8-13-89

June, 13, 1990

file #61

Delta Environmental Consultants, Inc.

WORK PLAN

AMOCO TERMINAL

SUPERIOR, WISCONSIN

DELTA NO. 10-88-457

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June 13, 1990

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1.0 INTRODUCTION

The purpose of this report is to present a brief summary of the current status of the site investigation (Section 2.0), and to discuss our plans for additional site assessment work (Section 3.0) at the Amoco bulk petroleum storage facility located in Superior, Wisconsin. The site is owned and operated by Amoco Oil Company (Amoco), and is located on the ~~east~~ west end of Superior, Wisconsin, on a 35 acre lot bounded by Winter Street, Susquehanna Avenue, Maryland Avenue, and U.S. Highway 2 (Figures 1 and 2).

A Remedial Investigation Report (RI) was prepared for this site and was submitted to the Wisconsin Department of Natural Resources (WDNR) on May 8, 1989. Information pertaining to general site history and site characteristics is presented in the RI, and will not be repeated in this report.

2.0 CURRENT STATUS

A total of 30 ground water monitoring wells have been installed for measuring water levels and product thicknesses, collecting water samples for chemical analyses, and determining ground water flow direction (Figure 3). In addition, seven recovery wells have been installed for the purpose of capturing and containing the contamination at the site (Figure 3).

Free liquid petroleum product is present in 10 of the 30 monitoring wells and in five of the seven recovery wells. Table 1 presents product thickness measurements from May 4, 1990, and Figure 4 presents a map showing the extent of free product. These data show that there are two separate plumes of free product, and that the extent of free product has been defined by the presence of downgradient monitoring wells not containing free product.

All of the monitoring wells not containing free product have been sampled for benzene, toluene, ethyl benzene, and xylenes (BTEX). Table 2 presents the analytical results from this sampling. Figure 5 shows the BTEX concentrations at each well expressed as the sum of B+T+E+X.

A water table contour map which was constructed from water level measurements on July 26, 1989, is presented as Figure 6. These data show that the predominant direction of flow is to the northwest, with several localized variations present. The data also show that the hydraulic gradient across the site is between 0.005 feet/foot and 0.007 feet/foot. The average linear flow velocity, calculated using the observed hydraulic gradient, an effective porosity range of 25% to 50%, and a hydraulic conductivity range of 0.5 to 1.0 (see below), is calculated to be between two and seven feet per year.

A single recovery well, RW-1, was installed near the northeast corner of the site in July, 1989. An aquifer performance test was conducted at RW-1 to provide an estimate of the hydraulic conductivity of the water bearing silt beneath the site. This test provided an estimate of the hydraulic conductivity of approximately 0.5 foot/day to 1.0 foot/day. Using this data, the radius of influence of a single recovery well was estimated to be between 75 feet and 100 feet. This data was used as the basis for determining the optimum locations for the six additional recovery wells.

3.0 WORK PLAN

There are several additional tasks which are currently scheduled at the site. These tasks will focus on providing the data necessary to design and install a remediation system, and will also provide for interim free product recovery during the design phase of the project. The three general categories of work include: I) additional site assessment activities; II) remediation system alternatives analysis; and, III) preparation and submittal of a report which will contain the results of the assessment activities and alternatives analyses. The following paragraphs outline the work which will be performed for each of these tasks.

I. Site Assessment Activities

Additional site assessment activities will focus on further source identification, an evaluation of the effects of vacuum enhancement of the recovery wells, monitoring well maintenance, and collection of toxicology information.

A. Vacuum Enhancement System Field Study

The vacuum enhancement field study will involve designing, installing, and performing a field test utilizing product extraction and vacuum enhancement techniques on selected recovery wells. Vacuum enhancement involves applying a vacuum (negative pressure) to the extraction well. Vacuum enhancement systems (VES) have been proven to be effective in increasing the removal rates of contaminants from recovery systems utilizing conventional fluid extraction. VES have been shown to increase contaminant removal rates by as much as 100% in particular hydrogeologic settings. VES increase contaminant removal rates by increasing recovery well yields and by removing contaminants from the unsaturated zone. Temperature, soil moisture, soil permeability, air flow rates, well construction details, and amounts of applied vacuum are factors that affect the utilization and effectiveness of VES. Therefore, a field study is necessary to determine site specific parameters and to evaluate the effectiveness of vacuum enhanced recovery.

This process will involve installing temporary recovery pumps, vacuum blowers, separator tanks and support equipment on selected recovery wells, and conducting aquifer pumping tests with and without utilizing various levels of applied vacuums. It is estimated that 30 to 60 days will be adequate to conduct the field study; however, the actual time will be based on information generated from the study. Equipment utilized for the vacuum enhancement field study will remain in operation to provide interim product recovery throughout the alternatives evaluation process or until late fall.

Throughout the study, quantitative and qualitative data will be collected for specific alternatives evaluation purposes. Data generation and collection is required to adequately evaluate the product extraction system efficiency with and without applied vacuum, treatment system and discharge alternatives for fluid waste stream of final product recovery system, and alternatives for off-gas treatment from the vacuum enhancement systems (if necessary).

