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PHASE I COMPLETION REPORT

FORMER SINCLAIR REFINERY SUPERFUND SITE (OU2)
WELLSVILLE, NEW YORK

PREPARED FOR:

ARCO ENVIRONMENTAL REMEDIATION, LLC
444 SOUTH FLOWER STREET
LOS ANGELES, CA 90071

PREPARED BY:

ENVIROGEN
4100 QUAKERBRIDGE ROAD
LAWRENCEVILLE, NJ 08648

SEPTEMBER, 1999

EXECUTIVE SUMMARY

Phase I of remediation at the Former Sinclair Refinery Superfund Site (summer 1995 to the present) involved construction and operation of a 30 GPM groundwater extraction and treatment system, and four separate air sparging/soil vapor extraction (AS/SVE) systems. The purpose of this work has been to remediate Site groundwater to the remediation goals (ARARs) specified in the ROD. Remediation system effectiveness and remedial progress in groundwater during Phase I operations has been evaluated based on three primary criteria:

1. remediation system VOC mass removal and operability,
2. reductions in groundwater contaminants, and
3. achievement and maintenance of ARARs.

In the National Fuels area, an AS/SVE system was installed in 1995 and operated for approximately 18 months. The local geology and hydrology of this area hampered this system's operability and VOC removal. This system was subsequently shut down and decommissioned for reasons of technical impracticability.

Two other AS/SVE systems (Southern and Central) and the Northern groundwater extraction and treatment system were installed in 1995. The Northern Expansion AS/SVE system was installed in 1997. All of these systems were generally operated as designed. When necessary, appropriate measures were taken to maintain and improve operability and VOC mass removal by these systems. Over the past four years, these systems operated well and affected the removal and *ex situ* treatment of nearly 125,000 pounds of volatile hydrocarbons from subsurface soils and groundwater at the Site. The vast majority of this hydrocarbon mass (over 90%) was removed by the SVE systems during the first 12 to 18 months of AS/SVE system operation. The estimated mass of BTEX and CVOCs removed by these systems was minimal compared to the estimated total mass of VOCs. The mass of contaminants eliminated from the subsurface as a result of *in situ* stimulated and natural biodegradation is likely far greater than the amount removed and treated by the AS/SVE systems.

Several lines of evidence indicate that BTEX compounds are naturally biodegrading in nearly all areas of the Site. Except for monitoring wells located in close proximity to air sparging zones, it was difficult to distinguish the groundwater remedial effects of the AS/SVE and groundwater extraction systems from background levels of natural attenuation. In close proximity to air sparging zones, significant decreases in groundwater BTEX concentrations were observed. However, these decreases occurred primarily during the initial period of operation of the AS/SVE systems, when large quantities of VOCs were being removed. Shortly after these abrupt decreases, groundwater BTEX concentrations became asymptotic. The start of asymptotic groundwater BTEX concentrations generally coincided with asymptotic VOC removal by AS/SVE systems.

ARARs have not been achieved at the site. Even within close proximity to air sparging zones, concentrations of BTEX compounds appear asymptotic and remain up to two orders of magnitude above MCLs. The asymptotic nature of BTEX concentrations in these remediation areas suggests that achievement of ARARs may be technically impracticable.

CVOCs are limited to the Northern area of the Site. Changes in CVOC concentrations over the past several years have been erratic, and do not appear to clearly coincide with operation of either the groundwater pumping or AS/SVE systems in the Northern area. Consequently, there is very little basis for evaluating remedial progress for CVOCs. CVOC concentrations remain between one and two orders of magnitude above MCLs.

ARARs for chromium and lead concentrations in groundwater have been met and maintained over a period of approximately two years. Reductions in these contaminant concentrations are coincident with, and probably a result of, improvements in groundwater sampling techniques.

Total arsenic concentrations in groundwater remain essentially unchanged from the baseline measurements in March 1996. This applies to areas both within and outside the influence of the remediation systems. It is likely that high oxygen demands in the subsurface have prevented the necessary geochemical conditions from occurring that promote immobilization of arsenic. Maximum total arsenic concentrations in groundwater at the Site remain approximately four times greater than the NYSDEC MCL of 25 μg/L. Achievement of MCLs for arsenic in groundwater may be technically impracticable.

LNAPL exists at the Site in discrete, discontinuous patches. Recovery of LNAPL from groundwater monitoring wells at the Site has been minimal, largely because LNAPL is not found in significant quantities. Recovery of significant amounts of LNAPL at the Site, such that LNAPL thicknesses can be reduced and/or eliminated, is technically impracticable.

LNAPL at seeps #5 and #6 occurs in relatively small volumes, occurs only during lowest river stages, and has been effectively contained using absorbent booms and removed from the river surface using absorbent pads. Additional measures for permanent containment of LNAPL at the edge of the Genesee River in this area have been previously proposed and will be one focus of the future Amended Feasibility Study.

Supplemental monitoring and investigation work at the Site focused on three subject areas. The results of these investigations are summarized below.

1. The Main Drainage Swale. Monitoring data indicate that the main drainage swale appears to act as a natural treatment zone between the Site and the Genesee River, effectively removing VOCs and immobilizing arsenic from swale surface water before entering the Genesee River.
2. The MW-70 area. The MW-70 area is characterized by an isolated plume of elevated groundwater nitrobenzene and aniline concentrations. In this area. Monitoring data show that benzene and xylene concentrations have been relatively steady at approximately two

orders of magnitude above MCLs. Nitrobenzene concentrations have fluctuated significantly, but for the most part have been approximately four to five orders of magnitude above the NYSDEC MCL of 0.4 μg/L in this area of the Site.

3. The Genesee River. Monitoring of the Genesee River was performed to evaluate impacts of groundwater discharge to the river. Under 10-year, 30-day average low flow conditions, monitoring data showed that MCLs were met for all measured EPA Method 8260 analytes and total arsenic. Nitrobenzene was found at the downstream end of the Site and at the former Wellsville water intake at concentrations approximately one to two orders of magnitude above the MCL.

The groundwater contaminants targeted by the remediation systems at the Site (i.e., BTEX compounds, chlorinated VOCs, and arsenic) were measured below MCLs in the river. Given that these contaminants were below MCLs in the river, and given that it may be technically impracticable to achieve NYSDEC MCLs for these contaminants in Site groundwater, it may be appropriate to establish surface water in the Genesee River as the point of compliance for remediation goals.

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1.0 INTRODUCTION

The Former Sinclair Refinery site is located approximately one half mile south of the center of Wellsville, NY, and is situated on the Genesee River (see Figure 1-1). The site was listed on the National Priority List (NPL) in 1983. The site is divided into two Operable Units: the landfill area is Operable Unit 1 (OU1), and the former refinery area is Operable Unit 2 (OU2). Construction of the OU1 remedy has been completed and is currently in operation and maintenance (O&M) phase. The OU2 site (Site) consists of a 90 acre area where petroleum refining operations took place from 1901 to 1958. Remedial investigation and feasibility study (RI/FS) and remedial design investigation (RDI) work was completed between 1985 and 1993.

Construction of groundwater remediation systems for OU2 began in 1994 and was completed in March 1995. A groundwater extraction and treatment system and three air sparging/soil vapor extraction (AS/SVE) systems were installed at the Site. Operation of OU2 remedial systems was initiated in August 1995, and an expanded portion of the AS/SVE system began operation in December 1997. These systems are currently operating under Phase I of Site remediation.

The purpose of this report is to summarize the results of Phase I remedial system operation and monitoring, and describe the effectiveness and limitations of remedial efforts at the Site. The results of supplemental Site monitoring and investigation data are also presented and discussed. Together, these data will be used to form the basis for a refined Site conceptual model and preparation of the Amended Feasibility Study.

During Phase I remediation, remedial system performance and remedial progress was reported to the Agencies in a series of Progress Monitoring Reports, covering the period between August 1995 through December 1998. This Phase I Completion Report summarizes previously reported data, and includes recent process and progress monitoring data from the first half of 1999, covering a total remediation system operating time frame of approximately four years.

This report is organized as follows:

Section 2.0 Project Background

This section describes the Site history, major activities, and investigation results prior to Phase I. Site physical and chemical characteristics are summarized based on the results of the RI/FS and RDI. The scope of Phase I remediation work is also discussed.

Section 3.0 Phase I Remediation Systems

A brief review of the operating principles, design criteria, locations, and construction details for each subsurface remediation system is provided in this section.

Section 4.0 Groundwater Physical, Geochemical, and Biological Monitoring Results

This section presents and discusses the results of water table level and geochemical measurements, and the results of biological analyses of groundwater samples collected during Phase I remedial operations. These data describe Site-wide hydraulic, geochemical, and biological conditions in the shallow aquifer, providing a foundation for interpreting and evaluating changes in chemical contaminant concentrations during Phase I remediation.

Section 5.0 Phase I Remedial Progress Monitoring Results

This section describes the performance criteria by which remedial performance is evaluated, followed by a discussion of the progress of remedial efforts at the Site from August 1995 to June 1999. The operation and performance of each remediation system is discussed with respect to operability and VOC mass removal. Finally, a summary of contaminant concentration changes over time is presented for each area, and remedial progress is evaluated with respect to the performance criteria.

Section 6.0 Results of Supplemental Studies

The results of supplemental investigation, testing, and monitoring are presented and discussed. Supplemental monitoring and/or investigation work was performed in the vicinity of MW-70 area, within the drainage swale, and along the Genesee River adjacent to the Site.

Section 7.0 Summary and Conclusions

The major findings and conclusions drawn from work performed during Phase I remediation are summarized in this section.

2.0 BACKGROUND

The information presented in this section is taken largely from the following project documents:

- Draft Final Remedial Investigation Report for the Sinclair Refinery Site, Wellsville, NY. Ebasco, March 1990.
- Draft Remedial Design Investigation Report for Wellsville Operating Unit Two, Wellsville, New York. Remediation Technologies, Inc., October 1993.
- Basis of Design Memorandum for the Sinclair Refinery Operating Unit Two, Wellsville, New York. Remediation Technologies, Inc., March 1994.

2.1 SITE HISTORY AND USAGE

The Sinclair Refinery was built in 1901 for processing Pennsylvania Crude oil. Products manufactured by the facility were made from New York and Pennsylvania crude oils, including crude from wells located several miles south of the refinery. Manufactured products included heavy oils and grease for lubrication, light oils for fuel, gasoline, lighter fluid, naphtha, and paraffin. During the early 1900's, the Wellsville Refining Company conducted operations at the Site.

In 1919, the Sinclair Refining Company purchased the facility. The Sinclair Refining Company owned and operated the facility until 1958.[1] In 1939 and 1958, two large fires occurred at the refinery, causing substantial damage. The refinery was rebuilt after the 1939 fire, but ceased operations following the 1958 fire. When the refinery was closed, the Sinclair Refining Company transferred a majority of the property to the Village of Wellsville. The remaining property was turned over to the New York Refinery Project.

[1] Sinclair Refining Company was a subsidiary of the Sinclair Oil Corporation. Sinclair Oil Corporation was acquired by ARCO in 1969.

The former refinery area is currently occupied by a number of manufacturing businesses and the State University of New York at Alfred (SUNY at Alfred). SUNY operates a vocational–technical school at the Site. Although most of the structures were removed before 1964, some of the original structures remain. A buried oil-water separator in the southern end of OU2, several former refinery buildings, and some of the original storm water sewers are still in place. Tenants of the existing industrial park and college campus renovated some of the refinery buildings, while others are or remain vacant.

2.2 Past Investigation and Remedial Activities

The Former Sinclair Refinery site covers an area of approximately 114 acres, including the 90 acre refinery area (OU2), which is the subject of this report, and a 10 acre landfill area adjacent to the south end of the refinery (OU1). In 1981 and 1982, a portion of the landfill was eroded by flooding of the adjacent Genesee River. As a result of the erosion, the New York State Department of Environmental Conservation (NYSDEC) initiated sampling of the river and landfill and prepared the "Remedial Action Master Plan" for the Site, calling for additional work to be performed at the Site. A remedial investigation at the Site was initiated. The remedial investigation (RI), feasibility study (FS), and a Record of Decision (ROD) for the landfill area were completed, calling for channelization of the Genesee River, excavation of refinery wastes and capping the landfill.

Studies and investigations of the refinery area began as early as 1981. The RI for the OU2 refinery area was initiated in 1984 by SMC Martin, under subcontract to the NYSDEC. Work on the RI for the refinery area was stopped in 1987, following completion of Phase I and a portion of Phase II (i.e., Phase IIa) of the RI. Subsequently, in 1988, ARCO entered into an Administrative Order on Consent with the U.S. Environmental Protection Agency (EPA) which called for additional site investigation work to be performed to complete the RI/FS. In 1988 ARCO assumed responsibility for completing Phase II of the RI (i.e., Phase IIb). Final RI and FS reports were completed by Ebasco, under subcontract to ARCO, and included SMC Martin's Phase I and IIa work. EPA approved the final RI/FS reports in June 1991.

The ROD for OU2 was issued in October 1991, specifying remedies for surface soils, subsurface soils, and groundwater at the Site. The ROD specified the following remedial actions at the Site:

1. excavation of surface soils for remediation of arsenic and lead;
2. no remedial action for subsurface soils;
3. extraction and treatment of contaminated groundwater from the shallow aquifer;
4. long term surface water, groundwater, and soil gas monitoring, and;
5. institutional controls to prevent future Site uses that could result in exposure to hazardous materials.

In September 1992 EPA issued a Unilateral Administrative Order for Remedial Design and Remedial Action for OU2 (UAO). The ROD and UAO specified cleanup levels for groundwater and surface water at the Site. The shallow aquifer at the Site is designated by New York State as a class GA aquifer, and the Genesee River adjacent to the Site is designated a Class A surface water. These classifications characterize the aquifer and river as potential sources of potable water. The Class A surface water designation also applies to water bodies that may be used for swimming and fish propagation. Chemical specific applicable or relevant and appropriate requirements (ARARs) for groundwater and surface water at the Site were therefore defined as Federal and State drinking water and surface water Maximum Contaminant Levels (MCLs).

Remediation Technologies, Inc. (ReTec) initiated remedial design investigation (RDI) work in 1993, under subcontract to ARCO. The RDI included additional subsurface soil and groundwater investigation, surface water sampling, as well as bench scale and field pilot testing. Remedial system construction for OU2 was initiated in 1994 by ReTec, and completed in March 1995. Operation of OU2 remedial systems began in August 1995. An expanded portion of the OU2 remedial system was designed and installed by Jacobs Engineering Group, Inc. and Envirogen, Inc. in July 1997. This expansion system began operation in December 1997. Design criteria and construction details for these systems are summarized in Section 3.0 of this report.

2.3 *SUMMARY OF SITE CHARACTERISTICS*

A topographic map of the Site is presented in Figure 2-1. This figure shows the locations of existing monitoring wells and the general sub-areas of OU2. The sub-areas are roughly configured based on the suspected locations of spatially distinguishable contaminant source areas or plumes. Subdividing OU2 on this basis is consistent with the nomenclature of previous Phase I progress monitoring reports, aids in distinguishing areas where remediation systems were installed, and provides a framework for discussing monitoring results and remedial performance in the Sections that follow.

2.3.1 Geology and Hydrology

The Site is located within the floodplain of the Genesee River in western New York, at an elevation of approximately 1,500 feet above mean sea level (AMSL). The hydrogeology of the Site is controlled by the Genesee River to the northeast and an abrupt transition to an eroded upland to the southwest. The Site is relatively flat with elevation increasing steeply as the upland is encountered on the southwest side of the Site. Fill materials were encountered primarily in the upper 0.5 feet to 8 feet of surface soils. The fill material is predominantly borrow soil composed of silty sands, sandy clays and gravels mixed with slag and construction debris believed to have been placed at the Site for grading purposes.

The general hydrogeologic units at the Site include a shallow upper aquifer, an aquitard, and a confined, artesian lower aquifer. The sediments comprising the shallow upper aquifer are fluvial in nature and range from 10 feet to greater than 50 feet in depth across the Site. Sediments beneath the Site reflect the heterogeneity associated with fluvial deposits; channel deposits contain well-sorted sands and gravels, while lower energy deposition areas contain deposits of sands, silts, and low-plasticity clays. The resulting upper aquifer sediments are generally coarse in texture, but have finer textured lenses that may be horizontally continuous for hundreds of feet.

Groundwater flow in the upper aquifer is towards the river from southwest to northeast. Average horizontal hydraulic gradients range from approximately 0.02 ft/ft in the northern portion of the

Site to 0.006 ft/ft in the central area. During the RI, two pumping tests and 20 slug tests were conducted in the upper aquifer at the Site. Calculated hydraulic conductivities ranged from 5 to 245 ft/day. Based on the results of the pumping tests, the soils in the Southern and Central areas of the Site are generally more permeable than those to the north. Pumping tests in the Southern area yielded a range of calculated hydraulic conductivities from 56 ft./day to 245 ft/day. A pumping test was also conducted in the Northern area of the Site as part of the RI. Calculated hydraulic conductivities in this area ranged from 5 to 62 ft/day, with an average of 26 ft/day. Calculated hydraulic conductivities from slug tests performed during the RI ranged from 6.7 to 69 ft./day.

The calculated average linear velocity of groundwater was 1.5 ft/day in the northern end of the Site, and 2.8 ft/day in the Southern and Central areas of the Site. The calculated time for groundwater to travel the width of the Site ranged from two years in the northern areas to one year in the Central and Southern areas of the Site. The RI report estimated an average groundwater discharge rate to the Genesee River of 186,000 gal/day (i.e., 130 gallons per minute).

The base of the shallow aquifer is defined by a low-permeability glaciolacustrine clay layer that acts as an aquitard. The surface of the glaciolacustrine clay layer reflects the erosional forces of the Genesee River. Channels cut into the clay layer appear to be deepest in the northern and northwestern portion of the Site. The clay layer appears to be continuous and of low permeability, based on the artesian nature of the underlying aquifer. The lower aquifer occurs at depths greater than 70 to 100 feet beneath the ground surface and was reached by only a few borings during past investigations. The lower aquifer materials are glacial sands and gravels that appear to be inter-bedded with glacial clays. The artesian nature of the lower aquifer indicates communication between the uplands and the lower aquifer. Contaminants from the Site have not penetrated into the lower aquifer based on groundwater analytical data.

Average annual precipitation between 1941 and 1970 was approximately 37 inches per year. Surface hydrology is impacted by local features. A drainage ditch known as the "main drainage swale" runs parallel to the river between the refinery area and a dike. The U.S. Army Corps of Engineers constructed the dike in 1976 on a former island in the river as part of a river channelization project. The swale was part of the river before the dike was constructed. The main drainage swale is a slow-flowing, low-lying marshy area. The drainage swale discharges surface water from the OU1 landfill cover, but is not subject to flow from the river.

The surface hydrology of the Site is dominated by the Genesee River. Approximately 2,000 feet downstream of the Site, Dyke Creek is tributary to the Genesee River, with a drainage area approximately one third the size of the drainage area for the Genesee River at this confluence. A USGS gauging station is located on the Genesee River approximately 3,200 feet downstream of the confluence with Dyke Creek (see Figure 1-1). According to available flow measurement data collected between October 1, 1972 and September 30, 1998 at the Wellsville USGS gauging station, the mean daily flow was 392.6 cubic feet per second (cfs). Annual minimum daily flows during that period ranged from 13 cfs in 1995 to 65 cfs on 1977, with an average of 30.7 cfs. Annual maximum daily flows were quite variable, ranging from 2,710 cfs in 1974 to 13,800 cfs in 1996. The peak flow on record of 38,500 cfs occurred in 1972, when a tropical storm soaked the area for five days. Extensive flooding in this area prompted construction of a variety of flood control projects on the Genesee River by the Army Corps of Engineers. These included channelization, bank stabilization, diversion, installation of several check dams, and construction of the dike adjacent to the main drainage swale (described above). Two of these check dams are found in the Genesee River adjacent to the Site, labeled "upper dam" and "lower dam" in Figure 2-1.

2.3.2 Site Chemical Constituents

The RI/FS and RDI work identified specific chemicals of interest for impacted groundwater, and included the following:

- organic compounds associated with past refinery operations such as
  - benzene,
  - ethylbenzene,
  - toluene,
  - xylenes, and
  - nitrobenzene;
- chlorinated organic compounds such as
  - 1,1-dichloroethane,
  - 1,1,1-trichloroethane,
  - vinyl chloride, and
  - 1,2-dichloroethene (total), and
- inorganic chemicals, such as
  - arsenic,
  - chromium, and
  - lead.

Data gathered during the RI indicated that the highest groundwater concentrations of non-chlorinated organic compounds were found in three areas on the Site. These plume areas, characterized by elevated concentrations of total benzene, toluene, ethylbenzene, and xylenes (BTEX) were located in the Northern, National Fuels, and Southern areas of the Site (see Figure 2-1). BTEX compounds were the most commonly found and widely distributed organic compounds of concern in groundwater at the Site.

Data from the RI and RDI indicated that chlorinated volatile organic compounds were found predominantly in the Northern area of the Site, and in low concentrations in the southern area of the Site. Nitrobenzene was encountered in groundwater in a small area near MW-27, in an area now referred to as the MW-70 area (see Figure 2-1). The RI and RDI work also identified arsenic as a widely distributed groundwater contaminant at the Site. Areas of elevated arsenic concentrations corresponded generally to those areas where BTEX concentrations were also elevated. The RI and RDI work investigated the presence of VOCs in subsurface soils, and found elevated concentrations of BTEX compounds above and below the water table within the National Fuels, Northern, and Southern areas of the Site.

2.4 *Summary of Evaluated Risks*

As part of the RI work, an Endangerment Assessment (EA) was performed by Versar, Inc. under subcontract to CDM Federal Programs Corporation. Ebasco performed a separate Risk Assessment (RA) under subcontract to ARCO, however the results of this RA were not included in the RI Report.[2]

The EA evaluated potential health risks associated with exposure to VOCs, semi-VOCs, and metals (arsenic and lead) in groundwater, soils, and surface water. The EA investigated four potential exposure scenarios:

1. inhalation of VOCs by excavation workers exposed to subsurface soils;
2. inhalation of fugitive dust emissions of metals and semi-volatile compounds by Site occupants;
3. inadvertent ingestion of soil contaminants by both excavation workers and trespassing children, and;
4. ingestion of dissolved contaminants in surface water by local residents.

[2] It was EPA's policy that EPA develop risk assessments for RI/FSs conducted by Potentially Responsible Parties (PRPs).

EPA's EA indicated that the calculated non-carcinogenic hazard index was less than one, so no adverse non-carcinogenic effects were expected. With respect to carcinogenic risks, the greatest risk identified was associated with inhalation of arsenic by adults that either work or attend the vocational school at the Site. The carcinogenic risk for the inhalation route was calculated to be 1.53E-05. Since the EA was performed, excavation of contaminated Site surface soils has been completed. Relocation of the Wellsville water intake upstream of the Site was completed in 1987. Accordingly, no Site risk was found associated with the ingestion of contaminants via surface water at the Site in the final 1991 EA report.

2.5 Scope of Phase I Activities

Following remedial design and construction in OU2, the scope of activities during Phase I remediation included system O&M, system process monitoring, and remedial progress monitoring. In addition, modifications and enhancements were made to the remediation systems, as needed, to improve operability and/or performance.

Operation, maintenance, and process monitoring of the installed remediation systems were performed following ReTec's June 1995 Operation and Monitoring Plan (revised July 1996). The O&M Plan describes the principles of operation of each remedial system, and the procedures and schedules for operation, monitoring, and maintenance of the remediation systems.

Procedures and schedules for groundwater, surface water, and remediation system discharge compliance monitoring were described in ReTec's June 1995 Sampling, Analysis, and Monitoring Plan (SAMP). The SAMP outlines procedures for pre-remediation baseline monitoring, start-up monitoring, and a schedule for environmental monitoring during operation of the remediation systems. More specific procedures for monitoring remedial progress at the Site are described in ReTec's May 1996 Progress Monitoring Plan (PMP). The PMP describes additional groundwater and process monitoring for the specific purpose of evaluating effectiveness of the OU2 remedial systems. The PMP also describes procedures for management of monitoring data using a relational database (Borland Paradox).

The following major process modifications or enhancements were made to remediation systems during Phase I, and are described in more detail in Section3.0:

- A metals treatment system was added to the groundwater extraction and treatment system in the spring of 1996.

- The AS/SVE system was expanded to an area immediately upgradient of the groundwater extraction wells in the Northern area.

3.0 REMEDIATION SYSTEMS

The March 1994 Basis of Design Memorandum (ReTec) summarized the remedial design criteria and assumptions for Phase I remediation in OU2. This document described the basic design parameters for each remediation system, and also defined the areas of the Site where remediation would take place. The information presented in this Section is taken largely from the Basis of Design Memorandum and the OU2 remediation system as-built civil layout and process drawings (included in Appendix A).

AS/SVE systems were initially designed for the National Fuels, Central, and Southern areas of the Site to remediate BTEX compounds in soil and groundwater, and to immobilize arsenic in groundwater. The Northern area was the focus for the groundwater extraction and treatment system, given the proximity of BTEX, chlorinated hydrocarbon, and arsenic impacted groundwater to the Genesee River in this area. An AS/SVE system was later expanded into the Northern area. For reference, a Site plan showing the general locations of the AS/SVE systems and groundwater recovery wells is presented in Figure 3-1.

3.1 REMEDIATION SYSTEM DESIGN CRITERIA

3.1.1 Air Sparging Systems

During air sparging, air is injected into a permeable aquifer. The injected air moves outward and upward from the point of injection through the pores of the saturated zone. The injected air competes with water in the soil pore space, driving water out temporarily and replacing it with air, typically in the form of channels. As the air moves through channels within the saturated zone, VOCs can partition into the injected air phase from the water and soil phase. Additionally, oxygen is available to partition to the aqueous phase where it may be consumed by aerobic bacteria during oxidation of organic carbon (in this case hydrocarbons), or immobilize contaminants through chemical changes such as precipitation.

The stripped VOCs travel with the injected air upward to the unsaturated zone where they are typically captured by a soil vapor extraction system. Under proper conditions, the use of air sparging coupled with soil vapor extraction (AS/SVE) can be an effective means of volatilizing and removing VOCs from the saturated zone. If the groundwater contaminants are biodegradable under aerobic conditions, AS/SVE can also affect significant contaminant destruction by providing a continuous source of oxygen to contaminant degrading aerobic bacteria. In some cases, there is sufficient oxygen to allow the stripped VOCs to biodegrade in the unsaturated zone as well, and SVE is unnecessary.

Air sparging may also be effective for remediation of mobile arsenic in each of the remediation areas. The predominant dissolved arsenic species in the environment are arsenite (As^{+3}) and arsenate (As^{+5}). The solubility of arsenic in groundwater is strongly influenced by adsorption of dissolved species at ferric (Fe^{+3}) oxyhydroxide surfaces. Under aerobic conditions typical of most uncontaminated water table aquifers, ferric oxyhydroxides are stable and mobility of arsenic is limited. However, aquifer conditions at the Site are predominantly anaerobic, which favors reduction of insoluble ferric iron to soluble ferrous (Fe^{+2}) iron and increases the mobility of arsenic in the aquifer. Air sparging introduces oxygen to the aquifer, and the soluble Fe^{+2} oxidizes to Fe^{+3}, rapidly hydrolyzing to form an amorphous colloidal gel of hydrous ferric oxide within the aquifer matrix. Soluble arsenic is adsorbed by the precipitated iron, and is immobilized by the aquifer matrix. This adsorption process favors the oxidized arsenic species arsenate (As^{+5}). Arsenite (As^{+3}) is adsorbed to a lesser extent.

The key design parameters for an air sparging system are the pressure and rate at which compressed air is injected into the aquifer to achieve an adequate air channel density, and the resulting zone of influence (ZOI) created by these air channels. The relationship between air sparging pressure and flow depends largely on the depth of the injection point below the water table and the permeability of the aquifer material. Higher air injection flow rates can increase the density of air channeling within the ZOI, but do not necessarily increase the size of the ZOI.

The size of the ZOI is controlled largely by aquifer heterogeneity and to some extent permeability.

The ZOI assumed in the AS system design for all areas of the Site was a radius of 15 feet from each AS well. All AS wells were laid out in lines oriented perpendicular to the general direction of groundwater flow. Each sparging well line consisted of AS wells in two rows, each spaced 30 feet apart. Spacing between AS wells along each row was 60 feet. Alignment of AS wells between each row is offset by 30 feet. Spacing between each line of AS wells varies from 60 feet to 90 feet (see Sheets S-5, S-6, and S-7 in Appendix A). It was assumed that advective mixing induced by the AS system and the natural groundwater flow through each system would increase the zone of influence to help treat the entire area. The AS wells are screened at the bottom of the sand & gravel layer, immediately above the lacustrine clay.

The AS well system is operated from several different headers, and the AS wells are arranged in groups. The manifold for each group is equipped with a time controlled automatic valve such that air flow to each group can cycle on and off at specified times. The design also called for a manifold system equipped with needle-valves and flow meters to allow individual adjustment of flow rate at each AS well. The design operating AS well flows and pressures are 6 to 10 SCFM at 8 psig to 10 psig. Design maximum air injection rates are limited to 50% of the vapor extraction system flow rate for each area.

3.1.2 Soil Vapor Extraction Systems

Vapor extraction is the process by which soil gas containing volatile organic compounds (VOCs) is flushed from the unsaturated soil (vadose zone) for the purpose of reducing soil VOC concentrations. Vapor extraction is achieved by installing a slotted pipe into the vadose in the area of contamination. Air is then flushed through the soil by applying vacuum to the pipe. The flushed air enhances 1) desorption and volatilization of contaminants from soil, 2) volatilization of contaminants from pore water, and 3) evaporation of non-aqueous phase liquids (NAPL).

The basic design parameters for a vapor extraction system are the relationship between radii of influence (ROI) and extraction flow rate, and the relationship between extraction flow rate and applied vacuum. The ROI is the radial distance from a well over which a sufficient air flow is induced in the vadose zone to achieve the soil remediation goal. The design criterion used for the SVE system design was one pore volume exchange every 8 hours (i.e., approximately 1,000 pore volume exchanges per year). Based on the results of pilot studies during the RDI, the design ROI of 100 feet was used for each vapor extraction well at the Site, with spacing of 150 feet on center to provide sufficient overlap for complete coverage. The SVE and AS wells are spaced such that the assumed ZOI of the air sparging wells are contained within the design ROI of the vapor extraction wells to allow for capture of injected air is captured by the vapor extraction system. The design operating conditions for each SVE well are 50 SCFM at an applied vacuum of 40 inches of water column (in.w.c.).

3.1.3 Groundwater Extraction and Treatment System

Groundwater modeling conducted during the RDI indicated that complete capture of the dissolved plume in the Northern area could be attained using three pumping wells, spaced 150 feet apart, operating at a flow rate of 10 gallons per minute (gpm) each, and aligned perpendicular to the direction of groundwater flow. The treatment system design criteria were determined based on the calculated distance weighted mean concentrations of target VOCs and metals in the Northern area. Distance weighted mean concentrations were calculated based on proximity of the measured data at monitoring wells to the location of the extraction wells. Treatment system design criteria also included the proposed discharge limits in the State Pollution Discharge Elimination System (SPDES) permit application. The preliminary treatment system design called for air stripping followed by carbon adsorption.

3.2 *REMEDIATION SYSTEM DESCRIPTIONS*

System layout drawings and process flow diagrams for each system are included in Appendix A. Construction of these systems was completed in March 1995.

3.2.1 National Fuels Area AS/SVE System

The layout for the National Fuels area air sparging system consists of two rows of air sparging wells containing five wells each, for a total of 10 sparging wells (see Sheet S-5 in Appendix A). The design maximum air injection flow rate for the National Fuels area AS system was 80 SCFM. The SVE system in the National Fuels area consists of five horizontal extraction wells placed in trenches spaced 30 feet to 50 feet on-center, with a total extraction flow rate of 150 SCFM (see Sheet S-8 in Appendix A). Each horizontal SVE trench well contains two to three individually controlled 80-foot screen sections. Air injection, vacuum extraction, air/water separation, and vapor treatment equipment for the National Fuels area is also shared by the Central AS/SVE system. These process air streams are treated using a 1,000 SCFM, 325,000 BTU/hr catalytic oxidizer. This equipment is located in the Northern Treatment Plant (see Sheets P-5, P-6, and P-7 in Appendix A). The catalytic oxidizer also treats off-gas streams from the groundwater extraction and treatment system.

The National Fuels AS/SVE system is located in an upgradient area of the Site where depths to groundwater are relatively shallow (i.e., two to four feet below grade). The decision to use horizontal trench-type SVE wells was driven primarily by the shallow depth to water in this area. To control groundwater levels during operation of the AS/SVE system, the final design also included three 6-inch PVC groundwater recovery wells designed to operate at a maximum flow rate of 5 GPM per well (see Sheet S-11 in Appendix A). Each well is equipped with a 0.5 hp submersible pump. Extracted groundwater was piped to the groundwater treatment system located in the Northern Treatment Plant. A fourth groundwater extraction well was added to the National Fuels AS/SVE system in the spring of 1996 to provide additional control of water table levels during system operation.

3.2.2 Central Area AS/SVE System

The layout for the Central area air sparging system consists of two lines of AS wells with 14 wells on one line and 16 wells on the other, for a total of 30 AS wells (see Sheet S-6 in Appendix A). The design maximum air injection flow rate for the Central area AS system is 110 SCFM. The SVE system in the Central area consists of five vertical vapor extraction wells with a total design operating flow rate of 250 SCFM (see Sheet S-9 in Appendix A). The air injection, vacuum extraction, air/water separation, and vapor treatment equipment for the Central AS/SVE system are shared with the National Fuels AS/SVE system, as described in the preceding paragraph.

3.2.3 Southern Area AS/SVE System

The layout for the Southern area air sparging system consists of 65 sparging wells situated among eight sparging well lines in the plume area and a group of five sparging wells located near the head of the main drainage swale (see Sheet S-7 in Appendix A). The design maximum air injection flow rate for the Southern area AS system is 240 SCFM. The SVE system in the Southern area consists of 12 vertical vapor extraction wells with a total design flow rate of 600 SCFM (see Sheet S-10 in Appendix A). The air injection, vacuum extraction, air/water separation, and vapor treatment equipment for the Southern area is located in the Southern Treatment Plant (see Sheets P-8 and P-9 in Appendix A). The vapor treatment system consists of a 600 SCFM, 325,000 BTU/hr catalytic oxidation system.

3.2.4 Northern Area Groundwater Extraction and Treatment System

The groundwater extraction system consists of three groundwater recovery wells located in the Northern area between the contaminant plume and the Genesee River (see Sheet S-11 in Appendix A). Each well is constructed of 6-inch diameter stainless steel, screened from approximately 15 feet to 25 feet below grade. Each well is equipped with a 0.5 hp submersible pump designed to operate in the range of 10 GPM to 17 GPM per well. Extracted groundwater is pumped to the groundwater treatment system in the Northern Treatment Plant.

A simplified diagram of the Northern groundwater treatment system is presented in Figure 3-2. Detailed process instrumentation diagrams are presented in Sheets P-3A, P-3B, and P-4 in Appendix A. Extracted groundwater enters a four-stage metals treatment process, which was added to the treatment system in the spring of 1996 to limit iron fouling. The metals treatment system starts with additions of hydrogen peroxide and sodium hydroxide followed by a sequence of coagulation, flocculation, and settling. The settled sludge is pumped directly to Wellsville's publicly owned treatment works (POTW). Clarified effluent from the metals treatment system is processed through a low profile air stripper followed by continuous-backwash sand filtration (also added in the spring of 1996) and two-stage carbon adsorption. The treated groundwater is discharged directly to the Genesee River at an outfall located adjacent to the Northern Treatment Plant. The air stripper off-gas is passed through a de-mister before being sent to the Northern catalytic oxidation system.

3.2.5 Northern Area AS/SVE Expansion System

In early 1997, monitoring data indicated that the Northern groundwater extraction and treatment system had been removing only a small amount of VOCs from the subsurface (i.e., between five and ten pounds per month). Groundwater contaminant levels and concentrations of extracted contaminants had not decreased significantly since operation of the system began. In addition, RI/FS and RDI data indicated elevated levels of BTEX compounds in unsaturated soils in the Northern area, and it was believed that the groundwater extraction and treatment system could require operation for a significant and indefinite period of time before groundwater ARARs were approached. For these reasons, an expanded AS/SVE system was designed and constructed in the Northern area contaminant plume, immediately upgradient of the groundwater extraction wells, to remediate soils and groundwater in this area.

In July 1997 the expanded AS/SVE system was installed in the Northern area of the Site. The expansion AS/SVE system was designed using the same design criteria that were used for the Central and Southern AS/SVE systems. The system consists of five vertical SVE wells with a maximum total design flow rate of 250 SCFM, and fifteen air sparging wells with a maximum total design flow rate of 80 SCFM (see Sheet EXP-1 in Appendix A). The SVE wells were spaced approximately 120 feet apart, allowing significant overlap of the design radii of influence of approximately 100 feet at extraction flow rates of 50 SCFM per well, and an applied vacuum of 40 inches of water. The air sparging wells are laid out in two lines positioned perpendicular to the ground water flow direction.

The expansion AS/SVE manifold lines were tied into the subsurface manifold lines previously servicing the National Fuels AS/SVE system. To treat the extracted soil vapors in the expansion area, the catalytic oxidation system in the Northern vapor treatment plant was fitted with four cubic feet of Engelhard VOCat™ Model 350 HC catalyst blocks, capable of oxidizing both chlorinated and non-chlorinated hydrocarbons extracted by the expanded AS/SVE system.

4.0 GROUNDWATER PHYSICAL, GEOCHEMICAL, AND BIOLOGICAL MONITORING RESULTS

4.1 GROUNDWATER TABLE ELEVATIONS AND LNAPL THICKNESS

Depths to groundwater and thickness of LNAPL were monitored periodically between July 1993 and March 1997. Since March 1997, monitoring has been performed on a weekly basis at several monitoring wells in the Southern area (operability of the Southern SVE system is impacted by high water table levels). Since July 1998 weekly monitoring has been performed at several additional monitoring wells where LNAPL has been detected. Groundwater table elevation measurements from July 1993 to June 1999 are tabulated in Appendix B. Water table elevation and LNAPL thickness data for wells where LNAPL has been frequently detected are summarized in Appendix C.

4.1.1 Groundwater Table Elevations

Groundwater table elevations are plotted over time for the Northern, National Fuels, Central, and Southern areas of the Site in Figures 4-1 through 4-4, respectively. Water table elevations can change dramatically and quickly in response to seasonal changes in recharge. Water table elevations across the Site fluctuate with season, with higher water table levels generally predominating from January to June, and lower levels predominating between July and December. Water table levels typically rise in the late fall, presumably when rainfall begins to exceed evapotranspiration rates. When evapotranspiration rates begin to exceed rainfall in the early summer, recharge to groundwater is reduced and water table levels decrease.

Water table elevations measured in the Northern area (see Figure 4-1) upgradient of the groundwater extraction wells appear to fluctuate by about two to three feet (i.e., MW-49 and MW-57). Water table levels between the groundwater extraction wells and the river (i.e., MW-10, MW-69A, MW-78, MW-11 in Figure 4-1) show fluctuations of four feet or greater. The larger groundwater fluctuations occur within the capture zone of the groundwater extraction system. Many of the sharp fluctuations in water table elevations, especially between July 1998 and January 1999 (see Figure 4-1), are closely related to variability in operation of the groundwater extraction wells.

In the Central area (see Figure 4-3), water table levels far upgradient of the river have fluctuated by as much as six feet (MW-1, located near the drainage ditch along South Brooklyn Avenue), while adjacent to the river in the Central area seasonal fluctuations are generally in the range of two feet. Water table levels adjacent to the Genesee River in the Central area do not vary as much as those in the Northern area, presumably because the groundwater extraction wells do not impact water table levels in the Central area. Water table level changes in the Southern area (see Figure 4-4) are similar to those in the Central area, where groundwater elevations vary by five feet or more near surface water impoundments and ditches further upgradient of the Genesee River (MW-28). However, adjacent to the Genesee River and the Main Drainage Swale water table levels fluctuate by only about one foot (MW-55).

Water table elevations adjacent to the river are very likely controlled by river stage, and undergo less seasonal variation than in areas of the Site far upgradient of the river. The two low-profile dams in the Central and Southern areas of the Site help maintain relatively steady river stages in these areas, which probably limits variations in groundwater elevation adjacent to the river in these areas even further.

Groundwater elevations in the shallow water table aquifer are contoured in Figures 4-5 and 4-6. September 15, 1997 data in Figure 4-5 represent low water table conditions at the Site. The impact of the groundwater extraction system in the Northern area is clearly visible in Figure 4-5 (note the locations of groundwater recovery wells RW-1, RW-2, and RW-3 in Figures 4-5 and 4-6). Groundwater flow direction is generally to the Northeast, at an angle roughly 50° to 70° to the Genesee River in the Southern and Central areas, and roughly 70° to 90° to the river in the Northern area. The dams installed by the Corps of Engineers increase the river and groundwater hydraulic heads in this area of the Site, and likely cause the angled direction of groundwater flow from the Southern and Central areas towards the North.

Average hydraulic gradients are highest in the area between National Fuels and the Northern area (approximately 0.02 ft./ft.), and appear to decrease with distance towards the South (approximately 0.01 ft./ft. in the Central area and 0.005 ft./ft. in the Southern area). This observation is generally consistent with the results of the RI/FS and RDI, which found that the shallow water table aquifer hydraulic conductivity is higher in the Southern/Central area than in the Northern area.

The April 13, 1998 data in Figure 4-6 are typical of high water table conditions. The water table in the vicinity of the Northern groundwater extraction system is not clearly depressed as indicated in the September 1997 contours, but the hydraulic gradient in this area is still relatively flat compared to the area upgradient of pumping wells RW-1, RW-2, and RW-3. Compared to the same locations in the September 1997 contour plot, average hydraulic gradients are somewhat higher in the Northern, Central and Southern areas of the Site during high water table levels (0.026 ft./ft., 0.015 ft./ft., and 0.008 ft./ft., respectively). Despite the increase in hydraulic gradients, groundwater flow directions at the Site do not appear to change significantly with seasonal changes in water table elevations, except where influenced by the groundwater extraction system.

4.1.2 LNAPL Thickness Measurements

Light non-aqueous phase liquid (LNAPL) has been detected in several monitoring wells at the Site. Of approximately 58 monitoring wells at the Site, LNAPL has been detected on at least one occasion at 16 wells. Of these 16 wells, nine wells have shown low or trace levels of LNAPL on an infrequent or erratic basis (i.e., MW-28, MW-55, MW-57, MW-73, MW-78, MW-85, MW-89, OW-1, and OW-3). Data from the remaining seven LNAPL wells indicate a fairly predictable recurrence of detectable LNAPL during periods when water table elevations are low (i.e., MW-49, MW-51, MW-70, MW-71, MW-75, MW-81, AND MW-86). LNAPL monitoring and recovery was implemented in November 1997 to evaluate the nature of LNAPL at the Site, and to monitor and recover LNAPL found at some Site monitoring wells. The results of LNAPL monitoring and recovery efforts are presented and discussed in Section 5.0.

4.2 *GROUNDWATER GEOCHEMICAL AND BIOLOGICAL PARAMETERS*

Selected groundwater geochemical monitoring data for Phase I are tabulated in Appendix D, including measurements of pH, dissolved oxygen (DO), oxidation-reduction potential (ORP), temperature, and specific conductivity. Groundwater turbidity measurements are also included in Appendix D. These data were collected in the field during groundwater sampling events during the RDI and Phase I of groundwater remediation, from October 1993 to April 1999.

Beginning in 1997, groundwater sampling and geochemical parameter measurements were performed in the field following the procedure described in EPA's Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells.[3] This sampling method allows more accurate measurements of groundwater geochemical parameters by withdrawing groundwater slowly from the well and conducting measurements within a closed flow-through cell, which prevents agitation and aeration of the sampled groundwater. Low flow purging limits agitation and entrainment of particles that are normally immobile within the aquifer, allowing collection of samples that are more representative of mobile organic and inorganic concentrations at ambient groundwater flow conditions. Aeration of the sample typically leads to artificially high measurements of DO and ORP, with the added effect of causing chemical changes that are not representative of subsurface conditions. Prior to 1997, Phase I groundwater samples were collected while purging at relatively low rates, but sampling did not include the use of a flow-through cell. Therefore, given the impact of sampling procedure on geochemical data quality, the data collected after 1996 are believed to best represent the geochemistry of the shallow water table aquifer at the Site.

The following summarizes the results of field geochemical measurements during Phase I remediation. The general range and trends for each parameter are discussed. Monitoring well

[3] SOP# GW0001, Revision 2, EPA Region I, July 30, 1996.

MW-74, located at the upgradient edge of the Site (see Figures 4-5 and 4-6), is situated at the highest hydraulic elevation at the Site, and provides geochemical data (specifically pH, DO, and ORP) that are considered indicative of conditions upgradient of Site related contaminants. MW-74 monitoring results are described below for comparison to Site geochemical monitoring results, where applicable.

pH Groundwater pH readings are compiled in Appendix D, Table D.1. Groundwater pH at upgradient monitoring well MW-74 is in the range of approximately 6.3 to 6.7. Groundwater pH across the remainder of the Site generally falls within a similar but broader range (6.0 to 7.5), with only a few measurements falling outside this range. There do not appear to be any consistent trends over time.

ORP Groundwater ORP readings[4] are compiled in Appendix D, Table D.2. Groundwater oxidation-reduction potential at MW-74 averages greater than +150 mV, and has ranged from +15 mV to +286 mV. ORP measurements at the remainder of the Site typically range from –150 mV to 50 mV. Compared to the Site average, ORP tends to be slightly higher from January to June when water tables levels are higher, presumably because of increased recharge of meteoric water to the aquifer, and when groundwater temperatures are lower. Overall, ORP measurements indicate that the Site aquifer is largely anaerobic. There is some evidence of increased ORP in areas where air sparging has been active, but these observations have not always been consistent.

DO Groundwater DO readings are compiled in Appendix D, Table D.3. Groundwater DO has varied significantly at upgradient well MW-74, ranging from 0.78 mg/L to 11.56 mg/L. DO measurements across the remainder of the Site are generally lower, typically in the range of 0.1 mg/L to 3.0 mg/L. There are some sporadic high DO readings at the Site, but these readings have been inconsistent. In general, the DO concentrations are slightly higher when water table

[4] ORP measurements are in units of millivolts, and were made using a platinum electrode referenced to a Ag/AgCl cell.

levels are high and temperatures are lower. Overall, however, the DO monitoring data support the ORP data, indicating anaerobic conditions and high oxygen demands in the Site aquifer.

Specific Conductivity Groundwater conductivity readings are compiled in Appendix D, Table D.4. Groundwater specific conductivity is an indication of the concentration of total dissolved solids (TDS). During Phase I groundwater sampling, conductivity measurements were used primarily to track sample quality during low flow purging. Conductivity measurements show no temporal trends, however spatial trends are identifiable. Groundwater conductivity in the southern end of the Site is typically less than 500 microsiemens per centimeter (μS/cm). In the northern end of the Site, conductivity is typically measured in the range of 500 μS/cm to 1,000 μS/cm. In the center of the Site, conductivity is generally greater than 1,000 μS/cm. Specific conductivity measurements during sampling correlate reasonably well with measured concentrations of both TDS and sodium in groundwater, with higher TDS and sodium concentrations where specific conductivity is high. The SUNY campus occupies the center of the site, and it is possible that the high TDS and sodium concentrations here result from the use of salt on parking lots and sidewalks in this area.

Temperature Groundwater temperature readings are compiled in Appendix D, Table D.5. Temperature measurements are also used primarily to track sample quality during sampling. Groundwater temperatures fluctuate over a wide range that is dependent on season. Temperatures vary from 7°C in the late winter to 20°C in the late summer. Seasonal temperature variations are greatest in areas of the Site where the depth to groundwater is low.

Turbidity Groundwater turbidity readings are compiled in Appendix D, Table D.6. The turbidity of groundwater samples over time has decreased at many monitoring wells, presumably a result of improvements in sampling technique and/or groundwater quality. There are several monitoring wells at the Site that have consistently shown the highest turbidity, namely MW-27, MW-52, MW-68A, MW-69A, MW-73, and MW-86. As expected, measurements of high turbidity in Site groundwater samples typically correspond with high measured concentrations of total suspended solids and suspended iron. However, there has been no consistent relationship between turbidity and suspended arsenic concentrations.

Groundwater Microbial Population Data

Soil bacteria play a major part in regulating and affecting changes in geochemistry. The hydrocarbons in Site soil and groundwater are an excellent source of energy for soil microbes. Soil bacteria gain energy and degrade hydrocarbons by catalyzing the transfer of electrons from the hydrocarbons to a variety of electron acceptors. Aerobic bacteria utilize oxygen as an electron acceptor. Electron acceptors utilized by anaerobic bacteria include, in order of preference, oxygen, nitrate, ferrous iron, sulfate, and carbon dioxide.

Bioremediation of BTEX groundwater hydrocarbons is primarily limited by the availability of oxygen, but can also be limited by microbial ecology. Collection and analysis of Site samples was performed to evaluate the nature and health of soil microorganisms at the Site. Groundwater samples were collected from selected monitoring wells for biological analyses in March, June, August, and December of 1996, and March of 1997. For these sampling events, analyses were performed for phospholipid fatty acids (PFLA), and total heterotrophic bacteria. In September 1997, measurements to quantify aerobic BTEX specific and nitrobenzene specific degrading organisms in groundwater samples were performed. It should be noted that analyses of bacteria in groundwater samples provide only an indication of the presence of different types of bacteria in an aquifer, and are not considered to be quantitative (most soil bacteria will adhere to the aquifer matrix).

PFLA analytical results are compiled in Appendix E, Table E.1. The PLFA analyses for all four sampling events generally show similar results. PLFA analyses showed that subsurface bacteria were generally healthy, with a limited number of samples indicating low levels of environmental stress as a result of starvation or toxicity. PLFA analyses indicate bacteria populations generally in the 10^3 to 10^6 cfu/mL range (i.e., colony forming units per mL of sample). Overall, the results of PLFA microbial analyses indicate that relatively healthy and diverse populations of microbes are thriving by degrading dissolved hydrocarbons in ground water at the Site.

Total heterotrophic and specific contaminant degrading bacteria plate count data are compiled in Appendix E, Tables E.2 and E.3. Total heterotrophic plate count results are generally in the same range as the PLFA analytical results. September 1997 plate counts for total aerobic BTEX degrading organisms were generally higher at locations where total BTEX concentrations were high. Aerobic nitrobenzene degrading organisms were isolated and quantified in groundwater samples collected at MW-70 and MW-27, which in the past have typically shown the highest concentrations and most consistent presence of nitrobenzene.

5.0 PHASE I REMEDIAL PROGRESS MONITORING RESULTS

5.1 Remedial Progress Evaluation Criteria

Phase I remedial efforts were performed with the goal of remediating groundwater. Evaluating Phase I remedial progress is performed using several criteria, which are described below.

VOC Mass Removal by the Remediation Systems

VOC mass removal is reviewed for each remediation system in terms of initial subsurface VOC removal rates, and changes in removal rates over time. Mass removal is used primarily as an indicator of individual remediation system performance. Given the inherent difficulty in determining initial contaminant mass at the Site with reasonable accuracy, mass removal data can not be used to estimate the mass of contaminants remaining. However, changes in VOC mass removal rates over time and under specific conditions can provide an indication of the relative reductions achieved for extractable subsurface VOCs. Additionally, laboratory analytical results for vapor samples collected from SVE systems provide an indication of system effectiveness in removing target groundwater contaminants (*target* contaminants is used here to signify EPA Method 8260 analytes). Contaminant mass removal is discussed for each system in Section 5.2, Remedial System Performance.

Reduction of Contaminant Concentrations in Groundwater

Changes in the concentrations of specific groundwater contaminants are reviewed Site wide. These specifically targeted contaminants are separated into four groups for evaluation of Phase I remedial progress (Section 5.3, Groundwater Remedial Progress). These four groups are:

1. Benzene, toluene, ethylbenzene, and isomers of xylene (i.e., BTEX);

2. Chlorinated VOCs (CVOCs) 1,1,1-trichloroethane, 1,1-dichloroethane, *cis* 1,2-dichloroethylene, and vinyl chloride;
3. Total arsenic, lead, and chromium; and
4. LNAPL.

In addition to the BTEX and CVOCs listed above, other VOCs have been detected during Phase I monitoring. However these VOCs are either common laboratory contaminants (i.e., MEK, acetone), are below NYSDEC and EPA groundwater standards, or have not been assigned EPA or NYSDEC groundwater standards.

The semi-VOCs naphthalene, 2-methylnaphthalene, and bis(2-ethylhexyl)phthalate have been detected in groundwater at the Site. However, detection of these compounds has been inconsistent and at relatively low concentrations. Since there are no temporal trends, there is no basis for discussing remedial progress for these compounds.

The semi-VOCs nitrobenzene and aniline have been detected at the Site in an area around monitoring well MW-70. This plume lies between the Central and Northern areas (see Figure 2-1). The nitrobenzene and aniline plumes do not appear to be significantly influenced by the nearby remediation systems, therefore it is not possible to discuss remedial progress for these compounds. Results of investigations of the nitrobenzene and aniline plume area in the vicinity of MW-70 are summarized in Section 6.0 as part of a series of Supplemental Studies.

Monitoring and recovery of LNAPL was performed during Phase I remediation. Procedures and LNAPL recovery results are discussed in Section 5.2, Remedial System Performance. Remedial progress and monitoring data for LNAPL are discussed in Section 5.3, Groundwater Remedial Progress.

Achievement and Maintenance of ARARs for Groundwater as Defined in the ROD

ARARs for groundwater at the Site were defined in the ROD as Federal and State MCLs. A summary of EPA and NYSDEC MCLs for target groundwater contaminants at the Site is compiled in Table 5-1. As indicated by the standards in this Table, ARARs are driven primarily by the NYSDEC Class GA groundwater MCLs, which for most site contaminants are five to 2,000 times lower than the corresponding Federal MCLs. The ROD and UAO specify that achievement of ARARs consists of meeting and maintaining MCLs Site-wide. Groundwater monitoring data in each area are reviewed here primarily with respect to benzene, which has the lowest MCL (1 μg/L). The data are reviewed to determine if ARARs have been met or whether there is any indication that ARARs might be achieved in the near future. Monitoring data are also reviewed for evidence of rebounding in contaminant concentrations following periods when remediation systems were not operating, suggesting that maintenance of ARARs may be difficult.

5.2 *SYSTEM PERFORMANCE*

Remedial system performance is discussed for the groundwater remediation systems installed in each of the major plume areas identified in the RI and RDI. Remedial system performance is evaluated primarily in terms of contaminant mass removal rates over time. Any issues related to system operability are also discussed, as this is an important factor that directly effects a system's ability to remove VOC mass.

During the first year of operation of the SVE systems (August 1995 to July 1996), hydrocarbon concentrations in the extracted vapor were high, and mass removal rates were estimated based on lower explosive limit (LEL) meter readings and SVE system flow rates. LEL meters were installed as safety devices on each of the catalytic oxidation units. The LEL meter readings for the Northern treatment plant catalytic oxidation unit are measured from the combined streams from the National Fuels and Central SVE systems. The LEL meters are not designed as accurate analytical instruments (readings below 10% LEL are to one significant figure), and the mass removal rates estimated from these readings likely included methane in addition to hydrocarbons. However, the LEL meter data were considered to be of sufficient quality to conduct trend analyses of mass removal.

By mid-1996, hydrocarbon concentrations in the extracted vapor streams had decreased to the point where LEL meter readings were in the low end of the meter range (i.e., 0% to 3% LEL), and were no longer considered accurate. At that time, daily photoionization detector (PID) meter readings were collected from the individual SVE system influent streams. After August 1996, mass removal was estimated by converting the daily PID readings to an equivalent total hydrocarbon concentration. The conversion factor was determined by correlation of laboratory analyses and corresponding PID readings for vapor samples collected from each vapor stream. Laboratory analysis of vapor samples included quantification of EPA Method 8260 target VOCs, and quantification of non-target tentatively identified compounds (TICs).

PID:TPH response factors are compiled in Table 5-2. Prior to October 1998, the response factor used to convert PID readings to total hydrocarbon concentrations in µg/L was an average derived from the first several sets of laboratory analyses listed in Table 5-2. However, November 5, 1998 laboratory vapor samples for the Central, Southern, and Expansion area SVE systems showed a consistent trend of decreasing correction factors. VOC mass removal was therefore re-calculated from the actual correction factors for each vapor sample rather than an assumed average. The re-calculated VOC mass removal estimates are presented here.

In addition to the PID monitoring, field analyses of extracted soil vapor were performed during the week of November 2 through November 6, 1998 in order to measure the concentrations of oxygen, carbon dioxide, and methane. The purpose of these analyses was to estimate *in situ* hydrocarbon biodegradation rates based on oxygen uptake. Results of these measurements were reported in the 4th Quarter 1998 Progress Monitoring Report (Envirogen, May, 1999). The monitoring results indicated that estimated rates of organic matter biodegradation in the Southern area and Northern AS/SVE expansion area were four to five times greater than the estimated total VOC removal rates by the SVE systems. In the Central area, hydrocarbon biodegradation was estimated to be approximately 20 times greater than total VOC removal by the SVE system. While system performance is evaluated primarily in terms of mass removal, it should be noted that mass removal likely represents only a fraction of each system's remedial capability. Biological degradation of hydrocarbons depends primarily on introduction of oxygen to the subsurface, which occurs naturally and is stimulated by operation of the AS/SVE systems.

Finally, system operability is described in the following sections by two similar factors: operability factor and on-line factor. The operability factor is the overall percentage of time that a system is operational over a specified period of time. The on-line factor is similar to the operability factor, but it does not include planned down-time for system maintenance or modifications.

5.2.1 National Fuels Area AS/SVE System Performance

Process monitoring data from the National Fuels AS/SVE system between August 1996 and July 1997 are compiled in Table 5-3. The National Fuels area SVE system began operation in August 1995. The air sparging system started operation in June 1996. The operability and on-line factors for this system are compiled in Table 5-3. The SVE system on-line factor for the first 10 months of operation was approximately 50%. The main causes of down time were problems related to water uptake by the system. The vapor stream for this system and the Central area system were combined upstream of the North plant LEL meter, therefore VOC mass removal data specific to this system are not available prior to initiation of daily PID measurements in September 1996.

With a limited vadose zone of approximately four feet or less in the National Fuels area, groundwater recovery wells were operated to control and lower the water table to limit water uptake by the AS/SVE system. In this capacity, the recovery wells generally performed as designed, operating in the range of approximately 2 GPM to 5 GPM per well. However, the National Fuels plume and AS/SVE system are located in a basin-like area, (i.e., an area where ground surface elevation is low over a large area relative to its surroundings). After most rain events, surface water collects in the immediate area of the AS/SVE system on top of a three to four foot thick surface layer of silty soil. When this occurred, surface water entered the horizontal SVE well trenches, causing the system to withdrawal significant quantities of water, which in turn reduced system operability.

Operability of the SVE system improved dramatically through the summer and fall of 1996, as did operability of the AS system, when water table levels dropped and precipitation decreased. However, as indicated in Table 5-3, hydrocarbon removal rates for this system were very low over this period (an estimated 6 pounds), largely because VOC concentrations in extracted soil vapor were very low. When the SVE system was operational, movement of soil vapor through the shallow, low air permeability silty surface soils of the National Fuels area was likely minimal due to short circuiting of air flow from the surface of the SVE well trenches, and this limited VOC removal.

When water table levels and precipitation increased in December 1997, severe operability problems related to water uptake were encountered again, and the system was shut down. The National Fuels AS/SVE was shut down because the system was unable to effectively and efficiently recover soil vapor and sparging vapors. The system was later decommissioned in July 1997 when the air sparging and SVE manifold lines leading to the National Fuels area were diverted to the Northern AS/SVE Expansion system.

