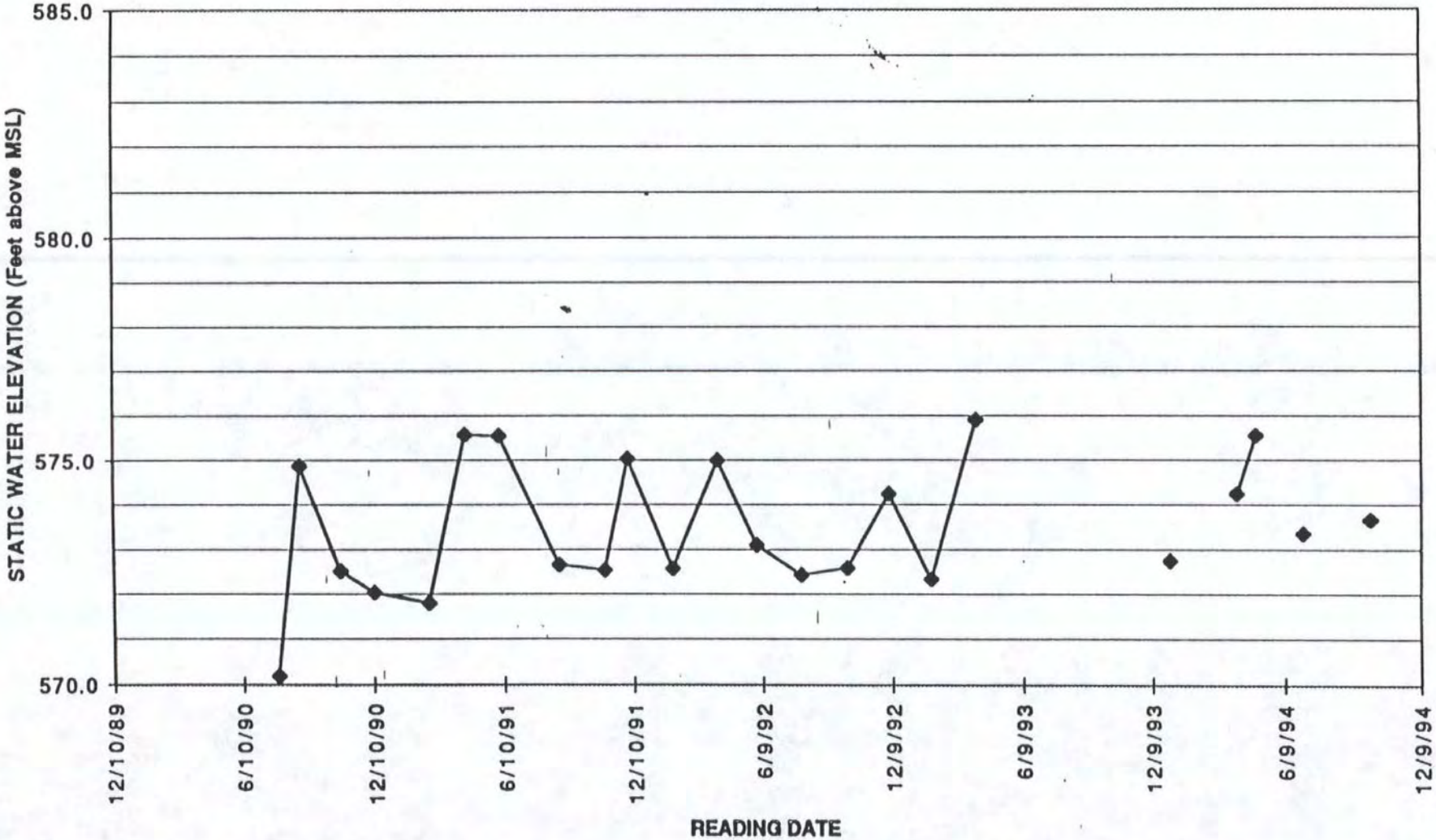


FIGURE A1-10

3M:GEOLOGY: BWK
CORD-81-1 HYDGPH
2/28/95

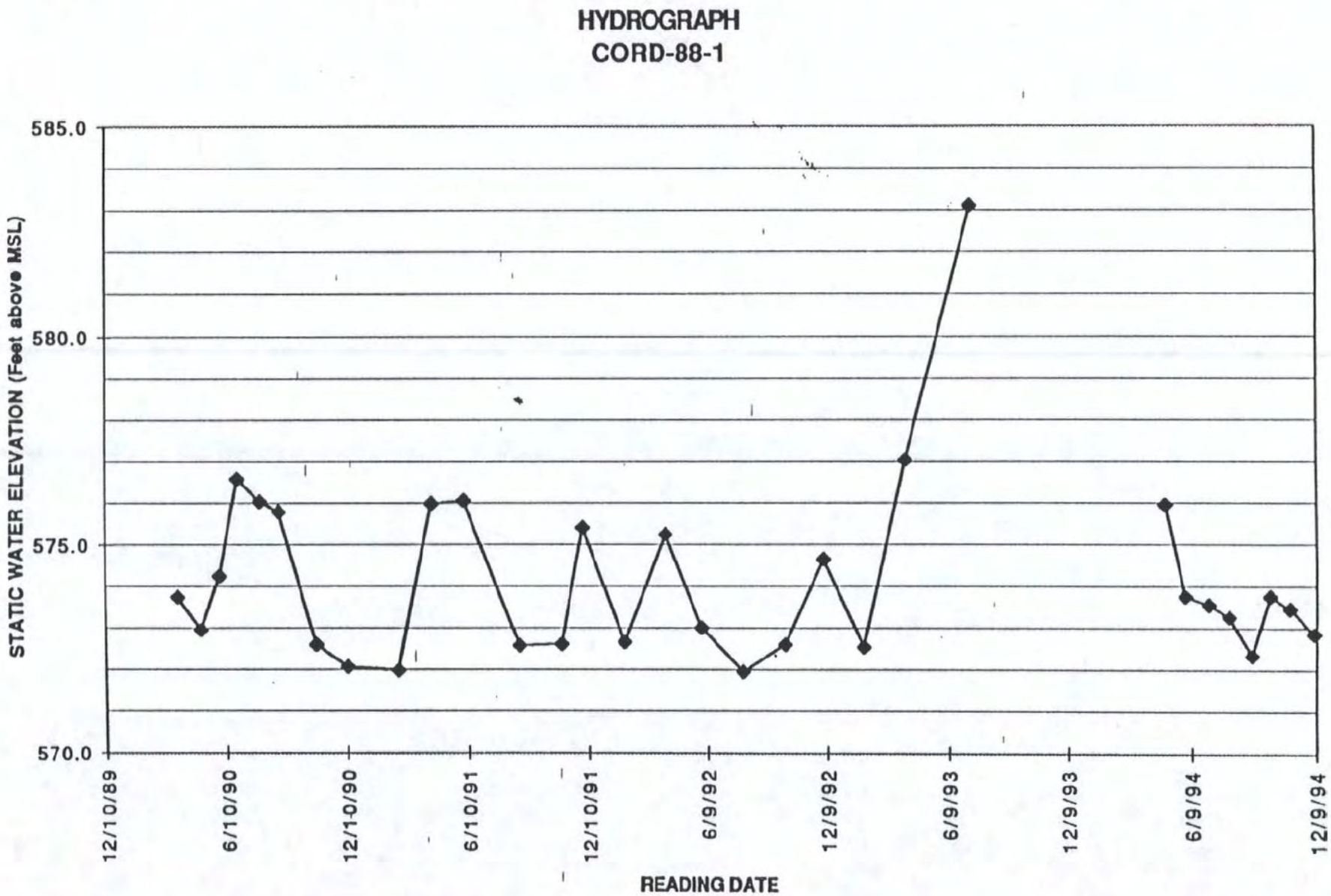


FIGURE A1-11

3M:GEOLOGY: BWK
CORD-88-1 HYDGPH
2/28/95

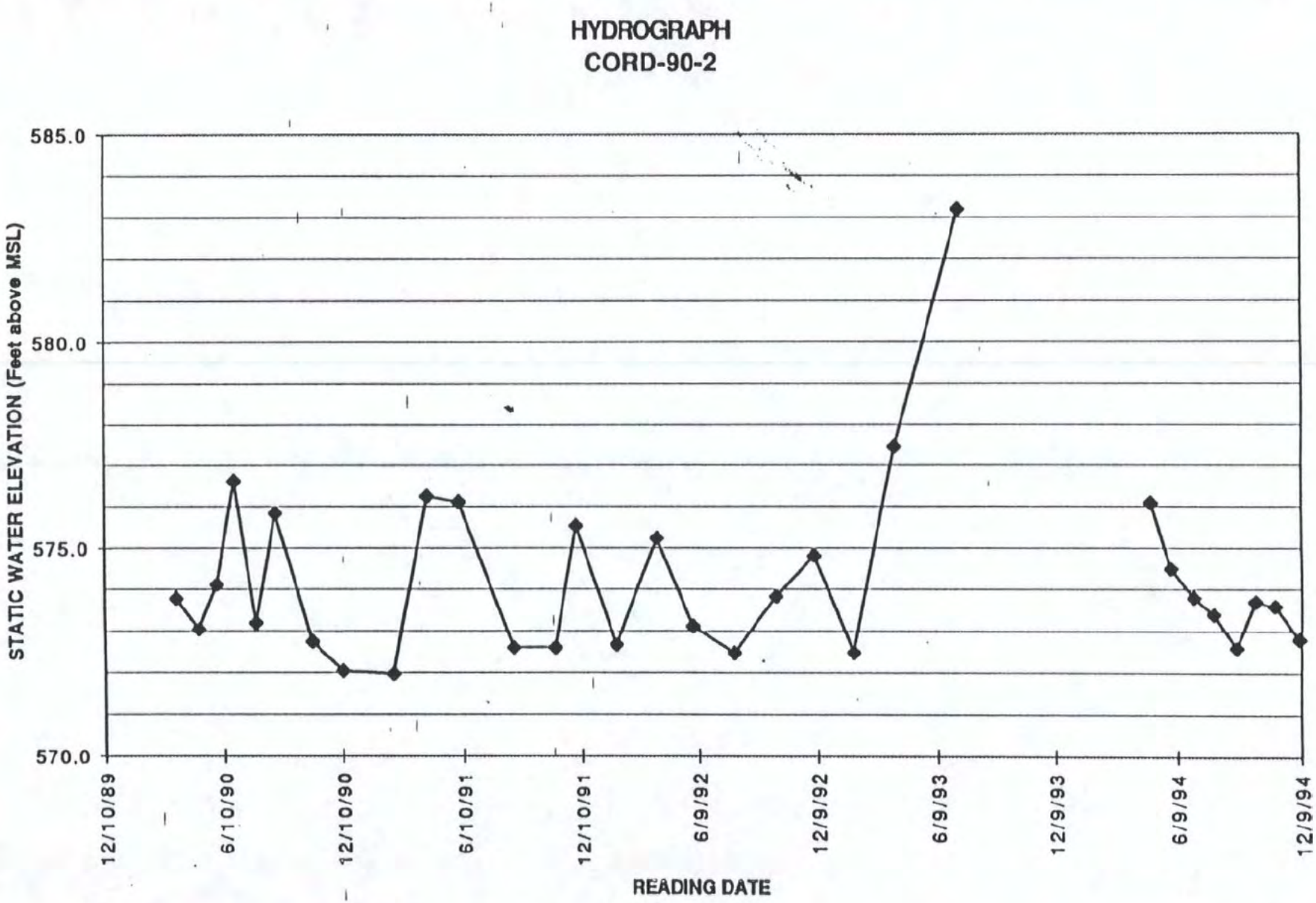


FIGURE A1-12

3M:GEOLOGY: BWK
CORD-90-2 HYDGPH
2/28/95

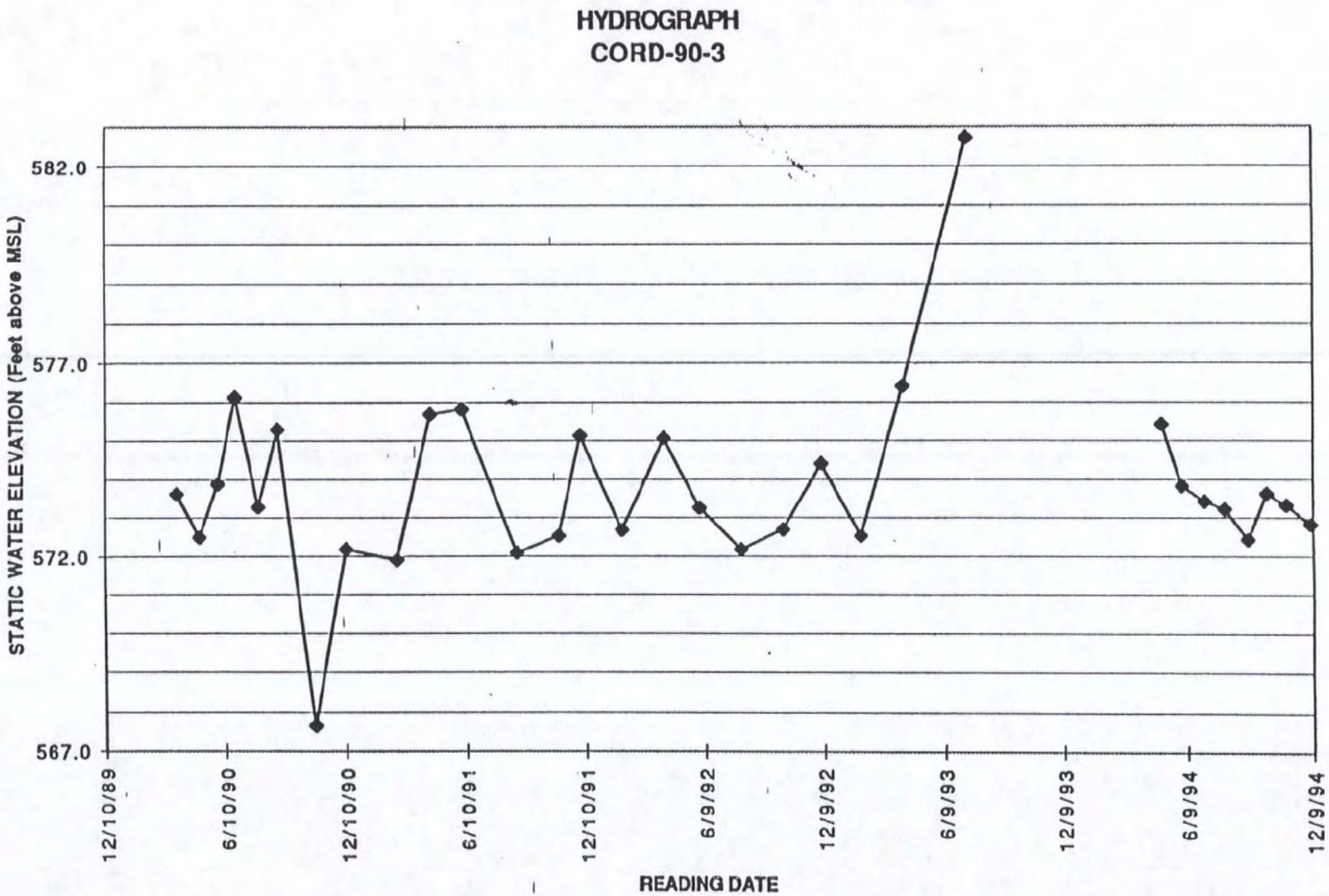


FIGURE A1-13

3M:GEOLOGY: BWK
CORD-90-3 HYDGPH
2/28/95

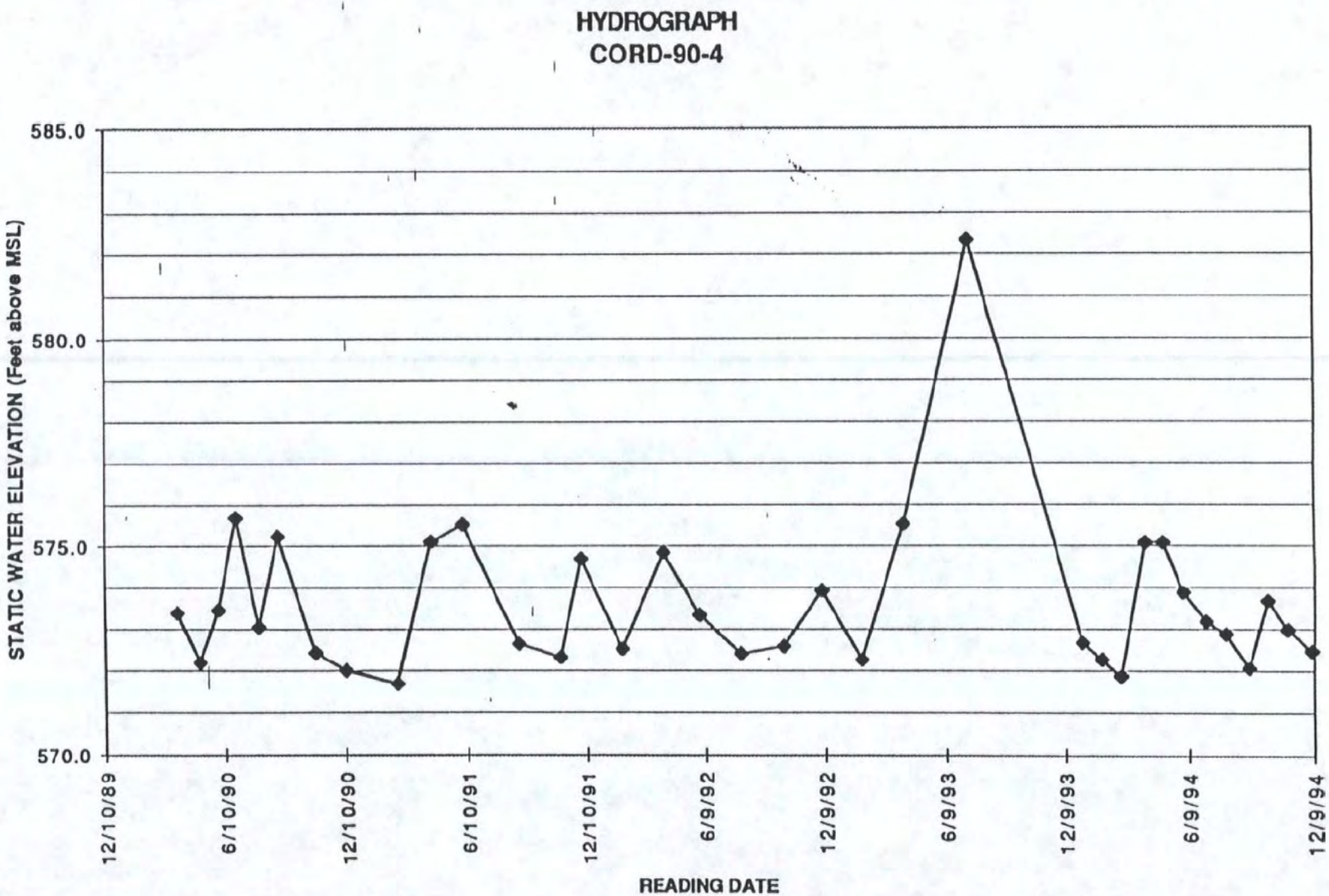


FIGURE A1-14

3M:GEOLOGY: BWK
CORD-90-4 HYDGPH
2/28/95

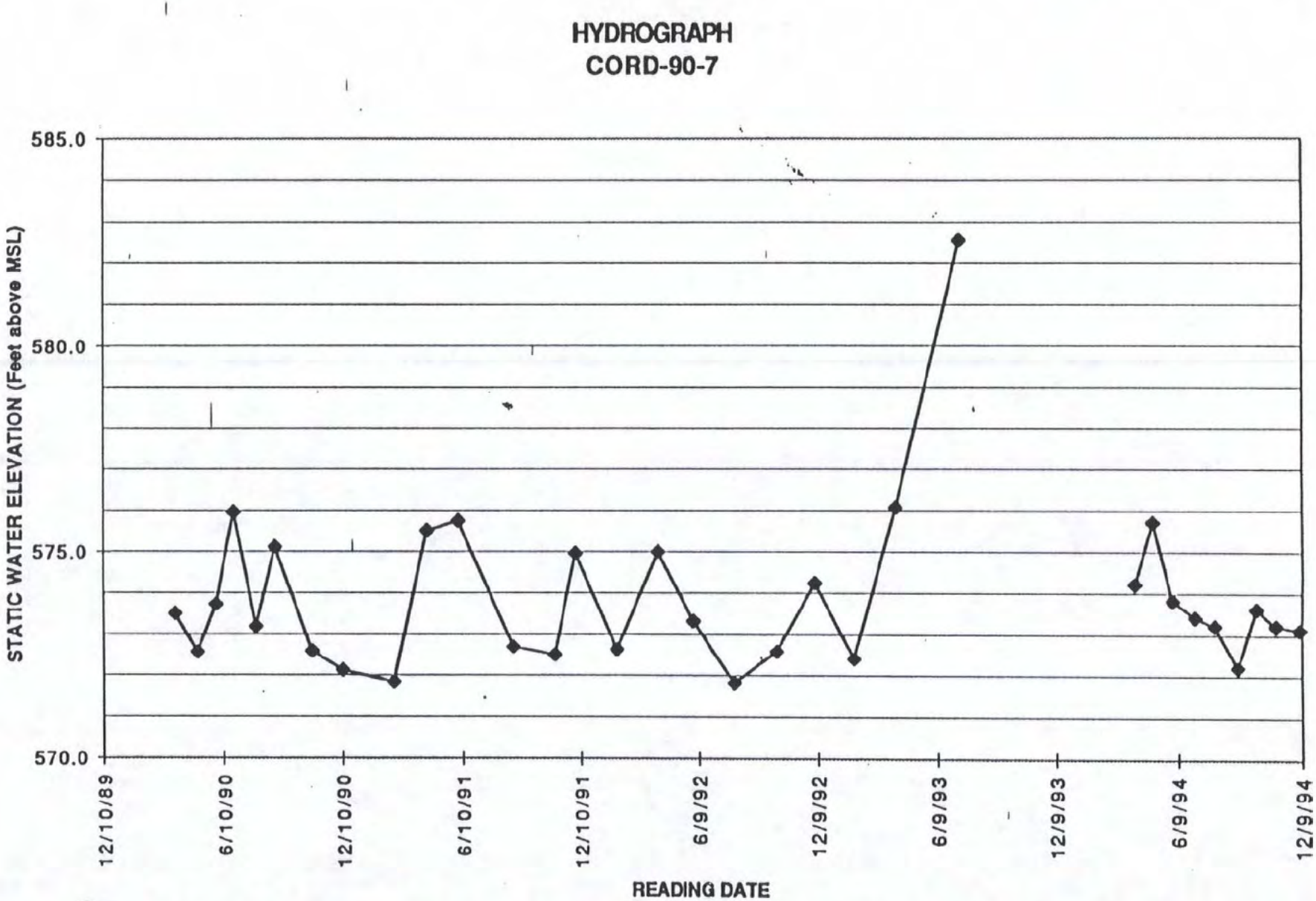


FIGURE A1-15

3M:GEOLOGY: BWK
CORD-90-7 HYDGPH
2/28/95

HYDROGRAPH
CORD-90-8

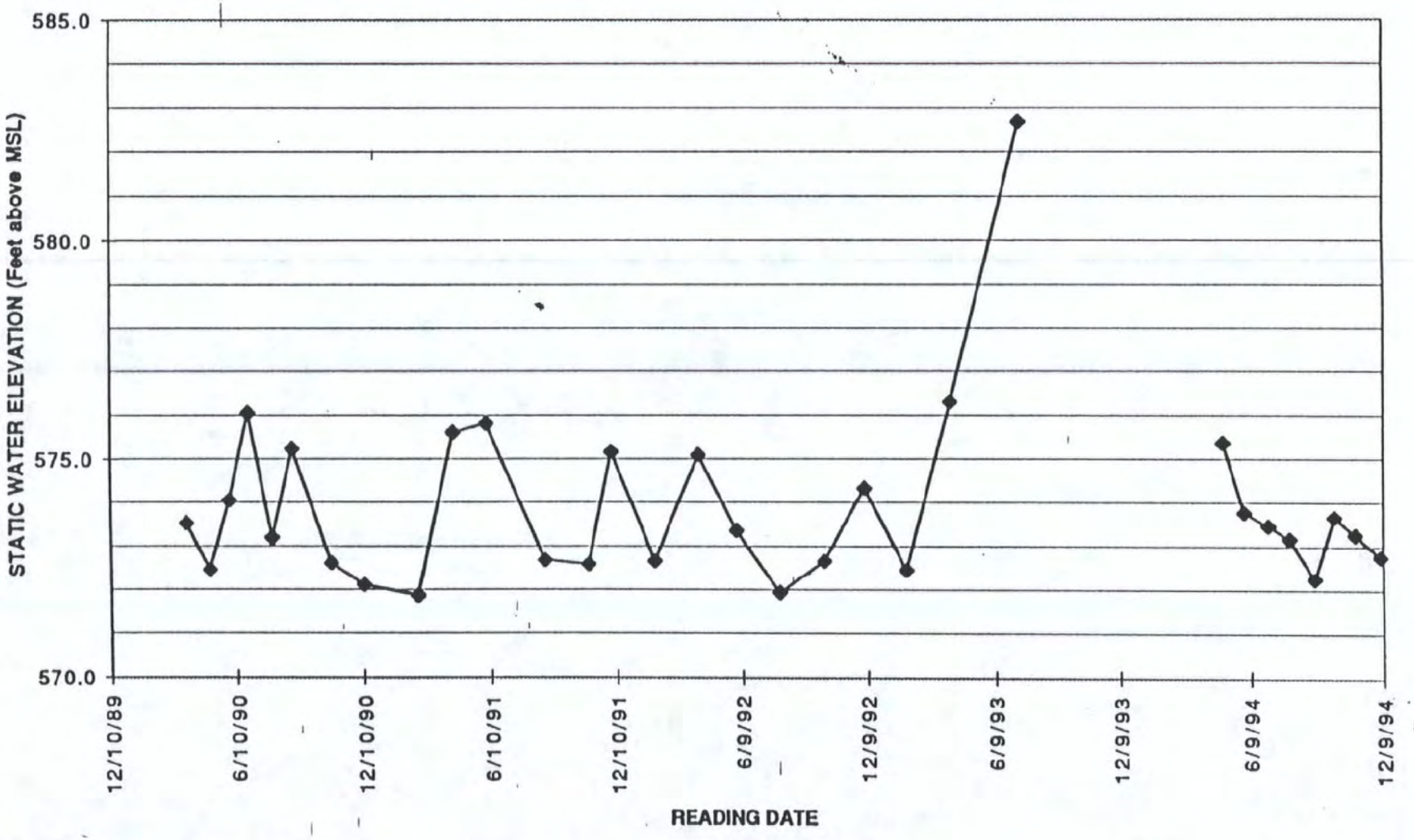


FIGURE A1-16

3M:GEOLOGY: BWK
CORD-90-8 HYDGPH
2/28/95

HYDROGRAPH
CORD-90-9

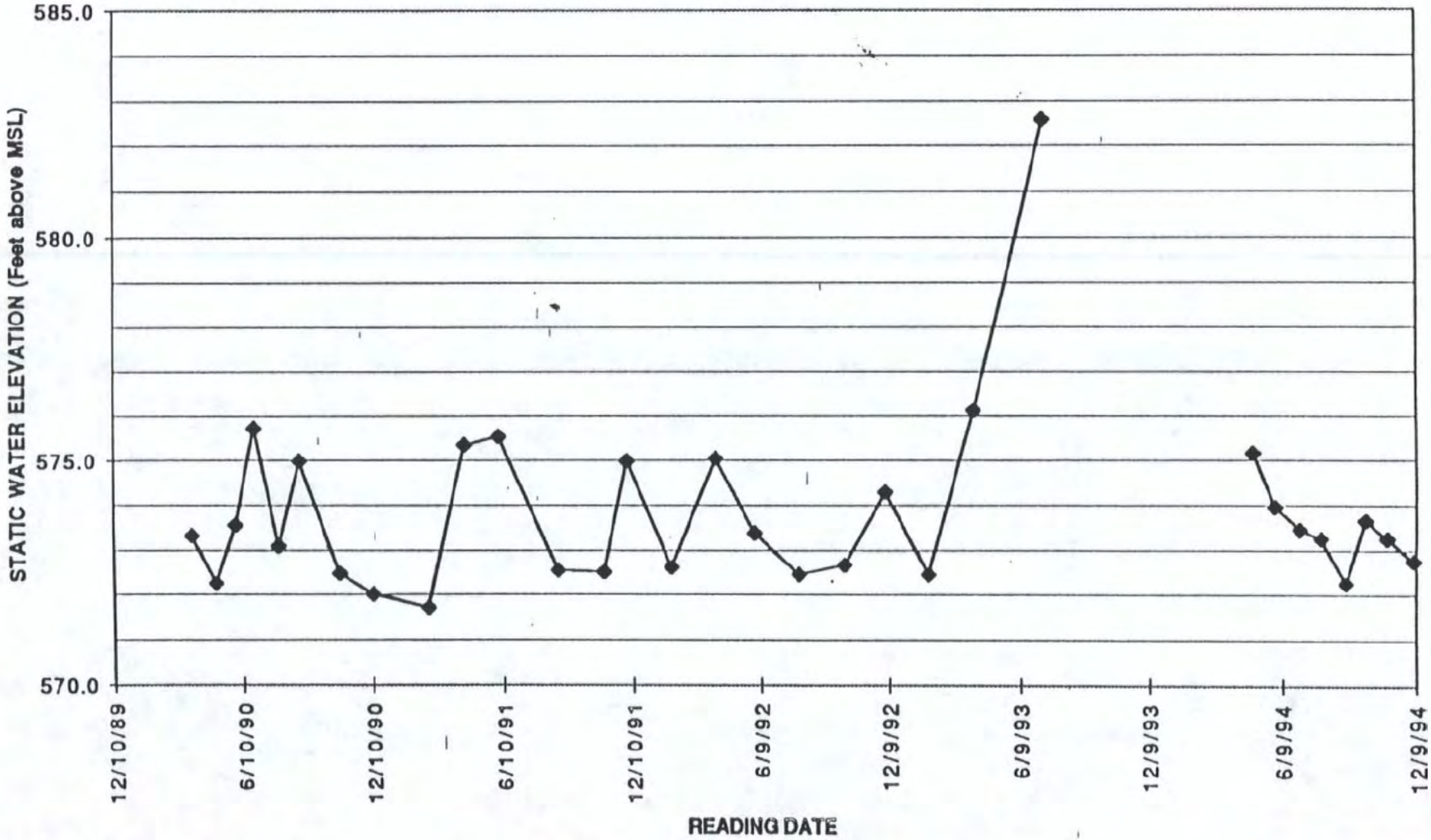


FIGURE A1-17

3M:GEOLOGY: BWK
CORD-90-9 HYDGPH
2/28/95

HYDROGRAPH
CORD-91-1

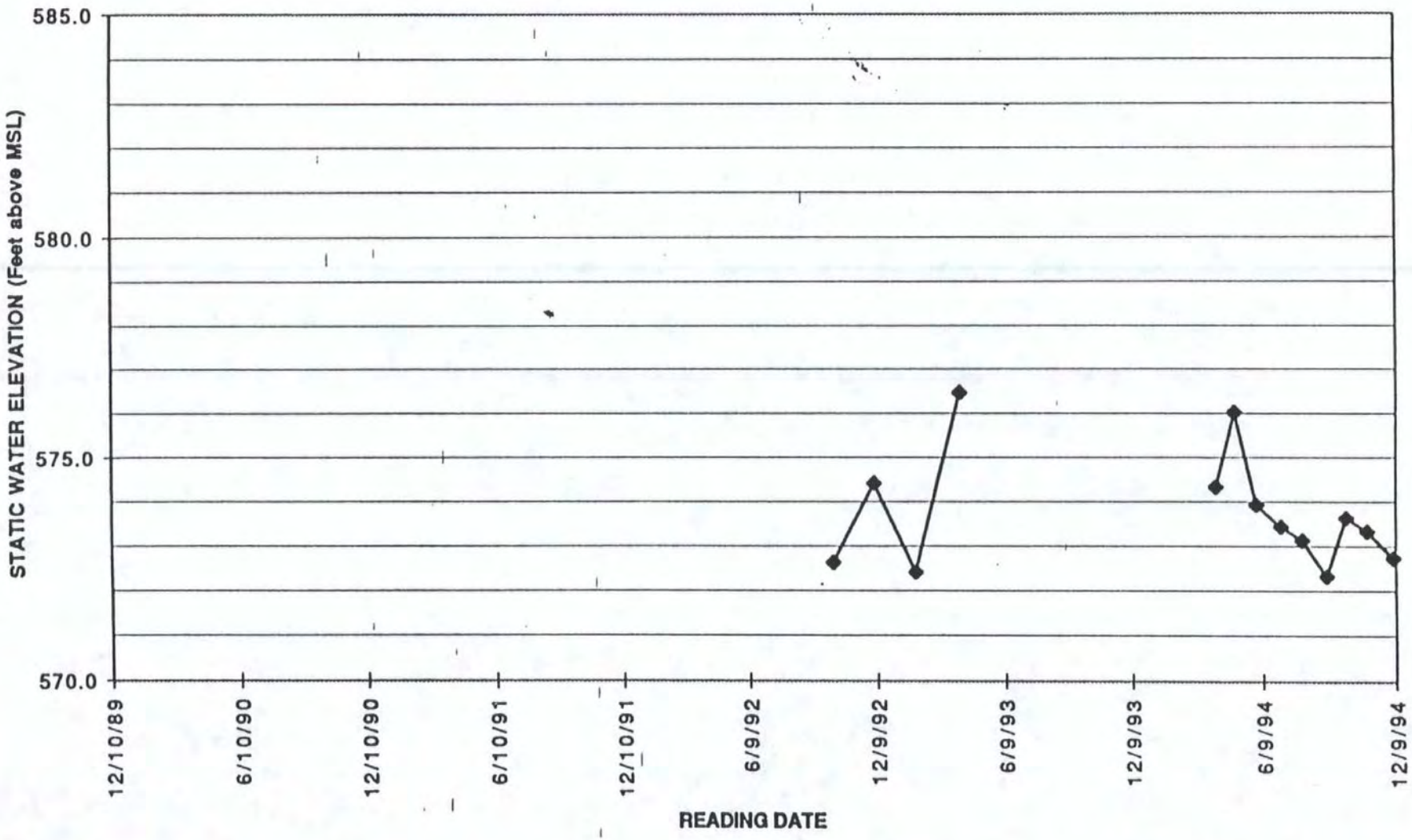
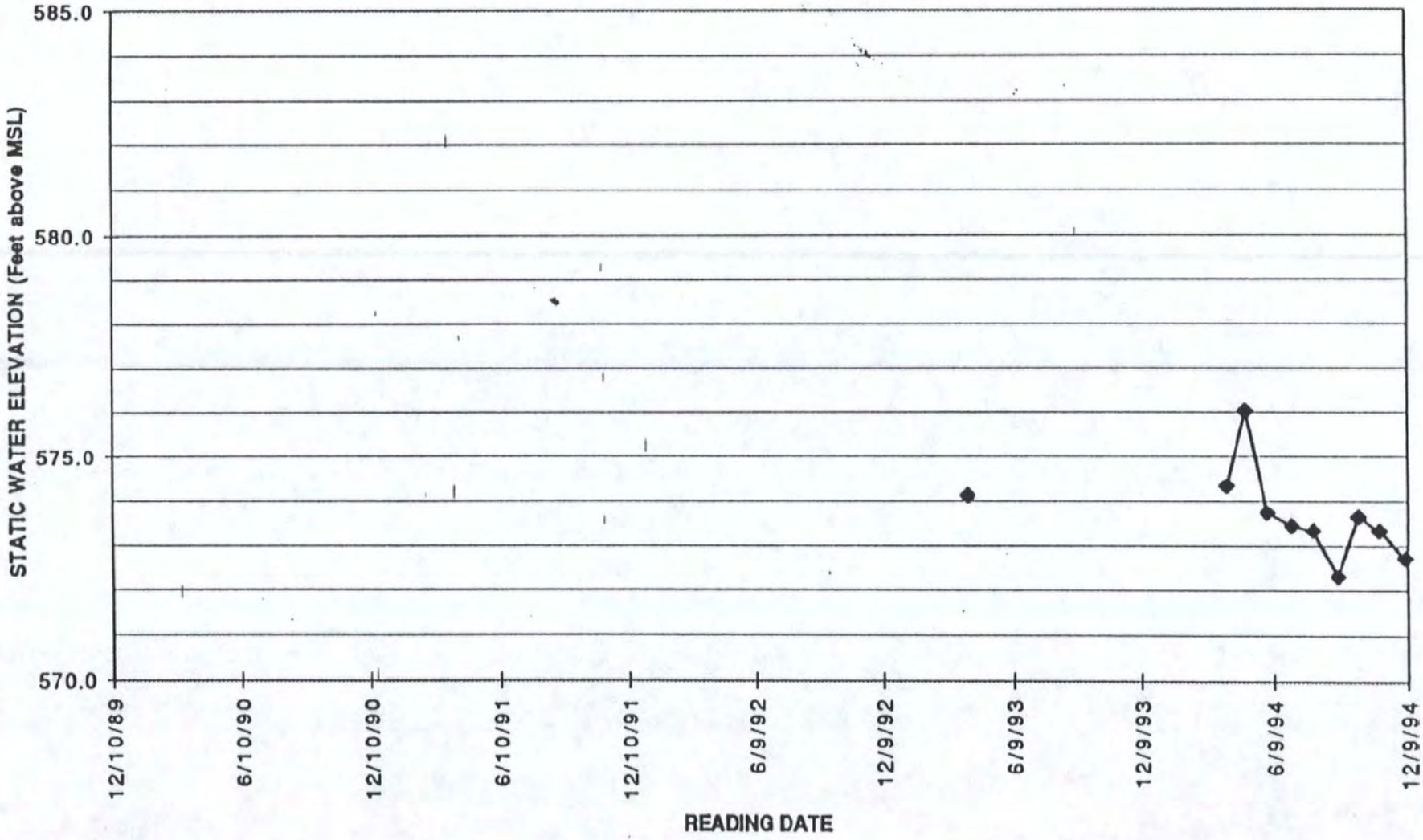


FIGURE A1-18

3M:GEOLOGY: BWK
CORD-91-1 HYDGPH
2/28/95

HYDROGRAPH
CORD-91-2R



3M:GEOLOGY: BWK
CORD-91-2R HYDGPH
2/28/95

FIGURE A1-19

HYDROGRAPH
CORD-93-1

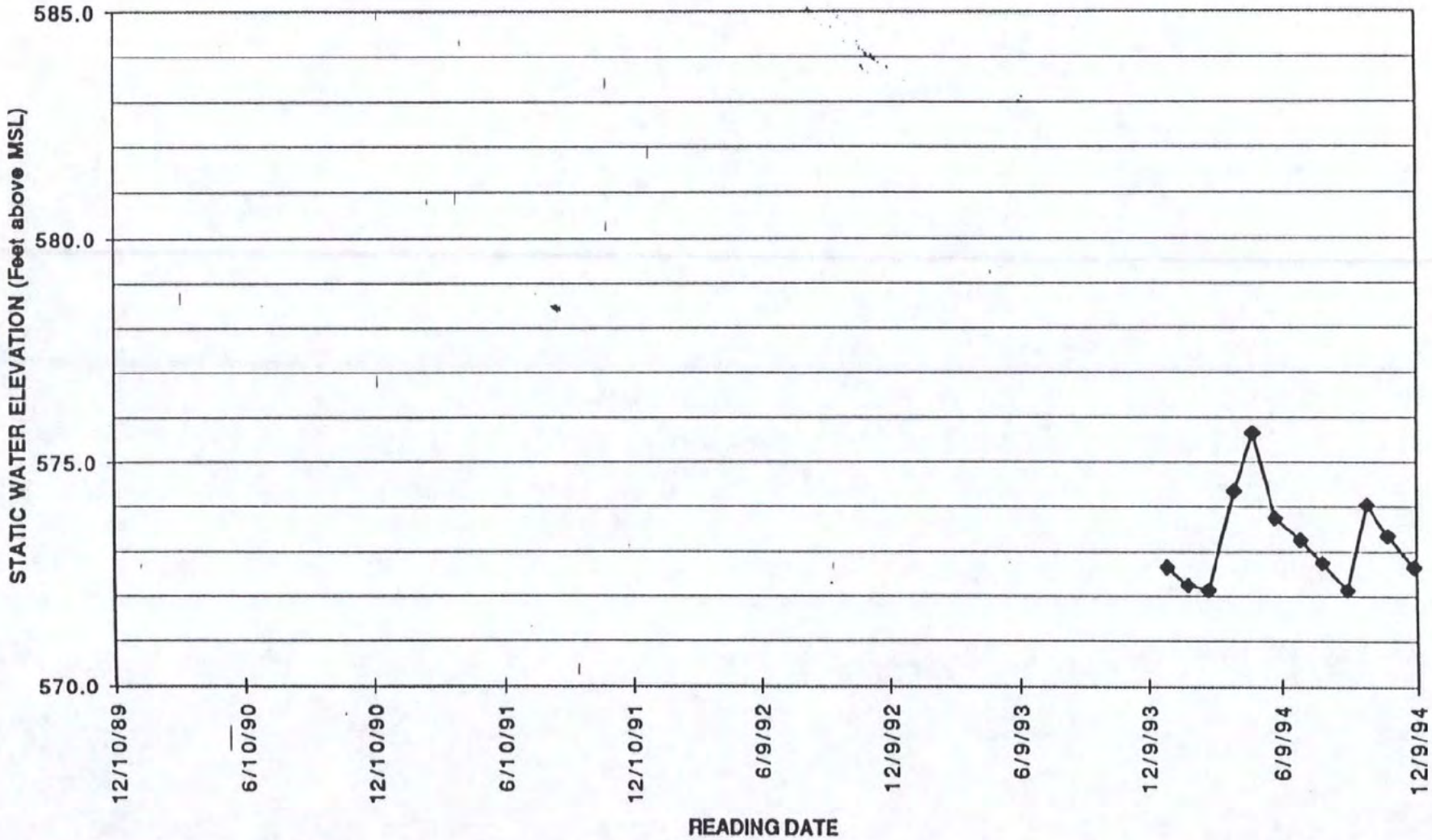


FIGURE A1-20

3M:GEOLOGY: BWK
CORD-93-1 HYDGPH
2/28/95

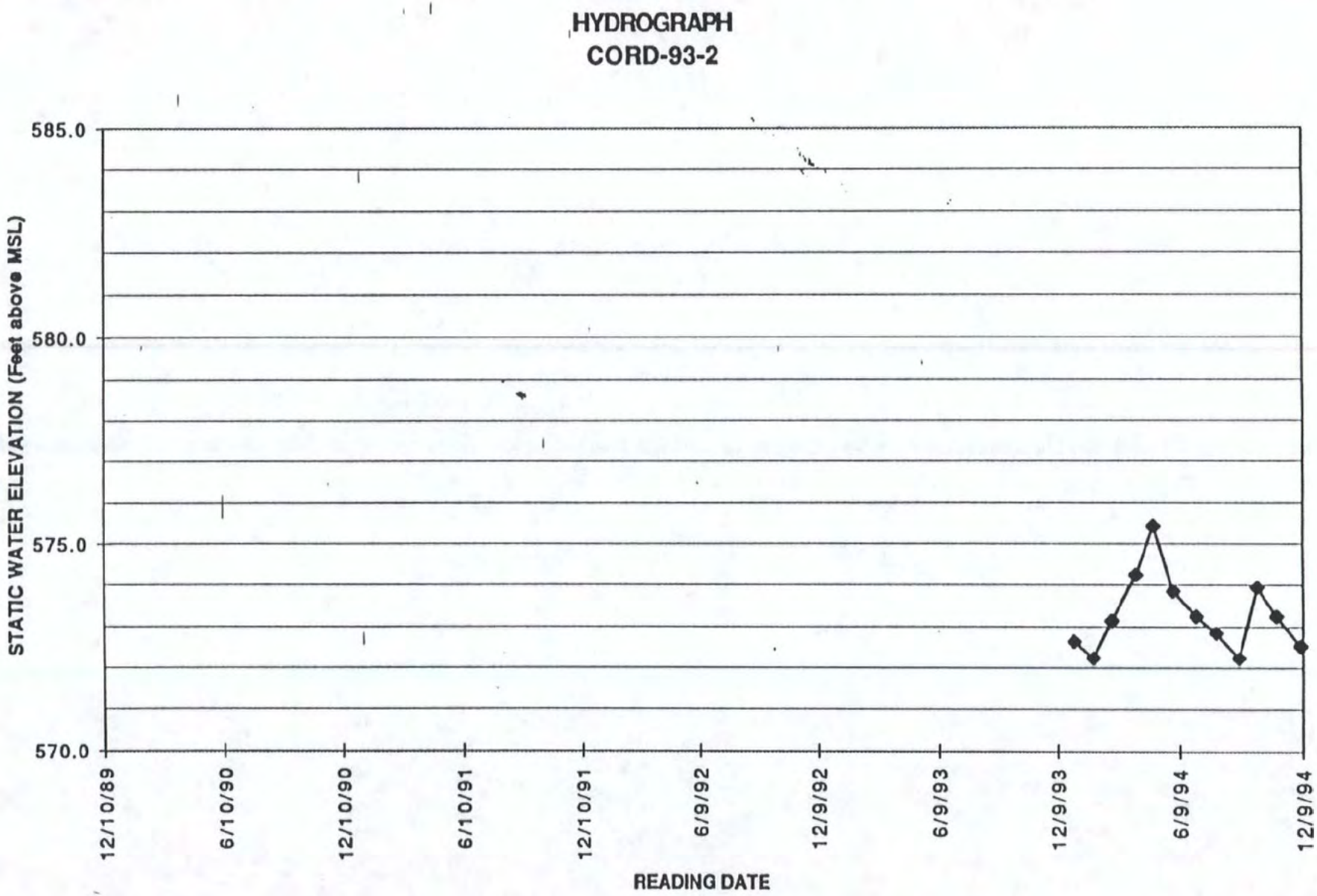
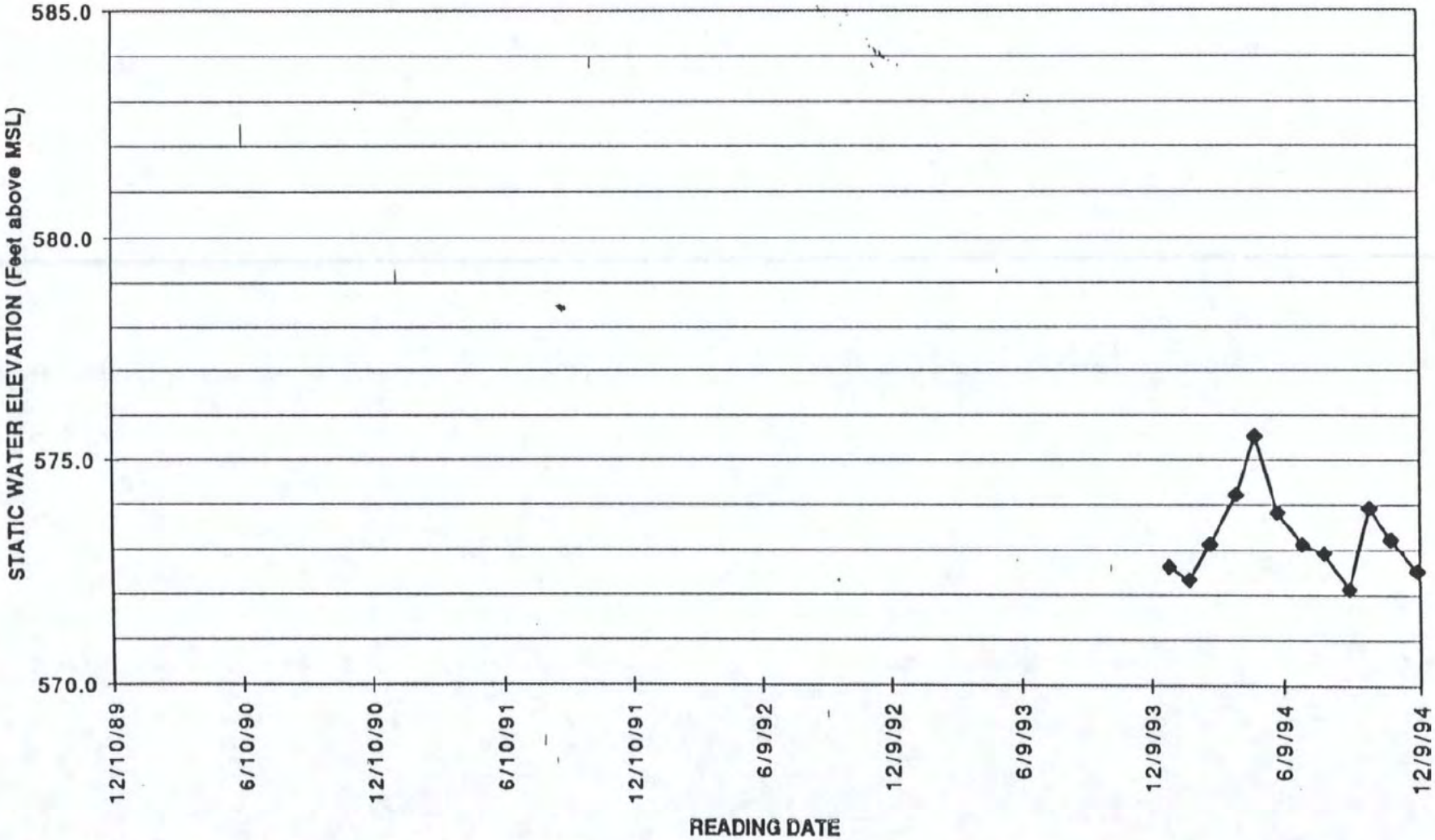


