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1991 Annual Report
East Hennepin Avenue Site
Minneapolis, Minnesota

Prepared for
General Mills, Inc.

January 1992

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1991 ANNUAL REPORT
EAST HENNEPIN AVENUE SITE

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1991 ANNUAL REPORT
EAST HENNEPIN AVENUE SITE

INTRODUCTION

This report summarizes the results from 1991 annual monitoring and remedial action operations conducted at the East Hennepin Avenue site during 1991. The monitoring data was collected and transmitted quarterly to the MPCA project leader. Appendix A summarizes the Quality Assurance/Quality Control (QA/QC) data validation; Appendix B presents a recommended monitoring plan for 1992; and, Appendix C presents historical water quality data for the site. The 1991 monitoring was carried out in response to the requirements of Part II of Exhibit A to the October 23, 1984 Response Order by Consent between General Mills and the Minnesota Pollution Control Agency (MPCA); the January 1985 Groundwater Pump-out System Plan - East Hennepin Avenue Site; the Minnesota Department of Natural Resources Water Appropriation Permits (85-6144 and 85-6145); the NPDES Permit MN 0056022; and, the 1991 Monitoring Plan. The East Hennepin Avenue site is located in Minneapolis, Minnesota (Figure 1). The generalized geologic column for the site is shown in Figure 2.

REMEDIAL ACTION OPERATIONS

The following section summarizes the remedial action operation and maintenance activities conducted at the East Hennepin Avenue site during 1991. The 1991 remedial actions consisted of operation of the groundwater pump-out and treatment systems, and implementation of a Magnolia Member pump test.

Groundwater Pump-Out Systems

The East Hennepin Avenue site groundwater pump-out systems consist of the site glacial drift pump-out system (pump-out Wells 109 and 110) (Figure 3), the site Carimona pump-out system (Well 108) (Figure 7), and the downgradient glacial drift pump-out system (pump-out Wells 111, 112, and 113) (Figure 3). The Magnolia pump-out system, when completed in 1992, will consist of two pump-out wells (M1 and M2) located in the vicinity of the former disposal area (Figure 10).

The site glacial drift pump-out system is designed to contain and remove groundwater with a concentration of trichloroethene exceeding 270 μg/L from the glacial drift aquifer. The site Carimona and Magnolia pump-out systems are designed to contain and remove groundwater with a concentration of trichloroethene exceeding 27 μg/L. The operation of the Magnolia pump-out wells is described in the November 1991 Magnolia Member Aquifer Pump Test Report, Remedial Action Design Plan, 2010 East Hennepin Avenue Site. Groundwater removed by the site glacial drift and Carimona Member pump-out well system is treated by air stripping. The effluent from the air stripper is discharged to the Minneapolis storm sewer network. The site area glacial drift and Carimona Member pump-out systems began operation on November 1, 1985. The Magnolia Member pump-out system is scheduled to begin operation during early 1992. The Magnolia Member pump-out system will discharge directly to the Minneapolis storm sewer network.

The downgradient glacial drift pump-out system is designed to contain and remove groundwater with a concentration of trichloroethene exceeding 270 μg/L. Groundwater removed by the downgradient pump-out well system is discharged directly to the Minneapolis storm sewer network. Passive air stripping occurs in the storm sewer between the downgradient pump-out system discharge point and the Mississippi River. The downgradient pump-out system began operation on December 5, 1985.

The average monthly pumping rate for each of the pump-out wells is presented in Table 1. The combined average pumping rate for the site glacial drift pump-out well system

during 1991 was 95 gallons per minute. The average monthly pumping rates for the individual pump-out wells ranged from 31 to 58 gallons per minute. A total volume of 49 million gallons of groundwater was removed from the glacial drift aquifer by the site glacial drift pump-out system. The site glacial drift pump-out system operated at a combined yearly average operating time of 93 percent during 1991.

The average pumping rate for the Carimona pump-out system was 11 gallons per minute. A total volume of 5.4 million gallons of groundwater was removed from the Carimona and Magnolia Members of the Platteville Formation during 1991. The Carimona pump-out system operated at a yearly average running time of 96 percent. The majority of the downtime for the Carimona pump-out system was due to the implementation of the Magnolia Member pump test.

The downgradient pump-out well system operated at a combined annual average rate of 281 gallons per minute. The average monthly pumping rates for the individual downgradient pump-out wells ranged from 58 to 113 gallons per minute. A total volume of 148 million gallons of groundwater was removed from the glacial drift aquifer by the downgradient glacial drift pump-out system during 1991. The downgradient pump-out system operated at a combined yearly average running time of 100 percent.

Maintenance and Downtime

The site and downgradient pump-out wells were operated continuously at the maximum sustainable yield of the pumps or aquifer during 1991, with the exception of shutdowns caused by electrical or mechanical failures, and the need for well maintenance. The 1991 operating and downtime data for the glacial drift and Carimona Member pump-out wells is presented in Table 2.

Maintenance during 1991 included repair and replacement of meters for Wells 109, 110, and 112; motor control replacements for Wells 109 and 110; and, replacement of belts and lubricating bearings for the stripper tower.

Groundwater Treatment System

The groundwater treatment system consists of a stripper tower located at the former disposal site. The tower is designed to remove 99 percent of volatile organic compounds from influent groundwater at a discharge rate of 150 gpm. The groundwater treatment system is required to treat influent groundwater to an annual average concentration of trichloroethene not to exceed 50 μg/L, and a daily maximum concentration of trichloroethene not to exceed 100 μg/L. The tower receives influent from glacial drift pump-out Wells 109 and 110 and from Carimona Member pump-out Well 108. The stripper tower began operation on November 11, 1985 and has operated continuously within NPDES permit standards during 1991.

GROUNDWATER MONITORING

Water Level Monitoring

The 1991 monitoring program involved the measurement of water levels from fifteen wells screened in the glacial drift (five pump-out wells and ten monitoring wells); eleven monitoring wells open to the Carimona Member of the Platteville Formation; one pump-out well open to the Carimona Member of the Platteville Formation; five monitoring wells open to the Magnolia Member of the Platteville Formation; and, four monitoring wells screened in the St. Peter Sandstone. All monitoring activities were carried out in accordance with the 1991 Monitoring Plan (see Appendix B, 1990 Annual Report) and the 1985 Quality Assurance/Quality Control Plan.

The results from 1991 water level monitoring are presented in the following sections. Historical water elevation data for the glacial drift wells, Carimona Member wells, Magnolia Member wells, St. Peter wells, and pump-out wells are presented in Appendix C.

Glacial Drift

Groundwater elevations were measured in glacial drift monitoring wells during April and September 1991 at the locations shown in Figure 3. The results from 1991 water level monitoring are presented in Table 3. A cross section of the glacial drift groundwater surface for the three monitoring periods is shown in Figure 4. The location of cross section A-A′ is shown on Figure 3. The glacial drift groundwater contours and the estimated containment zone limits for the site glacial drift pump-out system for each monitoring period are shown in Figures 5 and 6.

The groundwater elevation data indicate the direction of groundwater flow in the glacial drift is to the southwest. The 1991 data also indicate the groundwater elevations in the glacial drift are higher than the drought years of 1988 and 1989.

Water level measurements collected during 1985-1986, following start-up of the groundwater containment system, demonstrated the effectiveness of the site and downgradient pump-out systems in containment of those areas of the glacial drift groundwater with volatile organic compound concentrations greater than 270 μg/L. Glacial drift groundwater elevation data collected during 1991 indicate the capture zone established during 1985 and 1986 has been maintained.

Carimona Member of Platteville Formation

Groundwater elevations were measured in the Carimona Member monitoring wells during April and September 1991 at the locations shown in Figure 7. The results from 1991 water level monitoring are presented in Table 4. The Carimona potentiometric surface elevations for each monitoring period are shown in Figures 8 and 9.

The potentiometric surface elevation of the Carimona in the vicinity of the East Hennepin Avenue Site during 1991 was essentially flat. The average annual fluctuation of the potentiometric surface for the Carimona during 1991 was 0.70 feet. A potentiometric

surface contour map is not provided for the Carimona because the difference in piezometric elevations between wells is within measurement error. The results of potentiometric surface elevation monitoring collected from Carimona Member monitoring wells prior to 1991 also indicate a flat potentiometric surface. The data indicate a significant change in the slope of the Carimona's potentiometric surface has not occurred in 1991.

Water level data for the Carimona Member cannot be used to determine the real extent of the Carimona pump-out system because of the very low observed hydraulic gradients across the site. The 1991 water level data suggest hydraulic gradients are toward the Carimona Member pump-out Well 108 in the area encompassed by the site.

Magnolia Member of Platteville Formation

The potentiometric surface elevations were measured in the Magnolia Member monitoring wells during April and September 1991 at the locations shown in Figure 10. Magnolia Member pump-out Wells MG1 and MG2 were not measured during 1991. The results from 1991 water level monitoring are presented in Table 5. The Magnolia potentiometric surface elevations for each monitoring period are shown in Figures 11 and 12.

The average annual fluctuation of the potentiometric surface for the Magnolia during 1991 was 0.91 feet. The 1991 potentiometric surface elevation data indicate the direction of groundwater flow in the Magnolia Member is to the northwest with a hydraulic gradient of 0.004 feet/foot. The 1991 data is consistent with the potentiometric surface elevation data collected during prior monitoring years.

St. Peter Sandstone

The potentiometric surface elevations were measured in the St. Peter Sandstone monitoring wells during April and September 1991 at the locations shown in Figure 13. The results from 1991 water level monitoring are presented in Table 6. The St. Peter potentiometric surface elevations for each monitoring period are shown in Figures 14 and 15.

The 1991 potentiometric surface elevation data indicate the general direction of groundwater flow in the St. Peter Sandstone is to the southwest. The average annual fluctuations of the potentiometric surface for the St. Peter Sandstone during 1991 was 0.19 feet. The 1991 data is consistent with the potentiometric surface elevation data collected during prior monitoring years.

Water Quality Monitoring

The 1991 monitoring program involved the collection of water quality samples from monitoring wells screened in the glacial drift aquifer; wells open to the Carimona Member of the Platteville Formation; wells open to the Magnolia Member of the Platteville Formation; and wells screened in the St. Peter Sandstone. The monitoring activities were carried out in accordance with the 1991 Monitoring Plan and the 1985 Quality Assurance/Quality Control Plan.

The results from 1991 water quality monitoring are presented in the following section. Historical water quality data for glacial drift wells, Carimona Member wells, Magnolia Member wells, St. Peter Sandstone wells, Prairie du Chien/Jordan well, pump-out wells, and the groundwater treatment system influent and effluent are presented in Appendix C.

Glacial Drift

Groundwater samples were collected from nine glacial drift monitoring wells during April 1991 and from five glacial drift monitoring wells during September 1991. Samples collected during April 1991 were analyzed for the parameters shown in Table 7. Samples collected during September 1991 were analyzed for TCE. The results from the laboratory analyses are presented in Table 8. The reported concentrations of TCE and the sum of volatile organic compounds (VOCs) are also shown in Figures 16 through 18. The 1985 through 1991 TCE concentrations for glacial drift Wells Q, X, 1, B, V, 3, S, and T are shown in Figure 19.

Carimona Member of Platteville Formation

Groundwater samples were collected from eleven monitoring wells open to the Carimona Member of the Platteville Formation during April 1991, and from four Carimona Member monitoring wells during September 1991. Groundwater samples were also collected from pump-out Well 108 during April and September 1991. The samples collected during April 1991 were analyzed for the parameters shown in Table 7. The samples collected in September 1991 were analyzed for TCE. The results from the laboratory analyses are presented in Table 9. The concentration of TCE and the sum of VOCs are also shown in Figures 20 through 22. The 1985 through 1991 TCE concentrations for Carimona Wells BB, 108, 13, 10, 11, and WW are shown in Figure 23.

Magnolia Member of Platteville Formation

Groundwater samples were collected from five monitoring wells open to the Magnolia Member of the Platteville Formation during April 1991, and from three Magnolia Member monitoring wells during September 1991. The samples collected during April 1991 were analyzed for the parameters shown in Table 7. The samples collected during September were analyzed for TCE. The results from the laboratory analyses are presented in Table 10. The concentration of TCE and the sum of VOCs are also shown in Figures 24 through 26.

The 1985 through 1991 TCE concentrations for Magnolia Member Wells ZZ, OO, VV, QQ, and TT are shown in Figure 27.

Groundwater samples were also collected from one Magnolia pump-out well (MG1) during June 1991. The samples were analyzed for VOCs using EPA Method 624. The results from the laboratory analyses are presented in Table 11.

St. Peter Sandstone

Groundwater samples were collected from four monitoring wells screened in the St. Peter Sandstone during April 1991 and one St. Peter Sandstone monitoring well in September 1991. Samples collected during April were analyzed for the parameters shown in Table 7. Samples collected during September were analyzed for TCE. The results from the laboratory analyses are presented in Table 12. The concentration of TCE and the sum of VOCs are shown in Figures 28 through 30. The 1985 through 1991 TCE concentrations for St. Peter Sandstone Wells 200, 201, 202, and 203 are shown in Figure 31.

Prairie du Chien/Jordan

Groundwater samples were collected from the Henkel well during July 1991 and September 1991. The samples were analyzed for the parameters shown in Table 7. The results from the laboratory analyses are presented in Table 13.

Downgradient Groundwater Pump-Out System

Flow weighted composite groundwater samples were collected from the downgradient pump-out well system discharge during January, April, July, and September 1991. The samples collected during April and September 1991 were analyzed for the parameters shown in Table 14. The samples collected during January and July 1991 were analyzed for TCE. The results from the laboratory analysis are presented in Table 15. The 1985 through 1991

TCE concentrations for the downgradient groundwater pump-out system discharge are shown in Figure 32.

Site Groundwater Pump-Out & Groundwater Treatment System

Groundwater treatment system influent and effluent samples were collected during January, April, July, and September 1991. The samples collected during April 1991 were analyzed for the volatile fraction priority pollutants. The samples collected during September 1991 were analyzed for VOCs using EPA Method 601. The samples collected during January and July were analyzed for TCE. The results from the laboratory analyses are presented in Tables 16 and 17. The 1985 through 1991 TCE concentrations for the groundwater treatment system influent/effluent are shown in Figure 32.

QUALITY ASSURANCE PROCEDURES

Quality assurance procedures described in the February 1985 Quality Assurance/Quality Control (QA/QC) Plan were followed during collection and analysis of the water quality samples. Quality assurance procedures involved internal and external quality review procedures. The results from the quality review are presented in Appendix A. The results from the quality review indicate the 1991 data is valid.

DISCUSSION OF RESULTS

This section discusses the water quality data results for samples collected from glacial drift wells, Carimona Member wells, Magnolia Member wells, St. Peter Sandstone wells, Prairie du Chien/Jordan well, groundwater pump-out system wells, and the groundwater treatment system. Historical water quality data for each monitoring location are presented in Appendix C.

Glacial Drift

The results from the analysis of groundwater samples collected from the glacial drift during 1991 indicate the TCE concentrations range from not detected (Well T) to 1,500 μg/L (Well 3) (see Table 8). The total VOCs concentration range from not detected (Well T) to 1,600 μg/L (Well 3) (see Table 8).

The results from the analysis of groundwater samples collected from the glacial drift Wells B, Q, and T indicate TCE concentrations have decreased since the start-up of the site glacial drift pump-out system in 1985.

The results from the analysis of groundwater samples collected from Wells S, V, W, 1, and 3 during the period 1985 through 1991 indicate TCE concentrations are similar to historical water quality data. The high VOCs concentration reported in Well 3 during the April monitoring event may be attributable to Well 110 being down for sixteen days in April.

The results from the analysis of groundwater samples collected from glacial drift monitoring wells are similar to water quality data reported during 1989 and 1990. The 1991 data indicate the site glacial drift pump-out system is effective in containing a portion of the glacial drift groundwater with a concentration of TCE exceeding 270 μg/L. The 1991 data also indicate the downgradient pump-out system is effective in containing all glacial drift groundwater with a concentration of TCE exceeding 270 μg/L. This is evidenced by the water quality of the two monitoring wells located downgradient of the downgradient glacial drift pump-out system. The 1991 data for Wells V and W indicate the TCE concentrations range from 20 to 130 μg/L (see Table 8). The TCE concentrations in these wells has not changed significantly since start-up of the downgradient pump-out system.

Carimona Member of Platteville Formation

The results from the analysis of groundwater samples collected from the Carimona Member during 1991 indicate the TCE concentrations range from not detected (Well 12) to 1,100 μg/L (Well BB) (see Table 9). The total VOCs concentration range from not detected (Well 12) to 1,200 μg/L (Well BB) (see Table 9).

The results from the analysis of groundwater samples collected from Carimona Member Wells 8, 10, and WW indicate TCE concentrations have declined since the start-up of the Carimona Member pump-out system in 1985. The results from the analysis of groundwater samples collected from Wells RR, SS, UU, 9, and 12 during the period 1985 through 1991 indicate TCE concentrations are similar.

The results from the analysis of groundwater samples collected from Wells 11 and 13 during 1985 through 1991 show considerable variability. The TCE concentration of groundwater samples collected from Well 11 range from below the laboratory detection limit (May 1991) to 520 μg/L (December 1985). The TCE concentration of groundwater samples collected from Well 13 range from not detected (April 1991) to 140 μg/L (April 1987). The groundwater quality in the vicinity of Carimona Member Well 13 may be adversely impacted by leakage of Magnolia Member groundwater to the Carimona. The vertical gradient in this vicinity is upwards from the Magnolia Member to the Carimona Member of the Platteville Formation. The concentration of TCE in the samples of groundwater collected from Magnolia Member Well ZZ is consistently higher than the concentration of TCE in samples collected from Carimona Member Well 13. Carimona Member Well 13 and Magnolia Member Well ZZ are part of a well nest located at the intersection of 21st Avenue Southeast and Fairmont.

Magnolia Member of Platteville Formation

The results from the analysis of groundwater samples collected from Magnolia Member wells during 1991 indicate the TCE concentrations range from not detected (Well QQ) to 170 μg/L (Well ZZ) (see Table 10). The total VOCs concentrations range from 0.6 μg/L (Well QQ) to 180 μg/L (Well ZZ) (see Table 10). The highest concentrations of TCE were reported for samples collected from Magnolia Member Wells OO, VV, and ZZ. These wells are located upgradient of the former disposal area, and the water quality of samples collected from these wells appears to be adversely impacted by an unknown contaminant source located to the southeast of the site.

St. Peter Sandstone

The results from the analysis of groundwater samples collected from St. Peter Wells 201, 202, and 203 during 1991 indicate TCE concentrations were either trace or not detected. The results from analysis of samples collected from Well 200 during 1991 indicate TCE concentrations range from 77 to 140 μg/L (see Table 12). The results from the analysis of groundwater samples collected during the period 1985 through 1991 from Wells 200, 201, 202, and 203 indicate TCE concentrations are similar.

Prairie du Chien/Jordan

The results from the analysis of groundwater samples collected from the Henkel well during 1991 indicate the TCE concentrations range from 18 to 49 μg/L (see Table 13). The VOCs concentration range from 19 to 52 μg/L (see Table 13). The results from the analysis of groundwater samples collected during the period 1985 through 1991 indicate TCE concentrations are similar.

Downgradient Pump-Out System

The average concentration of TCE reported for samples collected from the downgradient pump-out system discharge was 190 μg/L, and the average total concentration of VOCs was 200 μg/L (see Table 15). The highest concentration of TCE reported during 1991 was 290 μg/L and the highest concentration of total VOCs reported during 1991 was 310 μg/L (see Table 15). The results from the analysis of discharge samples collected during the period 1985 through 1991 indicate the TCE concentrations are similar.

Site Groundwater Pump-Out System

The results from the analysis of samples collected quarterly from the site pump-out system indicate the average influent concentration of TCE was 500 μg/L and the average influent concentration of VOCs was 550 μg/L (see Table 16). The highest concentration of TCE reported in site pump-out system influent samples during 1991 was 890 μg/L (see Table 17). The maximum total concentration of VOCs reported was 1,000 μg/L (see Table 16). The results of influent samples collected during the period 1985 through 1991 indicate the concentration of TCE has decreased since start-up of the pump-out system in 1985.

The volatile fraction priority pollutant data and the routine volatile organic data (Table 17) indicate TCE is the primary volatile organic compound present in the groundwater at the East Hennepin Avenue site. The data also indicate the presence of twelve other VOCs including: 1,1-dichloroethane, 1,2-dichloroethylene, chloroform, 1,2-dichloroethane, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,1,2,2-tetrachloroethane, tetrachloroethylene, benzene, toluene, ethyl benzene, and xylenes. Methylene chloride and acetone were also reported, but are potentially false positive values based on those compounds being detected in the method blank.

Site Groundwater Treatment System

The results from the analysis of samples collected from the treatment system effluent indicate the average TCE concentration was 0.50 μg/L, and the average total VOCs concentration was 0.50 μg/L. The maximum TCE and VOCs concentration reported was 1.0 μg/L. The 1991 treatment system effluent data indicate the average treatment efficiency of the groundwater treatment system was in excess of 99 percent removal of volatile organic compounds.

SUMMARY AND CONCLUSIONS

Glacial Drift

Water quality and water level data indicate continued containment of groundwater with a concentration of TCE exceeding 270 μg/L in the glacial drift aquifer by the site glacial drift and downgradient glacial drift pump-out systems.

Carimona Member

The effectiveness of the Carimona Member pump-out system in containing Carimona groundwater has been demonstrated by the historical monitoring results in Wells WW, 8, and 10. Significant reductions in TCE concentrations have occurred in these wells since implementation of the pump-out system.

Carimona pump-out Well 108 has steadily declined in pumping rate from 1990 through 1991. Redevelopment of the well in 1990 resulted in no increase in flow rate. Well 108's reduction in flow is likely attributable to calcification of the formation in the vicinity of the well. This process is likely reducing and restricting the flow paths for groundwater to Well 108.

Magnolia Member

Magnolia Member water quality and water level data collected from the monitoring network suggests the primary source of TCE in the Magnolia Member originates from a contaminant source located upgradient of the East Hennepin Avenue Site with respect to Magnolia Member groundwater flow directions. Historically, the highest TCE concentrations are consistently found in samples from Magnolia Member wells located upgradient of the site.

The November 1991 "Magnolia Member Aquifer Pump Test Report, Remedial Action Design" indicates that two pump-out wells (MG1, MG2) constructed in the Magnolia Member operating at a combined pumping rate of 200 gpm will capture all of the groundwater in the Magnolia Member beneath the site, and a large percentage of the groundwater upgradient of the site. The effectiveness of one pump-out well will be evaluated during implementation of the Remedial Action Design. The report also indicates a likely increase in leakage of groundwater from the Carimona Member to the Magnolia Member, especially in the vicinity of the Magnolia Member pump-out wells. It appears likely that pumping of the proposed Magnolia Member pump-out wells will result in increased leakage in the vicinity of the Magnolia Member pump-out wells. The increased leakage is expected to create an extensive capture zone in both the Carimona and Magnolia Members. The Magnolia Member pump-out system will likely render the Carimona Well 108 unnecessary. The need to continue operation of Well 108 will be evaluated during the start-up of the Magnolia Member pump-out system.

St. Peter Sandstone

Water quality data collected from the St. Peter wells indicate the continued presence of VOCs in the St. Peter Sandstone aquifer at concentrations similar to historical water quality data.

Prairie du Chien/Jordan

Water quality data collected from the Henkel well indicate the continued presence of VOCs at concentrations similar to historical water quality data.

RECOMMENDATIONS

1. Continued operation of the site pump-out and groundwater treatment systems, and the downgradient glacial drift pump-out systems in accordance with the 1985 Consent Order; the 1985 Groundwater Pump-Out System Plan; the Department of Natural Resources Water Appropriation Permits; and, the 1992 Monitoring Plan (Appendix B).

2. Implement the "Magnolia Member Aquifer Pump Test Report, Remedial Action Design Plan" upon approval from the MPCA.

3. Evaluate the effectiveness of a one pump-out well during implementation of the Magnolia Member Remedial Action Design.

4. Monitoring of groundwater elevations and groundwater quality in accordance with the 1992 Monitoring Plan (Appendix B).

5. Abandonment of monitoring wells excluded from the 1991 and 1992 Monitoring Plan.

6. Ongoing inspection and maintenance of the groundwater pump-out and treatment systems.

7. Evaluation of necessity of Well 108 during start-up of the Magnolia Member pump-out system.

8. Evaluation of potential for reduction in monitoring locations during 1993.

9. Submittal of the 1992 Annual Report on January 31, 1993 instead of January 15, 1993.

Tables

TABLE 1

1991 PUMPING RATES
PUMP-OUT WELLS

	Glacial Drift Pump-Out Well Average Pumping Rate (GPM)					Carimona Pump-Out Well Average Pumping Rate (GPM)
	109	110	111	112	113	108
Jan 1991	54[2]	52	91	103	91	13
Feb 1991	38[2]	48	91	101	91	13
Mar 1991	44[2]	50	91	99	91	13
Apr 1991	48	49	91	58[1]	91	13
May 1991	52	31[2]	91	77[1]	91	10[4]
Jun 1991	58	44[2]	92	113	90	10
Jul 1991	49	47[2]	93	104[1]	89	12
Aug 1991	47	52	93	87	90	4.0
Sep 1991	40	51	93	112	90	20
Oct 1991	48[1,3]	50[3]	93	113	90	16[3]
Nov 1991	49	52	93	113	90	1.9
Dec 1991	41	52	93	113	90	1.9[1]
Annual Average Pumping Rate (gpm)	47	48	92	99	90	11

[1]Flow meter malfunction, estimated flow rate
[2]Well not pumping full-time due to motor control failure
[3]Well not pumping full-time due to stripper fan failure
[4]Well not pumping full-time due to Magnolia Member pump test

TABLE 2

1991 OPERATING AND DOWNTIME
PUMP-OUT WELLS

	Glacial Drift Pump-Out Well Downtime (Days)					Carimona Pump-Out Well Downtime (Days)
	109	110	111	112	113	108
Jan 1991	0	0	0	0	0	0
Feb 1991	8[1]	0	0	0	0	0
Mar 1991	0	0	0	0	0	0
Apr 1991	0	16[1]	0	0	0	0
May 1991	0	9[1]	0	0	0	8[2]
Jun 1991	0	2[1]	0	0	0	6[2]
Jul 1991	0	7[1]	0	0	0	0
Aug 1991	0	0	0	0	0	0
Sep 1991	0	0	0	0	0	0
Oct 1991	1	1	0	0	0	1
Nov 1991	0	0	0	0	0	0
Dec 1991	0	0	0	0	0	0
Percent (%) Operating Time	95	90	100	100	100	96

[1]Motor control failure.
[2]Magnolia Member pump test.

TABLE 3

1991 GROUNDWATER ELEVATIONS
GLACIAL DRIFT WELLS

(elevations in feet/MSL)

DATE	1	3	109 (1)	110 (1)	111 (1)
04/01/91	841.36	832.92	826.58	826.60	817.98
09/25/91	842.02	834.25	830.56	829.33	820.19

DATE	112 (1)	113 (1)	B	Q	S
04/01/91	808.26	817.91	842.76	827.43	825.96
09/25/91	816.07	820.27	843.46	828.90	828.42

DATE	T	U	V	W	X
04/01/91	832.14	835.35	815.60	815.69	DRY
09/25/91	833.06	836.54	818.19	818.18	824.25

(1) Pumping well.

2,.001

TABLE 4

1991 GROUNDWATER ELEVATIONS
CARIMONA MEMBER WELLS

(elevations in feet/MSL)

DATE	8	9	10	11	12
04/01/91	828.63	828.84	828.83	828.70	828.92
09/25/91	829.19	829.40	829.40	829.15	828.46

DATE	13	108 (1)	BB	RR	SS
04/01/91	828.06	807.87	828.75	828.76	826.42
09/25/91	828.55	804.55	829.25	829.41	826.95

DATE	UU	WW
04/01/91	828.69	828.66
09/25/91	829.23	831.23

(1) Pumping well.

2,.002

TABLE 5

1991 GROUNDWATER ELEVATIONS
MAGNOLIA MEMBER WELLS

(elevations in feet/MSL)

DATE	OO	QQ	TT	V V	ZZ
04/01/91	824.52	824.25	821.75	825.46	829.44
09/25/91	825.50	825.19	823.05	826.28	829.94

2,.003

TABLE 6

1991 GROUNDWATER ELEVATIONS
ST. PETER SANDSTONE WELLS

(elevations in feet/MSL)

DATE	200	201	202	203
04/01/91	761.75	778.01	753.50	752.94
09/25/91	761.38	778.26	753.38	752.96

2,.004

TABLE 7

1991 WATER QUALITY
ANALYTICAL PARAMETERS

Chlorinated Volatile Solvents

1,1-Dichloroethane

1,2-Dichloroethane

1,2-Dichloroethylene, cis

1,2-Dichloroethylene, trans

1,1,2,2-Tetrachloroethane

Tetrachloroethylene

1,1,1-Trichloroethane

Trichloroethene

TABLE 8

1991 WATER QUALITY DATA
GLACIAL DRIFT WELLS

(concentrations in ug/L)

	B	Q	S		T	U	V	
	04/03/91	04/02/91	04/03/91	09/26/91	04/02/91	04/02/91	04/03/91	09/26/91
1,1-Dichloroethane	2.2	2.4	0.5	--	<0.5	<0.5	<0.5	--
1,2-Dichloroethylene, cis	2.3	<0.5	27	--	<0.5	<0.5	8.0	--
1,2-Dichloroethylene, trans	<0.5	<0.5	2.2	--	<0.5	<0.5	0.7	--
1,2-Dichloroethane	<0.5	<0.5	<0.5	--	<0.5	<0.5	<0.5	--
1,1,2,2-Tetrachloroethane	<0.5	<0.5	<0.5	--	<0.5	<0.5	<0.5	--
Tetrachloroethylene	6.0	<0.5	5.4	--	<0.5	<0.5	<0.5	--
1,1,1-Trichloroethane	4.3	9.4	1.2	--	<0.5	<0.5	<0.5	--
Trichloroethylene	340	0.7	870	480	<0.5	2.0	130	73
Sum Volatile Organics	360	13	910	480	ND	2.0	140	73

	W		X	1		3	
	04/02/91	09/26/91	04/01/91	04/02/91	09/26/91	04/01/91	09/26/91
1,1-Dichloroethane	<0.5	--	--	<0.5	--	11	--
1,2-Dichloroethylene, cis	12	--	--	<0.5	--	32	--
1,2-Dichloroethylene, trans	<0.5	--	--	<0.5	--	<0.5	--
1,2-Dichloroethane	<0.5	--	--	<0.5	--	<0.5	--
1,1,2,2-Tetrachloroethane	<0.5	--	--	<0.5	--	<0.5	--
Tetrachloroethylene	<0.5	--	--	3.4	--	8.3	--
1,1,1-Trichloroethane	<0.5	--	--	<0.5	--	4.3	--
Trichloroethylene	40	20	--	3.1	1.3	1500	300
Sum Volatile Organics	52	20	DRY	6.5	1.3	1600	300

ND Not Detected.
-- Not Analyzed.

