PREPARED FOR

MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK

VOLUME I

REMEDIAL INVESTIGATION REPORT

MALCOLM PIRNIE

JULY 1993

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MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

July 30, 1993

Mr. Michael J. DiPietro
Engineering Geologist
Bureau of Western Remedial Action
Division of Hazardous Waste Remediation
New York State Department of Environmental Conservation
50 Wolf Road
Albany, New York 12233

Re: Miller Container RI/FS Order on Consent Index #A7-0227-90-04
Site #738029

Dear Mr. DiPietro:

Enclosed are four copies of the Remedial Investigation Report which is referenced in subsection 8.2.2 of the approved RI/FS Work Plan, and in Paragraph IV of Order on Consent Index #A7-0227-90-04.

Data incorporated into the RI Report include results of a pumping test performed during August 1992 at the Fulton municipal wells, and a pumping test performed during September 1992 at RW-1. The entirety of the Municipal Aquifer Pumping Test Report (November 1992) is contained within the RI Report as Appendix V; comments received from the NYSDEC following review of the pumping test report will be addressed in this letter.

The RW-1 Pumping Test Report (December 1992) has been revised (May 1993) and constitutes Appendix W to the RI Report. Specific NYSDEC comments on the RW-1 Pumping Test Report will also be addressed in this letter.

Section 8 of the Report contains an updated RI/FS schedule which has been modified to reflect RI/FS activities which will be performed during the next several months. This schedule reflects the submission of the RI Report by the end of July 1993 and calls for the submission of the Interim Remedial Action Alternative Screening Report (Preliminary Screening Report) by mid August 1993. The schedule also projects the filing of the FS Report in the middle of December 1993. With reference to the schedule submitted with the April 1992 Draft Remedial Investigation Report, we have reduced our time allotment for completion of the FS Report by 1 1/2 months. However, this time frame for submission of the FS Report is based upon the assumption that we will receive by mid September both formal written NYSDEC approval of the RI Report as well as comments on the Preliminary Screening Report.

In an effort to minimize paper volume and avoid unnecessary duplication, the appendices to this RI Report are presented in the form of addenda and updates to the appendices submitted as part of the Draft RI Report. The addenda generally consist of the additional

7481 HENRY CLAY BOULEVARD LIVERPOOL, NY 13088-3511 315-457-4105 FAX: 315-457-4959

Addendum to Appendix P (February 1993) - Hydraulic Conductivity Results and Graphs. Addition of the hydraulic conductivity results and Aqtesolv graphs for slug testing performed at MW-60S,I,D, and retesting at MW-12S; MW-13D; MW-15D; MW-23D; MW-28D; MW-29D; MW-31S,D; and MW-49D.

Appendix R (Updated February 1993) - Key Ground Water Parameters Data Tables. Entire appendix updated to reflect data through August 1992.

Appendix S (Updated February 1993) - Water Quality versus Time Graphs (Monitoring Wells, Recovery Wells, TCA & TCE at K-2 and M-2). Entire appendix updated to reflect data through August 1992.

Appendix V - Municipal Aquifer Pumping Test Report (November 1992).

Appendix W - RW-1 Pumping Test Report (December 1992, revised May 1993).

Draft RI appendices which remain unchanged are not included in the three volumes making up the RI Report; however, these appendices are referenced in the table of contents with the appropriate Draft RI Report volume number. In addition, Sheet 3 found in the back of Volume I is the only sheet which was revised since the Draft RI Report was issued; therefore, Sheets 1, 2, 4 and 5 have not been reissued with the final report. Should you require any additional copies of the appendices submitted with the Draft RI, the addenda submitted with this report, or Sheets 1, 2, 4 or 5, please do not hesitate to call.

As mentioned above, the NYSDEC returned several comments on the Municipal Aquifer Pumping Test Report (November 1992) and the RW-1 Pumping Test Report (December 1992) following their review of these reports. The NYSDEC's comments are addressed below.

<u>Municipal Aquifer Pumping Test Report (November 1992)</u>

The Municipal Aquifer Pumping Test Report is contained in the RI Report as Appendix V. No revisions have been made to the report itself; instead, we offer the following responses to specific comments.

1. While acknowledging the difficulties in attaining stabilization of the municipal aquifer (as referenced on pages 3-3, 4-5, 4-7, 6-1 and 6-2 of the report), emphasis was placed on the information which was obtained and the subsequent conclusions which were drawn from that information, within the constraints of the aquifer dynamics. We feel that the typical operation of the Kellar Well No.1 (K-1) system, pumping almost constantly at an optimal flow rate, provides adequate data to delineate the extent of influence at wells on the Miller property due to the operation of K-1.

2. The shape of the cone of depression around K-1 and Kellar Well No.

2/Municipal Well No.2 (K-2/M-2) are discussed within the report as being attributable to both the anisotropic nature of the overburden and the presence of the Oswego River acting as a recharge boundary. Subsurface soil descriptions and aquifer characteristics such as transmissivity indicate variations within the aquifer material. The influence of the Oswego River on the patterns of drawdown is addressed with reference to the cone around K-2/M-2 on page 4-2, and with reference on page 4-3 to the cone around K-1.

3. On Figure 4-7, equipotential lines are shown in blue and flow lines are shown in red. The flow lines terminate at approximately equally spaced intervals along an equipotential line near K-1 or K-2/M-2. The flow lines start at right angles to the Oswego River (recharge boundary) and intersect the equipotential lines at right angles. The intersection of the two families of lines produces a net of orthoganol cells that in some cases are nearly squares, but in most cases are not. The more the equipotential lines depart from concentric circles around a discharge point, the more non-square the cells will be. The geometry of the cone of depression around K-1 and K-2/M-2 results in asymmetric drawdown cones and therefore non-square cells. Theoretically, the flow through any cell equals the flow through any other cell.

4. The discussion on pages 6-2 through 6-4 of the report is presented with the understanding that municipal wells K-2 and M-2 have already been affected by contamination emanating predominantly from the area east of the Taylor Property on Miller Container property. Since ground water flow from identified source areas on the Miller Container property is to the west, in the general direction of K-2/M-2, and the principal component of ground water contaminant migration is due to advection, the contamination detected in the identified source areas would probably eventually be drawn to K-2/M-2 if the pumping regimen at these wells is maintained or increased and no interceptor wells are installed to contain the ground water contaminant plumes. Contamination referenced in this section of the pumping test report is considered to be contamination currently identified on the Miller Container site, with a discussion of the potential for further migration toward the municipal aquifer. Contaminant migration rates are discussed relative to the possibility of: contamination presently detected at K-2/M-2 migrating to K-1; contamination currently identified on Miller Container property continuing to migrate to K-2/M-2 and eventually to K-1; and contamination identified on Miller Container property migrating directly to the K-1 area.

RW-1 Pumping Test Report (December 1992, revised May 1993)

The RW-1 Pumping Test Report has been revised pursuant to many of the NYSDEC's comments and is included in its revised form in the RI Report as Appendix W. Responses to specific comments made by the NYSDEC are presented below.

1. We have provided the NYSDEC with the data on floppy disks.

2. In general, the correction factor is derived from measuring changes in water levels at "background" wells, i.e. wells considered to be out of the influence of the pumping well. Water level trends observed at the background wells over the duration of each phase of the pumping test are averaged and then subtracted from drawdown or recovery measured at the wells within the influence of the pumping well over the same time period.

   During the September 1992 RW-1 pumping test, we monitored water levels at upgradient shallow wells MW-38S and MW-39S. At the time, we felt that the monitoring of these wells would provide control data since they are located outside of the influence of any pumping well. However, as you point out in your comment letter, the wells monitored in the vicinity of RW-1 during the pumping test are screened at intermediate and deep intervals. Furthermore, many of the monitoring wells are located below the semi-confining silty clay layer which would serve to delay recharge. Therefore, the utilization of MW-38S and MW-39S as background monitoring wells was not appropriate in this case.

   Based on a review of the pumping test data, it is apparent that well MW-55D was not affected during the recovery or drawdown phases of the test. During these phases, the water level in MW-55D was on an overall slightly downward trend, and was apparently not affected by rainfall events that occurred during the test. This well would properly serve as a background well for RW-1 discharging at a rate of seven gallons per minute.

   Accordingly, the report has been modified to eliminate the use of MW-38S and MW-39S as background wells and to incorporate the use of MW-55D as a background observation well. The report has also been modified by :

   - Removing the precipitation data chart as the rainfall apparently had no observable effect on the wells monitored during the test.
   - Eliminating the corrected drawdown figure (Figure 4).
   - Inserting a new Figure 4 which illustrates the recovery during Phase 1 of the pumping test.

- Modifying tables in the report to reflect data that are not corrected by the MW-38S and MW-39S water levels.

In addition, background wells scheduled to be monitored during the planned flow increase at RW-1 (and RW-3) will include shallow and deep zone wells, and wells existing under both semi-confined and unconfined conditions. All background wells will be located outside of the expected influence of RW-1 at the higher pumping rate.

3. We agree with the NYSDEC comment that the fitting of type curves to the bulk data may not be the best approach with respect to isolating data between inflection points. However, the process of using the best-fit approach probably yields the best approximation of the data as a whole. We have included some additional applications of the solutions (see the response to Comment 4) where the type curves are fit to early data. We will also apply the information we obtain during the test of RW-1 at the increased flow rate to these solutions.

4. The Cooper-Jacob solution has been applied to MW-20D for data prior to the 100 minute point. Manually plotted data and calculated parameters are shown on a graph which has been added to Appendix B of the report. Table 2 and the discussion of the results have been modified to include these results.

5. An examination of the hydrographs in Appendix A reveals the presence of three recharge periods at most wells monitored during Phase 2 (drawdown phase) of the pumping test.

   The first recharge period, during which the smallest amount of recharge of the three recharge periods occurred, can be seen on the graphs beginning about one hour after the start of Phase 2 and was observed at all wells monitored except MW-19D, MW-56D (and MW-55D; however, no response was observed during any phase at MW-55D). The second recharge period occurred about one day into Phase 2, ranging from 18 hours at MW-17D to 24 hours at several wells and averaging about 23 hours into the drawdown phase. This period of recharge was observed at all wells except MW-56D (and MW-55D). The third recharge period, during which the greatest rebound occurred, started about two days into the drawdown phase and was observed at all wells except MW-17D (and MW-55D). A relatively small amount of recharge was detected at MW-19D during this period compared to the other wells where the third period of recharge occurred.

   The first recharge period may be the result of the intersection of sand and gravel units in the immediate vicinity of the pumping well as the drawdown spreads from the well. As the availability of ground water in these units is depleted, more rapid drawdown would resume. The second recharge period is attributed to the increased availability of ground water as the drawdown cone spreads into the area where the silty clay layer terminates. The earlier beginning of this period at MW-17D indicates that the silty clay layer is laterally less extensive in this direction from RW-1. The third period of recharge is attributed to the availability of ground water from the pond, and perhaps the drainage ditch that exits from the pond's southwest corner. The lack of this recharge period at MW-17D and the relatively minor recharge observed at MW-19D and MW-56D during this period are a function of the location of these wells relative to the pond.

Rapid drawdown/recovery fluctuations can be observed at each well during the peak traffic periods of the day at the Container Plant.

These observations have been incorporated into the modified RW-1 Pumping Test Report.

6. Data collected from MW-55D have been deleted from Appendix B (transmissivity and storativity graphs, including calculated aquifer parameters), Table 2, and the text has been modified accordingly.

   The MW-19D log-log plots in the draft RW-1 Pumping Test Report did not include the data collected late in Phase 2. As noted in the response to Comment 5, a recharge event did occur at this well at the end of Phase 2. The recharge can be seen on the hydrographs in Appendix A and is attributed to the effect of recharge from surface water in the area east and northeast of MW-19D. A smaller recharge event also occurred at this well at about 24 hours into Phase 2. This recharge is attributed to the availability of a larger supply of ground water as the drawdown from RW-1 spreads into the area where the silty clay layer ends and encounters a greater saturated thickness.

7. We have applied the Todd Equation the NYSDEC referenced in its comment letter to the pumping test data. According to the results, the ground water divide separating the area where contamination would or would not be drawn to RW-1 is located to the north of MW-8I. Therefore, according to this method, the contamination at MW-8I is being intercepted by RW-1. The ground water divide is shown on Figure 5 of the modified RW-1 Pumping Test Report. I should point out that the contamination in the vicinity of MW-56D and some contamination that is undoubtedly present between MW-56D and MW-8I is apparently not being captured by RW-1. This portion of the contaminant plume is probably responsible for the contamination observed at MW-13D.

We are hopeful that the Department's concerns relative to the Municipal Aquifer Pumping

Test Report and the RW-1 Pumping Test Report have been adequately addressed within this letter response.

Copies of this report are also being sent to the undersigned. We understand that one of the copies being sent to Charles Branagh (NYSDEC-Region 7) can be used for filing at the local Document Repository, the City of Fulton Public Library. If you should require additional copies of this report for this or other purposes, please let me know.

Very truly yours,

MALCOLM PIRNIE, INC.

Mark D. Wilder

Mark D. Wilder, CPG
Senior Project Hydrogeologist

enclosures

cc: Charles Branagh, NYSDEC (w/2 enclosures)
G. Anders Carlson, NYSDOH (w/2 enclosures)
Michael Lesser, NYSDEC (w/1 enclosure)
Ronald Heerkens, NYSDOH (w/1 enclosure)
Michael O'Toole, NYSDEC (w/1 enclosure)
Evan Walsh, Oswego County Health Department (w/1 enclosure)
Garrett Reich, Miller Brewing Company (w/1 enclosure)
Dan Barthold, Miller Brewing Company (w/1 enclosure)
Lev Kropp, Miller Brewing Company (w/1 enclosure)
Edward Martin, Miller Brewing Company (w/o enclosure)
Jeff Boehler, Miller Brewing Company (w/1 enclosure)
Alex Melnyk, Miller Brewing Company (w/1 enclosure)
Kelley Brown, Miller Brewing Company (w/o enclosure)
Kwesi Mends-Aidoo, Miller Brewing Company (w/1 enclosure)
Barry Kogut, Bond, Schoeneck, & King (w/1 enclosure)

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REMEDIAL INVESTIGATION REPORT

MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK

JULY 1993

MALCOLM PIRNIE, INC.

7481 Henry Clay Boulevard
Liverpool, New York 13088

2 Corporate Park Drive
White Plains, New York 10602

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1.0 INTRODUCTION

1.1 GENERAL

This Remedial Investigation (RI) Report has been prepared for the Miller Brewing Company, Container Division site (Registry #738029) located in Fulton, New York (Miller). The report includes information obtained during previous site investigations as reported in the Interim RI Report (June 1991), the Draft RI Report (April 1992), and data collected to supplement the information presented in the Draft RI Report including the municipal aquifer pumping test and the RW-1 pumping test. The IRI Report was based on data through March 1991. The RI Report is based on data collected through January 1993; however, water quality data presented in this report are through August 1992 since this was the most recent ground water sampling event which included all sampling locations. The RI Report has been developed based on United States Environmental Protection Agency (EPA) guidance on RI/FS report preparation and New York State Department of Environmental Conservation (NYSDEC) guidance on the RI/FS process.

The work performed for the RI is in accordance with the RI/FS Work Plan which was originally submitted in May 1990, revised in October 1990 and approved by letter from the NYSDEC dated February 13, 1991.

1.2 PURPOSE OF THE REMEDIAL INVESTIGATION REPORT

The purpose of the RI Report is to:

1. Discuss the field investigation activities performed at the site prior to and during the RI.

2. Present the additional data collected during the RI for the time period from March 1991 through January 1993. Present the ground water quality data collected through August 1992, plus the recent analytical data from the newest site well cluster (MW-60S,I,D).

3. Evaluate the data collected relative to defining the nature and extent of contamination attributable to the use of the former spill containment tank and additional source areas at the Miller Container facility.

4. Reassess the remediation being employed at the Miller Container site.

5. Present the baseline risk assessment.

6. Assess the data collected to determine if additional work is required at the site.

7. Define the aquifer from which K-1, K-2 and M-2 withdraw ground water in order to evaluate the potential for currently identified site contamination to migrate to K-1.

8. Present a refined list of remedial actions for review and assessment during the Feasibility Study (FS).

1.3 SITE BACKGROUND

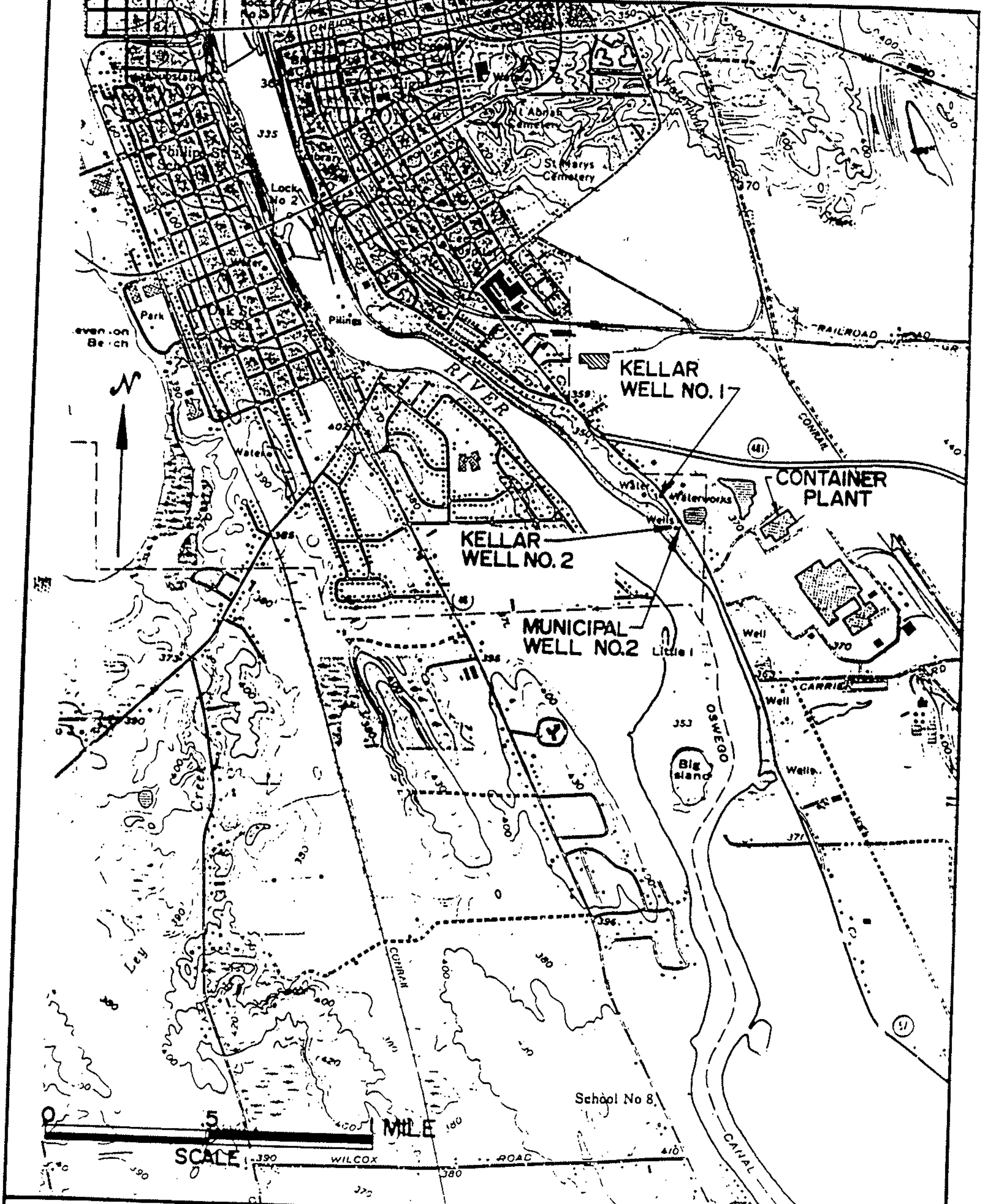
1.3.1 Site Location and History

Miller Brewing Company owns and operates a Container Division in the Town of Volney, Oswego County, New York.

The Container facility is located approximately 1200 feet southeast of the City of Fulton, New York municipal boundary, approximately 1000 feet northeast of the Oswego River and approximately 900 feet south of New York State Route 481 (Figure 1-1).

A spill containment tank, with an approximate capacity of 500 gallons, was installed when the Container Plant was constructed. Construction was completed in 1976. The tank originally installed was a steel tank which was replaced with a concrete tank in 1978. No evidence of leakage was found and no samples were collected at the time of this replacement. The tank was connected by three pipelines to trench drains in the drum storage room. The discharge outlets from the trench drains were plugged in December 1985. During April 1986, the spill containment tank and the piping to the drum storage room were excavated and removed. The former spill containment tank and its associated piping layout is shown on Figure 1-2.

Although there were no recorded spills in the drum storage room, visual and olfactory evidence of possible contamination during the tank removal led to the hiring of an engineering firm to collect samples from in and around the tank and its associated piping. Samples of the spill containment tank contents and samples of soil and water collected from outside the tank all contained relatively high levels of several volatile organic compounds (VOCs). Miller notified the NYSDEC and hired an engineering firm to conduct a hydrogeologic investigation in the vicinity of the former tank.



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MILLER CONTAINER DIVISION
SITE LOCATION MAP

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FIGURE NO.
1-1

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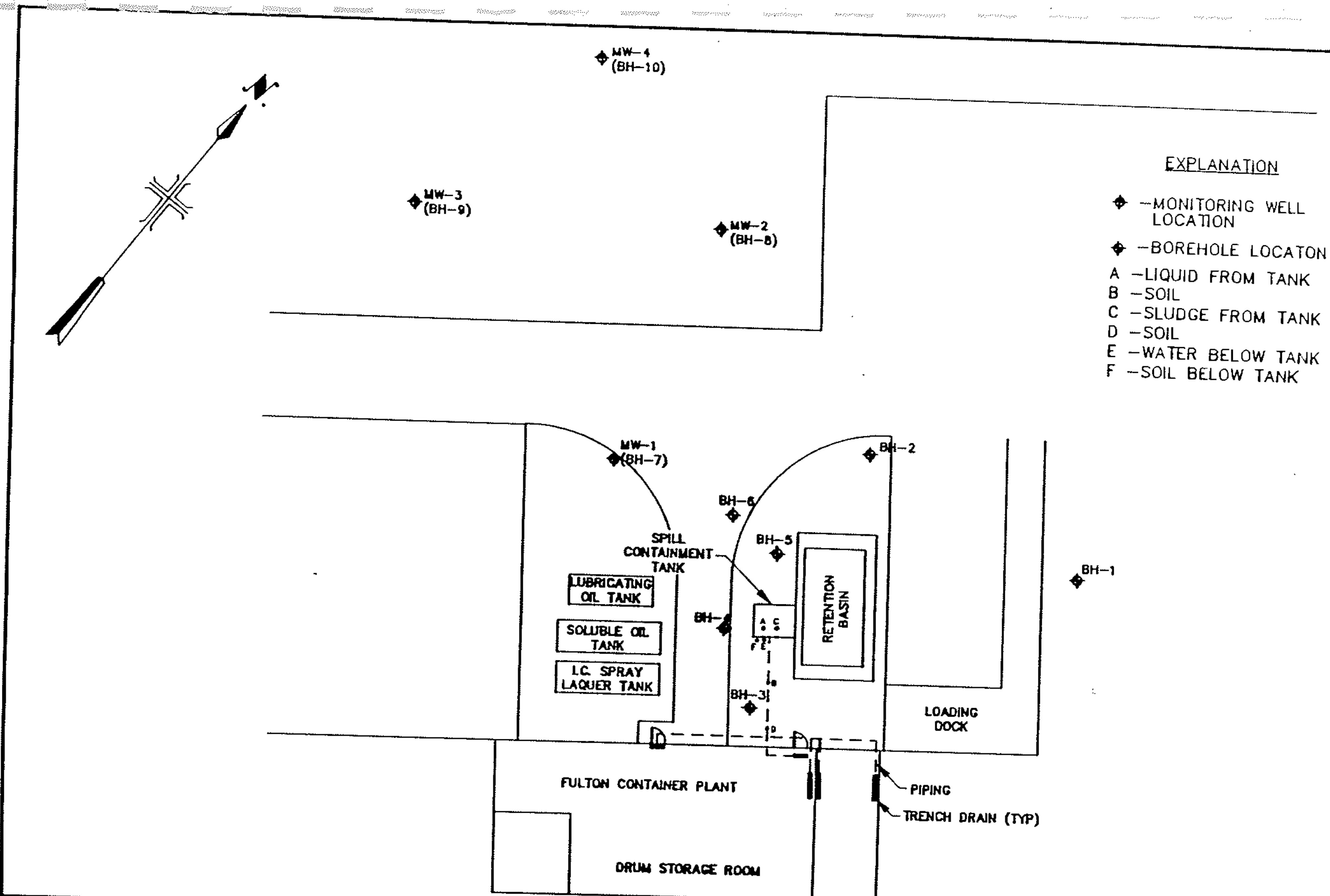

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1986 BOREHOLES AND MONITORING WELLS (C&S)

MALCOLM PIRNIE, INC.

FIGURE 1-2

During the course of what turned out to be the first phase of the hydrogeologic investigation, it was discovered that one of the same compounds that had been detected near the former spill containment tank had also been detected at one of the City of Fulton municipal water supply wells. This municipal well was determined to be roughly hydraulically downgradient of the spill containment tank area. Therefore, additional hydrogeologic investigations to determine the extent of contamination due to the leakage from the former spill containment tank system followed. During these investigations, numerous monitoring wells were installed at the site in an attempt to define the subsurface geological and hydrogeological characteristics and to provide points for collecting ground water samples for chemical analyses. Eventually, a ground water recovery system was installed to withdraw contaminated ground water for on-site treatment. A summary of all investigations performed at the site to date follows.

1.3.2 Previous Investigations

1.3.2.1 Spill Containment Tank Removal (1986)

Day Engineering, Rochester, New York was hired by Miller to collect samples from the spill containment tank contents, from the soil and water from the excavation area around the tank after it was removed and from the soil below the piping from the tank to the drum storage room. The samples were collected during April 1986.

The soil and water samples collected from inside and around the spill containment tank all contained elevated levels of 1,1,1-trichloroethane (TCA) and tetrachloroethylene (TTCE). The same compounds were also detected in soil samples collected from under the piping to the drum storage room. Some of the samples also contained methylene chloride, 1,1-dichloroethane (1,1-DCA), trichloroethylene (TCE), toluene, xylenes and ethylbenzene. A summary of the analytical results is listed in Table 1-1. This release of contamination into the soil and ground water around the tank prompted Miller to employ Calocerinos and Spina (C&S) to conduct further investigations in the vicinity of the former tank and its associated piping.

1.3.2.2 Phase I: Investigation by C&S (1986)

C&S was retained by Miller to perform the first phase of the hydrogeologic investigation. Ten soil borings were completed to determine the nature and thickness of geologic units around the former spill containment tank location, to permit collection of soil

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TABLE 1-1
APRIL 1986
SAMPLE RESULTS SUMMARY

	A Liquid from Spill Containment Tank (ug/l)	B Soil under Piping 19' North of Building (ug/kg)	C Sludge from Bottom of Spill Tank (ug/kg)	D Soil under Piping next to Building (ug/kg)	E Soil from South side of Spill Tank (ug/kg)	F Water from Excavated Area after Tank Removal (ug/l)
GC METHOD 601						
Methylene Chloride	58800	<500	533000	<500	<500	<100
1,1-Dichloroethane	13100	1055	58000	1400	<500	370
1,2-Dichloroethylene	<100	<500	<1000	<500	<500	460
1,2-Dichloroethane	1400	<500	3700	<500	<500	<100
1,1,1-Trichloroethane	119000	28000	686000	11000	54000	44500
Trichloroethylene	1300	3100	6400	4200	2000	<100
Tetrachloroethylene	8500	29000	2200	5500	1E+06	23800
GC METHOD 602						
Toluene	1600	1700	3200	<1000	<1000	560
Ethylbenzene	<200	<500	<2000	<1000	<1000	720
m-Xylene	700	3300	<2000	<1000	<1000	17900
o-Xylene	530	3200	<2000	<1000	<1000	19000

Modified from: C&S Report, August, 1986.

samples for an assessment of soil contamination and to provide boreholes for the installation of monitoring wells. Although the likely direction of ground water flow was predetermined to be generally to the west from the spill containment tank area toward the Oswego River, six borings were drilled in an approximate semi-circle around the former spill containment tank location to provide information on potential contaminant migration in different directions. The other four boreholes were drilled in a direction to the west and northwest from the former tank. The locations of these boreholes are shown on Figure 1-2.

The soil borings were drilled to an average depth of 50 feet below land surface, where a relatively low permeability glacial lodgement till occurs. Based on the drilling in this area, it was determined that overlying the lodgement till is a high gravel content silty sand, averaging four feet thick. Overlying this unit is a sandy silt deposit, averaging 37 feet in thickness, then fill material, averaging ten feet thick.

The top of the lodgement till was determined to dip to the west-northwest, resulting in a northwest thickening wedge of unconsolidated material overlying the lodgement till.

Recorded HNU readings revealed that the total organic vapor concentrations were low in the soil samples collected to the north, east and south of the former spill containment tank area. However, the total organic vapor content was relatively higher to the west and northwest. Therefore, four monitoring wells were installed in this direction from the former tank. The locations of the boreholes where monitoring wells were installed (BH-7, 8, 9 and 10) are also shown on Figure 1-2. The wells were screened in the silty sand and gravel unit immediately overlying the lodgement till (the "deep" zone) to monitor for the presence of a dense nonaqueous phase layer of contamination since many of the compounds have a specific gravity greater than that of water. It was assumed that the low permeability glacial lodgement till unit, compared to the overlying sand and gravel, would serve as a barrier to downward vertical contaminant migration. The drilling logs and well construction diagrams for wells MW-1, MW-2, MW-3 and MW-4 are provided in Appendix A.

Ground water samples collected from the wells were analyzed for the compounds on the EPA GC/MS Method 624 list. A summary of the analytical results is shown on Table 1-2. Several of the compounds detected during the analysis of the samples from in and around the spill containment tank and below the piping were also detected in the ground water samples.

Measurement of the water level elevations in the four monitoring wells indicated that the ground water occurring in the deep zone was flowing to the west toward the Oswego

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TABLE 1-2
SUMMARY OF COMPOUNDS DETECTED IN GROUND WATER SAMPLES DURING THE C & S INVESTIGATION (1986)

	METHYLENE CHLORIDE (ug/l)	1,1-DICHLORO-ETHYLENE (ug/l)	1,1-DICHLORO-ETHANE (ug/l)	1,1,1-TRICHLORO-ETHANE (ug/l)	TRICHLORO-ETHYLENE (ug/l)	TETRACHLORO-ETHYLENE (ug/l)	TOLUENE (ug/l)
MW-1	110	26	93	350	7J	230	6J
MW-2	BDL	11	21	860	BDL	BDL	BDL
MW-3	8J	13	73	460	BDL	150	15
MW-4	BDL	61	91	4300	BDL	BDL	BDL

NOTES:
BDL = Below Detection Limits (10 ug/l)
J = Estimated Concentration

River. The water level elevations collected from these wells during this phase of work are tabulated in Appendix B. One of the City of Fulton water supply wells, Municipal Well No. 2, was determined to be located hydraulically downgradient between the former spill containment tank location and the river. During the course of the C&S investigation, it was discovered that 2 ug/l of TTCE was detected at Municipal Well No. 2 during August 1985 and August 1986.

The presence of TTCE at Municipal Well No. 2 and in the soil and water near the spill containment tank, coupled with ground water flowing in roughly a direction toward Municipal Well No. 2 from the spill containment tank area, led to speculation by the NYSDEC that the contamination from the spill containment tank system was responsible for the contamination detected at Municipal Well No. 2. During August 1986, the NYSDEC first requested that Miller start sampling Municipal Well No. 2. In lieu of sampling the municipal well, Miller offered to install a well cluster (consisting of a shallow well screened at the water table and a deep well screened just above lodgement till) at the property boundary in line between the municipal well and the location of the former spill containment tank. The NYSDEC accepted this proposal, but it was also determined that additional work was necessary to:

1. Delineate the extent of the ground water plume emanating from the spill containment tank area.

2. Establish and evaluate potential remedial alternatives.

3. Ultimately implement a remedial approach that would clean up the spill containment tank contamination.

1.3.2.3 Phase II: Initial Investigation by MPI (1986)

Malcolm Pirnie, Inc. (MPI) was contracted during September 1986 to perform the following work tasks.

- Evaluate literature on the City of Fulton water supply system.
- Oversee test borings and test pit excavation.
- Collect soil samples for chemical analysis.
- Oversee the installation of monitoring wells.
- Estimate horizontal hydraulic conductivities and seepage velocities.

- Collect ground water and surface water samples for chemical analysis.

These tasks were completed during September and October 1986. The results were presented in a report, dated December 1986, and are summarized in the following paragraphs.

A. Literature Evaluation

Literature was not available on the well construction of the municipal wells or the discharge piping layout, nor were drilling logs available. Some information was obtained during conversations with city and county officials. Additional information was obtained on the general characteristics of the aquifer from which Municipal Well No. 2 draws its water supply.

Municipal Well No. 2 was initially reported to be a 3-foot diameter, concrete casing Ranney collector well which was dug in the early 1900's and extends to a depth of about 35 feet below land surface. At the bottom of the well, it was reported that six perforated cast iron pipes extend eight to ten feet radially from holes in the concrete well. However, based on information (in the form of a video tape recorded during the process of well redevelopment) made recently available by the City of Fulton, it appears that this well may not include the cast iron pipes as originally reported. The well diameter does not appear to be wider at the bottom than at the top, which would be required for hydraulically jacking the cast iron pipes out into the formation.

A United States Geologic Survey (USGS) well was installed near Municipal Well No. 2 during 1981 to obtain information on the subsurface units in the area. The location of this well and another USGS well (USGS-1) in the area are shown on Figure 1-3. The drilling logs for this well show, in descending order, eight feet of clayey sand and gravel, two feet of sandy clay, 25.5 feet of sand and gravel and 12.5 feet of coarse gravel. The total depth of drilling for the well was 48 feet. No information was available on the characteristics of the aquifer near Municipal Well No. 2 below this 48-foot depth.

B. Test Borings and Installation of Monitoring Wells

The test borings were drilled to permit the installation of a shallow well to a depth of about five feet below the water table and a deep well with its bottom coinciding with the sand and gravel/lodgement till contact. Eighteen test borings were completed during this phase of the investigation. A monitoring well was installed in each borehole. The location of the wells installed during this phase of work are shown on Figure 1-3.

Monitoring wells MW-10S,D were installed first, followed by MW-8S,D, MW-9S,D and MW-7S,D. Monitoring well cluster MW-10S,D is located about 150 feet east of Municipal Well No. 2 at the Miller property boundary. While cluster MW-8S,D was being installed, MW-10S,D were developed and sampled. The samples were submitted to an analytical laboratory and 24-hour turnaround was obtained. While cluster MW-9S,D was installed, water from MW-8S,D was sampled and analyzed, and so on. Well clusters MW-7 through MW-10 were intended to enable monitoring of ground water quality along potential contaminant flow paths between the spill containment tank area and Municipal Well No. 2. The ground water samples were analyzed for compounds on the EPA Methods 502.1 and 503.1 lists, based on NYSDEC request. All compounds were below the detection limit (generally 1 ug/l) in the initial samples collected from well clusters MW-10, MW-9, MW-7 and well MW-8S. However, 3 ug/l of 1,1-DCA was detected at well MW-8D.

Subsequent to well cluster MW-7, cluster MW-6S,I,D was installed. Well clusters were then completed at the initial four deep well locations (MW-1 through MW-4) by installing shallow wells and upgradient well MW-5 was installed to monitor background water quality. Due to the thin interval of unconsolidated material over the lodgement till at the MW-5 location, only a single shallow well was installed. The intermediate well in the MW-6 cluster, MW-6I, was installed due to the occurrence of oil staining in the interval between the projected screening depths for wells MW-6S and MW-6D. Oil-stained samples compiled from water obtained from MW-6I and oil samples from two underground storage tanks, which contain oil-based products and are located hydraulically upgradient of MW-6I, were analyzed by gas chromatograph (GC) in an attempt to cross-match GC peaks. No match was made.

The last well cluster installed during this phase of the investigation was MW-11S,D. This cluster was installed in response to the 1,1-dichloroethane contamination detected at MW-8D. Drilling logs and well construction diagrams for these wells are included in Appendix A.

C. Ground Water Quality

Ground water quality data were obtained from MW-5 in October 1986 and are contained in Appendix C. Contaminant concentrations observed at this well are considered background levels as MW-5 is located upgradient from and out of the influence of the spill containment tank area. All compounds measured were shown to be below a detection limit of 1 ug/l, except total xylenes listed as below a detection limit of 3 ug/l, and 1,2-dichloropropane measured at 2 ug/l.

Contamination above background was detected at shallow wells MW-1S, MW-2S and MW-6S. Contaminants above background levels were detected at deep zone wells MW-1D, MW-2D, MW-3D, MW-4D, MW-6D and MW-11D, in addition to the contamination noted at MW-8D. The data indicated that the ground water plume from the spill containment tank was more extensive within the deeper ground water zone.

D. Seepage Velocities

Ground water seepage velocities between wells were estimated based on hydraulic gradients, horizontal hydraulic conductivities and estimated effective porosity. The seepage velocity was estimated to be relatively low between wells MW-1D and MW-3D (2 feet per year); however, the seepage velocity increased with distance from the plant toward Municipal Well No. 2. Between wells MW-3D and MW-11D, the seepage velocity was estimated to be 60 feet per year. Between wells MW-11D and MW-8D, and between wells MW-8D and MW-10D, the seepage velocities were approximately 145 and 435 feet per year, respectively.

E. Surface Water Quality

Three surface water samples were collected from the pond and one surface water sample was collected from an intermittent stream that drains a topographically low area near cluster MW-10 during periods of heavy precipitation. No compounds were detected at concentrations exceeding the detection limit (usually 1 ug/l).

F. Test Pit

Three soil samples were collected from a test pit excavated from 10 feet north to 20 feet northwest of the former spill containment tank location (to a depth of about 10 feet) and were submitted for chemical analysis. The samples selected were based on relatively higher HNU readings detected in different parts of the test pit. The same compounds that were detected in the spill containment tank area were also detected in this test pit. The fact that the contaminants were detected in the unsaturated zone (the water table occurrence is about 20 feet below grade in this part of the site) at some distance from the former spill containment tank and its associated piping indicated that some type of remediation of the soil in the source area might be warranted.

1.3.2.4 Additional MPI Investigations Prior to Treatment System Startup

A. Additional Monitoring Wells

The NYSDEC reviewed the analytical results and the report summarizing the second phase of work at the site. Based on the contamination detected at MW-8D, the NYSDEC requested two additional deep wells to monitor contamination downgradient of MW-8D and to make sure that contamination was not migrating between well clusters MW-7, MW-8 and MW-9. During December 1986, Miller authorized the installation of deep wells MW-13D and MW-14D. The NYSDEC also requested that a shallow well be installed at the MW-12S location to monitor water levels and to validate the shallow ground water flow directions that were depicted in the December 1986 report. During December 1986, these three wells were installed. A shallow well was also installed at the MW-14D location in response to elevated HNU readings. These readings were detected when a soil sample collected during the drilling for MW-14D was subjected to organic vapor analysis. The location of these wells is shown on Figure 1-3.

B. Terrain Conductivity Survey

The occurrence of contamination in the shallow zone near MW-14D, coupled with the lack of shallow zone contamination between this location and the spill containment tank area, and the fact that buildings associated with the Taylor farm used to stand in this area, suggested that another source of contamination might be present in this area. A terrain conductivity survey was initiated during January 1987 to check for underground tanks that could have been abandoned when the farm was sold. The geophysical survey was also performed in the vicinity of cluster MW-10, where a building was formerly located and near MW-13D, where aerial photographs showed more buildings associated with the Taylor Farm. Conflicting information exists on the true nature of operations at the building which was located in the vicinity of cluster MW-10. The possible operation of a dry cleaning facility was reported; however, only a laundry may have existed here.

Relatively low conductivity values were obtained near cluster MW-10, except when near the sanitary sewer manhole. Low readings were also obtained near MW-13D. Higher values were obtained in the vicinity of well cluster MW-14 and to the south of cluster MW-14 along the eastern boundary of the Taylor property near the fence separating the Miller property and the Taylor property. The higher values along the fence, which were interpreted in the field as either interference due to the fence or a result of buried metallic objects, necessitated further investigation.

A backhoe was brought to the site and a trench was excavated along the fenceline. A 2-foot wide building foundation was uncovered in a location that corresponded to the barn that formerly stood in this area according to aerial photographs. Metal rebar was utilized during the construction of the foundation. A second trench was excavated further to the south, along the east side of the garage which is still standing on the Taylor property. Fill material, including styrofoam insulation with metal backing was uncovered. At the time, the higher conductivity readings in this area were attributed to this material. However, in retrospect, the higher readings were probably also due to the two buried steel tanks which were later discovered on the Taylor property about 10 feet west of where the excavation took place.

C. Ground Water Remediation Protocol

Ground water samples were collected from all wells on-site during December 1986. The analytical data from the December 1986 sampling event, and from preceding sampling events, were evaluated during January 1987. These data are tabulated in Appendix C.

A map showing the extent of contamination due to the spill containment tank leak was generated and incorporated into the Ground Water Remediation Protocol which was sent to the NYSDEC in February 1987. The contaminant plume shown on this map was defined by first determining the concentration value at each well cluster, as follows:

- The maximum concentration of each compound detected in any of the wells at a well cluster was identified from all available ground water analytical results.

- The maximum concentration of all compounds detected at each well cluster was summed, resulting in the maximum total detected organic contaminant concentration at each well cluster.

These values were considered to represent a worst-case scenario in terms of ground water contaminant levels. The contaminant plume was then drawn to encompass the following area.

Horizontally:

- Regions where the maximum total detected organic contaminant concentration exceeded 10 ug/l.
- Areas where the concentration of TCE exceeded 10 ug/l.
- Areas which contain detectable concentrations of benzene.

Vertically:

- The saturated ground water zone between the maximum high water table surface and the top of the glacial lodgement till below the horizontal area described above.

Benzene and TCE were utilized in the designation of the plume area because of the availability of NYSDEC Class GA ground water standards for these compounds.

Discussions between representatives of Miller and the NYSDEC led to the conclusion that the remedial program that could be implemented to address the ground water contamination in the shortest possible time involved the installation of recovery wells in the area of the plume and the routing of the contaminated ground water to the Fulton Municipal Wastewater Treatment Plant (WWTP) for treatment. The Ground Water Remediation Protocol was prepared with this program in mind; however, it recognized that other remedial alternatives for treating the contaminated ground water might also be feasible. Due to the proximity of Municipal Well No. 2, the ability to contain the plume and prevent its migration within a short time frame was given the greatest weight during the screening of remedial alternatives.

The pumping well capture-zone method, developed by Javandet and Tsang, was used to estimate the pumping rate and help locate the recovery wells which would be used to capture the contaminant plume. Recovery Well No.1 (RW-1) was intended to prevent migration of the contaminant plume in a downgradient direction toward Municipal Well No. 2. Recovery Wells No. 2 and No. 3 (RW-2 and RW-3) were intended to pump from specific areas of the plume to speed up the remediation process. The locations of these pumping wells are shown on Figure 1-3.

There are certain assumptions that are made about the physical properties of the aquifer when the pumping well capture-zone method is used, including:

- The aquifer is homogeneous and isotropic.
- The aquifer has uniform thickness.
- The aquifer is confined.
- The pumping well screen will fully penetrate the aquifer.

Assumptions such as these are inherent in any method used for the same application. In order to offset the assumptions, conservative estimates of the plume width, hydraulic conductivity, hydraulic gradient and saturated aquifer thickness were used.

Based on the conservative values used in the calculation, it was estimated that pumping 6 gallons per minute (gpm) from RW-1 would completely capture the plume. However, as stated in the Protocol, the actual pumping rate was to be determined by the operation of the installed system. It was envisioned that RW-1 would be installed with the discharge piping directly to the sanitary sewer. A pumping test would be performed and modifications to the 6 gpm discharge rate would be made as needed to obtain the desired drawdowns. RW-2 and RW-3 were intended to be initially pumped at 2 gpm each.

D. Post Ground Water Remediation Protocol Developments

Subsequent to the preparation of the Ground Water Protocol, the NYSDEC determined that pretreatment of the recovered ground water would be necessary prior to putting the water into the sanitary sewer.

This modification in the discharge requirements meant that a treatment system needed to be in place prior to the performance of the pumping test.

MPI started an evaluation of various treatment technologies to remove the quantity of volatile organic compounds that had been detected in the ground water due to the spill containment tank leak. The ground water analytical data available at the time of preparation of the protocol were averaged and the average values were totalled. The total detected organic compounds averaged 605 ug/l per analysis. Based on these low levels of contamination, the proportion of relatively clean water included in the total that would be pumped from RW-1 (60 percent) and the pretreatment discharge requirements, it was determined that air stripping would remove enough volatile organics to meet the effluent standards.

During February 1987, the NYSDEC conceptually approved of air stripping as the pretreatment method, provided that several conditions were met. These conditions included:

- Obtaining permission from the City of Fulton to discharge into the sanitary sewer system.
- Obtaining an approved Air Discharge Permit from the NYSDEC. This was to be the only permit required provided that Miller sign a Consent Order with the NYSDEC.
- Treatment of the contaminated water to NYSDEC specified effluent limits. The discharge limits set by the NYSDEC are listed on Table 1-3.

During February, March and April 1987, work was begun to select an appropriate air stripper that would treat the levels of contamination to the specified effluent limits. Calculations for the Air Discharge Permit were performed based on the discharge limits, drilling contractors were contracted for installation of the recovery wells, negotiations began between the City of Fulton and Miller and the necessity of a Consent Order was examined. On April 3, 1987, Miller was notified by the NYSDEC that an Interim Consent Order would be required. Drilling for installation of the recovery wells commenced as planned during April 1987. However, since the type of treatment system could be affected by the final language of the Interim Consent Order, it was necessary to delay work associated with the finalization of the treatment system.

On April 20, 1987, the NYSDEC communicated new discharge limits to Miller. The April 20, 1987 limits are also listed on Table 1-3. The lower discharge requirements resulted in a reevaluation of the treatment system that was intended to be utilized and required recalculation of the amount of organics that would be stripped to the air.

Drilling for the recovery wells occurred during April 1987. However, the wells could not be completed (well screens emplaced and wells developed) until a treatment system was in place. Negotiations with the NYSDEC regarding the Interim Consent Order and the Air Discharge Permit, and with the City of Fulton over the use of the sanitary sewer took place over the next several months. While these negotiations were underway the basic treatment system layout was designed. Following is a tabulation of important dates, and the events that took place on those dates relative to the operation of the treatment system.

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TABLE 1-3
FEBRUARY 20, 1987 AND APRIL 20, 1987
NYSDEC EFFLUENT LIMITS

PARAMETER	FEBRUARY 20, 1987 LIMITS (ug/l)	APRIL 20, 1987 LIMITS (ug/l)
METHYLENE CHLORIDE	25,000	50
1,1,1-TRICHLOROETHANE	500	20
TRICHLOROETHYLENE	10	10
TOLUENE	500	50
1,1-DICHLOROETHYLENE	50	30
1,1-DICHLOROETHANE	50	30
TETRACHLOROETHYLENE	400	400

June 1987 - Treatment system design received by Miller.

August 3, 1987 - Air Permit Application sent to NYSDEC.

August 4, 1987 - Sewer Use Permit Application filed with City of Fulton.

September 23, 1987 - Final bids for treatment system contract received by Miller.

October 1, 1987 - City of Fulton responds to Sewer Use Permit Application.

October 5, 1987 - Contract awarded for treatment system construction.

October 7, 1987 - Sewer Use Permit issued.

October 8, 1987 - NYSDEC issues Air Permit to Construct.

November 1987 - Treatment system construction begins and Interim. Order on Consent signed by Miller.

January 22, 1988 - Interim Order on Consent signed by NYSDEC.

Water levels were obtained at all monitoring wells on a monthly basis and monthly ground water samples were collected from a reduced list of monitoring wells. Samples were obtained from all monitoring wells quarterly. The water level records are listed in Appendix B and the results of the ground water analyses are included in Appendix C. The recovery wells were developed during April 1988. Step drawdown tests were performed at each well on an individual basis after well development was completed. These tests were conducted to determine well characteristics such as the capacity of the well to produce water (yield versus drawdown). This information would then be used to establish the pumping rate during the planned pumping test.

During the step drawdown test, each recovery well was pumped at a relatively low rate until the water level drawdown reached approximate stabilization. The rate was then increased in several steps in order to estimate optimum yield. Based on the step drawdown tests, it was estimated that RW-1, RW-2 and RW-3 would be capable of yielding at least 9-10 gpm, 15 gpm and 4 gpm, respectively, on a short-term basis without lowering the water level below the pump intake. In order to make a preliminary estimate of the long-term potential yield of the recovery wells, information on the characteristics of the aquifer (transmissivity, storativity, etc.) around each well was obtained. This information was gathered during the performance of a pumping test.

1.3.2.5 Pumping Test

The pumping test involved the removal of water from the wells while the reaction of the aquifer to the stress applied was observed. The observations were made at monitoring wells near each recovery well. The normal change in the water level is the creation of a cone-like zone of depression surrounding the wells. This cone is unique in shape and lateral extent and is dependent primarily on the time since the test started, the volume or rate of water withdrawn and the hydraulic characteristics of the aquifer. The reliability of the analyses performed on the data collected to evaluate the aquifer characteristics is dependent on the features of the test including test duration, number of observation wells and method of analysis.

The pumping test was performed during June 1988 starting with a combined withdrawal rate of 10 gpm. This rate was based on the estimates determined by the capture zone method. Water level readings were obtained at wells around the recovery wells for four hours, then the rate of withdrawal was increased to a combined 16 gpm discharge rate. This rate was maintained for about two days. In addition to providing information for an estimate of the aquifer characteristics, the test was also performed to check the general operating conditions of the treatment system, including: the performance of the submersible pumps, the integrity of the piping network and the performance of the air stripping column used for pretreatment. Ground water samples were collected during the test from each recovery well prior to treatment (influent), from the combined recovery well water prior to treatment (combined influent) and from the water discharged to the sanitary sewer after treatment (effluent). Water levels in the recovery wells and at all monitoring wells on-site, were recorded on several occasions during a period of premonitoring in order to establish any preexisting seasonal trends in water level fluctuation.

The results of the pumping test were presented in the Pumping Test Report, dated September 1988. The Pumping Test Report was also included as an Appendix in the December 1988 Status Report on the operation of the system.

The following conclusions were warranted by the data collected during the pumping test and the subsequent data evaluation.

- Water level drawdown due to pumping at the recovery wells was observed at several monitoring wells (including MW-8D) during the pumping test.

- The location of the monitoring wells that were affected by the pumping indicated that operation of the pumps on a continuous basis should create a cone of influence of sufficient area to capture the identified contaminant plume from the spill containment tank and prevent migration of the contaminants past RW-1.

- The specific capacity of RW-2 is approximately three times greater than RW-1 and five times greater than RW-3.

- The transmissivity of the aquifer near RW-1 is approximately twice the transmissivity near RW-2 and three times the transmissivity near RW-3. However, the transmissivity near all recovery wells is relatively low.

- The storativities calculated for the aquifer near the recovery wells ranged from 0.021 near RW-2 to 0.003 near RW-1. The average storativity (specific yield) near RW-3 was calculated to be 0.012. These values indicate that the aquifer near RW-1 is under confined conditions, while unconfined conditions exist near RW-2 and RW-3.

- Operation of the recovery system at higher rates and in a different mixture ratio is possible and may be advantageous depending on the availability of ground water and contaminant migration patterns.

- No compounds on the USEPA Methods 601 and 602 lists were detected above analytical detection limits in ground water collected from RW-1. One compound was detected in RW-2 ground water while several were present above detection limits in samples collected from RW-3. TTCE and TCA were detected at the highest concentrations.

- The effluent sample collected from the treatment system at the 10 gpm combined discharge rate contained no compounds on the 601/602 lists.

- The effluent sample at the 16 gpm combined rate contained 4 ug/l of TCA.

- A comparison of the combined influent concentration of TCA at the 16 gpm rate relative to the effluent concentration of the same compound at the same rate, results in a 98.5 removal percentage at the air stripper.

The operation of the treatment system formally began on June 27, 1988. Prior to system start-up, samples were collected at the Municipal WWTP to develop a data base to determine if the WWTP was affected due to operation of the Miller treatment system.

1.3.2.6 Operation of the Treatment System

The procedures for start-up of the ground water recovery and treatment system were specified in the Interim Order on Consent and in the City of Fulton Sewer Use Permit. Samples were collected, as shown on Table 1-4, in accordance with those documents. At the direction of the NYSDEC, the City of Fulton required Miller to sample Municipal Well No. 2 on a monthly basis. The sampling of Municipal Well No. 2 by Miller began in November 1987 and continued on a monthly basis until Miller's execution of a second Order on Consent in March of 1990 which increased the frequency to weekly sampling.

Since the system was started during a relatively dry period of the year, the initial pumping rates for the recovery wells were 6, 2 and 2 gpm at RW-1, RW-2 and RW-3, respectively. At these flow rates the concentration of contaminants in the air stripper effluent was consistently below the discharge limits. The results of the analyses performed on the samples collected at the air stripper immediately after the system began operating are listed in Appendix D.

On July 7 and July 8, 1988, the flow rates were increased to 8, 5 and 3 gpm at the three recovery wells, respectively, in order to check the efficiency of the air stripper at higher flow rates. At the end of the two-day period the rates were again adjusted to 6, 2 and 2 gpm. The analytical results of samples collected at the higher rates indicated that 30 ug/l of TCA was present in the tower effluent. On July 21 and 22, 1988, the rates were modified to 8, 5 and 2.5 gpm. At these flow rates the effluent limits were met. Plans were made to increase the flow rates upward when seasonal conditions permitted. However, the summer months of 1988 were unusually dry and before increased precipitation occurred during the autumn months RW-3 experienced difficulty maintaining even the 2 gpm flow rate. As shown on Table 1-5, low water levels in RW-3 automatically shut down RW-3 during August 1988.

Between August 30 and September 1, 1988, RW-3 was redeveloped in an attempt to make the well reliable again. Although this effort produced short-term positive results, RW-3 continued to have trouble maintaining flow.

As shown on Table 1-5, the flow rates from RW-1 and RW-2 were set at 3.5 and 5 gpm, respectively, during the period from September 27, 1988 to April 3, 1989. The flow rate was reduced at RW-1 and increased at RW-2 during this period due to the problems with the operation of RW-3. It was felt that if RW-1 was allowed to operate at a higher

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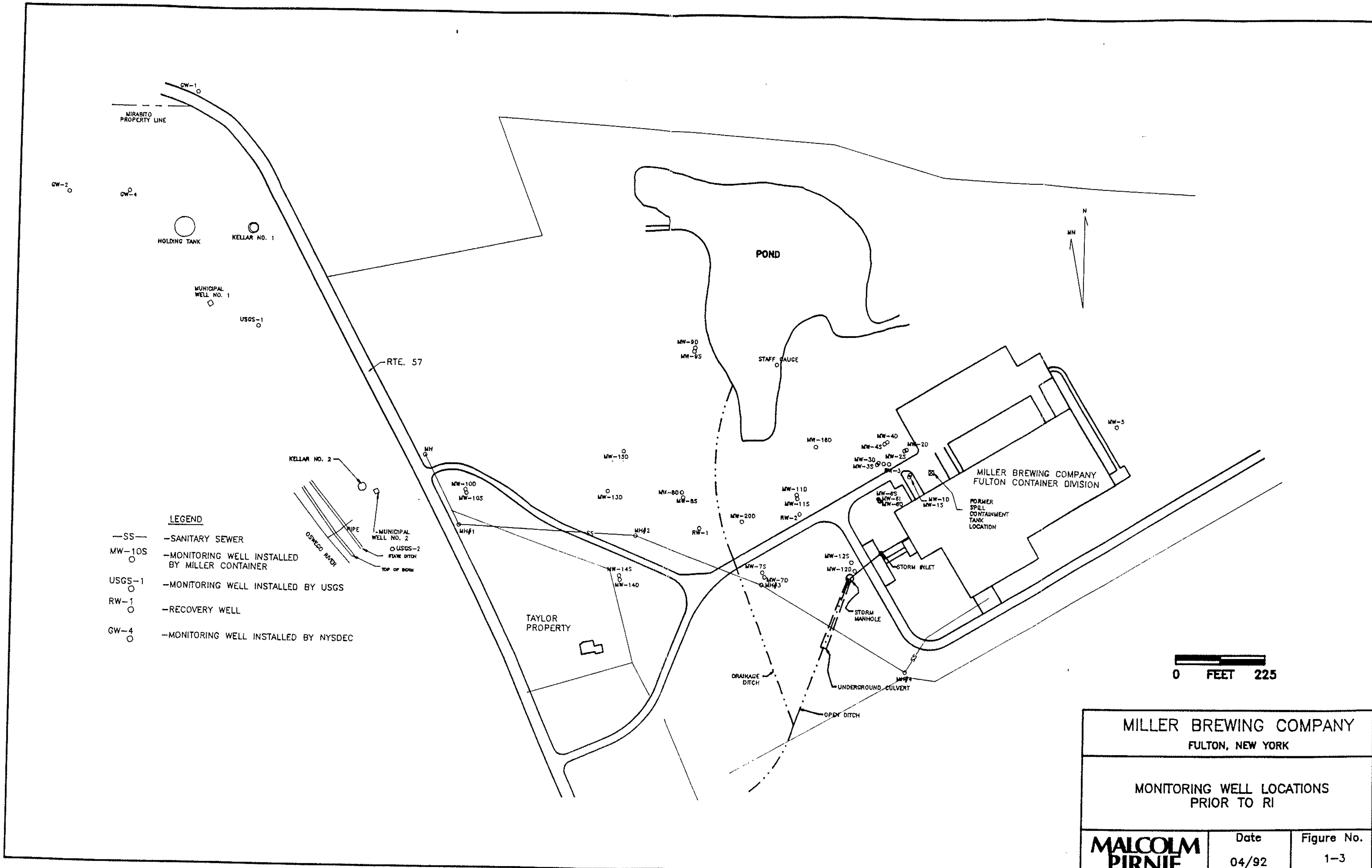
TABLE 1-4
SAMPLING AND ANALYSIS REQUIREMENTS
GROUND WATER RECOVERY AND TREATMENT SYSTEM

I.TREATMENT SYSTEM
-Sample Locations:
Recovery Wells #1,#2 and #3
Combined influent to tower
Combined effluent from tower
-Sampling Frequency:
During pumping tests(not DEC required;info only)-2-3 per well
1 hour after start-up-(5 locations)*
24 hours after start-up-(effluent only)
48 hours after start-up-(5 locations)*
14 days after start-up-(5 locations)*
1 month after start-up-(5 locations)
2 months after start-up-(5 locations)
3 months after start-up-(5 locations)
Semiannually (effluent only)
-Parameters:
USEPA 601 & 602 List of Compounds
II. FULTON CITY TREATMENT PLANT
-Sample Locations:
Wastewater influent
Wastewater effluent
Sludge
-Sample Frequency:
1 week prior to start-up(not DEC required;MPI recommendation)
Immediately prior to start-up
24 hours after start-up
1 month after start-up
Semiannually after the first month
-Parameters:
USEPA 601 & 602 List of Compounds
III. GROUND WATER
-Sample Locations:
Monthly: 1S,1D,4D,6S,6I,6D,8D,10S,10D,11D,13D,14D, Municipal Well No.2
Quarterly: All Miller Wells & Municipal Well No. 2
-Parameters:
USEPA 601 & 602 List of Compounds

*-24-48 hour turnaround



GW-1
MIRABITO PROPERTY LINE
GW-2
GW-4
HOLDING TANK
KELLAR NO. 1
MUNICIPAL WELL NO. 1
USGS-1
RTE. 57
POND
STAFF GAUGE
MW-9D
MW-9S
N
MN
MH
KELLAR NO. 2
MUNICIPAL WELL NO. 2
PIPE
USGS-2
OSWEGO RIVER
MW-10D
MW-10S
MH#1
MH#2
MH#3
SS
MW-15D
MW-13D
MW-8D
MW-8S
RW-1
MW-20D
MW-16D
MW-11D
MW-11S
RW-2
MW-4D
MW-4S
MW-3D
MW-3S
MW-2S
MW-2D
MW-6S
MW-6I
MW-6D
MW-1D
MW-1S
MW-5
MW-14S
MW-14D
MW-7S
MW-7D
MW-12S
MW-12D
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
FORMER SPILL CONTAINMENT TANK LOCATION
STORM INLET
STORM MANHOLE
TAYLOR PROPERTY
DRAINAGE DITCH
UNDERGROUND CULVERT
OPEN DITCH
LEGEND
—SS— —SANITARY SEWER
MW-10S —MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 —MONITORING WELL INSTALLED BY USGS
RW-1 —RECOVERY WELL
GW-4 —MONITORING WELL INSTALLED BY NYSDEC
0 FEET 225
MILLER BREWING COMPANY
FULTON, NEW YORK
MONITORING WELL LOCATIONS PRIOR TO RI
MALCOLM PIRNIE
Date 04/92
Figure No. 1-3

MILLER CONTAINER

TABLE 1-5
DISCHARGE SET POINTS AND ACTUAL FLOW RATES
TREATMENT SYSTEM RECOVERY WELLS

DATES		SET POINTS (GPM)			ACTUAL (GPM)			NOTES
from	to	RW-1	RW-2	RW-3	RW-1	RW-2	RW-3	
06/27/88 -	07/06/88	6	2	2	5.95	1.99	2.00	
07/07/88 -	07/08/88	8	5	3	8.07	4.95	2.91	
07/08/88 -	07/20/88	6	2	2	6.02	2.08	1.94	
07/21/88 -	07/22/88	8	5	2.5	7.86	4.98	2.46	
07/23/88 -	08/05/88	6	2	2	6.09	2.05	2.03	
08/06/88 -	08/12/88	6	2	1	5.96	1.99	1.63	
08/12/88 -	08/14/88	6	2	0.812	6.09	2.00	0.00	RW-3 DOWN 08/09-10/88.
08/15/88 -	08/15/88	6	2	0.686	5.93	1.99	0.00	
08/15/88 -	08/15/88	6	2	0.406	6.02	1.99	4.00	
08/16/88 -	08/18/88	6	2	DOWN	5.96	1.97	0.00	RW-3 not properly calibrated.
08/19/88 -	08/19/88	6	2	1	6.00	2.05	1.40	RW-3 DOWN 08/16-18/88.
08/21/88 -	08/22/88	6	2	DOWN	6.05	2.02	0.00	
08/22/88 -	09/01/88	6	2	1	5.96	1.97	0.00	RW-3 DOWN.
09/01/88 -	09/27/88	6	2	2	6.00	2.03	1.68	RW-3 DOWN majority of time interval.
09/27/88 -	04/03/89	3.5	5	1.5	3.49	2.86	3.20	RW-3 intermittent reporting. Wells fluctuate greatly during this time interval. RW-3 significant DOWN time; not properly calibrated.
04/03/89 -	04/10/89	3.5	3.5	3	3.67	1.48	3.02	
04/13/89 -	04/16/89	5	2	3	4.99	1.26	3.01	
04/18/89 -	05/22/89	7	2	1	6.79	1.02	1.31	
05/23/89 -	05/23/89	7	3	1	6.93	0.00	1.57	RW-2 DOWN 05/18-22/89.
05/24/89 -	12/31/89	7	2	1	7.02	1.97	1.88	RW-2 no reporting values.
01/30/90 -	12/18/90	7	2	1	6.99	1.95	0.99	

rate, relative to RW-2 and RW-3, then the contamination in the vicinity of RW-3 and RW-2 might be drawn away from the spill containment tank area toward RW-1. Therefore, the flow rate at RW-2 was increased in an attempt to capture as much contaminated water as possible for treatment at the air stripper.

During the period from January 30, 1989 to February 7, 1989, a replacement for RW-3 was installed utilizing alternate well construction techniques. The alternate techniques involved the emplacement of 14-inch temporary steel casing to the top of the lodgement till surface, drilling out the plug of soil inside the 14-inch casing and installing a 6-inch well to the total depth of the cased borehole. Once the well was in place, gravel was used to fill the annulus between the well and the borehole as the 14-inch casing was removed. Bentonite pellets and cement grout were used to seal the annulus.

The well was developed by hydraulic jetting, by backwashing and surging with air and by an air lifting process that results in formational water being pulled through the screens in one direction over a period of several hours. The development process was continued until the discharge water was clear of sand and silt. Discharge water was contained in a pit that was excavated next to the well. The water in the pit was allowed to infiltrate back into the ground where it would ultimately be pumped by the recovery well to the air stripper. At the end of the development process, the drillers estimated that the well was capable of yielding 10 to 15 gpm on a sustained basis.

The replacement recovery well, which will be referred to as RW-3 in the remainder of this report, was connected to the treatment system and began operating on March 30, 1989. The original RW-3 was left in operation during the interim period between when the new RW-3 was installed and when it was turned on.

The water level in RW-3 was measured and recorded just prior to turning the pump on and several times after operation had commenced. The water level measurements are listed versus their time of collection on Table 1-6. The water level in RW-3 lowered to 2.19 feet below the original water level after eight minutes of pumping at a discharge rate of 1.5 gpm. The water level then began to recover until on April 3, 1989 it was within 1.39 feet of the original water level. Since the aquifer appeared to be capable of sustaining the withdrawal of ground water at the 1.5 gpm discharge rate, the decision was made to increase the output. On April 3, 1989, the discharge at RW-3 was increased to 3 gpm. The 3 gpm discharge rate at RW-3 was maintained until April 18, 1989. The water level on April 18 was 3.58 feet below the original water level that was recorded on March 30, 1989.

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TABLE 1-6
REPLACEMENT RECOVERY WELL THREE (RW-3) START-UP DATA

DATE	TIME	WATER LEVEL (FT BMP)	DISCHARGE SET POINTS (GPM)			NOTES
			RW-1	RW-2	RW-3	
03/30/89	3:17 pm	20.53	3.5	5.0	1.5	RW-3 pump started.
	3:25 pm	22.72	3.5	5.0	1.5	
	3:27 pm	22.66	3.5	5.0	1.5	
	3:37 pm	22.33	3.5	5.0	1.5	
	4:00 pm	22.32	3.5	5.0	1.5	
03/31/89	3:05 pm	22.13	3.5	5.0	1.5	
04/03/89	2:25 pm	21.92	3.5	5.0	1.5	Samples obtained.
	2:40 pm		3.5	3.5	3.0	Increase discharge from RW-3.
	2:50 pm	23.26	3.5	3.5	3.0	
	3:02 pm	23.11	3.5	3.5	3.0	
04/04/89	7:55 am	23.40	3.5	3.5	3.0	
04/05/89	6:55 am	23.49	3.5	3.5	3.0	
04/06/89	7:45 am	23.69	3.5	3.5	3.0	
04/07/89	7:20 am	23.55	3.5	3.5	3.0	Samples obtained.
04/10/89	7:35 am	23.85	3.5	3.5	3.0	
04/13/89	2:20 pm	23.76	5.0	2.0	3.0	Adjusted discharge rates.
04 14/89	9:09 am	24.22	5.0	2.0	3.0	Samples obtained.
04/18/89	2:10 pm	24.11	7.0	2.0	1.0	Adjusted discharge rates.
04/19/89	2:17 pm	22.62	7.0	2.0	1.0	Samples obtained.

Samples were collected from the individual recovery wells, the combined influent and from the effluent after treatment on several occasions including prior to the time that the discharge rate was increased from 1.5 to 3 gpm on April 3, 1989. All samples were submitted for analysis for the compounds on the EPA Methods 601/602 lists. The results of the April 3, 1989 analysis, which are included in Appendix D, indicated that all compounds included in the analysis were below detection limits (generally less than 1 ug/l).

Additional samples were collected on April 7, 1989 while RW-3 was operating at a discharge rate of 3 gpm (see Table 1-6). The analytical results indicated that the concentration of TCA in RW-3 almost doubled, increasing from 5400 ug/l to 10,000 ug/l. The concentration of TCA on April 7 was more than three times the April 3 detected concentration. Although the percentage of removal of TCA at the air stripper was greater than 99 percent on April 7, there was still an exceedance of the Interim Consent Order standard of 20 ug/l for that compound.

After the April 7, 1989 results became available on April 13, 1989, the discharge rates were modified in an attempt to lower the combined influent concentrations. The discharge rates were changed to 5, 2 and 3 gpm from RW-1, RW-2 and RW-3, respectively, in order to incorporate more uncontaminated water from RW-1. Samples were then obtained on the following day (April 14, 1989). Although one sample that was analyzed contained less TCA than the effluent limit, a second sample contained a concentration that was still over the standard. Therefore, additional discharge rate adjustments were necessary.

On April 18, 1989, the discharge rates at the three recovery wells were changed to 7, 2 and 1 gpm, respectively. Samples were collected on the following day. The analytical results showed that all compounds were below detection limits except TTCE which was detected at 3 ug/l. The discharge rates have remained at the 7, 2 and 1 gpm settings fairly consistently from April 18, 1989 to the present. The discharge rates are summarized on Table 1-5.

Significantly higher levels of contamination were ultimately detected at wells near RW-3. For example, the level of TCA detected at MW-3D alone averaged 8735 ug/l through December 1989. Despite these higher levels of contamination, the air stripper has performed very efficiently. The records of levels of contamination delivered to the air stripper from each individual recovery well, the combined influent and the effluent discharged to the sanitary sewer after treatment are included as Appendix D.

1.3.2.7 Water Quality Trends

The ground water quality data for monitoring wells on-site are included in Appendix C of this report. Contaminant concentration trends were noted for several monitoring wells (based on ground water data through December 1989) in the March 1990 Status Report. The trends noted at that time are repeated here and will be updated in Section 4 of this report.

Several parameters have been routinely detected in the ground water samples collected from the site. These parameters include 1,1-dichloroethylene (DCE), 1,1-dichloroethane (1,1-DCA), 1,1,1-trichloroethane (TCA) and tetrachloroethylene (TTCE). In general, TCA is the major contaminant, followed by TTCE and DCE. This observation is based on the concentration levels reported and the number of wells where the compounds are detected.

- MW-1S - The concentration of TCA and TTCE followed an overall downward trend through December 1989.

- MW-3D - The concentration of TCA and TTCE at this well was relatively low until September 1988. The analysis of the sample collected during September 1988 revealed that the concentration of TCA increased from an average value of about 900 ug/l (over the period of analysis prior to 9/88) to 33,000 ug/l. The detected concentrations of TCA remained relatively high at this well through December 1989. The levels of TTCE followed a similar trend. The dramatic increase in the concentration of these compounds was interpreted as being the result of migration of a highly contaminated portion of the plume back toward RW-3 due to pumping at that recovery well. The samples collected from RW-3 after September 1988 also showed a marked increase in the concentration of TCA and TTCE.

- MW-4D - The concentration of TCA detected at this well decreased through December 1989.

- MW-6D - The concentration of several compounds have remained fairly consistent since monitoring began at this well.

- MW-8D - The concentration of TCA started to rise during October 1988 and continued on an overall upward trend through December 1989.

- MW-13D - A consistent increase in TCA was first detected at this well during March 1989. Although the detected concentrations were relatively low, the level of TCA increased at MW-13D through December 1989.

It was hypothesized that contamination at MW-13D may have originated from a source other than the spill containment tank leak, or, that contamination in an area north of MW-16D may be migrating into the vicinity of MW-13D.