FIGURE A1-21

3M:GEOLOGY: BWK
CORD-93-2 HYDGPH
2/28/95

HYDROGRAPH
CORD-93-3



3M:GEOLOGY: BWK
CORD-93-3 HYDGPH
2/28/95

FIGURE A1-22

HYDROGRAPH
CORD-PW-1

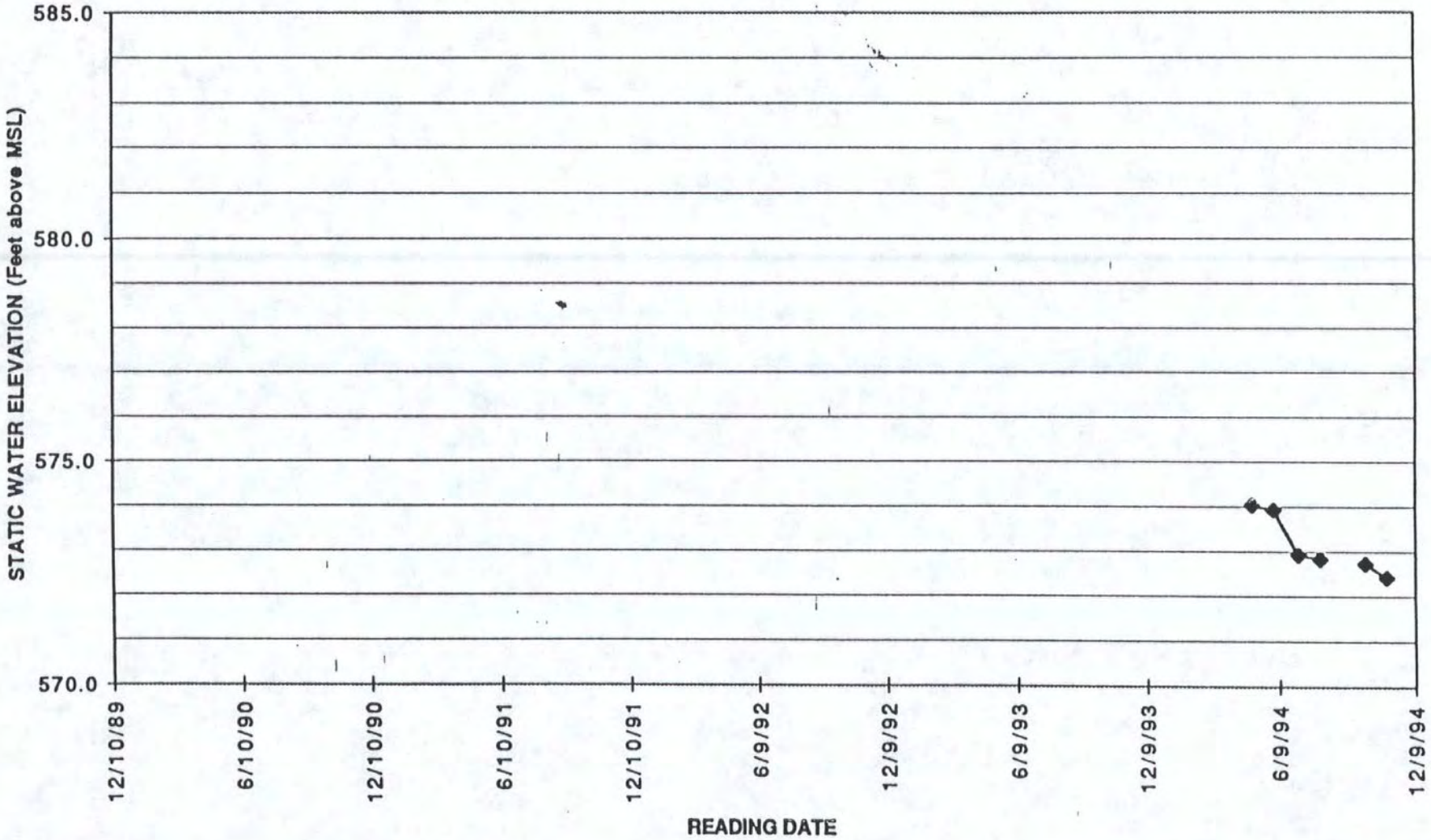
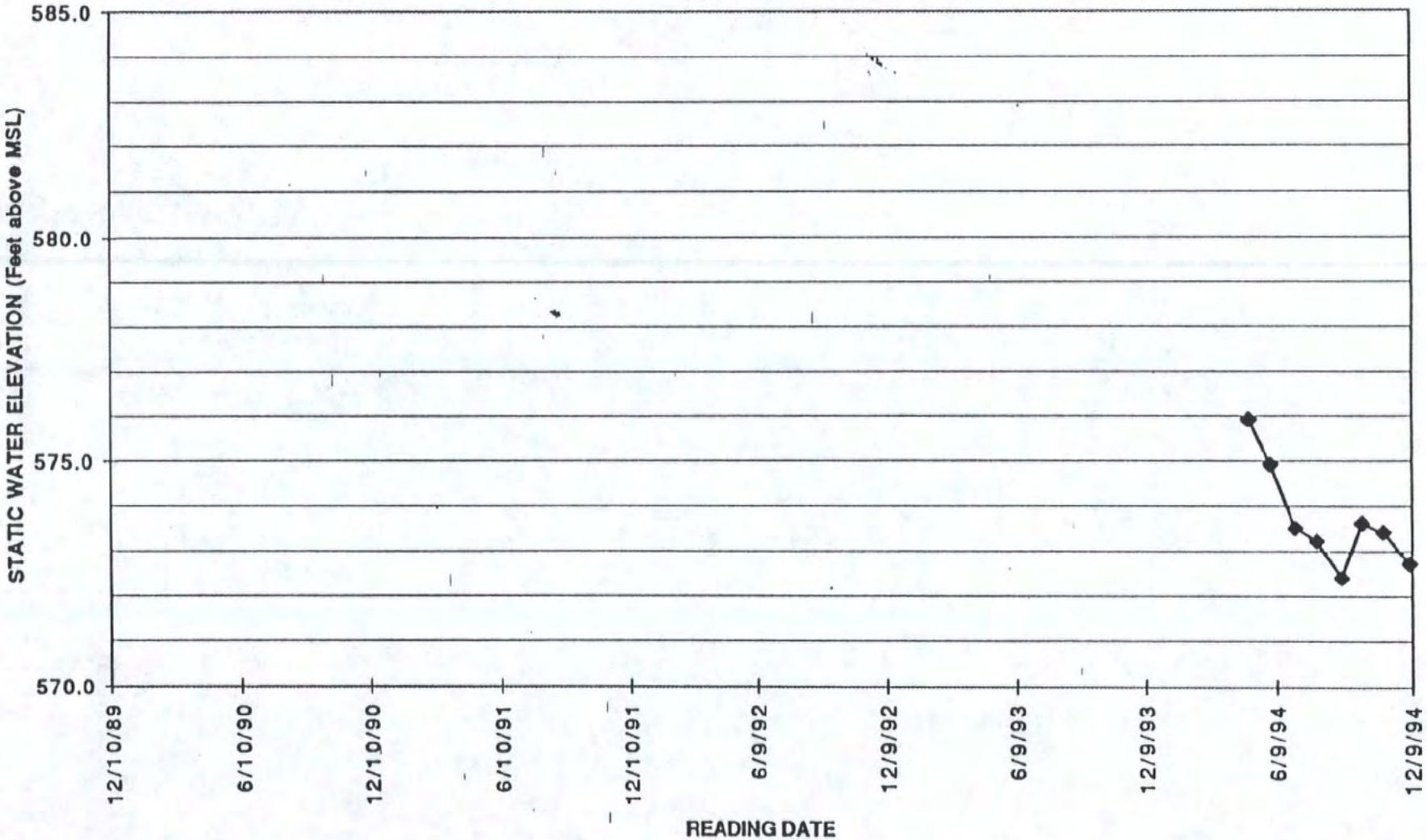


FIGURE A1-23

3M:GEOLOGY: BWK
CORD-PW-1 HYDGPH
2/28/95

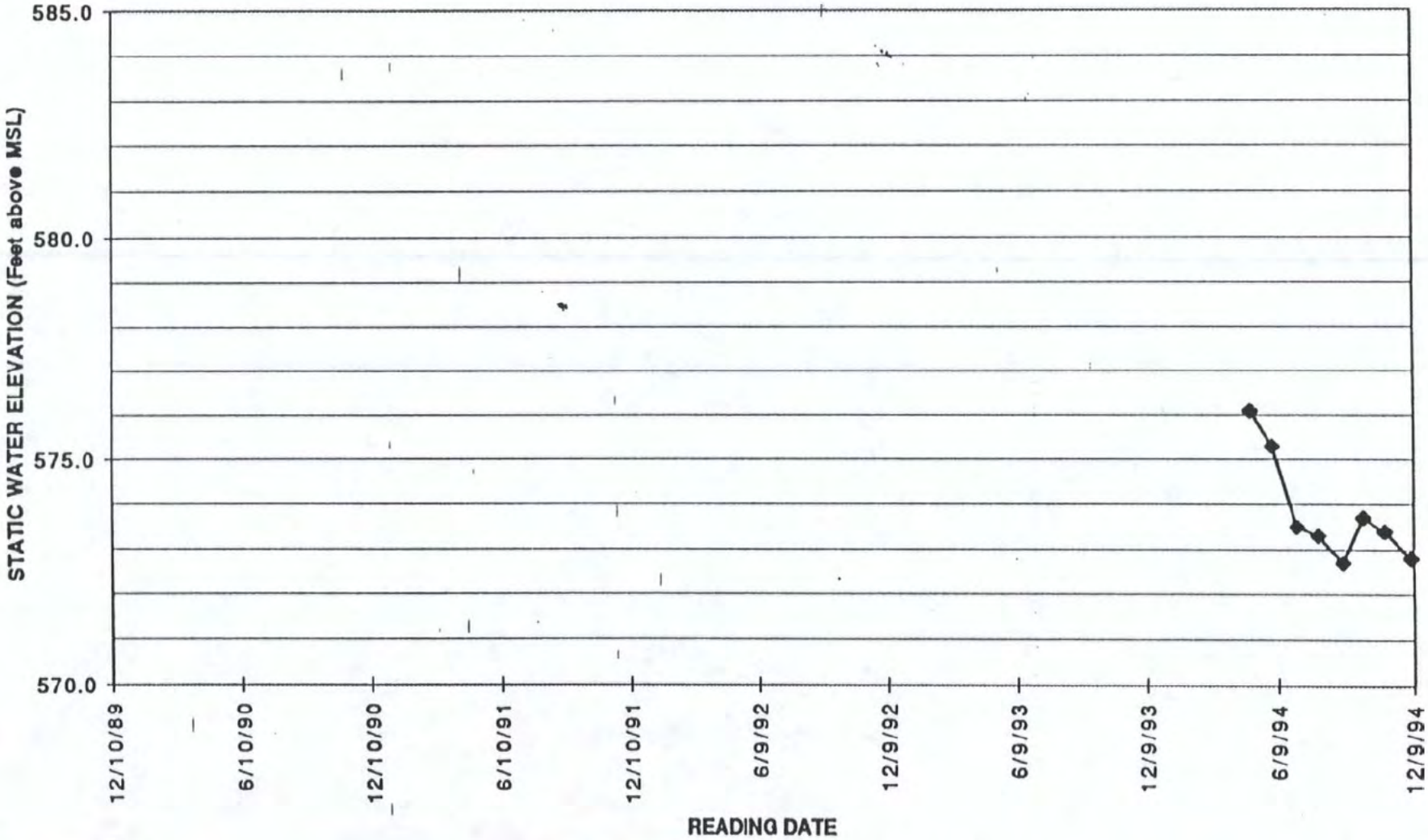
HYDROGRAPH
CORD-94-5



3M:GEOLOGY: BWK
CORD-94-5 HYDGPH
2/28/95

FIGURE A1-24

HYDROGRAPH
CORD-94-6



3M:GEOLOGY: BWK
CORD-94-6 HYDGPH
2/28/95

FIGURE A1-25

1994 3M CORDOVA STATIC WATER LEVELS

TABLE A1-1

	MW-1-79		MW-3-79		MW-4-79		MW-5-79	
COLLAR ELEVATION:	626.60	ELEV	633.33	ELEV	626.38	ELEV	623.83	ELEV
DATE								
1/4/94	56.70	569.90	62.00	571.33	57.70	568.68	57.80	566.03
2/1/94								
3/1/94								
4/6/94	58.40	568.20	63.00	570.33	58.50	567.88	58.20	565.63
5/3/94	58.50	568.10	62.40	570.93	58.40	567.98	58.10	565.73
6/1/94	58.50	568.10	62.40	570.93			57.10	566.73
7/5/94	59.20	567.40	63.40	569.93	58.90	567.48	58.80	565.03
8/3/94	59.70	566.90	63.70	569.63			58.90	564.93
9/6/94	59.80	566.80	64.20	569.13			59.10	564.73
10/3/94	59.60	567.00	64.10	569.23	59.50	566.88	58.90	564.93
11/1/94	59.60	567.00	64.10	569.23			58.90	564.93
12/6/94	59.60	567.00	64.20	569.13			59.30	564.53

1994 3M CORDOVA STATIC WATER LEVELS

TABLE A1-1

	MW-1-81		MW-2-81		MW-3-81		MW-4-81	
COLLAR ELEVATION:	592.35	ELEV	601.36	ELEV	591.91	ELEV	611.57	ELEV
DATE								
1/4/94	19.60	572.75	27.10	574.26	17.80	574.11	38.70	572.87
2/1/94								
3/1/94								
4/6/94	18.10	574.25	27.40	573.96	17.10	574.81	39.30	572.27
5/3/94	16.80	575.55	27.20	574.16	16.50	575.41	39.20	572.37
6/1/94			26.70	574.66	16.70	575.21	38.70	572.87
7/5/94	19.00	573.35	27.80	573.56	17.80	574.11	39.70	571.87
8/3/94			27.90	573.46	18.00	573.91	39.90	571.67
9/6/94			28.70	572.66	18.70	573.21	40.50	571.07
10/3/94	18.70	573.65	28.40	572.96	17.70	574.21	40.40	571.17
11/1/94			28.50	572.86	17.90	574.01	40.40	571.17
12/6/94			28.70	572.66	18.50	573.41	40.60	570.97

1994 3M CORDOVA STATIC WATER LEVELS

TABLE A1-1

	MW-5-81		MW-1-88		MW-1-90		MW-2-90	
COLLAR ELEVATION:	601.77	ELEV	595.25	ELEV	591.86	ELEV	596.59	ELEV
DATE								
1/4/94	33.50	568.27						
2/1/94								
3/1/94								
4/6/94	32.60	569.17						
5/3/94	32.00	569.77	19.30	575.95	15.80	576.06	20.50	576.09
6/1/94	32.20	569.57	21.50	573.75	18.20	573.66	22.10	574.49
7/5/94	33.10	568.67	21.70	573.55	18.30	573.56	22.80 -	573.79
8/3/94	33.30	568.47	22.00	573.25	18.60	573.26	23.20	573.39
9/6/94	34.10	567.67	22.90	572.35	19.40	572.46	24.00	572.59
10/3/94	32.80	568.97	21.50	573.75	18.10	573.76	22.90	573.69
11/1/94	33.50.	568.27	21.80	573.45	18.30	573.56	23.00	573.59
12/6/94	34.20	567.57	22.40	572.85	19.00	572.86	23.80	572.79

1994 3M CORDOVA STATIC WATER LEVELS

TABLE A1-1

	MW-3-90		MW-4-90		MW-5-90		MW-6-90	
COLLAR ELEVATION:	591.73	ELEV	593.58	ELEV	591.37	ELEV	627.38	ELEV
					591.94	Old Est El	627.26	Old Est El
DATE								
1/4/94			20.90	572.68				
2/1/94			21.30	572.28				
3/1/94			21.70	571.88				
4/6/94			18.50	575.08				
5/3/94	16.30	575.43	18.50	575.08	16.70	574.67	59.30	568.08
6/1/94	17.90	573.83	19.70	573.88	16.80	574.57	58.90	568.48
7/5/94	18.30	573.43	20.40	573.18	17.90	573.47	59.80	567.58
8/3/94	18.50	573.23	20.70	572.88	17.90	573.47	60.10	567.28
9/6/94	19.30	572.43	21.50	572.08	18.70	572.67	59.70	567.68
10/3/94	18.10	573.63	19.90	573.68	17.90	573.47	60.40	566.98
11/1/94	18.40	573.33	20.60	572.98	18.10	573.27	60.40	566.98
12/6/94	18.90	572.83	21.10	572.48	18.50	572.87	60.50	566.88

1994 3M CORDOVA STATIC WATER LEVELS

TABLE A1-1

	MW-7-90		MW-8-90		MW-9-90R	NEW	MW-1-91	
COLLAR ELEVATION:	596.32	ELEV	595.48	ELEV	596.86	ELEV	591.63	ELEV
					596.99	Old Est El		
DATE								
1/4/94								
2/1/94								
3/1/94								
4/6/94	22.10	574.22					17.30	574.33
5/3/94	20.60	575.72	20.10	575.36	21.70	575.16	15.60	576.03
6/1/94	22.50	573.82	21.70	573.76	22.90	573.96	17.70	573.93
7/5/94	22.90	573.42	22.00	573.46	23.40	573.46	18.20	573.43
8/3/94	23.10	573.22	22.30	573.16	23.60	573.26	18.50	573.13
9/6/94	24.10	572.22	23.20	572.26	24.60	572.26	19.30	572.33
10/3/94	22.70	573.62	21.80	573.66	23.20	573.66	18.00	573.63
11/1/94	23.10	573.22	22.20	573.26	23.60	573.26	18.30	573.33
12/6/94	23.20	573.12	22.70	572.76	24.10	572.76	18.90	572.73

1994 3M CORDOVA STATIC WATER LEVELS

TABLE A1-1

	MW-2-91R	NEW	MW-1-93		MW-2-93		MW-3-93	
COLLAR ELEVATION:	592.54	ELEV	593.95	ELEV	594.24	ELEV	594.43	ELEV
DATE								
1/4/94			21.30	572.65	21.60	572.64	21.80	572.63
2/1/94			21.70	572.25	22.00	572.24	22.10	572.33
3/1/94			21.80	572.15	21.10	573.14	21.30	573.13
4/6/94	18.20	574.34	19.60	574.35	20.00	574.24	20.20	574.23
5/3/94	16.50	576.04	18.30	575.65	18.80	575.44	18.90	575.53
6/1/94	18.80	573.74	20.20	573.75	20.40	573.84	20.60	573.83
7/5/94	19.10	573.44	20.70	573.25	21.00	573.24	21.30	573.13
8/3/94	19.20	573.34	21.20	572.75	21.40	572.84	21.50	572.93
9/6/94	20.20	572.34	21.80	572.15	22.00	572.24	22.30	572.13
10/3/94	18.90	573.64	19.90	574.05	20.30	573.94	20.50	573.93
11/1/94	19.20	573.34	20.60	573.35	21.00	573.24	21.20	573.23
12/6/94	19.80	572.74	21.30	572.65	21.70	572.54	21.90	572.53

1994 3M CORDOVA STATIC WATER LEVELS

TABLE A1-1

	PW-1		MW-1-94		MW-2-94		MW-3-94	
COLLAR ELEVATION:	599.23	ELEV	632.72	ELEV	612.25	ELEV	596.78	ELEV
DATE								
1/4/94								
2/1/94								
3/1/94								
4/6/94								
5/3/94	25.20	574.03						
6/1/94	25.30	573.93						
7/5/94	26.30	572.93						
8/3/94	26.40	572.83						
9/6/94								
10/3/94	26.50	572.73						
11/1/94	26.80	572.43						
12/6/94								

1994 3M CORDOVA STATIC WATER LEVELS

TABLE A1-1

	MW-4-94		MW-5-94		MW-6-94		MW-7-94	
COLLAR ELEVATION:	597.93	ELEV	590.02	ELEV	590.30	ELEV	597.93	ELEV
DATE								
1/4/94								
2/1/94								
3/1/94								
4/6/94								
5/3/94			14.10	575.92	14.20	576.10		
6/1/94			15.10	574.92	15.00	575.30		
7/5/94			16.50	573.52	16.80	573.50		
8/3/94			16.80	573.22	17.00	573.30		
9/6/94			17.60	572.42	17.60	572.70		
10/3/94			16.40	573.62	16.60	573.70	26.10	571.83
11/1/94			16.60	573.42	16.90	573.40		
12/6/94			17.30	572.72	17.50	572.80		

1994 3M CORDOVA STATIC WATER LEVELS

TABLE A1-1

	MW-8-94		MW-9-94		MW-10-94	
COLLAR ELEVATION:	595.56	ELEV	597.65	ELEV	602.24	ELEV
DATE						
1/4/94						
2/1/94						
3/1/94						
4/6/94						
5/3/94						
6/1/94						
7/5/94						
8/3/94						
9/6/94						
10/3/94	23.00	572.56	24.40	573.25	35.40	566.84
11/1/94						
12/6/94						

US CORP OF ENGINEERS

YEARLY STATUS REPORT – 1994
PRINCETON GAGING STATION – MISSISSIPPI RIVER
ALL REPORTED VALUES ARE DAILY MAXIMUM

River Mile = 502.10
Gage "0"= 565.56
Flood Stage = 13

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	M	8.5	9.0	10.1	10.7	9.4	9.4	9.3	8.8	10.1	9.2	9.0
2	8.9	8.5	9.0	10.1	10.8	9.6	9.3	9.0	8.7	9.5	9.3	9.0
3	8.9	8.6	9.2	10.1	10.9	9.2	9.3	8.9	8.6	9.5	9.4	9.2
4	8.9	8.5	9.4	9.9	11.0	9.1	9.0	9.0	9.0	9.3	9.4	9.0
5	8.9	8.6	9.6	10.1	11.5	9.1	9.3	9.0	8.8	9.4	9.4	8.8
6	8.9	8.5	9.9	10.1	11.6	9.0	9.5	8.8	8.9	9.3	9.4	8.8
7	9.0	8.5	9.8	9.8	11.7	9.1	9.4	8.7	9.0	9.3	9.1	8.8
8	9.2	8.5	9.5	9.7	11.7	9.2	9.6	8.7	8.7	9.3	9.1	8.6
9	9.2	8.4	9.9	9.8	11.7	9.1	9.7	8.7	8.7	9.2	9.1	8.6
10	9.1	8.4	9.9	9.9	11.6	9.0	9.5	8.7	8.6	9.3	9.0	8.8
11	9.1	8.4	9.9	9.9	11.5	9.0	9.4	8.7	8.6	9.1	8.9	8.9
12	8.9	8.4	10.1	9.6	11.4	9.0	9.9	9.0	8.7	9.1	8.9	8.9
13	8.8	8.4	10.1	9.6	11.3	9.1	9.7	8.3	8.7	9.2	9.1	9.0
14	8.7	8.4	10.3	9.7	11.1	9.1	9.7	9.3	8.7	9.0	9.1	9.0
15	8.7	8.4	10.4	9.5	11.1	9.1	9.7	9.3	8.7	9.0	9.0	9.1
16	8.7	8.4	10.1	9.6	10.8	9.0	9.7	9.3	8.8	8.8	9.0	9.1
17	8.6	8.4	9.8	9.8	10.8	9.0	9.6	9.4	9.1	8.9	9.0	9.2
18	8.6	8.4	9.8	9.7	10.6	9.0	9.6	9.3	9.2	9.0	8.9	9.2
19	8.6	8.4	9.7	9.7	10.5	8.9	9.6	9.3	9.1	9.1	8.9	9.3
20	8.5	9.5	9.7	9.5	11.5	9.0	9.6	9.6	9.4	9.3	8.9	9.3
21	8.5	9.8	9.8	10.0	10.5	8.9	9.3	9.1	9.4	9.3	9.1	9.4
22	8.4	9.9	9.8	10.3	10.1	9.4	9.4	9.1	9.4	9.0	9.1	9.4
23	8.4	9.7	9.9	10.1	10.1	9.4	9.4	9.0	9.6	9.1	9.1	9.4
24	8.4	9.6	10.1	10.0	9.9	9.9	9.4	9.1	10.1	9.1	9.0	9.4
25	8.3	9.4	10.1	10.2	9.8	9.4	9.3	9.2	10.2	9.3	9.1	9.4
26	8.3	9.3	9.9	10.3	9.8	9.7	9.2	9.2	10.4	9.2	9.1	9.1
27	8.3	9.1	9.9	10.2	9.6	9.4	9.1	9.0	10.4	9.2	9.1	9.0
28	8.3	9.0	9.8	10.6	9.6	9.2	9.2	8.9	10.1	9.2	9.0	9.1
29	8.5		9.9	10.5	9.5	9.3	9.3	9.0	10.1	9.2	9.2	9.0
30	8.5		9.9	10.5	9.5	9.4	9.4	8.9	10.2	9.3	9.2	8.7
31	8.5		10.0		9.4		M	8.7		9.3		8.8
MEAN	8.7	8.8	9.8	10.0	10.7	9.2	9.5	9.0	9.2	9.2	9.1	9.0
MAX	9.2	9.9	10.4	10.6	11.7	9.9	9.9	9.6	10.4	10.1	9.4	9.4
MIN	8.3	8.4	9.0	9.5	9.4	8.9	9.0	8.3	8.6	8.8	8.9	8.6

TABLE A1-2

3M CORDOVA MONITOR WELL CONSTRUCTION SCHEDULE:

BWK-2/23/95

WELL LOCATIONS (PLANT COORDINATES)
COLLAR ELEVATIONS (MSL DATUM)
CONSTRUCTION DETAILS

WELL ID	NORTH PLANT COORD	EAST PLANT COORD	CASING LIP ELEV.	TOTAL DEPTH FM SUR FT.	TOP OF SCREEN FM SUR ELEV.	SCREEN LENGTH FT.	NOMINAL WELL DIAMETER IN.	CASING MATERIAL	SCREEN MATERIAL
PLANT AREA WELLS									
MW-1-81	3264.23	1257.96	592.35	57.00	54.00	3.00	5.00	MS	SS
MW-1-88	3060.14	872.42	595.25	30.00	20.00	10.00	2.00	SS	SS
MW-1-90	2547.53	600.44	591.86	24.50	14.50	10.00	2.00	SS	SS
MW-2-90	1925.70	420.28	596.59	29.50	19.50	10.00	2.00	SS	SS
MW-3-90	2413.46	938.91	591.73	25.00	15.00	10.00	2.00	SS	SS
MW-4-90	3570.30	1696.54	593.58	27.00	17.00	10.00	2.00	SS	SS
MW-7-90	2704.71	1140.88	596.32	30.50	20.50	10.00	2.00	SS	SS
MW-8-90	2908.47	1113.18	595.46	30.00	20.00	10.00	2.00	SS	SS
MW-9-90R	2183.00	932.00	596.99	27.00	17.00	10.00	2.00	SS	SS
MW-1-91	2744.67	1018.76	591.63	23.00	13.00	10.00	2.00	SS	SS
MW-2-91R	2688.86	1010.90	592.54	24.00	11.50	10.00	2.00	SS	SS
MW-1-93	3620.18	1138.68	593.95	22.50	12.50	10.00	2.00	PVC	PVC
MW-2-93	3524.71	1261.07	594.24	21.80	11.80	10.00	2.00	PVC	PVC
MW-3-93	3545.52	1340.60	594.43	22.00	12.00	10.00	2.00	PVC	PVC
MW-3-94	2123.06	1344.46	596.78	28.50	18.50	10.00	2.00	SS	SS
MW-4-94	2845.02	1570.98	597.93	29.00	19.00	10.00	2.00	SS	SS
MW-5-94	2763.02	886.18	590.02	21.00	10.00	10.00	2.00	SS	SS
MW-6-94	2674.73	885.08	590.30	20.00	10.00	10.00	2.00	SS	SS
PW-1	2004.52	1726.45	599.23	?	WELL PT	2.00	2.00	GS	BR

GS - GALVANIZED STEEL
BR - BRASS
SS - STAINLESS STEEL
MS - MILD STEEL
PVC - PVC PLASTIC

TABLE A1-3

APPENDIX 2

BORING LOGS

LOG OF BORING NO. MW1-88

OWNER 3M

ARCHITECT

SITE CORDOVA, ILLINOIS

PROJECT NAME XYLENE TANK INVESTIGATION

Sample No.	Type Sample	Sampling Distance	Recovery	Blows/ft.	Unconfined Compressive Strength-lbs./ft.²	Water Content - %	Dry Density - lbs./ft.³	Unified Classification Symbol	Depth	Elevation	Description *	Monitoring Well Details
											LEAN TO FAT CLAY WITH SAND Dark Gray (3')	
											LEAN CLAY WITH SAND Brown (5')	
									5		CLAYEY SAND Brown (9')	
									10		FINE TO COARSE SAND Brown	
	HS								15			
					C				20			
									25			
									30		(30')	

BOTTOM OF BORING

*Subsurface soil descriptions based on driller's field classifications of disturbed samples.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WATER LEVEL OBSERVATIONS		
W.L.	W.S. OR W.D.	A.B.
W.L.	B.C.R.	A.C.R.
W.L.		

Terracon

BORING STARTED	12-16-88
BORING COMPLETED	12-16-88
RIG #2	FOREMAN GAE
APPROVED WKB	JOB # 40885231

LOG OF BORING NO. MW-1

OWNER/CLIENT 3M	CONTRACTOR/ENGINEER Mr. Bruce W. Cramer
22614 Highway 84 North Cordova, Illinois	PROJECT Contract Drilling and Sampling

Top of Casing Elevation: 96.68 ft.
Ground Surface Elevation: 93.6 ft.

DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	FIELD VAPOR TESTS (ppm)
SANDY LEAN CLAY Dark Brown 3.5 — 90.1				HS				
			1	SS				0
	5			HS				
			2	SS				0
	10			HS				
FINE TO COARSE SAND Brown			3	SS				0
	15			HS				
▽			4	SS				2
	20			HS				
24.5 — 69.1								
BOTTOM OF BORING								

WELL DETAIL

SOIL DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE DRILLING CREW

STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 8.2 in. LOCK:
WELL DIA.: 2.0 in. Wisdom 0-1

WATER LEVEL OBSERVATIONS
▽ 17.5' WD ▽20.12' 48 hr. AB

BORING STARTED 1-16-90
BORING COMPLETED 1-17-90

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LOG OF BORING NO. MW-2

OWNER/CLIENT 3M	CONTRACTOR/ENGINEER Mr. Bruce W. Cramer
22614 Highway 84 North Cordova, Illinois	PROJECT Contract Drilling and Sampling

Top of Casing Elevation: 101.21 ft.
Ground Surface Elevation: 98.5 ft.

DESCRIPTION		DEPTH (FT.)	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	FIELD VAPOR TESTS (ppm)
Gravel top 2"									
SANDY LEAN CLAY					HS				
3.1 Dark Brown	95.4								
		5		1	SS				0
					HS				
		10		2	SS				0
					HS				
FINE TO COARSE SAND Brown		15		3	SS				0
					HS				
		20		4	SS				0
		25			HS				
29.5	69.0								
BOTTOM OF BORING									

WELL DETAIL

SOIL DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE DRILLING CREW

STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 8.2 in. LOCK:
WELL DIA.: 2.0 in. Wisdom 0-1

WATER LEVEL OBSERVATIONS		
▽ 22.5'	WD ▽24.79' 48 hr. AB	

BORING STARTED	1-17-90
BORING COMPLETED	1-17-90
FOREMAN	GAE

-152

LOG OF BORING NO. MW-3

R/CLIENT 3M	CONTRACTOR/ENGINEER Mr. Bruce W. Cramer
22614 Highway 84 North Cordova, Illinois	PROJECT Contract Drilling and Sampling

Top of Casing Elevation: 96.53 ft.
Ground Surface Elevation: 94.0 ft.

DESCRIPTION		DEPTH (FT.)	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	FIELD VAPOR TESTS (ppm)
Gravel top 3" SANDY LEAN CLAY Dark Brown					HS				
4.4	89.6			1	SS				93
		5			HS				
				2	SS				0
		10			HS				
FINE TO COARSE SAND Brown				3	SS				0
		15			HS				
		20							
25.0	69.0	25							
BOTTOM OF BORING									

WELL DETAIL

SOIL DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE DRILLING CREW

STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 8.2 in. LOCK:
WELL DIA.: 2.0 in. Wisdom 0-1

WATER LEVEL OBSERVATIONS		
▽ 18.0'	WD	▽20.28' 24 hr. AB

Terracon

BORING STARTED	1-17-90
BORING COMPLETED	1-18-90
RIG Mobile B-53	FOREMAN GAE

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LOG OF BORING NO. MW-4

ER/CLIENT 3M	CONTRACTOR/ENGINEER Mr. Bruce W. Cramer
22614 Highway 84 North Cordova, Illinois	PROJECT Contract Drilling and Sampling

Top of Casing Elevation: 98.34 ft.
Ground Surface Elevation: 95.4 ft.

DESCRIPTION		DEPTH (FT.)	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	FIELD VAPOR TESTS (ppm)
SANDY LEAN CLAY Dark Brown	2.5 / 92.9				HS				
				1	SS				0
		5			HS				
FINE TO COARSE SAND Brown	10.0 / 85.4			2	AS				0
		10			HS				
				3	AS				0
		15			HS				
FINE TO COARSE SAND WITH GRAVEL Brown				4	AS				0
		20			HS				
				5	AS				0
		25			HS				
	27.0 / 68.4								
BOTTOM OF BORING									

WELL DETAIL

SOIL DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE DRILLING CREW

E STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 8.2 in. LOCK:
WELL DIA.: 2.0 in. Wisdom 0-1

WATER LEVEL OBSERVATIONS		
FL ▽ 20.0'.	WD ▽22.54' 24 hr. AB	
FL		

Terracon

BORING STARTED	1-18-90
BORING COMPLETED	1-18-90
RIG Mobile B-53	FOREMAN GAE

154

LOG OF BORING NO. MW-5

NER/CLIENT: 3M	CONTRACTOR/ENGINEER: Mr. Bruce W. Kramer
ITE: 22614 Highway 84 North, Cordova, Illinois	PROJECT: Contract Drilling and Sampling

Top of Casing Elevation: 100.03 ft.
Ground Surface Elevation: 97.4 ft.

Depth	Description	Elevation
1.5	LEAN CLAY WITH SAND Trace Organics, Dark Brown	95.9
9.0	SILTY FINE TO MEDIUM SAND Brown	88.4
12.5	COARSE SAND WITH GRAVEL Brown	84.9
24.5	FINE SAND Brown	72.9

BOTTOM OF BORING

SOIL DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE DRILLING CREW

DEPTH-ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	FIELD VAPOR TESTS (ppm)
			HS				
5		1	SS	17	9		0
			HS				
10		2	SS	15	17		0
			HS				
15		3	SS	15	8		0
			HS				
20		4	SS	13	1		0
			HS				

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 8.2 in. LOCK:
WELL DIA.: 2 in. Wisdom 01

WATER LEVEL OBSERVATIONS			
WL	▽ 17.5'	WD	▼
WL			

Terracon

BORING STARTED	2-26-90
BORING COMPLETED	2-26-90
RIG CME-55 (#3)	FOREMAN GAE
REV.	JOB # 42905007

15

LOG OF BORING NO. MW-6

ER/CLIENT
3M
22614 Highway 84 North
Cordova, Illinois

CONTRACTOR/ENGINEER
Mr. Bruce W. Kramer

PROJECT
Contract Drilling and Sampling

Top of Casing Elevation: 100.91 ft.
Ground Surface Elevation: 98.1 ft.

DESCRIPTION		DEPTH-ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	FIELD VAPOR TESTS (ppm)
CLAYEY SAND, Dark Gray	1.5 / 96.6								
COARSE SAND WITH GRAVEL, Brown	3.5 / 94.6				HS				
FINE TO MEDIUM SAND Brown		5		1	SS	16	6		
					HS				
		10		2	SS	17	8		
	13.0 / 85.1				HS				
MEDIUM TO COARSE SAND Brown		15		3	SS	15	6		
					HS				
		20		4	SS	16	3		
	22.0 / 76.1				HS				
FINE TO MEDIUM SAND TRACE GRAVEL Brown		25		5	SS	15	9		
					HS				
		30		6	SS	14	9		

Continued Next Page

SOIL DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE DRILLING CREW

[illegible]IFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES [illegible]OIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 8.2 in. LOCK:
WELL DIA.: 2 in. Wisdom 01

WATER LEVEL OBSERVATIONS
59.0' WD

Terracon ENVIRONMENTAL

BORING STARTED	2-27-90
BORING COMPLETED	2-27-90
RIG CME-55 (#3)	FOREMAN GAE
APPROVED DEK	JOB # 42905007

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LOG OF BORING NO. MW-6

OWNER/CLIENT: 3M

CONTRACTOR/ENGINEER: Mr. Bruce W. Kramer

SITE: 22614 Highway 84 North, Cordova, Illinois

PROJECT: Contract Drilling and Sampling

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH-ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	FIELD VAPOR TESTS (ppm)
	33.0 — 65.1 MEDIUM TO COARSE SAND TRACE GRAVEL, Brown					HS				
			35		7	SS	17	14		
						HS				
	MEDIUM TO COARSE SAND TRACE GRAVEL, Brown (Continued from page 1)		40		8	SS	16	7		
						HS				
			45		9	SS	13	11		
						HS				
	50.5 — 47.6		50		10	SS	15	23		
	52.0 — 46.1 GRAVEL WITH COARSE SAND, Brown					HS				
	FINE SAND, Brown		55		11	SS	16	11		
						HS				
	60.1 — 38.0		60		12	SS	14	30		

Continued Next Page

SOIL DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE DRILLING CREW

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WATER LEVEL OBSERVATIONS		
WL	▽ 59.0'	WD ▽
WL		

Terracon

BORING STARTED	2-27-90
BORING COMPLETED	2-27-90
RIG CME-55 (#3)	FOREMAN GAE

LOG OF BORING NO. MW-6

OWNER/CLIENT	CONTRACTOR/ENGINEER
3M	Mr. Bruce W. Kramer
E 22614 Highway 84 North Cordova, Illinois	PROJECT Contract Drilling and Sampling

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH-ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	FIELD VAPOR TESTS (ppm)
				SAMPLES					TESTS	
	MEDIUM TO COARSE SAND WITH GRAVEL Brown		65			HS				
	70.5 27.6		70							
	BOTTOM OF BORING									

SOIL DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE DRILLING CREW

E STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES TWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WATER LEVEL OBSERVATIONS			
WL	▽ 59.0'	WD	▽
WL			
WL			

Terracon ENVIRONMENTAL

BORING STARTED	2-27-90		
BORING COMPLETED	2-27-90		
RIG CME-55 (#3)	FOREMAN	GAE	
APPROVED DEK	JOB #	42905007	

15

LOG OF BORING NO. MW-7

OWNER/CLIENT: 3M

CONTRACTOR/ENGINEER: Mr. Bruce W. Kramer

SITE: 22614 Highway 84 North, Cordova, Illinois

PROJECT: Contract Drilling and Sampling

Top of Casing Elevation: 101.22 ft.
Ground Surface Elevation: 99.1 ft.

DEPTH-ft.	DESCRIPTION	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	FIELD VAPOR TESTS (ppm)
2.0	MEDIUM TO COARSE SAND TRACE CLAY, Dark Brown (97.1)			HS				
6.5	CLAYEY SAND, Dark Gray, Brown below 5.7' (92.6)		1	SS	17	15		830
				HS				
12.0	FINE TO MEDIUM SAND, Brown (87.1)		2	SS	16	8		0
				HS				
			3	SS	14	12		0
				HS				
	MEDIUM TO COARSE SAND, Brown		4	SS	17	11		0
				HS				
			5	SS	16	9		2
				HS				
30.5	(68.6)							

BOTTOM OF BORING

SOIL DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE DRILLING CREW

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 8.2 in. LOCK:
WELL DIA.: 2 in. Wisdom 01

WATER LEVEL OBSERVATIONS

WL	∇ 23.5'	WD	∇
WL			

Terracon ENVIRONMENTAL

BORING STARTED	2-27-90
BORING COMPLETED	2-27-90
RIG CME-55 (#3)	FOREMAN GAE
APPROVED DEK	JOB # 42905007

LOG OF BORING NO. MW-8

OWNER/CLIENT	CONTRACTOR/ENGINEER
3M	Mr. Bruce W. Kramer
22614 Highway 84 North Cordova, Illinois	PROJECT Contract Drilling and Sampling

Top of Casing Elevation: 100.37 ft.
Ground Surface Elevation: 97.3 ft.

DESCRIPTION	Depth	Elevation
FILL Silty Fine to Medium Sand Gray to Dark Brown	3.0	94.3
SILTY FINE SAND Brown	5.5	91.8
FINE SAND Brown	12.0	85.3
COARSE SAND Brown	20.0	77.3
MEDIUM TO COARSE SAND Brown	30.0	67.3
BOTTOM OF BORING		

SOIL DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE DRILLING CREW

DEPTH-ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	FIELD VAPOR TESTS (ppm)
			HS				
5		1	SS	18	7		2
			HS				
10		2	SS	16	17		1
			HS				
15		3	SS	16	8		1
			HS				
20		4	SS	15	9		2
25			HS				
30							

STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 8.2 in. LOCK:
WELL DIA.: 2 in. Wisdom 01

WATER LEVEL OBSERVATIONS			
WL	▽ 22.0'	WD	▽
WL			

Terracon ENVIRONMENTAL

BORING STARTED	2-28-90
BORING COMPLETED	2-28-90
RIG CME-55 (#3)	FOREMAN GAE
APPROVED DEK	JOB # 42905007

160

LOG OF BORING NO. MW-9

OWNER/CLIENT: 3M

CONTRACTOR/ENGINEER: Mr. Bruce W. Kramer

22614 Highway 84 North
Cordova, Illinois

PROJECT: Contract Drilling and Sampling

Top of Casing Elevation: 101.16 ft.
Ground Surface Elevation: 98.5 ft.