.001

TABLE 9

1991 WATER QUALITY DATA
CARIMONA MEMBER WELLS

(concentrations in ug/L)

	BB	RR	SS	UU	WW	8
	04/03/91	04/03/91	04/03/91	04/02/91	04/03/91	04/04/91
1,1-Dichloroethane	6.6	2.2	9.3	0.7	2.1	<0.5
1,2-Dichloroethylene, cis	40	15	1.6	7.8	23	1.9
1,2-Dichloroethylene, trans	1.6	<0.5	<0.5	1.8	2.6	<0.5
1,2-Dichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	0.8
1,1,2,2-Tetrachloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	11	0.5	<0.5	<0.5	4.0	1.2
1,1,1-Trichloroethane	7.4	0.9	<0.5	<0.5	2.9	1.0
Trichloroethylene	1100	150	4.5	64	420	80
Sum Volatile Organics	1200	170	15	74	460	85

	9		10		11	
	04/04/91	09/26/91	04/04/91	09/26/91	04/03/91	09/26/91
1,1-Dichloroethane	1.5	--	<0.5	--	0.7	--
1,2-Dichloroethylene, cis	<0.5	--	1.8	--	12	--
1,2-Dichloroethylene, trans	<0.5	--	<0.5	--	<0.5	--
1,2-Dichloroethane	3.8	--	<0.5	--	1.6	--
1,1,2,2-Tetrachloroethane	<0.5	--	<0.5	--	<0.5	--
Tetrachloroethylene	<0.5	--	1.0	--	0.6	--
1,1,1-Trichloroethane	<0.5	--	2.5	--	<0.5	--
Trichloroethylene	7.3	10	110	120	8.7	3.2
Sum Volatile Organics	13	10	120	120	24	3.2

	12		13	108	
	04/04/91	09/26/91	04/03/91	04/01/91	09/25/91
1,1-Dichloroethane	<0.5	--	<0.5	3.1	--
1,2-Dichloroethylene, cis	<0.5	--	<0.5	34	--
1,2-Dichloroethylene, trans	<0.5	--	<0.5	1.9	--
1,2-Dichloroethane	<0.5	--	<0.5	<0.5	--
1,1,2,2-Tetrachloroethane	<0.5	--	<0.5	<0.5	--
Tetrachloroethylene	<0.5	--	<0.5	3.4	--
1,1,1-Trichloroethane	<0.5	--	<0.5	2.2	--
Trichloroethylene	<0.5	<0.5	<0.5	710	76
Sum Volatile Organics	ND	<0.5	ND	760	76

-- Not analyzed.
ND Not Detected.

.002

TABLE 10

1991 WATER QUALITY DATA
MAGNOLIA MEMBER WELLS

(concentrations in ug/L)

	OO		QQ	TT
	04/03/91	09/26/91	04/03/91	04/01/91
1,1-Dichloroethane	<0.5	--	<0.5	0.7
1,2-Dichloroethylene, cis	9.1	--	<0.5	6.7
1,2-Dichloroethylene, trans	4.4	--	0.6	<0.5
1,2-Dichloroethane	<0.5	--	<0.5	<0.5
1,1,2,2-Tetrachloroethane	<0.5	--	<0.5	<0.5
Tetrachloroethylene	<0.5	--	<0.5	<0.5
1,1,1-Trichloroethane	<0.5	--	<0.5	<0.5
Trichloroethylene	5.1	5.0	<0.5	140
Sum Volatile Organics	19	5.0	0.6	150

	V V		ZZ	
	04/03/91	09/26/91	04/04/91	09/26/91
1,1-Dichloroethane	<0.5	--	0.6	--
1,2-Dichloroethylene, cis	6.0	--	6.4	--
1,2-Dichloroethylene, trans	<0.5	--	1.0	--
1,2-Dichloroethane	<0.5	--	0.6	--
1,1,2,2-Tetrachloroethane	<0.5	--	<0.5	--
Tetrachloroethylene	<0.5	--	0.7	--
1,1,1-Trichloroethane	1.3	--	<0.5	--
Trichloroethylene	75	48	170	30
Sum Volatile Organics	82	48	180	30

-- Not analyzed.

.003

TABLE 11

1991 WATER QUALITY DATA
MAGNOLIA MEMBER PUMP-OUT WELL

(concentrations in ug/L)

	MG1
	06/07/91
Chloromethane	<1.0
Bromomethane	<1.0
Vinyl Chloride	<1.0
Chloroethane	<1.0
Methylene Chloride	1.7
Dichlorodifluoromethane	<1.0
Trichlorofluoromethane	<1.0
1,1-Dichloroethylene	<1.0
1,1-Dichloroethane	<1.0
1,2-Dichloroethylene, trans	<1.0
1,2-Dichloroethylene, cis	2.6
Chloroform	<1.0
1,2-Dichloroethane	1.0
1,1,1-Trichloroethane	<1.0
Carbon Tetrachloride	<1.0
Bromodichloromethane	<1.0
1,2-Dichloropropane	<1.0
Cis-1,3-Dichloro-1-propene	<1.0
Trichloroethylene	33
Chlorodibromomethane	<1.0
1,1,2-Trichloroethane	<1.0
Benzene	<1.0
Trans-1,3-Dichloro-1-propene	<1.0
Bromoform	<1.0
Tetrachloroethylene	<1.0
1,1,2,2-Tetrachloroethane	<1.0
Toluene	<1.0
Chlorobenzene	<1.0
Ethyl Benzene	<1.0
Xylenes	<1.0
1,3-Dichlorobenzene	<1.0
1,4-Dichlorobenzene	<1.0
1,2-Dichlorobenzene	<1.0
Sum Volatile Organics	38

.010

TABLE 12

1991 WATER QUALITY DATA
ST. PETER SANDSTONE WELLS

(concentrations in ug/L)

	200		201	202	203
	04/04/91	09/26/91	04/04/91	04/04/91	04/04/91
1,1-Dichloroethane	<0.5	--	<0.5	<0.5	<0.5
1,2-Dichloroethylene, cis	6.5	--	<0.5	<0.5	<0.5
1,2-Dichloroethylene, trans	<0.5	--	<0.5	<0.5	<0.5
1,2-Dichloroethane	<0.5	--	<0.5	<0.5	<0.5
1,1,2,2-Tetrachloroethane	<0.5	--	<0.5	<0.5	<0.5
Tetrachloroethylene	0.7	--	<0.5	<0.5	<0.5
1,1,1-Trichloroethane	<0.5	--	<0.5	<0.5	<0.5
Trichloroethylene	140	77	<0.5	<0.5	3.0
Sum Volatile Organics	150	77	ND	ND	3.0

ND Not Detected.
-- Not analyzed.

.004

TABLE 13

1991 WATER QUALITY DATA
PRAIRIE DU CHIEN/JORDAN WELL

(concentrations in ug/L)

	HENKEL	
	07/11/91	09/26/91
1,1-Dichloroethane	2.2	0.95
1,2-Dichloroethylene, cis	<0.5	<0.5
1,2-Dichloroethylene, trans	<0.5	<0.5
1,2-Dichloroethane	<0.5	<0.5
1,1,2,2-Tetrachloroethane	<0.5	<0.5
Tetrachloroethylene	<0.5	<0.5
1,1,1-Trichloroethane	0.53	<0.5
Trichloroethylene	49	18
Sum Volatile Organics	52	19

.011

TABLE 14

1991 GROUNDWATER PUMP-OUT AND
TREATMENT SYSTEM WATER QUALITY PARAMETERS

Chlorinated Volatile Organic Compounds

1,1-Dichloroethane

1,2-Dichloroethane

1,2-Dichloroethylene, cis

1,2-Dichloroethylene, trans

1,1,2,2-Tetrachloroethane

Tetrachloroethylene

1,1,1-Trichloroethane

Trichloroethene

Non-Chlorinated Volatile Organic Compounds

Benzene

Toluene

Xylenes

TABLE 15

1991 WATER QUALITY DATA
DOWNGRADIENT PUMP-OUT SYSTEM

(concentrations in ug/L)

	DISCHARGE (1)			
	01/11/91	04/01/91	07/11/91	09/25/91
1,1-Dichloroethane	--	0.9	--	0.68
1,2-Dichloroethylene, cis	--	14	--	<0.5
1,2-Dichloroethylene, trans	--	<0.5	--	<0.5
1,2-Dichloroethane	--	<0.5	--	<0.5
1,1,2,2-Tetrachloroethane	--	<0.5	--	<0.5
Tetrachloroethylene	--	2.1	--	1.7
1,1,1-Trichloroethane	--	2.4	--	1.3
Trichloroethylene	150	290	210	110
Benzene	--	<0.5	--	<0.5
Toluene	--	<0.5	--	<0.5
Xylenes	--	<0.5	--	<0.5
Sum Volatile Organics	150	310	210	110

(1) Pump-out well 111, 112, 113.
-- Not analyzed.

.005

TABLE 16

1991 WATER QUALITY DATA
SITE PUMP-OUT AND TREATMENT SYSTEMS

(concentrations in ug/L)

	INFLUENT (1)			
	01/11/91	04/01/91	07/11/91	09/25/91
1,1-Dichloroethane	--	7.6	--	2.5
1,2-Dichloroethylene, cis	--	100	--	<0.5
1,2-Dichloroethylene, trans	--	1.6	--	0.93
1,2-Dichloroethane	--	7.3	--	2.0
1,1,2,2-Tetrachloroethane	--	<0.5	--	<0.5
Tetrachloroethylene	--	11	--	3.9
1,1,1-Trichloroethane	--	13	--	4.4
Trichloroethylene	430	890	370	320
Benzene	--	40	--	18
Toluene	--	80	--	36
Xylenes	--	9.2	--	13
Sum Volatile Organics	430	1000	370	400

	EFFLUENT (2)			
	01/11/91	04/01/91	07/11/91	09/25/91
1,1-Dichloroethane	--	<0.5	--	<0.5
1,2-Dichloroethylene, cis	--	<0.5	--	<0.5
1,2-Dichloroethylene, trans	--	<0.5	--	<0.5
1,2-Dichloroethane	--	<0.5	--	<0.5
1,1,2,2-Tetrachloroethane	--	<0.5	--	<0.5
Tetrachloroethylene	--	<0.5	--	<0.5
1,1,1-Trichloroethane	--	<0.5	--	<0.5
Trichloroethylene	0.8	1.0	<0.5	<0.5
Benzene	--	<0.5	--	<0.5
Toluene	--	<0.5	--	<0.5
Xylenes	--	<0.5	--	<0.5
Sum Volatile Organics	0.8	1.0	ND	ND

(1) Pump-out wells 108, 109, 110.
(2) Effluent from groundwater treatment system.
-- Not analyzed.

.006

TABLE 17

WATER QUALITY DATA
PRIORITY POLLUTANT VOLATILE ORGANIC ANALYSIS
EPA METHOD 624
APRIL 1, 1991

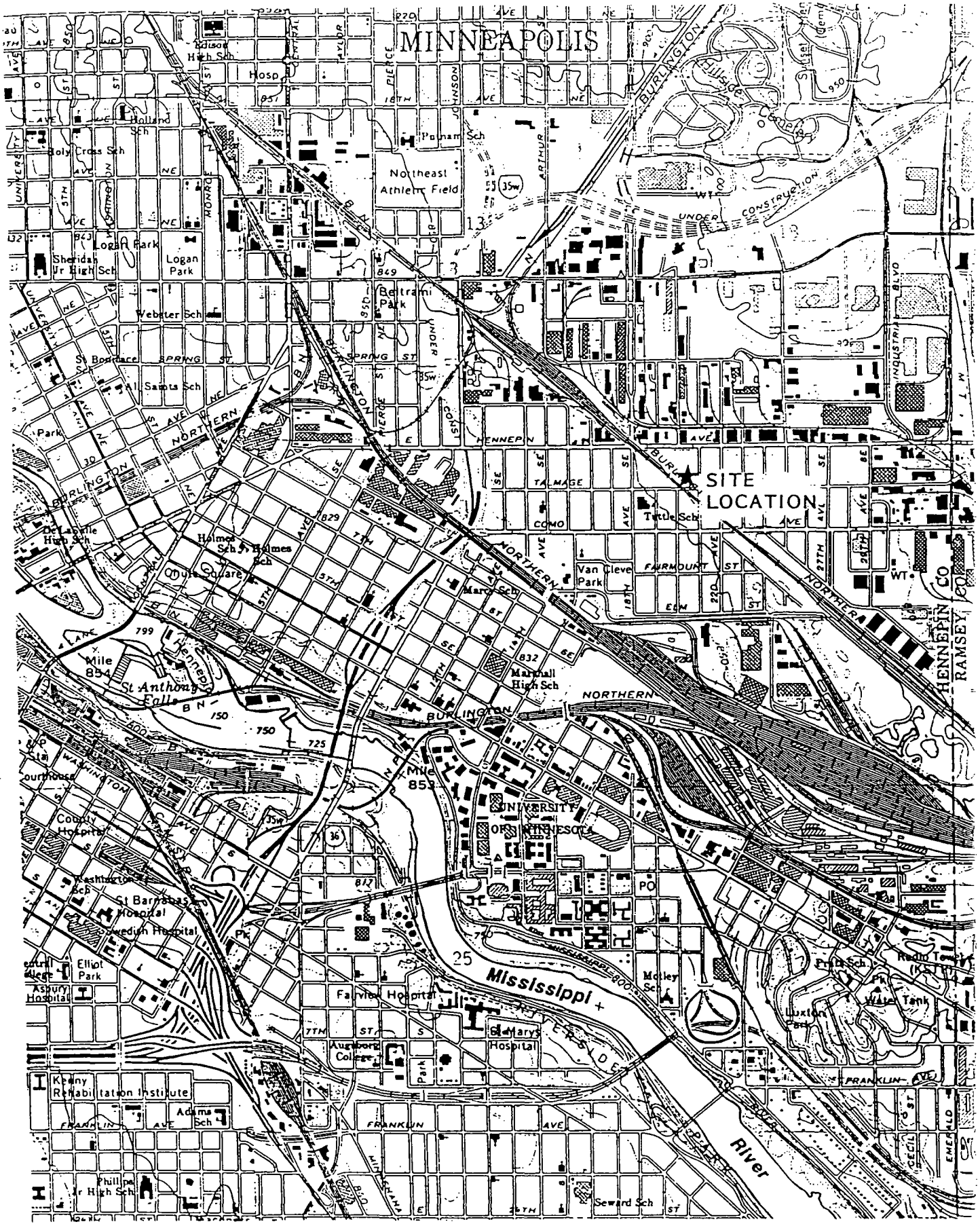
(concentrations in ug/L)

	INFLUENT (1)	BLANK
	04/01/91	04/01/91
Chloromethane	<10	<10
Bromomethane	<10	<10
Vinyl Chloride	<10	<10
Chloroethane	<10	<10
Methylene Chloride	3 bj	2 j
Acetone	8 bj	3 j
Carbondisulfide	<5	<5
Trichlorofluoromethane	<5	<5
1,1-Dichloroethylene	<5	<5
1,1-Dichloroethane	4 j	<5
1,2-Dichloroethylene	55	<5
Chloroform	22	<5
1,2-Dichloroethane	6	<5
Methyl Ethyl Ketone	<10	<10
1,1,1-Trichloroethane	8	<5
Carbon Tetrachloride	<5	<5
Vinyl Acetate (Vinyl Ester)	<10	<10
Bromodichloromethane	<5	<5
1,2-Dichloropropane	<5	<5
Cis-1,3-Dichloro-1-propene	<5	<5
Trichloroethylene	450	<5
Chlorodibromomethane	<5	<5
1,1,2-Trichloroethane	1 j	<5
Benzene	43	<5
Trans-1,3-Dichloro-1-propene	<5	<5
2-Chloroethylvinyl Ether	<10	<10
Bromoform	<5	<5
2-Hexanone	<10	<10
Methyl Isobutyl Ketone	<10	<10
Tetrachloroethylene	8	<5
1,1,2,2-Tetrachloroethane	3 j	<5
Toluene	100	<5
Chlorobenzene	<5	<5
Ethyl Benzene	4 j	<5
Styrene	<5	<5
Xylenes	20	<5
1,3-Dichlorobenzene	<5	<5
1,4-Dichlorobenzene	<5	<5
1,2-Dichlorobenzene	<5	<5
Sum Volatile Organics	720	5

b Potential false positive value based on data validation procedure.
j Reported value is less than method detection limit.
(1) Flow rate weighted composite sample (Pump-out wells 108, 109, 110).

.007

Figures



0 NORTH 2000

Scale in Feet

Figure 1

EAST HENNEPIN AVENUE SITE
REGIONAL LOCATION MAP

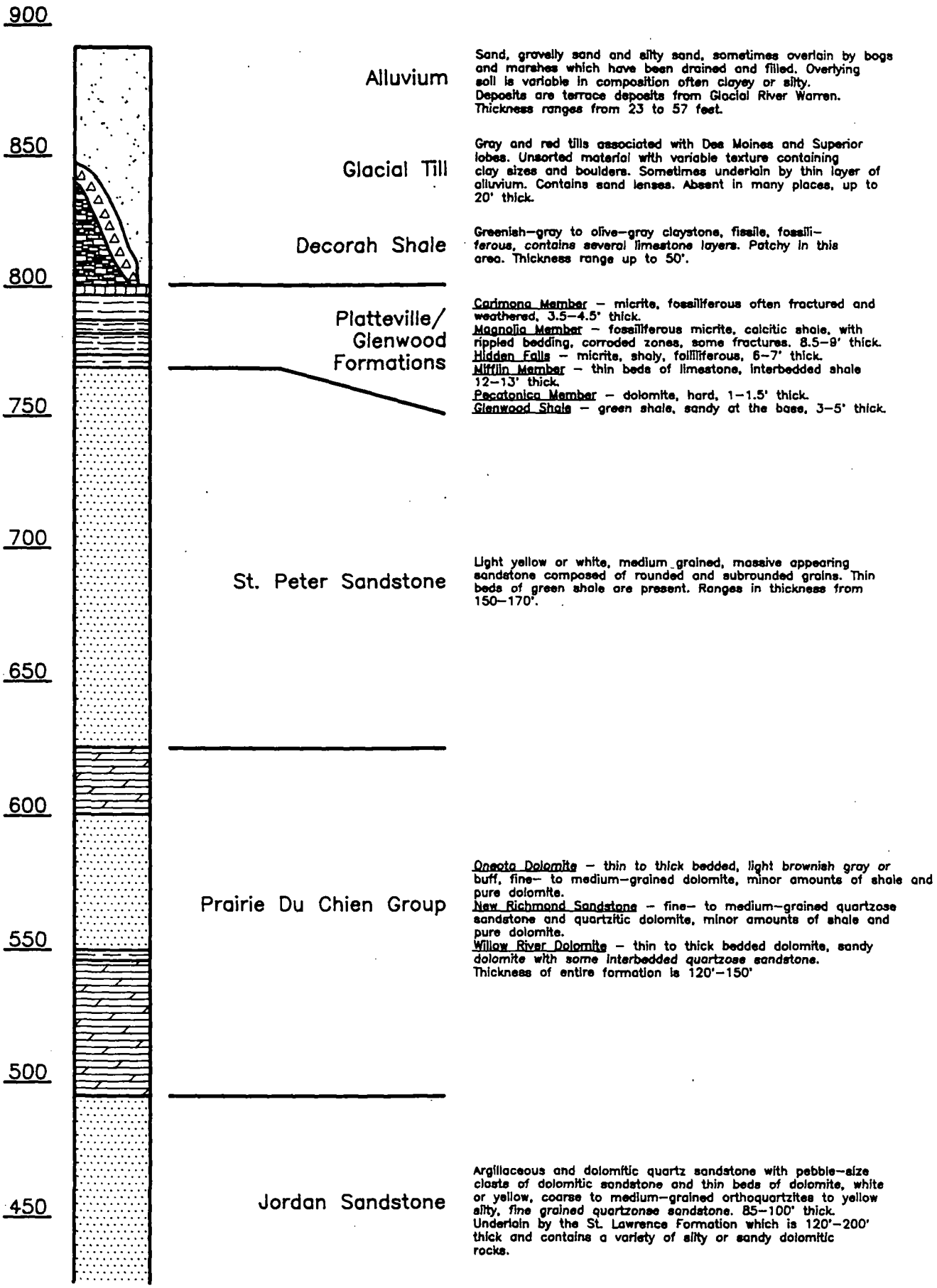
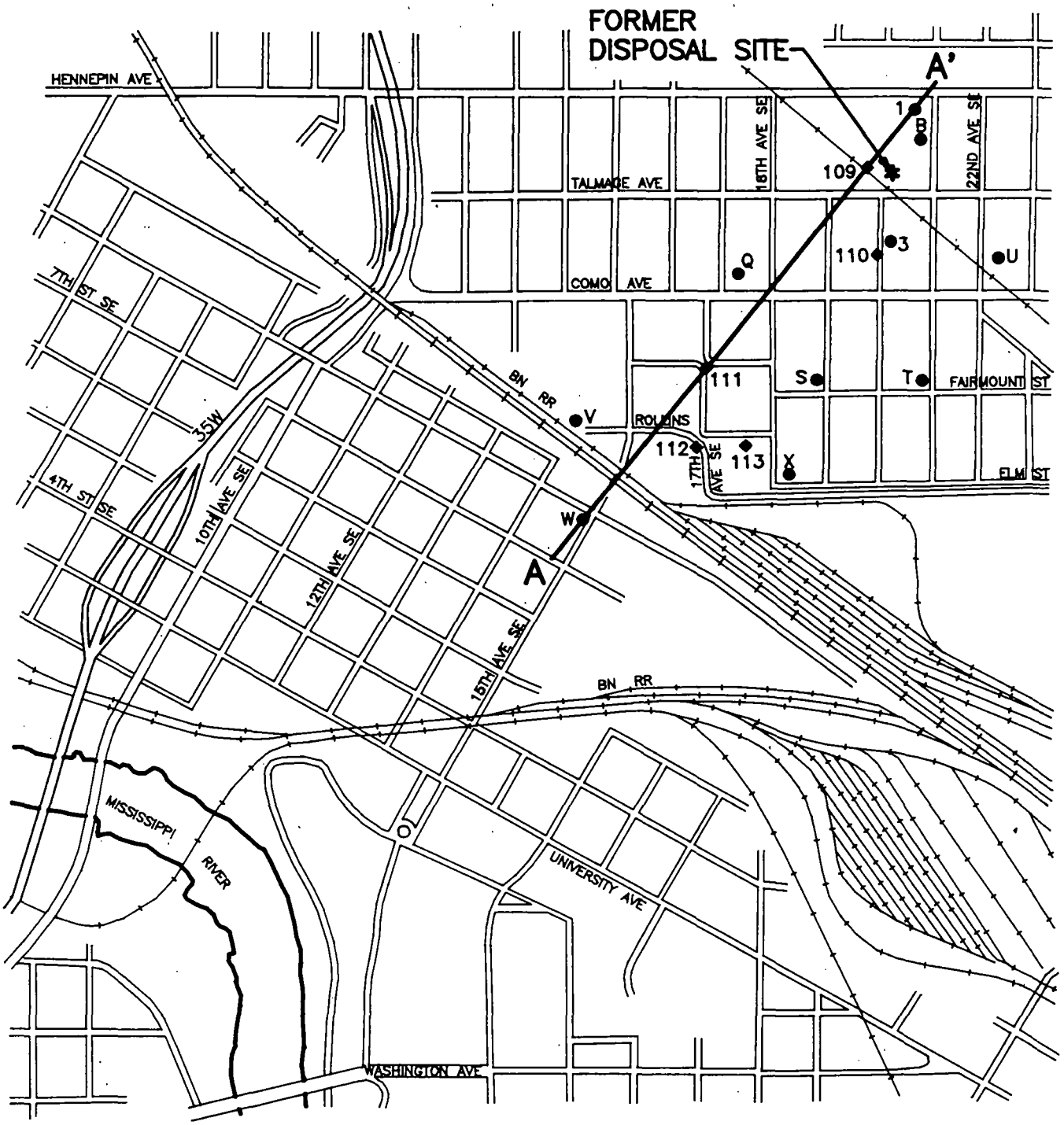