In summary:

- Low air permeability vadose zone soils and the shallow water table in the National Fuels area prohibited operation of the system a majority of the time. When operable, VOC removal effectiveness was limited due to short circuiting of air flow to the SVE system.
- The National Fuels AS/SVE system was decommissioned in July 1997.

5.2.2 Central Area AS/SVE System Performance

Process monitoring data from the Central AS/SVE system are compiled in Table 5-4. The SVE system began operation in August 1995. The AS system was started in May 1996. The Central AS/SVE system has operated with a high on-line factor; down-time has been associated primarily with scheduled maintenance and modifications. The Central AS/SVE system is in an area of the Site where the vadose zone thickness is typically eight to ten feet thick, and therefore overall operability is not significantly impacted by the seasonal groundwater level fluctuations of two feet or less in this area.

The Central area SVE system has been operated with well head vacuum levels in the range of 20 to 40 in.w.c. Vacuum extraction flow rates have been predominantly in the range of 40 CFM to 140 CFM. From March 1996 through September 1996, air sparging flow rates ranged from approximately 42 CFM to 70 CFM at pressures of 20 to 25 psi. In September 1996, operation of the upgradient line of air sparging wells in the Central area was suspected of causing increased hydrocarbon vapor concentrations in nearby underground utility lines, based on intermittent odors detected in SUNY buildings. The upgradient line of 14 AS wells was subsequently shut down with no subsequent vapor problems associated with this system. Since September 1996, total AS system flow rates have been relatively steady at approximately 24 CFM.

Central area AS/SVE system hydrocarbon removal and system operability are summarized in Figure 5-1. Based on LEL meter readings at the Northern catalytic oxidation system (which measured the combined vapor streams of the National Fuels and Central SVE systems) total VOC removal from August 1995 through April 1996 is estimated at approximately 23,650 pounds. Given the very low mass removal rates by the National Fuels SVE system, it is assumed that the Central SVE system likely contributed nearly all of this mass. From May to August 1996, mass removal could not be quantified because LEL meter readings were 0% and PID readings were not used to estimate VOC mass removal until September 1996.

The large quantity of VOCs removed during the first year of operation was followed by a significant decrease in removal rates. Estimated VOC mass removal rates over the past six months ranged from three to 49 pounds per month (based on PID readings) are low compared to the initial removal rates of 1,000 to 8,000 pounds per month (based on LEL meter readings). Over the 2¾ year period from September 1996 to June 1999, an estimated 3,291 pounds of additional VOCs were recovered from the Central area and treated by the Northern vapor treatment system. Most of this additional mass has been removed at rates of 100 to 250 pounds per month during the summer months when water table levels are lowest and hydrocarbons trapped in capillary zone soils are exposed. These conditions result in higher achievable SVE flow rates and increased VOC concentrations in extracted soil vapor. As indicated by the consistently low VOC mass removal data since September 1996, summarized in Figure 5-1, VOC recovery by the Central AS/SVE system has been asymptotic for approximately 3 years.

Total target VOC concentrations in Central area SVE system influent vapor samples are compiled in Table 5-2. Trace levels of target VOCs (BTEX) were detected in a charcoal tube sample of SVE system influent vapor in August 1996 (0.039 μg/L). Since February 1997, all target VOCs have been below detection limits (less than 5 μg/L) in SVE system influent vapor samples, indicating that during this period vapor phase removal of BTEX by this system was negligible. VOCs in vapor samples collected from this system have consisted primarily of tentatively identified aliphatic and cyclic aliphatic hydrocarbons.

In summary:

- The upgradient line of 14 AS wells ceased operation in September 1996. These AS wells may lie close to underground utilities and trenches, and operation of these wells was suspected of resulting in migration of hydrocarbon vapors outside of the Central area. Otherwise, operability of the Central AS/SVE system has been good, and operation of this system has generally been consistent with the design intent.
- The majority of VOC removal by the Central AS/SVE system occurred in the first year of operation. VOC removal declined significantly after the first year of operation and mass removal has been asymptotic for the past three years.
- During the past two years, no target VOCs have been detected in the SVE system influent. VOC mass removed from the subsurface by the Central AS/SVE system consists primarily of tentatively identified aliphatic and cyclic aliphatic hydrocarbons.

5.2.3 Southern Area AS/SVE System Performance

Process monitoring data from the Southern AS/SVE system are compiled in Table 5-5. The SVE system began operation in August 1995. The AS system was started in May 1996. SVE system operability data prior to May 1996 are not available. The operability of the Southern SVE system is strongly impacted by elevated water table levels that restrict vadose zone air flow during the winter and spring. Water table levels seasonally fluctuate by approximately four to five feet throughout most of the Southern AS/SVE system area. As a result, vadose zone thickness varies on a seasonal basis from as much as eight feet to as little as three feet.

Operability of the SVE system was generally good from August 1995 to February 1997. However, when water table levels increased from November 1996 to February 1997, achievable SVE flow rates and extracted soil vapor VOC concentrations were low. The SVE flow rates were insufficient to operate the AS system during this period. Following a rise in water table levels again in March 1997, the SVE system was marginally operable until July 1997 when water table levels fell. During periods of high water table levels in subsequent years, the SVE and AS systems were either shut down or system flow rates were significantly reduced in order to maintain operability.

In March 1999, appropriate Agency approval steps had been taken to start-up the Southern AS system in biosparging mode, in which the AS system is operated at low flow rates to supply oxygen to the aquifer for aerobic bioremediation of dissolved hydrocarbons. Because sparging flow rates are low, operation of the AS system in this mode can be performed without operation of the SVE system. Operation of the system in biosparging mode included operation of the small group of AS wells near MW-55. The Southern area operated in biosparging mode until mid-June 1999, when water table levels fell and operation was transitioned back to AS/SVE.

Operating SVE well vacuum levels and flow rates in the Southern area have varied depending on water table level conditions. During high water table levels, applied vacuum is typically less than 15 in.w.c. and flow rates are less than 30 CFM. During these periods, total AS system flow rates are typically less than 10 CFM. However, when water table levels are low, applied vacuum typically ranges from 30 in.w.c. to 50 in.w.c. and SVE system flow rates range from 150 CFM to 300 CFM. AS system flow rates under low water table level conditions have ranged from 40 CFM to 80 CFM.

Southern area AS/SVE system hydrocarbon removal and system operability are summarized in Figure 5-2. As indicated in this Figure and in Table 5-5, a large quantity of VOCs was removed between August 1995 and October 1996, but was followed by significantly lower VOC removal rates. VOC mass removal by the Southern AS/SVE system during the first 15 months of operation is estimated at approximately 57,300 pounds, based on LEL meter readings. Over the 2¾ year period from November 1996 through June 1999, PID readings indicate that an estimated 5,200 additional pounds of VOCs were recovered from the Southern area and treated by the Southern vapor treatment system.

Overall, the Southern AS/SVE system was effective in removing a large amount of hydrocarbons from this area between August 1995 and October 1996, despite being negatively impacted by seasonal changes in water table levels. Since November 1996, VOC removal by the Southern AS/SVE system has increased slightly in the late summer and early fall of each year as residual hydrocarbons in the capillary zone are exposed. It appears that performance of the Southern AS/SVE system can improve when water table levels fall lower than in previous years, as evidenced by increased mass removal rates during the summer and fall of 1998. However, VOC removal by this system is relatively insignificant for the remainder of the year.

Total target VOC concentrations in Southern area SVE system influent vapor samples are compiled in Table 5-2. Trace levels of *cis* 1,2, dichloroethylene were detected in a Tedlar bag sample of SVE system influent vapor in August 1998 (9 μg/L), however this compound has been detected very infrequently in the Southern area. Since August 1996, all other target VOCs (including BTEX compounds) have been below detection limits in SVE system influent vapor samples, indicating that during this period vapor phase removal of Southern area groundwater contaminants by this system was insignificant. VOCs in vapor samples collected from this system have consisted primarily of tentatively identified aliphatic and cyclic aliphatic hydrocarbons.

In summary:

- During a majority of the year, VOC mass removal by the Southern SVE system is limited because achievable SVE flow rates are low and soils containing hydrocarbons are submerged and not exposed to SVE air flow. In order to continue stimulation of hydrocarbon biodegradation in the Southern area aquifer during extended periods when operation of the SVE system is ineffective, appropriate measures were taken to operate the AS system in biosparging mode.
- The majority of VOC removal by the Southern AS/SVE system occurred in the first 15 months of operation. VOC removal declined significantly after this period. VOC mass removal by the SVE system increases during periods when water table levels drop, but for the past 2¾ years, maximum seasonal VOC mass removal rates have remained far below the earlier rates.
- During the past three years, BTEX compounds have not been detected in the SVE system influent, and BTEX mass removal by the Southern AS/SVE system over this period is considered to be relatively insignificant. VOC mass removed from the subsurface by the Southern AS/SVE system consists primarily of tentatively identified aliphatic and cyclic aliphatic hydrocarbons.

5.2.4 Northern Expansion AS/SVE System Performance

Process monitoring data from the Northern Expansion AS/SVE system are compiled in Table 5-6. The Expansion area SVE system started operation on December 3, 1997. As expected, initial hydrocarbon concentrations in the extracted soil vapor were very high. To prevent high vapor concentrations from overheating the treatment system catalyst, applied vacuum at the North/Central SVE system was controlled at a low level. As vapor concentrations decreased, applied vacuum and extraction flow rates were gradually increased. By March 1998, sufficient extraction flow rates were achieved such that operation of the AS system could begin. The

Northern Expansion AS system started operation at the end of March 1998 with an average flow rate of 5 CFM. As vapor concentrations in the undiluted SVE system influent decreased further, SVE and AS flows were gradually increased to approximately 110 CFM and 35 CFM, respectively. Reduced SVE system flow rates in the winter of 1998 and spring of 1999 were primarily a result of difficulties in adjusting flow rates between the Central and Northern Expansion SVE systems, which share the same vacuum pump.

Northern Expansion area AS/SVE system VOC removal and system operability are summarized in Figure 5-3. Overall, operability of the Expansion area AS/SVE system has been good. The Expansion AS/SVE system is in an area of the Site where vadose zone thickness ranges from 10 feet to 13 feet, and is therefore not significantly impacted by the three to four foot seasonal fluctuations in groundwater levels in this area. From December 1997 through June 1999, the Expansion area SVE and AS system had operational and on-line factors of approximately 85%. Much of the Expansion area system down-time was the result of mechanical problems with equipment in the Northern vapor treatment system during January of 1999.

The Northern Expansion AS/SVE system has been effective in removing large amounts of hydrocarbons from the subsurface. Over an operational period totaling 19 months, an estimated 34,960 pounds of VOCs were recovered from the Northern area and treated by the North/Central CATOX unit. VOC mass removal rates decreased to approximately 150 to 200 pounds per month during the first four months of 1999 when water table levels were high. This decrease in VOC removal was reflected by a significant drop in PID readings (see Table 5-6). VOC removal rates increased again to the range of 1,000 to 2,000 pounds per month when water table levels fell in May 1999, indicating that the majority of recoverable VOCs in this area are likely trapped in capillary zone soils close to the seasonal low water table level. Current monthly VOC removal by the Northern Expansion AS/SVE system is approximately 2,000 pounds per month.

A summary of analytical results for samples of extracted vapors from the Northern Expansion SVE system collected during the first year of operation is compiled in Table 5-2. Samples collected in May and August of 1998 contained measurable levels of target VOCs. The detected target VOCs consisted primarily of chlorinated VOCs. Only trace levels of ethylbenzene and xylene were detected in these samples (less than 10 μ/L each). The measured concentrations of total target VOCs on these dates correspond to removal rates of approximately 30 to 45 pounds of target VOCs per month. By November 1998, although total non-target VOC concentrations remained relatively high, no detectable target VOCs were found in extracted soil vapor. VOCs in vapor samples collected from this system have consisted primarily of tentatively identified aliphatic and cyclic aliphatic hydrocarbons.

In summary:

- Operability of the Northern Expansion AS/SVE system has been good, and operation of this system has been consistent with the design intent.
- VOC removal rates by this system have been and remain high, however when water table levels rise, soils containing hydrocarbons become submerged and VOC removal rates decrease.
- Target VOCs detected in the initial SVE system influent consisted primarily of chlorinated hydrocarbons. Vapor sample analytical results indicated target VOC removal rates of approximately 30 to 45 pounds per month during the first several months of operation, while at the same time total VOC removal rates were in the range of approximately 3,000 to 3,500 pounds per month. After approximately one year of operation, target VOCs were no longer detected in the SVE system vapor, but total VOC removal rates remained in the range of 1,000 to 2,000 pounds per month. VOC mass removed from the subsurface in this area consists primarily of aliphatic and cyclic aliphatic hydrocarbons.

5.2.5 Northern Area Groundwater Extraction and Treatment System Performance

Process monitoring data for the groundwater extraction system are compiled in Table 5-7. Operation of the groundwater extraction and treatment system began in August 1995. From November 1995 to June 1999 the groundwater extraction system was on-line for approximately 75% of the scheduled operable time. The majority of system down time involved the following:

1. The treatment system was shut down for approximately three months in the spring of 1996 to retrofit the metals treatment system and addition of the continuous backwash sand filter system.
2. Exceedances in aluminum discharge levels were a periodic problem resulting from the use of alum as a coagulant in the metals treatment system. The problem was amplified by a low permit discharge limit for aluminum (less than 0.1 mg/L). The system was shut down for an extended period of time in August and September 1998 while a suitable replacement coagulant was found.
3. Problems associated with iron and/or bacteria fouling in the sand filter and carbon beds attributed to much of the remaining down-time.

The Northern groundwater extraction and treatment system has recovered and treated a total of approximately 36 million gallons of groundwater in the Northern area. Throughout most of the operational period, groundwater extraction rates have typically ranged from 27 to 33 GPM. From August 1995 to December 1996, average pumping rates were approximately 5 GPM from the National Fuels area, and 25 GPM from the Northern area. Following shut down of the National Fuels AS/SVE system in December 1996, the recovery wells were no longer operated in the National Fuels area and that flow capacity was dedicated to the Northern area, which has operated at an average pumping rate of approximately 28 GPM since December 1996. The capture zone of the groundwater extraction system, as indicated by its impacts on water table levels and hydraulic gradients, is evident in the groundwater table contour maps in Figures 4-5 and 4-6.

Periodic sampling of the treatment system influent was performed throughout system operation to monitor compliance of the effluent with SPDES permit requirements. Pumping system influent and effluent concentrations and permit exceedances are compiled in Table 5-8. The majority of permit discharge limit exceedances were for aluminum, for the reasons discussed earlier. Most of the other permit exceedances were typically by low margins, and were the result of system upsets or carbon bed breakthrough. In all such instances, appropriate measures were taken to eliminate the discharge and correct the problem. Overall, treatment effectiveness of the system has been consistent with the design criteria.

Analytical results for BTEX compounds, CVOCs, and selected metals from August 1995 to June 1999 are summarized in Figures 5-4, 5-5, and 5-6, respectively. Total BTEX concentrations in the treatment system influent fluctuated between approximately 250 µg/L and 1,400 µg/L during the first three years of operation. Lower influent concentrations were typically observed during periods when water table levels were low, and vice versa. A gradual overall decreasing trend in total BTEX concentrations was observed between June 1996 and June 1998, followed by a significant decrease in total BTEX concentrations between July 1998 and October 1998. This significant drop in total BTEX concentrations closely coincides with operation of the Northern Expansion AS system, described above in Section 5.2.4. A similar trend was observed in concentrations of each of the CVOCs, as shown in Figure 5-5. As indicated in Figure 5-6, influent concentrations of total arsenic and total iron extracted from the Northern area have remained relatively steady throughout the entire operating period.

VOC mass removal by the groundwater extraction system is estimated using two methods: (1) VOC mass removed at the air stripper, based on daily PID readings and flow measurements of the air stripper off-gas, and (2) VOC mass entering the treatment system, based on monthly analysis of influent VOC concentrations and the volume of groundwater pumped by the system. These mass removal data are compiled in Table 5-7 and summarized in Figure 5-7. While each estimation method has its advantages and disadvantages, the daily PID measurement method has been used previously for progress reporting purposes. PID and air stripper flow measurements can reliably be made on a daily basis, while influent sampling is much less frequent (generally on a monthly basis). The two estimation methods are used and compared here for the purpose of evaluating and discussing system performance over the life of the project.

The mass removal estimates provide a good understanding of the groundwater extraction system's capacity to remove VOC mass from the subsurface compared to the Northern Expansion AS/SVE system. Based on the influent concentration method, an estimated total of approximately 280 pounds of target VOCs have been recovered and treated by the Northern area groundwater extraction system, at rates ranging from approximately five to ten pounds per month. Using the daily PID measurement method, an estimated total of approximately 183 pounds of VOCs were removed, at rates ranging from approximately two to seven pounds per month. By comparison, target VOC removal rates of approximately 30 to 45 pounds per month were measured at the Northern Expansion AS/SVE system during the first several months of operation (see Section 5.2.4). Over the same period of time that these high target VOC removal rates were measured at the Northern Expansion AS/SVE system (May 1998 and August 1998), groundwater treatment system influent target VOC concentrations and removal rates decreased sharply (see Figures 5-4, 5-5, and 5-7). By November 1998, removal of target VOCs by the groundwater pumping and AS/SVE systems was significantly reduced. Current total VOC removal rates by the groundwater pumping system are approximately two to three pounds per month, which is approximately three orders of magnitude less that the Northern Expansion AS/SVE system.

In summary:

- Operability of the Northern groundwater extraction and treatment system has been good, and operation of this system has been generally consistent with the design intent.
- VOC removal rates by the groundwater extraction and treatment system have been and remain very low compared to the AS/SVE systems at the Site.
- The groundwater extraction system is providing hydraulic containment in the Northern plume area but is extracting a very limited amount of groundwater contaminants.
- Significant reductions in influent contaminant concentrations occurred only after several months of air sparging in the immediate area by the Northern Expansion AS/SVE system.

5.2.6 LNAPL Monitoring and Recovery

LNAPL monitoring and recovery efforts were initiated at Site monitoring wells in November 1997. This work involved weekly inspection of monitoring wells that had previously shown the presence of LNAPL, in addition to all monitoring wells adjacent to the Genesee River. When LNAPL was found, an effort was made to remove the LNAPL by either bailing the well or installing an absorbent "sock". The results of this work are described below in Section 5.3.4.

The total volume of liquid LNAPL removed from Site monitoring wells has been very small. A precise volume LNAPL removed from Site monitoring wells is difficult to estimate, because much of it was recovered on absorbent material. The volume of LNAPL removed from Site monitoring wells by bailing and by absorbent material since November 1997 is estimated at less than five gallons.

5.3 GROUNDWATER REMEDIAL PROGRESS

5.3.1 BTEX Compounds in Groundwater

Groundwater benzene, toluene, ethylbenzene, total xylene, and total BTEX concentrations measured from March 1985 to April/May 1999 are compiled in Appendix F, Tables F.1 through F.5, respectively. Groundwater total BTEX concentrations in samples collected during the July 1993 RDI are the most representative data for pre-remediation groundwater conditions, and in fact formed the basis for the Phase I remedial system layout and design. Measurements of total BTEX concentrations over the following six year period are compared to the July 1993 concentrations to evaluate natural trends and remedial progress.

Groundwater BTEX concentration contours from July 1993, March 1997, April 1998, January 1999, and April/May 1999 are shown in Figures 5-8 through 5-12, respectively. Groundwater BTEX concentration data for much of the Site has shown a relatively consistent relationship where BTEX concentrations increase as water table levels increase. This relationship is typically observed when groundwater rises and becomes exposed to capillary zone soils that contain higher concentrations of contaminants. The increase in AS/SVE system VOC mass removal rates that is typically observed when water table levels fall is consistent with this phenomenon. The groundwater plume diagrams were therefore chosen to represent seasonal high BTEX concentrations over the past three years of remedial system operation.

5.3.1.1 National Fuels Area

Groundwater BTEX compound concentrations in the National Fuels area are summarized in Figure 5-13. Total BTEX concentrations near the center of the plume in the National Fuels area at monitoring well MW-73 has fluctuated predominantly between 3,000 μg/L and 6,000 μg/L from July 1993 to April 1999. Concentrations were somewhat lower at nearby monitoring well MW-52, ranging between approximately 1,500 μg/L and 2,500 μg/L. Over this period, no significant overall trend in total BTEX concentrations was observed near the center of the plume. At monitoring wells MW-85 and MW-86, situated on either side of the plume, total BTEX concentrations have also fluctuated, but show an overall gradual decline since July 1993. Total BTEX concentrations at monitoring well MW-72, located downgradient of the center of the plume, have remained relatively steady, ranging predominantly from 300 μg/L to 400 μg/L over the past six years. Analytical results for MW-73 and MW-72 show a ten-fold difference in BTEX concentrations over a distance of approximately 250 feet, which is a strong indication that the BTEX plume is being naturally attenuated.

These groundwater monitoring results are in agreement with the results of National Fuels remediation system monitoring, which showed that very little VOC mass removal was achieved. Within and downgradient of the National Fuels area plume, benzene and xylenes make up a significant fraction of the dissolved BTEX, and concentrations of benzene and xylenes remain two and three orders of magnitude above MCLs, respectively. The predominance of benzene in the center of the plume (MW-52) and downgradient (MW-72) is consistent with the anaerobic nature of the plume and benzene's slow rate of degradation under these conditions. Analytical results for MW-52 and MW-72 show a five fold difference in benzene concentrations over a distance of approximately 200 feet, which is again a strong indication of natural attenuation.

In summary:

- Groundwater BTEX concentrations were not impacted by operation of the National Fuels AS/SVE system. Xylenes remain three orders above MCLs, and therefore ARARs have not been achieved in the National Fuels area.
- Groundwater BTEX concentrations have been relatively stable over the past several years, and the BTEX plume does not appear to be expanding laterally or downgradient. The static condition of BTEX concentrations over several years indicates that the BTEX plume in the National Fuels area is being naturally attenuated.

5.3.1.2 Central Area

Groundwater BTEX compound concentrations within and upgradient of the Central area AS/SVE system are summarized in Figure 5-14. The Central AS/SVE system is situated immediately upgradient of monitoring wells MW-9 and MW-71, which lie on the periphery of the Central area BTEX plume. March and July 1993 total BTEX concentrations at these monitoring wells were in the range of approximately 150 μg/L to 814 μg/L, and showed a predominance of benzene. Between March 1993 and August 1994, prior to operation of the Central area SVE system, BTEX concentrations at these monitoring wells fluctuated as a function of season and were too variable to evaluate whether there was any overall upward or downward trend in BTEX concentrations. Benzene remained the predominant aromatic hydrocarbon during this period.

Five groundwater monitoring events from August 1994 (prior to SVE operation) to March 1997 (after two years of SVE and one year of AS system operation) show total BTEX concentrations at MW-9 and MW-71 decreasing by approximately 99% and 97%, respectively. Of particular importance is the near disappearance of benzene at these monitoring wells after June and August of 1996, as indicated in Figure 5-14, suggesting an abrupt change in conditions that favored physical and/or biological removal of benzene (i.e., air sparging).

TEX concentrations at MW-9 and MW-71 increased in April 1998, but by April 1999 were again significantly reduced. The AS system was fully operational for a three month period preceding the April 1998 sampling event, and therefore the April 1998 increase in TEX concentrations was probably not a result of rebound following remediation system shut-down. The increase was more likely coincident with the seasonal rise in water table levels. Groundwater analytical data for observation well OW-4, which was recently installed downgradient of the Central AS/SVE system to the north of MW-71, are consistent with the analytical data for MW-71.

Monitoring well MW-33 is located adjacent to and slightly upgradient of the Central AS/SVE system, on the periphery of the Central area BTEX plume. Prior to 1993, total BTEX concentrations ranged from 166 µg/L to 480 µg/L (see Appendix F, Table F.5). A spike in total BTEX concentrations to 1,091 µg/L was measured at MW-33 in March 1993 (and across much of the Central area), but total BTEX concentrations at MW-33 fell below 200 µg/L shortly thereafter. Since August of 1995, concentrations of benzene, toluene, and ethylbenzene have been mostly below 10 µg/L. Total xylene concentrations decreased more slowly, finally falling below 10 µg/L in March 1997. The significant decline in BTEX concentrations at this location occurred prior to operation of the Central AS/SVE system, and therefore can not be attributed to active remediation. Rather, it is likely attributable to natural attenuation processes.

Observation well OW-8 was installed and sampled in December 1998 as part of an investigation of the area near MW-70, which lies north of the Central AS/SVE system. Observation well OW-8 was installed in the center of the Central AS/SVE area, approximately 120 feet upgradient of MW-71, and is situated between the upgradient and downgradient AS well groups. As described earlier in Section 5.2.2, the AS well group located upgradient of OW-8 has not operated since September 1996. However, the AS well group located between OW-8 and MW-9/MW-71 has operated almost continuously. Analytical results for OW-8 have shown total BTEX concentrations of approximately 165 µg/L (nearly all benzene), while BTEX concentrations at MW-9 and MW-71 have been very low or below detection. These analytical results indicate that the downgradient AS well group has reduced groundwater BTEX concentrations significantly at the periphery of the Central area BTEX plume adjacent to the main drainage swale, and that total

BTEX concentrations in the middle of the Central area have remained relatively unchanged since July 1993.

Occurrence of BTEX concentrations below MCLs tends to be infrequent, inconsistent and appear to vary as a function of season and water table elevations in the Central area. The monitoring data show relatively asymptotic groundwater BTEX concentrations over the past several years at the perimeter wells MW-9, MW-71, and MW-33, where fluctuations in concentrations have rarely brought BTEX concentrations below MCLs. Asymptotic BTEX concentrations in groundwater are consistent with the Central AS/SVE system monitoring data showing no detectable BTEX concentrations in extracted soil vapor.

Benzene remains over two orders of magnitude above MCLs in the middle of the Central area, as indicated by observation well OW-8. ARARs have not been achieved in the Central area. Given the asymptotic nature of AS/SVE system performance and groundwater BTEX concentrations at peripheral monitoring wells, there is no clear evidence that ARARs can be achieved in the Central area.

In summary:

- On the downgradient periphery of the Central area BTEX plume, BTEX concentrations have declined significantly. The decline in benzene and total xylene concentrations downgradient of the AS/SVE system was coincident with start-up of this system.
- The abrupt decline in BTEX concentrations on the upgradient periphery of the Central area occurred prior to operation of the Central AS/SVE system, and is likely attributable to natural attenuation.
- Groundwater BTEX concentrations are asymptotic and near MCLs at the perimeter of the Central area, but benzene concentrations remain over two orders of magnitude above MCLs in the center of the plume.
- In general, ARARs have not been met in the Central area even though the remediation system in this area performed well and has met diminishing returns.

5.3.1.3 Southern Area

Groundwater BTEX compound concentrations upgradient, within, and downgradient of the Southern AS/SVE system are summarized along three transects in Figures 5-15, 5-16, and 5-17. The alignment of these transects is shown in Figure 5-8. In July 1993, the total BTEX plume in the Southern area appeared to center around two areas: MW-77 & MW-79, and MW-8 & MW-82. Total BTEX plume delineation maps (Figures 5-8 through 5-12) and the BTEX concentration graphs (Figures 5-15 through 5-17) show that total BTEX concentrations in these areas decreased significantly between July 1993 and April 1999. A decreasing trend can be observed at some locations prior to start-up of the Southern SVE system in August 1995. Weighted average total BTEX concentrations in the Southern area decreased by approximately 40% between July 1993 and August 1994, suggesting that natural attenuation of BTEX was underway in the Southern area prior to the start of active remediation.

As indicated in Figures 5-15 through 5-17, a significant and abrupt decrease in BTEX concentrations was observed in 1996 at monitoring wells within and in close proximity to the Southern area air sparging zones shortly after the AS system began operation (i.e., MW-77, MW-79, MW-53, and MW-8). However, since 1997, BTEX concentrations at these locations have become asymptotic while at the same time VOC removal by the Southern AS/SVE system has diminished.

As discussed in earlier Sections, evidence of the effects of air sparging can be found in monitoring data for benzene. Compared to TEX compounds, benzene degrades slowly under anaerobic conditions, but is often readily stripped from groundwater and/or biodegraded in the presence of air sparging. Pronounced reductions in the fraction of benzene in total BTEX concentrations between 1996 and 1999 were observed at monitoring wells MW-77, MW-79, and MW-8 (see Figures 5-15 through 5-17), as well as MW-76 and MW-89 (see Tables F.1 through F.5). These are all of the regularly sampled monitoring wells that are located within or between sparging zones in the Southern area. These benzene concentration data indicate that operation of the AS/SVE system in the Southern area improved groundwater quality by reducing groundwater benzene concentrations.

Groundwater monitoring data indicate fairly consistent seasonal increases in total BTEX concentrations each spring in the Southern area. These increases occur when water table levels increase, but also generally coincide with periods of low AS/SVE system operability. Because seasonal BTEX concentration fluctuations are relatively consistent across the site, no clear distinction can be made here between the effects of water table level changes and rebound following shut-down of the AS/SVE system.

Despite the overall improvements in groundwater quality in the Southern area between July 1993 and April 1999, xylene concentrations remain over two orders of magnitude above MCLs in the Southern area. At locations near the AS/SVE system where total BTEX concentrations have decreased the most (i.e., MW-79, MW-50, MW-77, MW-31, and MW-8), total BTEX concentrations appear to be asymptotic above MCLs, suggesting that MCLs may not be achievable in this area in a reasonable time frame. Overall, ARARs for groundwater have not been achieved in the Southern area, and there is no clear evidence that groundwater ARARs can be achieved in the foreseeable future.

In summary:

- Sharp decreases in groundwater total BTEX concentrations occurred at some locations following start-up of the AS system. Additionally, air sparging likely caused the observed reductions in benzene concentrations at all regularly monitored locations in close proximity to sparging zones. Overall, however, the magnitude of decreases in total BTEX concentrations resulting from operation of the Southern AS/SVE system is not clearly distinguishable from background rates of natural attenuation. The significance of *in situ* biological degradation of BTEX compounds in groundwater is further supported by the results of SVE system influent vapor sampling, which showed that BTEX removal by the SVE system was negligible.

- Groundwater BTEX concentrations at many locations in the vicinity of the Southern area AS/SVE system have appeared asymptotic over the past two years, while at the same time VOC removal by the AS/SVE system has diminished.
- Xylene concentrations remain over two orders of magnitude above MCLs in the Southern area. ARARs have therefore not been achieved, and there is no clear evidence that ARARs can be achieved in the foreseeable future.

5.3.1.4 Northern Area

Groundwater BTEX compound concentrations in the Northern area are summarized in Figure 5-18. In July 1993, the Northern area total BTEX plume contained a relatively large area where total BTEX concentrations were greater than 1,000 μg/L. Significant reductions in total BTEX concentrations have occurred in the Northern plume area since July 1993. Natural attenuation of BTEX compounds at monitoring wells situated between the recovery wells and the Genesee River (i.e., MW-10, MW-69A, and MW-78) was apparent before start-up of the groundwater extraction and treatment system. Decreases in total BTEX concentrations at these monitoring wells have continued with no clearly significant perturbations during operation of the groundwater extraction and Northern Expansion AS/SVE systems. On average, BTEX concentrations in monitoring wells adjacent to the Genesee River in the Northern area have decreased by approximately 96% since July 1993. However, these decreases appear to be primarily the result of a combination of natural attenuation and dilution due to pumping. Operation of the pumping wells likely limits the effects of the Northern Expansion AS/SVE system on this portion of the aquifer.

Significant reductions in total BTEX concentrations have occurred at MW-25 and MW-68A, which are in close proximity to the Northern Expansion AS/SVE system, immediately upgradient of the Northern area recovery wells. The most significant reductions in total BTEX concentrations were observed between 1997 and 1999, following approximately one year of AS system operation. Reductions in groundwater total BTEX concentrations at MW-25 and MW-68A are also reflected in the groundwater extraction system influent analytical results discussed earlier in Section 5.2.5. Based on the hydraulic gradients indicated in the groundwater table contour maps in Figures 4-5 and 4-6, much of the groundwater recovered by the Northern area pumping wells likely originates from upgradient and passes through the AS/SVE area.

Total BTEX concentrations upgradient of the Northern area (MW-49) are in the range of 200 μg/L to 350 μg/L and have not changed significantly over the past six years. The Northern area is almost directly downgradient from the National Fuels area. As long as BTEX concentrations remain above MCLs upgradient of the Northern area, even after the source of the Northern area contaminant plume is remediated, groundwater remediation efforts in the Northern area will become primarily defensive.

Although significant reductions in groundwater BTEX concentrations have been observed in the Northern area, benzene concentrations in the Northern plume area remain over two orders of magnitude above MCLs. As with the other remediation areas, current target VOC removal by the AS/SVE system is negligible. In contrast to the other AS/SVE systems, however, the Northern Expansion AS/SVE system continues to remove significant quantities of VOCs from the subsurface. Concentrations of toluene, ethylbenzene, and xylenes have been below MCLs in a few locations but do not remain below MCLs consistently. ARARs for groundwater have not been met in the Northern area, and there is no clear evidence that ARARs can be achieved in the near term.

In summary:

- Following start-up of the groundwater extraction system, decreases in total BTEX concentrations as a result of groundwater pumping were not clearly distinguishable from background levels of natural attenuation.
- Sharp decreases in total BTEX concentrations were recently observed in close proximity to the Northern AS/SVE system following approximately one year of AS system operation.

- Given the reductions in BTEX concentrations in the immediate vicinity of the Northern Expansion AS/SVE system between 1997 and 1999 following only one year of air sparging, further remedial progress in this area is possible.
- Benzene concentrations remain over two orders of magnitude above MCLs within and at the upgradient perimeter of the Northern area. ARARs have therefore not been achieved, and there is no clear evidence that ARARs can be achieved in the near future. Furthermore, migration of dissolved BTEX into the Northern area from upgradient may limit the ability to achieve and maintain ARARs in this area.

5.3.2 Chlorinated VOCs in Groundwater

Site-wide detections of CVOCs in groundwater are compiled in Table 5-9. This Table also includes detections of non-BTEX VOCs, but as stated earlier in Section 5.1, there is no basis for evaluating remedial progress for these compounds.

Consistent detection of chlorinated VOCs has been limited primarily to the Northern plume area. CVOC concentrations at selected monitoring wells in the Northern area are summarized in Figure 5-19. Since July 1993, only four CVOCs have been consistently detected above MCLs in Site groundwater: 1,1,1-trichloroethane, 1,1-dichloroethane, *cis* 1,2-dichloroethylene, and vinyl chloride. The occurrence of 1,1-Dichloroethane is likely a result of 1,1,1-trichloroethane degradation. The chlorinated ethylenes are most likely daughter products of anaerobic degradation of trichloroethylene and/or perchloroethylene, although *cis*-1,2-dichloroethylene has been observed as an abiotic byproduct of 1,1,1-trichloroethane degradation. No tri- or perchloroethylene was detected in Site groundwater from July 1993 to April 1999.

July 1993 groundwater monitoring data in the Northern area indicated total CVOC concentrations greater than 1,000 µg/L stretching from the center of the plume area (MW-57) to the edge of the Genesee River (MW-26). Total CVOC concentrations along the length of the plume ranged from approximately 7,600 µg/L at MW-57 to 2,500 µg/L at MW-26. CVOC concentrations have fluctuated erratically over the past two years, with the highest CVOC concentrations typically observed during the spring when water table elevations are high.

In April 1998, total CVOC concentrations at many locations in the Northern area spiked to concentrations greater than 1,000 µg/L. Operation of the AS system in the Northern area had just begun in March 1998, and the groundwater extraction and treatment system was down for repairs for a period of approximately two weeks prior to the April 1998 sampling event. It is likely that these perturbations in system operation may have effected groundwater CVOC concentrations. Between April 1998 and April 1999, total dissolved CVOC concentrations decreased by approximately 95%, on average. However, similar dramatic changes in CVOC concentrations were observed in the Northern area prior to 1998, and the cause of these changes is not clear.

April 1999 *cis* 1,2-dichloroethylene and vinyl chloride concentrations within the plume area remain between one and two orders of magnitude above MCLs. The majority of CVOCs at monitoring wells adjacent to the Genesee River in the Northern area are at concentrations either below or within a factor of approximately five of MCLs. The exception is monitoring well MW-10, where 1,2-dichloroethylene and vinyl chloride concentrations are within one order of magnitude of MCLs.

In summary:

- Changes in CVOC concentrations in the Northern area, especially the recent decline, are difficult to characterize because of the erratic changes observed previously. The individual effects of natural attenuation, dilution due to pumping, water table fluctuations, and operation of the groundwater extraction and AS/SVE system on concentrations of CVOCs in the Northern area can not be clearly discerned.
- There is insufficient monitoring data at this time to evaluate whether groundwater MCLs for CVOCs can be met and maintained within the Northern area.

5.3.3 Total Arsenic, Chromium, and Lead in Groundwater

5.3.3.1 Arsenic

Total and dissolved arsenic concentrations measured at the Site between March 1985 and April 1999 are compiled in Appendix G, Tables G.1 and G.2, respectively. Total arsenic concentrations from March 1996, March 1997, April 1998, January 1999, and April/May 1999 are contoured in Figures 5-20 through 5-24, respectively. Dissolved and suspended arsenic concentrations in groundwater at selected monitoring wells in each area of the Site are summarized in Figures 5-25 through 5-30.

Total arsenic concentrations were measured in July 1993, but these monitoring results are believed to be inflated as a result of sampling techniques that entrained excessive amounts of suspended solids. Evidence of this is found in the July 1993 monitoring results, which show high total and low dissolved arsenic concentrations at MW-28, MW-51, MW-53, and MW-7 in the Southern area, as well as MW-74 and MW-52 in the Central and National Fuels areas, respectively. After July 1993, low flow sampling methods have been used that reduce purge volumes and limit entrainment of suspended solids. Therefore, for comparative purposes, the March 1996 monitoring results shown in Figure 5-20 are the considered the best available pre-Phase I remediation data for total arsenic.

The applicable arsenic MCL is the NYSDEC groundwater standard of 25 µg/L (measured in total arsenic). Total arsenic concentrations in Site groundwater rarely exceeds 200 µg/L, and are found predominantly in the range of <10 µg/L to 100 µg/L. The highest total arsenic concentrations are consistently found in the Northern area, where concentrations are typically found in the range of 100 µg/L to 200 µg/L.

As shown in the plume maps in Figures 5-20 through 5-24, the general areas where total arsenic exceeds the MCL varies from one monitoring event to another. This is likely an artifact of slight variations in sampling technique. Overall, total arsenic concentrations are currently (April 1999) in the same general range that was measured in March 1996. This relatively stable trend is also apparent in the individual well plots shown in Figures 5-25 through 5-30.

As discussed earlier, the strategy for remediation of arsenic in groundwater was to oxygenate the groundwater, oxidize the dissolved ferrous iron, and immobilize As(III) and As(V) on the precipitated ferric oxyhydroxides. However, the aquifer geochemical changes required for immobilization of arsenic do not appear to be taking place. Monitoring data indicate that utilization of injected oxygen is rapid and almost complete. As discussed in Section 4.2, monitoring of DO and ORP in groundwater at the Site has shown that anaerobic conditions still predominate across much of the Site. However, monitoring of total and dissolved iron in groundwater, compiled in Appendix G, Tables G.3 and G.4, show that this injected oxygen is not ultimately utilized toward iron oxidation. In areas where air sparging has been active, iron is still primarily in the ferrous state, and little or no change in total or dissolved iron concentrations has been observed.

It appears that in addition to the iron oxygen demand, other oxygen demands in the subsurface (most likely biological) remain significant, and permanent immobilization of arsenic using this strategy will depend on overcoming these biotic oxygen demands and creating aerobic aquifer conditions. Given the relatively high concentrations of total petroleum hydrocarbons and natural organic matter found in subsurface soils during the RI and RDI, it is unlikely that application of the current remedial strategy for arsenic at the Site will be successful.

5.3.3.2 Chromium and Lead

Total and dissolved chromium and lead concentrations were measured in groundwater during 10 sampling events between August 1994 and July 1998. Groundwater total and dissolved chromium concentration data are compiled in Appendix G, Tables G.5 and G.6, respectively. Groundwater total and dissolved lead concentration data are compiled in Appendix G, Tables G.7 and G.8, respectively.

Total and dissolved chromium concentrations measured in groundwater during six monitoring events between August 1996 and July 1998 were below the applicable MCL of 50 µg/L at all sampling locations. Total and dissolved lead concentrations measured in groundwater during the same period were below the applicable MCL of 25 µg/L at all sampling locations. The data clearly show that concentrations of chromium and lead in groundwater meet ARARs. The observed reductions in groundwater chromium and lead concentrations coincide with implementation of EPA's Low Stress Purging and Sampling Procedure, and are probably attributable to improvements in sampling techniques.

5.3.4 LNAPL in Groundwater

5.3.4.1 Thickness Monitoring and Recovery

At most of the monitoring wells where LNAPL has been detected, LNAPL has been found at trace thicknesses. Furthermore, the appearance of measurable LNAPL in these wells has been erratic. The data from these monitoring wells are indicative of trace amounts of residual oil in the formation around the well that can collect in the well under low water table conditions. The focus of this discussion is on seven monitoring wells where LNAPL has been persistent, and where there has been evidence of LNAPL rebound after removal. These well locations are indicated in red in Figure 5-31. This Figure shows the location of all wells where LNAPL has been detected at least once. It is evident in Figure 5-31 that locations where LNAPL has been detected are relatively discrete. The data show no clear evidence of any continuous or widespread layers of LNAPL.

LNAPL monitoring and recovery data are summarized for monitoring wells MW-49, MW-51, MW-70, MW-71, MW-75, MW-81, and MW-86 in Figures 5-32 through 5-38, respectively. In addition to groundwater, LNAPL, and top of screen elevations, these figures show points in time where LNAPL was bailed from the well, or when absorbent socks were installed. As discussed earlier in Section 5.2.6, the total estimated volume of LNAPL recovered since initiation of LNAPL monitoring and recovery activities in November 1997 is estimated at less than five gallons.

LNAPL thickness and piezometric elevation monitoring at these wells indicates that in general, as the peizometric elevation decreases, the likelihood that LNAPL will appear increases. Furthermore, measured LNAPL thickness in wells generally increase when water table levels decrease further. However, the thickness and behavior of LNAPL in response to LNAPL recovery indicate that LNAPL is discontinuous and rapidly becomes depleted from the formation when removed from a well. These observations are consistent with LNAPL transport models that incorporate hysteresis and entrapment. As the water table decreases, oil that is discontinuous and trapped in the formation surrounding a monitoring well can form a more continuous phase and collect in the well under gravitational forces. As the water table elevation increases, this LNAPL often becomes trapped in the well while oil outside of the well becomes trapped in pore spaces and is immobilized until the water table levels decrease again. With each successive rise and fall in the water table, LNAPL accumulates in the well and is not released back to the aquifer, resulting in measured thicknesses that are not representative of the thickness of LNAPL surrounding the well. Evidence of this effect was found at monitoring wells MW-49, MW-51, MW-71, and MW-75. After bailing and skimming of LNAPL was initiated at these wells in November and December 1997, maximum LNAPL thickness during subsequent low water table levels was significantly reduced.

In summary, LNAPL thickness monitoring and recovery data indicates that distribution of LNAPL at the Site is discontinuous and limited. There is little potential for achieving remedial progress for LNAPL. The small volume of LNAPL recovered from monitoring wells at the Site during monitoring and recovery efforts is indicative of the limited volume of LNAPL in the subsurface and the technical impracticability of recovering this LNAPL.

5.3.4.2 LNAPL Analyses

In May 1997, LNAPL samples were collected at monitoring wells MW-51, MW-71, MW-73, MW75, MW-85, and MW-86 for laboratory analysis (Modified EPA Method 8015). The purpose of these preliminary analyses was to evaluate the hydrocarbon profile indicated by gas chromatography. The results of these analyses are provided in Appendix H. None of the

LNAPL samples showed a clear match to any of the common refined petroleum products. The chromatographic profile for the LNAPL sample from MW-86 showed a slight resemblance to weathered gasoline, while the LNAPL sample from MW-71 appeared to resemble kerosene. The remainder of the samples produced chromatograms that might be considered typical of weathered, light molecular weight unrefined petroleum.

6.0 RESULTS OF SUPPLEMENTAL STUDIES

6.1 MW-70 Area Investigation

The MW-70 area is located adjacent to the Genesee River, between the Central AS/SVE system and the Northern pumping and Expansion AS/SVE area (See Figures 2-1 and 3-1). The MW-70 area is not within the area of influence of or down-gradient of the Central AS/SVE system, and therefore has not been impacted by this remediation system. When the Site was an active refinery, the area in the vicinity of MW-70 contained aboveground storage tanks, a railroad spur, and a "nitro-acid treating plant".[5]

The MW-70 area contains elevated concentrations of BTEX, nitrobenzene and aniline in groundwater. Nitrobenzene and aniline appear to be isolated to this general area. In addition to dissolved constituents, LNAPL is found on groundwater and in seeps that occurred in the Genesee River. The locations of these seeps (#5 and #6) are shown in Figure 3-1, and are described further in Section 6.3.1 below.

Subsurface investigation was performed in the MW-70 area from December 1998 to May 1999. Investigation work included soil borings, installation of a series of observation wells, groundwater and soil vapor sampling, and laboratory treatability studies to evaluate biodegradation of groundwater contaminants. The results of this investigation work were presented and discussed in a report titled "Results of MW-70 Area Groundwater and LNAPL Investigation" (Envirogen, July 1999). The major findings of this investigation are as follows:

- BTEX compounds, nitrobenzene, and aniline are found predominantly within an area approximately 150 feet wide adjacent to the Genesee River and approximately 500 to 600

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[5] There is reference to "Nitro-acid Treating Plant" buildings on a list taken from a report titled "Industrial Facilities Available" (report not dated but known to be late 50's or early 60's). Cross-referencing the building numbers on this list with those on refinery drawings, the nitro-acid buildings were located in the vicinity of MW-70.

feet long downstream of the lower dam. Concentrations of nitrobenzene and aniline are as much as one to two orders of magnitude higher than total BTEX concentrations.

- Total BTEX and nitrobenzene concentrations at MW-70 have fluctuated with water table levels, but have not shown any upward or downward trend over the past six years. Higher contaminant concentrations are typically found during periods when the water table is high, suggesting that contaminants may be contained primarily in capillary zone soils.

- Limited soil analyses were performed, however the analytical data for these samples indicated the presence of high concentrations of nitrobenzene and aniline in shallow soils in the vicinity of the former nitro-acid plant buildings.

- Soil vapor samples from the MW-70 area show a characteristic depletion of oxygen and accumulation of carbon dioxide and methane, typical of anaerobic conditions where methanogenesis is the predominant microbially mediated hydrocarbon degradation process. Geochemical parameter monitoring results show the aquifer in the MW-70 area to be largely anaerobic, and organic contaminant concentrations in the MW-70 area groundwater have remained relatively steady.

- Soil samples from many of the boring locations in the MW-70 area, including those installed during previous phases of work at the Site, appeared oil stained and exhibited a petrochemical odor. The appearance of oil staining was predominantly (but not exclusively) near or within the capillary zone. However, qualitative field tests showed no evidence of a separable LNAPL phase in any of the samples that were examined.

- LNAPL monitoring data indicates gaps in the occurrence of LNAPL in this area, and distribution of LNAPL in the MW-70 area appears discontinuous and limited. There is no clear connection between LNAPL at MW-70, OW-3, and Seep #5. The appearance of

LNAPL at these locations is closely tied to water table elevations and river stage. When water table levels and river stage are low, LNAPL has been measured at MW-70, OW-3, and Seep #5 but the volumes were small.

- The biotreatability study established that target VOCs and semi-VOCs (including nitrobenzene) were readily biodegraded under aerobic conditions, and that significant levels of biodegradation can be achieved by providing oxygen to existing soil microorganisms.

Concentrations and extent of total BTEX in the vicinity of MW-70 are indicated in the plume maps in Figures 5-8 through 5-12. December 1998 and April 1999 nitrobenzene plume maps are presented in Figures 6-1 and 6-2, respectively. Aniline plume maps for these same periods are presented in Figures 6-3 and 6-4. Site wide semi-VOC analytical results are compiled in Table 6-1. The groundwater sampling event in April 1999 included more data points, and the apparent extent of nitrobenzene increased. As indicated in the plume maps, the upgradient extent of nitrobenzene and aniline is currently not clearly delineated.

Total BTEX concentrations in groundwater have ranged from 300 µg/l to 500 µg/L at MW-70, with individual BTEX compounds remaining anywhere from five to 50 times greater than MCLs. Current maximum nitrobenzene concentrations in groundwater are 13,000 µg/L, which is between four and five orders of magnitude above the applicable groundwater MCL of 0.4 µg/L. Current maximum groundwater aniline concentrations are 6,000 µg/L, which is three orders of magnitude above the applicable groundwater MCL of 5 µg/L.

6.2 MAIN DRAINAGE SWALE MONITORING RESULTS

6.2.1 Swale Surface Water Monitoring

Main drainage swale surface water sampling locations and analytical results from the RI/RDI are summarized in a Site map in Appendix I. Summaries of Phase I surface water sampling for VOCs and metals are compiled in Tables 6-2 and 6-3.

Swale monitoring typically occurs in the spring, when surface water stage in the swale is highest. During most of the year, however, surface water in the swale appears stagnant. Swale surface water monitoring data over the past two years has been relatively consistent. Low levels of BTEX compounds have been found in surface water at the head of the swale (SW-1) and midway along the swale (SW-2). However, BTEX compounds are volatilized, adsorbed, or degraded before they reach sampling location SW-3 near the mouth of the swale. Since May 1997, BTEX compounds have remained below MCLs or detection limits at SW-3.

Lead and chromium have been consistently below MCLs in surface water along the length of the swale. Since May 1997, total arsenic concentrations have been only slightly above MCLs at the head of the swale, and below MCLs elsewhere along the swale (SW-2 and SW-3).

6.2.2 Swale Sediment Monitoring

Main drainage swale sediment sampling locations and analytical results from the RI/RDI are summarized in a Site map in Appendix I. Summaries of Phase I swale sediment sampling for VOCs and metals are compiled in Tables 6-4 and 6-5.

Low concentrations of benzene, toluene, and total xylenes have been measured in swale sediments (less than 35 μg/Kg). Acetone, MEK, and methylene chloride have been detected in sediment samples, however these compounds are common laboratory contaminants and have not been detected in swale surface water samples.

Arsenic has been measured in the range of 25 μg/Kg to 714 μg/Kg in swale sediment samples. As indicated in Table 6-5, arsenic concentrations in swale sediment vary over time and from one location to another, especially at the center and mouth of the swale. Swale sediment is orange stained, and appears to contain a significant amount of oxidized iron which may immobilize arsenic through adsorption and co-precipitation. Therefore, the variability in arsenic concentrations in sediment samples is likely a result of spatial variability in sampling locations and the quantity of precipitated iron collected in each sample.

6.3 *GENESEE RIVER MONITORING RESULTS*

6.3.1 Surface Water Seep Monitoring

Over the past four years, seeps have been identified on the Genesee River. The locations of these seeps are indicated in Figure 3-1, and are numbered #1 through #6. Although the seeps typically appear around the same time each year (primarily during the late summer and early fall), the seeps are not similar in nature. "Surface water films" is the term used to describe what are considered to be non-petroleum material at Seeps #1, #2, #3, and #4. The materials at seeps #5 and #6 are known to be petroleum and these locations are described as "LNAPL seeps". Each are discussed below.

6.3.1.1 Surface Water Films

Seeps #1, #2 and #3 are all located in the same area along the dike adjacent to the main drainage swale. Seep #4 is located along the Genesee River adjacent to the Northern area. At these locations, seeps produce a film on the water surface that does not behave like oil. These seeps appear as breakable gray and/or orange slightly iridescent films, typical of lipids and fatty acids resulting from the decay of organic matter and amorphous iron films created by iron oxidizing bacteria. These films are distinctly different from the sheens exhibited by petroleum oils on surface water at Seeps #5 and #6.

Surface water films similar to those described above are observed throughout nature, and have been observed along nearby stretches of the Genesee River that are not impacted by the Site. The surface water films at Seeps #1 through #4, as well as in areas of the river unrelated to the Site, can result from any or all of the following:

- Iron oxidation and iron oxidizing bacteria – Where reduced iron dissolved in groundwater enters surface water, the environment is ideal for precipitation of iron oxides and growth of iron oxidizing bacteria. If water velocity is low, iridescent films form readily at the water-air interface.

- High molecular weight fatty acids – Decay of organic material can produce lipids that are insoluble and can display an iridescent sheen.

- Heterotrophic bacteria – Dissolved hydrocarbons and other organic material may provide a carbon source for these types of bacteria, which under some conditions may grow to form a visible film on surface water.

Groundwater discharging to surface water at the site is reduced, contains significant dissolved iron, and contains dissolved organic matter resulting from degradation of hydrocarbons and natural organic substances in soils and groundwater. When this water discharges to the oxygen rich surface water, a flush of microbial activity occurs. Sheens contain microbial biomass, insoluble organic compounds, and amorphous iron precipitate that provides iridescence to the film.

Sampling of the surface water film at Seeps #1, #2, and #3 was performed in October 1997. The film sampling procedure was derived from the literature.[6] The film sampling procedure allows collection of a concentrated film sample, but the sample still contains a significant fraction of water. The film samples were analyzed for TPH and for total direct microbial counts. EPA Method 8015 analytical results indicated that the surface water film was approximately 1.3 ppm by weight total petroleum hydrocarbons (TPH). This TPH concentration is relatively low, and this analysis may not distinguish biosynthesized aliphatic hydrocarbons from petroleum-derived hydrocarbons. By comparison, analyses of floating material at Seep #5 indicated that the sample was nearly 100% TPH. Direct microbial analysis of the Seep #1, #2, #3 film showed that a more significant portion of the non-aqueous fraction of the film was comprised of bacteria: about 10 ppm by weight and 100 ppm by volume.

[6] Carlson, D.J. 1982. A Field Evaluation of Plate and Screen Microlayer Sampling Techniques, Marine Chemistry, 11:189-208.

As part of the MW-70 area investigation work described in the previous section, observation wells OW-9 and OW-10 were installed at the top of the dike adjacent to the locations of Seeps #1, #2, and #3. Monitoring of these observation wells from December 1998 to June 1999 has revealed no detectable LNAPL at either of these wells.

6.3.1.2 LNAPL Seeps

In November 1996, oily materials were observed seeping from the river bank into the river at the location now known as Seep #5 (see Figure 3-1). At that time, personnel from the Army Corps of Engineers (COE) were operating machinery in the river channel along the northern portion of the Site to remove debris that had accumulated during a January 1996 flood. It was determined that the oily material did not originate from the machinery operated by the COE.[7] Approximately one week later, seepage of oil at this location had stopped.

Seep #5 became active once more in August 1997, and remained active until November 1997. The term "active" is used here to describe conditions when oily material is visually detected on the surface water immediately adjacent to the seep. Seep #5 consists of a patch of oil stained gravel and rip-rap material that occupies an area at the base of the river bank approximately three to five feet in length and approximately one foot high.

After a brief period of activity in June 1998, Seep #5 became active again in August 1998 and remained active until the river froze on December 31, 1998. Also in August 1998, a smaller oil seep (Seep #6) appeared approximately 150 feet downstream of Seep #5. This seep remained active until October 6, 1998. The appearance of LNAPL at these seeps in 1999 has been consistent with previous years; Seeps #5 and #6 become predictably active as water table elevations and river stage decrease to seasonal low levels.

LNAPL volumes at Seeps #5 and #6 are relatively small, and this LNAPL has been effectively contained using absorbent booms and removed from the river surface using absorbent pads.

[7] This information was reported on a NYSDEC Spill Report Form, Spill No. 9710774.

Additional measures for permanent containment of LNAPL in this area have been previously proposed[8] will also be addressed in the future Amended Feasibility Study.

In the summer of 1999, intermittent small (one foot diameter) patches of iridescent sheen were observed on the Genesee River surface in an area up to 50 feet from the shore of the Site, approximately 100 feet to 300 feet downstream of the lower dam. The frequency of these intermittent sheens was as much as a few per minute to as little as a few per day. Material from these intermittent "sub-aqueous" seeps was sampled in June 1999 and analyzed using EPA Method 8015B for diesel range organics (DRO). Analytical results showed approximately 140 mg/L DRO in the sheen sample, and <0.1 mg/L DRO in river water sampled below the water surface in the same location.[9] The chromatogram for the sheen sample suggested a mixture of heavy molecular weight petroleum hydrocarbons dissolved in a lighter hydrocarbon phase.

6.3.2 Genesee River Sampling

Genesee River sampling was performed during the RI and RDI phases. However, this monitoring data was derived from a series of grab samples collected from varying locations and was performed on a limited number of occasions. In addition, many of the analytical detection limits for contaminants were above the applicable MCLs. Evaluation of this surface water data with respect to impacts from groundwater and compliance with or exceedance of MCLs was not possible.

A focused surface water sampling program was performed in the late summer and early fall of 1998. The purpose of this work was to investigate potential groundwater discharge impacts on the Genesee River adjacent to OU2 and determine if surface water MCLs were being exceeded. The results of this sampling were presented and discussed in a report titled "Sampling and Analysis of the Genesee River to Assess Water Quality Impacts of the Former Sinclair Refinery Site" (Lawler, Matusky & Skelley Engineers, June 1999).

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[8] "Control Barrier for Seeps #5 and #6: Installation Work Plan", February, 1999 (Jacobs Engineering Group and Envirogen, Inc.)
[9] Columbia Analytical Services, Inc. Laboratory submission No. 9906000113.

NYSDEC's procedures for setting water quality-based effluent limits under the State Pollutant Discharge Elimination System (SPDES), which are applicable to point source discharges, are described in the Division of Water's Technical and Operational Guidance Series (TOGS). The basic approach in the TOGs is to develop a relationship between input loading, background water quality, downstream water quality and flow. These data are then used to extrapolate water quality at critical low flow conditions. Because surface water ARARs for the Site are based on protection of human health from drinking water sources, the 30-day average, 10-year low flow (30Q10) is an appropriate flow for the assessment.[10]

River sampling was performed at three locations: (1) upstream of the OU1 CELA, (2) near the downstream end of OU2, and (3) at the former village water intake. At the upstream and downstream locations, sampling was performed at five evenly spaced stations transecting the river perpendicular to the direction of flow. At the water intake location, which is approximately 1,500 feet downstream of the Site, grab samples were collected immediately adjacent to the concrete structure housing the water intake screens. A total of five river sampling surveys were performed between August 4 and October 5, 1998. Samples were collected and analyzed for VOCs (EPA Method 8260), nitrobenzene (EPA 8270, Selective Ion Monitoring mode), and total arsenic (EPA Method 206.2). Practicable quantitation limits for these analyses were set two to ten times lower than NYSDEC MCLs. River stages and volumetric flows were also measured at each sampling transect.

The results of river sampling are summarized as follows:

- Flow conditions in the river were consistent with the intended objective of low flow sampling. River flows declined steadily during the sampling period, and river flow at the USGS station in Wellsville during the 4th and 5th surveys was practically at 30Q10 conditions.

- All EPA 8260 VOCs and arsenic were below MCLs in the river during worst case flow conditions (i.e., 30Q10).
- The only measured contaminant found to exceed NYSDEC MCLs was nitrobenzene. All other measured contaminants were below detection limits or below MCLs. Nitrobenzene was found above the MCL of 0.4 μg/L at the downstream edge of the Site and at the former Wellsville water intake. The highest nitrobenzene concentrations were found in the river immediately adjacent to the Northern area (54 μg/L) & MW-70 area (26 μg/L).