DESCRIPTION		USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	FIELD VAPOR TESTS (ppm)
FILL Silty Sand Brown and Gray 3.5 / 95.0				HS				
FINE SAND Brown 8.0 / 90.5	5		1	SS	17	7		4
				HS				
	10		2	SS	18	10		6
				HS				
	15		3	SS	12	9		10
MEDIUM TO COARSE SAND Brown				HS				
	20		4	SS	13	8		10
				HS				
	25		5	SS	11	1		2
				HS				
30.0 / 68.5	30							
BOTTOM OF BORING								

SOIL DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE DRILLING CREW

[illegible]ATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES [illegible] SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 8.2 in. LOCK:
WELL DIA.: 2 in. Wisdom 01

WATER LEVEL OBSERVATIONS

WL	▼ 23.5'	WD	▼
WL			
WL			

Terracon ENVIRONMENTAL

BORING STARTED	3-1-90
BORING COMPLETED	3-1-90
RIG CME-55 (#3)	FOREMAN GAE
APPROVED DEK	JOB # 42905007

GEOENVIRONMENTAL SERVICES
3M CORDOVA PLANT
CORDOVA, ILLINOIS
3M PROJECT 10-7046
PROJECT NUMBER 42935114

Prepared for
3M COMPANY

PREPARED BY
TERRACON ENVIRONMENTAL, INC.

February 16, 1994

February 16, 1994

Terracon
ENVIRONMENTAL INC

3M Company
Geology Department
Building 42-8W-06
P.O. Box 3331
900 Bush Avenue
St. Paul, Minnesota 55133-3331

Attention: Mr. Bruce Kramer
Geologist

RE: Geoenvironmental Services
3M Cordova Plant
Cordova, Illinois
3M Project 10-7046
Terracon Project No. 42935114

Dear Mr. Kramer:

Terracon Environmental, Inc. (Terracon) has completed contract drilling services to install monitoring wells and abandon existing wells as defined in the 3M Company (3M) activating letter No. 3012, dated December 20, 1993 for the above-referenced site. The activating letter identified the contract number for this project as US-423-S-3012 and is included under the general contract (No. US-423-S) entered on April 25,1989.

Field services included the drilling and installation of six (6) monitoring wells, including well development and water level gauging. Monitoring well elevations and locations were also obtained. Field screening of soil samples using a flame ionization detector (FID) was conducted under this scope as per 3M's instructions. Field services also included the abandonment of eight (8) existing monitoring wells, as identified by Mr. Bruce Kramer, 3M.

1.0 DRILLING AND SAMPLING

A three (3) person Terracon drill crew and rig was on-site for an approximate six (6) day period. The drill rig used for the field exploration was equipped with a hydraulic head for drilling and sampling. The drilling equipment used was four and one-quarter (4.25) inch inside diameter (I.D.) continuous flight hollow stem augers and split-barrel samplers.

Soil samples were collected using a split-spoon sampler from locations MW-1-94 through MW-5-94 at five (5) foot intervals. Samples which underwent field screening were placed in Ziplock® bags and allowed to volatilize. The samples were evaluated for the presence of organic vapors using a Foxboro Organic Vapor Analyzer (OVA) Model Century OVA 128GC. This machine produces readings in parts per million (ppm) by ionizing volatile organic compounds released into sample headspace from soil samples. Organic vapors were detected in soil samples obtained from boring MW-3-94 at concentrations ranging from below the unit's detection level of one (1) ppm to twenty-two (22) ppm. OVA readings observed in boring MW-5-94 at concentrations ranging from below the unit's detection level of one (1) ppm to two hundred twenty (220) ppm. Organic vapors were not detected in boring MW-4-94. Split-spoon samples collected from boring locations MW-1-94 and MW-2-94 were not required to be field analyzed, as per 3M's instruction. Soil samples were not collected from boring location MW-6-94. The unit is calibrated using methane gas.

Soils were logged based on visual classification of the split barrel samples, auger cuttings and drill rig response. Excess auger cuttings were left on site for proper disposal by 3M's representatives.

1.1 Cleaning Procedures

Drilling tools were cleaned prior to and at the completion of field drilling services. The cleaning method involved a high pressure hot water (HPHW) and Alconox detergent wash. Continuous hollow stem augers were scraped of adhered soils and HPHW washed before and after well installation. Split-barrel soil samplers were washed with Alconox detergent and rinsed with potable water between sampling events.

1.2 Monitoring Well Construction

The monitoring wells installed consisted of two (2) inch nominal I.D. 316 screen and 304 stainless steel (SS), flush-jointed well casing. A ten (10)-foot section of nominal 0.01 inch manufactured 316 SS slotted screen was installed at the bottom of boreholes MW-2-94 through MW-6-94. A fifteen (15)-foot section of 316 SS slotted screen was installed at the bottom of borehole MW-1-94. The screen interval was positioned to intersect the apparent groundwater table encountered while drilling. A two (2) inch I.D.

solid 304 SS riser pipe was attached to each screen and extended to approximately three (3) feet above existing ground surface.

The borehole annulus was backfilled with #3 Muscatine gravel pack to a point approximately two (2) feet above the slotted screen interval. An approximate two (2) foot layer of bentonite pellets was placed in the annulus above the gravel pack and hydrated with potable water. The remaining annulus was filled with a cement/bentonite grout. Each well was installed with a 316 SS plug and top cap. A lockable steel protector cover was installed over each well casing. The protector cover extended below ground surface and was imbedded in concrete. At the direction of 3M's representative, four (4)-inch nominal diameter steel protective bollards were imbedded outside a concrete splash pad installed measuring approximately three (3) feet square by four (4) inches in thickness. Each well was secured with a padlock by Terracon personnel and the keys turned over to 3M personnel.

The boring logs with monitoring well details for the six (6) wells installed have been attached as Appendix A. The approximate location of the monitoring wells are shown on the attached Figure 1. Appendix A. Copies of Illinois #482-0126 Well Construction Report are attached in Appendix C. The original forms are being submitted under separate cover to the Rock Island County Health Department.

Prior to conducting well sealing and installation of new monitoring wells, the Illinois Department of Public Health was contacted at (217) 782-5830. Terracon confirmed that monitoring well construction and sealing activities were exempt from licensing requirements with the state of Illinois. Therefore, it should be noted that (NA) for not applicable was inserted in the License No. sections of those Illinois forms IL482-0126 and IL 482-0631.

1.3 Groundwater Measurement

Groundwater was measured in newly installed monitoring wells MW-3-94 through MW-6-94 at depths ranging from approximately seventeen (17) to twenty-five (25) feet below top of casing. Groundwater was measured in monitoring wells MW-1-94 and MW-2-94 at a depth of approximately sixty-two (62) and thirty-nine and one-half (39.5) feet from top of casing, respectively. Measurements were obtained prior to development, approximately twenty-four (24) hours after well completion.

1.4 Well Development

The monitoring wells were developed on January 11 and 12, 1994. Between sixty (60) and eighty (80) gallons of groundwater were removed from each well. A Grundfos Redi-Flow two (2) inch submersible pump was used to assist in well development. Well development continued until pH, specific conductance and temperature readings in each well reasonably stabilized. Development fluid was left uncontainerized on-site. Well development documentation has been attached as Appendix B.

1.5 Surveying

Top of casing (TOC) elevations of the monitoring wells MW-3-94 through MW-6-94 were measured relative to the TOC of existing monitoring well MW-7-90. The TOC elevation of the monitoring well MW-1-94 was measured relative to the TOC of existing monitoring well MW-3-79. The TOC elevation of the monitoring well MW-2-94 was measured relative to the TOC of existing monitoring well MW-4-81. These existing well elevations were assumed to be 100.00 feet at each location. Elevations were measured with a surveyor's level. Monitoring well locations were measured with a tape. Angles were estimated. The locations and elevations should be considered accurate only to the degree implied by the methods used.

2.0 MONITORING WELL ABANDONMENT

As requested by 3M personnel, Terracon abandoned a total of eight (8) existing monitoring wells. Seven (7) of the wells were abandoned and sealed as per Illinois Department of Public Health requirements over the period of January 4 through 6, 1994 and on January 11, 1994. One of the wells was replaced upon casing extraction consistent with the clients request. Copies of Illinois #482-0631 Water Well Sealing Form are attached in Appendix C. The approximate locations of the abandoned monitoring wells are shown on Figure 1, Appendix A.

Monitoring well abandonment generally consisted of the removal of obstacles in and around the well casings including outer protective casings. The casings were measured in the wells abandoned to determine the well depth and were filled with granular bentonite. During the abandonment procedures an attempt to extract the well casing, in its entirety, was made using the hydraulic assisted winches on

the drill rig. Well casings for existing 3M wells MW-7, MW-8, MW-9 and MW-13 were removed in this manner. The annulus from each well was filled with granular bentonite. These locations were then overdrilled to a depth of five (5) feet below ground surface. The borehole annulus was backfilled with granular bentonite from five (5) to three (3) feet below ground surface. Natural soils were then used to backfill the remaining annulus to ground surface to complete backfilling operations.

The complete extraction of existing monitoring wells MW-1, MW-5 and MW-11 was not possible. During the extraction attempt, the well casing either became disconnected before the extraction was complete or the well casing could not be extracted using the equipment on-site. These well casings were removed by a six (6) inch auger to a depth of five (5) feet below ground surface. The borehole annulus was backfilled with granular bentonite from five (5) to three (3) feet below ground surface. Natural soils were placed to ground surface to complete backfilling operations.

New well MW-6-94 was installed following the extraction of existing monitoring well WT-1 casing, using same procedures for well installation as MW-1 through MW-5-94. MW-6-94 was not sampled, because it was installed through the annulus of WT-1, and therefore would not be representative of existing soils.

3.0 GENERAL COMMENTS

We have not been asked to further interpret the data under this scope of services. We cannot assume any responsibility or liability of interpretation of the data by others.

This report is prepared for the exclusive use of our client for a specific application to the project discussed and as prepared in accordance with generally accepted environmental engineering practices. No warranties, either express or implied are intended or made.

We appreciate this opportunity to continue to provide geoenvironmental services to 3M Company. If you have any questions or require additional information please contact our office.

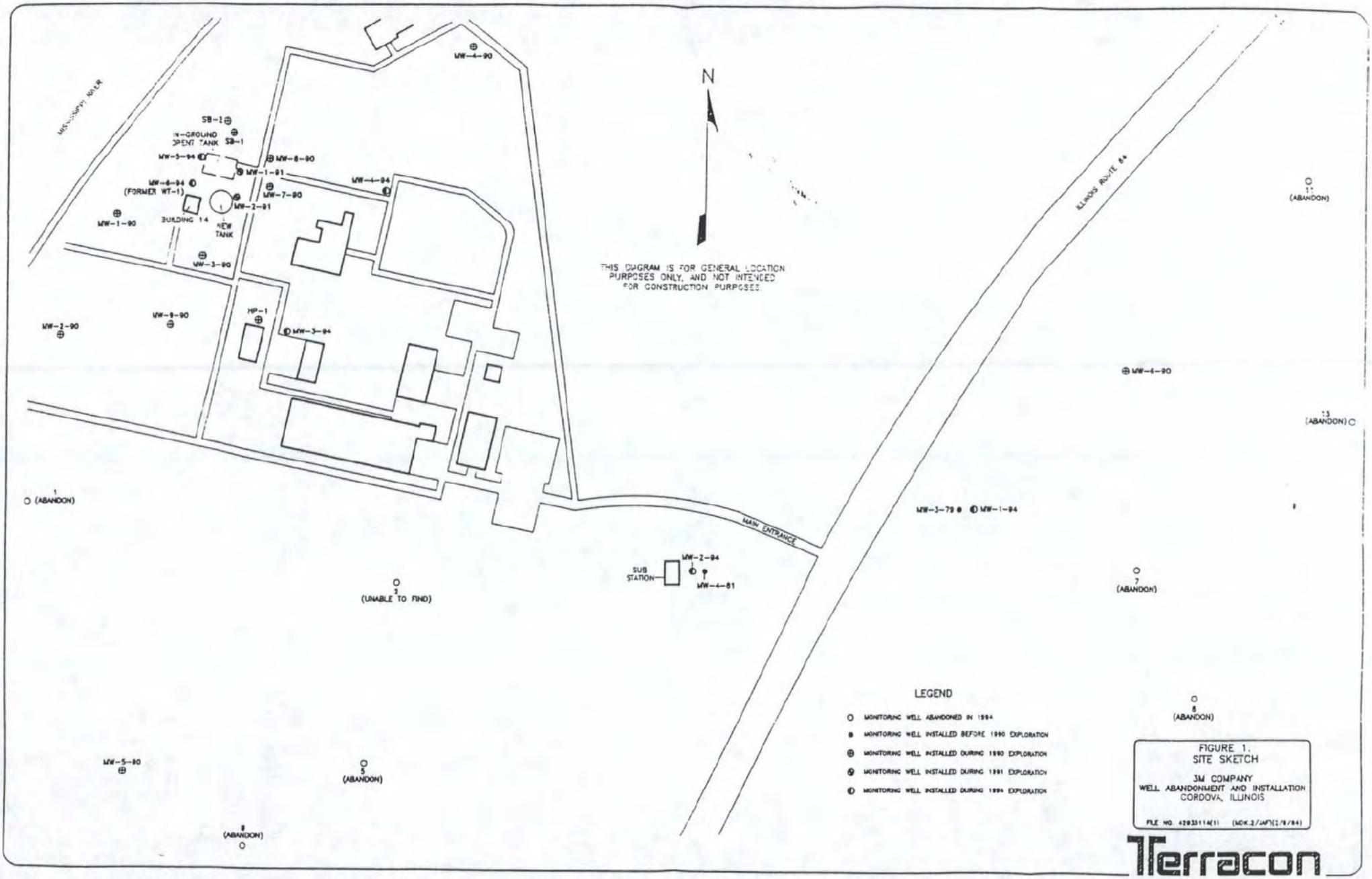
Very truly yours,
TERRACON ENVIRONMENTAL, INC.

Jay A. Fegley
Project Manager

Gregg P. Olberts
Environmental Engineer

dca/JAF/GPO/am3
(35114-01.rpt)

APPENDIX A
Figure
General Notes
Monitoring Well Logs


MISSISSIPPI RIVER
SB-1
IN-GROUND SPENT TANK
SB-1
MW-5-94
MW-6-90
MW-1-91
MW-4-94
MW-6-94
(FORMER WT-1)
MW-7-90
MW-2-91
MW-1-90
BUILDING 14
NEW TANK
MW-3-90
MW-4-90
MW-9-90
MW-2-90
HP-1
MW-3-94
N
THIS DIAGRAM IS FOR GENERAL LOCATION PURPOSES ONLY, AND NOT INTENDED FOR CONSTRUCTION PURPOSES
ILLINOIS ROUTE 84
(ABANDON)
MW-6-90
(ABANDON)
(ABANDON)
MW-3-79
MW-1-94
MAIN ENTRANCE
SUB STATION
MW-2-94
MW-4-81
(UNABLE TO FIND)
(ABANDON)
(ABANDON)
MW-5-90
(ABANDON)
(ABANDON)
LEGEND
MONITORING WELL ABANDONED IN 1994
MONITORING WELL INSTALLED BEFORE 1990 EXPLORATION
MONITORING WELL INSTALLED DURING 1990 EXPLORATION
MONITORING WELL INSTALLED DURING 1991 EXPLORATION
MONITORING WELL INSTALLED DURING 1994 EXPLORATION
FIGURE 1.
SITE SKETCH
3M COMPANY
WELL ABANDONMENT AND INSTALLATION
CORDOVA, ILLINOIS
Terracon

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS : Split Spoon - 1⅜" I.D., 2" O.D., unless otherwise noted
ST : Thin-Walled Tube - 2" O.D., Unless otherwise noted
PA : Power Auger
HA : Hand Auger
DB : Diamond Bit - 4", N, B
AS : Auger Sample
HS : Hollow Stem Auger
PS : Piston Sample
WS : Wash Sample
FT : Fish Tail Bit
RB : Rock Bit
BS : Bulk Sample
PM : Pressuremeter
DC : Dutch Cone
WB : Wash Bore

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch OD split spoon, except where noted.

WATER LEVEL MEASUREMENT SYMBOLS:

WL : Water Level
WCI : Wet Cave In
DCI : Dry Cave In
AB : After Boring
WS : While Sampling
WD : While Drilling
BCR : Before Casing Removal
ACR : After Casing Removal

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of ground water levels is not possible with only short term observations.

DESCRIPTIVE SOIL CLASSIFICATION:

Soil Classification is based on the Unified Soil Classification System and ASTM Designations D-2487 and D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel. medium dense (SM).

CONSISTENCY OF FINE-GRAINED SOILS:

Unconfined Compressive Strength, Qu, psf	Consistency
< 500	Very Soft
500 - 1,000	Soft
1,001 - 2,000	Medium
2,001 - 4,000	Stiff
4,001 - 8,000	Very Stiff
8,001 -16,000	Hard
> -16,000	Very Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS:

N-Blows/ft.	Relative Density
0-3	Very Loose
4-9	Loose
10-29	Medium Dense
30-49	Dense
50-80	Very Dense
80+	Extremely Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) (of Components Also Present in Sample)	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) (of Components Also Present in Sample)	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

GRAIN SIZE TERMINOLOGY

Major Component Of Sample	Size Range
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 sieve (0.075mm)

Terracon

MONITORING WELL DETAIL LEGEND

RISER PIPE

WELL SCREEN

GROUT

BENTONITE

SAND PACK

Terracon

Form 101—1-87

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification	
				Group Symbol	Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3[E]	GW	Well-graded gravel[F]
			Cu < 4 and/or 1 > Cc > 3[E]	GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel[F, G, H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[E]	Cu ≥ 6 and 1 ≤ Cc ≤ 3[E]	SW	Well-graded sand[I]
			Cu < 6 and/or 1> Cc > 3[E]	SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G, H, I]
			Fines classify as CL or CH	SC	Clayey sand[G, H, I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay[K, L, M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K, L, M]
		organic	Liquid limit — oven dried / Liquid limit — not dried < 0.75	OL	Organic clay[K, L, M, N] / Organic silt[K, L, M, O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K, L, M]
			PI plots below "A" line	MH	Elastic silt[K, L, M]
		organic	Liquid limit — oven dried / Liquid limit — not dried < 0.75	OH	Organic clay[K, L, M, P] / Organic silt[K, L, M, Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A]Based on the material passing the 3-in. (75-mm) sieve.

[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C]Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

[D]Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E]$Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains ≥ 15% sand, add "with sand" to group name.

[G]If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H]If fines are organic, add "with organic fines" to group name.

[I]If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J]If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K]If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel", whichever is predominant.

[L]If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

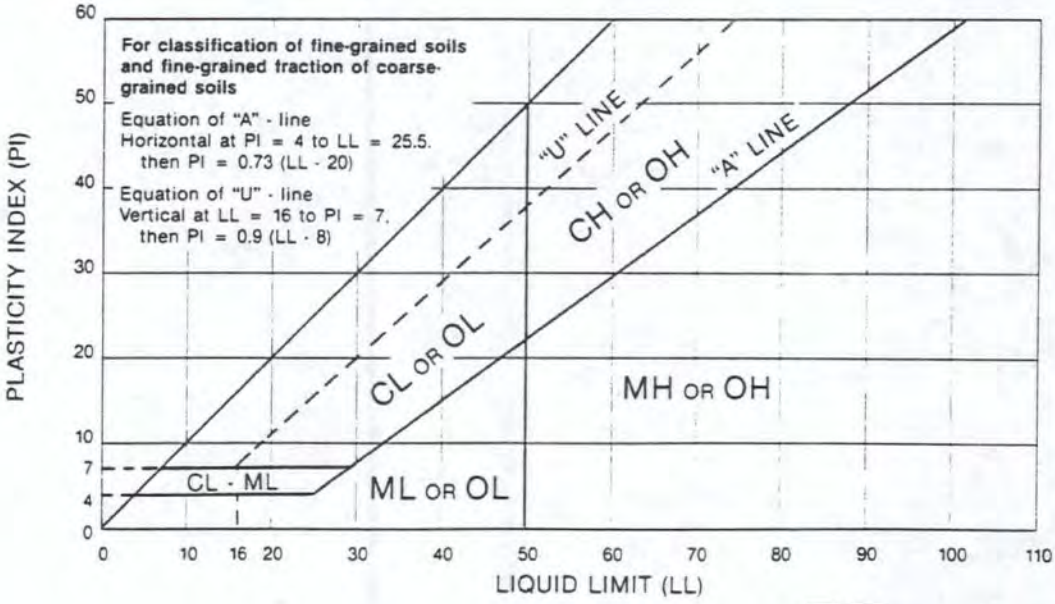
[M]If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N]PI ≥ 4 and plots on or above "A" line.

[O]PI < 4 or plots below "A" line.

[P]PI plots on or above "A" line.

[Q]PI plots below "A" line.



Terracon

Form 111—6-85

LOG OF BORING NO. MW-1-94

OWNER	CLIENT CONTACT
3M Company	Bruce Kramer
SITE	PROJECT
Cordova, Illinois	Well Abandonment and Installation

Top of Casing Elevation: 99.62 ft.
Ground Surface Elevation: 96.6 ft.

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH-ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	UNCONFINED * STRENGTH-psf	FIELD VAPOR TESTS - ppm
	4" Root Zone SANDY LEAN CLAY 3.5 Dark Brown 93.1					HS					
	FINE SAND Brown		5		1	SS	12	4			
						HS					
			10		2	SS	18	6			
						HS					
			15		3	SS	18	7			
	18.5 78.1					HS					
	FINE TO MEDIUM SAND TRACE GRAVEL Brown		20		4	SS	16	7			
						HS					
	With Coarse Sands below 24.5'		25		5	SS	18	8			
						HS					
			30		6	SS	18	12			
						HS					
			35		7	SS	18	16			
						HS					
			40								

Continued Next Page

SOIL AND BEDROCK DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE FIELD CREW

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 8.2 in. LOCK:
WELL DIA.: 2.0 in. Wisdom 05

WATER LEVEL OBSERVATIONS			
WL	▽ 58.5'	WD	▼
WL			
	61.72'	from TOC on 1/11/94	

Terracon ENVIRONMENTAL

BORING STARTED	1-5-94		
BORING COMPLETED	1-6-94		
RIG	#3	FOREMAN	SAS
APPROVED	JAF	JOB #	42935114

LOG OF BORING NO. MW-1-94

OWNER	CLIENT CONTACT
3M Company	Bruce Kramer
SITE	**PROJECT**
Cordova, Illinois	Well Abandonment and Installation

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH-ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	UNCONFINED * STRENGTH-psf	FIELD VAPOR TESTS - ppm
					8	SS	18	11			
	(continued)					HS					
			45		9	SS	18	22			
						HS					
	FINE TO COARSE SAND WITH GRAVEL		50		10	SS	18	13			
	Brown					HS					
			55		11	SS	18	14			
						HS					
			60		12	SS	18	16			
						HS					
			65		13	SS	18	16			
						HS					
	71.0	25.6	70		14	SS	12	17			
	BOTTOM OF BORING										

SOIL AND BEDROCK DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE FIELD CREW

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WATER LEVEL OBSERVATIONS					
WL	▽ 58.5'	WD	▼	BORING STARTED	1-5-94
WL				BORING COMPLETED	1-6-94
	61.72' from TOC on 1/11/94			RIG #3	FOREMAN SAS
				APPROVED JAF	JOB # 42935114

Terracon ENVIRONMENTAL

LOG OF BORING NO. MW-2-94

OWNER: 3M Company	CLIENT CONTACT: Bruce Kramer
SITE: Cordova, Illinois	PROJECT: Well Abandonment and Installation

Top of Casing Elevation: 100.66 ft.
Ground Surface Elevation: 97.2 ft.

DEPTH-ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	UNCONFINED * STRENGTH-psf	FIELD VAPOR TESTS - ppm
			HS					
5		1	SS	10	7			
			HS					
10		2	SS	18	5			
			HS					
15		3	SS	10	6			
			HS					
20		4	SS	14	9			
			HS					
25		5	SS	18	8			
			HS					
30		6	SS	18	11			
			HS					
35		7	SS	18	11			
			HS					
40								

DESCRIPTION

4" Root Zone

FINE SAND TRACE SILT
Dark Brown to Brown

19.5 — 77.7

FINE TO COARSE SAND TRACE GRAVEL
Brown

With Coarse Sands below 24.5'

Continued Next Page

SOIL AND BEDROCK DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE FIELD CREW

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 8.2 in. LOCK: Wisdom 06
WELL DIA.: 2.0 in.

WATER LEVEL OBSERVATIONS			
WL	36'	WD 37'	AB
WL	48'	1 hr AB	
	39.46'	from TOC on 1/11/94	

Terracon ENVIRONMENTAL

BORING STARTED	1-6-94		
BORING COMPLETED	1-10-94		
RIG	#3	FOREMAN	SAS
APPROVED	JAF	JOB #	42935114

LOG OF BORING NO. MW-2-94

OWNER: 3M Company	CLIENT CONTACT: Bruce Kramer
SITE: Cordova, Illinois	PROJECT: Well Abandonment and Installation

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH-ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	UNCONFINED * STRENGTH-psf	FIELD VAPOR TESTS - ppm
					8	SS	18	11			
	(continued) FINE TO COARSE SAND TRACE GRAVEL Brown					HS					
	44.5 — 52.7										
	BOTTOM OF BORING										

SOIL AND BEDROCK DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE FIELD CREW

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WATER LEVEL OBSERVATIONS				
WL	36'	WD	37'	AB
WL	48'	1 hr AB		
	39.46'	from TOC on 1/11/94		

Terracon ENVIRONMENTAL

BORING STARTED	1-6-94		
BORING COMPLETED	1-10-94		
RIG	#3	FOREMAN	SAS
APPROVED	JAF	JOB #	42935114

LOG OF BORING NO. MW-3-94

OWNER	CLIENT CONTACT
3M Company	Bruce Kramer
SITE	**PROJECT**
Cordova, Illinois	Well Abandonment and Installation

Top of Casing Elevation: 100.84 ft.
Ground Surface Elevation: 96.8 ft.

DESCRIPTION		DEPTH-ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	UNCONFINED * STRENGTH-psf	FIELD VAPOR TESTS - ppm
12" Gravel SANDY LEAN CLAY Dark Brown					HS					
5.0	91.8	5		1	SS	10	6			22
FINE TO COARSE SAND TRACE GRAVEL Brown					HS					
		10		2	SS	12	13			9
					HS					
		15		3	SS	18	8			4
					HS					
		20		4	SS	12	7			15
					HS					
		25		5	SS	18	3			ND
					HS					
28.5	68.3									

BOTTOM OF BORING

ND indicates reading of less than the field detection limit (FDL) of one (1) part per million isobutylene equivalents (ppmi).

SOIL AND BEDROCK DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE FIELD CREW

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 8.2 in. LOCK:
WELL DIA.: 2.0 in. Wisdom 05

WATER LEVEL OBSERVATIONS			
WL	20.5'	WS	
WL			
	23.77'	from TOC on 1/12/94	

Terracon ENVIRONMENTAL

BORING STARTED	1-10-94		
BORING COMPLETED	1-10-94		
RIG	#3	FOREMAN	SAS
APPROVED	JAF	JOB #	42935114

LOG OF BORING NO. MW-4-94

OWNER	CLIENT CONTACT
3M Company	Bruce Kramer
SITE	**PROJECT**
Cordova, Illinois	Well Abandonment and Installation

Top of Casing Elevation: 102.36 ft.
Ground Surface Elevation: 98.9 ft.

DEPTH-ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	UNCONFINED * STRENGTH-psf	FIELD VAPOR TESTS - ppm
			HS					
5		1	SS	15	10			ND
			HS					
10		2	SS	18	8			ND
			HS					
15		3	SS	17	13			ND
			HS					
20		4	SS	18	11			ND
			HS					
25		5	SS	18	3			ND
			HS					

GRAPHIC LOG

3" Root Zone
SILTY SAND
Dark Brown
5.0 — 93.9

FINE TO COARSE SAND TRACE GRAVEL
Brown
29.0 — 69.9

WELL DETAIL

BOTTOM OF BORING

ND indicates reading of less than the field detection limit (FDL) of one (1) part per million isobutylene equivalents (ppmi).

SOIL AND BEDROCK DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE FIELD CREW

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 8.2 in. LOCK:
WELL DIA.: 2.0 in. Wisdom 06

WATER LEVEL OBSERVATIONS			
WL	22.5'	WD	
WL			
	25.05' from TOC on 1/12/94		

Terracon ENVIRONMENTAL

BORING STARTED	1-10-94		
BORING COMPLETED	1-11-94		
RIG	#3	FOREMAN	SAS
APPROVED	JAF	JOB #	42935114

LOG OF BORING NO. MW-5-94

OWNER	CLIENT CONTACT
3M Company	Bruce Kramer
SITE	**PROJECT**
Cordova, Illinois	Well Abandonment and Installation

Top of Casing Elevation: 94.14 ft.
Ground Surface Elevation: 91.6 ft.

DEPTH-ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	MOISTURE, %	UNCONFINED * STRENGTH-psf	FIELD VAPOR TESTS - ppm
			HS					
		1	SS	18	7			ND
5			HS					
		2	SS	15	13			ND
10			HS					
		3	SS	18	7			65
15			HS					
		4	SS	15	5			220
20			HS					

GRAPHIC LOG

8" Gravel
10" Sandy Lean Clay
FINE TO COARSE SAND TRACE GRAVEL
Brown

21.0 — 70.6

BOTTOM OF BORING

ND indicates reading of less than the field detection limit (FDL) of one (1) part per million isobutylene equivalents (ppmi).

SOIL AND BEDROCK DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE FIELD CREW

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 8.2 in. LOCK:
WELL DIA.: 2.0 in. Wisdom 06

WATER LEVEL OBSERVATIONS			
WL	▽ 14'	WD	▼ 13.7' BCR
WL			
	17.14' from TOC on 1/12/94		

Terracon ENVIRONMENTAL

BORING STARTED	1-12-94		
BORING COMPLETED	1-12-94		
RIG	#3	FOREMAN	SAS
APPROVED	JAF	JOB #	42935114

LOG OF BORING NO. MW-6-94

OWNER: 3M Company	CLIENT CONTACT: Bruce Kramer
SITE: Cordova, Illinois	PROJECT: Well Abandonment and Installation

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH-ft.	SAMPLES: USCS SYMBOL	NUMBER	TYPE	RECOVERY-in.	SPT - N BLOWS / FT.	TESTS: MOISTURE, %	UNCONFINED * STRENGTH-psf	FIELD VAPOR TESTS - ppm
	Top of Casing Elevation: 94.47 ft. **Ground Surface Elevation:** 92.0 ft.										
	6" Gravel FINE TO COARSE SAND TRACE GRAVEL Brown		5			HS					
			10								
			15								
	20.0 72.0		20								

BOTTOM OF BORING

ND indicates reading of less than the field detection limit (FDL) of one (1) part per million isobutylene equivalents (ppmi).

SOIL AND BEDROCK DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE FIELD CREW

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 8.2 in. LOCK:
WELL DIA.: 2.0 in. Wisdom 06

WATER LEVEL OBSERVATIONS			
WL	▽ 14.5'	BCR	▼
WL			
	17.29' from TOC on 1/12/94		

Terracon ENVIRONMENTAL

BORING STARTED	1-12-94		
BORING COMPLETED	1-12-94		
RIG	#3	FOREMAN	SAS
APPROVED	JAF	JOB #	42935114

APPENDIX B
Well Development Documentation

SAMPLING INFORMATION SHEET

PROJECT 3M WELL ABANDONMENT + INSTALLATION JOB NO. 42935114
LOCATION CORDOVA, ILLINOIS

SAMPLING POINT MW-1-94 DATE 1-11-94 TIME 10:20
SAMPLING POINT DESCRIPTION

SAMPLING METHOD
DEPTH TO WATER(below MP) 61.72 WELL DEPTH(below MP) +70.00
CASING DIAMETER 2" PVC

STABILIZATION DATA

Time	pH	Temperature	Specific Conductance (x1000	Cumulative Volume of Water Removed From Well
11:01	5.20	51.6	1.46	10
11:09	5.36	49.3	1.37	20
11:21	5.61	48.5	1.41	30
11:47	5.60	46.8	1.46	40
11:57	5.60	47.7	1.40	50
12:05	5.60	48.0	1.35	60
12:13	5.60	48.0	1.32	70
12:23	5.65	47.5	1.31	80
—	—	—	—	90
—	—	—	—	100

SAMPLE APPEARANCE BROWN → CLEAR ODOR NONE
SAMPLING PROBLEMS PUMP SLOW DUE TO EXCESSIVE HEAD PRESSURE + SAND
CLEANING PERFORMED IN FIELD ALCONOX + WATER
SAMPLES COLLECTED NONE
COMMENTS 1.40 GAL = 1 STANDING VOLUME

FORM COMPLETED BY

Terracon

FORM 101—1.87

SAMPLING INFORMATION SHEET

PROJECT 3M WELL ABANDONMENT - INSTALLATION JOB NO. 42935114
LOCATION CORDOVA, ILLINOIS

SAMPLING POINT MW-2-94 DATE 1-11-94 TIME 1:00
SAMPLING POINT DESCRIPTION

SAMPLING METHOD
DEPTH TO WATER(below MP) 39.46' WELL DEPTH(below MP) 47.5
CASING DIAMETER 2" PVC

STABILIZATION DATA

Time	pH	Temperature	Specific Conductance (x 1000)	Cumulative Volume of Water Removed From Well
1:17	6.01	46.0	0.87	10
1:24	6.20	46.1	0.85	20
1:30	6.17	45.7	0.81	30
1:40	6.16	45.8	0.84	40
1:49	6.15	45.9	0.83	50
1:57	6.19	45.5	0.82	60
2:05	6.17	45.6	0.83	70
—	—	—	—	—

SAMPLE APPEARANCE BROWN → CLEAR ODOR NONE
SAMPLING PROBLEMS NONE
CLEANING PERFORMED IN FIELD ALCONOX + WATER
SAMPLES COLLECTED NONE
COMMENTS 1.37 GAL = 1 STANDING VOLUME

FORM COMPLETED BY [signature]

Terracon

Form 101—1-87

SAMPLING INFORMATION SHEET

PROJECT 3M WELL ABANDONMENT - INSTALLATION JOB NO. 42935114
LOCATION CORDOVA, ILLINOIS

SAMPLING POINT MW-3-94 DATE 1-12-94 TIME 1:51
SAMPLING POINT DESCRIPTION

SAMPLING METHOD
DEPTH TO WATER(below MP) 23.77 WELL DEPTH(below MP) 32.6
CASING DIAMETER 2" PVC

STABILIZATION DATA

Time	pH	Temperature	Specific Conductance (x 1000)	Cumulative Volume of Water Removed From Well
2:04	5.20	45.3	1.68	10
2:11	5.51	48.9	1.79	20
2:18	6.03	47.0	1.69	30
2:27	6.00	46.8	1.61	40
2:34	6.06	47.2	1.67	50
2:40	6.03	47.9	1.61	60
2:47	6.03	47.8	1.65	70
—	—	—	—	—

SAMPLE APPEARANCE BROWN → CLEAR ODOR NONE
SAMPLING PROBLEMS NONE
CLEANING PERFORMED IN FIELD ALCONOX - WATER
SAMPLES COLLECTED NONE
COMMENTS 1.50 GAL = 1 STANDING VOLUME

FORM COMPLETED BY [signature]

Terracon

Form 101—1.87

SAMPLING INFORMATION SHEET

PROJECT 3M WELL ABANDONMENT - INSTALLATION JOB NO. 42935114
LOCATION CORDOVA, ILLINOIS

SAMPLING POINT MW-4-94 DATE 1-12-94 TIME 11:40
SAMPLING POINT DESCRIPTION

SAMPLING METHOD
DEPTH TO WATER(below MP) 25.05' WELL DEPTH(below MP) 32.6'
CASING DIAMETER 2" PVC

STABILIZATION DATA

Time	pH	Temperature	Specific Conductance (x1000)	Cumulative Volume of Water Removed From Well
11:55	5.27	49.3	2.24	10
12:04	5.13	47.4	1.60	20
12:13	5.17	47.1	1.59	30
12:22	5.13	46.9	1.54	40
12:30	5.04	47.6	1.52	50
12:37	5.00	47.9	1.49	60
12:43	4.94	49.4	1.55	70
—	—	—	—	80

SAMPLE APPEARANCE BROWN → CLEAR ODOR NONE
SAMPLING PROBLEMS NONE
CLEANING PERFORMED IN FIELD ALCONOX - WATER
SAMPLES COLLECTED NONE
COMMENTS 1.28 GAL = 1 STANDING VOLUME

FORM COMPLETED BY

Terracon

SAMPLING INFORMATION SHEET

PROJECT 3M WELL ABANDONMENT - INSTALLATION JOB NO. 42935114
LOCATION CONDOVA, ILLINOIS

SAMPLING POINT MW-5-94 DATE 1-12-94 TIME 2:55
SAMPLING POINT DESCRIPTION

SAMPLING METHOD
DEPTH TO WATER(below MP) 17.14 WELL DEPTH(below MP) 22.0
CASING DIAMETER 2" PVC

STABILIZATION DATA

Time	pH	Temperature	Specific Conductance	Cumulative Volume of Water Removed From Well
3:02	6.76	48.1	1.39	10
3:08	6.76	49.2	1.32	20
3:14	7.40	51.2	1.45	30
3:20	7.41	50.4	1.35	40
3:24	7.40	49.6	1.31	50
3:32	7.40	49.5	1.31	60
3:38	7.41	49.1	1.35	70
—	—	—	—	—

SAMPLE APPEARANCE BROWN → CLEAR ODOR NONE
SAMPLING PROBLEMS NONE
CLEANING PERFORMED IN FIELD ALCONOX + WATER
SAMPLES COLLECTED NONE
COMMENTS 0.83 GAL = 1 STANDING VOLUME

FORM COMPLETED BY [signature]

Terracon

SAMPLING INFORMATION SHEET

PROJECT 3M WELL ABANDONMENT - INSTALLATION JOB NO. 42935114
LOCATION CONDOVA, ILLINOIS

SAMPLING POINT MW-6-94 DATE 1-12-94 TIME 3:47
SAMPLING POINT DESCRIPTION

SAMPLING METHOD
DEPTH TO WATER(below MP) 17.29' WELL DEPTH(below MP) 22.6'
CASING DIAMETER 2" PVC

STABILIZATION DATA

Time	pH	Temperature	Specific Conductance	Cumulative Volume of Water Removed From Well
3:54	6.98	45.8	1.14	10
4:01	7.02	47.5	1.25	20
4:06	6.98	47.6	1.08	30
4:11	6.99	48.2	1.13	40
4:16	6.96	47.7	1.13	50
4:21	7.00	48.1	1.18	60
—	—	—	—	70

SAMPLE APPEARANCE BROWN → CLEAR ODOR NONE
SAMPLING PROBLEMS NONE
CLEANING PERFORMED IN FIELD ALCONOX + WATER
SAMPLES COLLECTED NONE
COMMENTS 0.906 GAL = 1 STANDING VOLUME

FORM COMPLETED BY [signature]

Terracon

APPENDIX C
Well Construction Report
Water Well Sealing Form

WATER WELL SEALING FORM

ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 WEST JEFFERSON STREET
SPRINGFIELD, ILLINOIS 62761

RETURN ALL COPIES TO IDPH

TYPE OR PRESS FIRMLY

This form shall be submitted to this Department not more than 30 days after a potable water well, boring or monitoring well is sealed. Such wells are to be sealed not more than 30 days after they are abandoned in accordance with the sealing requirements in the Water Well Construction Code.

1. Ownership (Name of Controlling Party) Minnesota Mining & Manufacturing

2. Well Location: 22614 Route 84 North (Address - Lot Number) Cordova (City) Rock Island (County)

General Description: Section 5 Township 20 (N)(S) Range 2 (E)(W)
SE Quarter of the _____ Quarter of the _____ Quarter _____

3. Year Drilled Unknown

4. Drilling Permit No.(and date, if known) Well #1

5. Type of Well: Bored _____ Drilled x Other _____

6. Total Depth 27' Diameter (inches) 2" PVC

7 Formation clear of obstruction X yes _____ no

8. DETAILS OF PLUGGING

Filled with Holeplug bentonite (cement or other materials) from 3 to 27 ft.

Kind of plug _____ from _____ to _____ ft.

Filled with Natural Soils from 0 to 3 ft.

Kind of plug _____ from _____ to _____ ft.

Filled with _____ from _____ to _____ ft.

Kind of plug _____ from _____ to _____ ft.

9. CASING RECORD
Upper ~~3~~ 5 feet of casing removed X Yes _____ No

If well casing consists of brick, stone, concrete blocks, porous tile, or other porous material, casing was removed to a depth of 10 feet below the surface _____ Yes X No.

10. Date well was sealed: Month January Day 4 Year 94.

11. Licensed water well driller or other person approved by the Department performing well sealing:

Jay Fegley (Name) — NA (Complete License Number)

Terracon Envrionmental, Inc. (Address) — Rock Island (City) — IL, 61201 (State/Zip)

4470 48th Avenue Court

8/88

This State Agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act 85-0863. Disclosure of this information is mandatory. This form has been approved by the Forms Management Center.

IL 482-0631

WATER WELL SEALING FORM

ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 WEST JEFFERSON STREET
SPRINGFIELD, ILLINOIS 62761

RETURN ALL COPIES TO IDPH

TYPE OR PRESS FIRMLY

This form shall be submitted to this Department not more than 30 days after a potable water well, boring or monitoring well is sealed. Such wells are to be sealed not more than 30 days after they are abandoned in accordance with the sealing requirements in the Water Well Construction Code.

1. Ownership (Name of Controlling Party) Minnesota Mining & Manfacturing

2. Well Location: 22614 Route 84 North (Address - Lot Number) Cordova (City) Rock Island (County)

   General Description: Section 5 Township 20 (N)(S) Range 2 (E)(W)
   SE Quarter of the _____ Quarter of the _____ Quarter _____

3. Year Drilled 1970's

4. Drilling Permit No.(and date, if known) Well #5

5. Type of Well: Bored _____ Drilled X Other _____

6. Total Depth 32.7' Diameter (inches) 2"

7 Formation clear of obstruction X yes _____ no

8. DETAILS OF PLUGGING

   Filled with holeplug bentonite (cement or other materials) from 3 to 32.7 ft.

   Kind of plug _____ from _____ to _____ ft.

   Filled with Natural soils from 0 to 3 ft.

   Kind of plug _____ from _____ to _____ ft.

   Filled with _____ from _____ to _____ ft.

   Kind of plug _____ from _____ to _____ ft.

9. CASING RECORD
   Upper ~~3~~ 5 feet of casing removed X Yes _____ No

   If well casing consists of brick, stone, concrete blocks, porous tile, or other porous material, casing was removed to a depth of 10 feet below the surface _____ Yes _____ No.

10. Date well was sealed: Month January Day 4 Year 1994.

11. Licensed water well driller or other person approved by the Department performing well sealing:

    Jay Fegley (Name) NA (Complete License Number)

    Terracon Environmental, Inc.
    4470 48th Avenue Court (Address) Rock Island (City) IL 61201 (State/Zip)

8/88

This State Agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act 85-0863. Disclosure of this information is mandatory. This form has been approved by the Forms Management Center.

IL 482-0631

WATER WELL SEALING FORM

ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 WEST JEFFERSON STREET
SPRINGFIELD, ILLINOIS 62761

TYPE OR PRESS FIRMLY

RETURN ALL COPIES TO IDPH

This form shall be submitted to this Department not more than 30 days after a potable water well, boring or monitoring well is sealed. Such wells are to be sealed not more than 30 days after they are abandoned in accordance with the sealing requirements in the Water Well Construction Code.

1. Ownership (Name of Controlling Party) Minnesota Mining & Manufacturing

2. Well Location: 22614 Route 84 North (Address - Lot Number) Cordova (City) Rock Island (County)

General Description: Section ~~5~~ 4 Township 20 (N)(~~S~~) Range 2 (E)(~~W~~)
SE Quarter of the _____ Quarter of the _____ Quarter _____

3. Year Drilled Unknown

4. Drilling Permit No.(and date, if known) Well #7

5. Type of Well: Bored _____ Drilled X Other _____

6. Total Depth 69' Diameter (inches) 2" PVC

7 Formation clear of obstruction X yes _____ no

8. DETAILS OF PLUGGING

Filled with Holeplug Bentonite (cement or other materials) from 3 to 69 ft.

Kind of plug _____ from _____ to _____ ft.

Filled with natural soils from 0 to 3 ft.

Kind of plug _____ from _____ to _____ ft.

Filled with _____ from _____ to _____ ft.

Kind of plug _____ from _____ to _____ ft.

9. CASING RECORD
Upper ~~3~~ 5 feet of casing removed X Yes _____ No

If well casing consists of brick, stone, concrete blocks, porous tile, or other porous material, casing was removed to a depth of 10 feet below the surface _____ Yes _____ No.

10. Date well was sealed: Month January Day 5 Year 1994.

11. Licensed water well driller or other person approved by the Department performing well sealing:

Jay Fegley (Name) NA (Complete License Number)

Terracon Environmental, Inc. 4470 48th Avenue Court (Address) Rock Island (City) IL, 61201 (State/Zip)

8/88

This State Agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act 85-0863. Disclosure of this information is mandatory. This form has been approved by the Forms Management Center.