Figure 2

GENERALIZED GEOLOGIC COLUMN

RJW GED-COL 1.00 12/09/1991 16:08:27



- GLACIAL DRIFT MONITORING WELL
- GLACIAL DRIFT PUMP-OUT WELL

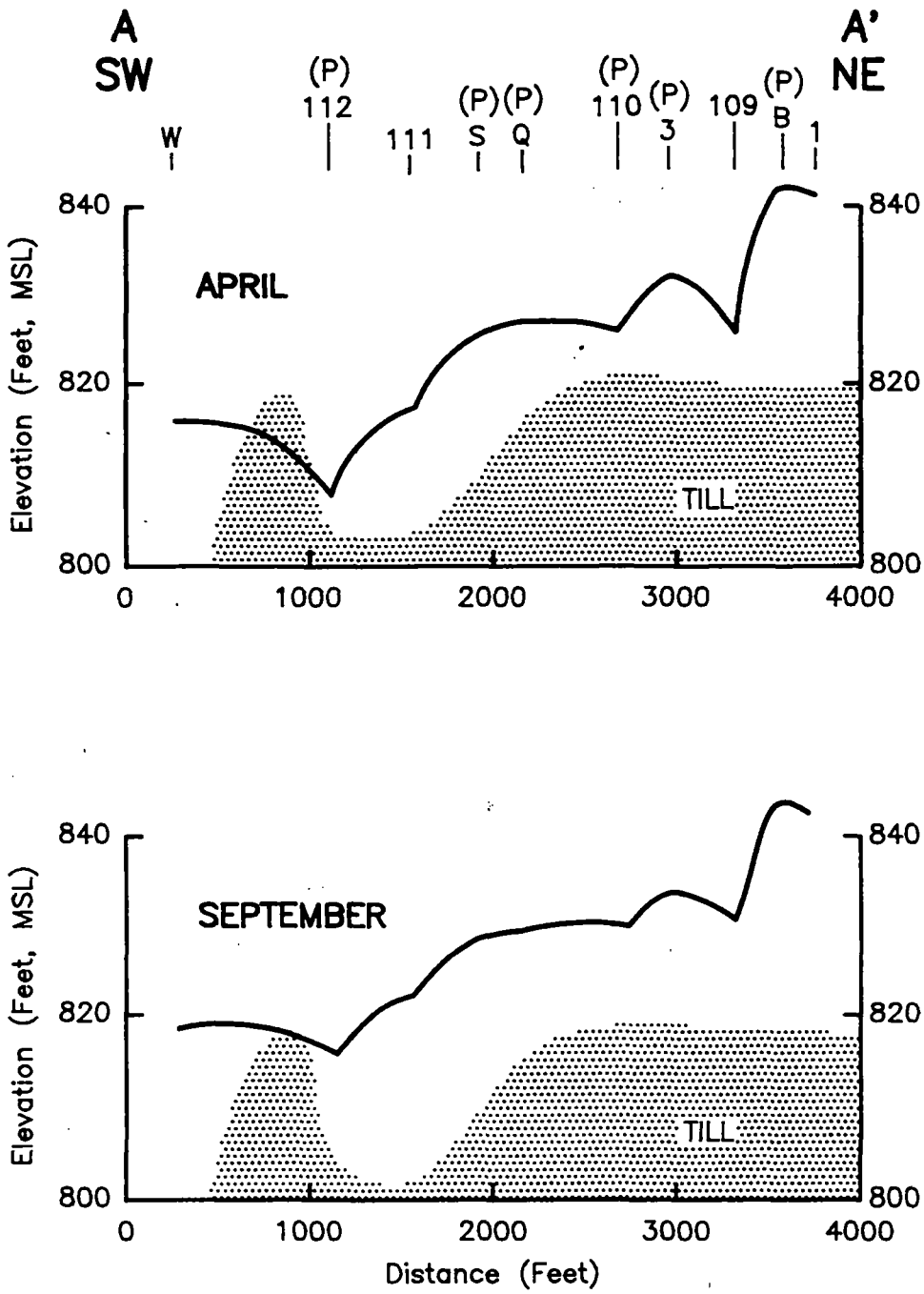
A—A' CROSS SECTION

0 1000
SCALE IN FEET

RJW GM91-F3 1.00 01/07/1992 10:30:48

Figure 3

1991 MONITORING LOCATIONS
GLACIAL DRIFT

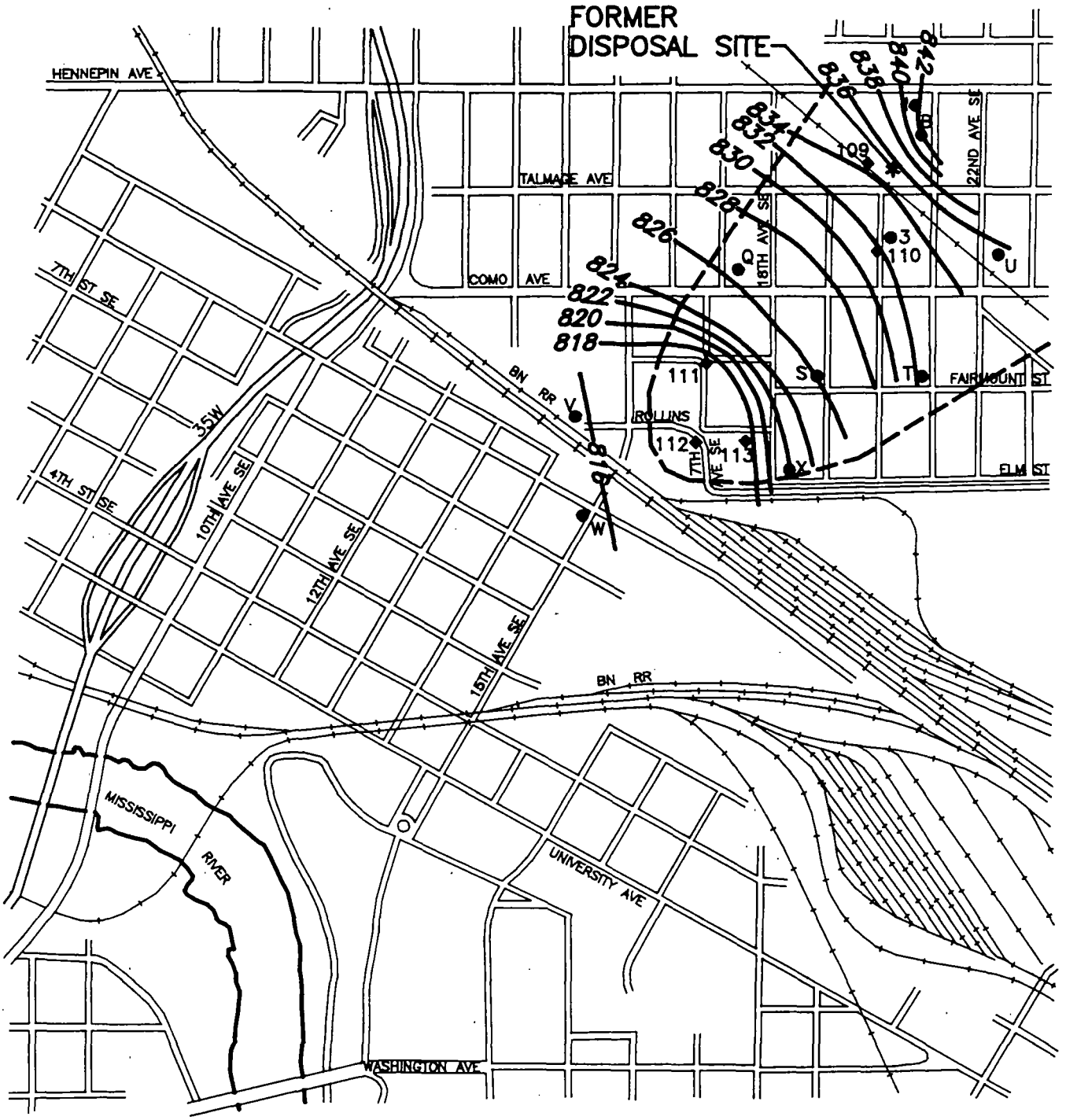


(P) PROJECTED

Figure 4

CROSS SECTION A–A'
GLACIAL DRIFT WATER TABLE ELEVATIONS
April, September 1991

RJW GM91-F4 1.00 01/07/1992 10:41:14



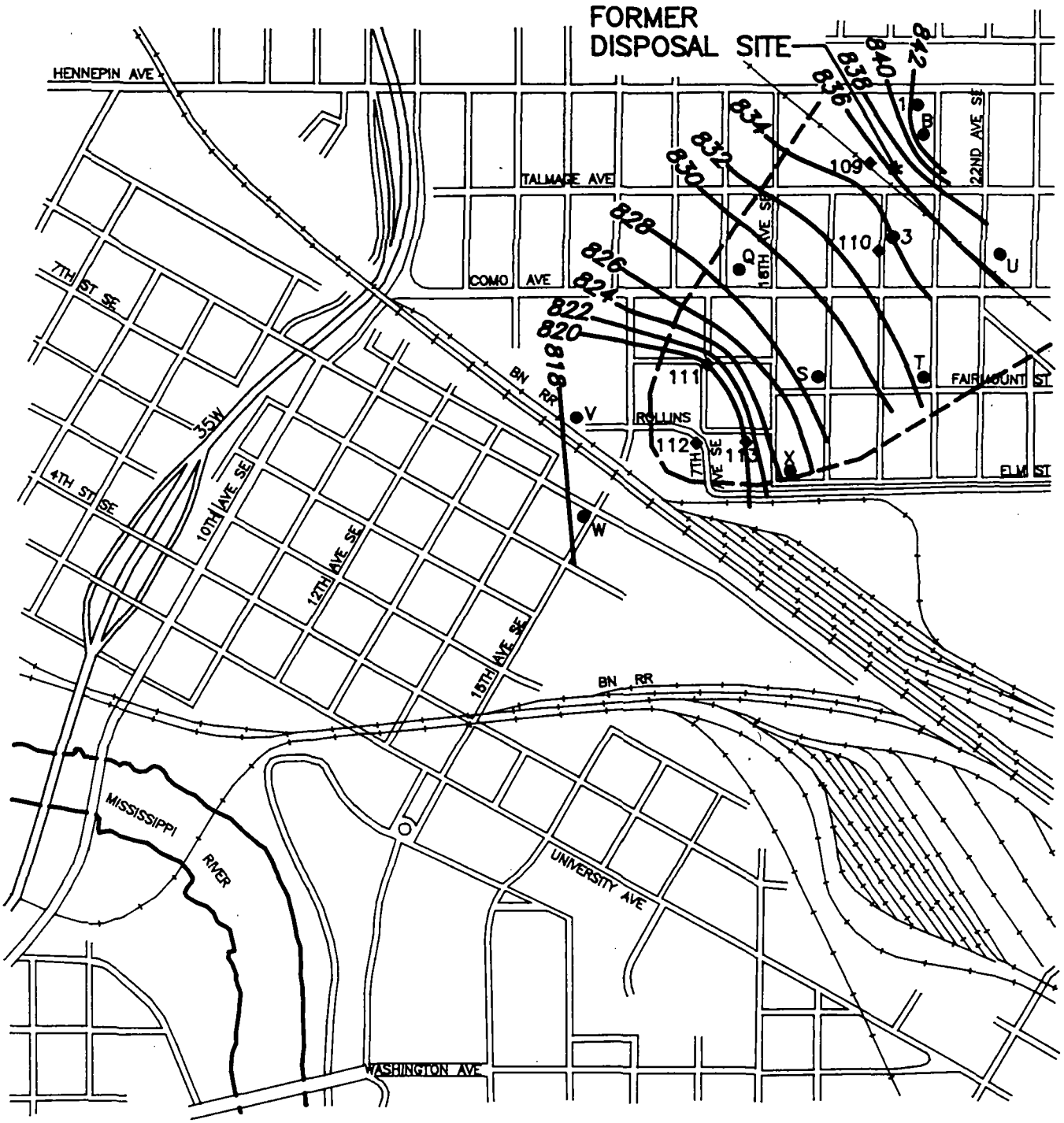
- GLACIAL DRIFT MONITORING WELL
- SITE AND DOWNGRADIENT GLACIAL DRIFT PUMP-OUT WELL
- —828— WATER TABLE CONTOUR (MSL)
- ESTIMATED CONTAINMENT ZONE

0 1000
SCALE IN FEET

RJW 0491-F5 1.00 01/07/1992 10:44:46

Figure 5

GLACIAL DRIFT AQUIFER
WATER TABLE ELEVATIONS
April 1991



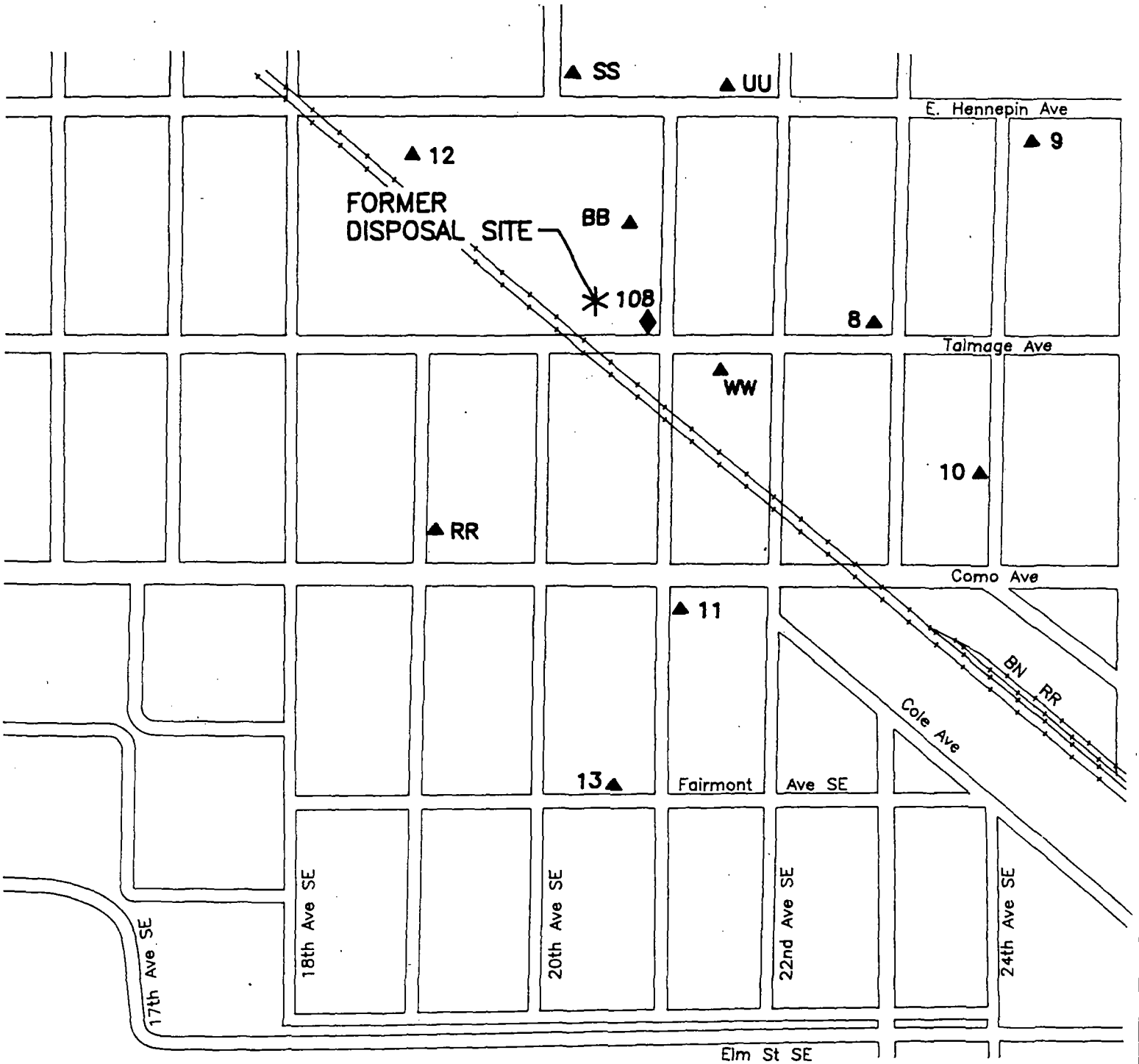
- GLACIAL DRIFT MONITORING WELL
- SITE AND DOWNGRADIENT GLACIAL DRIFT PUMP-OUT WELL
- —828— WATER TABLE CONTOUR (MSL)
- ESTIMATED CONTAINMENT ZONE

0 1000
SCALE IN FEET

RJW GM91-F6 1.00 01/07/1992 10:55:01

Figure 6

GLACIAL DRIFT AQUIFER
WATER TABLE ELEVATIONS
September 1991



▲ CARIMONA MEMBER MONITORING WELL

♦ CARIMONA MEMBER PUMP-OUT WELL

N

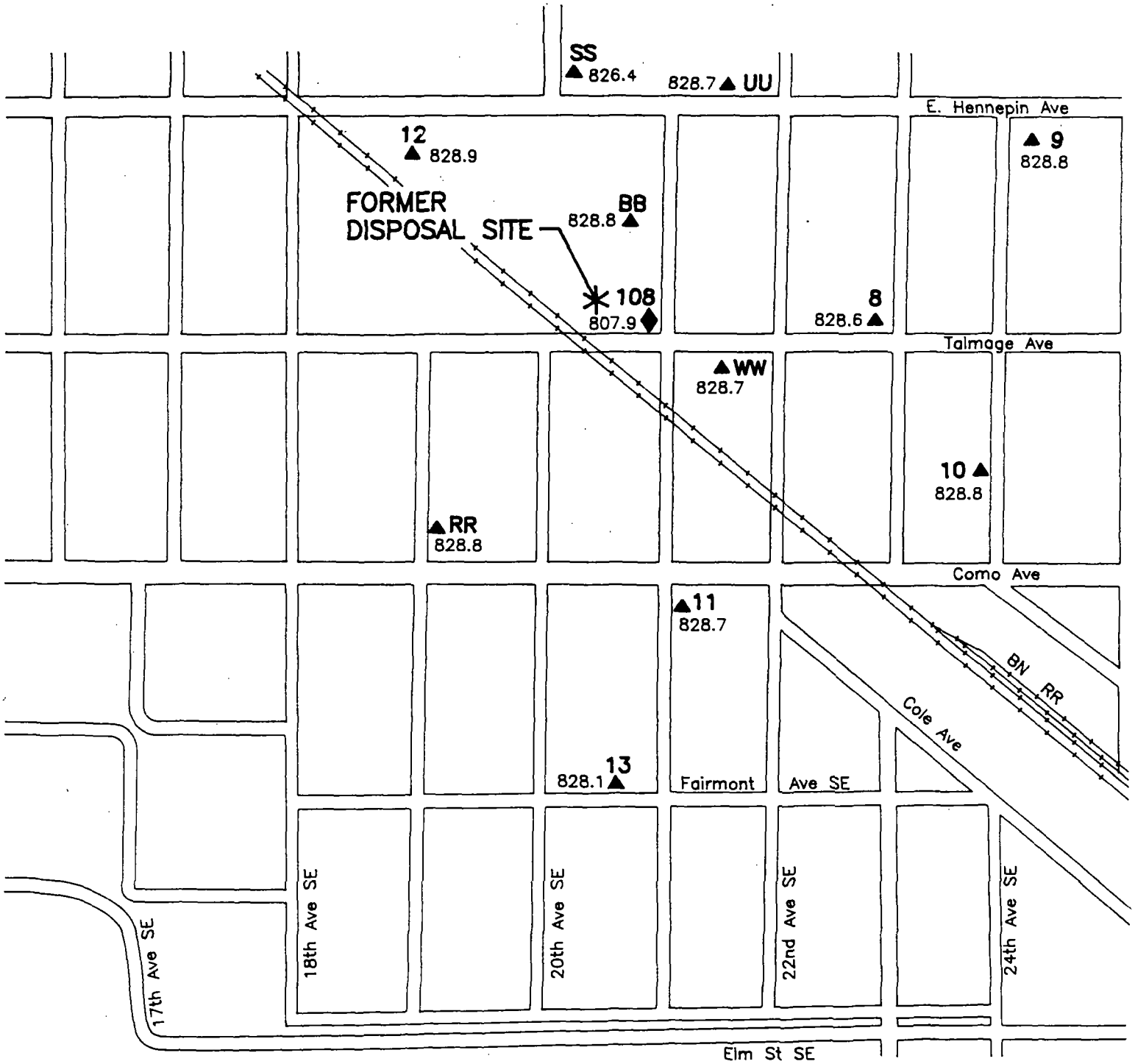
0 200 400

SCALE IN FEET

RUN GM81-F7 1.00 11/14/1991 10:46:30

Figure 7

1991 MONITORING LOCATIONS
CARIMONA MEMBER



▲ CARIMONA MEMBER MONITORING WELL

♦ CARIMONA MEMBER PUMP-OUT WELL

828.1 CARIMONA POTENTIOMETRIC SURFACE ELEVATION (MSL)

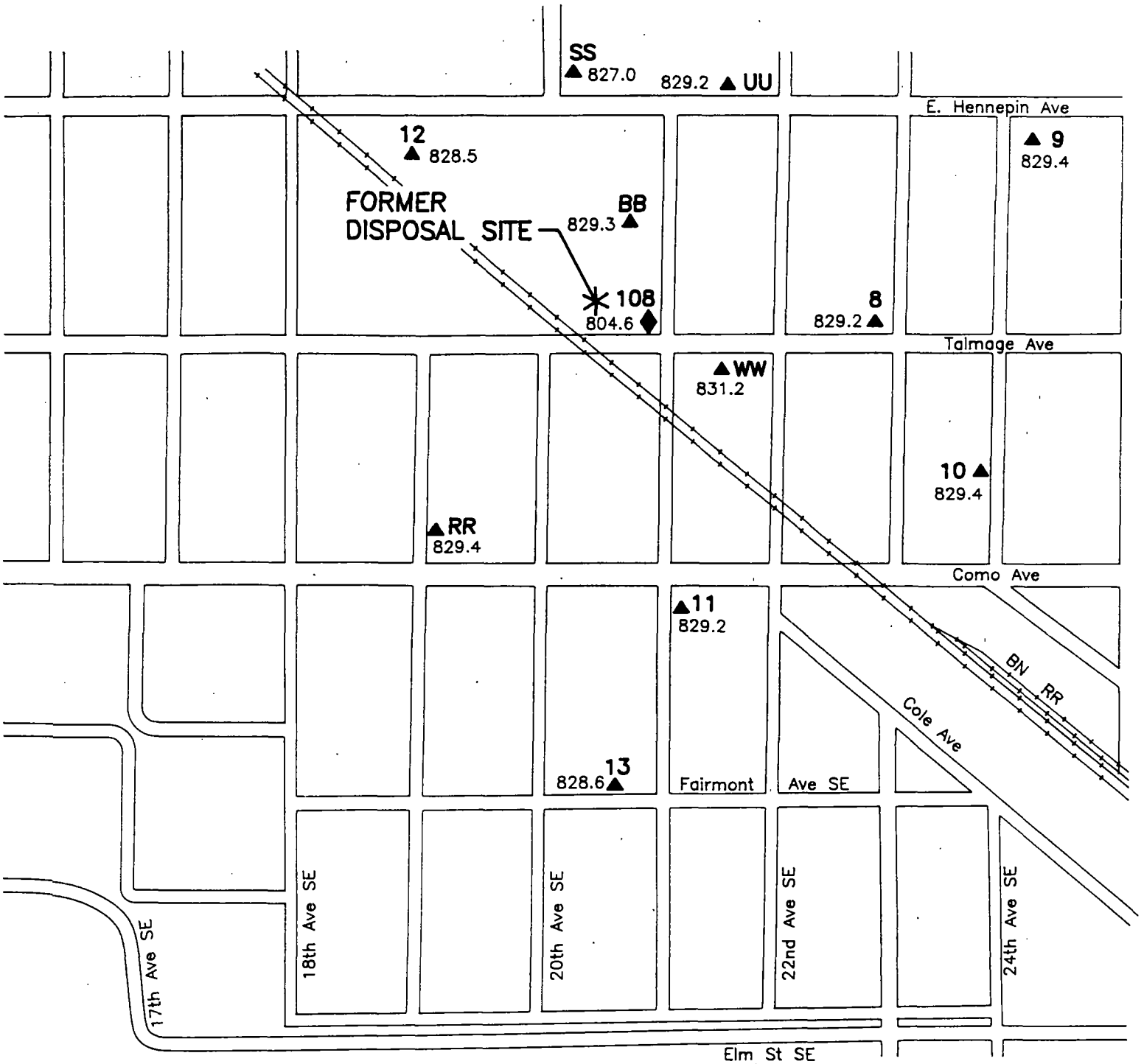
N

0 200 400

SCALE IN FEET

Figure 8

CARIMONA MEMBER
POTENTIOMETRIC SURFACE ELEVATION
April 1991



▲ CARIMONA MEMBER MONITORING WELL

♦ CARIMONA MEMBER PUMP-OUT WELL

829.2 CARIMONA POTENTIOMETRIC SURFACE ELEVATION (MSL)

N

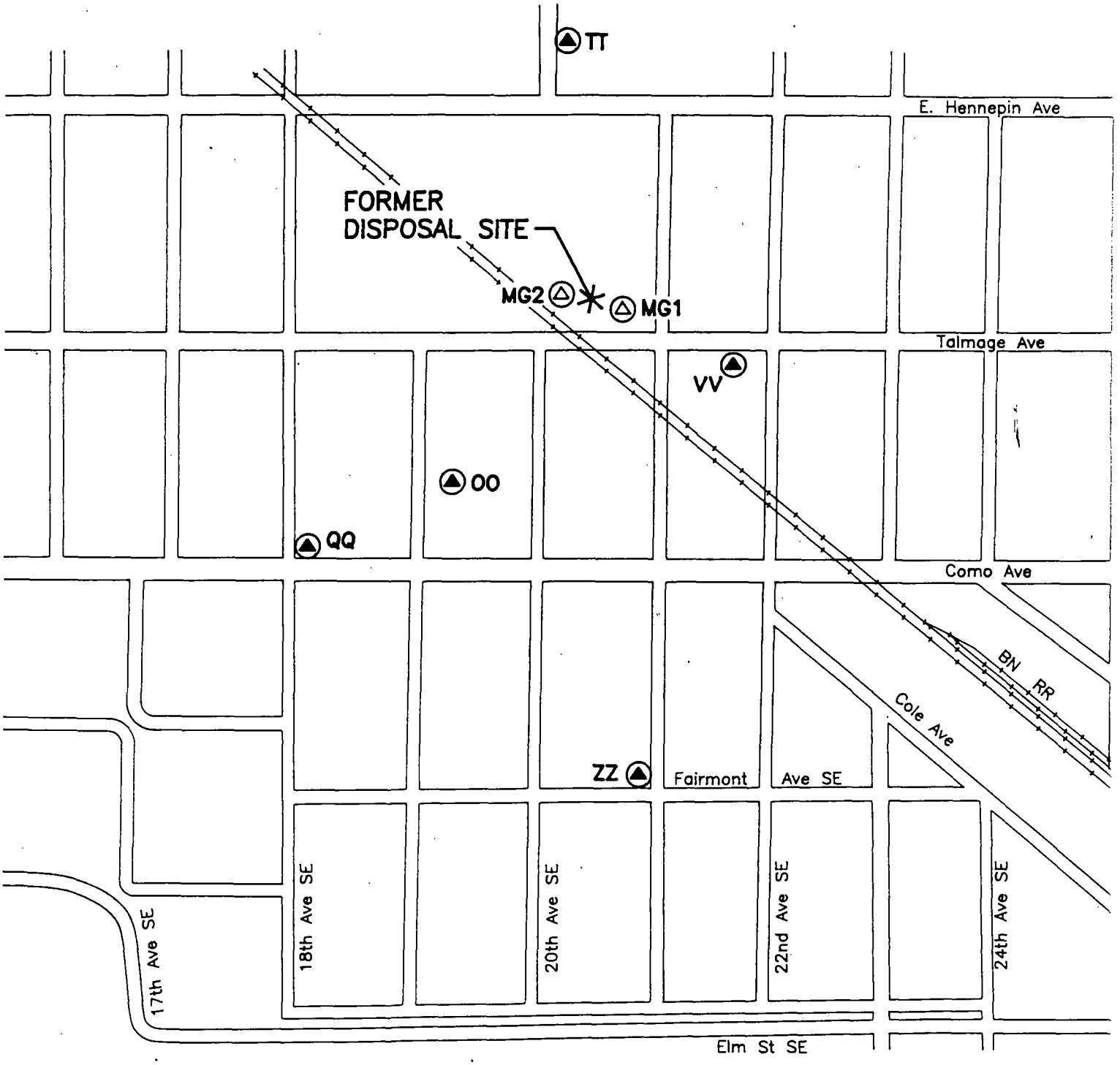
0 200 400

SCALE IN FEET

RJW GA91-F9 1.00 11/14/1991 10:58:57

Figure 9

CARIMONA MEMBER
POTENTIOMETRIC SURFACE ELEVATION
September 1991



MAGNOLIA MEMBER MONITORING WELL

MAGNOLIA MEMBER PUMP-OUT WELL

N

0 200 400

SCALE IN FEET

RJW GM091-F10 1.00 12/09/1991 16:12:35

Figure 10

1991 MONITORING LOCATIONS
MAGNOLIA MEMBER

TT
821.8

E. Hennepin Ave

FORMER
DISPOSAL SITE

Talmage Ave

822

825.5
VV

OO
824.5

QQ
824.3

824

Como Ave

826

BN RR

Cole Ave

829.4
ZZ

Fairmont Ave SE

828

17th Ave SE

18th Ave SE

20th Ave SE

22nd Ave SE

24th Ave SE

Elm St SE

MAGNOLIA MEMBER MONITORING WELL

821.8 MAGNOLIA POTENTIOMETRIC SURFACE ELEVATION (MSL)

MAGNOLIA POTENTIOMETRIC SURFACE CONTOUR (MSL)

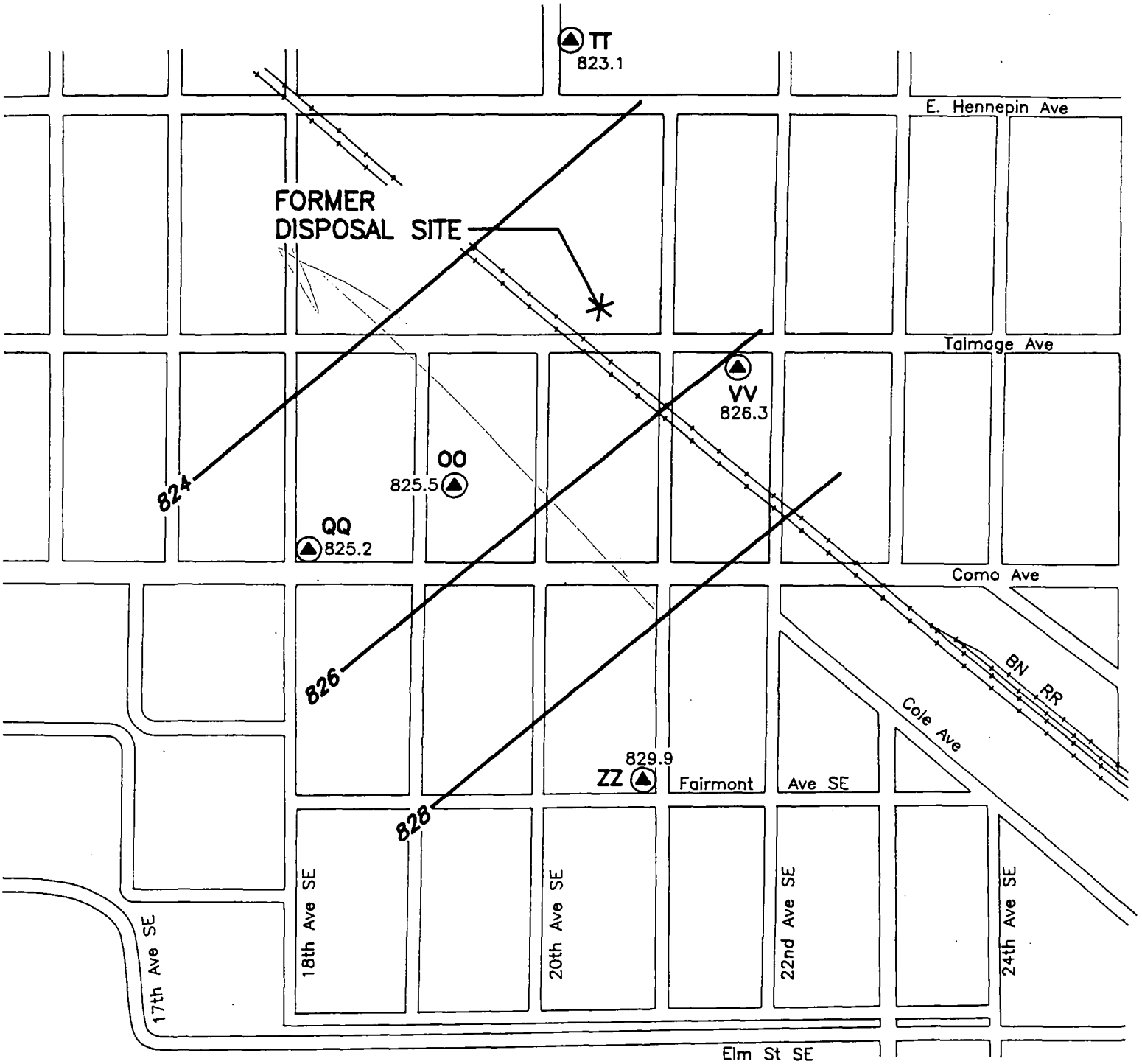
N

0 200 400
SCALE IN FEET

RJW GM91-F11 1.00 11/14/1991 11:10:37

Figure 11

MAGNOLIA MEMBER
POTENTIOMETRIC SURFACE ELEVATION
April 1991



MAGNOLIA MEMBER MONITORING WELL

823.1 MAGNOLIA POTENTIOMETRIC SURFACE ELEVATION (MSL)

MAGNOLIA POTENTIOMETRIC SURFACE CONTOUR (MSL)