The relationships among nitrobenzene concentrations, river flow, river stage, and groundwater hydraulic gradients adjacent to the river were analyzed. However, no clear correlation could be found. High levels of dilution, as well as variability in river flows and seepage rates during the study prevented drawing clear correlations from the relatively small number of sampling events.

[10] TOGS 1.3.1, Total Maximum Daily Loads and Water Quality-based Effluent Limits

7.0 SUMMARY AND CONCLUSIONS

7.1 SUMMARY

Phase I of remediation at the Former Sinclair Refinery Superfund Site, from summer 1995 to the present, involved construction and operation of a 30 GPM groundwater extraction and treatment system, and four separate AS/SVE systems. The purpose of this work has been to remediate Site groundwater to the remediation goals (ARARs) specified in the ROD. Remediation system effectiveness and remedial progress in groundwater during Phase I operations has been evaluated based on three primary criteria:

1. remediation system VOC mass removal and operability,
2. reductions in groundwater contaminants, and
3. achievement and maintenance of ARARs.

Site remediation system performance with respect to these criteria is summarized below, and is paraphrased in Table 7-1.

7.1.1 VOC Mass Removal and System Operability

In the National Fuels area, an AS/SVE system was installed in 1995 and operated for approximately 18 months. This system was not effective in removing VOCs from the subsurface, and operability was impacted by the local geology and hydrology of this area. This system was subsequently shut down and decommissioned.

The Southern and Central AS/SVE systems were also installed in 1995 and have operated for a period of four years. In 1997, the AS/SVE system was expanded to the Northern area in the vicinity of the groundwater extraction system. The Northern Expansion AS/SVE system has operated since December 1997. These systems have generally functioned as designed, and have had good operability. The Southern AS/SVE system, however, has encountered operability problems during periods of high water table levels and VOC recovery during these periods was minimal. Appropriate measures were taken to change the operating mode of this system such that effective operation of the AS system can continue through periods of high water table levels when the SVE system is inoperable.

The Southern and Central area AS/SVE systems were effective in removing a large mass of hydrocarbons from the subsurface during the first 12 to 18 months of operation. However, after this initial operating period, estimated mass removal rates achieved by the Southern and Central AS/SVE systems declined dramatically. VOC mass removal by the Central AS/SVE system has been low and asymptotic for the past three years. VOC mass removal by the Southern AS/SVE system is low and asymptotic for the majority of the year. The Expansion area AS/SVE system is in its second year of operation and continues to remove VOC mass from the subsurface at a significant rate. The most recent analyses of SVE system influent vapor samples indicate that no detectable target VOCs are being extracted from the subsurface by the any of the AS/SVE systems.

The Northern groundwater extraction and treatment system has shown good operability, and has operated at or near the design flow rate of 30 GPM on a fairly consistent basis. However, process monitoring data show that compared to the AS/SVE systems, the Northern groundwater extraction and treatment system has removed a very small amount of total VOCs over the life of the project. An accurate comparison of removal of target VOCs (i.e., EPA Method 8260 analytes) by the Northern groundwater extraction system and the Expansion AS/SVE system is not possible due to the limited number of SVE system influent vapor samples collected. However, significant decreases in influent target VOC concentrations at the pump and treat system were not observed until after the Expansion area AS/SVE system was installed and operated immediately upgradient of the pumping wells.

Monitoring of groundwater biological parameters and soil vapor oxygen and carbon dioxide concentrations during AS/SVE system operation provided data that indicates biological degradation of soil and groundwater contaminants is a significant process occurring at the Site. Biodegradation of hydrocarbons is induced by both the natural supply of oxygen to the subsurface and by introduction of oxygen by the AS/SVE systems. Therefore, estimates of VOC mass removal by AS/SVE systems likely reflect a fraction of the total amount of VOCs that have been naturally and actively eliminated at the Site since August 1995, when operation of the remediation systems was initiated.

7.1.2 Groundwater Remedial Progress

Remedial progress in groundwater was evaluated based on reductions in concentrations of four primary groundwater contaminants in the remediation areas, and whether ARARs for these contaminants were achieved and maintained. ARARs for groundwater at the Site are driven primarily by NYSDEC MCLs for Class GA aquifers. The following summarizes Site-wide remedial progress in terms of these four contaminant groups:

BTEX Compounds in Groundwater

In areas where AS/SVE systems were effective in removing significant amounts of VOCs during the initial periods of operation, reductions in groundwater BTEX concentrations coincident with these initial operating periods were also observed. Monitoring data shows that the remediation systems improved groundwater quality in these areas with respect to BTEX. However, it is not possible to clearly quantify the remedial effects of AS/SVE operation and groundwater pumping from background levels of natural attenuation in these areas. Natural biodegradation was evident at many monitoring well locations, both within and away from the direct influence of the AS/SVE systems. Overall, as a result of natural biodegradation and remediation system operation, reductions in average total BTEX concentrations at the Site ranged from approximately 86% (Southern area) to 95% (Central and Northern areas) between July 1993 to April 1999.

Progress towards the remedial goals of Federal and NYSDEC MCLs is summarized for the National Fuels area (Figure 7-1), Central area (Figure 7-2), Southern area (Figure 7-3), and Northern area (Figure 7-4). These Figures help to summarize benzene and xylene concentrations at monitoring wells representing locations where contaminant concentrations are highest in each area. For the Central and Northern areas, data from monitoring wells at the periphery of the plumes are also included.

In the National Fuels area, the AS/SVE system was ineffective in removing VOCs from the subsurface. As a result, concentrations of BTEX in groundwater were not impacted by operation of the AS/SVE system. BTEX concentrations in this area appear to be at a steady state over several years, and illustrate the importance of natural attenuation in preventing migration of high concentrations of BTEX away from the National Fuels area. As indicated by benzene and xylene concentrations in Figure 7-1, total xylenes at MW-73 (which are the highest at the Site) have been below the Federal MCL of 10,000 μg/L, however the NYSDEC MCL of 5 μg/L for xylene is exceeded by three orders of magnitude.

In the Central area, monitoring data for MW-33 (Figure 7-2) shows strong evidence of natural attenuation of benzene and xylene in groundwater upgradient of the Central area AS/SVE system, and prior to operation of the AS/SVE system. The first year of AS/SVE system operation resulted in the removal of a significant mass of VOCs from the subsurface. This initial period of effective VOC mass removal was followed by approximately three years of asymptotic performance. AS/SVE system performance during the first year of operation is reflected in the sharp decreases in benzene and xylene concentrations at downgradient perimeter well MW-9, as indicated in Figure 7-2. Similarly, asymptotic performance of the AS/SVE system over the past three years is reflected in asymptotic benzene concentrations above MCLs over the same period. Benzene concentrations at observation well OW-8, which lies in the center of the Central area and is upgradient of the operable line of AS wells, remains over two orders of magnitude above MCLs.

In the Southern area, AS/SVE system operation has resulted in the removal of a significant mass of VOCs. Like the Central area AS/SVE system, most of this mass was removed during the initial year of operation, and AS/SVE performance has been asymptotic for the past three years.

Monitoring results for MW-77, which lies at the center of the southern area BTEX plume, are summarized in Figure 7-3. The monitoring data show notable overall decreases in benzene and xylene concentrations after about one year of AS/SVE operation. However, for the past three years benzene and xylene concentrations appear asymptotic at levels approximately one and two orders of magnitude above MCLs, respectively.

In the center of the Northern area plume, indicated by monitoring data for MW-69A in Figure 7-4, there was evidence of natural attenuation prior to operation of the groundwater recovery and AS/SVE systems. The groundwater pumping system removed a small mass of total VOCs, and performance of the groundwater pumping system is reflected in the benzene and xylene concentrations at MW-69A, summarized in Figure 7-4. The rate of decline in benzene and xylene concentrations at MW-69A prior to operation of the groundwater pumping system remained relatively unchanged after approximately two years of groundwater pumping in the Northern area. Significant VOC mass removal was not achieved in this area until after installation and operation the Northern Expansion AS/SVE system. Notable and persistent decreases in concentrations of benzene and xylene were observed at MW-69A during the 1-½ year period following start up of the Northern Expansion AS/SVE system. However, current benzene and xylene concentrations at MW-69A are over an order of magnitude above MCLs, and an asymptotic trend appears to be starting at this location. At MW-49, located on the upgradient periphery of the Northern area, benzene and xylene concentrations show no overall upward or downward trend, and benzene concentrations remain over two orders of magnitude above MCLs.

The monitoring data clearly show that ARARs have not been achieved in any of the BTEX plume areas, and that there is no overall trend indicating ARARs will be achieved within a reasonable time frame.

Chlorinated VOCs in Groundwater

CVOCs are limited to the Northern area of the Site. Changes in CVOC concentrations over the past several years have been erratic, and do not appear to clearly coincide with operation of either the groundwater pumping or AS/SVE systems in the Northern area. Consequently, there is very little basis for evaluating remedial progress for CVOCs. Vinyl chloride and *cis* 1,2-dichloroethylene remain between one and two orders of magnitude greater than Federal and NYSDEC MCLs in the Northern area.

Metals in Groundwater

ARARs for chromium and lead concentrations in groundwater have been met and maintained over a period of approximately two years. Reductions in these contaminant concentrations are coincident with, and probably a result of, improvements in groundwater sampling techniques.

Current total arsenic concentrations in groundwater remain essentially unchanged from the baseline measurements of March 1996. This applies to areas both within and outside of the influence of the remediation systems. It is likely that high oxygen demands in the subsurface have prevented the necessary geochemical changes from occurring that promote immobilization of arsenic. Maximum total arsenic concentrations in groundwater at the Site remain approximately four times greater than the NYSDEC MCL of 25 μg/L.

LNAPL in Groundwater

LNAPL appears in small thicknesses at relatively discrete, discontinuous spots, and appears in limited areas of the Site. LNAPL recovery at the Site has been minimal, largely because LNAPL is not found in significant quantities. The limited distribution and discontinuous nature of the LNAPL illustrate the technical impracticability of LNAPL recovery at the Site.

7.1.3 Supplemental Investigation Results

Supplemental monitoring and investigation work at the Site focused on three subject areas. The results of these investigations are summarized below.

The Main Drainage Swale. Monitoring data indicate that the main drainage swale appears to act as a natural treatment zone between the Site and the Genesee River, effectively removing VOCs and immobilizing arsenic from swale surface water before entering the Genesee River.

The MW-70 area. The MW-70 area is characterized by an isolated plume of elevated nitrobenzene and aniline concentrations in groundwater. Investigation of the MW-70 area helped to delineate nitrobenzene and aniline in groundwater in this area, and provided data for developing a conceptual model for movement of groundwater and contaminants in this area. Nitrobenzene concentrations fluctuate strongly with time, but maximum concentrations are four to five orders of magnitude above the NYSDEC MCL of 0.4 μg/L. Phase I remedial efforts were not targeted in the MW-70 area, and therefore there is no basis for evaluating remedial progress in this area.

The Genesee River. Monitoring of the Genesee River was performed to evaluate impacts from groundwater discharge to the river. Under 10-year, 30-day average low flow conditions, monitoring data showed that MCLs were met for all EPA Method 8260 analytes and total arsenic. Nitrobenzene was found at the downstream end of the Site and at the former Wellsville water intake at concentrations approximately one to two orders above the MCL.

7.2 *CONCLUSIONS*

In the National Fuels area, an AS/SVE system was installed and operated for approximately 18 months. Operability and VOC removal was hampered by the local geology and hydrology of this area. This system was subsequently shut down and decommissioned for reasons of technical impracticability.

Three other AS/SVE systems (Southern, Central, and Northern Expansion) and the Northern groundwater extraction and treatment system were installed and generally operated as designed. Appropriate measures were taken to maintain and improve operability and VOC mass removal by these systems. Over the past four years, these systems operated well and affected the removal and *ex situ* treatment of nearly 125,000 pounds of volatile hydrocarbons from subsurface soils and groundwater at the Site. The vast majority of this hydrocarbon mass was removed by the SVE systems during the first 12 to 18 months of AS/SVE system operation, and consisted primarily of tentatively identified aliphatic and cyclic aliphatic petroleum hydrocarbons. The estimated mass of BTEX and CVOCs removed by these systems was minimal compared to the total mass of VOCs. Monitoring of aerobic biological respiration during AS/SVE operation has indicated that natural and enhanced *in situ* biodegradation of hydrocarbons is significant, and the actual mass of contaminants eliminated from the subsurface as a result of biodegradation is likely far greater than the amount removed and treated by the AS/SVE systems.

Several lines of evidence (i.e., analyses of bacteria, monitoring of biological respiration, and analysis of changes in groundwater contaminant concentrations over time) indicate that BTEX compounds are naturally biodegrading in nearly all areas of the Site. Except for monitoring wells located in close proximity to air sparging zones, it was difficult to distinguish the groundwater remedial effects of the AS/SVE and groundwater extraction systems from background levels of natural attenuation. In close proximity to air sparging zones, significant decreases in groundwater BTEX concentrations were observed. However, these decreases occurred primarily during the initial period of operation of the AS/SVE systems, when large quantities of VOCs were being removed. Shortly after these abrupt decreases, groundwater BTEX concentrations became asymptotic. The start of asymptotic groundwater BTEX concentrations generally coincided with asymptotic VOC removal by AS/SVE systems.

NYSDEC groundwater MCLs are equal to or more stringent than Federal MCLs, therefore ARARs are driven by NYSDEC MCLs. In all of the areas where remediation systems have operated, ARARs have not been achieved. Even within close proximity to air sparging zones, concentrations of BTEX compounds appear asymptotic and remain up to two orders of magnitude above MCLs. The asymptotic nature of BTEX concentrations in these remediation areas suggests that achievement of ARARs may be technically impracticable.

Concentrations of arsenic remain up to four times greater than MCLs. Given the high and potentially long lasting oxygen demands in the Site aquifer, it may not be possible to establish the appropriate geochemical conditions for immobilization of arsenic on the aquifer matrix in a reasonable time frame. Achievement of ARARs for arsenic in the groundwater aquifer beneath the site appears to be technically impracticable.

Concentrations of CVOCs in the Northern area have been too erratic over the past two years to allow evaluation of remedial progress for these compounds. CVOC concentrations remain between one and two orders of magnitude above MCLs.

LNAPL exists at the Site as discrete, discontinuous patches of separate phase material. Recovery of LNAPL from groundwater monitoring wells at the Site has been minimal, largely because LNAPL is not found in significant quantities. Recovery of significant amounts of LNAPL at the Site such that LNAPL thicknesses can be reduced and/or eliminated is technical impracticable. Similarly, LNAPL at seeps #5 and #6 occurs in relatively small volumes, occurs only during lowest river stages, and has been effectively contained using absorbent booms and removed from the river surface using absorbent pads. Additional measures for permanent containment of LNAPL at the edge of the Genesee River in this area have been previously proposed and will also be addressed in the future Amended Feasibility Study.

The Genesee River is the immediate downgradient receptor for Site groundwater. Surface water monitoring results for the Genesee River showed that nitrobenzene can be measured above MCLs in the river during very low river flow conditions. The most likely source of nitrobenzene is the MW-70 area. Nitrobenzene concentrations are not effected by any of the current groundwater remediation systems.

The groundwater contaminants targeted by the remediation systems at the Site (i.e., BTEX compounds, chlorinated VOCs, and arsenic) were not detected or were measured below MCLs in the river. Given that these contaminants were below MCLs in the river, and given that it may be technical impracticable to achieve ARARs for these contaminants in Site groundwater, it may be appropriate to establish surface water in the Genesee River as the point of compliance for remediation goals. Under this scenario, remedial efforts would be focused on achieving surface water goals in the river.

Table 5-1

Federal and State Maximum Concentration Levels (MCLs) for Target Contaminants

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Contaminant	Federal MCL (Drinking Water) ug/L	NY MCL (Class GA Groundwater) ug/L
Benzene	5	1
Toluene	1,000	5 (3)
Ethylbenzene	700	5 (3)
Xylenes	10,000 (1)	5 (3), (4)
1,1,1-Trichloroethane	200	5 (3)
1,1-Dichloroethane	NA	5 (3)
cis 1,2-Dichloroethylene	70	5 (3)
Vinyl Chloride	2	2
Arsenic	50	25
Chromium	100	50 (5)
Lead	15 (2)	25

Footnotes:

(1) Total xylenes.

(2) Action level for triggering treatment steps.

(3) The NYSDEC principal organic contaminant standard for groundwater of 5 ug/L applies to this substance.

(4) Applies separately to each of the three xylene isomers.

(5) Applies to total chromium and hexavalent cromium.

TABLE 5-2
Results of Laboratory Vapor Sample Analysis for SVE System Monitoring Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Tedlar Bag Samples (except as noted - *)

System	Sample Date	FID[a] (ppmv)	PID (ppmv)	VOCs[b] (ug/L)	Library Search TICs (ug/L)	Total Organics (ug/L)	Organic/FID Ratio (Fa)	Organic/PID Ratio (Fp)	FID/PID Ratio (Fb)	Fa*Fb
North Catox-Inlet	4-Dec-97	NT	109.2	ND	2708	2708	NA	24.80	NA	24.80
North Catox-Inlet	18-Dec-97	NT	412	ND	2108	2108	NA	5.12	NA	5.12
North Catox-Inlet	4-Feb-98	NT	NT	ND	1397	1397	NA	NA	NA	NA
North Catox-Inlet	28-May-98	1242	255	ND	4329	4329	3.49	16.98	4.87	16.98
North Catox-Inlet	27-Aug-98	1105	447.8	16	1120	1136	1.03	2.54	2.47	2.54
North Catox-Inlet	5-Nov-98	215	110.6	ND	331	331	1.54	2.99	1.94	2.99

Tedlar Bag Samples (except as noted - *)

System	Sample Date	FID[a] (ppmv)	PID (ppmv)	VOCs[b] (ug/L)	Library Search TICs (ug/L)	Total Organics (ug/L)	Organic/FID Ratio (Fa)	Organic/PID Ratio (Fp)	FID/PID Ratio (Fb)	Fa*Fb
Expansion Area SVE	4-Feb-98	8400	>1999	ND	BLR	NA	NA	NA	NA	NA
Expansion Area SVE	28-May-98	3730	>1999	162	4463	4625	1.24	NA	NA	NA
Expansion Area SVE	27-Aug-98	NT	>1999	174	1907	2081	NA	NA	NA	NA
Expansion Area SVE	5-Nov-98	2874	1198	ND	3833	3833	1.33	3.20	2.40	3.20

Tedlar Bag Samples (except as noted - *)

System	Sample Date	FID[a] (ppmv)	PID (ppmv)	VOCs[b] (ug/L)	Library Search TICs (ug/L)	Total Organics (ug/L)	Organic/FID Ratio (Fa)	Organic/PID Ratio (Fp)	FID/PID Ratio (Fb)	Fa*Fb
Central Field SVE*	28-Aug-96	NT	150.8	0.039	660	660	NA	4.38	NA	4.38
Central Field SVE	28-Feb-97	1327	258	ND	3197	3197	2.41	12.39	5.14	12.39
Central Field SVE	19-Mar-97	455	74.8	ND	487	487	1.07	6.51	6.08	6.51
Central Field SVE	30-Apr-97	260	120.9	ND	850	850	3.27	7.03	2.15	7.03
Central Field SVE	11-Nov-97	560	89.3	ND	732	732	1.31	8.20	6.27	8.20
Central Field SVE	4-Feb-98	460	72	ND	321	321	0.70	4.46	6.39	4.46
Central Field SVE	27-Aug-98	NT	169.4	ND	820	820	NA	4.84	NA	4.84
Central Field SVE	5-Nov-98	1485	436.9	ND	813	813	0.55	1.86	3.40	1.86

Tedlar Bag Samples (except as noted - *)

System	Sample Date	FID[a] (ppmv)	PID (ppmv)	VOCs[b] (ug/L)	Library Search TICs (ug/L)	Total Organics (ug/L)	Organic/FID Ratio (Fa)	Organic/PID Ratio (Fp)	FID/PID Ratio (Fb)	Fa*Fb
South Field SVE*	28-Aug-96	NT	327	ND	4300	4300	NA	13.15	NA	13.15
South Field SVE	11-Nov-97	960	181.8	ND	942	942	0.98	5.18	5.28	5.18
South Field SVE	4-Feb-98	90	14	ND	89	89	0.99	6.36	6.43	6.36
South Field SVE	27-Aug-98	5835	1147	9	3473	3482	0.60	3.04	5.09	3.04
South Field SVE	5-Nov-98	498	302.4	ND	1000	1000	2.01	3.31	1.65	3.31

Notes:

Daily mass removal calculation for the Central and South Field are based on laboratory analyses, and corresponding FID and PID readings from vapor samples collected from each system.
i.e., Total Organic Concentration (ug/L) = Daily PID Reading x Fa x Fb

ND - Not detected
NT - Not Tested
NA - Not Applicable
BLR - Beyond Linear Range
[a] FID readings normalized to methane
[b] Total Volatile Organic Compound - USEPA Method 8260 compounds.
* - Charcoal tube samples collected by ReTec.

TABLE 5-3
Summary of National Fuels Soil Vapor Extraction (SVE) and Air Sparging (AS) System Performance
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Month	Operational[1] Factors (%)	On-Line Factor (%)	SVE Flow[2] (cfm)	AS Flow[2] (cfm)	PID Readings[2] (ppm)	Air Volume Treated (scf)	Mass VOCs Removed (lbs)	VOC Removal (lb/scf*10^6)
Aug. 1995 - May 1996	34 / 0	49 / NA	110	OFF	NA	NA	NA	NA
June, 1996	55 / 42	55 / NA	68	4.5	NA	NA	NA	NA
July, 1996	100 / 77	100 / NA	131	11	NA	NA	NA	NA
August, 1996	64 / 63	94 / NA	132	8	9.5	3,771,187	NA	NA
September, 1996	100 / 53	100 / NA	100	8	12	4,461,768	3.7	0.83
October, 1996	99 / 98	99 / NA	84	8	5.1	3,361,680	1.2	0.36
November, 1996	100 / 100	100 / NA	91	8	5.0	3,800,160	1.3	0.34
December, 1996	2 / 2	100 / NA	OFF	OFF	4.9	79,920	0.03	0.38
January, 1997	0 / 0	NA / NA	OFF	OFF	NA	0	0	0.00
February, 1997	0 / 0	NA / NA	OFF	OFF	NA	0	0	0.00
March, 1997	0 / 0	NA / NA	OFF	OFF	NA	0	0	0.00
April, 1997	0 / 0	NA / NA	OFF	OFF	NA	0	0	0.00
May, 1997	0 / 0	NA / NA	OFF	OFF	NA	0	0	0.00
June, 1997	0 / 0	NA / NA	OFF	OFF	NA	0	0	0.00
July, 1997	DECOMISSIONED							
TOTALS						15,474,715	6.23	

Notes:

[1] Factors are for SVE and AS systems, respectively.

[2] These values represent calculated monthly averages.

NA - Not Applicable or Not Available

TABLE 5-4
Summary of Central Soil Vapor Extraction (SVE) and Air Sparging (AS) System Performance
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Month	Operational[1] Factors (%)	On-Line[1] Factor (%)	SVE Flow[2] (cfm)	AS Flow[2] (cfm)	PID Readings[2] (ppm)	Air Volume Treated (cf)	Mass VOCs Removed (lbs)	VOC Removal (lb/cf*10⁶)
Aug. 1995 - Apr. 1996	40 / NA	95 / NA	96	OFF	NA	15,095,800	23,650	156
May, 1996	29 / 22	100 / 97	85	17	NA	1,100,400	NA	NA
June, 1996	77 / 77	77 / 77	124	35	NA	4,124,700	NA	NA
July, 1996	99 / 99	99 / 99	126	67	NA	5,568,400	NA	NA
August, 1996	64 / 63	94 / NA	136	60	171	3,885,466	NA	NA
September, 1996	100 / 82	100 / NA	112	40	207	4,988,520	246	49
October, 1996	99 / 98	99 / NA	90	25	177	3,977,105	197	50
November, 1996	100 / 93	100 / NA	70	24	205	2,916,936	168	58
December, 1996	84 / 84	100 / NA	61	24	314	2,058,720	178	86
January, 1997	84 / 95	100 / NA	46	24	252	1,954,066	135	69
February, 1997	100 / 100	100 / NA	55	24	146	2,296,800	97	42
March, 1997	100 / 100	100 / 100	45	24	103	1,929,600	84	44
April, 1997	100 / 100	100 / 100	53	24	115	2,315,520	82	35
May, 1997	98 / 98	98 / 98	61	24	118	2,618,220	135	52
June, 1997	90 / 86	90 / 86	65	24	101	2,399,220	87	36
July, 1997	96 / 96	97 / 96	63	24	124	2,229,720	146	65
August, 1997	85 / 85	85 / 85	61	24	126	2,376,960	145	61
September, 1997	100 / 100	100 / 100	74	24	115	3,166,560	161	51
October, 1997	100 / 100	100 / 100	63	24	79	2,825,280	103	36
November, 1997	71 / 59	86 / 66	47	24	67	1,445,760	40	28
December, 1997	66 / 0	66 / 0	38	OFF	56	1,121,040	32	29
January, 1998	97/21	97/21	38	24	58	1,661,760	46	28
February, 1998	100/87	100/87	38	24	93	1,542,240	39	25
March, 1998	86/86	86/86	39	24	89	1,496,430	38	25
April, 1998	98/98	98/98	39	24	86	1,648,530	41	25
May, 1998	92/92	92/92	39	24	76	1,602,900	34	21
June, 1998	99/99	99/99	40	24	77	1,717,560	37	22
July, 1998	100/100	100/100	42	26	57	1,853,280	28	15
August, 1998	100/100	100/100	53	24	127	2,200,320	91	41
September, 1998	100/100	100/100	77	24	229	3,326,400	237	71
October, 1998	97/68	67/68	79	24	236	3,404,640	291	85
November, 1998	100/100	100/100	91	23	402	3,916,800	190	49
December, 1998	75/75	75/75	84	24	235	2,826,000	87	31
January, 1999	8/8	8/8	68	24	128	268,800	3	11
February, 1999	68/0	68/0	39	0	92	1,071,720	11	10
March, 1999	SYSTEM DOWN							
April, 1999	71/36	71/36	39	7	73	1,202,760	10	8
May, 1999	90/90	90/90	54	7	90	2,165,310	23	11
June, 1999	94/94	94/94	92	7	107	3754560	49	13
TOTALS						106,054,803	26,941	

Notes:
Shaded area represents current quarter.
[1] Factors are for SVE and AS systems, respectively.
[2] These values represent calculated monthly averages measured while system is operational.
NA - Not Applicable or Not Available

TABLE 5-5
Summary of Southern Soil Vapor Extraction (SVE)
and Air Sparging (AS) System Performance
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Month	Operational[1] Factors (%)	On-Line[1] Factor (%)	SVE Flow[2] (cfm)	AS Flow[2] (cfm)	PID Readings[2] (ppm)	Air Volume Treated (cf)	Mass VOCs Removed (lbs)	VOC Removal (lb/cf*10^6)
Aug. 1995 - May 1996	NA / NA	NA / NA	NA	NA	NA	NA	40,500	NA
June, 1996	92 / 86	92 / 86	139	43	NA	5,708,600	1,000	175
July, 1996	99 / 99	99 / 99	204	43	NA	9,015,500	8,200	910
August, 1996	82 / 82	82 / NA	278	51	417	10,176,134	4,500	442
September, 1996	92 / 34	95 / NA	178	59.2	289	7,343,712	2,116	288
October, 1996	74 / 3	100 / NA	102	35	232	3,385,056	944	279
November, 1996	87 / 0	96 / NA	24	OFF	53	884,640	44	50
December, 1996	87 / 0	100 / NA	15	OFF	23	519,900	10	19
January, 1997	98 / 0	100 / NA	12	OFF	74	540,428	23	43
February, 1997	71 / 0	100 / NA	17	OFF	126	500,400	51	102
March, 1997	0 / 0	0 / NA	0	OFF	NA	0	0	0
April, 1997	0 / 0	0 / NA	0	OFF	NA	0	0	0
May, 1997	29 / 0	29 / 0	50	OFF	47	576,300	5	9
June, 1997	14 / 3	14 / 3	10	24	27	58,500	1	11
July, 1997	66 / 0	67 / 0	60	OFF	93	1,281,000	64	50
August, 1997	90 / 53	90 / 53	58	39	144	2,354,400	160	68
September, 1997	91 / 91	91 / 91	139	55	133	5,276,400	300	57
October, 1997	100 / 51	100 / 51	73	22	83	3,268,800	126	39
November, 1997	93 / 1	93 / 1	14	33	92	556,800	13	24
December, 1997	100 / 88	100 / 88	10	7	100	446,400	14	31
January, 1998	100/94	100/94	10	7	88	445,800	11	25
February, 1998	100/100	100/100	10	7	70	417,600	11	26
March, 1998	97/97	97/97	10	7	59	432,000	9	21
April, 1998	100/100	100/100	10	7	59	432,000	11	25
May, 1998	59/59	59/59	10	7	56	264,900	6	24
June, 1998	SYSTEM DOWN							
July, 1998	SYSTEM DOWN							
August, 1998	65/59	65/59	139	50	338	4,072,800	217	53
September, 1998	80/80	77/77	194	67	987	6,700,200	1247	186
October, 1998	99/99	99/99	188	80	743	8,302,800	1212	146
November, 1998	97/96	97/96	179	77	428	7,531,200	657	87
December, 1998	100/98	100/98	153	71	220	6,811,200	340	50
January, 1999	93/93	93/93	128	70	148	5,299,800	198	37
February, 1999	25/36	100/100	30	31	66	302,400	4	13
March, 1999	0/99	0/99	OFF	4	NA	0	0	0
April, 1999	0/87	0/87	OFF	4	NA	0	0	0
May, 1999	0/90	0/90	OFF	4	NA	0	0	0
June, 1999	41/100	41/100	116	4	1062	2,038,800	472	232
TOTALS						**94,944,470**	**62,467**	

Notes:
Shaded area represents current quarter.
[1] Factors are for SVE and AS systems, respectively.
[2] These values represent calculated monthly averages measured while system is operational.
NA - Not Applicable or Not Available

TABLE 5-6
Summary of Northern Expansion Area Soil Vapor Extraction (SVE)
and Air Sparging (AS) System Performance
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Month	Operational[1] Factors (%)	On-Line[1] Factor (%)	SVE Flow[2] (cfm)	AS Flow[2] (cfm)	PID Readings[2] (ppm)	Air Volume Treated (cf)	Mass VOCs Removed (lbs)	VOC Removal (lb/cf*10^6)
December, 1997	58 / 0	63 / NA	43	0	>1,999	1,110,480	957	862
January, 1998	97/0	97/0	63	0	1957	2,740,980	2213	807
February, 1998	100/0	100/0	78	0	1938	3,136,320	3139	1001
March, 1998	86/14	86/14	76	5	1962	2,925,210	2607	891
April, 1998	97/74	98/97	80	8	>1,999	3,371,460	2935	871
May, 1998	92/92	92/92	84	25	1975	3,465,360	2895	835
June, 1998	99/85	99/85	83	25	>1,999	3,555,360	3124	879
July, 1998	100/99	100/99	91	27	1854	4,053,600	3057	754
August, 1998	100/100	100/100	95	29	1899	3,985,920	3507	880
September, 1998	100/100	100/100	103	35	1697	4,442,400	3360	756
October, 1998	97/97	97/97	111	35	819	4,766,880	1517	318
November, 1998	100/100	100/100	116	34	1279	5,018,400	1298	259
December, 1998	75/53	75/53	106	35	1303	3,564,120	922	259
January, 1999	8/8	8/8	80	35	734	268,800	40	149
February, 1999	68/29	68/29	57	35	343	1,565,100	181	116
March, 1999	96/46	96/59	63	6	303	2,697,480	167	62
April, 1999	100/100	100/100	73	12	336	3,150,720	212	67
May, 1999	90/90	90/90	98	12	1011	3,928,319	968	246
June, 1999	94/94	94/94	123	12	1854	5,000,640	1861	372
TOTALS						**62,747,549**	**34,960**	

Notes:
Shaded area represents current quarter.
[1] Factors are for SVE and AS systems, respectively.
[2] These values represent calculated monthly averages measured while system is operational.
NA - Not Applicable or Not Available

TABLE 5-7
Summary of Groundwater Treatment (GWT) System Performance
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Month	Operational Factor (%)	On-Line Factor (%)	AST Flow (cfm)	GWT Flow (gpm)	AST PID[1] Readings (ppm)	GW Volume Treated (gal)	Mass VOCs Removed (lbs)	Monthly VOC Removal (lbs)
Aug. '95 - Jul. '96	NA	NA	NA	NA	NA	6,539,440	52.1	56.9
August, 1996	55	85	230	NA	NA	650,000	NA	NA
September, 1996	75	76	230	30	19	1,020,671	5.80	7.23
October, 1996	73	73	230	29	15	963,571	4.90	9.99
November, 1996	100	100	230	31	15	1,335,443	6.70	13.78
December, 1996	99	100	230	31	17	1,225,880	7.30	11.39
January, 1997	86	100	230	27	11	1,039,622	5.21	5.44
February, 1997	93	93	230	26	12	978,900	4.84	8.21
March, 1997	71	87	234	27	13	778,690	3.88	8.23
April, 1997	66	86	232	28	12	796,200	3.2	9.01
May, 1997	96	97	232	27	12	1,165,680	5.46	*12.41*
June, 1997	90	90	227	26	12	1,007,760	3.06	10.06
July, 1997	95	96	227	26	12	1,105,260	5.29	*9.89*
August, 1997	64	67	227	26	11	747,120	3.48	*5.91*
September, 1997	100	100	232	26	12	1,118,520	3.86	*7.70*
October, 1997	98	100	226	25	12	1,117,560	5.37	6.54
November, 1997	45	54	219	17	11	482,820	1.45	5.99
December, 1997	60	60	229	26	11	703,980	2.44	8.26
January, 1998	80	80	226	27	11	963,900	2.89	12.56
February, 1998	70	87	235	27	12	765,450	3.39	7.69
March, 1998	80	80	231	27	12	955,155	4.07	10.89
April, 1998	45	49	232	28	15	545,160	2.80	6.56
May, 1998	75	92	227	28	14	942,460	4.55	11.99
June, 1998	82	91	231	28	13	992,880	4.68	5.43
July, 1998	63	63	228	31	13	865,200	3.13	5.44
August, 1998	24	24	226	28	14	297,360	1.89	1.87
September, 1998	SYSTEM DOWN							
October, 1998	68	68	233	28	13	855,960	3.60	2.69
November, 1998	41	41	232	25	12	451,860	2.32	1.00
December, 1998	61	61	232	27	12	745,200	3.50	1.64
January, 1999	4	4	229	28	11	48,720	0.18	0.12
February, 1999	68	68	232	28	13	766,080	3.52	1.91
March, 1999	99	99	233	28	12	1,234,800	5.57	4.00
April, 1999	83	83	228	28	12	1,008,840	4.40	3.58
May, 1999	89	89	231	28	11	1,114,680	4.93	3.62
June, 1999	65	65	227	28	11	768,840	3.12	2.11
TOTALS						36,099,482	183	280

Shaded area represents current quarter.
Numbers in italics represent interpolated monthly VOC removal estimates.
[1] These values represent calculated monthly averages measured while system is operational.
[2] Mass removal is estimated based on daily PID readings and air flow rates at the air stripper.
[3] Mass removal is estimated based on the influent VOC concentrations and monthly treatment volume.
NA - Not available
NR - Not recorded

TABLE 5-8 (page 1 of 3)
Groundwater Treatment System Compliance Monitoring Analytical Data
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Analyte	Influent 09/06/1996	Effluent 09/06/1996	Influent 10/09/1996	Effluent 10/09/1996	Influent 11/07/1996	Effluent 11/07/1996	Influent 12/12/1996	Effluent 12/12/1996	Influent 01/22/1997	Effluent 01/22/1997	Influent 02/28/1997	Effluent 02/28/1997	Permit Discharge Limit*
Benzene (ug/L)	195	ND	223	0.63	230	0.72	202	1.34	162	3.83	184	6.93	10
1,1-Dichloroethane (ug/L)	12.1	1.02	26.4	1.48	19.8	1.7	28	1.75	20.4	1.15	20.9	1.33	30
1,2-Trans-Dichloroethylene (ug/L)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30
Ethylbenzene (ug/L)	61.4	ND	130	ND	134	ND	126	ND	53	1.19	119	5.65	10
Toluene (ug/L)	57.9	ND	84.3	ND	68.6	ND	64.3	ND	47.2	1.36	64.4	2.68	10
1,1,1-Trichloroethane (ug/L)	30.8	0.63	45.5	0.76	40.3	1	53.6	1.15	29.4	0.53	33.3	0.69	10
Vinyl Chloride (ug/L)	97.4	0.64	104	ND	97.6	1.14	124	0.98	78.6	0.79	62.6	0.83	50
Xylenes, Total (ug/L)	335.1	ND	629.8	1.37	647.1	1.17	516.6	2.86	236.9	5.38	522	28.33	10
Aluminum, Total (mg/L)	NA	NA	0.062	0.071	0.03	0.036	0.029	0.027	0.092	0.099 J	ND	0.18	0.1
Arsenic, Total (mg/L)	NA	NA	0.019	ND	0.19	0.0075	0.17	0.0097	0.14	0.0066 J	0.16	0.011	0.15
Chromium, Total (mg/L)	NA	NA	0.0038	ND	0.0067	0.0027	ND	ND	ND	ND	ND	ND	0.5
Copper, Total (mg/L)	NA	NA	ND	0.002	0.004	ND	ND	ND	ND	0.013	ND	ND	0.5
Cyanide, Amenable (mg/L)	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	NA	ND	0.06
Iron, Total (mg/L)	NA	NA	49.1	0.17	45.5	0.067	47.9	0.25	49.5	0.55	47.8	0.34	4.0
Lead, Total (mg/L)	NA	NA	0.0015	NA	ND	0.0017	0.0012	ND	ND	ND	ND	ND	0.004
Nickel, Total (mg/L)	NA	NA	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND	0.77
Zinc, Total (mg/L)	NA	NA	0.0074	0.012	0.033	0.041	ND	0.0046 J	0.0092	0.0098 J	ND	ND	0.052
pH	NA	NA	NA	NA	NA	NA	NA	7.66	NA	7.88	NA	7.86	6.5-8.5
Oil and Grease (mg/L)	NA	NA	NA	NA	NA	ND	NA	ND	NA	1.51	NA	ND	15

Analyte	Influent 03/17/1997	Effluent 03/17/1997	Influent 04/30/1997	Effluent 04/30/1997	Influent 05/22/1997	Effluent 05/22/1997	Influent 06/19/1997	Effluent 06/19/1997	Influent 07/18/1997	Effluent 07/18/1997	Influent 08/20/1997	Effluent 08/20/1997	Permit Discharge Limit*
Benzene (ug/L)	226	10.4	140	<0.7	NA	<0.7	150	<0.7	NA	<0.7	NA	3.1	10
1,1-Dichloroethane (ug/L)	27.4	1.7	20	<1	NA	<2	16	<1	NA	<1	NA	<1	30
1,2-Trans-Dichloroethylene (ug/L)	<2	<0.1	<4	<1	NA	<1	<2	<1	NA	<1	NA	<1	Total cis &
1,2-Cis-Dichloroethene (u/L)	NA	NA	510	<1	NA	<1	420	6.1	NA	12	NA	16	trans = 30 ug/L
Ethylbenzene (ug/L)	149	9.42	82	<1	NA	<1	83	<1	NA	<1	NA	<1	10
Toluene (ug/L)	80.2	4.54	46	<1	NA	<1	44	<1	NA	<1	NA	2.2	10
1,1,1-Trichloroethane (ug/L)	46.4	1.23	58	<1	NA	<1	49	<1	NA	<1	NA	<1	10
Vinyl Chloride (ug/L)	91.4	0.936	110	<2	NA	<2	86	<2	NA	<2	NA	<2	50
Xylenes, Total (ug/L)	645	50.3	391	<2	NA	<2	349	<2	NA	<2	NA	4.3	10
Aluminum, Total (mg/L)	0.12	0.1	<0.1	<0.1	NA	<0.1	<0.1	<0.1	NA	<0.1	NA	<0.1	0.1
Arsenic, Total (mg/L)	0.12	0.007 J	0.166	<0.01	NA	<0.01	0.156	<0.01	NA	<0.01	NA	<0.01	0.15
Chromium, Total (mg/L)	<0.010	<0.010	<0.01	<0.01	NA	<0.01	<0.01	<0.01	NA	<0.01	NA	<0.01	0.5
Copper, Total (mg/L)	<0.010	<0.010	<0.02	<0.02	NA	<0.02	<0.02	<0.02	NA	<0.02	NA	<0.02	0.5
Cyanide, Amenable (mg/L)	NA	<0.02	NA	<0.01	NA	<0.01	NA	<0.01	NA	<0.01	NA	<0.01	0.06
Iron, Total (mg/L)	54.5	0.39	46.9	<0.1	NA	<0.1	44.8	<0.1	NA	<0.1	NA	<0.1	4.0
Lead, Total (mg/L)	<0.005	<0.005	<0.01	<0.01	NA	<0.01	<0.01	<0.01	NA	<0.01	NA	<0.01	0.004
Nickel, Total (mg/L)	<0.020	<0.020	<0.04	<0.04	NA	<0.04	<0.04	<0.04	NA	<0.04	NA	<0.04	0.77
Zinc, Total (mg/L)	<0.020	<0.020	<0.01	0.0116	NA	0.0147	0.022	0.0215	NA	<.01	NA	0.05	0.052
pH	NA	7.89	NA	7.64	NA	7.58	7.14	7.31	NA	7.99	NA	8.02	6.5-8.5
Oil and Grease (mg/L)	NA	<1.1	NA	<5	NA	<5	<5	<5	NA	<5	NA	<5	15

Notes:
NA - Not Available
ND - Not Detected
J - Estimated value
Effluent 1/22/97 - TPH Analysis Performed Inadvertently by Laboratory in place of Oil and Grease
Shaded values exceed discharge limit.
* Allowable Daily Maximum

TABLE 5-8 (page 2 of 3)
Groundwater Treatment System Compliance Monitoring Analytical Data
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Analyte	Influent 09/10/1997	Effluent 09/10/1997	Influent 10/17/1997	Effluent 10/17/1997	Influent 12/01/1997	Effluent 12/01/1997	Influent 12/18/1997	Effluent 12/18/1997	Influent 01/26/1998	Effluent 01/26/1998	Influent 02/20/1998	Effluent 02/20/1998	Permit Discharge Limit*
Benzene (ug/L)	110	<0.7	100	<0.7	180	3.2	150	1.6	150	0.9	140	<0.7	10
1,1-Dichloroethane (ug/L)	12	<1	10	<1.0	31	<1.0	23	<1.0	33	1.5	<10	<1	30
1,2-Trans-Dichloroethylene (ug/L)	<5	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Total cis &
1,2-Cis-Dichloroethene (u/L)	430	16	320	12	340	12	480	15	510	20	440	14	trans = 30 ug/L
Ethylbenzene (ug/L)	30	<1	21	<1.0	120	<1.0	100	<1.0	130	<1	85	<1	10
Toluene (ug/L)	29	<1	22	<1.0	62	<1.0	51	<1.0	57	<1	43	4.1	10
1,1,1-Trichloroethane (ug/L)	40	1	32	<1.0	59	<1.0	63	1.6	58	1.3	50	1	10
Vinyl Chloride (ug/L)	120	<2	96	<2.0	150	<2.0	140	<2.0	130	<2	70	<2	50
Xylenes, Total (ug/L)	138	<1	101	<1.0	546	6	401	1.4	495	2.1	377	<1	10
Aluminum, Total (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Arsenic, Total (mg/L)	0.196	0.0142	0.183	<0.01	0.182	0.0104	0.187	0.0104	0.156	0.0126	0.159	<0.01	0.15
Chromium, Total (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.42	0.5
Copper, Total (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.5
Cyanide, Amenable (mg/L)	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.06
Iron, Total (mg/L)	42.9	0.119	42.3	<0.1	50.3	<0.1	47.8	<0.1	47.3	<0.1	47.6	<0.1	4.0
Lead, Total (mg/L)	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.005	<0.004	<0.005	<0.004	0.004
Nickel, Total (mg/L)	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.77
Zinc, Total (mg/L)	0.0134	<0.01	0.0129	0.0102	0.0119	<0.01	0.0135	<0.01	0.0346	<0.01	0.0109	<0.01	0.052
pH	6.64	7.79	6.48	7.59	6.37	7.64	6.7	7.74	6.38	7.86	6.42	7.69	6.5-8.5
Oil and Grease (mg/L)	<5	<5	5.33	5.27	5.76	9.49	<5.0	<5.0	<5	<5	5.56	<5	15

Analyte	Influent 03/18/1998	Effluent 03/18/1998	Influent 04/23/1998	Effluent 04/23/1998	Influent 05/14/1998	Effluent 05/14/1998	Influent 06/17/1998	Effluent 06/17/1998	Influent 07/21/1998	Effluent 07/21/1998	Influent 10/15/1998	Effluent 10/15/1998	Permit Discharge Limit*
Benzene (ug/L)	110	<0.7	110	<0.7	110	<0.7	79	<0.7	70	<0.70	92	<0.70	10
1,1-Dichloroethane (ug/L)	23	1.4	24	1.6	26	<1	14	<1	12	<1.0	22	1.4	30
cis 1,2-Dichloroethylene (u/L)	580	26	590	29	600	<1	280	5.4	210	6	34	7.6	30
Ethylbenzene (ug/L)	90	<1	110	<1	120	<1	31	<1	79	<1.0	42	<1.0	10
Toluene (ug/L)	44	<1	47	<1	50	<1	22	<1	27	<1.0	25	<1.0	10
1,1,1-Trichloroethane (ug/L)	56	1.3	53	1.6	59	<1	30	<1	24	<1.0	10	<1.0	10
Vinyl Chloride (ug/L)	130	<2	100	<2	130	<2	68	<2	61	<2.0	68	<2.0	50
Xylenes, Total (ug/L)	334	<1	410	2.4	431	<1	132	<1	271	1.4	84	<1.0	10
Aluminum, Total (mg/L)	2.48	1.86	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.21	<0.1	0.196	0.1
Arsenic, Total (mg/L)	0.164	0.0152	0.145	<0.01	0.144	<0.01	0.172	0.0121	0.139	0.012	0.188	0.0228	0.15
Chromium, Total (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.0100	<0.0100	<0.0100	<0.0100	0.5
Copper, Total (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.0200	<0.0200	<0.0200	<0.0200	0.5
Cyanide, Amenable (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.0100	<0.0100	<0.0100	<0.0100	0.06
Iron, Total (mg/L)	46.7	0.141	50.6	<0.1	51	<0.1	44.6	<0.1	50.4	<0.100	44.4	0.2	4.0
Lead, Total (mg/L)	<0.005	<0.004	<0.005	<0.004	<0.005	<0.004	<0.005	<0.004	<0.00500	<0.00400	<0.00400	<0.00400	0.004
Nickel, Total (mg/L)	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.0400	<0.0400	<0.0400	<0.0400	0.77
Zinc, Total (mg/L)	3.06	2.24	0.0358	0.0454	0.0144	<0.01	0.0184	0.0138	0.0246	<0.0100	<0.0200	<0.0100	0.052
pH	6.57	7.85	6.6	7.48	6.82	7.98	6.42	7.68	6.11	7.99	6.41	9.06	6.5-8.5
Oil and Grease (mg/L)	<5	<5	5.73	8.06	<5	<5	<5	18.4	<5.00	<5.00	<5.00	<5.00	15

Notes:
NA - Not Available
ND - Not Detected
J - Estimated value
Effluent 1/22/97 - TPH Analysis Performed inadvertently by Laboratory in place of Oil and Grease
Shaded values exceed discharge limit.
* Allowable Daily Maximum

TABLE 5-6 (page 3 of 3)
Groundwater Treatment System Compliance Monitoring Analytical Data
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Analyte	Influent 12/04/1998	Effluent 12/04/1998	Influent 02/17/1999	Effluent 02/17/1999	Influent 03/18/1999	Effluent 03/18/1999	Influent 04/15/1999	Effluent 04/15/1999	Influent 05/13/1999	Effluent 05/13/1999	Influent 06/22/1999	Effluent 06/22/1999	Permit Discharge Limit*
Benzene (ug/L)	69	<0.70	53	<0.70	87	0.77	73	<0.70	67	<0.70	55	<0.70	10
1,1-Dichloroethane (ug/L)	11	<1.0	8	<1.0	12	<1.0	10	<1.0	14	<1.0	13	<1.0	30
cis 1,2-Dichloroethylene (u/L)	58	4.9	55	<1.0	110	3	140	3.3	130	6.5	100	5.5	30
Ethylbenzene (ug/L)	22	<1.0	40	<1.0	31	<1.0	44	<1.0	32	<1.0	26	<1.0	10
Toluene (ug/L)	14	<1.0	11	<1.0	18	<1.0	3333	<1.0	13	<1.0	9.5	<1.0	10
1,1,1-Trichloroethane (ug/L)	5.9	<1.0	3.1	<1.0	9.3	<1.0	12	<1.0	13	<1.0	10	<1.0	10
Vinyl Chloride (ug/L)	42	<2.0	26	<2.0	84	<2.0	67	<2.0	86	<2.0	82	<2.0	50
Xylenes, Total (ug/L)	42.4	1.4	103.6	<1.0	36.8	<1.0	65	<1.0	35	<1.0	33.4	<1.0	10
Aluminum, Total (mg/L)	<0.1	<0.100	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Arsenic, Total (mg/L)	0.188	0.0109	0.14	0.0132	0.167	0.0197	0.128	<0.0100	0.147	<0.0100	0.168	<0.0100	0.15
Chromium, Total (mg/L)	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	0.5
Copper, Total (mg/L)	<0.0200	<0.0200	<0.0200	<0.0200	<0.0200	<0.0200	<0.0200	<0.0200	<0.0200	<0.0200	<0.0200	<0.0200	0.5
Cyanide, Amenable (mg/L)	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	0.06
Iron, Total (mg/L)	45.8	<0.100	56.4	0.166	48.2	<0.100	60.6	<0.100	44.3	0.156	42	<0.1	4.0
Lead, Total (mg/L)	<0.00400	<0.00400	<0.00400	<0.00500	<0.00400	<0.00400	<0.00500	<0.00400	<0.00500	<0.00400	<0.00500	<0.00400	0.004
Nickel, Total (mg/L)	<0.0400	<0.0400	<0.0400	<0.0400	<0.0400	<0.0400	<0.0400	<0.0400	<0.0400	<0.0400	<0.0400	<0.0400	0.77
Zinc, Total (mg/L)	0.0124	<0.0100	0.0209	<0.0200	<0.0500	<0.0500	0.0131	<0.0100	<0.0100	<0.0100	<0.0200	<0.0200	0.052
pH	6.21	7.49	6.35	7.59	6.54	8.08	6.47	7.85	6.33	7.83	6.41	7.8	6.5-8.5
Oil and Grease (mg/L)	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	15

Notes:
NA - Not Available
ND - Not Detected
J - Estimated value
Effluent 1/22/97 - TPH Analysis Performed Inadvertently by Laboratory in place of Oil and Grease
Shaded values exceed discharge limit.
* Allowable Daily Maximum

TABLE 5-9 (page 1 of 3)

Groundwater Chlorinated VOC and Non-BTEX VOC Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Monitoring Well / Analyte	DATE														
	Jul-93	Aug-94	Nov-95	Mar-96	Jun-96	Aug-96	Dec-96	Mar-97	Sep-97	Apr-98	Jul-98	Oct-98	Dec-98	Jan-99	Apr-99
MW-1															
Carbon Disulfide	11	NA	NA	NA	NA		10 U	10 U	10 U	10 U		10 U			10 U
MW-8															
1,1-Dichloroethane	3 J	2.0	5 U	5 U	5 U	4.7 U	4.7 U	4.7 U	5 U	5 U	5 U			5 U	5 U
2-Butanone	20 U					NA	NA	NA	10 U	10 U	10 U			27	10 U
Acetone	110 U					10 U	10 U	10 U	20 U	20 U	20 U			39	20 U
2-Hexanone	20 U	NA	NA	NA	NA	10	10 U	10 U	10 U	10 U	10 U			10 U	10 U
MW-9															
Cis 1,2-Dichloroethylene	NA	NA	NA	NA	NA		10 U	10 U	5 U	5 U	7	5 U		5 U	5 U
Acetone	52	NA	NA	NA	NA		10 U	10 U	20 U	20 U	20 U	20 U		20 U	20 U
MW-10															
4-Methyl 2-pentanone	40 U	NA	NA	NA	NA		10 U	10 U	33	20 U	20 U	10 U		10 U	10 U
1,1,1-Trichloroethane	44	11	4 U	10 U	4 U		3.8 U	3.8 U	5 U	29	10 U	5 U		5 U	5 U
1,1-Dichloroethane	28	6.0	5 U	16	15		4.7 U	3 J	5.1	18	10 U	5 U		5 U	5 U
1,2,-Dichloroethylene (total)	540	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA		NA	NA
Cis 1,2-Dichloroethylene	NA	NA	NA	NA	NA		35	78.6	160	240	18	5 U		5 U	32
Vinyl Chloride	40 U	15	17	68	67		10U	18.4	38	97	5 U	5 U		5 U	20
MW-25															
4-Methyl 2-pentanone	100 U							25 U		25 U	10	10U			10 U
2-Hexanone	100 U							25 U		25 U	29	10U			10 U
Chloroethane	100 U											6.2			5 U
Cis 1,2-Dichloroethylene	NA							15.8 J		13 U	5 U	5 U			5 U
MW-26															
1,1,1-Trichloroethane	210							3.8 U		120		5 U			5 U
1,1-Dichloroethane	77							4.7 U		51		11			5 U
1,2,-Dichloroethylene (total)	1,700							NA		NA		NA			NA
Cis 1,2-Dichloroethylene	NA							4.7 J		1,200		5 U			5 U
Vinyl Chloride	550							10 U		220		5 U			2.2
MW-27															
Cis 1,2-Dichloroethylene	NA	NA							5 U	5 U	10		5 U		5 U
MW-31															
1,1-Dichloroethane	7*	2.0	4.1	3.3	5 U		4.7 U	4.7 U	5 U	5 U	5 U	5 U		5 U	5 U
MW-33															
Cis 1,2-Dichloroethylene	NA	NA	NA	NA	NA	10 U	10 U	10 U	5 U	5.4	5 U		5 U		5 U
MW-34															
1,1,1,-Trichloroethane	5 U	5 U				NA	NA	NA	NA	5 U	8.4	5 U			5 U
Cis 1,2-Dichloroethylene	NA	NA				NA	NA	NA	NA	6	70	5 U			5 U
MW-36															
Cis 1,2-Dichloroethylene	NA	NA	NA	NA	NA	10 U	10 U	10 U	5 U	5 U	5.3	5		5 U	5 U
MW-49															
Acetone	54	NA		NA				10 U	100 U	40 U	20 U	20U			67
Chlorobenzene	10 U	NA		NA				2.12 J	25 U	10 U	5.3	5 U			10 U
MW-50															
1,1-Dichloroethane	9	ND	5.5	5.1	9 U	4.7 U	4.7 U	9.4 U	5 U	5 U	5 U	5 U			5 U
MW-51															
Cis 1,2-Dichloroethylene	NA									5 U	5.3				5 U
MW-53															
1,1-Dichloroethane	16	10	20 U	20 U	9 U	9.4 U	4.7 U	12 U	5 U	5 U	5 U	5 U			
Acetone	360 U	NA	NA	NA	NA	92	10 U	25 U	20 U	20 U	20 U	20U			

TABLE 5-9 (page 2 of 3)

Groundwater Chlorinated VOC and Non-BTEX VOC Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Monitoring Well /	DATE														
Analyte	Jul-93	Aug-94	Nov-95	Mar-96	Jun-96	Aug-96	Dec-96	Mar-97	Sep-97	Apr-98	Jul-98	Oct-98	Dec-98	Jan-99	Apr-99
MW-55															
1,1-Dichloroethane	170 U	4.0	5 U	5 U	5 U		4.7 U	4.7 U	5 U	5 U	5 U	5 U		5 U	5 U
Methylene Chloride	17	NA	NA	NA	NA		2 U	2 U	5 U	5 U	5 U	5 U		5 U	5 U
MW-56															
1,1,1-Trichloroethane										6.8	5 U				
Cis 1,2-Dichloroethylene										34	5 U				
MW-57															
1,1,1-Trichloroethane	1,000	430		763				155	10 U	550	310	23		5 U	11
1,1-Dichloroethane	380	750		888				417	10	10 U	160	12		77	37
1,2,-Dichloroethylene (total)	6,200	NA		NA				NA	NA	NA	NA	NA		NA	NA
Acetone	330	NA		NA				50 U	40 U	40 U	20 U	20U		20 U	20 U
Cis 1,2-Dichloroethylene	NA	NA		NA				862	14	5,400	3,700	130		74	91
Trans 1,2-dichloroethylene	NA	NA		30U				8 U	10 U	10 U	6.4	5 U		5 U	5 U
2-Hexanone	500U	NA		NA				50 U	20 U	20 U	56	10U		10 U	10 U
1,1,-dichloroethylene	250U	NA		NA				10 U	10 U	18	8.8	5 U		5 U	5 U
Vinyl Chloride	500U	66		335				77.9	10 U	58	57	31		5 U	19
MW-67															
Cis 1,2-Dichloroethylene	NA	NA	NA	NA	NA		10 U	10 U	5 U	5 U	5.8		5 U		
MW-68A															
1,1,1-Trichloroethane	25 U							96.5		32	29	5 U			13
1,1-Dichloroethane	25 U							58.9		23	24	5 U			8.7
Acetone	75							25 U		40 U	20 U	20U			20 U
Cis 1,2-Dichloroethylene	NA							759		240	11	18			140
Vinyl Chloride	50 U							429		130	33	11			60
MW-68B															
1,1,1-Trichloroethane	10 U							47.7							
1,1-Dichloroethane	3 J							30.3							
1,2,-Dichloroethylene (total)	4 J							NA							
Acetone	61							10 U							
Cis 1,2-Dichloroethylene	NA							420							
Vinyl Chloride	20 U							267							
MW-69A															
1,1,1-Trichloroethane	330	270		48	151		3.8 U	14.8	5 U	75	19	12		5 U	5 U
1,1-Dichloroethane	110	88		38	102		5.7	9.19 J	8	51	18	28		14	11
1,2,-Dichloroethylene (total)	3,800	NA		NA	NA		NA	NA	NA	NA	NA	NA		NA	NA
Acetone	160	NA		NA	NA		10 U	25 U	20 U	200 U	58	20U		20 U	27
4-Methyl 2-pentanone	250 U	NA		NA	NA		10 U	25 U	10 U	100 U	21	10U		10 U	10 U
2-Butanone (mek)	NA	NA		NA	NA		NA	NA	10 U	100 U	10 U	10 U		14	10 U
2-Hexanone	250 U	NA		NA	NA		10 U	25 U	10 U	100 U	87	10U		10 U	10 U
Cis 1,2-Dichloroethylene	NA	NA		NA	NA		20	11.1 J	5 U	840	120	5 U		5 U	5 U
Vinyl Chloride	270	400		315	764		20	25 U	9.2	230	88	5 U		7.3	4.1
MW-69B															
1,1,1-Trichloroethane	750							6.42							
1,1-Dichloroethane	180 J							4.97							
1,2,-Dichloroethylene (total)	8,900							NA							
Cis 1,2-Dichloroethylene	NA							9.08 J							
Vinyl Chloride	500 U							18.7							
MW-70															
1,2,-Dichloroethylene (total)	12	NA	NA	NA	NA	11.6 U	11.6 U	11.6 U	50 U	NA	NA		NA		NA
Acetone	130	NA	NA	NA	NA	25	10 U	10 U	100 U	20 U	20 U		50 U		20 U

TABLE 5-9 (page 3 of 3)

Groundwater Chlorinated VOC and Non-BTEX VOC Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Monitoring Well / Analyte	DATE														
	Jul-93	Aug-94	Nov-95	Mar-96	Jun-96	Aug-96	Dec-96	Mar-97	Sep-97	Apr-98	Jul-98	Oct-98	Dec-98	Jan-99	Apr-99
MW-71															
4-Methyl 2-pentanone	10 U	NA	NA	NA	NA	5.8	10 U	10 U	10 U	10 U	10 U		10 U		10 U
MW-75															
Cis 1,2-Dichloroethylene	NA	NA	NA	NA	NA		10 U	10 U	5 U	13	5 U	50U			5 U
MW-76															
1,1-Dichloroethane	4 J	2.0	5 U	5 U	5 U		4.7 U	4.7 U	5 U	5 U	5 U	5 U			
MW-78															
Acetone	130							25 U		20 U	20 U	20 U		20 U	20 U
1,2,-Dichloroethylene (total)	12 J							NA		NA	NA	NA		NA	NA
1,1,1,-Trichloroethane	50 U							9.5 U		5 U	12	5 U		5 U	5 U
1,1-Dichloroethane	50 U							12 U		5 U	5 U	15		6.1	5 U
2-Butanone (mek)	100 U							NA		10 U	10 U	10 U		10	10 U
4-Methyl-2-pentanone (mibk)	100 U							NA		10 U	10 U	10 U		10	10 U
Vinyl Chloride	100 U							25 U		5 U	5 U	36		14	2 U
Cis 1,2-Dichloroethylene	NA							25 U		9.3	77	9.1		5.9	5 U
MW-79															
2-Butanone (mek)	50 U								10 U	10 U	10 U	10 U		12	10 U
MW-81															
Cis 1,2-Dichloroethylene	NA									33	5 U	5 U			5 U
MW-84															
Acetone	100	NA	NA	NA	NA		10 U	10 U	20 U		20 U				
MW-85															
2-Butanone (mek)	100 U						NA	NA	10 U	10 U	10 U				14
Acetone	170 U						10 U	10 U	20 U	20 U	20 U				100
MW-86															
2-Hexanone	20 U	NA	NA	NA	NA		58	10 U	10 U	10 U	10 U			10 U	10 U
2-Butanone (mek)	20 U						NA	NA	10 U	10 U	10 U			20	19
Acetone	67 U						10 U	10 U	20 U	20 U	20 U			57	53
Cis 1,2-Dichloroethylene	NA	NA	NA	NA	NA		10 U	10 U	5 U	12	5.5			5 U	5 U
4-Methyl 2-pentanone	20 U	NA	NA	NA	NA		32	10 U	10 U	10 U	10 U			10 U	10 U
MW-87															
Cis 1,2-Dichloroethylene	NA					10 U	NA	NA	NA	19					
MW-89															
1,1-Dichloroethane	15	10	4.5	9 U	9 U		4.7 U	4.7 U	5 U	5 U	5 U	5 U			5 U
Cis 1,2-Dichloroethylene	NA	NA	NA	NA	NA		10 U	10 U	5 U	19	5 U	5 U			5 U
OW-1															
Cis 1,2-Dichloroethylene													10		5 U
Vinyl Chloride													6.8		2 U
OW-4															
Acetone													20 U		24

Notes:
Blank indicates well was not sampled.
ND - Compound not detected (Detection Limit Unknown).
U - Compound not detected using detection limit shown.
J - Approximate value, less than the quantitation limit for that analysis, but greater than zero.
NA - Compound was not analyzed for or was not detected.
* - Sampled in May, 1993.