IL 482-0631

WATER WELL SEALING FORM

ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 WEST JEFFERSON STREET
SPRINGFIELD, ILLINOIS 62761

RETURN ALL COPIES TO IDPH

TYPE OR PRESS FIRMLY

This form shall be submitted to this Department not more than 30 days after a potable water well, boring or monitoring well is sealed. Such wells are to be sealed not more than 30 days after they are abandoned in accordance with the sealing requirements in the Water Well Construction Code.

1. Ownership (Name of Controlling Party) Minnesota Mining & Manufacutring

2. Well
Location: 22614 Route 84 North (Address - Lot Number) Cordova (City) Rock Island (County)

General Description: Section 34 Township 20 (N)(S) Range 2 (E)(W)
SE Quarter of the _____ Quarter of the _____ Quarter

3. Year Drilled Unknown

4. Drilling Permit No.(and date, if known) Well #8

5. Type of Well: Bored _____ Drilled X Other _____

6. Total Depth 67' Diameter (inches) 2" PVC

7 Formation clear of obstruction X yes _____ no

8. DETAILS OF PLUGGING

Filled with holeplug bentonite (cement or other materials) from 3 to 67 ft.

Kind of plug _____ from _____ to _____ ft.

Filled with Natural soils from 0 to 3 ft.

Kind of plug _____ from _____ to _____ ft.

Filled with _____ from _____ to _____ ft.

Kind of plug _____ from _____ to _____ ft.

9. CASING RECORD
Upper 3 feet of casing removed X Yes _____ No

If well casing consists of brick, stone, concrete blocks, porous tile, or other porous material, casing was removed to a depth of 10 feet below the surface _____ Yes _____ No.

10. Date well was sealed: Month January Day 5 Year 1994.

11. Licensed water well driller or other person approved by the Department performing well sealing:

Jay Fegley (Name) — NA (Complete License Number)

Terracon Environmental, Inc.
4470 48th Avenue Court (Address) — Rock Island (City) — IL, 61201 (State/Zip)

8/88

This State Agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act 85-0863. Disclosure of this information is mandatory. This form has been approved by the Forms Management Center.

IL 482-0631

WATER WELL SEALING FORM

ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 WEST JEFFERSON STREET
SPRINGFIELD, ILLINOIS 62761

RETURN ALL COPIES TO IDPH

TYPE OR PRESS FIRMLY

This form shall be submitted to this Department not more than 30 days after a potable water well, boring or monitoring well is sealed. Such wells are to be sealed not more than 30 days after they are abandoned in accordance with the sealing requirements in the Water Well Construction Code.

1. Ownership (Name of Controlling Party) Minnesota Mining & Manufacturing

2. Well Location: 22614 Route 84 North (Address - Lot Number) Cordova (City) Rock Island (County)

General Description: Section 5 Township 20 (N)(~~S~~) Range 2 (E)(~~W~~)
SE Quarter of the _____ Quarter of the _____ Quarter _____

3. Year Drilled Unknown

4. Drilling Permit No.(and date, if known) Well #9

5. Type of Well: Bored _____ Drilled X Other _____

6. Total Depth 25' Diameter (inches) 2" PVC

7 Formation clear of obstruction X yes _____ no

8. DETAILS OF PLUGGING

Filled with Borehole bentonite (cement or other materials) from 3 to 25 ft.

Kind of plug _____ from _____ to _____ ft.

Filled with Natural soils from 0 to 3 ft.

Kind of plug _____ from _____ to _____ ft.

Filled with _____ from _____ to _____ ft.

Kind of plug _____ from _____ to _____ ft.

9. CASING RECORD
Upper 3 feet of casing removed X Yes _____ No

If well casing consists of brick, stone, concrete blocks, porous tile, or other porous material, casing was removed to a depth of 10 feet below the surface _____ Yes _____ No.

10. Date well was sealed: Month January Day 6 Year 1994.

11. Licensed water well driller or other person approved by the Department performing well sealing:

Jay Fegley (Name) NA (Complete License Number)

Terracon Environmental, Inc. (Address) Rock Island (City) IL 61201 (State/Zip)
4470 48th Avenue Court

8/88

This State Agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act 85-0863. Disclosure of this information is mandatory. This form has been approved by the Forms Management Center.

IL 482-0631

WATER WELL SEALING FORM

ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 WEST JEFFERSON STREET
SPRINGFIELD, ILLINOIS 62761

RETURN ALL COPIES TO IDPH

TYPE OR PRESS FIRMLY

This form shall be submitted to this Department not more than 30 days after a potable water well, boring or monitoring well is sealed. Such wells are to be sealed not more than 30 days after they are abandoned in accordance with the sealing requirements in the Water Well Construction Code.

1. Ownership (Name of Controlling Party) Minnesota Mining & Manufacturing

2. Well Location: 22614 Route 84 North (Address - Lot Number) Cordova (City) Rock Island (County)

General Description: Section 34 Township 20 (N)(S) Range 2 (E)(W)
SE Quarter of the _____ Quarter of the _____ Quarter _____

3. Year Drilled Unknown

4. Drilling Permit No.(and date, if known) Well #11

5. Type of Well: Bored _____ Drilled X Other _____

6. Total Depth 64' Diameter (inches) 2" PVC

7 Formation clear of obstruction X yes _____ no

8. DETAILS OF PLUGGING

Filled with Holeplug bentonite (cement or other materials) from 3 to 64 ft.

Kind of plug _____ from _____ to _____ ft.

Filled with natural soils from 0 to 3 ft.

Kind of plug _____ from _____ to _____ ft.

Filled with _____ from _____ to _____ ft.

Kind of plug _____ from _____ to _____ ft.

9. CASING RECORD
Upper 5 feet of casing removed X Yes _____ No

If well casing consists of brick, stone, concrete blocks, porous tile, or other porous material, casing was removed to a depth of 10 feet below the surface _____ Yes _____ No.

10. Date well was sealed: Month January Day 5 Year 1994.

11. Licensed water well driller or other person approved by the Department performing well sealing:

Jay Fegley (Name) NA (Complete License Number)

Terracon Environmental, Inc.
4470 48th Avenue Court (Address) Rock Island (City) IL, 61201 (State/Zip)

8/88

This State Agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act 85-0863. Disclosure of this information is mandatory. This form has been approved by the Forms Management Center.

IL 482-0631

WATER WELL SEALING FORM

ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 WEST JEFFERSON STREET
SPRINGFIELD, ILLINOIS 62761

RETURN ALL COPIES TO IDPH

TYPE OR PRESS FIRMLY

This form shall be submitted to this Department not more than 30 days after a potable water well, boring or monitoring well is sealed. Such wells are to be sealed not more than 30 days after they are abandoned in accordance with the sealing requirements in the Water Well Construction Code.

1. Ownership (Name of Controlling Party) Minnesota Mining & Manufacturing

2. Well Location: 22614 Route 84 North (Address - Lot Number) Cordova (City) Rock Island (County)

   General Description: Section ~~3~~ 4 Township 20 (N)(~~S~~) Range 2 (E)(~~W~~)
   SE Quarter of the _____ Quarter of the _____ Quarter _____

3. Year Drilled Unknown

4. Drilling Permit No.(and date, if known) Well #13

5. Type of Well: Bored _____ Drilled X Other _____

6. Total Depth 60' Diameter (inches) 2" PVC

7 Formation clear of obstruction X yes _____ no

8. DETAILS OF PLUGGING

   Filled with Holeplug bentonite (cement or other materials) from 3 to 60 ft.

   Kind of plug _____ from _____ to _____ ft.

   Filled with natural soils from 0 to 3 ft.

   Kind of plug _____ from _____ to _____ ft.

   Filled with _____ from _____ to _____ ft.

   Kind of plug _____ from _____ to _____ ft.

9. CASING RECORD
   Upper ~~3~~ 5 feet of casing removed X Yes _____ No

   If well casing consists of brick, stone, concrete blocks, porous tile, or other porous material, casing was removed to a depth of 10 feet below the surface _____ Yes _____ No.

10. Date well was sealed: Month January Day 5 Year 1994.

11. Licensed water well driller or other person approved by the Department performing well sealing:

    Jay Fegley (Name) NA (Complete License Number)

    Terracon Environmental, Inc. (Name)
    4470 48th Avenue Court (Address) Rock Island (City) IL, 61201 (State/Zip)

8/88

This State Agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act 85-0863. Disclosure of this information is mandatory. This form has been approved by the Forms Management Center.

IL 482-0631

White [illegible] copies.
Ill. Dept. of Public Health
Yellow Copy: Well Contractor
Golden Copy: Well Owner

Well Construction Report

THIS FORM MUST BE COMPLETED WITHIN 30 DAYS
OF WELL COMPLETION AND SENT TO
THE ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 WEST JEFFERSON STREET
SPRINGFIELD, ILLINOIS 62761

1. Type of Well
   a. Bored X Hole Diam. 8.5 in. Depth 71 ft
      Buried Slab: Yes___ No X
   b. Driven____ Drive Pipe Diam.____in. Depth____ft
   c. Drilled____ Finished in Drift____ In Rock____
   d. Grout:

(KIND)	FROM (Ft.)	TO (Ft.)
Bentonite	50	52
Bentonite/ Portland	0	50

2. Well furnishes water for human consumption? Yes___ No X
3. Date well drilled 1-6-94
4. Permanent pump installed? Yes ___ Date_____ No X
   Manufacturer NA Type_____
   Location_____
   Capacity _____gpm. Depth of setting_____ft.
5. Well top sealed? Yes X No___ Type 3' x 3' concrete pad
6. Pitless adapter installed? Yes___ No X
   Manufacturer NA Model No._____
   How attached to casing?_____
7. Well disinfected? Yes___ No X
8. Pump and equipment disinfected Yes___ No X

IMPORTANT NOTICE

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IL482-0126

GEOLOGICAL AND WATER SURVEYS WELL RECORD

9. Driller Terracon Environmental, Inc. License No. NA
10. Well Site Address 22614 Route 84 North Cordova, Il
11. Property Owner Minnesota Mining & Manufacturing Well No. MW-1-94
12. Permit No. NA Date Issued
13. Location: From 3M main entrance & Route 84 ¼ mile north and ¼ mile east.
    NE¼ of SE¼ of NW¼ of Section 4
    Township 20N, Range 2E, Cordova, Il
    County Rock Island
    Sec. 4
    Twp. 20N
    Rge. 2E
    Show location in section plat
14. Water from sand at depth 58.5 ft to 70.0 ft

15. Casing and Liner Pipe

Diam. (in)	Kind and Weight	From (ft)	To (ft)
2"	Stainless steel 304	0	55.0'
2"	Stainless steel screen 316	55.0'	70.0'

16. Screen: Diam. 2 in, Length 80 in, Slot Size .01
17. Size hole below casing 0 in. 18. Ground Elev. ft msl
19. Static level 61.7 ft below casing top which is 3.0 ft. above ground level. Pumping level 0 ft, pumping gpm for 0 hours

20. Earth Materials Passed Through	Depth of Top	Depth of Bottom
Dark brown sandly lean clay	0	3.5
Brown fine sand	3.5	18.5
Brown fine to medium sand	18.5'	24.5'
Brown fine to coarse sand with gravel	24.5'	71.0'

Continue on separate sheet if necessary

Signed [signature] Date Feb 14, 94

Wh... copies.
Ill. De... of Public Health
Yellow Copy: Well Contractor
Golden Copy: Well Owner

Well Construction Report

THIS FORM MUST BE COMPLETED WITHIN 30 DAYS
OF WELL COMPLETION AND SENT TO
THE ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 WEST JEFFERSON STREET
SPRINGFIELD, ILLINOIS 62761

1. Type of Well
   a. Bored X Hole Diam. 8.5 in. Depth 44.5 ft
      Buried Slab: Yes ___ No X
   b. Driven ___ Drive Pipe Diam. ___ in. Depth ___ ft
   c. Drilled ___ Finished in Drift ___ In Rock ___
   d. Grout:

(KIND)	FROM (Ft.)	TO (Ft.)
Bentonite	30.0	32.0
Bentonite/ Portland	0	30.0

2. Well furnishes water for human consumption? Yes ___ No X
3. Date well drilled 1-6-94
4. Permanent pump installed? Yes ___ Date ___ No X
   Manufacturer NA Type ___
   Location ___
   Capacity ___ gpm. Depth of setting ___ ft.
5. Well top sealed? Yes X No ___ Type 3' x 3' concrete pad
6. Pitless adapter installed? Yes ___ No X
   Manufacturer NA Model No. ___
   How attached to casing? ___
7. Well disinfected? Yes ___ No X
8. Pump and equipment disinfected Yes ___ No X

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IL482-0126

GEOLOGICAL AND WATER SURVEYS WELL RECORD

9. Driller Terracon Environmental, Inc. License No. NA
10. Well Site Address 22614 Route 84 North Cordova, Il
11. Property Owner Minnesota Mining & Manufacturing Well No. MW-2-94
12. Permit No. NA Date Issued ___
13. Location: East of substation and south of main entrance 3M. SW¼ of NW¼ of Section 4 Township 20N, Range 2E, Cordova Il
    County Rock Island
    Sec. 4
    Twp. 20N
    Rge. 2E

Show location in section plat

14. Water from sand at depth 36 ft to 44 ft

15. Casing and Liner Pipe

Diam. (in)	Kind and Weight	From (ft)	To (ft)
2"	Stainless steel 304	0	34.0
2" X	Stainless steel screen 316	34.0'	44.0'

16. Screen: Diam. 2 in, Length 120 in, Slot Size 0'
17. Size hole below casing 0 in. 18. Ground Elev. ___ ft msl.
19. Static level 39.4 ft below casing top which is 3.5 ft. above ground level. Pumping level ___ ft, pumping gpm for ___ hours

20. Earth Materials Passed Through	Depth of Top	Depth of Bottom
Brown to dark brown fine sand, trace silt	0	0.4'
Brown fine sand, trace silt	0.4'	19.5'
Brown fine to coarse sand, trace gravel	19.5'	44.5'

Continue on separate sheet if necessary.

Signed Jay Diagley Date Feb 14, 94

White Pink Copies: Ill. Dept. of Public Health
Yellow Copy: Well Contractor
Golden Copy: Well Owner

Well Construction Report

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THE ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 WEST JEFFERSON STREET
SPRINGFIELD, ILLINOIS 62761

1. Type of Well
   a. Bored X Hole Diam. 8.5 in. Depth 28.5 ft
   Buried Slab: Yes ___ No X
   b. Driven ___ Drive Pipe Diam. ___ in. Depth ___ ft
   c. Drilled ___ Finished in Drift ___ In Rock ___
   d. Grout:

(KIND)	FROM (Ft.)	TO (Ft.)
Bentonite	14.0'	16.0'
Bentonite/		
Portland	0	14.0'

2. Well furnishes water for human consumption? Yes ___ No X
3. Date well drilled 1-10-94
4. Permanent pump installed? Yes ___ Date ___ No X
   Manufacturer NA Type ___
   Location ___
   Capacity ___ gpm. Depth of setting ___ ft.
5. Well top sealed? Yes X No ___ Type 3' x 3' concrete pad
6. Pitless adapter installed? Yes ___ No X
   Manufacturer NA Model No. ___
   How attached to casing? ___
7. Well disinfected? Yes ___ No X
8. Pump and equipment disinfected Yes ___ No X

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GEOLOGICAL AND WATER SURVEYS WELL RECORD

9. Driller Terracon Environmental, Inc. License No. NA
10. Well Site Address 22614 Route 84 North Cordova, Il
11. Property Owner Minnesota Mining & Manufacturing Well No. MW-3-94
12. Permit No. NA Date Issued ___
13. Location: In 3M plant, 77.0' West 16.0' North of NW corner Bldg 23. NE¼ of SE¼ of NE¼ of Section 5 Township 20N, Range 2E Cordova, Il
    County Rock Island
    Sec. 5
    Twp. 20N
    Rge. 2E
    Show location in section plat
14. Water from sand at depth 20.5 ft to 28.5 ft

15. Casing and Liner Pipe

Diam.(in)	Kind and Weight	From (ft)	To (ft)
2"	stainless steel 304	0	18.5'
2"	stainless steel screen 316	18.5'	28.5'

16. Screen: Diam. 2 in, Length 20 in, Slot Size, 01
17. Size hole below casing 0 in. 18. Ground Elev. ___ ft msl
19. Static level 23.0 below casing top which is 4.0 ft. above ground level. Pumping level ___ ft, pumping gpm for ___ hours.

20. Earth Materials Passed Through

	Depth of Top	Depth of Bottom
Brown coarse gravel	0	12"
Dark brown sandy lean clay	12"	5.0'
Brown fine to coarse sand, gravel	5.0'	28.5'

Continue on separate sheet if necessary

Signed [signature] Date Feb 14, 94

White [illegible]k Copies:
Ill. Dept. of Public Health
Yellow Copy: Well Contractor
Golden Copy: Well Owner

Well Construction Report

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OF WELL COMPLETION AND SENT TO
THE ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 WEST JEFFERSON STREET
SPRINGFIELD, ILLINOIS 62761

1. Type of Well
   a. Bored X Hole Diam. 8.5 in. Depth 29.0 ft
      Buried Slab: Yes___ No X
   b. Driven____ Drive Pipe Diam.____in. Depth____ft
   c. Drilled____ Finished in Drift____ In Rock____
   d. Grout:

(KIND)	FROM (Ft.)	TO (Ft.)
Bentonite	14.8'	17.0'
Bentonite/ Portland	0	14.8'

2. Well furnishes water for human consumption? Yes___ No X
3. Date well drilled 1-10-94
4. Permanent pump installed? Yes ___ Date_____ No X
   Manufacturer NA Type_____
   Location_____
   Capacity _____gpm. Depth of setting_____ft.
5. Well top sealed? Yes X No___ Type 3' x 3' concrete pad
6. Pitless adapter installed? Yes___ No X
   Manufacturer NA Model No._____
   How attached to casing?_____
7. Well disinfected? Yes___ No X
8. Pump and equipment disinfected Yes___ No X

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GEOLOGICAL AND WATER SURVEYS WELL RECORD

9. Driller Terracon Environmental, Inc. License No. NA
10. Well Site Address 22614 Route 84 North Cordova, Il
11. Property Owner Minnesota Mining & Manufacturing Well No. MW-4-94
12. Permit No. NA Date Issued
13. Location: In 3M plant, 39' East of SE corner Bldg 7
    SE¼ of NE¼ of Section 5
    Township 20N, Range 2E, Cordova Il.
    County Rock Island
    Sec. 5
    Twp. 20N
    Rge. 2E

Show location in section plat

14. Water from sand at depth 22.5 ft to 29.0 ft

15. Casing and Liner Pipe

Diam. (in)	Kind and Weight	From (ft)	To (ft)
2"	Stainless steel 304	0	19'
2"	Stainless steel screen 316	19'	29'

16. Screen: Diam. 2 in, Length 120in, Slot Size, 01
17. Size hole below casing 0 in. 18. Ground Elev. ___ ft msl
19. Static level 25.0ft below casing top which is 3.5 ft. above ground level. Pumping level ___ft, pumping gpm for ___ hours

20. Earth Materials Passed Through	Depth of Top	Depth of Bottom
Dark Brown silty fine sand roots	0	3"
Dark brown silty fine sand	3"	5.0'
Brown fine to coarse sand, trace gravel	5.0'	29.0'

Continue on separate sheet if necessary.

Signed Jay Gregory Date Feb 14, 94

White copies.
Ill. Dept. of Public Health
Yellow Copy: Well Contractor
Golden Copy: Well Owner

Well Construction Report

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THE ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 WEST JEFFERSON STREET
SPRINGFIELD, ILLINOIS 62761

1. Type of Well
   a. Bored X Hole Diam. 8.5 in. Depth 21.0 ft
      Buried Slab: Yes___ No X
   b. Driven____ Drive Pipe Diam.____ in. Depth____ ft
   c. Drilled____ Finished in Drift____ In Rock____
   d. Grout:

(KIND)	FROM (Ft.)	TO (Ft.)
Bentonite	5.5'	7.5'
Bentonite/ Portland	0'	5.5'

2. Well furnishes water for human consumption? Yes___ No X
3. Date well drilled 1-11-94
4. Permanent pump installed? Yes ___ Date_____ No X
   Manufacturer NA Type_____
   Location_____
   Capacity _____gpm. Depth of setting_____ ft.
5. Well top sealed? Yes X No___ Type 3' x 3' concrete pad
6. Pitless adapter installed? Yes___ No X
   Manufacturer NA Model No._____
   How attached to casing?_____
7. Well disinfected? Yes___ No X
8. Pump and equipment disinfected Yes___ No X

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GEOLOGICAL AND WATER SURVEYS WELL RECORD

9. Driller Terracon Environmental, Inc. License No. NA
10. Well Site Address 22614 Route 84 North Cordova, Il
11. Property Owner Minnesota Mining & Manufacturing Well No. MW-5-94
12. Permit No. NA Date Issued
13. Location: In 3M plant 127' north of building 14.
    SW¼ of NE¼ of NE¼ of Section 5 Township 20N, Range 2E, Cordova Il.
    County Rock Island
    Sec. 5
    Twp. 20N
    Rge. 2E

Show location in section plat

14. Water from sand at depth 13.7 ft to 21.0 ft

15. Casing and Liner Pipe

Diam.(in)	Kind and Weight	From (ft)	To (ft)
2"	Stainless steel 304	0	10.0'
2"	Stainless steel screen 316	10.0'	20.0'

16. Screen: Diam. 2 in, Length 120 in, Slot Size .01
17. Size hole below casing 0 in. 18. Ground Elev. ____ ft msl.
19. Static level 17.4 ft below casing top which is 2.5 ft. above ground level. Pumping level ____ ft, pumping gpm for ____ hours

20. Earth Materials Passed Through	Depth of Top	Depth of Bottom
Brown coarse gravel trace clay	0	8"
Brown sandy lean clay	8"	1.5'
Brown fine to medium sand, trace coarse sand	1.5'	21.0'

Continue on separate sheet if necessary.

Signed Jay Bigley Date Feb 14, 94

White & Pink Copies:
Ill. Dept. of Public Health
Yellow Copy: Well Contractor
Golden Copy: Well Owner

Well Construction Report

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THE ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 WEST JEFFERSON STREET
SPRINGFIELD, ILLINOIS 62761

1. Type of Well
   a. Bored X Hole Diam. 8.5 in. Depth 20 ft
      Buried Slab: Yes___ No X
   b. Driven____ Drive Pipe Diam.____in. Depth____ft
   c. Drilled____ Finished in Drift____ In Rock____
   d. Grout:

(KIND)	FROM (Ft.)	TO (Ft.)
Bentonite	5.5'	7.5'
Bentonite/		
Portland	0	5.5'

2. Well furnishes water for human consumption? Yes___ No X
3. Date well drilled 1-11-94
4. Permanent pump installed? Yes ___ Date_____ No X
   Manufacturer NA Type_____
   Location_____
   Capacity _____gpm. Depth of setting_____ft.
5. Well top sealed? Yes X No___ Type 3' x 3' concrete pad
6. Pitless adapter installed? Yes___ No X
   Manufacturer NA Model No._____
   How attached to casing?_____
7. Well disinfected? Yes___ No X
8. Pump and equipment disinfected Yes___ No X

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GEOLOGICAL AND WATER SURVEYS WELL RECORD

9. Driller Terracon Environmental, Inc. License No. NA
10. Well Site Address 22614 Route 84 North, Cordova, Il
11. Property Owner Minnesota Mining & Manufacturing Well No. MW-6-94
12. Permit No. NA Date Issued
13. Location: In 3M plant, 38' North of building 14.
    SW¼ of NE¼ of NE¼ of Section 5 Township 20N, Range 2E, Cordova, Il
    County Rock Island
    Sec. 5
    Twp. 20N
    Rge. 2E
    Show location in section plat
14. Water from sand at depth 14 ft to 20 ft

15. Casing and Liner Pipe

Diam. (in)	Kind and Weight	From (ft)	To (ft)
2"	Stainless steel 304	0	10'
2"	Stainless steel screen 316	10'	20'

16. Screen: Diam. 2 in, Length 20 in, Slot Size .01
17. Size hole below casing 0 in. 18. Ground Elev. ft msl
19. Static level 17.3 ft below casing top which is 2.5 ft. above ground level. Pumping level ___ft, pumping gpm for ___ hours

20. Earth Materials Passed Through

	Depth of Top	Depth of Bottom
Brown coarse gravel	0	0.5'
Brown fine to medium sand, trace coarse sand	0.5'	20.0'

Continue on separate sheet if necessary

Signed Jon Diegler Date Feb 14, 94

LOG OF BORING NO. MW-7-94

OWNER: 3M COMPANY

CLIENT CONTACT:

SITE: Cordova, Illinois

PROJECT: 3M Cordova Well Installation

Top of Casing Elevation: 598.04 ft.
Ground Surface Elevation: 595.4 ft.

Depth (ft.)	Description	Elevation
2.5	SANDY LEAN CLAY Dark Brown Trace Organic Brown Trace Gravel at 1'	592.9
9.0	FINE TO COARSE SAND WITH GRAVEL Brown	586.4
	FINE TO MEDIUM SAND Brown Trace Gravel at 19'	
35.5	BOTTOM OF BORING	559.9

Depth (ft.)	USCS Symbol	Number	Type	Recovery-in.	SPT - N Blows / Ft.	Moisture, %	Unconfined Strength-psf	Field Vapor Tests - ppm
			HS					
5		1	SS	18	6			
			HS					
10		2	SS	18	5			
			HS					
15		3	SS	1	5			
			HS					
20		4	SS	1	8			
			HS					
25		5	SS	4	2			
			HS					
30		6	SS	12	2			
			HS					
35		7	SS		4			

SOIL AND BEDROCK DESCRIPTIONS ASSIGNED ON THE BASIS OF VISUAL CLASSIFICATION BY THE FIELD CREW

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 7 in.
WELL DIA.: 2.0 in.
LOCK: DOLPHIN 1600

WATER LEVEL OBSERVATIONS	
WL ▽ 23.0	WS ▽
WL	

Terracon ENVIRONMENTAL

BORING STARTED	6-28-94
BORING COMPLETED	6-28-94
RIG #37	FOREMAN REF
APPROVED JAF	JOB # 42945064

APPENDIX 3

EXAMPLE FIELD EQUIPMENT LIST

10.0 SAMPLING AT SLUDGE INCORPORATION WELLS

Description: Sampling of monitoring wells located primarily in the sludge application areas and sampling at one well spicket located by the Employee Recreation Barn.

Project Lead: Carol Snyder
(612) 778-5388

Department: 0222

Project Number: 20-7903

Requester: JS Hunter/MJK/PMS

Purpose: The taking of these samples is required by the plant's sludge incorporation permit.

Frequency: Quarterly

Equipment:

220-volt Generator	Calculator
Submersible Pump	Sample Labels
pH Meter/Buffers	Field Forms
Conductivity Meter/Standard	Field Log Book
Thermometer	Cooler/Ice
Polyethylene Disposable Bailers	Decontamination Tube
In-line Filters (0.45 um)	Spray Bottle
Electric Water Level Indicator	Plastic Sheeting
Rope	Paper Towel
Five-gallon Buckets	Disposable Gloves
Sample Bottles and Preservatives	Well Keys
Deionized Water	Liquinox®
3" Clear Plastic Tape	

Instrument Calibration

Prior to any well sampling procedures, the pH and conductivity meters are calibrated. Standard pH buffers 4.01, 7.00, and 10.00 are used to calibrate the pH meter. A standard conductivity solution (447 microhms) is used to calibrate the conductivity meter. These instruments are calibrated daily and when erratic measurements are encountered. All calibration measurements are recorded in the Field Log Book.

APPENDIX 4

DATA QUALITY LEVELS
USEPA Region 5

December 1995

U.S. EPA REGION 5 WASTE MANAGEMENT BRANCH
RCRA DATA QUALITY LEVELS
DECEMBER 1995

I. GENERAL APPLICATION

The Region 5 Waste Management Branch (WMB) developed the RCRA Data Quality Levels (DQLs) to provide human health-based target levels for RCRA investigative and remedial activities. Specifically, the values expressed in this Table are intended to initiate consideration of facility-specific project objectives, required levels of instrument detection, and intended data usages in light of known toxicological risk factors to humans. The following list outlines uses of the DQLs which are **not consistent** with this guidance:

1. "Cleanup" levels for purposes of RCRA remediation;

2. "Reporting limits" for purposes of submitting RFI data to the U.S. EPA;

3. Anticipated detection limits, except in cases where it can be demonstrated that a laboratory-specific Method Detection Limit (MDL) closely corresponds to a published Practical Quantitation Limit (PQL) or Estimated Quantitation Limit (EQL);

4. Screening levels for elevating a "Phase I" RFI to a "Phase II" RFI;

5. Basis for selecting the "No Further Action" alternative without completion of a risk assessment or assessment of site-specific action levels;

6. Ecotoxicity thresholds, such that contaminant concentrations not exceeding these levels could be assumed to be protective of ecological resources; and

7. Detection levels sufficient to assess risk to local ecological resources.

The primary function of the DQLs is to establish analytical sensitivities for RCRA project data which may ultimately be included in a human health risk assessment. Accordingly, this Table includes "typical" SW-846 methods with corresponding PQLs or anticipated reporting limits which are less than or equal to corresponding human-health DQLs. Although the methods (and corresponding PQLs) are included for reference, facilities conducting investigations should be prepared to justify the use of methods other than those listed in the Table. When applying the DQLs to a specific project, consideration should be given to the media, cross-media interaction, current and future land uses, and compounds of concern (among other factors) as they relate to the overall project objectives and corresponding analytical requirements.

The revised DQL Table departs from the original June 1994 DQL Table in several ways. In this update, U.S. EPA Region 9 Preliminary Remediation Goals (PRGs) (First Half Update, 1995) are the exclusive source of the health-based DQLs. DQLs in the original DQL Table which were based on PQLs, and on the Superfund Soil Screening Levels draft guidance (September, 1994) have been removed. Consequently, all DQLs in the revised DQL Table are based on toxicological data where available. Facilities are advised of their responsibility to determine site-specific DQLs for those cases in which DQLs are not available, or reported DQLs are not appropriate for site-specific project objectives. The Table specifically notes those compounds for which DQLs are not established due to the unavailability of sufficient toxicological data.

The Region 5 WMB has also reconciled the nomenclatural discrepancies between compound listings in Appendix IX (Title 40 Code of Federal Regulations (40 CFR) Part 264) with corresponding listings in the Region 9 PRG Table. In particular, all metals in Appendix IX (and in the revised DQL Table) are reported as total metals (i.e, in total form). Several metals are listed accordingly in the Region 9 PRG Table. For other metals however, two types of listings are presented. As an example of the first type, barium is listed in the PRG Table as "barium and compounds". In such cases, Region 5 WMB has made the assumption that the "and compounds" extension is equivalent to the total form designation as found in Appendix IX for the compound.

For the second type, several complexes or species of a metal are listed in the PRG Table for metals such as thallium. Because analytical methods typically employed in RCRA investigations report the metals in total form, Region 5 WMB selected the lowest PRG from the suite of metal species listed in the PRG Table to represent the Region 5 DQL (e.g., the total form of the metal). Although this approach is not entirely consistent with the Region 9 presentation, it more closely aligns the DQL Table with Appendix IX, ensures consistency with typical methods selected, and is adequately conservative when the form of a metal contaminant is unknown. For each project however, a thorough evaluation of the types of anticipated contaminants should be undertaken with WMB staff.

The soil and ground water DQLs are taken from the "residential soil" and "tap water" exposure scenarios respectively in the Region 9 PRG guidance. For soil, users of the Table are advised that soil/ground water interactions are <u>not</u> considered in the exposure pathway derivation. Therefore, other factors such as the proximity of contaminated soil to ground water, and the mobility of soil contaminants in ground water should be assessed. Risk values for soil contaminants are derived from direct ingestion, dermal contact, and inhalation exposures. For the ground water DQLs, where available, Maximum Contaminant Levels (MCL) (U.S. EPA, Office of Water, 1993) are listed in brackets for reference purposes.

II. IMPLEMENTATION

When preparing a RFI Work Plan/QAPP, the following use of this guidance is recommended:

1. For each hazardous constituent and environmental medium, compare the proposed laboratory-specific reporting limit to the corresponding DQL.

2. After identifying all hazardous constituents for which the reporting limits "satisfy" the DQL requirements, identify the hazardous constituents for which the method reporting limits are higher than the DQLs.

3. If a disparity is identified between the method reporting limit and the DQL for a specific compound, the significance of the disparity must be assessed. Important factors which should be considered include the likelihood of the compound's presence and its suspected concentration; the degree of difference between the reporting limit and the DQL; and the specific project objective (e.g., hot-spot screening, development of data suitable for a risk assessment, etc.) A justification should be provided for the disparity. Alternatively, it may be necessary to propose another analytical method or an alternate DQL.

Disclaimer
The guidance presented in this document is solely intended to assist in the implementation of and the compliance with promulgated regulation. It is not intended and cannot be relied upon to create any rights, substantive or procedural, enforceable by any party in litigation with the United States. The U.S. EPA Region 5 Waste Management Branch reserves the right to act at variance with this guidance and to change it at any time with or without public notice.

U.S. EPA Region 5 Waste Management Branch Guidance: Data Quality Levels (1 mber 1995)

40 CFR PART 264 APPENDIX IX HAZARDOUS CONSTITUENT	DATA QUALITY LEVEL Soil (ug/kg)	METHOD REPORTING LIMITS[a] Low Level Soil (ug/kg)	method	DATA QUALITY LEVEL Ground water (ug/L)	METHOD REPORTING LIMITS[a] Ground water (ug/L)	method
acenaphthene	360,000 (saturation level)[d]	660	8270C	370 nca	10 200	8270C 8100
acenaphthylene	DQL not available[c]	660	8270C	DQL not available[c]	10	8270C
acetone	2,000,000 nca	100	8240	610 nca	100	8240
acetonitrile	390,000 nca	100	8240B	220 nca	10 100	8033 8240A
acetophenone	5,600,000 nca	-	-	3,700 nca	10	8270C
2-acetylaminofluorene (2-AAF)	DQL not available[c]	-	-	DQL not available[c]	20	8270C
acrolein	1,300,000 nca	7	8030	730 nca	15(MDL)[e] 11(MDL)[e]	8015B 8315A
acrylonitrile	130 ca	5	8030	3.7 ca	10 5	8031 8240
aldrin	26 ca	22.8	8081A	0.004 ca	0.34	8081A
allyl chloride	3,300,000 nca	5	8240B	1,800 nca	- 100	8010B 8240
4-aminobiphenyl	DQL not available[c]	-	-	DQL not available[c]	20	8270C
aniline	19,000 nca	-	-	11 nca	10	8270
anthracene	19,000 (saturation level)[d]	660	8270C	1,800 nca	200 10	8100 8270C
antimony (and compounds)[b]	31,000 nca	300	6010A	15 nca (MCL = 6)	30 300	7041 6010
Aramite	18,000 ca	-	-	2.7 ca	10	8270
arsenic	320 ca 22,0000 nca	100	6010A	0.038 ca	10 20 500	7060 7061 6010
barium (and compounds)[b]	5,300,000 nca	200	6010A	2,600 nca (MCL = 2000)	20 1,000	6010 7080
benzene	1,400 ca	0.09 5	8021B 8240	0.39 ca (MCL = 5)	0.09	8021B
benzo(a)anthracene	610 ca	660 8.7	8270C 8310	0.092 ca	0.13 10	8310 8270C
benzo(b)fluoranthene	610 ca	660 12.1	8270C 8310	0.092 ca	10 0.18	8270C 8310
benzo(k)fluoranthene	6,100 ca	660 11.4	8270C 8310	0.92 ca	10 0.17	8270C 8310

Footnotes and General Notes are listed at the end of this table.

U.S. EPA Region 5 Waste Management Branch Guidance: Data Quality Levels (1 cmber 1. 5)

40 CFR PART 264 APPENDIX IX HAZARDOUS CONSTITUENT	DATA QUALITY LEVEL Soil (ug/kg)	METHOD REPORTING LIMITS[a] Low Level Soil (ug/kg)	method	DATA QUALITY LEVEL Ground water (ug/L)	METHOD REPORTING LIMITS[a] Ground water (ug/L)	method
benzo(g,h,i)perylene	DQL not available[a]	660 51	8270C 8310	DQL not available[a]	10 0.76	8270C 8310
benzo(a)pyrene	61 ca	660 15.4	8270C 8310	0.0092 ca	10 0.23	8270 C 8310
benzyl alcohol	20,000,000 nca	1,300	8270C	11,000 nca	20	8270C
beryllium (and compounds)[b]	140 ca	20	7091	0.016 ca	2 3	7091 6010
alpha BHC (hexachlorocyclohexane-alpha)	71 ca	23.4	8081A	0.011 ca	0.35	8081A
beta BHC (hexachlorocyclohexane-beta)	250 ca	15.4	8081A	0.037 ca	0.23	8081A
delta BHC (hexachlorocyclohexane-delta)	DQL not available[a]	16.1	8081A	DLQ not available[a]	0.24	8081A
gamma BHC (lindane) (hexachlorocyclohexane-gamma)	340 ca	16.8	8081A	0.052 ca (MCL = 0.2)	0.25	8081A
bis (2-chloroethoxy) methane	DQL not available[a]	660	8270C	DQL not available[a]	10	8270C
bis (2-chloroethyl) ether	74 ca	660	8270C	0.0098 ca	10	8270C
bis (2-chloro-1-methylethyl) ether	6,300 ca	660	8270C	0.96 ca	10	8270C
bis (2-ethylhexyl) phthalate	32,000 ca	181	8061A	4.8 ca	2.7	8061A
bromodichloromethane	1,400 ca	5	8240	0.18 ca	1 5 0.2	8260B 8240 8021B
bromoform (tribromomethane)	56,000 ca	16 5	8021B 8240	8.5 ca	2 5	8010 8240
4-bromophenyl phenyl ether	DQL not available[a]	660	8270C	DQL not available[a]	10	8270C
butyl benzyl phthalate (benzyl butyl phthalate)	13,000,000 nca	660	8270C	7,300 nca	0.42 10	8061A 8270C
cadmium (and compounds)[b]	38,000 nca	10	7131	18 nca (MCL = 5)	1 40	7131 6010
carbon disulfide	16,000 nca	5 5	8240 8260B	21 nca	5 1	8240 8260B
carbon tetrachloride	470 ca	5 5	8240 8250B	0.17 ca (MCL = 5)	1	8260B
chlordane (as gamma)	340 ca	24.8	8081A	0.052 ca (MCL = 2)	0.37	8081A
p-chloroaniline (4-chloroaniline)	260,000 nca	1,300	8270C	150 nca	20	8270C

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U.S. EPA Region 5 Waste Management Branch Guidance: Data Quality Levels (1 ember 1995)

40 CFR PART 264 APPENDIX IX HAZARDOUS CONSTITUENT	DATA QUALITY LEVEL Soil (ug/kg)	METHOD REPORTING LIMITS[d] Low Level Soil (ug/kg)	method	DATA QUALITY LEVEL Ground water (ug/L)	METHOD REPORTING LIMITS[d] Ground water (ug/L)	method
chlorobenzene	160,000 nca	5 0.3	8240 8021B(PID)	39 nca	1 0.03 5	8260B 8021B(PID) 8240
chlorobenzilate	1,600 ca	-	-	0.25 ca	10	8270C
p-chloro-m-cresol	DQL not available[a]	240 1,300	8040 (FID) 8270C	DQL not available[a]	5 20	8040 8270C
chloroethane (ethyl chloride)	1,100,000 nca	10 5.2	8240 8010	710 nca -	1 10	8260B 8240
chloroform	530 ca	5 0.2	8240 8021B	0.16 ca	0.2 5 1	8021B 8240 8260B
2-chloronaphthalene (beta-chloronaphthalene)	5,200,000 nca	660 630	8270C 8120	2,900 nca	10 10	8120 8270C
2-chlorophenol	330,000 nca	660	8270 C	180 nca	5 10	8040 8270C
4-chlorophenyl phenyl ether	DQL not available[a]	660	8270C	DQL not available[a]	10	8270C
chloroprene	DQL not available[a]	5	8240B	DQL not available[a]	5	8240
chromium (total)	210,000 ca (1/6 ratio Cr VI/Cr III)	100	7191	180 nca (MCL = 100)	10 70	7191 6010
chrysene	24,000 (saturation level)[e]	660 100	8270C 8310	9.2 ca	10 1.5	8270C 8310
cobalt	DQL not available[a]	100	7201	DQL not available[a]	10 70	7201 6010
copper (and compounds)[b]	2,800,000 nca	600	6010A	1,400 nca	60 200	6010 7210
m-cresol (3-methylphenol)	3,300,000 nca	-	-	1,800 nca	10	8270C
o-cresol (2-methylphenol)	3,300,000 nca	660	8270C	1,800 nca	10	8270C
p-cresol (4-methylphenol)	330,000 nca	660	8270C	180 nca	10	8270C
cyanide[e]	380,000 nca	-	-	6.2 nca (MCL = 200)	40	9010
2,4-D (2,4-dichlorophenoxyacetic acid)	650,000 nca	1.2(EIL)[e]	8151A	370 nca (MCL = 70)	0.2(EDL)[e]	8151A
4,4'-DDD	1,900 ca	33.5	8081A	0.28 ca	0.5	8081A
4,4'-DDE	1,300 ca	38.9	8081A	0.20 ca	0.6	8081A
4,4'-DDT	1,300 ca	54.3	8081A	0.20 ca	0.8	8081A

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40 CFR PART 264 APPENDIX IX HAZARDOUS CONSTITUENT	DATA QUALITY LEVEL Soil (ug/kg)	METHOD REPORTING LIMITS[a] Low Level Soil (ug/kg)	method	DATA QUALITY LEVEL Ground water (ug/L)	METHOD REPORTING LIMITS[a] Ground water (ug/L)	method
diallate	7,300 ca	-	-	1.1 ca	10	8270C
dibenz(a,h) anthracene	61 ca	20.1 660 660	8310 8270C 8270C	0.0092 ca	10 0.3	8270C 8310
dibenzofuran	260,000 nca	660	8270C	150 nca	10	8270C
dibromochloromethane (chlorodibromomethane)	5,300 ca	5 0.3	8240 8021B	1 ca	0.3	8021B
1,2-dibromo-3-chloropropane (DBCP)	320 ca	100 5	8240B 8260B	0.048 ca (MCL = .2)	5 1	8240 8260B
1,2-dibromoethane (ethylene dibromide)	5.1 ca	5 5	8240B 8260B	0.00076 ca	5 1	8240 8260B
di-n-butyl phthalate	DQL not available[a]	221	8061A	3,700 nca	3.3 10	8061A 8270C
o-dichlorobenzene (1,2-dichlorobenzene)	2,300,000 (saturation level)[d]	5 0.5 760	8260B 8021B(PID) 8120	370 nca (MCL = 600)	10 0.5 1	8120 8021B 8260B
m-dichlorobenzene (1,3-dichlorobenzene)	2,800,000 (saturation level)[d]	5 0.2 800	8260B 8021B 8120	DQL not available[a] (MCL = 600)	10 0.2 1	8120 8021B 8260B
p-dichlorobenzene (1,4-dichlorobenzene)	7,400 ca	900 5 0.07	8120 8260B 8021B(PID)	0.47 ca (MCL = 75)	0.07 1	8021B(PID) 8260B
3,3'-dichlorobenzidine	990 ca	1,300	8270C	0.15 ca	20	8270C
trans-1,4-dichloro-2-butene	7.6 ca	5 100	8260B 8240B	0.0012 ca	1 5	8260B 8240
dichlorodifluoromethane	110,000 nca	5	8240B	390 nca	1 5	8260B 8240
1,1-dichloroethane	840,000 nca	5 5	8240 8260B	810 nca	1 5	8260B 8240
1,2-dichloroethane (ethylene dichloride)	440 ca	5 5	8240B 8260B	0.12 ca (MCL = 5)	1	8260B
1,1-dichloroethylene (vinylidene chloride)	38 ca	0.7 5	8021B 8240	0.046 ca (MCL = 7)	0.7	8021B
trans-1,2-dichloroethylene	170,000 nca	5 5	8260B 8240	120 nca (MCL = 100)	1 5	8260B 8240
2,4-dichlorophenol	200,000 nca	260 660	8040 (FID) 8270C	110 nca	5 10	8040 8270C
2,6-dichlorophenol	DQL not available[a]	-	-	DQL not available[a]	10	8270C

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U.S. EPA Region 5 Waste Management Branch Guidance: Data Quality Levels (L ember 1995)