B. Source Definition Work

The source definition work will involve performing a soil vapor survey along the Murphy Oil Company pipeline outside of the terminal, along Amoco pipelines within the terminal, and along selected segments of the Amoco pipeline leading to the boat docks. The goal of this work will be to determine if contamination is present at or near the pipelines, thereby indicating the presence of a leaking pipeline or preferential contaminant movement along the pipeline.

Soil vapor samples will be collected from approximately four feet in depth at variable increments along the pipelines. Because there is approximately 8,000 feet of pipeline in the immediate vicinity of the terminal, the investigation will be directed in the field to focus on the areas of greatest concern. We anticipate collecting samples from 100 to 200 locations. All vapor samples will be analyzed using a portable photoionization detector equipped with an 11.7 eV lamp.

C. Well Maintenance

This task will involve performing maintenance work on the existing monitoring wells in order to ensure the integrity of surface seals around the wells. As a result of frost heaving which occurs under the climatic conditions at the site, the concrete seals between the ground and the well casings are broken on many of the wells, thus creating a potential conduit from the surface to ground water. This is a particular problem at this site because many of the wells have been installed within the containment berms surrounding the storage tanks. The well seals should be replaced by digging around the well casings, removing the old concrete, and installing new concrete grout between the ground and the well casings. In addition, liquid tight well caps will be installed to prevent product from entering the wells in the event of a tank failure. note

D. Risk Assessment Activities

This work will involve performing a critical evaluation of the potential environmental and public health risks posed by ground water and soil contamination at the site. Given the nature of the soil and site hydrogeology, and the large area impacted by the release, it may not be possible to restore the entire site to pristine conditions. The risk assessment will evaluate what risks, if any, would result from contaminants remaining at the site.

Our concerns regarding potential environmental impacts due to soil contamination center on the presence of visible surficial soil contamination near the previously leaking product pipeline at tank No. 38. If surface water runoff from the site into St. Louis Bay is contaminated, then it may be necessary to remediate the surficial soil contamination. In order to address this concern and prepare the risk assessment, we propose to collect samples of the surface water runoff and sediment along the drainage pathway from the terminal to St. Louis Bay. The samples will be analyzed for volatile halocarbons and aromatics, polynuclear aromatic hydrocarbons, and metals. How about Risk of infiltration to groundwater + NR 700

Isn't it necessary to remediate the soil if it has TPH > 10 ppm anyway?

In addition, the risk assessment will evaluate the effects of dissolved phase ground water contamination which may remain after free product recovery is complete. This assessment will involve collecting additional ground water samples from the monitoring wells during the next sampling event. In addition to the routine volatile analyses, samples from selected wells will be analyzed for polynuclear aromatic hydrocarbons, dissolved metals, and a scan for purgeable halocarbons and aromatics.

After the health risk assessment is completed, a report will be prepared presenting the results of the assessment and recommendations regarding the need for cleanup activities in addition to the free product recovery efforts already underway.

II. Alternatives Analysis

An evaluation of available alternatives will be performed in order to ensure that the most cost-effective, environmentally sound, and technically feasible alternative is chosen for each component of the ground water remediation system. The following alternatives analyses will be performed for final design of the ground water remediation system.

A. Contaminant Extraction System Alternatives Analyses

This process will involve determining the amount of contaminant removed from the product extraction system with and without various levels of applied vacuum. As previously mentioned, VES have been documented to significantly increase contaminant removal rates, thereby reducing project life. However, implementation costs such as design, capital, installation, and operation and maintenance must be evaluated to determine overall project cost-effectiveness. The feasibility of implementing a VES in the ground water remediation system will be determined during this process.

B. Off-Gas Treatment System Alternatives Analyses

This process will involve evaluating available alternatives for off-gas treatment from vacuum blowers (if necessary). If off-gas treatment is required, catalytic and thermal incineration and vapor phase carbon adsorption are some of the alternatives that are available. Also, the vapor recovery unit currently installed and operating at the facility will be investigated as a potential off-gas treatment alternative. If necessary, the available alternatives will be evaluated based on a balanced consideration of technical, economic, health, and environmental factors. The most cost effective, technically sound treatment system that results in the greatest reduction in health risks will be identified and recommended during this process.

C. Waste Water Discharge Alternatives Analyses

This process will involve evaluating discharge alternatives for liquid waste stream disposal from the ground water remediation system. This process would involve evaluating data such as minimum and maximum discharge flow rates and discharge requirements. Following data evaluation, selected discharge alternatives will be evaluated based on a balanced consideration of technical, economic, health, and environmental factors. The most cost effective, technically sound discharge alternative that results in the greatest reduction in health risks will be identified and recommended during this process. Several of the discharge alternatives which exist for the system are as follows:

1. Sanitary sewer system - City of Superior, Wisconsin
2. Surface water discharge - NPDES Permit, St. Louis Bay
3. United Purification Corporation - local, private waste water treatment facility
4. Re-infiltration on site.