- MW-14D - The concentration of TCA detected at this well first began an overall upward trend in March 1988. The first consistent occurrence of TCA at this well predates the first consistent occurrence of TCA at well MW-8D by seven months. This fact and the hydraulically downgradient location of MW-14D relative to MW-8D (prior to groundwater recovery at RW-1) suggested that either another source for the contamination at MW-14D exists or that contamination from the spill containment tank leak was migrating to MW-14D via an alternate path.

  During January 1989, two abandoned underground storage tanks were discovered on the Taylor Farmhouse property near well cluster MW-14. Analysis of the contents of the tanks revealed that the southernmost tank contained gasoline while the northernmost tank (north tank) contained mostly fuel oil. However, trace levels of TCE were detected in the north tank when analyzed using a 1,000 ug/l detection limit. At this high detection limit, it is possible that other chlorinated hydrocarbons may have been present but not detected.

  Specialty Services, Inc. (SSI) was retained by representatives of Mr. Taylor to remove the tanks. The tanks were removed during May 1989. One and a half inch diameter holes were documented in both tanks. Detected in the soil below the tanks were high levels of gasoline constituents and 4,700 ug/kg of 1,1-DCA, 3,000 ug/kg TCE and up to 4,300 ug/kg of 1,2-DCA. Samples of soil from below the tanks and fluid from the tank contents were collected by a representative of Miller and the NYSDEC. The results of the analyses performed on these samples are listed on Table 1-7. As shown on Table 1-7, the detection limits utilized in the analysis performed for the NYSDEC were high. At these detection limits, the presence of additional compounds at levels below the detection limits, but still in significant concentrations, cannot be ruled out.

  Contaminated soil from below the two tanks was excavated and stock piled on the driveway near the tanks prior to its disposal off-site. Although BTEX-type compounds have been detected recently at M-2 and K-2, the absence of "significant levels" of these compounds at M-2 and K-2 could be explained by the excavation. (However, as noted later in this report, past operations at the Taylor property do not appear to be a major source of the VOC contamination detected at M-2 and K-2. This contamination appears to be primarily the result of an unidentified source located east of the Taylor property and MW-14D and MW-21S).

  The presence of TCE, a relatively dense chlorinated hydrocarbon, in one of the tanks and in the soil below the tanks led to speculation that this area could be the source of the sporadic contamination detected at the MW-10 cluster and the more consistent contamination detected at MW-14D, well MW-13D and

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TABLE 1-7
TAYLOR FARMHOUSE PROPERTY – ANALYTICAL RESULTS

Lab	Medium	Sample Date	Analysis	Detection Limits	Sample Location	COMPOUNDS DETECTED (ug/kg or ug/kg)											
						TCA	Benzene	Ethyl-benzene	Xylenes (total)	1,2-DCA	TCE	Toluene	MTBE	Total Hydro-carbons	1,1-DCA	2-Methyl-naph-thalene	Naph-thalene
GALSON Taylor Samples	Ground Water-4 Wells	06/05/89	EPA 601/602	1 ug/l	T-1 T-4	19.2 2.8											
UPSTATE Miller Samples	Ground Water-4 Wells	06/05/89	EPA 601/602	1 ug/l	T-1 T-4	9.0 2.0	1	1	4								
	Soil below tanks (SS-1)	06/02/89	EPA 8010	50 ug/kg	SS-1					4,300	3,000						
			EPA 8020 (plus Xylenes)	50 ug/kg	SS-1		30,000	15,000	54,000								
			EPA 8270	2000 ug/kg	SS-1											55,000	43,000
	Water-north tank contents	01/31/89	EPA 601/602	1000 ug/kg							TR<1000						
NET Miller Samples	Soil below tanks (SS-1)	06/02/89	EPA 8010/8020/8270	300-15000 ug/kg	S-1		101,000	610,000	2,876,000			1,760,000			4,700		300,000
	Soil below tanks (SS-2)	06/02/89	EPA 8010/8020/8270	300-15000 ug/kg	S-2		3,100	2,200	9,000			16,000					
OB&G NYSDEC Samples	Water-south tank contents	06/02/89	EPA 601/602	1000 ug/l			28,000	4,000	24,000	3,000		70,000					
	Soil-under south tank	06/02/89	EPA 8010/8020/8270	1000 ug/kg DRY			34,000	670,000	3,100,000	1,000		1,700,000					
	Water/Oil-north tank contents	06/02/89	EPA 601/602	100000 ug/l					1,100,000							220,000	220,000 **
	Soil-under north tank	06/02/89	EPA 8010/8020/8270*	~400 ug/kg													
	Water-south tank contents	06/02/89	Not Indicated	Ranged from: 10 ug/kg to 3000000 ug/l	Semi-volatiles 8270		26,000	5,600	26,000			58,000	22,000	520,000			
	Soil-under south tank	06/02/89	Not Indicated				130,000	560,000	2,500,000			1,800,000		40,000,000			
	Water/Oil-north tank contents	06/02/89	Not Indicated						1,000,000					880,000,000			
	Soil-under north tank	06/02/89	Not Indicated														

NOTES:

*Analyses requested by NYSDEC; never received 8010/8020 results for soil under north tank. Received variations of the requested analyses.

**Detection limit = 41000 ug/kg.

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at Municipal Well No. 2, since some of these compounds had been detected at these wells in the past. Xylenes and ethylbenzene were also detected at MW-10D and MW-13D. It was later determined, from water level data collected during the subsequent pumping test at RW-1, that MW-13D, MW-14D, and MW-21S are located upgradient from the Taylor property.

Galson Technical Services, Inc. (GTS) was contracted by Mr. Taylor to write a report documenting the installation of four shallow monitoring wells at and near the Taylor property. Ground water samples were collected from the monitoring wells and soil samples were collected during the drilling of the boreholes for the wells.

HNU head-space values for soil samples collected from the unsaturated zone below the former tanks ranged from 0.4 ppm at 10 feet below grade to 75 ppm at 34.4 feet below grade.

Although a ground water sample collected from the shallow monitoring well installed below the former location of the tanks during June 1989 showed no contamination, TCA, ethylbenzene and xylenes were detected in two downgradient shallow wells installed on the Taylor property. No contaminants were detected in the upgradient shallow well in the June 1989 sample.

The septic system on the Taylor property was also pointed out to the NYSDEC as a potential source of TCA/TTCE contamination since solvents are commonly used to clean septic tanks. The septic tank/ leach field would serve as a recharge area to ground water when in use and create a slight mound on the water table.

1.3.2.8 Additional Work Performed Due to Water Quality Trends

Additional work was scheduled in an attempt to determine why contamination was being detected at MW-8D while during the same time interval no contamination was being detected at RW-1. RW-1 is located less than 100 feet from MW-8D. The contaminants detected at the site have been detected primarily in the deep wells. Therefore, it has been reasoned that once the contaminated ground water reaches the basal sand and gravel unit, it has the tendency to remain in this unit due to the higher permeability of the sand and gravel unit relative to the underlying low permeability lodgement till and the overlying low permeability sand and silt. Based on this information, there were two hypotheses put forth.

- If the lower of the two screens installed at RW-1 was plugged, then the infiltration of the contaminated portion of the ground water column might be impeded.

- Clean water from the upper screen may have been entering the well at a higher rate than the lower screen due to the differences in the availability of water at the two different levels. The result would be the dilution of the contaminated water from the lower screen with clean water from the upper screen.

During August 1989, the pump was pulled from RW-1 and it was determined that the lower screen was not clogged by isolating the lower screen with an expandable packer and pumping from this lower screen only. Samples were obtained from this lower interval for chemical analysis. The upper screen was then isolated and samples were obtained. No compounds were detected in the sample collected from the lower screened interval. TTCE was detected in the sample collected from the upper screen at a concentration of 1 ug/l. The results of this exercise indicated that RW-1 was operating adequately in a mechanical sense, and also generated a new theory for the lack of contamination detected at RW-1, as follows: If the availability of ground water from one segment of the aquifer around RW-I was greater than from the other areas around the recovery well and this preferential area of flow was devoid of contamination, then the contaminated ground water entering RW-1 from other directions could be diluted with clean water.

The level of TCA contamination at MW-8D rose during the time period from June 1989 through January 1990 and averaged over 100 ug/l. As the contamination increased at MW-8D, levels of TCA started to be detected at RW-1.

Additional work was proposed to answer questions about the operation of the recovery system and identify potential contaminant migration pathways that would explain the reason for the contamination detected. This proposed work, which was to be performed in a phased manner, included:

- Utilizing seismic refraction and reflection techniques to profile the top of the lodgement till surface to determine if a low area on the till surface exists between cluster MW-3 and the pond. Since contamination was migrating in the sand and gravel overlying the till, lower zones on the till surface could indicate preferential directions for contaminant migration.

- Utilizing resistivity geophysics to determine the extent of the semi-confining clay layer around MW-8D and RW-1. This would be useful in locating the position for installation of the shallow well in the sewer bedding.

- Installing deep wells in areas where the till surface was lower.

- Installing a deep well in the bedrock in a location hydraulically downgradient from the former spill containment tank.

- Installing several monitoring wells around RW-1 to establish the configuration of the cone of depression due to pumping RW-1 and to provide additional sampling points for ground water quality analysis. This information would be used to determine if the availability of clean ground water from one segment of the aquifer was greater than the other areas around the well.

- Performing a pumping test at RW-1 to help define the characteristics of this portion of the aquifer.

- Installing a shallow well in the sewer bedding to determine if the bedding was acting as a medium for contaminant migration.

In accordance with the phased approach, several of these work tasks were approved by Miller soon after they were proposed. The following subsections summarize the work that was completed prior to the performance of the RI. The work tasks that are not summarized were included in the list of work proposed in the RI/FS work plan.

A. Seismic and Resistivity Geophysics

The seismic and resistivity techniques were employed to arrive at the final proposed well locations. The results of the seismic work indicated that the lodgement till surface is relatively low in the area between cluster MW-3 and the pond. A deep monitoring well, to be screened just above the top of the lodgement till surface, was determined necessary in this area to assess the impact of this lower area on the migration of contaminants. It was also determined that the deep area in the till may extend to the south between cluster MW-3 and RW-2 into the area below MW-12S. Therefore, a deep monitoring well was proposed near MW-12S. The results of the resistivity sounding and profiling indicated that the clay layer extended laterally to a distance of about 140 feet west of cluster MW-8. The edge of the clay layer trends roughly northeast-southwest between cluster MW-8 and MW-13D.

B. Installation of Additional Monitoring Wells

During November 1989, Miller approved the installation of two deep wells (MW-15D and MW-16D) and the bedrock well (BMW-1). The locations were approved by the NYSDEC, and the wells were installed, developed and sampled during December 1989. The location of these wells is shown on Figure 1-3. Drilling logs and well construction diagrams are included in Appendix A. The information obtained during the drilling process confirmed that the lodgement till was relatively deeper near MW-16D. TCA was also detected at this well in significant concentrations. The lodgement till surface was determined to be relatively higher near MW-15D. No contaminants were detected in the initial ground water samples collected from this well. According to ground water flow directions, it was determined that contaminated ground water emanating from the area near MW-16D is responsible for the contamination detected at MW-8D. It was also determined that the contamination at MW-8D should be captured by RW-1.

Ground water sampled from the bedrock near BMW-1 during December 1989 was not contaminated.

1.3.2.9 Treatment System Modifications

During July 1989, modifications were made to the treatment system to permit the recirculation of up to 10 gpm of contaminated ground water back into the air stripping tower. The modifications were made to address the NYSDEC concern regarding the low pumping rate at which RW-3 was being operated. In a letter dated August 22, 1989, the NYSDEC was asked for approval to operate the recirculation system during a pilot test period. The modifications would have allowed the removal of 3 gpm of highly contaminated ground water from RW-3 (relative to the contaminant concentrations detected at RW-1 and RW-2) while still meeting the discharge standards; however, the technical issues relative to utilization of this proposed system were not resolved.

1.3.2.10 Response to NYSDEC Demands for Information

The NYSDEC, pursuant to Article 27, Title 13 of the Environmental Conservation Law (ECL), filed two Demands for Information which were served to legal counsel representing Miller Brewing Company. The first was under cover of a letter dated May 23, 1990, and the second under cover of a letter dated May 20, 1991.

The Demand for Information dated May 23, 1990 was prompted by the ongoing investigation of a release of volatile organic compounds (VOCs) from the former spill containment tank. The information requested in the Demand is summarized below.

- A description of any known spills, leaks, or other discharges of VOCs, including the date(s) and location(s); the type and amount of material(s) spilled; the source of the material(s); the cause of the spill(s); what persons or agencies were notified; what remedial measures were taken, if any; any subsequent disposal(s); any known extent and migration of the spilled material(s) into the environment.

- The identification of all areas where VOCs are stored and/or used.
- The location of all floor drains and underground storage tanks, and the ultimate discharge location of all drains.
- The identification of the storage or disposal of bromochloromethane, or any grain treated with bromochloromethane.
- All analytical data and sampling locations for any samples collected, including ground water, surface water, soil, sediment, sludge and leachate.

Miller's response, dated June 29, 1990, formed the basis for much of the work conducted throughout the RI.

The Demand for Information dated May 20, 1991 was prompted by the discovery of oil and VOC contamination in the area of the four underground process tanks located below the southwest corner of the Container Plant. The oil and VOC contamination was reported to the NYSDEC on April 11, 1991 (the "spill"). Much of the information provided in Miller's response to the Demand is discussed in Section 4.4 (Oil Spill Investigation Below the Container Plant) of this report. As summarized below, the Demand requested information relevant to all aspects of the spill. Specific information requested included :

- The manner in which the spill occurred, including the time period during which the spill is known or believed to have occurred.
- The source(s) of petroleum products and hazardous constituents comprising the spill, including the source(s) of chlorinated solvents detected in the spill material.
- Description of how chlorinated solvents are used in and around machinery at the Container Plant such that they would be found in waste oil coming from the machinery.
- Description of current and former use, storage, and/or disposal of any chlorinated compounds, petroleum products and other hazardous constituents, including solvents, at the Container Plant.
- Correlation between the volumes of hazardous or petroleum raw products introduced into the industrial process, and the volumes of hazardous or petroleum wastes disposed of; inclusion of all reasons for and quantities of losses between introduction and disposal.
- Description of all instances where petroleum wastes were tested for hazardous constituents; analytical results of any testing.

- Description of all transportation and/or disposal facilities associated with petroleum or hazardous waste generated at the Container Plant.

- Identification of any natural or man-made barriers inhibiting migration of petroleum or hazardous wastes from the Container Plant.

- Construction and operation details of the Container Plant's waste system, i.e., subfloor waste collection and floor drain system.

- Documentation, if applicable, that waste system is operated under a state or federal permitting program such as Resource Conservation and Recovery Act (RCRA).

- Description of any investigation undertaken by Miller or its representatives to locate areas of the waste system which are or have been releasing hazardous constituents, or petroleum products into the Container Plant or the environment.

- Description of the characteristics of any waste system at the Fulton Brewery.

1.3.3 Summary of Site Consent Orders

1.3.3.1 Interim Order on Consent #A701118704

Miller and the NYSDEC executed Interim Order on Consent #A701118704 which become effective upon NYSDEC's execution of the Order on January 22, 1988. The Order covered the installation and start-up requirements for the ground water recovery and treatment system currently in use at the Miller site.

1.3.3.2 Amendment to Interim Order on Consent #A701118704

Miller, the City of Fulton and the NYSDEC executed an amendment to the Interim Order referenced in Section 1.3.3.1 during March 1990. The amended Order provided for the discharge of M-2 to the Oswego River with or without treatment depending on contaminant concentrations.

Subsequent contamination at municipal well K-2 resulted in the combined discharge of both wells to the Oswego River and eventually the use of a temporary granular activated carbon (GAC) unit to treat the water from the wells prior to discharge.

This Order also requires the performance of a study to further define the aquifer from which municipal wells K-1, K-2 and M-2 withdraw ground water in order to evaluate the potential for currently identified contamination to migrate to municipal well K-1.

1.3.3 Order on Consent #A702279004

Order on Consent #A702279004 was signed into effect during April 1990. This Order requires the performance of the RI/FS by Miller.

1.3.4 Order on Consent #A702659106

Order on Consent #A702659106 was executed by Miller, the City of Fulton and the NYSDEC during August 1991. The Order covers:

A. Temporary Pumping of K-1, K-2 and M-2 to the Oswego River (until June 30, 1992).

B. Long-term treatment of K-1, K-2 and M-2 water by an air stripping unit equipped with GAC treatment for off-gas emissions, to levels that will allow use of the treated water by the City of Fulton for municipal supply. The permanent treatment system has been operational since July 1, 1992.

C. Under Section XIV, the municipal aquifer study is to be incorporated into the Miller RI/FS. This study includes tasks initially outlined in Section VIII of the Amendment to Order on Consent #A701118704. These tasks are:

   1. Locate and determine the depth of all test wells and piezometers on the City of Fulton Water Works property.

   2. Determine the location, depths, yields, and pumping regimens for all wells located on the Water Works property (i.e., K-1, K-2 and M-2).

   3. Evaluate the potential for contamination in the vicinity of K-2 and M-2 to migrate to K-1.

These requirements were satisfied through the performance of a municipal aquifer pumping test, performed during August 1992, and the subsequent evaluation of data collected. The report describing the pumping test and results is included as Appendix V of this report.

2.0 REMEDIAL INVESTIGATION ACTIVITIES

2.1 GENERAL

The remedial investigation (RI) is designed to provide sufficient field data to enable preparation of a baseline risk assessment and feasibility study that will meet the remedial response objectives.

The RI is comprised of several components, including:

- Field investigation work tasks.
- Sample collection and analysis.
- Data evaluation and validation.
- Baseline risk assessment.
- Refinement of the remedial action goals.

The Interim RI Report (June 1991) was prepared to provide a preliminary assessment of the data collected for the site through March 1991 and to determine, based on the available data, if additional field work would be necessary to complete the RI. The IRI Report included all components listed above except the baseline risk assessment and the refinement of the remedial action goals. Based on the review of the data, it was determined in the IRI report that additional field work and sample collection and analysis would be required to complete the RI. The Draft RI Report (April 1992) incorporated the additional work performed and data collected through February 1992. The baseline risk assessment and the refinement of the remedial action goals were included in the Draft RI. During the last two years, the work tasks proposed in the IRI and additional work tasks required by the NYSDEC have been completed.

This report presents an assessment of the data available for the site. Included are supplemental RI data collected after the IRI Report was submitted, as presented in the Draft RI; results of the pumping test performed at RW-1 during September 1992; and results of the pumping test performed at municipal wells K-1 and K-2/M-2 during August 1992. The pumping test at the municipal wells was required to evaluate the aquifer in the vicinity of the municipal wells and determine the likelihood for currently identified contamination to migrate to K-1. The Municipal Aquifer Pumping Test Report (November 1992) is included as Appendix V; the RW-1 Pumping Test Report (December 1992, revised May 1993) is included as Appendix W.

A vacuum extraction (VE) pilot test was proposed in the RI/FS work plan for the former spill containment tank area; however, subsequent data indicated that the former southern drum storage area may be a more suitable location for the pilot test. The work plan for the pilot test was approved by the NYSDEC and the pilot test was performed during July 1992 in the former southern drum storage area. Also, boreholes were drilled and soil samples collected in the former northern drum storage area (north of the northern parking area) and in the former spill containment tank area to assess the applicability of vacuum extraction as a remedial alternative in these areas. Boring logs and analytical results are included in this report; the results of the pilot test and soil sampling will be discussed in the FS.

A description of the field investigation work tasks, sampling and analysis and data evaluation and validation that have been performed during the RI is presented in the following subsections. The results are discussed in Sections 3, 4 and 5. The baseline risk assessment is presented in Section 6 and the refinement of the remedial action objectives in Section 7.

2.2 RI FIELD INVESTIGATION WORK TASKS

The RI field work performed includes the following elements.

- Soil gas investigation, both on-site and off-site.
- Drilling and monitoring well installation, both on-site and off-site.
  - Well development.
  - Recording water levels.
  - Well surveying.
  - Permeability tests.
- Evaluation of other potential contaminant sources, both on-site and off-site.
- Recovery Well No. 1 (RW-1) pumping test.
- Soil and groundwater sampling and analyses.

Also completed during the RI time frame were:

- Vacuum extraction (VE) pilot test.
- Municipal aquifer study.
- Test borings in other source areas for evaluating the applicability of VE technology.

2.2.1 Soil Gas Investigation

A three-phased soil gas investigation was performed on Miller property and on adjacent property. The soil gas work was performed by Tracer Research Corporation (Tracer) and was coordinated and supervised by MPI.

The first phase of the investigation was performed during June 1990 in the following four areas of the Miller property.

1. In the northwest corner of the property near monitoring well cluster MW-23S, D.
2. West of the Container Plant in the vicinity of monitoring wells MW-18S, MW-21S, D and MW-14S, D.
3. North of the Container Plant around the former spill containment tank location.
4. Along the west side of the Container Plant building near the sanitary and storm sewers that exit from beneath the west side of the Plant.

The second phase of the investigation was performed during the end of July and the beginning of August 1990. During this phase, soil gas samples were collected from along the sanitary sewer, in an area north of the Container Plant's northern parking area where spent solvent drums were reportedly washed and stored, along the south side of the Plant where additional drums were reportedly cleaned and stored and in the vicinity of the City of Fulton municipal well field.

The third phase of the soil gas investigation involved collecting samples from the Taylor farm house property and immediately north and south of the Taylor property (on Miller property) during September and October 1990.

The soil gas investigation methodology utilized by Tracer can be summarized as follows. Sampling probes, consisting of 7-foot or 14-foot lengths of 3/4-inch diameter hollow steel pipe fitted with detachable drive tips, are hydraulically pushed to a desired depth. This depth was determined for each area of the investigation by vertically profiling the soil gas concentrations in areas of known contamination. A soil gas sample is then pumped out of the ground and analyzed for the presence of selected volatile organic compounds (VOCs) using an on-site gas chromatograph (GC) equipped with an electron capture detector (ECD) and a flame ionization detector (FID). The VOCs selected for the ECD analysis included the chlorinated hydrocarbons 1,1,1-trichloroethane (TCA), tetrachloroethylene (TTCE), 1,1-dichloroethane (DCA), 1,1-dichloroethylene (DCE) and trichloroethylene (TCE). Volatile hydrocarbons selected for analysis with the FID included benzene, toluene, xylenes and total petroleum hydrocarbons (THC). These compounds were selected for the analysis because of their suspected presence in the subsurface and their ability to be detected by the soil gas technology. Several additional chlorinated hydrocarbons were reported by Tracer because of their ability to be detected by the analysis selected. These included carbon tetrachloride, methylene chloride and chloroform.

The results of the soil gas investigation were used to finalize the locations of several RI monitoring wells. Therefore, the soil gas investigation was performed prior to any RI drilling activities. Reports detailing the results of each of the three phases of the soil gas investigation were prepared by Tracer. The reports are dated June 1990, August 1990 and October 1990. Copies of these reports are included in Appendix E. A map showing the soil gas sampling points during all phases of the investigation is presented as Sheet 1 at the back of this report. The results of the soil gas investigation are discussed in Section 4 of this report.

2.2.2 RI Drilling and Monitoring Well Installation Program

The drilling and well installation program during the RI involved three phases. Included in the first phase are the wells that were used to prepare the IRI Report. There were 48 wells installed on Miller, Taylor or City of Fulton property during this phase. There were 34 wells installed on Miller, City of Fulton or Riverscape Apartments property during the second phase of the RI drilling and well installation program. The second phase post-dated the start of the preparation of the IRI Report, but were incorporated into the Draft RI Report. MW-60S,I,D were installed during the third phase which post-dated the preparation of the Draft RI Report. The wells installed during each of the three phases are listed on Table 2-1.

The RI drilling and well installation activities were necessary to:

MILLER CONTAINER

TABLE 2-1
PRE-RI, PRE-IRI REPORT, AND POST-IRI REPORT MONITORING WELLS

Monitoring Wells Installed Prior to RI		Monitoring Wells Installed During RI (Through December 1991)					
		Pre-IRI			Post-IRI		
Located on Miller Container Property	Located on Taylor Property	Located on Miller Container Property	Located on Taylor Property	Located on City of Fulton Property	Located on Miller Container Property	Located on City of Fulton Property	Located on Riverscape Apartments Property
MW-1S,D	*T-1	MW-12D	MW-32D	MW-28S,I,D	MW-8I	MW-42S	MW-57S,D
MW-2S,D	*T-2	MW-17D	MW-34D	MW-29S,I,D	MW-47S	MW-43S,D	
MW-3S,D	*T-4	MW-18S	MW-35D	MW-30S,I,D	MW-48S	MW-44S	
MW-4S,D		MW-19S,D		MW-31S,I,D	MW-49S,I,D	MW-45S,D	
MW-5		MW-20D			MW-50S,I,D	MW-46S,D	
MW-6S,I,D		MW-21S,D			MW-51I,D		
MW-7S,D		MW-22S,D			MW-52S,I,D		
MW-8S,D		MW-23S,D			MW-53S,I,D		
MW-9S,D		MW-24S,D			MW-54S,I,D		
MW-10S,D		MW-25S,D			MW-55D		
MW-11S,D		MW-26S,D			MW-56D		
MW-12S		MW-27S,D			MW-58S		
MW-13D		MW-33S			MW-59S		
MW-14S,D		MW-36S,D			MW-60S,I,D		
MW-15D		MW-37S,I,D					
MW-16D		MW-38S,D					
BMW-1		MW-39S,I,D					
*T-3		MW-40S					
		MW-41S					
Total 30	Total 3	Total 33	Total 3	Total 12	Total 27	Total 8	Total 2

*Monitoring wells installed by Mr. Taylor.
Monitoring wells installed by Miller = 114.
Monitoring wells installed by Mr. Taylor = 4.

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- Aid in a determination of whether or not additional sources for VOCs exist on Miller property, and, if so, delineate the extent of contamination emanating from these sources.

- Determine the lateral extent of the spill containment tank-related ground water contamination.

- Determine if other migration pathways exist for contamination from the spill containment tank leak.

- Provide data around Recovery Well No. 1 (RW-1) to determine if the operation of RW-1 at its present rate is adequate or if a modification to the RW-1 pumping rate or expansion of the recovery system is required.

- Evaluate possible sources on nearby properties for the contamination detected at M-2, K-2, K-1 and at monitoring wells on the Miller property.

- Provide data collection points to evaluate the shape and extent of the cone of influence due to the withdrawal of ground water at K-1 and at M-2 and K-2.

- Provide early-warning water quality monitoring points in locations upgradient of K-1.

- Provide additional information which will enable a more detailed understanding of the subsurface geology and hydrogeology at the site.

- Enable monitoring of water levels to better define ground water flow patterns in the shallow and deep zones and to estimate vertical hydraulic gradients between monitoring well clusters.

- Evaluate contaminant migration in the interval between shallow and deep well screens (intermediate zone) in several key locations across the site.

- Determine if a north-northwestern migration pathway exists, north of MW-9S,D and MW-49S,I,D, linking the MW-38S,D area with the contamination detected at K-1 and/or MW-57S.

The following subsections present the rationale for the locations of the wells that were installed during the RI. The subsections themselves have been divided into pre-IRI Report and post-IRI Report sections where applicable, since, in most cases, the decision for the need and location of the post-IRI wells was dependent on the results of the pre-IRI wells.

2.2.2.1 Rationale for New Monitoring Wells on the Miller Property

A. Pre-IRI Report Wells

Monitoring wells were installed around RW-1 to provide additional information on the characteristics of the aquifer and the ground water quality in this area of the site. The location of the wells that were installed near RW-1 during the pre-IRI Report period are shown on Figure 2-1. These wells include MW-17D, MW-18S, MW-19S,D and MW-20D.

After these wells were installed, a pumping test was performed at RW-1. The pumping test generated data for an assessment of the flow regime around RW-1 and allowed a determination of the effectiveness of the recovery well under normal operating conditions. The pumping test results are discussed in Section 3. All of the aforementioned wells were used to collect water level data during the performance of the pumping test. Shallow wells MW-18S and MW-19S were installed near the sanitary sewer bedding to serve the additional purpose of monitoring for potential contaminant migration along the sewer bedding and/or leakage from the sewer as a source of contamination in the area. Monitoring wells MW-40S and MW-41S were also installed near the sewer bedding, and adjacent to sewer manholes after the manholes and sewer bedding were exposed by excavation, to monitor for leakage from the sewer at the junction of the sewer with the manholes.

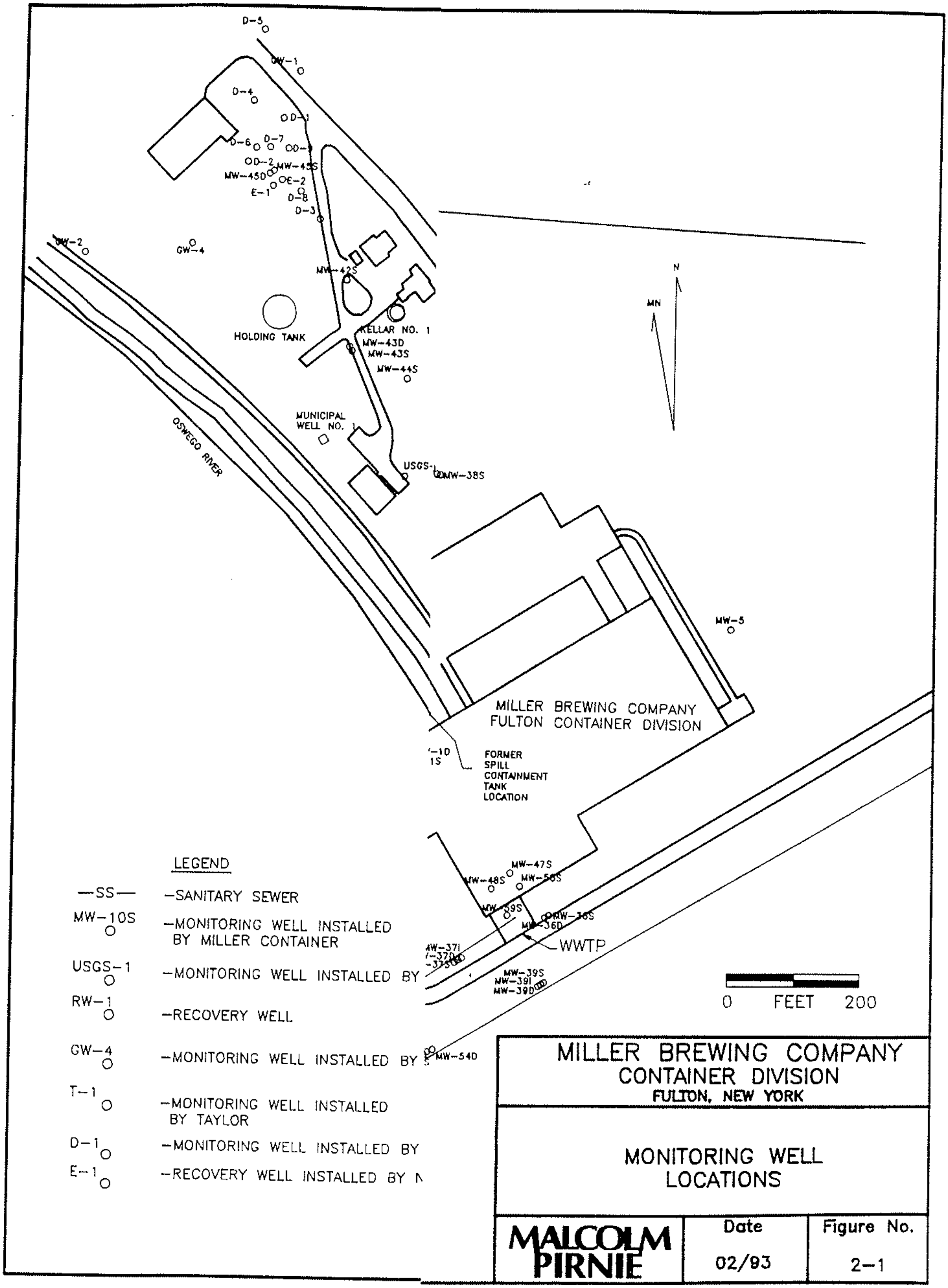
Monitoring well MW-12D was installed to determine if the lodgement till is deeper in the vicinity of MW-12S, as indicated by the seismic work.

Monitoring well clusters MW-21S,D, MW-22S,D and MW-27S,D were installed to test the theory of a southern source of contamination being responsible for the elevated concentrations of VOCs detected at MW-14D and at K-2 and M-2. The MW-21S,D and MW-22S,D clusters were installed, developed and sampled prior to selection of the MW-27S,D cluster location so that the ground water quality in the MW-21 and MW-22 cluster areas could be used for the siting of MW-27S,D.

Monitoring wells MW-24S,D, MW-25S,D and MW-26S,D were installed to help delineate the outer edge of contamination resulting from the spill containment tank leak.

Monitoring well cluster MW-23S,D was installed to allow monitoring of ground water quality upgradient of K-1 and between the former spill containment tank location and K-1.

Monitoring wells MW-38S,D were installed in the area north of the Container Plant's northern parking area in response to elevated soil gas readings which were obtained in this area. Elevated soil gas readings were also obtained on the south side of the Container Plant. For this reason, clusters MW-36S,D, MW-37S,I,D and MW-39S,I,D were installed.


D-5
GW-1
D-4
D-1
D-6
D-7
D-9
D-2
MW-45S
MW-45D
E-2
E-1
D-8
D-3
GW-2
GW-4
MW-42S
HOLDING TANK
KELLAR NO. 1
MW-43D
MW-43S
MW-44S
MUNICIPAL WELL NO. 1
OSWEGO RIVER
USGS-1
MW-38S
N
MN
MW-5
MILLER BREWING COMPANY
FULTON CONTAINER DIVISION
FORMER SPILL CONTAINMENT TANK LOCATION
MW-47S
MW-48S
MW-50S
MW-49S
MW-36S
MW-36D
WWTP
MW-39S
MW-39I
MW-39D
MW-54D
0 FEET 200
LEGEND
—SS— -SANITARY SEWER
MW-10S -MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 -MONITORING WELL INSTALLED BY
RW-1 -RECOVERY WELL
GW-4 -MONITORING WELL INSTALLED BY
T-1 -MONITORING WELL INSTALLED BY TAYLOR
D-1 -MONITORING WELL INSTALLED BY
E-1 -RECOVERY WELL INSTALLED BY
MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
MONITORING WELL LOCATIONS
MALCOLM PIRNIE
Date
02/93
Figure No.
2-1

More clusters were necessary on the south side of the plant than on the north side due to the lack of previous water quality monitoring points in the southern area. The intermediate wells in the MW-37 and MW-39 clusters (MW-37I and MW-39I) were installed due to elevated HNU readings that were obtained when the split-spoon samples collected from the intermediate screened intervals were subjected to head-space analysis.

B. Post-IRI Report Wells

The results of the pumping test performed at RW-1, which are presented in Section 3, indicated that a deep well north-northeast of MW-8D was necessary to monitor ground water quality and collect water level data to assess the extent of the cone of influence around RW-1. For these reasons, MW-51D was installed (Figure 2-1). Monitoring well MW-8I was installed adjacent to wells MW-8S,D and MW-51I was installed next to MW-51D. Both wells are screened at intermediate depths to provide water quality data from this zone. The drilling for MW-8I served the additional purpose of allowing the collection of samples from the subsurface silty clay layer to assess this layer's vertical hydraulic conductivity.

Monitoring wells MW-49S,I,D and MW-50S,I,D were installed to provide data collection points in locations between the former spill containment tank area, the former northern drum storage area and K-1.

Monitoring wells MW-52S,I,D, MW-53S,I,D and MW-54S,I,D were installed to provide additional data on the extent of contamination emanating from the former southern drum storage area and to assess the potential for contamination from this area to be migrating into the area of monitoring well clusters MW-21S,D, MW-14S,D and other wells on or in the vicinity of the Taylor property.

Monitoring wells MW-47S, MW-48S, MW-58S and MW-59S were installed below the Container Plant in the vicinity of four underground storage tanks (USTs) located near the Plant's wastewater treatment facility (WTF). These wells were installed to assess the magnitude and extent of oil and volatile organic compound (VOC) contamination which was the result of leakage from the UST system.

Monitoring wells MW-55D and MW-56D were installed to assess the extent of ground water contamination after the results of head space analysis performed on soil samples collected from boreholes located adjacent to these wells indicated the presence of VOCs above the top of the lodgement till. The boreholes were advanced to the top of the lodgement till ridge in these areas and then through the lodgement till to the top of bedrock to determine the thickness of the till and if any saturated zones occurred below the top of the till ridge. It was reasoned that if permeable saturated zones were present below the top of the till ridge, then contaminated ground water might be flowing through these zones from the east side of the ridge to the west.

Monitoring wells MW-60S,I,D were installed near the northwest corner of the pond. These wells were installed to evaluate the potential existence of a ground water contaminant plume emanating from the MW-38S,D area and moving northwest across the site toward K-1. Although local ground water flow patterns indicate west and southwest flow from the MW-38S,D area, it was suggested by the NYSDEC that contaminated ground water could be moving north of MW-9S,D and MW-49S,I,D and into the MW-57S,D area. The placement of these wells also provided data on the extent of the silty clay layer known to exist below the middle of the site.

Well specifications for each well installed on the Miller property during the RI, along with data for the wells installed on Miller property prior to the RI, are included in Table 2-2. Other pertinent information regarding the type of material screened and the depth to the top of the lodgement till unit is also included in the table. Drilling logs and well construction diagrams are included in Appendix A.

2.2.2.2 Rationale for Monitoring Wells Near Municipal Well No. 2 and Kellar Well No. 2

A. Pre-IRI Report Wells

In order to determine the direction from which contamination is reaching M-2 and K-2 and to determine the configuration of the cone of influence due to the withdrawal of water from these wells, it was necessary to install monitoring well clusters around these municipal wells. The monitoring wells that were installed around M-2 and K-2 include MW-28S,I,D, MW-29S,I,D, MW-30S,I,D and MW31S,I,D. The well locations are shown on Figure 2-1.

The final locations for the well clusters were determined based on soil gas investigation results and the requirements for collecting appropriate water level data to evaluate the shape of the cone of influence around the municipal wells.

MILLER CONTAINER

TABLE 2-2
MONITORING AND RECOVERY WELL SPECIFICATIONS

	MEAS. POINT ELEV. (MSL)	LAND SURFACE ELEV. (MSL)	TOTAL DEPTH WELL (BLS)	TOTAL DEPTH WELL (MSL)	SCREENED INTERVAL (BLS)	SCREENED INTERVAL (MSL)	MATERIAL SCREENED	TOP OF TILL (BLS)	TOP OF TILL (MSL)	DATE INSTALLED	WELL TYPE	DRILL TYPE
MW-1S	379.13	377.16	23.40	353.76	23.0 - 18.0	354.16 - 359.16	Slt+vfS	NA	NA	09/24/86	2" SS	A
MW-1D	378.53	376.82	56.00	320.82	56.0 - 51.0	320.82 - 325.82	S+G	56.0	320.82	07/10/86	2" SS	A
MW-2S	377.10	375.60	23.90	351.70	23.5 - 18.5	352.10 - 357.10	Slt+vfS	NA	NA	09/24/86	2" SS	A
MW-2D	377.46	375.46	56.50	318.96	56.5 - 51.5	318.96 - 323.96	S+G	57.3	318.16	07/11/86	2" SS	A
MW-3S	376.27	374.52	23.20	351.32	23.0 - 18.0	351.52 - 356.52	Slt+vfS	NA	NA	09/24/86	2" SS	A
MW-3D	376.52	374.31	57.50	316.81	57.5 - 52.5	316.81 - 321.81	S+G	58.0	316.31	07/14/86	2" SS	A
MW-4S	374.04	372.04	21.50	350.54	21.0 - 16.0	351.04 - 356.04	Slt+vfS	NA	NA	09/25/86	2" SS	A
MW-4D	373.74	372.17	56.50	315.67	56.5 - 51.5	315.67 - 320.67	S+G	57.0	315.17	07/15/86	2" SS	A
MW-5	377.38	375.32	20.30	355.02	20.0 - 15.0	355.32 - 360.32	S+G	20.0	355.32	09/30/86	2" SS	A
MW-6S	377.23	375.83	21.30	354.53	21.0 - 16.0	354.83 - 359.83	Slt+vfS	NA	NA	09/30/86	2" SS	A
MW-6I	377.66	376.01	40.40	335.61	40.0 - 29.6	336.01 - 346.41	Slt+vfS	NA	NA	09/30/86	2" SS	A
MW-6D	377.95	376.27	59.00	317.27	58.7 - 53.7	317.57 - 322.57	S+G	59.0	317.27	09/26/86	2" SS	A/F
MW-7S	372.80	370.91	15.40	355.51	15.0 - 10.0	355.91 - 360.91	Slt+vfS	NA	NA	09/25/86	2" SS	A
MW-7D	372.76	370.96	66.00	304.96	65.5 - 60.5	305.46 - 310.46	S+G	65.5	305.46	09/23/86	2" SS	A/F
MW-8S	368.68	366.62	15.49	351.13	14.9 - 9.9	351.72 - 356.72	Slt+vfS	NA	NA	09/18/86	2" SS	A
MW-8I	368.12	366.40	50.00	316.40	50.0 - 40.0	316.40 326.40	Slt+vfS	NA	NA	11/14/91	2" PVC	A
MW-8D	368.30	366.41	66.40	300.01	66.0 - 61.0	300.41 - 305.41	S+G	66.0	300.41	09/17/86	2" SS	A
MW-9S	366.79	365.38	9.40	355.98	9.0 - 4.0	356.38 - 361.38	Slt+vfS	NA	NA	09/22/86	2" SS	A
MW-9D	367.18	365.58	83.00	282.58	82.5 - 77.5	283.08 - 288.08	S+G	82.5	283.08	09/19/86	2" SS	A/F
MW-10S	364.41	362.74	16.00	346.74	15.4 - 10.4	347.34 - 352.34	Slt+vfS	NA	NA	09/16/86	2" SS	A
MW-10D	363.89	362.60	69.40	293.20	69.0 - 64.0	293.60 - 298.60	S+G	68.8	293.80	09/16/86	2" SS	A
MW-11S	372.69	370.92	24.40	346.52	24.0 - 19.0	346.92 - 351.92	Slt+vfS	NA	NA	10/02/86	2" SS	A
MW-11D	371.80	370.08	83.80	286.28	83.5 - 78.5	286.58 - 291.58	S+G	83.5	286.58	10/02/86	2" SS	A/F
MW-12S	376.22	374.08	21.00	353.08	21.0 - 16.0	353.08 - 358.08	Slt+vfS	NA	NA	12/01/86	2" SS	A
MW-12D	376.05	373.98	80.50	293.48	80.5 - 75.5	293.48 - 298.48	S+G	NOTE A	NOTE A	04/30/90	2" PVC	O
MW-13D	365.27	363.68	44.00	319.68	44.0 - 33.2	319.68 - 330.48	S+G	44.0	319.68	12/17/86	2" SS	A
MW-14S	380.07	378.30	30.50	347.80	30.1 - 25.1	348.16 - 353.20	Slt+vfS	NA	NA	12/18/86	2" SS	A
MW-14D	380.19	378.40	56.00	322.40	55.6 - 40.0	322.80 - 338.40	S+G	55.5	322.90	12/18/86	2" SS	A
MW-15D	369.99	367.95	42.00	325.95	41.5 - 36.5	326.45 - 331.45	S+G	42.7	325.25	12/08/89	2" SS	O
MW-16D	366.29	364.19	78.00	286.19	77.6 - 72.6	286.59 - 291.59	S+G	78.5	285.69	12/11/89	2" SS	O
MW-17D	372.74	370.52	34.50	336.02	34.5 - 29.5	336.02 - 341.02	S+G	33.5	337.02	04/11/90	2" PVC	O
MW-18S	375.66	373.44	30.00	343.44	30.0 - 15.0	343.44 - 358.44	S+G	NA	NA	04/11/90	2" PVC	O
MW-19S	371.25	369.12	19.00	350.12	19.0 - 4.0	350.12 - 365.12	SltCl+fS	NA	NA	04/13/90	2" PVC	O
MW-19D	371.52	369.30	51.00	318.30	51.0 - 46.0	318.30 - 323.30	S+G	51.0	318.30	04/12/90	2" PVC	O
MW-20D	371.35	369.14	81.00	288.14	81.0 - 71.0	288.14 - 298.14	S+G	81.0	288.14	04/20/90	2" PVC	O
MW-21S	379.26	377.11	30.00	347.11	30.0 - 25.0	347.11 - 352.11	S+G	NA	NA	04/23/90	2" PVC	O
MW-21D	379.95	377.69	37.50	340.19	37.5 - 32.5	340.19 - 345.19	S+G	37.5	340.19	04/23/90	2" PVC	O
MW-22S	368.31	366.52	21.00	345.52	21.0 - 16.0	345.52 - 350.52	Slt+vfS	NA	NA	04/26/90	2" PVC	O
MW-22D	368.20	366.46	53.00	313.46	53.0 - 48.0	313.46 - 318.46	S+G	52.5	313.96	04/26/90	2" PVC	O
MW-23S	366.49	364.72	27.00	337.72	27.0 - 22.0	337.72 - 342.72	S+G	NA	NA	05/03/90	2" PVC	O
MW-23D	366.88	365.08	73.00	292.08	73.0 - 68.0	292.08 - 297.08	S+G	73.0	292.08	05/02/90	2" PVC	O
MW-24S	363.54	361.78	17.00	344.78	17.0 - 12.0	344.78 - 349.78	fS	NA	NA	05/07/90	2" PVC	O

MILLER CONTAINER

TABLE 2-2
MONITORING AND RECOVERY WELL SPECIFICATIONS

	MEAS. POINT ELEV. (MSL)	LAND SURFACE ELEV. (MSL)	TOTAL DEPTH WELL (BLS)	TOTAL DEPTH WELL (MSL)	SCREENED INTERVAL (BLS)	SCREENED INTERVAL (MSL)	MATERIAL SCREENED	TOP OF TILL (BLS)	TOP OF TILL (MSL)	DATE INSTALLED	WELL TYPE	DRILL TYPE
MW-24D	363.67	361.72	42.00	319.72	42.0 - 37.0	319.72 - 324.72	S+G	42.0	319.72	05/04/90	2" PVC	O
MW-25S	365.98	364.36	24.00	340.36	24.0 - 19.0	340.36 - 345.36	fmS+Slt	NA	NA	05/11/90	2" PVC	O
MW-25D	368.14	366.14	56.50	309.64	56.5 - 51.5	309.64 - 314.64	S+G	56.5	309.64	05/08/90	2" PVC	O
MW-26S	366.78	364.67	17.00	347.67	17.0 - 12.0	347.67 - 352.67	Slt+vfS	NA	NA	05/10/90	2" PVC	O
MW-26D	366.52	364.77	79.00	285.77	79.0 - 74.0	285.77 - 290.77	S+G	NOTE B	NOTE B	05/10/90	2" PVC	O
MW-27S	365.86	364.11	16.00	348.11	16.0 - 11.0	348.11 - 353.11	Slt+vfS	NA	NA	05/18/90	2" PVC	O
MW-27D	365.76	364.13	59.00	305.13	59.0 - 49.0	305.13 - 315.13	S+G	59.0	305.13	05/18/90	2" PVC	O
MW-28S	356.94	355.08	13.00	342.08	13.0 - 8.0	342.08 - 347.08	S+G	NA	NA	08/23/90	2" PVC	A/O
MW-28I	357.44	355.36	39.70	315.66	39.7 - 29.7	315.66 - 325.66	S+G	NA	NA	08/22/90	2" PVC	O
MW-28D	357.04	354.89	66.00	288.89	66.0 - 61.0	288.89 - 293.89	S+G	68.5	286.39	08/22/90	2" PVC	O
MW-29S	355.27	353.35	13.00	340.35	13.0 - 8.0	340.35 - 345.35	S+G	NA	NA	08/31/90	2" PVC	O
MW-29I	355.37	353.55	44.80	308.75	44.8 - 29.8	308.75 - 323.75	S+G	NA	NA	08/31/90	2" PVC	O
MW-29D	355.25	353.61	64.00	289.61	64.0 - 59.0	289.61 - 294.61	S+G	64.4	289.21	08/24/90	2" PVC	O
MW-30S	354.11	352.51	18.00	334.51	18.0 - 8.0	334.51 - 344.51	Slt+vfS	NA	NA	09/07/90	2" PVC	O
MW-30I	354.11	352.41	39.90	312.51	39.9 - 29.9	312.51 - 322.51	S+G	NA	NA	09/06/90	2" PVC	O
MW-30D	354.07	352.47	64.10	288.37	64.1 - 59.1	288.37 - 293.37	S+G	64.8	287.67	09/05/90	2" PVC	O
MW-31S	355.62	353.94	13.00	340.94	13.0 - 8.0	340.94 - 345.94	Slt+vfS	NA	NA	09/10/90	2" PVC	A
MW-31I	355.67	353.92	40.00	313.92	40.0 - 30.0	313.92 - 323.92	S+G	NA	NA	09/10/90	2" PVC	O
MW-31D	356.22	354.26	61.00	293.26	61.0 - 56.0	293.26 - 298.26	S+G	64.4	289.86	09/07/90	2" PVC	O
MW-32D	381.31	379.77	61.00	318.77	61.0 - 56.0	318.77 - 323.77	S+G	61.5	318.27	09/12/90	2" PVC	O
MW-33S	383.23	380.88	37.00	343.88	37.0 - 32.0	343.88 - 348.88	S+G	51.3	329.58	09/13/90	2" PVC	A
MW-34D	385.08	382.50	60.00	322.50	60.0 - 55.0	322.50 - 327.50	S+G	63.5	319.00	09/14/90	2" PVC	O
MW-35D	381.36	378.98	72.00	306.98	72.0 - 67.0	306.98 - 311.98	S+G	72.0	306.98	09/17/90	2" PVC	O
MW-36S	376.61	376.94	26.00	350.94	26.0 - 21.0	350.94 - 355.94	Slt+vfS	NA	NA	11/14/90	2" PVC	A
MW-36D	376.94	376.95	59.50	317.45	59.3 - 49.3	317.65 - 327.65	S+G	59.3	317.65	11/13/90	2" PVC	A
MW-37S	376.96	375.26	25.00	350.26	25.0 - 15.0	350.26 - 360.26	Slt+vfS	NA	NA	11/16/90	2" PVC	A
MW-37I	377.30	375.56	40.00	335.56	40.0 - 30.0	335.56 - 345.56	Slt+vfS	NA	NA	11/16/90	2" PVC	A
MW-37D	377.20	375.39	55.50	319.89	55.5 - 50.5	319.89 - 324.89	S+G	55.5	319.89	11/15/90	2" PVC	A
MW-38S	373.61	371.64	20.00	351.64	20.0 - 10.0	351.64 - 361.64	Slt+vfS	NA	NA	11/27/90	2" PVC	A
MW-38D	373.14	371.43	35.00	336.43	35.0 - 30.0	336.43 - 341.43	S+G	35.0	336.43	11/26/90	2" PVC	A
MW-39S	372.26	370.61	18.00	352.61	18.0 - 8.0	352.61 - 362.61	Slt+vfS	NA	NA	11/29/90	2" PVC	A
MW-39I	372.34	370.68	35.00	335.68	35.0 - 25.0	335.68 - 345.68	Slt+S+G	NA	NA	11/29/90	2" PVC	A
MW-39D	372.45	370.64	55.00	315.64	55.0 - 45.0	315.64 - 325.64	S+G	55.0	315.64	11/28/90	2" PVC	A
MW-40S	372.06	369.80	13.00	356.80	13.0 - 8.0	356.80 - 361.80	S+G	NA	NA	03/18/91	2" PVC	NA
MW-41S	371.24	369.70	13.00	356.70	13.0 - 8.0	356.70 - 361.70	S+G	NA	NA	03/18/91	2" PVC	NA
MW-42S	354.06	352.40	20.40	332.00	20.4 - 5.4	332.00 - 347.00	Slt+vfS	NA	NA	05/06/91	2" PVC	A
MW-43S	353.58	352.00	20.15	331.85	20.2 - 5.2	331.85 - 346.80	Slt+vfS	NA	NA	05/07/91	2" PVC	A
MW-43D	353.50	352.00	56.10	295.90	55.8 - 50.8	296.20 - 301.20	S+G	55.3	296.81	05/07/91	2" PVC	A
MW-44S	353.06	351.40	20.40	331.00	20.4 - 5.4	331.00 - 346.00	Slt+vfS	NA	NA	05/07/91	2" PVC	A
MW-45S	354.50	352.90	20.10	332.80	20.1 - 5.1	332.80 - 347.80	Slt+vfS	NA	NA	05/08/91	2" PVC	A
MW-45D	354.04	352.40	29.60	322.80	29.6 - 24.6	322.80 - 327.80	S+G	29.4	323.08	05/08/91	2" PVC	A
MW-46S	354.12	352.50	20.50	332.00	20.5 - 5.5	332.00 - 347.00	Slt+vfS	NA	NA	05/09/91	2" PVC	A

MILLER CONTAINER

TABLE 2-2
MONITORING AND RECOVERY WELL SPECIFICATIONS

	MEAS. POINT ELEV. (MSL)	LAND SURFACE ELEV. (MSL)	TOTAL DEPTH WELL (BLS)	TOTAL DEPTH WELL (MSL)	SCREENED INTERVAL (BLS)	SCREENED INTERVAL (MSL)	MATERIAL SCREENED	TOP OF TILL (BLS)	TOP OF TILL (MSL)	DATE INSTALLED	WELL TYPE	DRILL TYPE
MW-46D	354.24	352.40	70.60	281.80	68.6 - 63.6	283.80 - 288.80	S+G	68.5	283.89	05/09/91	2" PVC	A
MW-47S	380.66	381.10	40.00	341.10	35.0 - 20.0	346.10 - 361.10	Slt+vfS	NA	NA	06/18/91	6" PVC	A
MW-48S	380.76	381.10	40.00	341.10	35.0 - 20.0	346.10 - 361.10	Slt+vfS	NA	NA	06/19/91	6" PVC	A
MW-49S	378.93	377.60	35.00	342.60	35.0 - 25.0	342.60 - 352.60	S+G	NA	NA	11/22/91	2" PVC	A
MW-49I	379.16	377.50	52.00	325.50	52.0 - 42.0	325.50 - 335.50	S+G	NA	NA	11/22/91	2" PVC	A
MW-49D	379.04	377.40	72.20	305.20	72.2 - 62.2	305.20 - 315.20	S+G	72.5	304.90	11/21/91	2" PVC	A
MW-50S	362.82	361.40	18.00	343.40	18.0 - 8.0	343.40 - 353.40	Slt+vfS	NA	NA	11/12/91	2" PVC	A
MW-50I	362.57	361.50	45.00	316.50	45.0 - 35.0	316.50 - 326.50	Slt+vfS	NA	NA	11/11/91	2" PVC	A
MW-50D	362.67	361.40	72.00	289.40	72.0 - 62.0	289.40 - 299.40	S+G	72.0	289.40	11/08/91	2" PVC	A
MW-51I	367.84	366.20	52.00	314.20	52.0 - 42.0	314.20 - 324.20	S+G	NA	NA	11/06/91	2" PVC	A
MW-51D	367.37	366.00	88.00	278.00	88.0 - 78.0	278.00 - 288.00	S+G	87.5	278.50	11/05/91	2" PVC	A
MW-52S	368.74	367.20	18.00	349.20	18.0 - 13.0	349.20 - 354.20	S+G	NA	NA	11/14/91	2" PVC	A
MW-52I	368.36	367.00	27.00	340.00	27.0 - 22.0	340.00 - 345.00	S+G	NA	NA	11/13/91	2" PVC	A
MW-52D	368.09	366.70	39.00	327.70	39.0 - 34.0	327.70 - 332.70	S+G	38.5	328.20	11/13/91	2" PVC	A
MW-53S	370.16	368.60	70.00	298.60	20.0 - 10.0	348.60 - 358.60	Slt+vfS	NA	NA	11/19/91	2" PVC	A
MW-53I	369.62	368.30	38.00	330.30	38.0 - 28.0	330.30 - 340.30	S+G	NA	NA	11/18/91	2" PVC	A
MW-53D	369.47	367.90	54.00	313.90	54.0 - 44.0	313.90 - 323.90	S+G	54.0	313.90	11/18/91	2" PVC	A
MW-54S	372.37	370.90	16.00	354.90	16.0 - 11.0	354.90 - 359.90	Slt+vfS	NA	NA	11/01/91	2" PVC	A
MW-54I	372.45	371.10	44.70	326.40	44.7 - 39.7	326.40 - 331.40	Slt+vfS	NA	NA	11/01/91	2" PVC	A
MW-54D	372.56	371.20	73.00	298.20	73.0 - 68.0	298.20 - 303.20	S+G	72.5	298.70	10/31/91	2" PVC	A
MW-55D	374.57	373.20	46.00	327.20	46.0 - 36.0	327.20 - 337.20	S+G	45.8	327.40	12/02/91	2" PVC	A
MW-56D	367.73	366.20	67.50	298.70	67.5 - 57.5	298.70 - 308.70	S+G	67.5	298.70	12/09/91	2" PVC	A
MW-57S	365.01	365.20	25.00	340.20	25.0 - 10.0	340.20 - 355.20	Slt+vfS	NA	NA	12/11/91	2" PVC	A
MW-57D	365.23	365.40	76.00	289.40	76.0 - 66.0	289.40 - 299.40	S+G	75.0	290.40	12/11/91	2" PVC	A
MW-58S	380.73	381.10	39.50	341.60	34.5 - 9.5	346.60 - 371.60	Slt+vfS	NA	NA	12/14/91	6" PVC	A
MW-59S	380.53	381.10	39.50	341.60	34.5 - 9.5	346.60 - 371.60	Slt+vfS	NA	NA	12/16/91	6" PVC	A
MW-60S	367.79	366.30	23.00	343.30	23.0 - 13.0	343.30 - 353.30	S+G	NA	NA	12/23/92	2" PVC	A
MW-60I	367.67	366.20	45.00	321.20	45.0 - 35.0	321.20 - 331.20	S+G	NA	NA	12/23/92	2" PVC	A
MW-60D	367.79	366.20	63.00	303.20	63.0 - 53.0	303.20 - 313.20	S+G	63.0	303.20	12/22/92	2" PVC	A
BMW-1	372.04	370.19	99.00	271.19	99.0 - 93.4	271.19 - 276.79	IntSS+Sltst	84.5	285.69	12/05/89	2" SS	R/O
RW-1	368.94	367.03	74.80	292.23	NOTE C	NOTE C	S+G	74.0	293.03	04/25/88	6" SS	C
RW-2	374.28	372.37	85.50	286.87	NOTE D	NOTE D	S+G	85.5	286.87	04/26/88	6" SS	C
RW-3 new	376.19	374.59	58.00	316.59	58.0 - 52.6	316.59 - 321.99	S+G	58.1	316.49	02/03/89	6" SS	R
RW-3 old	376.05	375.25	57.70	317.55	57.5 - 52.5	317.75 - 322.75	S+G	57.5	317.75	04/27/88	6" SS	C
T-1	381.75	379.77	37.50	342.27	37.5 - 27.5	342.27 - 352.27	Slt+vfS	NA	NA	05/19/89	2" PVC	A
T-2	385.06	382.56	39.20	343.36	39.2 - 14.2	343.36 - 368.36	Slt+vfS	NA	NA	05/23/89	4" PVC	A
T-3	381.07	378.73	33.00	345.73	33.0 - 23.0	345.73 - 355.73	Slt+vfS	NA	NA	05/24/89	2" SS	A
T-4	380.22	378.8	38.50	340.30	38.5 - 23.5	340.30 - 355.30	S+G	NA	NA	06/01/89	2" PVC	A
USGS-1	356.16	350.8	24.00	326.80	24.0 - 21.0	326.80 - 329.80	CG	72.0	278.8			
USGS-2	355.81	352.3	28.00	324.30	28.0 - 25.0	324.30 - 327.30	S+G	NA	NA			
GW-1	364.66	362.7	35.00	327.70	21.0 - 31.0	341.70 - 331.70	NA	NA	NA	11/16/88	2" PVC	A
GW-2	354.04	351.3	25.00	326.30	14.0 - 24.0	337.30 - 327.30	NA	NA	NA	11/14/88	2" PVC	A

MILLER CONTAINER

TABLE 2-2
MONITORING AND RECOVERY WELL SPECIFICATIONS

	MEAS. POINT ELEV. (MSL)	LAND SURFACE ELEV. (MSL)	TOTAL DEPTH WELL (BLS)	TOTAL DEPTH WELL (MSL)	SCREENED INTERVAL (BLS)	SCREENED INTERVAL (MSL)	MATERIAL SCREENED	TOP OF TILL (BLS)	TOP OF TILL (MSL)	DATE INSTALLED	WELL TYPE	DRILL TYPE
GW-4	352.86	350.7	21.00	329.70	9.0 - 19.0	341.70 - 331.70	NA	NA	NA	11/15/88	2" PVC	A
K-1	355.54	353.50	23.80	329.70	NOTE A	NOTE A	S+Slt	NA	NA			
M-1	354.12	352.20	40.00	312.20	NOTE B	NOTE B	S+Slt/S+G	NA	NA			DUG
K-2	355.51	353.00	23.00	330.00	NOTE A	NOTE A	S+Slt/S+G	NA	NA			
M-2	356.27	355.00	37.30	317.70	NOTE B	NOTE B	S+Slt/S+G	NA	NA			DUG
D-1	359.10	359.30	18.00	341.30	8.0 - 18.0	351.30 - 341.30	S	NA	NA	09/25/91	2" PVC	A
D-2	351.26	351.70	10.00	341.70	3.0 - 10.0	348.70 - 341.70	S+Slt	NA	NA	09/26/91	2" PVC	A
D-3	353.79	354.40	14.00	340.40	4.0 - 14.0	350.40 - 340.40	S+Slt	NA	NA	09/26/91	2" PVC	A
D-4	359.48	359.80	18.00	341.80	8.0 - 18.0	351.80 - 341.80	S+Slt/S+G	NA	NA	09/26/91	2" PVC	A
D-5	359.97	360.00	18.00	342.00	8.0 - 18.0	352.00 - 342.00	S+Slt	NA	NA	09/26/91	2" PVC	A
D-6	352.80	353.00	13.00	340.00	3.0 - 13.0	350.00 - 340.00	S+Slt	NA	NA	09/27/91	2" PVC	A
D-7	354.46	354.70	14.00	340.70	4.0 - 14.0	350.70 - 340.70	S+Slt	NA	NA	10/21/91	2" PVC	A
D-8	355.43	NOTE E	20.00	NOTE E	5.0 - 20.0	NOTE E	S+Slt/S+G	NA	NA	10/21/91	2" PVC	A
D-9	357.70	NOTE E	20.00	NOTE E	5.0 - 20.0	NOTE E	S+Slt	NA	NA	10/30/92	2" PVC	A
E-1	348.60	NOTE F	24.00	NOTE F	4.0 - 24.0	NOTE F	S+Slt/S+G	NA	NA	10/30/92	2" PVC	A
E-2	351.54	NOTE F	28.80	NOTE F	3.8 - 28.8	NOTE F	S+Slt/S+G	NA	NA	10/29/92	6" PVC	A

NOTES:
NOTE A = No Till, bedrock encountered at 81 feet BLS
NOTE B = No Till, bedrock encountered at 79 feet BLS
NOTE C = Two Screens:BLS 50.0-46.0; 74.0-58.0 / MSL 317.03-321.03; 293.03-309.03
NOTE D = Two Screens:BLS 54.0-50.0; 85.5-77.0 / MSL 318.37-322.37; 286.87-295.37
NOTE E = Survey data incomplete; measuring points of wells are approximately 1.5-2 feet ABOVE land surface (inside standpipe).
NOTE F = Survey data incomplete; measuring points of wells are approximately 1.5-2 feet BELOW land surface (inside manway).

EXPLANATION:
2" PVC = 2 inch inner diameter PVC well
4" PVC = 4 inch inner diameter PVC well
6" PVC = 6 inch inner diameter PVC well
2" SS = 2 inch inner diameter stainless steel well
6" SS = 6 inch inner diameter stainless steel well
A = Hollow-stem augers
F = Flush-joint casing
R = Rotary method
O = ODEX method
C = Cable tool
RW-,E- = Recovery wells

MSL = Relative to feet above Mean Sea Level
BLS = Relative to feet Below Land Surface
NA = Not Applicable
S+G = Sand and gravel
Slt+vfS = Silt and very fine grained Sand
IntSS+Sltst = Interbedded Sandstone and Siltstone
fmS+Slt = fine to medium grained Sand and Silt
fS = fine grained Sand
SltCl+fS = Silty Clay and fine grained Sand
Slt+S+G = Silt and Sand and Gravel
CG = Clayey Gravel

The total depth of K-2 is about 20 feet below grade and the total depth of M-2 is about 35 feet below grade. However, the depth to the top of the lodgement till in this area is about 64 feet below grade. Based on the need to evaluate potential contamination over the entire thickness of the aquifer and on the results of the head-space analysis, which showed elevated HNU readings corresponding to the interval where M-2 is screened, three wells were installed per cluster. The shallow well was screened at the water table, the intermediate well was screened between about 30 to 40 feet below grade and the deep well was screened in the interval directly above the lodgement till contact.

The screened interval of each of these wells is given in Table 2-2, relative to land surface and to Mean Sea Level (MSL). Other monitoring well specifications are also included.

B. Post-IRI Report Wells

There were no monitoring wells installed in the immediate vicinity of K-2 and M-2 after the preparation of the IRI Report. Monitoring wells MW-46S,D were installed subsequent to the IRI Report in a location approximately half way between K-2/M-2 and K-1 to assess the relative extent of the cone of influence around these wells and to serve as ground water quality monitoring points for potential contaminant migration from K-2/M-2 toward K-1.

2.2.2.3 Rationale for Monitoring Wells Near K-1

A. Pre-IRI Report Wells

Four shallow monitoring wells were installed by the NYSDEC prior to the preparation of the IRI Report to investigate the Mirabito suspected Inactive Hazardous Waste Disposal Site. This site is located along the northern boundary of the Municipal Water Works property, which is near K-1. Three of the wells are shown on Figure 2-1. The fourth well (GW-3) is located off the map area.

B. Post-IRI Report Wells

In order to determine the direction from which contamination is reaching K-1 and to determine aquifer characteristics such as the configuration of the cone of influence due to withdrawal of water from this well, it was necessary to install monitoring wells around this municipal well. Wells installed in the immediate vicinity of K-1 are MW-42S, MW-43S,D, MW-44S, MW-45S,D and MW-57S,D; MW-46S,D were installed to serve as early warning wells for potential contamination approaching K-1. The locations are shown on Figure 2-1. Most of the wells installed around K-1 are also located in areas where slightly elevated soil gas readings were obtained.

Subsequent to these well installations, the NYSDEC had seven monitoring wells installed in the vicinity of MW-45S,D during September and October 1991. These wells were installed as part of an investigation into gasoline-type compounds (BTEX) detected at MW-45S,D. In addition, an underground diesel fuel storage tank located near a sewer lift station about 75 feet north of MW-45S,D was removed, and during October 1991, a soil gas survey was performed. Elevated BTEX concentrations at MW-45S,D prompted the NYSDEC to install a ground water recovery system consisting of two withdrawal wells, an air stripping unit, and two additional monitoring wells. Monitoring wells installed by the NYSDEC are shown on Figure 2-1 and are used as data collection points for water table configuration maps presented in this report.

2.2.2.4 Rationale for Monitoring Wells on the Taylor Property

A. Pre-IRI Report Wells

Three shallow monitoring wells (T-1, T-2 and T-4) were installed on the Taylor property by a representative of Mr. Taylor to monitor ground water quality below and downgradient of the two former underground storage tanks on the Taylor property. An additional shallow well (T-3) was installed on Miller property by Mr. Taylor to serve as an upgradient water quality monitoring well. These wells were installed prior to the RI and are shown on Figure 2-1.

Deep wells were installed by Miller during the RI in locations adjacent to Taylor wells T-1, T-2 and T-4 to complete well clusters at these locations. These wells were labeled MW-32D, MW-34D and MW-35D, respectively, and are also shown on Figure 2-1. Well specifications for these wells and the Taylor wells are included in Table 2-2.

An additional shallow monitoring well (MW-33S) was installed on the Miller side of the fence between the Taylor property and the Miller property as a result of the septic tank/leach field investigation performed at the Taylor Farmhouse. This investigation involved excavating to expose the components of the septic system, collecting a septic tank sludge sample and drilling a test boring during which soil samples were collected for head-space analysis. Monitoring well MW-33S was ultimately installed in this borehole. The test boring was originally intended to be located on Taylor property. However, during the excavation process, an overflow pipe leading from the main septic tank on the Taylor property to a dry well on Miller property was unearthed. A schematic illustrating the components of the septic system, as they appeared during the excavation conducted by Miller, is shown on Figure 2-2. The overflow pipe was disconnected and replaced with the perforated pipe at some time in the recent past. However, it was determined by the on-site NYSDEC and MPI representatives that the best location for the borehole would be in the vicinity of the dry well on the Miller property. This borehole was advanced to the top of the lodgement till to provide information on the occurrence of the top of this unit and to provide soil samples for head-space analysis. Continuous split-spoon samples were collected to below the top of the water table. Split-spoon samples were collected at 5-foot intervals, thereafter, to the total depth of the borehole. According to the head-space results, the highest HNU readings were obtained in the interval between 28 and 37 feet below land surface, which correlated with the occurrence of the water table. Therefore, the decision was made to screen MW-33S in this interval.

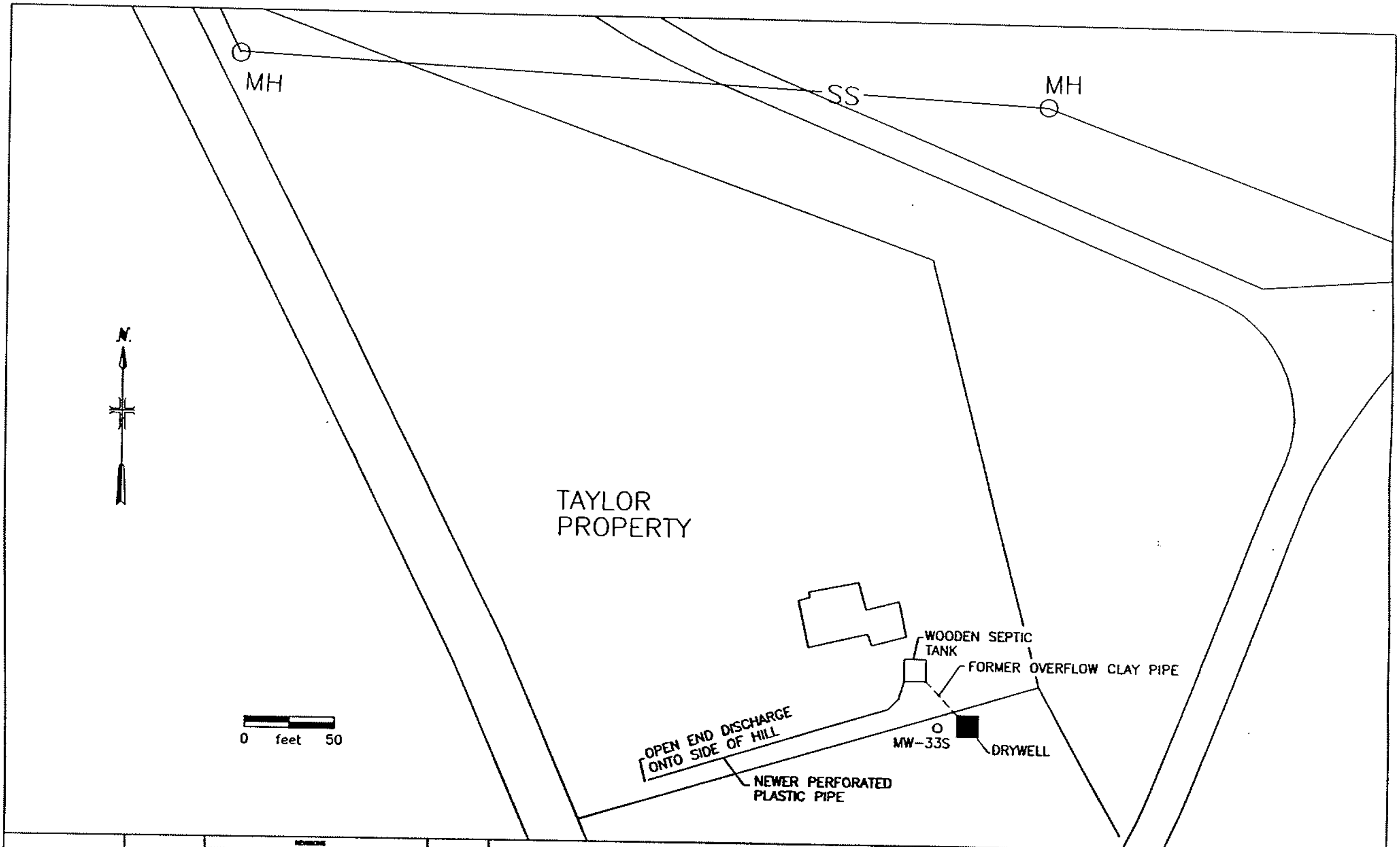
B. Post-IRI Report Wells

There were no wells installed on the Taylor property after the IRI Report was prepared.