TABLE 6-1 (page 1 of 3)
Groundwater Semi-Volatile Organic Compound Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Monitoring Well / Analyte	May-93	Jul-93	Nov-95	Mar-96	Jun-96	Sep-97	Apr-98	Jul-98	Oct-98	Dec-98	Jan-99	Apr-99
	Date											
MW-10												
2-Methylnaphthalene		4J 4J	11U	10U	11	18	3 J					
Dimethyl Phthalate						5 U	2.6 J					
Naphthalene		10 U 10 U	1.8U	2.3	2.3	5 U	5 U					
Nitrobenzene		10 U 10 U	2.1U	2U	62	8,700	5 U	*340*	*10 U*		*10 U*	*57*
MW-25												
2-Methylnaphthalene		39										
MW-26												
Naphthalene		12 17										
2-Methylnaphthalene		20 42										
Dibenzofuran		10 U 1J										
Flourine		10 U 1J										
Phenanthrene		10 U 1J										
Nitrobenzene		10 U 10U							*10 U*			*1,900*
MW-27												
4-Nitrophenol						20 U	10 J					
Aniline								2,100 JND		1,400		3,380
Azoxybenzene								140 JND		250 U		
Nitrobenzene	440J	5,200				2,800	1,900	540		2,800		6,500
Nitrosobenzene								87 JND				
Di-n-butyl phthalate	81J	27J				5 U	5 U					
MW-33												
2-Methylnaphthalene	2J	1J				10 U						
Di-n-butyl phthalate	1J	10 U				5 U						
Nitrobenzene	11 U	6J				5 U				14		*100*
Unknown TICs										1,248 J		
MW-49												
2-Methylnaphthalene		13		10U		100						
Phenanthrene		1J		5.6U		50 U						
1,2-Dichlorobenzene		10 U		2.4		50 U						
Nitrobenzene		10 U		8.6		50 U						
Naphthalene		10 U		1.9		50 U						
bis(2-Ethylhexyl)phthalate		10 U		10 U		370						
MW-54												
Naphthalene		20										
2-Methylnaphthalene		33										
Acenaphthalene		3J										
Phenanthrene		5J										
MW-57												
Naphthalene	18*	29										
2-Methylnaphthalene	15*	19										
Phenanthrene	10 U	1J										

TABLE 6-1 (page 2 of 3)
Groundwater Semi-Volatile Organic Compound Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

	Date												
Monitoring Well / Analyte	May-93	Jul-93	Nov-95	Mar-96	Jun-96		Sep-97	Apr-98	Jul-98	Oct-98	Dec-98	Jan-99	Apr-99
MW-67													
2-Methylnaphthalene		40		10U	11U		10 U				10U		
Acenaphthalene		1J		3.6U	2.1U		5 U				5.1U		
Flourine		2J		2U	2.1U		5 U				5.1U		
Phenanthrene		2J		5.6U	6U		5 U				5.1U		
bis(2-Ethylhexyl)phthalate		3J		10U	11U		5 U				5.1U		
Nitrobenzene		10 U		92.9	101		5 U	*10U*	*24*		5.1U		*10 U*
Cyclo-aliphatic TICs											78 JN		
Substituted Aromatic TICs											85 JN		
Unknown TICs											33JN		
MW-70													
Azobenzene													210
Azoxybenzene													470 JND
Aniline											790		6,300
4-Nitrophenol							210 U	15 J	20U		200U		
2-Methylnaphthalene		27J	10U	10U	10U	10 U	100 U	10 U	10U		100U		
Di-n-butyl phthalate		30J	15	10U	10U	10 U	52 U	5 U	5U		50U		
bis(2-Ethylhexyl)phthalate		8J	10U	10U	10U	10 U	100	1.4 J	5U		210		
Naphthalene		206 U	5.0	3.9	4.4	4.5	52 U	3.1 J	5U		50U		
Nitrobenzene		5,300	21,700	26,000	20,700	22,700	4,900	62,000	6,500		50U		8,400
Pentachlorophenol							210 U	3.6 J	20U		200U		
Cyclo-aliphatic TICs									54 JN		3,010 JND		
Substituted Aromatic TICs									245 JN				110 JND
Unknown hydrocarbon											13,940JD		
Unknown TICs									223J		14,610 JD		
MW-71													
bis(2-Ethylhexyl)phthalate							12				5U		
Cyclo-aliphatic TICs											7 JN		
Nitrobenzene			2U	153			5 U		*120*		22		*440*
Unknown TICS											262 J		
OW-1													
Aniline											130J		2,860
Nitrobenzene											2,900		290
Nitrosobenzene													57 JND

TABLE 6-1 (page 3 of 3)
Groundwater Semi-Volatile Organic Compound Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

	Date										
Monitoring Well / Analyte	May-93*	Jul-93	Nov-95	Mar-96	Jun-96	Sep-97	Apr-98	Jul-98	Oct-98	Dec-98	Jan-99	Apr-99
OW-3												
Aniline										990		5,100
Azobenzene												104
Azoxybenzene												150 JND
Cyclo-aliphatic TICs												48 JND
N-hydroxy-N-nitrobenzenamine												44 JND
Nitrobenzene										2,200		13,000
Substituted Aromatic TICs												82 JND
Unknown TICs												95 JD
OW-4												
Cyclo-aliphatic TICs										14 JN		28 JN
Nitrobenzene										16		5 U
Unknown TICs										50 J		375 J
OW-6												
Aniline										213		2,410
Azobenzene												60
Azoxybenzene												110 JND
Nitrobenzene										61		480
Nitrosobenzene												210 JND
Substituted aromatic TICs										190 JND		
Unknown TICs										399 JD		
OW-8												
Cyclo-aliphatic TICs										21 JN		
Nitrobenzene										10		*10 U*
Substituted aromatic TICs										52 JN		
Unknown TICs										100 J		

Notes:

Sampling occurred from July 7-14, October 7-13, December 28-29, 1998, January 28-29, 1999, and April 27 through May 10, 1999.

Analytical results for nitrobenzene shown in *Italics* are EPA 8260 analyses. All other analytical results are EPA 8270 analyses.

J - Approximate value, less than the quantitation limit for that analysis, but greater than zero.

U - Compound not detected using detection limit shown.

N - Spiked sample recovery not within control limits.

D - Spike diluted out.

Blank indicates well was not sampled, parameter was not analyzed for, or TICs not found.

A - This flag indicates that a TIC is a suspected aldol-condensation product.

- Original Analysis; Duplicate Anaylsis

* - Originally reported in Table 3-8B of ReTec's Draft Remedial Design Investigation Report (RDIR), dated October, 1993, as 18 ppb of 1,2,4,-trichlorobenzene, and 15 ppb of hexachlorobutadiene, which are each one text line above napthalene and 2-methylnapthalene, respectively, in Table 3-8B. Based on subsequent analyses, this is

TABLE 6-2
Swale Surface Water VOC Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Date / Analyte	Monitoring Point			
	SW-1*	SW-2	SW-3	OF-2
May-93				
Acetone	10UJ		12UJ	14.0
Benzene	10U		10U	10U
Toluene	1J		1J	10U
Ethylbenzene	4J		10U	10U
Xylene, Total	11.0		6J	2J
TOC	21.1		24.7	NA
Nov-95				
Benzene		1.6	2.5	
Toluene		6U	6U	
Ethylbenzene		7.2U	7.2U	
Xylene, Total		10U	10U	
Mar-96				
Benzene		4.4U	3.5	
Toluene		0.6	1.3	
Ethylbenzene		7.2U	5.2	
Xylenes, Total		3.6	7.2	
May-97				
Benzene	7.3	5U	5U	
Toluene	5U	5U	5U	
Ethylbenzene	9.0	6.8	5U	
Xylenes, Total	12.0	18.0	5U	
Apr-98				
Benzene	7.3	5.8	5U	
Toluene	5U	5.1	5U	
Ethylbenzene	12.0	10.0	5U	
Xylenes, Total	16.0	19.0	5U	
Apr-99				
Benzene	3.3	4.6	1U	
Toluene	5U	5U	5U	
Ethylbenzene	9.0	10.0	5U	
Xylenes, Total	5U	13.0	5U	

Notes
Blank indicates monitoring location was not sampled.
U - compound not detected at the MDL shown
J - Estimated value
ND - Not detected.
NA - Not analyzed for.
* - Samples collected in 1993 were from location SW-5, referenced in ReTec's October, 1993 Draft RDIR, which is analogous to location SW-1/SED-1 referenced in Figure 4-4 of the June, 1995 Sampling, Analysis and Monitoring Plan (SAMP).

TABLE 6-3
Swale Surface Water Metals Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Date / Analyte	Monitoring Point			
	SW-1*	SW-2	SW-3	OF-2
May-93				
Arsenic, Total	29.8		44.6	
Chromium, Total	4U		4U	
Lead, Total	1U		1.4	
Jul-93				
Arsenic, Total	24.5		7.5B	1U
Chromium, Total	4U		4U	4U
Lead, Total	1.1		3.7	2.0
Nov-95				
Arsenic, Total		23.0	53.0	
Chromium, Total		4.5	5.0	
Lead, Total		1.9	5U	
Arsenic, Dissolved		21.0	10.0	
Chromium, Dissolved		4.0	4.0	
Lead, Dissolved		5U	5U	
Mar-96				
Arsenic, Total		18.0	37.0	
Chromium, Total		3.9	4.3	
Lead, Total		5U	5U	
May-97				
Arsenic, Total	31.1	10.9	10U	
Chromium, Total	10U	10U	10U	
Arsenic, Dissolved	31.7	15.8	10U	
Chromium, Dissolved	10U	10U	10U	
Lead, Dissolved	5U	5U	5U	
Apr-98				
Arsenic, Total	25.5	16.6	10U	
Chromium, Total	10U	10U	10U	
Lead, Total	5U	5U	5U	
Apr-99				
Arsenic, Total	17.0	14.6	10U	
Chromium, Total	NA	NA	NA	
Lead, Total	NA	NA	NA	

Notes:

Blank indicates monitoring location was not sampled.

U - compound not detected at the MDL shown

B - Compound detected in laboratory blank

NA - analyte not analyzed for

* - Samples collected in 1993 were from location SW-5, referenced in ReTec's October, 1993 Draft RDIR, which is analogous to location SW-1/SED-1 referenced in Figure 4-4 of the June, 1995 Sampling, Analysis and Monitoring Plan (SAMP).

TABLE 6-4
Swale Sediment VOC Concentrations (ug/Kg)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Date / Analyte	Monitoring Point		
	SED-1	SED-2	SED-3
Nov-95			
Acetone		624.0	125.0
Toluene		33.1	21U
Xylenes, Total		63U	10.0
Mar-96			
Acetone		1710.0	1060.0
2-Butanone (MEK)		457.0	158.0
Toluene		7.5	40U
May-97			
Acetone	47U	78U	190.0
2-Butanone (MEK)	23U	39U	57.0
Xylenes, Total	19.0	20U	20U
Apr-98			
Acetone	94U	950.0	170U
Benzene	34.0	34U	42U
Apr-99			
Acetone	130U	78U	210.0
Methylene Chloride	40.0	20U	14U

Notes:
Blank indicates location not sampled
U = compound not detected at the MDL shown
J = estimated value

TABLE 6-5
Swale Sediment Metals Concentrations (mg/Kg)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Date/Analyte	Monitoring Point		
	SED-1	SED-2	SED-3
Nov-95			
Arsenic, Total		270	714
Chromium, Total		13	7
Lead, Total		17	14
Mar-96			
Arsenic, Total		420	620
Chromium, Total		16	5
Lead, Total		29	17
May-97			
Arsenic, Total	468	332	78.5
Chromium, Total	6.7	7	15.5
Lead, Total	15.5	20	47.8
Apr-98			
Arsenic, Total	440	504	162
Chromium, Total	4.69U	6.80U	13.8
Lead, Total	24.6	31.1	51.4
Apr-99			
Arsenic, Total	450	271	24.6
Chromium, Total	NA	NA	NA
Iron, Total	11.6	12.6	2.64
Lead, Total	NA	NA	NA

Notes:
Blank indicates location not sampled
U = compound not detected at the MDL shown
J = estimated value
NA - analyte not analyzed for

[redacted]

TABLE 7-1

SUMMARY OF REMEDIAL PROGRESS

PHASE I COMPLETION REPORT
FORMER SINCLAIR REFINERY SUPERFIND SITE (OU2), WELLSVILLE, NY

System/Area	Operability	VOC Mass Removal: Total Est. (lbs.)	VOC Mass Removal: Initial Rates (range in lbs./month)	VOC Mass Removal: Current Rates (range in lbs./mo. between 1/99 and 6/99)	Changes in Groundwater Contaminant Concentrations: BTEX	Changes in Groundwater Contaminant Concentrations: CVOCs	Changes in Groundwater Contaminant Concentrations: Arsenic	Maximum Contaminant Concentrations Relative to MCLs	Evidence for Achieving ARARs
National Fuels AS/SVE	Poor. Impacted by very shallow water table and low permeability vadose zone. Decommissioned in July 1997.	6	NA	NA	BTEX concentrations not impacted by AS/SVE operation. Concentrations appear stable and illustrate significant natural attenuation.	NA	There has been no significant overall change in groundwater total arsenic concentrations at the Site. Arsenic remains approximately 2x to 4x above MCLs across much of the Site.	Xylenes remain nearly 1,000x greater than MCLs.	None
Central AS/SVE	Good. Thick vadose zone and small seasonal water table fluctuations. Operation of upgradient AS wells discontinued.	26,900	1,000 to 8,000	3 to 49 (Asymptotic). Minimal amounts of recoverable VOCs remain.	BTEX decreased to asymptotic levels on periphery as a result of AS/SVE operation and natural attenuation. Little or no change in center of plume.			BTEX compounds are near MCLs on perimeter of area. Benzene over 100x greater than MCLs in center of area.	None
Southern AS/SVE	Fair. Vadose zone thickness fluctuates significantly on a seasonal basis.	62,500	2,000 to 12,000	4 to 472 (Asymptotic). Most of the year, VOC recovery is minimal because VOCs are submerged.	Large BTEX decreases within main portion of AS/SVE area and gradual decreases on perimeter of area resulting from AS/SVE operation and natural attenuation. BTEX concentrations within AS/SVE area are at asymptotic levels.			Xylenes remain over 100x greater than MCLs in center of plume area.	None
Northern GW Extraction & Treatment	Good. Operability controlled primarily by mechanical performance.	Approx. 180 to 280	5 to 9	0.2 to 5.6 (Rates dropped in mid-1998 after Expansion area AS system started).	Large BTEX decreases throughout Northern area due to AS/SVE, natural attenuation, and dilution by pumping.	CVOC concentrations have risen and fallen on an erratic basis over the past several years. Current CVOC concentrations are at or near the lowest levels yet observed. No basis for evaluating remedial progress for CVOCs.		Benzene remains over 100x greater than MCLs. CVOCs are up to 30x greater than MCLs	None
Northern Expansion AS/SVE	Good. Thick vadose zone and small seasonal water table fluctuations.	35,000	1,000 to 3,000	40 to 1,861 (levels near initial rates still achievable).					None

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS

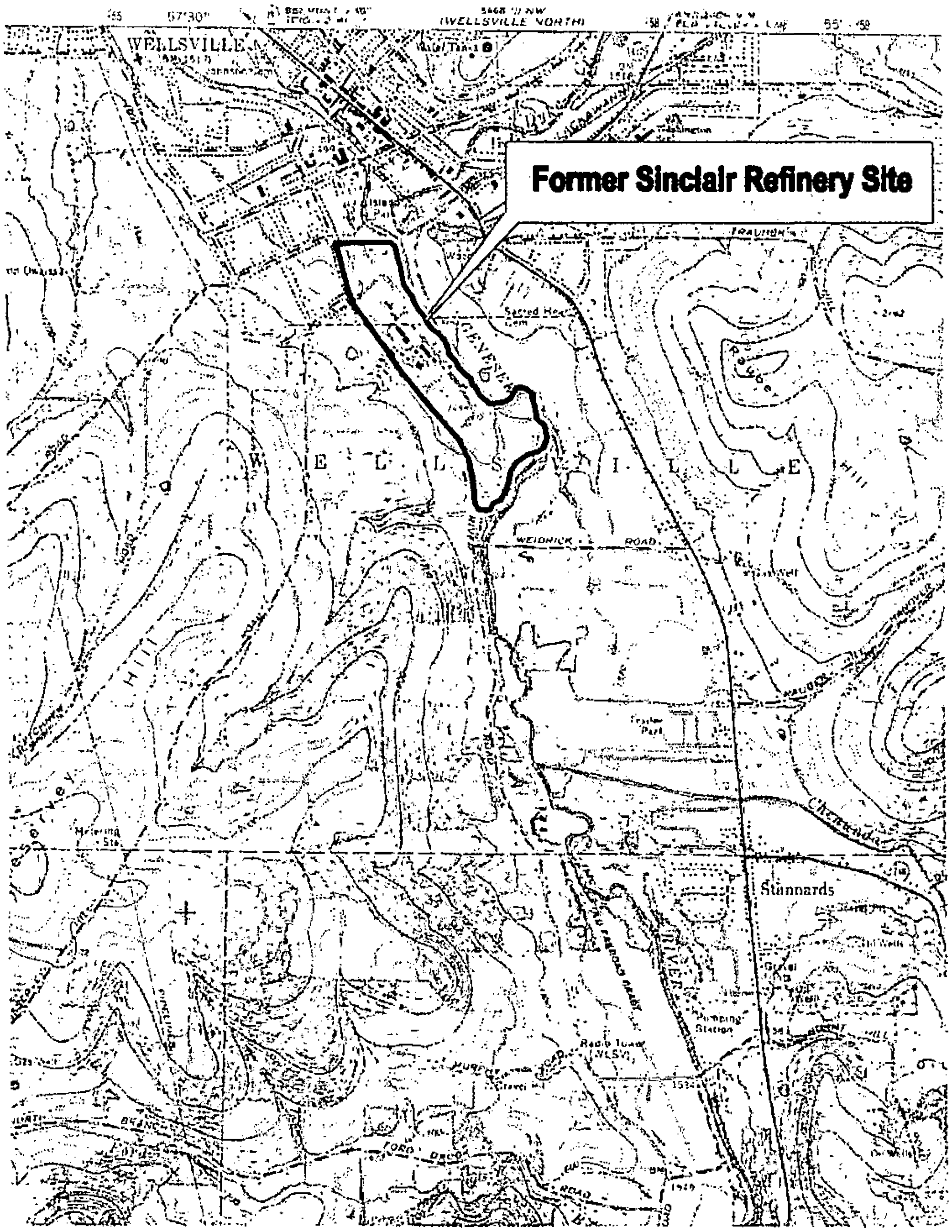

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FIGURE 1-1
SITE LOCATION MAP

FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK
SITE LOCATION.DWG

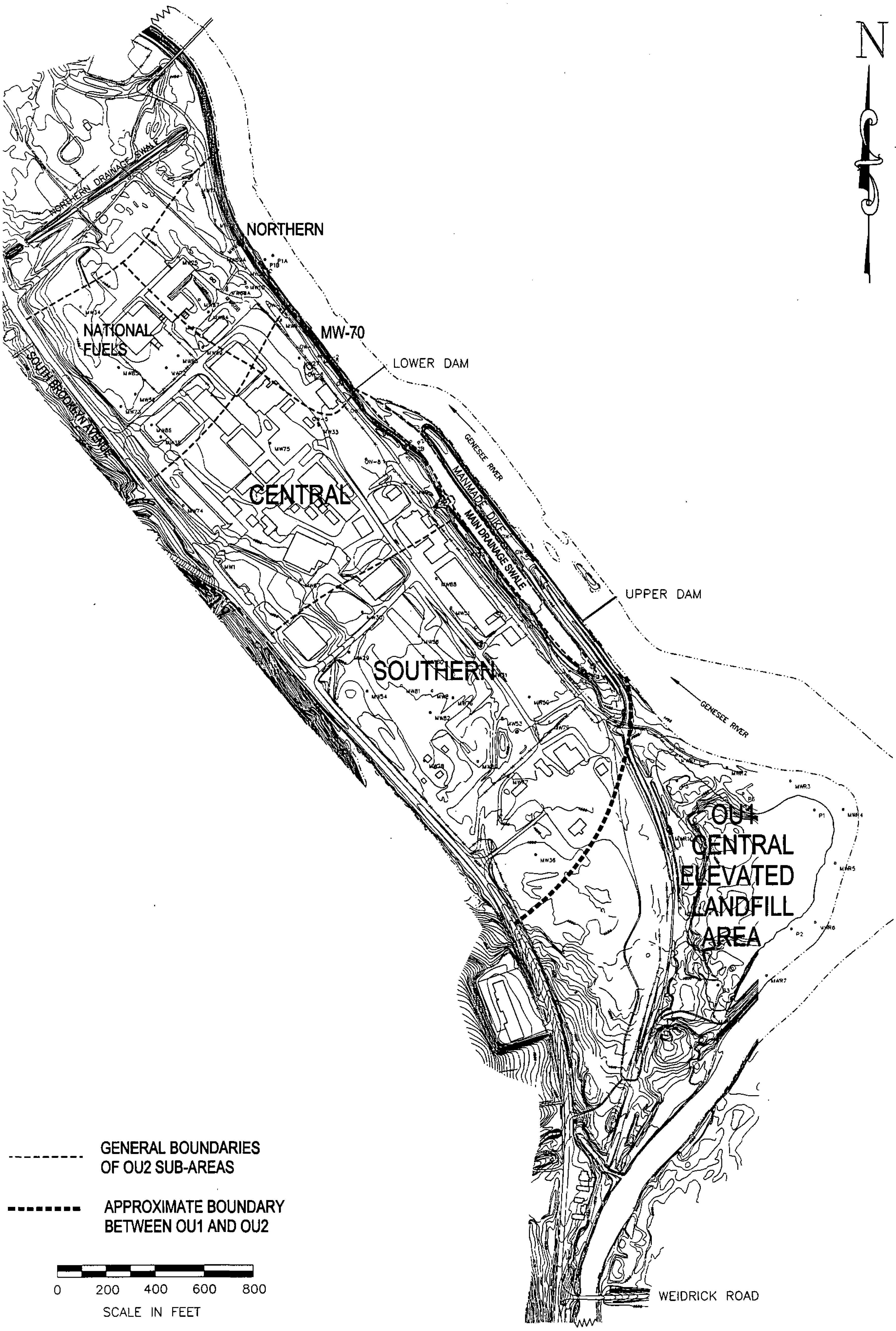

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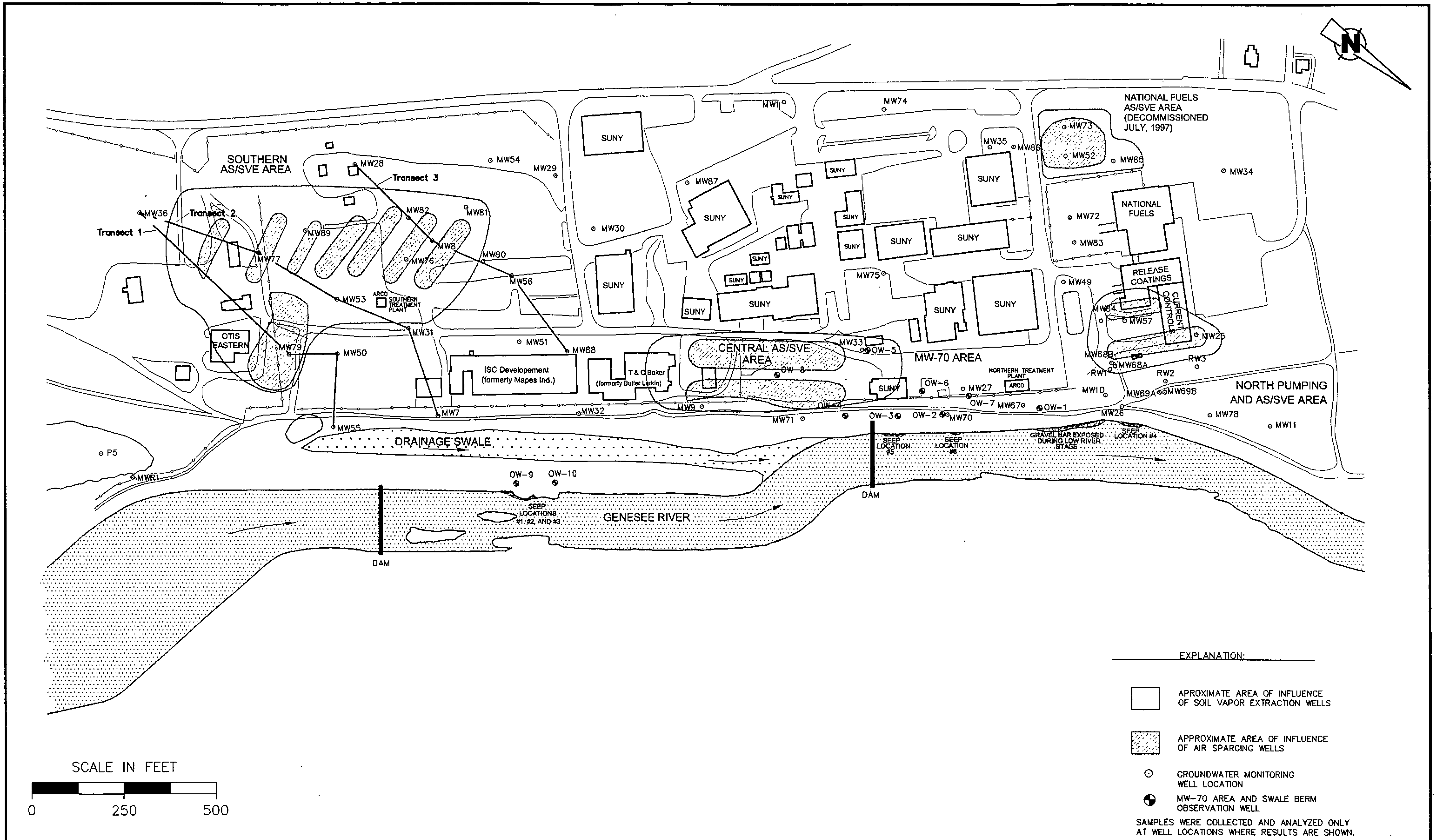
FIGURE 2-1
SITE TOPOGRAPHY AND NOMENCLATURE

FORMER SINCLAIR REFINERY SITE, WELLSVILLE, NY
PHASE I BASEMAP.DWG



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NEW SOLUTIONS TO HAZARDOUS WASTE PROBLEMS

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FIGURE 3-1
SITE PLAN AND
GROUNDWATER REMEDIATION SYSTEM LAYOUT

FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK
arcoPh1.dwg

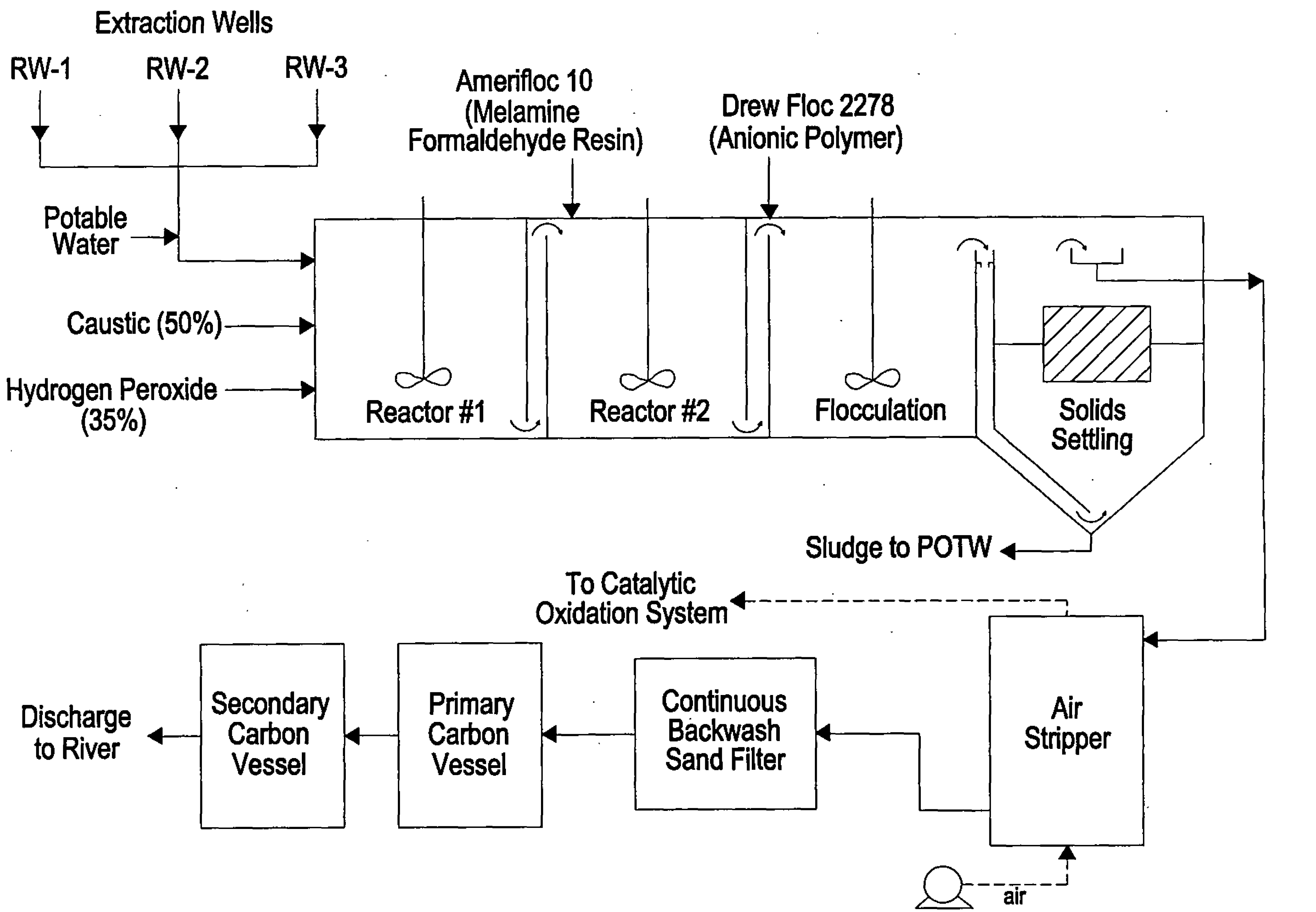

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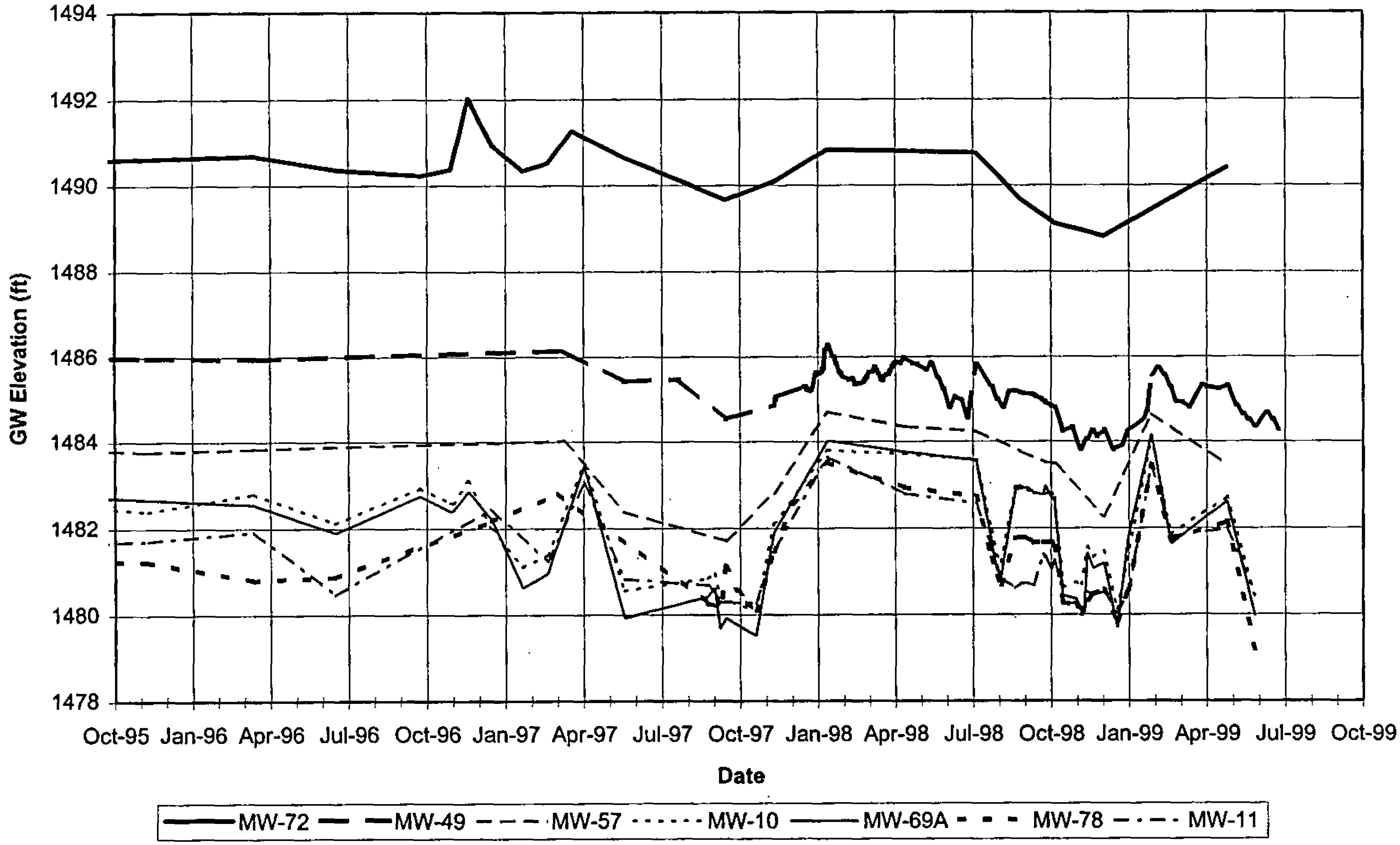
FIGURE 3 - 2

GROUNDWATER TREATMENT SYSTEM - PROCESS DIAGRAM

FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK

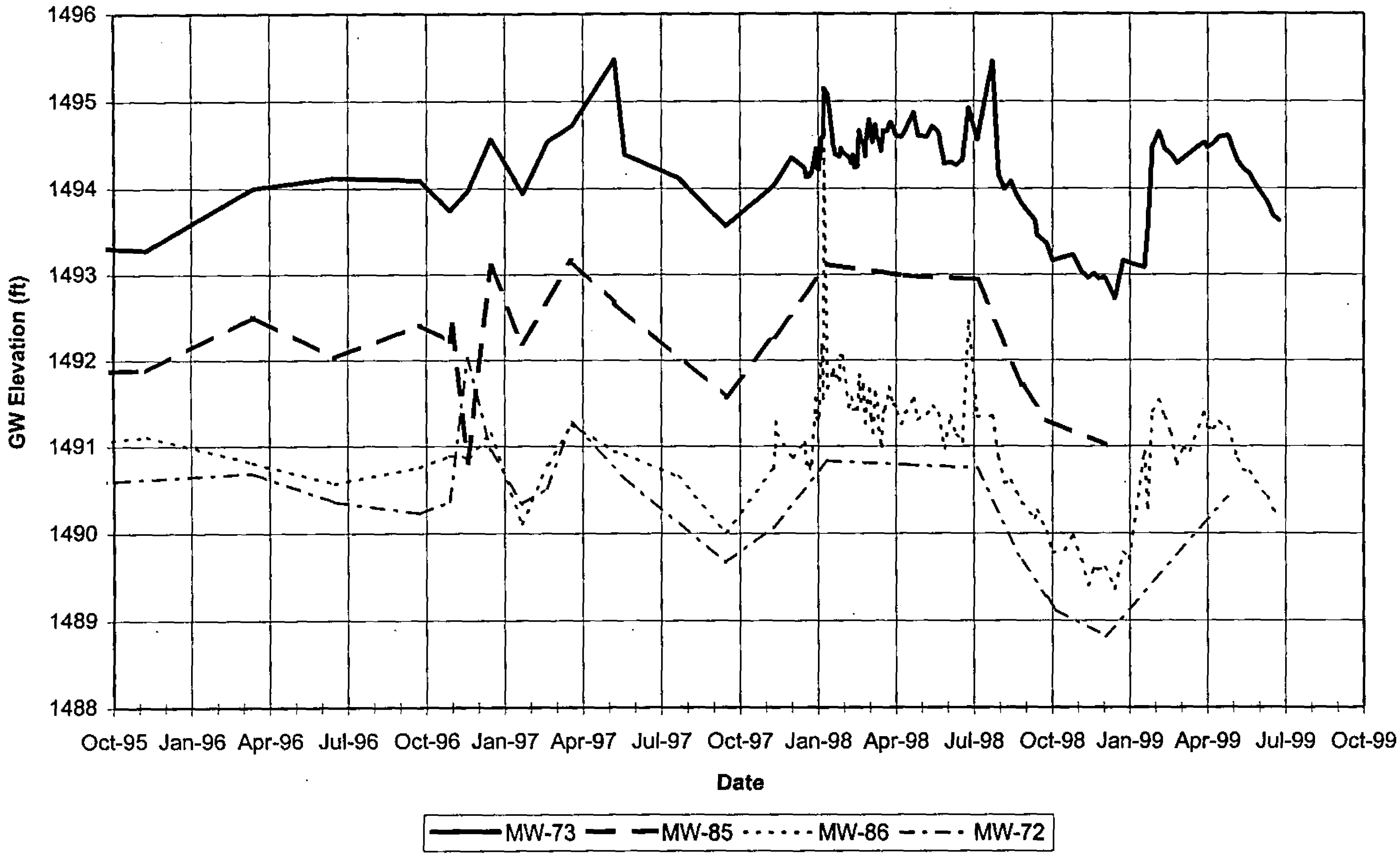
GW System Layout.dwg

FIGURE 4-1
Northern Pumping and AS/SVE Area
Groundwater Elevations



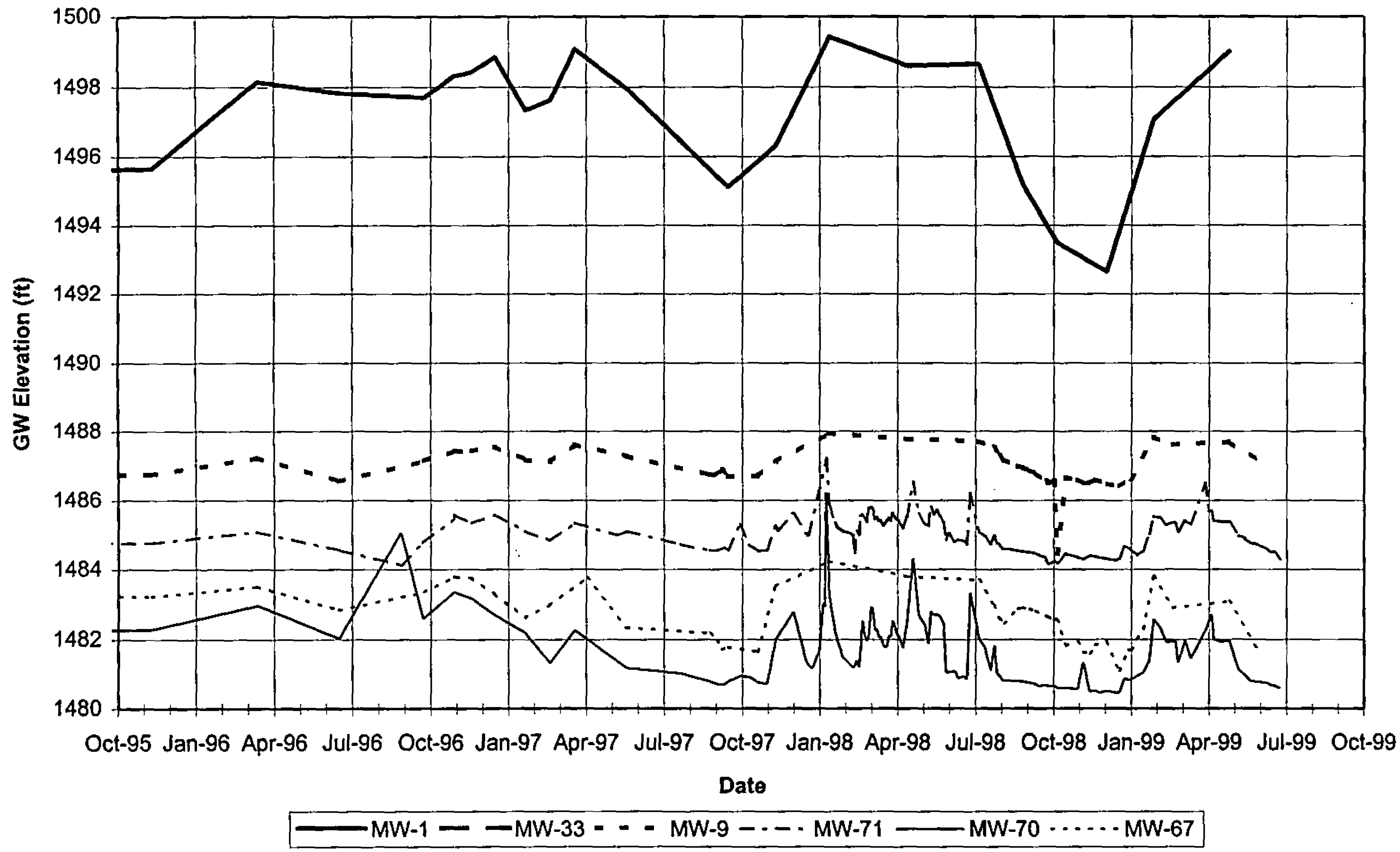
gwelev.xls

FIGURE 4-2
National Fuels Area
Groundwater Elevations



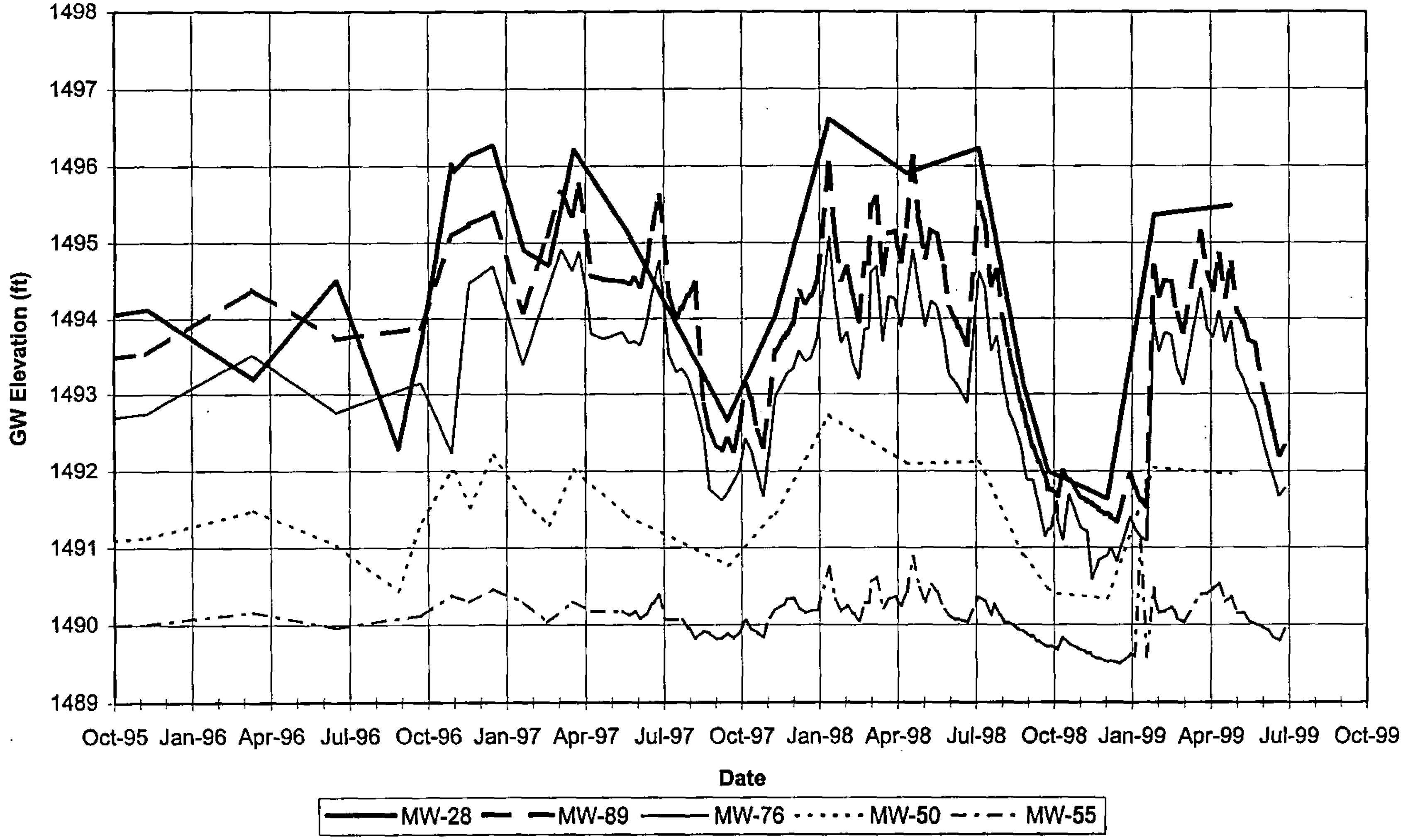
gwelev.xls

FIGURE 4-3
Central AS/SVE Area
Groundwater Elevations



gwelev.xls

FIGURE 4-4
Southern AS/SVE Area
Groundwater Elevations



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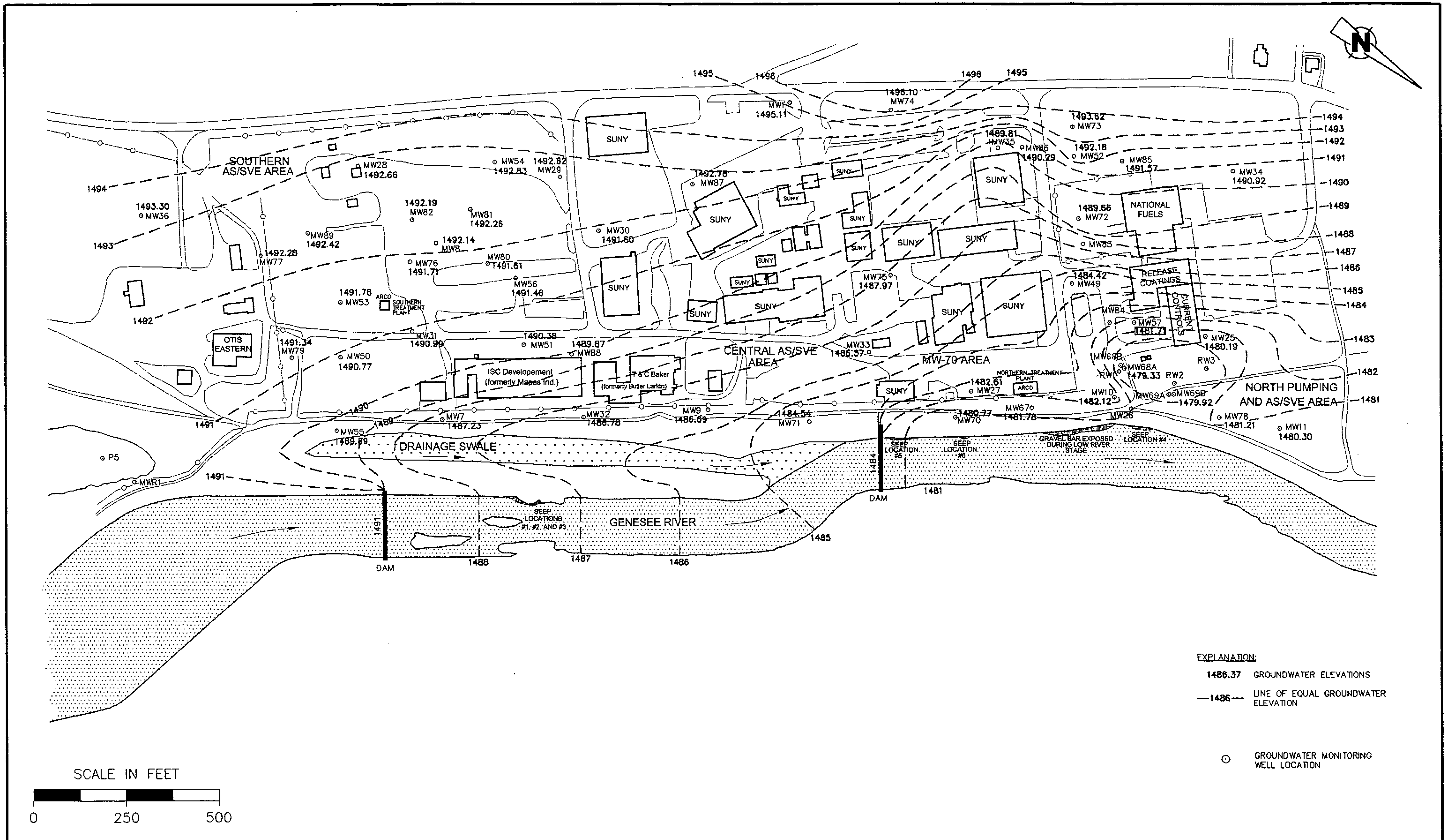

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FIGURE 4-5
GROUNDWATER ELEVATION CONTOURS
SEPTEMBER 15, 1997

FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK
GW Contours.dwg

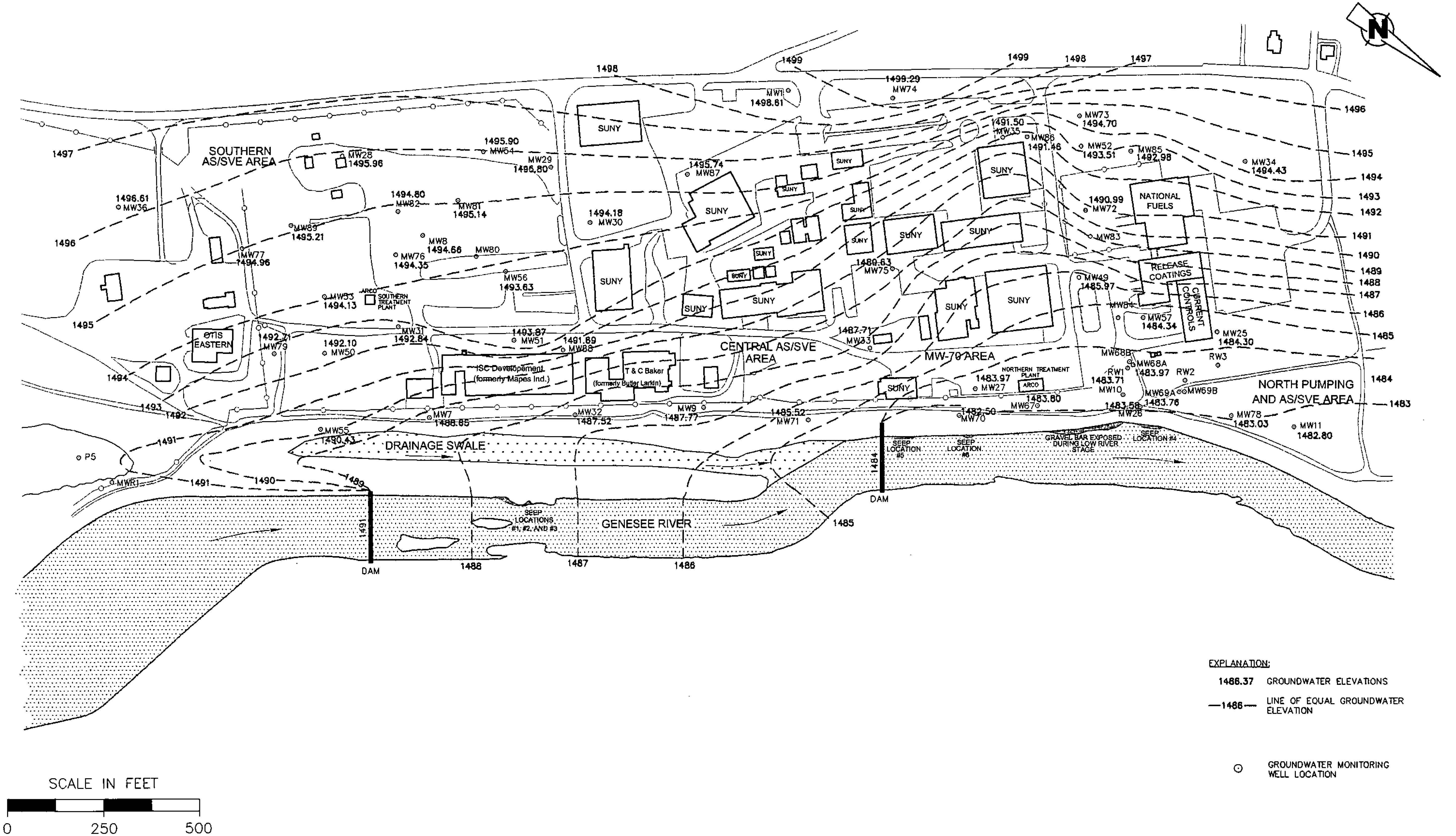

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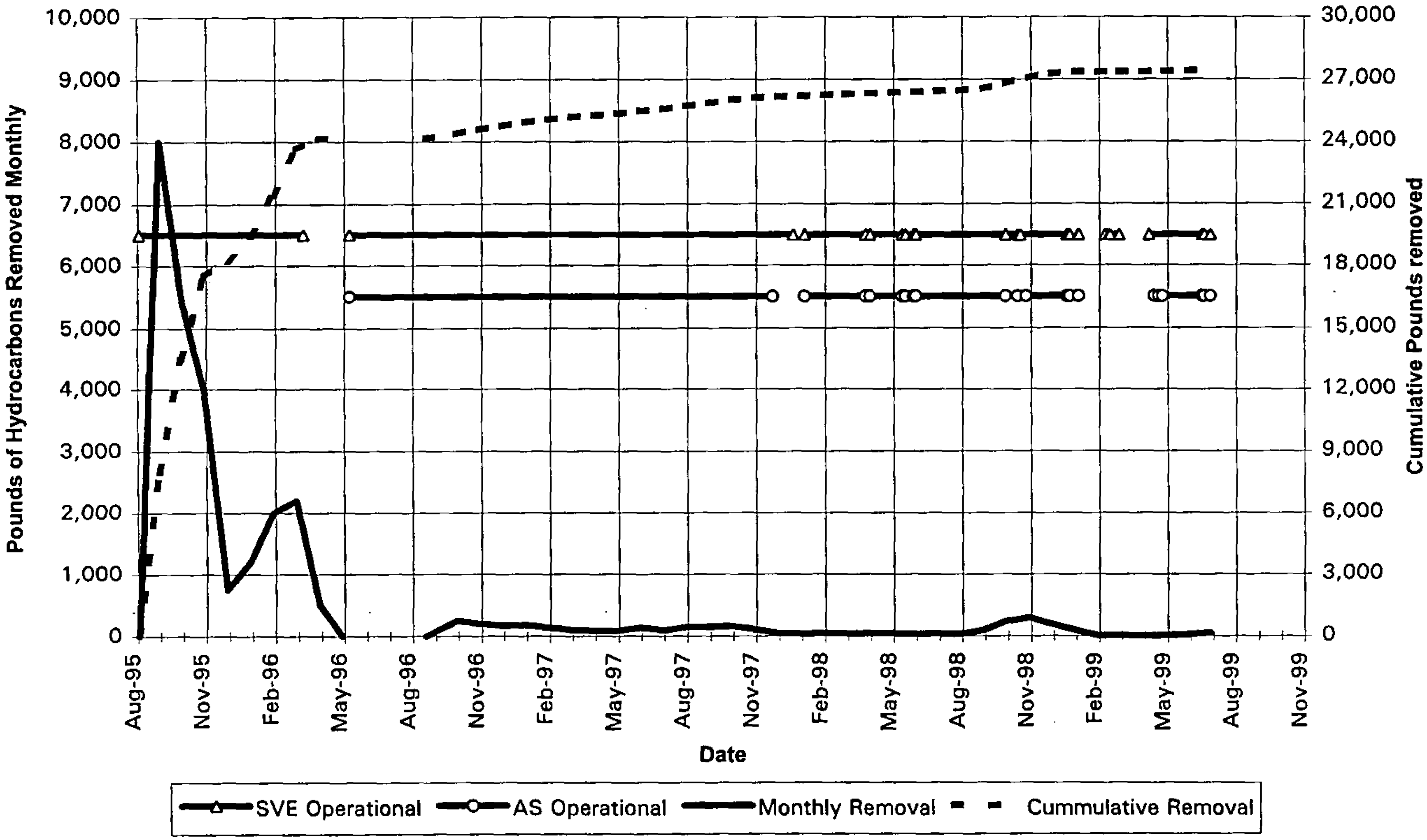
FIGURE 4-6
GROUNDWATER ELEVATION CONTOURS
APRIL 13, 1998