D. Waste Water Treatment System Alternatives Analyses

This process will involve evaluating alternatives for treatment of waste water from the ground water remediation system. This will involve evaluating data generated from the pilot study such as minimum and maximum flow rates and chemical characterization (identification and concentration) from the liquid waste stream. Following data evaluation and review of discharge alternatives, several treatment alternatives will be evaluated based on a balanced consideration of technical, economic, and environmental factors. The most cost effective technically sound treatment system alternative will be identified and recommended during this process.

E. Pumping System and Controller Alternatives Analyses

This process will involve generating and submitting a bid package to qualified equipment vendors for the pumping system equipment and controller. Telemetry controls will be evaluated on cost effectiveness to be incorporated into the system controller.

III. Report Preparation

Following the completion of the site assessment and the alternatives analysis, Delta will generate a report which will include an evaluation of remediation alternatives, our recommendations regarding a ground water remediation and discharge treatment system, and the results of the additional site assessment work. This report will also include a schedule for final design, installation, and operation of the proposed system.

DELTA ENVIRONMENTAL CONSULTANTS, INC.

John C. Grams
Hydrogeologist/Project Manager

Gary D. Gilbert
Project Engineer

JCG/clo

TABLE 1

Product Measurements
May 4, 1990
Amoco Terminal
Superior, Wisconsin
Delta No. 10-88-457

Well	Well Diameter (inches)	Depth to Product (feet)	Depth to Water (feet)	Product Thickness (feet)	Volume (gallons)
MW-1	2	21.24	24.78	3.54	0.58
MW-2	2	20.95	22.98	2.03	0.33
MW-12	2	17.11	18.95	1.84	0.30
MW-14	2	21.17	26.42	5.25	0.86
MW-22	2	22.78	26.34	3.56	0.60
MW-23	2	18.03	22.29	4.26	0.69
MW-24	2	21.81	25.24	3.43	0.56
MW-25	2	21.48	27.15	5.67	0.92
MW-26	2	21.16	24.39	3.23	0.53
MW-27	2	22.89	31.70	8.81	1.43
RW-1	12	20.35	28.75	8.40	49.30
RW-2	6	21.70	30.45	8.75	12.80
RW-3	6	---	22.55	0.00	0.00
RW-4	6	21.60	36.00	4.40	6.50
RW-5	6	23.50	24.35	0.85	1.20
RW-6	6	20.98	25.69	4.71	6.90
RW-7	6	---	18.23	0.00	0.00
				Total:	83.30 gallons

clo.601

TABLE 2

Dissolved Hydrocarbon Concentrations
Amoco Terminal
Superior, Wisconsin
Delta No. 10-88-457