N

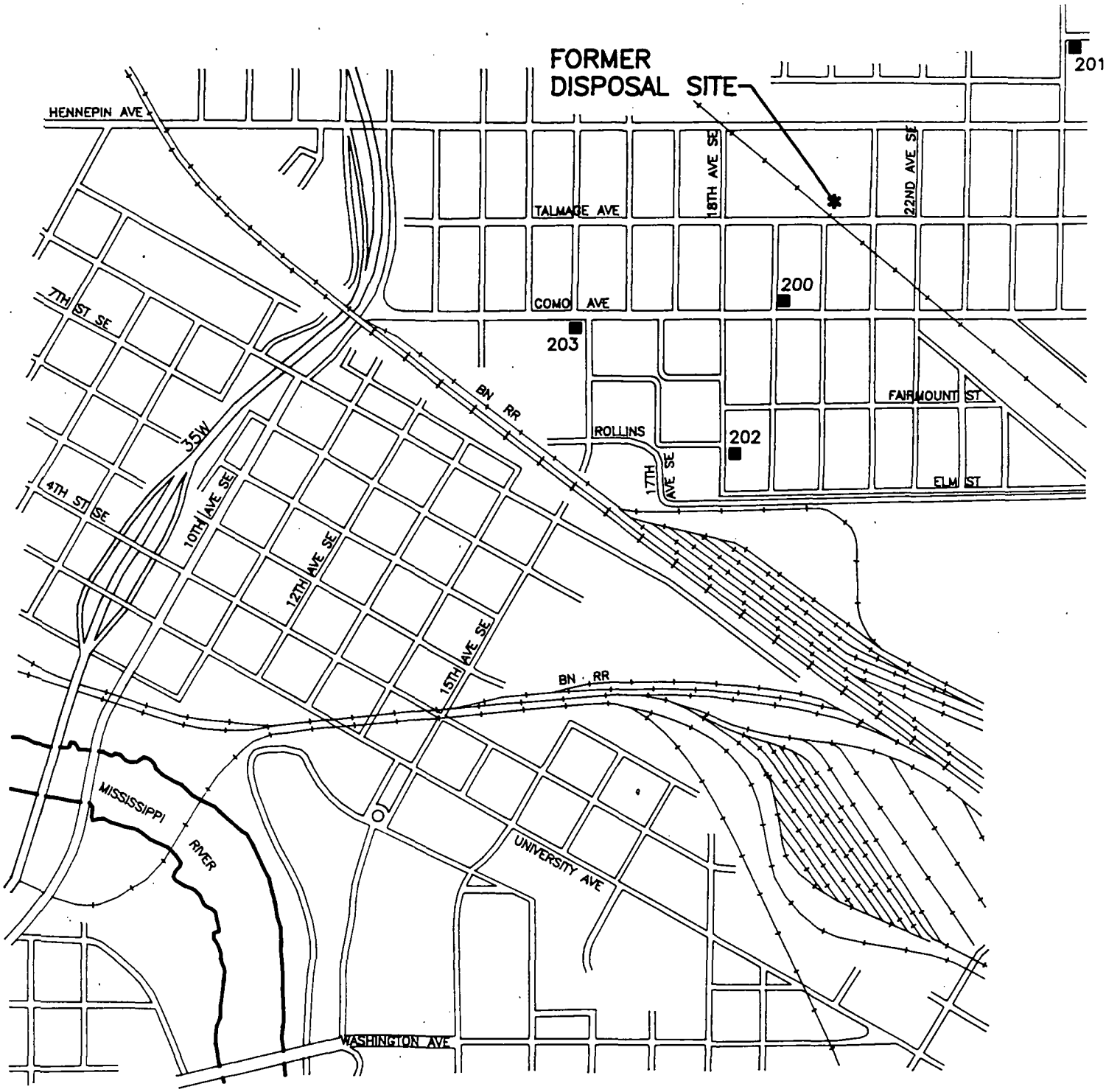
0 200 400

SCALE IN FEET

RJW GA91-F12 1.00 11/14/1991 11:19:06

Figure 12

MAGNOLIA MEMBER
POTENTIOMETRIC SURFACE ELEVATION
September 1991



■ ST. PETER SANDSTONE MONITORING WELL

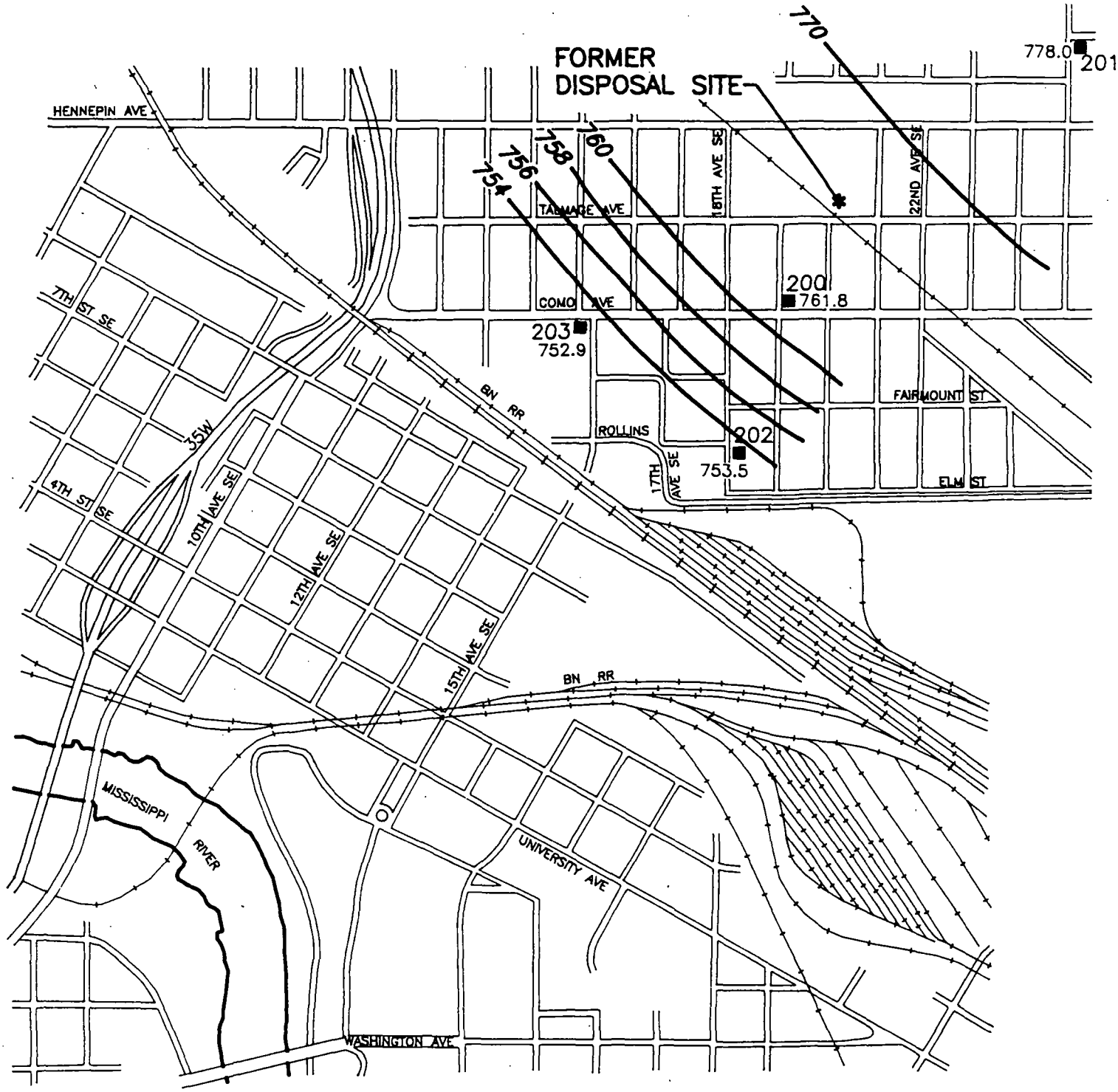
N

0 1000
SCALE IN FEET

RJW GM91-F13 1.00 11/14/1991 11:21:19

Figure 13

1991 MONITORING LOCATIONS
ST. PETER SANDSTONE



■ ST. PETER SANDSTONE MONITORING WELL

761.8 ST. PETER SANDSTONE POTENTIOMETRIC SURFACE ELEVATION (MSL)

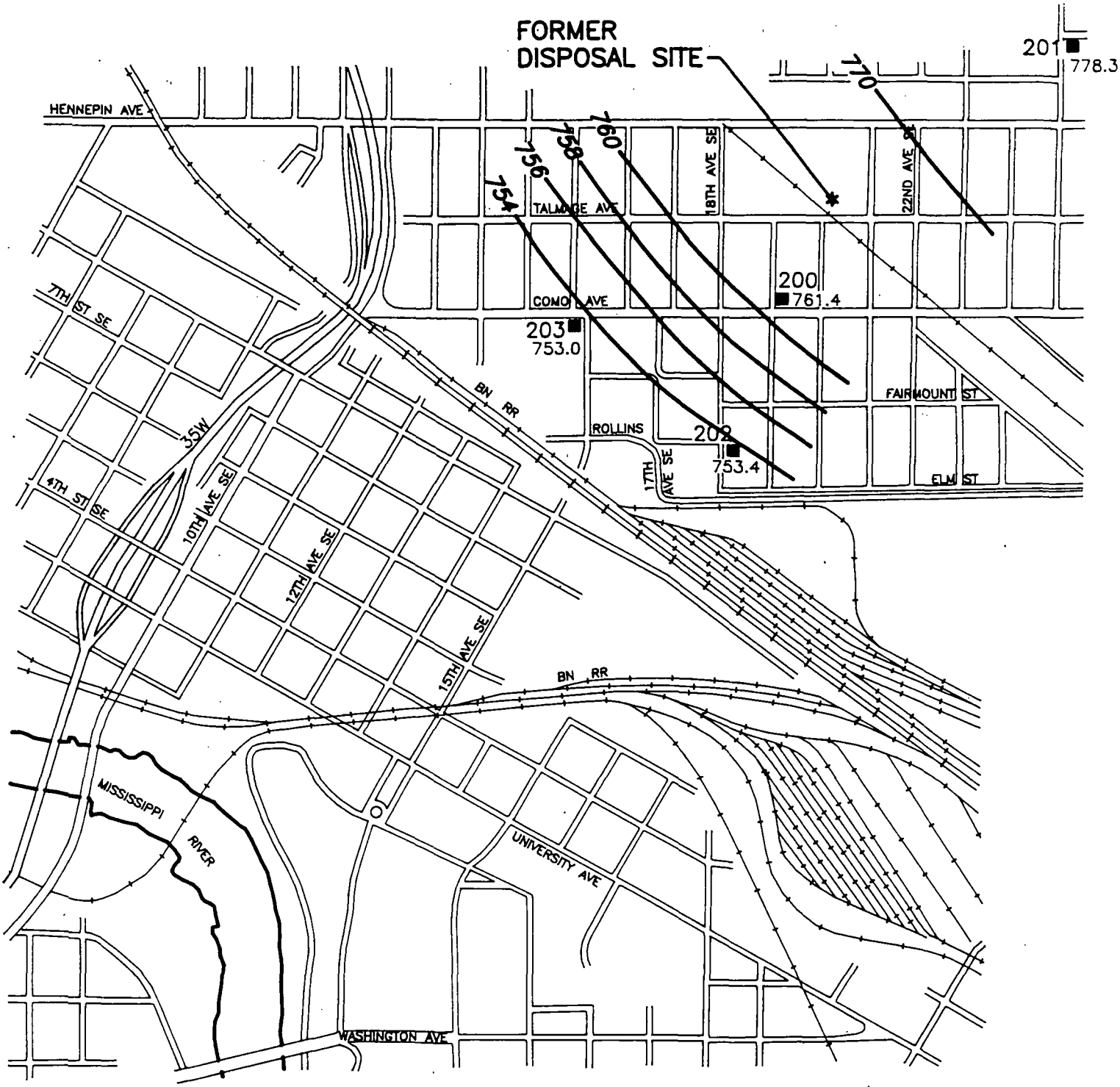
—— ST. PETER SANDSTONE POTENTIOMETRIC SURFACE CONTOUR (MSL)

N

0 1000
SCALE IN FEET

Figure 14

ST. PETER SANDSTONE
POTENTIOMETRIC SURFACE ELEVATION
April 1991



■ ST. PETER SANDSTONE MONITORING WELL

761.4 ST. PETER SANDSTONE POTENTIOMETRIC SURFACE ELEVATION (MSL)

—— ST. PETER SANDSTONE POTENTIOMETRIC SURFACE CONTOUR (MSL)

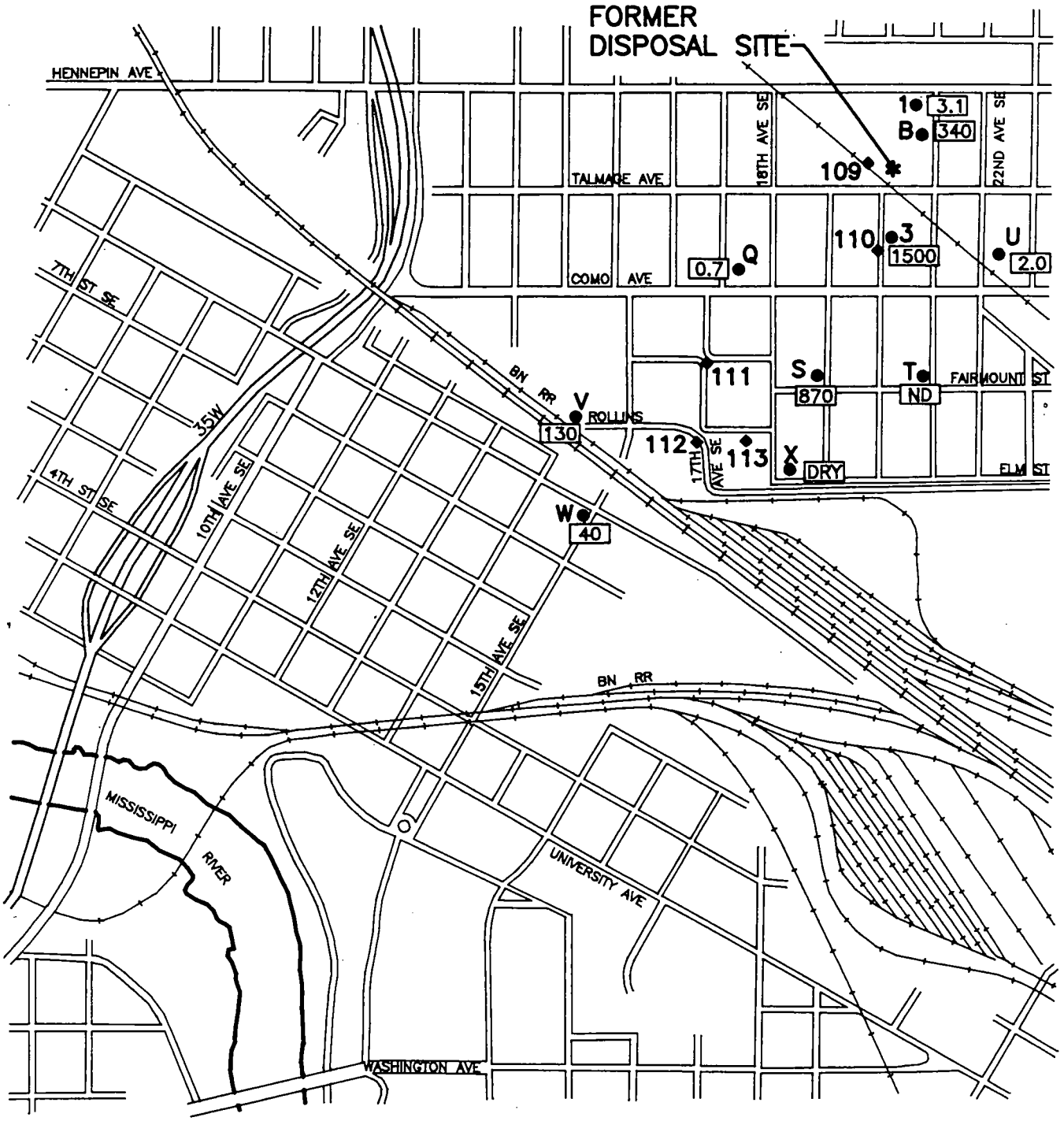
N

0 1000
SCALE IN FEET

RJW GM91-F15 1.00 11/26/1991 15:57:54

Figure 15

ST. PETER SANDSTONE
POTENTIOMETRIC SURFACE ELEVATION
September 1991



● GLACIAL DRIFT MONITORING WELL

◆ SITE AND DOWNGRADIENT GLACIAL DRIFT PUMP-OUT WELL

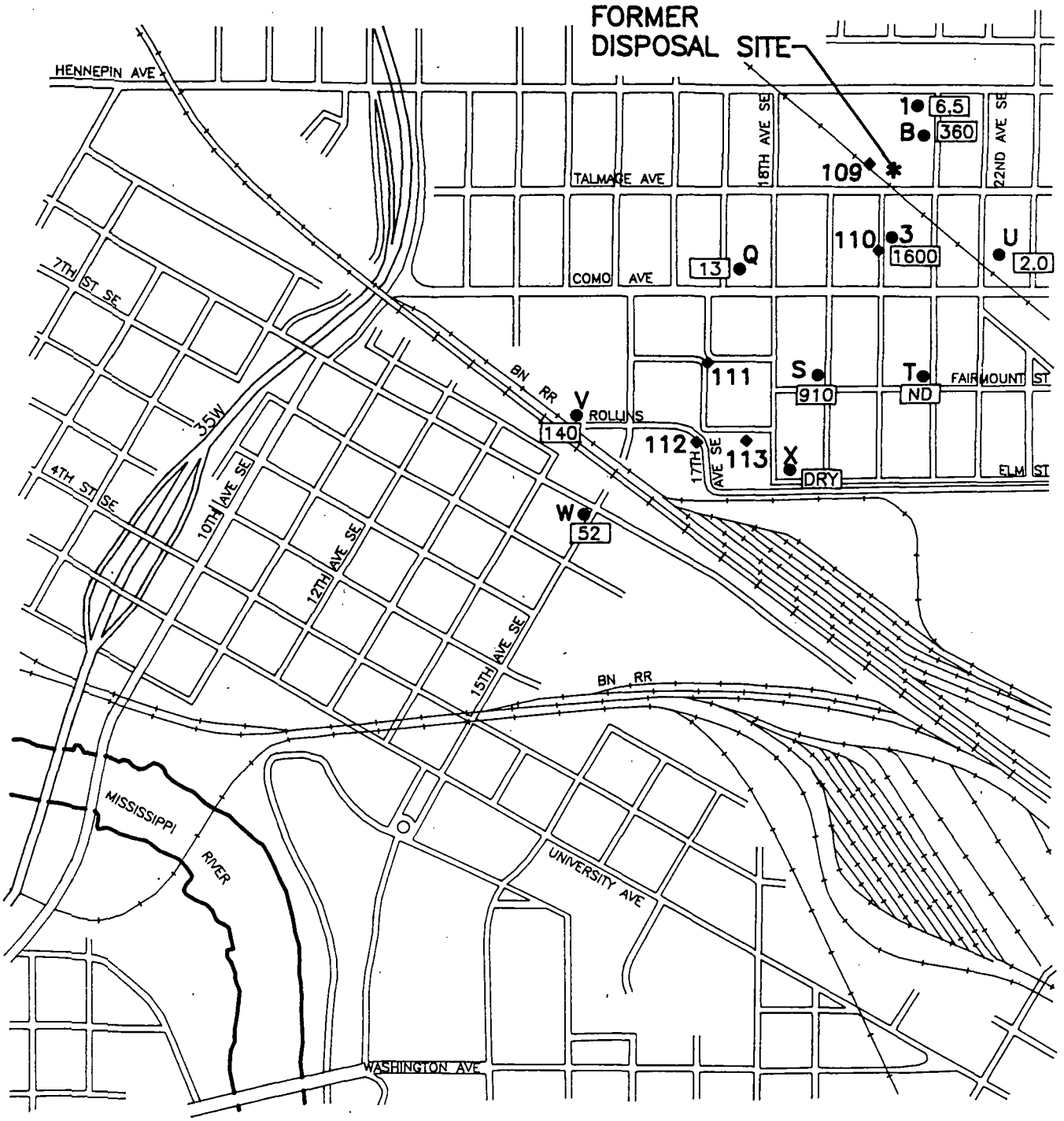
140 TRICHLOROETHENE CONCENTRATION (TCE) (ug/L)

ND NOT DETECTED

0 1000
SCALE IN FEET

RJW GA81-F16 1.00 01/07/1992 10:58:43

Figure 16
GLACIAL DRIFT AQUIFER
WATER QUALITY (TCE)
April 1991



- ● GLACIAL DRIFT MONITORING WELL
- ◆ SITE AND DOWNGRADIENT GLACIAL DRIFT PUMP-OUT WELL
- 140 SUM OF VOLATILE ORGANIC CONCENTRATIONS (VOC) (mg/L)
- ND NOT DETECTED