2.2.2.5 Drilling Methods and Monitoring Well Installation Procedures

Either hollow-stem auger drilling (4 1/4-inch or 8 1/4-inch I.D. Augers) or the ODEX drilling method was used to drill the boreholes for installation of the monitoring wells during the RI. However, monitoring wells MW-40S and MW-41S were constructed aboveground and installed in a trench that was excavated to the base of the sewer line bedding near manhole #3 and #4 prior to backfilling. The type of drilling method used at each borehole location is listed in Table 2-2. The ODEX method (Overburden Drilling by Eccentric Casing) was used when large gravel zones or flowing sands were anticipated or when the total depth of the borehole was expected to be relatively great.

Split-spoon samplers (2-inch I.D.) were used to collect soil samples from the land surface to the total depth of each deep well in a cluster, and at each single well location (where multiple wells in a cluster were not installed). Most wells installed during the RI were sampled at 5-foot intervals where possible. However, wells MW-8I and MW-49D



MALCOLM PIRNIE

MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK

TAYLOR SEPTIC SYSTEM

MALCOLM PIRNIE, INC.
DATE FEBRUARY 1993
SHEET ___ OF ___
DWG. NO. 2-2

through MW-54D were sampled continuously to the top of lodgement till. Boreholes adjacent to MW-55D and MW-56D were sampled in standard intervals to the top of lodgement till and then continuously from the top of till to the top of bedrock. MW-40S and MW-41S were not sampled due to their method of installation. MW-47S, MW-48S, MW-58S and MW-59S were sampled continuously to the water table, then at standard 5-foot intervals to the total depth of the well.

No split-spoon samples were collected at shallow or intermediate wells which were part of a well cluster containing a deeper well due to the availability of the adjacent deeper borehole soil samples. Additional split-spoon samples were collected in some instances, for example, where changes in subsurface drilling conditions were noted by the driller. Portions of each split-spoon sample were tested for the presence of VOCs by the head-space method. The head-space methodology is described in Appendix H of the RI/FS work plan (QAPP). The results of the head-space screening for VOCs are shown on the drilling logs in Appendix A. The remainder of the samples were described by an MPI geologist and retained in sample jars. The soil descriptions are also contained in Appendix A.

After the total depth of each borehole was reached, a ground water monitoring well was constructed in the borehole, except for wells MW-55D and MW-56D which were installed in adjacent boreholes to the top of lodgement till. The final depth of each well was determined by the MPI and NYSDEC representatives present on site.

Each monitoring well installed outside the Container Plant during the RI has the same following components. Detailed cross sections of most wells are included on the drilling logs in Appendix A.

1. Two-inch I.D. PVC slotted screen (0.010 inch slots) was utilized.
2. Two-inch I.D. PVC riser extends from the screened interval to the top of the well.
3. Select sand (size 2Q ROK or equivalent) was packed in the annular space between the well and the borehole to approximately two feet above the top of the screened interval.
4. A minimum of two feet of bentonite was emplaced above the sand pack to act as a well seal.
5. A Portland Cement/bentonite grout was used to fill the remaining annulus to land surface. The proportions of the mixture were from three to five pounds

of bentonite per 94-pound bag of cement plus 6.5 gallons water, depending on field consistency.

6. With the exception of well clusters MW-36S,D and MW-57S,D, a four-inch I.D. protective, steel guard pipe with a lockable cap was lowered over the well casing and cemented into place with a collar sloping away from the well. Due to the location of wells MW-36S,D near the road along the southern edge of the Container Plant, and MW-57S,D on the Riverscape Apartments property, a curb box was installed at the surface around each of these wells.

All monitoring wells installed inside the Container Plant were constructed with the following components:

1. Six-inch I.D. PVC slotted screen was utilized (0.02 inch slots for MW-47S and MW-48S and a combination of 0.02 inch and 0.01 inch slots for MW-58S and MW-59S).

2. Six-inch I.D. PVC riser extends from the top of the screened interval to the top of the well.

3. Six-inch I.D. PVC riser extends from the bottom of the screened interval to five feet below the bottom of the screened interval to act as a sediment trap.

4. Select sand was packed in the annular space between the well and the borehole to approximately two feet above the top of the screened interval. Grade 0 sand was used around all 0.01 inch slot screens, while Grade 1 sand was used around all 0.02 inch slot screen.

5. A Portland Cement/bentonite grout was used to fill the remaining annulus to the bottom of the Container Plant floor. The proportions of the mixture were from three to five pounds of granular bentonite per 94-pound bag of cement plus 6.5 gallons water, depending on field consistency.

6. A two-foot diameter steel manhole cover was set over the top of each well as a protective cover.

To prevent the possibility of cross-contamination between boreholes, the drilling rig and all drilling accessories were thoroughly decontaminated before arriving on-site and between drilling sites. A pressurized steam cleaner was used to decontaminate the drilling rig and its accessories. All split-spoon samplers were decontaminated with a detergent/water wash between usage.

2.2.2.6 Monitoring Well Development

As each well installation was completed, the well was developed by bailing and/or by the use of a well development pump to remove drilling cuttings and drilling fluids that were added during the drilling process. Records of the turbidity changes during the RI well development process were maintained and are listed in Appendix F.

An attempt was made to develop each well to a turbidity level of less than 50 NTU. However, since many of the wells were screened in a fine-grained unit, development to the 50 NTU level was not always possible. In the case where the 50 NTU level was not obtainable, the wells were developed until pH and conductivity stabilized or until ten well volumes had been removed.

2.2.2.7 Disposition of Drill Cuttings and Development/Purge Water

In accordance with the RI/FS work plan, all drill cuttings, except those generated during the installation of wells MW-47S, MW-48S, MW-58S and MW-59S, were disposed of within 20 feet of their respective boreholes. Since monitoring wells MW-47S, MW-48S, MW-58S and MW-59S were installed below the floor of the Container Plant, the drill cuttings generated during their installation were drummed and subsequently disposed off-site. All development and purge water was also disposed of near the wells, except for the water generated at the wells that were installed inside the Container Plant. The water from these wells was drummed for disposal.

2.2.2.8 Permeability Testing

Falling-head or rising-head permeability tests (slug tests) were performed at each monitoring well installed during the RI to permit estimation of the saturated horizontal hydraulic conductivity of the soils in the vicinity of the screened interval. Several wells had such a rapid recharge rate that slug testing could not be properly conducted. Some of these wells were retested during January 1993 for the purpose of estimating seepage velocities across the site; the hydraulic conductivity values estimated are discussed further in Section 3.4.2.2 of this report. Also, all indoor wells were not slug tested because their screened intervals extended into the unsaturated zone and might produce erroneous results.

Four falling-head tests were conducted at various points around the site in order to determine the saturated vertical hydraulic conductivity of the lodgement till. This method involved pounding a 2-inch casing into the top of the till and removing the plug of till in the end of the rod. Then water was added to the casing and the amount of water released to the formation over time was recorded. Unfortunately, it was not possible to pound the casing more than 0.5 feet into the till, therefore, a good seal between the till and the casing did not occur. For this reason, the results of the tests are invalid.

Permeability testing was also conducted at the MW-8I location. A Shelby tube was collected from above the clay layer and one from within the clay layer. Two attempts were made to collect Shelby tubes from below the clay layer; however, no recovery was obtained from either sample due to the lack of cohesiveness of the samples. Results of the permeability testing are discussed in Section 3.

2.2.2.9 Well Surveying

The elevation of the land surface and the top of the well casing for each monitoring well were surveyed by a licensed surveyor to the nearest 0.01 foot and tied to a USGS datum (relative to Mean Sea Level) to enable correlation of water levels and subsurface units. The elevations are listed on Table 2-2. A topographic map of the site with a contour interval of two feet was prepared and is included as Sheet 2. The monitoring well locations were established and plotted on the site topographic map.

2.2.2.10 Water Level Measurements

Water levels in the monitoring wells installed during the RI, as well as those installed during previous investigations, have been measured and recorded on a monthly basis. The water levels are reported in tables in Appendix B as a function of the year in which they were recorded. These data have been used to map the configuration of the water table and other potentiometric surfaces below the site. An assessment of the water level data is presented in Section 3.

2.2.3 Evaluation of Potential Contaminant Sources on the Miller Property

A. Container Plant site drawings were examined to determine where underground utilities exit from below the Container Plant building foundation. Soil gas samples were then collected from as close to the utility trenches as possible.

B. Shallow monitoring wells were installed near the sanitary sewer that traverses the site and soil gas samples were collected near the sewer line in an attempt to determine if the sewer bedding is serving as a conduit for contaminant migration.

C. The soil around the City of Fulton manhole located at the junction of the Miller sanitary sewer and the City of Fulton sanitary sewer (labeled as MH#1 on Figure 2-1) was excavated in response to elevated soil gas readings that were obtained near the manhole. Soil samples were collected from below the sewer lines near their connection at the manhole. The results of the analyses are discussed later in this report.

Additional excavations were performed around two Miller sanitary sewer manholes (labeled as MH#3 and MH#4 on Figure 2-1) due to the results of the analyses performed on the soil samples collected from below the sewer pipes at MH#1. Shallow monitoring wells were ultimately installed in the excavation at the MH#3 and MH#4 locations prior to backfilling. Ground water was not encountered at MH #1.

D. A Schonstedt MAC-51B magnetometer was used to survey the area of the Miller site where a former laundry and/or dry cleaning establishment may have been operated when the site was owned by Irwin Taylor. This area is located southwest of the MW-10S,D well cluster near the present Taylor farmhouse property line.

The magnetometer was used to locate buried ferrous materials that were left in the area when the building was razed. A backhoe was then brought on site to excavate down to the metallic objects to determine their identity. An HNU organic vapor analyzer was used to screen the excavated soil for total VOCs.

Several metallic objects were located with the magnetometer and uncovered during the excavation process. These included an abandoned natural gas line that was apparently the service to the former building, some steel piping and some reinforced concrete from the former building. No readings above background were obtained with the HNU during the excavation. This investigation provided conflicting information about whether a dry cleaning facility in fact existed.

E. The soil gas investigation, which was described earlier in this report (Section 2.2.1), was used in part to investigate other potential sources on the Miller property. The results of this investigation are summarized in Section 4.

F. An investigation to determine the magnitude and extent of an oil spill that was discovered during April 1991 below the Container Plant floor has been initiated. Analysis of recovered oil has revealed elevated levels of several VOCs and ground water samples collected from wells installed near the USTs have also shown high levels of VOCs. This ongoing investigation is discussed in more detail in Section 4.

2.2.4 Evaluation of Potential Off-Site Contaminant Sources

Several areas located off Miller property have been identified in previous documents as possible sources for the contamination detected at K-2 and M-2. These areas include the Mirabito property, the Taylor property, the Oswego River, the State Ditch and the 12-inch gravity water line that formerly connected K-2 and M-2 with other municipal wells located farther to the south along Route 57.

The Mirabito property has been investigated by the NYSDEC as a suspected Inactive Hazardous Waste Disposal Site; it was concluded by the NYSDEC that the property is not a source area.

A soil gas investigation performed around K-2 and M-2 was used to determine the direction from which shallow (water table) contamination is reaching these wells. The Taylor property, the Oswego River, the State Ditch and the 12-inch water line (and associated bedding material) were evaluated as sources of shallow contamination at K-2/M-2 during this investigation. The shallow ground water around K-1 was evaluated with a soil gas investigation to determine the direction of possible sources for the contamination at this well. The soil gas data were also used to determine the locations for shallow groundwater monitoring wells that were installed around K-1 and around K-2 and M-2. The soil gas and ground water sampling are described in the following sections.

There has been no evidence found during this remedial investigation to suggest that the 12-inch gravity water line is a contaminant source or a pathway for contaminant migration.

Samples collected from the State Ditch contained acetone and methylene chloride. Methylene chloride was detected in the trip blank; however, neither compound was detected in the laboratory's method blank. Since these compounds are common laboratory-introduced contaminants, their presence in samples collected from the State Ditch are inconclusive. Acetone has not been observed as a contaminant at K-2 or M-2; however, it is not a routine analyte.

Sporadic, low-level VOC contamination has been detected at K-1. The source of this contamination was investigated during the RI. The two most common contaminants in K-1 have been trichloroethylene (TCE) and 1,1,1-trichloroethane (TCA); BTEX compounds have also been detected during the last several months. During June 1992, water was observed leaking from two pipelines which entered K-1. City of Fulton personnel indicated that one line was formerly connected to K-2, but that the line had been cut and capped previously; the leakage from this pipe appeared to be from around the outside of the pipe. Leakage from the second line appeared to be from the inside of the pipeline itself. City of Fulton personnel indicated that this line originated at M-2 and that the leakage observed probably was M-2 water. Attempts by Water Works personnel to close the valve between M-2 and K-1 were unsuccessful. Samples of the leaking water were collected from both pipelines and submitted for analysis according to EPA Method 502.2. The analytical results are included in Appendix C. The sample labeled "K-2 infiltration" showed all compounds on the 502.2 list as below detection limits; the sample labeled "M-2 infiltration" showed detectable levels of four compounds on the 502.2 list, including 23 ug/l of 1,1,1-trichloroethane (TCA). The City of Fulton has indicated that both ends of the pipeline originating at M-2 have been plugged since this sampling event. TCA was not detected at K-1 during July, August or September; however, very low levels of TCA were detected at K-1 in October and November 1992. The occurrence of TCA at K-1, prior to plugging the pipeline from M-2, may have been linked to contamination at M-2; however, TCE is a common contaminant at K-1 but is not detected at M-2, and TCA has been detected twice at K-1 since the pipeline was plugged.

BTEX contamination in the vicinity of K-1 and monitoring wells MW-45S,D, located northwest of K-1, has been investigated by the NYSDEC through the installation of several monitoring wells and the performance of a soil gas survey in this area. Ultimately, additional monitoring wells and an air stripping treatment system were installed. NYSDEC-sponsored monitoring wells and recovery wells are shown on Figure 2-1 as "D-" and "E-", respectively. Low levels of chlorinated compounds, including TCE and TTCE, have been detected at NYSDEC wells D-2, D-4 and D-5, and at Mirabito well GW-1.

2.2.5 RI Sampling and Analyses

2.2.5.1 Soil Gas Investigation Sampling and Analysis

A total of 394 soil gas samples were collected and analyzed by Tracer during the three phases of the investigation. During the first, second and third phases, 104, 165 and 125 soil gas samples were collected, respectively. Eleven ground water samples were collected by Tracer during the first phase, and five sanitary sewer (water) samples and one ground water sample were collected during the second phase. All of the soil gas and all of the water samples, except the ground water sample collected during the second phase, were analyzed by Tracer using their on-site GC. The ground water sample that was not analyzed by Tracer was collected from a location to the northwest of K-2 in response to slightly elevated soil gas readings which were obtained in this area. The ground water sample was collected from about five feet below grade and was delivered to Upstate Laboratories, Inc. (Upstate) for analysis for the compounds on the EPA Method 8240 list. This analysis is by GC/MS and was performed in an attempt to identify a C_1-C_3 hydrocarbon which could not be identified in the field by the Tracer GC.

Soil gas probes were used to collect samples during the three phases of the investigation from depths ranging from two to 14 feet below grade. The desired depth for the sample collection was determined for each area of the investigation by vertically profiling the soil gas concentrations in areas of known or suspected contamination. Ground water samples were obtained from nearby monitoring wells, where available, to correlate the soil gas readings with ground water contaminant concentrations. The sanitary sewer samples were collected from the manholes shown on Figure 2-1 during the investigation that was performed adjacent to the sewer line.

The Tracer equipment, sampling procedures, analytical procedures and QA/QC procedures are described in the three reports that were prepared by Tracer following the performance of each phase of the field work. The Tracer reports are included in this report as Appendix E.

2.2.5.2 Ground Water Sampling and Analysis

A list of monitoring wells that were installed prior to and during the two phases of the RI is presented in Table 2-1.

A ground water sample was collected from each monitoring well on this list during December 1991, except for BMW-1, MW-5, and MW-60S,I,D. BMW-1 is the monitoring well screened in bedrock and MW-5 is the upgradient monitoring well located on the east side of the Container Plant. MW-60S,I,D are the most recent wells, installed during December 1992 as part of the third phase of the RI. RI monitoring wells installed during the first two phases were installed from April through November 1990, and March through December 1991.

Monthly groundwater samples were collected from a reduced list of wells during the RI well installation process, except during quarterly sampling months when samples were collected from all available wells listed in Table 2-1. As each RI well was completed, it was added to the list of monitoring wells available for monthly and quarterly sampling. The installation date for each well is listed in Table 2-2. Monitoring wells MW-60S,I,D were sampled once in December 1992 following installation, and twice in January 1993. The groundwater quality (analytical) data available from prior to and during the RI (through August 1992) are presented in Appendix C.

The monthly and quarterly ground water samples collected from the monitoring wells were analyzed for the parameters on the EPA Methods 601 and 602 lists. During the RI, ground water samples were also obtained from the recovery wells that are in operation, from the combined influent prior to air stripping and from the air stripper effluent. The samples were obtained monthly and analyzed for the 601 and 602 compounds. The analytical results have been incorporated into Appendix D. Standard commercial deliverables have been required for reporting the results of these analyses.

Weekly samples are collected from municipal wells K-1 and K-2 in accordance with the requirements stipulated in the Amendment to Order on Consent #A701118704. Municipal Well M-2 is also sampled weekly. The municipal well samples are analyzed according to drinking water method (EPA) 502.2 by Life Sciences Laboratory (LSL), formerly Syracuse Research Corporation (SRC). The results of these analyses (through December 1992) have been summarized in Tables in Appendix C.

During the RI, additional ground water samples were collected from several monitoring wells and the municipal wells for supplemental analyses. These samples were collected during the December 1990 quarterly sampling event and were analyzed and reported according to NYSDEC ASP Category B reporting and deliverables requirements. Analyses of samples requiring NYSDEC ASP deliverables was conducted by Galson Laboratories, Syracuse, New York (Galson). A breakdown of where the additional samples were collected and the analyses performed on the samples is listed in Table 2-3. A summary of the results of these analyses is tabulated in Appendix G.

Data validation of the analytical reports was performed on all samples submitted for NYSDEC ASP analyses. The data validation was performed by Environmental Standards, Inc., Valley Forge , Pennsylvania (ESI). The quality assurance review prepared by ESI indicated that, overall, Galson did a "very good job" with the analyses of the samples. A copy of the quality assurance review is provided in appendix H. Also included in Appendix H is a copy of Galson's responses to ESI's comments.

Until January 1991, the analyses of monitoring well samples (requiring standard commercial deliverables) was performed by Upstate. However, the analytical work for Miller was bid during the end of 1990. Galson was awarded the analytical work; therefore, a change-over from Upstate to Galson for the monthly and quarterly analyses began during January 1991. During January and February 1991, samples were split between Upstate and Galson to provide data to correlate the two sets of analytical results. In March 1991, Galson received all of the samples collected and submitted for analysis.

2.2.5.3 City of Fulton WWTP Sampling and Analysis

Samples are collected at the City of Fulton Wastewater Treatment Plant (WWTP) on a semiannual basis in accordance with the City of Fulton Sewer Use Permit. Samples were collected from the wastewater influent and effluent and from the digester sludge. The samples collected were analyzed for the compounds on the EPA Method 601 and 602 lists. The results of the analyses are tabulated in Appendix I.

2.2.5.4 Additional Sampling and Analysis

One sample of sludge was obtained from the septic tank on the Taylor property (Figure 2-2). The sludge sample was analyzed by Upstate for the compounds on the EPA Method 8240 list. The analytical results are presented in Appendix J.

Two samples were collected from the State Ditch. One was collected in a location west of K-2/M-2 and the other was collected in a location west of K-1. These samples were

MILLER CONTAINER

TABLE 2-3
SUPPLEMENTAL ANALYSES PERFORMED DURING THE RI (GALSON ASP)

LOCATION	PARAMETER	QA/QC	QUANTITY	CONTAINER
MW-1S	USEPA 8240		3	40-ml septum vial
MW-3D	USEPA 8240		6	40-ml septum vial
MW-13D	USEPA 8240		6	40-ml septum vial
MW-14D	USEPA 8240		6	40-ml septum vial
MW-21S	USEPA 8240		6	40-ml septum vial
MW-36S	USEPA 8240		6	40-ml septum vial
MW-36D	USEPA 8240	MS/MSD	6	40-ml septum vial
MW-38S	USEPA 8240		6	40-ml septum vial
MW-38D	USEPA 8240		6	40-ml septum vial
MW-6S,I,D	USEPA 8270*		2	2-liter glass
MW-34D	USEPA 8270	MS/MSD	4	1-liter glass
MW-33S	USEPA 8270		2	1-liter glass
T-2	USEPA 8270		2	1-liter glass
M-2	USEPA 502.2/624		4	40-ml septum vial
K-1	USEPA 502.2/624	MS/MSD	8	40-ml septum vial
K-2	USEPA 502.2/624		4	40-ml septum vial

*USEPA 8270 did not include pesticides/PCBs.

analyzed for the compounds on the EPA Method 8010/8020 list and the analytical results are given in Appendix J.

Soil samples were collected from four soil borings advanced northwest of the Container Plant during July 1992. The boring locations are shown on Figure 2-1. A surface soil sample was collected at the VB-1 location (adjacent to the northwest corner of the northern parking area) and submitted for analysis according to EPA Method 8240. This sample was required for completion of the baseline risk assessment with respect to the former northern drum storage area. The results are contained in Appendix J and are discussed in Section 6.0 of this report.

Additional samples were collected from each of the boreholes, VB-1 and VB-2 in the former northern drum storage area, and VB-3 and VB-4 in the former spill containment tank area, for the evaluation of vacuum extraction applicability. Samples from each borehole were analyzed for compounds on the EPA Method 8240 list, for grain size distribution analysis (GSDA), and for total organic carbon content. Results of the EPA Method 8240 analyses are contained in Appendix J and will be discussed in Section 4.6 of this report; these data will also be used in the FS. GSDA and organic carbon content results are given in Appendix K.

A vacuum extraction pilot study was conducted in the former southern drum storage area, near MW-36S,D, during July 1992. As part of the pilot study, two vapor extraction wells were installed in one borehole. VE-01/02 are shown on Figure 2-1. A soil sample was collected during the drilling for VE-01/02 and submitted for EPA Method 8240 analysis; the analytical results are contained in Appendix J. The methods and results of the vacuum extraction pilot study will be discussed in the FS portion of this project.

3.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

3.1 PHYSIOGRAPHY, TOPOGRAPHY AND DRAINAGE

3.1.1 Physiography and Topography

The Miller site lies within the Erie-Ontario Plain physiographic province. Glacial deposits overlie most of this province. The topography on the Erie-Ontario Plain is a gently rolling landscape that is interspersed with moderately large level areas. The level areas commonly are swampy.

The topography of the Miller site is shown on Sheet 2. Also shown on the topographic map are some areas in the immediate vicinity of the site, including the City of Fulton Water Works property and the Oswego River. In general, this area is gently rolling; however, the present topographic expression of the Plant site area is a reflection of modifications to the land surface which were made when the Container Plant was built and prior to when the Plant was built. For example, the land surface below the Plant was leveled by borrowing soil from the area below the present pond. Drainage ditches to and from the pond were also constructed during the building process. The hill present below the former Taylor house shown on Sheet 2, which was standing when the aerial photographs were taken but has since burned down, formerly extended to the north and connected to the hill shown at the old fence line. The low level area that currently exists between these hills is the result of sand and gravel mining which occurred prior to Plant construction. The Water Works property used to be a marshy area, but the land surface in this area has been elevated by landfilling.

3.1.2 Drainage

All of Oswego County lies within the Lake Ontario drainage basin. The Oswego River system drains the south-central part of the County, including the Miller site. The Oswego River flows north through the County and empties into Lake Ontario at the City of Oswego. Stream gradients on the Erie-Ontario Plain are generally low.

Surface drainage at the Miller site is facilitated by the drainage ditches that were constructed when the Container Plant was built. One ditch located north of the Plant, shown on Sheet 2, conveys surface water runoff into the pond (northwest of the Plant). There are two outlets from the pond. One outlet is located on the northwest side of the pond and the other outlet is located on the pond's southern end. Both of these outlets allow water to discharge from the pond after periods of heavy precipitation. Therefore, surface water discharge from the pond occurs only on an intermittent basis. The northwest outlet conveys water into a marshy area. There is no known surface water outlet from this marshy area. The southern pond outlet conveys water through a drainage ditch which merges with drainage ditches from other parts of the site and eventually discharges to the Oswego River. The Oswego River is maintained by a downstream hydroelectric dam at an elevation of about 353 feet above MSL.

3.2 CLIMATE

Oswego County has a humid-continental climate that is greatly influenced by Lake Ontario. Lake Ontario moderates the yearly temperature and significantly effects precipitation in the winter. The normal annual total precipitation in the vicinity of Fulton, New York is approximately 42 inches. The mean annual lake evaporation is approximately 26 inches. Prevailing winds are from the south and southwest (Oswego County Soil Survey, 1981).

3.3 GEOLOGY

3.3.1 Introduction

Data characterizing the geology of the site were obtained from boreholes which were drilled by Miller, Taylor, the United States Geological Survey (USGS), the NYSDEC and the City of Fulton.

Miller conducted drilling activities to obtain geotechnical information both prior to and after Plant construction. Miller also emplaced borings to enable installation of monitoring wells and recovery wells during the various phases of the site hydrogeologic investigation.

Prior to construction of the Container Plant, test holes were drilled to accumulate geotechnical data to determine subsurface soil conditions. These data were used to determine the type and extent of the foundation needed during Plant construction. The locations of the boreholes on the Miller property are shown on Figure 3-1. The boreholes labeled "TH-" were drilled prior to construction of the Plant. The boreholes labeled "B-" were drilled later for possible expansion of the Container Plant. In general, these test holes were not drilled deeper than 30 feet below grade.

During the Phase I Investigation by C&S (1986), ten borings were advanced into overburden to the north and west of the Container Plant (BH-1 through BH-10) to collect data for the assessment of soil and ground water contamination near the former spill containment tank location. The first six borings are labeled "BH-" on Figure 3-1. The last four boreholes were then converted into ground water monitoring wells MW-1D through MW-4D.

Prior to the commencement of building construction for the long-term municipal well treatment system, two boreholes were drilled below the building footprint on the Water Works Property. These boreholes are labeled TB-1 and TB-2 on Figure 3-1.

During the Phase II Investigation by MPI (1986), 25 more boreholes were drilled on the Miller property. As discussed in Section 1, either a shallow, intermediate or deep ground water monitoring well was constructed in each borehole to allow further characterization of the aquifer beneath the Miller site.

The remainder of the borings drilled by Miller were completed during the RI phase of the project. Monitoring wells were installed in each of these boreholes, except at the boreholes adjacent to MW-55D and MW-56D; the vapor extraction boreholes in the former northern drum storage area; and the vapor extraction boreholes in the former spill containment tank area. These boreholes were backfilled to land surface with non-shrink grout.

Mr. Taylor had four boreholes drilled, three on his property and one on Miller property, to investigate ground water contamination from the former USTs located on his property. Wells were ultimately installed in these boreholes and are labeled "T-" on Figure 3-1.

Two boreholes, which were later converted to monitoring wells, were drilled by the USGS on the Water Works property . The wells are labeled USGS-1 and USGS-2 on Figure 3-1.

The NYSDEC installed four monitoring wells to investigate potential contamination on the Mirabito suspected Inactive Hazardous Waste Disposal Site located northwest of K-1. Nine monitoring wells were installed by the NYSDEC to investigate the origin of gasoline-type contamination detected at MW-45S, northwest of K-1. This investigation is on-going and recently two ground water withdrawal wells were also installed by the NYSDEC in the MW-45S,D area. Three of the Mirabito wells are shown on Figure 3-1. They are labeled GW-1, GW-2 and GW-4. The fourth well (GW-3) is located to the north-northwest of GW-2. The monitoring wells installed to investigate gasoline-type contamination are labeled "D-", and the withdrawal or recovery wells are labeled "E-" on Figure 3-1.

The City of Fulton drilled 12 boreholes on the Water Works property for geotechnical and hydrogeologic data. The boreholes are labeled "*TH-*" on Figure 3-1.

Most of the subsurface geologic information was used to produce cross sections and fence diagrams in an attempt to better understand the interrelationship of geologic units in the area of the site. Figures 3-2 and 3-3 are maps showing the locations of the cross sections and the fence diagrams which were prepared for this report.

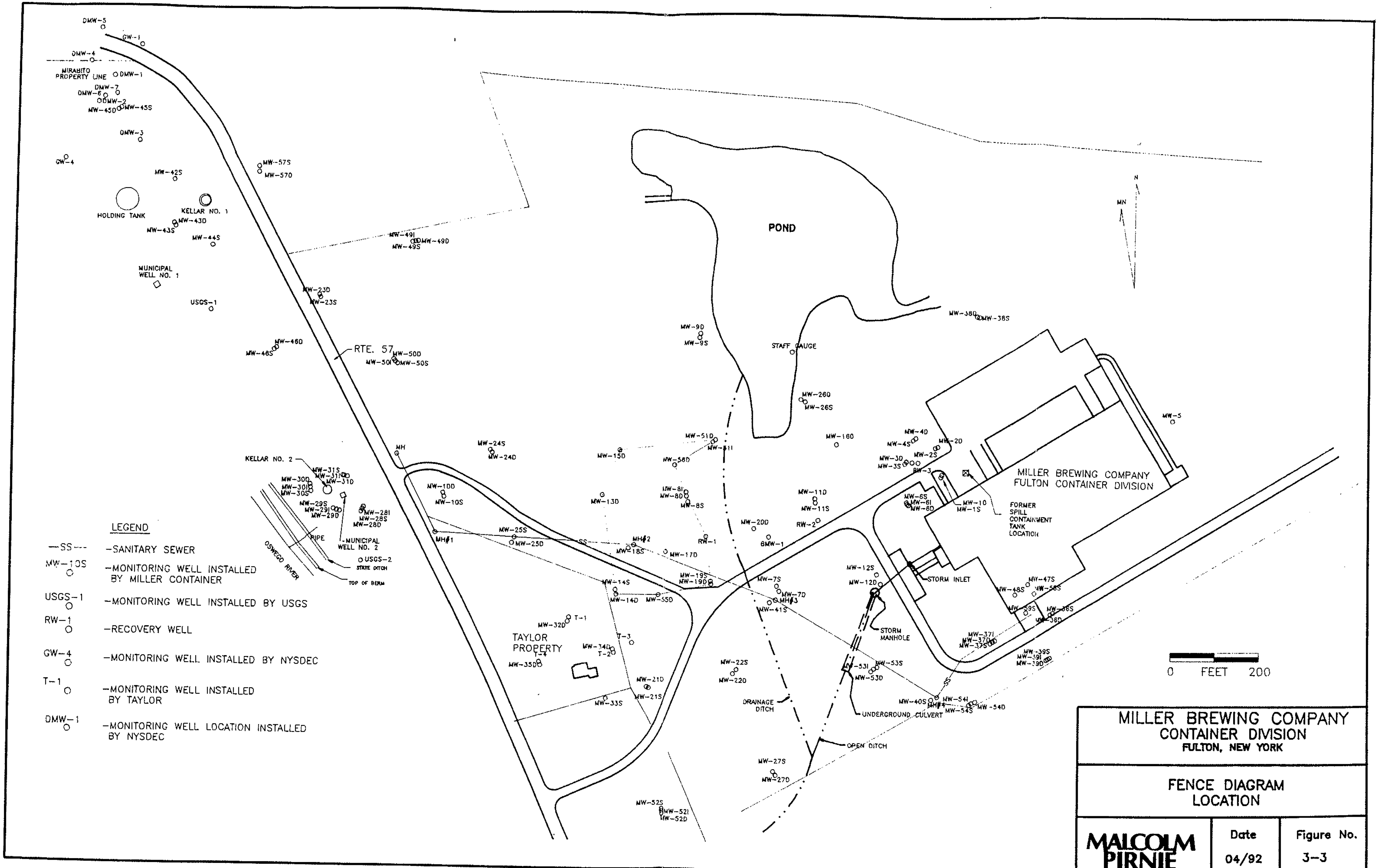
3.3.2 Regional Geology

The surficial geology of Oswego County, and more specifically that part of Oswego County that lies within the Erie-Ontario Plain physiographic province, is dominated by unconsolidated glacial material deposited during and after the last period of glaciation.

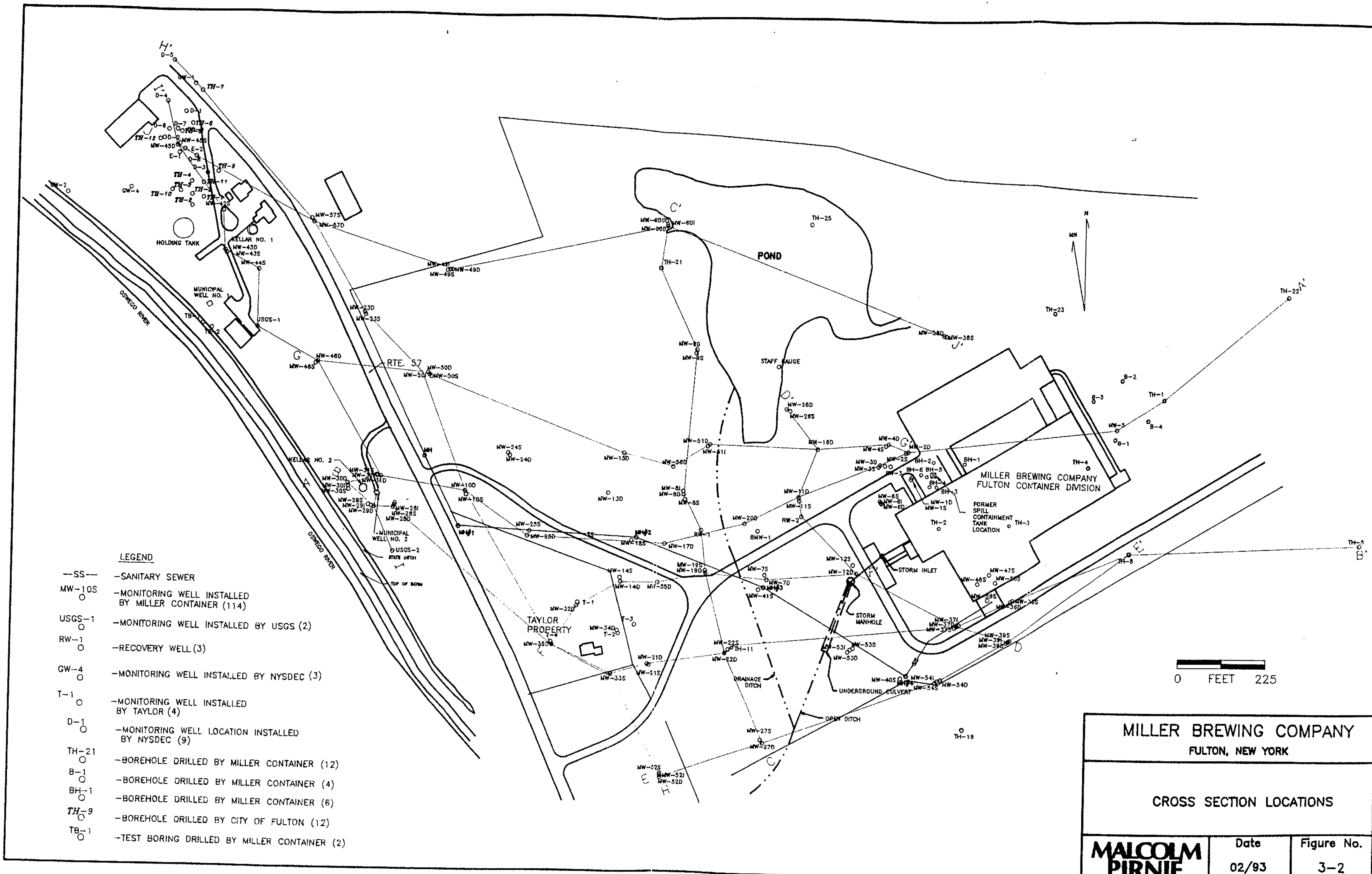
The predominant glacial deposit on the Erie-Ontario Plain is glacial till. Lodgement till consists of a mixture of rock fragments, gravel, sand, silt and clay that was mostly deposited directly on the surface as material was carried along at the bottom of the glacier. Most of the sediments in the Fulton area are derived from glaciation and associated glacial lakes and glacial outwash. Glaciolacustrine (lake) deposits cover bedrock or till with as much as 150 feet of silt, clay, sand and gravel.

Many lakes were formed and fed by glacial melt water in the area. Fine-grained material, such as fine sand and silt, were deposited in the lowlands underlying these glacial lakes. Beach and wave currents in the glacial lakes deposited sand and gravel as irregular patches along once-active shores.

Streams flowing during and after glaciation deposited alluvium and eroded glacial material previously deposited. In some cases, bedrock has been exposed at the land surface where erosion has sufficiently removed the glacial deposits.



POND
STAFF GAUGE
RTE. 57
HOLDING TANK
KELLAR NO. 1
KELLAR NO. 2
MUNICIPAL WELL NO. 1
MUNICIPAL WELL NO. 2
MIRABITO PROPERTY LINE
TAYLOR PROPERTY
OSWEGO RIVER
STATE DITCH
TOP OF BERM
PIPE
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
FORMER SPILL CONTAINMENT TANK LOCATION
STORM INLET
STORM MANHOLE
UNDERGROUND CULVERT
OPEN DITCH
DRAINAGE DITCH
0 FEET 200
LEGEND
—SS--- -SANITARY SEWER
MW-10S -MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 -MONITORING WELL INSTALLED BY USGS
RW-1 -RECOVERY WELL
GW-4 -MONITORING WELL INSTALLED BY NYSDEC
T-1 -MONITORING WELL INSTALLED BY TAYLOR
DMW-1 -MONITORING WELL LOCATION INSTALLED BY NYSDEC
MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
FENCE DIAGRAM
LOCATION
MALCOLM PIRNIE
Date 04/92
Figure No. 3-3



POND
MILLER BREWING COMPANY
FULTON CONTAINER DIVISION
FORMER SPILL CONTAINMENT TANK LOCATION
TAYLOR PROPERTY
RTE. 57
OSWEGO RIVER
HOLDING TANK
KELLAR NO. 1
KELLAR NO. 2
MUNICIPAL WELL NO. 1
MUNICIPAL WELL NO. 2
STAFF GAUGE
STORM INLET
STORM MANHOLE
UNDERGROUND CULVERT
OPEN DITCH
DRAINAGE DITCH
TOP OF BERM
0 FEET 225
LEGEND
—SS— –SANITARY SEWER
MW–10S –MONITORING WELL INSTALLED BY MILLER CONTAINER (114)
USGS–1 –MONITORING WELL INSTALLED BY USGS (2)
RW–1 –RECOVERY WELL (3)
GW–4 –MONITORING WELL INSTALLED BY NYSDEC (3)
T–1 –MONITORING WELL INSTALLED BY TAYLOR (4)
D–1 –MONITORING WELL LOCATION INSTALLED BY NYSDEC (9)
TH–21 –BOREHOLE DRILLED BY MILLER CONTAINER (12)
B–1 –BOREHOLE DRILLED BY MILLER CONTAINER (4)
BH–1 –BOREHOLE DRILLED BY MILLER CONTAINER (6)
TH–9 –BOREHOLE DRILLED BY CITY OF FULTON (12)
TB–1 –TEST BORING DRILLED BY MILLER CONTAINER (2)
MILLER BREWING COMPANY
FULTON, NEW YORK
CROSS SECTION LOCATIONS
MALCOLM PIRNIE
Date 02/93
Figure No. 3–2

These exposures indicate that the bedrock surface has a low and gently undulating relief in the Erie-Ontario Plain. Bedrock in the Erie-Ontario Plain consists of nearly flat-lying Ordovician and Silurian sedimentary formations. These formations were deposited in marine and terrestrial environments 400 to 500 million years ago. These groups of rocks occur in broad bands that generally dip gently to the south-southwest. Bedrock formations are older (those on the bottom) with distance northward in the province. The oldest bedrock in the County is the siltstone and shale of the Pulaski and Whetstone Gulf Formation. Overlying this formation is the Oswego Sandstone which crops out in a band extending from Lake Ontario to near the eastern border of the County. These formations are overlain by younger sandstones of the Medina Group and then by the sandstone and shale of the Herkimer, Willowvale and Sauquoit Formations, which occur near the southern boundary of the County and which represent the youngest bedrock formations in the County.

3.3.3 Site Geology

3.3.3.1 Bedrock

According to samples collected from the bedrock during the drilling for wells BMW-1, MW-12D, MW-26D, MW-23D, MW-55D, MW-56D and TH-5, bedrock consists of interbedded dark gray to black shale, moderate reddish brown fine- to medium-grained sandstone, dark reddish brown shale and green mudstone. Dark reddish brown clay lenticles less than two inches in length are common in the red sandstone interbeds. Medium gray clay lenticles occur in the dark gray to black shale. This geologic unit is interpreted as belonging to the Silurian Willowvale Formation (Clinton Group). Rock quality designations (RQDs) for rock core samples collected from BMW-1 and MW-26D are 80 percent and 96 percent, respectively. The RQD provides an estimation of the competence of the rock and is calculated by dividing the cumulative length of unfractured rock greater than four inches in length by the length of the core run. The result is multiplied by 100 to obtained a percentage. In general, the lower the RQD percentage, the higher the fracture content in the rock. The RQD percentage obtained in these locations shows that the bedrock in these areas has a low fracture content. Since the frequency of the fractures in bedrock is one of the main factors in determining the permeability of the rock, the low fracture content means that the bedrock immediately below the site is probably a poor water-bearing unit.

3.3.3.2 Unconsolidated Deposits

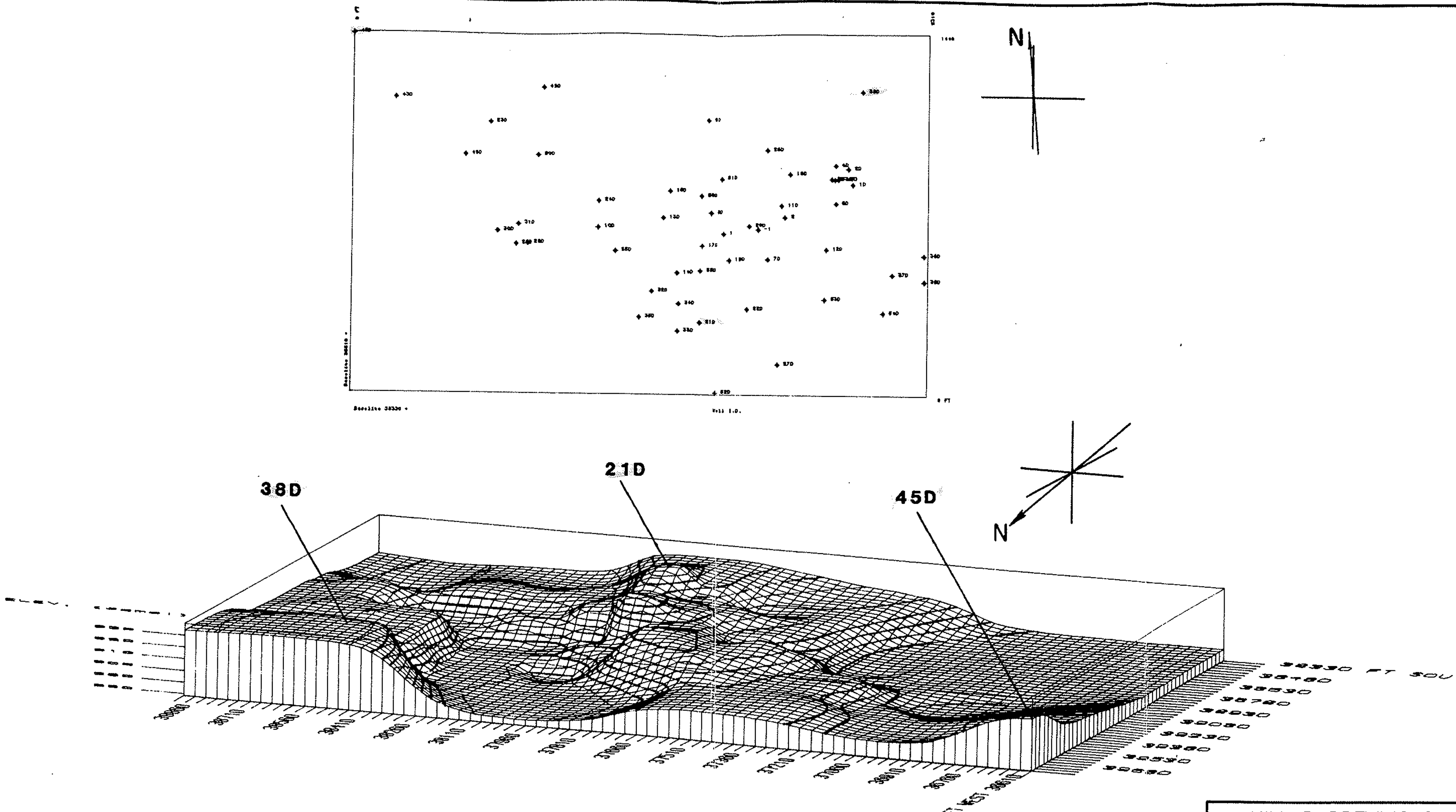
The major unconsolidated deposits across the site consist of fill material, glaciolacustrine silt and sand, interbedded glaciofluvial sand and silt, glaciolacustrine silty clay, glaciofluvial sand and gravel, ablation till, lodgement till, and varved silt and clay. The interrelationship of these units is shown on the cross sections on Sheet 3.

The bedrock toward the middle of the site (and possibly in other areas of the site) is overlain by a thin layer of varved pale brown silt and red clay. This unit was penetrated during the drilling of the boreholes adjacent to wells MW-55D and MW-56D and probably was deposited prior to the last glacial event in this area. This unit may predate all unconsolidated deposits on-site and is very dense and compact with a low moisture content. Due to its great density, this unit would be highly resistant to erosion and may have acted as a minor ice-divide causing deposition of a mound of lodgement till along its axis when ice moved through the region.

Bedrock is interpreted to be overlain by a layer of dark reddish-brown to olive gray glacial lodgement till over the rest of the site; however, drilling was discontinued by design immediately below the top of the lodgement till unit in most deep boreholes at the site. The lodgement till was actively emplaced at the bottom of the ice as the glacier overrode the area. The lodgement till consists of coarse gravel to clay-size particles and is very dense and compact due to its depositional nature and relatively high clay content in most areas. The lodgement till is continuous across the site except around test hole TH-5 and monitoring wells MW-12D and MW-26D where the till has been completely eroded as shown on Cross Sections B-B' and D-D' on Sheet 3. The relatively low permeability of the lodgement till makes it an effective water barrier between the bedrock and overlying units where it is present.

The top of the lodgement till shows a great deal of relief from east to west across the site. The changes in the lodgement till surface are represented on Figure 3-4 and Figure 3-5, which are maps of the top of the lodgement till. The perspective for Figure 3-5 is from the north of the site, looking south. The lodgement till surface is deeper near MW-11D, RW-1, MW-20D and MW-51D and is elevated near MW-17D, MW-21D, MW-52D, MW-55D, MW-56D and MW-38D. The change in elevation of the lodgement till across the site is also illustrated on Cross Section A-A' (Sheet 3).

The higher elevation of the lodgement till toward the middle of the site forms a drumlin-type ridge with its axis trending almost north-south (parallel to the direction of ice

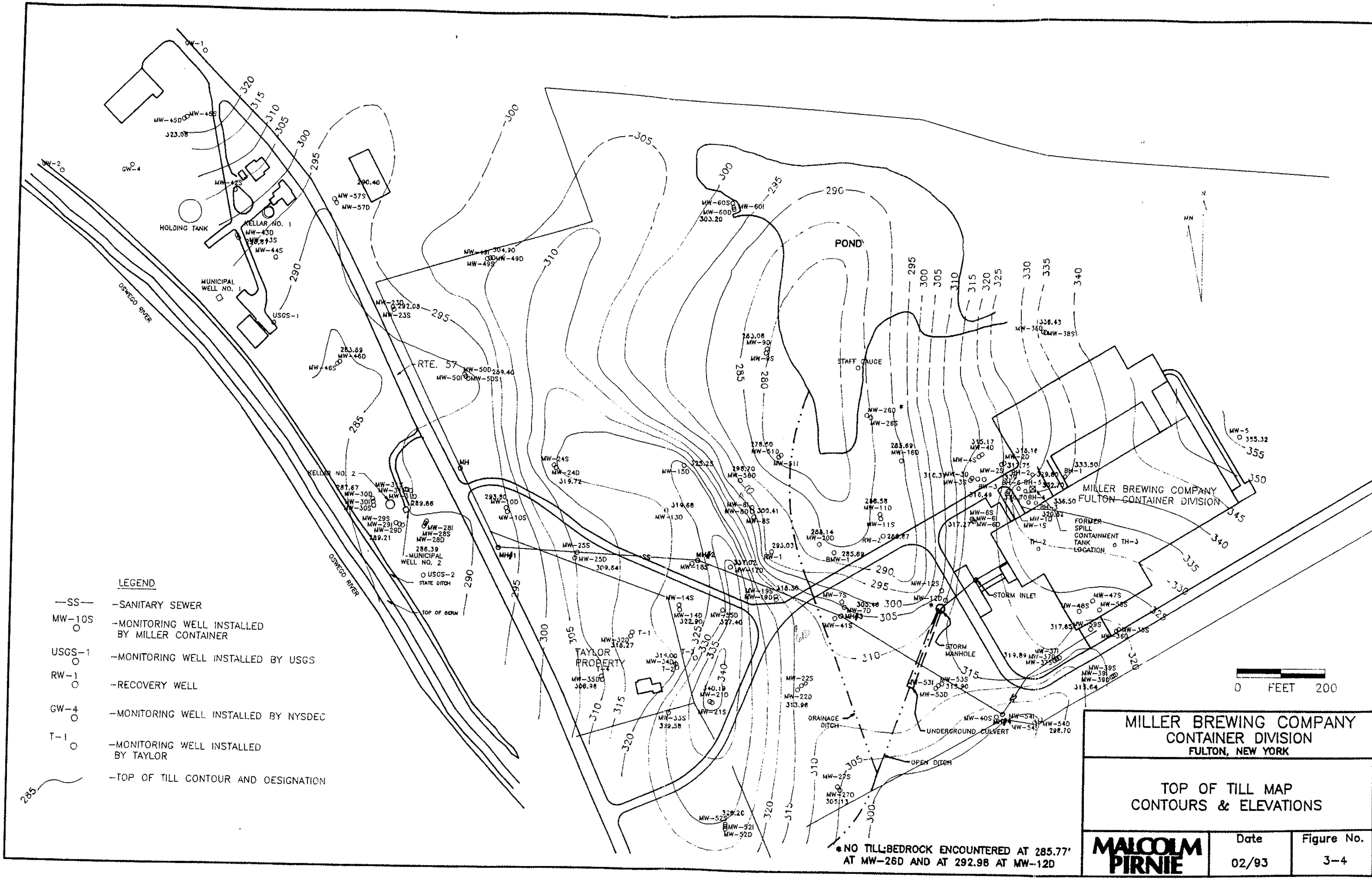


MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK

ISOMETRIC
TILL SURFACE MAP
ISOTILL.DWG

MALCOLM PIRNIE

Date	Figure No.
APRIL 1992	3–5

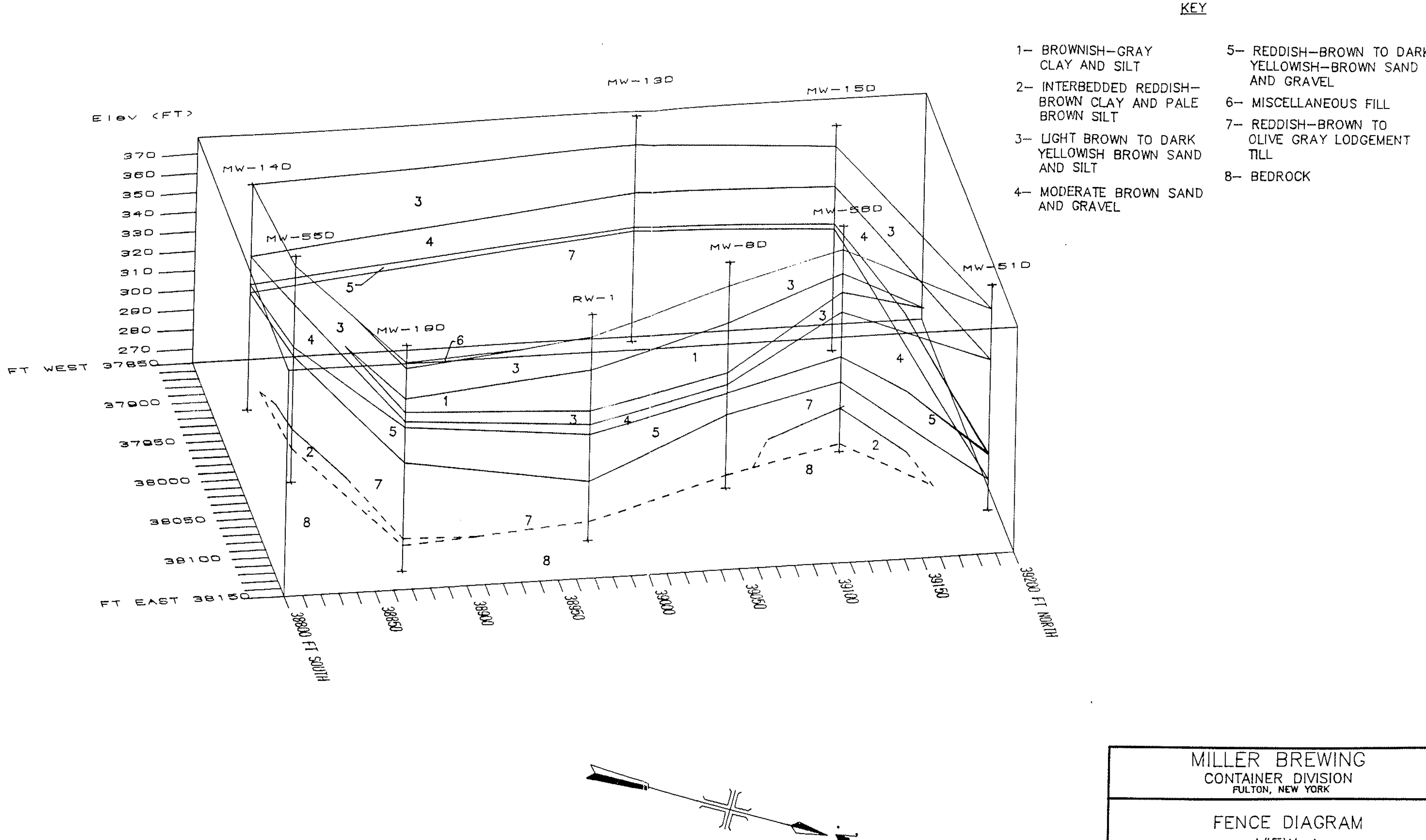


LEGEND
—SS— -SANITARY SEWER
MW-10S -MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 -MONITORING WELL INSTALLED BY USGS
RW-1 -RECOVERY WELL
GW-4 -MONITORING WELL INSTALLED BY NYSDEC
T-1 -MONITORING WELL INSTALLED BY TAYLOR
285 -TOP OF TILL CONTOUR AND DESIGNATION
OSWEGO RIVER
RTE. 57
HOLDING TANK
KELLAR NO. 1
KELLAR NO. 2
MUNICIPAL WELL NO. 1
MUNICIPAL WELL NO. 2
STATE DITCH
TOP OF BERM
TAYLOR PROPERTY
POND
STAFF GAUGE
STORM INLET
STORM MANHOLE
DRAINAGE DITCH
UNDERGROUND CULVERT
OPEN DITCH
FORMER SPILL CONTAINMENT TANK LOCATION
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
0 FEET 200
* NO TILL;BEDROCK ENCOUNTERED AT 285.77' AT MW-26D AND AT 292.98 AT MW-12D
MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
TOP OF TILL MAP
CONTOURS & ELEVATIONS
MALCOLM PIRNIE
Date 02/93
Figure No. 3-4

movement across the region). The northward and southward extent of the buried drumlinoid is not known. A drumlin is a smoothly rounded, elongate oval hill, mound or ridge of compact glacial till built under the margin of a glacier and shaped by its flow or carved out of an older moraine by readvancing ice (Bates and Jackson, 1980). This ridge appears to have been the site of a former drainage divide as this subsurface area is a zone of depositional transition within units and between different units (Cross Sections A-A'and B-B'). Due to its transitional nature, this area of the site is geologically complex. The fence diagrams on Figures 3-6 and 3-7 have been prepared to show the distribution of the unconsolidated subsurface units in this portion of the site. The effect of the lodgement till ridge on ground water contaminant migration and drawdown around RW-1 is discussed in Section 5.

The thickness of lodgement till is unknown in most portions of the site because most boreholes were intentionally discontinued at about three feet below the top of the lodgement till. However, adjacent to the MW-55D and MW-56D locations, which were situated along the approximate axis of the drumlinoid, boreholes were advanced through the lodgement till to the top of bedrock. The combined thickness of the lodgement till unit and the dense varved clay and silt unit at these two locations is 47.0 feet and 31.8 feet, respectively. At the borehole drilled for the monitoring well installed in bedrock (BMW-1), the lodgement till is eight feet thick. At the BMW-1 location, the lodgement till has a high degree of clay content, which is typical of most of the lodgement till on the site. Some of the lodgement till toward the western and southern edges of the Miller site, however, has a higher sand content and contains a relatively small amount of clay. This sandier till is as dense and compact as the clay-rich till and possesses similar low moisture content indicating that it would be just as effective in preventing vertical contaminant migration as the clay-rich till.

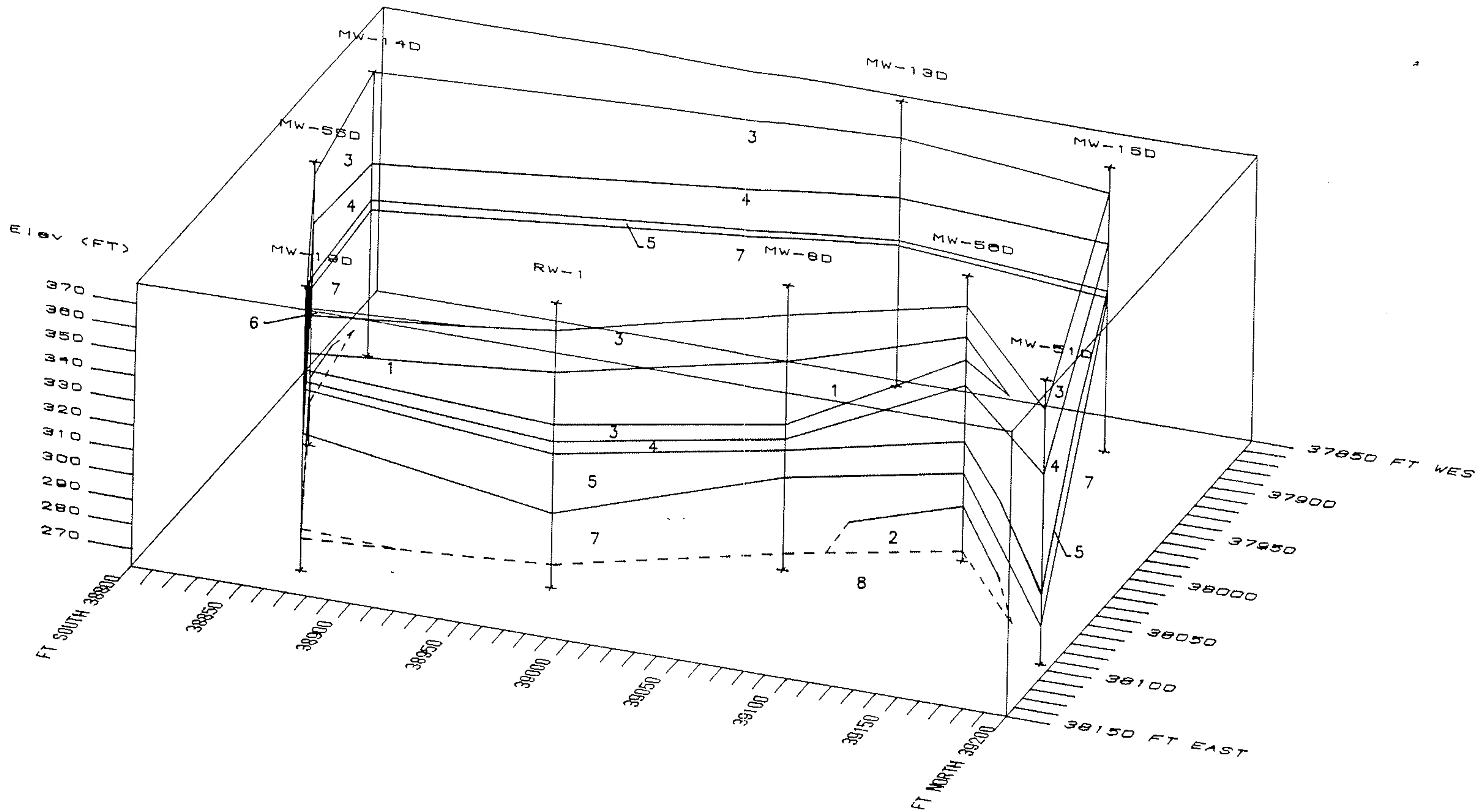
Directly above the lodgement till across the site is a thin layer of reddish brown to dark yellowish brown ablation till which was deposited passively by a glacier as it retreated. The ablation till was found in every monitoring well installed during the various phases of the site hydrogeologic investigation; however, the unit is absent in the eastern edge of the site according to the drilling logs prepared from the geotechnical borings made prior to Plant construction (B-B' & G-G'). The grain size distribution in this till ranges from cobbles to clay-size particles. In most places, the ablation till has a relatively high permeability compared to the underlying and overlying units and, thus, is a potential conduit for accelerated contaminant migration.



MILLER BREWING
CONTAINER DIVISION
FULTON, NEW YORK

FENCE DIAGRAM
VIEW A

MALCOLM PIRNIE	Date	Figure No.
	APRIL 1992	3-6



1– BROWNISH–GRAY CLAY AND SILT

2– INTERBEDDED REDDISH–BROWN CLAY AND PALE BROWN SILT

3– LIGHT BROWN TO DARK YELLOWISH BROWN SAND AND SILT

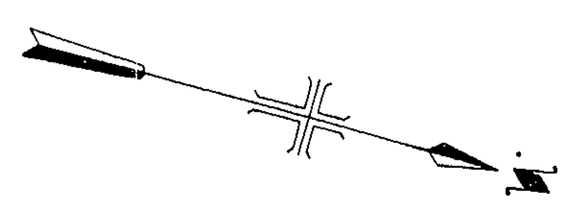
4– MODERATE BROWN SAND AND GRAVEL

5– REDDISH–BROWN TO DARK YELLOWISH–BROWN SAND AND GRAVEL

6– MISCELLANEOUS FILL

7– REDDISH–BROWN TO OLIVE GRAY LODGEMENT TILL

8– BEDROCK



MILLER BREWING
CONTAINER DIVISION
FULTON, NEW YORK

FENCE DIAGRAM
VIEW B

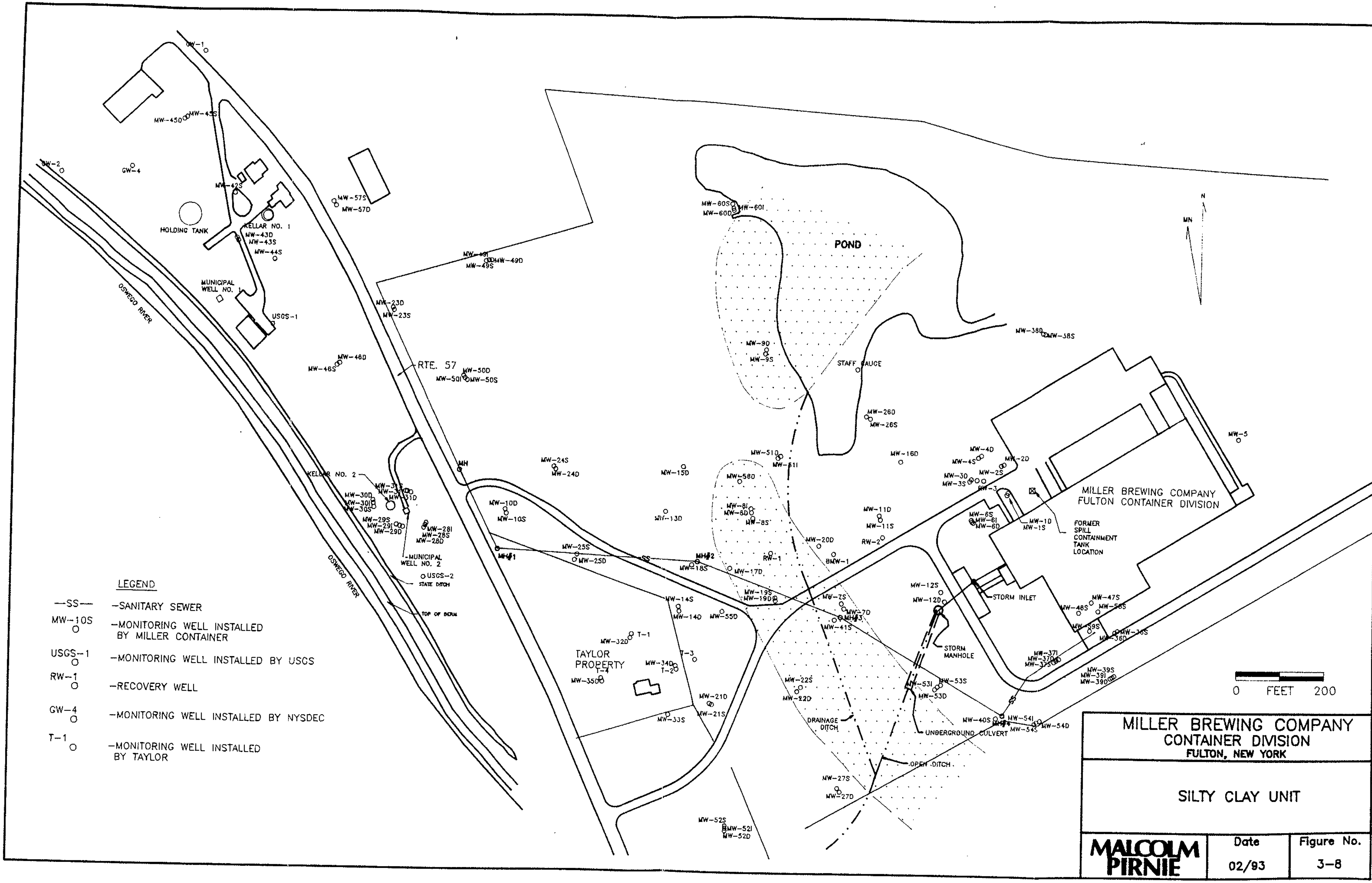
MALCOLM PIRNIE	Date	Figure No.
	APRIL 1992	3–7

The glaciolacustrine silt and sand is light to dark yellowish brown in color and was deposited when proglacial Lake Iroquois covered the area. While this unit is stratified on the western side of the ridge of lodgement till, it is relatively unstratified on the eastern side of the ridge indicating differing depositional environments within the same unit. This unit is up to 70 feet thick toward the middle of the site (near MW-11D) where a deep channel was formed in the underlying glacial till (Cross Section A-A'). The lake silt and sand is fine grained, massive and relatively homogeneous in the area near the former spill containment tank location as indicated by grain size distribution analyses (GSDA) performed on samples from this unit. The results of these analyses are located in Appendix K. This unit typically exhibits a flowing nature at depths greater than 25 feet below the occurrence of the water table. However, at wells MW-26D and MW-24D flowing sand was encountered at only 10 feet below the water table. Conversely, flowing sand was not encountered until 50 feet below the water table at MW-29D and MW-23D.

The fill material was utilized to build up relatively low lying areas of the site prior to construction of the Miller Container Plant. It consists of mottled brown and gray clay, silt and sand that has been compacted into place. GSDA conducted on the fill material near the former spill containment tank location shows that silt and clay comprises over 73 percent of the fill material in this area. Results of these analyses are included in Appendix K. This unit is very dense and has a relatively low permeability. The fill material is believed to have originated from borrow areas on-site that were created during construction of the Plant site.

Other major sediment types on the site include a layer of brownish gray glaciolacustrine silty clay which was deposited toward the middle of the site, contemporaneously with the silt and sand unit; and a layer of moderate brown interbedded glaciofluvial sand and gravel, which separates the glaciolacustrine silt and sand unit from the ablation till on the western side of the site and near the MW-51 cluster (C-C').

The silty clay layer can be found below the middle of the site in the area extending from northeast to southeast in a "horseshoe" type shape from below the northeastern portion of the pond, east of MW-60S,I,D, to the southern end of the site west of MW-53S,I,D but east of MW-27S,D. Figure 3-8 illustrates the approximate areal distribution of the silty clay layer as if it were projected up to land surface. It occurs beneath the MW-9, MW-56, MW-8, MW-19, MW-17, MW-7 and MW-22 cluster locations, but is not present at the MW-51 cluster location indicating that it may have been removed by later erosional events in this area. In cross section, the silty clay layer is up to 30 feet thick near MW-9S,D, but is



POND
STAFF GAUGE
RTE. 57
OSWEGO RIVER
OSWEGO RIVER
HOLDING TANK
KELLAR NO. 1
KELLAR NO. 2
MUNICIPAL WELL NO. 1
MUNICIPAL WELL NO. 2
STATE DITCH
TOP OF BERM
TAYLOR PROPERTY
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
FORMER SPILL CONTAINMENT TANK LOCATION
STORM INLET
STORM MANHOLE
UNDERGROUND CULVERT
DRAINAGE DITCH
OPEN DITCH
N
MN
0 FEET 200
LEGEND
—SS— —SANITARY SEWER
MW-10S —MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 —MONITORING WELL INSTALLED BY USGS
RW-1 —RECOVERY WELL
GW-4 —MONITORING WELL INSTALLED BY NYSDEC
T-1 —MONITORING WELL INSTALLED BY TAYLOR
MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
SILTY CLAY UNIT
MALCOLM PIRNIE
Date 02/93
Figure No. 3-8

thinner in other areas where it was encountered. The distribution and shape of this clay unit indicate that it may have been formed in an oxbow lake in an abandoned meandering river channel that formerly flowed through the area. The clay plug has relatively low permeability and acts hydraulically as a semi-confining or confining layer throughout its extent.