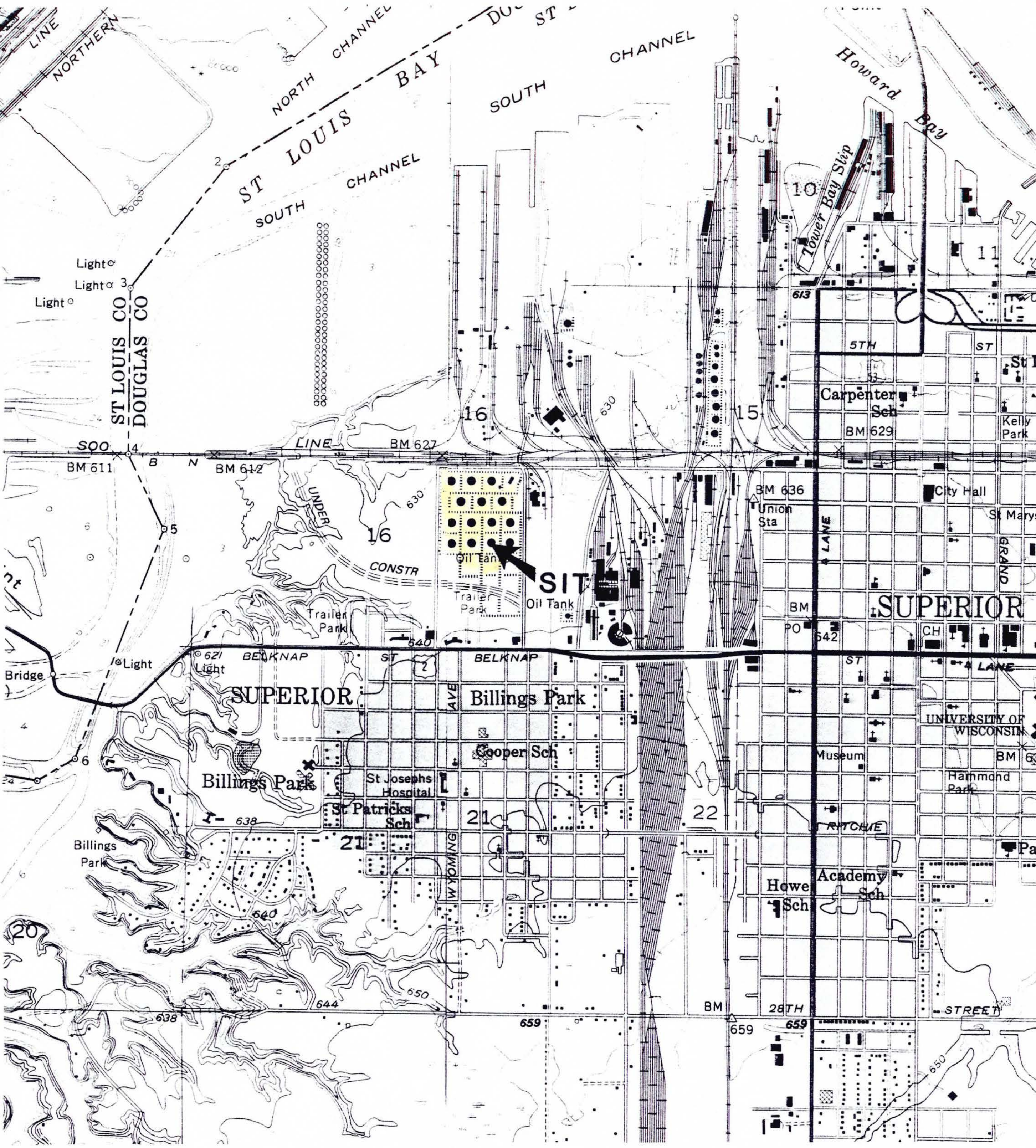
Samples Collected April 27, 1989

Well No.	Benzene	Toluene	Ethyl Benzene	Total Xylenes	BTEX Total
3	3.73	5.01	0.049	7.18	15.969
4	bdl	bdl	bdl	bdl	<0.01
5	bdl	bdl	bdl	bdl	<0.01
6	bdl	bdl	bdl	bdl	<0.01
7	bdl	bdl	bdl	bdl	<0.01
8	bdl	bdl	bdl	bdl	<0.01
9	0.261	1.28	1.60	3.65	6.791
10	0.260	0.042	0.018	0.045	0.365
11	0.147	0.019	0.018	0.019	0.203
13	bdl	bdl	bdl	bdl	<0.01
15	0.036	0.002	0.005	0.006	0.049
16	1.54	2.38	0.358	3.41	7.688
17	bdl	bdl	bdl	bdl	<0.01
18	0.641	0.027	0.007	0.031	0.706
Samples Collected July 11, 1989					
19	0.003	bdl	0.009	0.009	0.012
20	bdl	bdl	bdl	bdl	<0.01
21	1.97	0.031	0.027	0.050	2.078
28	bdl	bdl	bdl	bdl	<0.01
30	2.67	0.282	0.008	0.368	3.328
31	0.003	bdl	bdl	bdl	0.003

Notes:

1. All data expressed as mg/l.
2. bdl = below method detection limits.
3. Detection limit for benzene, toluene, and ethyl benzene is 0.002 mg/l. Detection limit for total xylenes is 0.004 mg/l.
4. Total BTEX represents the sum of benzene + toluene + ethyl benzene + xylenes.
5. Samples were analyzed by Amoco Laboratories in Tulsa, Oklahoma.

clo.601



WEST DULUTH QUADRANGLE
MINNESOTA–WISCONSIN
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 SUPERIOR 15' QUADRANGLE

N
0 2000
Scale Feet

MINN.
QUADRANGLE LOCATION

FIGURE 1
SITE LOCATION MAP
SUPERIOR TERMINAL
SUPERIOR, WISCONSIN
DELTA NO. 10-88-457

Delta Environmental Consultants, Inc.