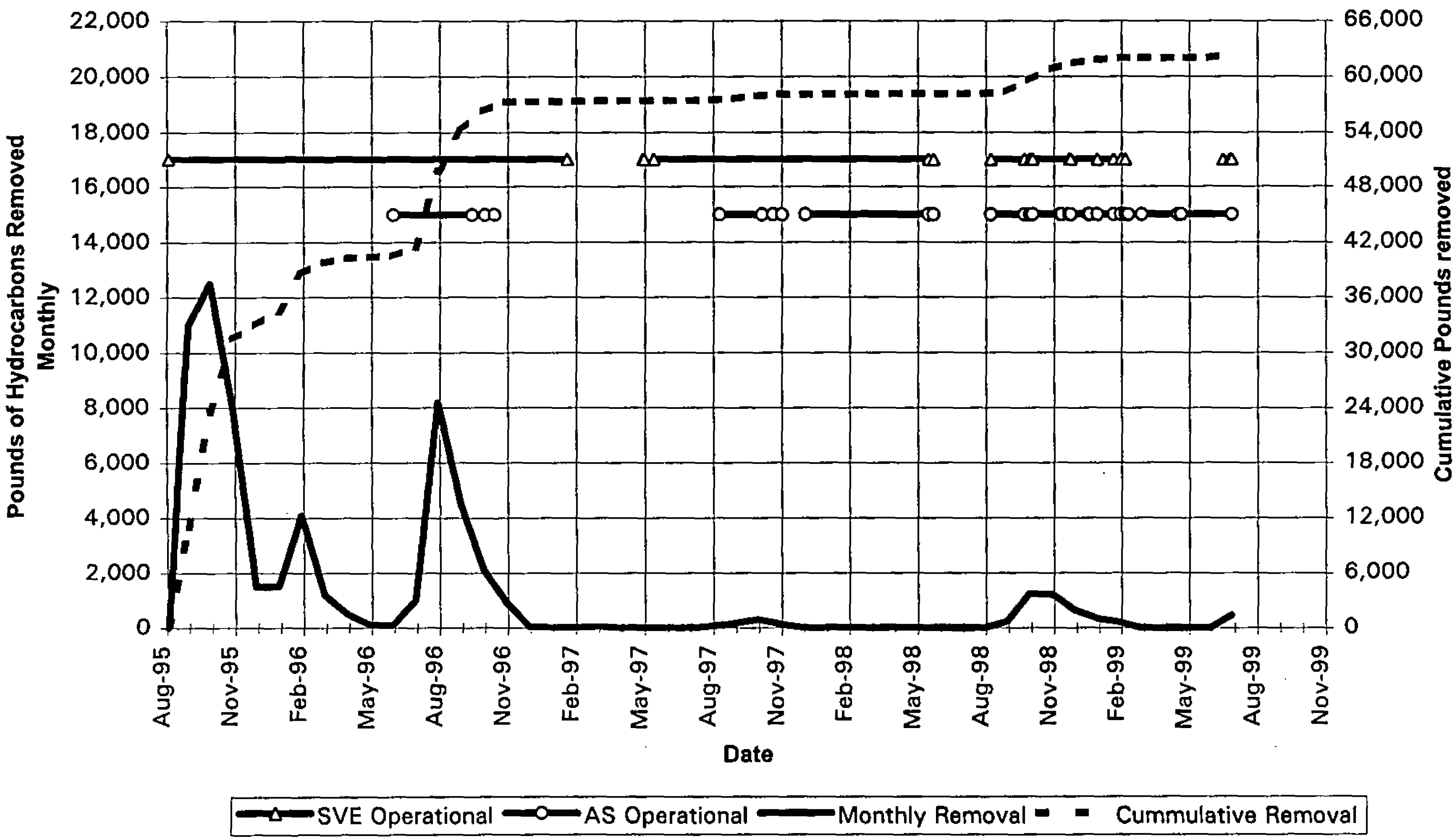
FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK
GW Contours.dwg

Figure 5-1
Central Area AS/SVE System
Hydrocarbon Removal and Operability Summary



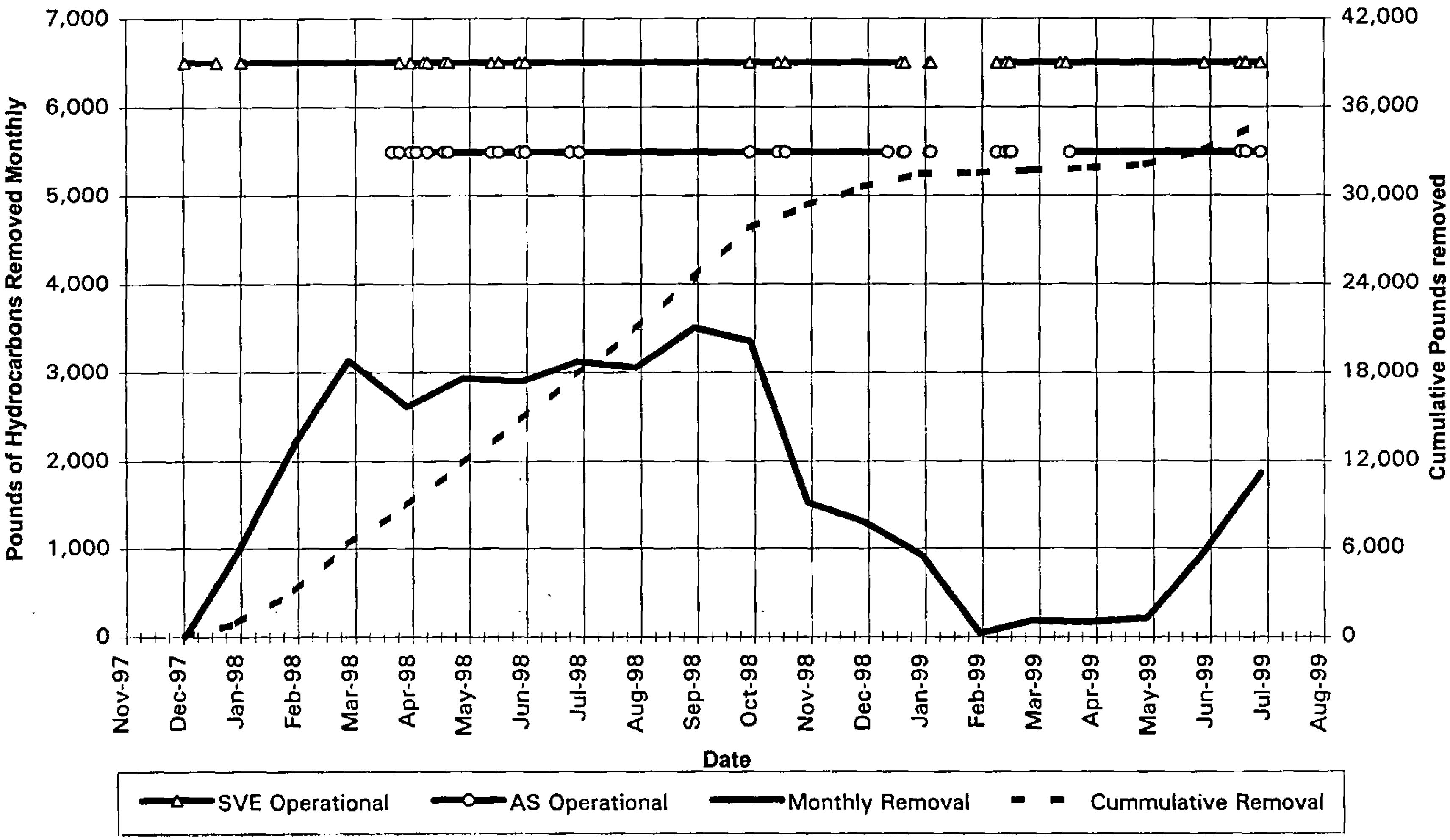
SysFlow.xls

Figure 5-2
Southern Area AS/SVE System
Hydrocarbon Removal and Operability Summary



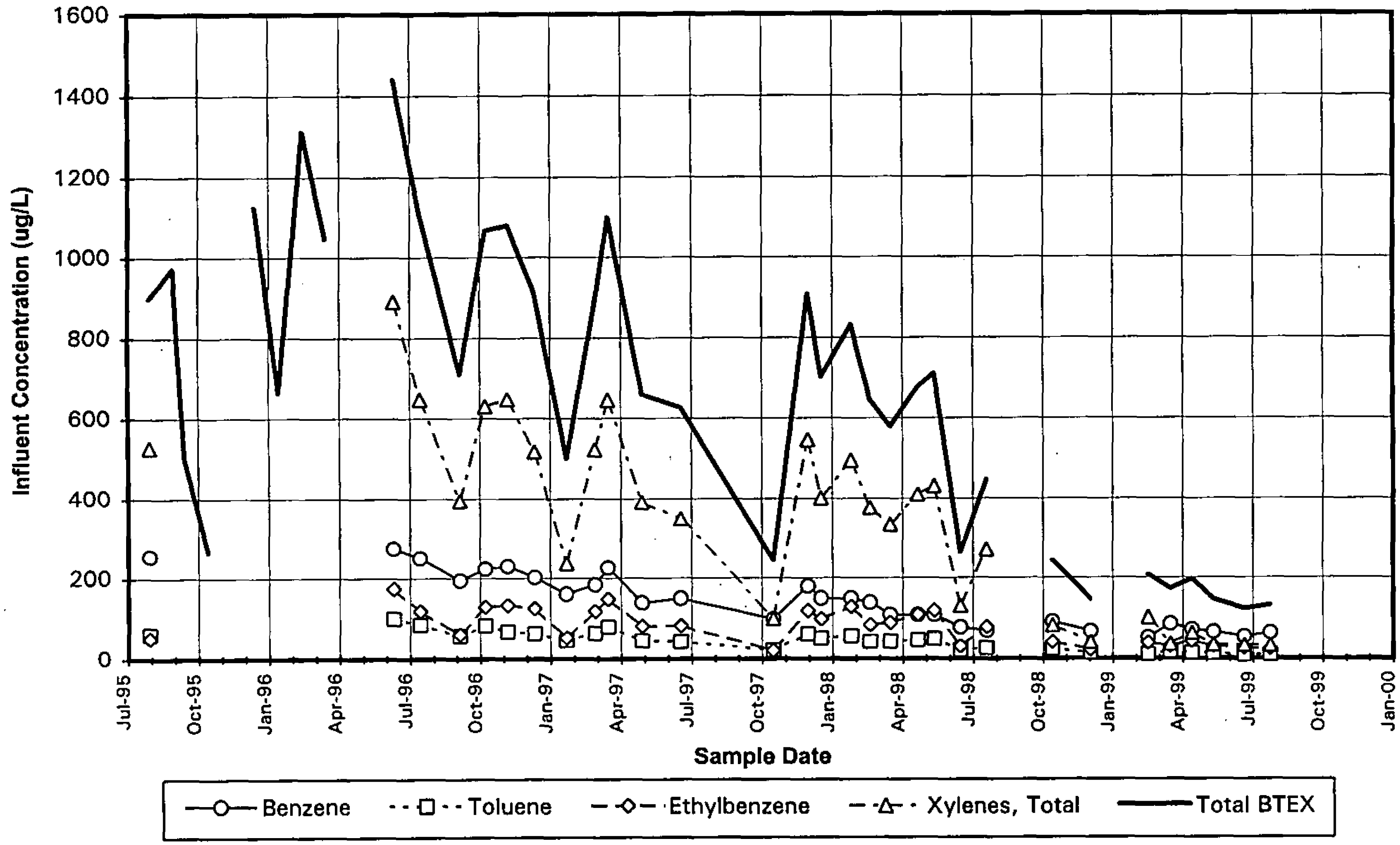
SysFlow.xls

Figure 5-3
Expansion Area AS/SVE System
Hydrocarbon Removal and Operability Summary



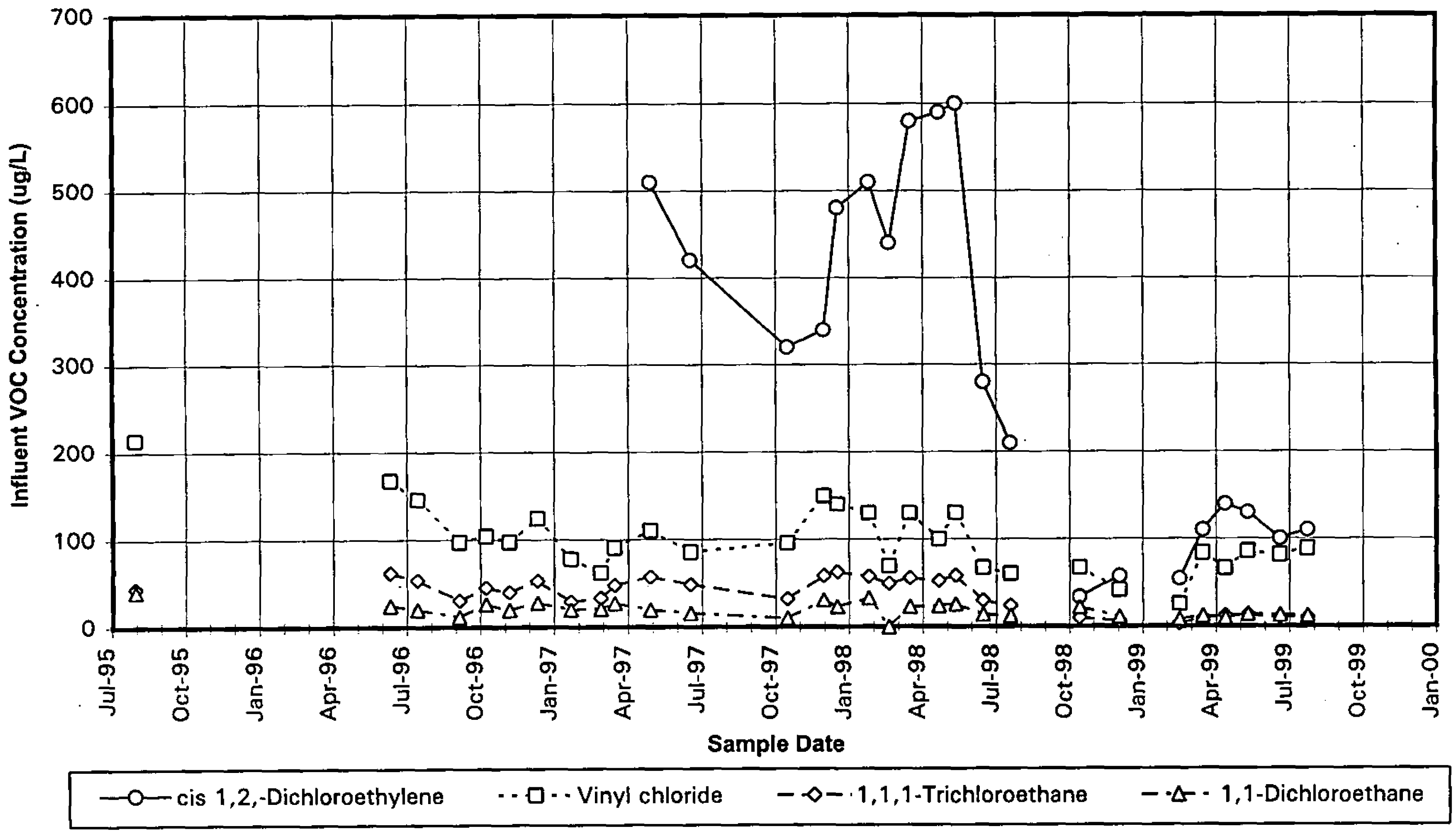
SysFlow.xls

FIGURE 5-4
Total BTEX Concentrations in Groundwater Extraction System Influent



cmp-figures Ph I Rpt.xls

FIGURE 5-5
Chlorinated VOC Concentrations in Groundwater Extraction System Influent



cmp-figures Ph I Rpt.xls

FIGURE 5-6
Metals Concentrations in Groundwater Extraction System Influent

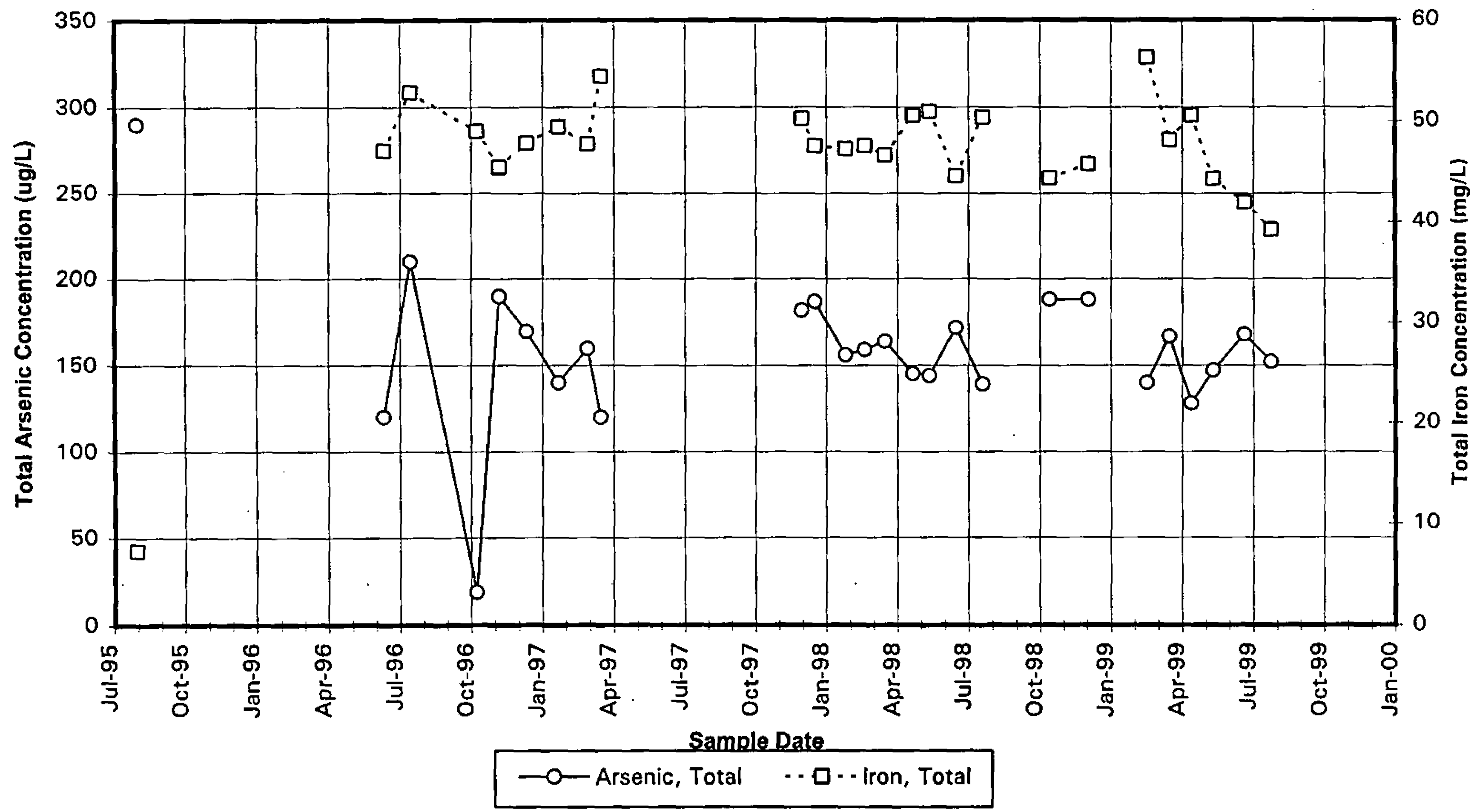
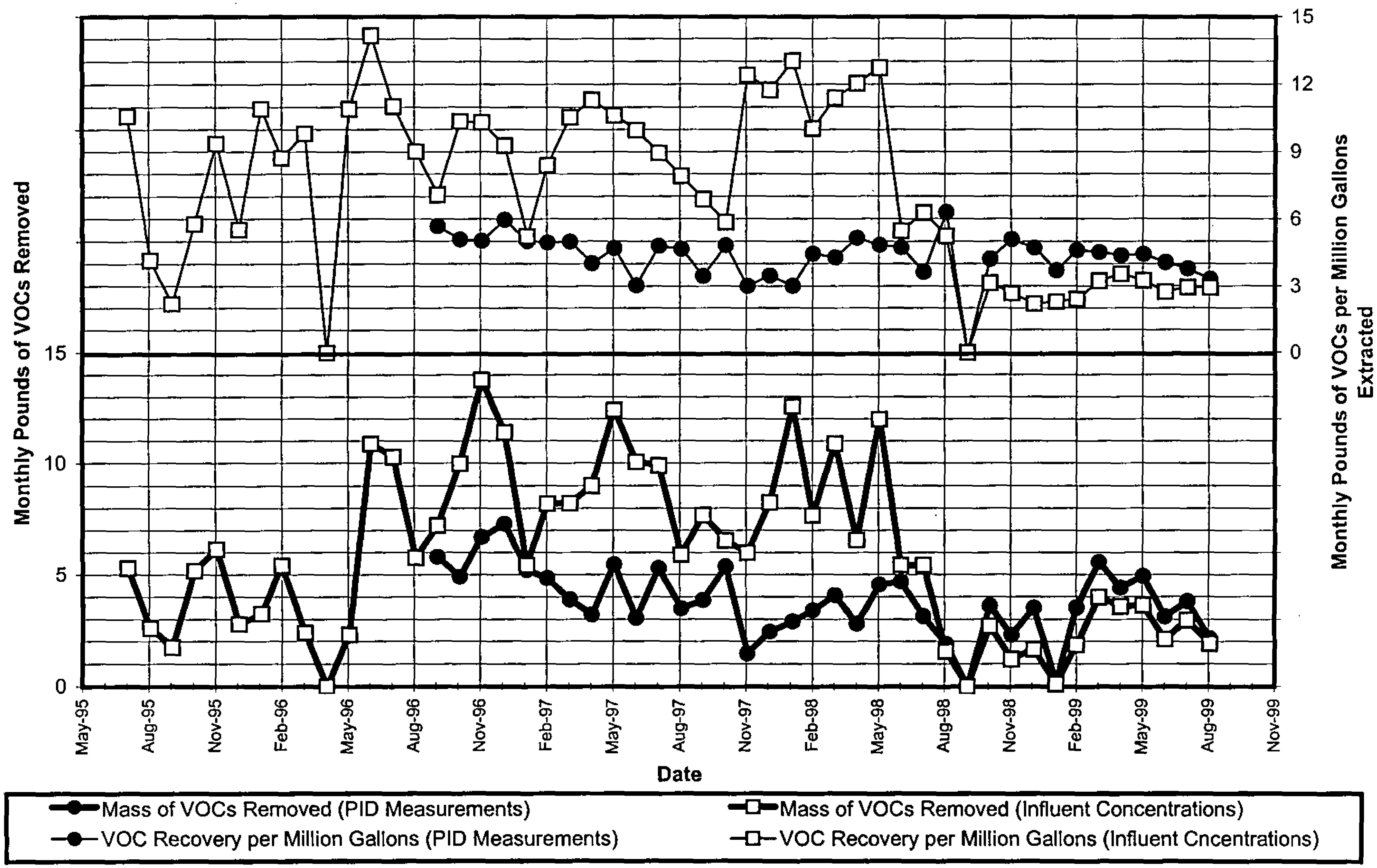


FIGURE 5-7

Summary of Groundwater Extraction System Performance



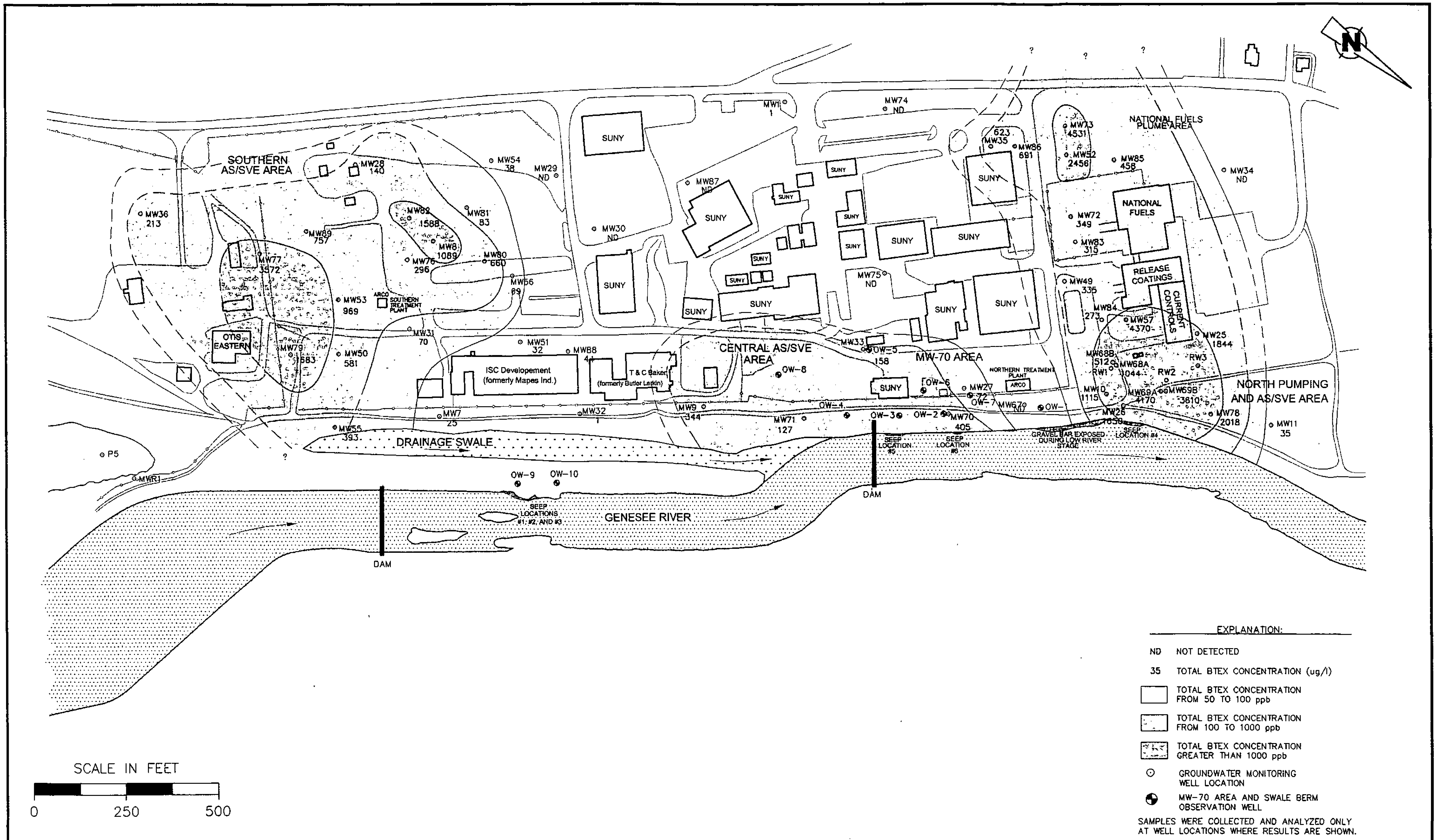


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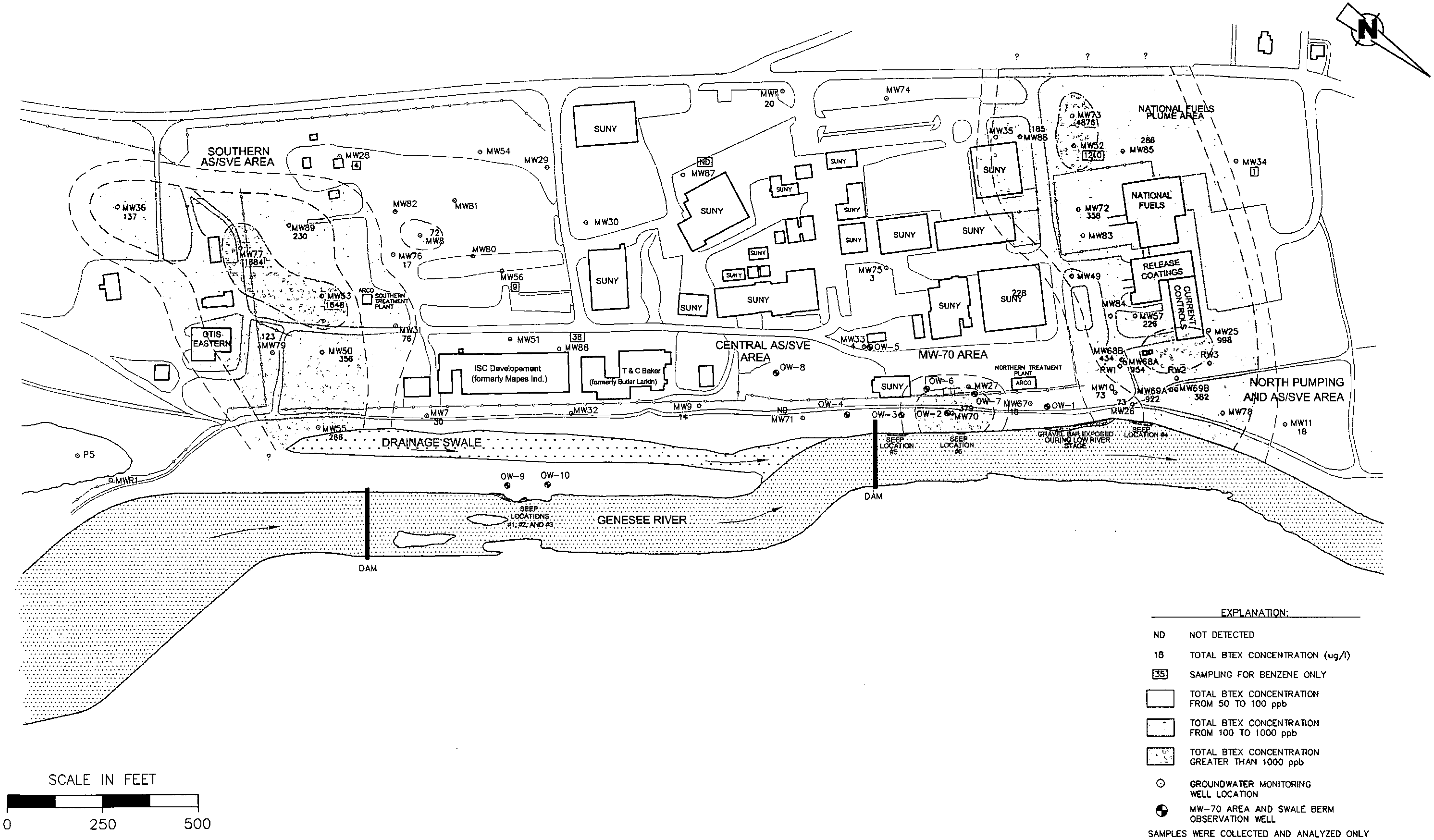
FIGURE 5-8
GROUNDWATER TOTAL BTEX CONCENTRATION CONTOURS - JULY 1993

FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK
arcoPh1.dwg



EXPLANATION:

ND	NOT DETECTED
18	TOTAL BTEX CONCENTRATION (ug/l)
$\boxed{35}$	SAMPLING FOR BENZENE ONLY
	TOTAL BTEX CONCENTRATION FROM 50 TO 100 ppb
	TOTAL BTEX CONCENTRATION FROM 100 TO 1000 ppb
	TOTAL BTEX CONCENTRATION GREATER THAN 1000 ppb
	GROUNDWATER MONITORING WELL LOCATION
	MW-70 AREA AND SWALE BERM OBSERVATION WELL

SAMPLES WERE COLLECTED AND ANALYZED ONLY AT WELL LOCATIONS WHERE RESULTS ARE SHOWN.

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FIGURE 5-9
GROUNDWATER TOTAL BTEX CONCENTRATION CONTOURS - MARCH 1997

FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK
arcoPh1.dwg

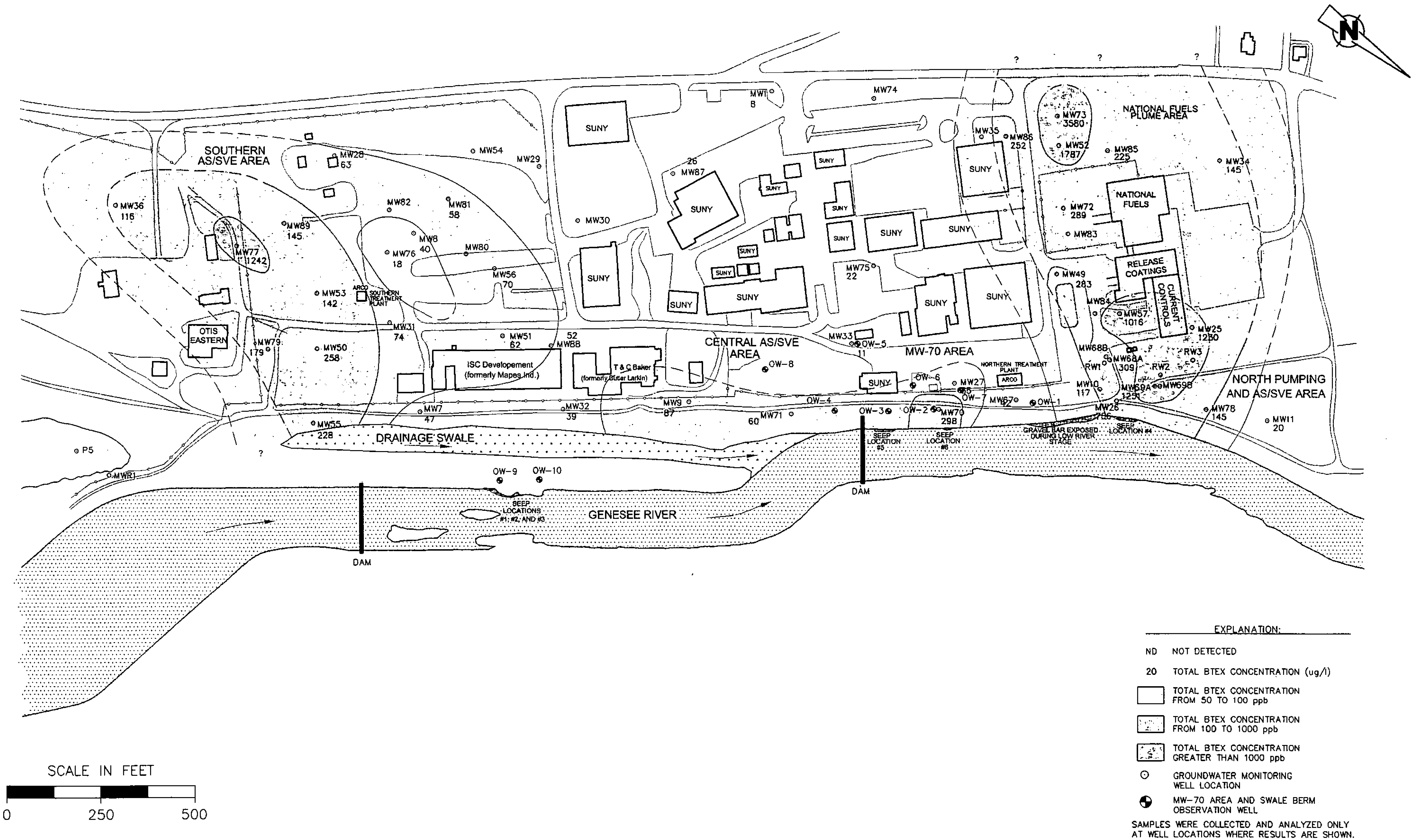

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FIGURE 5-10
GROUNDWATER TOTAL BTEX CONCENTRATION CONTOURS - APRIL 1998
FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK
arcoPh1.dwg

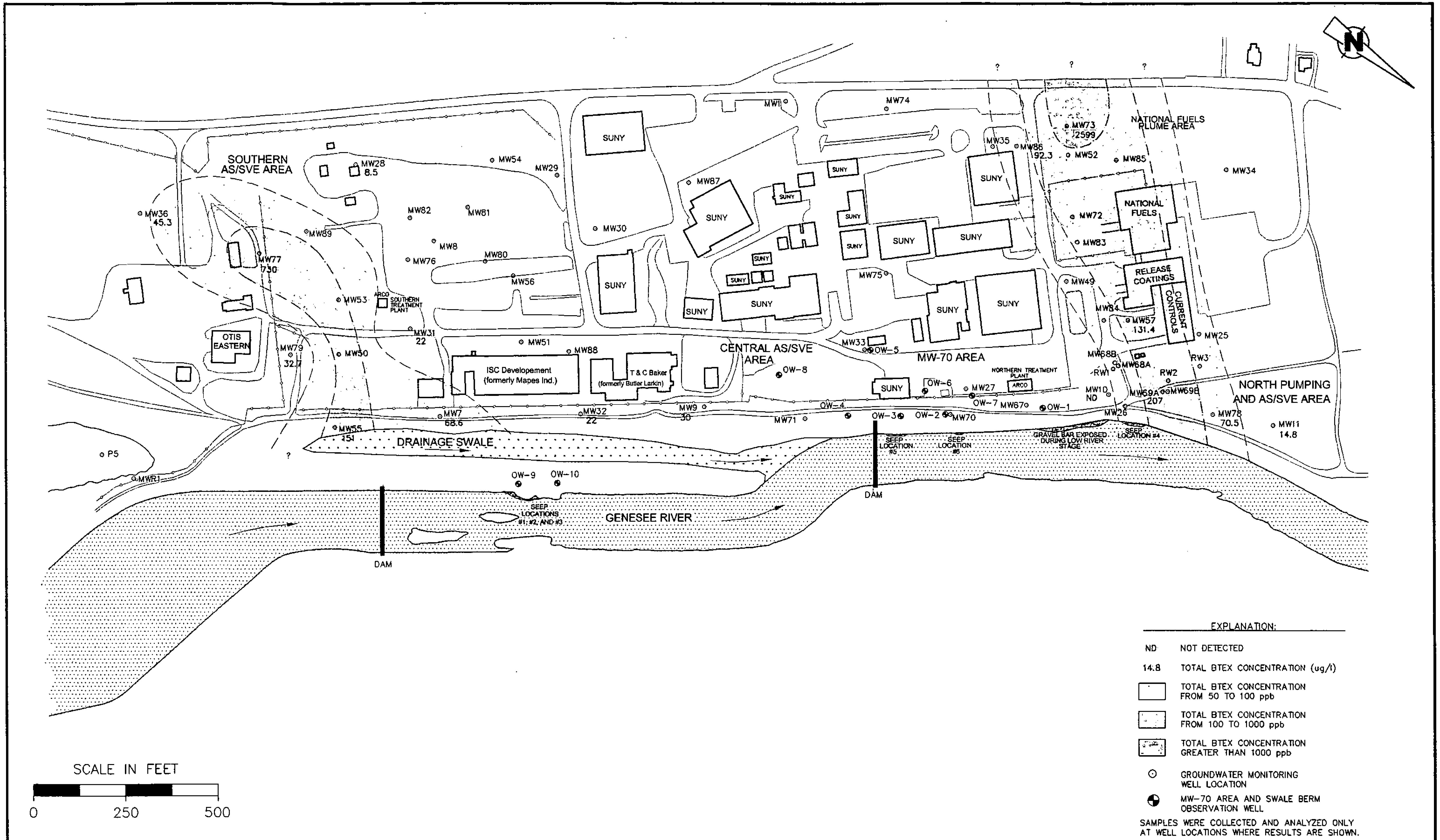

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FIGURE 5-11
GROUNDWATER TOTAL BTEX CONCENTRATION CONTOURS - JANUARY 28-29, 1999

FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK
arcoPh1.dwg

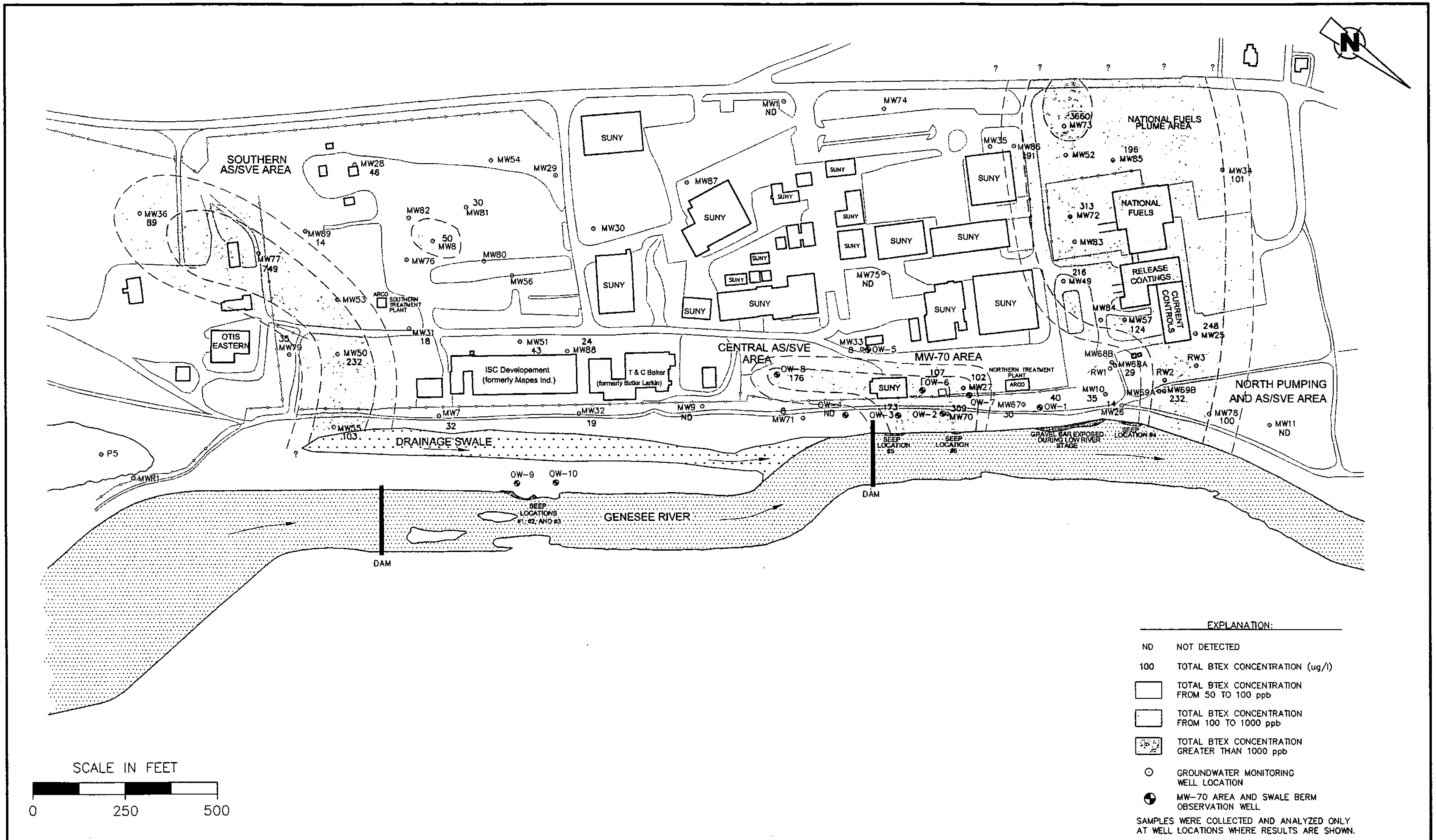

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FIGURE 5-12
GROUNDWATER TOTAL BTEX CONCENTRATION CONTOURS - APRIL 27-MAY 10, 1999

FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK
arcoPh1.dwg

FIGURE 5-13
NATIONAL FUELS AREA, GROUNDWATER BTEX CONCENTRATIONS

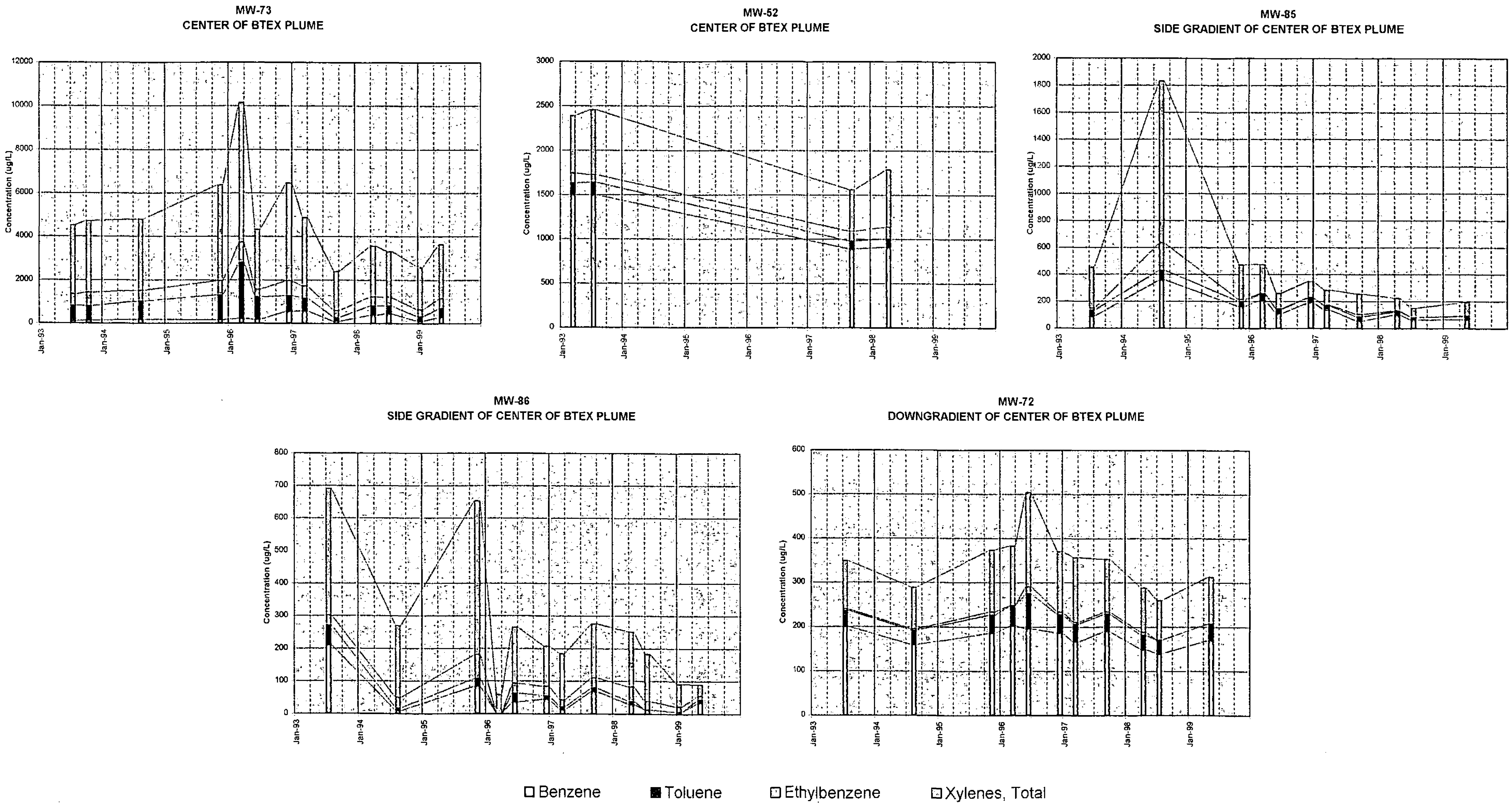


FIGURE 5-13

btex plots - n c.xls

FIGURE 5-14
CENTRAL AS/SVE AREA and MW-70 AREA, GROUNDWATER BTEX CONCENTRATIONS

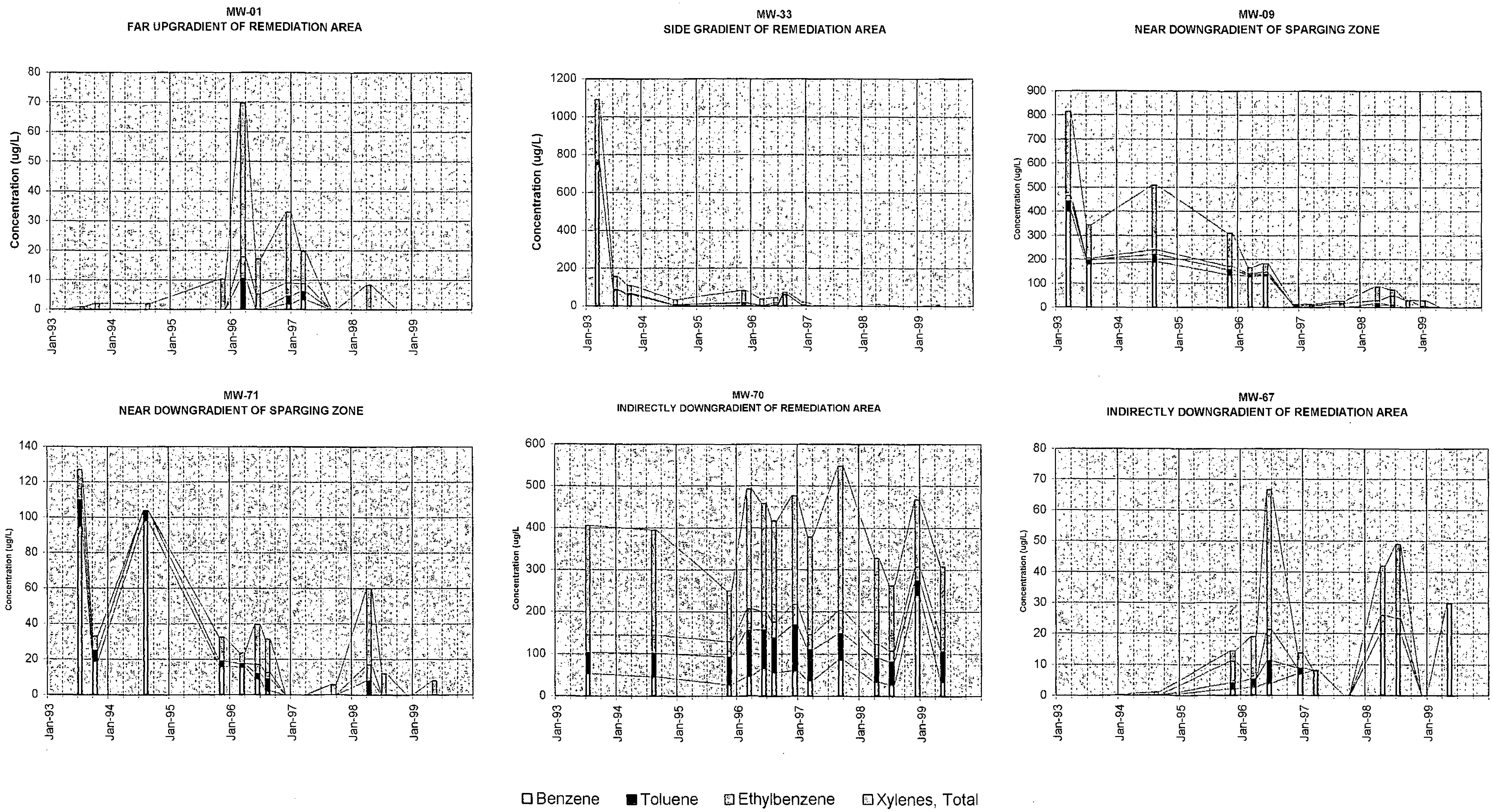


FIGURE 5-14

btex plots - n c.xls

FIGURE 5-15
SOUTHERN AS/SVE AREA - TRANSECT 1
GROUNDWATER BTEX CONCENTRATIONS

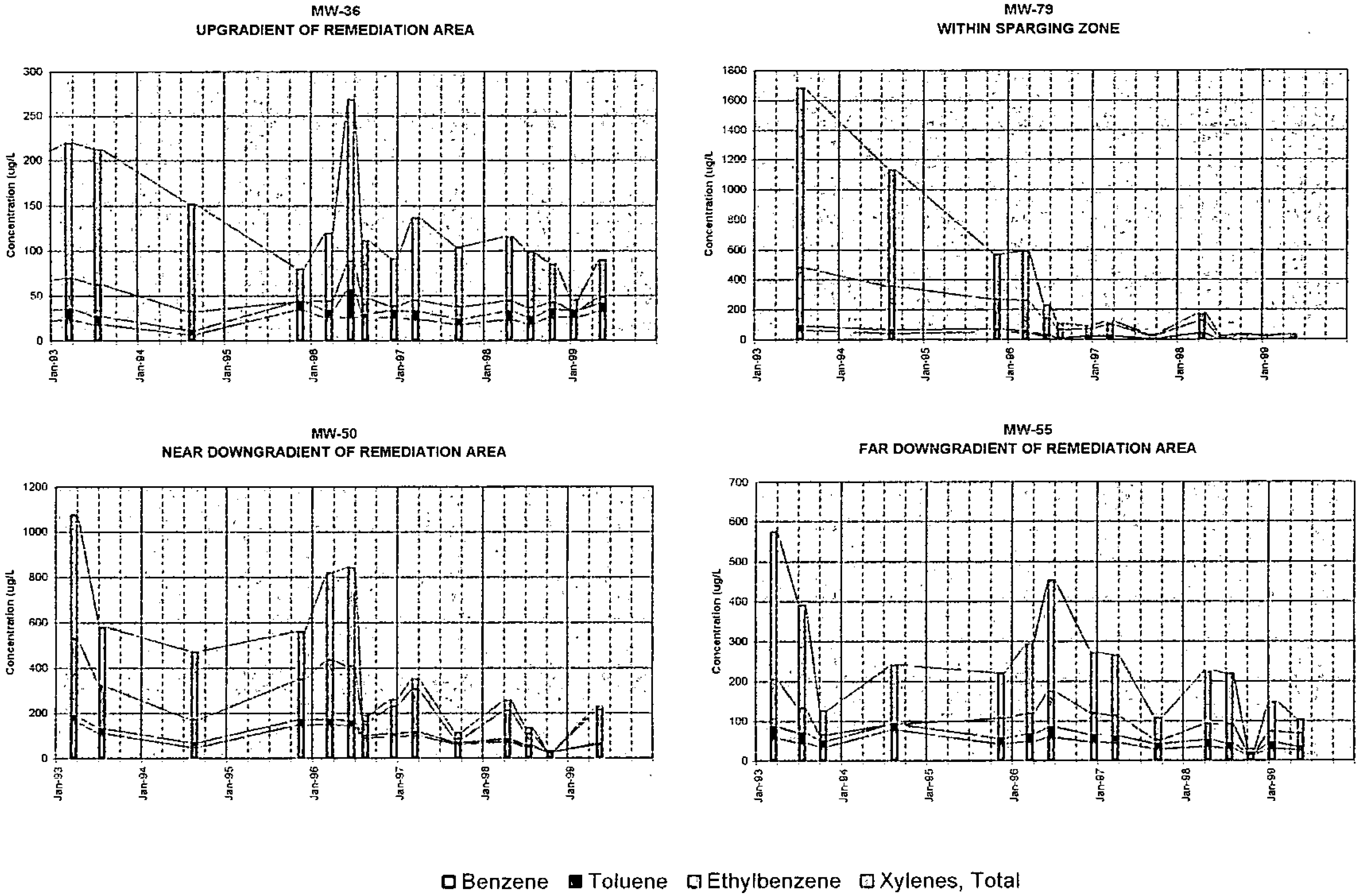


FIGURE 5-15
btex plots - south.xls

FIGURE 5-16
SOUTHERN AS/SVE AREA - TRANSECT 2
GROUNDWATER BTEX CONCENTRATIONS

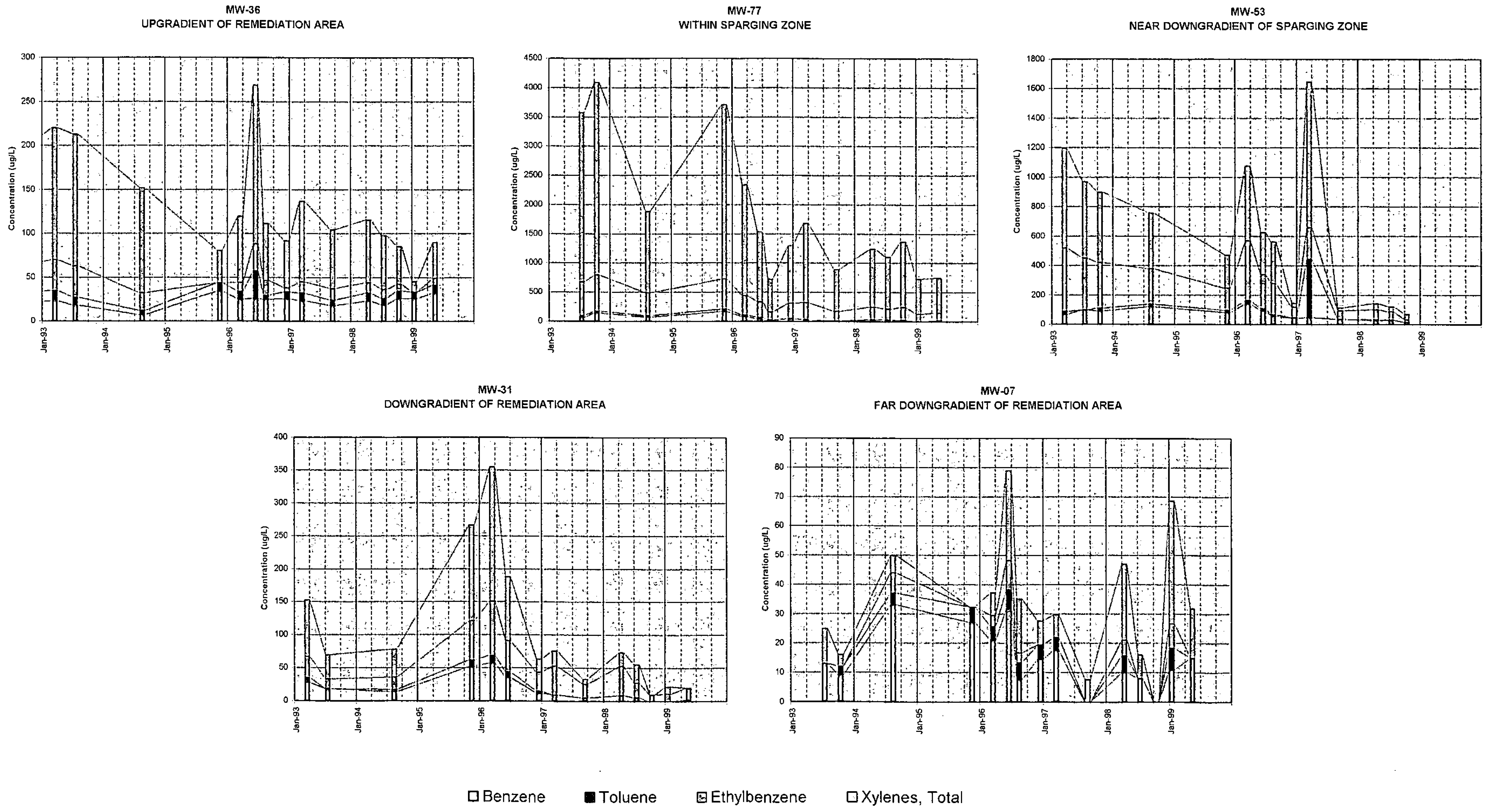
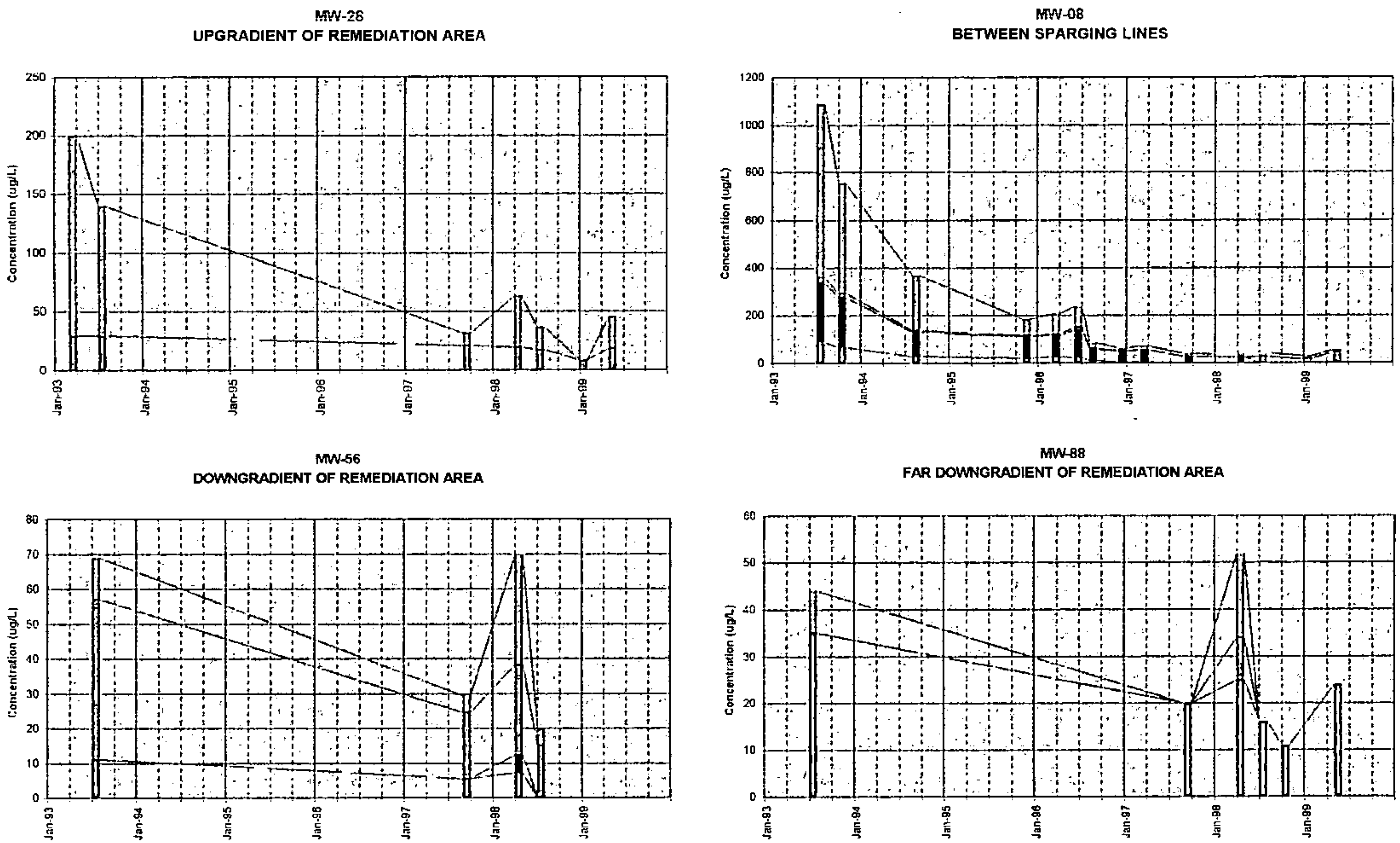