40 CFR PART 264 APPENDIX IX HAZARDOUS CONSTITUENT	DATA QUALITY LEVEL Soil (ug/kg)	METHOD REPORTING LIMITS[a] Low Level Soil (ug/kg)	method	DATA QUALITY LEVEL Ground water (ug/L)	METHOD REPORTING LIMITS[a] Ground water (ug/L)	method
1,2-dichloropropane	680 ca	5	8260B	0.16 ca (MCL = 5)	0.06 1	8021B 8260B
cis-1,3-dichloropropene	510 ca	5	8240	0.081 ca	1 5	8260B 8240
trans-1,3-dichloropropene	510 ca	5	8240	0.081 ca	5 1	8240 8260B
dieldrin	28 ca	29.5	8081A	0.0042 ca	0.44	8081A
diethyl phthalate	52,000,000 nca	660 168	8270C 8061A	29,000 nca	10 2.5	8270C 8061A
O,O - diethyl O-2-pyrazinyl phosphorothioate (thionazin)	DQL not available[a]	-	-	DQL not available[a]	20	8270C
dimethoate	13,000 nca	130	8141A	7.3 nca	20 2.6	8270C 8141A
p-(dimethylamino)-azobenzene	DQL not available[a]	-	-	DQL not available[a]	10	8270C
7,12-dimethyl-benz(a) anthracene	DQL not available[a]	-	-	DQL not available[a]	10	8270C
3,3'-dimethylbenzidine	48 ca	-	-	0.0073 ca	10	8270C
alpha, alpha-dimethylphenethylamine	DQL not available[a]	-	-	DQL not available[a]	10	8270
2,4-dimethylphenol	1,300,000 nca	660	8270C	730 nca	5 10	8040 8270C
dimethyl phthalate	DQL > 1 x 10^8	660 429	8270C 8061A	370,000 nca	6.4 10	8061A 8270C
m-dinitrobenzene (1,3-DNB)	6,500 nca	0.25	8330	3.7 nca	0.11 20	8330 8270C
4,6-dinitro-o-cresol	DQL not available[a]	3,300	8270	DQL not available[a]	50	8270
2,4-dinitrophenol	130,000 nca	3,300 8,710	8270C 8040 (FID)	73 nca	50	8270C
2,6-dinitrotoluene (2,6-DNT)	65,000 ca	6.7 660 0.26	8090 (ECD) 8270C 8330	37 ca	0.1 10	8090 8270C
2,4-dinitrotoluene (2,4-DNT)	130,000 nca	660 13.4 0.25	8270C 8090 8330	73 nca	0.2 10 0.02	8090 8270C 8330
dinoseb (2-sec-butyl-4,6-dinitrophenol)	65,000 nca	47	8150	37 nca (MCL = 7)	1 20	8150 8270C
di-n-octyl-phthalate	1,300,000 nca	32.8	8061A	730 nca	0.5 10	8061A 8270C

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U.S. EPA Region 5 Waste Management Branch Guidance: Data Quality Levels (L ember 1995)

40 CFR PART 264 APPENDIX IX HAZARDOUS CONSTITUENT	DATA QUALITY LEVEL Soil (ug/kg)	METHOD REPORTING LIMITS[a] Low Level Soil (ug/kg)	method	DATA QUALITY LEVEL Ground water (ug/L)	METHOD REPORTING LIMITS[a] Ground water (ug/L)	method
1,4-dioxane (p-dioxane)	14,000 ca	-	-	1 ca	150(MDL X 10)[b] 8015B 12(MDL)[c] 8260B/5031	
diphenylamine	1,600,000 nca	-	-	910 nca	10	8270
disulfoton	2,600 nca	35	8141A	1.5 nca	0.7	8141A
endosulfan I	3,300 nca	20.1	8081A	1.8 nca	0.3	8081A
endosulfan II	3,300 nca	26.8	8081A	1.8 nca	0.4	8081A
endosulfan sulfate	DQL not available[a]	23.4	8081A	DQL not available[a]	0.35	8081A
endrin	20,000 nca	26.1	8081A	11 nca (MCL = 2)	0.39	8081A
endrin aldehyde	DQL not available[a]	33.5	8081A	DQL not available[a]	0.5	8081A
ethylbenzene	2,900,000 (saturation level)[d]	0.05 5	8021B 8240	1,300 nca (MCL = 700)	0.05 5	8021B 8240
ethyl methacrylate	340,000 (saturation level)[d]	5	8240B	550 nca	10 5 10	8015 8240 8270
ethyl methane sulfonate	DQL not available[a]	-	-	DQL not available[a]	20	8270C
famphur	DQL not available[a]	-	-	DQL not available[a]	20	8270C
fluoranthene	2,600,000 nca	660	8270C	1,500 nca	10 200 2.1	8270C 8100 8310
fluorene	300,000 (saturation level)[d]	660	8270C	240 nca	10 200 2.1	8270C 8100 8310
heptachlor	99 ca	26.8	8081A	0.015 ca (MCL = .4)	0.40	8081A
heptachlor epoxide	49 ca	21.4	8081A	0.0074 ca (MCL = .2)	0.32	8081A
hexachlorobenzene	280 ca	3.8	8121	0.042 ca (MCL =1)	0.056	8121
hexachlorobutadiene	5,700 ca	0.9 660	8121 8270	0.86 ca	0.014	8121
hexachlorocyclopentadiene	450,000 nca	161 660	8121 8270C	260 nca	2.4 10	8121 8270C
hexachloroethane	32,000 nca	1.1 660	8121 8270	4.8 ca	0.016	8121
hexachlorophene	20,000 nca	-	-	11 nca	50	8270C
hexachloropropene	DQL not available[a]	-	-	DQL not available[a]	50	8270C

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40 CFR PART 264 APPENDIX IX HAZARDOUS CONSTITUENT	DATA QUALITY LEVEL Soil (ug/kg)	METHOD REPORTING LIMITS[a] Low Level Soil (ug/kg)	method	DATA QUALITY LEVEL Ground water (ug/L)	METHOD REPORTING LIMITS[a] Ground water (ug/L)	method
2-hexanone	DQL not available[a]	50	8240	DQL not available[a]	50	8240
indeno (1,2,3-cd) pyrene	610 ca	29 660	8310 8270C	0.092 ca	0.43 10	831010 8270C
isobutyl alcohol (isobutanol)	2×10^7 nca	7 (MDL)[a]	8260B/5031	11,000 nca	50	8015
isodrin	DQL not available[a]	-	-	DQL not available[a]	20	8270C
isophorone	470,000 ca	10,500 3,800	8090 (ECD) 8090 (FID)	71 ca	- 60 10	8091 8090 8270C
isosafrole	DQL not available[a]	-	-	DQL not available[a]	10	8270C
kepone	25 ca	-	-	0.0037 ca	- 20	8081A 8270C
lead	400,000 nca	100 4200	7421 6010A	4 nca	10 40	7421 6010
mercury (inorganic)	23,000 nca	100	7471	11 nca (MCL =2)	2	7470
methacrylonitrile	1,300 nca	100	8240B	1 nca	- 5 5	8260B 8015 8240
methapyrilene	DQL not available[a]	-	-	DQL not available[a]	100	8270C
methoxychlor	330,000 nca	57.6	8081A	180 nca (MCL = 40)	0.86 10	8081A 8270C
methyl bromide (bromomethane)	15,000 nca	10	8240	8.7 nca	10 1	8240 8260B
methyl chloride (chloromethane)	2,000 ca	10 0.8	8240 8010	1.5 ca	1	8260B
3-methylcholanthrene	DQL not available[a]	-	-	DQL not available[a]	10	8270C
methylene bromide (dibromomethane)	650,000 nca	5	8240B	370 nca	1 5	8260B 8240
methylene chloride (dichloromethane)	11,000 ca	5	8240B	4.3 ca	1 5	8260B 8240
methyl ethyl ketone (MEK)	8,700,000 nca	100	8240	1,900 nca	10 100 16(MDL)[a]	8015 8240 8260B/5031
methyl iodide (iodomethane)	DQL not available[a]	5	8240B	DQL not available[a]	5	8240
methyl methacrylate	5,200,000 nca	50	8240B	2,900 nca	- 2 5	8260B 8015 8240

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40 CFR PART 264 APPENDIX IX HAZARDOUS CONSTITUENT	DATA QUALITY LEVEL Soil (ug/kg)	METHOD REPORTING LIMITS[a] Low Level Soil (ug/kg)	method	DATA QUALITY LEVEL Ground water (ug/L)	METHOD REPORTING LIMITS[a] Ground water (ug/L)	method
methyl methanesulfonate	DQL not available[a]	-	-	DQL not available[a]	10	8270C
2-methylnaphthalene	DQL not available[a]	660	8270C	DQL not available[a]	10	8270C
methyl parathion (parathion methyl)	16,000 nca	20	8140	9.1 nca	0.5 -	8140 8321A
4-methyl-2-pentanone (methyl isobutyl ketone)	5,200,000 nca	50	8240	2,900 nca	5 50	8015 8240
naphthalene	800,000 (saturation level)[d]	660	8270C	240 nca	10	8270C
1,4-naphthoquinone	DQL not available[a]	-	-	DQL not available[a]	10	8270C
1-naphthylamine	DQL not available[a]	-	-	DQL not available[a]	10	8270C
2-naphthylamine	DQL not available[a]	-	-	DQL not available[a]	10	8270C
nickel[c]	1,500,000 nca	1500	6010A	730 nca (MCL = 100)	50	6010
o-nitroaniline (2-nitroaniline)	3,900 nca	3,300 670	8270C 8131	2.2 nca	50 10	8270C 8131
m-nitroaniline (3-nitroaniline)	DQL not available[a]	3,300 2211	8270C 8131	DQL not available[a]	50 33	8270C 8131
p-nitroaniline (4-nitroaniline)	DQL not available[a]	7370	8131	DQL not available[a]	20	8270C
nitrobenzene (NB)	33,000 nca	660 0.26 9200 2400	8270C 8330 8090 (ECD) 8090 (FID)	18 nca	10 6.4	8270C 8330
o-nitrophenol (2-nitrophenol)	DQL not available[a]	300	8040 (FID)	DQL not available[a]	5 -	8040 8041
p-nitrophenol (4-nitrophenol)	DQL not available[a]	470	8040 (ECD)	DQL not available[a]	10 -	8040 8041
4-nitroquinoline-1-oxide	DQL not available[a]	-	-	DQL not available[a]	40	8270C
N-nitrosodi-n-butylamine	82 ca	-	-	0.012 ca	10	8270C
N-nitrosodiethylamine	3 ca	-	-	0.00045 ca	20	8270C
N-nitrosodimethylamine	8.7 ca	-	-	0.0013 ca	1.5	8070A
N-nitrosodiphenylamine	91,000 ca	660	8270C	14 ca	8.1	8070A
N-nitroso di-n-propylamine	63 ca	660	8270C	0.0096 ca	4.6	8070A
N-nitroso-(N)-methylethylamine	20 ca	-	-	0.0031 ca	10	8270
N-nitrosomorpholine	DQL not available[a]	-	-	DQL not available[a]	10	8270

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40 CFR PART 264 APPENDIX IX HAZARDOUS CONSTITUENT	DATA QUALITY LEVEL Soil (ug/kg)	METHOD REPORTING LIMITS[a] Low Level Soil (ug/kg)	method	DATA QUALITY LEVEL Ground water (ug/L)	METHOD REPORTING LIMITS[a] Ground water (ug/L)	method
N-nitrosopiperidine	DQL not available[a]	-	-	DQL not available[a]	20	8270C
N-nitrosopyrrolidine	210 ca	-	-	0.032 ca	40	8270C
5-nitro-o-toluidine	DQL not available[a]	-	-	DQL not available[a]	10	8270C
parathion	390,000 nca	-	-	220 nca	10	8270C
polychlorinated biphenyls (PCBs)	66 ca	36.2 to 603[a]	8082	0.0087 ca	5.4 to 9.0[a]	8082
polychlorinated dibenzo-p-dioxins (PCDDs)	DQL not available[a]	-	-	DQL not available[a]	0.01	8280
polychlorinated dibenzofurans (PCDFs)	DQL not available[a]	-	-	DQL not available[a]	0.01	8280
pentachlorobenzene	52,000 nca	-	-	29 nca	10	8270C
pentachloroethane	DQL not available[a]	10	8240B	DQL not available[a]	5 -	8240 8260B
pentachloronitrobenzene	1,700 ca	-	-	0.26 ca	- 20	8091 8270C
pentachlorophenol	2,500 ca	5,000 400 3,300	8040 (FID) 8040 (ECD) 8270C	0.56 ca (MCL = 1)	5 0.076 (EDL)[a]	8040 8151A
phenacetin	DQL not available[a]	-	-	DQL not available[a]	20	8270C
phenanthrene	DQL not available[a]	660	8270C	DQL not available[a]	10	8270C
phenol	39,000,000 nca	94 1470 660	8040 (FID) 8040 (ECD) 8270C	22,000 nca	1 10 -	8040 8270C 8041
p-phenylenediamine	12,000,000 nca	-	-	6,900 nca	10	8270C
phorate	13,000 nca	20	8141A	7.3 nca	0.4	8141A
2-picoline	DQL not available[a]	-	-	DQL not available[a]	5	8240
pronamide	4,900,000 nca	-	-	2,700 nca	10	8270C
propionitrile (ethyl cyanide)	DQL not available[a]	100	8240B	DQL not available[a]	5	8240
pyrene	2,000,000 nca	660	8270C	1,100 nca	10 2.7	8270C 8310
pyridine	65,000 nca	-	-	37 nca	- 5 10	8260 8240 8270
safrole	DQL not available[a]	-	-	DQL not available[a]	10	8270C

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40 CFR PART 264 APPENDIX IX HAZARDOUS CONSTITUENT	DATA QUALITY LEVEL Soil (ug/kg)	METHOD REPORTING LIMITS[a] Low Level Soil (ug/kg)	method	DATA QUALITY LEVEL Ground water (ug/L)	METHOD REPORTING LIMITS[a] Ground water (ug/L)	method
selenium	380,000 nca	200 200	7740 7741	180 nca	20 20 750	7740 7741 6010
silver (and compounds)[b]	380,000 nca	700	6010	180 nca	70	6010
silvex (2-(2,4,5-trichlorophenoxy)propanoic acid)	DQL not available[c]	0.28(EDL)[e]	8151A	290 nca	0.75(EDL)[e]	8151A
styrene	2,200,000 (saturation level)[d]	5	8240	1,600 nca (MCL = 100)	1 5	8020 8240
sulfide	DQL not available[c]	-	-	DQL not available[c]	10,000	9030
2,4,5-trichlorophenoxyacetic acid (2,4,5-T)	650,000 nca	130	8150	370 nca	0.8(EDL)[e]	8151A
1,2,4,5-tetrachlorobenzene	20,000 nca	-	-	11 nca	10	8270C
2,3,7,8-tetrachloro-dibenzo p-dioxin (2,3,7,8-TCDD)	0.0038 ca	0.8	8280	0.00000045 ca (MCL = 3×10^{-5})	0.01	8280A
1,1,1,2-tetrachloroethane	4,800 ca	5	8240B	0.43 ca	1 5	8260B 8240
1,1,2,2-tetrachloroethane	900 ca	5	8240	0.055 ca	1	8260B
tetrachloroethene (PCE)	7,000 ca	0.4 5	8021B 8240	1.1 ca	1 0.4	8260B 8021B
2,3,4,6-tetrachlorophenol	2,000,000 ca	-	-	1,100 nca	10	8270C
tetraethyldithiopyrophosphate (sulfotepp)	33,000 nca	35	8141A	18 nca	10 0.7	8270 8141A
thallium[c]	6,100 nca	100	7841	2.9 nca (MCL = 2)	10 400	7841 6010
tin (and compounds)[b]	46,000,000	2,000	7870	22,000 nca	8,000	7870
toluene (methyl benzene)	1,900,000 nca	5 2	8240 8020	720 nca (MCL = 1000)	1 5 2	8260B 8240 8021B
o-toluidine	DQL not available[c]	-	-	DQL not available[c]	10	8270C
toxaphene	400 ca	57.6	8081A	0.061 ca (MCL = 3)	0.86	8081A
1,2,4-trichlorobenzene	620,000 nca	660 34	8270C 8120	190 nca (MCL = 70)	10 1	8270C 8260B
1,1,1-trichloroethane (methyl chloroform)	3,200,000 nca	5	8240	1,300 nca (MCL = 200)	5 1	8240 8260B
1,1,2-trichloroethane	1,400 ca	5 0.2	8240 8010	0.20 ca (MCL = 5)	- 1	8021B 8260B

Footnotes and General Notes are listed at the end of this table.

U.S. EPA Region 5 Waste Management Branch Guidance: Data Quality Levels (L[illegible]ember 1995)

40 CFR PART 264 APPENDIX IX HAZARDOUS CONSTITUENT	DATA QUALITY LEVEL Soil (ug/kg)	METHOD REPORTING LIMITS[e] Low Level Soil (ug/kg)	method	DATA QUALITY LEVEL Ground water (ug/L)	METHOD REPORTING LIMITS[e] Ground water (ug/L)	method
trichloroethene (trichloroethylene)	7,100 ca	0.1 5	8021B 8240	1.6 ca (MCL = 5)	1 0.1	8260B 8021B
trichlorofluoromethane	710,000 nca	0.3	8021B -	1,300 nca	0.3 5	8021B 8240
2,4,5-trichlorophenol	6,500,000 nca	660	8270C	3,700 nca	10	8270C
2,4,6-trichlorophenol	40,000 ca	430 390 660	8040 (FID) 8040 (ECD) 8270C	6.1 ca	5 -	8040 8041
1,2,3-trichloropropane	6.6 ca	5 5 4.0	8240B 8260B 8021B	31 ca	4.0 1 5	8021B 8260B 8240
O,O,O-triethyl phosphorothioate	DQL not available[a]	-	-	DQL not available[a]	10	8270
sym-trinitrobenzene (1,3,5-TNB)	3,300 nca	250	8330	1.8 nca	0.26	8330
vanadium	540,000 nca	-	-	260 nca	80 40	6010 7911
vinyl acetate	65,000,000 nca	50	8240	37,000 nca	5	8240
vinyl chloride (chloroethene)	5.2 ca	0.2	8021B	0.020 ca (MCL = 2)	0.2	8021B
xylenes (total) (dimethylbenzene)	980,000 (saturation level)[d]	0.1 5	8021B 8240	1,400 nca (MCL = 10,000)	0.1 5 1	8021B 8240 8260B
zinc[c]	23,000,000 nca	200 500	6010A 7950	11,000 nca	20 50	6010 7950

Footnotes

(a) DQL not available due to absent or limited toxicological data for this compound. Wherever applicable, site-specific DQLs should be developed.

(b) DQL based on multiple forms of this compound. The cited analytical method(s) report(s) the total amount of the constituent of interest.

(c) DQL is based on the lowest PRG value as listed in the Region 9 PRG Table (February 1, 1995) corresponding to the most toxic species of this metal. If warrented by site-specific objectives, metals species in addition to the total form of this metal should be considered.

(d) Concentration above which constituent can no longer be absorbed, dissolved, or retained in soil.

(e) The "Method Reporting Limits" listed in the Columns 3 and 5 of this table are derived from U.S. EPA SW-846 methods which may allow the detection of the hazardous constituent near or below the DQL in a respective matrix. These reporting limits are based on one of the following "detection limits":

- PQL: Practical Quantitation Limit, corresponds to the description in footnote 6 of Appendix IX;
- EQLs: Estimated Quantitation Limit, where referenced, is described in the corresponding SW-846 method;

U.S. EPA Region 5 Waste Management Branch Guidance: Data Quality Levels (L ember 1995)

Footnotes (cont.)

- MDL: Minimum Detection Limit, corresponds to the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte;

- EDL: Estimated Detection Limit, is defined as the MDL, or a concentration of analyte in a sample yielding a peak in the final extract with signal-to-noise ration of approximately 5, whichever is higher; or

- EIL: The minimum amount of analyte to give a Finnigan INCOS FIT value of 800 as the methyl derivative versus the spectrum obtained from 50 ng of the respective free acid herbicide.

- For 1,4-dioxane in the ground water matrix, the method reporting limit indicated is the MDL multiplied by a conservative factor of 10 for method 8015B. The range expressed for PCBs indicates the analytical sensitivity range for seven PCB Aroclors.

These "detection limits" are derived from the following SW-846 versions:

- Third Edition, 1986;
- Final Update 1, July 1992;
- Proposed Update, November 1992; and
- Proposed Update, January 1995.

Users should note that many Appendix IX methods are not listed in this table because their analytical sensitivities do not meet the DQL criteria. Users are also advised that primary consideration should be given to the appropriateness of the methods and corresponding "reporting limits", as they pertain to site-specific project objectives. Other methods may be proposed for use.

General Notes

- The U.S. EPA Region 5 Waste Management Branch Data Quality Levels (DQLs) expressed in the attached table are NOT intended to be used in the following applications:

  1. "Clean up" levels for purposes of RCRA remediation;
  2. "Reporting limits" for purposes of submitting RFI data to the U.S. EPA;
  3. Anticipated detection limits, except in cases where it can be demonstrated that a laboratory-specific Method Detection Limit (MDL) closely corresponds to a published Practical Quantitation Limit (PQL) or Estimated Quantitation Limit (EQL);
  4. Screening levels for elevating a "Phase I" RFI to a "Phase II" RFI;
  5. Basis for determining whether the "No Further Action" alternative is justified, without completion of a risk assessment or assessment of site-specific action levels;
  6. Ecotoxicity thresholds, such that contaminant concentrations not exceeding these levels could be assumed to be protective of ecological resources; and
  7. Contaminant detection levels sufficient to assess risk to local ecological resources.

- To aid in the identification of many compounds, common synonyms for Appendix IX hazardous constituents (40 Code of Federal Regulations (40 CFR) Part 264) are given in parentheses.

- For several hazardous constituents in this table, MCL values are included with the ground water DQLs for reference purposes. The MCL (maximum contaminant level) is the maximum permissible level of a contaminant in water which is delivered to any user of a public water system (U.S. EPA Office of Water, 1993).

- A known carcinogen is denoted as ca; a non-carcinogen is denoted as nca.

- Due to its common use for metals analysis, SW-846 Method 6010 is included for reference purposes.

- Electron Capture Detector is abbreviated as "ECD".
  Flame Ionization Detector is abbreviated as "FID".
  Photoionization Detector is abbreviated as "PID".

APPENDIX 5

3M CONTINGENCY PLAN

RED BOOK

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EMERGENCY PHONE NUMBER LISTING

	Title	Home Phone	Plant Ext.
SMD/SA&C PLANT			
• L. L. Anderson	Safety & Security Specialist	3[redacted]	1255
• H. S. Boggs	Safety Specialist	3[redacted]	1375
• M. D. Gores	Plant Quality Manager	3[redacted]	1300
• B. W. Haberkorn	Logistics Manager	3[redacted]	1303
• J. A. Hensch	H.R. Manager	3[redacted]	1126
• W. R. Myers	Site Manager	3[redacted]	1236
Manufacturing Product Managers			
• R. F. Henderson	Fluorochemicals	[redacted]	1550
• W. H. Raun	Specialties	[redacted]	1374
• P. S. Thornton	Polymers	[redacted]	1234
Manufacturing Product Supervisors			
• D. D. Leech	Fluorochemicals	[redacted]	1237
• R. D. Boelkins	Polymers	[redacted]	1301
• T. L. Ottens	Specialties	[redacted]	1281
Medical			
• R. L. Cox	Occupational Nurse	309-659-2191	1133
Plant Engineering			
• J. A. Rutenbeck	Plant Engineering Mgr.	3[redacted]	1341
• T. G. Blank	Plant Engineering Specialist	3[redacted]	1175
• _____	Resident Engr. Sup.	_____	1382
• D. A. Schulze	Environmental Specialist	[redacted]	1233
• P. M. Sheller	Environmental Engineer	3[redacted]	1344
A&VPD PLANT			
• L. J. Wagner	Plant Manager	3[redacted]	1168
• G. F. Lane	Production Superintendent	3[redacted]	1142
• P. H. Boreen	Technical Supervisor	[redacted]	1136
• **AMBULANCE - ESDA - FIRE - POLICE**		**9-911**	**1911**
• **HOSPITALS**			
• Samaritan North - Clinton		319-244-5555	
• Illini - Silvis		309-792-9363	
• University of IA - Iowa City		319-356-1616	

- **3M PLANT CELLULAR PHONES**
  - 781-2323
  - 781-7158
  - 781-7176
  - 781-7177

MAJOR DISASTER CONTROL PLAN

I. PURPOSE

This plan is to guide you in an effective and organized effort to cope with an actual or potential disaster situation, and to limit the consequences from the incident.

II. GENERAL

The type of disaster which might occur (fire, explosion, storm or chemical release) will dictate the specific course of action which must be taken. This plan will serve as a general guide which you must alter to control results of the immediate emergency. THE OBJECTIVES; however, will always remain the same:

A. Prevent personal injuries.
B. Minimize 3M property damage.
C. Combat the actual emergency situation.
D. Provide for prompt resumption of operations.

III. IMPLEMENTATION LOGISTICS

This plan will be implemented by the Plant Emergency Squad Captain who will act in the Plant/Site Manager's absence. If the disaster affects either SA&C/SMD or A&VPD, that manager will be notified first and he will call the additional people necessary (refer to Telephone Listing, Section A).

A. CONTROL CENTER

The Emergency Control Center will be established in the Plant/Site Manager's office of the plant involved in the emergency. The two offices will serve as alternate Control Centers for each other. If the disaster is of such magnitude that those offices must be evacuated, the Control Center will be established at the Plant Entrance Gate (3M Drive and Video Drive).

B. COMMAND AND AUTHORITY

The Captain of the Emergency Squad on duty will be in charge of DISASTER CONTROL AT THE SCENE OF THE EMERGENCY SITUATION. The Captain will retain control of 3M personnel after the arrival of the municipal or industrial assistance groups. He will maintain functional control through the Chiefs of these assistance groups.

The Plant/Site Manager of the affected site will assume overall command of the operation, if he is available. If not, the assigned manufacturing product manager will act for him. The aid of personnel from both plants will be utilized, if necessary.

III. IMPLEMENTATION LOGISTICS (Continued)

C. COMMUNICATIONS

The plant-wide paging system will be used for general announcements or instructions. Telephone usage will be severely curtailed during the emergency. The paging system will be used only under the instructions of the Supervisor in charge.

Radio communications will be established between the Emergency Squad and the Emergency Control Center, and used where needed.

D. ALARM SIGNALS

Building Evacuation: Instructions will be transmitted via the paging system. The Emergency Squad Captain will issue the order.

Plant-wide Evacuation: The paging system will be used, and the Emergency Squad Captain will issue the order.

Fire Alarms: If a sprinkler head is activated, an automatic signal will be sent to Honeywell and to the Boilerhouse. At the same time, an area alarm bell will sound. The Boilerhouse will call out the Plant Emergency Squad and announce evacuation of the building(s) involved. If directed by the Squad Captain, the Cordova Fire Dept. (Phone Number: 911) may be called to respond.

If a fire is discovered prior to water flowing or the fire is in an unsprinklered area, the Emergency Squad shall be called out and the local fire department contacted for response, if necessary.

The Emergency Squad is alerted by contacting the Boilerhouse on the Plant Emergency Extension 1911. The Boilerhouse will dispatch the Emergency Squad via the Emergency Page System.

III. IMPLEMENTATION LOGISTICS (Continued)

E. EVACUATION ASSEMBLY AREAS

If evacuation is directed, either for individual buildings or the entire plant, employees will report to their assigned assembly area for accountability, control and orderly departure. The Plant Supervisor and Process Specialists will report missing persons to the Captain of the Emergency Squad.

Strict adherence to this requirement cannot be overemphasized. It will preclude searching hazardous areas for persons who may have safely exited. At the discretion of the Emergency Squad Captain, evacuees and other employees will form a reserve manpower pool available for disaster control duty.

- EVACUATION EXTERIOR ASSEMBLY AREAS

  Building 1 - Chemical Plant - Main Parking Lot
  Buildings 2,3,4 - Roadway West of Building 1
  Buildings 5 & 6 - Roadway East of Buildings 5 & 6
  Building 50 - A&VPD Plant Parking Lot
  Building 20 - Roadway West of Building 20
  Building 23 - Roadway West of Building 23

F. EMERGENCY SQUADS

Four Emergency Squads (one for each shift) will provide twenty-four hour protection. Each Squad will be directed by 2 Chemical Plant Production Supervisors and will receive monthly fire/disaster control training. Process Specialists of the building affected will provide technical assistance and/or information to the Squad Captains as required. (Refer to "Cordova Emergency Response Program" for additional information, Section C-1).

G. SECURITY

Security will be the responsibility of the Guard. They will establish access controls to the plant and the disaster area.

Spectators are unnecessarily exposed to the hazards and may even interfere or hamper control operations. Key 3M employees will be allowed entry, as well as those whose areas are operating. Traffic control at the plant access road will serve to keep the road to the plant clear. (Refer to Section E of the "Red Book" for additional information).

III. IMPLEMENTATION LOGISTICS (Continued)

H. RECALL

A priority recall of supervisors will be initiated by the Plant Supervisor in charge and carried out by the Boiler Operator or Quality Technician as directed. If the emergency occurs after business hours, supervisors may be advised to return to the plant, and initiate recall of those employees in their department whose presence may be required. If the on-shift supervisor cannot be contacted, an alternate will be called. Plant Supervisors will establish their own recall procedure. The Emergency Squad Captain will decide whether or not to initiate recall.

I. MEDICAL AND WELFARE

The dispensary will be activated by the Plant Emergency Squad, or other trained first aid personnel. They will man it as required. The Occupational Nurse should be called when time permits. (Refer to Phone Number Listing - Section A).

Advance arrangements will be made to obtain outside medical assistance if required. Liaison with public organizations and industrial mutual aid groups will be established and maintained.

J. PUBLIC RELATIONS

Provisions will be made by the Human Resources Manager for the reception and escort of representatives from newspapers, radio, or television. Prompt release of accurate information will prevent erroneous reports from being published. Management will be guided in this area by Section D of the "Red Book."

Communications between the scene of the emergency and the Human Resources Area will be via portable radios (frequency 157.680). These will normally be operated by the Human Resources Manager and Plant Safety.

a. The designated media center is the Building 1 Conference Room.

b. Media personnel have been identified as:

Contact: Jo A. Hensch
Office: 436-1126
Home: PII [redacted]0

Backup: W. R. (Bill) Myers or Designee
Office: 463-1236
Home: PII [redacted]6

IV. RESPONSIBILITY (Continued)

9. Make advance arrangements to have confiscated film developed at any hour.

10. Have available for immediate dissemination, press release which cites 3M safety devices, procedures, training programs and excellent safety record.

J. MEDICAL FIRST AIDERS OR OCCUPATIONAL NURSE

1. Will activate appropriate dispensary and provide medical assistance.

2. Will remain and assist for the duration of the emergency or until no longer needed.

V. REPORTS AND INVESTIGATION

A. Plant/Site Managers will, as soon as practical, make telephone report of the emergency to their respective Division Management in St. Paul and St. Paul Security: (612) 733-6100.

B. Human Resources Manager will, within 48 hours after the emergency is under control, submit a written summary of the emergency and publicity activities conducted, to 3M Public Affairs.

C. The Plant Supervisor will submit incident report on Form #3450. Personal injuries will be reported on First Report of Injury Form.

D. Plant Safety will conduct a complete investigation to include recommendations which may preclude recurrence.

VI. PLANT EVACUATION PLAN

The are two types of incidents that could necessitate evacuation of the plant site:

1. A condition external to the plant that could threaten the safety of individuals within the plant if they were to remain there.

2. A condition within the plant that could threaten the safety of individuals if they were to remain in the plant.

The following action will be taken if the Emergency Squad Captain believes either condition 1 or 2 exists.

A. The Emergency Squad Captain will direct employees to assemble at the predetermined location in each building.

B. The local police and Rock Island County Sheriff's Department shall be notified and requested to provide traffic control at our plant entrance and Route 84.

VI. PLANT EVACUATION PLAN (Continued)

C. If condition 1 exists:

1. Members of the Emergency Squad and Management Staff will report to the SA&C/SMD and A&VPD parking lots. Their primary duty is to maintain order and to insure a safe vehicle departure.

2. Employees in the assembly areas will be directed, via the plant paging system, to proceed to parking lots and leave the plant in their private vehicles. The designated order of release is: Buildings 1, 50, 2, 3, 4, 5, 6, 23 and 20. There should be approximately five minutes between releases.

3. When employees reach Route 84, they will be instructed which direction to turn.

4. Upon departure from the plant it is each employee's personal responsibility to proceed home by the safest acceptable route.

5. Employees will be notified by telephone when they are to report back to work.

D. If condition 2 exists:

1. Time permitting and atmospheric conditions allowing, the action plan to evacuate via personal vehicles will be followed. The Emergency Squad Captain will direct.

2. If it is unsafe to proceed to the parking lots, the occupants of each building shall proceed as directed by the person in charge of their group to exit the plant on foot via the closest and safest perimeter fence gate.

3. Each group shall remain at a location remote from the plant until they are informed it is safe to return.

The successful completion of a general plant evacuation will depend on the cooperation of each person in the plant. Plant visitors and contractors will have to be directed and instructed at the time of the evacuation.

The plant paging system is essential to facilitate this action plan. Only use of the paging system as directed by the Emergency Squad Captain is allowed.

EMERGENCY ALARMS AND SIGNALS

3M SA&C/SMD CORDOVA

Building 1: Sprinkler water flow - loud buzzers on east wall, lab west wall; computer room alarm; and Co_2 alarm in lab.

Building 2:

1. Sprinkler water flow - loud bell by each of five sprinkler risers along north and south walls of building.
2. Electronic Tone on Building P.A. System.
3. Cold Room Alarm - bell on wall by cooler door rings when room is too warm.

Building 3:

1. Sprinkler water flow - electronic gong over P.A. system.
2. Weigh tank hi-level - air horn over each panel, cannot be shut off without draining tank.
3. Acrylate storage tank, hi-level, hi-temp indicating lights, 306 panel indicate hi-level or hi-temp in Acrylate storage tanks, auto dump inhibitor into Acrylate on hi-temp.
4. Flammable Solvent Shut-off System:
   a. Sprinkler water flow will automatically shut off no indication.
   b. Manual trip buttons at north and south doors of building - no indication.
   c. Pump timer - if any one pump runs continuously, more than 15 minutes, that pump will shut off and red light appears over TF MCC or in Building 3 MCC.
5. UG tank heater recirculation pump - red light above pump indicates pump is off, restart pump.
6. Elevators - single gong, elevator in use -continuous gong, elevator in trouble (emergency alarm).

Building 4:

1. Sprinkler water flow - electronic gong over P.A. System.

2. Weigh tank hi-level - air horn over each panel, cannot be shut off without draining tank.

3. Flammable Solvent shut-off system:

   a. Sprinkler water flow will automatically shut off - no indication.

   b. Manual trip buttons at north and south doors of building - no indication.

   c. Pump timer - if any one pump runs continuously, more than 15 minutes, that pump will shut off and red light appears over TF MCC or Building 4 MCC.

4. Direct Fired Reactor - lights on panel indicate problem area.

5. Elevators - single gong, elevator in use - single gong, elevator in trouble, emergency alarm.

Building 5: Sprinkler water flow - loud bell by water riser on east side of building.

Plant Wide: Emergency Squad Call Out - 5-10 seconds warble signal over P.A. system followed by emergency announcement (see Emergency Call Out Guide).

Building 50: Sprinkler water flow - electronic gong over P.A. system.

Building 20: Evacuation alarm, manually activated, electronic warble over P.A. System.

Building 23:

1. Sprinkler water flow - electronic gong over P.A. System.

2. Weigh tank hi-level - alarm at each panel, cannot be shut off without draining tank.

Building 23:

3. Flammable Solvent shut off system:

   a. Sprinkler water flow will automatically shut off - no indication.

   b. Manual trip buttons at north and south doors of building - no indication.

   c. Pump timer - if any one pump runs continuously, more than 15 minutes, that pump will shut off and red light appears over TF MCC or Building 4 MCC.

4. Elevators - single gong, elevator in use - continuous gong, elevator in trouble, emergency alarm.

EMERGENCY PAGE ANNOUNCEMENTS

FIRE (Water Flow Alarm)

1. Sound Tone.

*2. Emergency Squad Report to Pickup Area. This is a RED ALERT.

*3. Water Flow Alarm in Building _____.
All occupants of building - PLEASE evacuate Building _____.

(Repeat message a second time.)

PERSONAL INJURY

1. Sound Tone.

*2. Emergency Squad report to Pickup Area. This is a YELLOW ALERT.

*3. Personal Injury in (State Location).

(Repeat message a second time.)

GAS RELEASE

1. Sound Tone.

*2. Emergency Squad report to Pickup Area. This is a GREEN ALERT.
Gas Release at (State Area). (Observe direction of wind).

*3. Occupants of all buildings report to designated internal building assembly area.

(Repeat message a second time.)

NOTE: Emergency Squad Captain will assess the situation and determine if evacuations are necessary. If Squad Captain calls for buildings to be evacuated, announce the following:

1. Sound Tone.

*2. Evacuate Building (Building(s) Specified by Squad Captain).
Wind is from (State Direction of Wind).

(Repeat message a second time.)

PLANT EVACUATION (Directed by the Emergency Squad Captain)

1. Sound Tone.

*2. Emergency Squad Report to Pickup Area. All employees prepare to evacuate the plant. Report to designated internal building assembly area.

3. (When Emergency Squad Captain directs - SOUND TONE and announce).

*4. Begin evacuation of the following buildings. (Repeat message and follow the order of release, as per Section C-2.9 through C-2.24).

SEVERE STORM OR TORNADO (Directed by Emergency Squad Captain)

1. Sound Tone.

*2. This is a (State Problem) report to your designated tornado shelter.

(Repeat message a second time.)

(ALL CLEAR as directed by Squad Captain)

1. Sound Tone.

*2. All clear you may return to your work station.

(Repeat message a second time.)

* Designates actual verbal announcements.

EMERGENCY SQUAD

For

FIRE

To alert the EMERGENCY SQUAD, dial 1911. Inform the Boilerhouse of a RED ALERT and give the location.

For

INJURY

To alert the EMERGENCY SQUAD, dial 1911. Inform the Boilerhouse of a YELLOW ALERT and give the location.

For

CHEMICAL SPILL

To alert the EMERGENCY SQUAD, dial 1911. Inform the Boilerhouse of a GREEN ALERT and give the location.

CORDOVA 3M SECURITY PROGRAM

OBJECTIVE

The objective of 3M's security program is to protect company property and interests against theft, fire and other losses, and to assure 3M's compliance with insurance and other agencies requirements.

Basic Requirements

Plant security is the protection of company property and control of people entering and leaving the plant. This normally involves:

A. Enforcing employee and visitor identification and entrance.

B. Controlling entrance of vehicular traffic.

C. Checking restricted areas against unlawful or unauthorized entry.

D. Physical protection systems.

E. Assuring fire and safety regulations.

F. Miscellaneous.

RESPONSIBILITY

At Cordova, the above requirements will be assigned to 3M employees as part of their work responsibility. The overall responsibility is assigned to the Plant Security and plant management for implementation with all personnel responsible for the above requirements.

A. PERSONNEL IDENTIFICATION AND ENTRANCE

1. Cordova Employee Pass

   The employee identification card is a photo-identification badge and should be worn as to be visible at all times.

2. Temporary Employee Pass

   Employees who do not have their pass with them will be issued a temporary pass by the guard for temporary admittance.

3. Visitors - 3M

The Employee Register, Form 3397-D, (Green) is used for all non-Cordova 3Mers. They should wear the identification card that will be issued to them so as to be visible at all times.

4. Visitors - General

3M's manufacturing facilities are restricted and unescorted outsiders are not permitted. The reason for this is the necessity of safeguarding proprietary information. Where exceptions are required, the responsibility falls upon the plant or divisional manager, and the visitor shall not be given detailed information or the opportunity to acquire same, and shall be admitted only under the following regulations:

a. Visitors must be pre-approved by the Plant Manager or in his absence by his designee.

b. All visitors are to be escorted to and from the point of entry.

c. Visitors shall be registered on the Visitor Register, Form 3396.

d. Registers shall be retained for a minimum of two years.

e. Visitors will display their authorization pass at all times.

It is the responsibility of supervision and other building occupants to control visitor access. They should ensure that any visitor has proper escort while in the building.

5. Trade Personnel

Identification cards are issued by the Guard each time a visitor enters the plant. A systematic record shall be kept of all identifications issued, and proper identification is to be made of those that are lost. When not in use, the identification cards are kept on file at the guard's desk. The recipient is not allowed to retain the card overnight. This also applies to any temporary work force that might be authorized for employment. Each visitor must also register on the Visitor Register, Form 3396. A separate log sheet is maintained at the AVPD shipping office for truckers who enter at the AVPD side gate. Vehicle passes are not issued to those truckers. No other vehicles are allowed to use this side gate.

A. PERSONNEL IDENTIFICATION AND ENTRANCE (Continued)

6. Construction Personnel

a. The construction gate guard will log each worker including name, contractor, badge number and time in and time out. The guard will give each worker a badge to be worn and be visible at all times. When leaving the plant site, the badge will be returned to the guard.

b. The Contractor will obtain a work permit for each area they will be working in from the area supervisor. The Contractor should know in advance which area supervisor is involved. This should be clarified with his 3M representative. The work permit will be obtained daily.

c. Construction workers shall not roam around the plant. They must remain in the area defined by their 3M representative.

d. If construction workers are to work in any Division I area, such as Buildings 3, 4, 20 and 23, their shoes must be conductive.

B. ENTRANCE OF VEHICULAR TRAFFIC

1. 3M Employees

Employee vehicles are not to enter the plant except for specific purposes such as the pickup or delivery of equipment and/or material. In such cases, the employee must obtain and display the orange vehicle pass.

2. Trade Personnel

Vendor vehicles are allowed on the plant site only to the extent that they are needed to perform their services. Each driver must sign the safety log sheet and receive an orange vehicle pass which must be displayed in every vehicle entering the plant.

3. Construction Personnel

a. Vehicles marked with contractor's name will be permitted to enter the plant. Each vehicle entering the plant will be provided with a vehicle permit and will be logged in and out.

b. Contractor personnel vehicles will also be allowed on the site for specifically defined purposes but only when a company-owned vehicle is not available or suitable.

- for the transport of tools and/or materials.
- when the distance to the job site is distant enough that walking is not practical. In such situations car pooling should be done as much as possible.
- when the job sites are scattered within the plant.
- for contractor supervisory personnel who do not work on the site and are here to review matters with their people or their 3M representative.

c. During non-office hours (normally after 4:30 p.m. and on holidays and weekends), contractor vehicles can enter and leave through the front gate. Whenever possible sucharrangements should be made in advance. The Contractor shall log in and out on the log sheet located at the guard desk in the lobby.

d. All contractor vehicles must obey posted plant speed limits and yield the right-of-way to fork lift trucks.

All vehicle occupants must follow 3M rules includes:

- no smoking except in designated areas of the plant.
- no cameras, firearms, alcohol, or other non-prescribed drugs are allowed in the plant.

e. 3M reserves the right to inspect any contractor vehicle and by accepting a vehicle permit, the contractor agrees to abide by all 3M Plant rules and policies.

C. RESTRICTED AREAS

Every plant has need of restricted areas, posted by signs, and often locked or sealed to exclude all but authorized personnel. Such areas are established because of trade secret matters which require a high degree of security because of safety factors, and for quality control reasons.

For example, Building 20 at Cordova is set up as restricted to afford technical security to the experiments and processes, to insure a higher factor of safety by admitting only thoseemployees who are properly instructed and equipped, and to avoid contamination of materialsby untrained persons. Likewise, electrical rooms are posted and labeled to excludeunauthorized people in the interests of safety.

D. PHYSICAL PROTECTION SYSTEMS

1. Patrolling Outlying Areas and Plant Perimeters

The Utilities Department makes regular rounds to check the condition of the plant site and looks for any unusual situations.

2. Patrolling Buildings

During plant shut down when only the Utility Department is on the plant site, additional patrolling of buildings is required. Frequency of patrol rounds is influenced by such factors as construction of buildings, type of occupancy, whether sprinkled or connected with a central supervisory service, number and distribution of employees during off-shift hours, location of exterior doors, etc. A system of Detex stations is used to adequately cover the property from a security as well as safety viewpoint. Security Guards make two rounds per shift in Building 1.

3. Locks and Keys

A control system for locks and keys is maintained by the Plant Security Specialist. The issuing of new and replaced keys will be handled by the Plant Security Specialist. Unused and unneeded keys should be returned to the Plant Security Specialist.

4. Fences and Night Lights

A system of fences and night lights is maintained around the operating areas of the plant.

E. FIRE AND SAFETY REGULATIONS

To protect 3M property and personnel, the prevention of fires and/or accidents is of vital importance and the responsibility of every individual on the plant site. An Automatic Alarm is maintained with a central station in the Boilerhouse office to monitor sprinkler flow, shut off valves, water levels, etc. to assure the status of the fire protection systems. All basic guidelines as stated in the Plant Safety Guide shall be followed.

Areas of special concern are as follows:

HOT WORK - If any hot work or spark-producing activity is to be performed, a Spark Permit is required. This shall be obtained from the area supervisor or Plant Safety.

EMERGENCY - In the event of a fire or serious personal emergency, call EXTENSION 1911. Give your name, location and what the nature of the emergency is.

SMOKING - Smoking within the Chemical Plant area is positively forbidden, and is permitted only in areas where designated.

HEAD AND EYE PROTECTION - Hard hats and safety glasses are required in all areas of the plant except lunch rooms, restrooms and offices (unless specifically doing a job in those areas).

ANY SPECIAL INSTRUCTIONS AND REQUIREMENTS MAY BE ISSUED BY THE SUPERVISOR IN THE AREA.

F. MISCELLANEOUS

1. Contraband Articles

   Intoxicants and firearms are considered contraband, and are not to be allowed on 3M premises.

APPENDIX 6

HEALTH AND SAFETY TABLES

A. Body position and movement	kcal/min*
Sitting	0.3
Standing	0.6
Walking	2.0-3.0
Walking uphill	add 0.8 per meter rise

B. Type of work	Average kcal/min	Range kcal/min
Hand work		
light	0.4	0.2-1.2
heavy	0.9	
Work one arm		
light	1.0	0.7-2.5
heavy	1.8	
Work both arms		
light	1.5	1.0-3.5
heavy	2.5	
Work whole body		
light	3.5	2.5-9.0
moderate	5.0	
heavy	7.0	
very heavy	9.0	

C. Basal metabolism	1.0

D. Sample calculation**	Average kcal/min
Assembling work with heavy hand tools	
1. Standing	0.6
2. Two-arm work	3.5
3. Basal metabolism	1.0
Total	5.1 kcal/min

* For standard worker of 70 kg body weight (154 lbs.) and 1.8 m^2 body surface (19.4 ft^2).