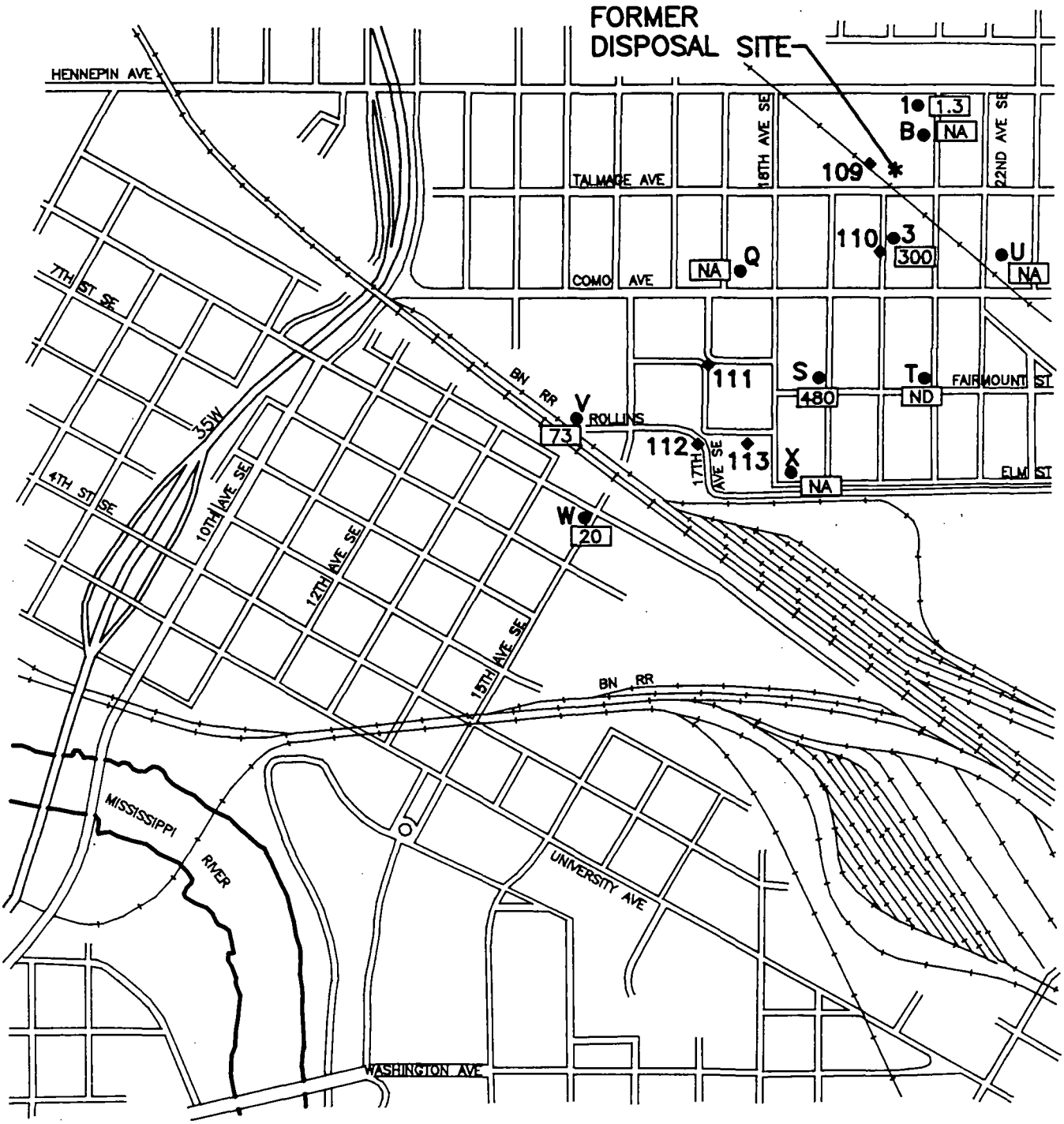
N

0 1000
SCALE IN FEET

RJW GM91-F17 1.00 01/07/1992 11:00:53

Figure 17

GLACIAL DRIFT AQUIFER
WATER QUALITY (VOC)
April 1991



● GLACIAL DRIFT MONITORING WELL

◆ SITE AND DOWNGRADIENT GLACIAL DRIFT PUMP-OUT WELL

300 TRICHLOROETHENE CONCENTRATION (TCE) (ug/L)

ND NOT DETECTED

NA NOT ANALYZED

N

0 1000

SCALE IN FEET

RJW GM91-F18 1.00 01/07/1992 11:02:48

Figure 18

GLACIAL DRIFT AQUIFER
WATER QUALITY (TCE)
September 1991

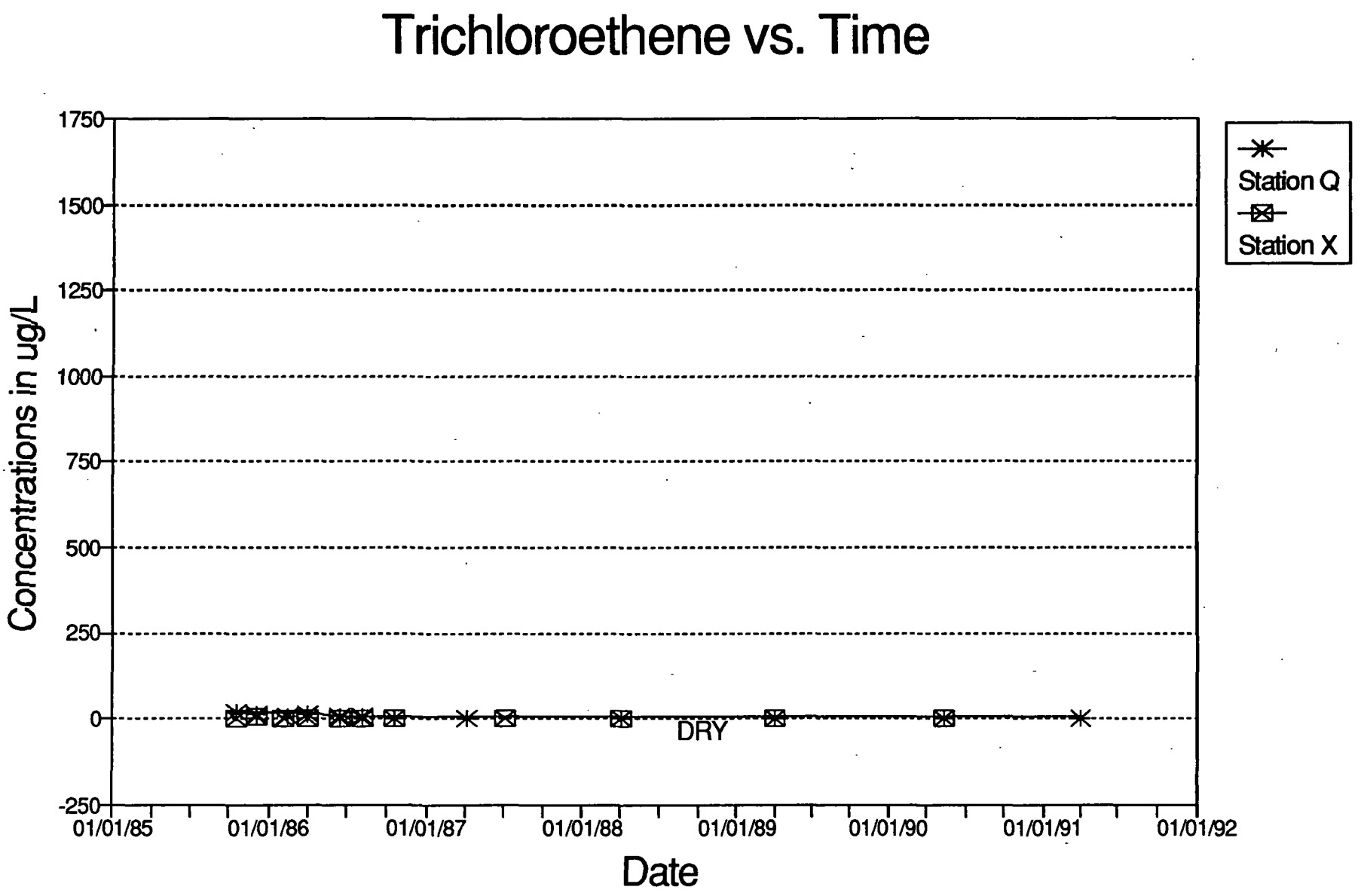


FIGURE 19
GLACIAL DRIFT WELLS
TCE CONCENTRATIONS
1985-1991

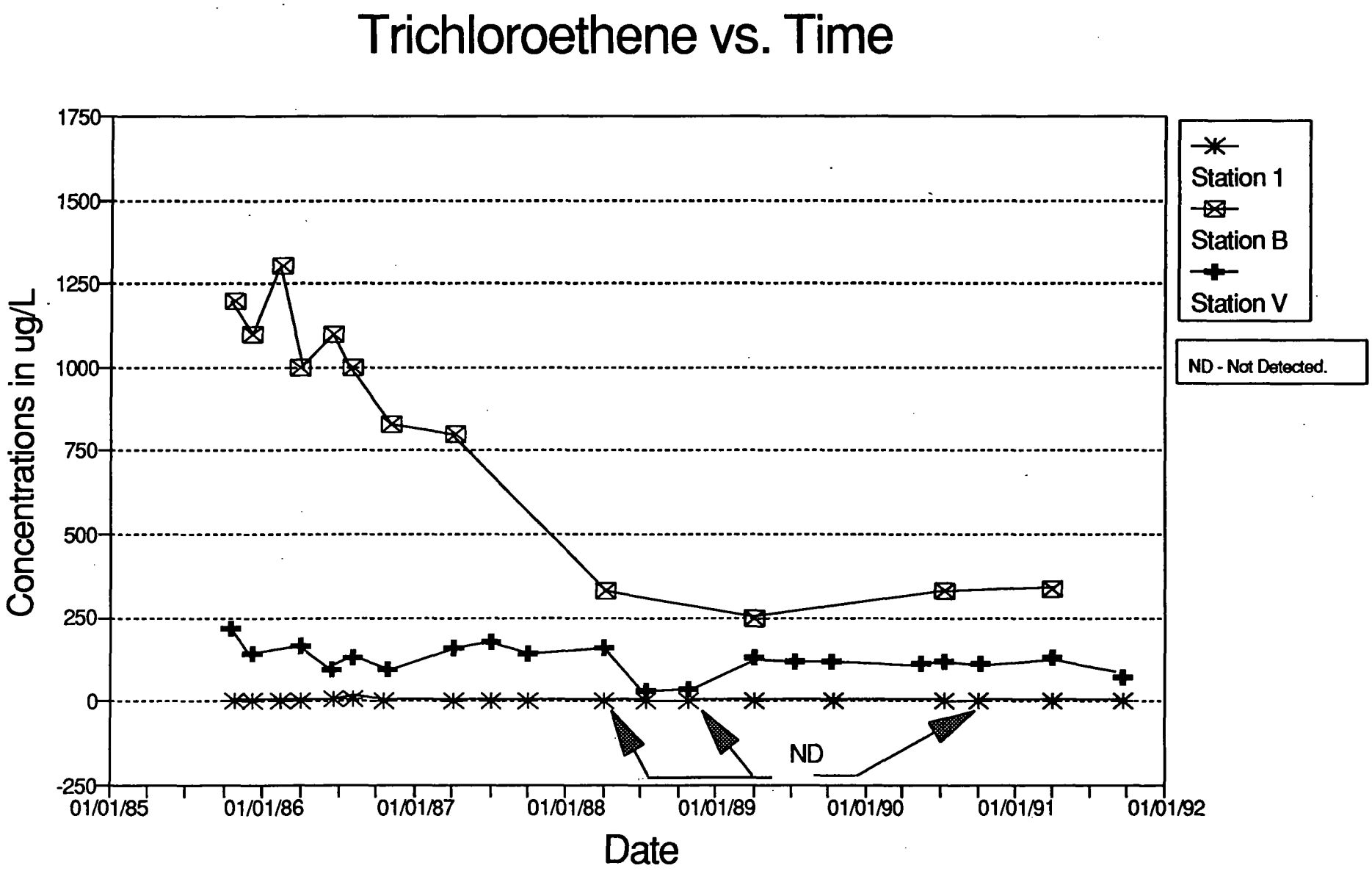


FIGURE 19 (cont.)
GLACIAL DRIFT WELLS
TCE CONCENTRATIONS
1985-1991

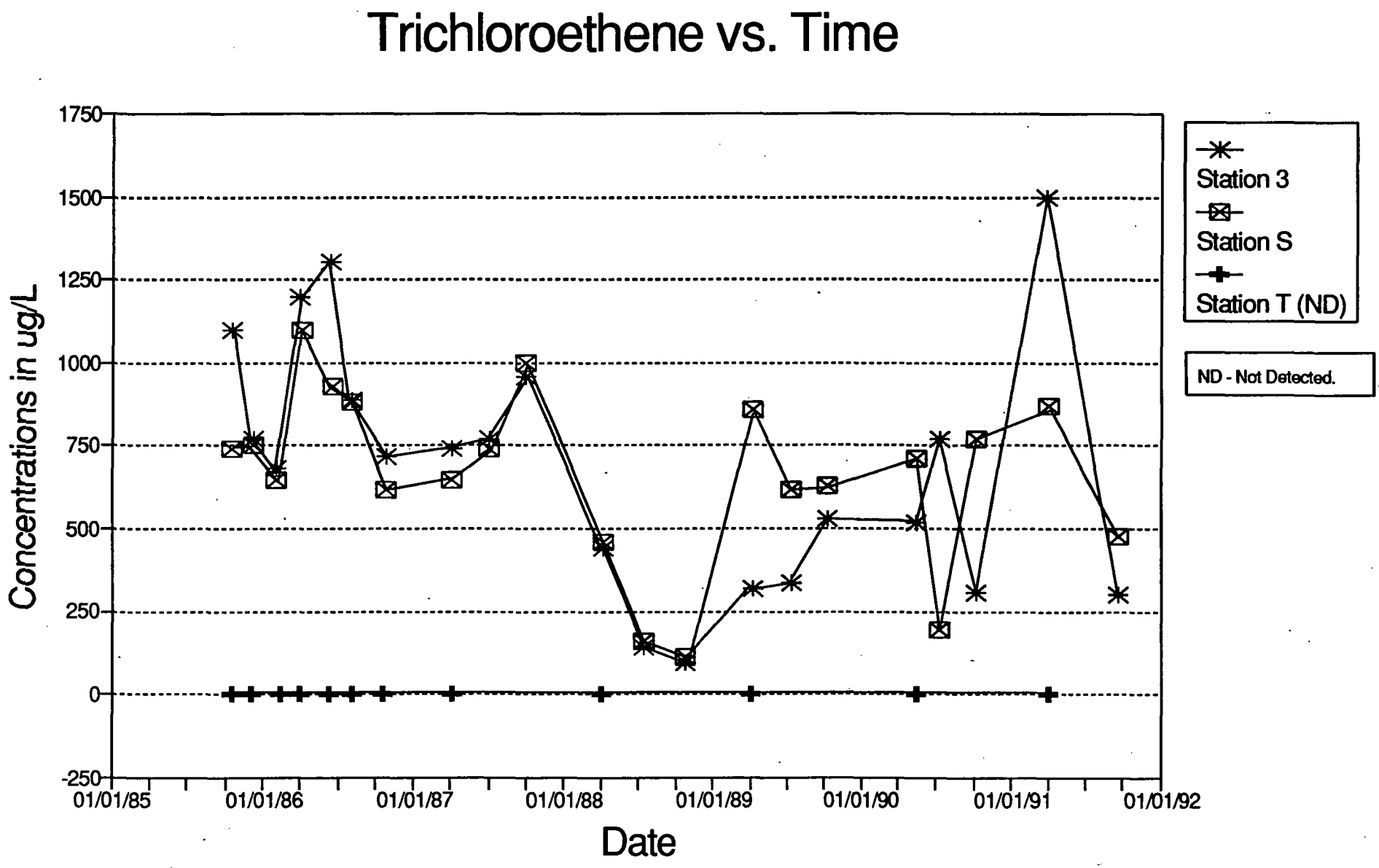
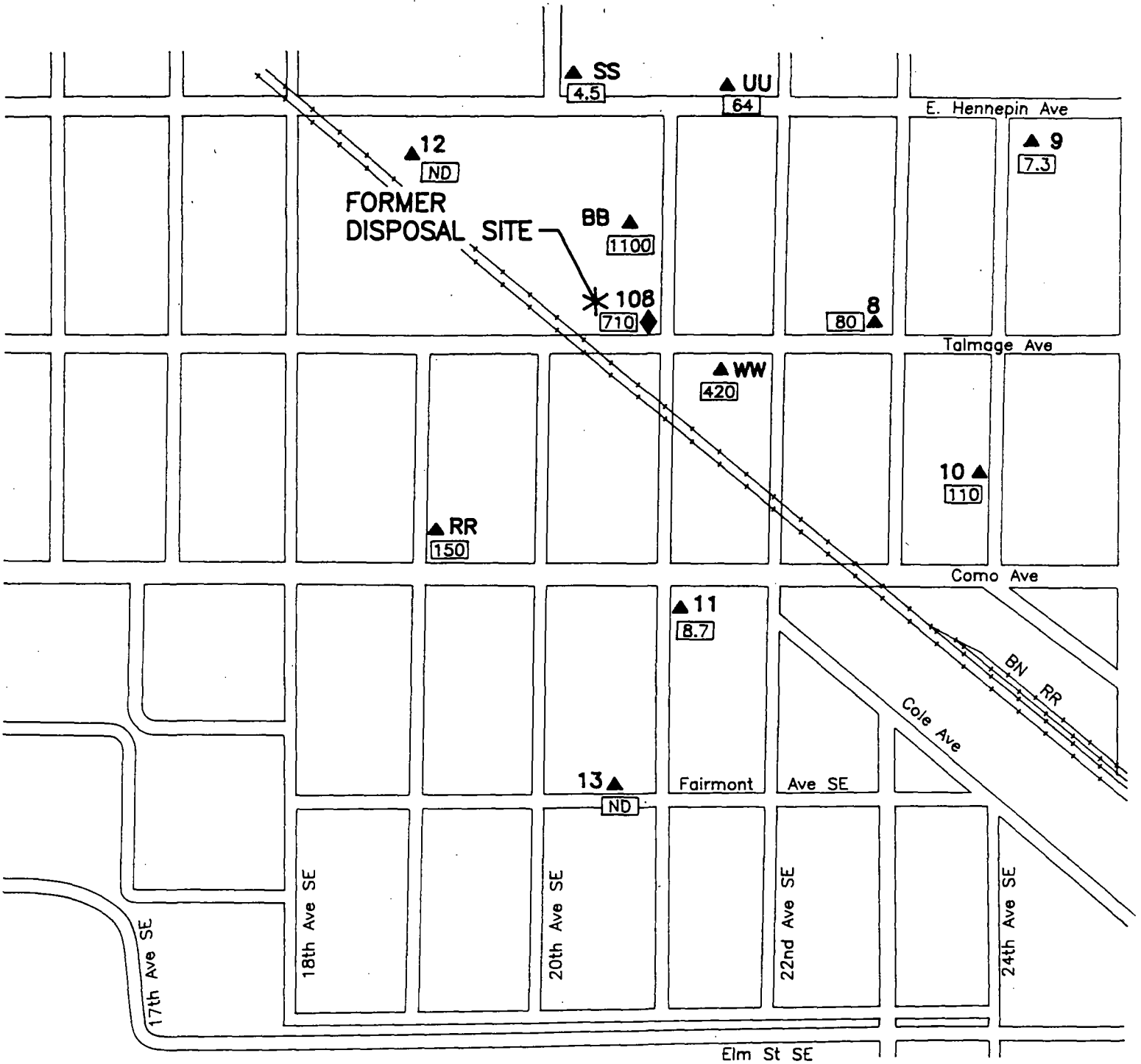


FIGURE 19 (cont.)
GLACIAL DRIFT WELLS
TCE CONCENTRATIONS
1985-1991



▲ CARIMONA MEMBER MONITORING WELL

♦ CARIMONA MEMBER PUMP-OUT WELL

420 TRICHLOROETHENE CONCENTRATION (TCE) (ug/L)

ND NOT DETECTED

N

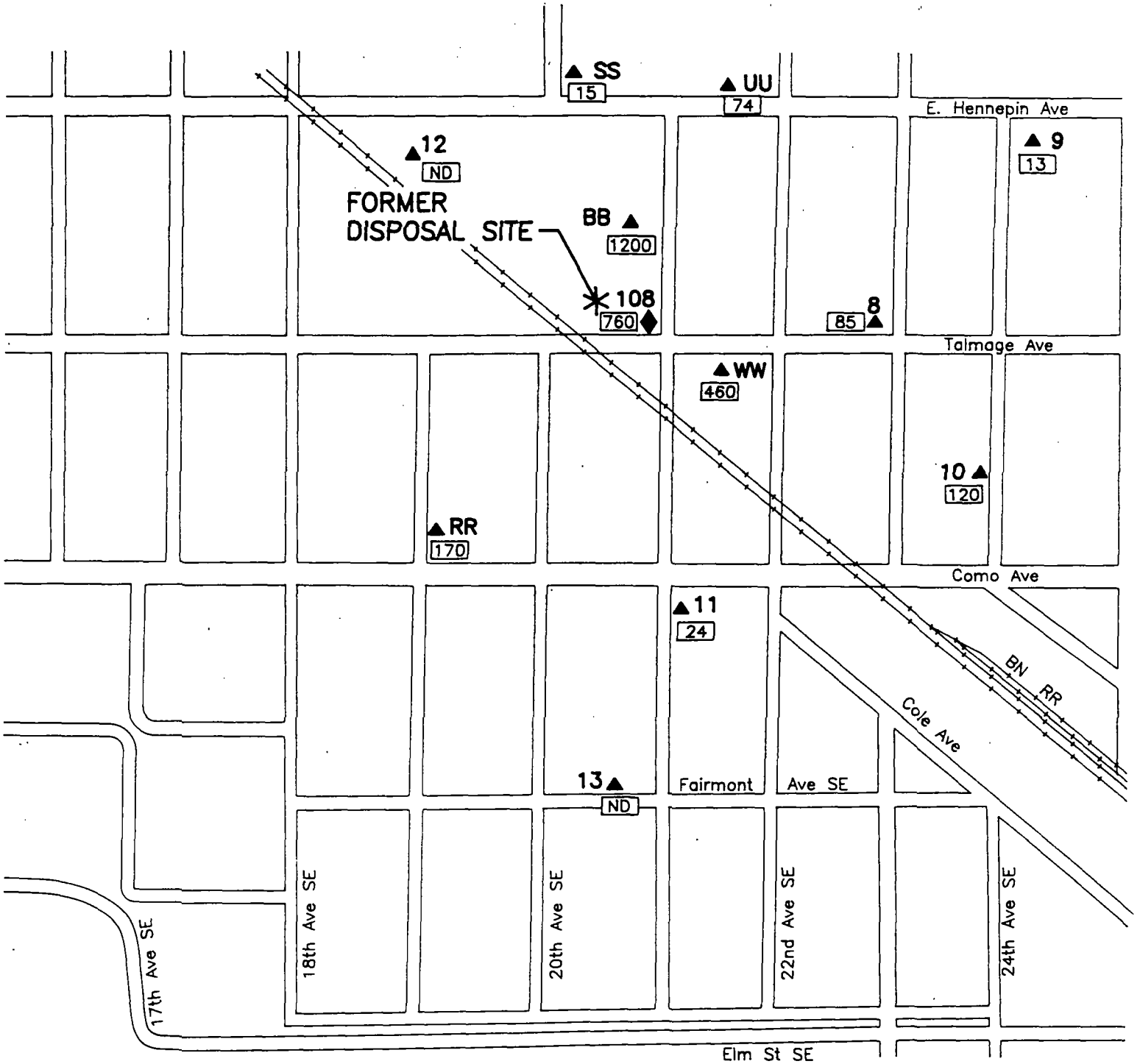
0 200 400

SCALE IN FEET

RJW GM91-F20 1.00 11/14/1991 14:12:42

Figure 20

CARIMONA MEMBER
WATER QUALITY (TCE)
April 1991



▲ CARIMONA MEMBER MONITORING WELL

◆ CARIMONA MEMBER PUMP-OUT WELL

460 SUM OF VOLATILE ORGANIC CONCENTRATIONS (VOC) (ug/L)

ND NOT DETECTED

N

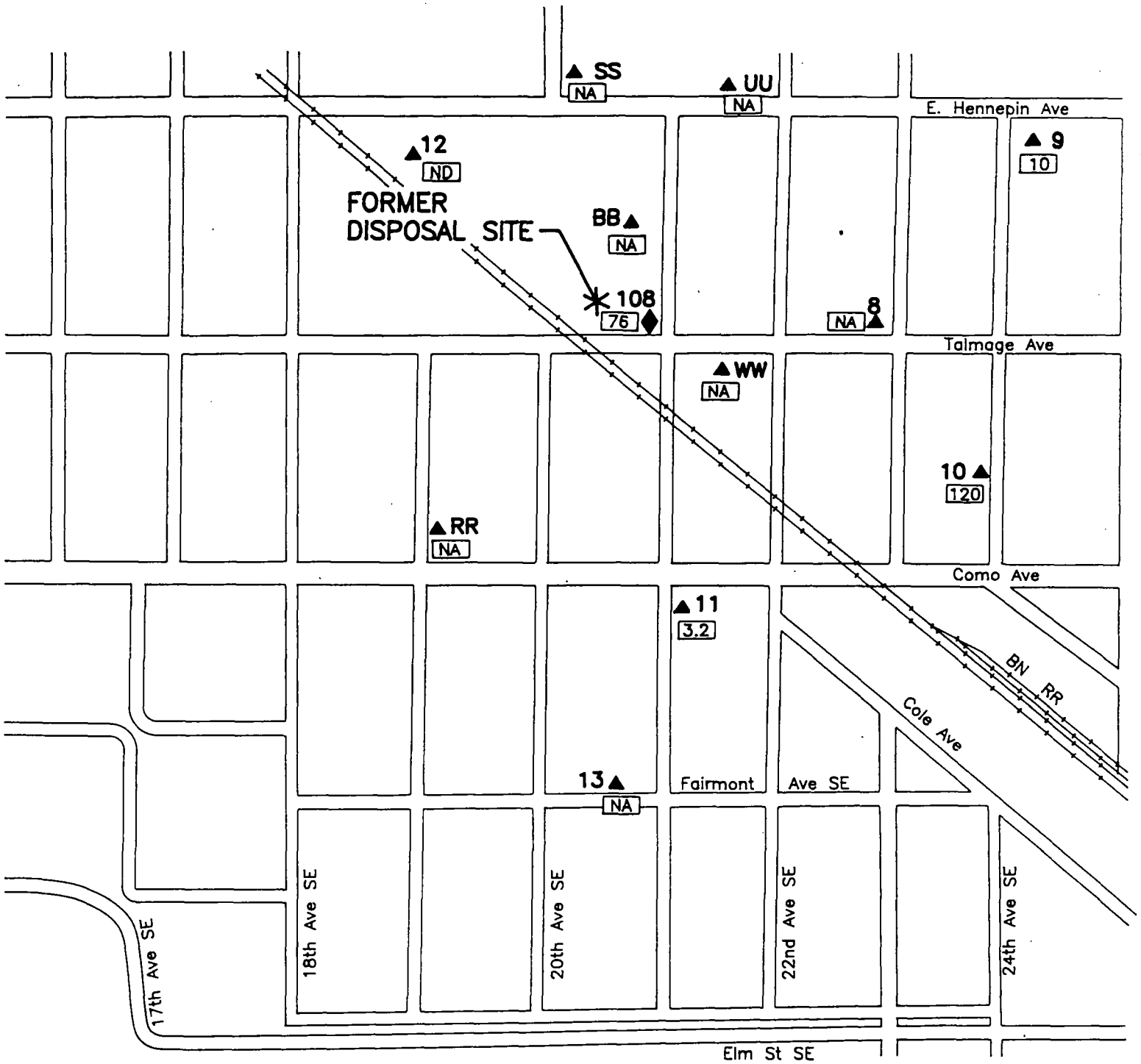
0 200 400

SCALE IN FEET

RJW GM91-F21 1.00 11/14/1991 14:20:47

Figure 21

CARIMONA MEMBER
WATER QUALITY (VOC)
April 1991



▲ CARIMONA MEMBER MONITORING WELL

♦ CARIMONA MEMBER PUMP-OUT WELL

140 TRICHLOROETHENE CONCENTRATION (TCE) (ug/L)

ND NOT DETECTED

NA NOT ANALYZED

N

0 200 400

SCALE IN FEET

Figure 22

CARIMONA MEMBER
WATER QUALITY (TCE)
September 1991

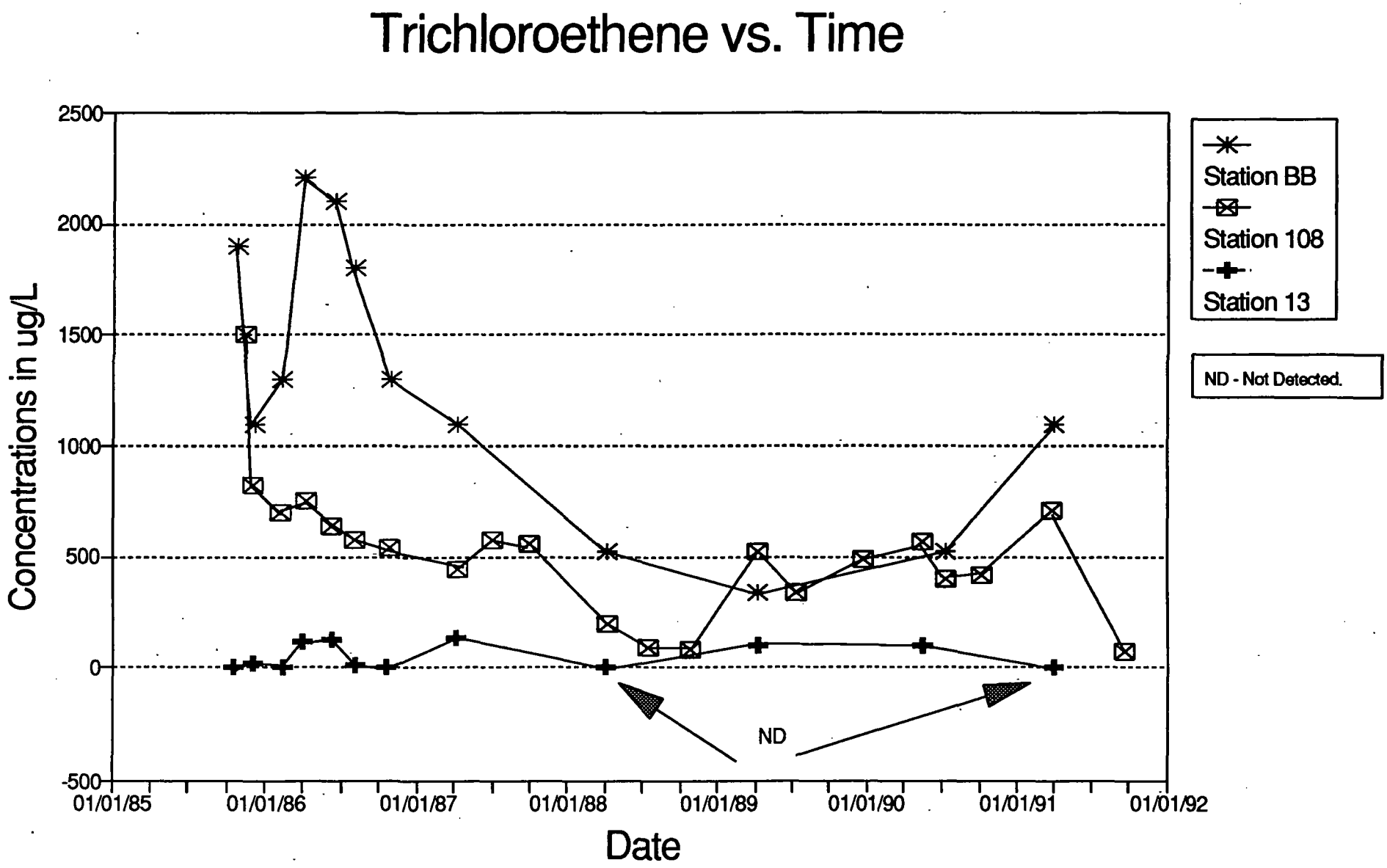


FIGURE 23
CARIMONA MEMBER WELLS
TCE CONCENTRATIONS
1985-1991

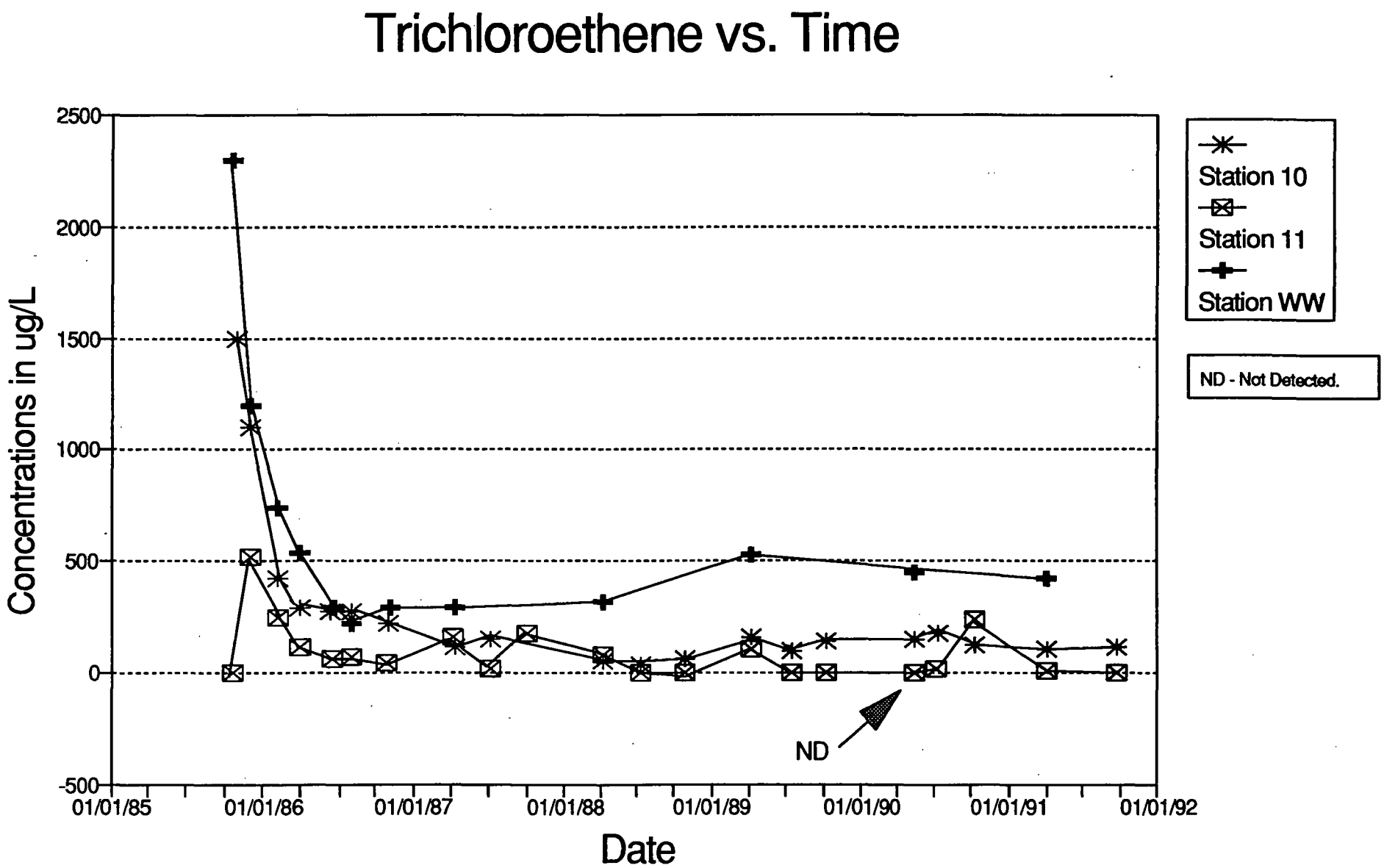
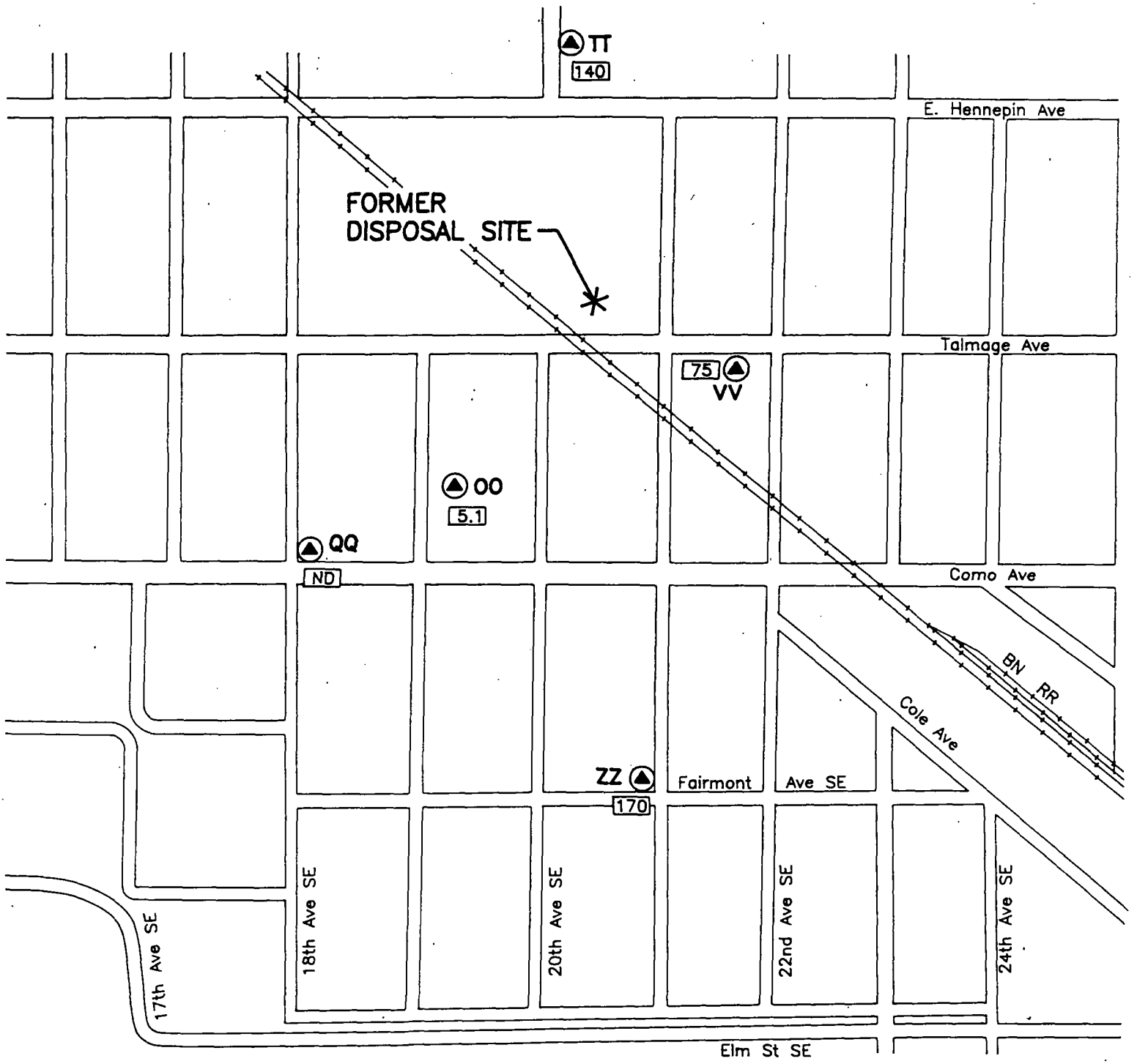


FIGURE 23 (cont.)