The interbedded sand and gravel unit is 48 feet thick near MW-51I,D and up to 50 feet thick on the western side of the site. Moving from west to east, this unit generally terminates after draping over the drumlinoid feature (A-A', B-B'and F-F'). However, in the area east of MW-15D and MW-56D (G-G') the sand and gravel thickens near MW-51I,D. This unit is highly permeable due to the large amount of sand and gravel present and may be the most permeable unit underlying the site. The large amount of gravel in this unit indicates that it was deposited in a high energy environment which was capable of eroding and replacing the clay layer at the MW-51I,D location.

Laterally and vertically discontinuous lenses of clay, silty clay, sand and gravelly sand are dispersed throughout the site (Sheet 3). These lenses represent minor deposits at the site.

3.4 HYDROGEOLOGY

3.4.1 Regional Hydrogeology

Ground water occurs in the bedrock formations and in the unconsolidated deposits overlying bedrock. In general, the most water is available from sand and gravel deposits, less is available from bedrock and the least from glacial till or silt and clay deposits.

Ground water receives recharge from the infiltration of snowmelt and rain water through the soil to the saturated zone. Discharge occurs in streams, lakes and topographically low wetlands.

The water table in the unconsolidated deposits generally mirrors the land surface, flowing subparallel to topography. The general direction of deep ground water flow in the bedrock is toward Lake Ontario.

3.4.2 Site Hydrogeology

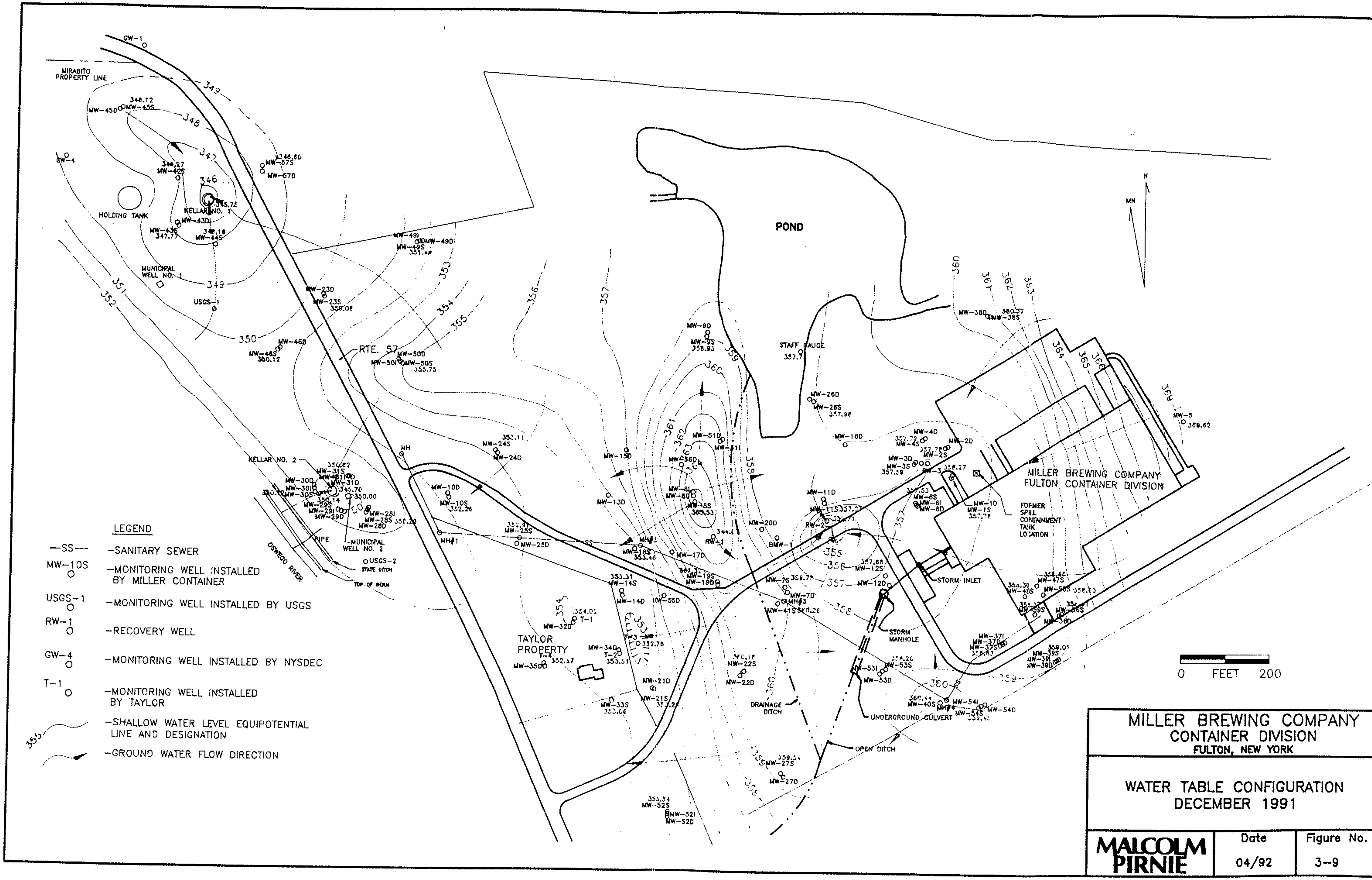
Ground water at the site occurs predominantly under unconfined conditions. Water percolating downward through spaces between soil particles in the unsaturated zone joins the ground water body at the water table. The water table is in direct contact with the atmosphere through the open pores of the overlying material and is therefore under atmospheric pressure. Monitoring wells that are screened at the water table will have water levels that are reflective of atmospheric pressure. Below the water table, the combination of atmospheric pressure and the weight of overlying water creates pressures in the zone of saturation. Monitoring wells screened in discrete intervals at depths considerably below the water table will have water levels that are representative of the head in the aquifer at the depth of the screened interval.

Ground water flows from areas of higher ground water pressure head to areas of lower ground water pressure head along flow lines defined by the system. By installing monitoring well clusters (adjacent wells screened at discrete intervals below as well as at the water table) and collecting water level data, the three-dimensional distribution of the ground water pressure head in the unconsolidated aquifer below the site can be established.

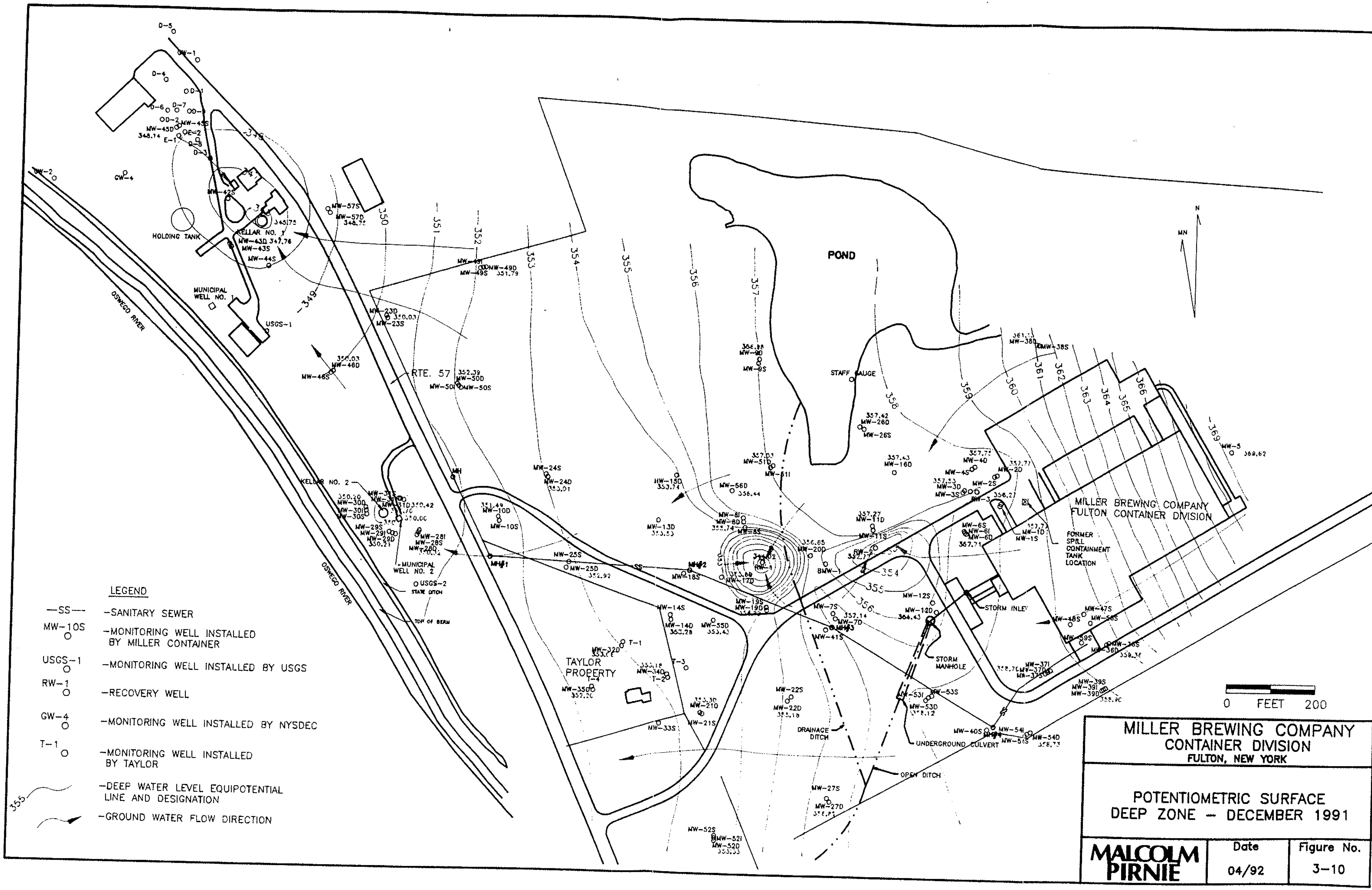
Water level data have been collected at monitoring wells on-site on a monthly basis since March 1987. Additional water level data were collected during October and December 1986. The water level elevations collected through January 1993 are presented in a tabular format in Appendix B, and in a graphical format in Appendix L.

The water levels recorded during December 1991, January 1992, and January 1993 have been plotted on Figures 3-9 through 3-14 to illustrate the configuration of the water table and potentiometric surface of the deeper zone wells, respectively, on the three dates mentioned above.

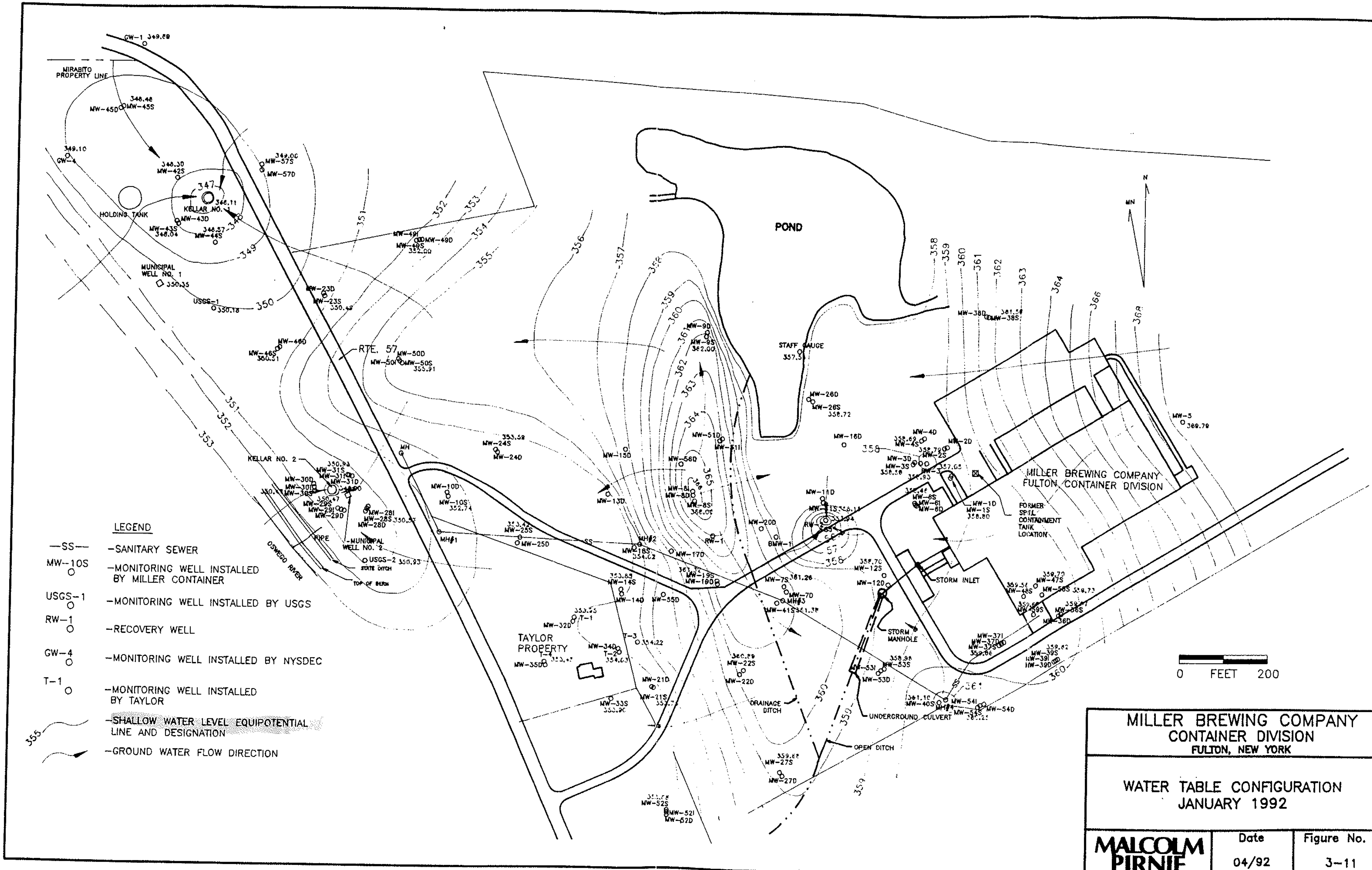
Typically, ground water elevations fluctuate on a seasonal basis with the highest annual elevations occurring in late winter/early spring months. The water levels generally decline throughout the summer, due to the reduction in water available for recharge as a result of reduced precipitation and to greater evapotranspiration, and reach overall lows in the late summer/early fall months. There is a gradual increase in water levels through the later fall due to increased precipitation and less evapotranspiration, through the winter months and into the spring. These trends are evident from the hydrographs presented in Appendix L. Ground water elevations measured in August 1992 were unusually high compared to 1991 and 1990; in many cases 3.5 to 4.0 feet above the water levels observed during previous years. This is a direct function of the unusually high precipitation the area received during the summer of 1992. Despite the unusually high water levels observed in most monitoring wells during August 1992, the water levels recorded in wells around K-1

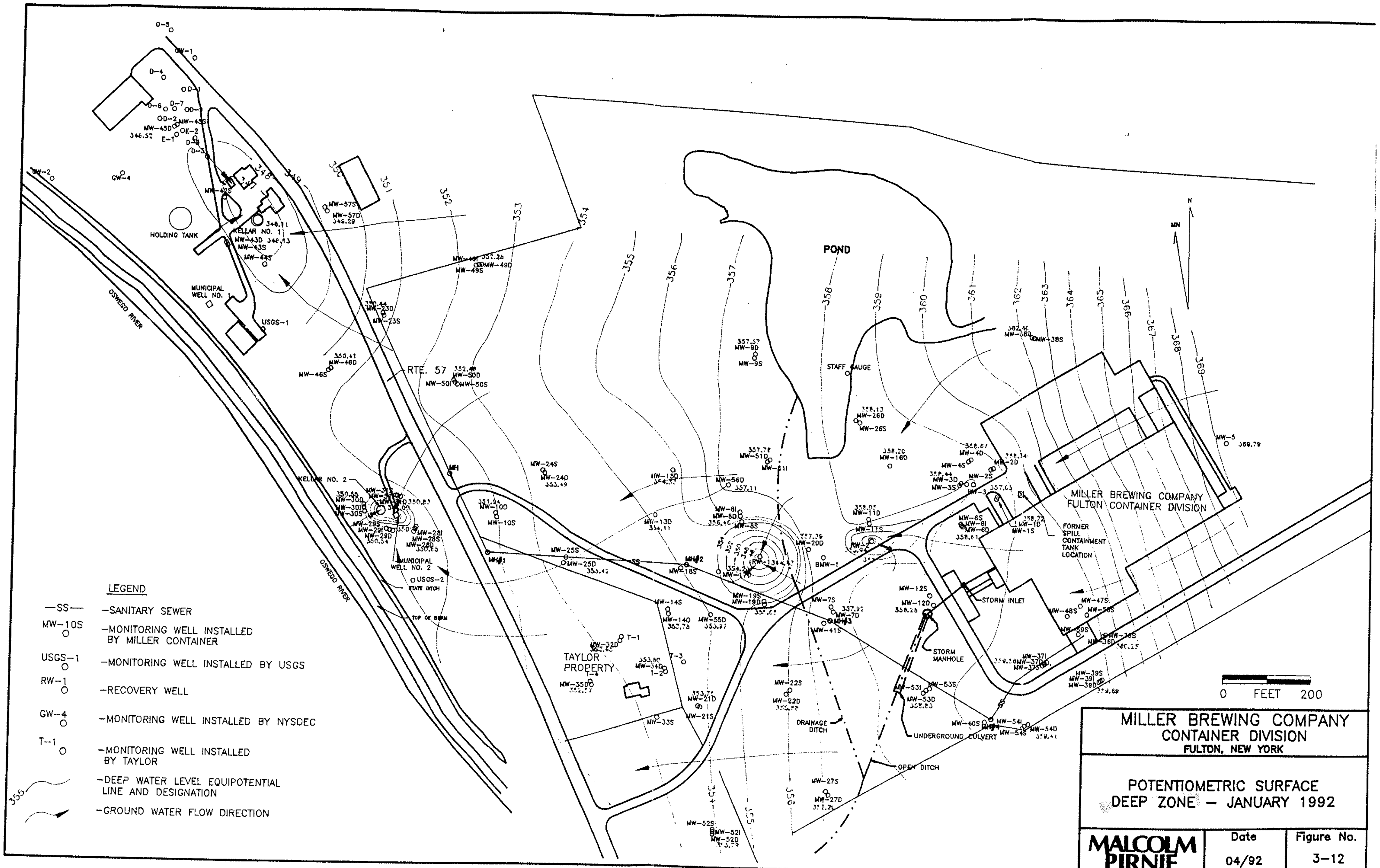


LEGEND
—SS— -SANITARY SEWER
MW-10S -MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 -MONITORING WELL INSTALLED BY USGS
RW-1 -RECOVERY WELL
GW-4 -MONITORING WELL INSTALLED BY NYSDEC
T-1 -MONITORING WELL INSTALLED BY TAYLOR
355 -SHALLOW WATER LEVEL EQUIPOTENTIAL LINE AND DESIGNATION
-GROUND WATER FLOW DIRECTION
POND
MIRABITO PROPERTY LINE
HOLDING TANK
KELLAR NO. 1
KELLAR NO. 2
MUNICIPAL WELL NO. 1
MUNICIPAL WELL NO. 2
RTE. 57
OSWEGO RIVER
TAYLOR PROPERTY
STAFF GAUGE
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
FORMER SPILL CONTAINMENT TANK LOCATION
STORM INLET
STORM MANHOLE
DRAINAGE DITCH
UNDERGROUND CULVERT
OPEN DITCH
0 FEET 200
MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
WATER TABLE CONFIGURATION
DECEMBER 1991
MALCOLM PIRNIE
Date 04/92
Figure No. 3-9

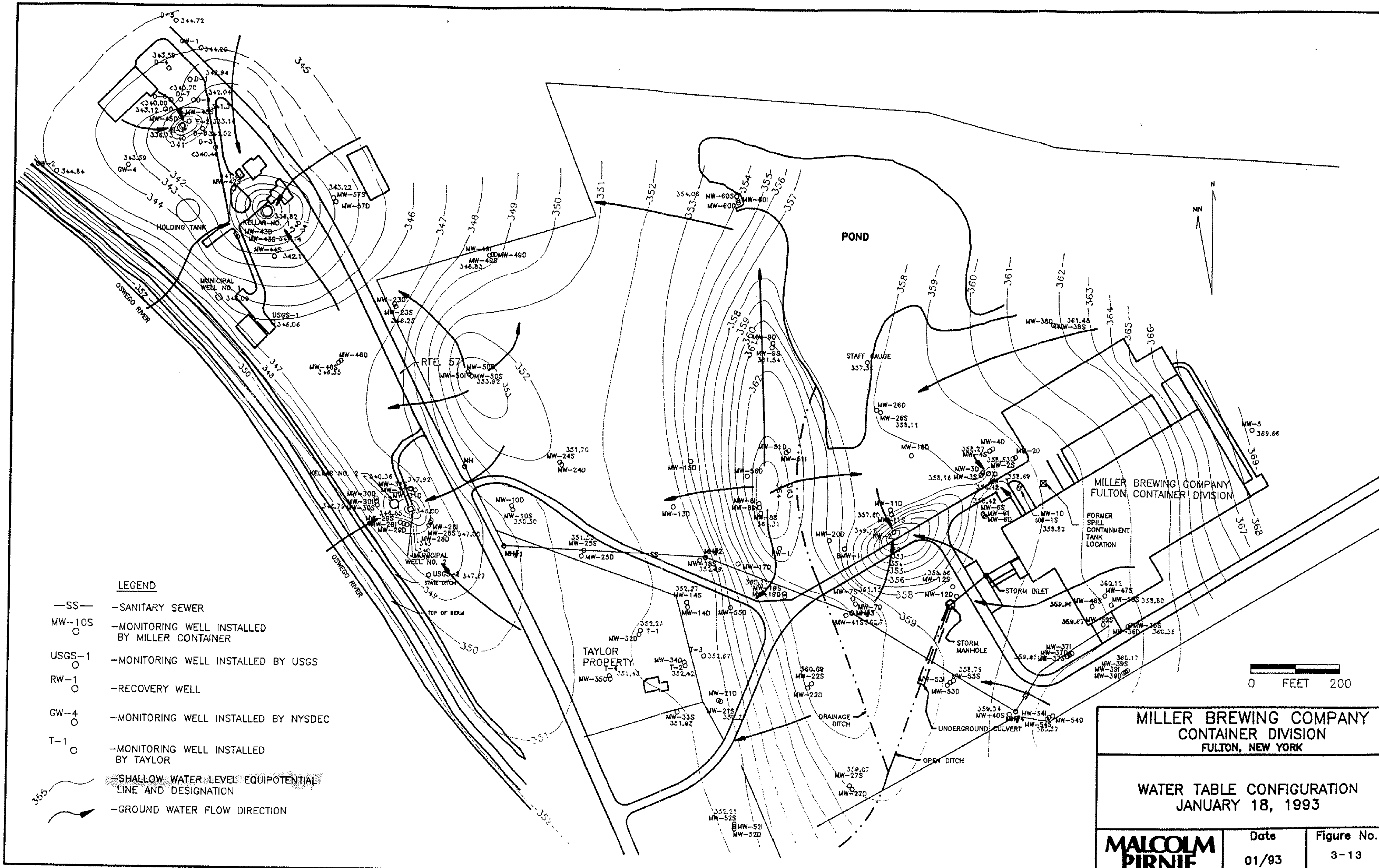


LEGEND
—SS— -SANITARY SEWER
MW-10S -MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 -MONITORING WELL INSTALLED BY USGS
RW-1 -RECOVERY WELL
GW-4 -MONITORING WELL INSTALLED BY NYSDEC
T-1 -MONITORING WELL INSTALLED BY TAYLOR
355 -DEEP WATER LEVEL EQUIPOTENTIAL LINE AND DESIGNATION
-GROUND WATER FLOW DIRECTION
POND
OSWEGO RIVER
RTE. 57
TAYLOR PROPERTY
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
FORMER SPILL CONTAINMENT TANK LOCATION
HOLDING TANK
KELLAR NO. 1
KELLAR NO. 2
MUNICIPAL WELL NO. 1
MUNICIPAL WELL NO. 2
STAFF GAUGE
STORM INLET
STORM MANHOLE
DRAINAGE DITCH
UNDERGROUND CULVERT
OPEN DITCH
0 FEET 200
MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
POTENTIOMETRIC SURFACE
DEEP ZONE – DECEMBER 1991
MALCOLM PIRNIE
Date
04/92
Figure No.
3-10

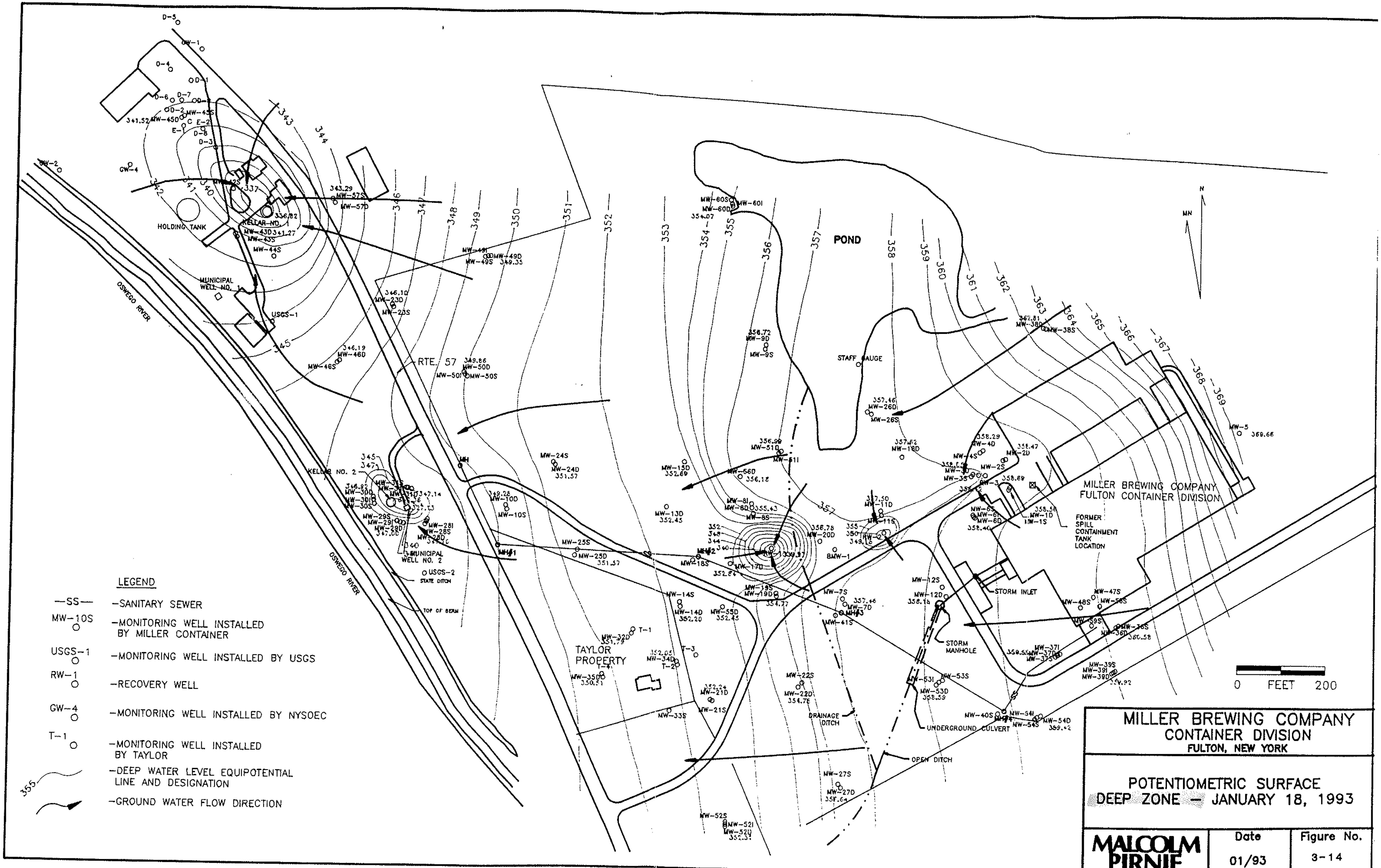

MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
WATER TABLE CONFIGURATION
JANUARY 1992
MALCOLM PIRNIE
Date
04/92
Figure No.
3-11
LEGEND
—SS— -SANITARY SEWER
MW-10S -MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 -MONITORING WELL INSTALLED BY USGS
RW-1 -RECOVERY WELL
GW-4 -MONITORING WELL INSTALLED BY NYSDEC
T-1 -MONITORING WELL INSTALLED BY TAYLOR
355 -SHALLOW WATER LEVEL EQUIPOTENTIAL LINE AND DESIGNATION
-GROUND WATER FLOW DIRECTION
0 FEET 200
POND
MIRABITO PROPERTY LINE
HOLDING TANK
KELLAR NO. 1
KELLAR NO. 2
MUNICIPAL WELL NO. 1
MUNICIPAL WELL NO. 2
RTE. 57
OSWEGO RIVER
TAYLOR PROPERTY
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
FORMER SPILL CONTAINMENT TANK LOCATION
STAFF GAUGE
STORM INLET
STORM MANHOLE
DRAINAGE DITCH
UNDERGROUND CULVERT
OPEN DITCH
STATE DITCH
TOP OF BERM
PIPE
N
MN



MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
POTENTIOMETRIC SURFACE
DEEP ZONE – JANUARY 1992
MALCOLM PIRNIE
Date
04/92
Figure No.
3-12
LEGEND
—SS— -SANITARY SEWER
MW-10S -MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 -MONITORING WELL INSTALLED BY USGS
RW-1 -RECOVERY WELL
GW-4 -MONITORING WELL INSTALLED BY NYSDEC
T-1 -MONITORING WELL INSTALLED BY TAYLOR
355 -DEEP WATER LEVEL EQUIPOTENTIAL LINE AND DESIGNATION
-GROUND WATER FLOW DIRECTION
0 FEET 200
POND
OSWEGO RIVER
RTE. 57
TAYLOR PROPERTY
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
FORMER SPILL CONTAINMENT TANK LOCATION
HOLDING TANK
KELLAR NO. 1
KELLAR NO. 2
MUNICIPAL WELL NO. 1
MUNICIPAL WELL NO. 2
STAFF GAUGE
STORM INLET
STORM MANHOLE
DRAINAGE DITCH
UNDERGROUND CULVERT
OPEN DITCH
STATE DITCH
TOP OF BERM



POND
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
FORMER SPILL CONTAINMENT TANK LOCATION
TAYLOR PROPERTY
OSWEGO RIVER
RTE. 57
HOLDING TANK
MUNICIPAL WELL NO. 1
MUNICIPAL WELL NO. 2
KELLAR NO. 1
KELLAR NO. 2
STAFF GAUGE
STORM INLET
STORM MANHOLE
UNDERGROUND CULVERT
OPEN DITCH
DRAINAGE DITCH
STATE DITCH
TOP OF BERM
LEGEND
—SS— -SANITARY SEWER
MW-10S -MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 -MONITORING WELL INSTALLED BY USGS
RW-1 -RECOVERY WELL
GW-4 -MONITORING WELL INSTALLED BY NYSDEC
T-1 -MONITORING WELL INSTALLED BY TAYLOR
355 -SHALLOW WATER LEVEL EQUIPOTENTIAL LINE AND DESIGNATION
-GROUND WATER FLOW DIRECTION
0 FEET 200
N
MN
MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
WATER TABLE CONFIGURATION
JANUARY 18, 1993
MALCOLM PIRNIE
Date 01/93
Figure No. 3-13


LEGEND
—SS— -SANITARY SEWER
MW-10S -MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 -MONITORING WELL INSTALLED BY USGS
RW-1 -RECOVERY WELL
GW-4 -MONITORING WELL INSTALLED BY NYSOEC
T-1 -MONITORING WELL INSTALLED BY TAYLOR
355 -DEEP WATER LEVEL EQUIPOTENTIAL LINE AND DESIGNATION
-GROUND WATER FLOW DIRECTION
POND
OSWEGO RIVER
RTE. 57
HOLDING TANK
KELLAR NO. 1
KELLAR NO. 2
MUNICIPAL WELL NO. 1
MUNICIPAL WELL NO. 2
TAYLOR PROPERTY
STAFF GAUGE
STORM INLET
STORM MANHOLE
DRAINAGE DITCH
OPEN DITCH
UNDERGROUND CULVERT
TOP OF BERM
STATE DITCH
FORMER SPILL CONTAINMENT TANK LOCATION
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
N
MN
0 FEET 200
MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
POTENTIOMETRIC SURFACE
DEEP ZONE - JANUARY 18, 1993
MALCOLM PIRNIE
Date 01/93
Figure No. 3-14

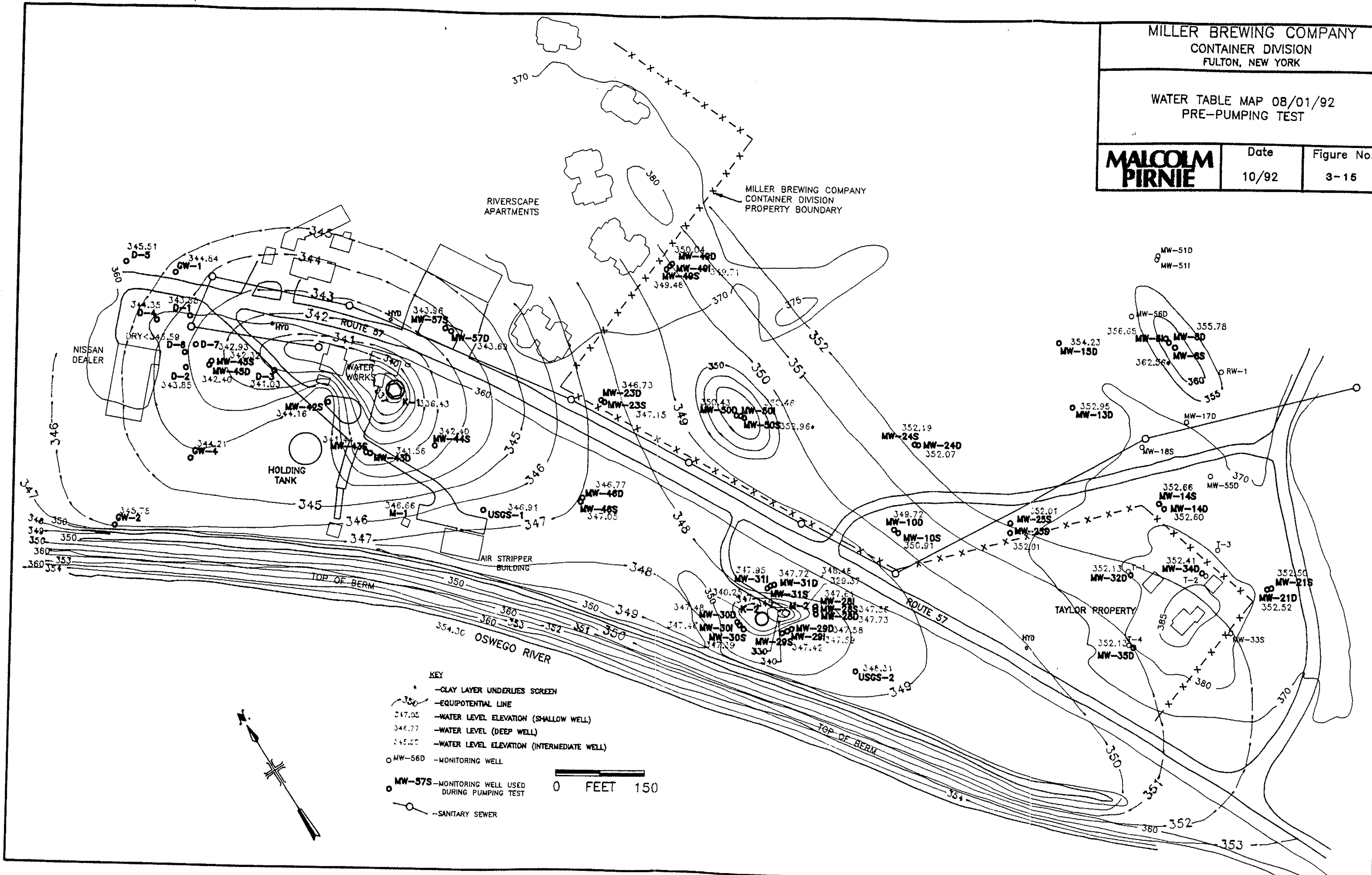
and K-2/M-2 were significantly lower in August 1992 than in August 1991 (these wells were not available for water level measurements in August 1990). This exception to the seasonal trend is due to the municipal wells being pumped at higher rates during August 1992 than during previous months.

Ground water elevations at the site during 1992 do not show a distinct "dry season"; therefore, water table and potentiometric surface maps generated from December 1991 and January 1992 (Figures 3-9 through 3-12) are representative of ground water configurations throughout the year. Water levels collected during January 1993 have been plotted on Figures 3-13 and 3-14 to incorporate data collected from the new well cluster MW-60S,I,D.

The deep zone wells are generally screened in the sand and gravel unit that overlies lodgement till below the site. Flow direction arrows on the maps show the general direction of ground water flow, but care should be taken when basing interpretations on these maps since these types of potentiometric surface maps are essentially maps of hydraulic head contours on a two-dimensional horizontal cross section, which are based on a three-dimensional hydraulic head pattern that exists in the subsurface. Since there are vertical components of flow, these maps should be interpreted in conjunction with the hydrogeologic cross sections shown on Sheet 4. The water level data collected during January 1992 is portrayed on Sheet 4.

Shallow ground water flow, as depicted on Figure 3-9, 3-11 and 3-13, is generally from the east to the west toward the Oswego River; however, the effect of pumping at recovery wells RW-2 and RW-3 and at municipal wells K-1, K-2 and M-2 can be seen on the figures by the depressed equipotential lines in the vicinities of these wells. The effect of pumping from the NYSDEC recovery wells E-1 and E-2 can be seen on Figure 3-13.

The area around the municipal wells K-1, K-2, and M-2 has been enlarged on Figure 3-15 to allow a more detailed representation of the equipotential lines in this area. The water levels shown are based on August 1, 1992 data. Figure 3-15 was originally presented in the Municipal Aquifer Pumping Test Report (November 1992) as Figure 4-3. The report is included as Appendix V. The pumping test consisted of various phases, each defined by a change in the flow regime at the K-1 system, or the K-2 and M-2 system. For example, Phase I consisted of operating K-1 at typical discharge rates, turning the K-2/M-2 system off and measuring water level recovery; Phase II was initiated by turning K-1 off; Phase III involved the measurement of drawdown when K-1 was restarted at a minimum flow rate. The entire pumping test incorporated five phases as described in the pumping test report.


MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
WATER TABLE MAP 08/01/92
PRE-PUMPING TEST
MALCOLM PIRNIE
Date
10/92
Figure No.
3-15
MILLER BREWING COMPANY
CONTAINER DIVISION
PROPERTY BOUNDARY
RIVERSCAPE APARTMENTS
NISSAN DEALER
WATER WORKS
HOLDING TANK
AIR STRIPPER BUILDING
ROUTE 57
TOP OF BERM
OSWEGO RIVER
TAYLOR PROPERTY
KEY
* —CLAY LAYER UNDERLIES SCREEN
350 —EQUIPOTENTIAL LINE
347.05 —WATER LEVEL ELEVATION (SHALLOW WELL)
346.77 —WATER LEVEL (DEEP WELL)
345.55 —WATER LEVEL ELEVATION (INTERMEDIATE WELL)
MW-56D —MONITORING WELL
MW-57S —MONITORING WELL USED DURING PUMPING TEST
—SANITARY SEWER
0 FEET 150
N

K-2 and M-2 were treated as one pumping system, K-2/M-2, for the purposes of the pumping test because these wells are located within 30 feet of one another and are both pumped from essentially the same zone within the aquifer.

Aquifer transmissivity (T) and storativity (S) were estimated for the K-1 and K-2/M-2 areas from data collected during the pumping test. The K-1 area exhibited overall higher estimates of transmissivity as compared to those approximated for the K-2/M-2 area. Storativity values estimated for both the K-1 and K-2/M-2 areas are typical of unconfined aquifer conditions.

Based on water table and potentiometric surface maps generated from data collected while both municipal pumping systems were off, natural ground water flow is to the west from the Miller site toward the Oswego River. Ground water then trends northwest in the vicinity of the river in a direction subparallel to the flow of the river. Ground water tends to move along this boundary as the river is artificially maintained at a higher elevation than that of the surrounding water table. Operation of the K-1 system without K-2/M-2 operating indicated that the cone of influence of K-1 does extend into the K-2/M-2 area, but does not include (with the exception of wells MW-23S,D) shallow or deep zone wells on the Taylor property, or the Miller property.

Under typical pumping conditions, (K-1 and K-2/M-2 systems operating at optimum rates) the K-1 system exerts a greater influence on the aquifer than the pumping from the K-2/M-2 system. This is attributed primarily to the higher discharge rates at K-1 (over long periods of time), and partially to the relatively higher transmissivity estimates in the K-1 area. The rate of ground water movement from the K-2/M-2 area toward K-1 is lowest under non-pumping conditions when both the K-1 and K-2/M-2 systems are off; however, concurrent pumping from the municipal well systems (K-1 and K-2/M-2) greatly reduces the rate of ground water movement along this flow path when compared to pumping at the K-1 system only.

As shown on Figure 3-15, the cones of depression around K-1 and K-2/M-2 are ellipsoidal rather than symmetrical. The elevated Oswego River is connected to the permeable aquifer deposits and serves as a constant source of recharge (a recharge boundary) to the pumping wells. The River influences K-1 and K-2/M-2 by stopping the expansion of the cone of depression. As the River provides a source of recharge to replace the flow normally received from outside the boundary, the drawdown stabilizes between the wells and the boundary, and the removal of water from storage is limited. In the pumping wells, the rate of drawdown is decreased, the specific capacity is increased and the slope of the cone of depression is not only greater on the River's side of the wells, but is lessened on the opposite side. Also, transmissivity values estimated within the K-1 area are consistent with the ellipsoidal shape of the drawdown cone, with higher T values occurring along the elongated axis of the cone.

A flow net was constructed using water level data collected under typical pumping conditions at the municipal wells. The flow net was presented as Figure 4-7 in the Municipal Aquifer Pumping Test Report (November 1992). Based on the construction of this flow net, it is estimated that over 60 percent of the shallow ground water entering K-1 originates at the Oswego River recharge boundary. The amount of water received from the east and northeast directions is estimated at about 35 percent while less than five percent is supplied from north and northwest of K-1. Only about 10 percent of the water originates from the direction of the Miller property, southeast of K-1. Water quality data at wells located in this area, including the MW-23, MW-49 and MW-50 well clusters, are not indicative of a plume of contamination, in particular, no TCE has been detected at the wells in this area. The K-2/M-2 system receives nearly three-quarters of its shallow flow from the River. The amount of water received from areas underlying the Miller site to the northeast and east, and the Taylor property to the east-southeast, comprises about 25 percent. A small amount of flow is contributed to K-2/M-2 from the north.

Table 3-1 lists well yields and drawdown data from K-1, K-2 and M-2. Based on these data, the average specific capacity (yield divided by drawdown) has been estimated for the three municipal wells. As indicated on Table 3-1, the specific capacity of K-2 is more than 2.6 times greater than that of M-2; the specific capacity of K-1 is four times greater than K-2, 10.2 times greater than M-2, and 5.4 times greater than K-2 and M-2 averaged together as one pumping system.

The relatively higher drawdown at M-2 versus K-1 and K-2 is the result of the inefficiency of the M-2 well design (limited screened area for water to flow through and relatively small well radius) compared to the more efficient well design of K-1 and K-2 (20-foot diameter "open-bottom" infiltration wells, 23-24 feet in depth), and other factors such as the proximity of surface water available to recharge K-1 and K-2 and heterogeneity and anisotropy in the unconfined aquifer. In this area, the vertical hydraulic conductivity is less than the horizontal hydraulic conductivity due to the layered nature of the deposits. There are also variations in the vertical relative to the horizontal hydraulic conductivity which are the result of nonuniformity in the geometry of the void spaces between grains in the aquifer. These aquifer characteristics lead to flow conditions that vary with direction (anisotropy and heterogeneity).

The silty clay layer that occurs below a portion of the pond and the central portion of the site (Figure 3-8) has lower permeability than the surrounding units. A falling head flexible wall permeability test was performed on a sample collected from the sandy silt above the silty clay layer and a sample collected from the silty clay layer during the drilling of MW-8I. The results indicate that the sandy silt sample has a vertical hydraulic conductivity of 1.5×10^{-6} cm/sec (or 4.9×10^{-8} ft/sec) and the silty clay has a vertical hydraulic conductivity of 9.6×10^{-8} cm/sec (or 3×10^{-9} ft/sec). These test results are included in Appendix K. An attempt was made to collect a Shelby tube sample from a coarser grained unit below the silty clay. However, the sample was not cohesive enough to remain in the tube. This indicates low plasticity and relatively higher hydraulic conductivity.

The lower permeability of the silty clay results in delayed infiltration across the unit and the creation of a mound on the water table. The water table mound above the silty clay layer is evident on Figures 3-9, 3-11 and 3-13, and on hydrogeologic Cross Sections A-A', B-B', F-F' and G-G' on Sheet 4. The presence of the silty clay layer above the screens in recovery well RW-1 reduces the influence of the recovery well on the shallow zone. This is illustrated by hydrogeologic Cross Section A-A' on Sheet 4 and on Figures 3-9 through 3-14. The mounding effect above the silty clay layer can be seen on the water table maps that represent the shallow zone ground water elevations, and the drawdown caused by RW-1 can be seen on the potentiometric surface maps that represent the deep zone elevations.

Ground water occurring at the base of the unconsolidated aquifer (the deep zone) flows from east to west across the site, except in the vicinity of the recovery wells and the municipal wells where the flow is diverted. The ground water flow patterns in the deep zone in December 1991, January 1992 and January 1993 are shown in map view on Figures 3-10, 3-12 and 3-14, respectively. January 1992 data are shown in the cross sections on Sheet 4.

As seen on Cross Sections A-A' and B-B', an upward gradient from the deep zone toward the shallow zone exists in the area around cluster MW-36 and near municipal wells K-2 and M-2. An upward gradient also exists near cluster MW-38 and along the east side of the lodgement till ridge. However, in most areas on the site, a downward vertical gradient or a lateral flow component predominates. For example:

1. A lateral component of flow generally occurs in the basal sand and gravel unit that overlies the lodgement till, including, as noted above, where the lodgement till slopes upward on the east side of the till ridge (which results in flow over the top of the till ridge).

2. A steep downward gradient exists from the shallow zone toward the deep zone across the silty clay layer below the middle portion of the site.

The effect of the clay layer on the distribution of pressure head in the aquifer is illustrated on the graphs in Appendix L. The water levels between the shallow and deep well in a cluster where the clay layer is absent are very similar and exhibit slight downward gradients (except at MW-36S,D and MW-38S,D) throughout the year. However, at well clusters where the clay layer is present (e.g. MW-7, MW-8, MW-9, MW-19 and MW-22), the water level in the shallow well in each cluster is generally a few feet above the water level in the adjacent deeper well.

3.4.2.1 RW-1 Pumping Tests

During June 1990, an initial pumping test was performed at RW-1 to generate information for an assessment of the area of influence of the well under normal operating conditions (7 gpm) as requested by the NYSDEC in a comment letter on the RI/FS work plan.

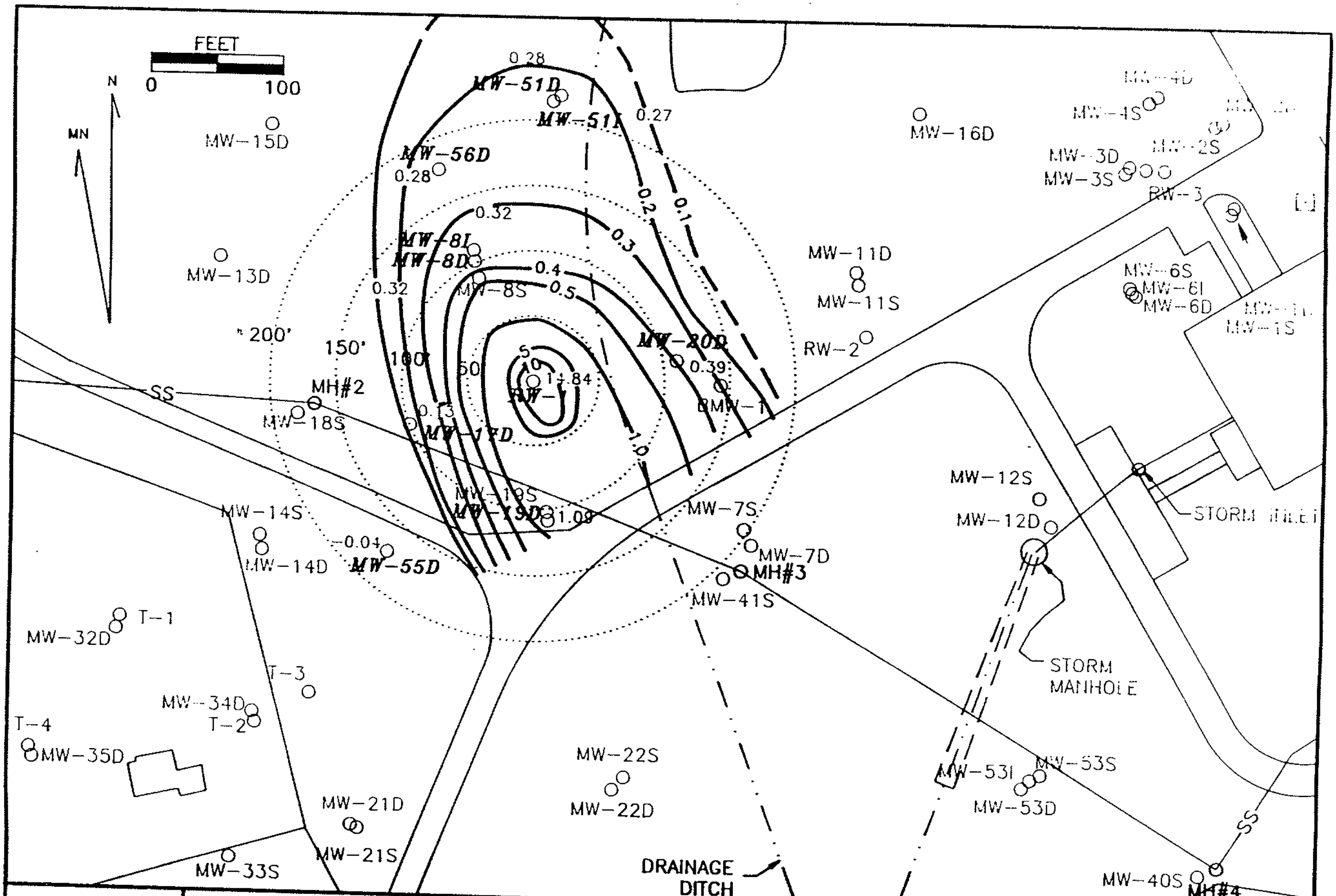
Subsequent to the installation of monitoring wells MW-8I, MW-51I,D, MW-55D, and MW-56D, a pumping test was again conducted during September 1992. This pumping test was requested by the NYSDEC to demonstrate that the cone of influence of RW-1 extends to MW-8I under current pumping conditions (7 gpm). The RW-1 Pumping Test Report, dated December 1992 and revised May 1993, is presented as Appendix W of this report; results of the 1990 and the 1992 pumping tests are summarized within the following discussion.

The 1990 pumping test was initiated by turning off the pump in RW-1 for a period of approximately 46 hours and measuring the water levels in nearby monitoring wells and at the recovery well. After the 46-hour period, the pumping rate of 7 gpm was reestablished at RW-1 and the drawdown at RW-1 and nearby monitoring wells was measured and recorded. Water levels were also measured and recorded at the same well locations during a period of pre-pumping test monitoring in order to establish the preexisting trend in water level fluctuation.

The water level data collected during the 1990 pumping test at the monitoring wells and recovery well have been plotted as a function of time on the graphs in Appendix M. The premonitoring data collected at the wells indicate that the trend in water level fluctuation prior to the pumping test was downward. Therefore, an upward deflection on the graph of water level versus time at a monitoring well during the time period when the pump in RW-1 was off indicates that the well is under the influence of pumping at RW-1. As can be seen on the graphs, monitoring wells MW-7D, MW-8D, MW-17D, MW-19D and MW-20D are definitely within the area influenced by the withdrawal of water at RW-1. Wells MW-13D, MW-14S, MW-14D, MW-15D, MW-18S, MW-21S, MW-21D, MW-22S and MW-22D appeared to be outside the area influenced by RW-1 while pumping at 7 gpm.

Although fewer wells were used as monitoring points during the 1992 pumping test, results confirm that the drawdown due to pumping RW-1 at a 7 gpm extends into the MW-8D, MW-17D, MW-19D and MW-20D areas, and in addition, into the MW-8I, MW-51I,D and MW-56D areas. Data collected during this pumping test have been used to generate a map of the amount of water level rebound which occurred in the deep and intermediate ground water zones during the recovery phase (Figure 3-16). Water levels in the shallow wells in the area were not monitored during the 1992 test because of the effect of the silty clay layer present between RW-1 and the shallow well screens. During the 1990 pumping test, water level rebound was not evident at MW-7S, MW-8S and MW-19S due to the presence of the silty clay layer. A rise in water elevation observed at several wells outside the influence of RW-1 during the 1990 test is attributed to rainfall that occurred on June 25, 1990.

During the 1990 pumping test, the greatest amount of water level recovery at a monitoring well over the 46-hour test period occurred at MW-19D (1.46 feet). The second highest amount of recovery occurred at well MW-7D (0.46 foot), even though MW-7D is located about 200 feet from RW-1 while MW-8D, MW-19D and MW-20D are about 100 feet closer. The amount of drawdown at MW-7D was closely followed by the response at MW-8D (0.42 foot). The least amount of recovery occurred at wells MW-17D and MW-20D (0.37 and 0.33 foot, respectively). It should be noted that the ultimate recovery at MW-8D would probably have been greater since the water level in this well was still rising when RW-1 was restarted. The relative amounts of drawdown and recovery observed at wells during the 1992 pumping test are similar to those observed during the 1990 test although they are somewhat lower overall. This may be attributed to seasonal trends in water availability.



MALCOLM PIRNIE

MILLER BREWING COMPANY – CONTAINER DIVISION

FEET OF RECOVERY (WATER LEVEL RISE)

DURING PHASE 1 – RW-1 PUMPING TEST, September 1992

MALCOLM PIRNIE, INC.

FIGURE 3-16

The pattern of drawdown in the vicinity of RW-1 suggests that there is less water available for recharge on the south and southeast sides of RW-1 (in the direction of MW-19D and MW-7D). The discontinuous nature of the silty clay layer in directions to the west (MW-17D), northwest (between MW-8D and MW-15D) and east (MW-20D) provide more saturated thickness and, therefore, more water available to recharge RW-1 from these directions. Geologic information gathered during the drilling of boreholes for wells MW-51I,D indicates that the silty clay layer is also discontinuous to the north and northeast of RW-1. Sands and gravels were penetrated in the interval from 26 to 74 feet below land surface at MW-51D and no silty clay layer was present. The sand and gravel deposit appears to be highly transmissive and may represent a significant barrier to the spread of the cone of influence of RW-1. In addition, the pond and possibly the drainage ditch which exits from the pond's southwest corner contribute to the availability of ground water from north-northeast of RW-1.

The lodgement till ridge is present below MW-17D (Figure 3-4 and 3-5) and, since the effects from pumping RW-1 extend into this area, one might expect that the drawdown near MW-17D would be relatively great due to the lack of recharge along the till boundary. However, since there is relatively little drawdown at MW-17D, it may be assumed that the effect of the elevated till on water availability is minor compared to other factors:

1. The greater saturated thickness due to the lateral discontinuity of the silty clay layer in this area.

2. Relatively high transmissivity sands and gravel in the vicinity of MW-17D and MW-51I,D.

3. The relatively low pumping rate at RW-1.

During the 1990 pumping test, the recovery at MW-8D was still occurring when RW-1 was restarted; therefore, drawdown in the northerly direction was presumed to be greater than the maximum recorded value at MW-8D. Pumping test data from 1992 indicate that the spread of the cone of influence to the north is significant in the area below the silty clay layer. The presence of the silty clay layer in this area to the north, and to the south and southeast of RW-1 lowers the readily available water supply in these directions.

The data collected during the pumping tests at RW-1 were used to reevaluate the aquifer in the vicinity of the pumping well. The earliest evaluation at RW-1 (1988) was made without the benefit of the observation wells that were installed during the RI.

Following the 1990 pumping test, Jacob's Straight Line graphical approach (log of time vs. drawdown) was used to evaluate the data collected in the area of MW-8D, MW-19D and MW-7D. Due to the relatively smaller amount of drawdown near MW-17D and MW-20D, the transmissivity and storativity were evaluated using two unconfined methods: one developed by Theis and another developed by Cooper-Jacob. In the case of an unconfined aquifer, storativity is taken to be equal to the specific yield. The data collected at MW-8D, MW-19D and MW-7D were also evaluated by Theis and Cooper-Jacob methods for confined aquifers, and by the Hantush method for leaky aquifer conditions with storage in the aquitard.

Values of transmissivity (T) and storativity (S) were calculated from the 1992 pumping test data for the observation wells under semi-confining conditions using two Hantush leaky-aquifer methods. The first Hantush method (Hantush 1) assumes that no storage is occurring in the overlying aquitard while the second Hantush method (Hantush 2) assumes that significant storage does occur in the overlying aquitard. Wells under unconfined conditions were analyzed using the Theis and/or Cooper-Jacob methods.

The results of the time-drawdown analysis of data from the 1990 and 1992 pumping tests are presented in Table 3-2. The backup calculations and graphs from 1990 data are included in Appendix N; backup material from the 1992 test is contained in the RW-1 Pumping Test Report (December 1992, revised May 1993) as presented in Appendix W. The analyses from both pumping tests indicate that the transmissivity in the aquifer is higher near MW-8I, MW-17D, and MW-20D compared to the values estimated near MW-7D, and MW-8D, and MW-19D. The transmissivity estimated near MW-8D is similar to the previously (1988) calculated value of 0.91 ft^2/min. Transmissivity around RW-1 is relatively low, with the lowest values estimated near MW-19D. The steep drawdown cone around RW-1 is a result of the low T values observed.

The storativity values estimated around RW-1 are in the range expected for confined aquifer conditions (10^{-5} to 10^{-3}) except near MW-56D. The portion of the aquifer below the silty clay layer is probably reacting to the pumping at RW-1 as a confined aquifer. However, due to the discontinuous nature of the silty clay layer in easterly and westerly directions, and to the northeast near MW-51I,D, these portions of the aquifer are under semiconfining or leaky aquifer conditions. Values for S estimated for wells under unconfined conditions (located near the edge or beyond the extent of the silty clay unit) are lower than would be expected. It was noted in the 1992 pumping test report that the estimation of specific yield

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TABLE 3-1
SPECIFIC CAPACITY
MUNICIPAL WELLS K-1, K-2 & M-2

Date	Well	Yield (GPM)	Water Level (Feet Below Measuring Point)	Water Level Elevation	Drawdown (Feet Below Static Water Level)	Specific Capacity (GPM/FT)
04/24/87	M-2	62.5	25.76	330.43	18.64	3.35
12/11/90	M-2	32.6	15.09	341.10	7.97	4.09
12/11/90	K-2	35.4	10.59	344.70	3.09	11.46
03/28/91	M-2	22.2	12.27	343.92	5.15	4.31
03/28/91	K-2	38.2	10.61	344.68	3.11	12.28
01/21/92	K-2	25.8	9.51	346.00	1.98	13.03
01/31/92	K-2	44.4	11.57	343.94	3.57	12.44
03/16/92	M-2	39.9	13.96	342.31	6.84	5.83
03/16/92	K-2	44.9	12.18	343.33	4.68	9.59
03/16/92	K-1	418.	13.71	341.83	9.07 *	46.1
07/29/92	M-2	51	27.06	329.21	22.19 *	2.3
07/29/92	K-2	44	15.56	339.95	11.05 *	3.98
07/29/92	K-1	535	19.8	335.74	15.16 *	35.29

M-2 Average Specific Capacity = 3.98 GPM/FT
K-2 Average Specific Capacity = 10.46 GPM/FT
K-1 Average Specific Capacity = 40.70 GPM/FT
K-2/M-2 Average Specific Capacity = 7.51 GPM/FT

* Drawdown measured from static water levels recorded when pumping wells were off during the municipal aquifer pumping test in August 1992.

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TABLE 3-2
RESULTS OF TIME-DRAWDOWN ANALYSES
JUNE 1990 and SEPTEMBER 1992
RW-1 PUMPING TESTS

Well Location	Transmissivity (ft*2/min)	Storativity	r/B	B	Method	Aquifer Type
MW-7D	1.040	0.00006			Jacob	
	1.370	0.00002			Theis	C
	1.370	0.00002			Cooper-Jacob	C
	0.890	0.00004			Hantush 1	C
MW-8I	***1.892***	***0.00094***	***0.1215***	---	***Hantush 1***	***C***
	1.756	***0.00065***	---	***0.0698***	***Hantush 2***	***C***
MW-8D	1.040	0.00050			Jacob	
	1.210	0.00033			Theis	C
	1.220	0.00031			Cooper-Jacob	C
	0.830	0.00037			Hantush 1	C
	0.926	***0.00069***	***0.2215***	---	***Hantush 1***	***C***
	1.116	***0.00041***	---	***0.0722***	***Hantush 2***	***C***
MW-17D	1.730	0.00002			Theis	U
	1.720	0.00002			Cooper-Jacob	U
	1.128	***0.00241***	***0.3135***	---	***Hantush 1***	***C***
	2.000	***0.00110***	---	***0.0494***	***Hantush 2***	***C***
	2.915	***0.00890***	---	---	***Theis***	***U***
MW-19D	0.170	0.00050			Jacob	
	0.140	0.00067			Theis	C
	0.180	0.00047			Cooper-Jacob	C
	0.100	0.00054			Hantush 1	C
	0.249	***0.00079***	***0.2151***	---	***Hantush 1***	***C***
	0.290	***0.00049***	---	***0.0628***	***Hantush 2***	***C***
MW-20D	1.340	0.00006			Theis	U
	1.340	0.00006			Cooper-Jacob	U
	2.070	***0.00032***	---	---	***Theis***	***U***
	2.174	***0.00020***	---	---	***Cooper-Jacob***	***U***
	0.893	***0.00048***	---	---	***Cooper-Jacob (0-100 minutes)***	***U***
MW-51I	***3.944***	***0.00043***	***1 E-5***	---	***Hantush 1***	***C***
	3.853	***0.00047***	---	***1 E-5***	***Hantush 2***	***C***
	3.763	***0.00051***	---	---	***Theis***	***U***
MW-51D	***3.802***	***0.00050***	***1 E-5***	---	***Hantush 1***	***C***
	3.565	***0.00065***	---	***1 E-5***	***Hantush 2***	***C***
	3.488	***0.00068***	---	---	***Theis***	***U***
MW-56D	***2.291***	***0.00170***	***1 E-5***	---	***Hantush 1***	***C***
	2.031	***0.00260***	---	***1 E-5***	***Hantush 2***	***C***
	1.856	***0.00320***	---	---	***Theis***	***U***

F:\PROJ\1028248\RITABLES\RITAB3-2.WK1

Notes: All 1992 data are in Italics
Storativity, r/B, and B are dimensionless
Jacob – Jacob Stright Line Method

Hantush 1 – No staorage in aquitards
Hantush 2 – Storage in aquitards

C – Confined Aquifer
U – Unconfined Aquifer

in an unconfined aquifer by normal aquifer test methods, may result in unrealistically low values. This has been especially evident during relatively short pumping tests when there are significant vertical hydraulic gradients.

Leakage factors (r/b and B) were calculated from the 1992 pumping test data. Values estimated for wells in semiconfined areas were similar, indicating a fairly uniform, unfractured silty clay layer. Wells near the edges of the silty clay unit were analyzed using both confined and unconfined aquifer test methods. T and S values showed little difference between methods; however, leakage factors calculated for MW-51I, MW-51D, and MW-56D are very low, indicating unconfined conditions. The leakage factors estimated at MW-17D, MW-19D, MW-8I, and MW-8D were in the normal range expected for confined conditions.

According to the results of the pumping tests at RW-1, the drawdown due to pumping at RW-1 is spreading preferentially below the silty clay layer and is apparently greatest near MW-19D. The cone of influence below the silty clay layer to the north and northwest extends past MW-8D to include MW-56D; MW-51I and MW-51D are influenced by the pumping at RW-1, but may be near the edge of the cone of influence. The availability of recharge water, due to the location of the pond and the thick sand and gravel unit near MW-5I,D, may limit the spread of the cone of influence in a direction to the northeast. Todd's (1980) method for calculating the location of a ground water divide, marking the boundary of a region producing inflow to a pumping well, was applied to the 1992 pumping test data. According to the results, the ground water divide separating the area where contamination would or would not be drawn to RW-1 is located to the north of MW-8I. (The ground water divide is shown on Figure 5 of the RW-1 Pumping Test Report in Appendix W.)

RW-1 was operated at 7 gpm during both the 1990 and 1992 pumping tests. During the 1992 test, 16 feet of drawdown was observed at RW-1. This drawdown represents 34 percent of the maximum possible drawdown, or 54 percent of the maximum yield of the well. The pumping rate at RW-1 is expected to be increased to 12 gpm upon approval from local and state regulatory agencies. This is expected to produce a drawdown of about 32 feet, representing 90 percent of the maximum well yield. Obtaining water levels at monitoring wells MW-51I,D and MW-56D after the increased pumping rate will allow a more accurate assessment of the expansion of the cone of influence under the proposed RW-1 pumping rate increase.

3.4.2.2 Hydraulic Conductivity and Average Linear Velocity

Slug tests were performed at each monitoring well installed during the RI, except at MW-40S, MW-41S, and at the large diameter wells below the container plant, to collect data for an estimation of the saturated horizontal hydraulic conductivity (K_h) of the soils in the vicinity of the screened interval. The water level data collected during the slug tests were evaluated using the Bouwer and Rice (1976) method to arrive at the K_h estimates. A copy of the Bouwer and Rice method is included in Appendix O. The graph of drawdown versus time for each well, the water level data obtained during the slug tests, the well construction parameters for each well that were used in the evaluation (radius, screen length, etc.) and the estimate of K_h at each well are included in Appendix P. The K_h estimates for the wells installed during the RI are listed on Table 3-3, along with K_h values for monitoring wells installed prior to the RI. The slug test was unsuccessful at several wells due to rapid recharge or a low water level in the well. Subsequent to the submittal of the Draft RI Report, slug tests were redone at several of the wells which had exhibited rapid recharge. Table 3-3 also identifies wells that were recently retested, and those wells where no K_h estimate is available and the reason for the lack of information.

K_h values estimated at site wells are shown on Figure 3-17. The estimates of K_h across the site are fairly consistent, averaging in the range expected for silty sands (10^{-5} to 10^{-3} cm/sec) and sands and gravels (10^{-3} to 10^{-1} cm/sec). The highest quantified estimates of K_h are near MW-9D, MW-15D, MW-21S, MW-23D, MW-24D, MW-25D, MW-28D, MW-29D, and MW-49I,D; however, K_h appears to be greater around several wells where the recharge occurs at too great a rate to permit accurate data collection. The areas where this phenomenon occurs are in the vicinities of MW-23S, MW-26D, MW-28I, MW-29I, MW-30S,I,D, MW-31I, MW-35D, and MW-51I. It should be noted that the ground water flow in the vicinity of the municipal pumping wells does not occur under natural conditions. The horizontal hydraulic conductivity has most likely been increased by the removal of finer-grained materials from the formation, due to the continuous pumping of the municipal wells for many years.