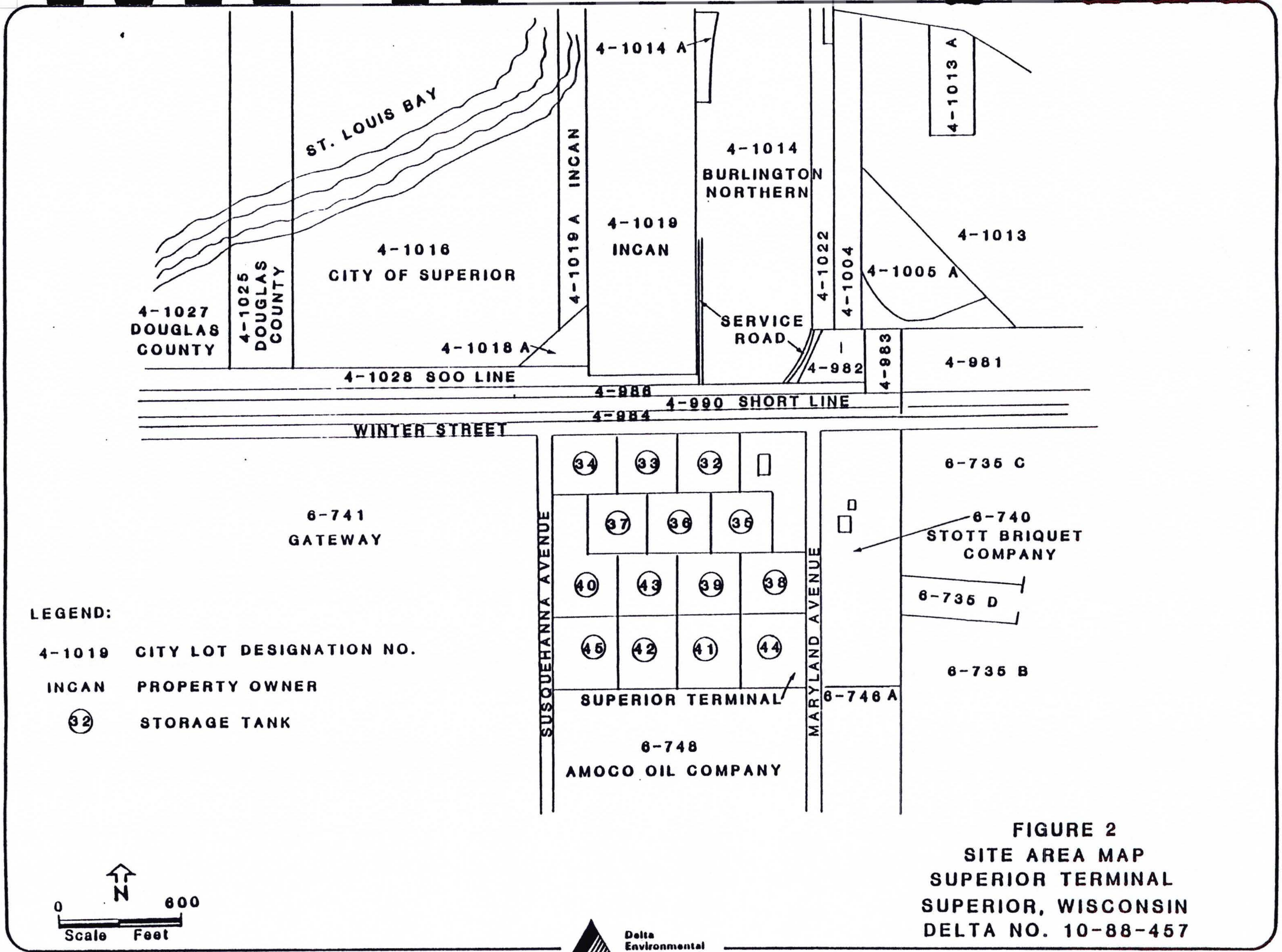


FIGURE 2
SITE AREA MAP
SUPERIOR TERMINAL
SUPERIOR, WISCONSIN
DELTA NO. 10-88-457

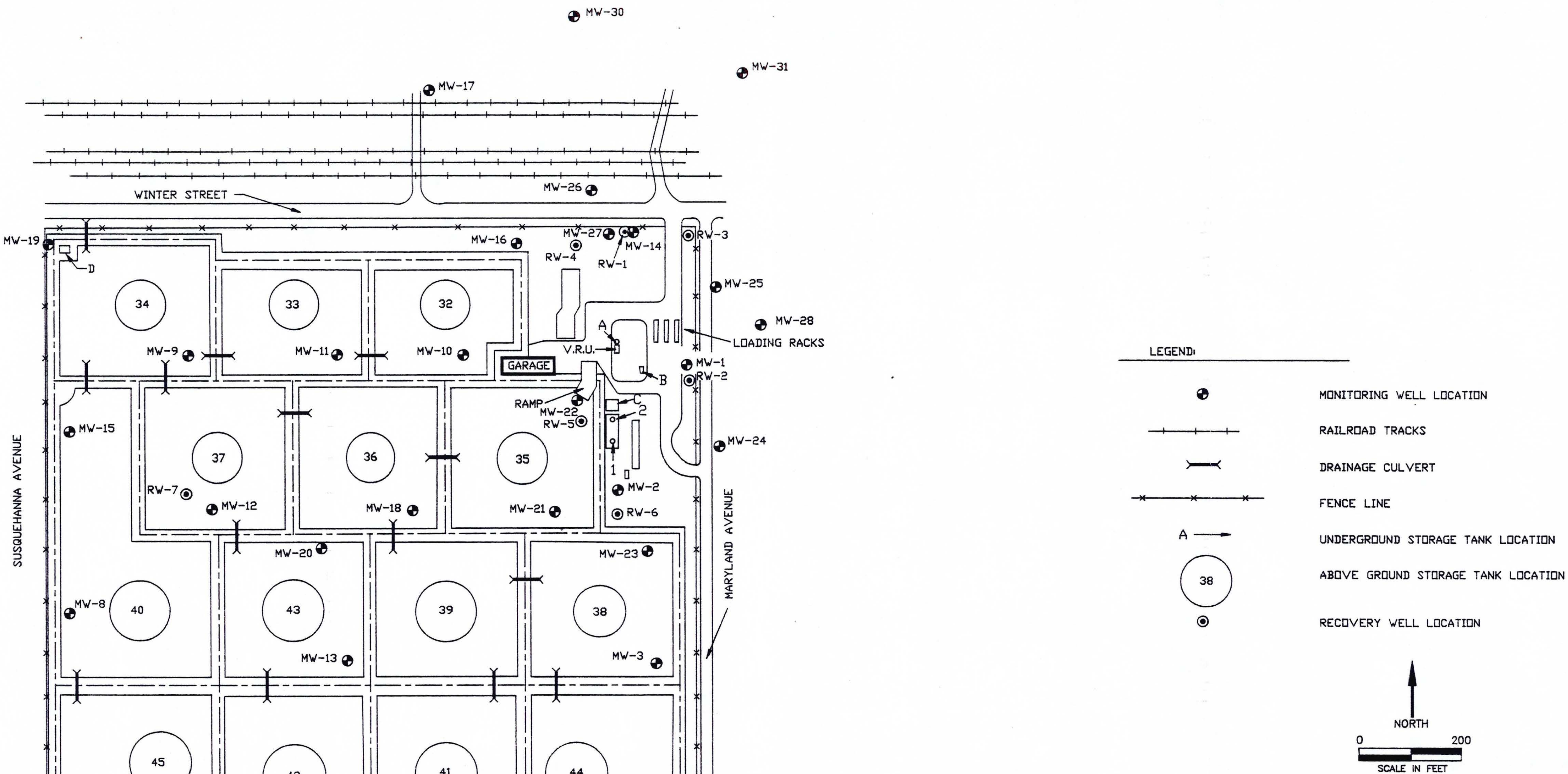


FIGURE 3
SITE MAP
SUPERIOR TERMINAL
SUPERIOR, WISCONSIN

PROJECT NO.	PREPARED BY
10-88-457	JCG/PR
DATE	REVIEWED BY
2/5/90	

Delta Environmental Consultants, Inc.