FIGURE 5-16

btex plots - south.xls

FIGURE 5-17
SOUTHERN AS/SVE AREA - TRANSECT 3
GROUNDWATER BTEX CONCENTRATIONS



Benzene ■ Toluene Ethylbenzene Xylenes, Total

FIGURE 5-17

btex plots - south.xls

FIGURE 5-18
NORTHERN AREA, GROUNDWATER BTEX CONCENTRATIONS

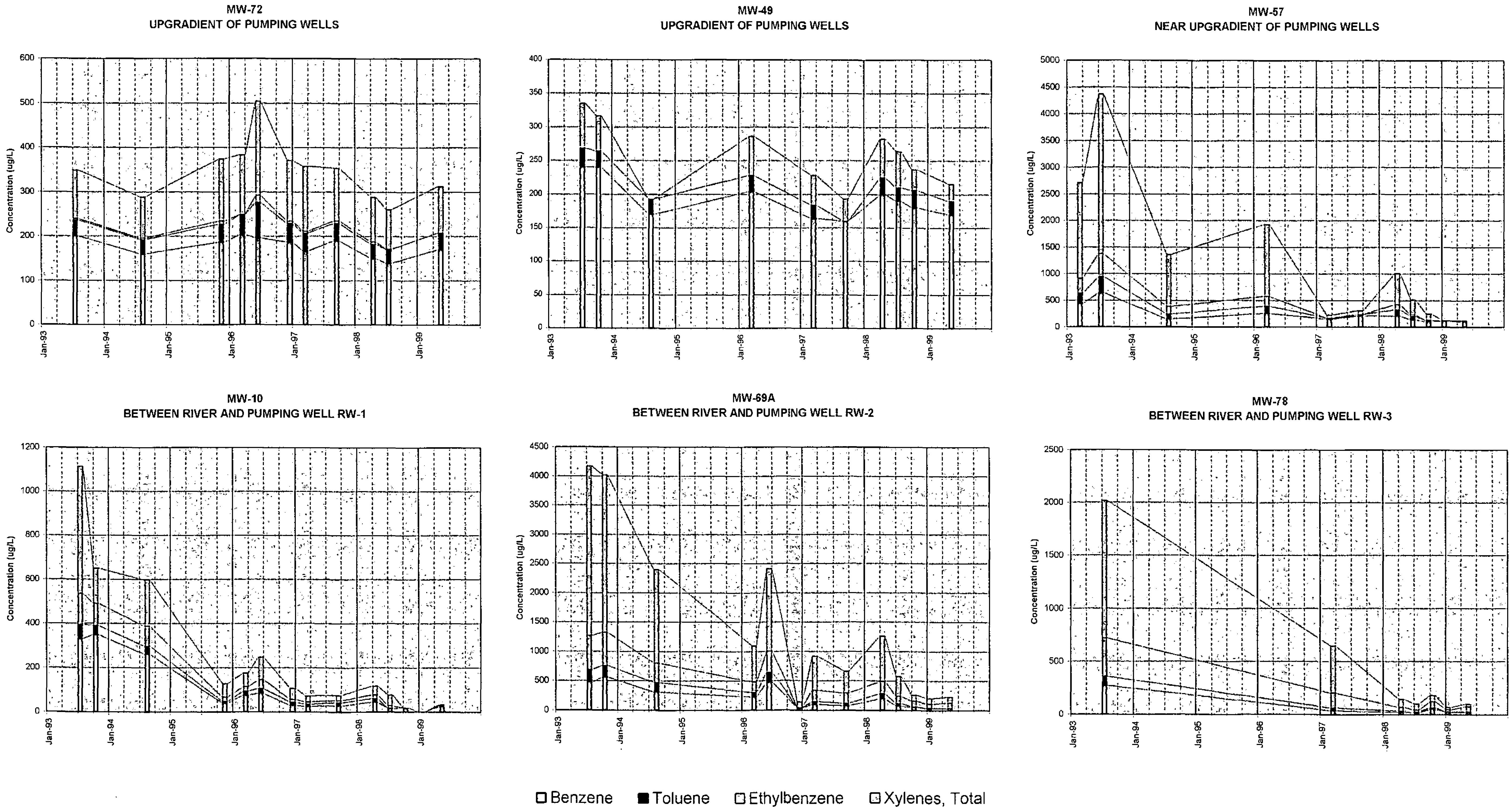


FIGURE 5-19
NORTHERN AREA, GROUNDWATER CHLORINATED HYDROCARBON CONCENTRATIONS

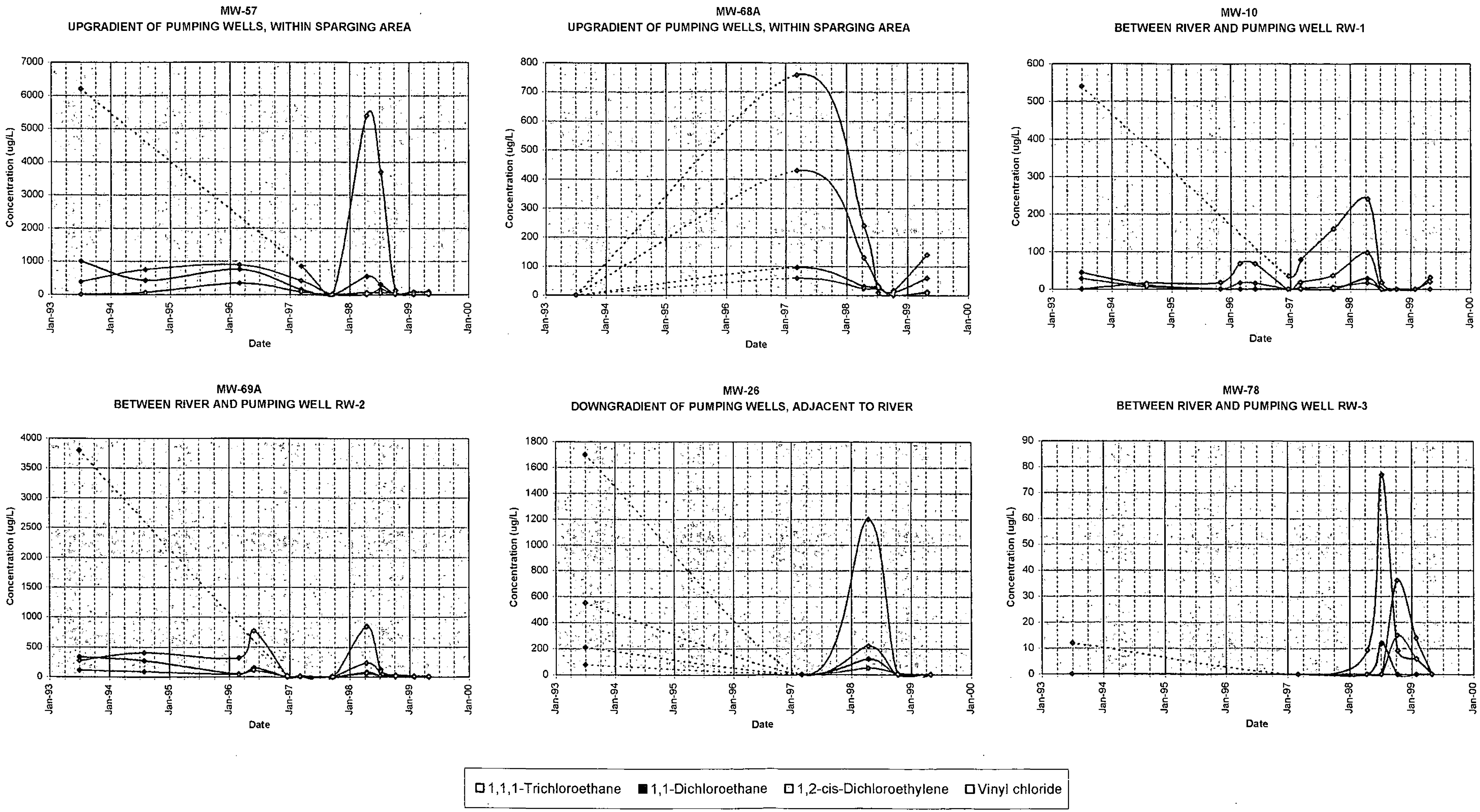


FIGURE 5-19

chc plots Phl.xls

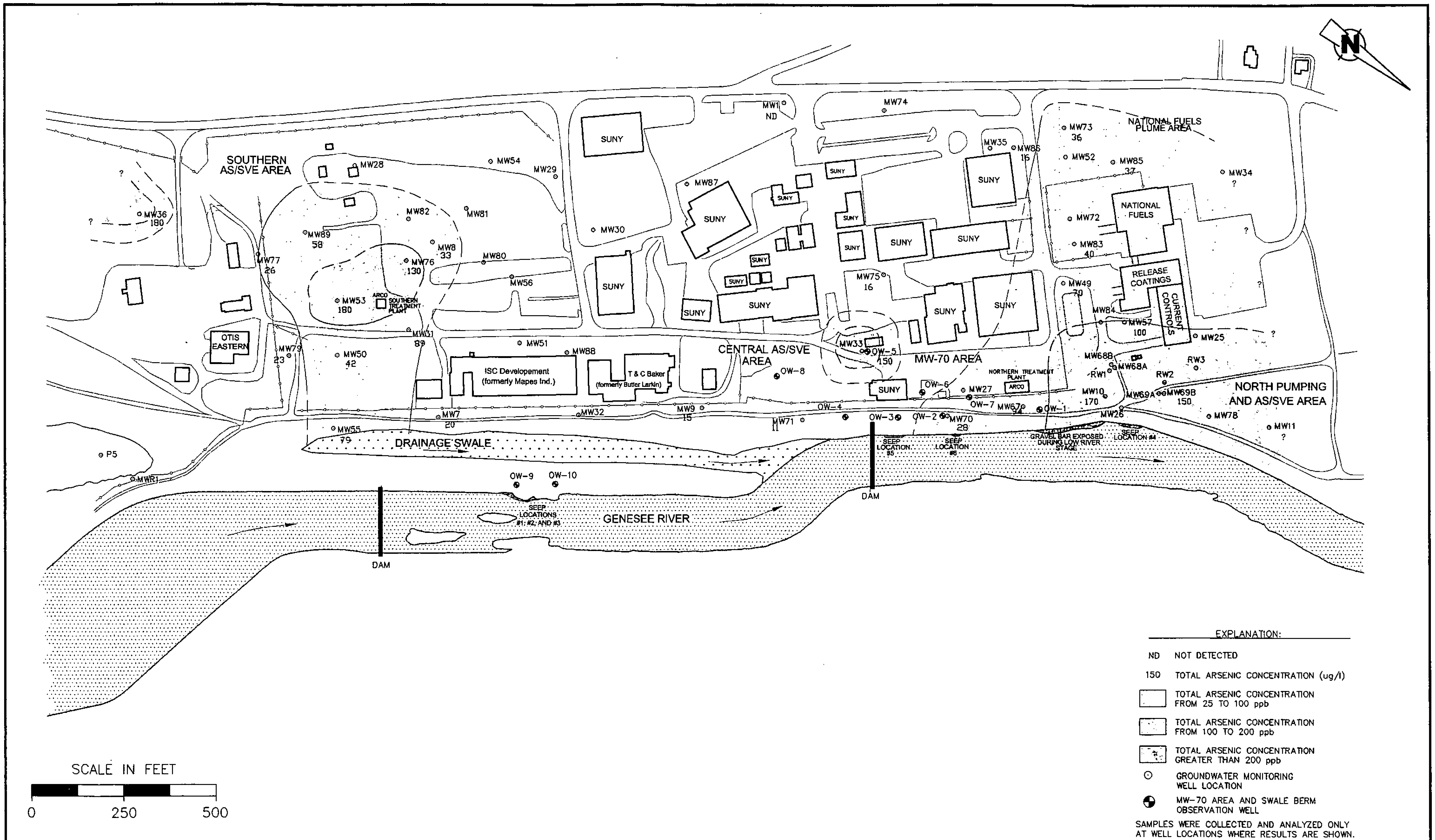


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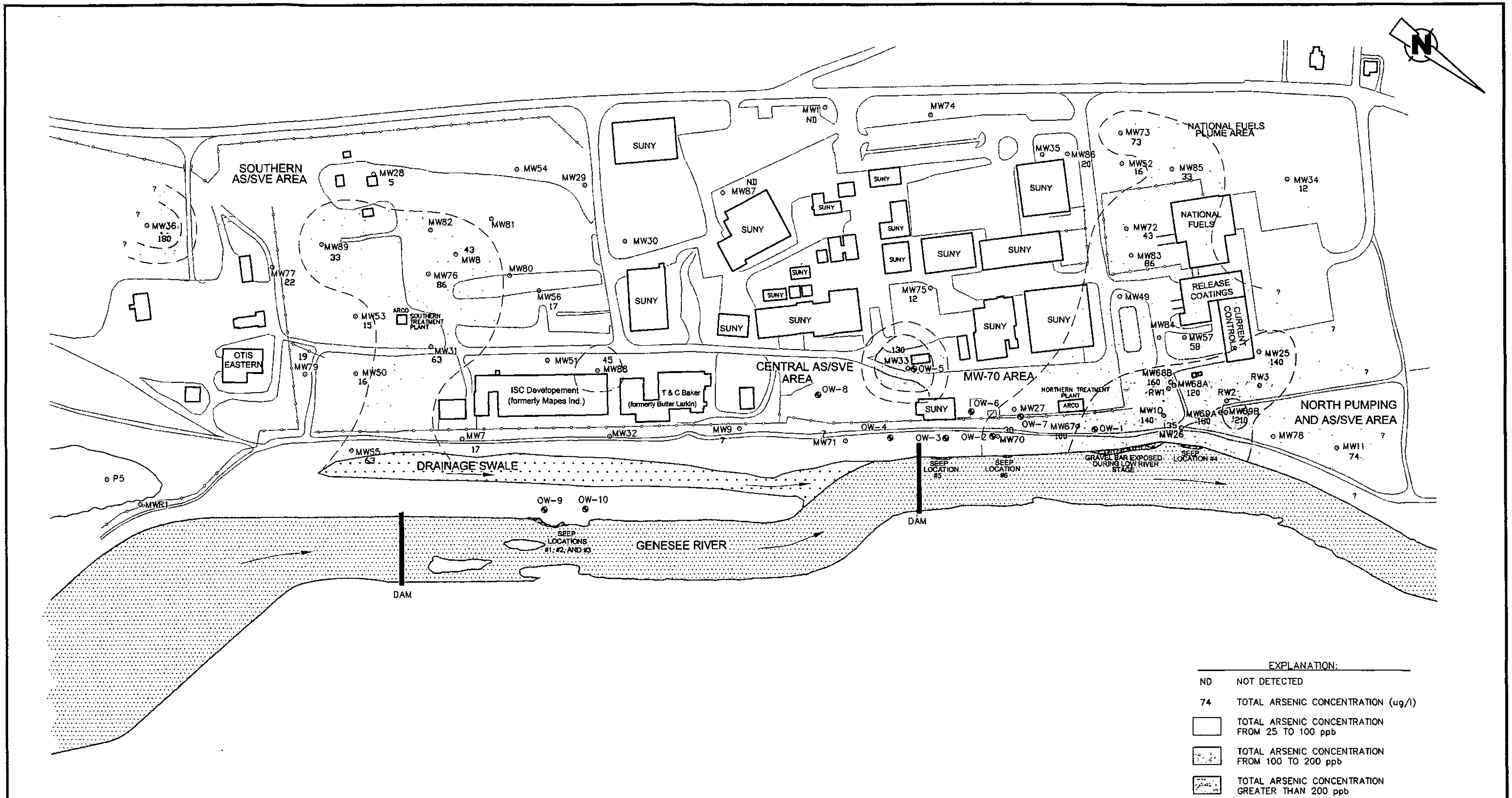
FIGURE 5-20
GROUNDWATER TOTAL ARSENIC CONCENTRATION CONTOURS - MARCH, 1996

FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK

arcoPh1.dwg



EXPLANATION:

ND	NOT DETECTED
74	TOTAL ARSENIC CONCENTRATION (ug/l)
	TOTAL ARSENIC CONCENTRATION FROM 25 TO 100 ppb
	TOTAL ARSENIC CONCENTRATION FROM 100 TO 200 ppb
	TOTAL ARSENIC CONCENTRATION GREATER THAN 200 ppb
	GROUNDWATER MONITORING WELL LOCATION
	MW-70 AREA AND SWALE BERM OBSERVATION WELL

SAMPLES WERE COLLECTED AND ANALYZED ONLY AT WELL LOCATIONS WHERE RESULTS ARE SHOWN.

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FIGURE 5-21
GROUNDWATER TOTAL ARSENIC CONCENTRATION CONTOURS - MARCH 1997

FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK
arcoPh1.dwg

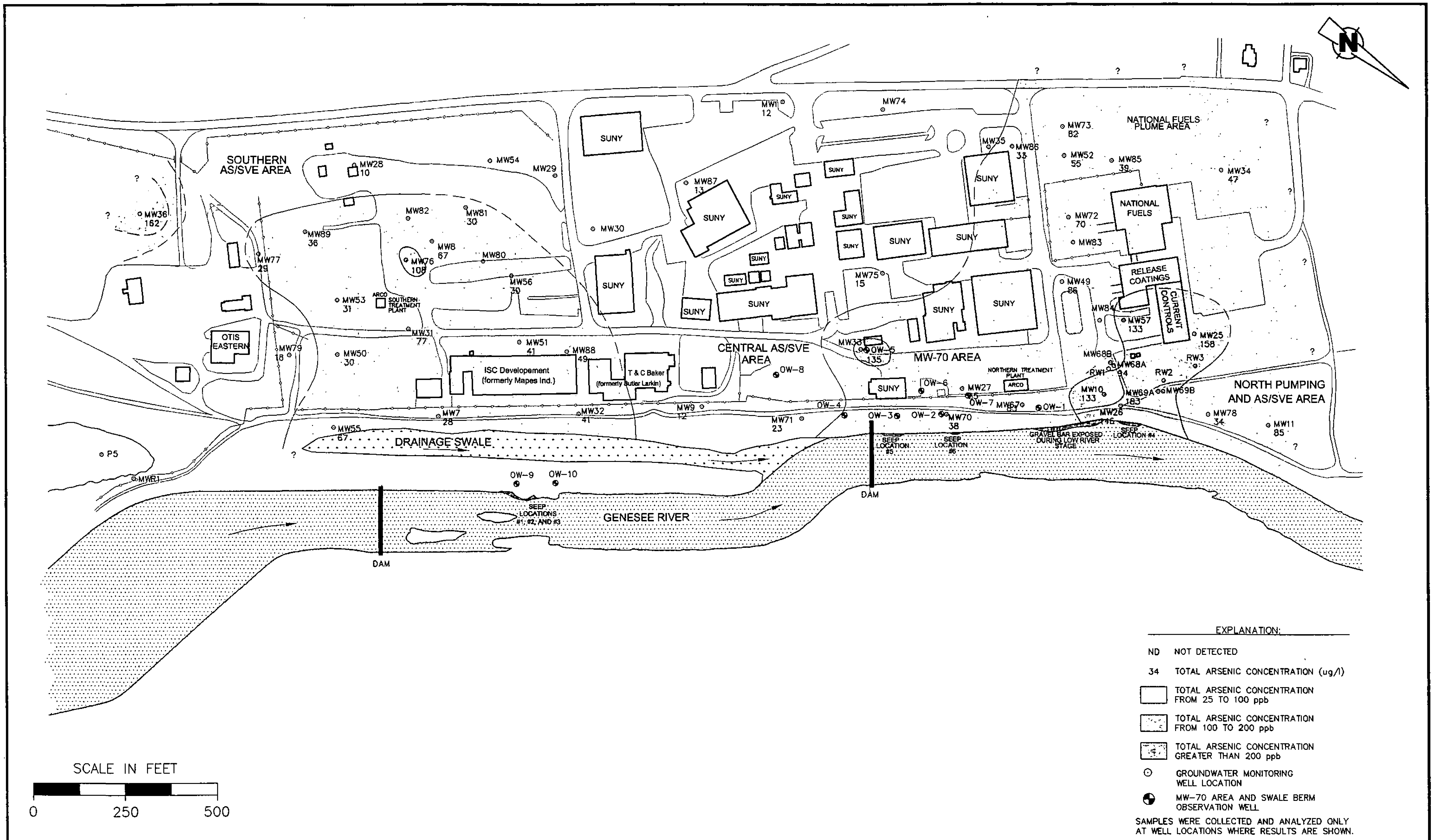

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FIGURE 5-22
GROUNDWATER TOTAL ARSENIC CONCENTRATION CONTOURS - APRIL 1998

FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK

arcoPh1.dwg

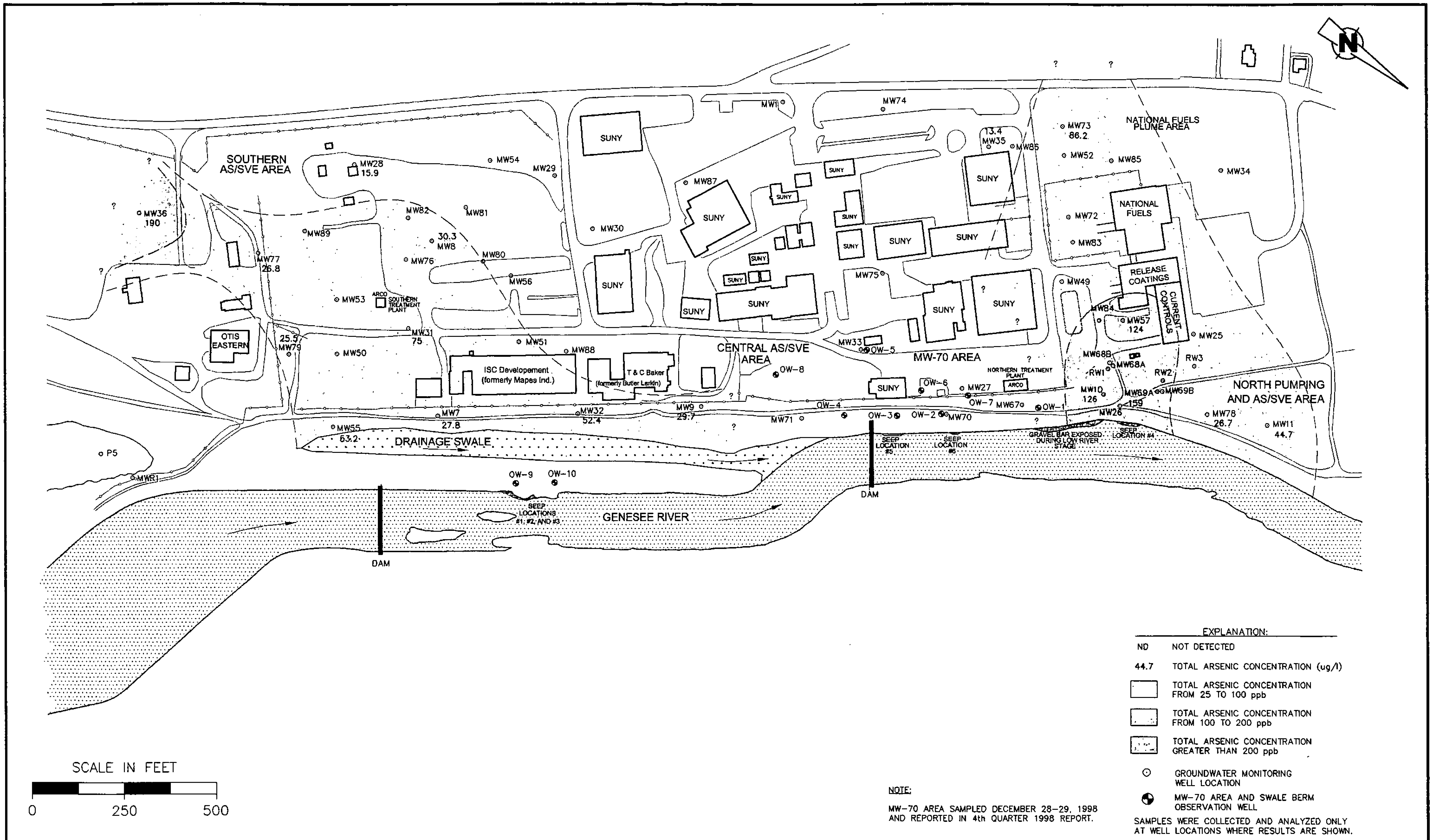

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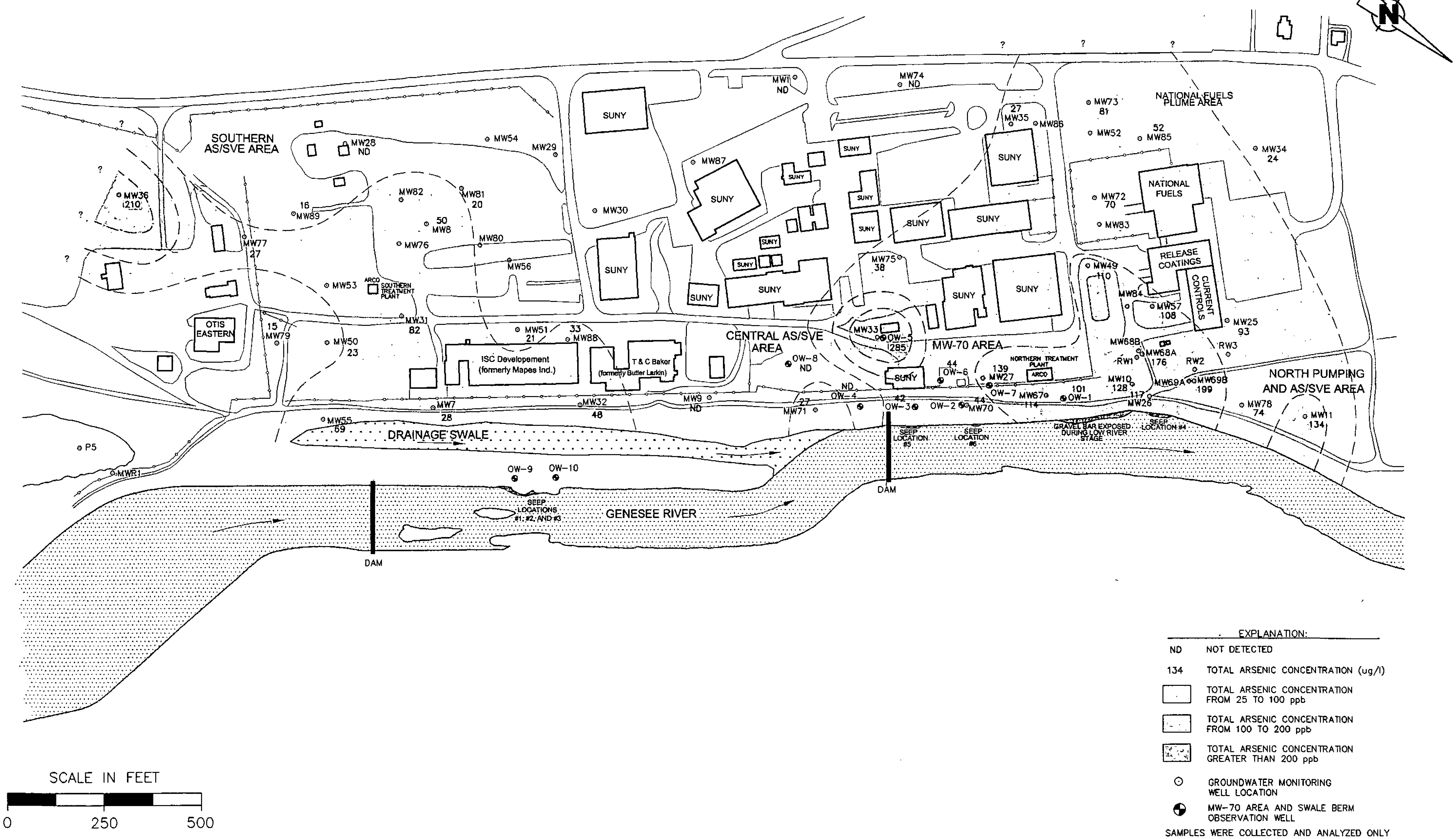
FIGURE 5-23
GROUNDWATER TOTAL ARSENIC CONCENTRATION CONTOURS - JANUARY 28-29, 1999
FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK
arcoPh1.dwg



EXPLANATION:

ND NOT DETECTED

134 TOTAL ARSENIC CONCENTRATION (ug/l)

TOTAL ARSENIC CONCENTRATION FROM 25 TO 100 ppb

TOTAL ARSENIC CONCENTRATION FROM 100 TO 200 ppb

TOTAL ARSENIC CONCENTRATION GREATER THAN 200 ppb

GROUNDWATER MONITORING WELL LOCATION

MW-70 AREA AND SWALE BERM OBSERVATION WELL

SAMPLES WERE COLLECTED AND ANALYZED ONLY AT WELL LOCATIONS WHERE RESULTS ARE SHOWN.

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FIGURE 5-24
GROUNDWATER TOTAL ARSENIC CONCENTRATION CONTOURS - APRIL 27-MAY 10, 1999

FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK
arcoPh1.dwg

FIGURE 5-25
NATIONAL FUELS AREA, GROUNDWATER TOTAL ARSENIC CONCENTRATIONS

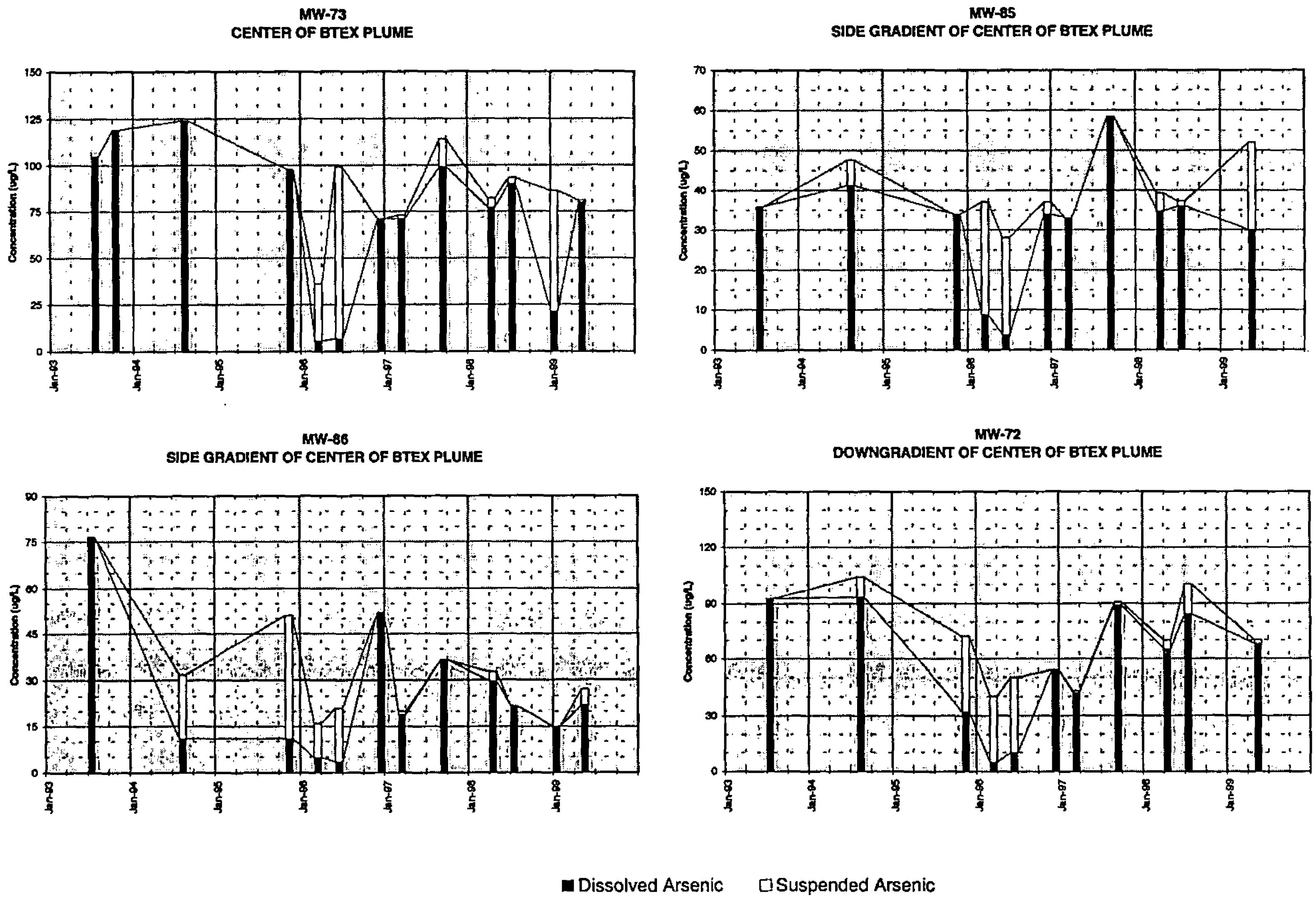


FIGURE 5-25

arsenic transect plots.xls

FIGURE 5-26
CENTRAL AS/SVE AREA, GROUNDWATER TOTAL ARSENIC CONCENTRATIONS

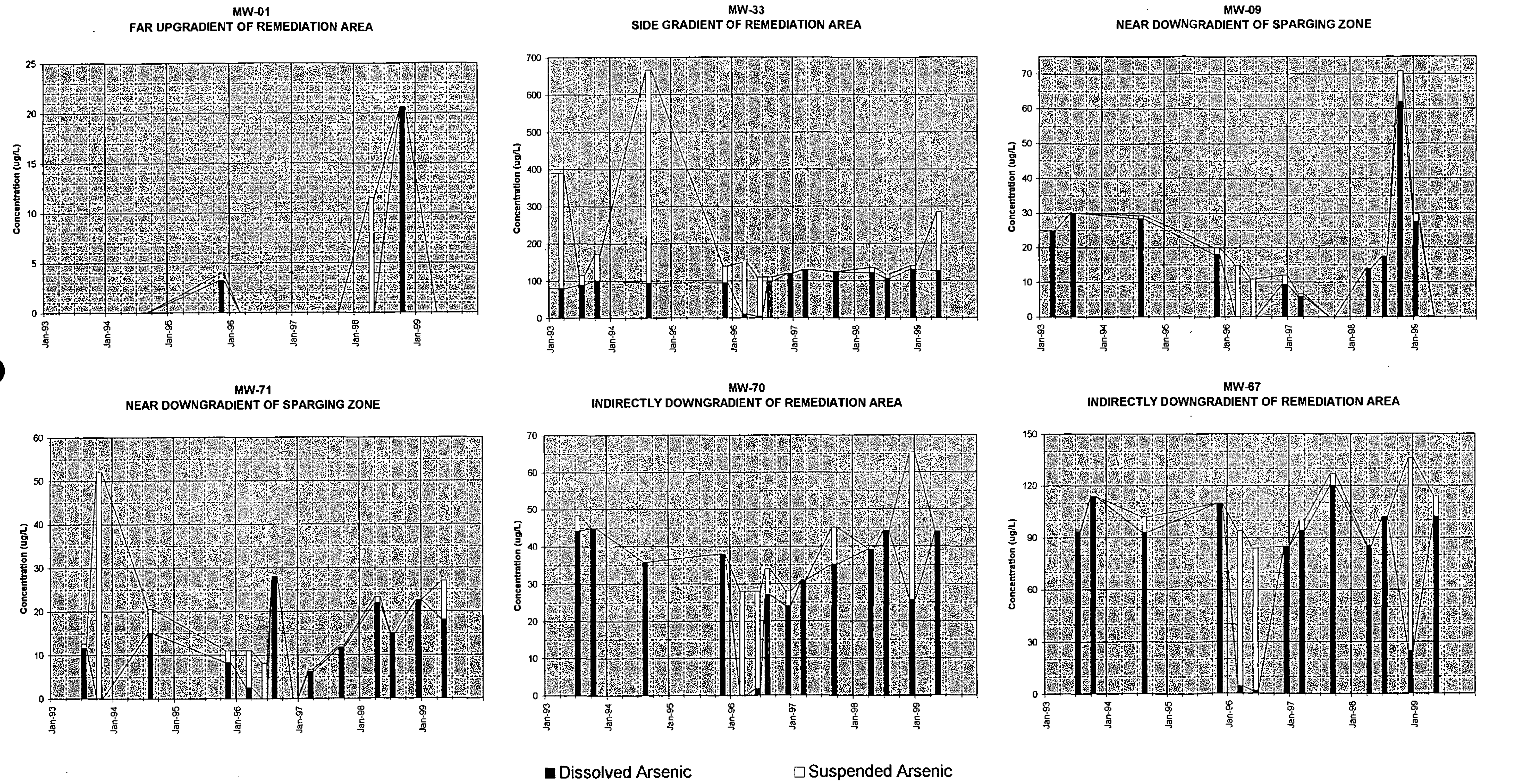


FIGURE 5-27
SOUTHERN AS/SVE AREA - TRANSECT 1, GROUNDWATER TOTAL ARSENIC CONCENTRATIONS

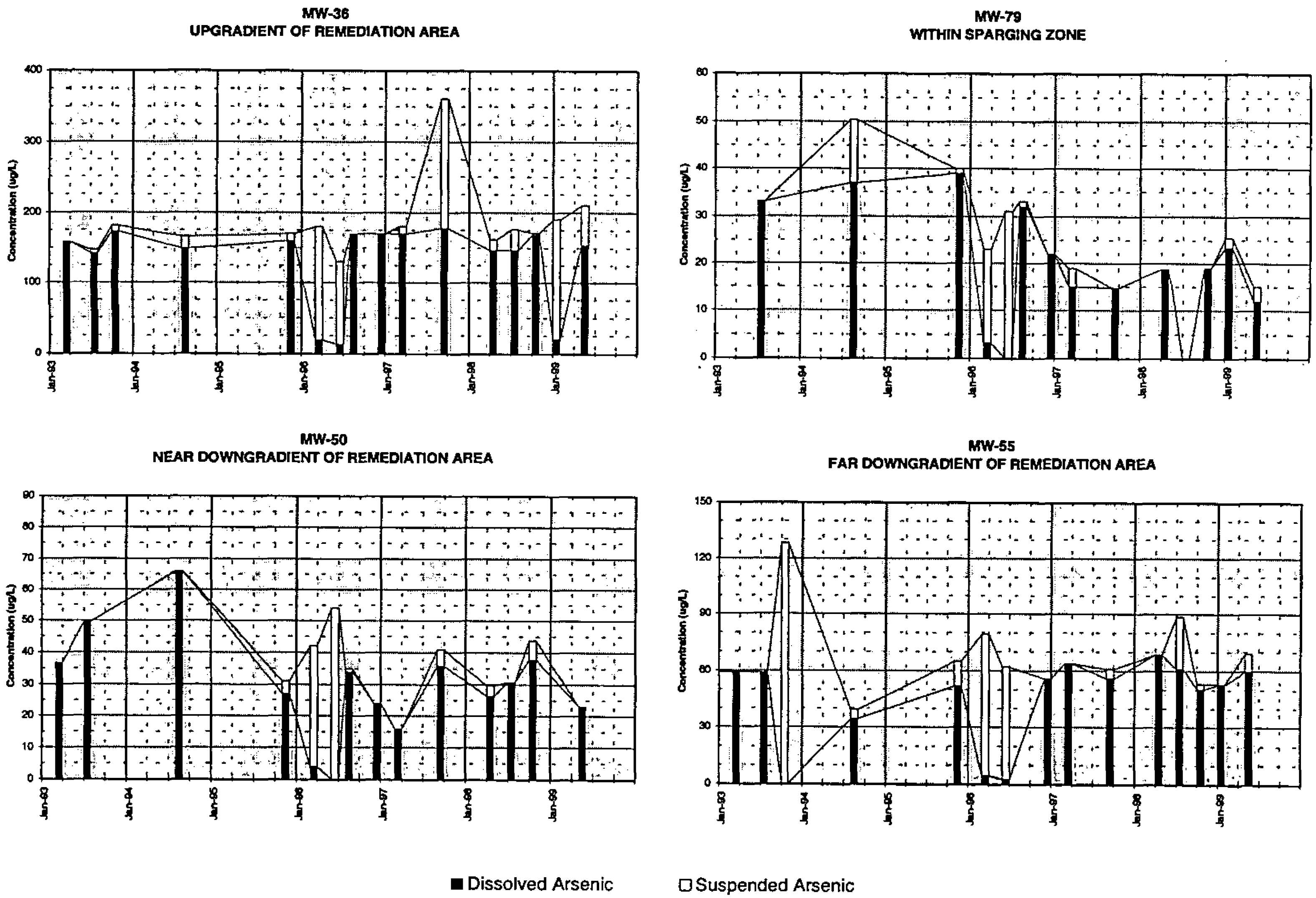


FIGURE 5-28
SOUTHERN AS/SVE AREA - TRANSECT 2, GROUNDWATER TOTAL ARSENIC CONCENTRATIONS

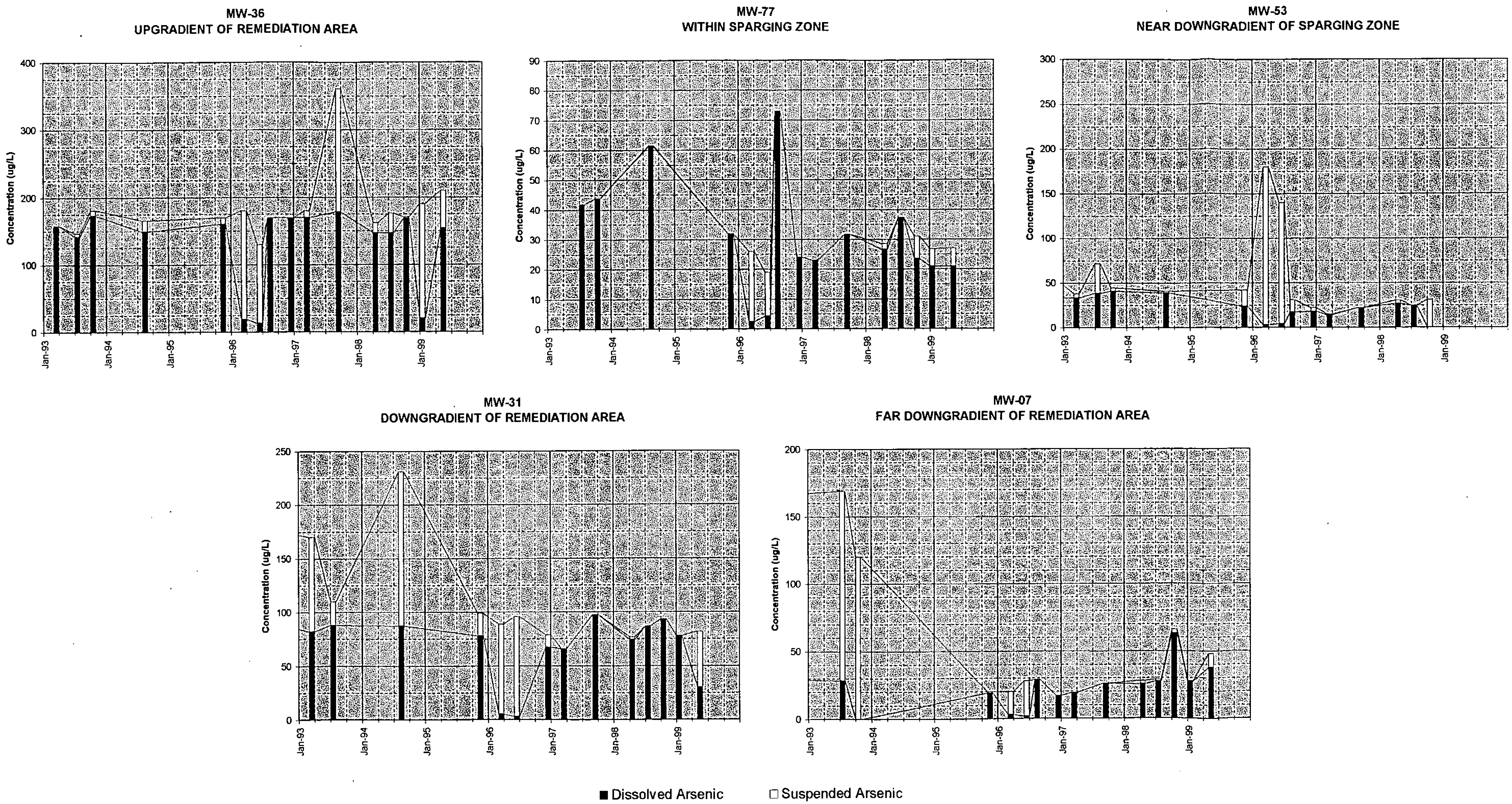


FIGURE 5-29

SOUTHERN AS/SVE AREA - TRANSECT 3, GROUNDWATER TOTAL ARSENIC CONCENTRATIONS

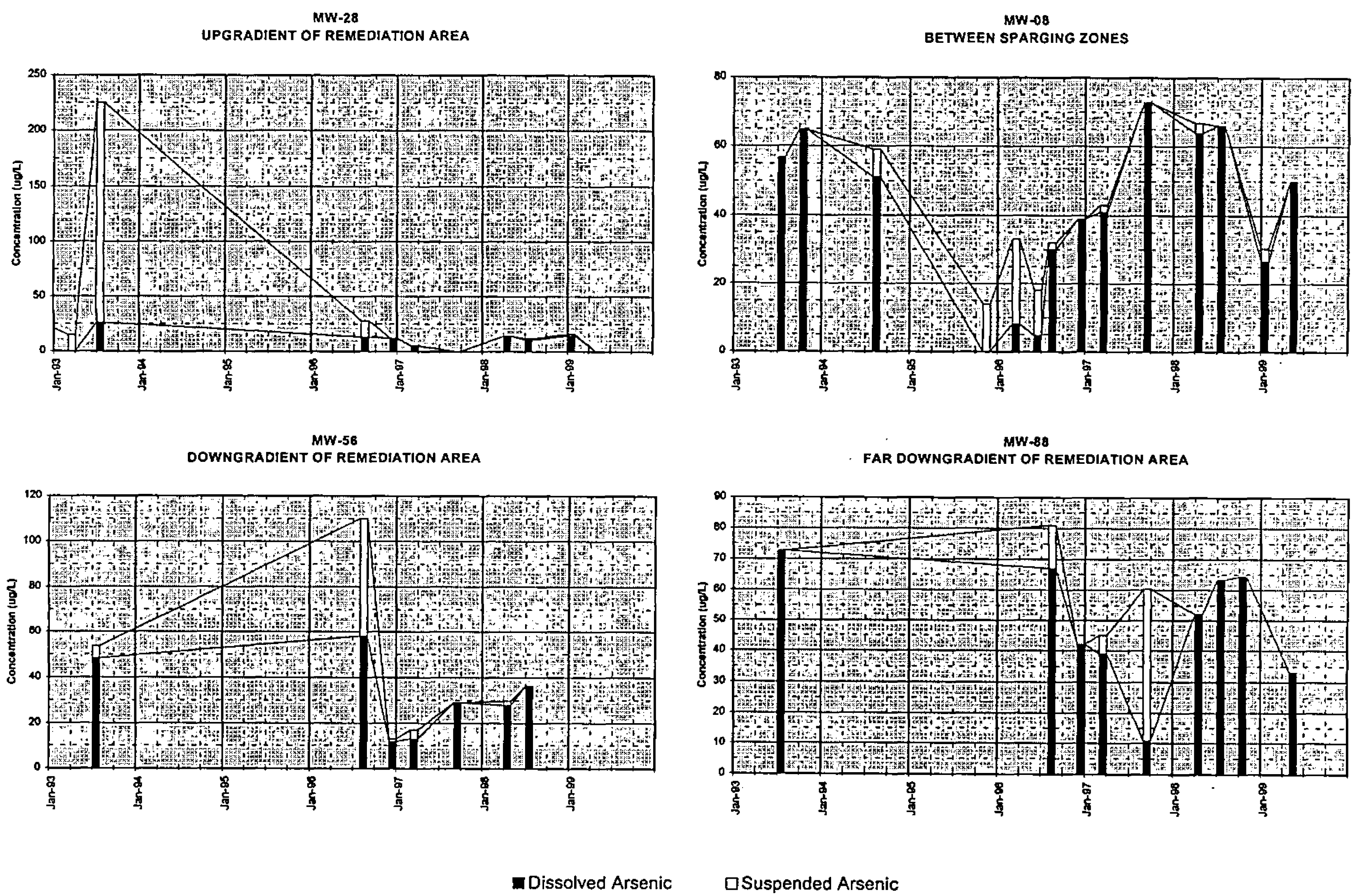
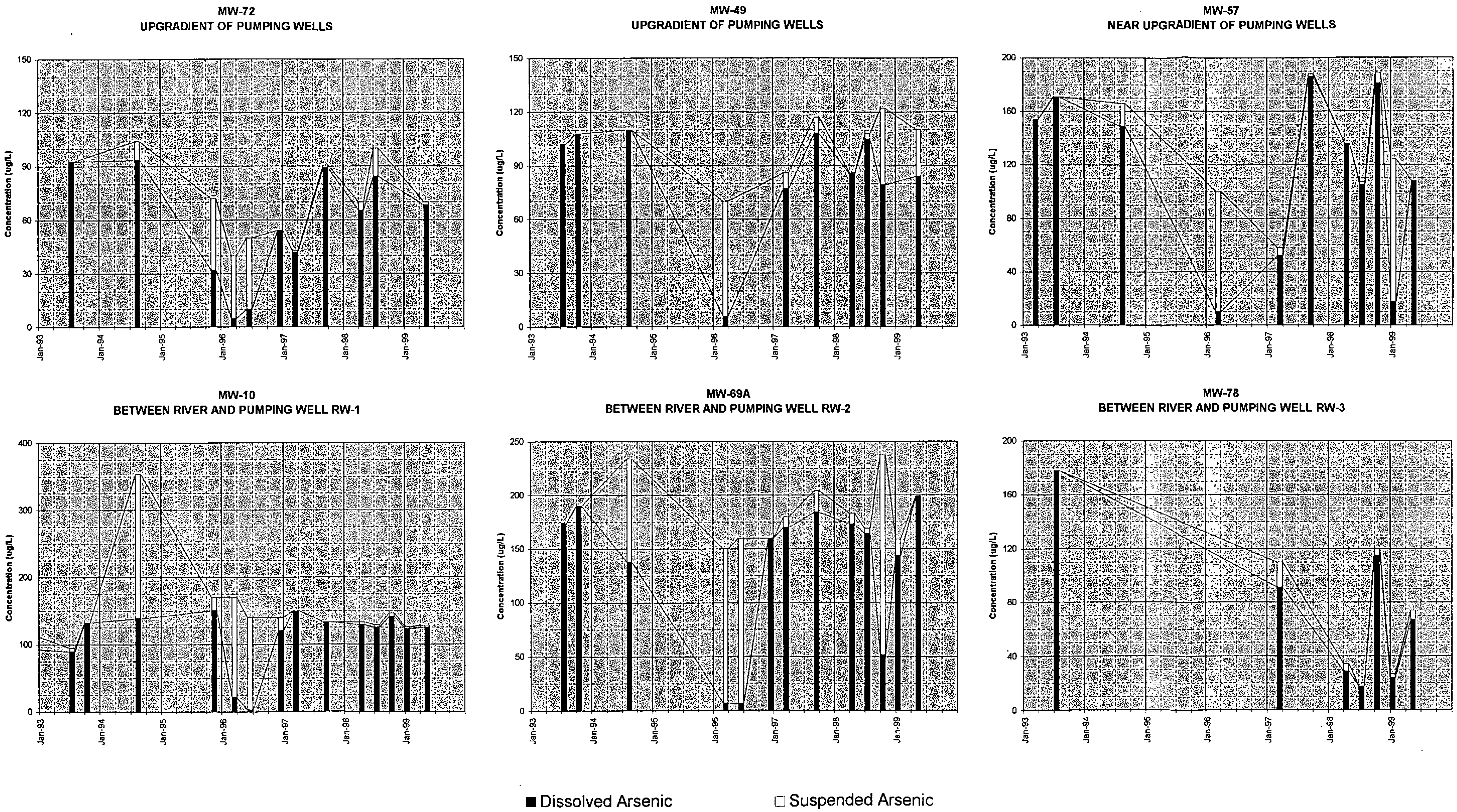


FIGURE 5-29

arsenic transect plots.xls

FIGURE 5-30
NORTHERN AREA, GROUNDWATER TOTAL ARSENIC CONCENTRATIONS



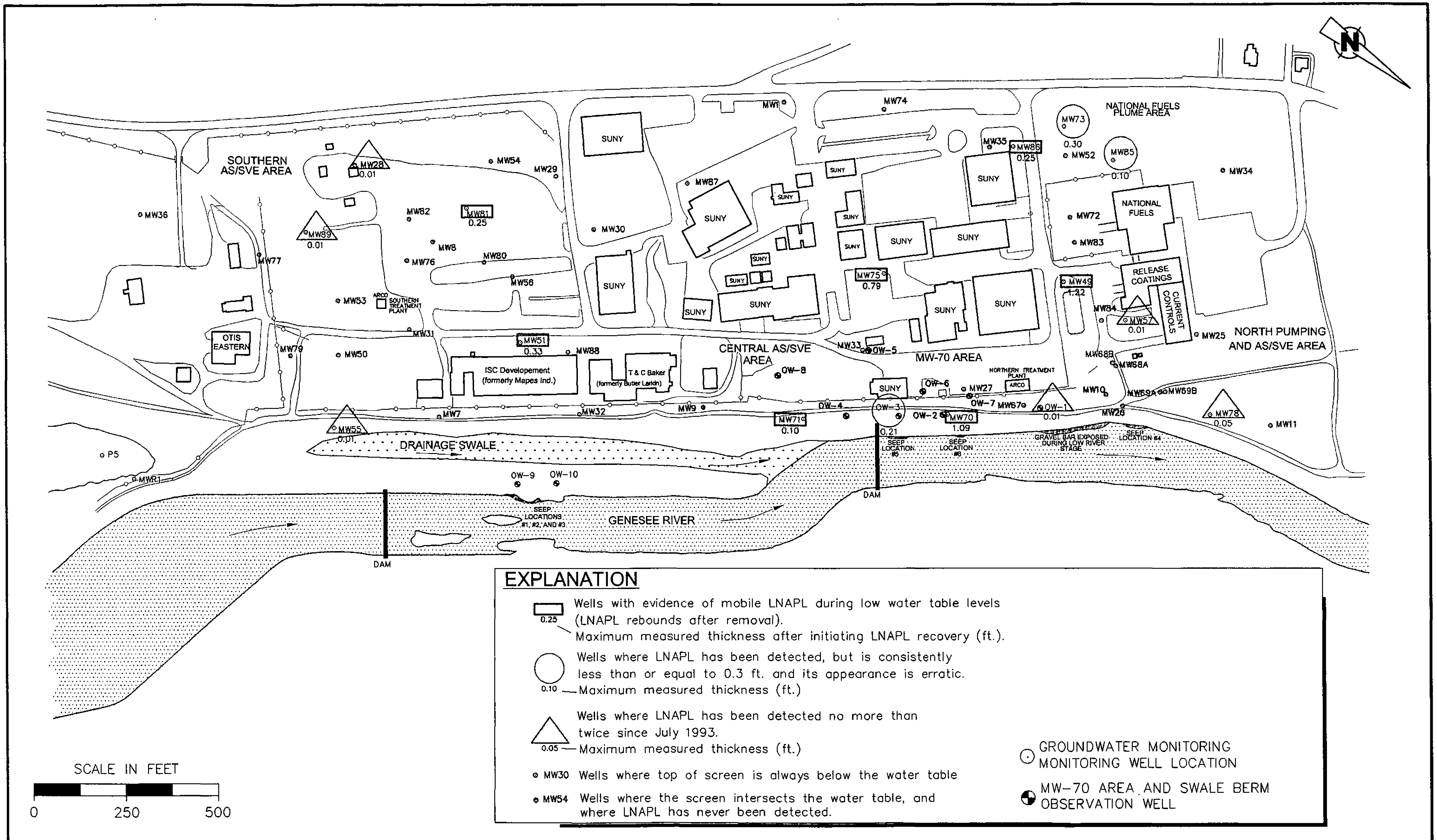


FIGURE 5-31

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SUMMARY OF LNAPL THICKNESS MEASUREMENTS

FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK
LNAPL Summary Map.dwg

Figure 5-32
LNAPL Monitoring and Recovery at MW-49

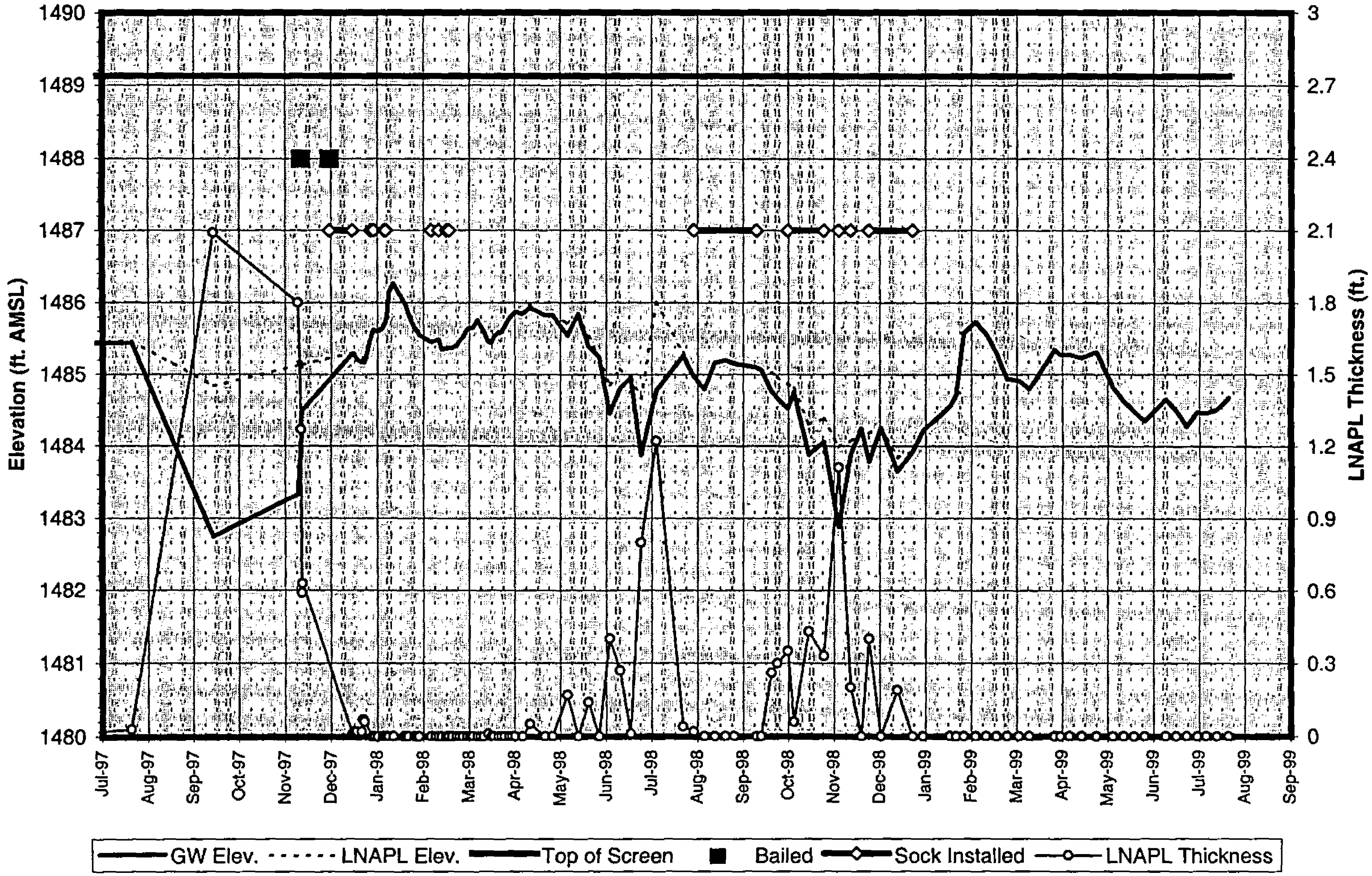


Figure 5-33
LNAPL Monitoring and Recovery at MW-51

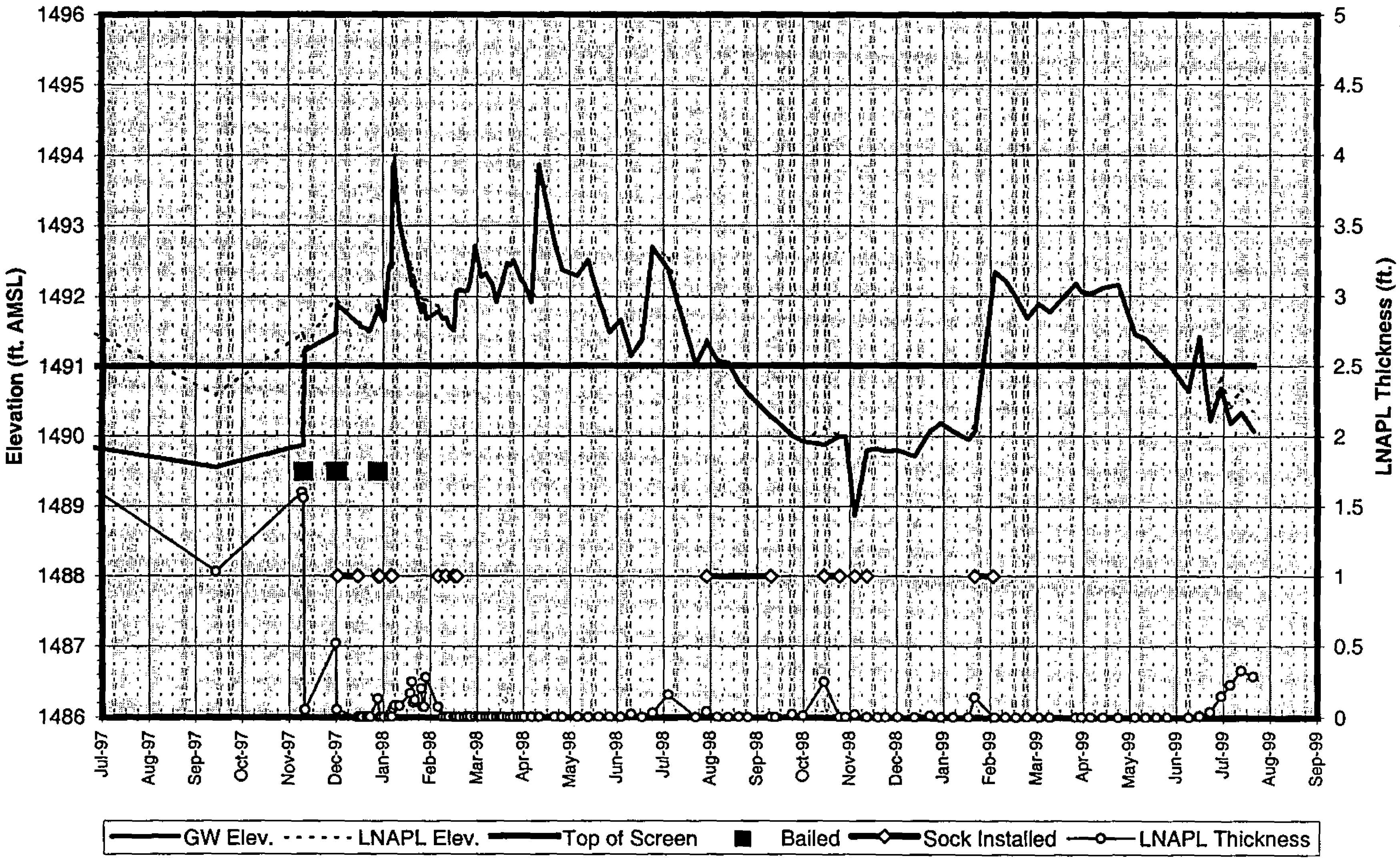


Figure 5-34
LNAPL Monitoring and Recovery at MW-70

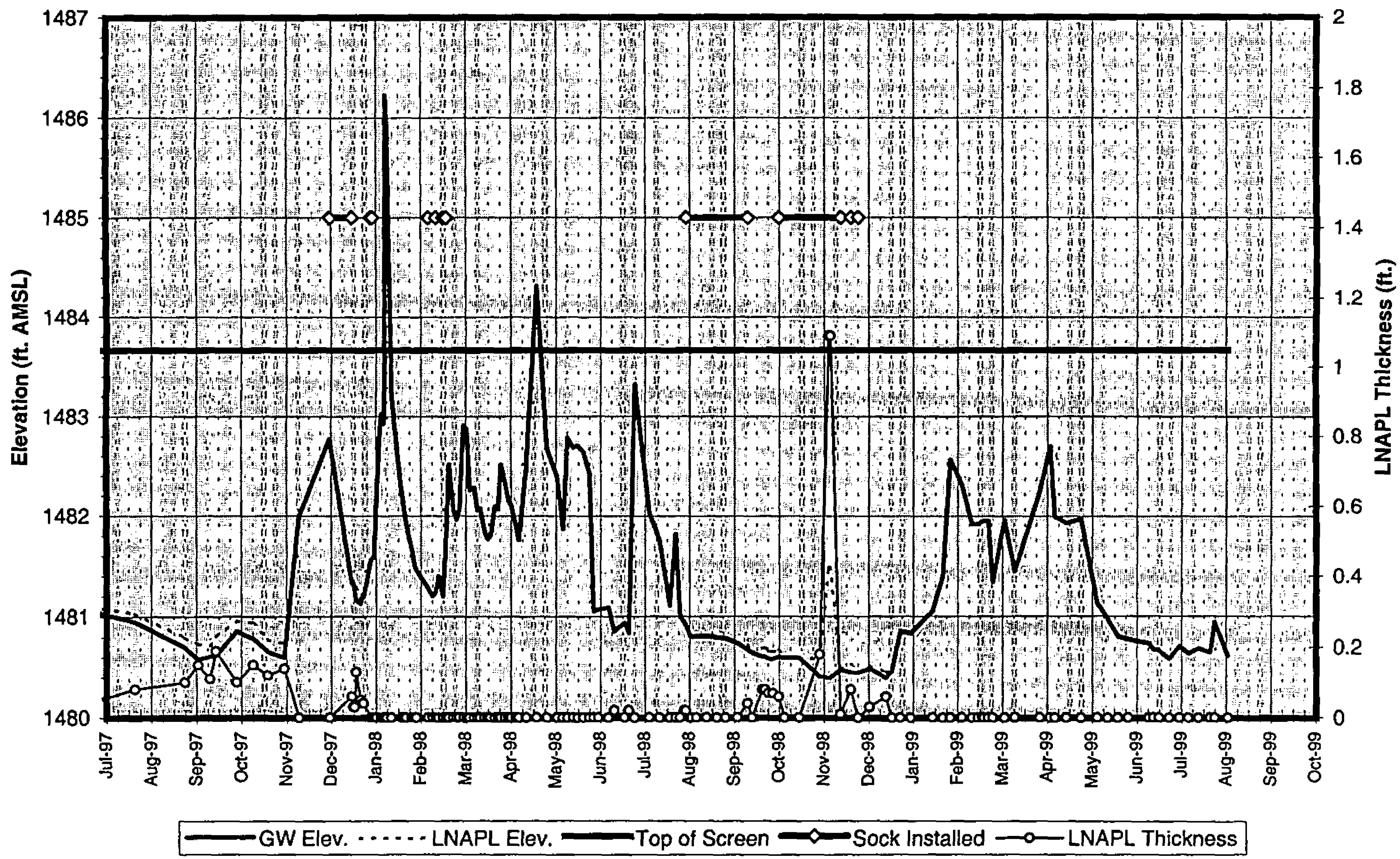


Figure 5-35
LNAPL Monitoring and Recovery at MW-71

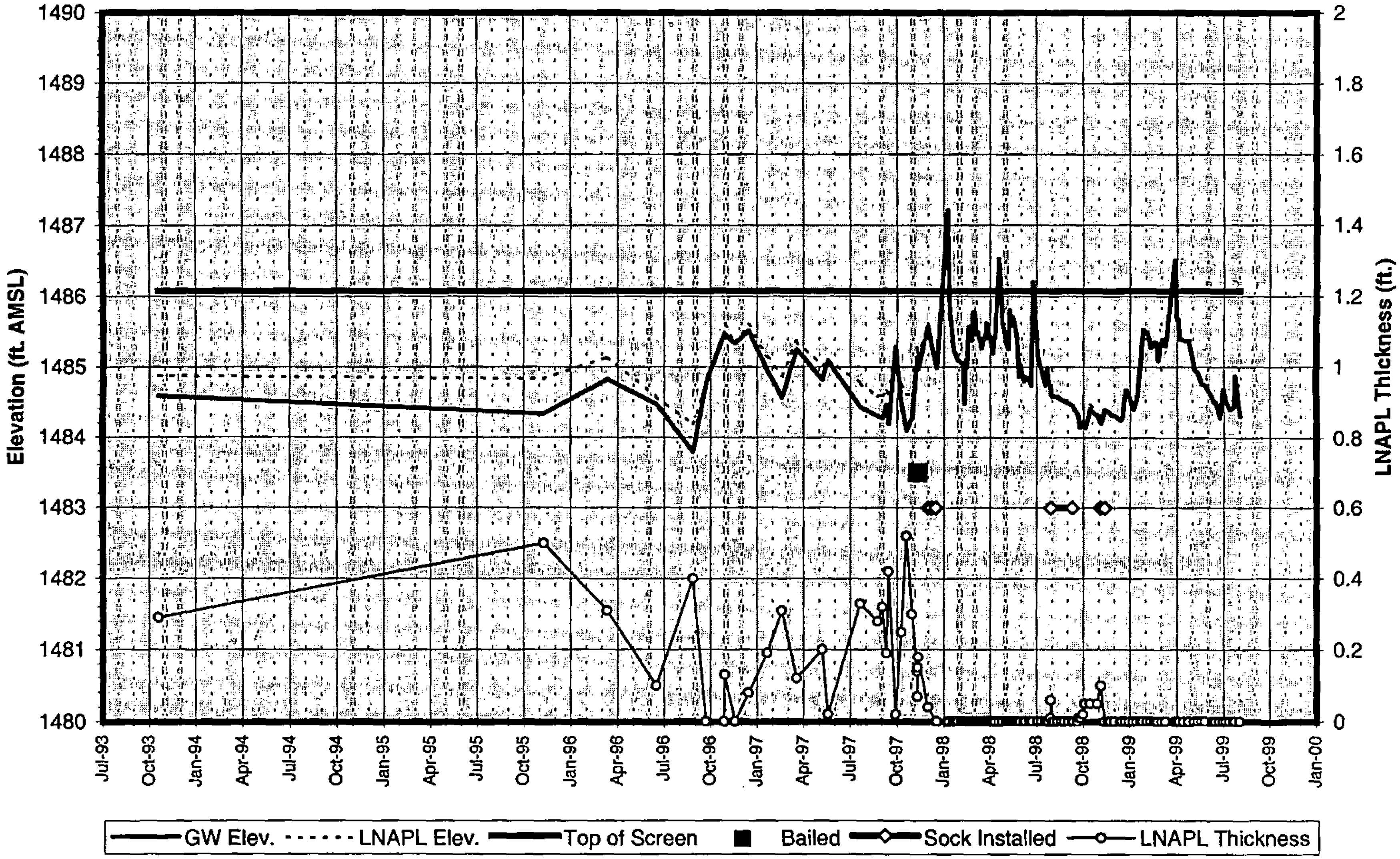


Figure 5-36
LNAPL Monitoring and Recovery at MW-75

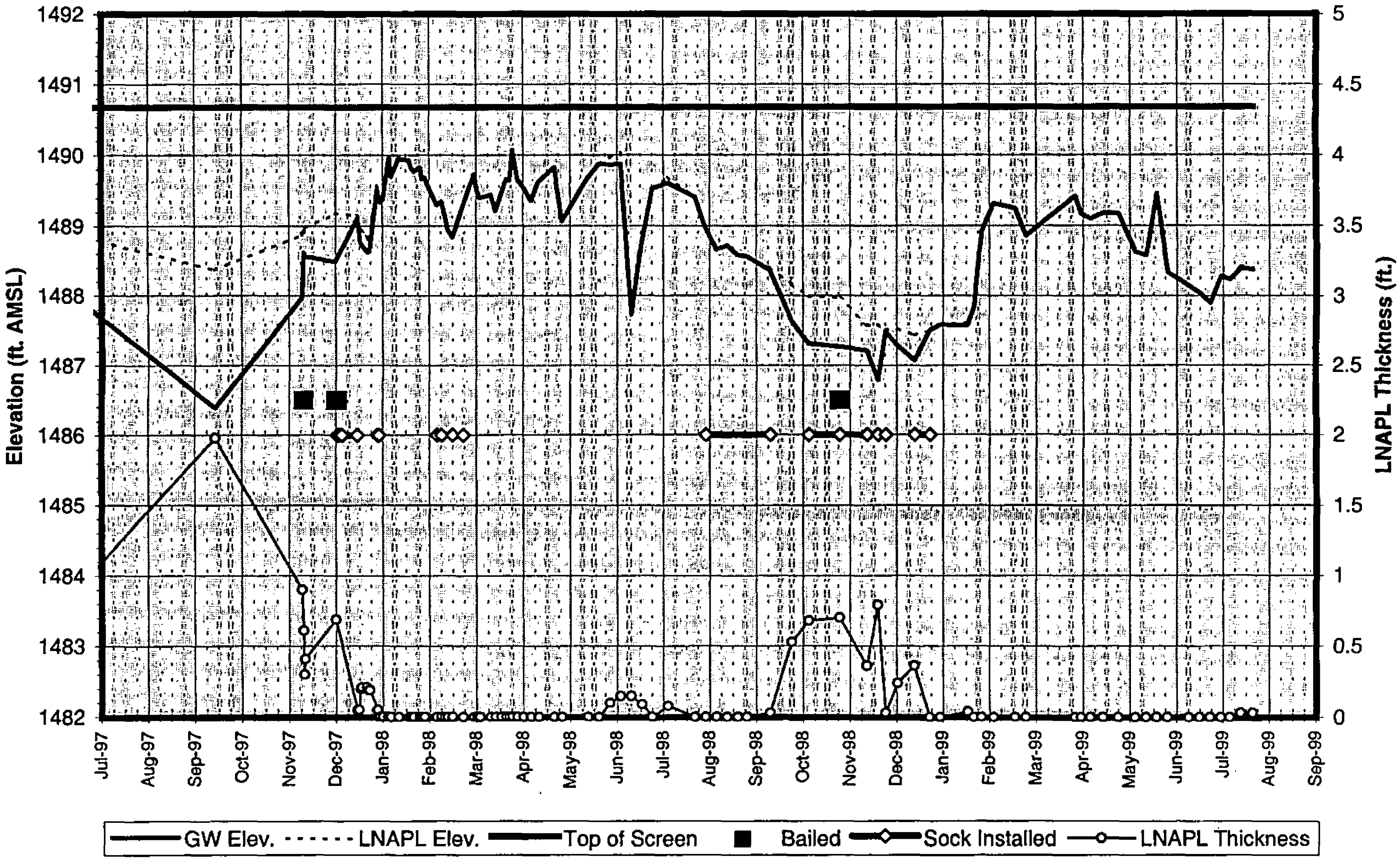


Figure 5-37
LNAPL Monitoring and Recovery at MW-81

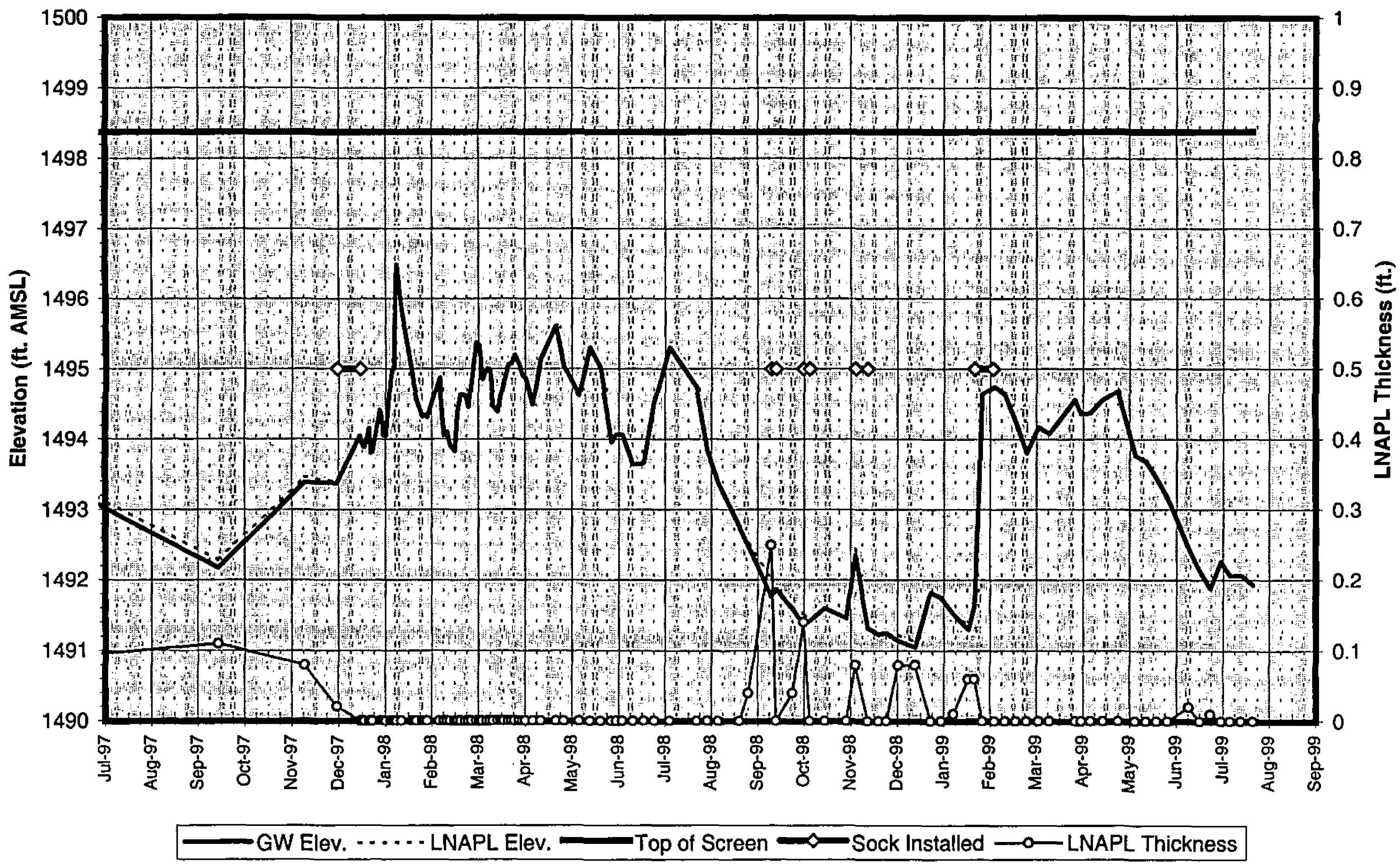
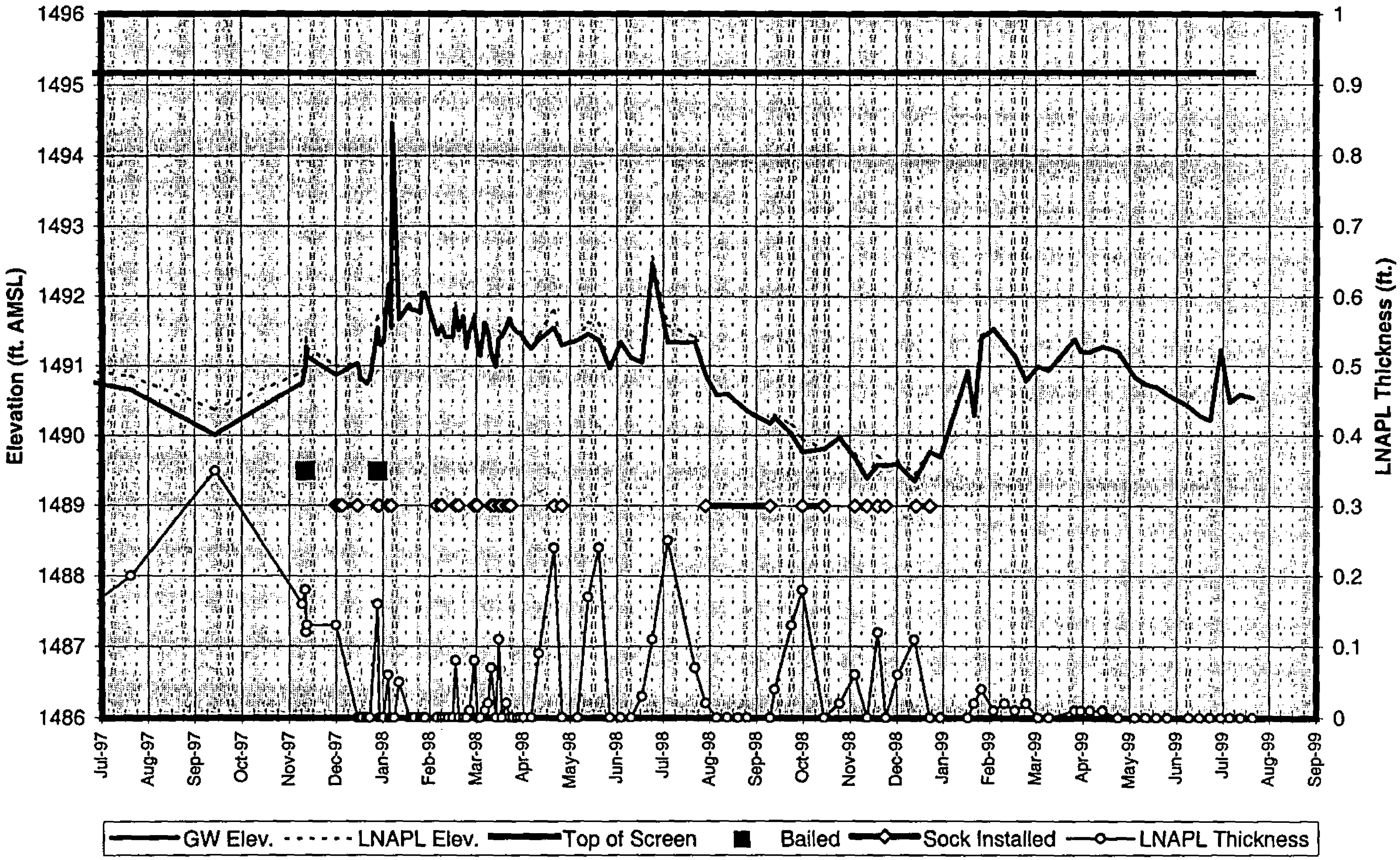


Figure 5-38
LNAPL Monitoring and Recovery at MW-86



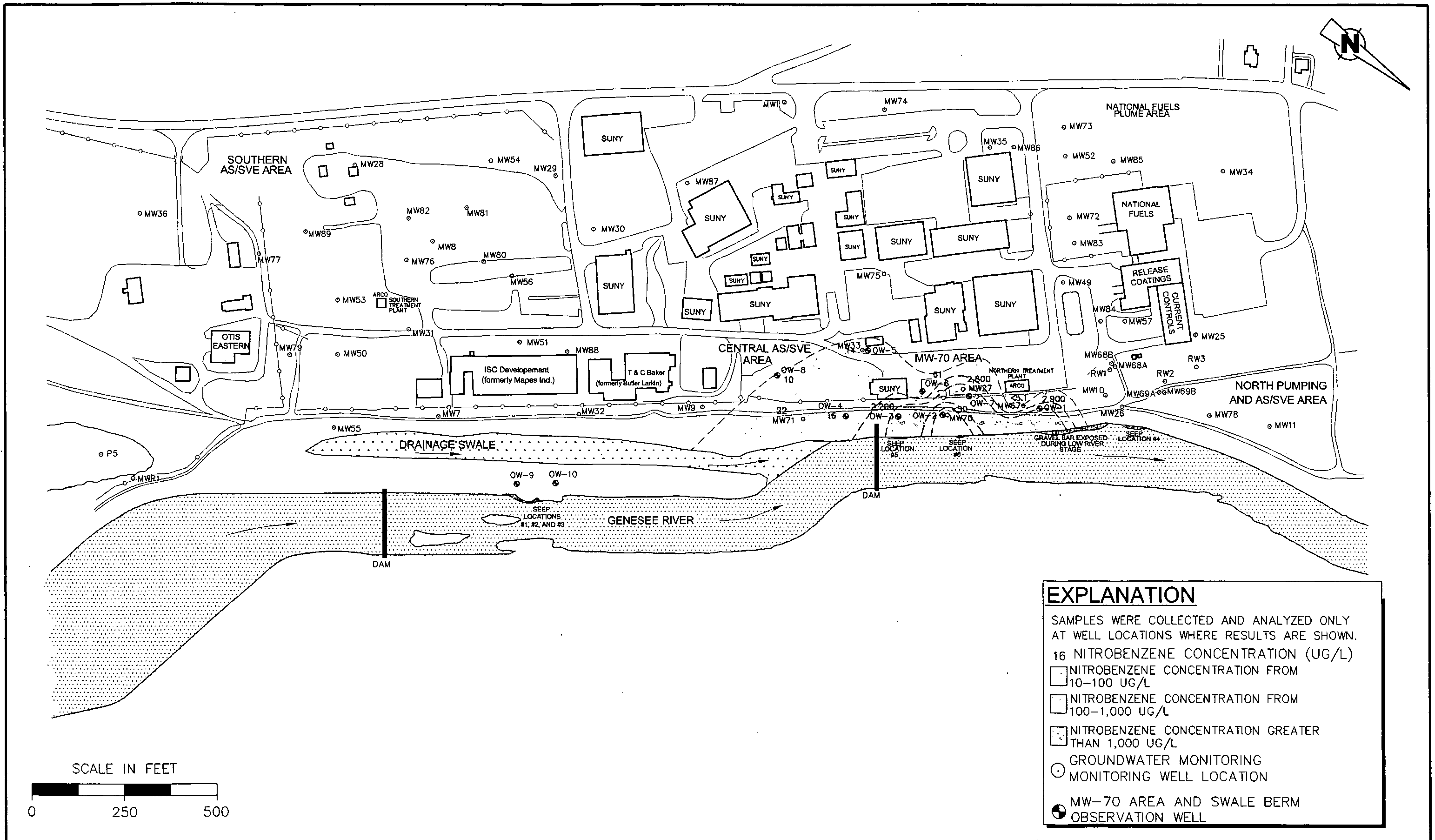


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FIGURE 6-1
GROUNDWATER NITROBENZENE CONCENTRATION CONTOURS - DECEMBER 1998

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semiVOC.dwg

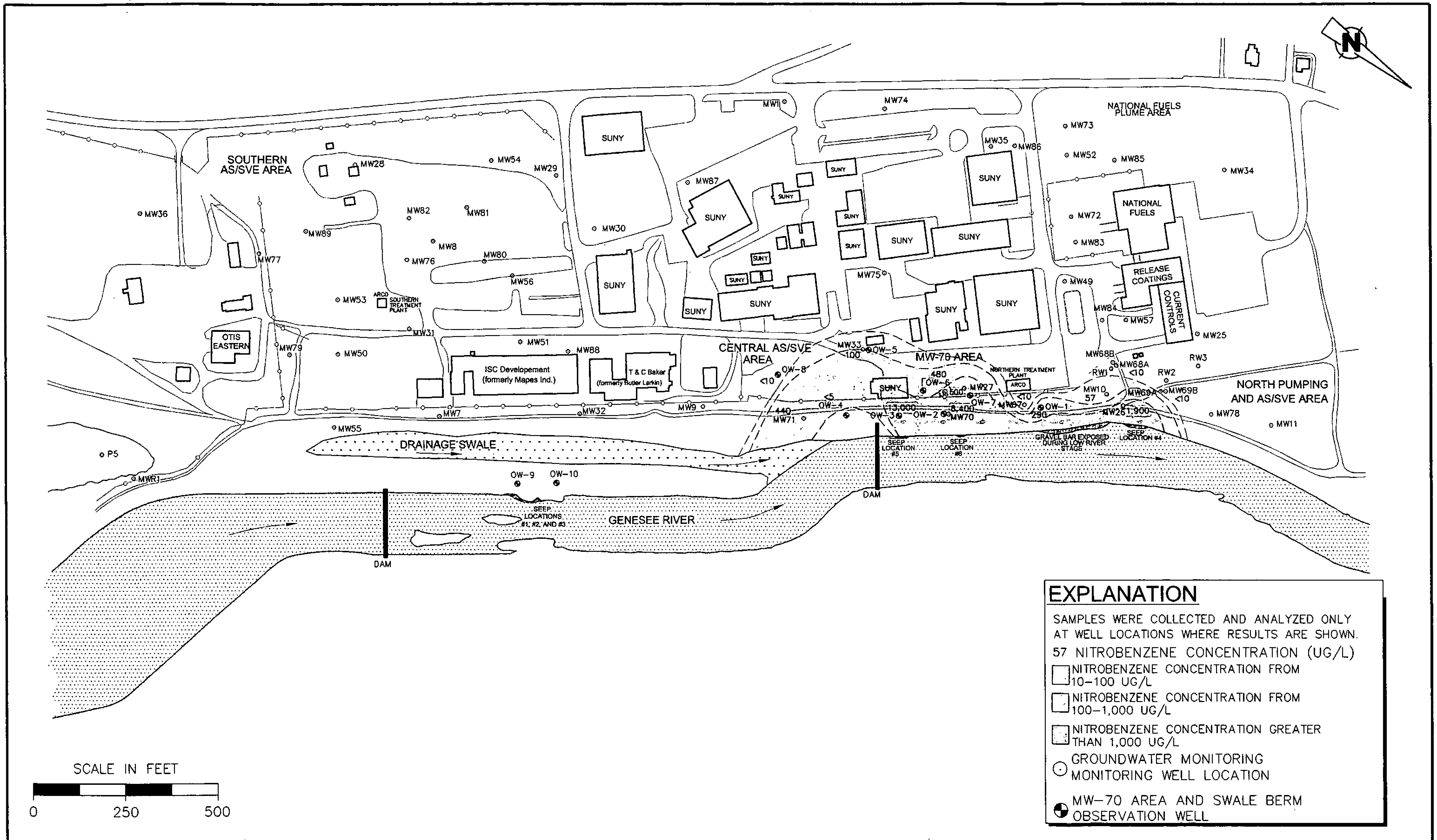

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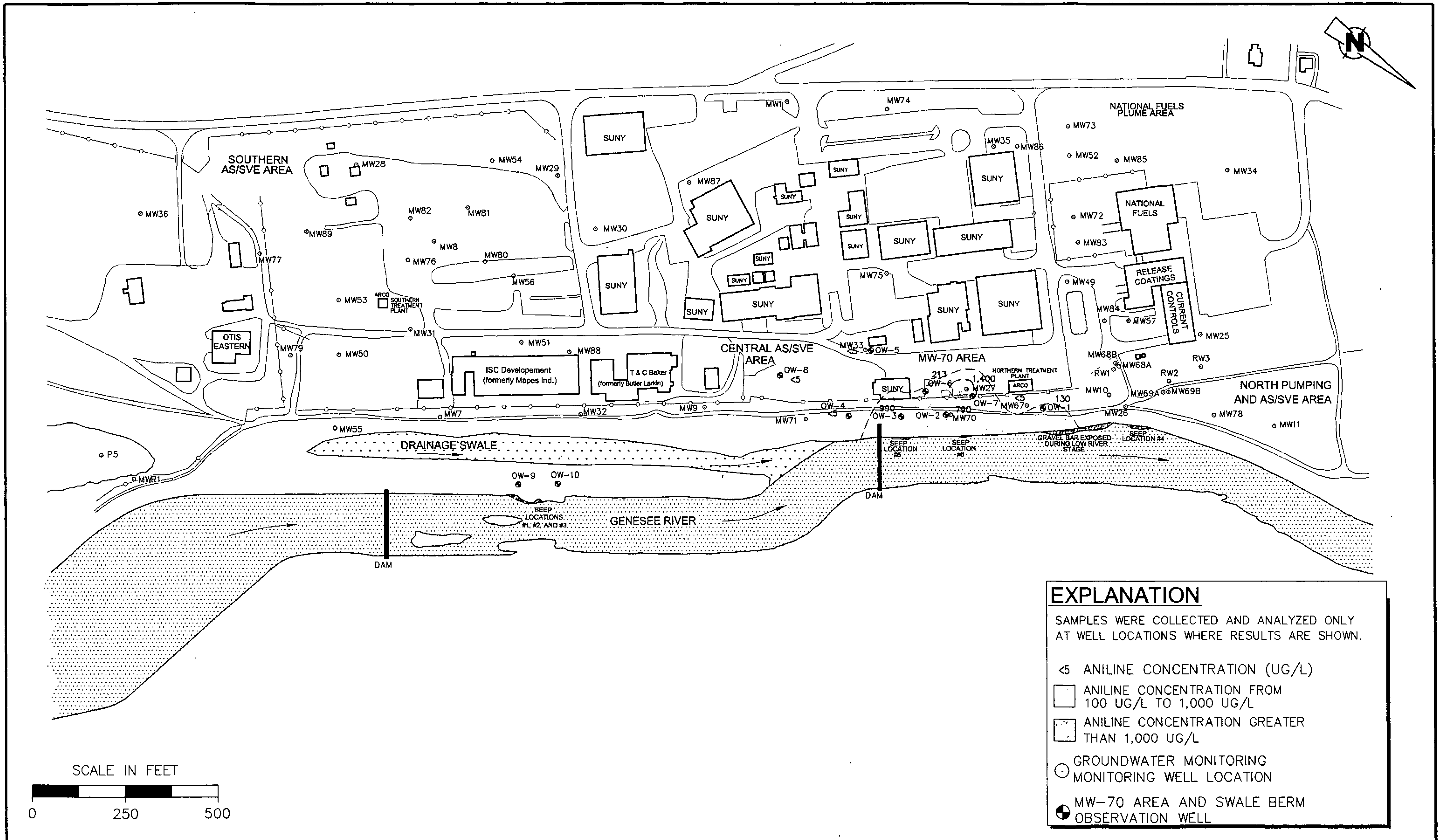
FIGURE 6-2
GROUNDWATER NITROBENZENE CONCENTRATION CONTOURS - APRIL 27-MAY 10, 1999
FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK
semiVOC.dwg



EXPLANATION

SAMPLES WERE COLLECTED AND ANALYZED ONLY AT WELL LOCATIONS WHERE RESULTS ARE SHOWN.

<5 ANILINE CONCENTRATION (UG/L)

ANILINE CONCENTRATION FROM 100 UG/L TO 1,000 UG/L

ANILINE CONCENTRATION GREATER THAN 1,000 UG/L

GROUNDWATER MONITORING MONITORING WELL LOCATION

MW-70 AREA AND SWALE BERM OBSERVATION WELL

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FIGURE 6-3
GROUNDWATER ANILINE CONCENTRATION CONTOURS - DECEMBER 1998

FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK
semiVOC.dwg

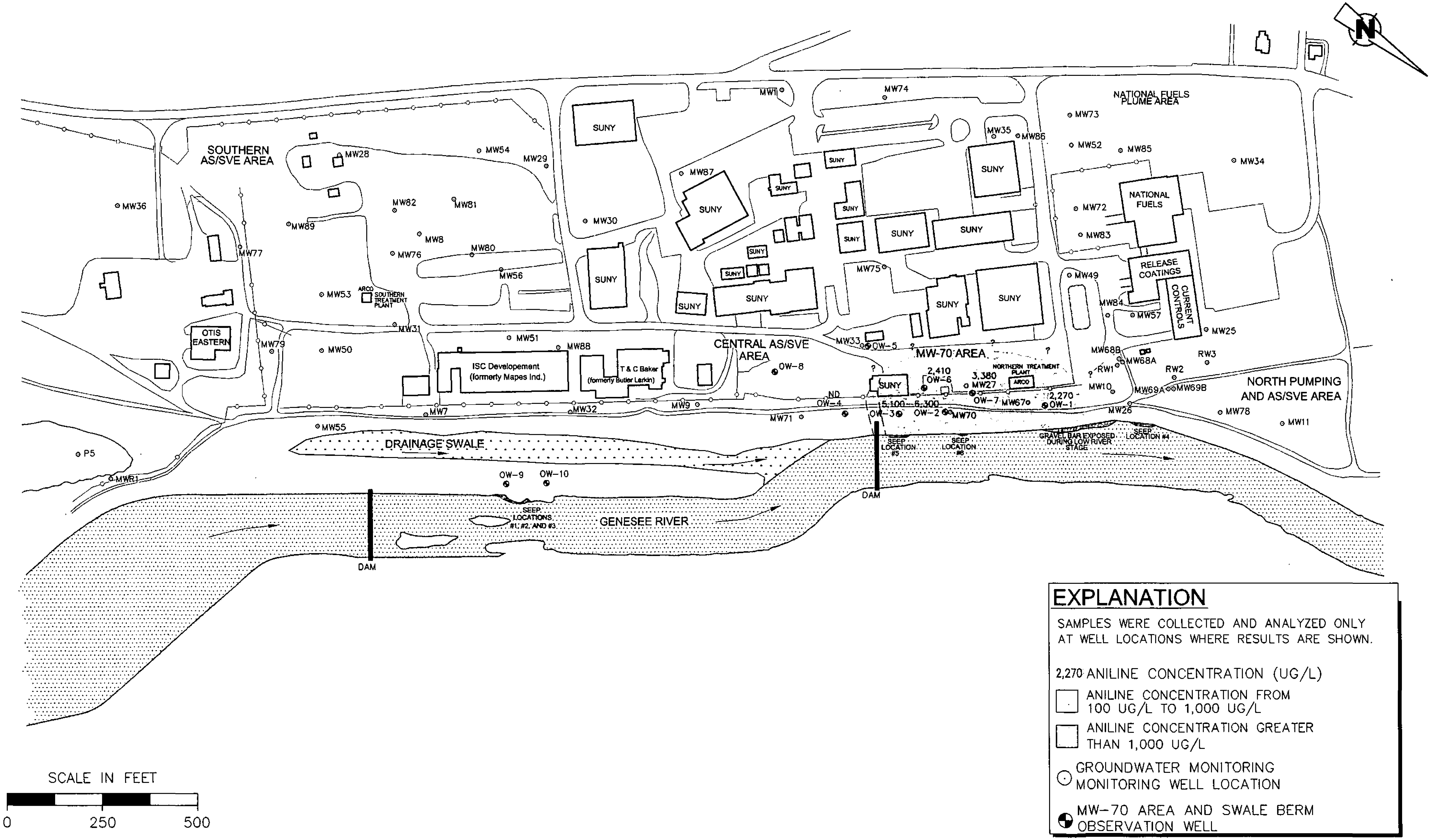

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FIGURE 6-4
GROUNDWATER ANILINE CONCENTRATION (ppb)
CONTOURS - APRIL 27-MAY 10, 1999

FORMER SINCLAIR REFINERY, WELLSVILLE, NEW YORK
semiVOC.dwg

FIGURE 7-1
MW-73 (National Fuels Area)
Concentrations of Benzene and Total Xylenes Relative to Federal and NYSDEC MCLs

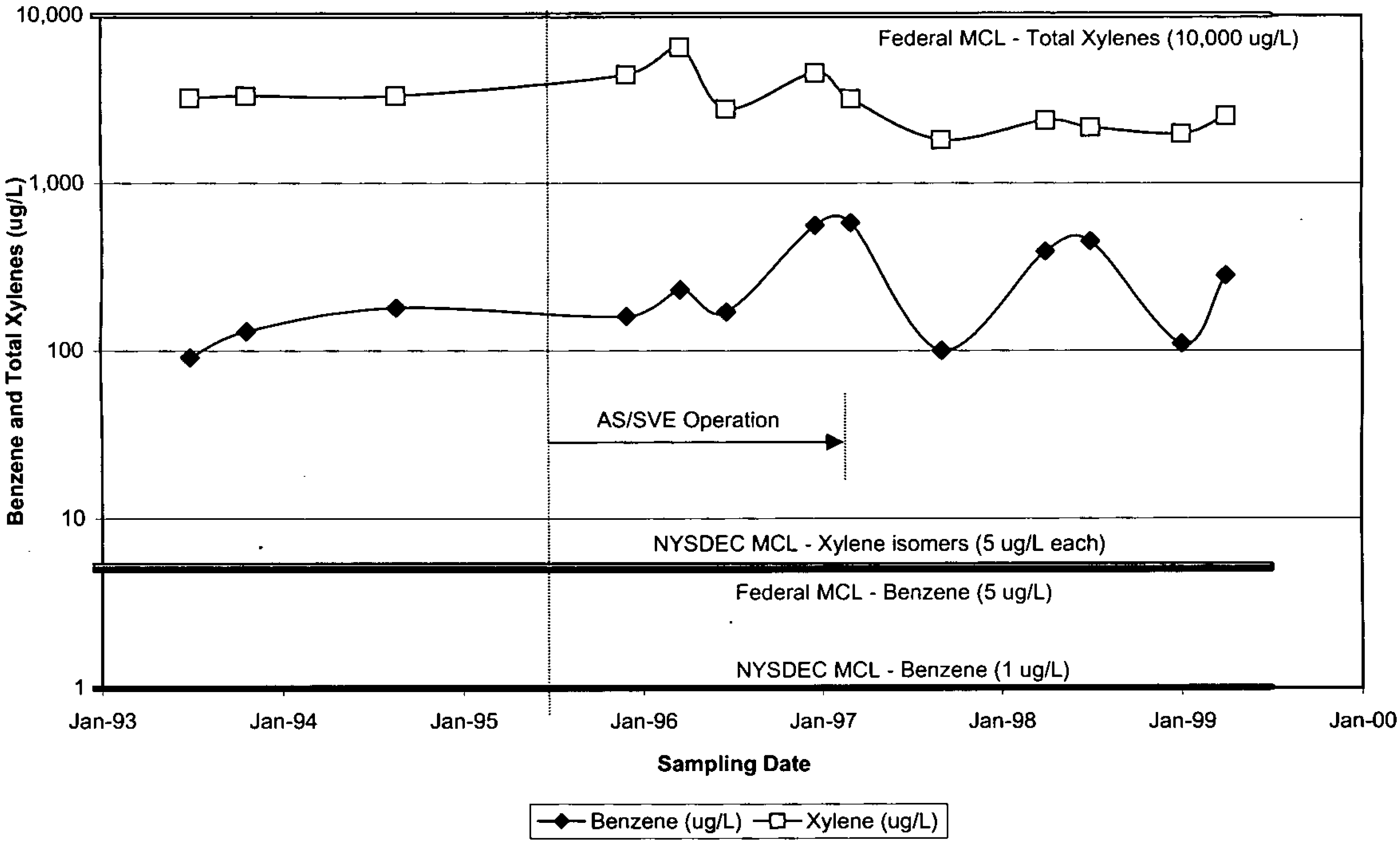
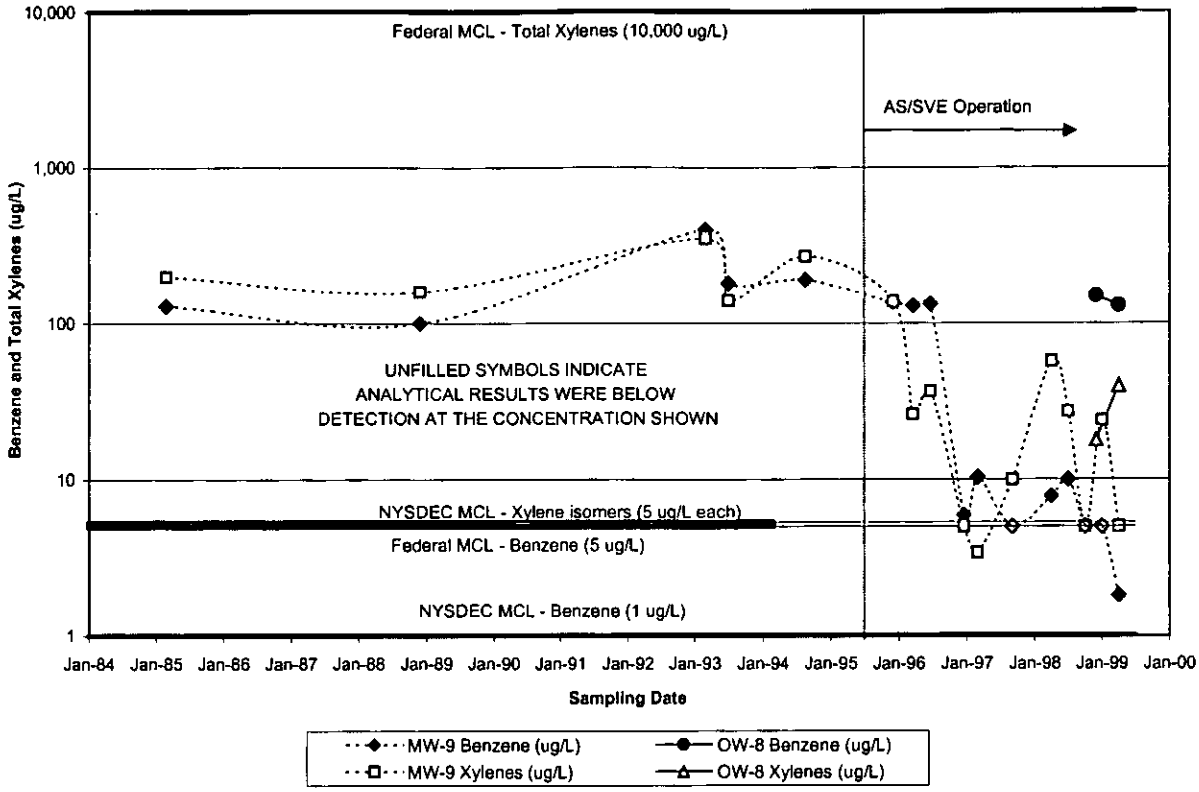


FIGURE 7-2

Central Area

Concentrations of Benzene and Total Xylenes Relative to Federal and NYSDEC MCLs
MW-9 (Downgradient Periphery), OW-8 (Plume Center), and MW-33 (Upgradient Periphery)



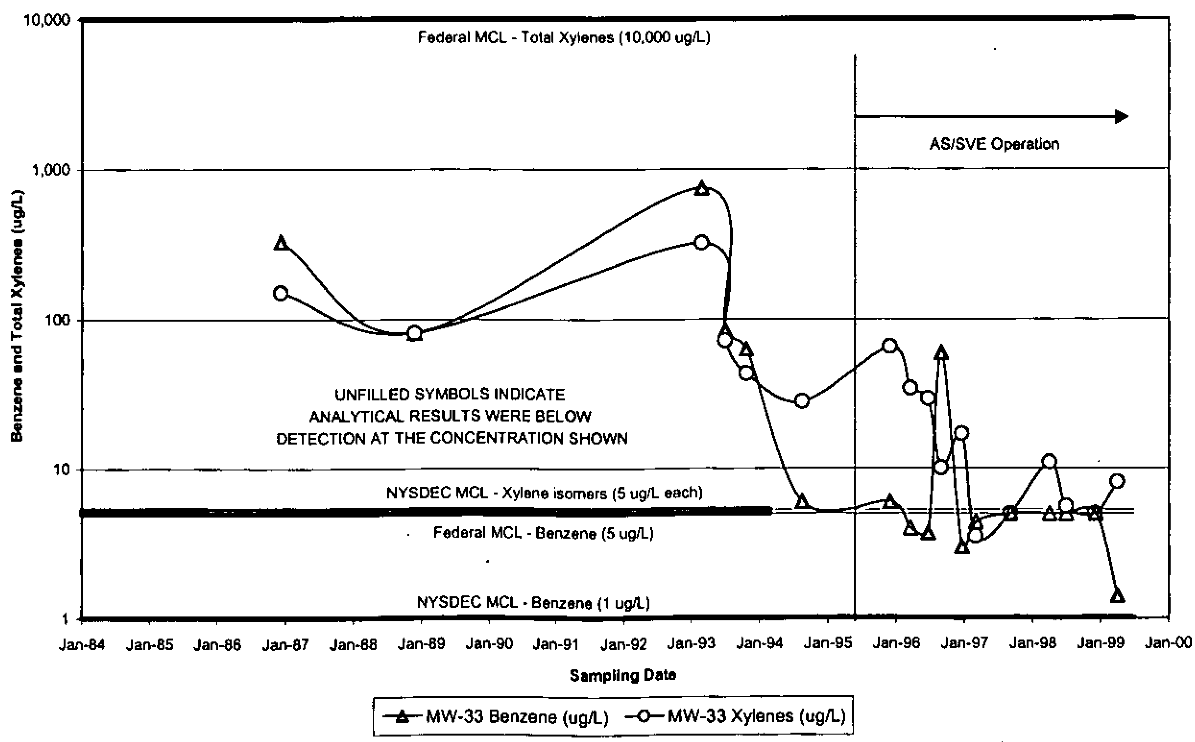
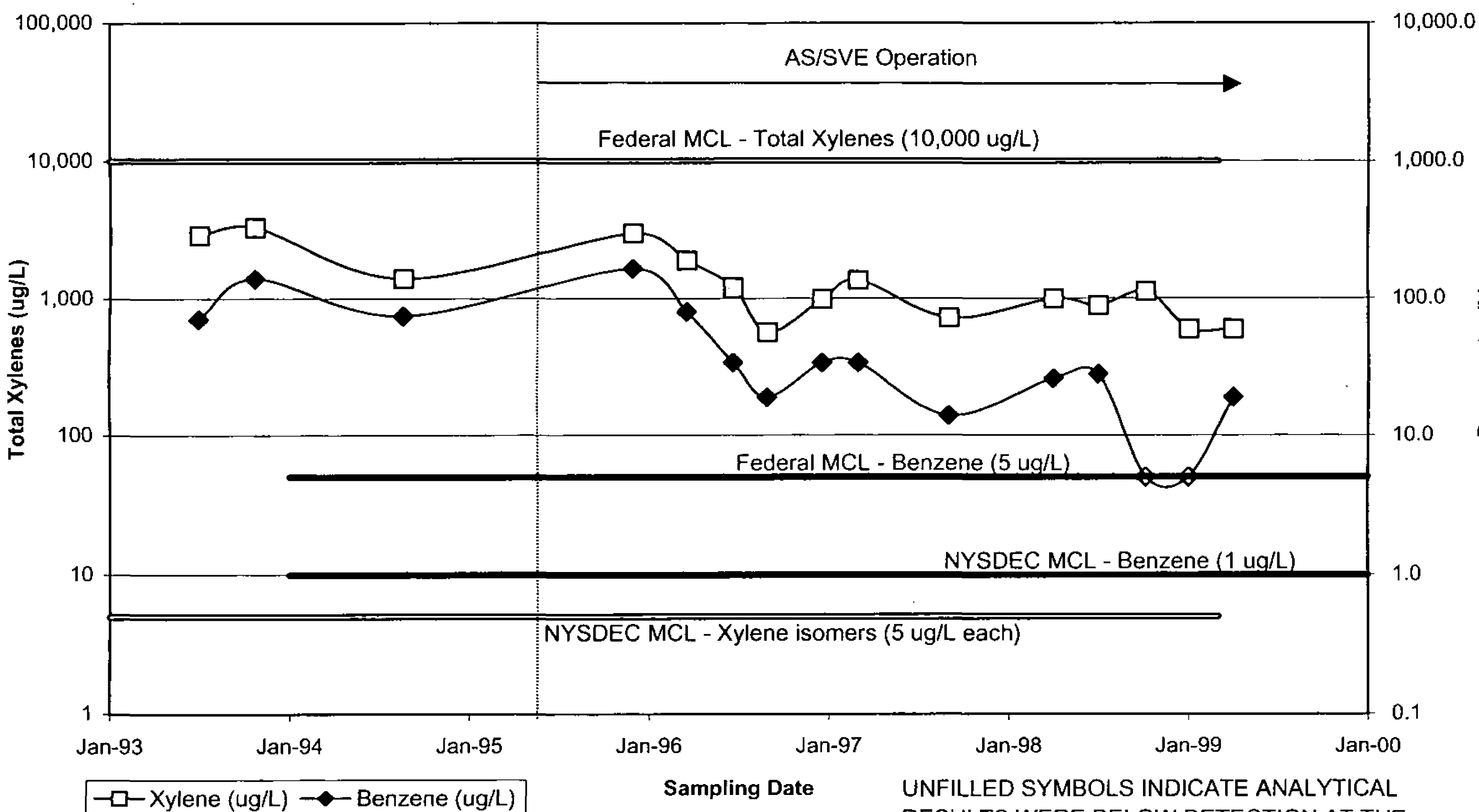
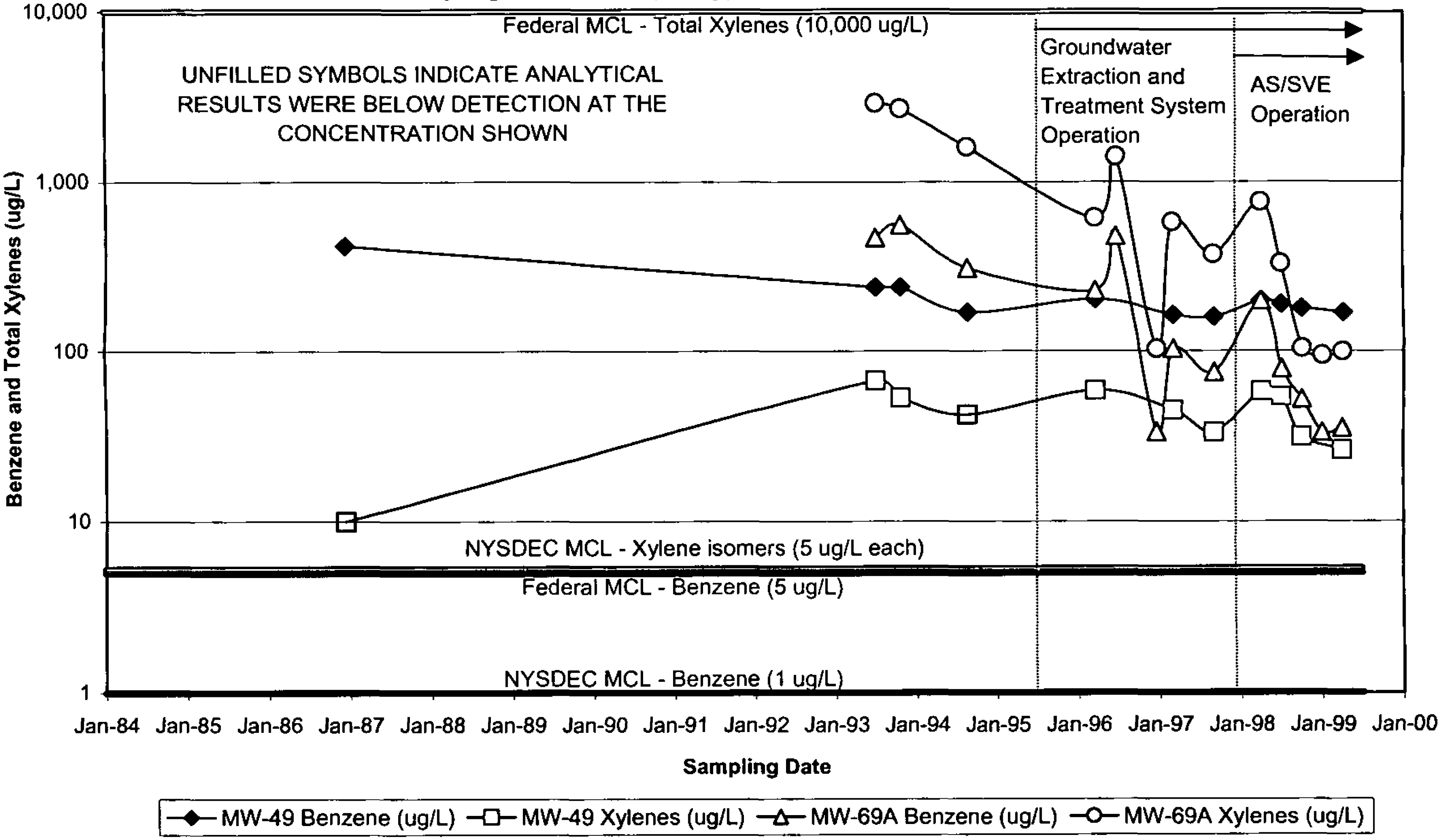