The horizontal hydraulic conductivity near the shallow well screens averages approximately 2 x 10^{-3} cm/sec, and the conductivity near the deep well screens averages about 5 x 10^{-3} cm/sec. These averages do not incorporate K_h values for the wells which recharged too rapidly to accurately measure the conductivity. Where data exist for both the shallow and deep well in a cluster, K_h in the vicinity of the shallow well screen is often less

MILLER CONTAINER

TABLE 3–3
HYDRAULIC CONDUCTIVITIES FOR SITE WELLS

SHALLOW WELLS				INTERMEDIATE WELLS		DEEP WELLS			
WELL ID	K (CM/SEC)	WELL ID	K (CM/SEC)	WELL ID	K (CM/SEC)	WELL ID	K (CM/SEC)	WELL ID	K (CM/SEC)
MW-1S	4E-03	MW-50S	4E-05	MW-6I	2E-04	MW-1D	1E-04	MW-45D	2E-03
MW-2S	1E-04	MW-52S	3E-04	MW-8I	4E-04	MW-2D	3E-04	MW-46D	5E-04
MW-3S	2E-04	MW-53S	1E-04	MW-28I	*****	MW-3D	3E-04	MW-49D +	1E-02
MW-4S	2E-04	MW-54S	4E-06	MW-29I	*****	MW-4D	5E-04	MW-50D	9E-05
MW-5	1E-04	MW-57S	1E-04	MW-30I	*****	MW-6D	7E-04	MW-51D	6E-04
MW-6S	1E-04	MW-60S	1E-03	MW-31I	*****	MW-7D	2E-03	MW-52D	3E-04
MW-7S	7E-03			MW-37I	2E-04	MW-8D	8E-03	MW-53D	3E-05
MW-8S	2E-04			MW-39I	3E-03	MW-9D	2E-02	MW-54D	5E-06
MW-9S	5E-04			MW-49I	2E-02	MW-10D	4E-03	MW-55D	4E-03
MW-10S	9E-04			MW-50I	2E-03	MW-11D	6E-03	MW-56D	2E-05
MW-11S	3E-04			MW-51I	*****	MW-12D	6E-03	MW-57D	5E-05
MW-12S +	9E-05			MW-52I	1E-02	MW-13D +	7E-04	MW-60D	3E-04
MW-14S	2E-04			MW-53I	1E-02	MW-14D	4E-03		
MW-18S	3E-04			MW-54I	4E-03	MW-15D +	2E-02		
MW-19S	3E-06			MW-60I	4E-04	MW-16D	9E-04		
MW-21S	5E-02					MW-17D	8E-05		
MW-22S	2E-05					MW-19D	2E-05		
MW-23S	*****					MW-20D	2E-04		
MW-24S	2E-03					MW-21D	4E-04		
MW-25S	4E-03					MW-22D	1E-05		
MW-26S	8E-04					MW-23D +	2E-02		
MW-27S	1E-05					MW-24D	3E-02		
MW-28S	5E-03					MW-25D	2E-02		
MW-29S	2E-03					MW-26D	*****		
MW-30S	*****					MW-27D	7E-05		
MW-31S +	2E-04					MW-28D +	2E-02		
MW-33S	4E-04					MW-29D +	2E-02		
MW-36S	3E-04					MW-30D	*****		
MW-37S	4E-06					MW-31D +	9E-03		
MW-38S	2E-05					MW-32D	5E-03		
MW-39S	2E-05					MW-34D	1E-03		
MW-42S	1E-03					MW-35D	*****		
MW-43S	7E-05					MW-36D	2E-05		
MW-44S	2E-03					MW-37D	4E-05		
MW-45S	1E-03					MW-38D	1E-04		
MW-46S	1E-04					MW-39D	5E-06		
MW-49S	7E-04					MW-43D	3E-04		

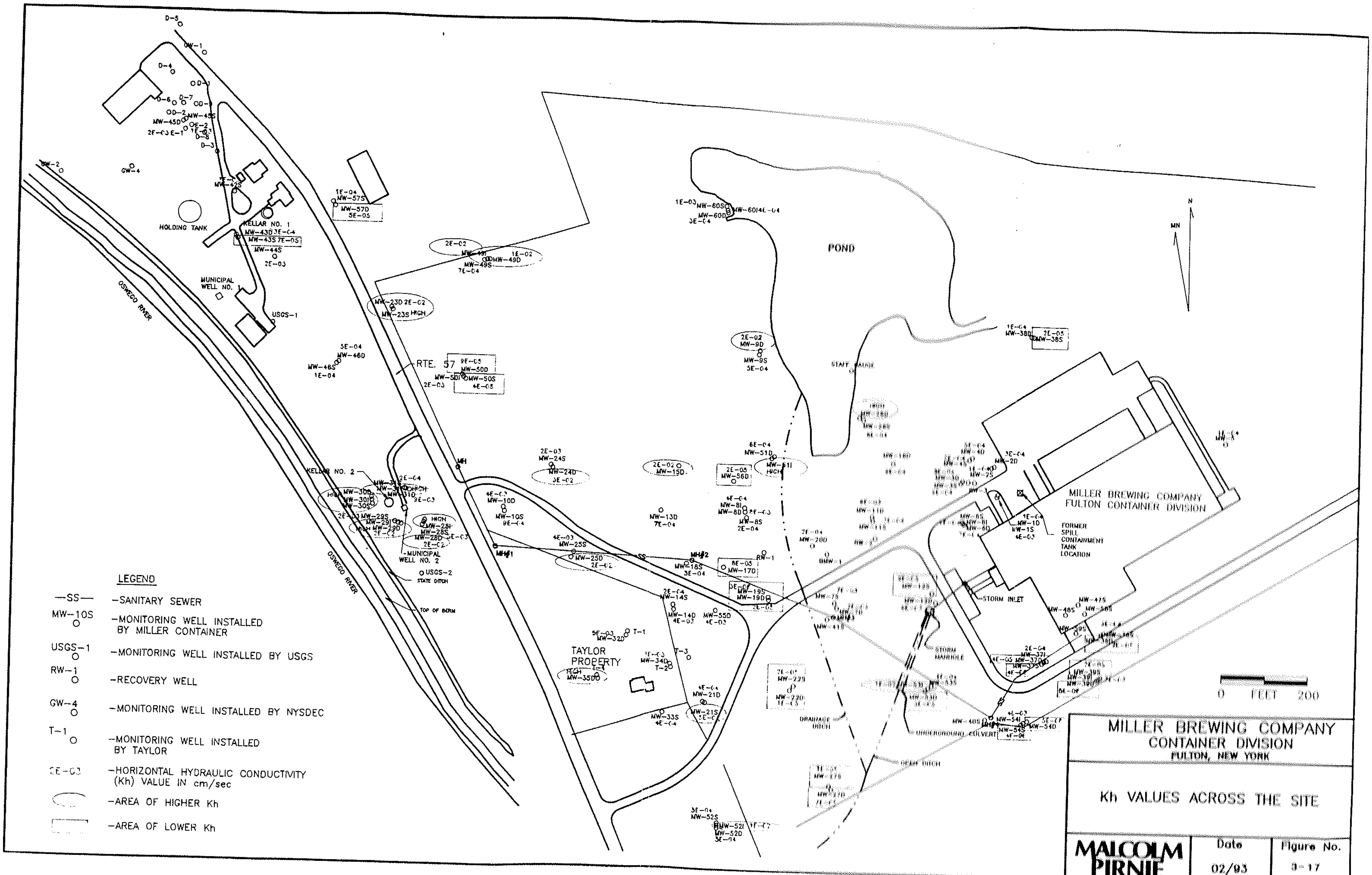
Shallow Wells:
average= 2E-03 *
range-> 3E-06 to 5E-02

Intermediate Wells:
average 5E-03 **
range-> 2E-04 to 2E-02

Deep Wells:
average= 5E-03 ***
range-> 5E-06 to 3E-02

All Wells:
average= 4E-03 ****
range-> 3E-06 to 5E-02

NOTES:
***** = Recharge too rapid for quantitation.
+ = Slug tests redone January 1993; no K values prior to this due to rapid recharge.
* = Not including 2 rapid recharge wells.
** = Not including 5 rapid recharge wells.
*** = Not including 10 rapid recharge wells.
**** = Not including 18 rapid recharge wells.


POND
OSWEGO RIVER
RTE. 57
HOLDING TANK
KELLAR NO. 1
KELLAR NO. 2
MUNICIPAL WELL NO. 1
MUNICIPAL WELL NO. 2
TAYLOR PROPERTY
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
FORMER SPILL CONTAINMENT TANK LOCATION
STORM INLET
STORM MANHOLE
UNDERGROUND CULVERT
DRAINAGE DITCH
STATE DITCH
TOP OF BERM
N
MN
0 FEET 200
LEGEND
—SS— -SANITARY SEWER
MW-10S -MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 -MONITORING WELL INSTALLED BY USGS
RW-1 -RECOVERY WELL
GW-4 -MONITORING WELL INSTALLED BY NYSDEC
T-1 -MONITORING WELL INSTALLED BY TAYLOR
2E-03 -HORIZONTAL HYDRAULIC CONDUCTIVITY (Kh) VALUE IN cm/sec
-AREA OF HIGHER Kh
-AREA OF LOWER Kh
MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
Kh VALUES ACROSS THE SITE
MALCOLM PIRNIE
Date 02/93
Figure No. 3-17

than K_h for the material screened in the adjacent deep well. By assigning a K_h value of 5 x 10^{-2} cm/sec (the highest quantified estimate of K_h) to those wells identified as recharging too rapidly to allow for quantification, the average conductivity near the shallow wells can be estimated at 4 x 10^{-3} cm/sec and the average conductivity near the deep wells can be estimated at 8 x 10^{-3} cm/sec. Of the fifteen intermediate zone wells, ten yielded K_h values which averaged about 5 x 10^{-3} cm/sec, and five recharged too rapidly to collect accurate data, including the four wells screened in the intermediate zone around K-2 and M-2.

Generally, the K_h values are naturally higher in the deeper screened zone in the area west and southwest of the pond toward K-2 and M-2 (Figure 3-17) and in the intermediate screened zone along the southern portion of the site. Lower K_h values measured in the vicinity of both the water table and the basal sand and gravel unit occur in the south-southeastern area of the site, and in the south-central area along the eastern slope of the till ridge.

The average linear velocity (V_a), or seepage velocity, between wells screened in the deep zone is estimated based on the horizontal hydraulic gradient (dh/dl), the averaged horizontal hydraulic conductivities near each well screen, and the estimated effective porosity (n_e). The effective porosity was estimated previously (during the IRI Report preparation) at 0.22.

The average linear velocity represents the rate at which ground water actually moves through the pore spaces between grains in the formation. It is estimated by using the equation $V_a = -(K/n_e)(dh/dl)$. This equation does not take into consideration factors that account for dispersion, which is a phenomenon that occurs because ground water flows through different pores at different rates and because various flow paths are of different length. Since the equation does not include a dispersion factor, it cannot be used to predict the average linear rate of movement of a solute front. This is especially true for ground water flow through fine grained aquifer material,.where the process of diffusion may also be important in the movement of a solute from an area of greater to lesser concentration. A modification of the above equation can be used to estimate the average linear velocity of a solute front. In the modified equation, an experimentally derived Darcian pore factor is multiplied by the effective porosity to determine the effective Darcian porosity, n_{ed}, which is substituted into the above equation for n_e. The results of the substitution of n_{ed} into the equation are presented in Section 5.

Estimates of the average linear velocity (V_s) in the deep zone between several wells on-site are listed on Table 3-4 and shown on Figure 3-18. The horizontal hydraulic gradients used in the estimates are derived from January 1992 and January 1993 water level data. Figure 3-18 represents January 1993 data. The flow paths along which the estimates have been made were selected using the following guidelines:

- The flow paths approximate the general ground water flow patterns in the deep zone.
- The flow paths are generally out of the influence of pumping at any recovery well. (Paths which terminate in the vicinity of K-2 and M-2 are influenced by the pumping at these municipal wells.)

The highest seepage velocity estimates generally occur along the western portion of the site, especially in the vicinity of municipal wells K-2 and M-2. As discussed previously, continuous pumping at the municipal wells has likely induced unnaturally high K_h values in that area. The unusually high gradient is also a function of lower water levels in the area of the municipal wells due to the withdrawal of ground water that is occurring. Several of the flow paths which terminate at MW-28D or MW-31D have been estimated to have some of the highest seepage velocities calculated across the site.

Higher velocities estimated in the northwestern portion of the site (MW-9D to MW-49D, MW-9D to MW-31D, to MW-50D to MW-23D) are attributed to high K_h values near MW-9D and MW-23D. A lower seepage velocity is estimated from MW-9D to MW-50D due to the lower horizontal hydraulic gradient. The lower estimates calculated for flow paths MW-50D to MW-46D and MW-60D to MW-57D are due to low K_h values in the vicinity of all four wells.

Average linear velocity values estimated within the west-central portion of the site vary significantly. The highest values are seen near K-2 and M-2 (except flow path MW-10D to MW-31D which averages a lower K_h than other flow paths in the area). Seepage velocities calculated for flow paths MW-34D to MW-35D and MW-51D to MW-15D are higher than for nearby paths due to higher K_h values in the MW-15D and MW-35D areas, and to higher horizontal hydraulic gradients along these flow paths. Velocities calculated from MW-51D to MW-56D and MW-56D to MW-13D are much lower than nearby estimates because of low hydraulic conductivities in the vicinity of each of these wells and because of lower horizonal hydraulic gradients.

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TABLE 3-4
AVERAGE LINEAR VELOCITY ESTIMATES - DEEP ZONE

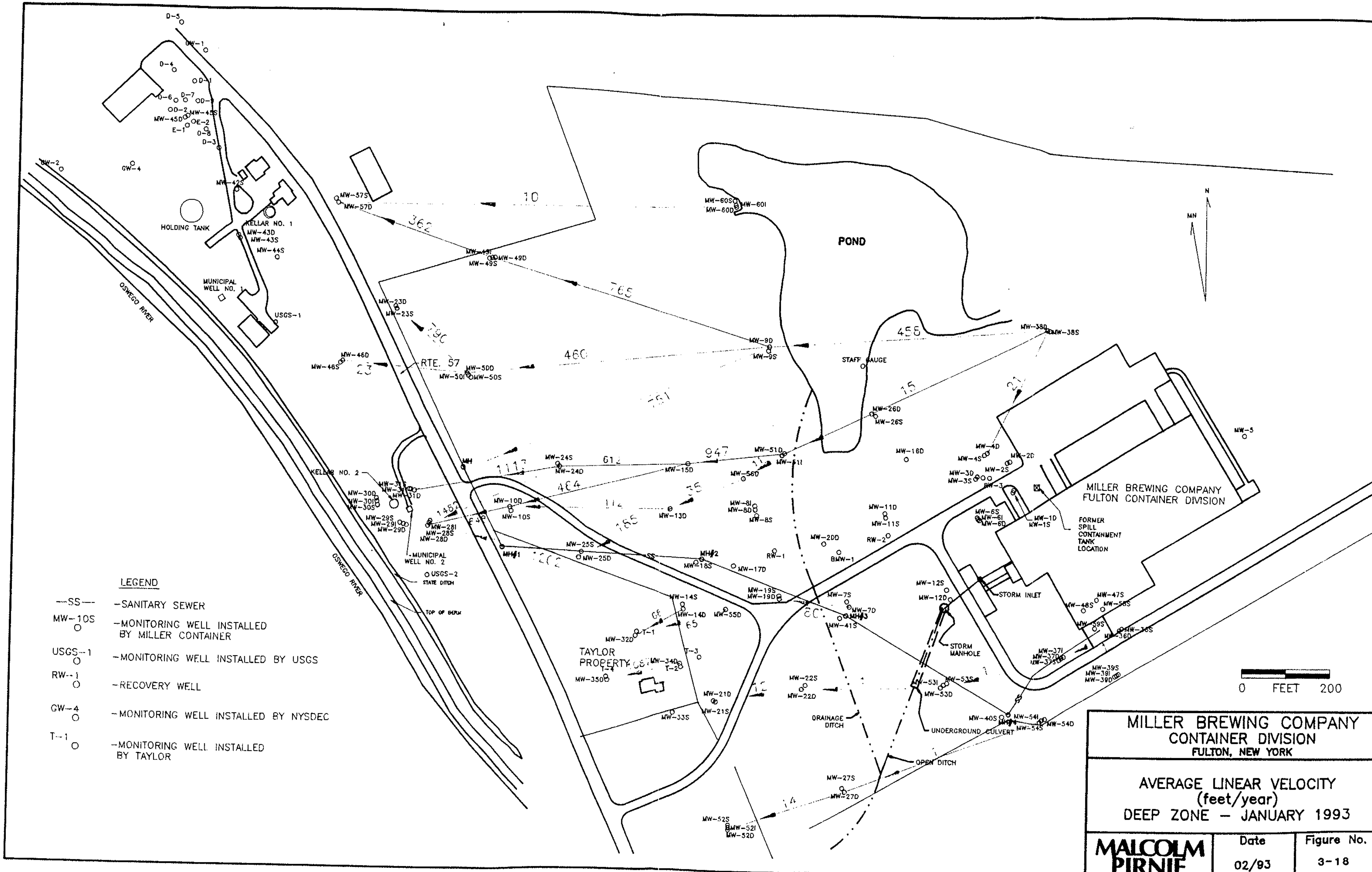
Flow Path	Horizontal Hydraulic Gradient		Average Horizontal Hydraulic Conductivity, Kh (cm/sec)	Effective Porosity	Average Linear Velocity (feet/year)		
	January 1992	January 1993			January 1992	January 1993	Average
MW-7D to MW-19D	0.0142	0.0168	1.0E-03	0.22	67	80	74
MW-9D to MW-31D	0.0077	0.0110	1.5E-02	0.22	528	751	640
MW-9D to MW-49D	0.0078	0.0108	1.5E-02	0.22	549	765	657
MW-9D to MW-50D	0.0072	0.0097	1.0E-02	0.22	341	460	400
MW-10D to MW-28D	0.0068	0.0115	1.2E-02	0.22	383	648	515
MW-13D to MW-10D	0.0070	0.0102	2.4E-03	0.22	77	112	95
MW-13D to MW-25D	0.0030	0.0038	1.0E-02	0.22	144	184	164
MW-14D to MW-32D	0.0026	0.0032	4.5E-03	0.22	55	68	62
MW-15D to MW-10D	0.0058	0.0082	1.2E-02	0.22	325	464	394
MW-15D to MW-24D	0.0029	0.0052	2.5E-02	0.22	338	612	475
MW-22D to MW-21D	0.0104	0.0125	2.1E-04	0.22	10	12	11
MW-24D to MW-28D	0.0088	0.0126	2.5E-02	0.22	1034	1482	1258
MW-24D to MW-31D	0.0080	0.0121	1.9E-02	0.22	735	1113	924
MW-25D to MW-28D	0.0079	0.0128	2.0E-02	0.22	745	1202	973
MW-27D to MW-52D	0.0124	0.0157	1.8E-04	0.22	11	14	12
MW-34D to MW-35D	0.0061	0.0091	2.6E-02 **	0.22	727	1087	907
MW-36D to MW-37D	0.0048	0.0072	3.0E-05	0.22	1	1	1
MW-37D to MW-53D	0.0026	0.0034	3.5E-05	0.22	1	1	1

MILLER CONTAINER

TABLE 3-4
AVERAGE LINEAR VELOCITY ESTIMATES - DEEP ZONE

Flow Path	Horizontal Hydraulic Gradient		Average Horizontal Hydraulic Conductivity, Kh (cm/sec)	Effective Porosity	Average Linear Velocity (feet/year)		
	January 1992	January 1993			January 1992	January 1993	Average
MW-38D to MW-4D	0.0122	0.0147	3.0E-04	0.22	17	21	19
MW-38D to MW-9D	0.0077	0.0097	1.0E-02	0.22	363	458	410
MW-38D to MW-51D	0.0071	0.0089	3.5E-04	0.22	12	15	13
MW-49D to MW-57D	0.0076	0.0153	5.0E-03	0.22	178	362	270
MW-50D to MW-23D	0.0091	0.0167	1.0E-02	0.22	428	790	609
MW-50D to MW-46D	0.0095	0.0169	3.0E-04	0.22	13	23	18
MW-51D to MW-56D	0.0059	0.0074	3.1E-04	0.22	9	11	10
MW-51D to MW-15D	0.0156	0.0195	1.0E-02	0.22	755	947	851
MW-53D to MW-22D	0.0095	0.0122	2.0E-05	0.22	1	1	1
MW-54D to MW-27D	0.0046	0.0058	3.7E-05	0.22	1	1	1
MW-55D to MW-32D	0.0024	0.0031	4.5E-03	0.22	51	65	58
MW-56D to MW-13D	0.0167	0.0207	3.6E-04	0.22	28	35	32
MW-60D to MW-57D	***	0.0118	1.7E-04	0.22	***	10	10

** = Based on an assumed horizontal hydraulic conductivity value of 5E-02 cm/sec (the highest Kh value measured at the site) at one or both of the wells.
*** = Dates prior to installation of one or both of the wells.



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CONTAINER DIVISION
FULTON, NEW YORK

AVERAGE LINEAR VELOCITY (feet/year)
DEEP ZONE – JANUARY 1993

MALCOLM PIRNIE | Date: 02/93 | Figure No. 3-18

Average linear velocity estimates are significantly lower in the eastern and southeastern portions of the site. Low seepage velocities estimated for flow paths MW-38D to MW-26D and MW-4D are primarily a function of low horizontal hydraulic conductivities. The estimated velocity from MW-38D to MW-9D is higher because of the higher K_h in the MW-9D area.

Low velocity estimates for flow paths in the southeast portion of the site are the result of low K_h values, with horizontal hydraulic gradients having a lesser affect; however, higher gradients such as those measured from MW-7D to MW-19D, MW-22D to MW-21D, and MW-27D to MW-52D, and slightly higher averaged K_h values, account for the comparatively higher velocity estimates along these paths. The higher horizontal hydraulic gradient from MW-7D to MW-19D, and the resultant seepage velocity estimate, are elevated due to the pumping at RW-1.

4.0 NATURE AND EXTENT OF CONTAMINATION

4.1 GENERAL

There are two contaminated media at the site: soil and ground water. One area of soil contamination was known prior to the performance of any RI-related activities. This area is the former spill containment tank area, which is located outside the Container Plant in an area that is not capped with low permeability material. The performance of RI work tasks, including a soil gas survey, ground water sampling and soil sampling, has verified that three additional soil source areas exist on the Miller property. These areas include:

1. The former northern drum storage area, which is also not capped.

2. The former southern drum storage area, which has been capped with concrete, asphalt or an extension of the Container Plant building.

3. The area near the USTs below the Container Plant near the Waste Treatment Facility (WTF).

Data from the RI have suggested two additional soil source areas: east of the Taylor/Miller eastern property line, and near the sanitary sewer where the Miller line joins the City's sewer line at Route 57. The identified soil contamination/soil source areas are discussed further in Sections 5, 6, and 7 of this report. A map delineating these areas is presented in Section 5 as Figure 5-1.

The ground water contamination is the result of contaminants being transported from soil source areas to the water table. In the case of soil source areas that are located outside the Container Plant and are presently not capped with asphalt or concrete, the driving force for the migration is the leaching of compounds from the soil as precipitation and snowmelt infiltrates downward through the contaminated soil in the unsaturated zone to the water table. In exterior source areas where the surface has been capped with asphalt, concrete or other low permeability material, the infiltration of precipitation and snowmelt would be reduced and the predominant mechanism for contaminants entering the saturated zone would be the seasonal fluctuation of the water table causing a rise in water level into a contaminated soil zone. In the case of the source area located below the Container Plant near the four abandoned USTs, VOCs are being transported to the water table in the aqueous part of the oil/water mixture as the water slowly percolates downward to the saturated zone. In most areas around the USTs, the oil has apparently not reached the water table due to the viscosity of the oil; the fine grained, naturally occurring sandy silt that is present around the tanks and below the anchor pads for the tanks; and the anchor pads for the tanks which provide a barrier to downward oil migration. Oil has migrated to the water table, however, in the area of the sump pit that was constructed adjacent to the USTs. The occurrence of oil in this area is discussed in Section 4.3.

The RI work tasks also have identified shallow ground water contamination in the area located northwest and east-northeast of K-1. The source of the ground water contamination located northwest of K-1 is not attributed to source areas on the Miller property and is being investigated by the NYSDEC. The source of the shallow ground water contamination on the east-northeast side of K-1 is not known but according to available data does not appear to be attributable to Miller source areas.

The types of contaminants present in the soil gas, soil and ground water are generally solvent-type chlorinated hydrocarbons (VOCs); however, some petroleum hydrocarbons have also been detected.

The results of the soil gas investigation, oil-spill investigation, ground water and soil sampling and the types of contamination present in each medium are discussed in the following sections.

4.2 SOIL GAS INVESTIGATION RESULTS

A total of 394 soil gas samples, 11 ground water samples and five sanitary sewer samples were collected and analyzed by Tracer using an on-site GC unit. It should be noted that in the Tracer Phase I and Phase II reports, the sanitary sewer line is referred to as a storm sewer line. One additional ground water sample was collected by Tracer but was analyzed at Upstate by GC/MS. The data from the three phases of the soil gas investigation are tabulated in the Tracer reports in Appendix E. The 11 ground water samples analyzed by GC were collected from shallow monitoring wells on the Miller property to correlate with soil gas data collected from adjacent locations. The five sanitary sewer samples were collected during the second phase of the investigation during which soil gas samples were collected from along the sanitary sewer line that crosses the Miller site. The ground water sample analyzed by GC/MS was collected during the second phase of the investigation from a location on the Municipal Well field northwest of K-2 in response to an unknown C_1-C_3 hydrocarbon which was being detected by the GC. This sample was analyzed for the compounds on the EPA Method 8240 list. The result of the GC/MS analysis is included in Appendix C. No compounds were detected by the GC/MS analysis. Surface water samples were collected from the State Ditch and analyzed for the EPA Method 8240 compounds. The results are presented in Appendix J.

The VOCs included in the three phases of the soil gas investigation are listed on Table 4-1. Most of these compounds were selected for analysis because they have been detected at the site. Carbon tetrachloride is not a suspected site contaminant. It was reported because it could be identified based on the set of standards being used by Tracer. The chlorinated hydrocarbons were analyzed by an ECD and the petroleum hydrocarbons by an FID.

Ambient air samples were collected during the investigation to determine the level of significance for the selected VOCs in the soil gas samples. The level of significance is the level above which Tracer considered concentrations to be meaningful. It is based on ambient air concentrations, background levels and Tracer's experience. Based on the evaluation of these factors, Tracer determined that the level of significance was 0.1 ug/l for the petroleum hydrocarbons and 0.01 for the chlorinated hydrocarbons. According to Tracer, soil gas concentrations in excess of 10 ug/l could indicate a possible source area of contamination.

The Phase I soil gas investigation was performed in the following four areas of the Container Plant property.

1. West of the Container Plant in the area east of the Taylor property, in an attempt to find a possible source area for the MW-14D, MW-18S and MW-21S contamination.

2. North of the Container Plant in the former spill containment tank area, to determine the level of VOCs and assess whether a pilot vacuum extraction test should be performed in this area.

3. Immediately west of the Container Plant along underground sanitary and storm sewer lines that exit from below this side of the Plant.

4. Northwest of the Container Plant near MW-23S,D in response to ground water contamination that had been detected in this area.

The soil gas data collected during this phase of the investigation were mapped and contoured by Tracer. The maps are included in Appendix E.

Based on the soil gas data, Tracer concluded that in the area west of the Container Plant (#1 above), there are two areas of significant soil gas levels: west of the fork in the road where benzene, toluene, TCA and TTCE (PCE) were detected and along the sewer line near MW-18S. Samples collected from this area contained significant levels of benzene, TCA and TTCE. Although the readings were significant in these two areas, no shallow source areas were identified. TCA was detected at the highest concentration, 2 ug/l.

Tracer concluded that the former spill containment tank area has elevated soil gas concentrations that are indicative of a nearby source of shallow contamination. Benzene was detected at a level of 1,100 ug/l in two samples near the former tank location and at an elevated level along the foundation adjacent to the drum storage room. TCA was detected at levels up to 1,900 ug/l and TTCE was detected up to 2,700 ug/l. In both cases, the contaminant levels were high near the building foundation. Employee interviews were conducted during 1990 in response to the NYSDEC Demand for Information on the Miller site. During the interviews, it was revealed that for an undefined period in the late 1970s, the drains in the drum storage room were used for the disposal of mop buckets used to clean the plant floors, and that plant washings were also disposed directly onto the ground outside of the drum storage room. These washings were believed to have contained the solvent cleaners in use at that time, which would have contained the VOCs detected in this area during the soil gas investigation. The disposal of washings outside of the drum storage room is believed to be the source of the elevated soil gas readings obtained near the building foundation. Soil samples were collected in July 1992 for additional GSDA and for organic carbon content analysis; these results will be used to assess the amenability of the soil in this area to the vacuum extraction technology.

Samples collected from the west side of the Container Plant indicated that elevated levels of TCA (up to 11 ug/l), TCE (up to 1 ug/l), TTCE (up to 20 ug/l) and benzene (up to 2 ug/l) were found along the sanitary sewer, but that samples collected adjacent to the storm sewers were not contaminated. The levels detected near the sanitary sewer were of sufficient magnitude to indicate a potential nearby source.

The last area investigated during Phase I was the area around MW-23S (northwest of the Container Plant). Very low levels of TCA (up to 0.4 ug/l), TTCE (up to 0.09 ug/l) and toluene (up to 0.5 ug/l) were detected in this isolated area. The levels increased towards the property line.

Phase II of the soil gas investigation was performed in the following four areas.

1. North of the Container Plant's northern parking area, in an area where empty VOC drums were reportedly washed and stored.

2. South of the Container Plant in another reported VOC drum storage and washing area.

3. Along the sanitary sewer line, in response to the Phase I results obtained next to the sewer near the Container Plant.

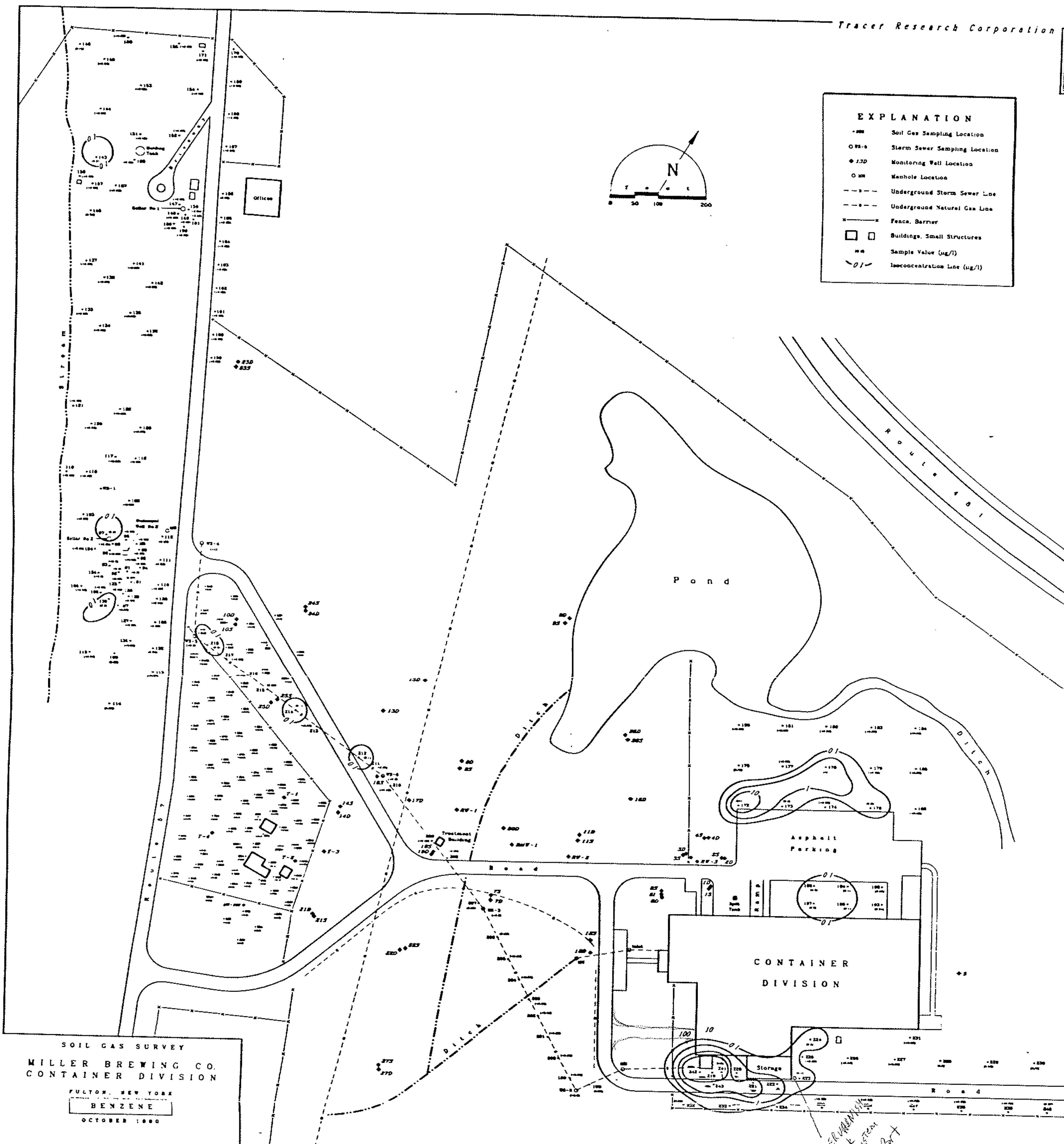
4. Around Municipal Wells K-1, K-2 and M-2.

The third phase of the soil gas investigation was performed on the Taylor property and immediately north of the Taylor property near MW-10S,D and the sanitary sewer.

The data collected during the second and third phases of the investigation were plotted and contoured together on one series of maps (Figures 4-1 through 4-11). Sheet 1 identifies the data collection points for all three phases of the soil gas investigation and is provided at the back of Volume I of the Draft RI Report (April 1992).

Significant concentrations of several compounds were detected in the soil gas in the area north of the Container Plant's northern parking area and south of the Container Plant (i.e., the two reported areas where empty VOC drums were washed and stored). In fact, the highest readings of total petroleum hydrocarbons (THC), TCA, TCE and TTCE detected at the site were found in the southern area. Benzene was also detected in the southern area (up to 400 ug/l). TCA was detected up to 1,700 ug/l, while 8,100 ug/l of TCE, 5,300 ug/l THC and 120,000 ug/l of TTCE was detected in the southern area. In the northern area, THC, methylene chloride, chloroform, TCA, carbon tetrachloride, TCE and TTCE were detected above the level of significance. TCA was detected at the highest level (1,100 ug/l) while TTCE (500 ug/l) was detected second highest in this area. These values are obviously indicative of nearby source areas. The high readings detected in the southern area were hypothesized to be connected to the elevated soil gas readings obtained along the sanitary sewer during Phase I of the soil gas investigation since the Miller sanitary sewer line starts below the Miller WTF which is in the southern drum storage area.

Isolated concentrations of several compounds were detected along the sanitary sewer line. The higher concentrations were detected along the west end of the sewer line, especially near where the sanitary sewer makes a bend to parallel Route 57. According to Tracer, the values obtained for THC, TCA and TTCE indicate a possible source area near



SOIL GAS SURVEY

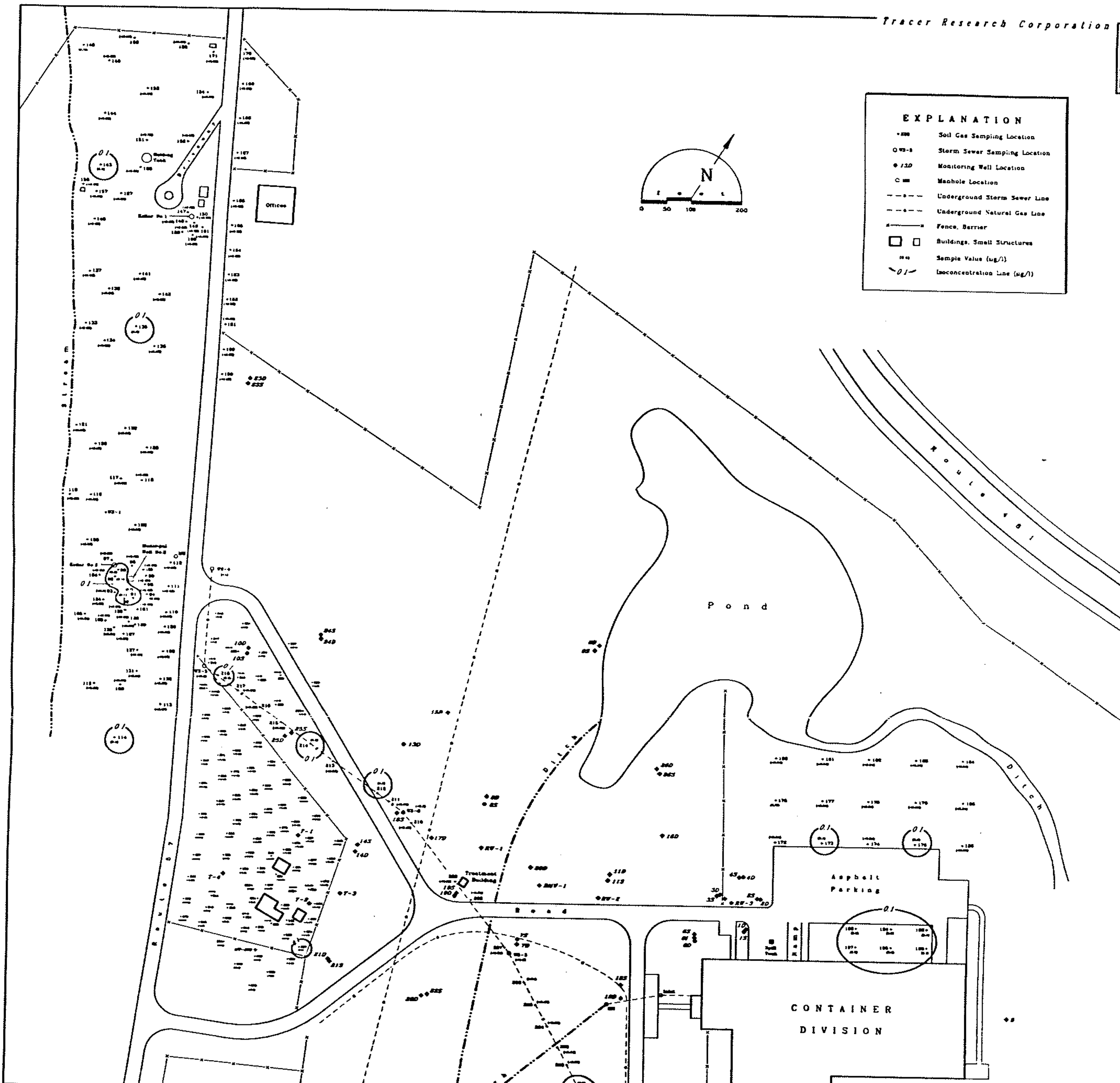
MILLER BREWING CO.
CONTAINER DIVISION

FULTON, NEW YORK

BENZENE

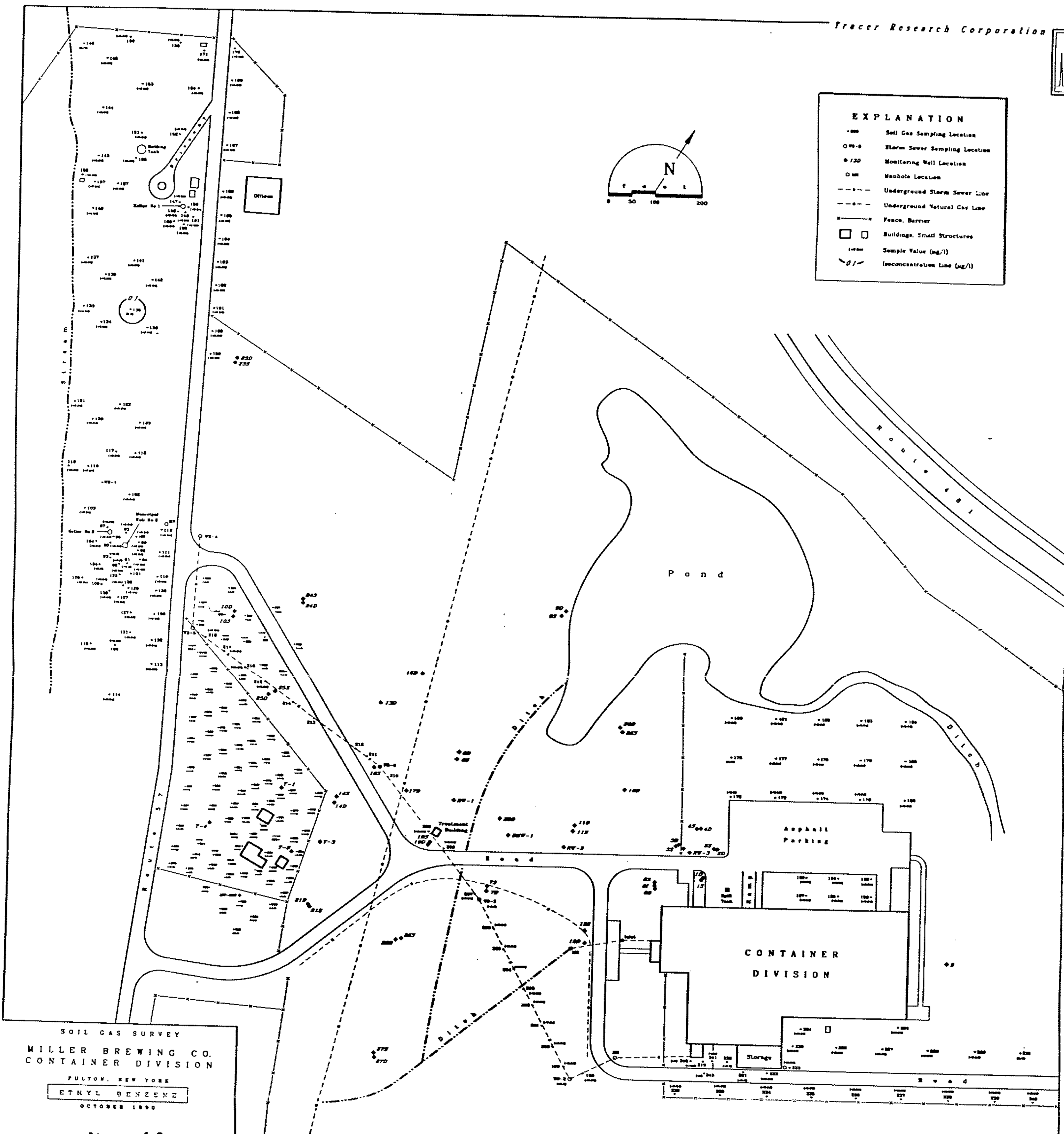
OCTOBER 1990

Figure 4-1

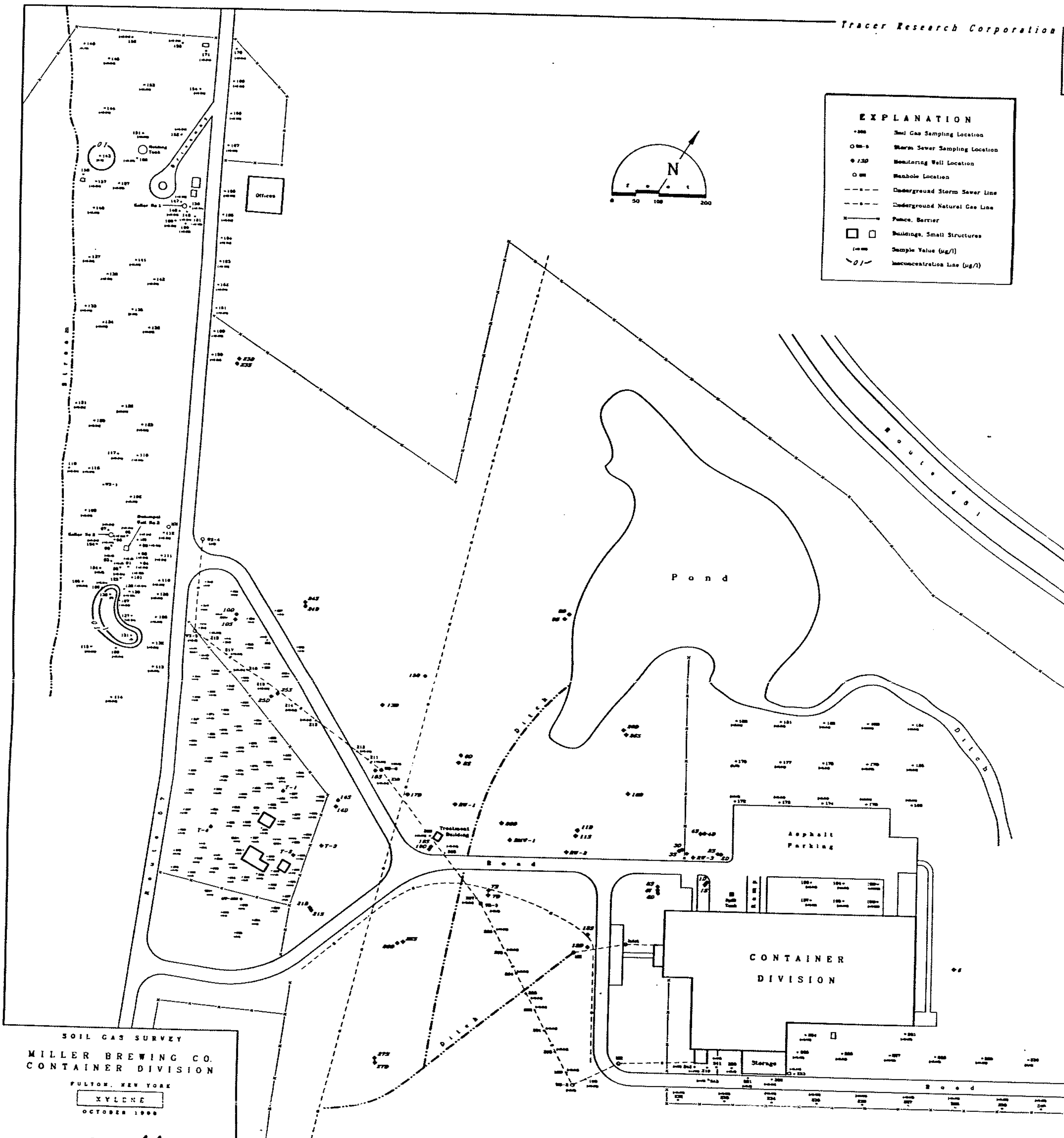


SOIL GAS SURVEY
MILLER BREWING CO.
CONTAINER DIVISION
FULTON, NEW YORK
TOLUENE
OCTOBER 1990

Figure 4-2



SOIL GAS SURVEY
MILLER BREWING CO.
CONTAINER DIVISION
FULTON, NEW YORK
ETHYL BENZENE
OCTOBER 1990
Figure 4-3



SOIL GAS SURVEY

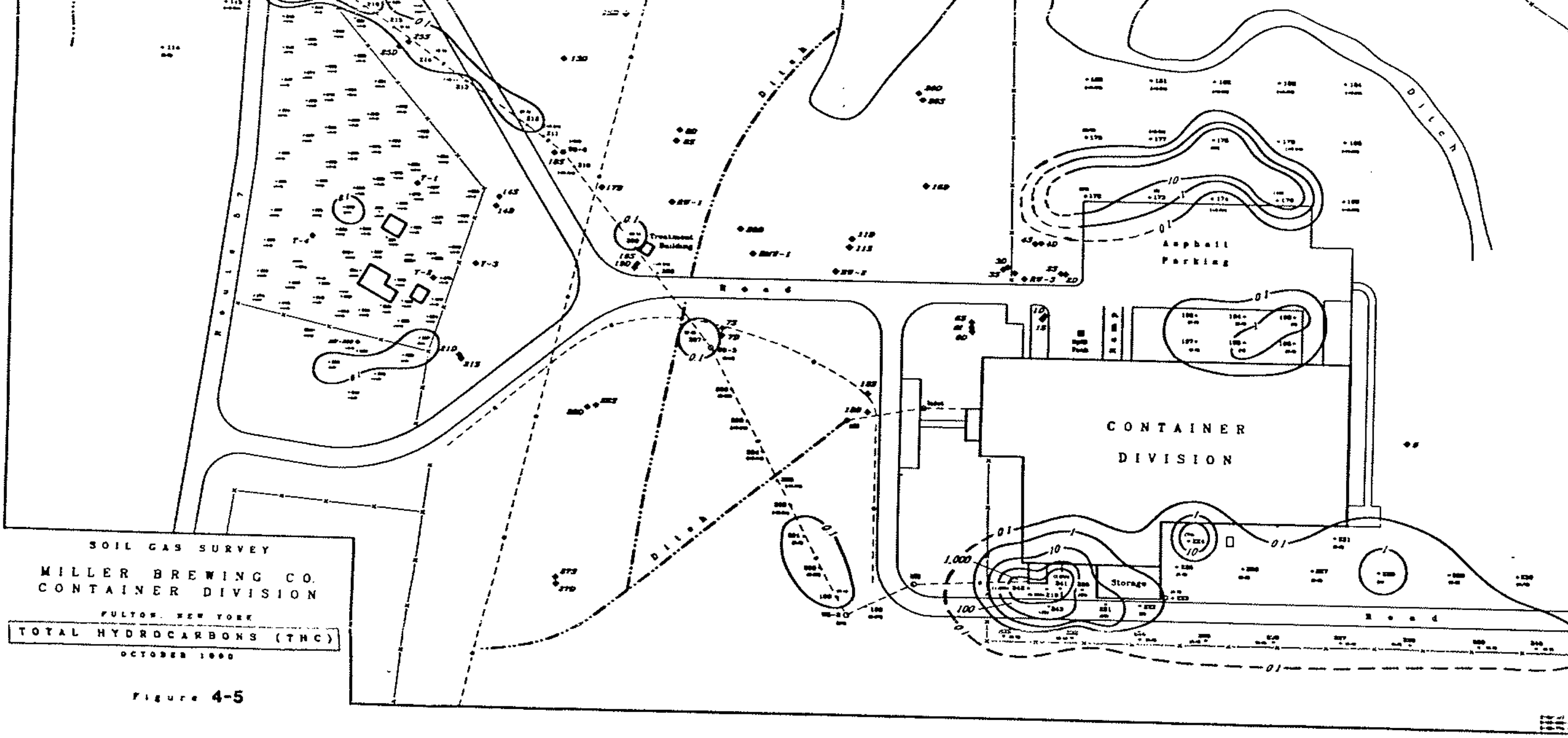
MILLER BREWING CO.
CONTAINER DIVISION

FULTON, NEW YORK

XYLENE

OCTOBER 1988

Figure 4-4



SOIL GAS SURVEY

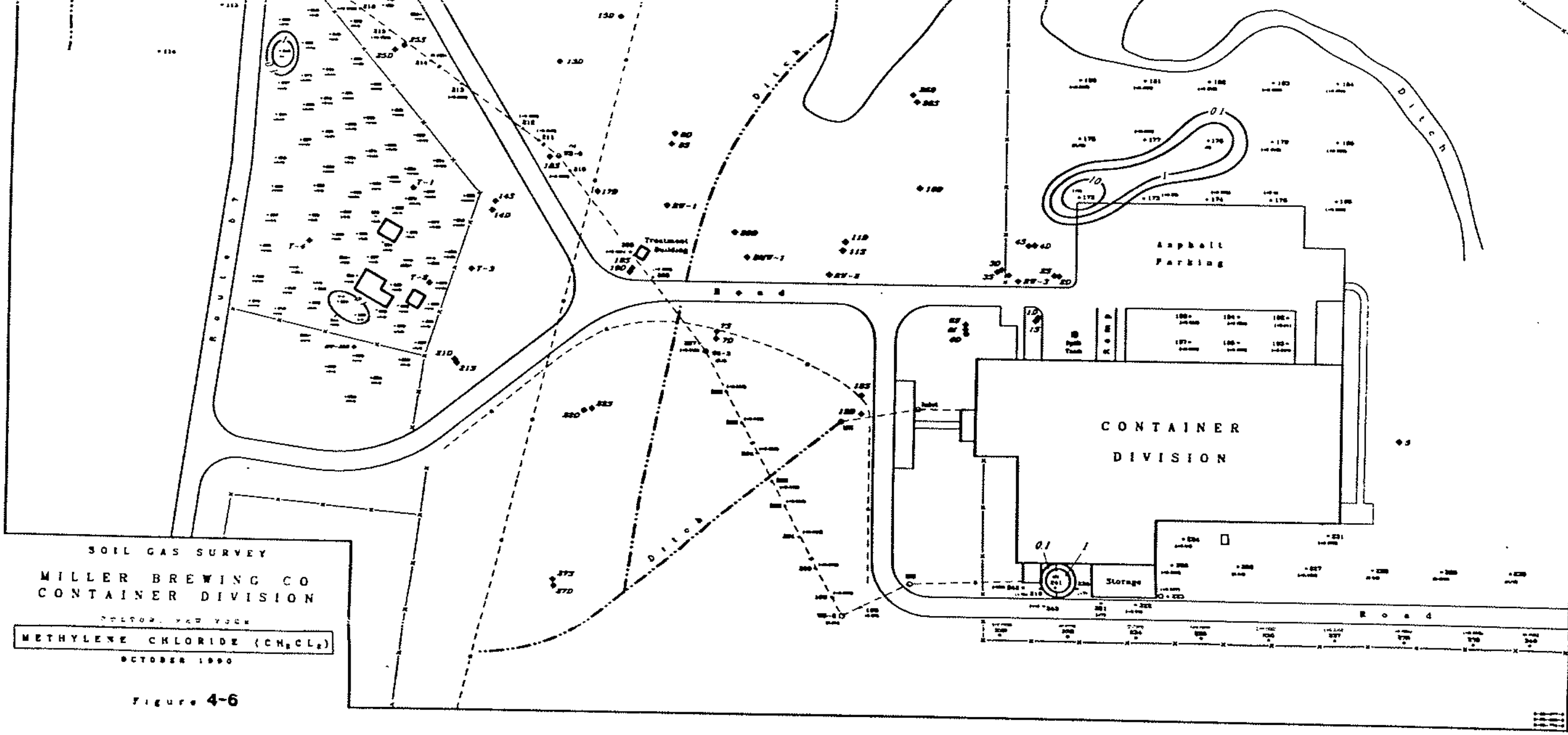
MILLER BREWING CO.
CONTAINER DIVISION

FULTON, NEW YORK

TOTAL HYDROCARBONS (THC)

OCTOBER 1990

Figure 4-5



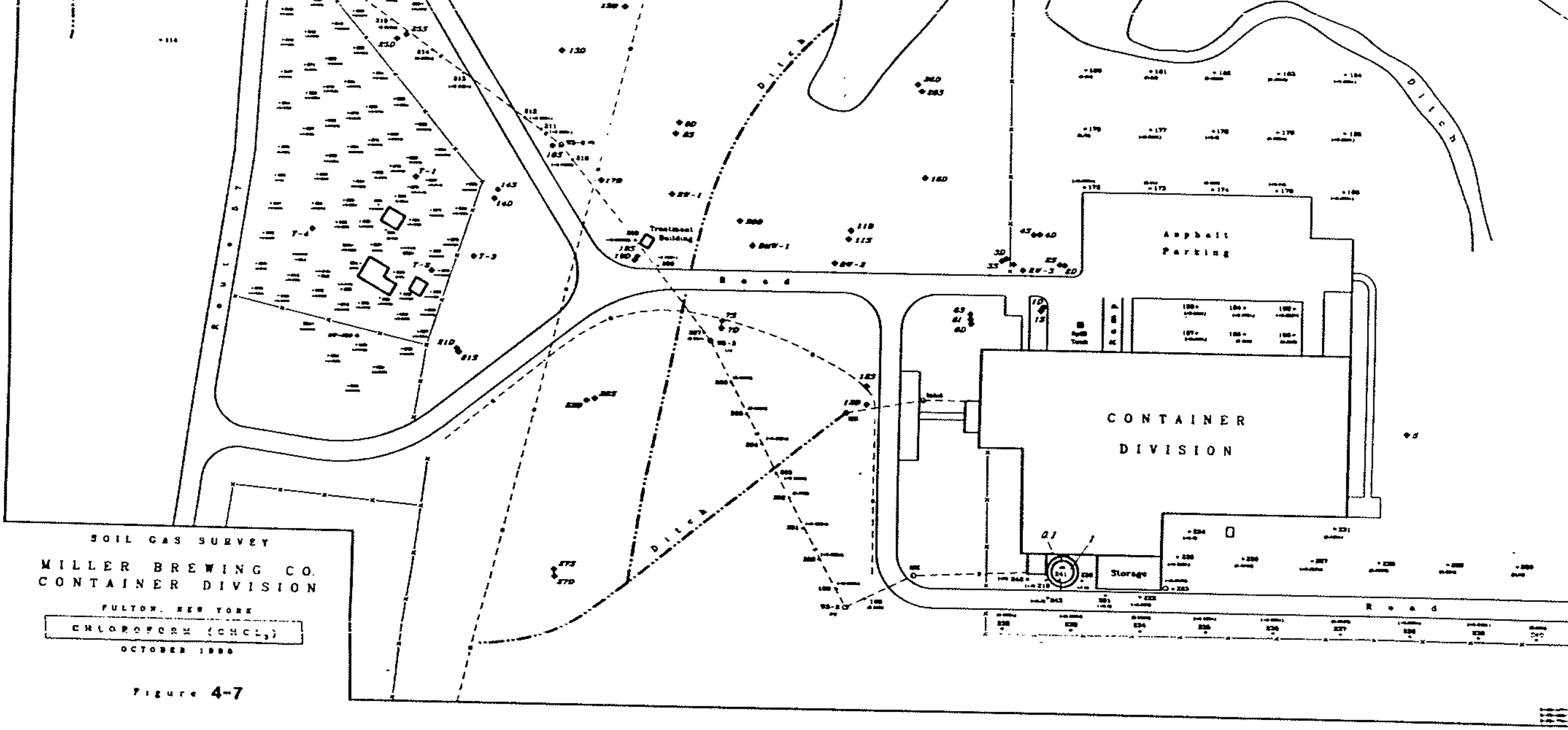
SOIL GAS SURVEY

MILLER BREWING CO
CONTAINER DIVISION

METHYLENE CHLORIDE (CH_2CL_2)

OCTOBER 1990

Figure 4-6



SOIL GAS SURVEY

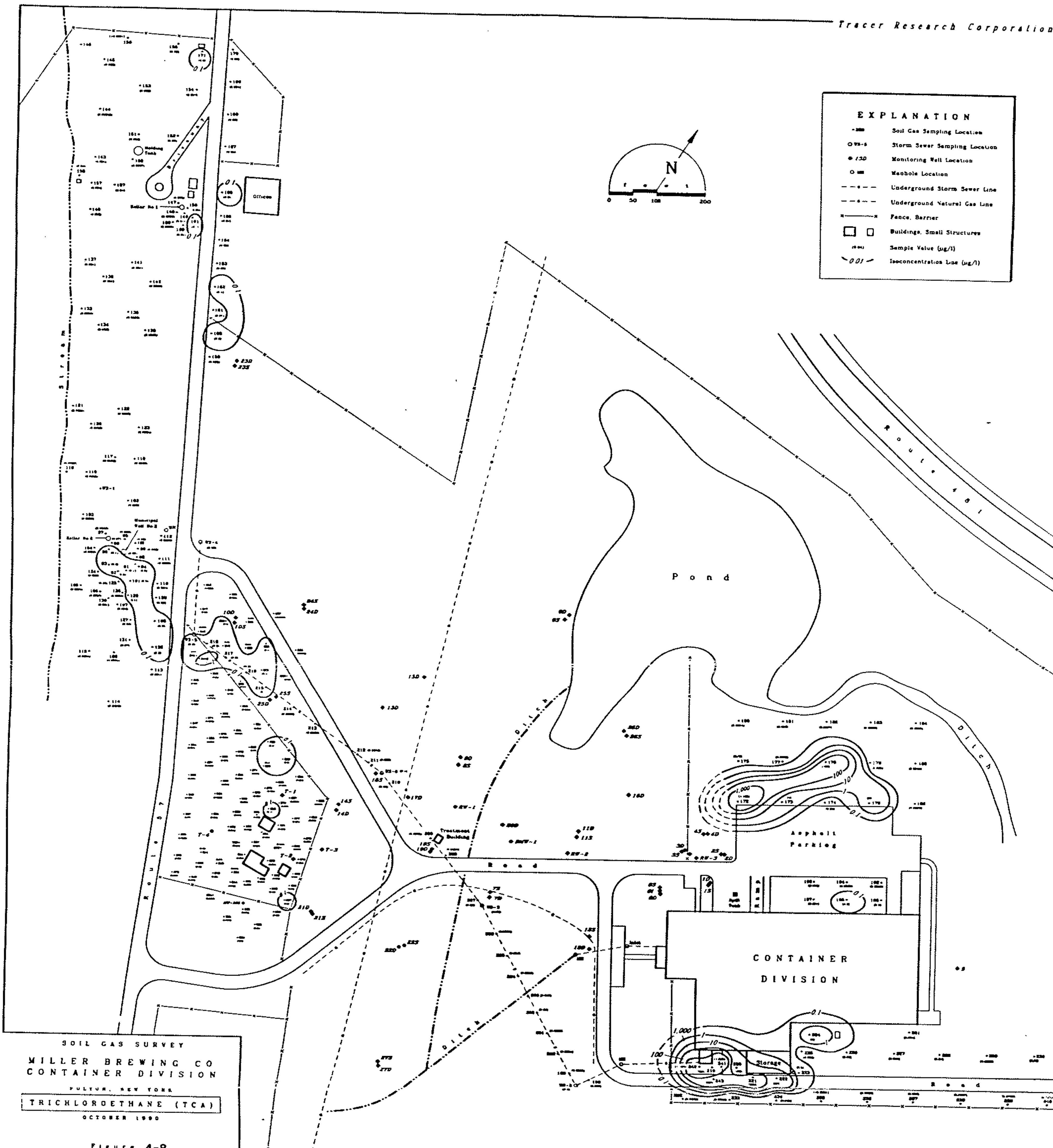
MILLER BREWING CO.
CONTAINER DIVISION

FULTON, NEW YORK

CHLOROFORM ($CHCl_3$)

OCTOBER 1986

Figure 4-7



SOIL GAS SURVEY

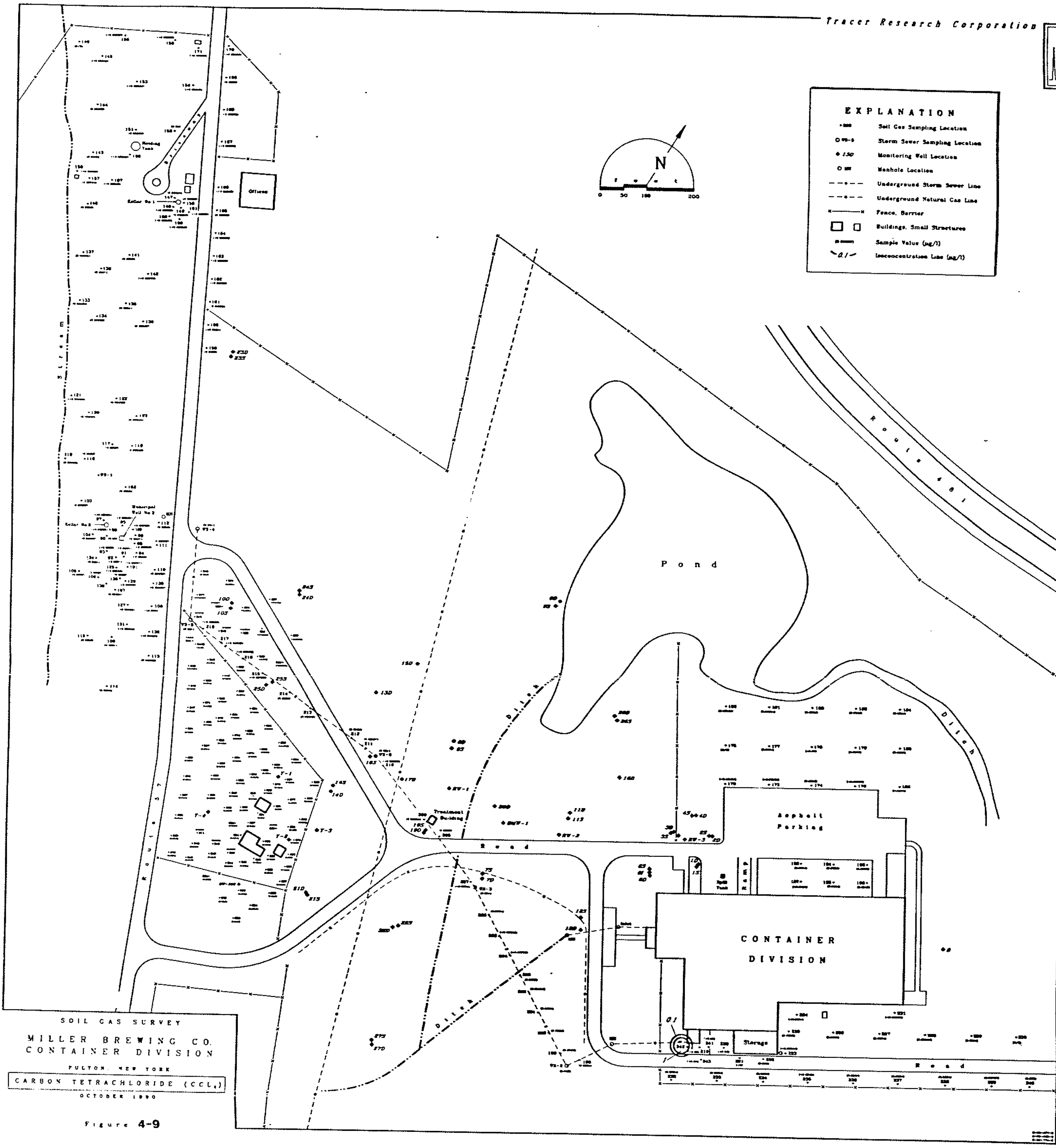
MILLER BREWING CO
CONTAINER DIVISION

FULTON, NEW YORK

TRICHLOROETHANE (TCA)

OCTOBER 1990

Figure 4-8



SOIL GAS SURVEY

MILLER BREWING CO.
CONTAINER DIVISION

FULTON, NEW YORK

CARBON TETRACHLORIDE (CCl_4)

OCTOBER 1990

Figure 4-9

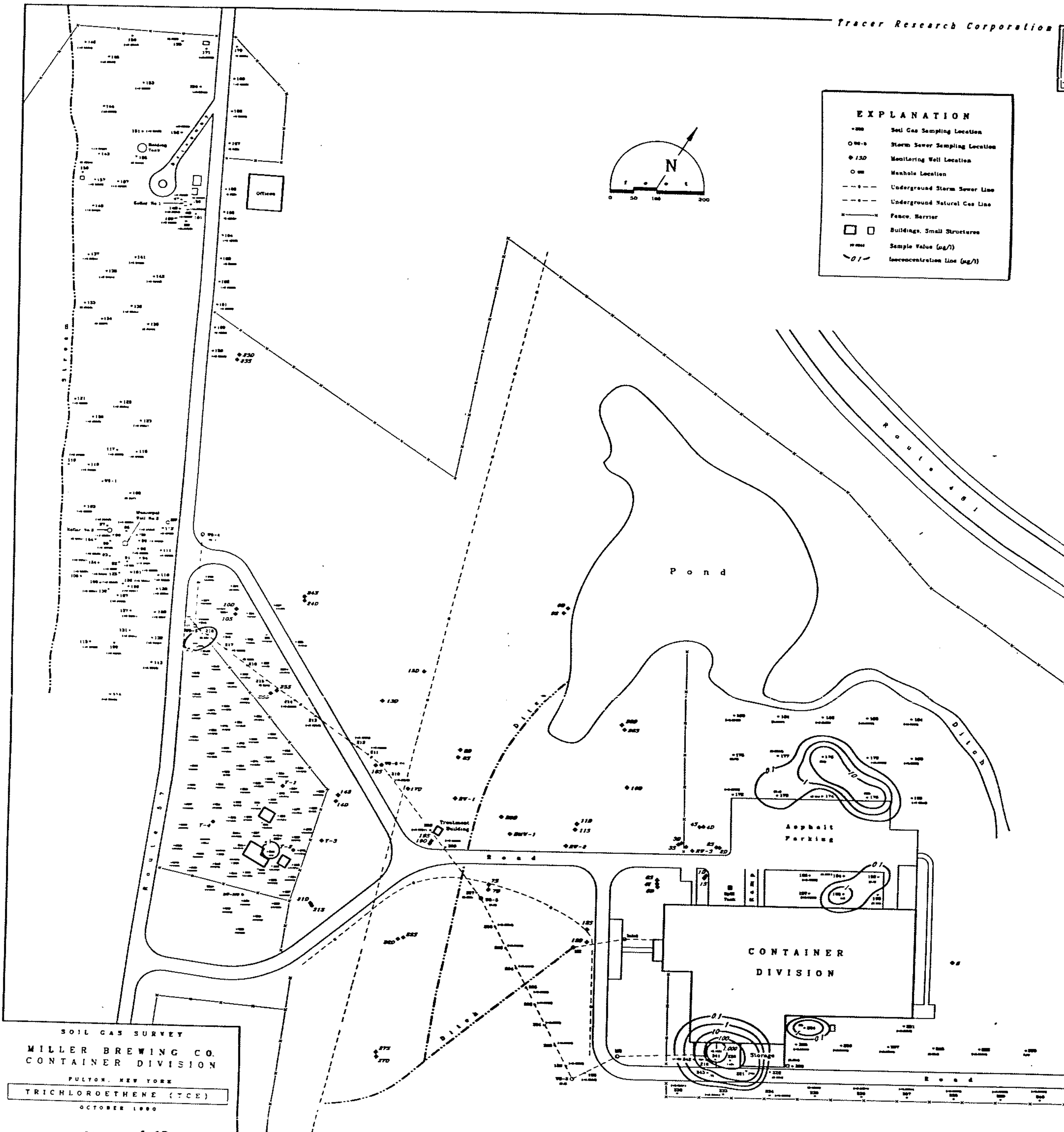
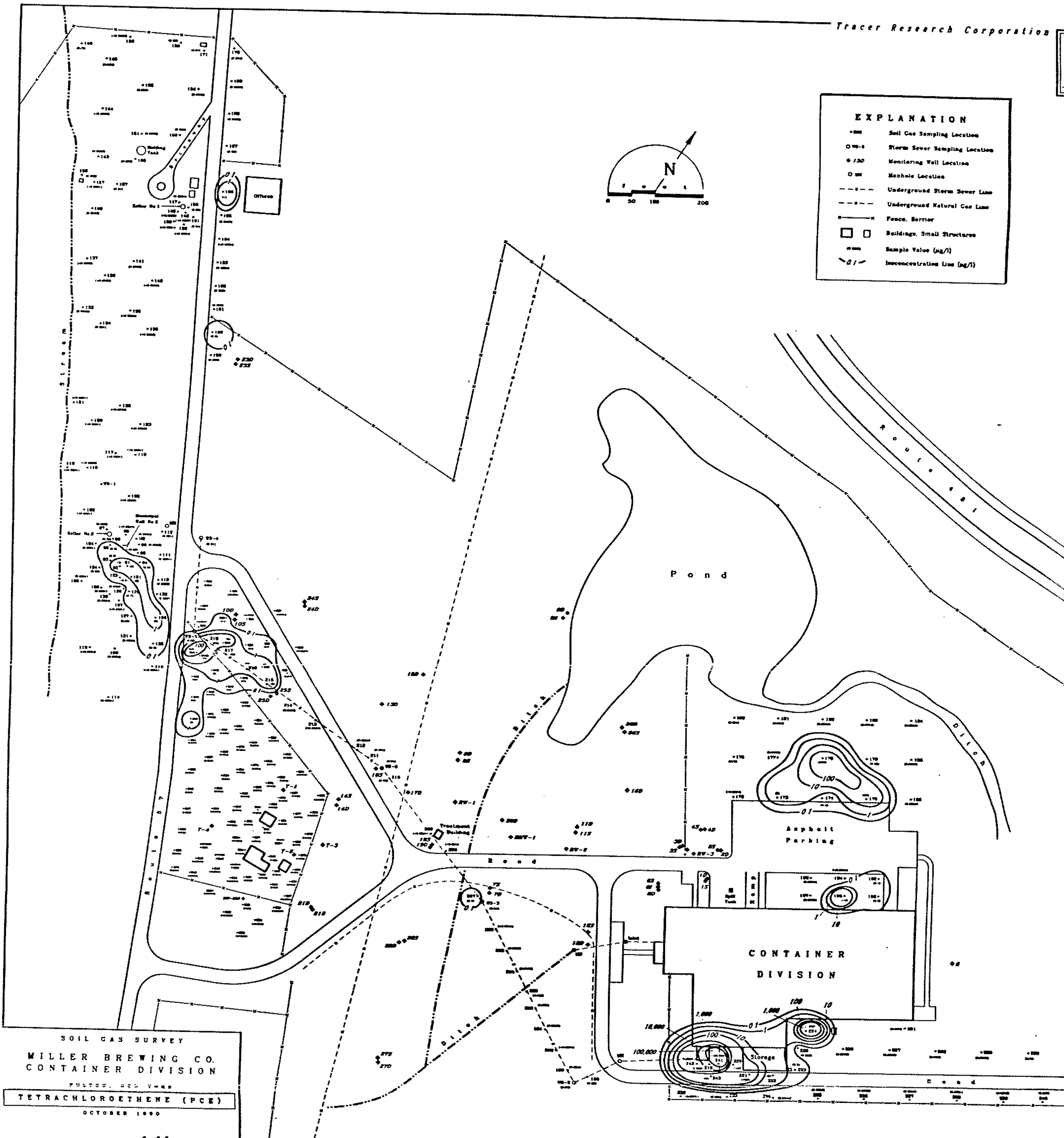

Tracer Research Corporation
EXPLANATION
Soil Gas Sampling Location
Storm Sewer Sampling Location
Monitoring Well Location
Manhole Location
Underground Storm Sewer Line
Underground Natural Gas Line
Fence, Barrier
Buildings, Small Structures
Sample Value (µg/l)
Isoconcentration Line (µg/l)
N
feet
0 50 100 200
Route 481
Pond
Ditch
Asphalt Parking
CONTAINER DIVISION
Storage
Treatment Building
Road
Offices
Route 57
SOIL GAS SURVEY
MILLER BREWING CO.
CONTAINER DIVISION
FULTON, NEW YORK
TRICHLOROETHENE (TCE)
OCTOBER 1990

Figure 4-10



SOIL GAS SURVEY

MILLER BREWING CO.
CONTAINER DIVISION

FULTON, NEW YORK

TETRACHLOROETHENE (PCE)

OCTOBER 1990

Figure 4-11

the manhole at the bend, MH#1. Follow-up investigations of the sanitary sewer and its bedding material were conducted. These investigations are summarized in a subsequent section.