**Example of measuring metabolic heat production of a worker when performing initial screening.

Adapted from References 2,108,111,112.

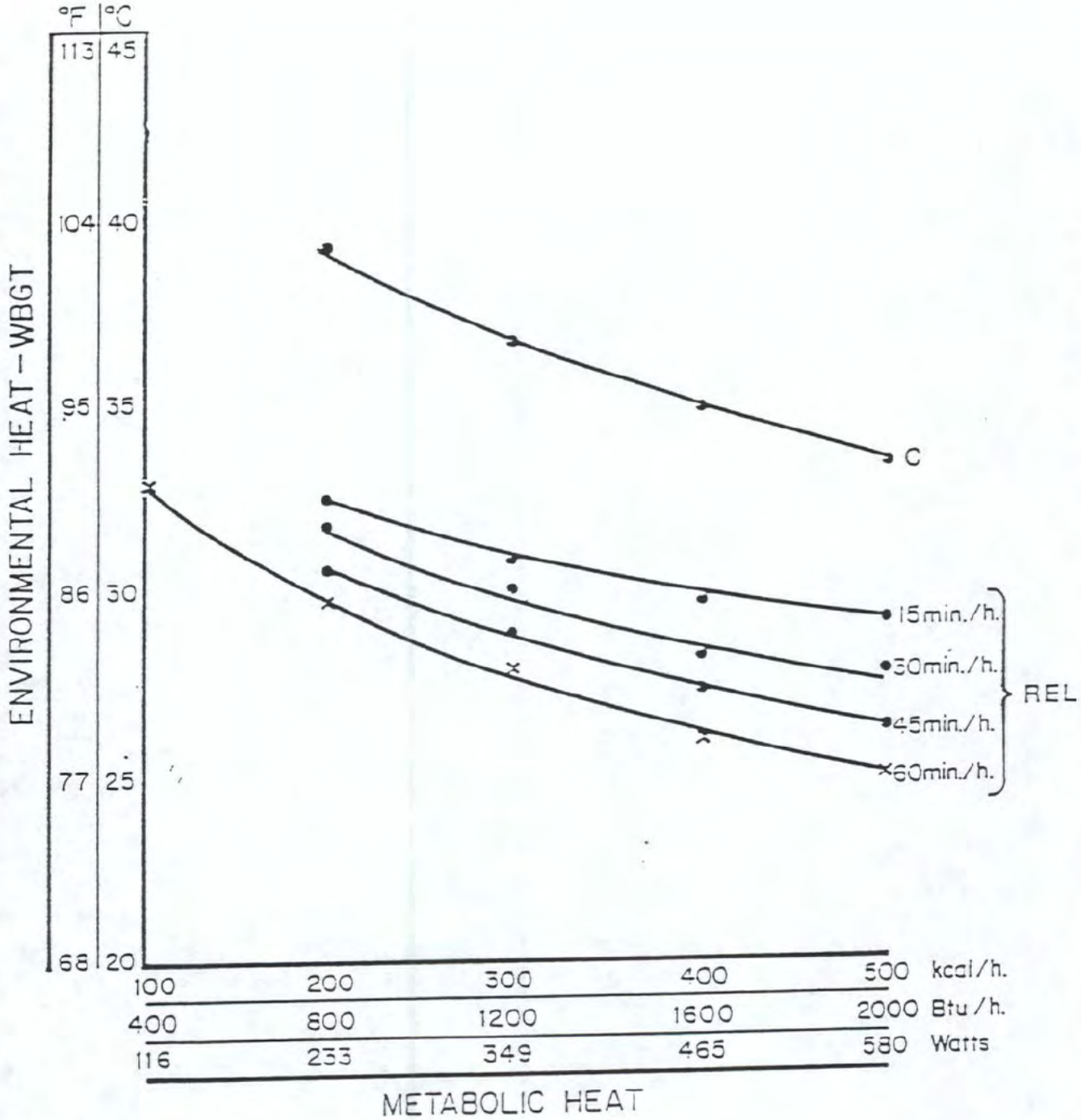

Figure 2. Recommended Heat-Stress Exposure Limits
Heat-Acclimatized Workers

C = Ceiling Limit
REL = Recommended Exposure Limit
*For "standard worker" of 70 kg (154 lbs) body weight and 1.8 m^2 (19.4 ft^2) body surface.
Based on References 2,3,4,5,6,7,8.

TABLE 1. Progressive Clinical Presentations of Hypothermia[A]

Core Temperature °C	Core Temperature °F	Clinical Signs
37.6	99.6	"Normal" rectal temperature
37	98.6	"Normal" oral temperature
36	96.8	Metabolic rate increases in an attempt to compensate for heat loss
35	95.0	Maximum shivering
34	93.2	Victim conscious and responsive, with normal blood pressure
33	91.4	Severe hypothermia below this temperature
32 / 31	89.6 / 87.8	Consciousness clouded, blood pressure becomes difficult to obtain; pupils dilated but react to light; shivering ceases
30 / 29	86.0 / 84.2	Progressive loss of consciousness; muscular rigidity increases; pulse and blood pressure difficult to obtain; respiratory rate decreases
28	82.4	Ventricular fibrillation possible with myocardial irritability
27	80.6	Voluntary motion ceases; pupils nonreactive to light; deep tendon and superficial reflexes absent
26	78.8	Victim seldom conscious
25	77.0	Ventricular fibrillation may occur spontaneously
24	75.2	Pulmonary edema
22 / 21	71.6 / 69.8	Maximum risk of ventricular fibrilation
20	68.0	Cardiac standstill
18	64.4	Lowest accidental hypothermia victim to recover
17	62.6	Isoelectric electroencephalogram
9	48.2	Lowest artificially cooled hypothermia patient to recover

[A]Presentations approximately related to core temperature. Reprinted from the January 1982 issue of *American Family Physician*, published by the American Academy of Family Physicians.

temperature should be used when estimating the combined cooling effect of wind and low air temperatures on exposed skin or when determining clothing insulation requirements to maintain the deep body core temperature.

2. Unless there are unusual or extenuating circumstances, cold injury to other than hands, feet, and head is not likely to occur without the development of the initial signs of hypothermia. Older workers or workers with circulatory problems require special precautionary protection against cold injury. The use of extra insulating clothing and/or a reduction in the duration of the exposure period are among the special precautions which should be considered. The precautionary actions to be taken will depend upon the physical condition of the worker and should be determined with the advice of a physician with knowledge of the cold stress factors and the medical condition of the worker.

TABLE 2. Cooling Power of Wind on Exposed Flesh Expressed as Equivalent Temperature (under calm conditions)*

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	*LITTLE DANGER* In < hr with dry skin. Maximum danger of false sense of security.				*INCREASING DANGER* Danger from freezing of exposed flesh within one minute.				*GREAT DANGER* Flesh may freeze within 30 seconds.			
	Trenchfoot and immersion foot may occur at any point on this chart.											

* Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

☐ Equivalent chill temperature requiring dry clothing to maintain core body temperature above 36°C (96.8°F) per cold stress T.L.V.

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3M CORDOVA

1989/1990 INVESTIGATION

REPORT

NOVEMBER 28, 1990

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EXECUTIVE SUMMARY

On March 31, 1987 a RCRA Permit was issued to the 3M Cordova facility containing Corrective Action requirements. 3M appealed the permit initiating negotiations between 3M and USEPA Region V. In September of 1987, 3M submitted an investigation proposal to USEPA. In the fall of 1989, 3M notified USEPA of its intention to conduct this work and after reviewing preliminary findings with USEPA in March of 1990, these studies were completed. This report provides a summary of these investigations.

The purpose of these investigations was to provide specific monitoring data which could be used to better define the need for and scope of future RCRA Facility Investigations (RFI). With this information, 3M hopes that an agreement related to the permit conditions can be reached and that the outstanding RCRA permit appeal can be resolved.

A total of nine (9) monitoring wells were installed and seven (7) soil samples were collected as a part of this study. Six (6) wells were located around the plant wastewater treatment facilities and two (2) were located within the land incorporation areas. One up-gradient well, providing background ground water quality information, was located in the northwest corner of 3M's property.

Soil samples were collected from areas of the plant site which have been used for the land application of wastewater treatment plant sludges. Soil sampling locations and depths were consistent with monitoring locations used for compliance testing for the Illinois Environmental Protection Agency (IEPA) sludge incorporation permit issued to the Cordova facility.

All samples were analyzed for all constituents listed in 40 CFR Part 261, Appendix IX and were collected and analyzed in accordance with Contract Laboratory Procedures (CLP). Monitoring for additional water quality parameters(ground water) and agronomic characteristics(soil) was also conducted.

The results of this investigation are summarized below:

(1) No Appendix IX volatile organics (Method 624), semi-volatile organics (Method 625), organochlorine pesticides/PCBs (Method 608), or herbicides (Method 615) were detected in any of the groundwater samples.

(2) Within the vicinity of the wastewater treatment plant, water from one well had an above background concentration of cobalt and several wells had low levels of cyanide. All of the total cyanide concentrations were below USEPA's proposed MCL and MCLG of 0.2 mg/l.

(3) Water from the wells located within the sludge application areas had concentrations below background levels of all inorganic hazardous constituents, including heavy metals.

(4) Static water elevations indicate that the movement of ground water beneath the site is controlled by the plant production wells and is moving in an easterly direction towards the plant well field.

(5) No Appendix IX volatile organics (Method 624), semi-volatile organics (Method 625), organochlorine pesticides/PCBs (Method 608), or herbicides (Method 615) were detected in any of the soil samples.

(6) One soil sample had concentrations of several inorganic constituents which were slightly above background, however. Furthermore, a sample in the same location at greater depth did not show any elevated values.

As a result of the above investigations, 3M proposes to install two additional wells and collect an additional round of groundwater samples from all monitoring wells. These samples will be analyzed for volatile organic compounds, heavy metals and water quality parameters. Water elevations will continue to be monitored on a routine basis.

(I) INTRODUCTION

This report summarizes the results of soil and ground water investigations conducted by 3M at its manufacturing facilities located in Cordova, Illinois during 1989-1990. The report first provides a brief introduction to the plant operations and a summary of the site environmental setting. This information is followed by a description of the Cordova site Solid Waste Management Units (SWMUs). Finally, a detailed discussion of the recent investigations and the results is provided in addition to a proposal for the next phase of the investigation.

(A) CORRECTIVE ACTIONS HISTORY

On March 31, 1987, USEPA Region V, in conjunction with Illinois Environmental Protection Agency(IEPA), issued a RCRA permit to the 3M Cordova plant. Specific requirements related to RCRA Corrective Action were included in the Region V portion of the permit. USEPA's RCRA Corrective Actions Program initially called for a RCRA Facility Investigation (RFI) to determine whether releases of hazardous constituents had occurred from site Solid Waste Management Units (SWMU). The SWMUs addressed under USEPA's Corrective Actions Program included surface impoundments contained within the plant wastewater treatment facilities and areas at the plant site which have been used for the land incorporation of wastewater treatment plant sludges. The Corrective Actions Program also called for additional follow-up investigations to further define detected releases and potentially corrective measures to remediate contaminated areas.

The Corrective Actions portion of the permit was appealed by 3M in April, 1987. Discussions between 3M and USEPA focused on several issues, including: (1) The need for additional monitoring information and the adequacy of existing data base, (2) The number and type of monitoring wells, and, (3) The criteria for determining when and whether subsequent investigations and/or corrective measures would be required.

On September 29, 1987, 3M proposed a revised Corrective Actions Program which included specific RFI activities, including soil and ground water investigations. A copy of this submittal is provided in Appendix A. Negotiations on this proposal continued, and on October 30, 1989, 3M notified USEPA of its intention to conduct these studies, in the absence of a formal resolution of the appeal.

Additional wells were installed early in 1990 and samples collected soon thereafter. A meeting was held on March 26, 1990 between USEPA and 3M to present information about the initial findings from this work. Upon receipt of the results from the laboratory, 3M sent copies of the information to USEPA, Region V on May 15, 1990. A meeting was held on June 7, 1990 at the USEPA Region V office to review the results. At that time USEPA requested a formal report, describing the investigation effort. This report is intended to fulfill that request.

(B) PURPOSE OF INVESTIGATIONS

3M and USEPA's discussions have covered a wide range of issues. 3M's primary concern has dealt with the lack of information showing that a release of a hazardous constituent had occurred. Given that no evidence of a release from a SWMU had been found, there appeared to be no justification for an RFI. Therefore, the purpose of these investigations was to provide specific data which could be used to define the need for and scope of future RFI activities.

(II) SITE BACKGROUND INFORMATION

(A) SITE HISTORY AND ENVIRONMENTAL SETTING

(1) SITE HISTORY

3M has operated manufacturing operations at the Cordova site since 1970. Two 3M operating divisions currently have facilities at the site, the Consumer Video/Audio Products Division (CVAPD) and the Specialty Adhesives and Chemical Division (SACD) . CVAPD produces iron oxide for magnetic recording tapes. SACD produces a variety of specialty chemicals for use as feedstocks at other 3M manufacturing facilities, including adhesives, polymers, resins, and fluorochemicals.

The 3M site is a part of a larger industrial park, located east and adjacent to the Mississippi River which has included fertilizer manufacturers, a nuclear power generating facility, and sand and gravel manufacturers. Prior to 3M's presence at the site, the area was used for agricultural purposes. This type of activity continues to be the prevailing land use on adjoining properties.

(2) LOCATION AND PHYSIOGRAPHY

The 3M manufacturing facility at Cordova, Illinois, is located adjacent to the Mississippi River in the northern portion of Rock Island County. The plant location is shown in Figure 1.

The plant site consists of a total acreage of 488.69 acres and is bisected by Illinois Route 84 and the CMSP&P Railroad. Manufacturing occurs in only a 100 acre, triangular portion of the site, near the river and west of Illinois Route 84. The 280 acre portion of the site located east of Illinois Route 84 is maintained primarily as a high capacity, alluvial, well field. Figure 2 shows the site property boundary and area topography.

(3) TOPOGRAPHY AND DRAINAGE

Normal pool elevation for the Mississippi River in the vicinity of the 3M Cordova facility is 572 feet above mean sea level. The plant manufacturing facilities are at an elevation of 588 to 598 feet. The highest elevation on the site is about 630 feet above mean sea level, east of Illinois Route 84, near the well field buildings. Surface drainage is generally from east to west with culverts and

road ditches directing most precipitation runoff from the surrounding agricultural area to the river.

The Army Corps of Engineers estimate that the 100 year flood crest at Cordova will be at 588.5 feet elevation and the 200 year flood will crest at 589.5 feet elevation. Natural mounding and river front road maintenance have raised the levee area near the river above this flood elevation.

(4) CLIMATE

Rock Island County has a continental climate typical of the north central United States. Temperatures range from average summer highs in the 90's to winter lows in the teens below zero. Annual precipitation averages about 33 inches. Snowfall averages about 28 inches with an average water content of 10 inches snow per inch of water.

(5) SOILS

The USDA-SCS General Soil Map of Rock Island County, Figure 3, shows the soils at the 3M Cordova site to be the Sparta-Dickinson-Coyne (35%-15%-15%) association. These are "nearly level to strongly sloping, well drained to excessively drained soils formed mainly in sandy material on terraces". The remaining 35% of soils are minor occurrences.

Sparta soils consist of very dark, grayish-brown sand to a depth of about 28 inches and a subsoil of dark yellowish-brown sand about 8 inches thick. The underlying material is yellowish-brown loose sand.

Dickinson soils consist of dark grayish-brown sandy loam about 13 inches thick and, a subsoil layer about 22 inches thick consisting of dark-brown sandy loam and dark yellowish-brown loamy sand. The underlying material is yellowish-brown loose sand.

Coyne soils consist of a 5 inch layer of very dark gray fine sandy loam, a 14 inch layer of brown fine sandy loam, and a 13 inch layer of reddish-brown silty clay loam. The underlying material is brown to dark-brown sand and fine gravel.

The general soil profile from soil borings west of Illinois Route 84 consists of 1 to 3.5 feet of topsoil underlain by 2 feet of loose sandy silt and a one foot layer of clayey silt. Below this clayey silt layer is loose fine to coarse sand to 10 feet in depth and medium dense sands to 50 feet in depth. The general soil profile from soil borings east of Illinois Route 84 consists of 1 to 2.5 feet of topsoil underlain by loose sand to fine gravel to a depth of 15 feet. Below this sand and gravel layer is medium dense sand to 50 feet in depth.

(6) BEDROCK AND HYDROGEOLOGY

(a) Bedrock Geology

Rock Island County and the 3M Cordova plant site are located at the northwestern edge of the Illinois Basin. Silurian dolomites subcrop below the 60 to greater than 100 foot thick alluvium cover on the 3M site. These same dolomites outcrop further south toward Port Byron and further north toward Savanna at the Mississippi Palisades north of the Plum River fault and the Savanna anticline.

(b) Glacial and Alluvial Geology

The 3M site is located north of the Rock River confluence with the Mississippi on alluvial terrace deposits in the northwestern extreme of the Illinoian Till Plain. Desiccation, meandering and alluvial deposition along the Mississippi and Rock Rivers has formed an alluvial landscape locally with wave formed terraces and alluvial valleys. The site is bounded on the east by the steep slope of a former channel of the Mississippi River.

Alluvium depth averages over 50 feet at the 3M site. Using 3M well records and original Layne-Western Company Cordova Industrial Park reports, a compilation of depth to bedrock data was done over the site. Figure 4 shows this compilation as a bedrock elevation contour map. Figure 5 is an east-west cross section of the site showing near surface stratigraphy.

(c) Aquifers

Potable water aquifers in the vicinity of the 3M site include surficial sand and gravel deposits (20 to 180 feet deep) generally used for agricultural irrigation and residential use; creviced, Niagran series (Silurian) dolomites, clays and siltstones (20 to 400 feet deep) for low volume residential and agricultural use and; deep, (400 feet to 1600 feet deep) Ordovician and Cambrian dolomites, shales, and sandstones used primarily for municipal, utility and industrial needs.

(d) Cordova Plant Water Supply

Water supply at the 3M facility is ground water obtained from five alluvial wells located on the eastern edge of the plant property. These wells are within the influence of a buried, former channel of the Mississippi River and withdraw water from a depth of 150 to 180 feet below the surface. Each well has a design capacity of 1000 to 1200 gallons per minute. Considering well field interference, well field capacity is about 80% of the total capacity of the five individual wells. Figure 6 shows the location of the alluvial well field, the location of the buried channel and, the approximate area of influence of pumping. Water is conveyed through a single transmission line from the well field and is then distributed for various uses within the plant.

(e) Alluvial Ground Water Flow Conditions

Figure 7 shows water table contours over the site for late 1978. Of particular interest is the north-south trending ground water divide in the vicinity of Highway 84. This divide is coincident with the bedrock high shown in Figures 4 and 5. The bedrock high acted as a hydrologic boundary to the alluvial well field pumping prior to installation of a fifth production well (#37) in 1988. Added pumping from the fifth well caused increased drawdown and an extension of local hydro-geologic boundaries in the alluvium. Figure 8 shows water table contours for August, 1990 with all five production wells in operation. Ground water flow is now from west to east toward the well field over the entire site. Table 1 summarizes water levels taken on the site since March, 1990.

(B) SOLID WASTE MANAGEMENT UNITS

(1) INTRODUCTION

Wastewater treatment facilities were provided at the time that the initial manufacturing facilities were constructed. Additions to the wastewater treatment facilities have been made to meet the needs of various plant expansions or changes in environmental requirements. The plant is currently operated under NPDES Permit No. IL0003140. The permit is presently under an automatic continuance, while the IEPA processes the permit renewal. The wastewater treatment operations produce two sludges which are land incorporated onsite. Onsite land incorporation of these sludges has been conducted since 1975 in the areas east of Highway 84 and south of the main manufacturing facilities.

Below is a brief description of the wastewater treatment facilities followed by a discussion of land incorporation operations.

(2) WASTEWATER TREATMENT PLANT

An aerial description of the wastewater treatment facilities is shown in Figure 9 and a flow schematic is provided in Figure 10. The system consists of a variety of tanks and surface impoundments, connected with accondomant piping, to process wastewaters and sludges by gravity flow or through pressurized piping. Figures 9 and 10 include the tanks and impoundments that are part of the wastewater treatment system. Impoundments are lined with either concrete or synthetic liners as shown in Figure 9. Figure 10 indicates which units are currently under RCRA interim status.

Wastewaters produced at the plant fall into five general categories, which are blended after intermediate treatment steps and combined into a single discharge to the Mississippi River. The five wastewater groups and generalized treatment descriptions are provided below.

(a) CVAPD Wastewaters

CVAPD manufactures iron oxide used in magnetic recording tapes. Wastewaters from these facilities contain high concentrations of ferrous sulfate which must be removed prior to discharge. Wastewater from this location is pumped to an onground equalization tank and then metered into an aeration tank where soluble ferrous sulfate is converted to insoluble ferric hydroxide. Alum is added to coagulate precipitated ferric hydroxide and polymers are added to promote flocculation and settling. Settling occurs in the inorganic settling tank. Treated wastewater from this tank is pumped to Polishing Ponds 2 and 3 and then discharged to the Mississippi River. Sludge removed in the inorganic settling tank is pumped into one of two inorganic sludge holding basins where the sludge will further consolidate. Supernatant from these tanks is returned to the CVAPD sewer.

(b) Building 20 Wastewaters

Fluorochemical products are manufactured in Building 20. Wastewaters from this area periodically contain high levels of fluoride which must be treated with lime to produce insoluble calcium fluoride. Wastewaters flow continuously through a mixing tank . Lime is added when high fluoride concentrations are present in the wastewater. From the mix pit, this water flows into the CVAPD wastewater lift station and combines with CVAPD wastewaters. An equalization basin is located off-line and was installed to retain wastewater while fluoride treatment was underway.

(c) SACD Wastewaters

SACD produces a variety of organic chemical products and intermediates which are used as feedstocks at other 3M locations. Wastewaters from these processes may have a high Chemical Oxygen Demand (COD) which is treated in a biological treatment system. Settlable and floating materials are first removed in a primary settling tank. Both primary sludge (settled solids) and primary scum (floating materials) are disposed of at off-site disposal facilities. Wastewater from the primary settling tank discharges into equalization basins I and II, which provide both flow and

loading equalization for the activated sludge system.

3M recently modified its Part A permit application to obtain interim authorization to operate these two equalization basins as surface impoundments. These units are indicated on Figure 10. Periodically the benzene concentration in the influent SACD sewer may exceed 0.5 mg/l. Although benzene is not used as a raw material at the plant, small amounts of benzene are present as impurities in raw materials. For this reason, the concentration may exceed the allowable level under the recently revised Toxicity Characteristic (D019). As a precaution, 3M has filed for interim status for these units.

Wastewaters in the equalization basins are pumped into the aeration tank and seeded with return activated sludge from the final settling tanks. In this process, organic constituents are converted to carbon dioxide, water and cell mass.

Treated wastewater from the final settling tank flows to Pond 1 and is conveyed by a screw-type pump into the influent of the CVAPD inorganic settling tank. Excess biomass generated in this process is metered into the aerobic digestor which has a 800,000 gallon holding capacity. In the digestor, sludge is further digested for stabilization and volume reduction. Before removing sludge from this tank, the diffusers in the digestor will be shut off. After the sludge has settled, supernatant will be removed and returned to the organic wastewater treatment plant.

(d) Noncontact Process Waters

Much of the water used in production areas is not contaminated with process residues. To reduce the volume of wastewater being discharged to the SACD, Building 20, and CVAPD sewers, these wastewaters are segregated and discharged to separate sewers. These wastewaters will contain only those constituents which are already present in ground water. Non-contact process waters are blended with all other wastewaters at the outlet of Pond 3 and then discharged to the Mississippi River.

(e) Sanitary Wastewaters

Domestic wastewaters are mixed with chemical wastewaters in Equalization Basin II. These wastes are then processed in conjunction with the other chemical wastes and undergo biological treatment as well as settling prior to blending and discharge.

(3) LAND INCORPORATION OF WASTEWATER TREATMENT PLANT SLUDGES

(a) Introduction

3M Cordova utilizes two land incorporation areas to dispose of two sludges generated by the plant wastewater treatment system. These areas have been operated under permits from IEPA since 1975. The current operating permit number is 1989-CS-2375 which expires on February 1, 1992. A copy of this permit is included in Appendix B. This section will briefly describe the operation of these facilities and the characteristics of the sludges being land applied. A compendium of monitoring information obtained as required by this permit is also provided in Appendix C.

(b) Area Description and Sludge Application Methods

The land incorporation areas are shown in Figure 11. These areas include a 93 acre track west of Highway 84 and a 182 acre area, including a control plot for baseline soils monitoring and crop analysis, west of Highway 84. A total of 257 acres is used for landspreading. Surface topography and soils information were previously discussed.

The land incorporation areas are managed through the use of a number of zones. Figure 11 shows the 10 (ten) zones and the control area. Approximately 400,000 gallons of aerobically digested sludge (3.8% solids) and 700,000 gallons of inorganic sludge (27% solids) are incorporated each year. Land application typically occurs from March through November, as permitted by prevailing weather conditions. Sludges are typically applied prior to planting in the spring. A portion of the land application areas is usually left open for application during the summer. After fall harvest, the sludges are again land applied over the entire area.

Sludge application is typically conducted in "campaigns" when either the aerobic digestor or inorganic sludge holding tanks become filled. Spreading rates are based on agronomic requirements (nitrogen content) and have averaged about 8,000 gallons per acre per year. Land application zones are rotated to provide for uniform distribution. Sludges are typically spread on the surface followed by incorporation with a plow.

(c) IEPA Monitoring Requirements

Site monitoring is conducted for both agronomic and environmental purposes. Media being monitored, monitoring frequency, and parameters are summarized in Table 2. Brief summaries of monitoring methods and locations are provided below.

(i) Sludges

Grab samples of the aerobically digested and inorganic sludges are obtained semi-annually from their respective storage tanks. Samples of sludge are taken during or immediately prior to incorporation. The aerobic digestor is completely mixed with air and a single grab sample is taken to represent the tank contents. Samples of inorganic sludge are periodically collected and composited as the sludge is being removed from the holding basin. This sampling technique accounts for variations in density with depth.

(ii) Soils

Soil sampling locations are shown in Figure 11. Surface samples are taken from the top six inches at 44 locations, including three within the control plot. Each surface sample consists of a composite of five discrete samples taken in the area surrounding the sample point. At six locations, including one in the control plot, samples are also taken at depths of 2.5 and 5 feet. Each of these samples is a discrete sample taken near the prescribed sample point. Soil samples are analyzed for both extractable and total metals.

(iii) Ground Water

A number of wells were drilled on the Cordova plant site in 1976, 1979 and 1981 for the purpose of monitoring the ground water quality in the sludge incorporation areas. The 1976 wells were two inch diameter, PVC cased wells with short galvanized steel screens placed near the top of the water table. These wells were replaced in 1979 and 1981 with a network of five inch diameter, mild-steel cased wells with a short (3 foot) section of stainless steel screen placed about 20 to 30 feet below the top of the water table. These wells are designated on Figure 8 as 1-79,3-79,4-79, 81-1, 81-2, 81-3,81-4,81-5, and the Barn. The Barn is a water well located in the plant recreational area. Well 81-1 is located within the

manufacturing area of the site and is considered to be upgradient from the sludge incorporation areas.

(iv) Crops

Feed corn is the only agricultural crop currently harvested in the sludge incorporation areas. Corn samples are taken at the end of each growing season. Samples are taken at approximately twelve locations with the number of sampling locations being dependent on the size of the harvest. Each sample will consist of five ears of corn taken from within the sampling location. These locations typically include two from the control areas, one from zone 10, and the remaining locations are selected from around the planted fields randomly. These samples are composited and analyzed for heavy metals and the yield is recorded.

(d) Previous Monitoring Data

IEPA's monitoring requirements have focused on hazardous constituents which are present in the sludges at elevated concentrations and/or which are of particular concern in soil environments. Certain hazardous constituents, such as cadmium, which are not used at the plant and are not contained in either of the land applied sludges, are monitored due to their environmental significance. An important factor in the design of land treatment systems is the ability of soil to adsorb heavy metal constituents.

It is recognized that the application of sludges will enrich the soil with heavy metals. Limitations on application rates specified in the permit and continued monitoring insure that concentrations in soil, ground water, and crops are at acceptable levels. A summary of information obtained in accordance with the sludge incorporation permit is contained in Appendix C.

While IEPA's monitoring program has focused on a subset of Appendix VIII heavy metals, analyses for an expanded list of hazardous constituents, i.e. Priority Pollutants, have also been conducted in preparation for permit applications in the past and in response to previous Agency requests. Relevant monitoring information of hazardous constituents in sludges, soils and ground water have been submitted to USEPA in the past. This information is contained in Appendix D.

(III) 1989-1990 SOIL/GROUND WATER INVESTIGATIONS

(A) INTRODUCTION

This section will discuss the ground water and soil investigations conducted by 3M in 1989 and 1990. These investigations stemmed from a proposal initially made by 3M in September of 1987. The proposal included an abbreviated RFI style investigation to determine whether releases of hazardous constituents had occurred from site SWMUs. USEPA was notified in October of 1989 of 3M's intention to conduct this work with some modifications. 3M's plan called for ground water analysis in the vicinity of both the wastewater treatment plant and the sludge application areas and for additional soil sampling in the land incorporation areas.

The discussion of these investigations is divided into separate sections dealing with ground water monitoring and soil sampling. Included in each section is a discussion of the initial investigation plan proposed by 3M, justification for sampling locations and rationale for analytical parameters selected. Monitoring well locations and parameter lists were modified as the investigation proceeded and justification for these changes follows. Finally, this section discusses sampling and analytical procedures.

(B) GROUND WATER MONITORING

(1) SEPTEMBER, 1987 PROPOSED REMEDIAL INVESTIGATIONS

Figure 12 shows the location of monitoring wells initially proposed by 3M in September of 1987. Figure 7 shows that there was a ground water high present near the center of the site which was consistent with subsurface bedrock topography, depicted in Figure 4. From the center of the site, ground water was sloping both towards the facility well field on the east and towards the Mississippi River on the west.

The September, 1987 proposal called for the installation of eight new monitoring wells. Existing monitoring wells at the site would be used in this study as piezometers. These wells were not constructed to current RCRA specifications; they were typically screened beneath the ground water table and constructed of materials other than stainless steel or teflon. Five of the new wells

would be installed, approximately in a straight line, between the Mississippi River and the wastewater treatment facilities. These monitoring wells would be placed as to provide down-gradient water quality information from the entire wastewater treatment plant area, with particular emphasis being placed on the surface impoundments, but inclusive of tanks and subsurface piping as well.

Two of the wells were located in the sludge application area. Their locations were coincident with two existing wells, screened at deeper intervals which would provide information on the vertical gradient in these areas. Finally one up-gradient well would be installed at the center of the site to provide background ground water quality information.

3M initially proposed that all wells be analyzed for EPA Volatile and Semivolatile Organics (Methods 624 and 625). These methods do not cover the full spectrum of hazardous constituents in use at the Cordova plant or potentially present in the wastewater treatment system. They do however include the major portion of hazardous constituents present and those present at the highest concentrations in the plant wastewaters. On this basis, it was proposed that analysis for these constituents would provide conclusive evidence that no release had occurred.

These wells were not intended to provide information on releases from specific impoundments or tanks, but would provide an indication whether or not a release from the area had occurred. The presence of hazardous constituents in any of these wells could lead to the installation of additional wells to further define a source of contamination in subsequent phases of the investigation or as a part of an RFI.

3M proposed a similar analysis for the two wells in the sludge incorporation areas. The absence of metals from the monitoring list was based on the quantity of data available from previous sampling. Both volatile and semi-volatile constituents had been detected in wastewater treatment sludges, as shown in Appendix D, therefore, analysis for these constituents was considered appropriate.

(2) OCTOBER, 1989, PROPOSAL

In October of 1989, 3M notified USEPA of its intention to implement the September, 1987 investigations proposal. The only modification to the original proposal was an intention to analyze all Appendix IX constituents, except dioxins and furans, in the ground water monitoring wells. The analysis of a more expanded list of constituents would provide more conclusive evidence that there had been no releases from these units.

(3) 1989/1990 MONITORING WELL INSTALLATION

(a) Monitor Well Location Rationale and Installation

(i) Initial Well Placement

The monitor well locations proposed in 1987 were suggested prior to the installation of the fifth production well , # 37, shown in Figure 8. This original plan included an up-gradient well near Highway 84 and down-gradient wells in the sludge incorporation fields and on the river side of the waste treatment facility. Prior to monitoring well construction, a pieziometric survey of existing monitoring wells was conducted. The results indicated that local gradient condition had changed with all site ground water flowing in an easterly direction toward the plant well field.

Reflecting the uncertain gradient information, a phased program of monitor well placement was instituted in the vicinity of the waste treatment facility. 3M contracted with Terracon Environmental Inc. to install all monitor wells during this investigation. The first phase of four (4) monitor wells (MW-1-90 - MW-4-90) were installed in January, 1990, shown in Figure 8. The criteria for placement of the first four wells was to obtain up-gradient water quality information at location 4-90, central waste treatment area water quality information at location 3-90 and down-gradient water quality information at locations 1-90 and 2-90. In addition, a previously installed stainless steel well at location 1-88 would be used for down-gradient water quality. This well was drilled in 1988

for the purpose of monitoring ground water near the waste solvent storage tank. The well location is shown on Figure 6. This well is a two inch diameter stainless steel cased well with a ten (10) foot stainless steel screen placed to bracket the top of the water table.

These wells were surveyed and checked for water levels in preparation for the follow-up second phase well installation. In addition, each well was tested for volatile organics (Methods 601 and 602) to provide water quality information which could better focus subsequent monitoring well installation.

The results of the water level survey indicated that ground water from beneath the plant site was flowing in an easterly direction toward the well field. The results of the VOC analysis is included in Appendix E. The results showed near detection limits of several constituents, including 1,2-dichloroethylene (cis & trans), 1,1,2-trichloroethylene, and benzene. The field blank was contaminated with several aromatic compounds, including benzene. Neither of the chlorinated compounds are constituents in use at the plant. These results indicate that the constituents detected were most likely the result of laboratory cross contamination. Furthermore, the concentrations were not sufficient to affect the location of subsequent monitoring wells.

(ii) Final Well Placement

As a result of the information gathered during the initial well placement, wells were drilled in March of 1990 on the east side of the waste treatment facility. These wells (7-90,8-90 and 9-90) were drilled to complement wells 2-90 and 3-90 as down-gradient monitor wells, as shown in Figure 8. The new wells were located to rapidly intercept any potential release from the waste treatment facility. Wells 1-88 and 1-90 are technically up-gradient to the facility, but because of their very close proximity to the facility on the river side, well 4-90 is considered the up -gradient water quality point.

Two additional monitor wells (MW 5-90 and MW 6-90) were installed in the sludge incorporation fields nested with existing monitor wells 81-3 and 4-79, respectively, as originally planned. These new field wells were located to serve two purposes; first, as a check on past water quality results from the older wells and, second, to measure vertical hydraulic gradients. The new wells were designed to bracket the top of the water table aquifer and the older 1979 and 1981 monitor wells were designed as point sample wells screened below the top of the water table aquifer.

(iii) Well Construction Details

All wells installed in this program were constructed of flush jointed, stainless steel screen and riser. The wells are a nominal two (2) inch diameter. Each well has a ten (10) foot section (15 foot for well MW-6-90) of manufactured 0.01 inch slot, continuous wire wrapped, UOP Johnson Inc., stainless steel screen bracketing the top of the first (water table) aquifer. Screens were positioned approximately 3 feet above and 7 feet below (well MW-6-90, screen positioned 5 feet above and 10 feet below) the water table. The solid, flush jointed, stainless steel riser pipe was attached to the screen and extended to approximately 3 feet above existing ground surface.

The borehole annulus was backfilled with #3 Muscatine gravel pack to a point approximately one (1) foot above the slotted screen interval. An approximate two (2) foot layer of bentonite pellets were placed, tamped and hydrated in the annulus above the gravel pack and the remaining annulus was filled with a cement/bentonite grout. Each well was covered with a stainless steel cap and a lockable steel protector cover. The protector covers were extended below ground surface and imbedded in concrete. Encircling each well are three or four, 4 inch diameter, steel protective posts and a concrete splash pad measuring approximately 3 feet by 3 feet by 4 inches thick. The field wells are also protected from tractors and harvesters by a blaze orange, 12 foot long, steel range pole imbedded in a concrete pad near the well.

Boring logs with monitoring well details for the nine (9) monitor wells installed in this program are included in Appendix F. Table 3 is a concise summary of screen and construction details for the complete monitor well network currently in use at the Cordova plant.

(C) SOIL SAMPLING IN LAND INCORPORATION AREAS

(1) SEPTEMBER, 1987, PROPOSAL

The data base on concentrations of heavy metals in soils within the land incorporation area was already adequate at the time of these investigations were initiated. This information is contained in Appendix C. The concentrations of heavy metals are below those levels required in the permit and within the range of acceptable levels for land treatment systems. Based on these circumstances, 3M proposed no additional monitoring for heavy metals in the soil.

However, in the September 1987 proposal 3M agreed to conduct additional soil sampling beneath the incorporation zone for organic contituent analysis. A general definition of an incorporation zone is the zone of waste and soil in which degradation, transformation, and/or immobilization occurs, extending no more than five feet (150 cm) below the surface and no more than five feet above the water table. 3M's proposal called for the collection of six samples each at the 2.5 and 5.0 sampling locations. This would provide information on concentrations both within and at the base of the incorporation zone. It was initially 3M's intention to analyze all of these samples for volatile and semi-volatile organics (Method 624 and 625, respectively). Analysis of these parameters would provide substantive information on the concentration of organic hazardous constituents in the sludge incorporation areas.

(2) OCTOBER, 1989, PROPOSAL

The only modification to the updated proposal was the inclusion of all Appendix IX constituents, with the exception of dioxins and furans, to the analytical list.

(D) SAMPLING AND ANALYTICAL METHODS

Sampling and analyses were conducted in accordance with CLP procedure. A copy of the sample plan is attached as Appendix G. Samples were taken with and stored in appropriate tools and containers. Required preservatives were used, samples were shipped in accordance with requirements, and analysis was conducted within the specified holding times. Full chain-of-custody documentation was prepared. Both field duplicates and lab duplicates were collected and analyzed. Method spikes and travel blanks were employed. Precautions were taken to avoid cross contamination. Wells were stabilized and samples of ground water were field filtered as appropriate.

Analyses included the full Appendix IX parameters, except for dioxins and furans, and additional characteristic data. Data was also obtained on Al, alkalinity, hardness, B, Ca, chloride, fluoride, Fe, Mg, Mn, nitrate, K, silica, Na, Sr, and sulfates.

(IV) RESULTS AND DISCUSSION

(A) GROUND WATER MONITORING

(1) WATER ELEVATIONS

Since 1988, water levels across the western portion of the 3M site have been influenced by the alluvial well field. The former hydro-geologic boundary , the bedrock high shown in Figure 4, has been overcome. Furthermore, the gradient on the west side of the site is very flat when compared to the gradient on the east side of the site. This flat gradient reflects the general high permeability and lack of stress on the aquifer on west side. Efforts by the Corps of Engineers to maintain a near constant Mississippi River pool elevation is another reason for the flat gradient on the west side of the site. This pool and the river alluvium surrounding the pool have become a constant head boundary for the water supply system at Cordova and, they are up-gradient to the entire site.

(2) GROUND WATER WATER QUALITY

All analytical results are contained in Appendix H and a summary of pertinent results is contained in this section. The results showed that there were no Volatile Organics (624), Semi-Volatile Organics (625), Organochlorine Pesticides/PCBs (608), and Herbicides (615) present in any of the samples tested. Heavy metal constituents and water quality parameters are discussed below. Ground water data for these compounds is summarized in Table 4 .

Both barium and strontium were detected in most of the wells samples indicating a natural background condition. Cobalt was detected in MW 1-88 at a concentration of 0.077 mg/l. Cobalt was not detected in any of the other wells. Verification of this result is required.

Nickel was also detected in MW 1-88 and in MW 8-90 both at concentrations of 0.13 mg/l, only slightly above the detection level. These levels are below the 0.7 mg/l action level contained in Appendix E of USEPA's recent proposed Corrective Actions regulations (40 CFR Part 264.521(a)(2)(i-iv)). This concentration is also less than the 0.150 mg/l Recommended Allowable Limit (from the U.S. EPA Office of Drinking Water, Final Health Advisory,

March 31,1987). Slightly elevated levels of zinc were also detected in these two wells just above detection levels.

Cyanide was detected in six of the monitoring wells in the vicinity of the wastewater treatment plant area. The concentrations were all below the Maximum Contaminent Level Goals (MCLG) and the Maximum Contaminent Levels (MCL) of 0.1 mg/l recently proposed by USEPA.

With respect to water quality parameters, the iron and manganese concentrations in MW 1-88 were slightly above detection limits. The fluoride concentration was also above site background conditions in MW 3-90 and MW 8-90, at concentrations of 4.3 and 3.2 mg/l, respectively. The fluoride concentration in MW 3-90 was just slightly above the 4.0 mg/l MCL. Elevated nitrate concentrations were detected in several of the monitoring wells. Nitrate has been detected in site monitoring wells for several years, apparently due to a release from a fertilizer plant south of the 3M site.

With the exception of the nitrate, the source of which is discussed above, neither of the wells located within the sludge incorporation areas showed elevated concentrations of any hazardous constituent or water quality parameters.

(B) SOIL SAMPLING

All analytical results are contained in Appendix H and a summary of pertinent results is contained in Table 5. The results showed that there were no Volatile Organics (624), Semi-Volatile Organics (625), Organochlorine Pesticides/PCBs (608), and Herbicides (615) present in any of the samples tested.

The results of heavy metal analyses are shown in Table 5. With the exception of sample location 14 at 2.5 feet, none of the samples collected had above background concentrations of any other constituents.
The concentrations of a number of constituents (As, Ba, Co, Cr-total, Pb, Sr, Vd, Zn) in the same sample were slightly elevated above background.

The sample taken at the same location at five (5) feet, does not show values above background for any of these constituents.

(C) BUILDING 20 INVESTIGATIONS

In January, 1990 a fractured sewer line was discovered under the floor of Building 20. Wastewater flowing from the cracked sewer had created a void beneath the production area floors. Soil samples were collected from the side wall and bottom of the void and analyzed for appropriate constituents.

In addition, a hydropunch sample was collected. Figure 13 shows the location of the hydropunch as H1-90. Semi volatile and volatile organic analyses were conducted, as well as pH and fluoride. The results are included in Appendix I. Low levels of acetone were found in the sample and the pH was slightly depressed. Additional monitoring at this location appears warranted and is discussed in the recommendation section below.

(V) RECOMMENDATIONS

Based on the results of the investigation discussed above, 3M is proposing additional studies at the Cordova site. These investigations were discussed with USEPA in a meeting with on June 7, 1990. This work includes:

(1) Continued monitoring of static water elevations every other month.

(2) Installation of two additional wells, as shown in Figure 13 which are down-gradient from the wastewater treatment facility. The farther south well is also down-gradient from the Building 20 sewer leak discussed above and will continue to monitor that area. The more northern location will provide additional information in the area down-gradient from the wastewater treatment plant.

(3) Collection of one additional round of samples from all the RCRA groundwater monitoring wells and analysis for volatile organic constituents, Appendix IX heavy metals and the water quality parameters listed in Table 4.