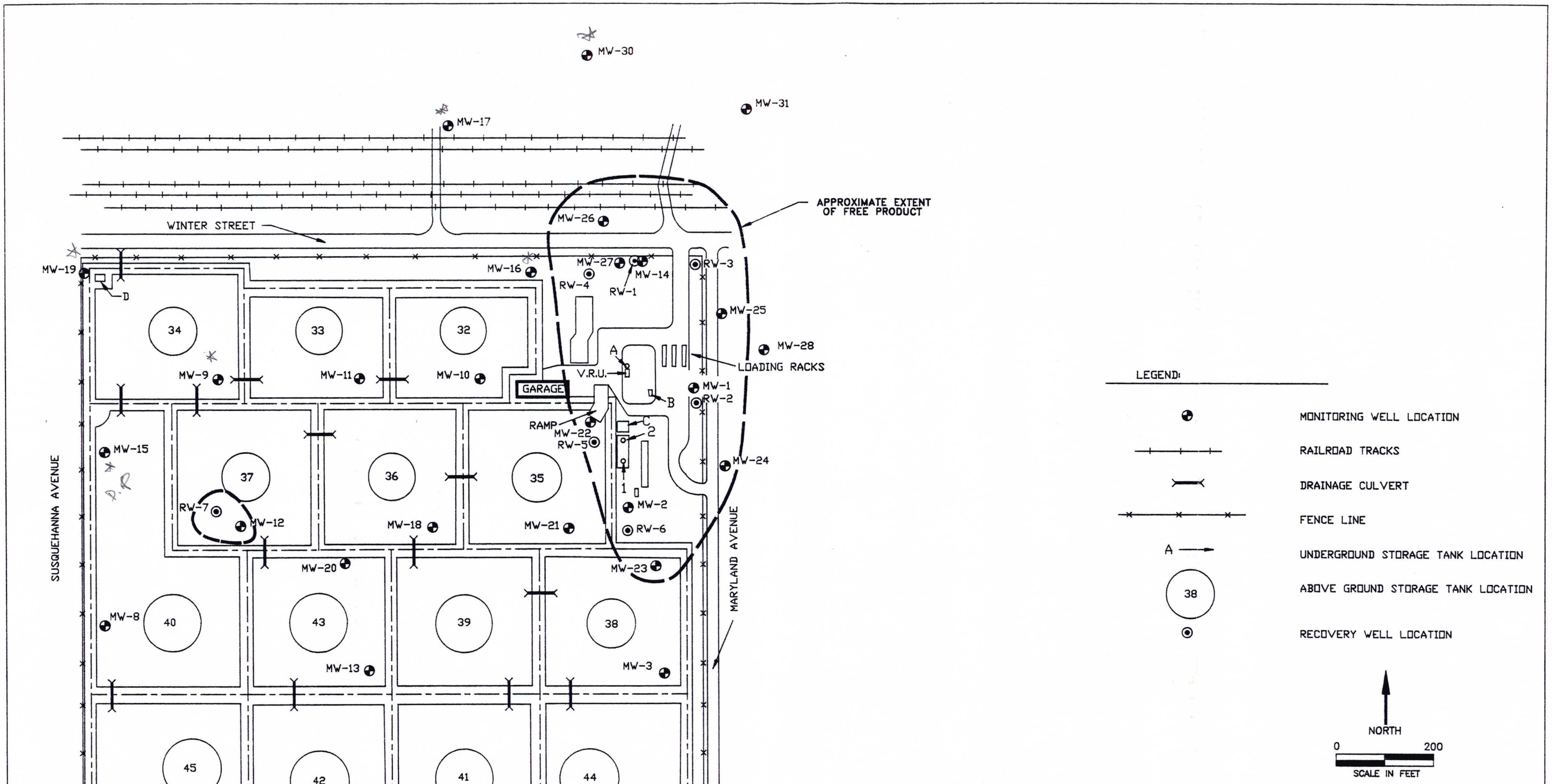


FIGURE 4
EXTENT OF FREE PRODUCT
SUPERIOR TERMINAL
SUPERIOR, WISCONSIN

PROJECT NO.	PREPARED BY
10-88-457	JCG/PR
DATE	REVIEWED BY
2/5/90	

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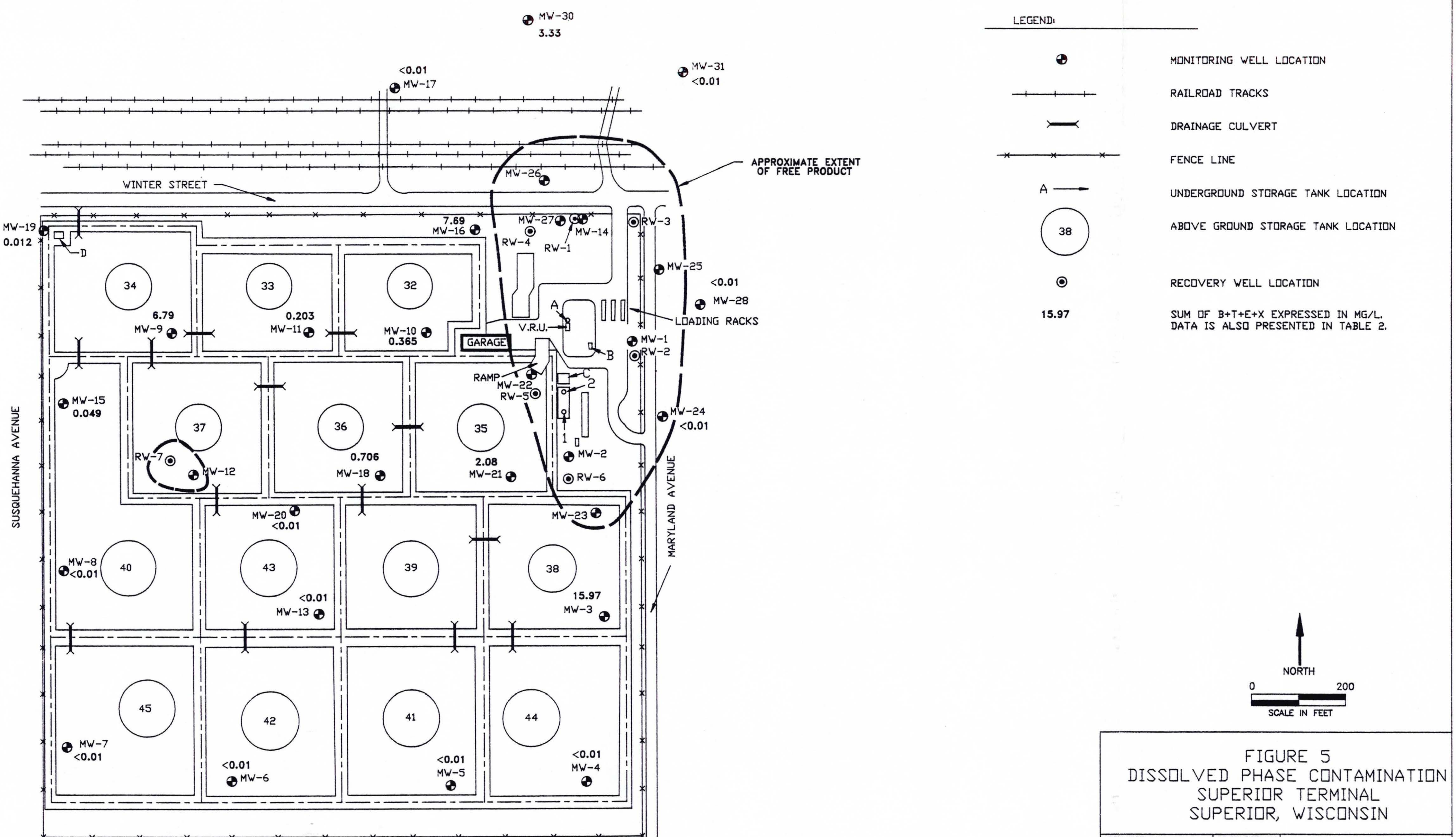