Low levels of several compounds were detected in the soil gas collected around each municipal well. Benzene and toluene were detected at significant levels on the southwest and northwest sides of K-2 and M-2 and west of K-1. Toluene and ethylbenzene were also detected south of K-1. Xylenes were detected south of K-2 and M-2 and west of K-1. Isolated hits of THC were found on all four sides of K-1, while THC levels near K-2 and M-2 appeared to be an extension of the higher levels detected around the sanitary sewer manhole (MH#1). Methylene chloride (CH_2Cl_2) was detected on the west and northwest sides of K-1. Chloroform ($CHCl_3$) was also detected to the northwest of K-1. TCA was found to the north, east and southeast sides of K-1, while TTCE was found only to the east and southeast of K-1. Both TCA and TTCE near K-2 and M-2 could be connected to the shallow soil gas contamination near the sanitary sewer manhole, although the levels of TTCE (up to 510 ug/l) in the vicinity of the sewer were significantly higher than the TCA levels (up to 1 ug/l). These values appear to correlate well with the results of the analyses performed on the soil samples collected from the sanitary sewer bedding material.

Additional low levels of soil gas contamination were found west of the Container Plant near MW-14S,D, MW-21S,D and MW-18S, northwest of the Container Plant in the area north of MW-23S,D and in the vicinity of municipal wells K-1, K-2 and M-2. No elevated (> 10 ug/l) soil gas readings were found in the vicinity of the 12-inch water line, its associated bedding material, or between the River and K-2 and M-2. These data suggest that the water line and the Oswego River near K-2 and M-2 are not sources of the shallow contamination found near K-2 and M-2. The soil gas contamination near the west end of the sanitary sewer appears connected to the contamination around K-2 and M-2. The source for the low level soil gas contamination on the northwest side of K-2 is not known. Although the soil gas readings in this area are < 10 ug/l, and are, according to Tracer, not indicative of a shallow source of contamination, the occurrence of significant algal growth in the State Ditch may be indicative of the presence of organic material in the water. Therefore, sampling of water from the State Ditch in this area was conducted. The source of the low level contamination on all four sides of K-1 is also not known. Several compounds were detected at low levels in the soil gas collected between the River and K-1 and the Mirabito property and K-1. The levels appear to be too low to indicate that the

River is a source of shallow contamination; however, the installation of monitoring wells around K-1, coupled with ground water sampling and analysis, were necessary to provide additional information regarding the shallow soil gas contamination and ground water contamination near K-1.

In summary, the soil gas investigation results suggested the location of four shallow source areas, as follows.

1. The former northern drum storage and washing area, north of the Container Plant's northern parking area.

2. The former southern drum storage and washing area, south of the Container Plant.

3. Near the former underground spill containment tank, including the area adjacent to the drum storage room on the north side of the Container Plant's building foundation.

4. Along the western end of the sanitary sewer near the point where the sewer makes a bend to parallel Route 57 (sanitary sewer manhole MH#1). Soil samples collected from below the sanitary sewer near Route 57 and above the water table provided additional proof of a source of contamination associated with the sewer.

4.3 SANITARY SEWER INVESTIGATION

As a follow-up to the soil gas investigation, soil was excavated from around sanitary sewer manhole MH#1 during February 1991 to expose the piping entering and leaving the manhole. NYSDEC and Owego County Health Department representatives were present during the excavation. Although no leakage from the pipes could be seen, up to 349 ug/kg of TTCE, 27 ug/kg of TCA, 5.4 ug/kg of 1,1-DCE, 3.1 ug/kg of TCE and 1.7 ug/kg methylene chloride were detected in soil samples collected by Miller from below the sanitary sewer line entering and leaving the manhole. The highest levels of all compounds detected were found below the northern pipe (exiting the manhole). The results of the soil sample analyses are included as Appendix Q. During the examination of the manhole at this location, it was observed that a valved water pipe (approximately 3/4-inch diameter) had been emplaced through the side of the manhole and that a sleeve around the water line (approximately 4-inch) could allow sanitary sewer water to exit from the manhole if it were to rise to the level of the sleeve. The high water mark in the manhole was observed to be above the water pipe. Since this manhole is a City of Fulton manhole, the City was notified of the need to have the water line removed and the hole plugged. Due to the soil gas and soil sample results at this manhole, additional investigations were performed along the sanitary sewer, including excavating to expose additional sewer bedding at other manholes and the collection of soil and water samples from the bedding material.

In light of the soil gas and soil sample results from around this manhole, MPI hypothesized that the contamination detected in this area could be the result of preferential contaminant migration along the sewer bedding and that the source of the contamination could be from the MW-36S area.

In this theory, the reason for the elevated soil gas readings along the western end of the line is a function of topography, the relative depth to the bedding material and the site hydrogeology. Near the western end of the line, the site is topographically lower and, therefore, the land surface is nearer to the sewer bedding and the water table. The soil gas readings obtained between the manhole near MW-18S (MH#2), which is near the top of a hill, and the manhole in question (MH#1) were progressively higher in concentration as they were collected closer to MH#1, which is near the bottom of the hill. In other words, the samples collected from lower elevations (closer to the bedding material and the water table) contained higher contaminant levels.

According to this theory, the site hydrogeology helps to transport the contaminated ground water near MW-36S to the area near MW-18S. A trench in the silty clay layer that runs through the middle of the site may have been created to lay the sewer pipe and associated bedding material. A trench in the clayey material could help convey contaminated ground water from the area near MW-36S and MW-37S,I to where the clayey layer ends near MW-18S. The increased hydraulic conductivity in the permeable sewer bedding material would serve to convey contaminated ground water in the bedding material at an accelerated rate, particularly where the silty clay layer exists, since the hydraulic conductivity of the silty clay is much lower. The contaminated ground water might have more of a tendency to leach downward from the bedding material to the water table after the clayey layer ends (near MW-18S) due to the increased hydraulic conductivity of the natural sand and gravel in this area.

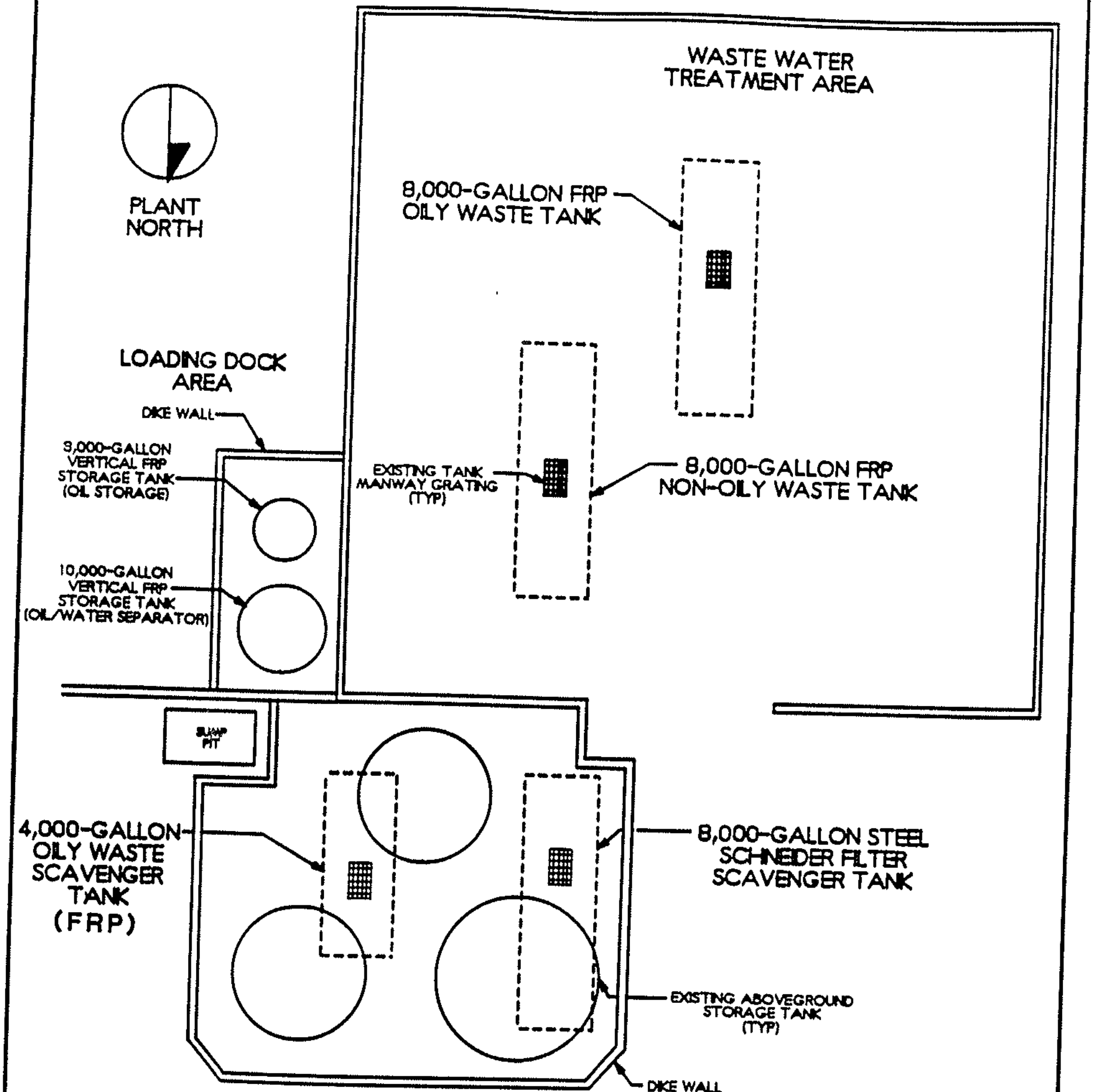
For these reasons, the soil around sewer manholes MH#3 and MH#4 was excavated in March 1991 to expose the sewer bedding and allow the collection of water samples from the bedding material. A clay layer was encountered near MH#4 at about five feet below land surface. This clay unit extends from the 5-foot depth to below the sewer bedding material. However, this unit appears to be fill material and not the gray silty clay encountered across the middle of the site. The gray silty clay unit was encountered at an elevation corresponding to near the top of the sewer near MH#3. Large quantities of water were present in the sewer bedding material at both MH#3 and MH#4. The sewer bedding was dry near MH#1. While the sewer pipes were exposed, monitoring wells (MW-40S and MW-41S) were installed near the bedding material. Samples were collected from the soil in the bedding material and ground water samples were collected in March, April and December 1991, and during January 1992. The soil results are included in Appendix Q; the ground water results have been incorporated into the tables in Appendix C; the raw data are provided in Appendix Q.

No VOCs were detected in the soil analytical results. Low levels of VOCs have been detected in the ground water, including, 0.7 ug/l of TCA at MW-40S on December 18, 1991 and slightly higher levels of toluene and/or ethylbenzene at MW-41S during December 1991, January 1992 and August 1992. Although these ground water data and an elevated water level near MW-40S indicate potential leakage from the sewer at least near MW-40S, the levels of VOCs detected both in the sewer water and in the water collected from the sewer bedding do not account for the levels of VOCs detected near MH#1 or in other downgradient areas. Furthermore, the sewer bedding does not appear to be a conduit for contaminant migration from the MW-36S,D and MW-37S,I,D area.

4.4 OIL SPILL INVESTIGATION BELOW THE CONTAINER PLANT

4.4.1 General

There are four underground storage tanks (USTs) located below the Container Plant in the vicinity of the Plant's Waste Treatment Facility (WTF) as shown on Figure 4-12. The WTF location is shown on Figure 2-1. The four USTs include a 4,000-gallon FRP oily waste scavenger tank, an 8,000-gallon steel Schneider filter scavenger tank, an 8,000-gallon FRP oily waste treatment tank and an 8,000-gallon FRP non-oily waste treatment tank. The last two tanks are located below the WTF. As part of a company-wide plan, Miller intended to take these four UST systems out-of-service and conduct a proper closure of each tank system. Due to the location and proximity of adjacent aboveground storage tanks and equipment, removal of these tank systems was not possible without severe facility



SITE PLAN VIEW

NOT TO SCALE

MALCOLM PIRNIE	MILLER BREWING COMPANY CONTAINER DIVISION UNDERGROUND STORAGE TANK LAYOUT	MALCOLM PIRNIE, INC FIGURE 4-12

disruptions. Since removal of these tank systems was not feasible, the intent was to abandon each system in place.

4.4.2 Oily Waste Interceptor Sump

Construction of an oily waste interceptor sump located adjacent to the 4,000-gallon FRP oily waste scavenger tank began in November 1990. The sump was intended to be used as a temporary collection basin for oily wastes prior to the pumping of the waste to new aboveground tanks.

The first step in construction of the sump was to cut out a slab of concrete from the Container Plant floor. Subsequent to cutting the slab and prior to removing the slab, Miller requested that an MPI representative take preliminary air quality measurements around the perimeter of the slab with a photoionization detector. This precautionary step was considered necessary due to the availability of soil gas data from the Plant exterior in the former southern drum storage area. A portion of the WTF may have been built over part of the area where the drums were formerly washed and stored. An HNU meter equipped with an 11.7 ev lamp was used based on the type of contaminants detected in the former southern drum storage area.

Readings taken around the slab indicated VOC contamination below the slab, while readings taken in the breathing zone around the slab showed no noticeable change with respect to background readings obtained outside the Container Plant. Results of the preliminary HNU readings are listed in Table 4-2.

Due to the elevated HNU readings around the slab, it was necessary to utilize a portable gas chromatograph (GC) to identify compounds occurring in the soil gas beneath the slab. Upstate Laboratories, Inc. was contracted to collect the soil gas samples and analyze them with the portable GC. In order to prevent contamination from being released into the Container Plant during the soil gas sampling, the concrete slab was left in place. The samples were collected from above the kerf made by the blade and from a four-inch drill hole through the slab which was made to lift the slab. The four-inch hole extended to a depth of about six inches into the soil. No compounds were detected in the gas collected from above the floor level; however, VOCs were detected in the soil gas collected from below the slab. The results of the soil sampling performed in the four inch hole are listed on Table 4-3.

MILLER CONTAINER

TABLE 4–2
PRELIMINARY HNU READINGS IN FLOOR SLAB SAW CUT

SAMPLE ID	RESULT (ppm)
#1	17.4
#2	15.4
#3	15.2
#4	16.4
#5	15.0
#6	5.2
#7	26.2

MILLER CONTAINER

TABLE 4-3
SOIL GAS SAMPLING RESULTS
EPA METHOD 624

COMPOUND ID	RESULT (ug/m3)	
1,1-DCA	870	970*
1,1,1-TCA	4,800	4,700*
TCE	160	170*

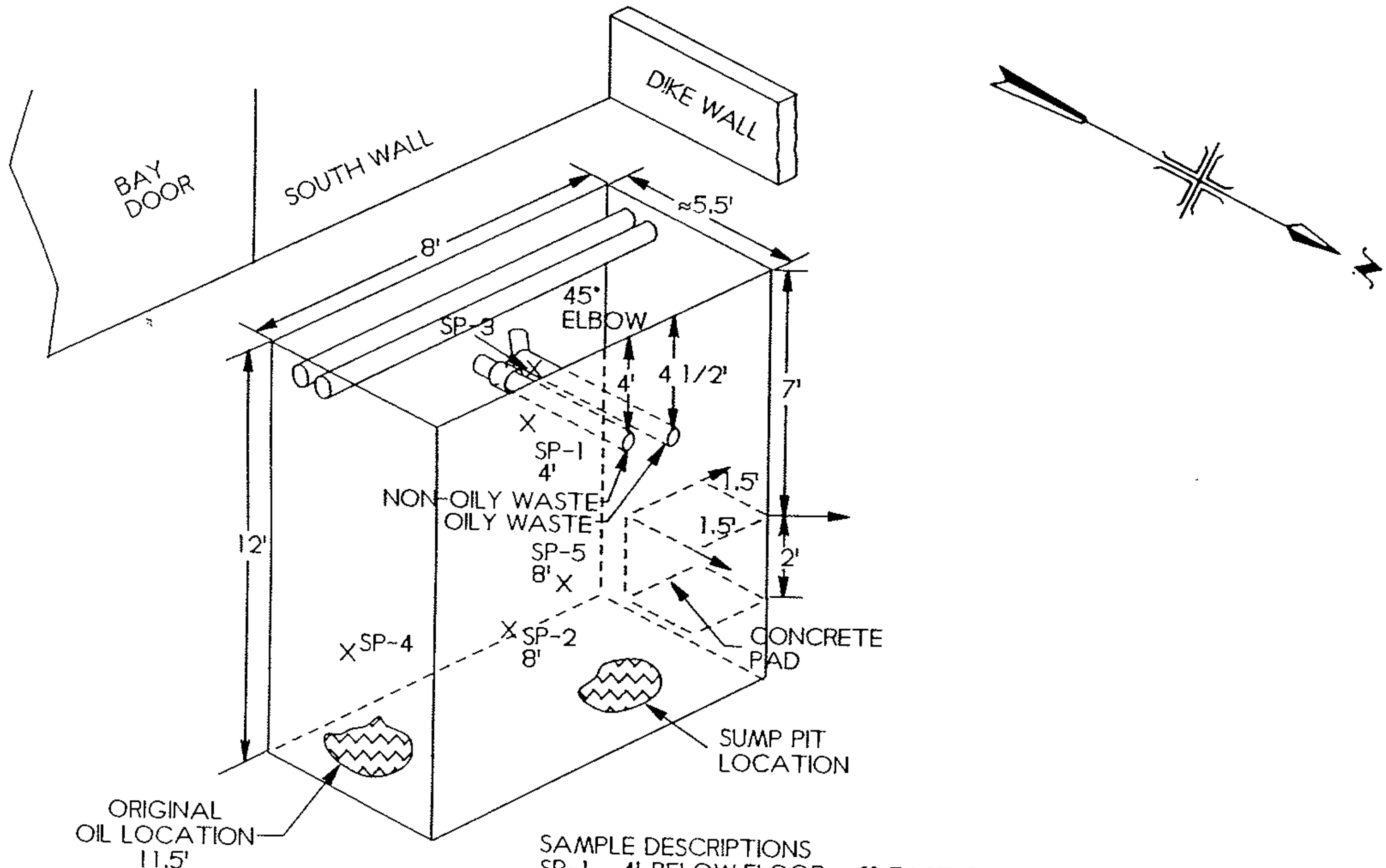
NOTES:
1,1-DCA - 1,1-Dichloroethane
1,1,1-TCA - 1,1,1-Trichloroethane
TCE - Trichloroethylene
* - Duplicate sample

Due to the occurrence of the VOCs below the slab, it was determined to be necessary to construct a tent area for continued excavation. It was also determined by Miller that air monitoring as well as soil sampling should be conducted by MPI representatives during the excavation.

Excavation of the hole for the sump pit began on April 9, 1991. During the excavation of the hole for the sump pit, oil-stained soil was encountered approximately five feet below the Plant floor. The oil content in the soil generally increased with depth. Five soil samples were collected during the excavation (SP-1 to SP-5). Sample locations are shown on Figure 4-13. The first two samples were analyzed for the VOCs on the EPA Method 8240 list and the last three samples were analyzed for both VOCs and petroleum products (according to EPA Methods 8010, 8020, 310-13 and 418.1). The results of the soil analyses listed in Table 4-4 indicate that many of the VOCs that occur in the sump pit area are also found in many monitoring wells on-site. However, other compounds (for example, ketones) are only found in the sump pit area and in some of the wells on the Plant's south side.

During the excavation for the sump pit, a concrete structure was encountered at a depth of about seven feet below the Plant floor (Figure 4-13). This concrete structure was originally thought to be the concrete anchor pad for the 4000-gallon oily waste scavenger tank. However, based on a review of Container Plant records, it was determined that the top of the anchor pad for the 4000-gallon tank and the adjacent 8000-gallon Schneider filter scavenger tank would be located at a depth of about 14 feet below the Plant floor. The anchor pads were later determined to be absent below the 4,000-gallon FRP oily waste scavenger tank and the 8,000-gallon Schneider filter scavenger tank.

At a depth of about 11.5 feet below the floor, the oil content in the sump pit increased to the point where the soil was saturated and two pools of oil began collecting in low spots on the east and west sides of the excavation. At this point, an oil sample was collected by MPI from both pools and submitted for analysis for VOCs and petroleum products according to the EPA Methods 8010/8020. These samples are identified on Table 4-5 as unknown samples #18 and #19. In addition, a sample of oily soil (#20 on Table 4-5) from below the oily waste line at the top of the pit was collected for analysis (Figure 4-13). The gas chromatograms for the product standards, waste samples and unknowns listed on Table 4-5 were compared in an attempt to determine what type(s) of oil was leaking into the ground in the sump pit area. The GC/FID results are listed on Table 4-6.



SAMPLE DESCRIPTIONS
SP-1 - 4' BELOW FLOOR, ≈6" EAST OF NON-OILY WASTE PIPE CENTER.
SP-2 - 8' BELOW FLOOR AND DIRECTLY BELOW SP-1.
SP-3 - 1' BELOW 45° ELBOW ON OILY WASTE LINE.
SP-4 - 8' BELOW FLOOR, 6" IN FROM CENTER OF EASTERN EXCAVATION EDGE.
SP-5 - 9' BELOW FLOOR, 5' BELOW 45° ELBOW ON OILY WASTE (4' BELOW SP-3).

MALCOLM PIRNIE

SUMP SAMPLING DIAGRAM

MALCOLM PIRNIE, INC.

FIGURE 4-13

MILLER CONTAINER

TABLE 4-4
SUMP PIT EXCAVATION SAMPLES

SAMPLE ID			SP-1 (SOIL)	SP-2 (SOIL)	SP-3 (SOIL)	SP-4 (SOIL)	SP-5 (SOIL)
LOCATION			4' below floor (CENTER OF PIT)	8' below floor (CENTER OF PIT)	1' below 45 degree elbow on OILY WASTE line	8' below floor, 6" in from EASTERN EXCAVATION EDGE (CENTER)	9' below floor, 5' below 45 degree elbow on OILY WASTE LINE (4' below SP-3)
Analyses Performed	EPA Method No.	8010			X	X	X
		8020			X	X	X
		8240	X	X		X	X
		310-13			X	X	X
		418.1			X	X	X
		TPH (mg/kg)			30,000	37,000	26,000
		Percent Moisture			5	6	6
		Percent Petroleum Product			1.8	1.6	1.7
(ug/kg)		1,1-DCA	23	3J			180
		c-1,2-DCE					750
		MC		8	60	700 (1)	310
		TTCE	90	12	81	5,700 (1) 1,100 (2)	240
		TCA	100	17	150	7,000 (1) 120 (2)	1,600
		TCE	110	12	97	12,000 (1) 660 (2)	640
		BENZENE					800
		TOLUENE					460
		ACETONE	41	22		81 (2)	
		1,1-DCE (total)	5	5J			
		MIBK	28	14		67 (2)	
		MBK		8J		220 (2)	
		XYLENE					
		MAK		45		2,900 (2)	
		MP		11			
		ALPHA-PINENE		20			
		HMK				810 (2)	

NOTES:
8010/8020 - GC (VOCs)
8240 - GC/MS (includes VOCs, KETONES, and TICs)
310-13 - FID petroleum products
418.1 - TPH (total petroleum hydrocarbons)
TPH = total petroleum hydrocarbons
1,1-DCA = 1,1-dichloroethane
c-1,2-DCE = cis-1,2-dichloroethylene
MC = methylene chloride
TTCE = tetrachloroethylene
TCA = 1,1,1-trichloroethane
TCE = trichloroethylene
1,2- DCE = 1,2-dichloroethylene
MIBK = methyl isobutyl ketone = 4-methyl-2-pentanone
MBK = methyl butyl ketone = 2-hexanone
MAK = methyl amyl ketone = 2-heptanone
MP = 4-methl-2-pentanol
HMK = hepta methyl ketone = 2-octanone
J = estimated concentration
(1) = GC
(2) = GC/MS

MILLER CONTAINER

TABLE 4-5
SUMMARY OF VOC ANALYSES
KNOWN VS. UNKNOWN OIL SAMPLES

SAMPLE ID	SAMPLE DESCRIPTION	RESULT (ug/kg)
PRODUCT STANDARDS		
1	Mobil DTE Extra Heavy (hydraulic oil)	<2,500
2	Molluballoy (hydraulic oil)	<2,500
3	Mack 17A2 (soluable oil)	<2,500
4	Ironsides 919 (soluable oil)	<2,500
5	Ironsides K212 (soluable oil)	3,500 (Total Xylenes)
17	Mobil DTE 24 (hydraulic oil)	4,100 (Methylene Chloride) 2,500 (Toluene) 2,500 (Total Xylenes)
WASTE SAMPLES		
6	Schneider Filter Scavenger Tank	<2,500
7	Oily Waste Scavenger Tank	3,500 (Toluene) 6,500 (Total Xylenes)
8	WWTP Oily Waste Tank	10,000 (Total Xylenes)
10	WWTP Non-oily Waste Tank	3,700 (Methylene Chloride)
11	Bodymakers (coolant)	3,300 (Methylene Chloride)
12	Cuppers (strip lube)	3,000 (Methylene Chloride)
14	RCRA Storage Room Sump	3,700 (Methylene Chloride) 22,000 (Ethylbenzene) 41,000 (Toluene) 120,000 (Total Xylenes)
15	Briquetter Floor Trench	3,400 (Methylene Chloride)
UNKNOWNS		
18	Sump Pit Oil (east pool)	19,000 (1,1-DCA) 160,000 (c-1,2-DCE) 15,000 (Methylene Chloride) 190,000 (TTCE) 580,000 (1,1,1-TCA) 130,000 (TCE) 19,000 (Toluene) 8,000 (Total Xylenes) <2,500 (Ethylbenzene)
19	Sump Pit Oil(west pool)	22,000 (1,1-DCA) 350,000 (c-1,2-DCE) 9,500 (Methylene Chloride) 91,000 (TTCE) 590,000 (1,1,1-TCA) 62,000 (TCE) 19,000 (Toluene) 7,700 (Total Xylenes) <2,500 (Ethylbenzene)
20	Sump Pit Oily Soil (below oily waste line)	1,000 (1,1-DCA) 5,000 (c-1,2-DCE) 1,500 (Methylene Chloride) 8,500 (TTCE) 20,000 (1,1,1-TCA) 7,500 (TCE) 2,500 (Toluene) 790 (Total Xylenes) <270 (Ethylbenzene)

Notes:
1,1-DCA - 1,1-Dichloroethylene
c-1,2-DCE - cis-1,2-Dichloroethylene
TTCE - Tetrachloroethylene
1,1,1-TCA - 1,1,1-Trichloroethane
TCE - Trichloroethylene

MILLER CONTAINER

TABLE 4–6
SUMMARY OF GC/FID COMPARISONS

SAMPLE ID	DESCRIPTION	PLACE OF USE	NOTES
PRODUCT STANDARDS			
1	Mobil DTE Extra Heavy (hydraulic oil)	Cuppers/Bodymakers	Chromatogram similar to #2 and #17, but lacked 10.4 minute peak
2	Molluballoy (hydraulic oil)	Briquetter	Chromatogram identical to #17
3	Mack 17A2 (soluable oil)	OLD–> Bodymaker (coolant)	Very poor response, pattern ID not possible
4	Ironsides 919 (soluable oil)	CURRENT–> Bodymaker (coolant)	Very poor response, pattern ID not possible
5	Ironsides K212 (soluable oil)	Cuppers (strip lube)	Large 10.5 minute peak, broad hydrocarbon pattern
17	Mobil DTE 24 (hydraulic oil)	Briquetters and Cuppers (strip lube emulsifier)	Chromatogram identical to #2
WASTE SAMPLES			
6	Schneider Filter Scavenger Tank		Chromatogram similar to #5, but had reduced 10.5 minute peak
7	Oily Waste Scavenger Tank		<50% oil, Chromatogram similar to #5, but had reduced 10.5 minute peak
8	WWTP Oily Waste Tank		Mostly water, little oil, no pattern
10	WWTP Non-oily Waste Tank		No pattern
11	Bodymakers (coolant)		Not injected due to matrix characteristics
12	Cuppers (strip lube)		Not injected due to matrix characteristics
14	RCRA Storage Room Sump		Chromatogram closely resembled #1
15	Briquetter Floor Trench		Chromatogram closely resembled #1, except for 9.5 minute peak
UNKNOWNS			
18	Sump Pit Oil (east pool)		Chromatogram faintly resembled #2 and #17
19	Sump Pit Oil(west pool)		Chromatogram faintly resembled #2 and #17
20	Sump Pit Oily Soil (below oily waste line)		Chromatogram faintly resembled #2 and #17

Unfortunately, the comparison indicated that there was no strong correlation between the types of oil found in the pit and a specific sample of oil currently in use at the Plant.

The recovery of the oil in the sump pit was considered to be advantageous. Therefore, the contractor was instructed to deepen a central location in the pit to facilitate the recovery process. At a depth of about 12.5 feet below the top of the Plant floor, the contractors encountered a column spread footer. This footer was determined to be present below the entire sump pit area. A profile showing the vertical relationship of the spread footer and the adjacent tanks is shown on Figure 4-14.

4.4.3 Occurrence of the Oil and VOC Contamination

Due to the proximity of the oily waste scavenger and Schneider filter scavenger tanks, it was felt that one or both of these tanks may have leaked and were the likely source of the oil in the sump pit area. However, the extent of the oil contamination and the origin of the VOC contamination were not known. During April, May and June 1991, an evaluation of the origin and extent of the oil and VOC contamination in the sump pit area was begun.

The goals of this evaluation were to:

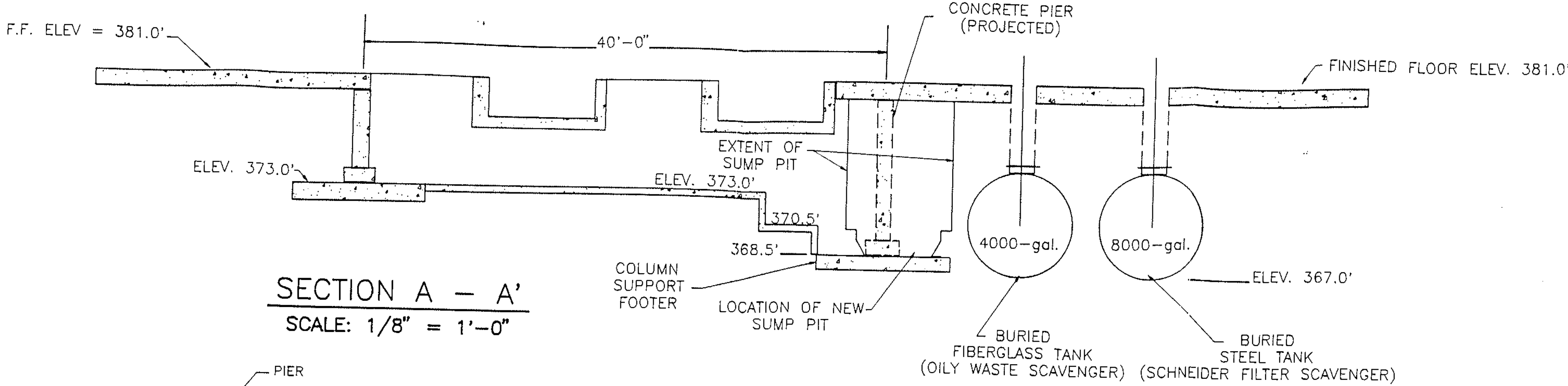
1. Determine the likely source of the oil and VOC contamination.

2. Identify methods for determining the vertical and horizontal extent of the oil and VOC contamination and if the contamination (oil and/or VOC) had affected ground water quality in the area. If so, the levels of ground water contamination would need to be established.

3. Develop a safe and efficient method for recovering oil from the sump pit.

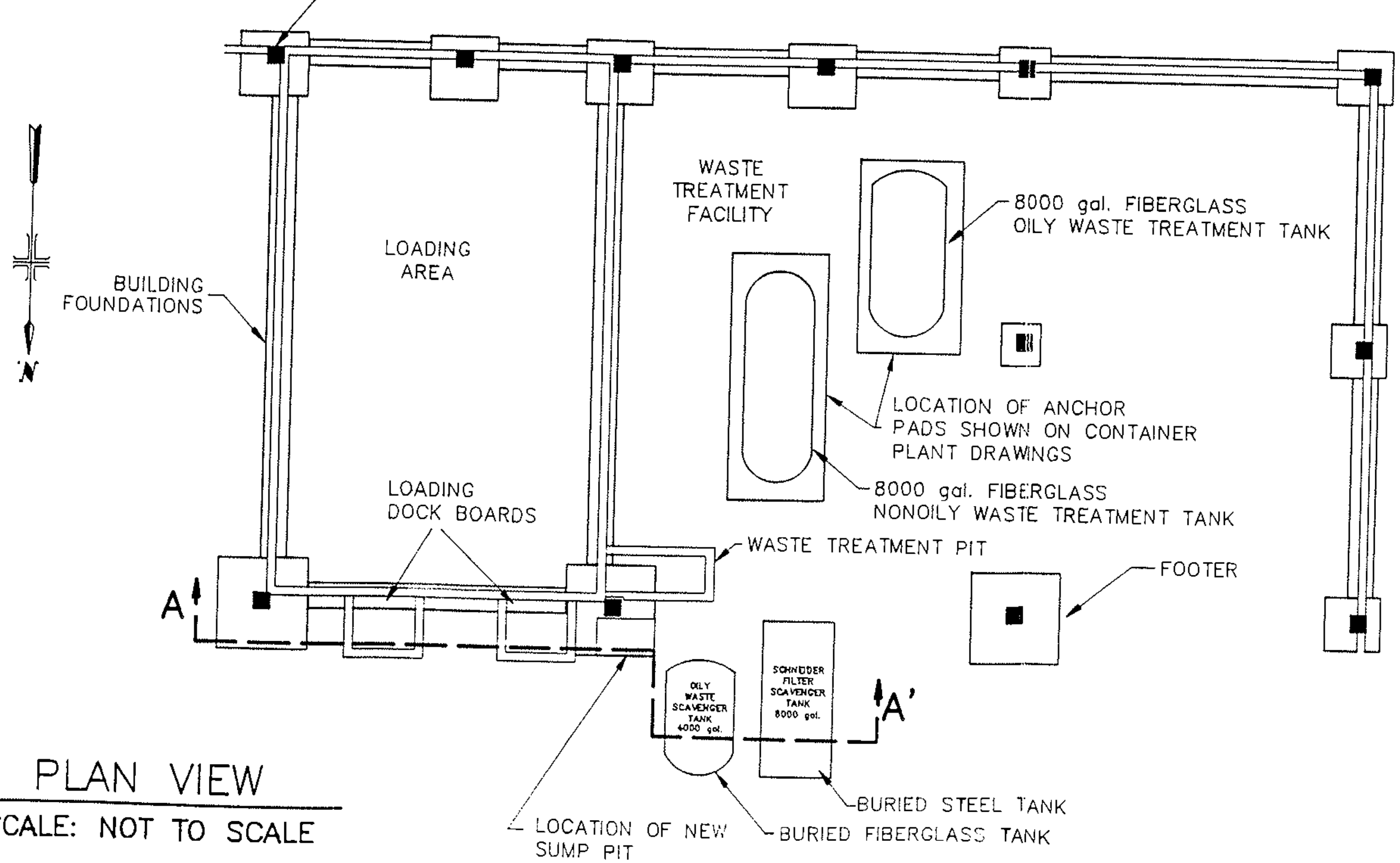
The results of this preliminary assessment would be used to evaluate methods for removing contamination from the affected area and determine the relationship of the oil and VOC contamination to contamination present in other areas of the site, especially the contamination present on the south side of the Container Plant. During May 1991, the NYSDEC served Miller with a Demand for Information relative to the oil and VOC contamination occurring in this area. The Demand for Information required information to be provided relative to the source and volume of the oil and VOCs, along with other information outlined in Section 1.3.2.10 of this report.

As a part of the investigation in response to the NYSDEC Demand for Information, Miller interviewed 18 hourly employees who have worked at the Container Plant since



SECTION A – A'

SCALE: 1/8" = 1'-0"



PLAN VIEW

SCALE: NOT TO SCALE

MILLER BREWING COMPANY CONTAINER DIVISION FULTON, NEW YORK		
SUMP PIT CROSS SECTION & PLAN VIEW MSMPX.DWG		
MALCOLM PIRNIE	Date FEBRUARY 1993	Figure No. 4–14

operations began in 1976. The individuals are assigned to four different crews, each of which work alternating 12-hour shifts. Miller also interviewed six supervisors who were responsible for production operations in the early years.

Based on the interviews, the following information regarding the source of oil and VOC contamination was obtained.

1. On occasion, waste oil flowed from the oily waste scavenger tank and the Schneider filter scavenger tank into the manway above the tanks. It was believed that the manways were an integral part of the construction of the tanks and that any oily waste from the tanks which would enter the manways would be contained there. The manways were to be sealed along all four sides of their base at the point of connection with the tanks; however, it is now believed that over time, the caulking, which was to seal the point where the walls of the manways meet the outer surface of the tanks, wore away and that waste oil in the manway seeped through these openings into the space around the outside of the tanks.

   During the subsequent cleaning of the oily waste scavenger tank, a six inch long crack and two small holes were found in this tank, which is constructed of fiberglass. The Schneider filter scavenger tank is constructed of steel and was visually observed to be intact at the time of cleaning.

2. The recovered waste oil from the sump pit area has been found to contain hazardous constituents, a number of which would have been constituents of cleaners used at the Container Plant from 1976 when the Plant began manufacturing operations until 1987 to clean machinery and component parts. These products included: Machine Cleaner 70/30 and 1,1,1-trichloroethane. The Material Safety Data Sheet for MC 70/30 describes the contents as "chlorinated hydrocarbons." In addition, a solvent material named CK 900 was also used for cleaning machines. CK 900 contained a mixture of methyl ethyl ketone, methyl isobutyl ketone and toluene. Other cleaning materials used at the Container Plant contained methylene chloride (Strip-It-Special and F.O. 368-L).

3. Machines were cleaned by soaking a cloth in the cleaning solvent and rubbing it over the machines or by filling a bucket with cleaner and dipping metal parts into it for degreasing. Also, employees would fill a non-stationary 20-gallon cleaning tank with solvent material into which they dipped machine parts to clean them.

Some hourly employees interviewed indicated that, from commencement of operations in 1976 until approximately 1980/1981, small amounts of spent cleaning material were handled in the following ways which would have allowed hazardous constituents to enter into the waste oil stream.

A. Trenches Under Bodymakers

A trench, approximately 120 feet long, is located under each of two rows of bodymaker machines. A number of the employees indicated that spent cleaning material was disposed into these trench drains from 5-gallon buckets or a 20-gallon parts cleaning tank. The parts cleaning tank, which was usually filled with an estimated 15 gallons of cleaning material, was emptied approximately once a week. It is unclear how frequently cleaning material was emptied from buckets or the parts cleaning tank into these trenches rather than into waste storage drums or the trench drains in the drum storage room. In fact, supervisory personnel indicated that they specifically directed hourly employees not to use the bodymaker trench drains for the disposal of cleaning material.

Prior to 1981/1982, material in the bodymaker trenches was collected in the Schneider filter sump and pumped to either the oily waste scavenger tank or Schneider filter scavenger tank. The material collected in the sump is currently pumped into the Schneider filter to be filtered and reused. Before the UST systems were taken out of service, it was pumped to either the oily waste treatment tank or the Schneider filter scavenger tank for processing through the waste treatment facility. After treatment, the oily phase of the wastewater was directed to the oily scavenger tank. In this way, hazardous constituents in the cleaning material could have been transferred in oily waste to the oily waste scavenger tank. It is believed that from the tank manway, oily waste containing hazardous constituents would seep through cracks in the deteriorated caulking at the base of the manway and collect around the outside of the tank. The waste oil then flowed into the excavation made adjacent to the tank in April 1991. It is also now known that the integrity of the 4,000-gallon oily waste scavenger tank was compromised some time in the past. Leakage would have occurred from the holes in the tank on a more regular basis.

B. Direct Disposal to Oily Waste Scavenger Tank

Employees also reported that, in the early years of operation, cleaning material was disposed on occasion directly into the oily waste scavenger tank through the manway opening. Only five of the employees interviewed remembered using the oily waste scavenger tank themselves to dispose of cleaning material. The amount of material which would have been disposed in this manner cannot be determined.

C. Cleaning Practices

The Container Plant operates three cupper machines which produce an aluminum cup which is later formed into a can by the bodymakers. Components of the cuppers and bodymakers would often be dipped into a bucket of cleaning material and replaced in the machines immediately. Hazardous constituents from these components could have entered the machine coolant or lubricating oil which flowed to the oily waste treatment tank prior to treatment. However, the amounts of hazardous constituents introduced in this manner would likely have been insignificant because most of the cleaner would have volatilized before the part was replaced.

In addition, in the past, siphon sprayers containing 1,1,1-trichloroethane were used to clean the cupper brake shoes by applying a solvent vapor or mist to degrease the component. There is a floor drain located in front of each cupper which leads to the oily waste treatment tank. It is possible that some solvent material entered the cupper drain, but the scenario is unlikely because the mist would probably have dissipated after it was sprayed.

The best method to determine the horizontal and vertical extent of the oil and VOC contamination was determined to be the collection of soil samples during subsurface drilling adjacent to the sump pit and the USTs; followed by the collection and analysis of ground water samples from monitoring wells that would be installed in the boreholes. A meeting was held with the NYSDEC during June 1991 to discuss proposed borehole locations. During the meeting, the locations of MW-47S and MW-48S were approved.

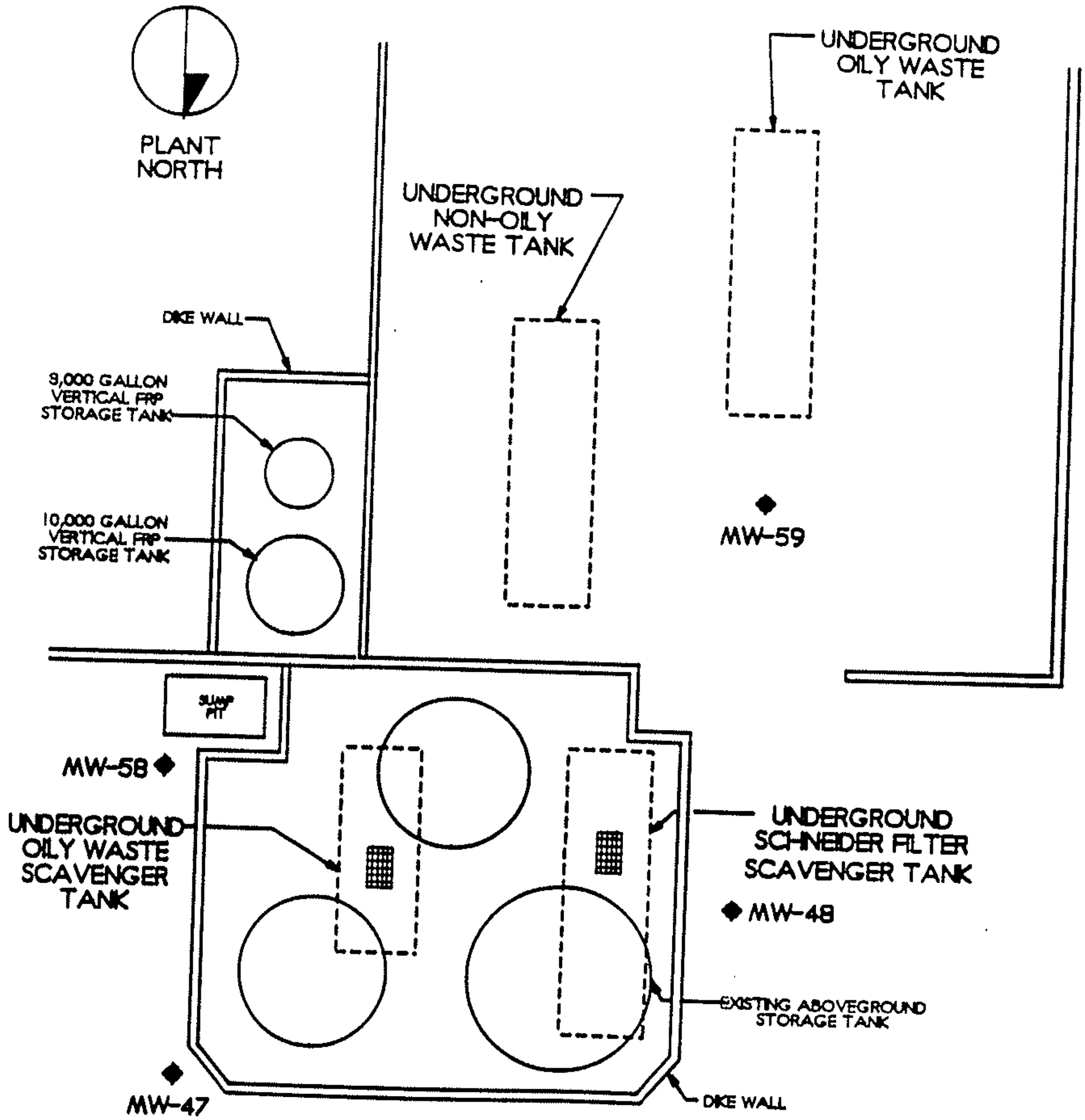
The continued recovery of oil from the sump pit was still considered to be advantageous; however, safety considerations necessitated a less labor-intensive, more automated process of recovery. It was determined in the preliminary assessment that a design for automating the recovery would be prepared.

4.4.4 Initial Drilling and Well Installation Results

To determine if the oil had migrated to the water table and impacted ground water quality, MPI recommended that a six-inch diameter recovery well (MW-47S) be installed to below the ground water level in an area north of the sump pit in the corner between the sump pit and the new aboveground tank dike. The location for this well is shown on Figure 4-15. Soil samples were collected ahead of the drill bit to determine the depth to ground water, to characterize the subsurface geology and make observations regarding the occurrence of oil and VOCs in the area around the sump pit.

The borehole was drilled with 8 1/4-inch I.D. hollow-stem augers. Split-spoon samples were collected continuously from immediately below the floor of the Container Plant to just below the occurrence of the water table. Split-spoon samples were collected at five-foot intervals thereafter to the total depth of the well. A portion of each split-spoon sample was placed in a jar for head-space analysis with an HNU photoionization detector. The remaining portion of each sample was described by an MPI geologist and retained. The results of the head-space analysis and the description of the soil penetrated during drilling are included on the drilling logs in Appendix A.

Soil samples were submitted to a laboratory for chemical analysis for VOCs (EPA Method 601) and semivolatiles (EPA Method 8270) as well as for grain size and organic carbon content analyses. The grain size and organic carbon content analyses were performed to allow evaluation of the soil relative to potential remedial technologies. The



SITE PLAN VIEW

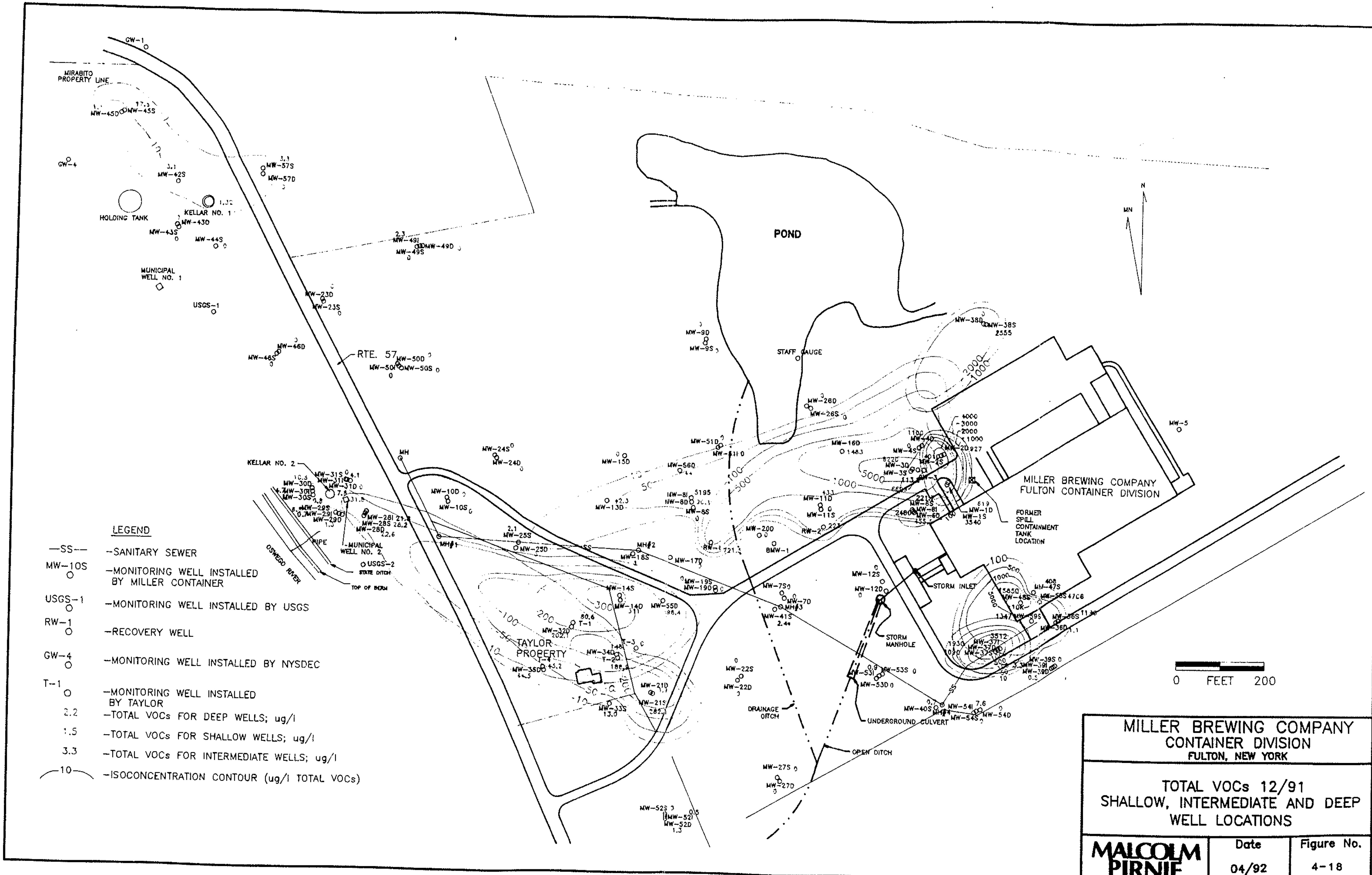
NOT TO SCALE

MALCOLM PIRNIE

MILLER BREWING COMPANY
CONTAINER DIVISION
MONITORING WELL LOCATIONS

MALCOLM PIRNIE, INC

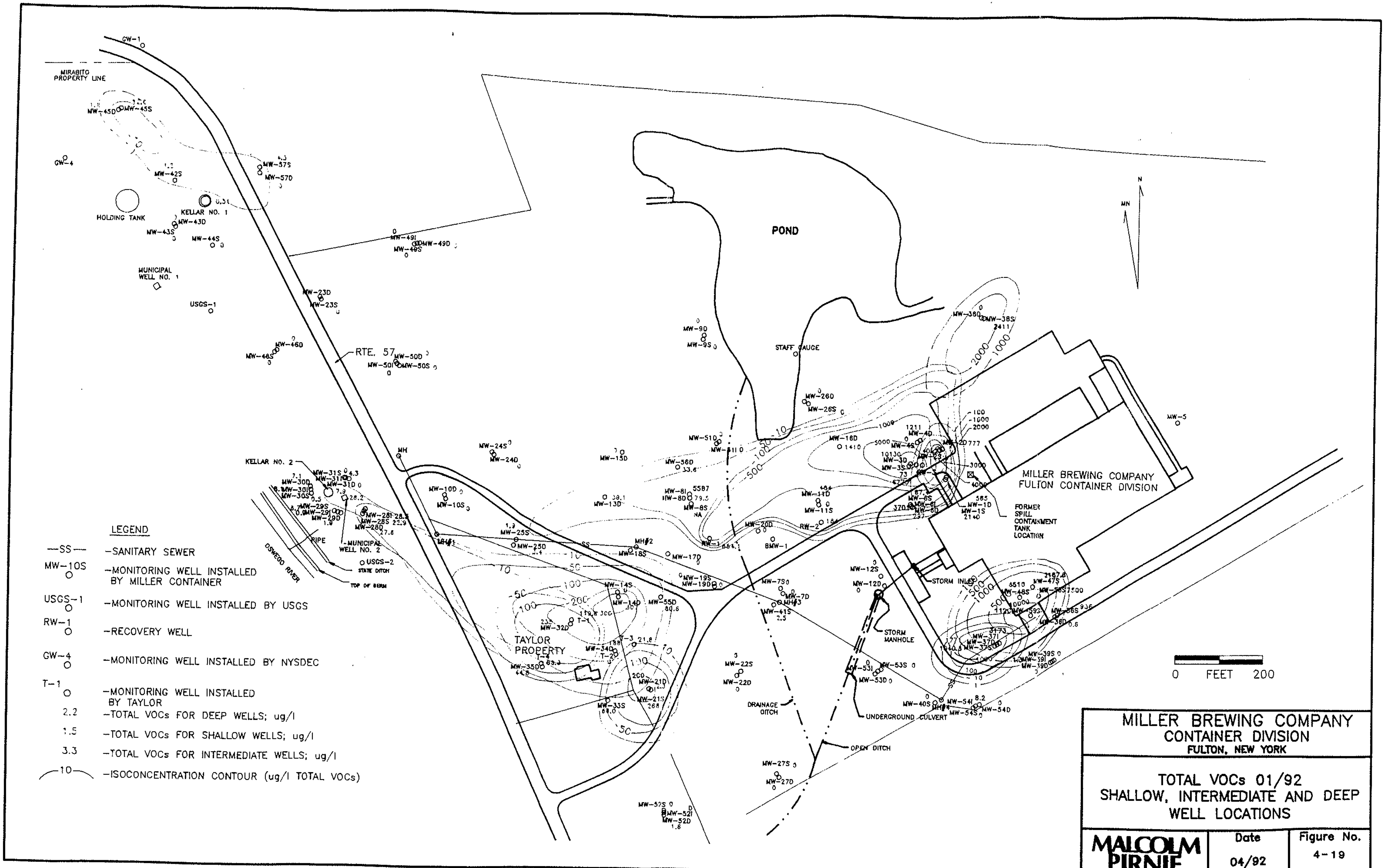
FIGURE 4-15



MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK

TOTAL VOCs 12/91
SHALLOW, INTERMEDIATE AND DEEP WELL LOCATIONS

MALCOLM PIRNIE | Date 04/92 | Figure No. 4-18


MIRABITO PROPERTY LINE
HOLDING TANK
KELLAR NO. 1
MUNICIPAL WELL NO. 1
RTE. 57
POND
STAFF GAUGE
KELLAR NO. 2
OSWEGO RIVER
MUNICIPAL WELL NO. 2
STATE DITCH
TOP OF BERM
TAYLOR PROPERTY
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
FORMER SPILL CONTAINMENT TANK LOCATION
STORM INLET
STORM MANHOLE
DRAINAGE DITCH
UNDERGROUND CULVERT
OPEN DITCH
N
MN
0 FEET 200
LEGEND
—SS— -SANITARY SEWER
MW-10S -MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 -MONITORING WELL INSTALLED BY USGS
RW-1 -RECOVERY WELL
GW-4 -MONITORING WELL INSTALLED BY NYSDEC
T-1 -MONITORING WELL INSTALLED BY TAYLOR
2.2 -TOTAL VOCs FOR DEEP WELLS; ug/l
1.5 -TOTAL VOCs FOR SHALLOW WELLS; ug/l
3.3 -TOTAL VOCs FOR INTERMEDIATE WELLS; ug/l
—10— -ISOCONCENTRATION CONTOUR (ug/l TOTAL VOCs)
MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
TOTAL VOCs 01/92
SHALLOW, INTERMEDIATE AND DEEP WELL LOCATIONS
MALCOLM PIRNIE
Date 04/92
Figure No. 4-19

results of the VOC analysis are listed in Table 4-7. The results of the grain size and organic carbon analyses are presented in Appendix K.

Once the ground water was located, the monitoring well was installed and grouted in place. The location of the well screen was determined based on the drilling data. Although oil-stained soil was present, the soil did not appear to be saturated with oil. The well screen was spread over a considerable depth to allow the future use of vacuum extraction techniques if these should prove desirable.

MPI, the NYSDEC and Miller also determined that an additional well (MW-48S) should be installed in a potentially hydraulically downgradient location on the west side of the two USTs nearest to the sump pit to determine the extent of the oil contamination in this area. This well was constructed in the same manner as MW-47S and is shown on Figure 4-15.

The lithologic units penetrated during drilling of the two boreholes can be correlated to similar units encountered while drilling nearby wells outside of the Container Plant.

The Container Plant sub-grade fill consists of rounded to subrounded gravel up to 0.25 inch with some fine sand. This fill unit extends to about three feet below the top of the floor (BTOF) and is underlain by moderate to dark brown fine to coarse sand and subangular gravel up to 1.5 inch. This unit extends to 10.3 feet BTOF at MW-47S and 11.0 feet BTOF at MW-48S. Below the sand and gravel unit is a minor unit of grayish-brown fine to medium sand with some subangular gravel up to 0.5 inch which extends to 13.0 feet BTOF at MW-47S and 12.4 feet at MW-48S. The sand and silt unit was noticeably oil stained between 10.0 feet and 13 feet BTOF at the MW-47S location. At the MW-48S location, oil stained soil was not noticed. Below this sand and silt unit is a very fine sand and silt unit. This unit was oil stained from 13.0 to 14.0 feet at the MW-47S location and exhibits a "flowing" nature at depth below the water table which prohibited collection of split-spoon samples below 32 feet. According to the driller's observations and drill cuttings, the very fine sand and silt unit extends to approximately 37 feet BTOF at MW-47S and 39 feet at MW-48S, where the driller noted the occurrence of a sand and gravel unit.

The results of the head-space analyses indicated VOC contamination at both locations. All head space readings were above the background for the Plant area. The highest value obtained from the MW-47S location was 120 ppm within the 10-to 12-foot sample with an overall average value of 41 ppm throughout the borehole. At the MW-48S

MILLER CONTAINER

TABLE 4-7
MW-47 SOIL SAMPLE RESULTS

COMPOUND ID	RESULT (ug/m3)	
	EPA METHOD GC/MS 8270	EPA METHOD 601
Phenanthrene	39 J	NA
TTCE	NA	3,000
1,1,1-TCA	NA	170
TCE	NA	280
Toluene	NA	92

NOTES:
TTCE - Tetrachloroethylene
1,1,1-TCA - 1,1,1-Trichloroethane
TCE - Trichloroethylene
J - Estimated result
NA - Not Applicable

location, the highest value was 28 ppm within the 8-to 10-foot sample with an overall average of 5.4 ppm throughout the borehole.

The water table during drilling was observed to be about 22.0 feet BTOF at the MW-47S location and about 21.0 feet BTOF at the MW-48S location. This depth is about nine to 10 feet below the top of the concrete column spread footer that underlies the sump pit. These two wells were sampled monthly in order to better assess the contamination in the sump pit area.

4.4.5 Additional Sampling and Analysis

On June 3, 1991, Miller collected two more samples of oil for analysis. The first sample was from the oily waste storage tank manway and the second sample was from the west side of the sump pit (Figure 4-12). The samples were collected due to increased flow into the sump pit and to attempt to match the identities of the two oils. The results of these analyses are listed in Table 4-8. The two results of the analysis did not correlate well. The sample from the sump pit contained VOCs while the manway sample contained only BTEX compounds that were found in the earlier analysis of product samples.

4.4.6 Subsequent Investigations and Meetings

A Container Plant Interior Oil Contamination Study Work Plan was written and submitted to the NYSDEC in October 1991. The work plan addressed the oil contamination and outlined recommendations for installing additional wells and identifying and recovering the petroleum wastes in the sump pit and UST area. The plan was approved by the NYSDEC in a November 26, 1991 letter signed by Michael J. DiPietro.

A meeting was held on December 17, 1991 at the Container Plant with NYSDEC Region 7 Spill Engineer, Dale Vollmer. Discussed at the meeting was Miller's desire to abandon the four UST systems (including piping) in place. A copy of the approved Container Plant Interior Oil Contamination Project Study Work Plan was submitted to Mr. Vollmer. Miller requested that the plan be used as the site assessment for the tank closure since the components of the work plan would adequately cover the required components of a tank closure site assessment.

After discussing the various aspects of the work plan, including the installation of the two additional wells shown on Figure 4-15 (MW-58S and MW-59S), Mr. Vollmer agreed that using this work plan as the tank closure site assessment would be acceptable. Mr. Vollmer

MILLER CONTAINER

TABLE 4-8
SUMP PIT OIL SAMPLE RESULTS
(SECOND ROUND)
EPA METHOD 8010/8020

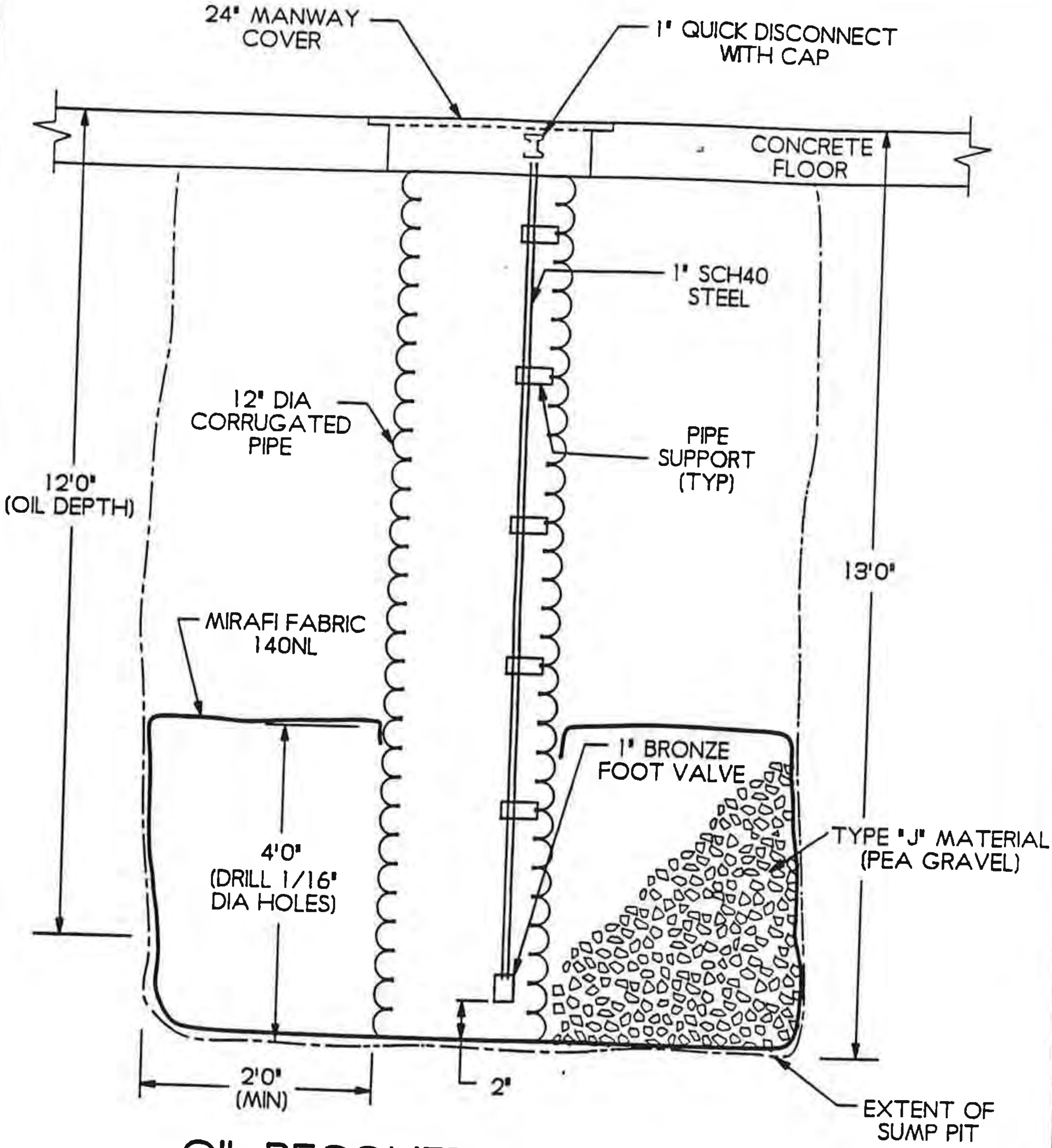
COMPOUND ID	RESULT (ug/l)	
	OIL 1	OIL 2
1,1-DCA	<1,000	1,800
cis-1,2-DCE	<1,000	240,000
Methylene Chloride	<1,000	17,000
TTCE	<1,000	580,000
1,1,1-TCA	<1,000	530,000
TCE	<1,000	110,000
Ethylbenzene	<1,000	2,000
Toluene	1,200	32,000
Total Xylenes	1,800	13,000

NOTES:
1,1-DCA - 1,1-Dichloroethane
cis-1,2-DCE - cis-1,2-Dichloroethylene
TTCE - Tetrachloroethylene
1,1,1-TCA - 1,1,1-Trichloroethane
TCE - Trichloroethylene

stated, however, that the free product present in the soil in and around the sump pit area and the tanks would need to be recovered. A conceptual design was submitted at the December 17th meeting which outlined the tank abandonment procedure and proposed a process for recovering the oil through the conversion of the USTs into temporary collection sumps. Mr. Vollmer concurred with the proposal which called for potentially transforming the underground storage tanks into oil collection sumps in order to recover the free product. He also stated that all product lines connected to the UST system could be abandoned and filled with a concrete slurry. At the December 17th meeting, the floor sump pit was also proposed to be retrofitted with a corrugated pipe and pump station to allow automated oil recovery from this area. Figure 4-16 outlines the modifications necessary to convert the floor sump pit into an oil collection sump. Mr. Vollmer approved of this process and the sump pit has been retrofitted. Mr. Vollmer has since left the NYSDEC. A work plan detailing the conversion of the USTs into temporary sumps prior to their in-place closure was discussed with Richard Brazell, acting Region 7 Spill Engineer, on April 2, 1992 and was submitted to the NYSDEC on June 25, 1992. In a letter dated July 24, 1992, Mr. Brazell approved the work plan.

Due to the oil contamination in the UST area, and the inability to excavate the oil-contaminated soil or install oil recovery sumps in new boreholes in the oil saturated area in the immediate vicinity of the tanks, the work plan called for the potential utilization of three of the four USTs as oil-collection sumps after the tanks were isolated and cleaned. The three storage tanks proposed to be evaluated for conversion into collection sumps were the 4,000-gallon oily waste scavenger tank, the 8,000-gallon Schneider filter scavenger tank and the 8,000-gallon oily waste treatment tank (located in the WTF). This tank was included in the planned assessment due to its contents and the utilization of overfilling techniques which allowed oil to accumulate in the manway as at the other two oily waste tanks. In the work plan, the 8,000-gallon non-oily waste treatment tank in the WTF was proposed to be filled with inert material after the cleaning process was completed. Figure 4-17 shows a typical design drawing of the modifications necessary to convert the three USTs into oil-collection sumps.

The two additional wells near the UST area that were proposed in the October 1991 work plan have been installed since the work plan was approved. The drilling and well installation procedures were conducted in the same manner as the previous boreholes in this



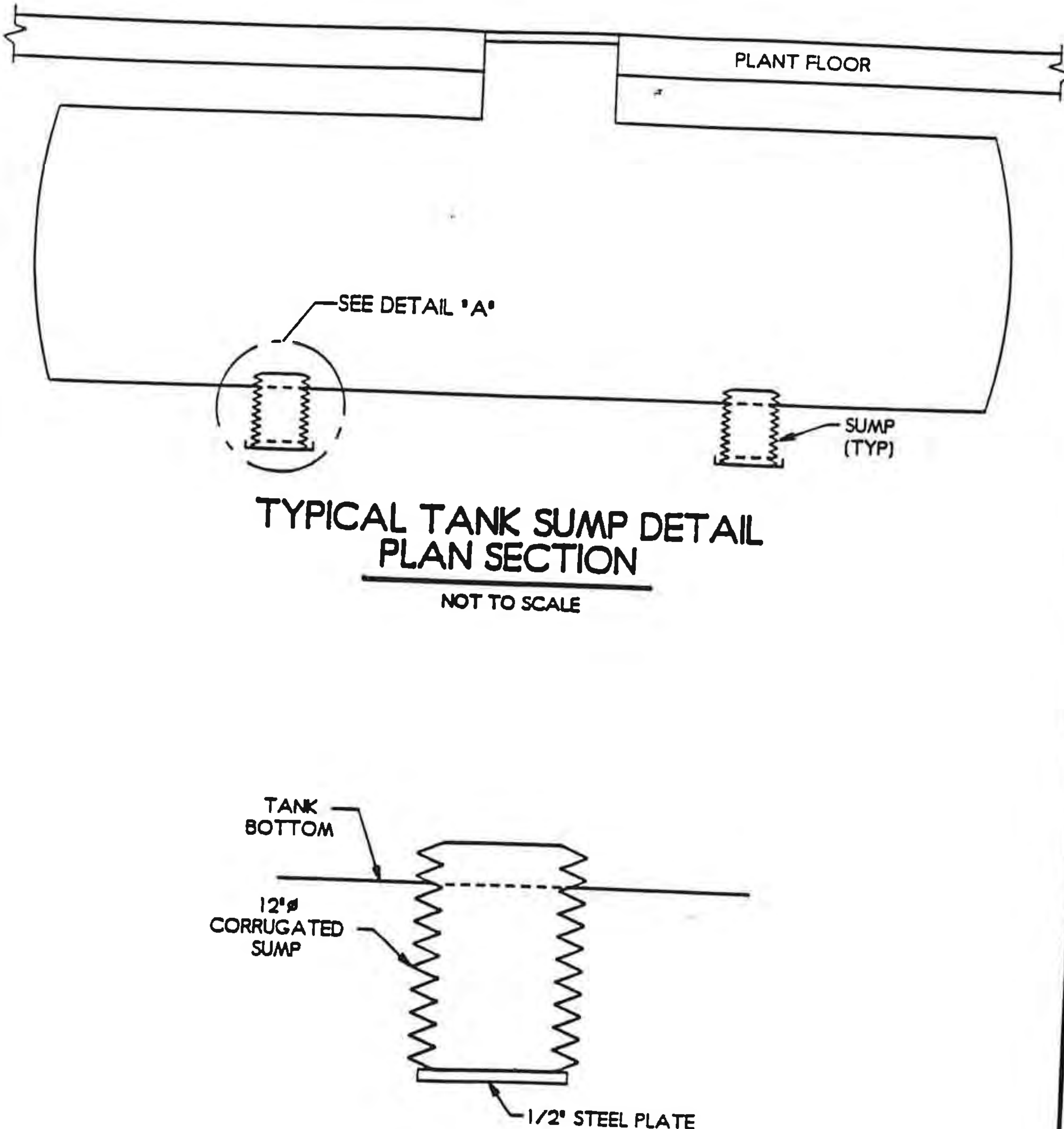
OIL RECOVERY SUMP DETAIL

MALCOLM PIRNIE

MILLER BREWING COMPANY
CONTAINER DIVISION
OIL RECOVERY SYSTEM

MALCOLM PIRNIE, INC

FIGURE 4-16



TYPICAL TANK SUMP DETAIL
PLAN SECTION

NOT TO SCALE

DETAIL "A"

MALCOLM PIRNIE

MILLER BREWING COMPANY
CONTAINER DIVISION
OIL RECOVERY SYSTEM

MALCOLM PIRNIE, INC

FIGURE 4-17

area (MW-47S and MW-48S). The wells were designated as MW-58S and MW-59S and are shown on Figure 4-15.