CARIMONA MEMBER WELLS
TCE CONCENTRATIONS
1985-1991



MAGNOLIA MEMBER MONITORING WELL

75 TRICHLOROETHENE CONCENTRATION (TCE) (ug/L)

ND NOT DETECTED

N

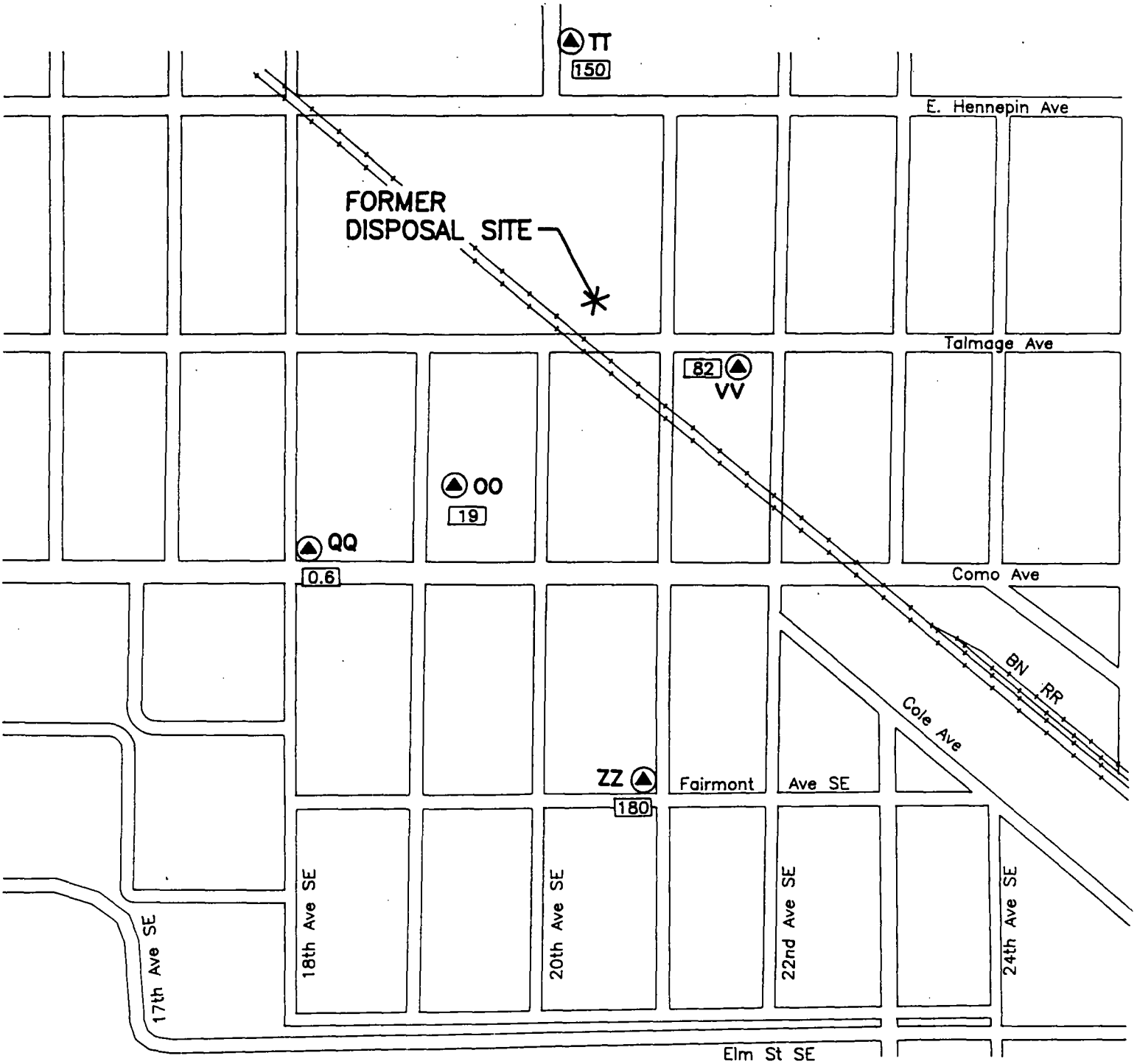
0 200 400

SCALE IN FEET

Figure 24

MAGNOLIA MEMBER
WATER QUALITY (TCE)
April 1991

RJW GM91-F24 1.00 11/14/1991 14:30:16



MAGNOLIA MEMBER MONITORING WELL

19 SUM OF VOLATILE ORGANIC CONCENTRATIONS (VOC) (ug/L)

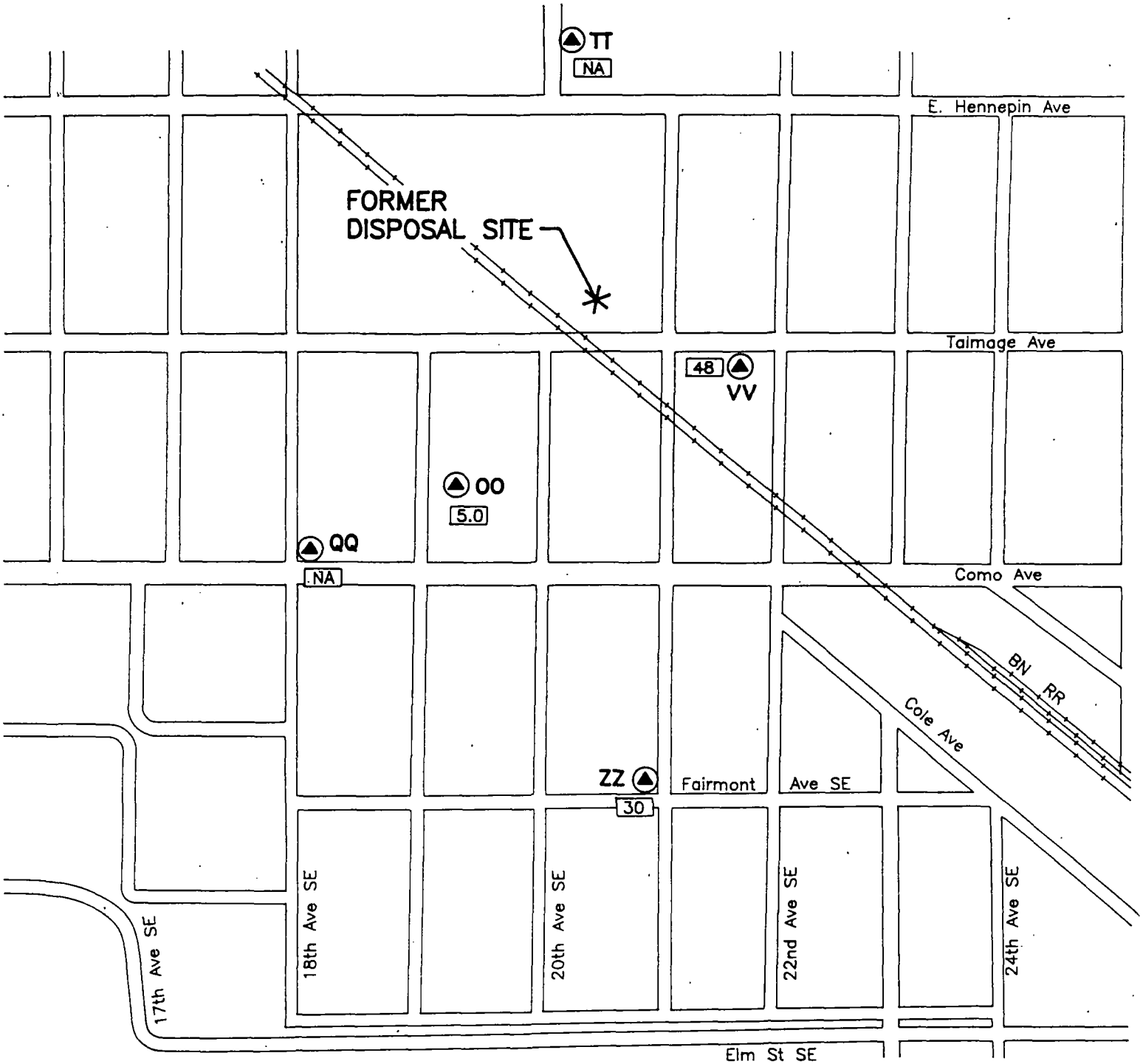
N

0 200 400
SCALE IN FEET

RJW GM91-F25 1.00 11/14/1991 14:43:45

Figure 25

MAGNOLIA MEMBER
WATER QUALITY (VOC)
April 1991



MAGNOLIA MEMBER MONITORING WELL

30 TRICHLOROETHENE CONCENTRATION (ug/L) (TCE)

NA NOT ANALYZED

N

0 200 400

SCALE IN FEET

RJW GM91-F26 1.00 11/26/1991 14:41:05

Figure 26

MAGNOLIA MEMBER
WATER QUALITY (TCE)
September 1991

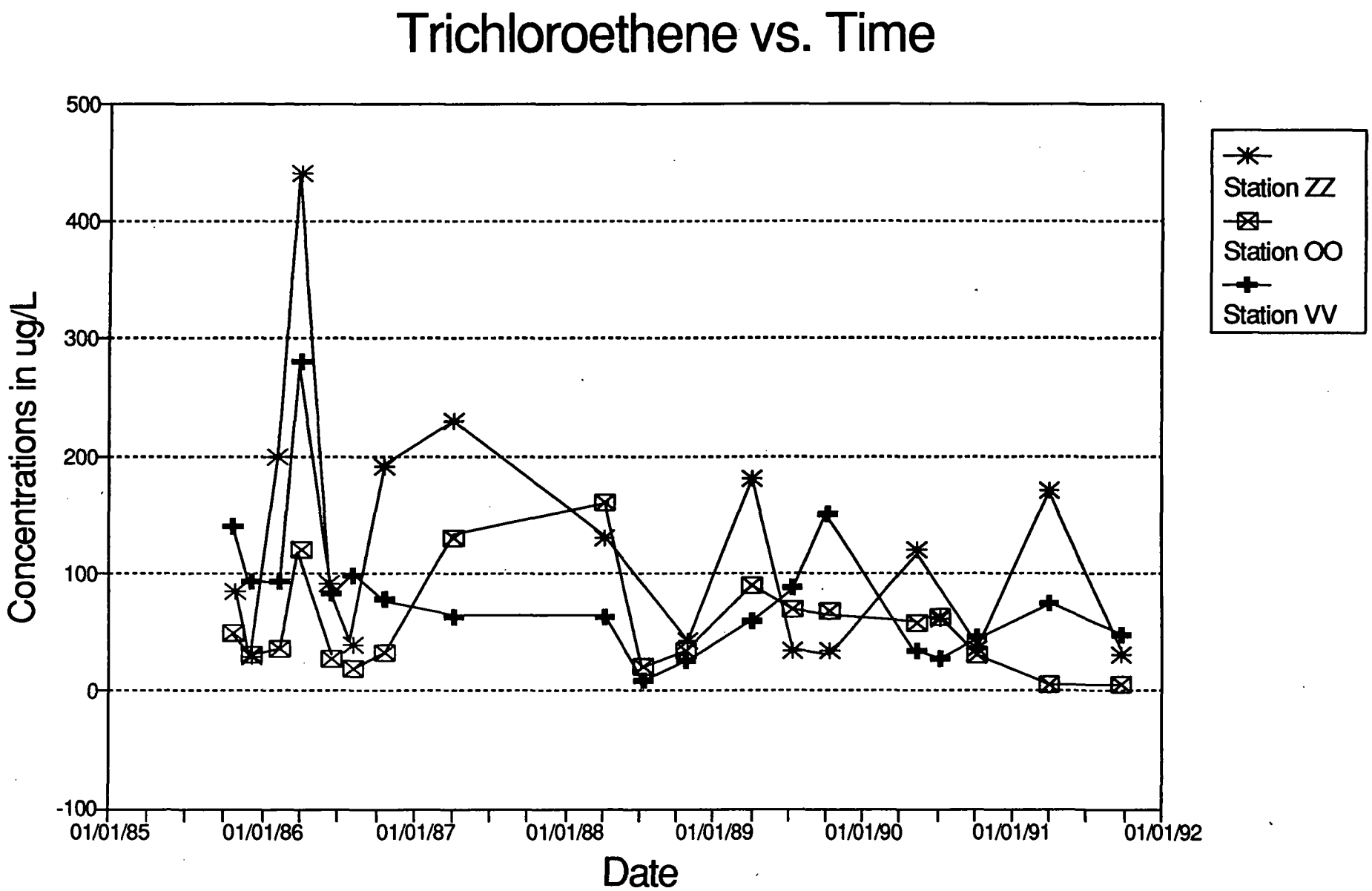


FIGURE 27
MAGNOLIA MEMBER WELLS
TCE CONCENTRATIONS
1985-1991

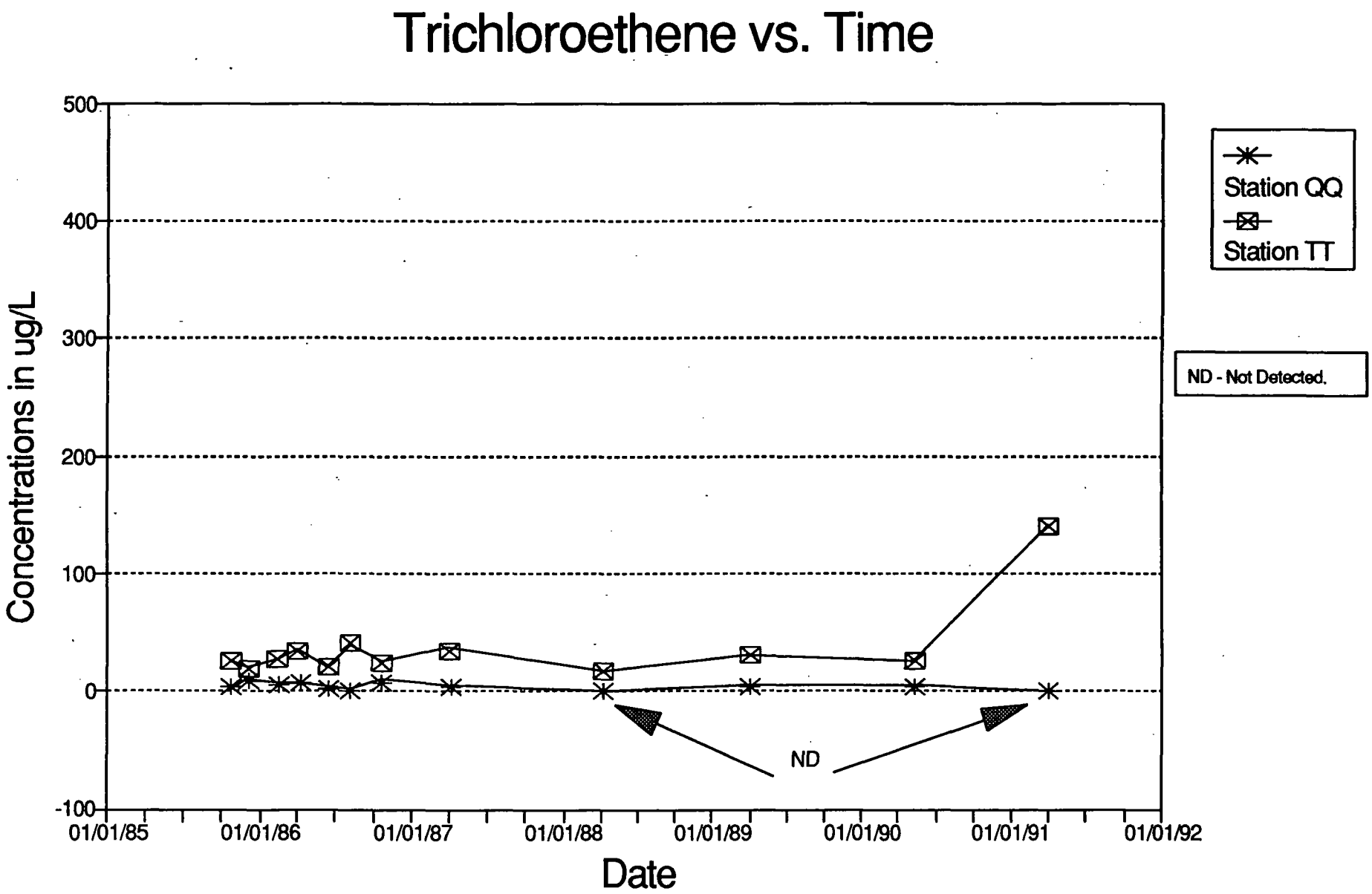
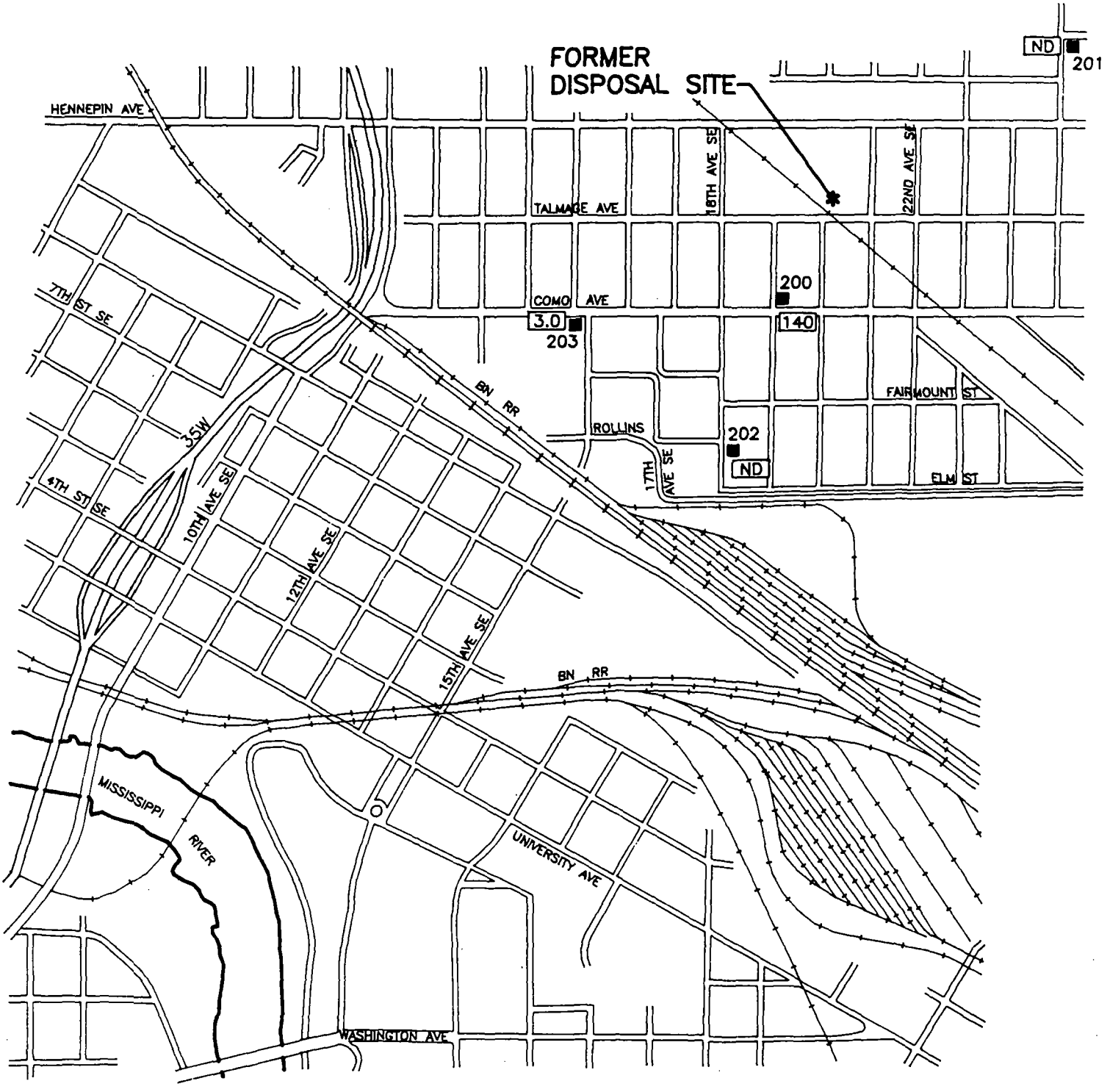