FIGURE 5
DISSOLVED PHASE CONTAMINATION
SUPERIOR TERMINAL
SUPERIOR, WISCONSIN

PROJECT NO.	PREPARED BY
10-88-457	JCG/PR
DATE	REVIEWED BY
2/5/90	

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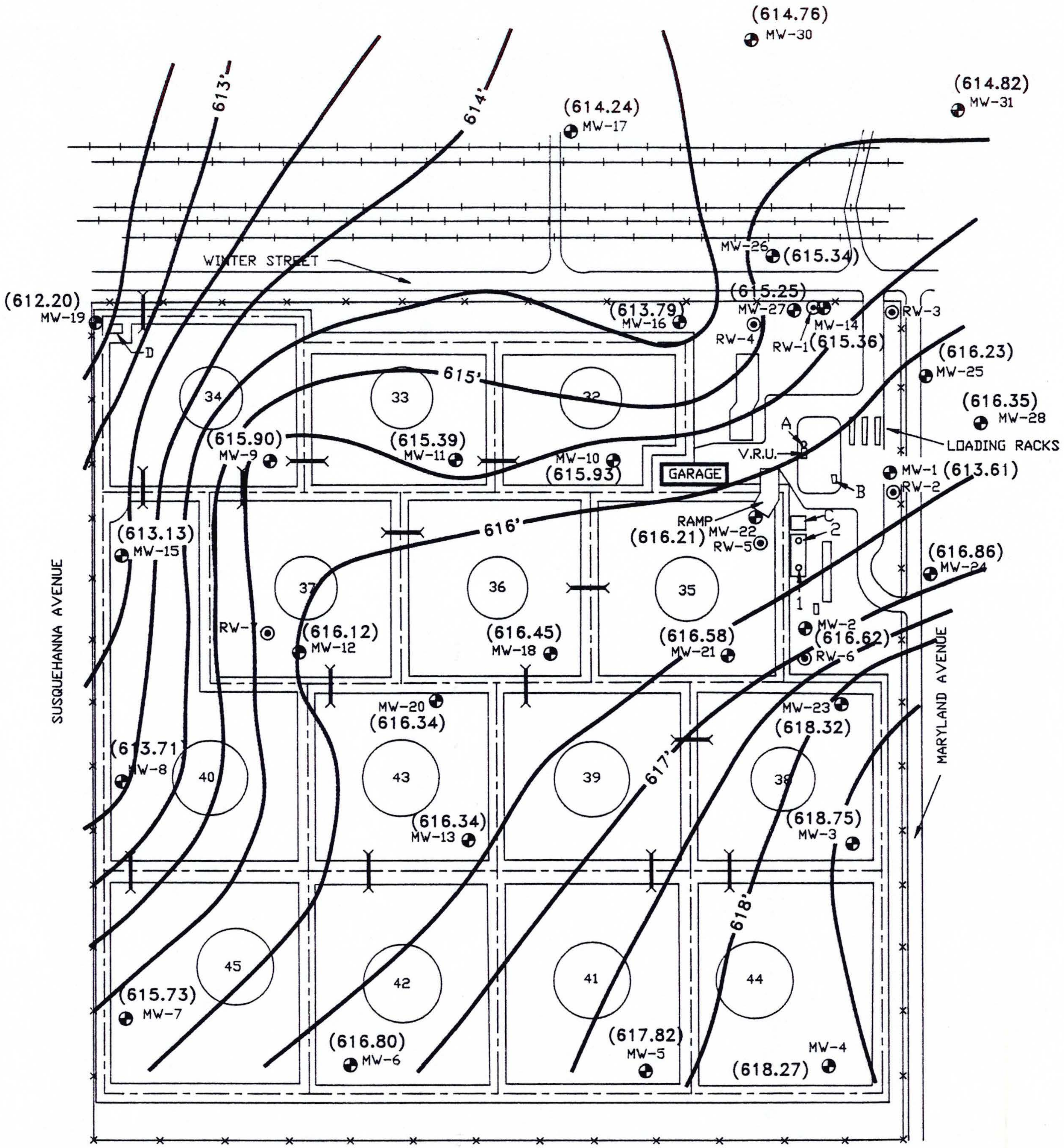

LEGEND:

- MONITORING WELL LOCATION
- RAILROAD TRACKS
- DRAINAGE CULVERT
- FENCE LINE
- A → UNDERGROUND STORAGE TANK LOCATION
- 38 ABOVE GROUND STORAGE TANK LOCATION
- RECOVERY WELL LOCATION
- (617.82) WATER TABLE ELEVATION (IN FEET)
- 618' WATER TABLE CONTOUR

NOTES:

1. **WATER TABLE ELEVATIONS EXPRESSED IN FEET ABOVE MEAN SEA LEVEL.**
2. **DATA FROM WELLS CONTAINING FREE PRODUCT WERE CORRECTED USING A PRODUCT SPECIFIC GRAVITY OF 0.78.**
3. **WATER LEVEL MEASUREMENTS WERE COLLECTED JULY 26, 1989.**

NORTH

0 200
SCALE IN FEET

FIGURE 6
WATER TABLE CONTOUR MAP
SUPERIOR TERMINAL
SUPERIOR, WISCONSIN

PROJECT NO.	PREPARED BY	
10-88-457	JCG/PR	Delta Environmental Consultants, Inc.
DATE 2/5/90	REVIEWED BY	