The boreholes were drilled with 8 1/4-inch I.D. hollow-stem augers. Two-inch ID split-spoon samples were collected continuously from immediately below the floor of the Container Plant to just below the occurrence of the water table. Split-spoon samples were collected in five-foot increments thereafter to the total depth of the well. A portion of each split-spoon sample was placed in a jar for head-space analysis with an HNU photoionization detector. The remaining portion of each sample was described by an MPI geologist and retained. The results of the head-space analysis and the description of the soil penetrated during drilling are included on the drilling logs in Appendix A.

The lithologic units encountered during drilling of these boreholes appear to be consistent with the units penetrated during the drilling of the two previous boreholes in this area. Approximately three feet of fill material exists below the concrete floor slab at each location. The fill unit is underlain by two sand and gravel units which extend to approximately 14.8 feet BTOF at the MW-58S location and 14.0 feet at the MW-59S location. Below the sand and gravel units, is a unit of very fine sand and silt with a trace of clay which extends to about 18.8 feet BTOF at the MW-58S location and to about 20.9 feet BTOF at the MW-59S location. This sand and silt unit was noticeably oil stained between 8.0 feet and 18.8 feet BTOF at the MW-58S location. At the MW-59S location, oil stained soil was noticed from 12.0 feet to 12.9 feet BTOF; however, it should be noted that no sample was recovered from 10 feet to 12 feet BTOF at this location and it is possible that oil may be also located in this interval. Below this sand and silt unit is a very fine sand and silt unit.

According to the driller's observations and drill cuttings, this unit extends to approximately 38 feet BTOF at both locations, where the driller noted the occurrence of a sand and gravel unit.

The results of the head-space analysis indicated VOC contamination at both locations. All head space readings were above the background for the Plant area. The highest value obtained from the MW-58S location was 50 ppm within the 10- to 12-foot sample with an overall average value of 21.8 ppm throughout the borehole. At the MW-59S location, the highest value was 38 ppm within the 25- to 27-foot sample with an overall average of 16.0 ppm throughout the borehole. The water table during drilling was observed to be about 22.5 feet BTOF at the MW-58S location and about 22.0 feet BTOF at the MW-59S location.

Although oil staining was observed, no oil-saturated soil was encountered during the drilling of the boreholes and no free oil was observed at the water table during drilling in either location. However, after MW-58S was installed, a thin layer of oil was observed on the water table in the well. The layer of oil was too thin to be measured, but was observed on the tip of the water level probe when it was lowered into the well to measure the depth to the water table prior to sampling the well. On April 23, 1992, as part of the monthly sampling event, the water level probe was again lowered into the well to measure the depth to the water table. On this date, 2.2 feet of oil was measured above the water table. Since April 1992, the occurrence of oil in MW-58S has been monitored. When oil is observed in the well, the oil is removed by bailer and transferred to the above ground storage tank used to collect other recovered oil from the area. On October 1, 1992, a sample of the oil bailed from MW-58S was collected for analysis at Galson Laboratories according to GC/MS Method 8240. The results of the analysis are included in Appendix J and are summarized in Table 4-9. A thin layer of oil on the water table has been observed occasionally at MW-59S. The oil at MW-59S is also removed whenever it is detected.

Due to the very fine nature of the sand and silt units in this area, it was decided that a smaller screen size should be used in the lower ten feet of screen section during the construction of MW-58S and MW-59S in an attempt to prevent excess sand and silt entering the wells. Also, the screen length was increased from 15 feet (in MW-47S and MW-48S) to 25 feet in MW-58S and MW-59S to better apply a soil-gas vapor extraction process should this technology prove advantageous. Other than these two modifications, the well construction remained consistent with that of MW-47S and MW-48S (Appendix A).

Ground water samples have been collected from monitoring wells MW-47S, MW-48S, MW-58S and MW-59S during December 1991 and during January, February, and August 1992. Ground water samples were also collected from MW-47S, MW-48S and MW-59S during April 1992; however, no sample was collected from MW-58S during April due to the first occurrence of oil in the well. The samples were submitted to Galson for analysis using EPA Methods 601/602. The compounds detected in each of the four ground water samples are listed in Table 4-10, the results of the VOC analysis are included in Appendix C.

These results indicate that elevated levels of VOCs are present in the ground water below the tanks. The origin of the VOCs may be entirely from the USTs or may be a

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TABLE 4-9

Summary of Analytical Results
MW-58S Oil Sample and Oily Waste Scavenger Tank Sump Oil Sample
(GC/MS Method 8240)

Compounds Detected µg/l	MW-58S (Oil) (Sampled: 10/01/92)		Oily Waste Scavenger Tank Sump (Oil) (Sampled: 10/01/92)	
Acetone		525,000	ND	250,000
1,1-Dichloroethane		24,000	ND	250,000
1,2-Dichloroethylene (total)		557,000	ND	250,000
1,1,1-Trichloroethane		2,070,000		761,000
Trichloroethylene	J	59,000	J	55,000
Tetrachloroethylene		1,140,000		720,000
Toluene	J	54,000	J	26000
Ethylbenzene	J	18,000	J	8800

J = Estimated value, value is below the compound quantitation limit.
ND 250,000 = Not detected at a detection limit of 250,000 µg/l.

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TABLE 4-10
MONITORING WELL SAMPLING – ANALYTICAL RESULTS
(EPA METHOD 601 & 602)

Well No.	Date Sampled	1,1-Di-chloro-ethane	1,1-Di-chloro-ethylene	t-1,2-Di-chloro-ethylene	Methylene chloride	Tetra-chloro-ethylene	1,1,1-Tri-chloro-ethane	Tri-chloro-ethylene	Toluene	Total Xylenes	c-1,2-Di-chloro-ethylene
MW-47S	12/19/91	BDL50	BDL50	BDL50	BDL50	120	160	50	BDL50	BDL50	78
	01/24/92	120	170	BDL5	43	200	960	320	BDL5	BDL5	350
	02/20/92	56	68	BDL5	BDL5	120	420	140	BDL5	BDL5	190
	04/24/92	23	13	BDL5	10	73	79	25	BDL5	BDL5	45
	08/27/92	34	34	BDL5	15	79	130	17	BDL5	BDL5	48
MW-48S	12/19/91	1000	280	BDL100	280	280	830	180	BDL100	BDL100	13000
	01/24/92	530	280	BDL100	BDL100	360	840	100	BDL100	BDL100	6400
	02/20/92	430	230	BDL100	BDL100	290	720	110	BDL100	BDL100	7200
	04/24/92	500	270	BDL100	280	^220	690	120	BDL100	BDL100	11000
	08/27/92	930	350	BDL100	200	250	310	200	BDL100	BDL100	32000
MW-58S	12/19/91	370	BDL50	BDL50	210	810	2600	270	66	BDL50	380
	01/24/92	930	BDL50	BDL50	980	640	4900	850	82	BDL50	1200
	02/20/92	570	BDL50	BDL50	880	280	4000	2000	81	BDL50	2500
	04/24/92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	08/27/92	1300	290	BDL250	2800	630	11000	340	BDL250	BDL250	27000
MW-59S	12/19/91	64	BDL50	BDL50	BDL50	53	230	BDL50	BDL50	80	920
	01/24/92	490	210	BDL50	140	BDL50	320	120	BDL50	BDL50	10000
	02/20/92	1300	530	BDL100	340	BDL100	990	BDL100	BDL100	BDL100	29000
	04/24/92	1800	1100	BDL250	650	BDL250	2000	BDL250	BDL250	BDL250	34000
	08/27/92	2100	650	BDL250	460	BDL250	3100	BDL250	BDL250	BDL250	40000

Note: All results are reported in ug/l.

combination of contamination emanating from the southern drum storage area and the USTs, which is considered the most likely scenario. Since the ground water contamination from the two areas may overlap, remediation techniques will need to be considered which address the contaminated area as a whole.

4.4.7 Tank Closure Activities

On January 6, 1992, Diment Construction Company (Diment) began work on the 4,000-gallon oily waste scavenger tank located beneath the new aboveground storage tanks. Piping leading to and from the tank was disconnected and all residual product and sludge was removed from the underground storage tank and placed in 55-gallon drums. Approximately 100 gallons of product and sludge was removed from the tank. Workers then entered the tank and cleaned the interior with a high pressure spray wash. After the tank was cleaned, the workers noticed three penetrations through the tank shell beneath the tank manway. A crack approximately six inches in length and two small circular holes were found in this area.

The workers also noticed water infiltrating into the tank through the penetrations. Water level readings taken from wells in the area indicated that the ground water table should be at an elevation of about 359 feet above Mean Sea Level (FAMSL) in the adjacent tank area. Since the tank bottom is at an elevation of 367 FAMSL, the infiltrating water must be from a source other than ground water.

One possible source of the infiltrate is from the non-oily waste sump adjacent to (and just southeast of) the oily waste scavenger tank (Figure 4-12). Due to the deterioration of the non-oily waste sump liner, a new liner was installed in the mid 1980s. Thus, the infiltrate could represent non-oily waste sump water which escaped from the waste sump prior to it being relined. This theory is strengthened due to the fact that the water previously contained in the non-oily waste sump would have had a pH similar to the acidic water found in the oily waste scavenger tank.

Samples were taken of the water infiltrate and submitted to Galson for analysis using EPA GC Method 601/602. Additional samples were submitted for coliform bacteria count (to evaluate leakage from the Miller sanitary sewer line as a source of the water) and VOC analysis according to EPA GC/MS Method 8240. The VOCs detected in the samples are listed in Table 4-11. The results of the VOC analyses and coliform analysis are also included in Appendix J. The results of the coliform bacteria count were negative, no fecal

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TABLE 4-11
OILY WASTE STORAGE TANK – WATER INFILTRATE ANALYTICAL RESULTS

	GC METHOD 601/602	GC/MS METHOD 8240
COMPOUND	SAMPLE ID: OWST-1 (Sampled 01/10/92)	SAMPLE ID: OWST-2 (Sampled 01/13/92)
1,1-Dichloroethane	1500	430
1,2-Dichloroethylene	1900	1100
Methylene Chloride	20000	6200
Tetrachloroethylene	2400	900
1,1,1-Trichloroethane	25000	12000
Trichloroethylene	2500	730
Acetone	NA	760
MIBK*	NA	4000

NOTES:
All results are reported in ug/l.
*MIBK = Methyl Isobutyl Ketone = 4-Methyl-2-Pentanone
NA = Not Applicable

coliform were detected. Therefore, the sanitary sewer was not investigated further as a source of the water infiltrating into the tank.

On January 13, 1992, the contractor began cleaning activities on the 8,000-gallon steel Schneider filter scavenger tank. All residual product and sludge were removed from the tank and placed in 55-gallon drums after pipes leading to and from the tank were disconnected. Approximately 100 gallons of product and sludge were removed from the tank. The contractor then entered the tank and cleaned the interior. After the tank was cleaned, a visual inspection of the tank indicated no penetrations through the tank shell.

The process transfer influent and effluent pipes leading to and from the tanks below the WTF area were disconnected during February 1992. Tank cleaning of the oily waste tank and non-oily waste tank in the WTF took place during the end of February and the beginning of March utilizing the procedure referenced above. Based on a visual examination, both tanks appeared to be intact and no perforations or penetrations were noted.

Grouting of the underground piping leading to and from each tank was completed on March 24, 1992. The floor sump located adjacent to the oily waste scavenger tank has been converted to a recovery sump and Miller has converted an existing 10,000-gallon above ground storage tank located in the coil loading dock (shown on Figure 4-12) to a temporary waste oil/water holding tank.

During August 1992, Allwash, Inc. drilled 1/4 inch diameter holes in the 4,000-gallon oily waste scavenger tank. Drilling began approximately two feet up from the bottom (elevation of 369 FAMSL) and proceeded downward to near the bottom of the tank (elevation 367 FAMSL). Oil was observed to be entering the tank at an elevation of about 368 FAMSL while water was reported to be entering at an elevation of about 367.5 FAMSL. The oil and water was pumped to the 10,000-gallon above ground storage tank for temporary storage before disposal off-site. A total of about 1,740 gallons of oil and water was ultimately pumped from the bottom of the tank after entering the tank through the drilled holes. After the level of oil and water was lowered to near the bottom of the tank, a 12-inch diameter sump was constructed in the north and south ends of the tank. The sumps were installed during November 1992. The sumps were originally intended to extend down to the top of the anchor pad shown on Plant drawings to exist below the tank. However, no anchor pad was found below the 4,000-gallon FRP oily waste scavenger tank. The sumps extend down to the top of the naturally occurring dense sandy silt that is found in this area of the site. The bottom of the sumps are at an elevation of about 366 FAMSL. Through February 25, 1993, a total of approximately 300 gallons of oil and water have been pumped from the sumps below the oily waste scavenger tank. Two oil/soil samples were collected from below the tank during installation of the sumps (Cansoil 1 and Cansoil 2) and submitted for analysis according to EPA Method 8240. The results are summarized in Table 4-12 while the full analytical results are presented in Appendix J. A sample of oil was collected from one of the sumps in the oily waste scavenger tank on October 1, 1992. The results are included in Appendix J and are summarized in Table 4-9.

During the same time frame that the sumps were installed below the oily waste scavenger tank, holes were drilled in the side of the 8,000-gallon steel Schneider filter scavenger tank. Oil entered this tank through holes drilled along the east side of the tank at an elevation of about 368.5 FAMSL. The Allwash technician drilling the holes reported that the holes on the west side of the tank were producing a lower quantity of oil from an overall lower elevation. As of February 25, 1993, a total of 400 gallons of oil and water have been pumped from the bottom of the Schneider filter scavenger tank as a result of seepage through the drilled holes.

Later in November 1992, Allwash installed two sumps in the Schneider filter scavenger tank. The sumps extend down to the top of the natural material below the pea gravel used as backfill around the tanks. No concrete anchor pad was found below the Schneider filter scavenger tank. Through February 25, 1993, about 212 gallons of oil and water have been recovered from below the Schneider filter scavenger tank.

After the sumps were installed in the Schneider filter scavenger tank, Allwash proceeded to drill holes in the 8,000-gallon FRP oily waste treatment tank located below the Container Plant's WTF. The drilling process was completed on November 24, 1992.

The contractor reported that oil entered this tank at an elevation of about 368.5 FAMSL and that the oil was entering this tank at a relatively faster rate than that observed at the previous two USTs. Approximately 1,050 gallons of relatively pure oil entered this tank until January 15, 1993 when the infiltrate changed to predominantly water. As of February 25, 1993 about 3,308 gallons of oil and water have been recovered from the oily waste treatment tank. A sample of the oil from this tank was collected and submitted for analysis according to EPA Method 8240. A summary of the compounds detected is provided on Table 4-12 (Can-oil 1) and the complete results are furnished in Appendix J. High levels of several chlorinated compounds were detected in this sample.

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TABLE 4-12

Summary of Analytical Results
Oil Samples from Inside or Below USTs
(GC/MS Method 8240)

Compounds Detected (ug/l)	CANSOIL 1 (Sampled: 11/09/92)	CANSOIL 2 (Sampled: 11/09/92)	CAN-OIL 1 (Sampled: 11/24/92)
1,1,1-Trichloroethane	59000	314000	996000
Tetrachloroethylene	53000	260000	128000
1,2-Dichloroethylene (total)	ND 13,000	63000	831000
Trichloroethylene	ND 13,000	J 9,700	J 20,000
1,1-Dichloroethane	ND 13,000	ND 25,000	218000
1,2-Dichloroethane	ND 13,000	ND 25,000	101000
Carbon Tetrachloride	ND 13,000	ND 25,000	94000
Toluene	ND 13,000	ND 25,000	98000

NOTES:
ND 13,000 = Not detected at a detection limit of 13,000 ug/l.
J = Estimated value, value below the compound quantitation limit.

recently excavated sump pit, and traces of oil have also been noted at well MW-59S. Elevated levels of acetone (a ketone) and several chlorinated VOCs have been detected in an oil sample collected from MW-58S. The oil in the vicinity of the USTs and the sump pit may be concentrated primarily in the fill material in the vicinity of the USTs due to the viscosity of the oil and the occurrence of the low permeability natural soil around the tanks.

Elevated levels of several chlorinated VOCs and ketones have been found in ground water samples collected from monitoring wells installed near the tanks and the sump pit. Similar compounds have been detected in oil samples collected from the sump pit, the 4,000-gallon oily waste scavenger tank located adjacent to the sump pit, and the 8,000-gallon oily waste treatment tank. The water that infiltrated into the 4,000-gallon oily waste scavenger tank also contained similar compounds, as do ground water samples collected from wells installed outside the Container Plant to investigate contamination resulting from the washing and storing of empty drums of VOCs on the Plant's south side. Some of the drum storage and washing may have taken place on ground that was formerly outside the Container Plant, but was subsequently the site of construction of part of the Plant's WTF. The ketones have also been detected in the samples collected from this area that were subjected to the EPA Method 8240 analysis (MW-36S in Appendix G). The ground water contamination below the Plant may be due primarily to the leaching of VOCs and ketones from the oil and soil in the UST area; however, the migration of VOCs from the former southern drum storage area probably has also contributed to contamination in this area.

A work plan detailing the UST closure process and the oil recovery process has been submitted to the acting NYSDEC Region 7 Spill Engineer, Richard Brazell. Mr. Brazell has stated that the recovery of oil from the sump pit and the oil (and water) from the UST(s) will be performed under the guidance of NYSDEC, Region 7. However, the VOC contamination present in the soil and ground water must be addressed under the guidance of NYSDEC, Division of Hazardous Waste Remediation, Albany. The VOC contamination in the soil and ground water will therefore be evaluated during the RI/FS process.

As part of the oil recovery process, holes have been drilled in the 4,000-gallon oily waste scavenger tank, the 8,000-gallon Schneider filter scavenger tank and the 8,000-gallon oily waste treatment tank. Sumps have been installed below the oily waste scavenger tank and Schneider filter scavenger tank. A sump is planned for installation below the oily waste treatment tank. Oil and water have been recovered from all three oily waste tanks. The greatest recovery has occurred in the oily waste treatment tank below the WTF. In all, over

11,245 gallons of oil and water have been recovered through February 25, 1993, from the three underground process tanks and the sump pit area.

4.5 GROUND WATER SAMPLING AND ANALYTICAL RESULTS

4.5.1 General Information and Water Quality Trends

The results of the analyses performed on the monthly and quarterly samples collected from the monitoring wells from 1986 through August 1992 are tabulated in Appendix C. Also included in Appendix C are the analytical results from the weekly municipal well sampling and the one ground water sample collected near K-2 during the soil gas investigation. The results of the monthly analyses conducted on the recovery well samples and the influent and effluent at the Miller air stripping tower are listed in Appendix D. A series of tables reporting the results of the supplemental analyses (ASP reporting and deliverables) from samples collected at select monitoring wells and the three municipal wells during December 1990 are available in Appendix G.

There are several parameters that are detected most often in the ground water at the site. They are, in order of most common occurrence, 1,1,1-trichloroethane (TCA), tetrachloroethylene (TTCE), 1,1-dichloroethylene (1,1-DCE), 1,1-dichloroethane (1,1-DCA) and cis-1,2-dichloroethylene (cis-1,2-DCE). These "key parameters" have been tabulated to provide an easy reference table for the ground water quality at the site. The table is included as Appendix R. Also included on the table are miscellaneous compounds (e.g. trichloroethylene (TCE)) detected at each well. Graphs of contaminant concentration versus time for the recovery wells and for the monitoring wells where compounds are routinely detected are included in Appendix S. Also included in Appendix S are graphs of TCA and TTCE over time at K-2 and M-2. The graphs indicate that overall trends in water quality are occurring at several wells, as follows:

- MW-1S - The concentrations of TCA and TTCE followed an overall downward trend through December 1989. The concentrations of these compounds have leveled off following that date. 1,1-DCE and 1,1-DCA were generally not present at this well before March 1990, but have commonly been detected since that date. c-1,2-DCE, which is not shown on the graph in Appendix S, but is listed in the analytical data tables (see Appendix R), has been detected at this well on almost all dates since May 1990.

- MW-2S - The concentrations of 1,1-DCE, 1,1-DCA, TCA and TTCE all have been increasing through time at this well.

- MW-2D - The concentration of TCA has decreased with time.

- MW-3S - Overall, the concentrations of the key parameters have been low. TCA did reach an overall high of 130 ug/l in April 1990, but has decreased since then.

- MW-3D - Overall contaminant levels at this well are high. The TCA and TTCE levels increased dramatically in September 1988 reaching highs of 42,000 ug/l (October 1988) and 14,000 ug/l (September 1988), respectively. The levels of these compounds (in particular TCA) decreased somewhat between Fall 1989 and Spring 1990, then increased until Summer 1991. After that date the contaminant levels have been somewhat lower, but still remain high relative to most other wells on site. The well is located about 15 feet from recovery well RW-3. The samples collected at RW-3 showed an increase in the level of contamination during Fall 1988.

- MW-4S - In comparison to other wells in the immediate area, this well is virtually uncontaminated.

- MW-4D - The concentration of TCA has decreased with time. TTCE has increased over time; however, the levels of TTCE have been lower overall.

- MW-6S - TCA appears to increase somewhat during the Spring months, but, overall the contaminant concentrations at this well are relatively low compared to the other wells in the well cluster.

- MW-6I - The contaminant concentrations of 1,1-DCE, TCA and TTCE are significantly higher at this well than at MW-6S and the concentration of these compounds is increasing. Some seasonal fluctuation is evident. 1,1-DCA, cis-1,2-DCE and TCE are generally absent.

- MW-6D - All key parameters, except TCE, are routinely detected at this well. The concentrations have remained relatively consistent and low. Since May 1990, c-1,2-DCE has been also detected routinely. This compound has been detected also at MW-1S, MW-1D and MW-3D during recent months. According to the EPA 8270 analysis performed at this well (ASP), three unknown alkylbenzenes were tentatively identified.

- MW-8I - Relatively high levels of TCA and TTCE, and lower levels of 1,1-DCA, 1,1-DCE, and toluene were detected in December 1991 and January 1992. The concentrations decreased slightly during February 1992, and more drastically during March 1992. Levels of these same contaminants increased slightly during April, and more significantly by August 1992.

- MW-8D - From October 1988 to February 1991, the level of TCA increased. After February 1991, the TCA concentration has dropped. 1,1-DCE, 1,1-DCA and TTCE have been detected with more frequency since the beginning of 1990, but the levels have decreased recently, except for higher levels observed in April 1992.

- MW-10S - There was no graph produced due to the overall lack of contamination, however, from December 1990 through June 1991, low levels of TCA and TTCE (up to 3 and 2 ug/l, respectively) were present in this well. All common compounds were non-detect from August 1991 through April 1992, when TCA was present at 0.6 μg/l and TTCE was present at 1.2 μg/l. August 1992 results show all compounds as non-detectable.

- MW-11D - TCA has been detected consistently. Since May 1990, 1,1-DCE and 1,1-DCA have been found at low, but increasing levels. c-1,2-DCE has also been detected recently.

- MW-13D - TCA continues to be detected at relatively low concentrations. 1,1-DCE and 1,1-DCA have been present at low levels on almost all sampling dates from December 1990 through August 1992.

- MW-14D - Since March 1988, TCA has been detected at this well. The concentration increased to a high of 410 μg/l in May 1991, after which it fluctuated in the range of 200 μg/l. Since May 1992, the concentration has been decreasing somewhat. TTCE first was detected at quantifiable levels in September 1990. This compound is now detected consistently, as is 1,1-DCE. 1,1-DCA was first detected in January 1991 and has remained around the detection level since that date. The source for contamination at this well may be an unidentified source area upgradient and east of MW-14D.

- MW-16D - Relatively high levels of TCA (up to 1,600 ug/l) have been present in samples from this well. 1,1-DCE has also been detected. The highest detected concentrations for both compounds were found in March 1991. Concentrations of TCA have been decreasing slightly since December 1991; 1,1-DCE has remained at fairly consistent levels since September 1991. According to ground water flow directions, the source of the contamination detected at this well is the area north of the Plant's northern parking area.

- MW-18S - Low levels of TCA (up to 40 ug/l), 1,1-DCE (up to 2 ug/l) and TTCE (at 3 ug/l) have been detected at this shallow well. TCA concentrations have remained below 5 μg/l since March 1991, and were non-detected during August 1992. 1,1,-DCE and TTCE has been non-detected since June 1991. The continued occurrence TCA in the shallow zone at this location, which is isolated from the known source areas, is indicative of a potential nearby source. MW-18S is located adjacent to the sanitary sewer and is screened at an elevation that corresponds to the depth of the sewer bedding.

- MW-21S - Consistent contamination, in the form of TCA, TTCE and 1,1-DCE, has been detected since this well was installed. The concentration of 1,1-DCE has been fairly consistent since October 1991. TCA levels were high (220-390 μg/l) but consistent from August 1991 through February 1992, then decreased slightly and have leveled off. As is the case with MW-18S, the contamination in this shallow area at considerable distance from any known source indicates that there may be a separate nearby source. The adjacent deeper well (MW-21D) has shown only recent low level TCA contamination. There is no vertical hydraulic gradient between these wells, flow is essentially lateral.

- MW-23S and MW-23D - Low levels of TCA have been detected sporadically at MW-23S, though not since March 1991, and low levels of toluene have been detected at both wells. The toluene may be the result of laboratory contamination, as it is detected inconsistently at other wells on site and in the laboratory's method blanks. The source of the MW-23S contamination is not known, but the soil gas results indicate that there is no shallow plume of contamination from the south or southeast (in the direction of the known sources on the Miller property) that is entering onto this portion of the site. The highest soil gas readings were obtained north-northwest of the monitoring well locations. The vertical hydraulic gradient between the wells is downward.

- MW-25S and MW-25D - Low concentrations of 1,1-DCA and toluene have been detected in both the shallow and deep wells. Benzene, total xylenes and toluene have been detected in the shallow well and 1,1-DCE and TCA have been detected in the deep well.

- MW-26S and MW-26D - During January 1991, samples were split from MW-26S, and other wells on site, between Galson and Upstate. Although several compounds were detected at MW-26S by Galson, none were detected by Upstate. Except for common laboratory contaminants, the well has not been contaminated since that date. Very low levels of TCA have been detected at MW-26D in nine of the last 17 analyses (through August 1992).

- MW-27S and MW-27D - Low levels of toluene have been detected sporadically at MW-27S, and consistently at MW-27D since December 1990. Concentrations of less than 1 $\mu g/l$ have been detected in MW-27S in three of the last 12 analyses. Concentrations observed in MW-27D have remained at or less than 3 $\mu g/l$.

- MW-28S, MW-28I and MW-28D - Consistent TCA contamination is present and is increasing at all three wells in the cluster. 1,1-DCE has been detected about 50 percent of the time in all three wells since Galson began analyzing the samples. Since Galson took over, 1,1-DCA has been detected consistently at low levels in MW-28S. 1,1,-DCA has been detected consistently at low levels in MW-28I and MW-28D, but only since December 1991. TTCE has been detected at all three wells, but only in the shallow zone since December 1990.

- MW-29S, MW-29I and MW-29D - TCA is present in the vicinity of all three well screens in this cluster. The concentrations decreased from May through December 1991, but have been increasing slightly since then. The contamination is highest in the shallow well, similar to TCA levels detected at the MW-28 cluster. TTCE was detected primarily in the shallow well until

August 1991; it was not observed again in MW-29S until August 1992. 1,1,-DCE is detected occasionally in the shallow and intermediate wells.

- MW-30S, MW-30I and MW-30D - TCA is found at this cluster location at the highest levels in the deep zone well. The TCA level has been decreasing in the shallow well and increasing in the intermediate well. TTCE is mostly absent. 1,1-DCE was detected during the first few months of 1991 at MW-30S and MW-30D but has not been detected recently. It has not been detected at the intermediate well location. 1,1-DCA has been detected often in the intermediate and deep wells during the last two years.

- MW-31S, MW-31I and MW-31D - TCA was found at low levels in the intermediate well on most dates. It was found twice in the shallow well and several times in the deep well, but not since August 1991. TTCE was detected one time in the intermediate and one time in the deep well. Chloroform and bromodichloromethane have been detected in the intermediate well on several dates since Galson began analyzing the samples (January 1991). These compounds are trihalomethanes which are produced when water is chlorinated. Their presence at the intermediate well screen in this location is anomalous.

- T-1 and MW-32D - Relatively high levels of TCA and 1,1-DCE have been detected at these wells. The concentrations present in this area often exceed those detected at MW-14D (upgradient). MW-14S is usually not contaminated. TTCE has been detected twice at T-1 (December 1990 and April 1992), and once at MW-32D (May 1991). TTCE started to be detected regularly at MW-14D in December 1990. c-1,2-DCE was detected once at T-1, at 100 ug/l, during December 1990. 1,1,-DCA is detected at low levels fairly consistently at T-1, and only occasionally at MW-32D.

- MW-33S - TCA, 1,1-DCE, toluene, and recently 1,1-DCA and TTCE have been detected at this well, which was installed near the abandoned portion of the septic system associated with the Taylor property. TCA levels have increased significantly since September 1991, until August 1992 when the concentration dropped. 1,1-DCE is detected fairly regularly at low levels; 1,1-DCA was detected for the first time in April 1992 and again in August 1992, both times at low levels. TTCE was detected for the first time in August 1992 at 1.3 μg/l. Toluene has been present occasionally in low concentrations; however, the highest level at MW-33S (15 μg/l in December 1990) is the highest concentration of toluene detected at any wells in this area.

- T-2 and MW-34D - Low levels of TCA, TTCE and c-1,2-DCE have occasionally been detected at the shallow well (T-2) which was installed below the former underground tanks on the Taylor property. However, during December 1991 TCA, 1,1-DCA and 1,1,-DCE were detected at unusually high levels at T-2. Higher levels of these constituents, plus 1,1-DCA, have been detected more regularly at the deeper well in the cluster. TCA and 1,1-DCE have been at fairly consistent concentrations in the deep well. TTCE, detected in T-2 only once, had been present in MW-34D at low levels until June 1991; TTCE was non-detect in MW-34D until April 1992.

- T-3 - TCA has been detected consistently, except during December 1991, and 1,1-DCE, TTCE and c-1,2-DCE have also been detected at this well.

- T-4 and MW-35D - TCA has been found regularly at both wells and was increasing at T-4 until April 1992. TCA has been decreasing at MW-35D since September 1991. 1,1-DCE is also decreasing at MW-35D. TTCE has not been detected at MW-35D, and only once at T-4.

- MW-36S and MW-36D - Several key parameters, plus dichloromethane (methylene chloride), toluene, xylenes, acetone and MIBK (from EPA 8240 analysis (ASP)) have been detected in relatively high concentrations at the shallow well, while the deep well has shown only occasional low levels of 1,1-DCA, TCA, TTCE, toluene, and c-1,2-DCE. TTCE has been detected at MW-36D at low levels, but consistently since September 1991. As indicated earlier, the upward vertical component of ground water flow between these wells is inhibiting the downward migration of contamination in the area. The level of c-1,2-DCE is one of the highest on site. The overall concentrations of all compounds detected at MW-36S have been relatively stable during recent months with slight increases of 1,1-DCE, 1,1-DCA, and TCA in August 1992.

- MW-37S, MW-37I and MW-37D - All three wells show relatively high concentrations of all key parameters, except TTCE, which is present consistently only in the intermediate well; however, TTCE was recently (August 1992) detected in MW-37S for the first time since December 1990. TCE is detected occasionally at the shallow well, has been decreasing in concentration at the intermediate well, and has been detected for the first time in several months at the deep well. TCA levels have been decreasing recently at the shallow and intermediate wells, and have shown a general decrease since December 1991 in the deep well. 1,1,-DCA and 1,1-DCE concentrations have been relatively consistent at MW-37S and MW-37D, though at much lower levels at MW-37S; both have decreased recently at MW-37I. c-1,2-DCE is detected at all three wells and is highest at MW-37I. Toluene and xylenes have been found only once, at the intermediate well.

- MW-38S and MW-38D - TCA and TTCE are found consistently and at relatively high concentrations at MW-38S. Present at lower levels, though not consistently, at this well are 1,1-DCE, 1,1-DCA, c-1,2-DCE and TCE. The deep well in this cluster is not contaminated. As is the case at MW-36S,D, an upward vertical hydraulic gradient exists near MW-38S,D. Overall, the values are lower near MW-38S,D than near MW-36S,D. The concentrations detected are relatively consistent.

- MW-39S, MW-39I and MW-39D - Low levels of 1,1-DCA and TCA have been consistently detected at the intermediate well; these compounds have been detected occasionally at MW-39D. 1,1,-DCE and TTCE are detected occasionally at both MW-39I and MW-39D; c-1,2-DCE has been observed in low levels occasionally at MW-39I. The shallow well is virtually uncontaminated.

- MW-40S - TCA and toluene have each been detected once at low levels.

- MW-41S - Ethylbenzene and toluene have been detected at low levels during the last three sampling events.

- MW-42S - Several hits of the trihalomethane chloroform have been found. Low levels of 1,1-DCA and toluene are also common.

- MW-43S and MW-43D - Toluene and chloromethane have each been detected once at MW-43S; toluene during July 1991 and chloromethane during April 1992. Low levels of toluene have been detected at MW-43D occasionally, but not since December 1991. None of the key parameters have been found in these wells.

- MW-45S and MW-45D - Benzene, toluene, ethylbenzene, and total xylenes (BTEX) have been detected in both wells, though not in the deep well since June 1991. Levels of these compounds have increased recently in the shallow well. Low levels of 1,2-DCA have been observed occasionally at both wells. Chloroform has been detected at MW-45D during two of the last four sampling events. These wells are under the influences of pumping at K-1, and pumping at two nearby ground water recovery wells installed by the NYSDEC.

- MW-47S, MW-48S, MW-58S and MW-59S - High levels of all key parameters are consistently detected at these wells, which are located in the vicinity of the USTs inside the Container Plant. The highest levels of c-1,2-DCE on site are found at MW-48S, and MW-59S. TCE and TTCE are detected less frequently at MW-59S than at the other wells. The total VOCs have increased significantly at MW-48S, MW-58S and MW-59S.

- MW-52I and MW-52D - Low levels of TCA have been found at both wells, while 1,1-DCA has been detected at the deep well; neither compound has been detected since February 1992.

- MW-54I - 1,1-DCA has been detected consistently but at low levels. Low levels of c-1,2-DCE were detected for the first time in August 1992.

- MW-55D - Moderate concentrations of TCA and low levels of 1,1-DCE, 1,1,-DCA and TTCE are found at this well.

- MW-56D - TCA, 1,1-DCE, 1,1-DCA, TTCE and c-1,2-DCE have been found consistently at this well. The levels are fairly low overall.

- MW-57S and MW-57D - TCA, TTCE and toluene are detected at low levels in the shallow well; toluene and xylenes have been detected occasionally in the deep well.

- MW-60S - Very low levels of some gasoline-type compounds were detected at MW-60S when initially sampled in December 1992 and January 1993. Follow-up samples which were also collected in January from MW-60S showed non-detect levels for the previously detected compounds. No chlorinated hydrocarbons have been detected at the shallow, intermediate or deep well in the MW-60 cluster since their installation in December 1992.

- RW-1 - TCA is the predominant compound detected at this recovery well. It was not found consistently until November 1989. After that date, the concentration of TCA followed an upward trend. The largest jump in the contaminant's concentration occurred after July 1991. The rise in TCA at the recovery well is due to increased contaminant levels on the north (and northeast) side of RW-1, in the vicinity of MW-8I and MW-8D.

- RW-2 - The level of TCA, which is the predominant compound detected, has remained fairly consistent over time. Concentrations of c-1,2-DCE and TTCE have increased slightly since February and June 1992, respectively.

- RW-3 - Several compounds are detected at this recovery well. The highest is TCA, followed by TTCE. Contaminant concentrations are generally higher at RW-3 than at the other recovery wells.

- K-2, M-2 and K-1 - The levels of TCA have increased in K-2 and M-2 since Spring 1990. Although TTCE concentrations are much lower compared to TCA, this compound has been detected in K-2 and M-2 consistently since Spring 1990 and has shown sporadic increases over time. 1,1,-DCA and 1,1-DCE have been detected at low levels but with increasing regularity at both K-2 and M-2. Very low levels of TCA have been detected occasionally at K-1 throughout 1991 and 1992. TCE, which is not present in K-2 or M-2, has been detected fairly regularly at low levels in K-1 since January 1992. Gasoline-type compounds (BTEX) have also been detected in K-1 since June 1992.

Several VOCs, including TCA, TTCE, 1,1-DCE and 1,1-DCA, are detected in relatively high concentrations in four shallow monitoring wells in the spill containment tank area (MW-1S, MW-2S, MW-3S and MW-6S), in two of the shallow monitoring wells installed along the southern edge of the Container Plant (MW-36S and MW-37S), in the four monitoring wells in the UST area below the Container Plant (MW-47S, MW-48S, MW-58S and MW-59S) and in shallow monitoring well MW-38S which is located in the area north of the Container Plant's northern parking area. The presence of these contaminants at relatively high levels in the shallow zone in these areas supports the soil gas data and is proof of a source of contamination in these areas. Shallow ground water contamination detected at MW-21S, MW-33S, T-1, T-2, T-3 and T-4 in the absence of significant upward vertical hydraulic gradient, suggests a separate source in this area. The lack of ground water contamination in upgradient monitoring wells supports this theory.

There are additional compounds present in the shallow zone in the former northern drum storage area (north of the northern parking area), below the Container Plant and in the former southern drum storage area (south of the Container Plant) which are not generally found in the shallow zone ground water or are found at much lower levels near the former spill containment tank. These include cis-1,2-dichloroethylene (c-1,2-DCE), 4-methyl-2-pentanone and dichloromethane (DCM). DCM is also known as methylene chloride and the 4-methyl-2-pentanone is also known as methyl isobutyl ketone (MIBK). Also present in the southern source area shallow zone ground water are acetone, toluene and xylenes.

As noted earlier, contamination in the shallow zone is generally absent across the middle section of the site, but reappears in the vicinity of MW-21S and T-1, T-2, T-3 and T-4 on the Taylor property. Shallow contamination can also be found northwest and east-northeast of K-1. The contamination found at MW-45S (northwest of K-1) is predominantly gasoline-type BTEX (benzene, toluene, ethyl-benzene, xylenes) compounds. The NYSDEC has installed a ground water recovery and treatment system in the vicinity of MW-45S, and is investigating the source of this contamination. This BTEX contamination cannot be attributed to Miller. The shallow contamination found east-northeast of K-1, at MW-57S, is mostly TCA and TTCE. The source of this contamination is unknown and also doesn't appear to be attributed to Miller based on ground water flow patterns and the identity and occurrence of the contamination.

Ground water contamination in the deep zone is more wide-spread relative to the shallow zone in the area downgradient of the former spill containment tank area. In the former spill containment tank area the level of ground water contamination is of higher magnitude in the deep zone than in the shallow zone. However, in the former northern drum storage area (at MW-38D) there is virtually no deep contamination. Contamination emanating from the MW-38S area apparently merges with the deep zone contamination from the spill containment tank area in the vicinity of MW-4D and MW-16D. The lack of chlorinated hydrocarbon contamination in wells located between MW-38S and K-1, including the MW-60 well cluster installed during December 1992, indicates that there is not a ground water contaminant plume moving from the MW-38S area towards K-1. In the former southern drum storage area, there is also virtually no contamination at MW-36D while there is substantial contamination at MW-36S. However, the deep zone contamination is of higher magnitude at MW-37D than at MW-37S. The contamination at the intermediate well between MW-37S and MW-37D (MW-37I) is of even higher magnitude than that present at MW-37D.

Upward hydraulic gradients exist in the vicinity of MW-36S,D and MW-38S,D, but a downward component of flow is exhibited near MW-37S,D. Therefore, the presence or absence of ground water contamination at a well in these source areas is primarily a function of the flow regime within the aquifer.

Figures 4-18 and 4-19 illustrate the occurrence of total volatile organic compounds (VOCs) in the shallow and deep zones across the site. Data for these maps were collected during December 1991 and January 1992 and initially presented in the Draft RI Report (April 1992). The analytical data available from these sampling events were selected for mapping since all monitoring wells were sampled on these dates. Nearly all monitoring wells were sampled again in April and August 1992; however, the pattern of total VOC occurrence has not changed significantly. General trends in VOC concentrations through August 1992 data are discussed within this section.

The values shown at the wells in Figures 4-18 and 4-19 represent the total VOCs detected at a well on the date of sampling. Red values represent deep well values, blue represent shallow, and intermediate well values are shown in black. The shallow well values have been contoured in blue and the deep wells were contoured in red. The intermediate well values were not contoured because of the separation between data collection points.

The highest values of total VOCs in the shallow zone occur below the Container Plant in the UST area wells, followed by the wells in the vicinity of the former spill containment tank and the former northern drum storage area. Total VOC concentrations have increased significantly at MW-48S, MW-58S and MW-59S, three of the shallow zone wells below the Container Plant. The highest total VOC values in the deep zone occur downgradient of the former spill containment tank and the former northern drum storage area. The contamination present at MW-4D, MW-16D, and potentially MW-3D appears to be due to a combination of the source in these two areas.

Significant, high levels of total VOCs in the intermediate zone were detected at MW-8I, MW-6I, and MW-37I. Total VOCs at MW-37I have been steadily decreasing in concentration during 1992. The other intermediate wells were virtually not contaminated and this is also significant since the lack of VOCs can be used to rule out migration of contaminants in this zone in key locations at the site, particularly when coupled with the lack of shallow and deep zone contamination at these cluster locations. For example, clusters

MW-49S,I,D, MW-50S,I,D and MW-60S,I,D are not contaminated with chlorinated hydrocarbons. These wells were installed to monitor for potential contaminant migration to K-1 from the former northern drum storage area and the former spill contaminant tank area.

MW-52S,I,D, MW-53S,I,D and MW-54S,I,D were installed in an attempt to delineate the extent of contamination emanating from the former southern drum storage area and to test the theory of a southern source of contamination being responsible for the contamination detected on and near the Taylor property. These well clusters are also useful in delineating the extent of VOC contamination emanating from beneath the Container Plant. The installation of these wells has served their intended function. There is virtually no contamination at the MW-53S,I,D well cluster. Very low levels of TCA have been detected at MW-52I and MW-52D, and very low levels of 1,1-DCA have been detected at MW-52D; however, neither of these compounds have been detected at this well cluster since January 1992. Low levels of 1,1-DCA have been detected consistently at MW-54I. Although the concentrations have been above ground water standards, they are very low compared to those detected at MW-37I and other wells in the former southern drum storage area. According to the analytical results from these clusters, the southern drum storage and UST VOC contamination can be delineated and there appears to be no southern migration route to the wells near and on the Taylor property.

The contamination detected at MW-8I is under the influence of RW-1. The wells located north and northeast of MW-8S,I,D (MW-9S,D; MW-60S,I,D; and MW-51I,D) can be used to delineate the outer edge of contamination in the MW-8S,I,D area, and as an indication that contamination is not flowing across the site north of MW-51I,D since none of these wells are contaminated with chlorinated hydrocarbons.

Low level VOC contamination has been detected at MW-56D. The levels at this well correlated well with the concentrations detected at MW-13D according to December 1991 and January 1992 sample results; however, levels at MW-56D were higher than at MW-13D during both April and August 1992 sampling events.

Contamination in the shallow and deep wells in the vicinity of the Taylor property extends into the cone of influence of municipal wells M-2 and K-2. The lower level contamination at MW-13D and MW-25S,D joins the plume of contamination from the vicinity of the Taylor property and east of the Taylor property in the area west of MW-25S,D.

The two distinct plumes of shallow contamination shown during January 1992 (Figure 4-19) near MW-21S and on the Taylor property are the result of the lack of contamination at T-2. Contamination detected at T-2 during December 1991 allowed one plume of contamination to be contoured. Analytical results from the April 1992 sampling showed very low total VOCs at T-2, suggesting the overlap of two shallow plumes centered at MW-21S and at T-1. The "T-" wells were not sampled during the August 1992 sampling event.

Low levels of VOCs have also been detected in the ground water near the sanitary sewer at MW-18S, MW-40S and MW-41S.

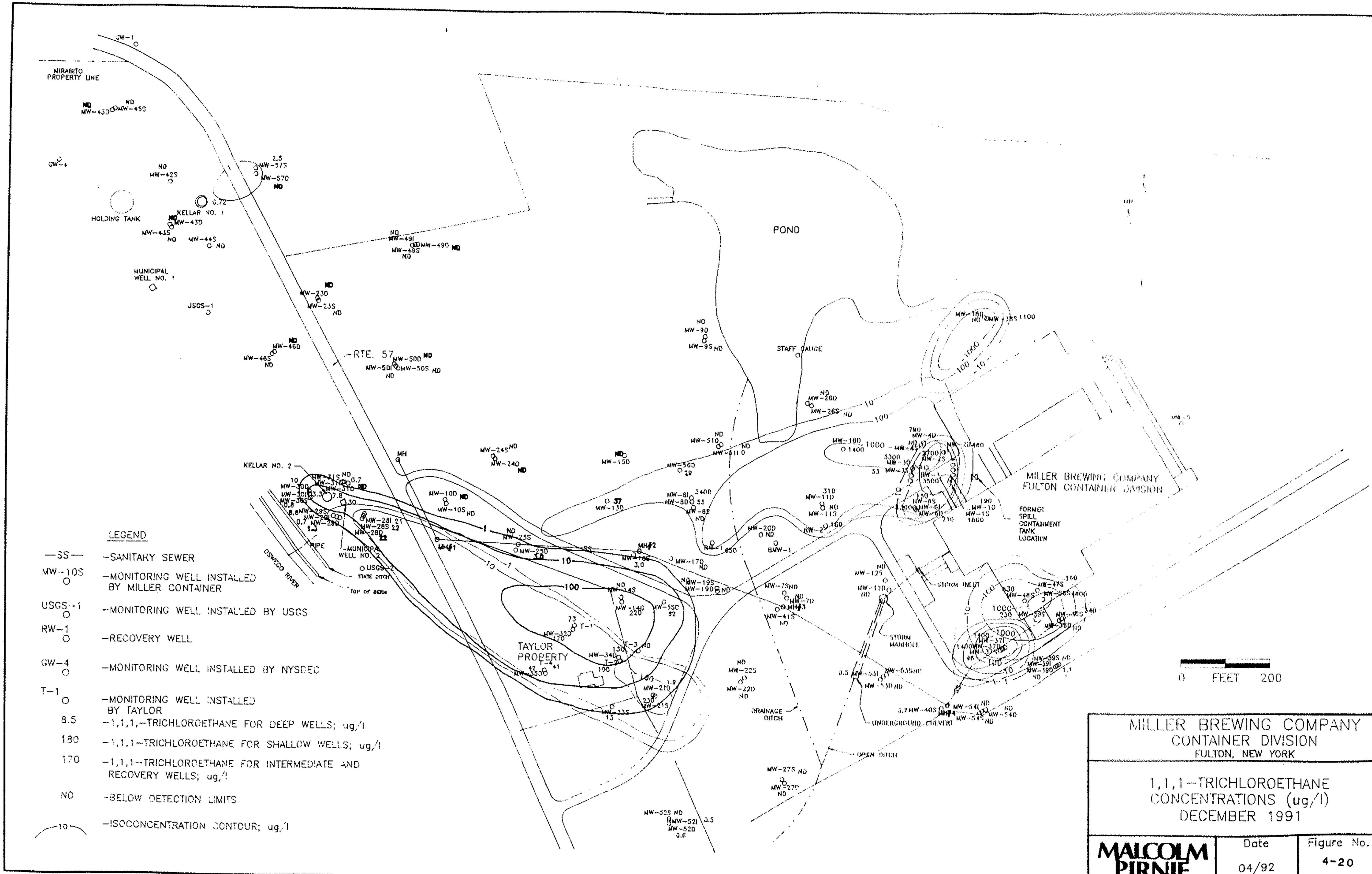
The graphs of contaminant concentration versus time (Appendix S) show that there is some seasonal fluctuation in contaminant levels at several wells on site and at the municipal wells. The increased precipitation and reduced evapotranspiration during the late fall, early winter and spring months probably account for the higher contaminant levels in the spring.

A review of the ground water data from the semivolatile analyses according to EPA Method 8270, reveals that no semivolatile compounds on the 8270 list were detected at any of the wells sampled. The library search tentatively identified the presence of three unknown alkylbenzene compounds at MW-6D and one unknown at MW-34D. The results are included in Appendix G.

Maps of individual VOCs, including TCA, TTCE and TCE, for the shallow and deep zone in December 1991 and January 1992 were also prepared for the Draft RI Report (April 1992) and are included in this report. TCA is the predominant contaminant on site and this is illustrated by the similarity between the maps of this compound (Figures 4-20 and 4-21) and the maps of total VOCs.

TTCE, although one of the more commonly detected compounds, is detected less ubiquitously than TCA (Figures 4-22 and 4-23).

The maps of TCE (Figures 4-24 and 4-25) have been prepared to illustrate the separation between the occurrence of this compound on the Miller site and the occurrence of TCE at K-1. Results from April and August 1992 sampling are similar to those depicted on Figures 4-24 and 4-25, except for the detection of TCE at MW-37D (August 1992) after several months of non-detectable levels. TCE is the most commonly detected compound at K-1; however, there is no migration pathway for this parameter from the source areas near the Plant or near the Taylor property to K-1. A potential migration pathway may have existed in the pipeline connecting M-2 to K-1 which was discovered in June 1992; however,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MUNICIPAL WELL NO. 1
RTE. 57
POND
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KELLAR NO. 2
OSWEGO RIVER
MUNICIPAL WELL NO. 2
STATE DITCH
TOP OF BERM
TAYLOR PROPERTY
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
FORMER SPILL CONTAINMENT TANK LOCATION
STORM INLET
STORM MANHOLE
DRAINAGE DITCH
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OPEN DITCH
0 FEET 200
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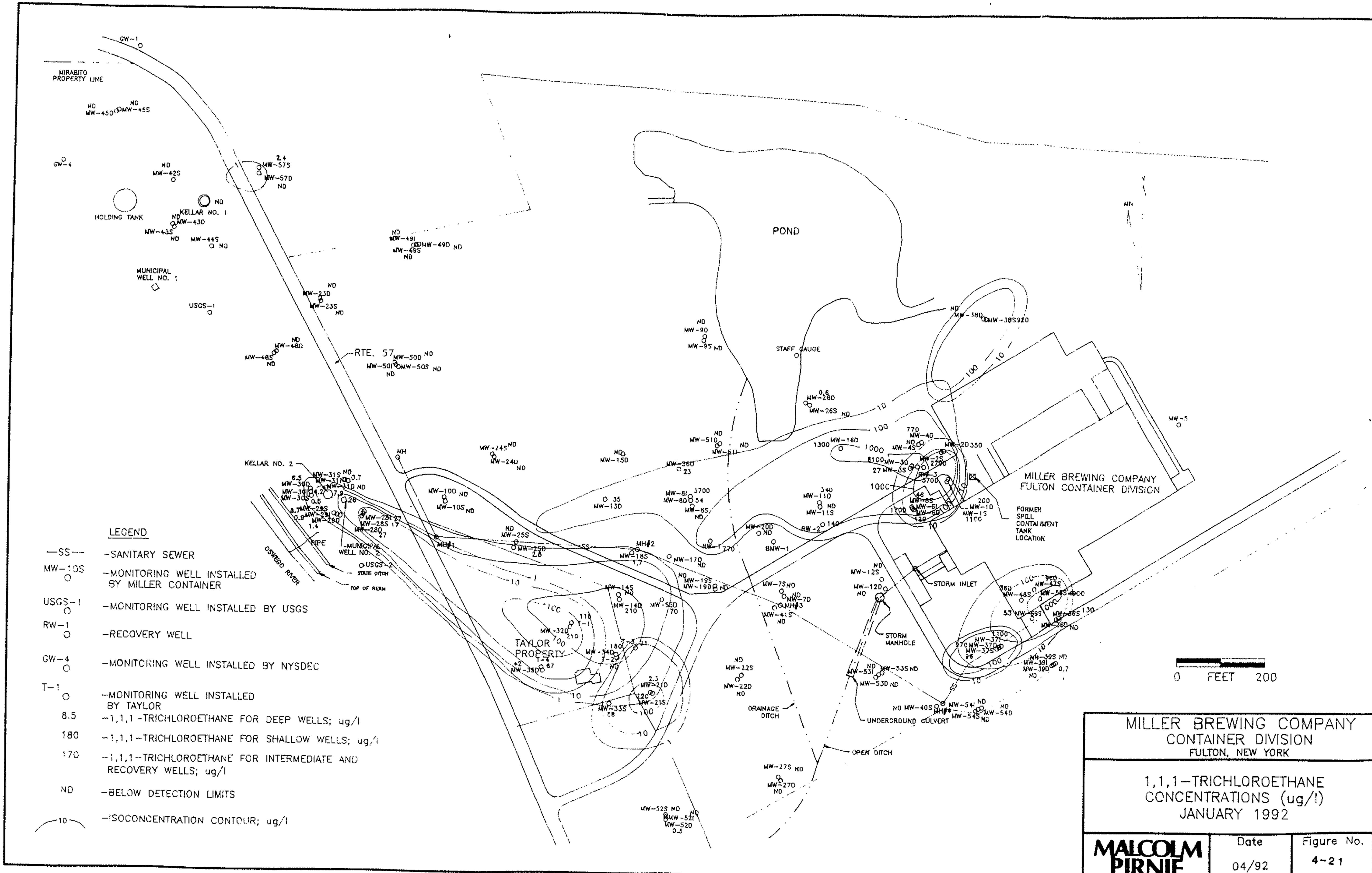
MW-10S -MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 -MONITORING WELL INSTALLED BY USGS
RW-1 -RECOVERY WELL
GW-4 -MONITORING WELL INSTALLED BY NYSDEC
T-1 -MONITORING WELL INSTALLED BY TAYLOR
8.5 -1,1,1,-TRICHLOROETHANE FOR DEEP WELLS; ug/l
180 -1,1,1-TRICHLOROETHANE FOR SHALLOW WELLS; ug/l
170 -1,1,1-TRICHLOROETHANE FOR INTERMEDIATE AND RECOVERY WELLS; ug/l
ND -BELOW DETECTION LIMITS
10 -ISOCONCENTRATION CONTOUR; ug/l
MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
1,1,1-TRICHLOROETHANE CONCENTRATIONS (ug/l) DECEMBER 1991
MALCOLM PIRNIE
Date 04/92
Figure No. 4-20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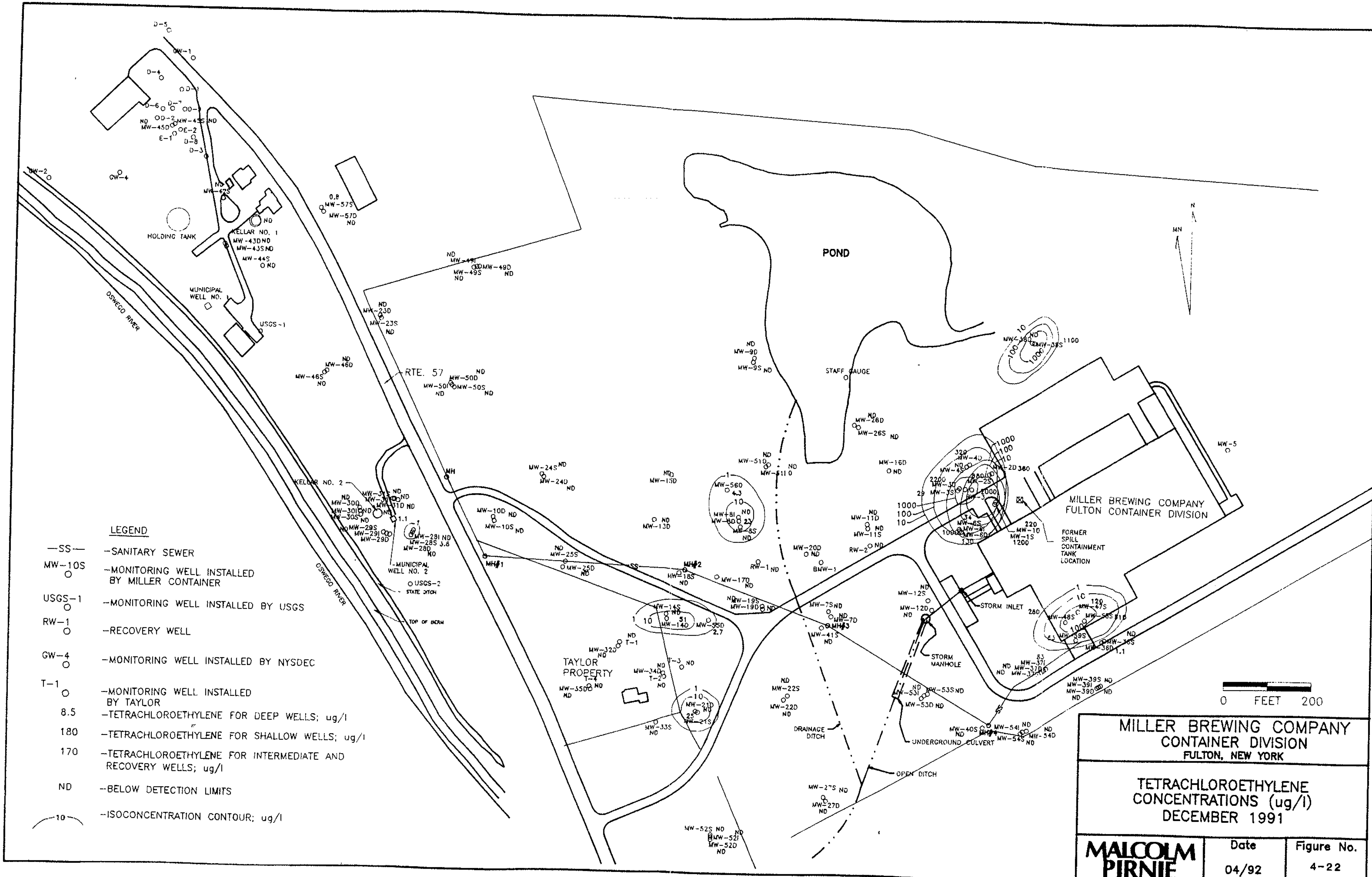
MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
1,1,1-TRICHLOROETHANE CONCENTRATIONS (ug/l) JANUARY 1992
MALCOLM PIRNIE
Date 04/92
Figure No. 4-21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RW—1 —RECOVERY WELL
GW—4 —MONITORING WELL INSTALLED BY NYSDEC
T—1 —MONITORING WELL INSTALLED BY TAYLOR
8.5 —TETRACHLOROETHYLENE FOR DEEP WELLS; ug/l
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ND —BELOW DETECTION LIMITS
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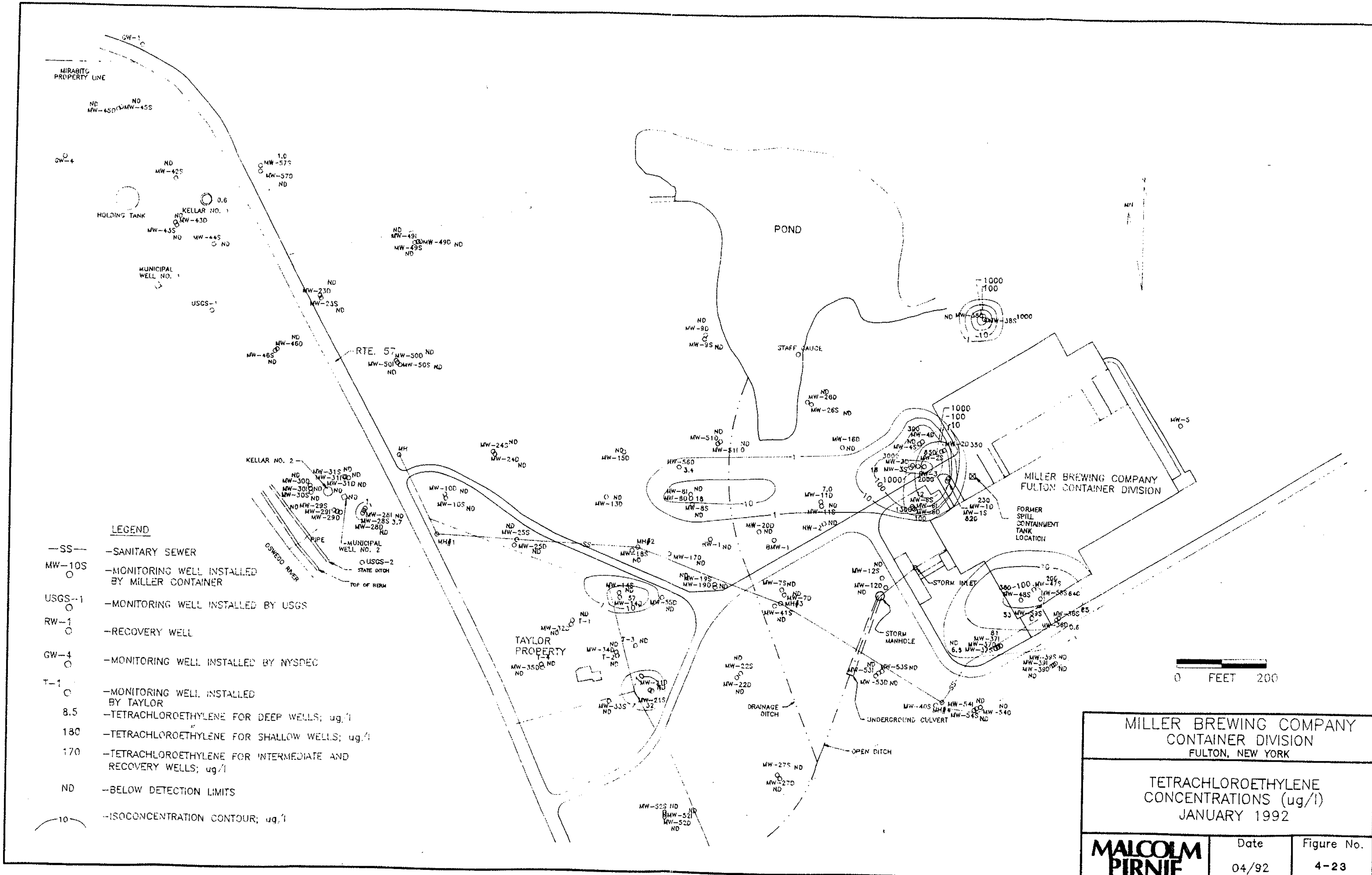
0 FEET 200
MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
TETRACHLOROETHYLENE CONCENTRATIONS (ug/l)
DECEMBER 1991
MALCOLM PIRNIE
Date
04/92
Figure No.
4-22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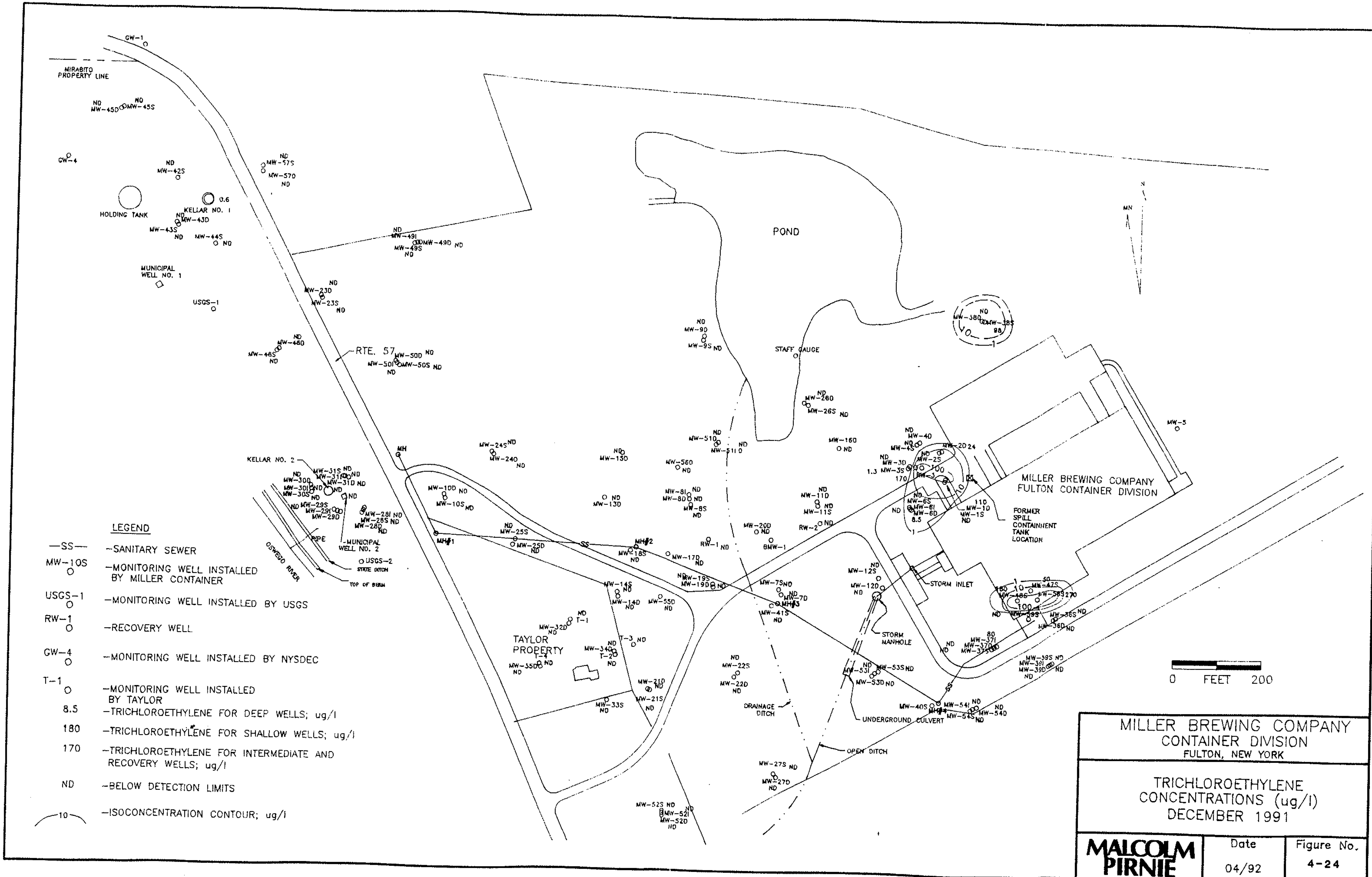
CONTAINER DIVISION
FULTON, NEW YORK
TETRACHLOROETHYLENE CONCENTRATIONS (ug/l)
JANUARY 1992
MALCOLM PIRNIE
Date 04/92
Figure No. 4-23



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MILLER BREWING COMPANY
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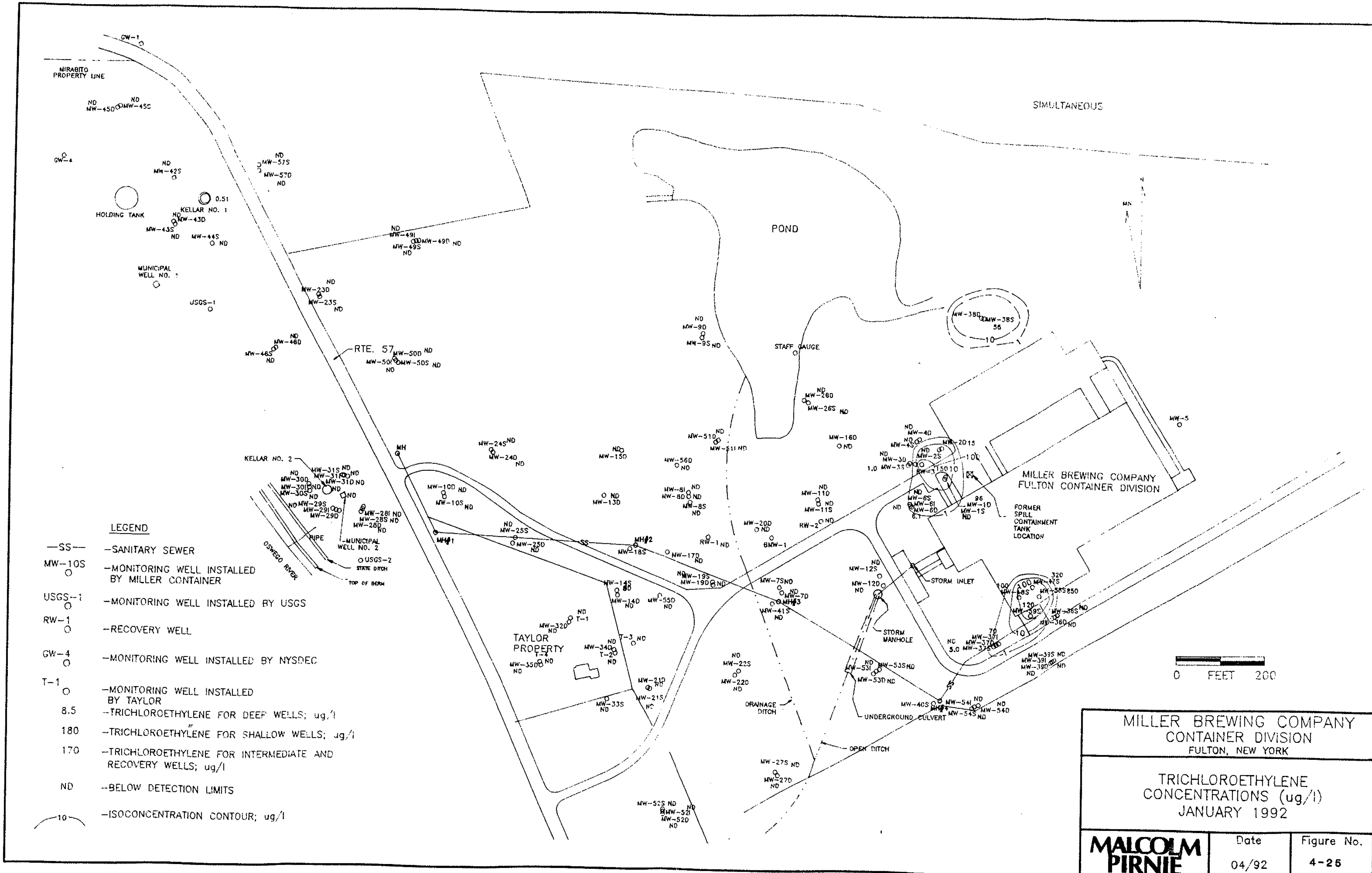
TRICHLOROETHYLENE CONCENTRATIONS (ug/l) DECEMBER 1991
MALCOLM PIRNIE
Date 04/92
Figure No. 4-24



MIRABITO PROPERTY LINE
GW-1
GW-4
HOLDING TANK
KELLAR NO. 1
0.51
MUNICIPAL WELL NO. 1
USGS-1
RTE. 57
SIMULTANEOUS
POND
STAFF GAUGE
MH
KELLAR NO. 2
MUNICIPAL WELL NO. 2
USGS-2
STATE DITCH
TOP OF BERM
OSWEGO RIVER
PIPE
TAYLOR PROPERTY
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
FORMER SPILL CONTAINMENT TANK LOCATION
STORM INLET
STORM MANHOLE
UNDERGROUND CULVERT
DRAINAGE DITCH
OPEN DITCH
0 FEET 200
LEGEND
—SS— –SANITARY SEWER
MW-10S –MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 –MONITORING WELL INSTALLED BY USGS
RW-1 –RECOVERY WELL
GW-4 –MONITORING WELL INSTALLED BY NYSDEC
T-1 –MONITORING WELL INSTALLED BY TAYLOR
8.5 –TRICHLOROETHYLENE FOR DEEP WELLS; ug/l
180 –TRICHLOROETHYLENE FOR SHALLOW WELLS; ug/l
170 –TRICHLOROETHYLENE FOR INTERMEDIATE AND RECOVERY WELLS; ug/l
ND –BELOW DETECTION LIMITS
–10– –ISOCONCENTRATION CONTOUR; ug/l
MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
TRICHLOROETHYLENE CONCENTRATIONS (ug/l) JANUARY 1992
MALCOLM PIRNIE
Date 04/92
Figure No. 4-25

the City of Fulton has since plugged this line. Although TCA was detected in the leakage from the line originating at M-2, TCE was not and low levels of TCA were detected at K-1 again in October and November 1992, after the line was reportedly plugged. Therefore, based on the available data, the TCA and TCE contamination detected at K-1 cannot be attributed to source areas on the Miller site.