TABLE 1

CORDOVA WATER LEVELS

	Reading Date(s):		Monitor Wells (MW-) 8/28-29/90 Production Wells (PW-) 8/7/90		Monitor Wells (MW-) 5/2/90 Production Wells (PW-)		Monitor Wells (MW-) 3/29/90 Production Wells (PW-)	
	WELL No.	COLLAR ELEV.	DEPTH TO WATER (FT)	WATER ELEV.	DEPTH TO WATER (FT)	WATER ELEV.	DEPTH TO WATER (FT)	WATER ELEV.
	MW- 1-90	591.93	16.01	575.92	19.03	572.90	18.14	573.79
	MW- 2-90	596.46	20.75	575.71	23.55	572.91	22.82	573.64
	MW- 3-90	591.78	16.43	575.35	19.23	572.55	18.10	573.68
	MW- 4-90	593.59	18.34	575.25	21.38	572.21	20.20	573.39
	MW- 5-90	591.94	16.61	575.33	19.00	572.94	18.26	573.68
	MW- 6-90	627.29	57.18	570.11	61.07	566.22	61.89	565.40
	MW- 7-90	596.47	21.20	575.27	23.75	572.72	22.82	573.65
	MW- 8-90	595.62	20.22	575.40	23.00	572.62	21.94	573.68
	MW- 9-90	596.41	21.42	574.99	24.14	572.27	23.09	573.32
	MW- 1-88	595.25	19.46	575.79	22.29	572.96	21.51	573.74
	MW- 81-1	592.35	17.48	574.87			18.40	573.95
	MW- 81-2	601.36	25.93	575.43			29.68	571.68
	MW- 81-3	591.91	16.52	575.39			18.36	573.55
	MW- 81-4	611.57	37.58	573.99			41.82	569.75
	MW- *81-5	601.77	30.34	571.43			33.26	568.51
	MW- 1-79	626.60	55.34	571.26			61.23	565.37
	MW- 3-79	633.33	60.75	572.58			65.60	567.73
	MW- 4-79	626.38	56.21	570.17			60.68	565.70
	MW- 5-79	623.83	55.81	568.02			59.72	564.11
Pumping Level	PW- 11	624.00	95.25	528.75				
Pumping Level	PW- 12	624.00	97.00	527.00				
Pumping Level	PW- 13	624.00	117.50	506.50				
Pumping Level	PW- 24	624.00	90.25	533.75				
Pumping Level	PW- 37	624.00	91.25	532.75				

BLANK VALUES - WELLS NOT MEASURED
*Casing Shortened - 2/1/90

3M Cordova FIGURES AND TABLES FOR 1989/1990 INV. REPORT 10-28-90

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TABLE 2

3M CORDOVA LAND INCORPORATION AREAS
MONITORING SUMMARY

	Sludge*	Soil	Groundwater	Crops
Frequency	Semi-annual	Annual	Semi-annual	Annual
Parameters Analyzed	% Total solids Kjeldahl nitrogen Nickel Zinc Lead Cadmium Manganese Chromium (3+) Chromium (6+) Cobalt	Phosphorus Lead** Zinc** Copper** Cadmium** Iron** pH Nickel** Cobalt**	Nitrate Lead Iron Phosphorus Nickel Cobalt Ammonia	Cadmium Total chromium Copper Lead Mercury Manganese Nickel Zinc Crop yield

*Aerobic and Inorganic

**Total and Extractable

TABLE 3

3M CORDOVA
MONITOR WELL CONSTRUCTION DETAILS

WELL NUMBER	COLAR ELEVATION FT.	TOTAL DEPTH FT.	TOP OF SCREEN FT.	LENGTH OF SCREEN FT.	WELL DIAMETER IN.	CASING MATERIAL	SCREEN MATERIAL
1-79	626.60	75.00	72.00	3.00	5.00	STEEL	STAINLESS
3-79	633.33	75.00	72.00	3.00	5.00	STEEL	STAINLESS
4-79	626.38	90.00	87.00	3.00	5.00	STEEL	STAINLESS
5-79	623.83	80.00	77.00	3.00	5.00	STEEL	STAINLESS
81-1	592.35	57.00	54.00	3.00	5.00	STEEL	STAINLESS
81-2	601.36	38.00	35.00	3.00	5.00	STEEL	STAINLESS
81-3	591.91	45.00	42.00	3.00	5.00	STEEL	STAINLESS
81-4	611.57	69.00	66.00	3.00	5.00	STEEL	STAINLESS
81-5	601.77	65.00	62.00	3.00	5.00	STEEL	STAINLESS
1-88	595.25	30.00	20.00	10.00	2.00	STAINLESS	STAINLESS
1-90	591.93	24.50	14.50	10.00	2.00	STAINLESS	STAINLESS
2-90	596.46	29.50	19.50	10.00	2.00	STAINLESS	STAINLESS
3-90	591.78	25.00	15.00	10.00	2.00	STAINLESS	STAINLESS
4-90	593.59	27.00	17.00	10.00	2.00	STAINLESS	STAINLESS
5-90	591.94	24.50	14.50	10.00	2.00	STAINLESS	STAINLESS
6-90	627.29	70.50	55.50	15.00	2.00	STAINLESS	STAINLESS
7-90	596.47	30.50	20.50	10.00	2.00	STAINLESS	STAINLESS
8-90	595.62	30.00	20.00	10.00	2.00	STAINLESS	STAINLESS
9-90	596.41	30.00	20.00	10.00	2.00	STAINLESS	STAINLESS

Table 4

3M CORDOVA GROUNDWATER DATA

Parameter*	Reporting Limit-CLP	Well MW1-88	Well MW1-90	Well MW2-90	Well MW2-90#	Well MW3-90	Well MW4-90	Well MW5-90	Well MW6-90	Well MW6-90#	Well MW7-90	Well MW8-90	Well MW9-90
Aluminum	0.10	ND	ND	0.40	ND	0.92	ND	ND	ND	ND	ND	1.4	ND
Antimony	0.050	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.0050	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	0.010	0.22	0.076	0.060	0.057	0.16	0.036	0.048	0.063	0.062	0.054	0.082	0.084
Beryllium	0.0020	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.10	0.14	ND	0.24	ND	0.19	0.10	0.13	ND	ND	0.10	0.12	ND
Cadmium	0.0050	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	0.10	56.0	37.1	38.2	37.8	72.2	41.4	38.8	62.3	62.5	52.8	60.6	57.2
Chromium	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cobalt	0.010	0.077	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	0.1000	20.0	13.4	13.6	13.5	23.3	14.5	15.5	21.2	21.3	17.2	25.0	18.0
Copper	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.1000	0.82	ND	0.33	0.11	ND	ND	0.23	ND	ND	ND	ND	ND
Lead	0.0050	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.010	15.6	0.40	0.012	ND	3.9	0.013	0.022	ND	ND	0.010	8.2	0.029
Mercury	0.00020	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.040	0.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.13	ND
Potassium	5.0	ND	ND	ND	ND	23.2	ND	ND	ND	ND	ND	41.2	ND
Selenium	0.0050	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	5.0	9.8	54.6	9.3	9.1	32.8	10.1	ND	6.2	6.2	18.3	37.1	13.5
Strontium	0.050	0.19	0.16	0.15	0.15	0.35	0.20	0.090	0.080	0.081	0.25	0.29	0.26
Thallium	0.0050	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tin	0.050	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.010	0.046	ND	ND	ND	ND	0.011	ND	ND	ND	ND	0.034	ND
Cyanide, Tot.	0.010	0.015	0.037	ND	NA	0.095	ND	ND	ND	ND	0.081	0.11	0.028
Fluoride	0.10	0.17	0.35	0.14	0.14	4.3	0.20	ND	ND	ND	0.48	3.2	0.20
Nitrate as N	0.050	12.4	18.9	2.40	2.5	52.2	5.2	13.4	12.7	12.6	17.0	48.1	25.3

* = All values are reported in mg/l.
# = Duplicate analysis.

ND = Not Detected.
NA = Not Analyzed.

Samples taken March 29, 1990.

Table 5

3M CORDOVA SOIL DATA

Location	C1	C1	14	14	27	27	34	34	911	911	912	912	610	610
Depth	2.5'	5'	2.5'	5'	2.5'	5'	2.5'	5'	2.5'	5'	2.5'	5'	2.5'	5'
Parameter *														
Silver	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Arsenic	1.2	0.96	3.6	1.2	1.9	1.8	1.2	0.35	1.5	0.85	0.894	0.81	1.0	ND
Barium	43	29	150	49	60	48	42	40	38	31	24	28	29	33
Beryllium	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	<5	<5	7	<5	5	<5	5	<5	5	<5	<5	<5	<5	<5
Chromium (Tot)	13	13	31	13	19	15	17	7.5	13	7. 1	9.1	9.4	12	9.2
Chromium (6+)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Copper	8.6	7.2	12	7.1	10	9.8	9.2	7.9	9.6	5.5	5.7	6.2	6.6	5.9
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	17	12	20	14	18	17	13	12	19	10	11	12	10	12
Lead	5	4	12	3	8	4	3	4	4	<3	4	3	3	3
Antimony	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Strontium	19	12	32	18	20	18	17	20	20	12	11	12	13	13
Thallium	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
Tin	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Vanadium	27	17	69	28	35	30	26	24	25	14	16	18	19	11
Zinc	17	12	36	15	21	17	19	15	19	10	11	11	15	12
Cyanide (Tot)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

* = All values are reported in mg/kg.
ND = Not Detected.

Samples taken
March 28,1990.

FIGURE 1
Plant Location

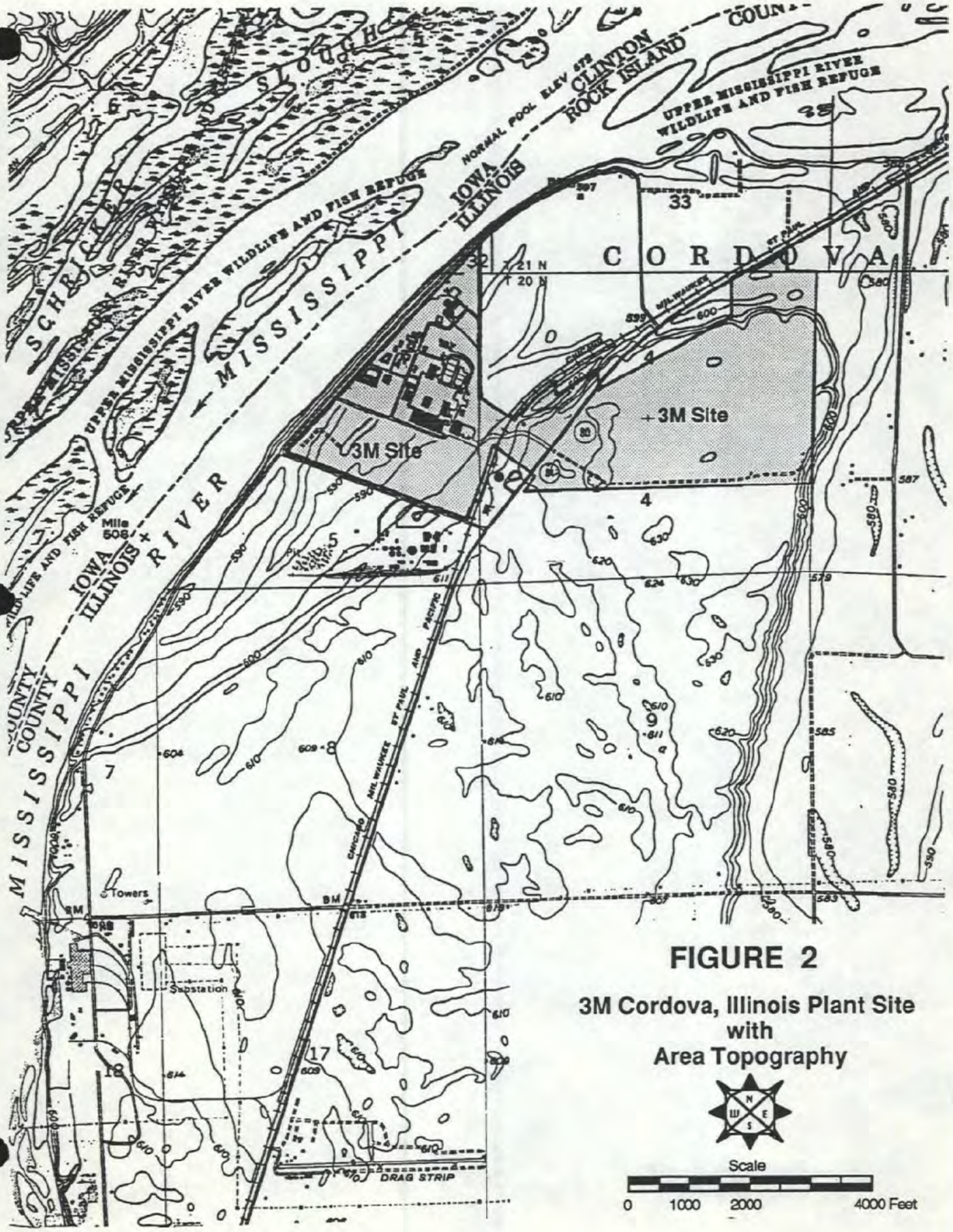
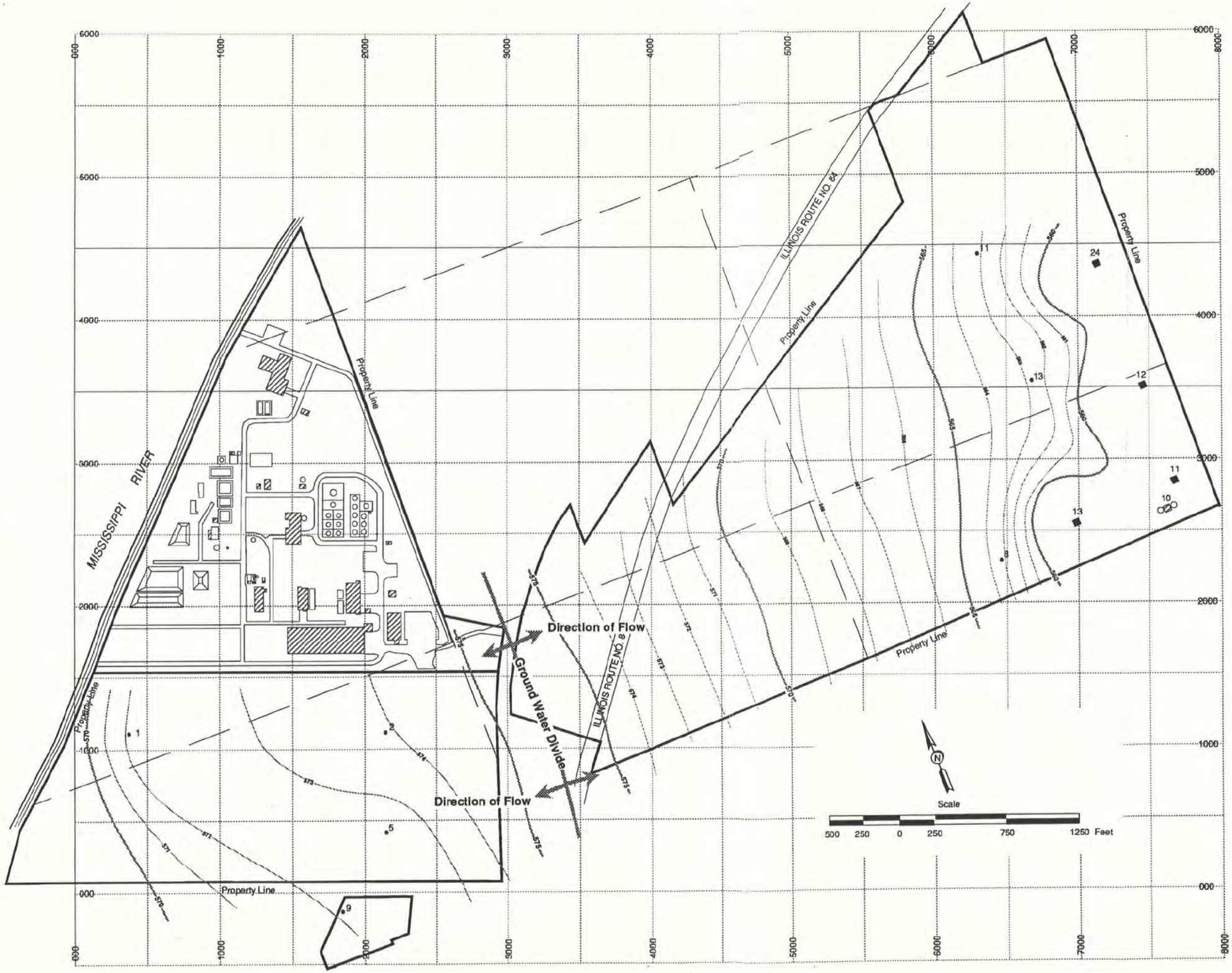


FIGURE 2

3M Cordova, Illinois Plant Site with Area Topography

Scale

0 1000 2000 4000 Feet



3M

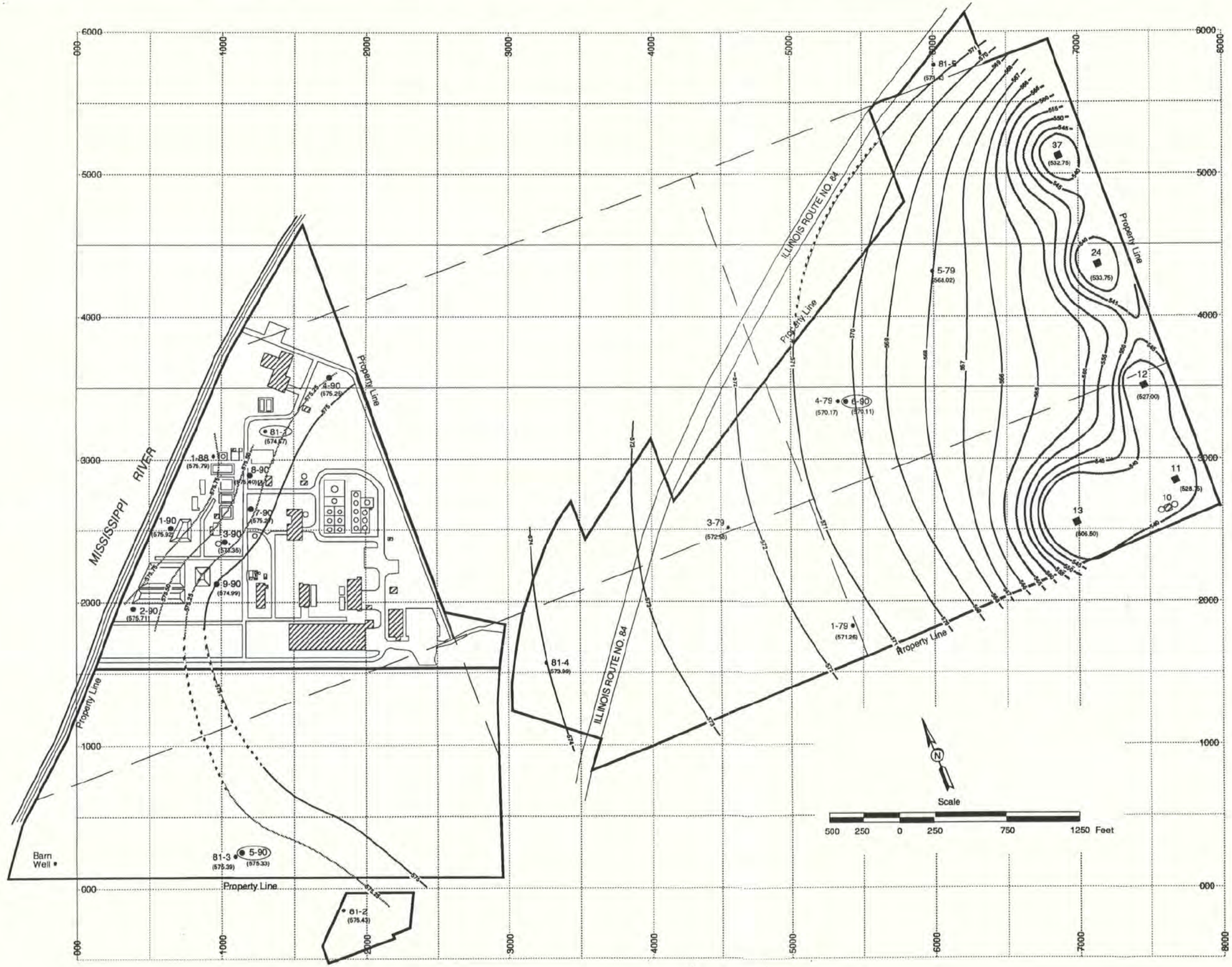
CORDOVA

Water Table Contour Map

Fall, 1978

- Existing Pre-1978 2" Dia. PVC Monitor Well
- Production Wells
- Ground Water Contour (Sea Level Datum) (1.0 Ft. Contour Interval)

FIGURE 7



3M

CORDOVA

Water Table Contour Map

August, 1990

(564.11) - Water Elevation (Sea Level Datum)

● - 1990 Monitor Well Location

• - pre-1990 Monitor Well Location

■ - Production Wells

- Ground Water Contour (Dashed where inferred) (1.0 Ft. Contour Interval)

- Ground Water Contour (0.25 Ft. Contour Interval)

- Ground Water Contour (5 Ft. Contour Interval)

- Circled Well Location indicates water level known but not used for contouring at this location due to screen interval differences

WELL NUMBER	WATER ELEVATION
MW-1-88	575.79
MW-1-90	575.92
MW-2-90	575.71
MW-3-90	575.35
MW-4-90	575.25
MW-5-90	575.33
MW-6-90	570.11
MW-7-90	575.27
MW-8-90	575.40
MW-9-90	574.99
MW-81-1	574.87
MW-81-2	575.43
MW-81-3	575.39
MW-81-4	573.99
MW-81-5	571.43
MW-1-79	571.26
MW-3-79	572.58
MW-4-79	570.17
MW-5-79	568.02
PW-11	528.75
PW-12	527.00
PW-13	506.50
PW-24	533.75
PW-37	532.75

FIGURE 8

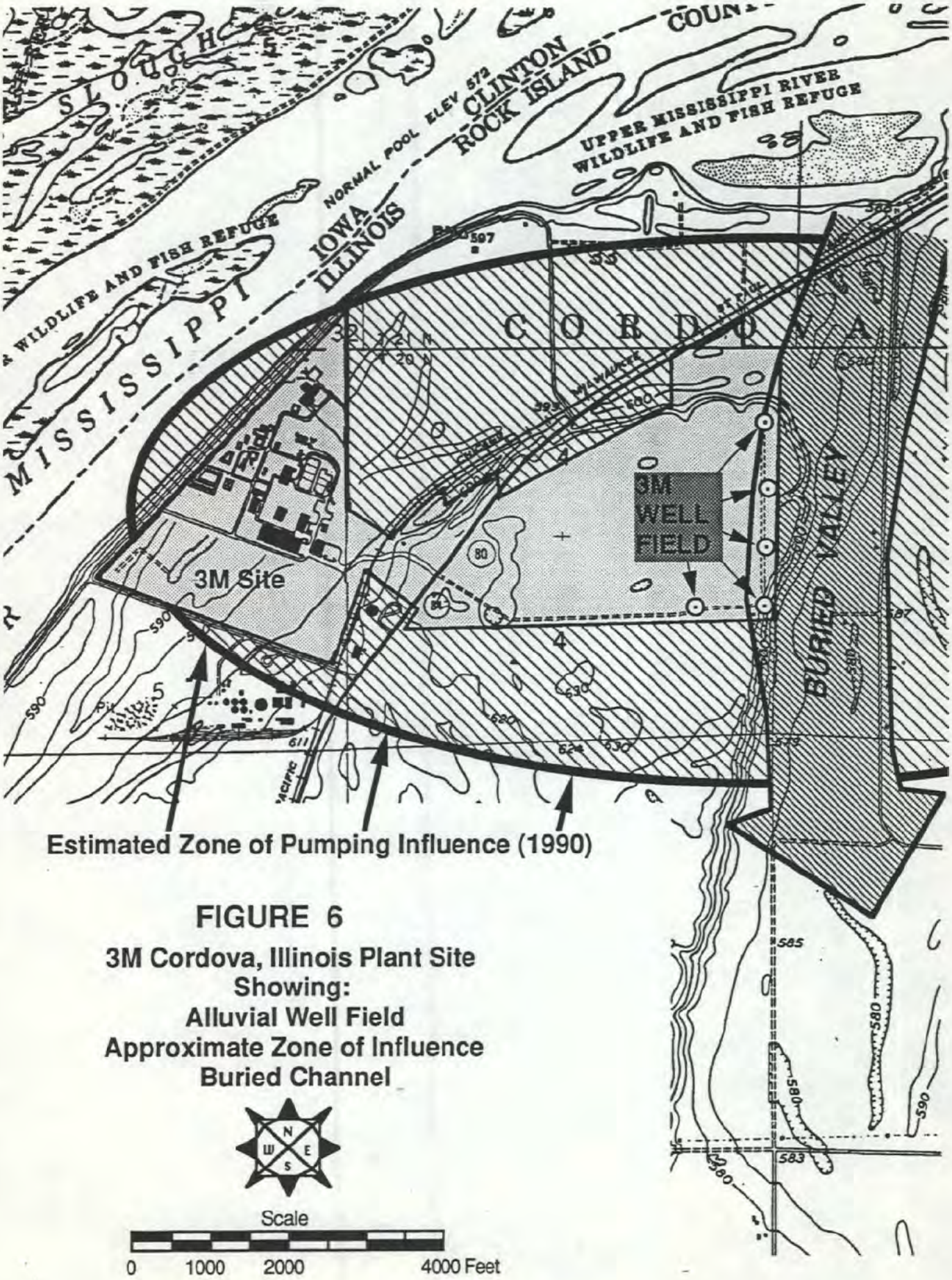


FIGURE 6

3M Cordova, Illinois Plant Site
Showing:
Alluvial Well Field
Approximate Zone of Influence
Buried Channel

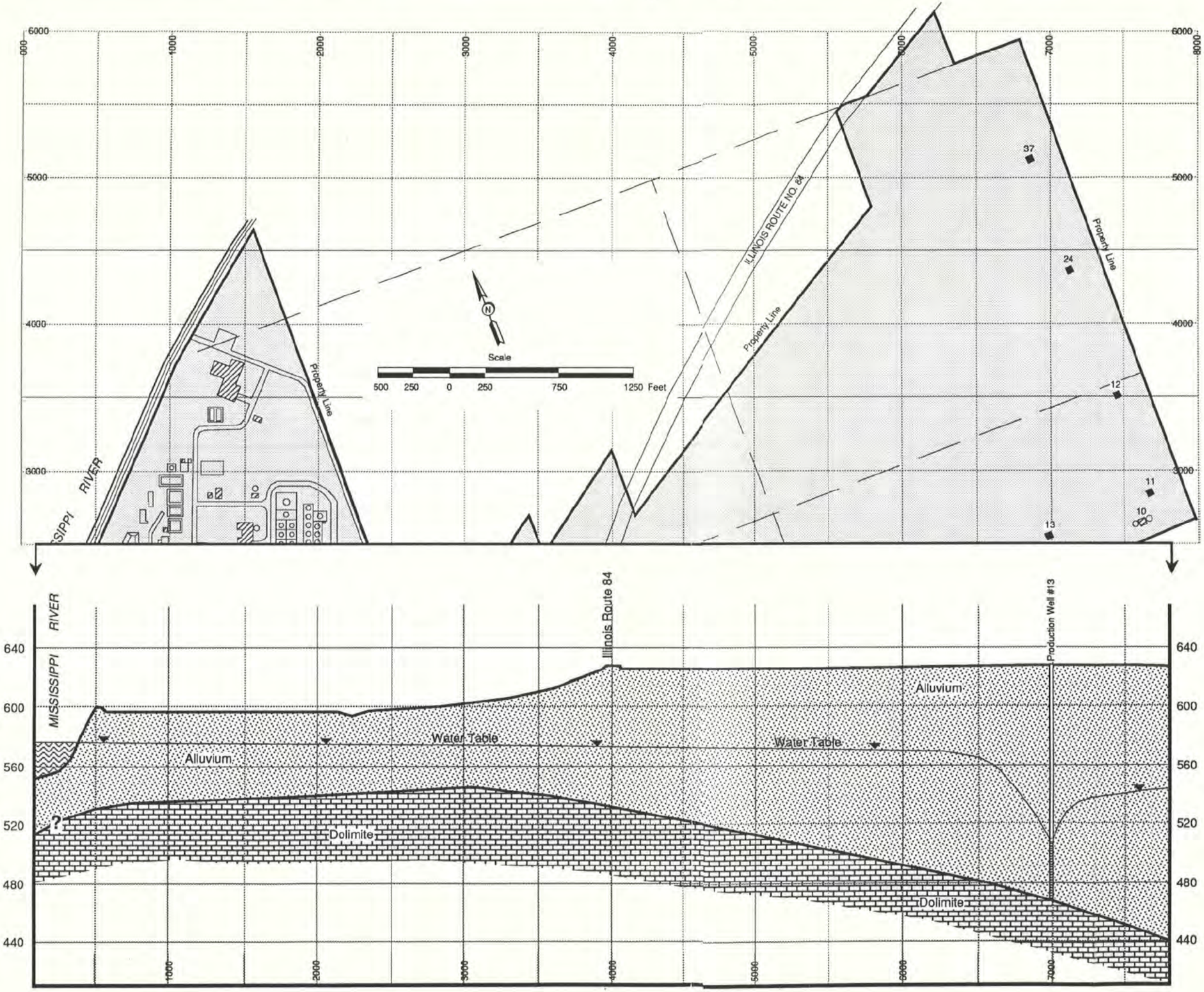
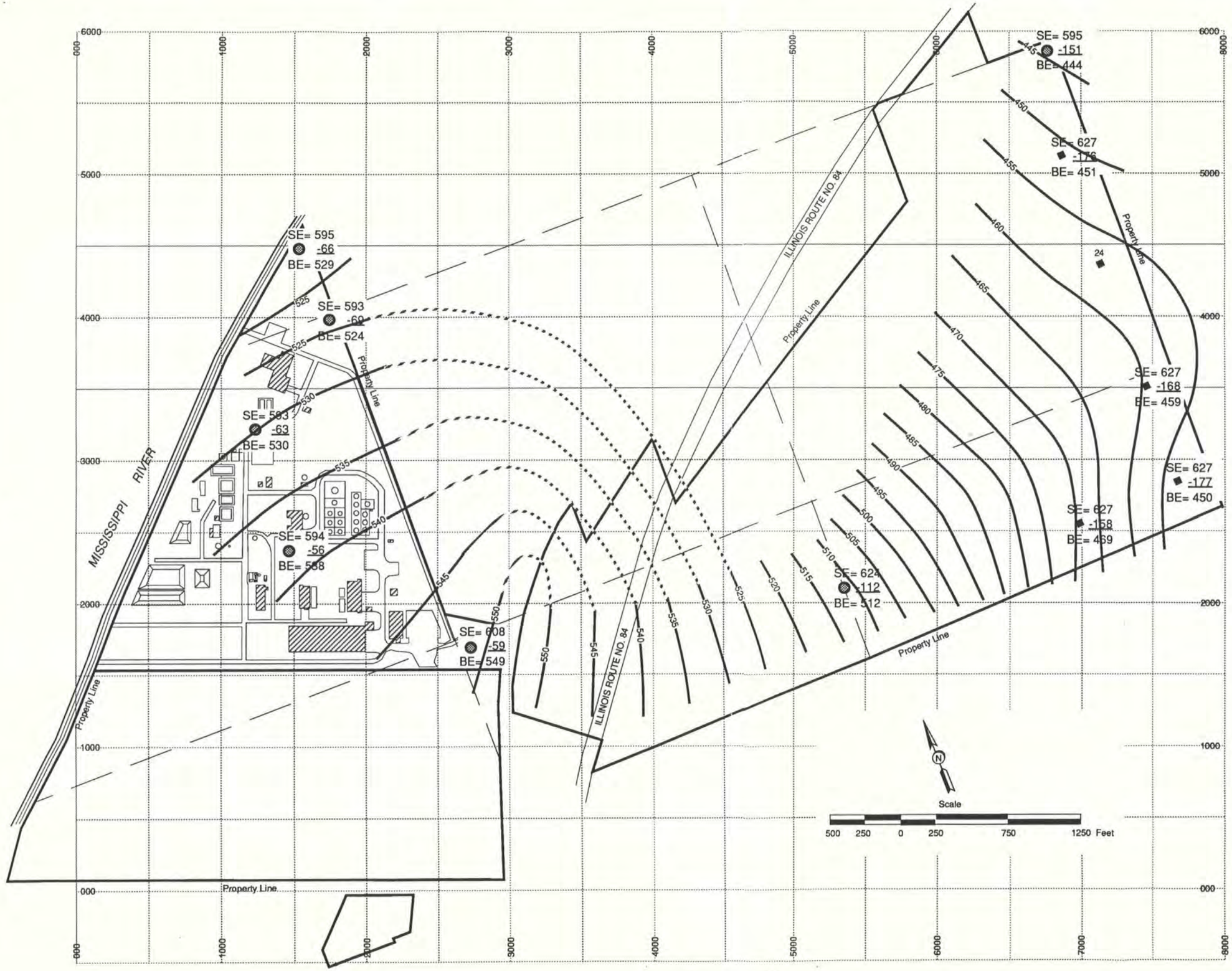

3M
CORDOVA
East-West
Vertical Section
Showing
Near Surface
Stratigraphy
and
Water Table
■ - Production Wells
Scale
500 250 0 250 750 1250 Feet
ILLINOIS ROUTE NO. 84
Property Line
MISSISSIPPI RIVER
Illinois Route 84
Production Well #13
Alluvium
Water Table
Dolimite
ELEVATION IN FEET
(VERTICAL DATUM: MEAN SEA LEVEL)

FIGURE 5



3M

CORDOVA

Bedrock Contour Map

August, 1990

SE= 627 - Surface Elevation
-158 - Depth to Bedrock
BE= 469 - Bedrock Elevation (Sea Level Datum)

■ - Existing Production Well

● - Previous Bedrock Well or Boring Data Point

- Bedrock Contour (Dashed where inferred) (5 Ft. Contour Interval)

FIGURE 4

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ILLINOIS AGRICULTURAL EXPERIMENT STATION

FIGURE 3

GENERAL SOIL MAP
ROCK ISLAND COUNTY, ILLINOIS

Scale 1:253,440
1 0 1 2 3 4 Miles

SOIL ASSOCIATIONS

1 — Fayette-Sylvan-Hickory association: Gently sloping to very steep, well drained and moderately well drained soils formed in loess or loamy glacial till; on uplands

2 — Muscatine-Tama association: Nearly level to strongly sloping, somewhat poorly drained and well drained soils formed in loess; on uplands

3 — Hickory-High Gap association: Moderately steep to very steep, well drained and moderately well drained soils formed in loamy glacial till or in loamy glacial till and in the underlying weathered shale; on uplands

4 — Seaton-Oakville-Lamont association: Gently sloping to very steep, well-drained soils formed in loess or sandy material; on uplands

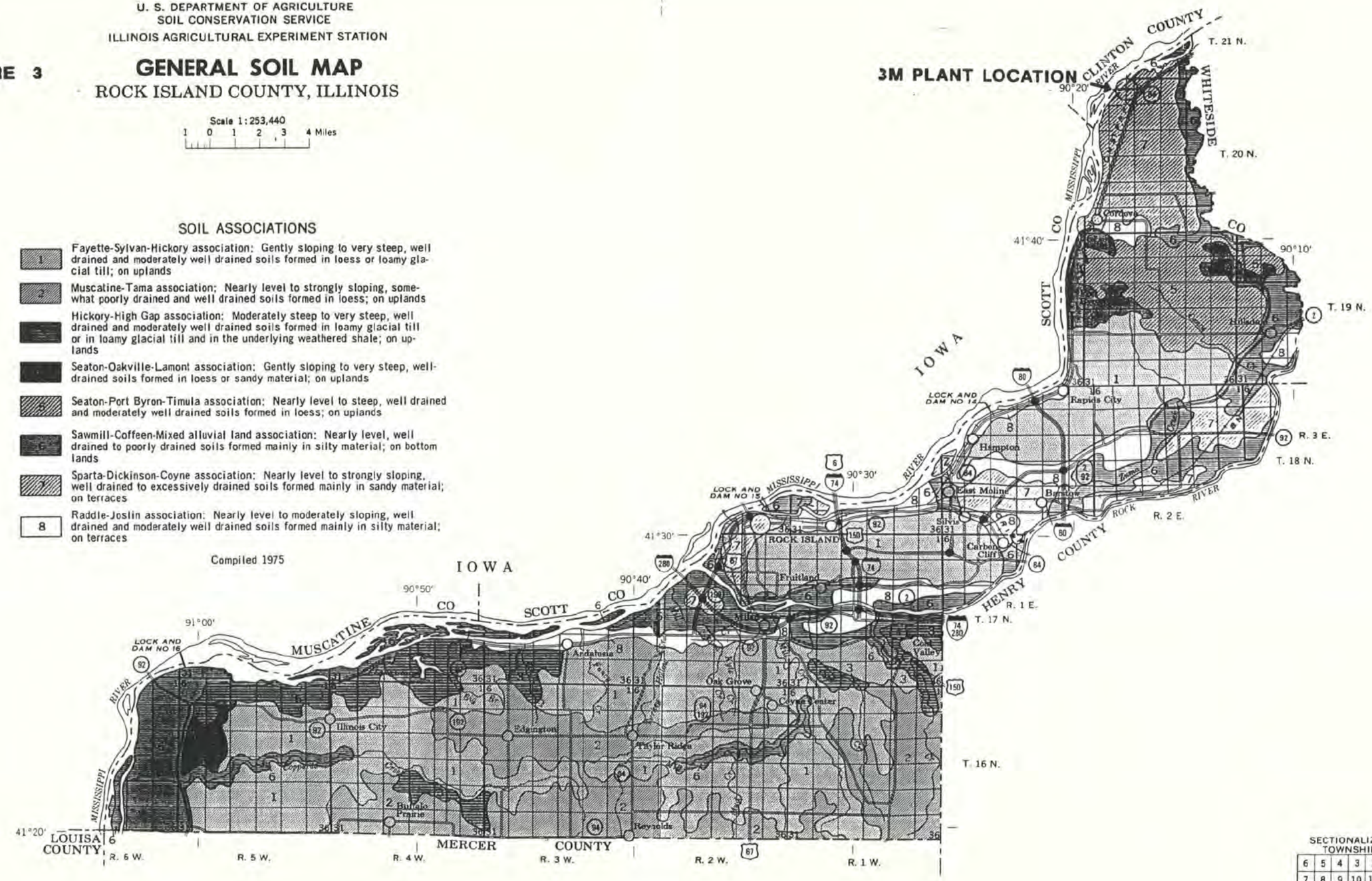
5 — Seaton-Port Byron-Timula association: Nearly level to steep, well drained and moderately well drained soils formed in loess; on uplands

6 — Sawmill-Coffeen-Mixed alluvial land association: Nearly level, well drained to poorly drained soils formed mainly in silty material; on bottom lands

7 — Sparta-Dickinson-Coyne association: Nearly level to strongly sloping, well drained to excessively drained soils formed mainly in sandy material; on terraces

8 — Raddle-Joslin association: Nearly level to moderately sloping, well drained and moderately well drained soils formed mainly in silty material; on terraces

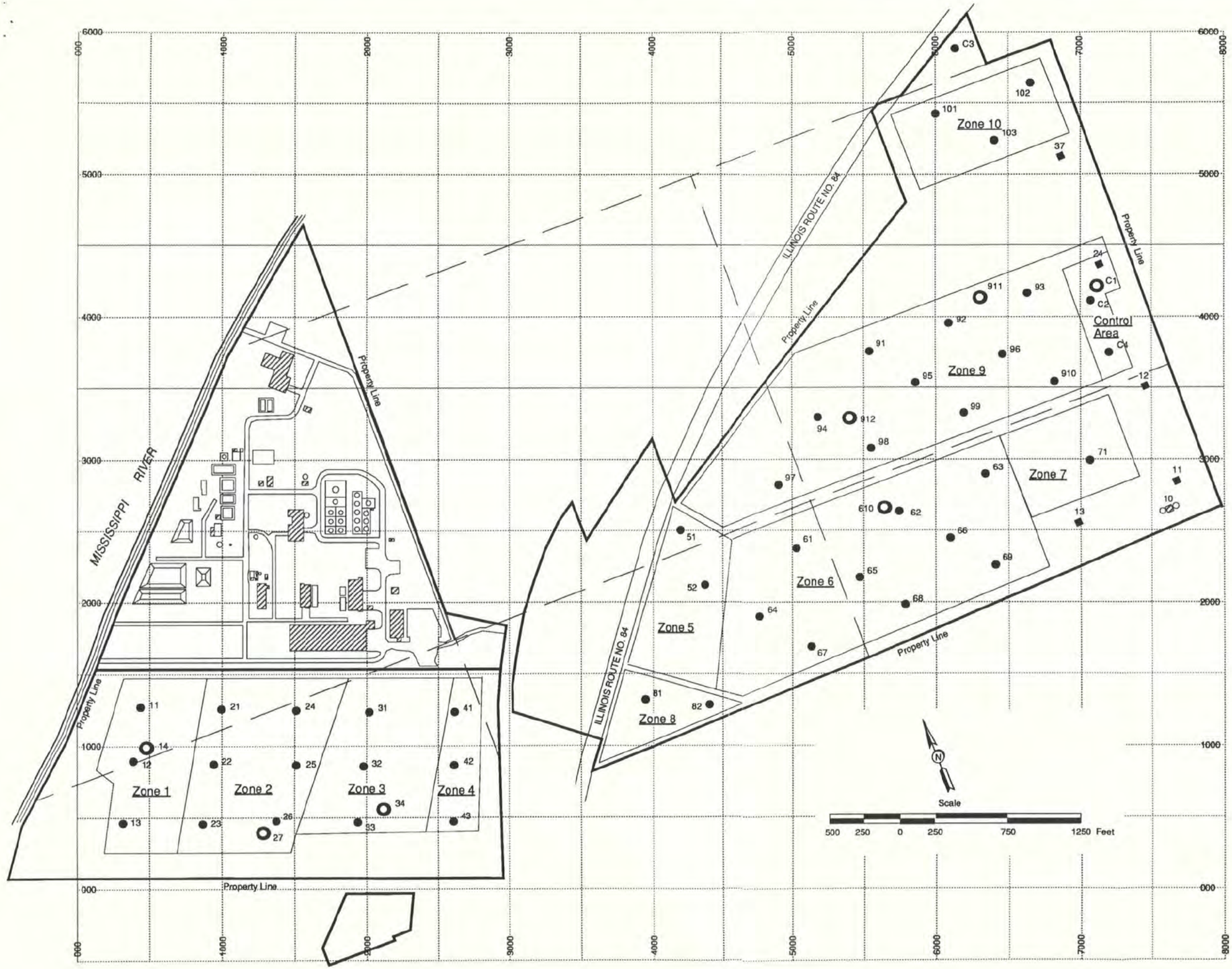
Compiled 1975



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



3M

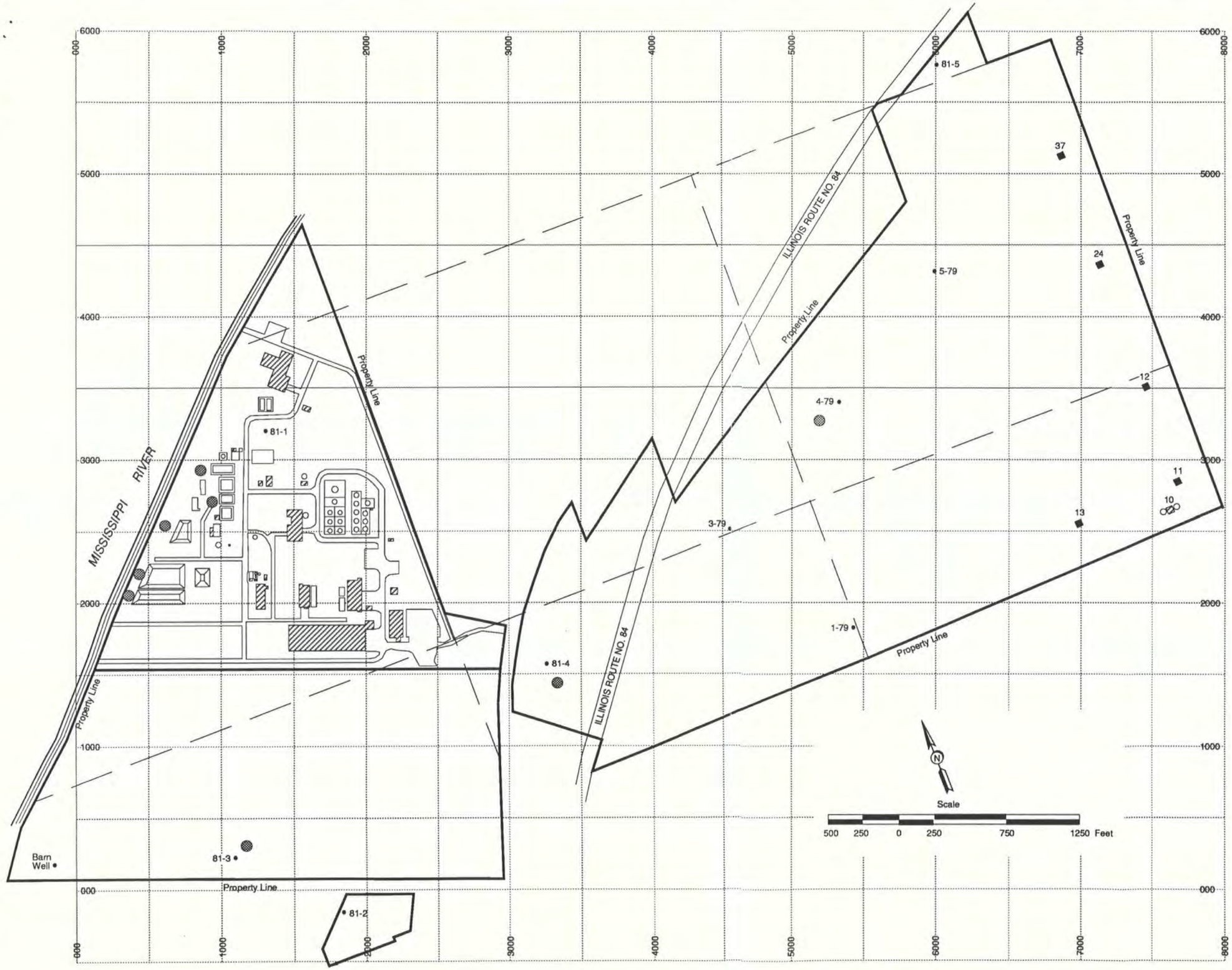
CORDOVA

Sludge Incorporation Zones and Soil Sample Locations

○ - Sample Location Included in Corrective Action Program (Sample Depths of 2.5' & 5.0')