FIGURE 27 (cont.)
MAGNOLIA MEMBER WELLS
TCE CONCENTRATIONS
1985-1991



■ ST. PETER SANDSTONE MONITORING WELL

140 TRICHLOROETHENE CONCENTRATION (TCE) (ug/L)

ND NOT DETECTED

N

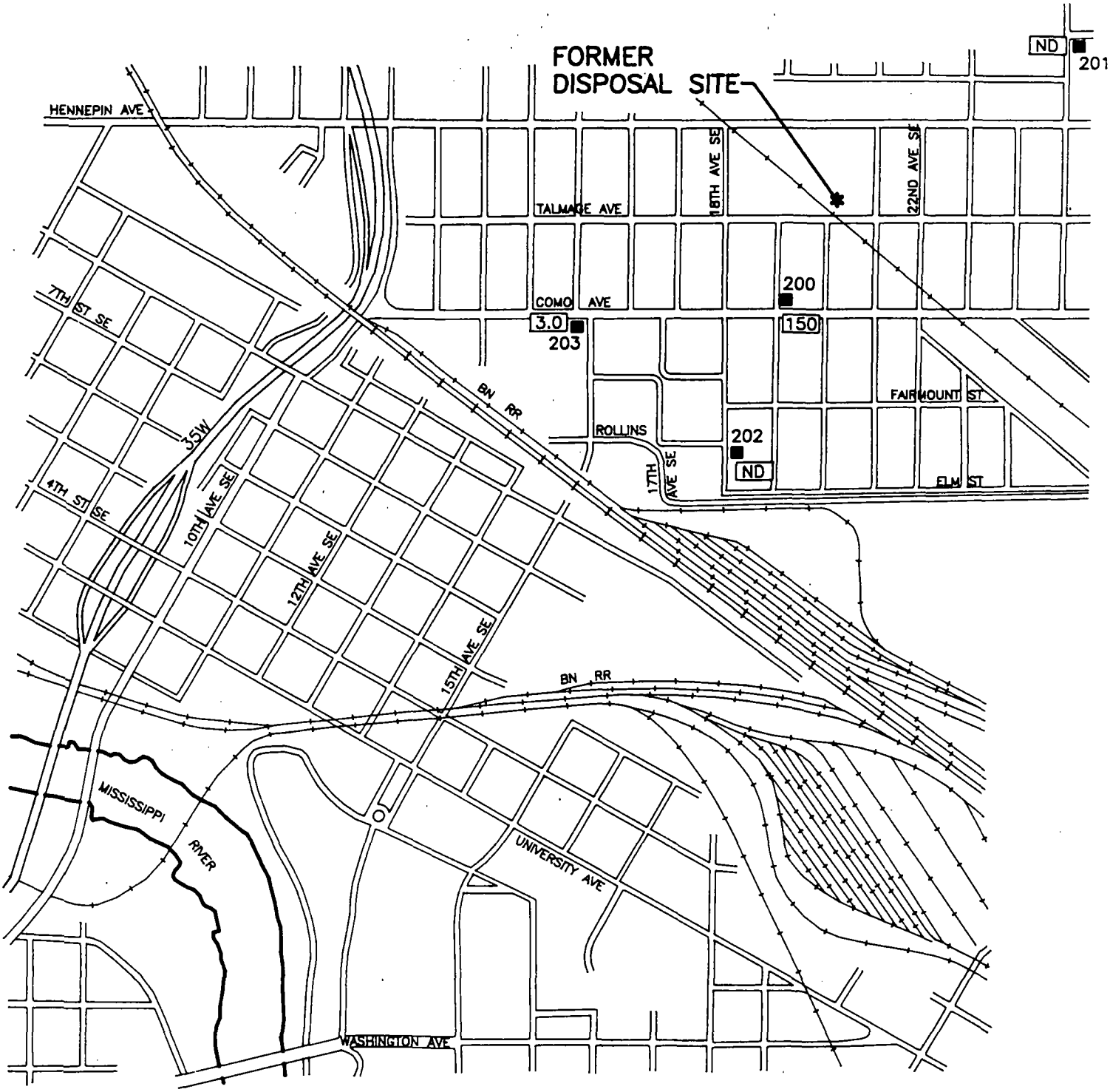
0 1000

SCALE IN FEET

RJW G491-F28 1.00 11/14/1991 15:30:38

Figure 28

ST. PETER SANDSTONE
WATER QUALITY (TCE)
April 1991



■ ST. PETER SANDSTONE MONITORING WELL

120 SUM OF VOLATILE ORGANIC CONCENTRATIONS (VOC) (ug/L)

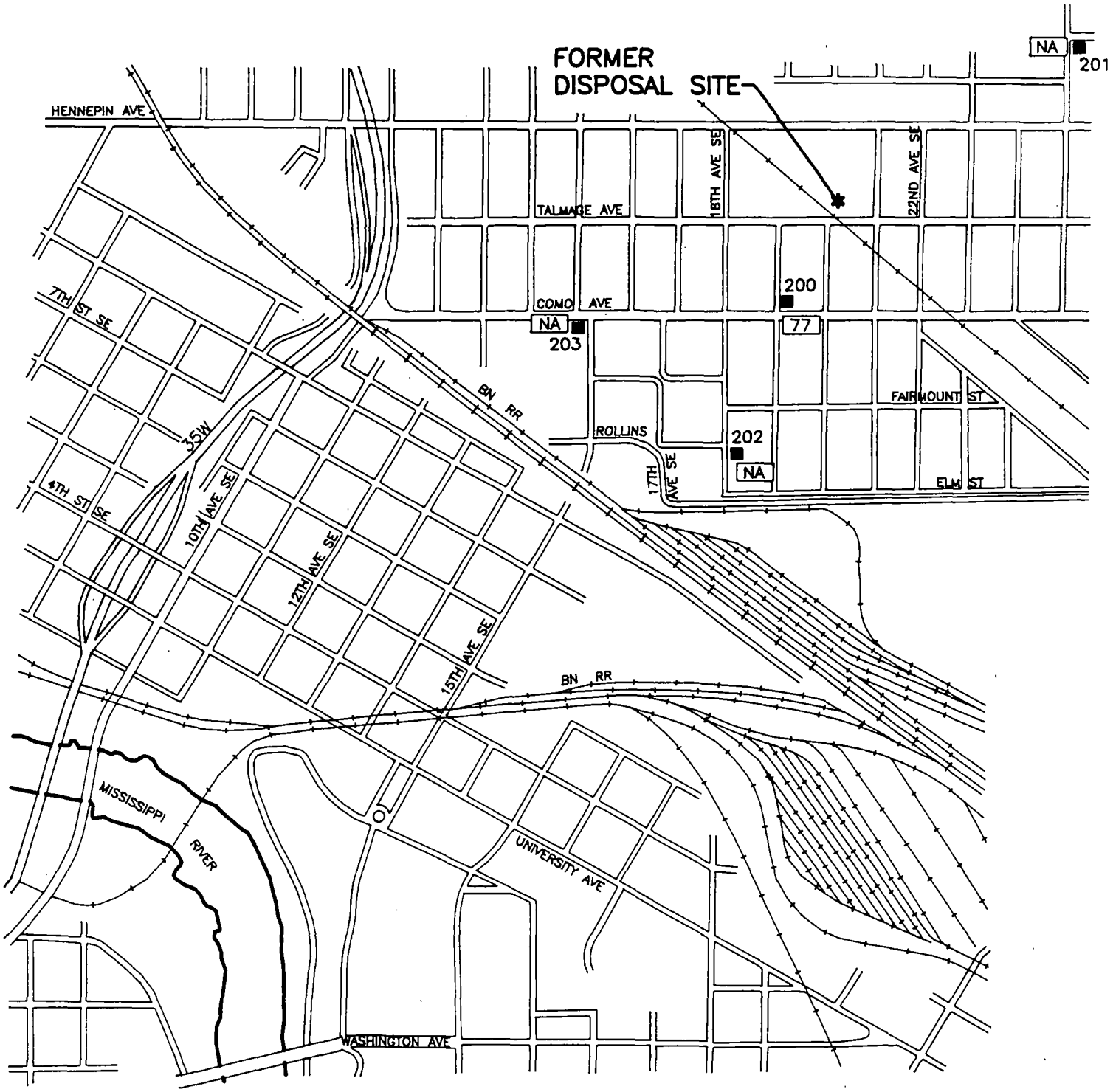
ND NOT DETECTED

0 1000
SCALE IN FEET

RJW GM-F36 1.00 11/19/1990 13:52:07

Figure 29

ST. PETER SANDSTONE
WATER QUALITY (VOC)
April 1991



■ ST. PETER SANDSTONE MONITORING WELL

77 TRICHLOROETHENE CONCENTRATION (TCE) (ug/L)

NA NOT ANALYZED

N

0 1000
SCALE IN FEET

RJW GM91-F30 1.00 11/25/1991 14:39:23

Figure 30

ST. PETER SANDSTONE
WATER QUALITY (TCE)
September 1991

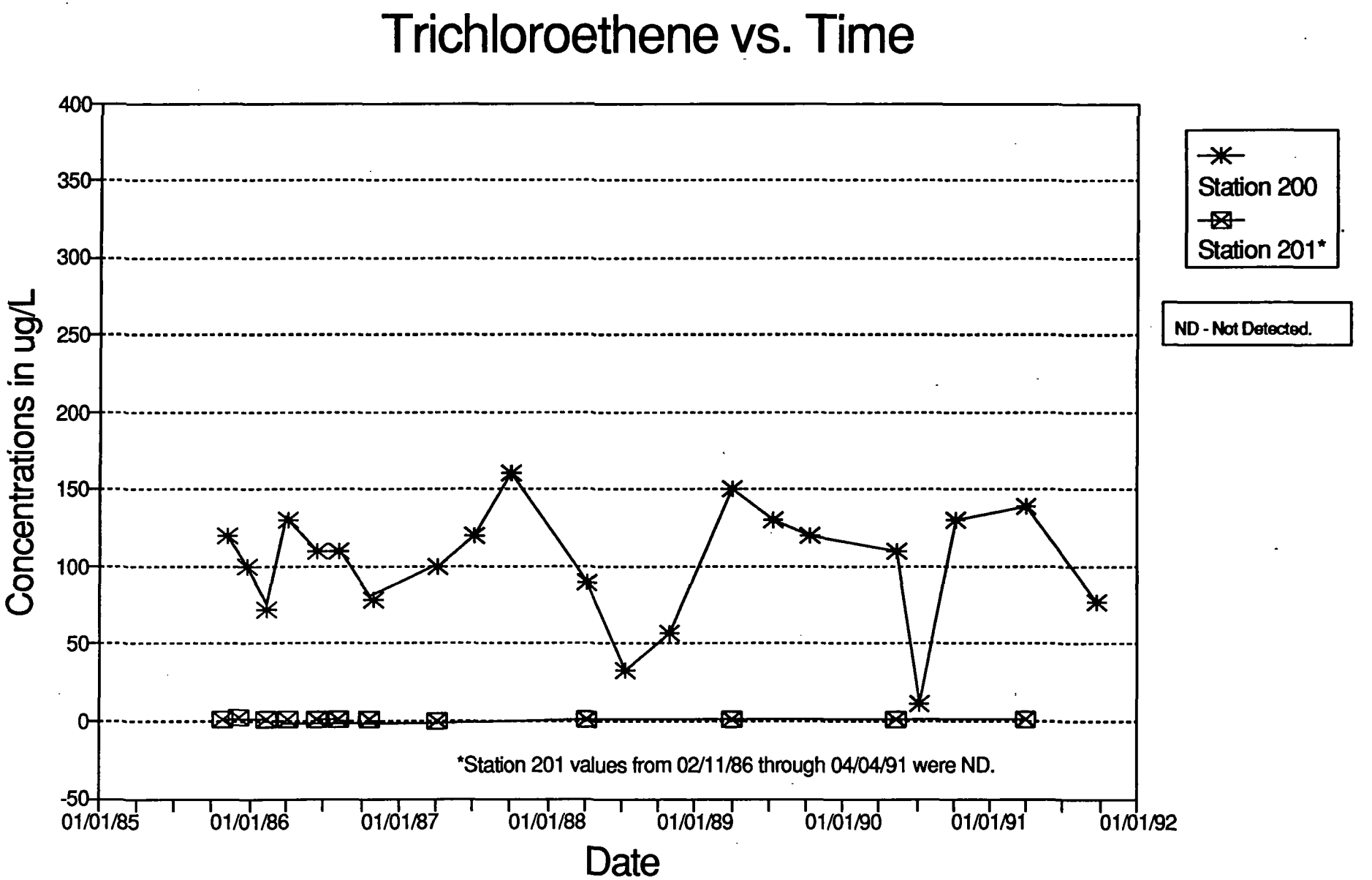


FIGURE 31
ST. PETER SANDSTONE WELLS
TCE CONCENTRATIONS
1985-1991

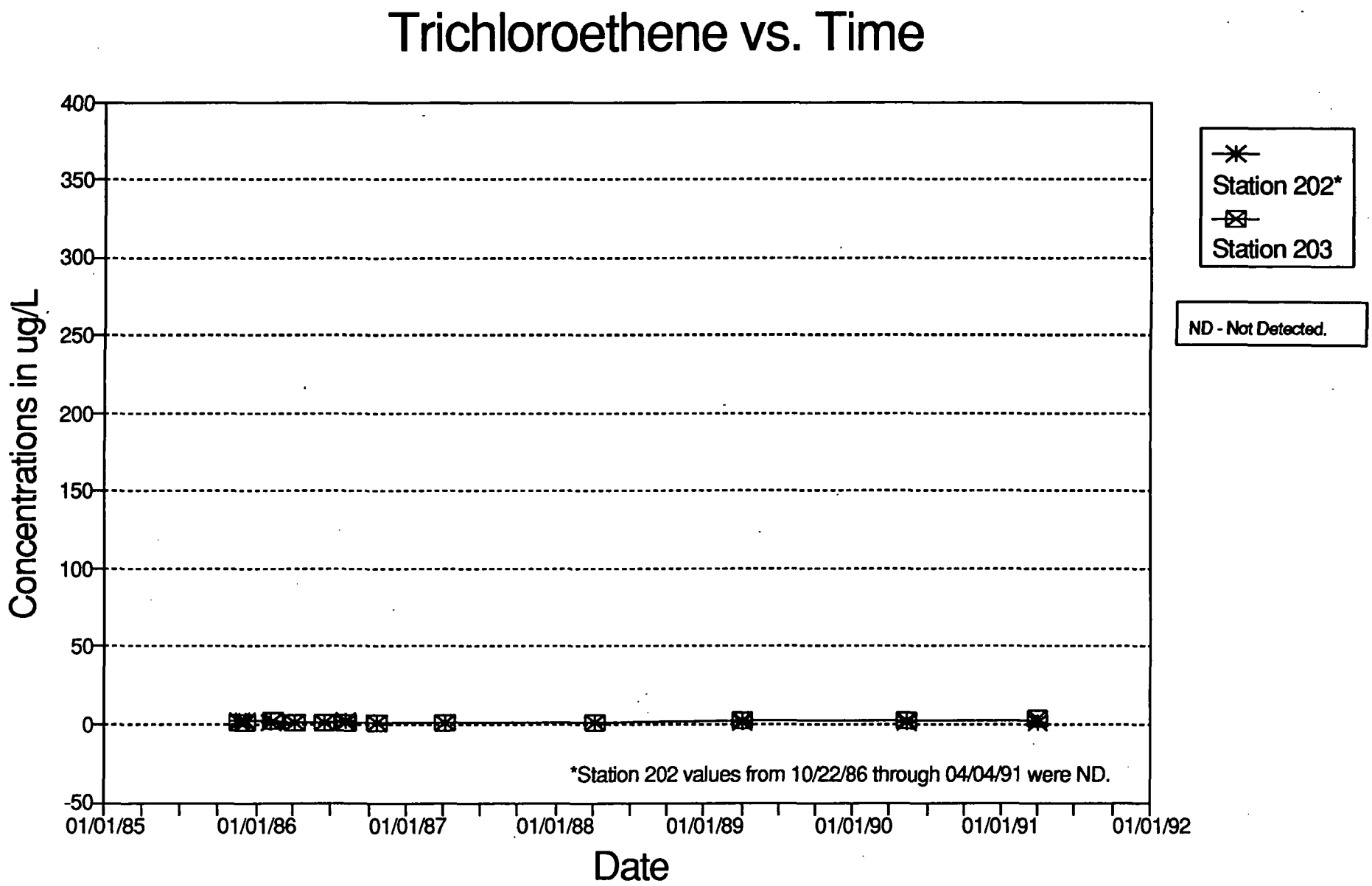


FIGURE 31 (cont.)
ST. PETER SANDSTONE WELLS
TCE CONCENTRATIONS
1985-1991

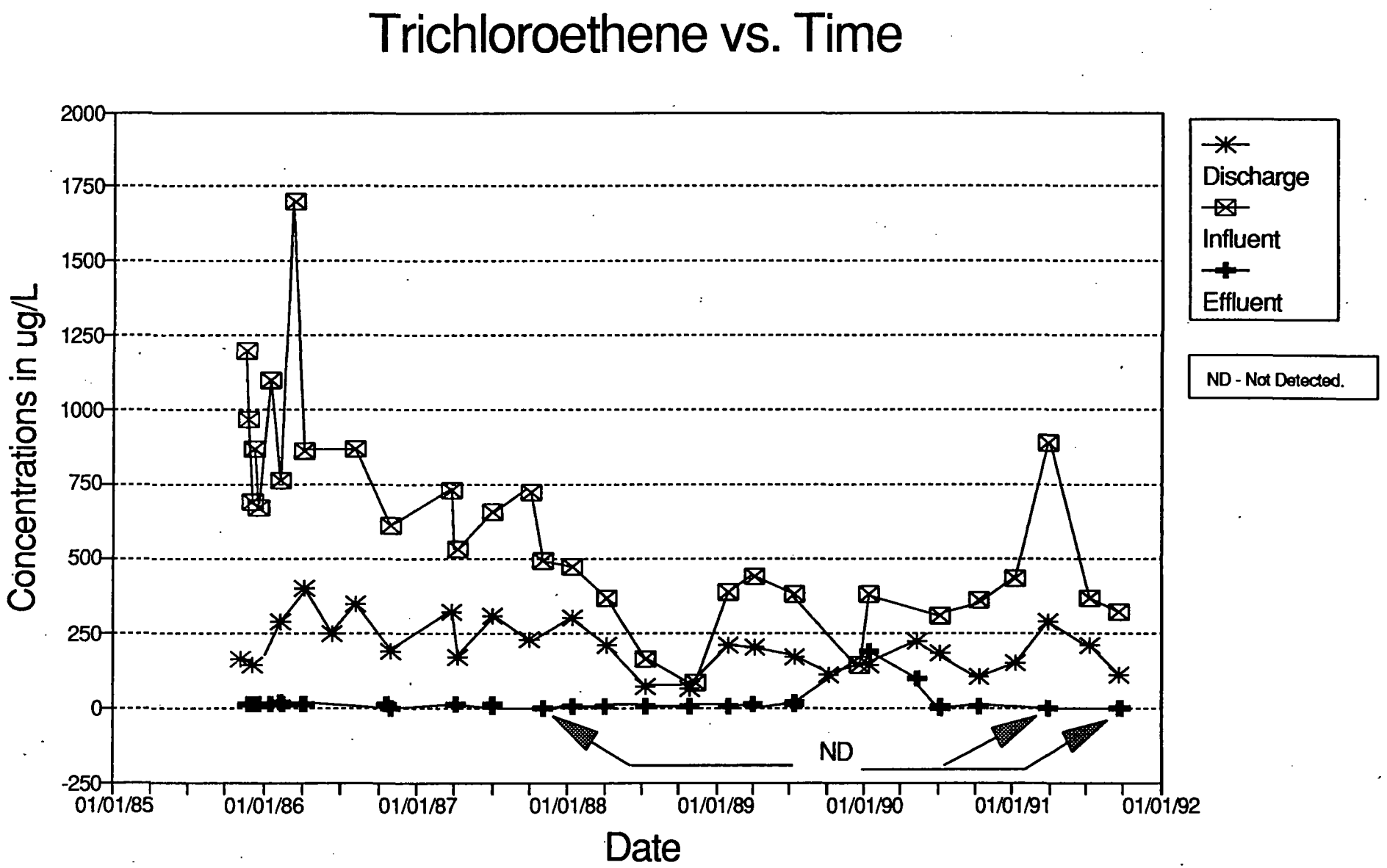


FIGURE 32
DOWNGRADIENT PUMP-OUT SYSTEM DISCHARGE
(111,112,113) AND GOUNDWATER TREATMENT
SYSTEM INFLUENT/EFFLUENT (108,109,110)
TCE CONCENTRATIONS
1985-1991

Appendices

Appendix A

QA/QC Data and Validation

APPENDIX A

QUALITY ASSURANCE/QUALITY CONTROL DATA AND VALIDATION

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TABLE A-2 1991 Blind Duplicate Data

APPENDIX A
QUALITY ASSURANCE/QUALITY CONTROL DATA AND VALIDATION

INTRODUCTION

A review of quality control data was conducted to assess the integrity of the sampling procedures and analytical results for samples collected from January through September 1991. The quality control data included analytical results from samples collected to determine both internal and external quality control. Internal quality control included initial and ongoing programs of quality assurance performed by CH_2M Hill Quality Analytical Lab ratory (CH_2M Hill) in accordance with their laboratory Quality Assurance/Quality Control Plan. External quality control involved the collection and analysis of field blank samples and masked duplicate samples according to procedures described in the Groundwater Monitoring Quality Control/Quality Assurance Plan submitted to the MPCA in February 1985.

CH_2M Hill analyzed the 1991 water samples for volatile organic compounds (VOCs) according to EPA Methods 601/602 and priority pollutant VOCs with tentatively identified compounds according to EPA Method 624.

The Minnesota Department of Health (MDH) requires that laboratories conducting analytical tests for wastewater parameters (including VOCs) be certified by the MDH. CH_2M Hill is a certified environmental laboratory in the state of Minnesota with Laboratory ID No. 001-99-250.

INTERNAL QUALITY CONTROL

Intra-laboratory quality control procedures were conducted on a daily basis to determine the acceptability of the analytical results. Internal quality control procedures followed in the analysis of samples for volatile organic compounds included spiking 10 percent of the samples with reference standards and calculating the percent recovery;

analyzing 10 percent of the samples in duplicate; and, analyzing daily laboratory blanks to check for system contamination.

Accuracy of the analytical data was assessed by evaluating percent recovery in spiked samples. CH_2M Hill uses statistical control procedures to establish and track data accuracy.

Data precision was assessed by evaluating laboratory duplicate analyses. A duplicate analysis is a replicate of a separate aliquot of the sample which has been taken through the same preparation procedures as the original sample. The relative percent difference (RPD) was computed for each duplicate set of results. Quality control data generated during the analysis of samples demonstrated acceptable precision.

Laboratory deionized water blanks were analyzed periodically throughout the analysis of samples. Laboratory blanks are used to evaluate possible system contamination.

Methylene chloride and acetone were detected in the laboratory blank associated with the priority pollutant analysis from April 1991 (Table 17). The laboratory qualified these results with a "j" indicating that these concentrations are estimates because the concentrations are less than the laboratory reporting limits. U.S. Environmental Protection Agency guidance (Laboratory Data Validation Functional Guidelines for Evaluating Organic Analysis, February 1988) for the evaluation of organic analysis data specifies that in cases where common laboratory contaminants (such as methylene chloride and acetone) are detected, the data must be qualified by raising the detection limit to ten times the reported blank concentration. In this case, application of the guidance has the effect of raising the detection limit of methylene chloride to 20 μg/L and the detection limit of acetone to 30 μg/L. This report qualifies data in accordance with these guidelines, with the exception of qualifying the data as "false positive" rather than "not detected at a higher detection limit". The false positives are qualified with a "b" in the data tables.

EXTERNAL QUALITY CONTROL

External quality control procedures were used to assess laboratory precision and accuracy and the effect of sample bottle preparation and handling processes on the quality of the analytical results. Procedures included the analysis of: field blanks for detection of contamination introduced during sample collection, and masked duplicate samples as a check on the reproducibility of the analytical results.

Five field blanks were collected and analyzed for volatile organic compounds. The results are presented in Table A-1. No volatile organic compounds were detected in the field blanks collected during 1991.

Three samples were collected in duplicate and the results of the analysis are shown in Table A-3. The precision of the masked duplicate samples were evaluated by computing the RPD for each volatile organic compound. The RPD for each duplicate pair are summarized in Table A-3. Water quality data are considered indeterminate values when the RPD exceeds 25 percent for a parameter. RPDs for 1,1-dichloroethane and 1,1,1-trichloroethane for station 200 exceed the 25 percent advisory limit. However, because the results are within 0.1 μg/L of the laboratory reporting limits, these results are considered acceptable.

Appendix A

Tables

TABLE A-1

1991 BLANK SAMPLE DATA

(concentrations in ug/L)

	FIELD BLANKS					METHOD BLANKS	
	01/11/91	04/02/91	04/03/91	07/11/91	09/26/91	01/14/91	01/15/91
1,1-Dichloroethane	--	<0.5	<0.5	--	--	--	--
1,2-Dichloroethane	--	<0.5	<0.5	--	--	--	--
1,2-Dichloroethylene, cis	--	<0.5	<0.5	--	--	--	--
1,2-Dichloroethylene, trans	--	<0.5	<0.5	--	--	--	--
1,1,2,2-Tetrachloroethane	--	<0.5	<0.5	--	--	--	--
Tetrachloroethylene	--	<0.5	<0.5	--	--	--	--
1,1,1-Trichloroethane	--	<0.5	<0.5	--	--	--	--
Trichloroethylene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

	METHOD BLANKS						
	04/01/91	04/02/91	04/03/91	04/04/91	04/04/91	07/11/91	09/25/91
1,1-Dichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethylene, cis	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethylene, trans	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-Tetrachloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,1-Trichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethylene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

	METHOD BLANKS			
	09/25/91	09/26/91	09/26/91	09/26/91
1,1-Dichloroethane	--	<0.5	--	--
1,2-Dichloroethane	--	<0.5	--	--
1,2-Dichloroethylene, cis	--	<0.5	--	--
1,2-Dichloroethylene, trans	--	<0.5	--	--
1,1,2,2-Tetrachloroethane	--	<0.5	--	--
Tetrachloroethylene	--	<0.5	--	--
1,1,1-Trichloroethane	--	<0.5	--	--
Trichloroethylene	<0.5	<0.5	<0.5	<0.5

-- Not analyzed.

.009

TABLE A-2

1991 BLIND DUPLICATE DATA

(concentrations in ug/L)

	200		RPD	T	
	04/04/91 Sample	04/04/91 Duplicate		04/02/91 Sample	04/02/91 Duplicate
1,1-Dichloroethane	<0.5	0.5	67	<0.5	<0.5
1,2-Dichloroethane	<0.5	<0.5		<0.5	<0.5
1,2-Dichloroethylene, cis	6.5	6.4	1.5	<0.5	<0.5
1,2-Dichloroethylene, trans	<0.5	<0.5		<0.5	<0.5
1,1,2,2-Tetrachloroethane	<0.5	<0.5		<0.5	<0.5
Tetrachloroethylene	0.7	0.8	13	<0.5	<0.5
1,1,1-Trichloroethane	<0.5	0.6	83	<0.5	<0.5
Trichloroethylene	140	130	7	<0.5	<0.5
Sum Volatile Organics	150	140		ND	ND

	9		RPD
	09/26/91 Sample	09/26/91 Duplicate	
1,1-Dichloroethane	--	--	
1,2-Dichloroethane	--	--	
1,2-Dichloroethylene, cis	--	--	
1,2-Dichloroethylene, trans	--	--	
1,1,2,2-Tetrachloroethane	--	--	
Tetrachloroethylene	--	--	
1,1,1-Trichloroethane	--	--	
Trichloroethylene	10	9.7	3
Sum Volatile Organics	10	9.7	

-- Not analyzed.
ND Not detected.

.008

Appendix B

Recommended 1992 Monitoring Program

APPENDIX B
RECOMMENDED 1992 MONITORING PLAN

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FIGURE B-3 Magnolia Member, 1992 Monitoring Locations

FIGURE B-4 St. Peter Sandstone, 1992 Monitoring Locations

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APPENDIX B
RECOMMENDED 1991 MONITORING PLAN

INTRODUCTION

The following monitoring plan is recommended for the period January 1, 1992 through December 31, 1992 to fulfill the requirements of Section 1.9 of Part II of Exhibit A to the Order by Consent between General Mills, Inc. and the MPCA dated October 12, 1984. The recommended 1992 Monitoring Plan is similar to the 1991 Monitoring Plan. Changes in the 1992 Monitoring Plan include monitoring of Magnolia Member Pump-out Wells MG1 and MG2, and increased sampling frequency of Magnolia Member Monitoring Well TT (third quarter of 1992).

The 1992 monitoring locations are shown on Figures B-1 through B-4. Water quality samples collected during the second quarter will be analyzed for volatile compounds presented in Table B-2. Water quality samples collected during the fourth quarter will be analyzed for trichloroethene. Monitoring of site pump-out well effluent (108, 109, and 110), downgradient pump-out well effluent (111, 112, and 113), Magnolia Member pump-out well effluent, and stripper tower effluent will be conducted according to NPDES Permit requirements. A summary of the sampling schedule, including monitoring activities and parameters for analysis, are presented by monitoring location and sampling period in Table B-1.

GROUNDWATER MONITORING

Glacial Drift

The following monitoring program will be conducted in 1992 to monitor the effectiveness of the glacial drift pump-out systems:

- Water levels will be measured in Wells 1, 3, B, Q, S, T, U, V, W, X, 109, 110, 111, 112, and 113 during the second and fourth quarters.

- Samples will be collected from Wells 1, 3, B, Q, S, T, U, V, W, and X during the second quarter and analyzed for the List 1 compounds in Table B-2.

- Samples will also be collected from Wells 1, 3, S, V, and W during the fourth quarter and analyzed for TCE.

Carimona Member

The following monitoring program will be observed to confirm the Carimona Member pump-out system continues to influence the Carimona Member in the vicinity of the East Hennepin Avenue site:

- Water levels will be measured in Wells 8, 9, 10, 11, 12, 13, 108, BB, RR, SS, UU, and WW during the second, and fourth quarters.

- Samples will be collected from Wells 8, 9, 10, 11, 12, 13, 108, BB, RR, SS, UU, and WW during the second quarter and analyzed for the List 1 compounds in Table B-2.

- Samples will also be collected from Wells 9, 10, 11, 12, and 108 during the fourth quarter and analyzed for TCE.

Magnolia Member

The following monitoring program will be conducted to confirm the anticipated effectiveness of the Magnolia Member pump-out system. This monitoring program is dependent upon approval of the Magnolia Member pump test and Remedial Action Plan and construction of the Magnolia Member pump-out system in 1992.

- Water levels will be measured in Wells MG1, MG2, OO, QQ, TT, VV, and ZZ during the second and fourth quarters.

- Samples will be collected from Wells OO, QQ, TT, VV, and ZZ, during the second quarter and analyzed for the List 1 compounds in Table B-2.

- Samples will also be collected from Wells OO, TT, VV, and ZZ during the fourth quarter and analyzed for TCE.

St. Peter Sandstone

- Water levels will be measured in Wells 200, 201, 202, and 203 during the second and fourth quarters.

- Samples will be collected from Wells 200, 201, 202, and 203 during the second quarter and analyzed for the List 1 compounds in Table B-2.

- Well 200 will be sampled in the fourth quarter and analyzed for TCE.

Prairie du Chien/Jordan (Henkel Well)

- Samples will be collected from the Henkel well during the second and fourth quarters and analyzed for the List 1 compounds in Table B-2.

Groundwater Pump-Out and Treatment Systems

- Samples will be collected from the site (glacial drift and Carimona Member) pump-out system (108, 109, 110) during the first, second, third, and fourth quarters. Samples collected during the first and third quarters will be analyzed for TCE. Samples collected during the second quarter will be analyzed for the List 2 and List 3 compounds in Table B-2. Samples collected during the fourth quarter will be analyzed for the List 2 compounds in Table B-2.

- Samples will be collected from the effluent of the site groundwater treatment system during the first, second, third, and fourth quarters. Samples collected during the first and third quarters will be analyzed for TCE. Samples collected during the second and fourth quarters will be analyzed for the List 2 compounds in Table B-2.

- Samples will be collected from the downgradient glacial drift pump-out system effluent during the first, second, third, and fourth quarters. Samples collected during the first and third quarters will be analyzed for TCE. Samples collected during the second and fourth quarters will be analyzed for the List 2 compounds in Table B-2.

- Samples will be collected from the Magnolia Member pump-out system effluent during the first, second, third, and fourth quarters. Samples collected during the first and third quarters will be analyzed for TCE. Samples collected during the second and fourth quarters will be analyzed for the List 2 compounds in Table B-2.

REPORTING

Quarterly

General Mills will submit the analytical results to the MPCA Project Leader by the 15th day of the month following completion of all analyses of samples collected during the previous quarterly sampling event.

Annual Monitoring Report

General Mills will submit an annual monitoring report for the previous calendar year to the MPCA Project Leader on or before January 31, 1993. Each annual report will contain the following information:

- Results of all water level measurements and chemical analyses for the previous calendar year.

- Water level contour maps (if applicable) for each aquifer showing groundwater levels.

- Vertical cross sections of the glacial drift groundwater elevations between Wells 1 and W.

- Maps showing the sum of the List 1 compounds listed in Table B-2 for each well location monitored during the second quarter sampling event, and maps showing the TCE concentrations for the fourth quarter sampling event.

- A discussion and summary of the reporting year's data in comparison to previously available data.

- A proposed sampling plan for the next monitoring year including an assessment of the monitoring parameters and frequencies, and the feasibility for the deletion of monitoring wells, parameters, or a decrease in sampling frequency.

Appendix B

Tables

TABLE B-1

RECOMMENDED 1992 WATER LEVEL MONITORING LOCATIONS

	Monitoring Station	Apr-May Monitoring	Oct-Nov Monitoring
Glacial Drift	1	WL[1]	WL
	3	WL	WL
	109[2]	WL	WL
	110[2]	WL	WL
	111[2]	WL	WL
	112[2]	WL	WL
	113[2]	WL	WL
	B	WL	WL
	Q	WL	WL
	S	WL	WL
	T	WL	WL
	U	WL	WL
	V	WL	WL
	W	WL	WL
	X	WL	WL
Carimona Member	8	WL	WL
	9	WL	WL
	10	WL	WL
	11	WL	WL
	12	WL	WL
	13	WL	WL
	108[2]	WL	WL
	BB	WL	WL
	RR	WL	WL
	SS	WL	WL
	UU	WL	WL
	WW	WL	WL
Magnolia Member	MG1[2]	WL	WL
	MG2[2]	WL	WL
	OO	WL	WL
	QQ	WL	WL
	TT	WL	WL
	VV	WL	WL
	ZZ	WL	WL
St. Peter Sandstone	200	WL	WL
	201	WL	WL
	202	WL	WL
	203	WL	WL

[1]Water level measurement
[2]Pump-out well

TABLE B-1 (Continued)

RECOMMENDED 1992 MONITORING
STATIONS AND SAMPLING FREQUENCIES

	Monitoring Station	Apr-May Parameter Monitoring	Oct-Nov Parameter Monitoring
Glacial Drift	1	List 1[3]	TCE
	3	List 1	TCE
	B	List 1	--
	Q	List 1	--
	S	List 1	TCE
	T	List 1	--
	U	List 1	--
	V	List 1	TCE
	W	List 1	TCE
	X	List 1	--
Carimona Member	8	List 1	--
	9	List 1	TCE
	10	List 1	TCE
	11	List 1	TCE
	12	List 1	TCE
	13	List 1	--
	108	List 1	TCE
	BB	List 1	--
	RR	List 1	--
	SS	List 1	--
	UU	List 1	--
	WW	List 1	--
Magnolia Member	OO	List 1	TCE
	QQ	List 1	--
	TT	List 1	TCE
	VV	List 1	TCE
	ZZ	List 1	TCE
St. Peter Sandstone	200	List 1	TCE
	201	List 1	--
	202	List 1	--
	203	List 1	--
Prairie du Chien-Jordan	Henkel[5]	List 1	List 1

[3]List 1 - Collection and analysis of water quality samples for List 1 parameters using EPA Method 601.

[4]TCE - Collection and analysis of water quality samples for trichloroethene (TCE) using EPA Method 601.

[5]Henkel - Collection of water quality samples dependent upon operation status of former Henkel Corporation well.

TABLE B-1 (Continued)

RECOMMENDED 1992 MONITORING
STATIONS AND SAMPLING FREQUENCIES

	Jan-Feb	Apr-May	Jul-Aug	Oct-Nov
Influent (Pump-Out Wells 108, 109, 110), Station 20100	TCE[4]	List 2,[6] List 3[7]	TCE	List 2
Effluent (Pump-Out Wells 108, 109, 110), Station 20100	TCE	List 2	TCE	List 2
Discharge (Pump-Out Wells 111, 112, 113), Station 20200	TCE	List 2	TCE	List 2
Magnolia Pump-Out System Effluent (Pump-Out Wells MG1 and MG2)	TCE	List 2[6]	TCE	List 2

---

[6]List 2 - Collection and analysis of water quality samples for List 2 parameters using EPA Method 601/602.

[7]List 3 - Collection and analysis of water quality samples for List 3 parameters using EPA Method 624 with tentatively identified compounds (TIC).

TABLE B-2

RECOMMENDED 1992 WATER QUALITY
ANALYTICAL PARAMETER LISTS

List 1[1]

Chlorinated Volatile Organics

1,1-Dichloroethane
1,2-Dichloroethane
1,2-Dichloroethylene, cis
1,2-Dichloroethylene, trans
1,1,2,2-Tetrachloroethane
Tetrachloroethylene
1,1,1-Trichloroethane
Trichloroethene

List 2[2]

Chlorinated Volatile Organics

1,1-Dichloroethane
1,2-Dichloroethane
1,2-Dichloroethylene, cis
1,2-Dichloroethylene, trans
1,1,2,2-Tetrachloroethane
Tetrachloroethylene
1,1,1-Trichloroethane
Trichloroethene

Non-Chlorinated Volatile Organics

Benzene
Toluene
Xylenes

List 3[3]

Priority Pollutant Volatile Organics

Acetone
Benzene
Bromodichloromethane
Bromoform
Bromomethane
Carbondisulfide
Carbon Tetrachloride
Chlorobenzene
Chloroethane
2-Chloroethylvinyl Ether
Chloroform
Chloromethane
Chlorodibromomethane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
1,2-Dichloroethene
1,2-Dichloropropane
cis-1,3-Dichloropropane
trans-1,3-Dichloro-1-propene
Ethyl Benzene
2-Hexanone
Methylene Chloride
Methyl Ethyl Ketone
Methyl Isobutyl Ketone
Styrene
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Toluene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Trichlorofluoromethane
Vinyl Acetate (Vinyl Ester)
Vinyl Chloride
Xylenes

---

[1]List 1 - Analyzed using EPA Method 601.
[2]List 2 - Analyzed using EPA Methods 601/602.
[3]List 3 - Analyzed using EPA Method 624 with tentatively identified compounds (TIC).

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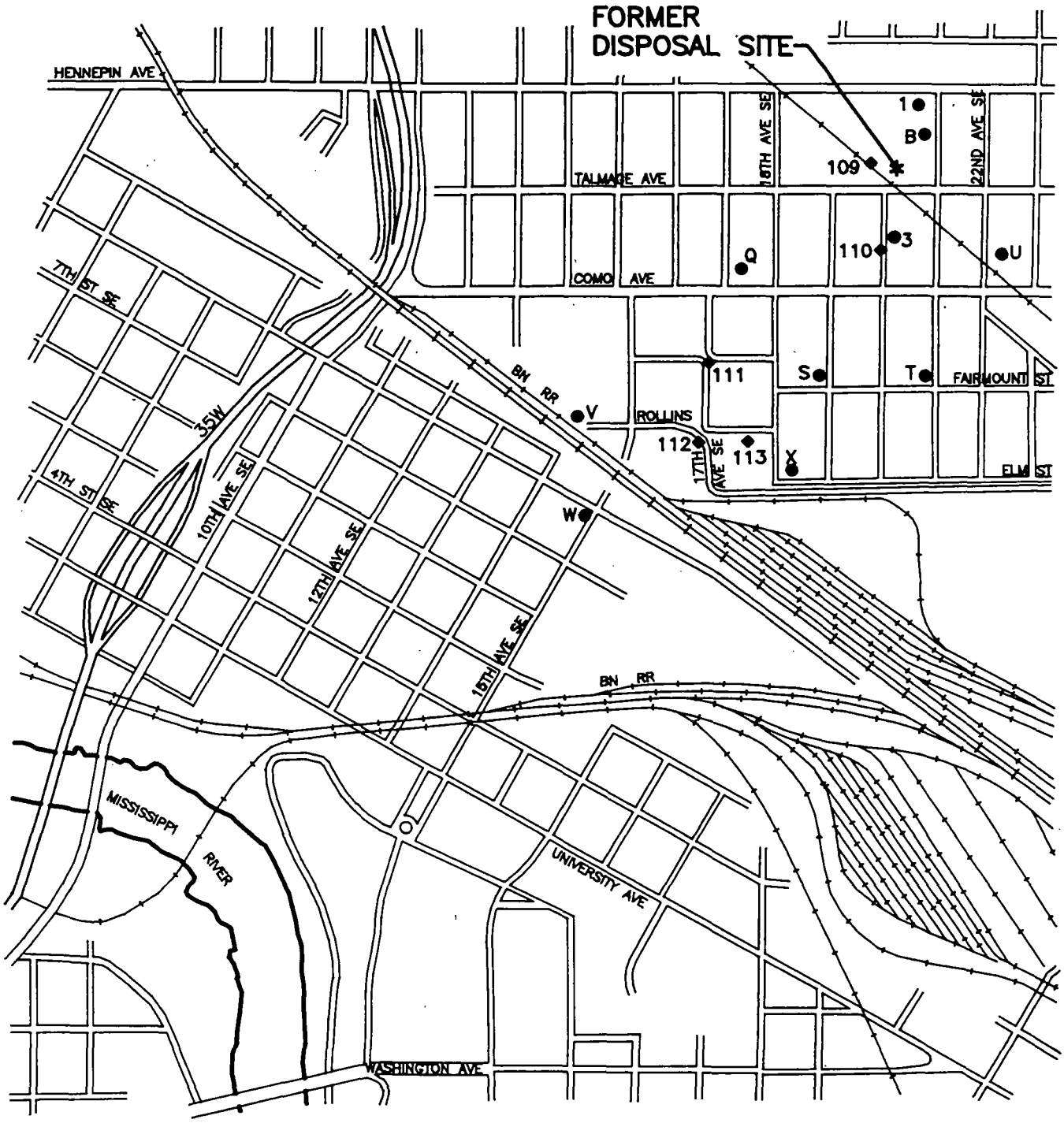
Appendix B