4.6 ADDITIONAL RI SAMPLING AND ANALYSES

The sludge sample collected from the main septic tank on the Taylor property was analyzed for the compounds on the EPA Method 8240 list. 150 ug/kg of toluene was detected in this sample.

Effluent samples collected from the Miller air stripping tower continue to be free of contamination.

Since there are no compounds in the tower effluent, there is no impact on the City of Fulton WWTP due to the operation of the air stripper.

Samples collected from the State Ditch in a location west of M-2/K-2 and west of K-1 were analyzed for the compounds on the EPA Method 8010/8020 list. Acetone and methylene chloride were detected in both samples. The methylene chloride was also detected in the trip blank sample; neither was detected in the laboratory's method blank. Since these compounds are both common laboratory-introduced contaminants, additional sampling and analyses would be necessary to confirm their presence in the State Ditch.

Soil samples were collected during the drilling of two borings (VB-1 and VB-2) in the former northern drum storage area, and two borings (VB-3 and VB-4) in the former spill containment tank area. The boring locations are shown on Figure 2-1. Samples were submitted for analysis according to EPA Method 8240. A surface soil sample and a deeper (8-10 feet below land surface) sample from VB-1 were both non-detect for all parameters, with the exception of 17 μg/l of acetone detected in the deeper sample. Acetone is a common laboratory contaminant, and although it was not present in the method blank, its presence in the soil sample is inconclusive. Analytical results of soil collected from 0-4 feet below land surface at VB-2, located near MW-38S,D, indicated 7 μg/l of TTCE.

Results of samples collected in the vicinity of the former spill containment tank area, at about 18 feet below land surface, indicated 170 μg/l of TTCE at VB-3, and 7 μg/l of

TTCE at VB-4. The sample from VB-3 also contained 50 $\mu g/l$ of TCA and 380 $\mu g/l$ of 1,2-DCE.

A soil sample was also collected when the borehole for the vapor extraction wells VE-01/02 was being drilled in the former southern drum storage area, near MW-36S,D. 800 $\mu g/l$ of TTCE and 52 $\mu g/l$ of acetone were detected in this sample.

5.0 CONTAMINANT FATE AND TRANSPORT

5.1 CONTAMINANT MIGRATION ROUTES

There are two basic processes that operate to transport contaminants that are dissolved in ground water. The process by which moving ground water carries dissolved solutes is known as advection. Diffusion is a process by which both ionic and molecular species dissolved in water move from areas of higher concentration to lower concentration. It is possible for solutes to move through a porous medium by diffusion, even if the hydraulic gradient is zero. In low permeability unconsolidated units, the ground water may be moving very slowly, as is the case in many areas at the site. Diffusion will often result in the solute (or plume) being transported faster than the rate at which ground water is flowing.

Other, less important processes that affect the movement of a solute front are dispersion and retardation. Dispersion acts to dilute the solute(s) as the ground water moves through porous media due to the mixing of a contaminated fluid with noncontaminated water. Retardation of solute movement can be caused by chemical and physical processes (e.g., the adsorption of a solute onto the surface of a mineral) resulting in solute movement that is slower than the advection rate.

In terms of retardation, solutes can be classified into two broad groups: conservative and reactive. Conservative solutes do not react with the soil and/or ground water or undergo biological decay. Reactive substances can undergo biological and chemical reactions, such as adsorption-desorption and cation exchange, that will reduce the concentration or mobility of a solute. Synthetic organic chemicals, such as the chlorinated hydrocarbons found at the site, are reactive substances and will be adsorbed by organic carbon present in the soil. The relative tendency for a compound to be adsorbed onto soil organic carbon is a function of the organic carbon content in the soil and the soil-water partition coefficient (K_{oc}) of the compound. The solubility of the compound in water is also very important in determining potential rates of movement. Table 5-1 lists the solubility, K_{oc} and the general mobility class, which is due to the combination of the solubility and the K_{oc}, for the compounds detected in the ground water at the site. The organic carbon content at the site is generally low, but would be greater in clay-rich units.

MILLER CONTAINER

TABLE 5-1
SOLUBILITY, SOIL-WATER PARTITION COEFFICIENT (Koc), AND MOBILITY CLASS FOR SITE GROUND WATER CONTAMINANTS

COMPOUND	SOLUBILITY (PPM)	Koc	MOBILITY CLASS
4-Methyl-2-Pentanone (MIBK)	23,000	20	very high
Dichloromethane	13,200	25	very high
Chloroform	7,840	34	very high
1,2-Dichloroethane	8,450	36	very high
t-1,2-Dichloroethylene	6,300	39	very high
1,1-Dichloroethane	5,100	45	very high
Trichloroethylene	1,100	152	moderate
1,1,1-Trichloroethane	700	155	moderate
1,1-Dichloroethylene	400	217	moderate
Toluene	500	242	moderate
Tetrachloroethylene	200	303	moderate
o-Xylene	170	363	moderate
p-Xylene	156	552	low
m-Xylene	146	588	low

Six contaminated soil areas were identified in Section 4 of this report:

1. The former spill containment tank area.
2. The former northern drum storage area
3. The former southern drum storage area.
4. The area near the USTs below the Plant.
5. An area east of the Taylor/Miller eastern property line.
6. An area near the sanitary sewer manhole MH#1.

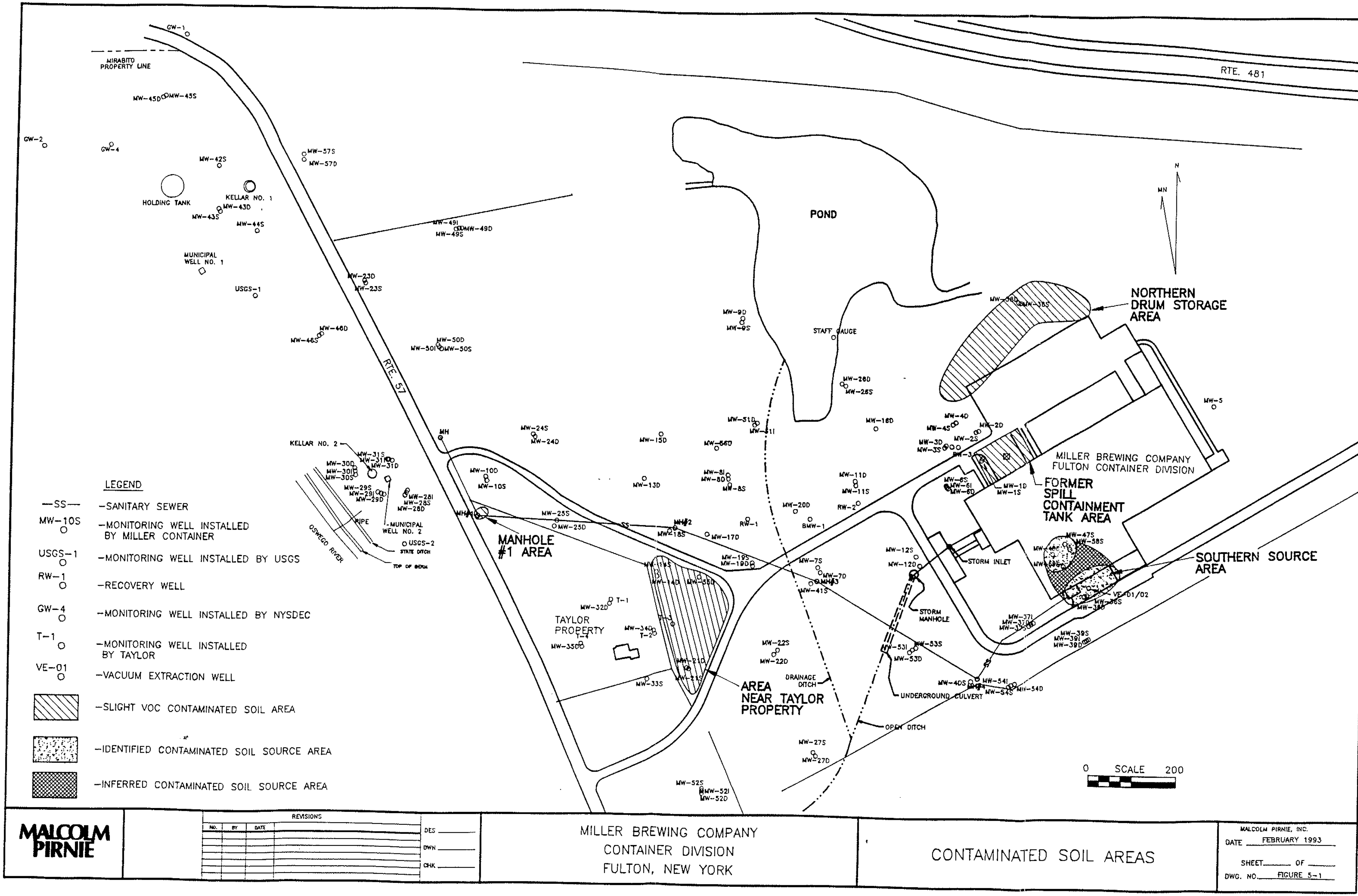
These contaminated soil/soil source areas are shown on Figure 5-1, and are discussed further in Sections 6 and 7.

The occurrence of contamination at a monitoring well downgradient of a source area is primarily the result of the ground water flow patterns (advection); however, as noted above, diffusion can play an important role in contaminant migration rates in relatively low permeability soils. The combined effects of these processes can be estimated by using the Darcian pore factor in place of the effective porosity in the estimation of average linear velocity. Table 5-2 lists the estimates of this rate of movement across the site.

As with the estimates of the average linear velocity, the estimates of the potential rate of movement of a solute front are very low on the south and southeast portions of the site. The relatively low estimates of the solute front average linear velocity in the south and southeast areas of the site indicate that ground water contamination emanating from the south side of the Plant may be moving very slowly. The analytical results of ground water samples collected from wells located in this portion of the site support these data.

The ground water flow patterns at the site are influenced by the withdrawal of ground water at the recovery wells and municipal wells. The deep zone ground water flow direction arrows shown for December 1991 (Figure 3-10) have been superimposed on the map of total VOCs for December 1991 (Figure 4-18) to illustrate the probable contaminant migration routes in this zone (Figure 5-2). The deep zone flow arrows for January 1992 (Figure 3-12) are superimposed on the map of total VOCs for January 1992 (Figure 4-19) as shown on Figure 5-3. As discussed earlier in this report, the total VOC plume patterns and the deep zone flow arrows do not change significantly through the end of 1992.

According to the ground water flow directions at the site, the contamination detected at MW-13D appears to be the result of the migration of contaminated shallow ground water from the former northern drum storage area located north of the Container Plant's northern


RTE. 481
RTE. 57
POND
MIRABITO PROPERTY LINE
HOLDING TANK
KELLAR NO. 1
MUNICIPAL WELL NO. 1
KELLAR NO. 2
MUNICIPAL WELL NO. 2
OSWEGO RIVER
STAFF GAUGE
NORTHERN DRUM STORAGE AREA
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
FORMER SPILL CONTAINMENT TANK AREA
SOUTHERN SOURCE AREA
STORM INLET
STORM MANHOLE
MANHOLE #1 AREA
TAYLOR PROPERTY
AREA NEAR TAYLOR PROPERTY
DRAINAGE DITCH
UNDERGROUND CULVERT
OPEN DITCH
0 SCALE 200
LEGEND
—SS— -SANITARY SEWER
MW-10S -MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 -MONITORING WELL INSTALLED BY USGS
RW-1 -RECOVERY WELL
GW-4 -MONITORING WELL INSTALLED BY NYSDEC
T-1 -MONITORING WELL INSTALLED BY TAYLOR
VE-01 -VACUUM EXTRACTION WELL
-SLIGHT VOC CONTAMINATED SOIL AREA
-IDENTIFIED CONTAMINATED SOIL SOURCE AREA
-INFERRED CONTAMINATED SOIL SOURCE AREA
MALCOLM PIRNIE
REVISIONS
NO. BY DATE
DES
DWN
CHK
MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
CONTAMINATED SOIL AREAS
MALCOLM PIRNIE, INC.
DATE FEBRUARY 1993
SHEET OF
DWG. NO. FIGURE 5-1

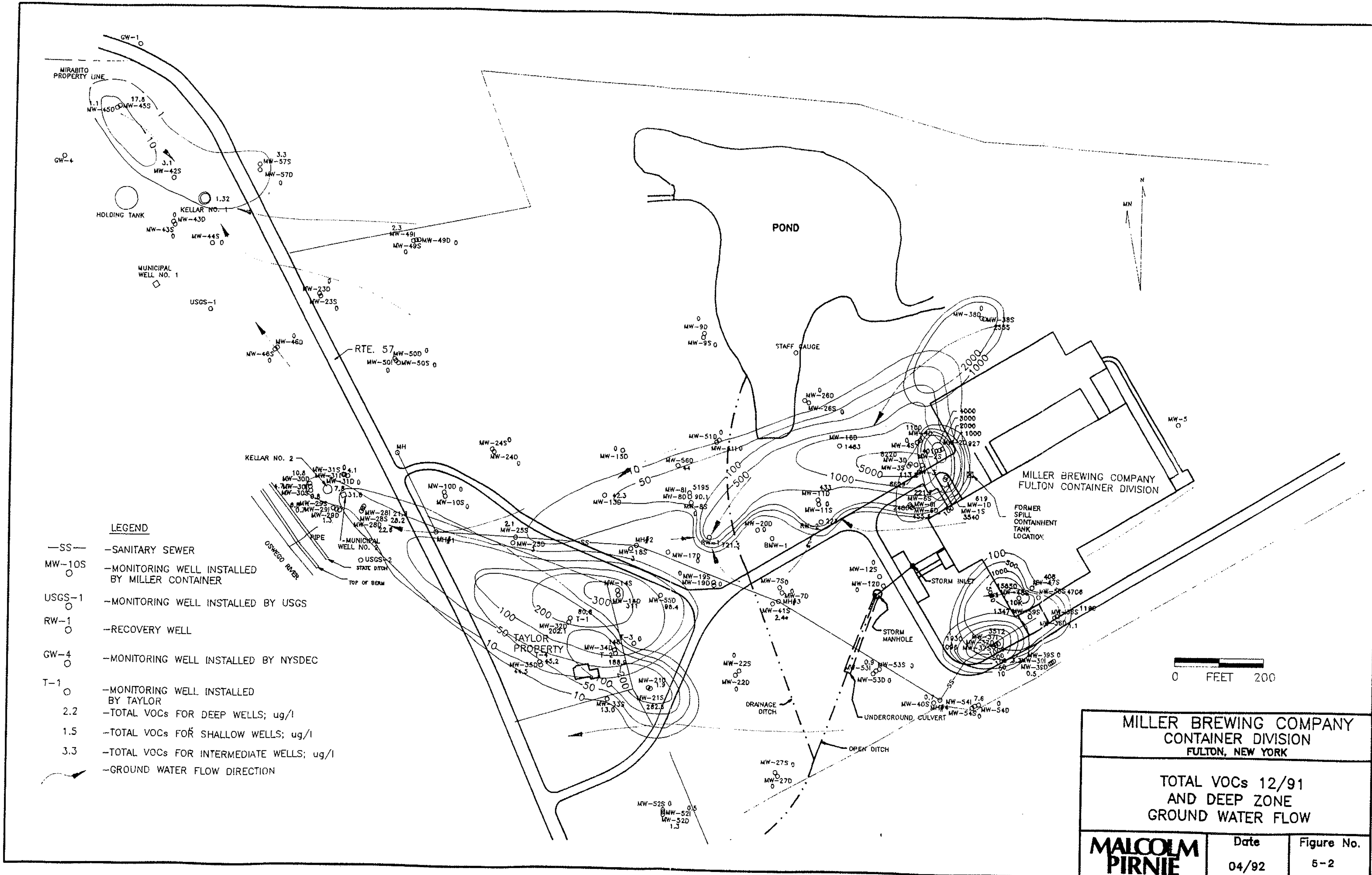
MILLER CONTAINER

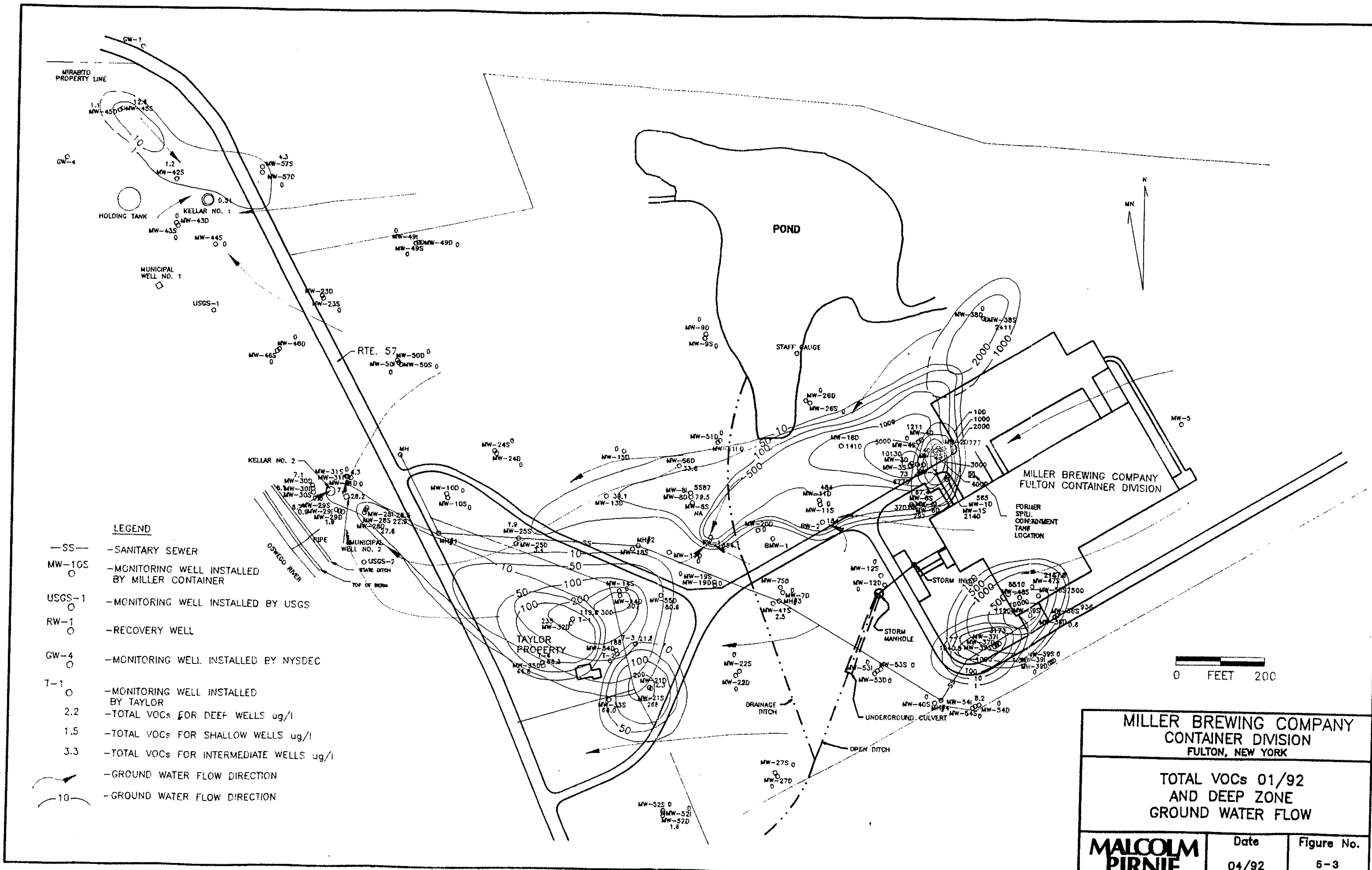
TABLE 5-2

SOLUTE FRONT AVERAGE LINEAR VELOCITY ESTIMATES

Flow Path	Horizontal Hydraulic Gradient		Average Horizontal Hydraulic Conductivity (cm/sec)	Darcian Pore Factor	Effective Darcian Porosity	Solute Front Average Linear Velocity (feet/year)		
	January 1992	January 1993				January 1992	January 1993	Average
MW-13D to MW-25D	0.0030	0.0030	1.0E-02	0.975	0.215	143	183	163
MW-14D to MW-32D	0.0026	0.0026	4.5E-03	0.960	0.211	57	71	64
MW-34D to MW-35D	0.0061	0.0061	2.6E-02 **	0.982	0.216	755	1134	945
MW-36D to MW-37D	0.0048	0.0048	3.0E-05	0.825	0.182	1	1	1
MW-37D to MW-53D	0.0026	0.0026	3.5E-05	0.835	0.184	1	1	1
MW-54D to MW-27D	0.0046	0.0046	3.8E-05	0.837	0.184	1	1	1
MW-55D to MW-32D	0.0024	0.0024	4.5E-03	0.960	0.211	53	68	61
MW-56D to MW-13D	0.0167	0.0167	3.6E-04	0.921	0.203	31	38	35

** = Based on an assumed horizontal hydraulic conductivity value of 5E-02 cm/sec (the highest Kh value measured at the site) at one or both of the wells.


MIRABITO PROPERTY LINE
HOLDING TANK
KELLAR NO. 1
MUNICIPAL WELL NO. 1
USGS-1
RTE. 57
POND
STAFF GAUGE
KELLAR NO. 2
OSWEGO RIVER
PIPE
MUNICIPAL WELL NO. 2
STATE DITCH
TOP OF BERM
TAYLOR PROPERTY
STORM INLET
STORM MANHOLE
DRAINAGE DITCH
UNDERGROUND CULVERT
OPEN DITCH
MILLER BREWING COMPANY FULTON CONTAINER DIVISION
FORMER SPILL CONTAINMENT TANK LOCATION
0 FEET 200
LEGEND
—SS— –SANITARY SEWER
MW-10S –MONITORING WELL INSTALLED BY MILLER CONTAINER
USGS-1 –MONITORING WELL INSTALLED BY USGS
RW-1 –RECOVERY WELL
GW-4 –MONITORING WELL INSTALLED BY NYSDEC
T-1 –MONITORING WELL INSTALLED BY TAYLOR
2.2 –TOTAL VOCs FOR DEEP WELLS; ug/l
1.5 –TOTAL VOCs FOR SHALLOW WELLS; ug/l
3.3 –TOTAL VOCs FOR INTERMEDIATE WELLS; ug/l
–GROUND WATER FLOW DIRECTION
MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK
TOTAL VOCs 12/91
AND DEEP ZONE
GROUND WATER FLOW
MALCOLM PIRNIE
Date 04/92
Figure No. 5-2



MILLER BREWING COMPANY
CONTAINER DIVISION
FULTON, NEW YORK

TOTAL VOCs 01/92
AND DEEP ZONE
GROUND WATER FLOW

MALCOLM PIRNIE

Date	Figure No.
04/92	6-3

parking area into the deep zone northeast of MW-16D, then into the area near MW-56D and southwest toward MW-13D. The pumping test conducted at RW-1 in September 1992 indicated that MW-56D is affected by the withdrawal of ground water at RW-1 (see Figure 3-16); however, contaminated ground water in the area of MW-56D appears to be outside the capture zone of RW-1. In addition, ground water contamination moving into the area is also transported by the effects of dispersion and diffusion, which may result in the spread of low-level contamination into the MW-13D area.

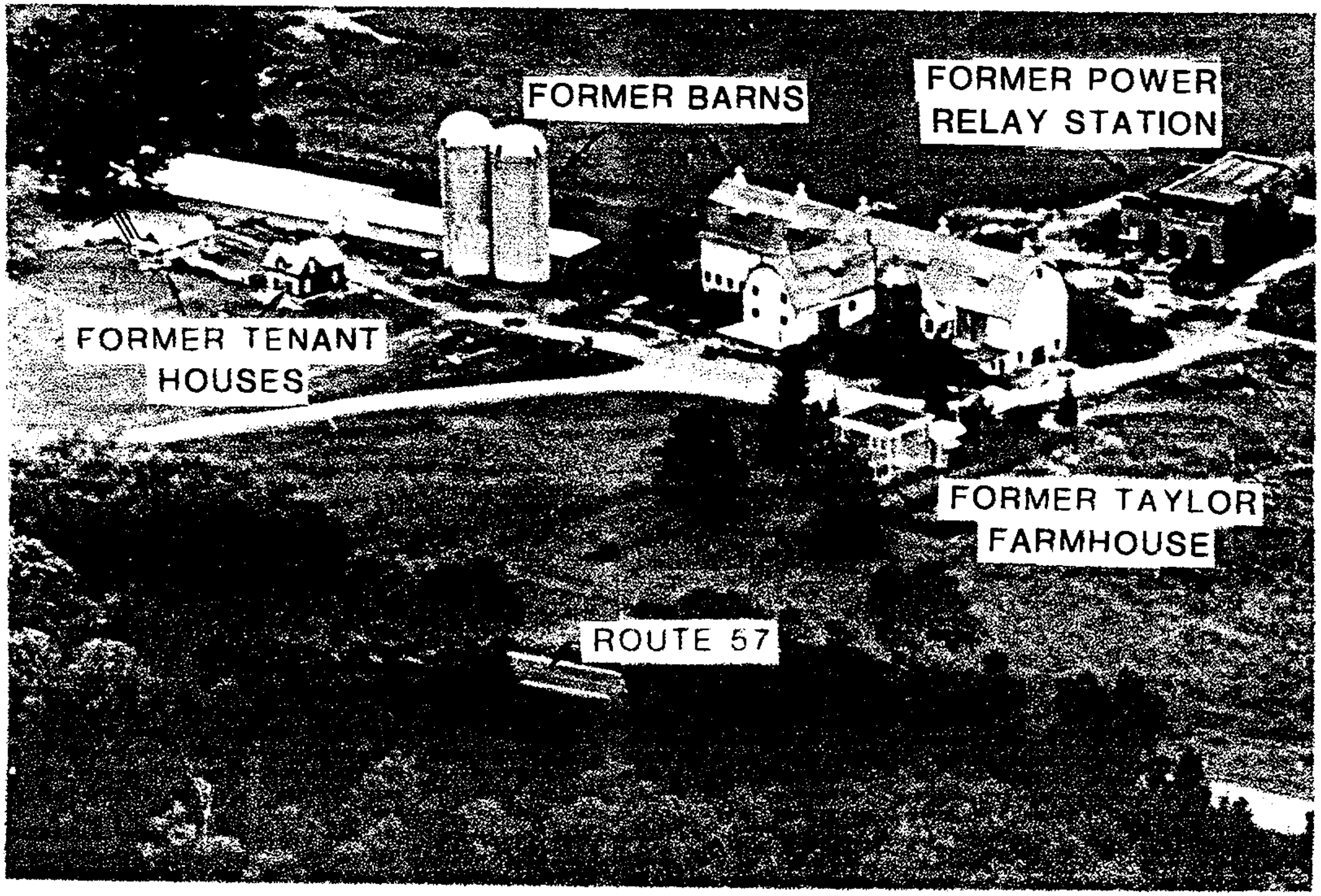
MW-13D is located on the western, downslope side of the ridge of lodgement till. The highest known part of the ridge is located to the southeast of MW-13D (near MW-21D). The part of the ridge east of MW-13D is about 13 feet lower than the highest known elevation and the top of the screened interval in MW-13D extends above the elevation of the ridge in this area. The ridge has been theorized to be a barrier to the movement of contamination in the deep zone from the area north of MW-8D into the MW-13D area. However, based on the occurrence of ground water contamination in the area and the apparent ground water flow patterns in the deep zone, the till ridge does not appear to be preventing the westward migration of contamination.

Total VOC values from January 1992 have been added to the hydrogeologic cross sections shown on Sheet 4 to allow viewing of the occurrence of ground water contamination in profile (Sheet 5). Cross Sections A-A', B-B', E-E', F-F' and G-G' all are drawn from west to east, in a direction that is roughly parallel to the ground water flow at the site. The equipotential lines shown on these cross-sections are representative of the actual flow directions at the site. Cross Section C-C' was not included on Sheet 4 because this section is drawn from south to north in a direction perpendicular to the ground water flow pattern at the site. The equipotential lines shown on this section are only valid around RW-1, where flow is radial. The flow near the MW-27 and MW-22 clusters and the MW-51 and MW-9 clusters is actually to the west, or into the page on this drawing. C-C' has been included on Sheet 5 to illustrate the occurrence of contamination near MW-8I,D, MW-56D and MW-51I,D. MW-8I has relatively high levels of total VOCs, while MW-51I, which is screened at a corresponding elevation is not contaminated. MW-56D appears to be on the outer edge of the contaminant plume in this area. While the contaminants present at MW-8I and MW-8D are captured by RW-1, the effect of the cone of influence from the recovery well, at its present flow rate, does not appear to be significant enough to capture all of the contamination in the vicinity of MW-56D. The 1992 pumping test at RW-1 confirmed that drawdown occurs at MW-56D as a result of pumping RW-1; however, maps of the potentiometric surface in this area would indicate that the contamination just to the north of MW-56D is bypassing RW-1 and flowing into the MW-13D area. The possibility remains that contamination may have been contributed to the MW-13D area from activities conducted during the operation of the Taylor farm. However, the most likely source for the contamination at MW-13D appears to be from the MW-56D area, which in turn originates from the MW-16D and ultimately the MW-38S area. Increasing the flow rate at RW-1 may spread the cone of influence sufficiently to cut off this migration pathway. A proposal to increase the RW-1 flow rate is being evaluated by the NYSDEC.

The source of the contamination at MW-14D, and at MW-21S and the wells on the Taylor property, remains unknown. The occurrence of shallow contamination at MW-21S and in the shallow Taylor wells suggests a nearby source. This concept is further illustrated on the B-B' cross section on Sheet 5. Tracing the flow lines back from MW-21S to the east indicates a potential shallow source area between MW-22S and MW-19S. Miller investigated the Taylor Farmhouse property and the former operations and practices on the Taylor farm prior to Miller acquisition of the property in an attempt to find a source for the shallow contamination. According to the soil gas investigation results, there does not appear to be any current shallow source on the present Taylor property. However, the two underground storage tanks and a large quantity of contaminated soil were removed from the Taylor property by a representative of Mr. Taylor during May 1989. The removal of the soil has reduced the level of shallow contamination in this area. Therefore, the soil gas readings from this area were low.

A list of questions relative to the former buildings and practices on the Taylor farm was generated during February 1991 in order to better evaluate the operations/practices on the former Taylor farm. The questions are included in Appendix T and a photograph of the former Taylor farm is shown on Figure 5-4. The list of questions was sent to Mr. Taylor, but no relevant information was obtained. The Taylor farmhouse shown on Figure 5-4 was destroyed by fire during the early part of 1991.

The contamination in the deep zone in the vicinity of MW-14D and MW-32D, according to the interpretation shown on Figures 5-2 and 5-3, merges with the contamination detected near MW-13D and MW-25D and is then drawn toward K-2 and M-2. The municipal aquifer pumping test, performed during August 1992, indicated that operation of the municipal wells K-2 and M-2 at typical flow rates (and in conjunction with the normal



FORMER TAYLOR FARM

FIGURE 5-4

operation of K-1) does not result in drawdown at wells MW-13D, MW-25D, MW-14D or any of the wells on the Taylor property. Drawdown was observed at well MW-10D and was roughly twice that observed at the shallow well in the cluster. Although shallow and deep zone ground water emanating from the Miller and Taylor properties has been shown to be moving west toward the municipal water wells, the percentage of naturally upgradient water received by the pumping wells is limited by the abundance of water supplied by the Oswego River. The River is hydraulically connected to the permeable aquifer deposits and serves as a recharge boundary. The River replaces flow which would normally be received from outside the boundary, and limits the removal of water from storage. A flow net was constructed from water table data collected just prior to the pumping test and was presented in the Municipal Aquifer Pumping Test Report (November 1992). Based on the construction of this flow net, it was estimated that K-2 and M-2 receive nearly three-quarters (74 percent) of their shallow supply from the River; 25 percent of the shallow water received originates from the northeast, east and southeast directions, which include the Miller and Taylor properties.

The source of the sporadic low-level VOC contamination detected in K-1 and in well MW-57S is unknown. Based on ground water flow patterns and the most recent analytical data collected from monitoring well cluster MW-60S,I,D, contamination observed in the shallow ground water zone at the MW-57S,D location does not appear to be the result of a ground water contaminant plume emanating from the MW-38S,D area. Seepage velocities estimated during various phases of the municipal aquifer pumping test indicated that the rate of ground water movement from the K-2/M-2 area toward K-1 is significantly decreased when K-2/M-2 are also operating at typical flow rates. The gasoline-type contamination in the vicinity of MW-45S is not attributable to any Miller source and continues to be under investigation by the NYSDEC.

The source of the contamination in the sewer bedding material near the manhole at the bend near Route 57 (MH#1) is unknown. In light of the soil gas and soil sample results from around this manhole, MPI hypothesized that the contamination detected in this area could be the result of preferential contaminant migration along the sewer bedding and that the source of the contamination could be from the MW-36S area. However, analytical data generated from the soil and ground water samples collected near manholes MH #3 and MH #4, and from the sanitary sewer water, have not indicated a connection between the MW-36S area and the MH #1 area. The contamination in the sewer bedding may be the result of leakage from the manhole itself. The City of Fulton recently filled in an open sleeve around a water line into MH#1; this formerly open sleeve may have allowed sewer water to escape from the manhole.

The extent of contamination emanating from the former southern drum storage area and the UST area on the south side of the Container Plant has been delineated by collecting and analyzing ground water samples from the wells installed during the RI. According to the solute front average linear velocity estimates, the migration rate in this area is very low. Cross Sections B-B' and E-E' illustrate the occurrence of contamination in some of the wells in this area and/or show the lack of contamination in downgradient monitoring wells.

5.2 Assessment of Miller Air Stripping System

The air stripper presently in use on the Miller property was designed to collect contaminated ground water originating from the spill containment tank area, as delineated based on the first and second phases of the hydrogeologic investigation at the site. To date, the stripper tower efficiency has surpassed the original design expectations, since significantly higher influent concentrations than anticipated have been detected while the stripper effluent has been consistently below detection limits. In terms of its intended function, the air stripping system has operated as planned.

The RI data collected to date have verified the presence of three more source areas for ground water contamination. These source areas include the former northern drum storage area, located on the north side of the Container Plant's northern parking area, the former southern drum storage area and the UST area inside the Plant, which are located below or adjacent to the south side of the Container Plant. According to the RI data, the northern source area appears to be the source of contamination detected at MW-13D. The NYSDEC is currently reviewing a request to increase the flow rate at RW-1; the proposed increase is predicted to double the amount of drawdown at RW-1 and produce 90 percent of the well's maximum yield. Increasing the flow rate at RW-1 may spread the cone of influence sufficiently to the north to capture the contamination along this migration pathway.

6.0 BASELINE RISK ASSESSMENT - HUMAN HEALTH EVALUATION

This public health risk assessment evaluates the possible health effects associated with contaminated media from the Miller site. The objectives of this evaluation are to provide an analysis of baseline risks in the absence of any additional actions to control or mitigate site contamination, and to assist in determining the need for additional remedial measures. Risks associated with both present land use and possible future land use were considered.

This section of the RI is broken into five subsections, as listed below:

- Review of sources of contamination
- Exposure assessment
- Review of data for media of concern
- Toxicity assessment
- Qualitative assessment of pathways of concern

The first subsection involves identification of contaminant releases at the Miller site. In the exposure assessment, contaminant releases identified and potential exposure pathways (target receptors, exposure routes, and exposure points) are discussed. In the third subsection, the data for media identified as potential exposure points are evaluated and analytes of concern are identified. In the toxicity assessment, qualitative chemical toxicity data are summarized. The final subsection will qualitatively discuss the risks associated with the potential pathways of concern.

To the extent feasible at this stage of the RI, the approach outlined in the current USEPA risk assessment guidance was followed. The current guidance document, "Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual" (Part A), Interim Final (USEPA, 1989), replaces the "Superfund Public Health Evaluation Manual" (USEPA, 1986).

The information presented in this risk assessment has been developed only to help determine what actions are necessary to reduce risks and not to fully characterize site risks.

6.1 SOURCES OF CONTAMINATION

The studies performed to date indicate that past operations at the Miller site have contaminated soil and ground water in a number of areas. The following source areas have shown elevated levels of contaminants in the soil and ground water:

- Former spill containment tank area
- Former northern drum storage area
- Former southern drum storage area
- Underground storage tank (UST) area near the Plant's WTF

An additional source of contamination was also found on the Taylor property; however, contaminated soil was excavated below the USTs in an effort to remediate the source. A description of past practices and sampling activities performed to date, including analytical results, are presented in previous sections of this report.

6.2 EXPOSURE ASSESSMENT

In the exposure assessment, contaminant releases are analyzed and potential exposure pathways are identified. The subsections that follow discuss the elements of the exposure assessment.

6.2.1 Exposure Pathways

The determination of possible exposure pathways consists of the identification of three items. These are the transport media, the target receptors, and exposure routes. The potential transport/exposure media at the site would include both physical modes and biological modes. Physical modes would include exposure to ground water, surface water, surface soil, and soil gas (air). Biological modes would include actions such as food chain transport. The possible target receptors include: Miller employees (including subcontractors), surrounding residents, trespassers, and Fulton WWTP workers. The potential routes of exposure to contaminants originating or possibly originating from the site fall into three categories: direct contact (dermal absorption), ingestion, and inhalation.

Based on current and possible future land use of surrounding areas, the potential pathways that could reasonably be attributed to the Miller site were determined and are listed on Table 6-1. The items included on the table are exposures that could potentially occur, regardless of the contaminant levels of the transport medium. The subsections that follow discuss several of the potential pathways. The subsections are grouped by potential exposure routes.

With respect to the specific case of municipal well K-1, this well has not been considered as an exposure pathway since all available data indicate that contamination from Miller source areas is not connected to K-1 contamination.

DERMAL CONTACT

Direct contact with contaminants at the site is fairly limited. The only exposure point which may result in direct contact with contaminated material is with surface soil in the former northern drum storage area. Soil samples were collected from two boreholes in this area during the advancement of test borings for the evaluation of the feasibility of vacuum extraction. The location of boreholes VB-1 and VB-2 (shown on Figure 3-1) were selected based on soil gas data. The uppermost sample collected from VB-1 (at a depth of 0-2 feet below land surface) was submitted for analysis. The results showed all analytes on the EPA Method 8240 list as non-detectable. These results are contained in Appendix J. A sample composited from the 0-2 and 2-4 foot intervals at VB-2 was also submitted for analysis. Tracer soil gas data had indicated a relatively higher soil gas level at about 2 feet below land surface; therefore, the composite from around the 2 foot interval was considered to be appropriate. The results from this sample indicated a low level (7 ug/kg) of TTCE. Although these data do not quantitively eliminate the possibility of risk through dermal contact with contaminated soil in the former northern drum storage area, since the samples were collected in an area where soil gas readings were high and there were low or no compounds detected, the data would appear to minimize the risk. A cover (building, concrete or asphalt) was placed over the former southern drum storage area; therefore, the potential for exposure for direct contact with contaminants in this area is unlikely.

Subsurface contamination has been identified in a number of areas at the site in both soil and soil gas samples. The potential exists for dermal contact with contaminants during construction activities in the areas of contamination. Although the potential for exposure exists, no construction activities are planned. If future construction does occur in

TABLE 6-1
POTENTIAL ROUTES OF EXPOSURE

Potentially Exposed Population	Exposure Route, Medium & Exposure Point	Pathway Selected For Evaluation	Reason For Selection or Exclusion
Current Land Use Residents	Ingestion of ground water from wells downgradient of the site.	No	Ground water downgradient from the site is currently undergoing treatment prior to distribution in the municipal supply. The treatment system is designed to remove contaminants to levels below an analytical detection limit of 0.5 ug/l.
	Direct contact of chemicals in ground water while bathing.	No	See above.
	Inhalation of chemicals volatilized from ground water during showering.	No	See above
	Direct contact with surface water (Oswego River).	No	Based on the lack of contaminants detected in the discharge to the River.
	Ingestion of surface water (Oswego River).	No	See above.
	Exposure to humans from consumption of fish.	No	See above.
Current Land Use Trespassers/On-site Workers	Contact with surface water in on-site pond or State ditch	No	Both the pond and the ditch are shallow. No waders have been observed in either area. Samples of pond water were collected on one occasion and data indicated levels below quantification limit for all parameters analyzed.

Potentially Exposed Population	Exposure Route, Medium & Exposure Point	Pathway Selected For Evaluation	Reason For Selection or Exclusion
Current Land Use On-site Workers/Trespassers/Residents	Exposure to air emissions from treatment units (unit on site and unit under construction).	No	NYSDEC air emission permits will address any health risks.
	Direct contact with possible surface soil contamination (former northern drum storage area).	Yes	Since a potential exposure route, medium, and exposure point exist, this pathway was qualitatively evaluated.
	Incidental ingestion of possible surface soil contamination (former northern drum storage area).	Yes	See above.
	Direct contact with possible surface soil contamination (former southern drum storage area).	No	A building, concrete or asphalt pad was constructed over the area eliminating the possibility of direct contact.
	Incidental ingestion of possible surface soil contamination (former southern drum storage area).	No	See above.
	Inhalation of VOCs via soil gas into building.	No	Ambient air data showed no VOCs detected.
Current Land Use Fulton Treatment Plant Workers	Direct contact with contaminants discharged from treated water from on-site air stripper.	No	The levels detected in the effluent (treated water) from the air stripper are well below the established permit limits. The effluent flow is also an extremely small contribution to the sewer system.

Potentially Exposed Population	Exposure Route, Medium & Exposure Point	Pathway Selected For Evaluation	Reason For Selection or Exclusion
Future Land Use Residents/Industrial Workers	Ingestion of ground water from wells downgradient of site.	No	As discussed previously, ground water is currently undergoing treatment. Since the City of Fulton owns the property downgradient from the site, control of future land use should easily be accomplished.
	Inhalation of contaminants volatilized from ground water during showering, or from process water used for future industry.	No	See above
	Direct contact with contaminants in ground water while bathing or from process water used for future industry.	No	See above
Future Land Use Miller Employees/Subcontractors	Contact with contaminated subsurface soil during future construction activities.	No	Although the potential does exist, no construction activities are presently planned. If future construction does occur, a site specific health and safety plan would be developed to protect all workers from potential exposure. Since Miller owns the property, land use restrictions would be easy to enforce.

the affected areas, a site-specific health and safety plan would be developed to protect all workers from potential exposure. Since Miller owns the property, future use of the land can easily be controlled by in-house management. Therefore, the risks associated with future use of the land are alleviated. It should be noted that remediation (e.g., vacuum extraction) may be implemented in the source areas in the former northern and southern drum storage areas and in the vicinity of the former spill containment tank area.

Present use of untreated ground water is not considered to be a reasonable exposure route; therefore, dermal contact of residents with ground water during bathing and dermal contact of industrial workers with ground water used as process water was not evaluated.

Presently, the existing air stripper on the Miller property treats approximately 10 gpm of ground water collected from three on-site recovery wells. The treated ground water is discharged to the City of Fulton sanitary sewer system. The total average flow to the Fulton Treatment Plant is 3.04 mgd. The discharge is regulated by a sewer use permit. Contaminant levels detected in the air stripper effluent are well below the established permit limits and are normally not detected at the given quantification limits. Based on the effluent quality and the extremely small flow contribution to the sewer system, there are no health hazards to the sewage treatment plant workers due to the discharge from the Miller air stripper.

Dermal contact with the River, pond water, and the water in the State Ditch is not evaluated. The rationale for excluding these pathways from further evaluation is discussed in the ingestion subsection.

INGESTION

Effects on ground water quality attributable to site contamination are discussed in Section 4 of this RI report. It is recognized that ground water quality has been affected by the site; ground water downgradient from the site is currently undergoing treatment prior to distribution to the municipal drinking water supply. Two municipal wells located downgradient from the site showed levels of volatile organics above the drinking water standards; therefore, water from these wells was temporarily diverted through a GAC system and discharged to the Oswego River while the treatment system was under construction. A third municipal well, which all evidence to date indicates is not contaminated by sources occurring on the Miller property, was also taken off-line and temporarily discharged to the Oswego River even though water quality meets NYS Drinking Water Standards. A remediation system (air stripping unit) for treatment of the ground water in the vicinity of the municipal well field was constructed and has been operational since July 1992. The treatment system is designed to treat ground water from all three municipal wells to levels below the NYS Drinking Water Standards; in fact, the system is designed to treat the VOCs in the ground water to levels below the quantitation limit (0.5 ug/l). Because the NYS Drinking Water Standards were established based on health risks, a risk assessment of present and future use of the ground water was not considered necessary. In addition, the City of Fulton owns the property downgradient from Miller; therefore, future land use would be easily controlled. The treatment system along with restrictions on property use would alleviate the concern of future risks due to ground water exposure. It should be noted that the Oswego River is adjacent to the City property; the river serves as a barrier to further migration of contaminants downgradient from the site because the River level is artificially maintained by a downstream hydroelectric dam.

Ingestion of surface water (Oswego River) during recreational use is also a possible exposure route; however, exposure to contaminants by this route is unlikely. Prior to completion of the permanent treatment system and while K-2 and M-2 were diverted to the Oswego River, the combined discharge from K-2 and M-2 after GAC treatment showed non-detectable levels of contaminants previously detected in these wells. The discharges during this interim period were regulated by consent order. Based on the lack of contaminants detected in the discharge to the River, exposure by ingestion of surface water was not included in the risk assessment.

Ingestion of pond water on the Miller property and water in the State Ditch is not considered further. Both the pond and the water in the ditch are relatively shallow and no observation of trespassers wading in either area has been made. In addition, samples were collected from the on-site pond on one occasion; the results of the analysis showed levels below the quantification limit for all parameters analyzed. Samples collected from the State Ditch contained low levels of common laboratory contaminants (acetone and methylene chloride). The laboratory method blank sample did not contain either compound.

Although consumption of fish from the River was considered as a potential exposure pathway, this route of exposure was eliminated. Risks for this route of exposure were not quantified based on the lack of contaminants in the regulated discharges.

Miller employees, particularly lawn maintenance personnel, and trespassers may be exposed to analytes of potential concern by incidental ingestion of contaminated surface soil in the area of the former northern drum storage area. As discussed previously, drums and cleaning solutions were discharged to the ground in this area; however, a near surface soil sample (collected at a depth of 0-2 feet) collected in this area showed non-detectable levels of the contaminants of concern. A building, concrete or asphalt pad has been installed over the former location of the southern drum storage area, eliminating the possibility of incidental ingestion in this area.

INHALATION

Site air monitoring conducted during the excavation of the sump pit near the USTs below the Container Plant was discussed in Section 4. Relatively high levels of VOCs (up to 20 ppm, as measured with the HNU meter equipped with an 11.7 eV lamp) were reported just above the cuts made in the concrete slab. Two air samples were collected simultaneously, for a one hour period, in a four inch boring to a depth of about six inches below the top of the floor slab. The samples were analyzed by GC/MS by USEPA Method 624. The results of the analysis indicated levels of TCA, 1,1-DCA, TCE, and 1,2-DCE that were below OSHA permissible exposure levels. Ambient air samples taken above the slab did not contain any detectable volatile organics at detection level of 17 ug/m^3. These data, coupled with the fact that the concrete slab is intact with no noticeable cracks, indicate that ambient air quality is not affected by the existing subsurface contamination. Therefore, inhalation in the Container Plant was not evaluated.

As discussed in the previous subsection, the ground water downgradient from the Container Plant is treated prior to being used as a drinking water source. Therefore, volatilization of organics during showering or process water usage for future industry is not evaluated.

Exposure to air emissions from the on-site air stripper and the air stripper operating at the Municipal Water Works is possible; however, the air permits issued by the NYSDEC take into consideration all health risks associated with these emissions. Therefore, this route of exposure will not be considered further.

In summary, no inhalation exposure pathways were further evaluated.

6.3 REVIEW OF THE DATA FOR THE MEDIA OF CONCERN

The purpose of this subsection is to identify contaminants that have the potential to cause adverse health effects. The exposure point of concern identified in the previous subsection was for surface soil contamination in the former northern drum storage area. The analytes detected in the soil gas samples collected in this area during July 1990 were used to qualitatively evaluate risks associated with this exposure point. Soil gas samples collected in the area showed elevated levels of total petroleum hydrocarbons (TPH), methylene chloride, chloroform, TCA, carbon tetrachloride, TCE, and TTCE.

6.4 TOXICITY ASSESSMENT

The toxicity assessment for this risk assessment consists of a hazard evaluation for each analyte of concern. The evaluations are summarized in brief toxicity profiles included in Appendix U. The information presented was obtained from the respective Draft or Final Toxicological Profile prepared by the U.S. Public Health Service's Agency for Toxic Substances and Disease Registry (1989 through 1991), if available.

6.5 QUALITATIVE ASSESSMENT OF RISKS

A qualitative risk assessment of the two pathways of concern was performed for the RI report. The qualitative evaluation is presented below.

The soil gas survey performed in the former northern drum storage area indicated detectable levels of some VOCs along with some petroleum hydrocarbons. Based on the data and interviews with employees who have stated that drums containing solvents were washed and dumped in this area, a potential risk exists to any employees who work in this area. Activities in this area appeared to be limited to lawn maintenance personnel who come in contact with surface soil by either incidental ingestion and/or dermal contact. The majority of the contaminants detected in the soil gas samples collected in this area are highly volatile; therefore, it is likely that the contaminants have flashed off and only low levels of contaminants may remain at the surface in this area.

7.0 REFINEMENT OF REMEDIAL ACTION ALTERNATIVES

7.1 REMEDIAL ACTION ALTERNATIVES

7.1.1 Alternatives to Remediate Soil

Based on the data collected during the performance of RI work tasks, six contaminated soil areas were identified. These areas are listed below.

1. The former spill containment tank area, which is contaminated with VOCs.
2. The former northern drum storage and washing area, which is contaminated with VOCs.
3. The former southern drum storage and washing area, which is contaminated with VOCs.
4. The underground tank area located below the southwest part of the Container Plant near the WTF, which is contaminated with VOCs and oil.
5. The manhole MH#1 area, which is contaminated with VOCs.
6. The area east of the Taylor property, in the vicinity of wells MW-14S,D and MW-21S,D, which is contaminated with VOCs and BTEX compounds.

As part of the FS process, clean-up levels were determined for each soil area in accordance with the November 16, 1992 NYSDEC Technical and administrative Guidance Memorandum (TAGM) on the determination of soil clean-up goals. The clean-up levels represent concentrations that would be protective of human health and ground water/drinking water quality for its best use. The need for soil remediation in each of the areas listed above has been evaluated with respect to the soil clean-up goals.

The extent of soil contamination in the former northern and southern drum storage areas, in the underground tank area below the plant's southwest corner, and in the manhole MH #1 area, can be approximated by soil and soil gas data that were collected in these areas. Soil samples from the former spill containment tank area and the former northern drum storage area were also collected for grain size distribution, total organic carbon, and VOC analyses during July 1992. Soil gas samples obtained from the area east of the Taylor property indicated very low levels of VOCs, benzene and toluene. Based on the sample results from these areas, the soil clean-up goals, and the lack of apparent risk to human health, it was determined that soil contamination in the former spill containment tank area, in the former northern drum storage area, in the manhole MH #1 area, and in the area east of the Taylor property does not require remediation.

Based on the analytical data and the soil clean-up goals, the VOC contamination present in the soil in the former southern drum storage area and in the underground tank area below the southwest corner of the Container Plant may require some form of remediation to reduce contaminant concentrations to below acceptable levels. Remedial techniques to clean up the VOC contamination in the soil in these areas will be screened during the FS. Soil flushing or vacuum extraction may be appropriate technologies. The concrete/asphalt cap over the former southern drum storage area and the flooring within the Container Plant would aid in the recovery of soil gas from these areas. A pilot vacuum extraction test was conducted in the southern drum storage area during July 1992. The results of the pilot test will be evaluated further in the FS. Any required remediation will be conducted under the supervision of the RI/FS NYSDEC project manager, Michael DiPietro.

The oil contamination of the soil below the southwest portion of the Plant is being addressed under the supervision of NYSDEC Region 7, Oil Spill Division. Work to date has consisted principally of the collection of oil by using the underground tanks as recovery vessels.

7.1.2 Alternatives to Remediate Ground Water

Remedial alternatives to address the plumes of contaminated ground water on-site shall be evaluated. Sources of ground water contamination located off site will need to be addressed by the responsible party and these sources will not be specifically addressed in this section.

A list of potential remedial alternatives to address the ground water contamination at the site were identified in the Draft RI Report:

1. Continued pumping as at present. Miller would continue to pump from the existing recovery wells. The recovered ground water would continue to be treated to the levels set forth in the City of Fulton sewer use permit before discharge to the sanitary sewer.

2. Pump and treat ground water from the present recovery system, but at an accelerated rate which will contain the on site plume(s) of contaminated ground water with or without additional recovery wells and/or treatment facilities, as may be necessary. The recovered ground water would be treated prior to discharge to the sanitary sewer.

3. Pump and treat, as above, with the addition of bioremediation of the plume to shorten the time required to meet remedial action goals.

4. Pump and treat, as above, with the construction of a grout curtain to increase the likelihood of intercepting the plumes.

   Note: All applicable or relevant and appropriate requirements (ARARs) will be considered in evaluating pump and treat technologies.

5. No action. In this case, the use of the recovery system already in place would be discontinued. Water quality would continue to be checked by sampling the monitoring wells already in place at the site.

The RI data collected to date have delineated the horizontal and vertical extent of the ground water contaminant plumes on the Miller property and this has allowed the following evaluation of the remedial alternatives.

Alternative 1, "Continued pumping as at present," will not adequately address all ground water contamination sources that have been identified on site. This alternative will not be considered during the FS.

Alternative 2, pump and treat from the present recovery system, but at an accelerated rate, may ultimately address the ground water contamination emanating from the former spill containment tank area and the former northern drum storage area. This alternative will not effectively address the contaminated ground water in the former southern drum storage area which includes the ground water contamination resulting from the VOCs that emanated from the oil spill area. This alternative will also not address the ground water contamination present below the Taylor property and east of the Taylor property. The use of the City of Fulton 1 MGD Water Treatment Facility to remediate the contamination in the vicinity of the Taylor property (MW-14D, MW-21S, MW-33S and wells on the Taylor property) is not recommended because the contaminant levels associated with this plume are relatively high compared to the contaminant levels currently in the vicinity of M-2 and K-2. Although the 1 MGD Water Treatment Facility was designed to treat ground water containing VOCs at concentrations that are much higher than present contaminant levels, if the plume near MW-14D, MW-21S and on the Taylor property was allowed to migrate to K-2 and M-2, the higher contaminant concentrations could require modifications to the permanent treatment system in order to meet required treatment levels. Alternative 2 may be useful to address some of the ground water contamination emanating from on-site, but this alternative will have to be combined with other ground water remedial alternatives to be comprehensive. A discharge location, in addition to the sanitary sewer, will be investigated.

Alternative 3, pump and treat, as in Alternative 2, with the addition of bioremediation may have some relevance if combined with other alternatives, but will not be effective by itself. For example, the implementation of bioremediation would not be an effective approach to remediate contaminated ground water without ground water extraction. The technology will be screened in the FS in combination with other alternatives.

Alternative 4, pump and treat as in Alternative 2, with the addition of a grout curtain is not practical given the extent of ground water contamination documented during the RI. The complex nature of the geologic units below the site would make the keying of a grout curtain into a low permeability unit downgradient of the identified contaminated ground water areas technically infeasible.

The no-action alternative will be included in the FS screening process in accordance with requirements.

The most effective remedial alternative to address contaminated ground water emanating from sources on the site will probably be a combination of techniques assembled into one alternative. Soil remedial alternatives for the former southern drum storage area and the underground tank area will be considered in the overall site remedial approach.

8.0 SUMMARY AND CONCLUSIONS

8.1 SUMMARY

The RI Report has been prepared with the intent of:

1. Discussing the field investigation activities performed prior to and during the RI.

2. Presenting the data collected during the RI for the time period through January 1993. Water quality data presented are through August 1992, since this was the most recent complete round of ground water sampling, and include recently collected (January 1993) data from the newest site well cluster MW-60S,I,D.

3. Evaluating the data collected relative to defining the nature and extent of contamination attributable to the spill containment tank leak and the identification of any additional source areas at the Miller facility.

4. Reassessing the remediation being employed at the Miller site.

5. Presenting the baseline risk assessment.

6. Determining if any additional data are considered necessary.

The field work completed and the data generated through the performance of Items 1 and 2 above have been presented in this report. An additional goal of the RI is to define the aquifer from which K-1, K-2 and M-2 withdraw ground water in order to evaluate the potential for identified contamination to migrate to K-1.

These data have been evaluated with respect to the nature and extent of contamination at the site and near the municipal well field. The data have also been evaluated in this report relative to:

1. The identification of any new source areas either on Miller property or on adjacent property.

2. The relevance of the identified source areas to the occurrence of contamination in the area.

3. An assessment of the current remediation system in use on Miller property.

4. The determination of whether the collection of any additional data may be necessary to complete the RI.

Nature and Extent of Contamination and Contaminant Source Areas

1. There are two contaminated media at the site: soil and ground water. The types of contaminants detected in the soil, soil gas and ground water consist predominantly of chlorinated hydrocarbons (VOCs) although some petroleum hydrocarbons and ketones have also been detected.

2. The ground water contamination is the result of (a) the infiltration of precipitation through contaminated soil source areas to the water table (for all sources exposed to weather) (b) the leaching of VOCs from oil in the unsaturated zone to the water table or (c) the seasonal rise of the water table into a contaminated soil area.

3. One soil source area was known prior to performance of the RI: the former spill containment tank area.

4. Performance of the RI has verified three additional sources areas: the former drum washing and storage area in the area north of the Container Plant's northern parking area, the area south of the Container Plant where drums were also washed and stored, and the UST area located below the southwestern portion of the Container Plant near the Plant's WTF. Additional compounds (MIBK, toluene and xylenes) and high levels of c-1,2-DCE are found in the former southern drum storage area and below the Plant near the WTF. Relatively high levels of c-1,2-DCE are also found in the shallow ground water below the former northern drum storage area. Of these compounds, only c-1,2-DCE is found sporadically in the spill containment tank area.

5. The RI has suggested two additional source areas: in the vicinity of MH#1; and east of the Taylor property and MW-14D and MW-21S.

6. Gasoline-type compounds (BTEX) were found in shallow well MW-45S, located northwest of K-1. The NYSDEC is investigating the source of this contamination. VOC contamination has been detected on the east-northeast side of K-1. All evidence to date indicates that the contamination in both of these areas is not attributable to sources on the Miller property.

7. Analytical data obtained from well cluster MW-60S,I,D and additional data collected throughout the RI, do not indicate the presence of a ground water contaminant plume emanating from the MW-38S,D area and moving northwest across the site toward K-1.

8. According to the soil gas data, the Oswego River near K-2 and M-2 and the 12-inch water line south of K-2 and M-2 do not appear to represent sources of shallow contamination.

9. The ground water contamination detected at K-2 and M-2 is connected to the contamination detected beneath the Taylor property and at MW-14D and MW-21S. Although the contamination in the MW-13D area is of significantly less magnitude than the contamination detected at MW-14D, MW-21S and in wells located on the Taylor property, the plume from the MW-13D area extends into the MW-25S,D area where it joins the plume of contamination in the MW-14D, MW-21S and Taylor property area before migrating toward K-2 and M-2.

10. The most likely source of the contamination at MW-13D appears to be the migration of contaminated ground water from the shallow zone near MW-38S, into the deeper zone northeast of MW-16D, then north of MW-16D and MW-8D in the area near MW-56D. Drawdown was observed at MW-56D during the 1992 pumping test; however, contamination in this area appears to be out of the capture zone of RW-1 under the current pumping conditions.

11. Contaminant concentrations in the shallow ground water are highest on the Plant's south side and below the Container Plant near the UST area. However, the relatively low horizontal hydraulic conductivity and hydraulic gradient in this area indicate that the contaminant migration rate is very slow in the south and southeastern portions of the site. Ground water analytical data from wells installed in this area support this; the contamination from this area is confined at present to a relatively small area.

12. The shallow zone contamination, which is also found in relatively lower concentrations in the former spill containment tank area and in the former northern drum storage area, is absent across the middle of the site, but reappears near MW-21S and in the shallow wells on the Taylor property. These data suggest a potential source area for ground water contamination east of MW-14D, MW-21S and the Taylor property. The identity of this source is not known.

13. Ground water contaminant migration from the source areas is basically a function of the ground water flow patterns.

14. The sanitary sewer bedding was investigated as a potential contaminant migration pathway. The presence of shallow contamination near MW-18S, MW-40S and MW-41S and an elevated water level near MW-41S would seem to indicate leakage from the sewer. However, the analytical data do not support the theory of high levels of contamination migrating in the sewer bedding from MW-36S and MW-37I across the site to the MW-18S area and beyond.

15. Significant contamination has been detected at intermediate well MW-8I. This well is under the influence of pumping at RW-1. No contamination has been detected at intermediate well MW-51I, located to the northeast of MW-8I. No contamination has been found in intermediate wells located between MW-8I and K-1. The shallow and deep wells in the clusters between the MW-8S,I,D cluster and K-1 are also not contaminated.

Hydrogeology

1. The central portion of the site is hydrogeologically complex. The monitoring wells installed during the RI have provided information that has aided in the understanding of the hydrogeologic regime in this area.

2. The silty clay layer has been eroded and replaced with a thick sand and gravel unit in the area north and northeast of RW-1 (MW-51 cluster). The discontinuous nature of the silty clay layer in the area north of RW-1 may be a limiting factor in the spread of the cone of influence of RW-1 at higher pumping rates. The sand and gravel unit may serve as a recharge boundary.

3. The pumping rate at RW-1 should be increased to its maximum as soon as possible. Water level readings at MW-56D should be taken before and after the increase in flow rate to measure the increased drawdown and determine if the influence of RW-1 will be sufficient to cut off the contamination in this area.

4. Average linear velocity (seepage velocity) estimates indicate that ground water flow rates are low in the south and southeast parts of the site compared to the north and northwest areas. This is primarily a function of the lower horizontal hydraulic conductivity in the southern and southeastern areas. The velocity estimates are also high on the west side of the site, but many of these estimates are biased by the high gradient due to induced flow conditions near the municipal wells.

5. Results of the pumping test performed at municipal wells K-1, K-2 and M-2 indicate relatively low seepage velocities from the K-2/M-2 area toward K-1 when both systems are operating at typical flow rates.

6. The Oswego River is hydraulically connected to the municipal pumping wells and acts as a constant source of recharge (a recharge boundary). Consequently, it is estimated that about 60 percent of the shallow water entering K-1 originates at this recharge boundary and only about 10 percent is supplied from the direction of the Miller property; the remainder originates mostly from areas to the east and northeast of K-1. K-2 and M-2 are located closer to the Oswego River recharge boundary and receive nearly 75 percent of their combined shallow water supply from the River; about 25 percent of the water entering these wells originates from the northeast, east and southeast directions which include flow from the Miller site and the Taylor property.

7. Continuous split-spoon samples were collected in two boreholes drilled from the top of the lodgement till to bedrock. The locations of the boreholes were situated along the approximate axis of the lodgement till ridge and upgradient of wells with unexplained ground water contamination to provide information on potential migration pathways to these wells. The lodgement till was found to be a thick, dense unit with no saturated intervals.

8. Vertical hydraulic conductivity tests performed on Shelby tube samples collected from the silty clay layer and above the silty clay in the silty sand unit indicate that the clay layer is of low permeability relative to other site units and would behave as a confining or semi-confining layer. Data from the 1992 RW-1 pumping test confirm that wells screened below the silty clay layer exist under confined or semi-confined conditions.

8.2 CONCLUSIONS

The performance of the RI has allowed the delineation of the horizontal and vertical extent of contamination emanating from the known source areas on the Miller site. These source areas include the former spill containment tank area, the former northern drum storage area, the former southern drum storage area and the area in the vicinity of the USTs below the Container Plant near the Plant's WTF.

The data collected during the RI have indicated that additional source areas exist in the area east of the current Taylor property and MW-14D and MW-21S on the Miller property, and in the vicinity of MH#1. Analytical data indicate that the sewer bedding is not a migration pathway for contamination occurring on the Plant's south side and below the UST area, to reach the MH#1 vicinity. Monitoring wells installed during the RI along the south side of the site have provided analytical data that rule out the theory of a plume of contamination that originates on the south side of the Container Plant then migrates across the site and into the MW-21S, MW-14D and Taylor property area. No specific sources for these areas of contamination have been found, but, despite the lack of known sources, enough data currently exist to assess the need for the implementation of remedial alternatives in the source areas and devise a remediation approach for those areas requiring remediation.

The identified ground water contamination in the vicinity of the current Taylor property and to the east near MW-14D and MW-21S is responsible for the majority of the contamination at municipal wells K-2 and M-2. A smaller, lower concentration plume from the MW-13D area joins this plume near MW-25S,D and then is pulled toward K-2 and M-2. A long-term treatment system to treat the K-2/M-2 ground water is currently in operation. Following treatment to below detection limits, the ground water is added to the City of Fulton municipal drinking water supply.

VOC and gasoline-type ground water contamination has been found in the vicinity of and at K-1; although the source(s) of the contamination has not been identified, it does not appear to be attributable to Miller sources based on ground water flow patterns and the identity and occurrence of the contamination.

The pumping from municipal well K-1 exerts a greater influence on the aquifer than the pumping from K-2 and M-2; however, operation of the K-1 and K-2/M-2 systems concurrently greatly reduces the rate of ground water movement from the K-2/M-2 area toward K-1. Wells located between K-2/M-2 and K-1 show no evidence of chlorinated hydrocarbon contamination. In addition, the most common contaminant detected at K-1, TCE, is not detected at M-2 or K-2. Analytical data obtained from well cluster MW-60S,I,D and additional data collected throughout the RI, do not indicate the presence of a ground water contaminant plume emanating from the MW-38S,D area and moving northwest across the site toward K-1.

The NYSDEC has installed a ground water treatment system northwest of K-1, in the vicinity of MW-45S,D, in response to the gasoline-type contamination in this area. The NYSDEC is currently investigating the contamination in order to identify the source and the responsible party for the contamination. Water from K-1 is also routed through the permanent treatment facility operated by the City of Fulton.

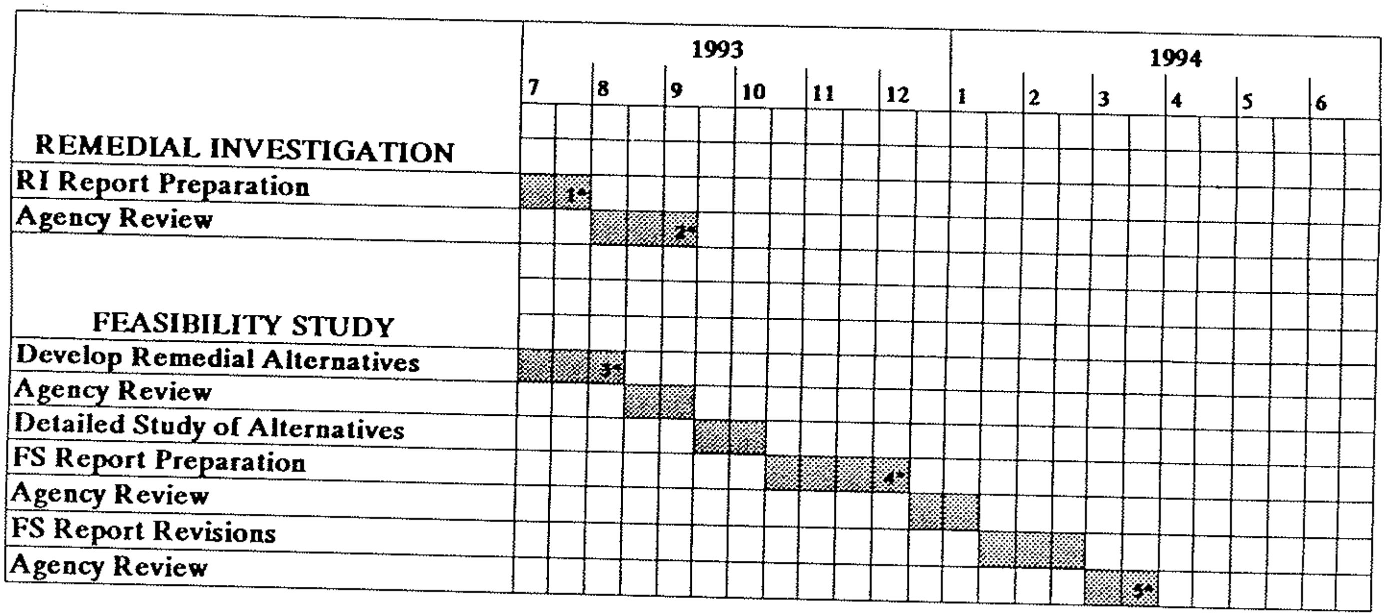
The air stripping system in use at the Miller site has operated efficiently with respect to the removal of VOCs from ground water collected downgradient of the former spill containment tank area, despite the occurrence of significantly higher levels of total VOCs than were originally estimated. The presence of the contamination in the MW-4D, MW-16D, and possibly MW-3D areas appears to be the result of contamination migrating from the former northern drum storage area and/or the former spill containment tank area. Although the air stripping and recovery well system was not designed to address ground water contamination from the northern drum storage area, it may be capable of collecting and treating contaminated ground water from that area with a minor adjustment to the flow rate at recovery well RW-1. The proposal to increase the withdrawal rate at RW-1, dated March 19, 1992, is being evaluated by the NYSDEC at this time.

The RI data, which has been used to delineate the vertical and horizontal extent of contamination at the Miller site, will also be used to develop and then screen a list of combined remedial alternatives to remediate the identified contamination. The remedial alternatives that will be combined to address each area have been refined in this report and will be carried through in the FS portion of this project. An updated RI/FS project schedule is shown on Figure 8-1.

MILLER CONTAINER

FIGURE 8–1

RI/FS SCHEDULE
JULY 1993



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NOTES:

1* – RI Report Submitted
2* – RI Report Accepted
3* – Interim Remedial Action Alternative Screening Report Submitted
4* – FS Report Submitted
5* – FS Report Approved, NYSDEC Issues ROD

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