● - Sludge Incorporation Sample Location

Figure 11



3M

CORDOVA

Proposed Monitor Well Locations, September 1987

-1987 Proposed Location

• - pre-1990 Monitor Well Location

Figure 12

FIGURE 13

3M

CORDOVA

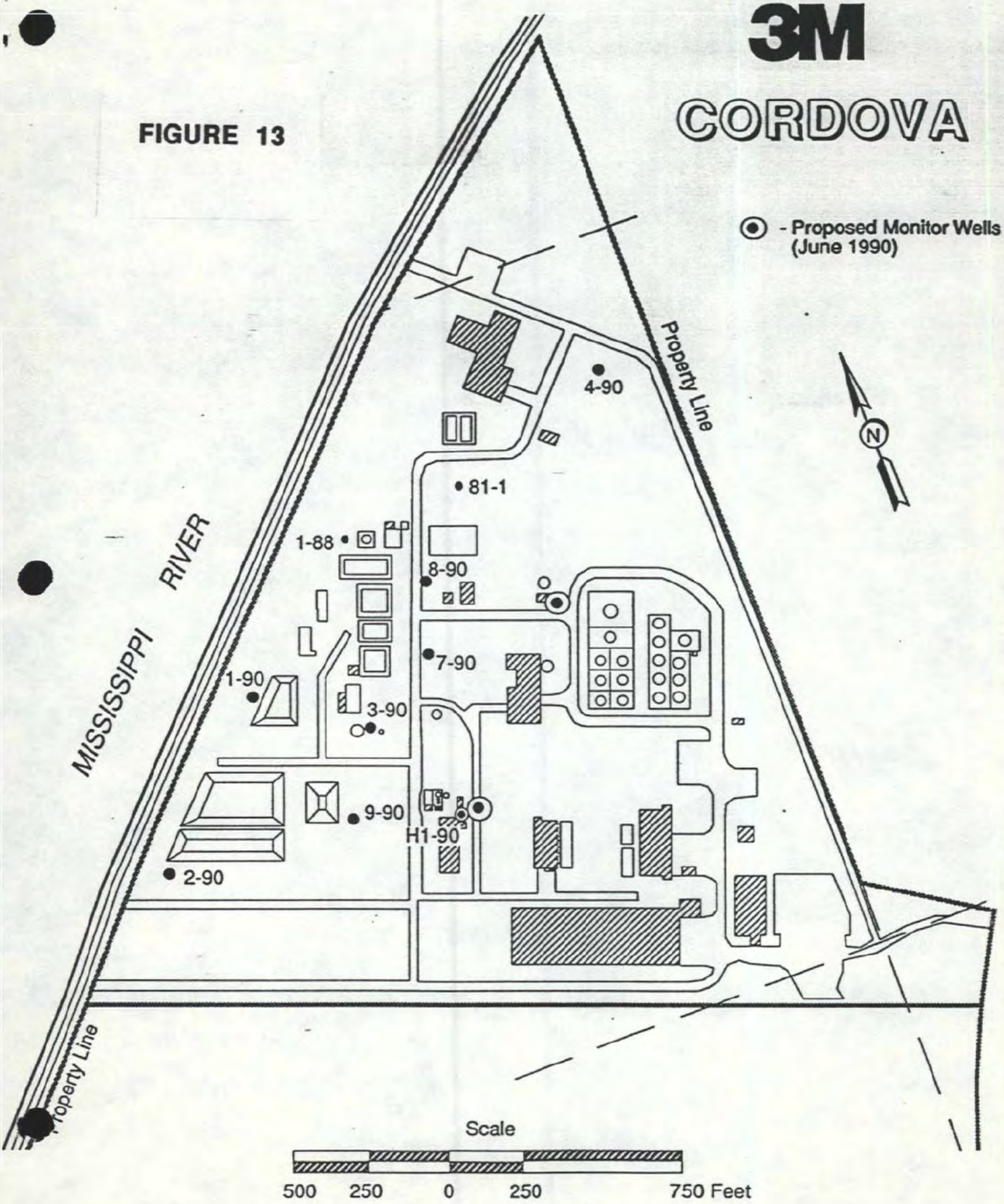
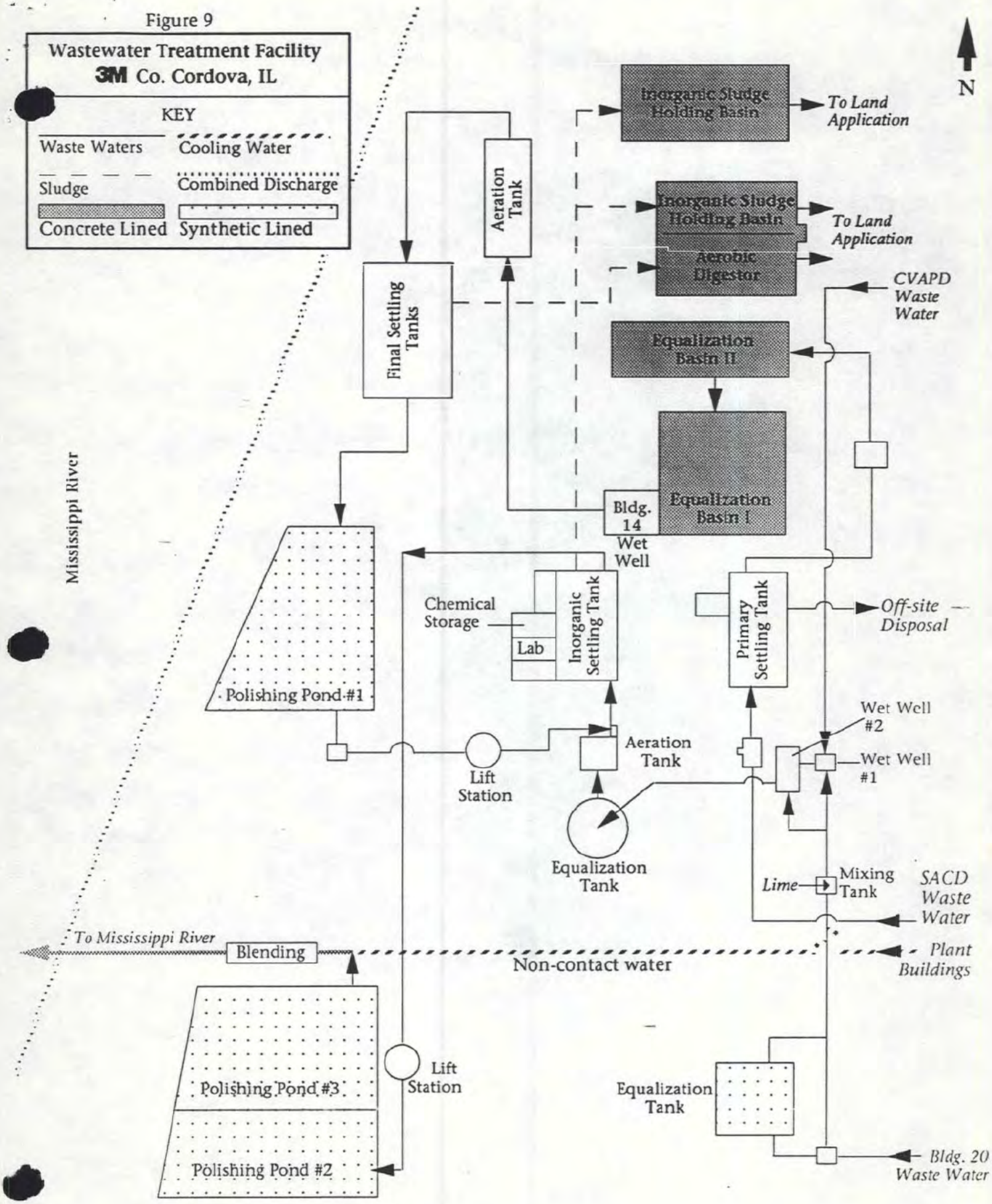


Figure 9


Wastewater Treatment Facility
3M Co. Cordova, IL
KEY
Waste Waters
Cooling Water
Sludge
Combined Discharge
Concrete Lined
Synthetic Lined
N
Inorganic Sludge Holding Basin
To Land Application
Aeration Tank
Inorganic Sludge Holding Basin
To Land Application
Aerobic Digestor
CVAPD Waste Water
Final Settling Tanks
Equalization Basin II
Equalization Basin I
Bldg. 14 Wet Well
Mississippi River
Chemical Storage
Lab
Inorganic Settling Tank
Primary Settling Tank
Off-site Disposal
Polishing Pond #1
Wet Well #2
Aeration Tank
Wet Well #1
Lift Station
Equalization Tank
Lime
Mixing Tank
SACD Waste Water
To Mississippi River
Blending
Non-contact water
Plant Buildings
Polishing Pond #3
Lift Station
Equalization Tank
Polishing Pond #2
Bldg. 20 Waste Water

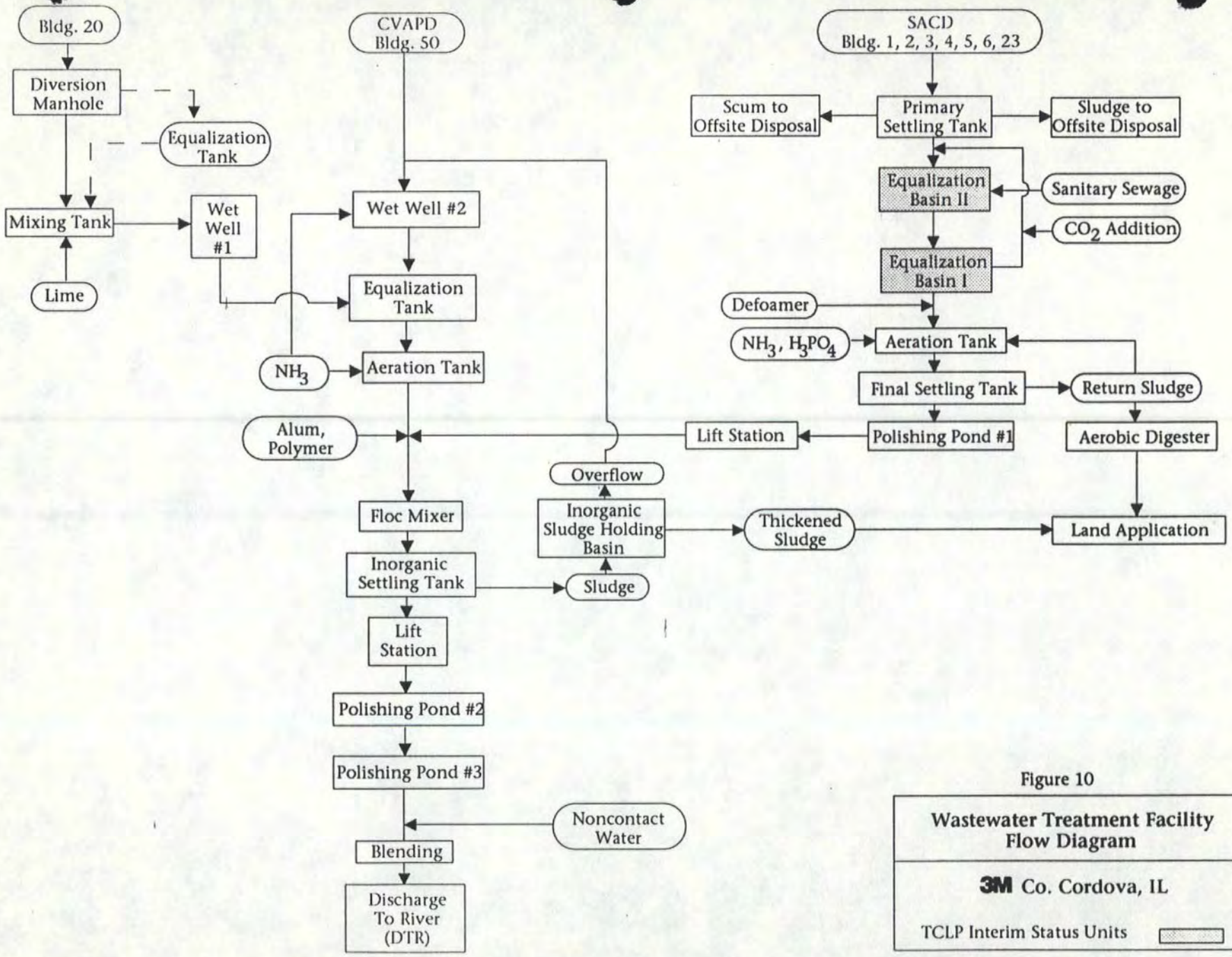


Figure 10

Wastewater Treatment Facility Flow Diagram

3M Co. Cordova, IL

3M Environmental Engineering
and Pollution Control

PO Box 33331
St. Paul, Minnesota 55133-3331
612/778 4791

LWE

3M

January 10, 1987

Subject: 3M Cordova Hazardous Waste Storage Tank Containment Remediation

FEDERAL EXPRESS

Mr. Rob Watson
Division of Land Pollution Control
Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, IL 62706

RECEIVED
JAN 14 1988
SOLID WASTE BRANCH
REGION V

Dear Mr. Watson:

This letter is in being submitted as a follow up to our meeting in your office on December 2, 1987. The purpose of that meeting was to discuss the findings of subsurface investigations conducted around the Cordova hazardous waste storage tank. Provided with this correspondence is a report which summarizes the work which has been conducted to date. The report includes:

(1) A description of the affected area,
(2) Soil sampling conducted to date,
(3) Analytical results and methodology,
(4) A description of the proposed remediation.

We are currently proceeding with the design of the ISV system described in the report and anticipate start-up in early February. Please call me at 612-778-6277 if you have any questions.

Sincerely yours,

Dana M Schnobrich

Dana M. Schnobrich
Senior Environmental Engineer
Bldg 21-2W-05

Enclosure

RECEIVED
JAN 11 1988
IEPA-DLPC

2

3M CORDOVA

HAZARDOUS WASTE STORAGE TANK

SOIL INVESTIGATIONS

DECEMBER, 1987

RECEIVED

JAN 11 1988

IEPA-DLPC

(A) INTRODUCTION

Pumpable liquid solvents which are incinerated in the Cordova plant incinerator are pumped from a hazardous waste storage tank. This storage tank is of stainless steel construction with a 30,000 gallon capacity. It is constructed on a concrete slab, 1.5 feet thick, with an additional five-foot ringwall footing. The existing storage tank was installed in 1981 and replaced a slightly smaller tank which had originally been installed in 1973. A site map, depicting the location of this tank is provided in Figure 1.

During the last week of October, work began on the construction of concrete diking around the site's hazardous waste storage tank. Secondary containment for hazardous waste storage tanks is being required under 40 CFR 264 Subpart J and must be provided by January 12, 1989 and a project was initiated to meet these requirements.

During the excavation of the existing containment system solvent odors were detected and excavation activities were suspended. The contaminated soil does not appear to have been caused by a release from the existing storage tank.

(B) SITE INVESTIGATIONS

Two separate sampling visits were made in response to this incident. The first occurred on November 2 and the second was on November 12 and 13. The sampling methods used during both visits were in accordance with SW-846.

Sample locations for the first sampling visit are shown in Figure 2. For this sampling visit a hand auger was utilized to bore a hole to varying depths and soil profiles were then extracted with a thin wall sampling tube and then placed directly into headspace vials. Samples were taken at eight(8) locations with multiple depth samples being taken at several of the locations.

The second set of samples were taken as a follow up to the first visit. Samples were extracted using a mobile drilling rig(hollow stem auger) with a split spoon sampler. Split spoon samples were placed directly into headspace vials. Samples were taken at six(6)

locations(Figure 3); four(4) within the containment area and two(2) outside of it. The sample points within the containment area were drilled to a depth of fifteen (15) feet with samples being taken every five (5) feet. Sample points within the containment areas were limited to 15 feet to prevent the potential for vertical migration of contaminants. In the sample points outside the area, holes were drilled to twenty (20) feet with samples again being taken at five (5) foot intervals.

(C) ANALYTICAL RESULTS

(1) Methodology

Preliminary analysis was limited to volatile organics (EPA Test Method 3810). Since the material stored in this tank consists of a solvent mixture destined for onsite incineration, analysis for only these constituents is appropriate.

(2) Results

(a) Sample Set I

The results are summarized in Table 1. The only compounds detected were ethyl benzene, toluene, and xylene. Both toluene and ethyl benzene are impurities contained in commercial grade xylene and it is likely that the initial release consisted of xylene solvent. The highest concentrations were found at sample points 2 and 7, with total volatile organic concentrations of 186.3 mg/kg and 493.9 mg/kg respectively. Both of the aforementioned samples were at the three foot depth. The total volatile concentrations in all other samples were typically less than 50 mg/kg.

(b) Sample Set II

Analytical results for the second sampling visit are summarized in Table 2. Total volatile concentrations are depicted in Figures 4 and 5. The solvents detected were again limited to xylene, toluene, and ethyl benzene, although ethyl benzene concentrations have been consolidated with the xylene isomers in the attached Table 2. The highest concentrations were found at sample points HWTSB-N-87, HWTSB-S-87, and HWTSB-E-87 with total solvent concentrations of 246 mg/kg, 496 mg/kg, and

394 mg/kg, respectively. The highest concentrations were all detected at five foot depths with levels generally decreasing at lower depths. The south(HWTSB-S-87) and east(HWTSB-E-87) borings had the highest concentrations which is somewhat consistent with the findings of the first sampling visit.

The borings taken outside the storage dike indicate that the contamination is contained below the diked area. Only one of the samples taken outside of the diking had levels above the detection limit. The measured concentration in that sample(N2-87-05) was 3 mg/kg or practically insignificant.

(3) Ongoing Analysis of Collected Samples

Analysis is currently underway to substantiate the absence of semi-volatile organics and heavy metals in a limited number of the samples collected during the second sampling visit. The samples being analyzed for these constituents were selected at random and are listed in Table 3. These results will be submitted as soon as they become available.

The methods used for analysis of the samples are summarized below:

CONSTITUENTS	EPA TEST METHOD
semi-volatile fraction	3510/8270
heavy metals:	
mercury	7470/7471
chromium	7190/7191
lead	7420/7421
cadmium	7130/7131

(D) SOILS TYPES

Soils were characterized during the second sampling visit. The area is overlain by a somewhat impermeable silt-loam. Underlying soils consist of medium to coarse grained sands with some gravel.

(E) REMEDIAL ACTION

(1) Recommended Remedial Technology

The volatile organic constituents present in the soils

beneath the hazardous waste storage have low water solubilities. In soil systems they will partition primarily in the air and soil matrices as opposed to soil pore water. All of the compounds are biodegradable and it is possible that they will naturally degrade with time. The construction of concrete diking over this area would prevent vertical migration and allow for removal via this mechanism.

Based on the above discussion we believe that the construction of the concrete diking would be an effective remediation technique. However, to expedite clean-up we are proposing to use In-situ Volatilization (ISV) for soil remediation. Two wells, screened only in the unsaturated zone, would be installed adjacent to the tank and connected to an extraction blower which would remove air with volatile organic contaminants from the unsaturated zone. This technology has been used extensively for remediating soils contaminated with VOC's. It is especially suited to this site because:

(1) Excavation of the soils would not be possible without the total removal of the tank and demolition of the tank base,
(2) Fine and course-grained sands are especially suited to this technology, and
(3) The removal of the specific organic constituents present in the soil are especially suited to this technology.

The two wells would be screened from five (5) feet to twenty (20) feet. These wells will be subjected to vacuum using a 200 CFM blower. The soil gases removed from the wells will be discharged directly to the atmosphere. The concentrations of volatile organic in the air discharge are expected to be at very low levels i.e. about 10 lbs/day and 3M believes that carbon adsorption of the discharge air is not necessary. The locations of the wells are shown in Figure 3 and a diagram of the ISV system can be found in Figure 6.

We estimate that remediation will be complete within three month of system start-up.

(2) Performance Monitoring

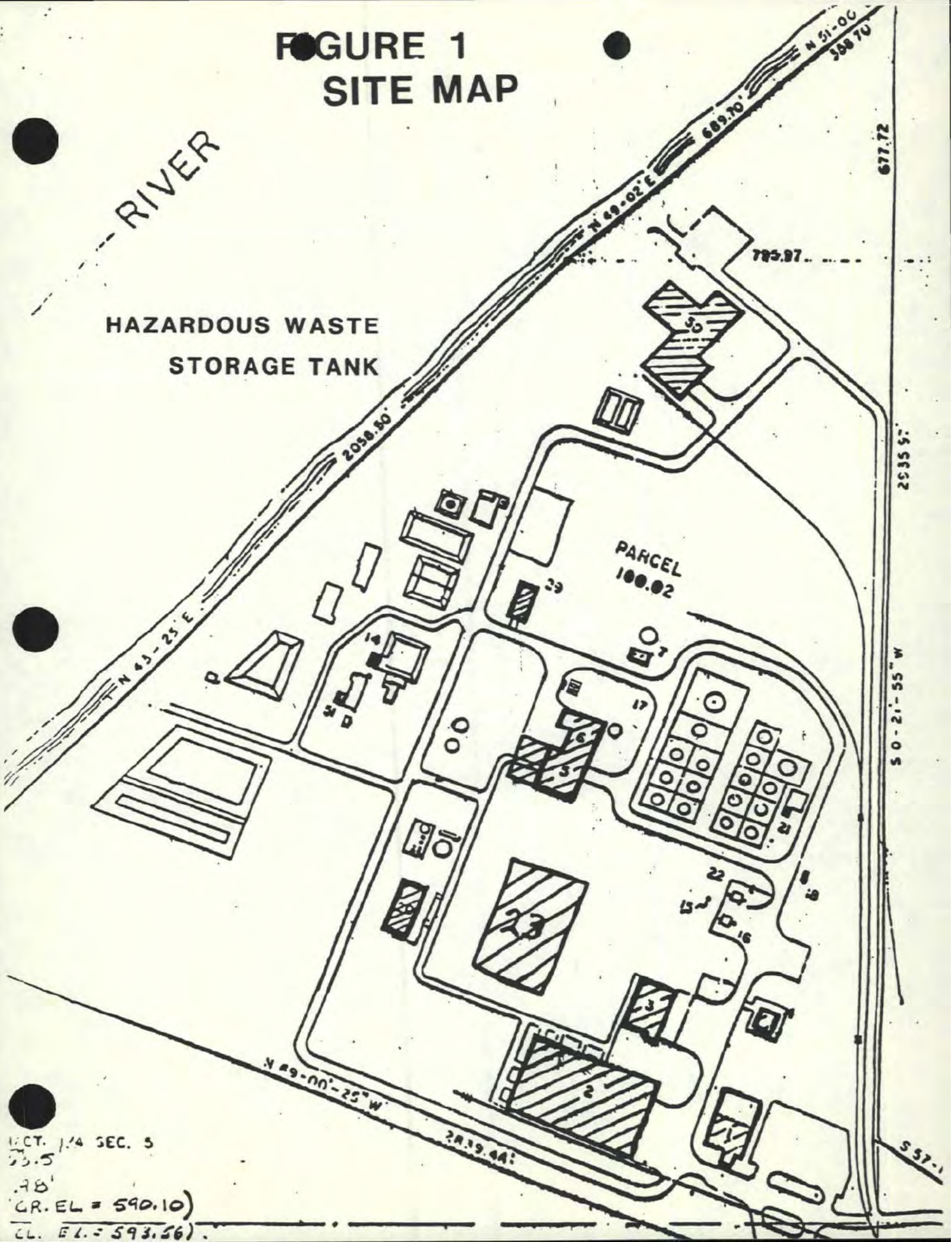
During start-up, air flowrates and VOC concentrations will be measured at least every hour. For the next week readings will be taken at least daily. Weekly readings will then be taken for the duration of

system operation.

Air flows will be taken with pitot tubes and VOC concentrations will be monitored using an HNu analyzer. A samples will be collected periodically with carbon tubes to characterize the organics present and calibrate the HNu readings.

The operation of the blower will continue until the VOC concentrations of the air stream reach acceptable levels, probably in the range of 50-100 ppmv. At that time, core samples will be taken to verify clean-up. It's possible that blower operation will continue depending on the relationship between measured gas and soil concentrations. IEPA would obviously be consulted as the project proceeds.

FIGURE 1
SITE MAP



CT. 1/4 SEC. 5
55.5
.98'
GR. EL = 590.10)
CL. EL. = 593.56).

FIGURE 2

3M - CORDOVA HAZARDOUS WASTE TANK

HAND AUGER LOCATIONS - 11/2/87

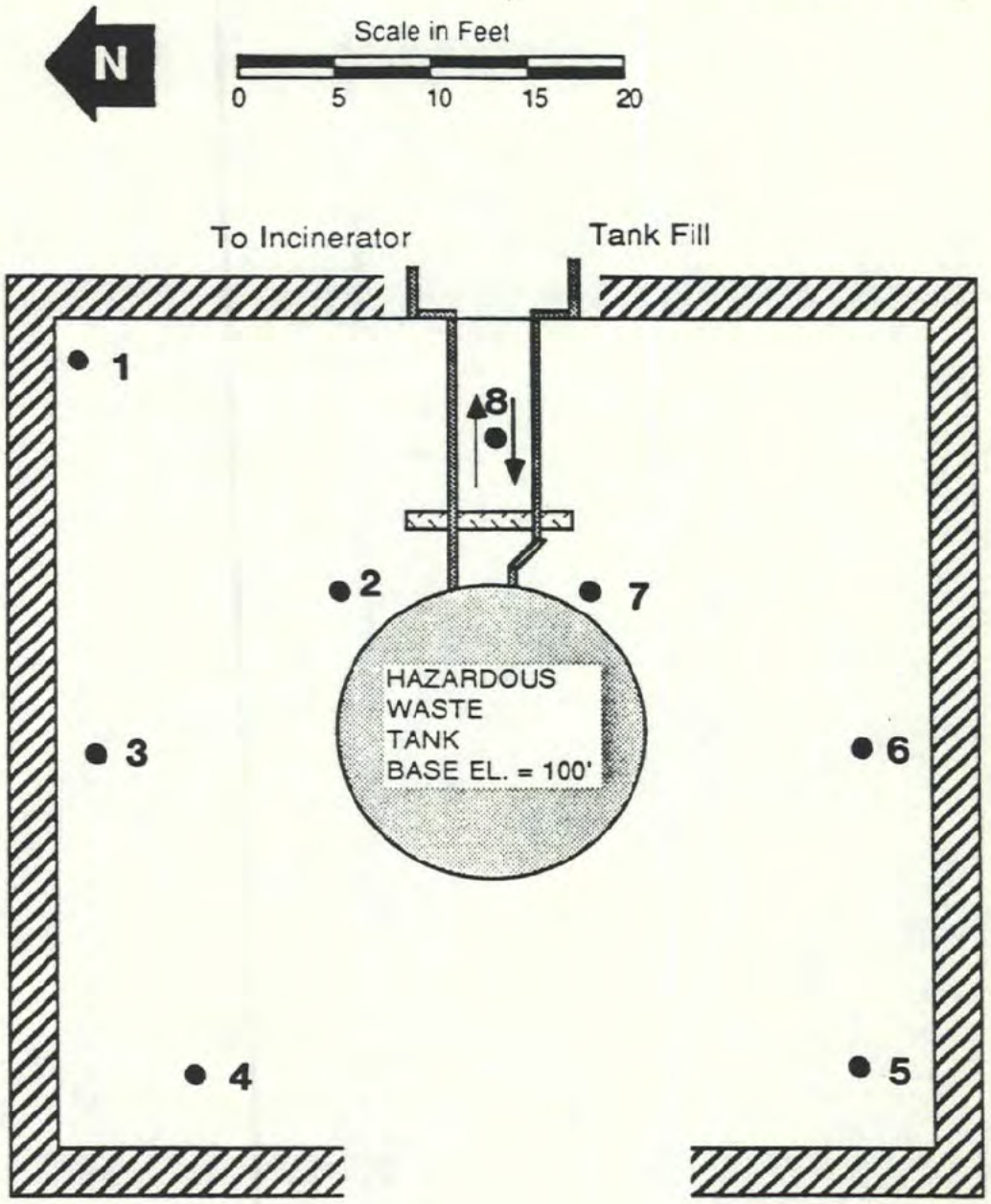


FIGURE 3

3M - CORDOVA HAZARDOUS WASTE TANK
SOIL BORING PLAN - NOVEMBER 12-13, 1987

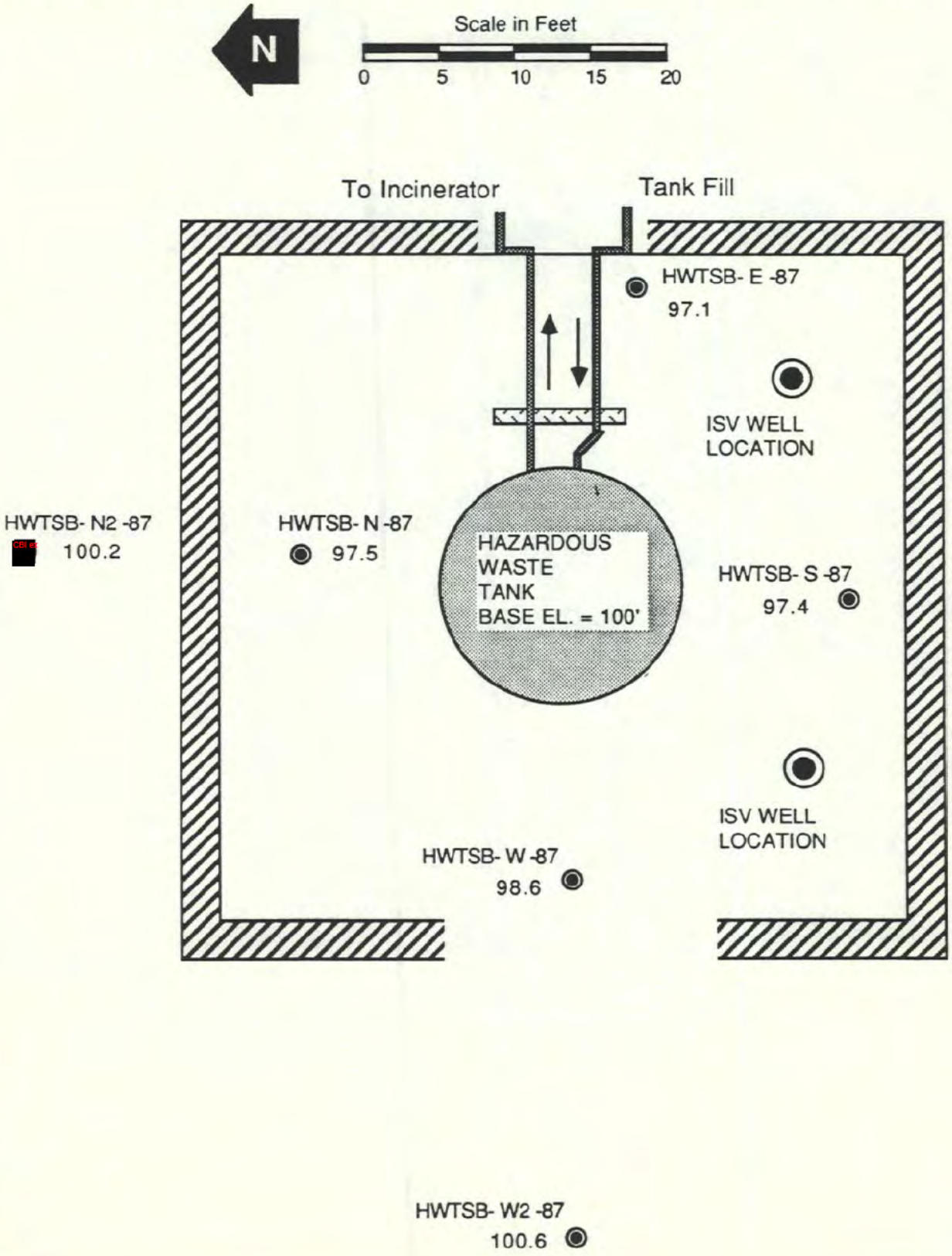


FIGURE 4

3M - CORDOVA HAZARDOUS WASTE TANK
NORTH - SOUTH CROSS SECTION
NOVEMBER 12-13, 1987 SOIL BORING PROGRAM

TOTAL VOLATILE ORGANIC CONCENTRATION (mg/l)

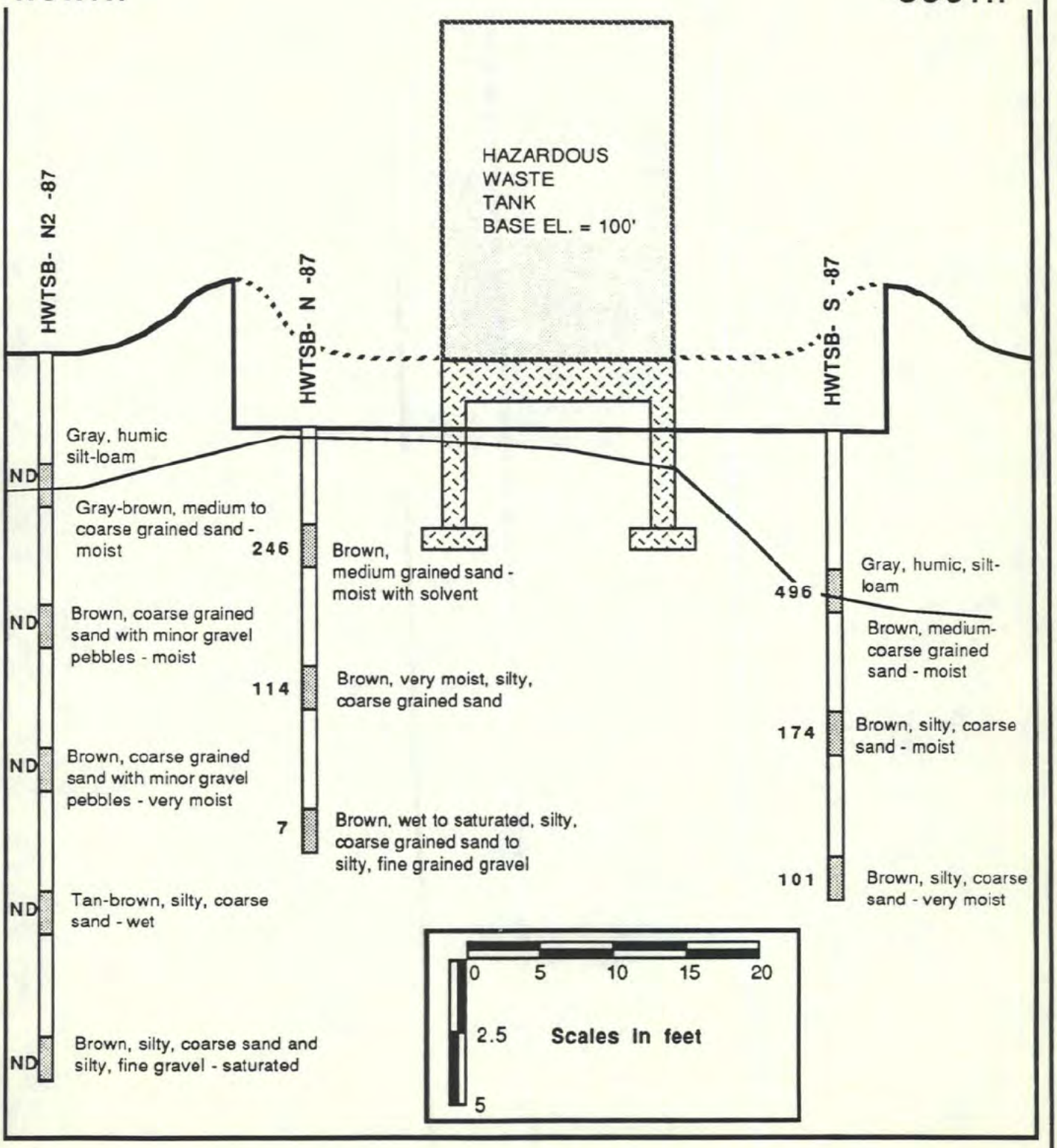
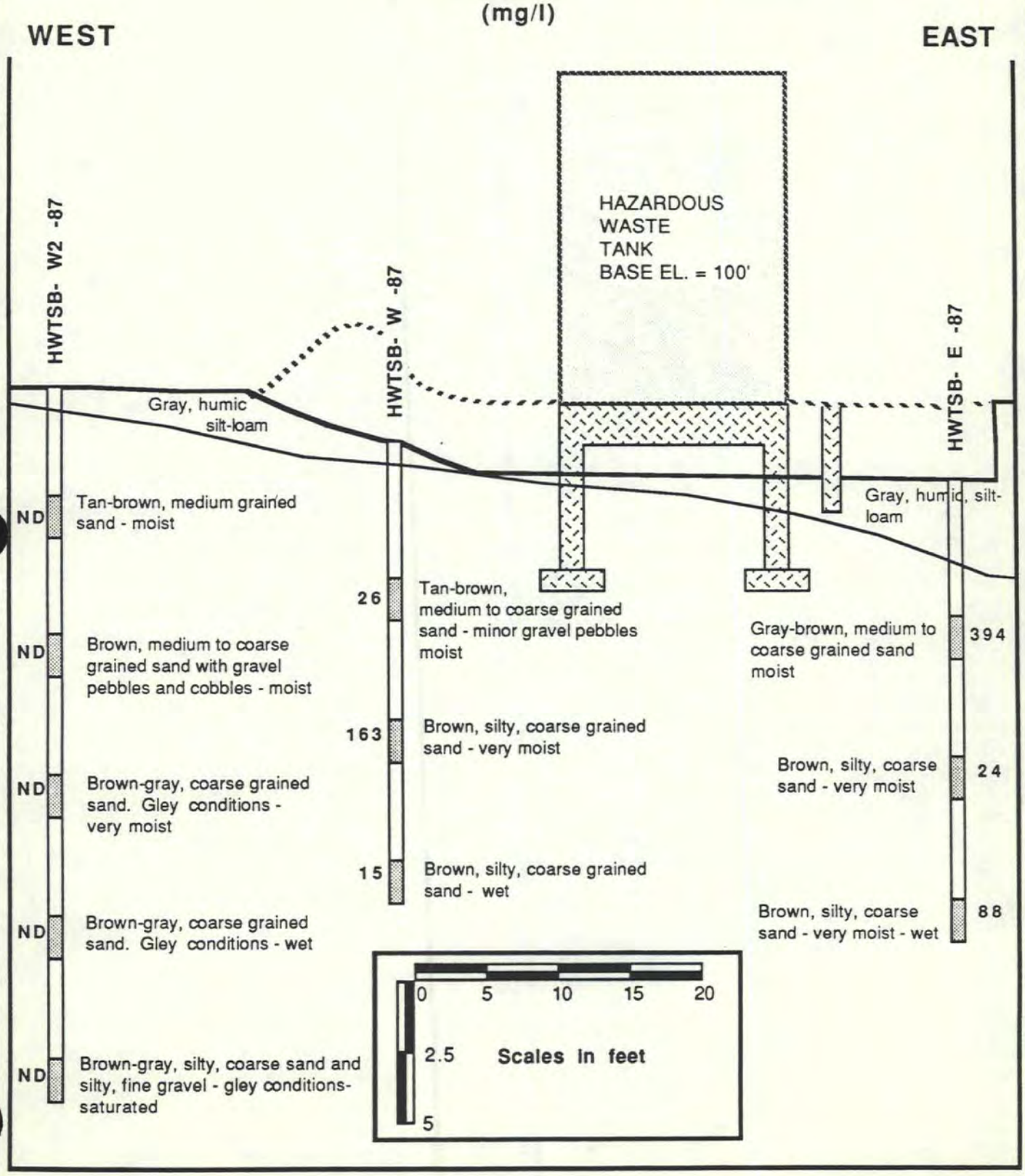
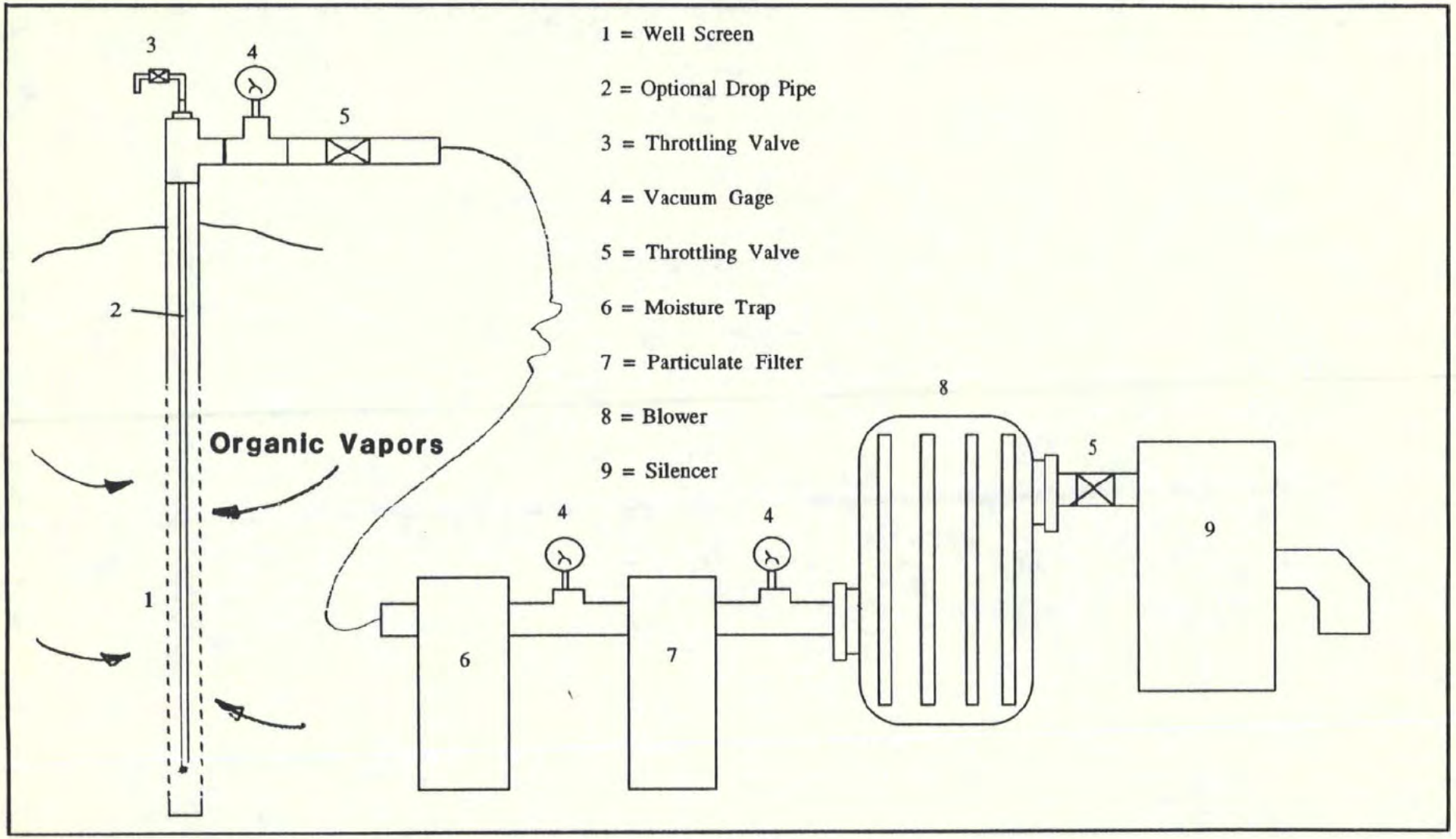


FIGURE 5

3M - CORDOVA HAZARDOUS WASTE TANK
EAST - WEST CROSS SECTION
NOVEMBER 12-13, 1987 SOIL BORING PROGRAM

TOTAL VOLATILE ORGANIC CONCENTRATION (mg/l)





Preliminary Design Details : 3M Cordova, IL

Project # : 11-29-87

FIGURE 6

TABLE 1

SOIL SOLVENT CONTENTS

SAMPLING DATE: NOV. 2, 1987

SAMPLE LOCATION	SAMPLE DEPTH (ft)	SOLVENT CONCENTRATIONS(mg/kg)			
		XYLENE*	TOLUENE	ETHYLBENZENE	TOTAL
1	0.5	3.7	0.7	0.9	5.2
1	1	10.8	2.0	2.6	15.4
1	3	1.3	0.3	0.3	1.9
2	0.5	39.3	8.9	11.2	59.4
2	1	18.5	3.4	4.2	26.1
2	3	127.6	22.8	35.9	186.3
3	0.5	7.9	1.2	1.9	11.0
3	3	6.3	1.5	1.9	9.7
4	0.5	4.2	1.2	1.2	6.6
4	3	1.7	0.4	0.5	2.6
5	3	1.8	0.5	0.5	2.8
6	3	ND	ND	ND	ND
7	3	255.5	133.7	104.7	493.9
8	3	18.3	4.0	4.7	26.7

*INCLUDES ALL ISOMERS

TABLE 2

SOIL SOLVENT CONCENTRATIONS

SAMPLING DATE: NOVEMBER 12, 1987

SAMPLE LOCATION	XYLENE* (mg/kg)	TOLUENE (mg/kg)	TOTAL (mg/kg)
N-87-05	218	21	239
N-87-10	88	26	114
N-87-15	6	1	7
S-87-05	348	138	486
S-87-10	134	40	174
S-87-15	81	20	101
E-87-05	330	64	394
E-87-10	21	3	24
E-87-15	81	7	88
W-87-05	22	4	25
W-87-10	86	77	163
W-87-15	13	2	15
N2-87-05	3	<1	3
N2-87-10	<1	<1	<1
N2-87-15	<1	<1	<1
N2-87-20	<1	<1	<1
N2-87-25	<1	<1	<1
W2-87-05	<1	<1	<1
W2-87-10	<1	<1	<1
W2-87-15	<1	<1	<1
W2-87-20	<1	<1	<1
W2-87-25	<1	<1	<1

* Listed xylene concentrations include O,M, and P-Xylene and Ethlybenzene.

Minumum detection limit was 1 mg/kg.

TABLE 3

SOIL SAMPLES BEING ANALYZED
FOR SEMI-VOLATILES AND SELECTED HEAVY METALS

SAMPLE NUMBER
E-87-05
S-87-10
E-87-10
E-87-15
W2-87-05