Figures



● GLACIAL DRIFT MONITORING WELL

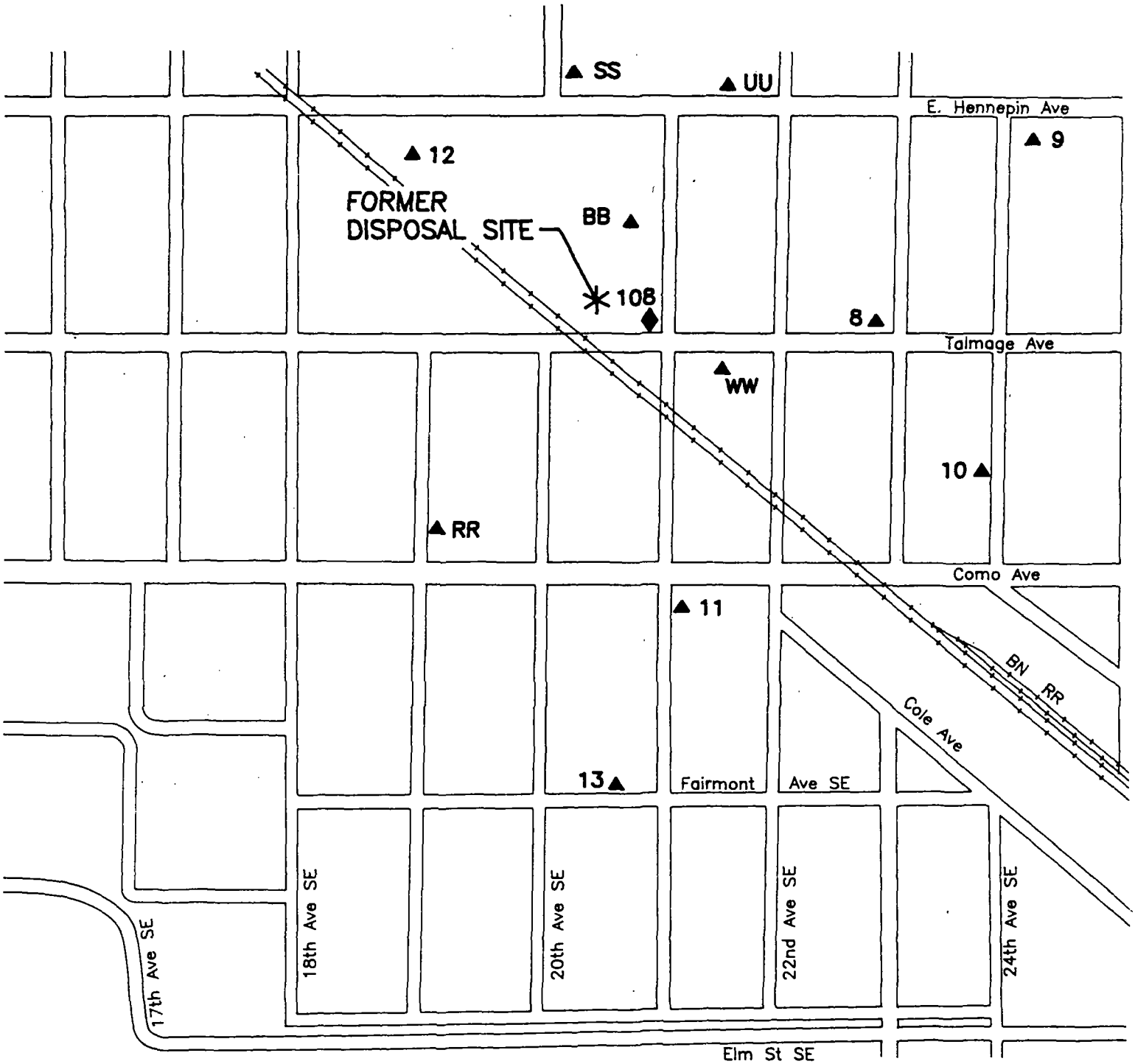
◆ GLACIAL DRIFT PUMP-OUT WELL

0 1000
SCALE IN FEET

RJW QM91-B1 1.00 01/07/1992 10:30:02

Figure B-1

GLACIAL DRIFT AQUIFER
1992 MONITORING LOCATIONS



▲ CARIMONA MEMBER MONITORING WELL

♦ CARIMONA MEMBER PUMP-OUT WELL

N

0 200 400

SCALE IN FEET

Figure B-2

CARIMONA MEMBER
1992 MONITORING LOCATIONS

TT

E. Hennepin Ave

FORMER
DISPOSAL SITE

MG2

MG1

Talmage Ave

VV

OO

QQ

Como Ave

BN RR

Cole Ave

ZZ

Fairmont Ave SE

17th Ave SE

18th Ave SE

20th Ave SE

22nd Ave SE

24th Ave SE

Elm St SE

MAGNOLIA MEMBER MONITORING WELL

MAGNOLIA MEMBER PUMP-OUT WELL

N

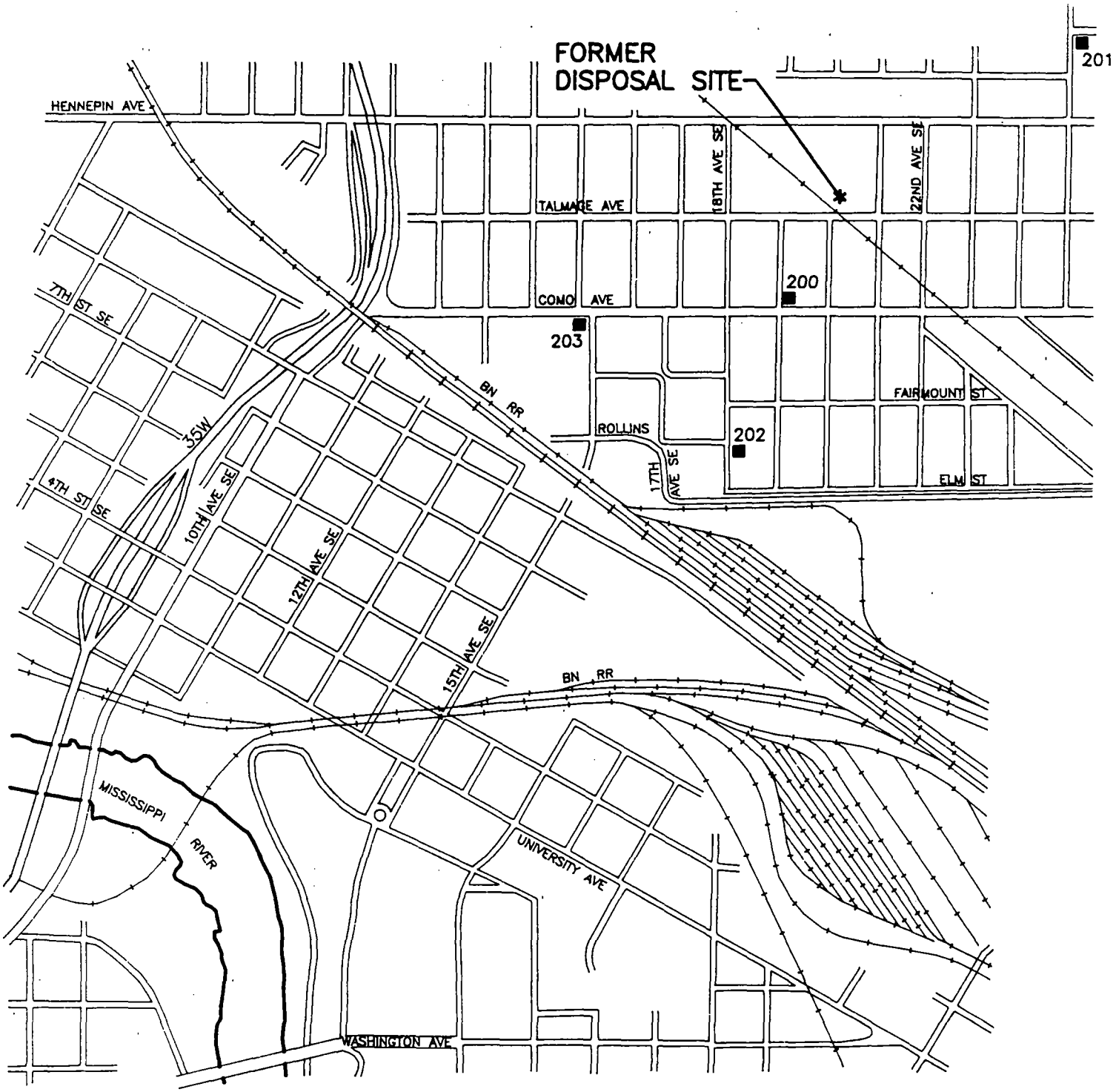
0 200 400

SCALE IN FEET

RJW QM91-83 1.00 12/09/1991 16:10:03

Figure B-3

MAGNOLIA MEMBER
1992 MONITORING LOCATIONS



■ ST. PETER SANDSTONE MONITORING WELL

N

0 1000
SCALE IN FEET

RJW GM91-B4 1.00 11/14/1991 15:52:26

Figure B-4

ST. PETER SANDSTONE
1992 MONITORING LOCATIONS

Appendix C

Historical Water Elevation and Water Quality Data

APPENDIX C

HISTORICAL WATER ELEVATION AND WATER QUALITY DATA

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TABLE C-8	Historical Water Quality Data, Magnolia Member Wells, Trichloroethene
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TABLE C-10	Historical Water Quality Data, Prairie du Chien/Jordan Well, Trichloroethene
TABLE C-11	Historical Water Quality Data, Site Pump-Out and Treatment System, Downgradient Pump-Out System, Trichloroethene

Appendix C

Tables

TABLE C-1

HISTORICAL WATER ELEVATION DATA
GLACIAL DRIFT WELLS

(elevations in feet/MSL)

DATE	1	3	4	106	107
02/82	843.19	--	--	--	--
02/82	842.37	--	--	--	--
03/82	842.37	--	--	--	--
03/82	842.28	--	--	--	--
03/82	842.29	835.95	833.20	--	--
04/82	842.54	836.07	833.30	--	--
04/82	842.54	836.07	833.35	--	--
11/82	843.70	836.48	833.89	--	--
02/83	842.96	836.16	833.53	--	--
04/83	843.44	836.88	834.11	840.25	840.19
06/83	842.90	837.58	834.88	839.40	839.25
09/83	--	836.95	834.38	838.80	838.68
11/83	--	--	--	838.57	--
01/84	--	--	--	839.40	837.36
01/84	--	--	--	838.48	838.41
03/84	--	837.23	834.20	838.68	838.65
10/85	842.68	836.57	--	838.52	838.42
12/85	842.38	835.19	833.40	837.12	836.96
07/87	842.0	832.75	--	--	--
10/87	842.34	834.30	--	--	--
04/88	841.90	832.89	830.23	835.63	835.54
07/88	841.69	832.45	--	--	--
10/88	841.77	833.00	--	--	--
04/89	841.74	833.30	830.79	--	835.34
07/89	841.75	833.76	--	--	--
10/89	841.72	833.98	--	--	--
05/90	--	833.65	830.43	--	--
07/90	841.90	834.35	--	836.36	836.17
10/90	841.69	834.15	--	--	--
04/91	841.36	832.92	--	--	--
09/91	842.02	834.25	--	--	--

-- Not measured.

2,.012

TABLE C-1 (cont.)

HISTORICAL WATER ELEVATION DATA
GLACIAL DRIFT WELLS

(elevations in feet/MSL)

DATE	B	Q	R	S	T
10/81	843.31	--	--	--	--
02/82	844.45	--	--	--	--
02/82	842.78	--	--	--	--
02/82	842.77	--	--	--	--
03/82	842.84	--	--	--	--
03/82	842.72	--	--	--	--
03/82	842.68	--	--	--	--
03/82	824.89	--	--	--	--
04/82	842.96	--	--	--	--
04/82	843.03	--	--	--	--
04/82	843.03	--	--	--	--
04/82	843.14	--	--	--	--
11/82	843.56	--	--	--	--
12/82	843.59	--	--	--	--
02/83	843.30	--	--	--	--
04/83	844.13	--	--	--	--
06/83	844.37	--	--	--	--
09/83	844.14	--	--	--	--
11/83	844.01	--	--	--	--
01/84	843.93	--	--	--	--
02/84	--	830.49	827.64	829.85	832.38
03/84	844.13	832.08	829.15	831.21	833.89
10/85	843.89	831.58	829.00	832.00	833.96
12/85	843.86	831.22	828.73	830.95	833.37
07/87	--	--	DRY	824.91	831.74
10/87	--	--	--	826.36	832.72
04/88	843.38	826.86	--	824.94	831.80
07/88	--	826.46	DRY	824.63	832.44
10/88	--	826.77	DRY	824.92	833.03
04/89	843.17	827.45	DRY	825.23	832.25
07/89	--	827.95	DRY	825.55	832.41
10/89	--	828.26	DRY	826.45	832.23
05/90	--	827.08	DRY	825.92	832.14
07/90	844.33	828.50	DRY	827.38	832.89
10/90	--	828.28	DRY	827.43	832.62
04/91	842.76	827.43	--	825.96	832.14
09/91	843.46	828.90	--	828.42	833.06

-- Not measured.

2,.012

TABLE C-1 (cont.)

HISTORICAL WATER ELEVATION DATA
GLACIAL DRIFT WELLS

(elevations in feet/MSL)

DATE	U	V	W	X
02/84	837.07	--	--	--
03/84	838.82	818.16	818.25	829.00
10/85	838.11	818.61	818.49	831.59
12/85	837.30	817.99	817.96	829.02
07/87	--	815.3	814.4	DRY
10/87	--	815.93	816.10	--
04/88	835.58	814.51	814.59	DRY
07/88	--	814.03	814.03	DRY
10/88	--	814.44	814.54	DRY
04/89	835.72	814.19	814.34	DRY
07/89	--	814.77	814.86	822.05
10/89	--	815.16	815.26	DRY
05/90	835.86	814.64	814.38	822.07
07/90	--	816.65	816.75	822.95
10/90	--	816.70	816.80	823.08
04/91	835.35	815.60	815.69	DRY
09/91	836.54	818.19	818.18	824.25

-- Not measured.

2.,012

TABLE C-2

HISTORICAL WATER ELEVATION DATA
CARIMONA MEMBER WELLS

(elevations in feet/MSL)

DATE	8	9	10	11	12	13
11/82	828.91	--	--	--	--	--
04/83	836.76	--	--	--	--	--
06/83	835.81	--	--	--	--	--
09/83	838.68	--	--	--	--	--
09/83	835.51	--	--	--	--	--
03/84	830.15	830.15	830.21	830.18	831.43	830.21
10/85	830.58	830.61	830.62	830.65	832.11	830.01
12/85	829.71	830.05	829.86	829.73	831.50	829.25
07/87	827.10	827.3	827.28	827.26	827.83	826.49
10/87	828.79	828.69	828.72	828.79	828.63	828.14
04/88	827.71	827.85	827.86	827.74	828.12	827.05
07/88	824.91	825.12	825.07	824.97	825.40	824.36
10/88	826.83	826.98	826.99	826.86	826.61	826.17
04/89	827.13	827.37	827.37	827.16	827.20	826.63
07/89	825.41	825.64	825.59	825.43	826.18	824.74
10/89	827.32	827.52	827.82	827.37	826.70	826.78
05/90	827.06	827.38	827.26	827.31	827.52	826.65
07/90	827.92	828.18	828.10	827.84	826.73	827.20
10/90	828.38	828.59	828.58	828.41	828.23	827.78
04/91	828.63	828.84	828.83	828.70	828.92	828.06
09/91	829.19	829.40	829.40	829.15	828.46	828.55

-- Not measured.

2,.011

TABLE C-2 (cont.)

HISTORICAL WATER ELEVATION DATA
CARIMONA MEMBER WELLS

(elevations in feet/MSL)

DATE	108 (1)	BB	RR	SS	UU	WW
10/81	--	828.09	--	--	--	--
11/81	--	827.85	--	--	--	--
02/82	--	829.87	--	--	--	--
02/82	--	827.85	--	--	--	--
02/82	--	827.77	--	--	--	--
03/82	--	827.85	--	--	--	--
03/82	--	828.61	--	--	--	--
03/82	--	827.81	827.73	--	--	--
03/82	--	827.76	827.73	--	--	--
04/82	--	827.89	827.76	--	--	--
04/82	--	827.82	--	--	--	--
04/82	--	827.82	827.57	--	--	--
04/82	--	828.08	828.17	--	--	--
11/82	--	829.07	829.12	835.43	828.85	828.91
12/82	--	829.18	829.22	835.67	831.10	829.08
02/83	--	828.89	828.98	834.07	828.98	828.76
02/83	--	--	--	834.25	--	--
04/83	--	829.69	829.72	834.13	829.54	829.48
06/83	--	829.96	829.97	834.29	829.86	829.77
09/83	--	829.66	829.53	823.15	829.55	829.45
11/83	830.12	830.15	830.08	833.90	830.24	829.95
01/84	--	829.84	--	833.55	829.80	829.69
01/84	830.65	830.12	828.99	833.50	830.02	829.94
03/84	830.92	830.25	830.16	832.34	830.18	830.08
10/85	830.77	830.26	830.19	831.76	830.63	830.60
12/85	812.90	829.76	829.90	830.59	829.88	829.79
07/87	805.9	--	827.11	826.18	--	--
10/87	806.06	--	828.82	827.27	--	--
04/88	804.57	827.81	827.85	826.22	827.72	827.71
07/88	804.45	--	825.11	824.05	--	--
10/88	804.49	--	826.95	825.37	--	--
04/89	807.81	827.34	827.35	825.54	827.31	827.31
07/89	804.51	--	825.65	823.62	--	--
10/89	827.49	--	827.57	825.12	--	--
05/90	--	--	827.41	824.77	827.28	827.27
07/90	804.54	828.01	827.98	827.05	--	--
10/90	804.64	--	828.48	826.74	--	--
04/91	807.87	828.75	828.76	826.42	828.69	828.66
09/91	804.55	829.25	829.41	826.95	829.23	831.23

(1) Carimona pump-out well.
-- Not measured.

2,.011

TABLE C-3

HISTORICAL WATER ELEVATION DATA
MAGNOLIA MEMBER WELLS

(elevations in feet/MSL)

DATE	OO	QQ	TT	W	ZZ
03/82	823.60	823.25	--	--	--
03/82	823.60	823.34	--	--	--
03/82	823.48	823.29	--	--	--
04/82	823.64	823.37	--	--	--
04/82	823.72	823.42	--	--	--
04/82	823.99	823.75	--	--	--
11/82	824.96	824.61	822.41	825.57	--
12/82	824.79	824.41	822.59	825.76	--
02/83	825.51	823.57	822.34	825.50	--
02/83	--	--	822.62	--	--
04/83	825.29	823.00	822.90	826.32	--
06/83	825.80	825.61	823.60	826.43	--
09/83	824.71	825.20	829.55	826.18	--
11/83	825.69	825.44	823.44	826.52	--
01/84	825.46	--	823.26	826.32	--
03/84	825.78	825.61	823.54	826.64	830.2
02/85	--	--	822.62	--	--
10/85	825.76	825.46	823.26	826.99	830.67
12/85	825.57	825.39	822.74	826.24	830.65
02/86	824.74	824.49	822.10	825.60	830.05
04/86	824.75	824.52	822.10	825.60	829.65
06/86	824.89	824.68	822.31	825.66	828.31
08/86	824.86	824.71	822.32	825.65	829.44
10/86	825.49	825.24	822.90	826.33	830.45
04/87	823.87	823.66	821.46	824.83	829.25
07/87	822.85	822.53	820.42	823.42	827.93
10/87	824.24	823.96	821.77	824.99	829.98
04/88	823.31	823.03	820.91	824.14	828.44
07/88	821.14	820.82	818.88	821.73	825.73
10/88	822.46	822.11	820.13	823.34	827.57
04/89	822.82	822.47	820.46	823.75	828.72
07/89	821.66	821.32	819.38	822.36	826.05
10/89	823.07	822.70	820.69	823.98	828.20
05/90	822.79	822.51	820.42	823.65	828.04
07/90	823.67	823.36	821.35	824.57	828.65
10/90	823.99	823.73	821.56	824.88	829.16
04/91	824.52	824.25	821.75	825.46	829.44
09/91	825.50	825.19	823.05	826.28	829.94

-- Not measured.

2,.010

TABLE C-4

HISTORICAL WATER ELEVATION DATA
ST. PETER SANDSTONE WELLS

(elevations in feet/MSL)

DATE	200	201	202	203
10/85	--	779.64	751.98	752.05
12/85	758.68	780.24	752.60	757.58
07/87	760.63	777.82	753.86	753.43
10/87	760.47	779.35	753.28	753.42
04/88	761.89	780.40	753.36	753.37
07/88	758.57	773.59	752.28	752.10
10/88	760.78	778.42	752.53	752.43
04/89	762.22	779.61	753.67	753.57
07/89	758.96	775.98	752.77	752.37
10/89	760.36	777.25	752.70	752.43
05/90	761.79	778.59	753.72	753.29
07/90	759.54	776.15	753.16	752.61
10/90	759.90	776.67	752.44	751.93
04/91	761.75	778.01	753.50	752.94
09/91	761.38	778.26	753.38	752.96

-- Not measured.

2,.013

TABLE C-5

HISTORICAL WATER ELEVATION DATA
GLACIAL DRIFT PUMP-OUT WELLS

(elevations in feet/MSL)

DATE	109 (1)	110 (1)	111 (2)	112 (2)	113 (2)
10/85	837.21	835.62	829.25	829.10	829.20
12/85	828.19	829.11	828.83	828.59	828.77
07/87	831.26	829.63	816.75	811.67	814.24
10/87	829.94	828.98	813.70	814.64	815.68
04/88	828.90	823.37	808.70	811.81	813.00
07/88	831.00	822.35	815.35	807.91	812.63
10/88	829.99	829.52	815.62	811.68	813.15
04/89	831.41	828.90	818.43	811.80	817.22
05/90	--	830.71	818.20	807.67	817.96
07/90	827.27	831.02	819.07	811.77	818.80
10/90	829.63	831.51	819.23	811.03	819.12
04/91	826.58	826.60	817.98	808.26	817.91
09/91	830.56	829.33	820.19	--	820.27

-- Not measured due to restricted site access.
(1) Site glacial drift pump-out wells.
(2) Down-gradient glacial drift pump-out wells.

2,.012

TABLE C-6

HISTORICAL WATER QUALITY DATA
GLACIAL DRIFT WELLS
TRICHLOROETHENE

(concentrations in ug/L)

DATE	B	Q	R	S	T
04/82	6.0	--	--	--	--
12/82	1100	--	--	--	--
12/83	780	--	--	--	--
02/84	--	<1.3	670	770	<1.3
10/85	1200	20	1100	740	<0.3
12/85	1100	14	820	750	<0.8
02/86	1300	11	31	650	<0.5
04/86	1000	13	DRY	1100	<0.2
06/86	1100	4.7	160	930	<0.2
08/86	1000	5.6	DRY	880	<0.2
10/86	--	3.2	--	620	<0.2
11/86	830	--	--	--	--
04/87	800	2.6	DRY	650	<0.2
07/87	--	--	DRY	740	--
10/87	--	--	--	1000	--
04/88	330	0.86	DRY	460	<0.50
07/88	--	--	DRY	160	--
10/88	--	--	DRY	110	--
04/89	250	1.1	DRY	860	<0.5
07/89	--	--	DRY	620	--
10/89	--	--	DRY	630	--
05/90	--	0.7	DRY	710	<0.5
07/90	330	--	DRY	200	--
10/90	--	--	DRY	770	--
04/91	340	0.7	--	870	<0.5
09/91	--	--	--	480	--

-- Not analyzed.

2,.014

TABLE C-6 (cont.)

HISTORICAL WATER QUALITY DATA
GLACIAL DRIFT WELLS
TRICHLOROETHENE

(concentrations in ug/L)

DATE	1	3	4
04/82	6.0	780	4.5
12/83	27	800	380
10/85	1.4	1100	--
11/85	--	--	440
12/85	1.5	770	440
02/86	1.4 s	680	200
04/86	3.1	1200	210
06/86	8.1	1300	180
08/86	9.3	890	280
10/86	0.9	720	200
04/87	2.7	740	120
07/87	0.4	770	--
10/87	0.8	960	--
04/88	<0.50	440	55
07/88	0.5	140	--
10/88	<0.50	98	--
04/89	0.8	320	55
07/89	0.6 s	340	--
10/89	0.5	530	--
05/90	--	520	77
07/90	0.8	770	--
10/90	<0.5	310	--
04/91	3.1	1500	--
09/91	1.3	300	--

-- Not analyzed.
s Potential false positive value based on data validation procedures.

2,.016

TABLE C-6 (cont.)

HISTORICAL WATER QUALITY DATA
GLACIAL DRIFT WELLS
TRICHLOROETHENE

(concentrations in ug/L)

DATE	U	V	W	X
02/84	<1.3	--	--	--
03/84	--	78	7.5	2.2
10/85	2.6	220	8.1	2.1
12/85	3.9	140	32	5.0
02/86	2.9	180	14	0.9 s
04/86	3.2	170	18	0.9
06/86	1.6	97	10	0.9
08/86	16	130	18	0.7
10/86	1.4	92	6.2	0.5
04/87	2.7	160	24	--
07/87	--	180	42	--
10/87	--	140	56	--
04/88	--	160	43	DRY
07/88	--	33	8.1	--
10/88	--	37	26	--
04/89	--	130	57	DRY
07/89	--	120	22	--
10/89	--	120	25	--
05/90	--	110	31	DRY
07/90	--	120	<0.5	--
10/90	--	110	11	--
04/91	2.0	130	40	--
09/91	--	73	20	--

-- Not analyzed.
s Potential false positive value based on data validation procedures.

2,.015

TABLE C-7

HISTORICAL WATER QUALITY DATA
CARIMONA MEMBER WELLS
TRICHLOROETHENE

(concentrations in ug/L)

DATE	BB	RR	SS	UU	WW
05/82	--	46	--	--	--
06/82	1600	--	--	--	--
12/82	1600	43	<0.05	78	2100
12/83	1400	33	<1.5	81	1700
10/85	1900	110	0.4 s	150	2300
12/85	1100	95	1.2	79	1200
02/86	1300	88	<0.5	71	740
04/86	2200	170	0.4	81	540
06/86	2100	85	0.3	37	290
08/86	1800	100	0.3	45	220
10/86	--	--	<0.2	36	--
11/86	1300	100	--	--	290
04/87	1100	110	1.2	12	290
04/88	530	220	<0.50	23	320
04/89	340	180	1.3	38	530
05/90	--	60	4.1	35	450
07/90	530	--	--	--	--
04/91	1100	150	4.5	64	420
09/91	--	--	--	--	--

-- Not analyzed.
s Potential false positive value based on data validation procedures.

2,.017

TABLE C-7 (cont.)

HISTORICAL WATER QUALITY DATA
CARIMONA MEMBER WELLS
TRICHLOROETHENE

(concentrations in ug/L)

DATE	8	9	10	11	12	13	108
04/83	820	--	--	--	--	--	--
11/83	--	--	--	--	--	--	1100
12/83	96	<0.05	2.6	120	<1.5	--	--
01/84	--	--	--	--	--	--	1100
03/84	--	--	--	--	--	25	--
10/85	2300	17	1500	2.7	--	1.9	--
11/85	--	--	--	--	<0.2	--	1500
12/85	650	10	1100	520	<0.8	21	820
02/86	240	6.7	420	250	<0.5	9.7	700
04/86	180	8.0	290	120	0.5	120	750
06/86	140	6.1	280	58	<0.2	130	640
08/86	160	6.7	270	67	0.2	14	580
10/86	110	5.4	220	40	<0.2	0.5	540
04/87	86	5.1	120	160	<0.2	140	450
07/87	--	0.6	150	25	<0.2	--	580
10/87	--	9.5	170	180	<0.5	--	560
04/88	160	4.5	56	79	<0.5	<0.50	200
07/88	--	1.7	34	0.3	<0.5	--	96
10/88	--	10	58	0.7	1.0 s	--	87
04/89	380	9.8	160	110	<0.5	110	530
07/89	--	9.9	99	3.6	2.1	--	340
10/89	--	12	140	5.0	<0.5	--	--
12/89	--	--	--	--	--	--	490
05/90	100	8.5	150	<0.5	0.7	110	570
07/90	--	43	180	16	<0.5	--	400
10/90	--	9.4	130	240	<0.5	--	420
04/91	80	7.3	110	8.7	<0.5	<0.5	710
09/91	--	10	120	3.2	<0.5	--	76

s Potential false positive value based on data validation procedures.
-- Not analyzed.

2,.005

TABLE C-8

HISTORICAL WATER QUALITY DATA
MAGNOLIA MEMBER WELLS
TRICHLOROETHENE

(concentrations in ug/L)

DATE	OO	QQ	TT	VV	ZZ
05/82	15	--	--	--	--
06/82	--	13	--	--	--
12/82	56	13	8.9	--	--
03/84	--	--	--	--	14
10/85	49	2.9	26	140	85
12/85	31	7.3	19	93	28
02/86	36	5.2	27	92	200
04/86	120	6.0	33	280	440
06/86	27	1.0	20	83	91
08/86	19	0.6	40	99	39
10/86	32	6.4	23	77	190
04/87	130	2.5	34	63	230
04/88	160	<0.50	16	63	130
07/88	20	--	--	9.4	--
10/88	34	--	--	25	43
04/89	90	3.7	30	59	180
07/89	70	--	--	87	34
10/89	67	--	--	150	33
05/90	58	3.4	26	33	120
07/90	62	--	--	27	61
10/90	30	--	--	46	36
04/91	5.1	<0.5	140	75	170
09/91	5.0	--	--	48	--

-- Not analyzed.

2,.007

TABLE C-9

HISTORICAL WATER QUALITY DATA
ST. PETER SANDSTONE WELLS
TRICHLOROETHENE

(concentrations in ug/L)

DATE	200	201	202	203
10/85	--	0.5 s	--	--
11/85	120	--	2.6	0.5 s
12/85	100	2.9	2.0	1.2
02/86	72	<0.5	1.9	2.5
04/86	130	<0.2	0.2	0.6
06/86	110	<0.2	0.2 s	0.5
08/86	110	<0.2	2.7	0.5
10/86	78	<0.2	<0.2	0.5
04/87	100	0.1	<0.2	0.7
07/87	120	--	--	--
10/87	160	--	--	--
04/88	89	<0.50	<0.50	<0.50
07/88	33	--	--	--
10/88	56	--	--	--
04/89	150	<0.5	<0.5	2.1
07/89	130	--	--	--
10/89	120	--	--	--
05/90	110	<0.5	0.8	2.8
07/90	11	--	--	--
10/90	130	--	--	--
04/91	140	<0.5	<0.5	3.0
09/91	77	--	--	--

s Potential false positive value based on data validation procedures.
-- Not analyzed.

2,.008

TABLE C-10

HISTORICAL WATER QUALITY DATA
PRAIRIE DU CHIEN/JORDAN WELL
TRICHLOROETHENE

(concentrations in ug/L)

DATE	HENKEL
10/85	71
12/85	44
02/86	48
04/86	OFF
06/86	OFF
08/86	54
11/86	6.9
04/87	7.1
07/87	20
10/87	6.7
04/88	13
07/88	1.5
10/88	8.0
04/89	12
07/89	10
10/89	11
07/91	49
09/91	18

2,.006

TABLE C-11

HISTORICAL WATER QUALITY DATA
SITE PUMP-OUT AND TREATMENT SYSTEM
DOWNGRADIENT PUMP-OUT SYSTEM
TRICHLOROETHENE

(concentrations in ug/L)

DATE	DISCHARGE (1)	INFLUENT (2)	EFFLUENT (3)
11/85	160	1200	13
12/85	140	870	12
01/86	--	1100	17
02/86	290	760	8.4
03/86	--	1700	14
04/86	400	860	11
06/86	250	--	--
08/86	350	870	6.7
10/86	190	610	1.0
03/87	320	730	6.8
04/87	170	530	8.3
07/87	310	660	2.8
10/87	230	720	<0.5
11/87	--	490	2.6
01/88	300	470	4.4
04/88	210	370	5.3
07/88	70	160	1.2
10/88	64	--	--
11/88	--	84	3.7
01/89	210	390	9.8
04/89	200	440	13
07/89	170	380	20
10/89	110	--	--
12/89	--	140	190
01/90	140	380	96
05/90	220	370	1.2
07/90	180	310	0.9
10/90	100	360	2.9
01/91	150	430	0.8
04/91	290	890	1.0
07/91	210	370	<0.5
09/91	110	320	<0.5

(1) Flow rate weighted composite sample (pump-out wells 111, 112, and 113)
(2) Flow rate weighted composite sample (pump-out wells 108, 109, and 110)
(3) Effluent from treatment system.
-- Not analyzed.

2,.009