FIGURE 7-3
MW-77 (Southern Area)
Concentrations of Benzene and Total Xylenes Relative to Federal and NYSDEC MCLs



UNFILLED SYMBOLS INDICATE ANALYTICAL RESULTS WERE BELOW DETECTION AT THE CONCENTRATION SHOWN

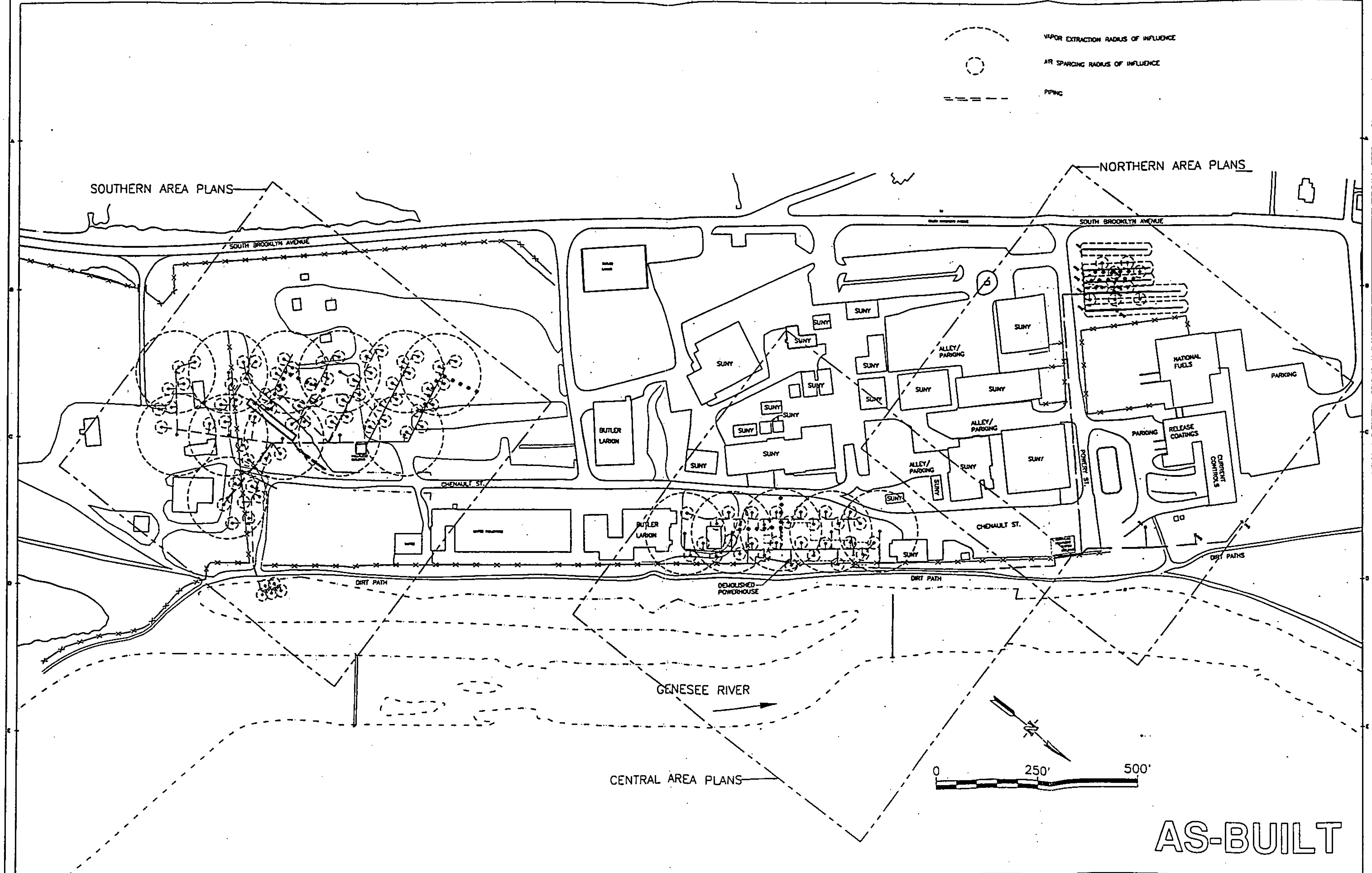
FIGURE 7-4
Northern Area
Concentrations of Benzene and Total Xylenes Relative to Federal and NYSDEC MCLs
MW-49 (Upgradient Periphery) and MW-69A (Center of Plume)



APPENDIX A

AS-BUILT CIVIL LAYOUT AND PROCESS DRAWINGS

Sheet #	Title
S-4	System Layout Plan
S-5	Northern Area Sparging System Layout
S-6	Central Area Sparging System Layout
S-7	Southern Area Sparging System Layout
S-8	Northern Area Vapor Extraction System Layout
S-9	Central Area Vapor Extraction System Layout
S-10	Southern Area Vapor Extraction System Layout
S-11	Northern Area Groundwater Extraction System Layout
EXP-1	Groundwater Remediation System Expansion
P-3A	Northern Groundwater Treatment System P&ID
P-3B	Northern Groundwater Treatment System P&ID
P-4	Northern Groundwater Treatment System P&ID
P-5	Northern and Central Areas Air Sparging Systems P&ID
P-6	Northern and Central Areas Vapor Extraction Systems P&ID
P-7	Northern and Central Areas Thermal Oxidation P&ID
P-8	Southern Air Sparging System P&ID
P-9	Southern Vapor Extraction and Thermal Oxidation System P&ID



AS-BUILT

10775A01	RETECo 100% DESIGN				
		3	CAP	7/98	AS-BUILT - ADDITIONAL PUMPING WELL RW-7
		2	RCW	11-95	AS-BUILT FINAL
		1	ScV	4-93	AS-BUILT
		0	ScV	08/29/94	100 % DESIGN - ISSUE TO AGENCY
REFERENCE DWG	DESCRIPTION				

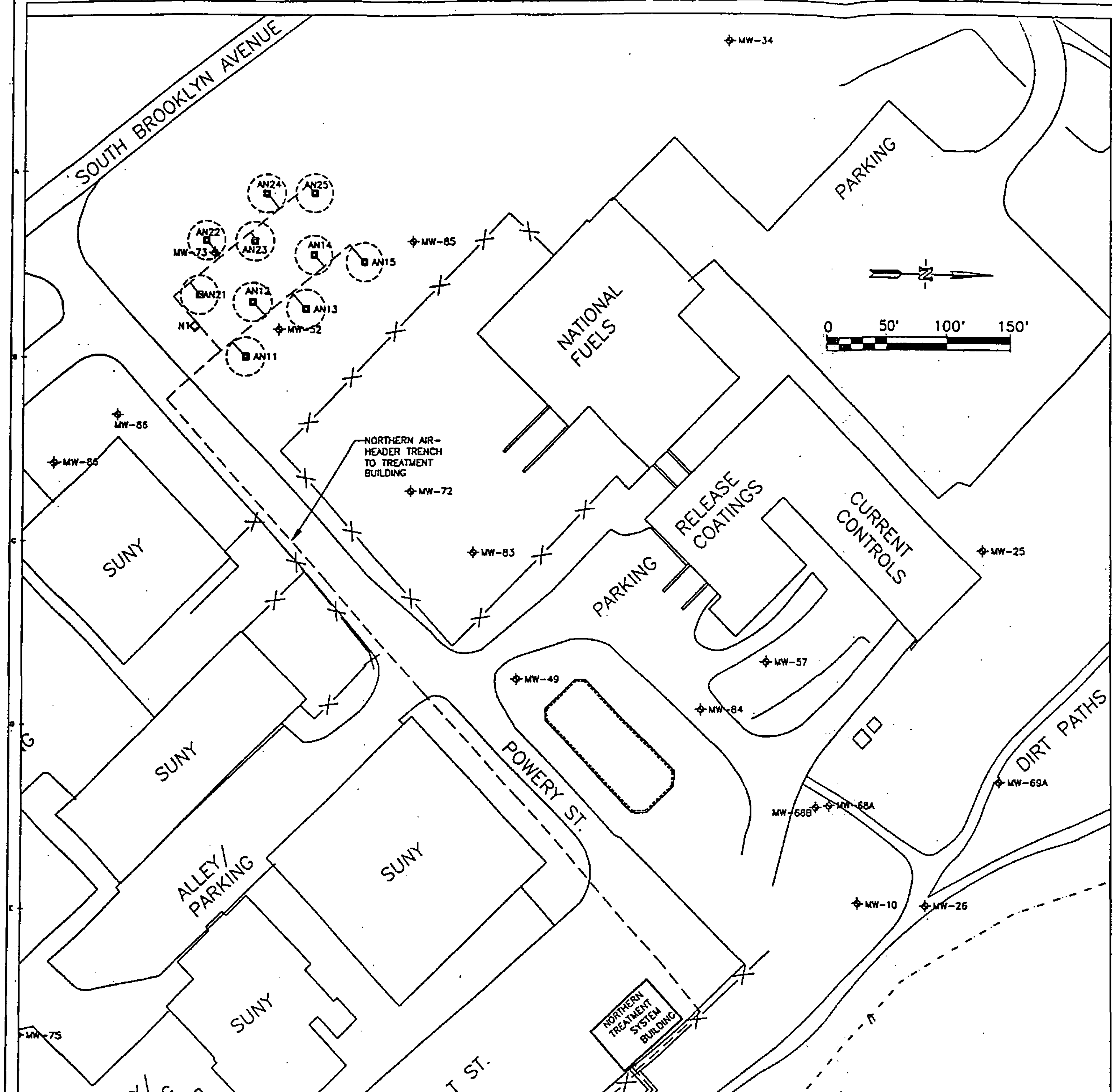
ARCO

SINCLAIR REFINERY SITE
OPERABLE UNIT 2
1-1658

SYSTEM LAYOUT PLAN

WELLSVILLE, NY

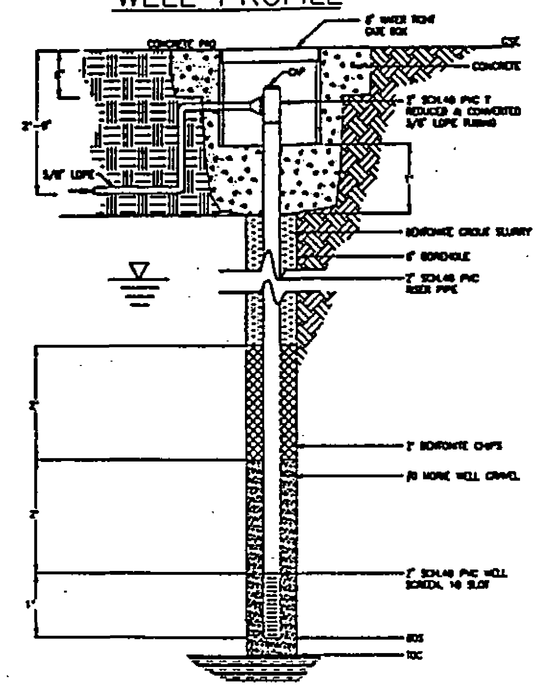
RETEC REMEDIATION TECHNOLOGIES INC



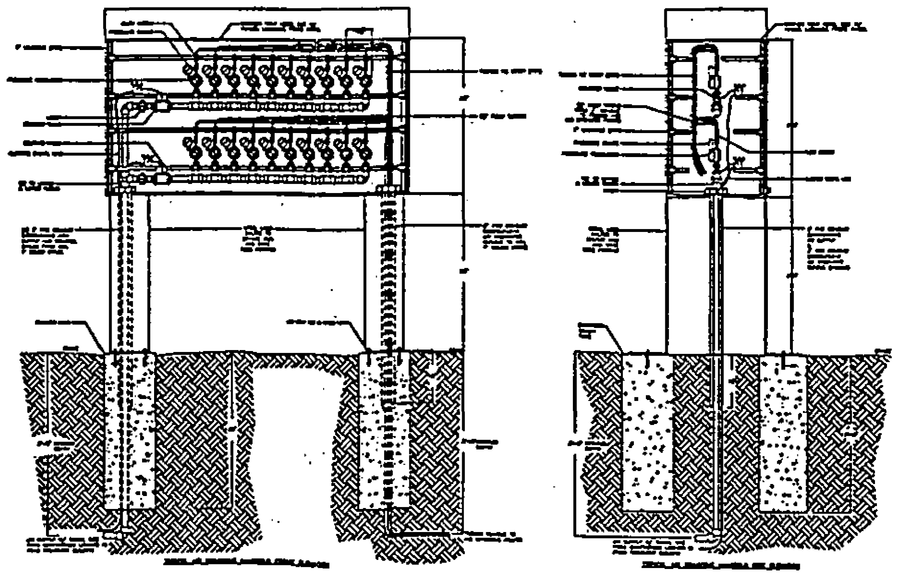
WELL SCHEDULE

WELL #	NORTHING	EASTING	GSE	BOS	TOC
AN11	769713.83	672985.91	1496.10	1483.10	1482.40
AN12	769719.39	672943.96	1495.70	1475.70	NA
AN13	769761.03	672949.17	1495.65	82.65	1482.05
AN14	769767.07	672907.39	1495.61	1475.61	NA
AN15	769808.62	672912.35	1495.46	1475.46	1475.66
AN21	769672.77	672933.96	1496.20	1487.70	1487.45
AN22	769682.58	672896.60	1496.72	1485.72	1485.32
AN23	769720.62	672896.90	1496.19	1486.69	1486.09
AN24	769729.83	672659.82	1496.30	1486.30	1486.40
AN25	769767.43	672659.49	1495.82	1487.82	1487.82

WELL PROFILE



AIR SPARGING DISTRIBUTION/CONTROL BOX DETAIL



N1 ☐ AIR SPARGING CONTROL PANEL SYMBOL ON LAYOUT

AS-BUILT

NO	DRWN	DATE	REVISION
2	RCW	11-95	AS-BUILT FINAL
1	BCV	3-95	AS-BUILT
0	BCV	08-29-94	100% DESIGN - ISSUE TO AGENCY

REFERENCE DWG | DESCRIPTION | CHK'D | DATE | APPV'D | DATE

ARCO

SINCLAIR REFINERY SITE
OPERABLE UNIT 2
1-1658

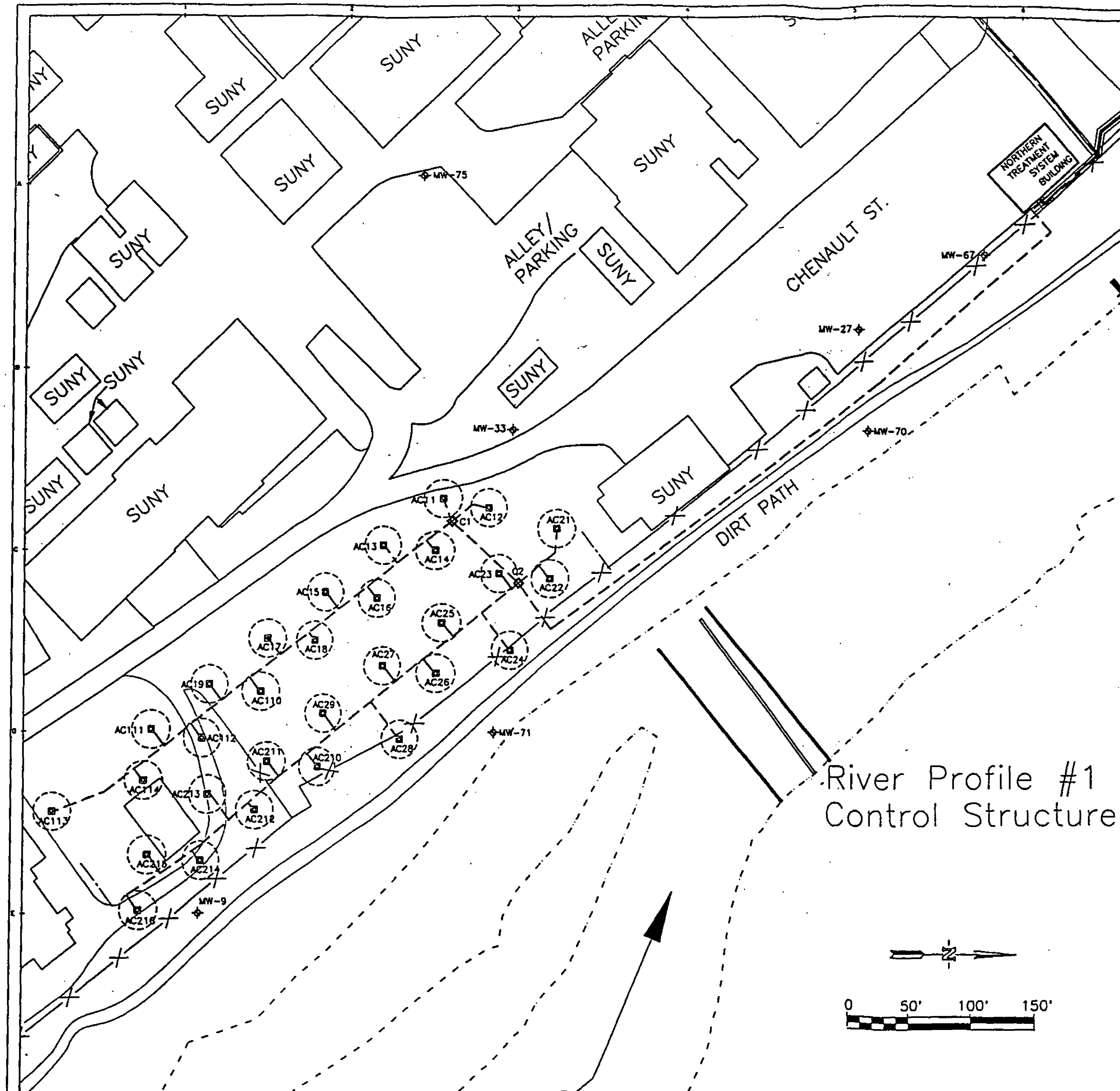
CURRENT DATE: 11-95 CAD FILE 18585001

NORTHERN AREA
SPARGING SYSTEM LAYOUT

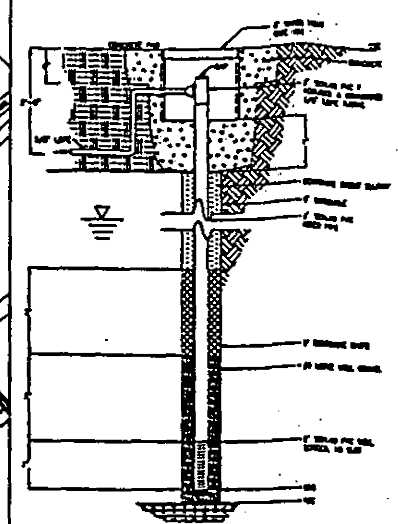
WELLSVILLE, NY

REMEDIATION TECHNOLOGIES INC.

DRAWING NO. S-5 REV. 2



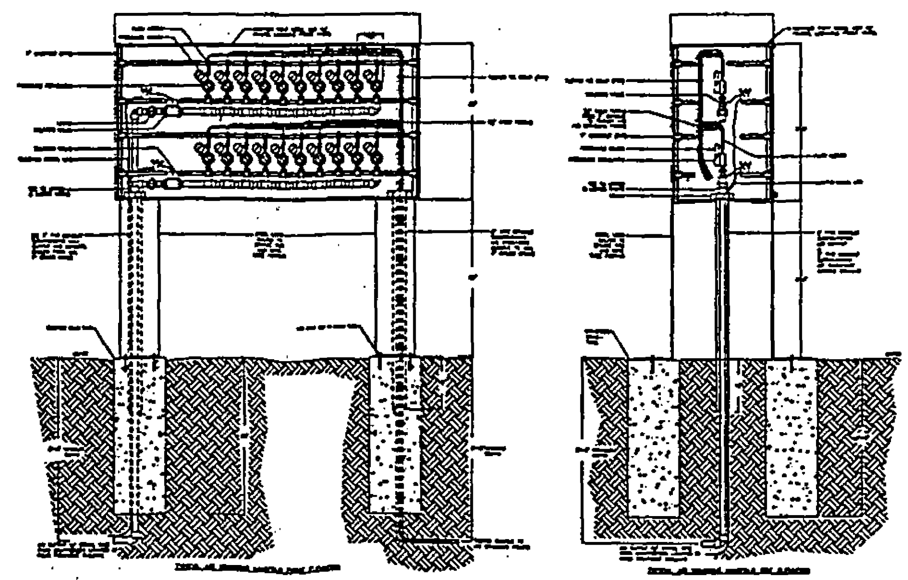
WELL PROFILE



WELL SCHEDULE

WELL#	NORTHING	EASTING	CSE	BOS	TOC
AC11	769552.86	673767.19	1497.20	1477.70	NA
AC12	769589.62	673774.39	1496.76	1477.26	NA
AC13	769504.99	673803.82	1496.68	1477.18	NA
AC14	769546.77	673808.21	1496.39	1476.89	NA
AC15	769457.70	673840.58	1496.45	1476.45	NA
AC16	769499.86	673845.70	1496.64	1477.44	NA
AC17	769410.63	673877.69	1496.52	1477.02	NA
AC18	769449.02	673878.80	1496.98	1477.98	NA
AC19	769363.45	673914.02	1496.53	1482.03	1481.53
AC110	769405.41	673919.51	1496.56	1478.56	1477.36
AC111	769315.91	673949.27	1497.86	1478.86	1478.36
AC112	769357.55	673956.04	1497.57	1487.57	1482.57
AC113	769238.63	674013.88	1496.99	1477.99	1477.59
AC114	769309.96	673988.97	1498.26	1484.26	1483.26
AC21	769645.45	673790.96	1496.30	1481.81	1481.30
AC22	769640.13	673830.50	1496.29	1478.79	1478.29
AC23	769598.24	673826.63	1496.33	1479.33	1478.33
AC24	769607.39	673887.11	1496.84	1481.84	1478.34
AC25	769551.92	673865.40	1496.88	1479.88	1478.88
AC26	769547.38	673905.35	1497.06	1484.06	1482.06
AC27	769504.47	673899.09	1496.82	1477.32	NA
AC28	769518.86	673957.12	1497.10	1482.10	1481.60
AC29	769456.05	673938.13	1497.20	1479.20	1478.20
AC210	769451.34	673977.97	1497.18	1478.18	1477.68
AC211	769410.09	673974.29	1497.12	1482.12	1481.12
AC212	769400.88	674012.30	1498.50	1483.50	1482.00
AC213	769362.24	674000.11	1498.83	1497.33	NA
AC214	769358.69	674051.78	1497.57	1482.57	1481.57
AC215	769313.10	674047.32	1498.25	1479.25	1478.75
AC216	769308.17	674090.81	1497.19	1477.19	NA

AIR SPARGING DISTRIBUTION/CONTROL BOX DETAIL



C1 AIR SPARGING CONTROL PANEL SYMBOL ON LAYOUT

AS-BUILT

NO	DRWN	DATE	REVISION
2	RCW	11-95	AS-BUILT FINAL
1	BKY	3-95	AS-BUILT
0	BKY	06-29-94	100% DESIGN - ISSUE TO AGENCY

REFERENCE DWG | DESCRIPTION | CHKD | DATE | APPVD | DATE

ARCO

SINCLAIR REFINERY SITE
OPERABLE UNIT 2
1-1658

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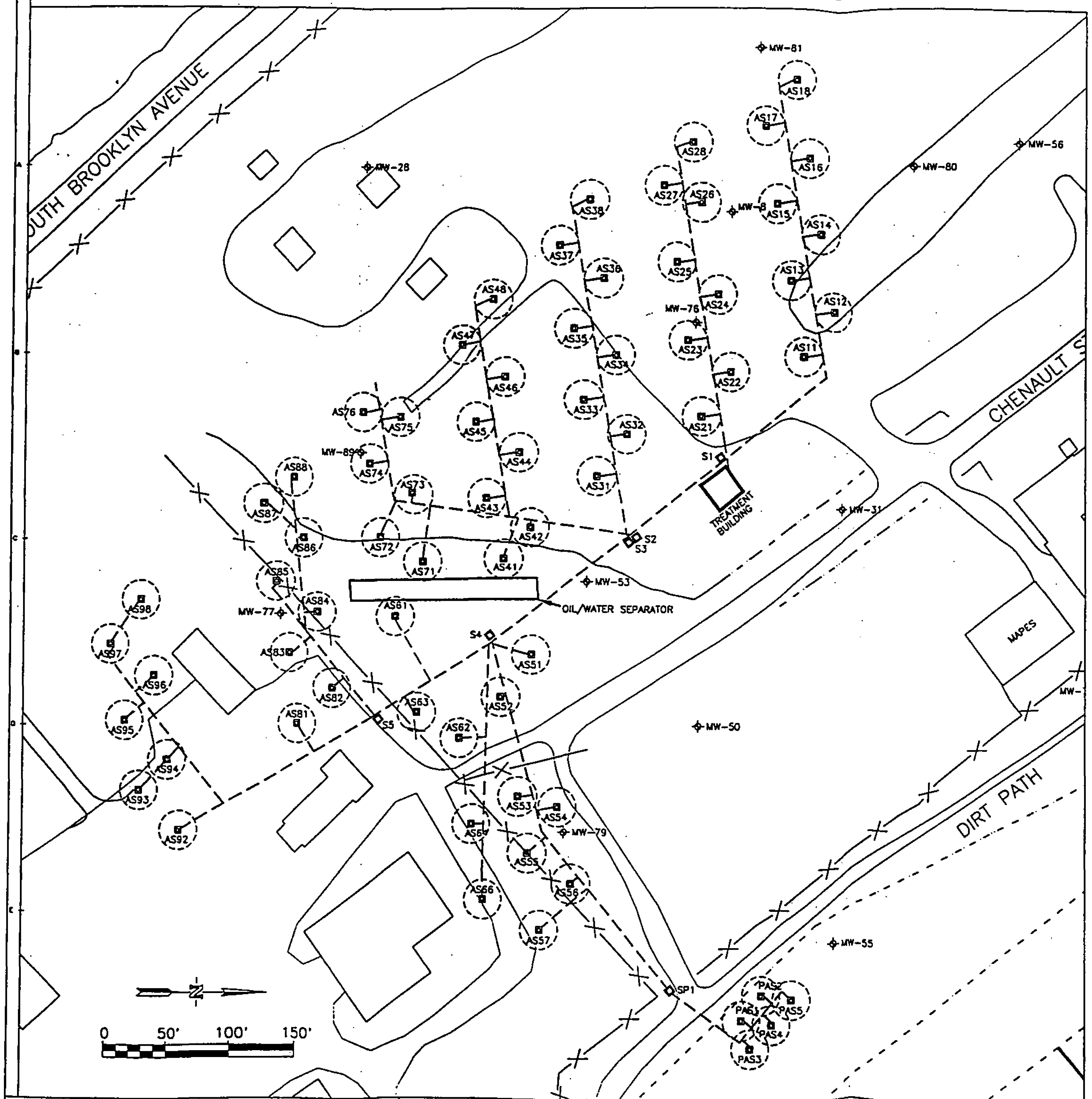
CURRENT DATE: 11-95 | CAD FILE 16585001

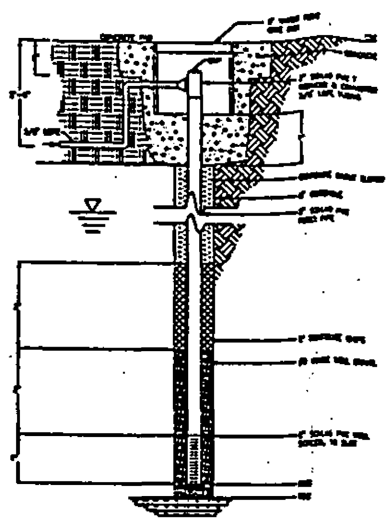
CENTRAL AREA
SPARGING SYSTEM LAYOUT
WELLSVILLE, NY

RETEC
REMEDIATION TECHNOLOGIES INC

DRAWING NO. S-6 REV 2



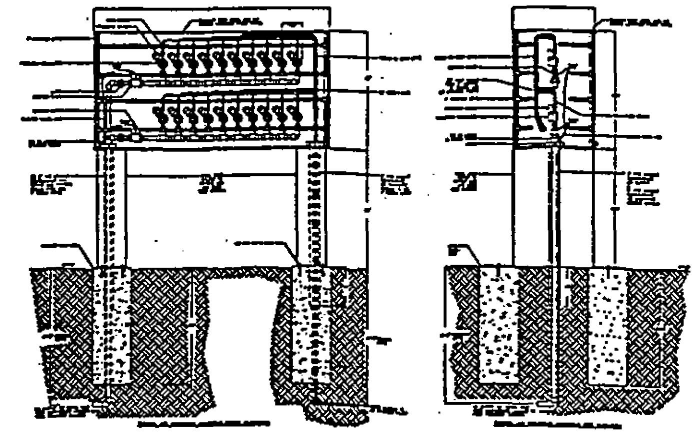
WELL PROFILE



WELL SCHEDULE

WELL#	NORTHING	EASTING	GSE	BOS	TOC
AS11	768559.44	674286.24	1498.26	1474.26	NA
AS12	768583.03	674251.48	1498.28	1474.28	NA
AS13	768549.09	674227.67	1498.30	1473.30	NA
AS14	768572.12	674192.35	1498.63	1475.83	NA
AS15	768537.40	674169.01	1498.75	1475.75	NA
AS16	768562.97	674134.55	1498.78	1475.78	NA
AS17	768527.36	674109.37	1498.46	1476.46	1475.48
AS18	768552.45	674073.87	1498.32	1476.32	1475.32
AS21	768477.53	674332.39	1498.76	1474.76	NA
AS22	768500.81	674297.87	1498.36	1473.36	NA
AS23	768466.70	674273.89	1498.52	1474.52	NA
AS24	768490.45	674238.31	1498.57	1474.59	NA
AS25	768457.61	674213.98	1498.91	1474.91	NA
AS26	768476.79	674168.13	1498.87	1474.87	NA
AS27	768446.85	674155.77	1499.26	1475.26	NA
AS28	768469.78	674122.50	1479.07	1475.07	NA
AS31	768395.50	674379.33	1498.59	1474.59	NA
AS32	768418.52	674348.56	1497.87	1473.87	NA
AS33	768384.95	674320.35	1498.41	1474.41	NA
AS34	768409.68	674285.73	1499.04	1475.05	NA
AS35	768376.94	674265.58	1499.23	1475.23	NA
AS36	768399.87	674226.92	1499.33	1474.33	NA
AS37	768365.48	674201.91	1499.30	1474.30	NA
AS38	768388.67	674166.94	1499.11	1476.11	NA
AS41	768322.51	674443.42	1499.33	1474.33	NA
AS42	768343.11	674419.08	1497.54	1472.94	NA
AS43	768308.86	674396.67	1498.59	1473.59	NA
AS44	768334.07	674360.98	1498.95	1474.95	NA
AS45	768299.65	674337.46	1498.93	1474.93	NA
AS46	768322.84	674302.81	1498.05	1474.05	NA
AS47	768288.32	674278.18	1499.91	1474.91	NA
AS48	768313.11	674243.50	1498.55	1474.15	NA
AS51	768344.33	674517.52	1497.40	1472.40	NA
AS52	768320.64	674550.43	1497.94	1483.94	1481.94
AS53	768334.40	674626.92	1497.74	1472.74	NA
AS54	768365.57	674634.88	1497.74	1472.74	NA
AS55	768342.10	674670.16	1497.95	1472.95	NA
AS56	768376.52	674693.39	1497.94	1472.94	NA
AS57	768351.81	674728.56	1498.20	1473.20	NA
AS61	768238.21	674487.93	1498.58	1473.58	NA
AS62	768287.60	674581.85	1498.50	1484.50	NA
AS63	768253.49	674581.95	1498.09	1473.09	NA
AS64	768297.73	674647.81	1498.39	1473.39	NA
AS65	NOT	INSTALLED			
AS66	768307.25	674705.58	1498.35	1473.35	NA
AS71	768257.85	674445.50	1499.23	1476.23	1475.23
AS72	768224.26	674426.73	1496.85	1472.35	NA
AS73	768249.20	674392.22	1499.48	1474.28	NA
AS74	768215.32	674389.50	1499.58	1474.28	NA
AS75	768239.41	674333.54	1500.09	1475.09	NA
AS76	768209.60	674329.76	1499.84	1475.14	NA
AS81	768157.75	674570.80	1498.84	1474.94	NA
AS82	768185.83	674543.26	1498.48	1473.48	NA
AS83	768151.38	674516.27	1498.59	1473.59	NA
AS84	768173.65	674484.48	1498.67	1473.67	NA
AS85	768140.78	674460.78	1498.50	1473.50	NA
AS86	768162.55	674427.36	1497.76	1472.96	NA
AS87	768130.69	674400.76	1498.64	1473.64	NA
AS88	768154.54	674380.53	1499.08	1474.08	NA
AS91	NOT	INSTALLED			
AS92	768066.25	674852.68	1499.27	1476.27	NA
AS93	768034.21	674821.95	1499.20	1474.20	NA
AS94	768056.76	674598.63	1498.76	1473.76	NA
AS95	768022.45	674568.31	1498.97	1479.17	1475.97
AS96	768045.99	674533.97	1499.36	1482.36	1479.36
AS97	768010.71	674509.83	1498.98	1476.98	1475.98
AS98	768035.22	674475.43	1499.15	1426.15	1425.15
PAS1	768511.21	674797.06	1498.55	1477.05	1475.55
PAS2	768526.89	674778.09	1497.84	1475.64	1474.84
PAS3	768518.32	674818.88	1498.16	1475.16	1474.16
PAS4	768535.31	674800.25	1497.29	1475.29	1474.29
PAS5	768551.19	674750.72	1496.76	1476.76	1475.01

AIR SPARGING DISTRIBUTION/ CONTROL BOX DETAIL



S1 ☐ AIR SPARGING CONTROL PANEL-SYMBOL ON LAYOUT

AS-BUILT

2	RCV	11-95	AS-BUILT FINAL	
1	BCV	3-95	AS-BUILT	
0	BCV	08-28-94	100% DESIGN - ISSUE TO AGENCY	
NO	DRWN	DATE	REVISION	CHKD DATE APPVD DATE

REFERENCE DWG | DESCRIPTION

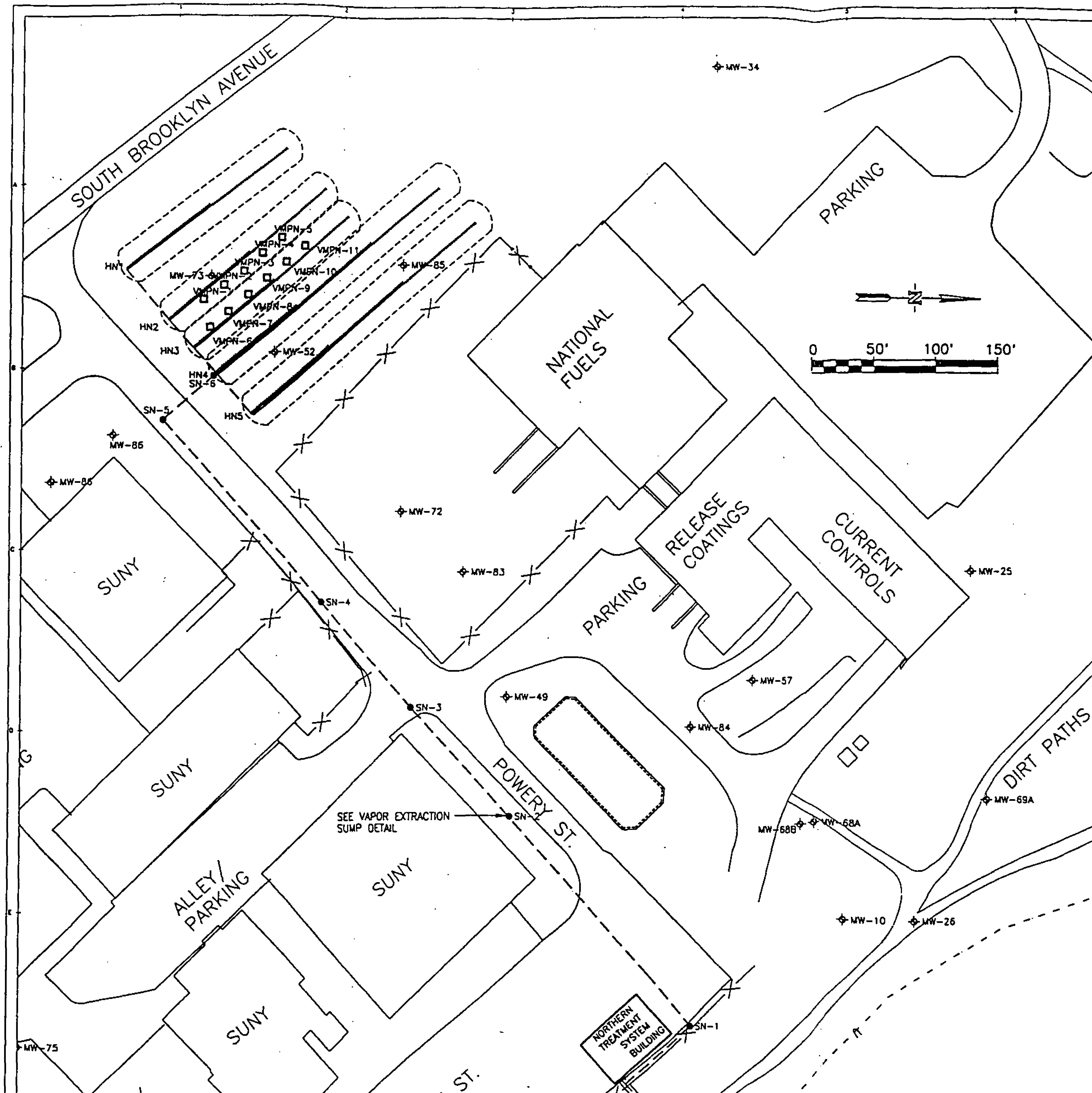
ARCO

SINCLAIR REFINERY SITE
OPERABLE UNIT 2
1-1658

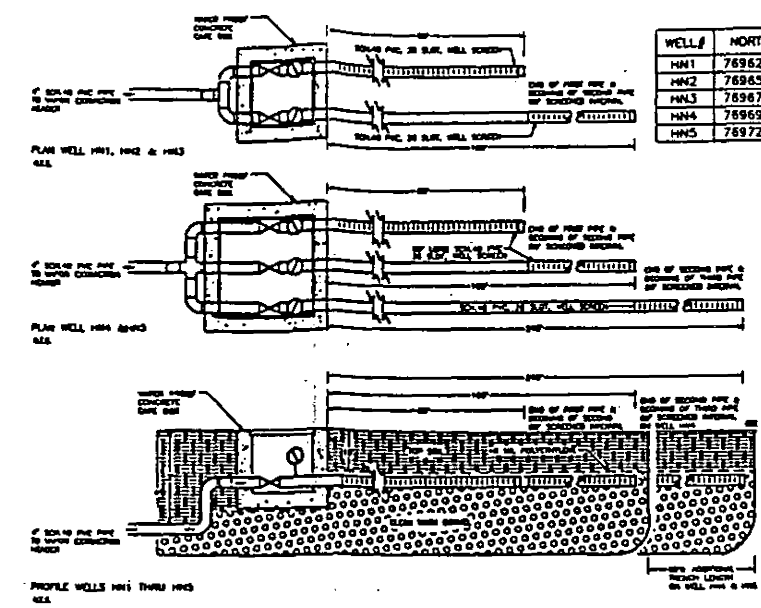
SOUTHERN AREA
SPARGING SYSTEM LAYOUT

WELLSVILLE, NY

RETEC
REMEDIATION TECHNOLOGIES INC

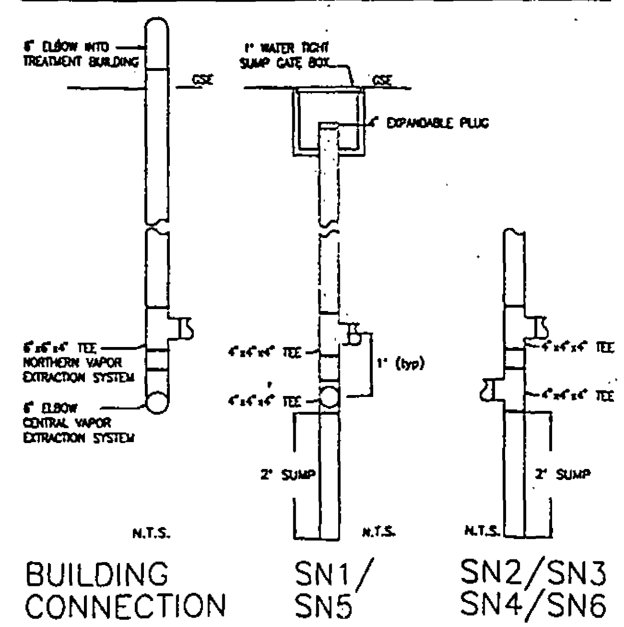


HORIZONTAL VAPOR EXTRACTION WELL PLANS & PROFILE AND WELL BOX SCHEDULE



WELL#	NORTHING	EASTING	GSE
HN1	769621.83	672900.41	1502.45
HN2	769656.14	672939.71	1496.32
HN3	769675.90	672961.68	1496.33
HN4	769694.41	672981.38	1496.40
HN5	769722.69	673013.76	1496.55

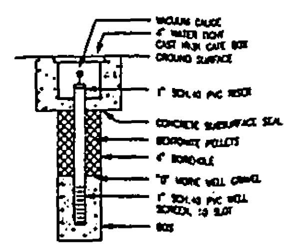
VAPOR EXTRACTION SUMP PROFILES



LEGEND

- VAPOR EXTRACTION HORIZ. WELL SEGMENT
- VAPOR EXTRACTION RADIUS OF INFLUENCE
- SUMP GATE BOX
- VAPOR EXTRACTION PIPE

VACUUM MONITORING POINT PROFILE & SCHEDULE



WELL#	NORTHING	EASTING	GSE	BOS
VMPN1	769682.81	672924.11	1496.27	1492.27
VMPN2	769698.79	672912.72	1496.09	1492.09
VMPN3	769715.08	672901.96	1496.28	1492.28
VMPN4	769729.87	672887.60	1496.35	1492.35
VMPN5	769745.21	672875.61	1496.25	1492.25
VMPN6	769687.92	672945.95	1496.15	1492.15
VMPN7	769702.51	672933.50	1495.97	1492.97
VMPN8	769718.33	672920.20	1496.13	1492.13
VMPN9	769733.48	672907.40	1496.22	1492.22
VMPN10	769748.94	672895.10	1496.02	1492.02
VMPN11	769764.78	672882.26	1496.07	1492.07

AS-BUILT

NO	DRWN	DATE	REVISION
3	RCW	11-95	AS-BUILT FINAL
2	BCV	3-95	AS-BUILT
1	BCV	9-23-94	DETAILED HEADER SUMPS
0	BCV	08-29-94	100% DESIGN - ISSUE TO AGENCY

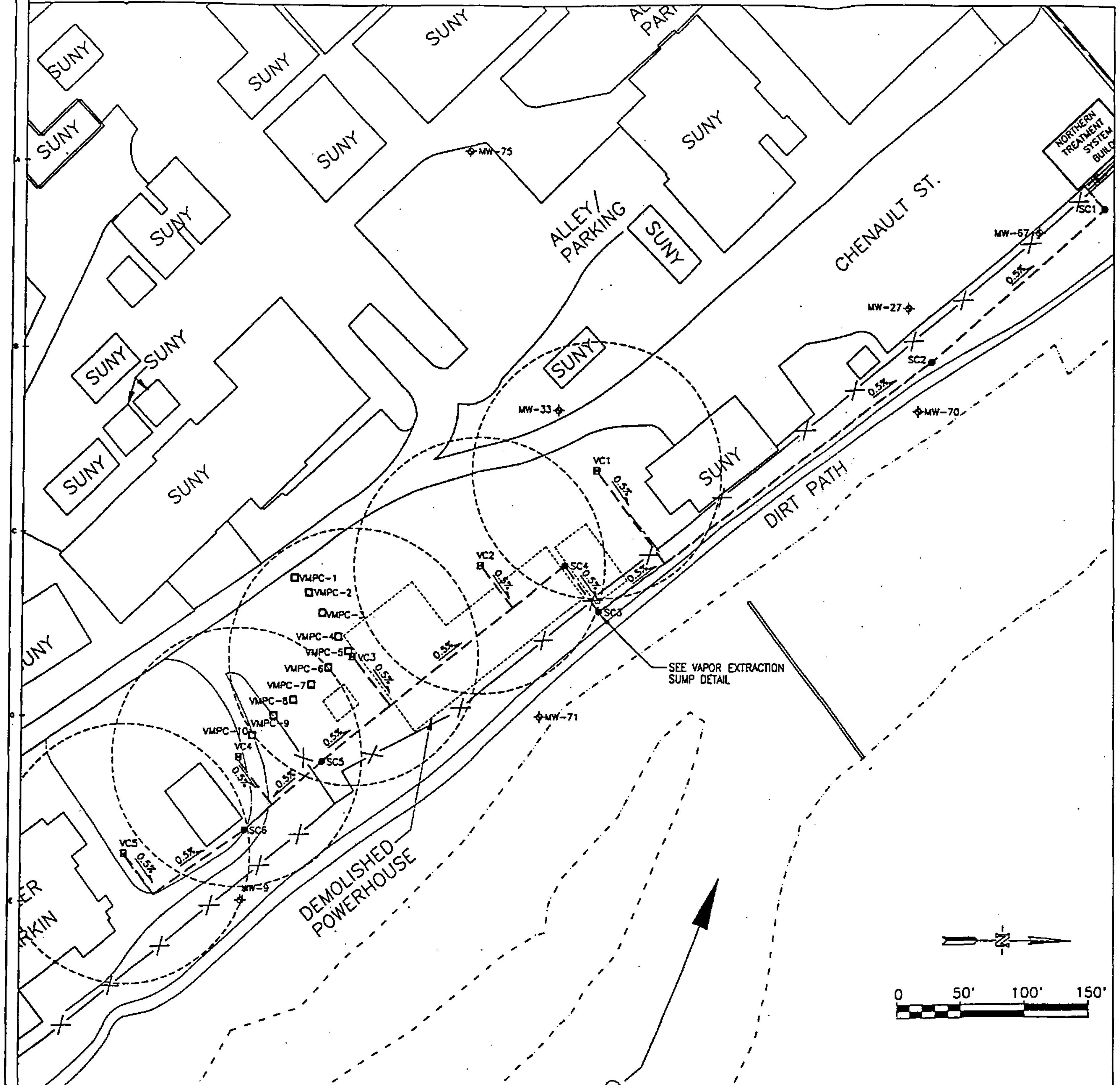
REFERENCE DWG | DESCRIPTION | CHKD | DATE | APPVD | DATE

ARCO

SINCLAIR REFINERY SITE
OPERABLE UNIT 2
1-1658

NORTHERN AREA
VAPOR EXTRACTION SYSTEM LAYOUT
WELLSVILLE, NY

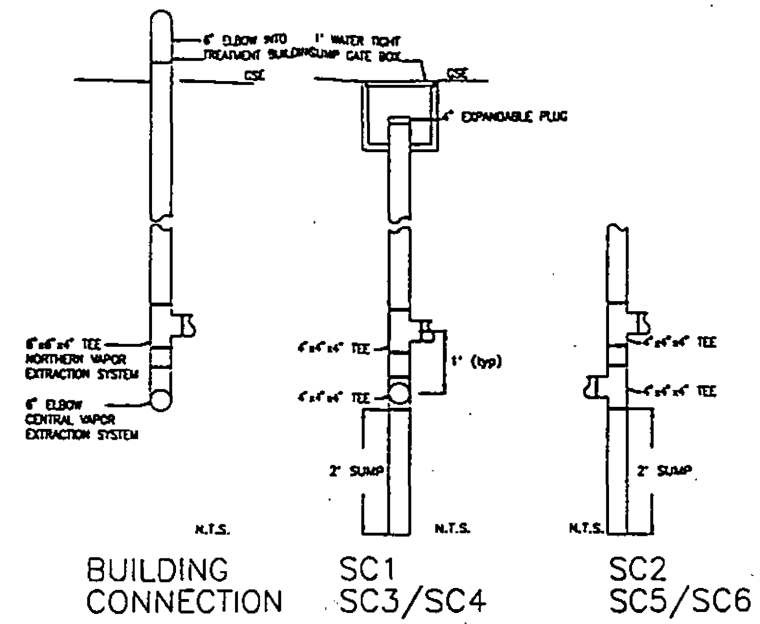
REMEDIATION TECHNOLOGIES INC



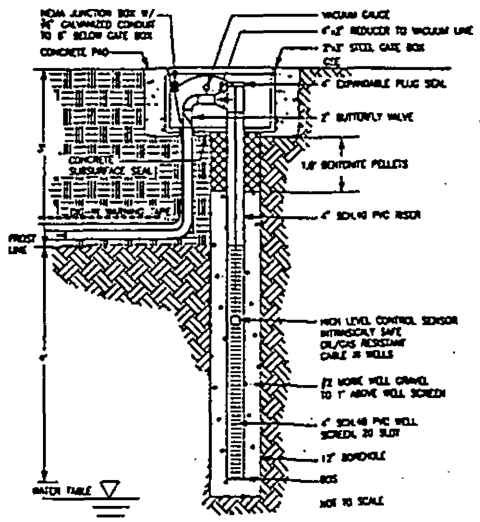
LEGEND

- MW- MONITORING WELL
- VC- VAPOR EXTRACTION POINT
- VMPC- VACUUM MONITORING POINT
- SC- VAPOR EXTRACTION SUMP
- VAPOR EXTRACTION PIPE
- VAPOR EXTRACTION RADIUS OF INFLUENCE

VAPOR EXTRACTION SUMP PROFILES

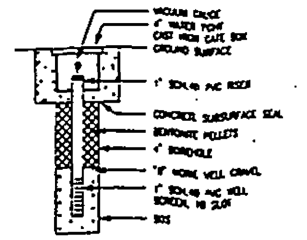


VAPOR EXTRACTION WELL PROFILE & SCHEDULE



WELL#	NORTHING	EASTING	GSE	BOS
VC1	769639.39	673759.97	1496.45	1487.45
VC2	769546.00	673834.18	1496.77	1487.77
VC3	769444.68	673904.96	1497.12	1488.12
VC4	769352.88	673982.80	1493.43	1484.43
VC5	769262.59	674057.05	1497.01	1488.01

VACUUM MONITORING POINT PROFILE & SCHEDULE



WELL#	NORTHING	EASTING	GSE	BOS
VMPC-1	769397.52	673843.55	1497.18	1493.18
VMPC-2	769408.88	673855.06	1496.89	1492.89
VMPC-3	769419.83	673871.07	1496.75	1492.75
VMPC-4	769433.39	673889.42	1496.79	1492.79
VMPC-5	769441.50	673900.54	1497.09	1493.09
VMPC-6	769425.02	673913.39	1497.03	1493.03
VMPC-7	769411.12	673926.53	1497.06	1493.06
VMPC-8	769396.80	673938.84	1496.53	1492.53
VMPC-9	769380.92	673951.06	1496.54	1492.54
VMPC-10	769364.03	673966.04	1497.16	1493.16

AS-BUILT

NO	DRAWN	DATE	REVISION
3	RCW	11-95	AS-BUILT FINAL
2	BCV	3-95	AS-BUILT
1	BCV	9-23-94	DETAILED SUMPS ALONG VAPOR EXTRACTION HEADER
0	BCV	8-29-94	100% DESIGN ISSUE TO AGENCY

CHK'D | DATE | APPV'D | DATE

REFERENCE DWG | DESCRIPTION

ARCO

SINCLAIR REFINERY SITE
OPERABLE UNIT 2
1-1658

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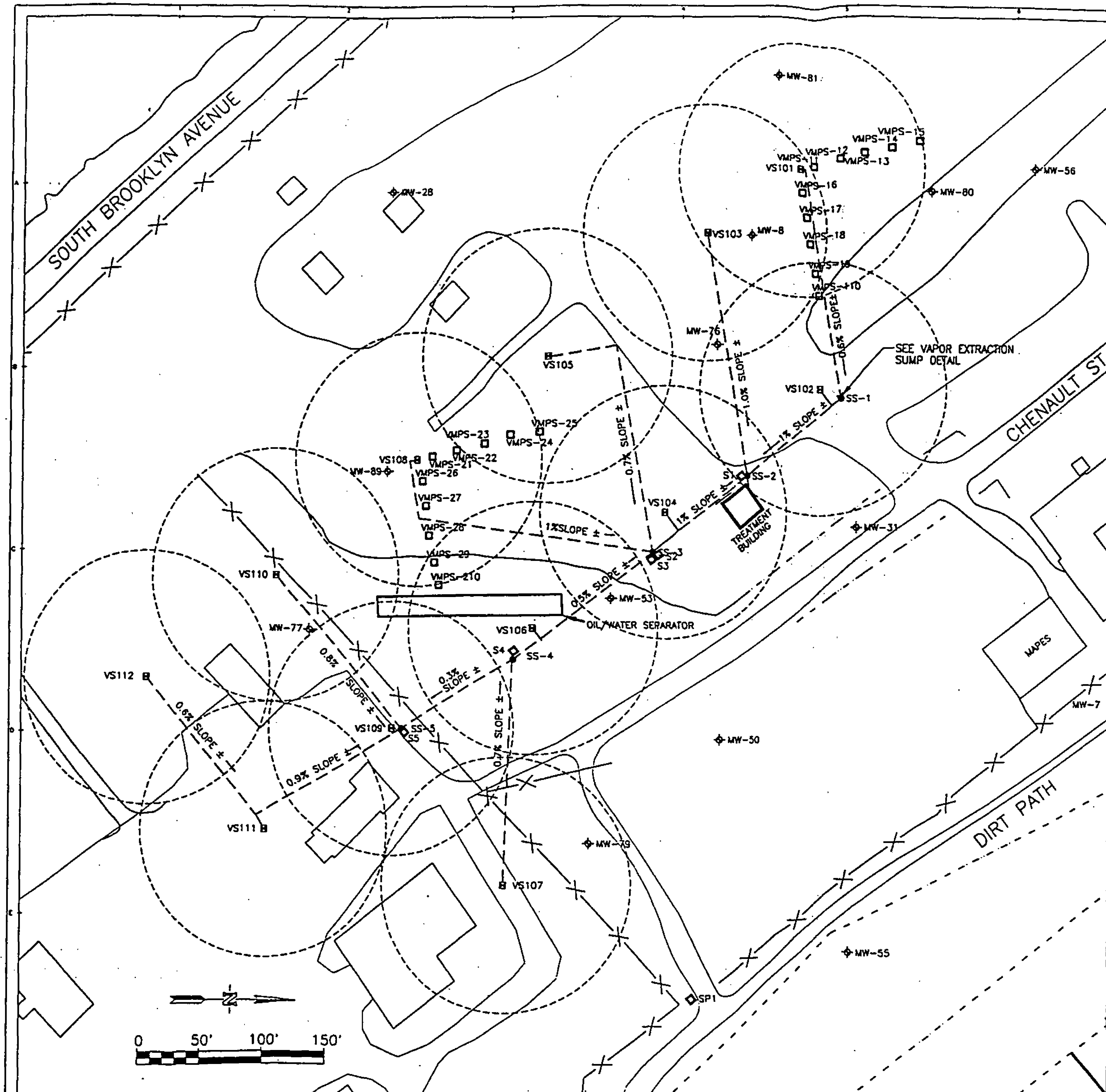
CURRENT DATE: 11-95 | CAD FILE 16585001

CENTRAL AREA
VAPOR EXTRACTION LAYOUT

WELLSVILLE, NY

REMEDIATION TECHNOLOGIES INC

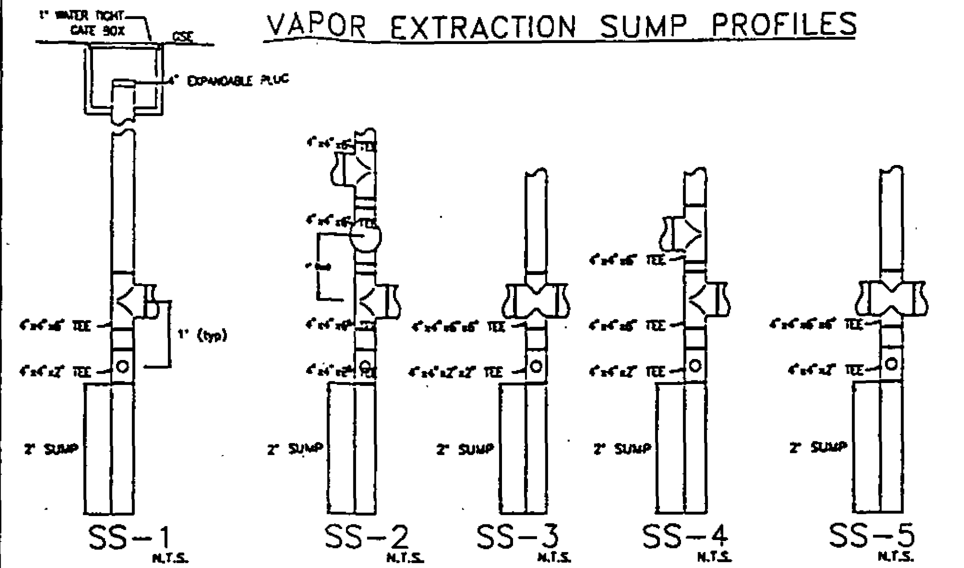
DRAWING NO. S-9



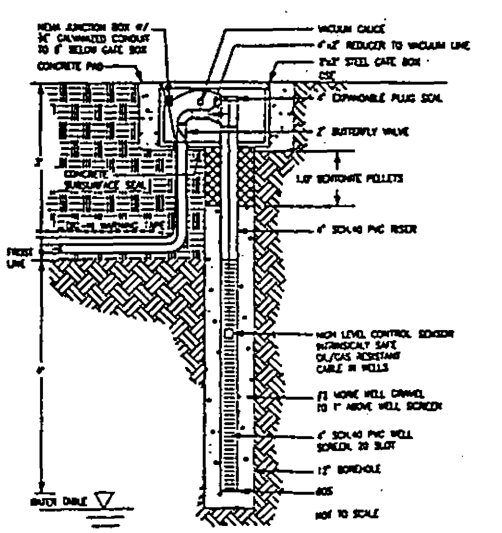
LEGEND

MW-	MONITORING WELL	VMP-	VACUUM MONITORING POINT		VAPOR EXTRACTION PIPE
VS	VAPOR EXTRACTION POINT	SS-	VAPOR EXTRACTION SUMP		VAPOR EXTRACTION RADIUS OF INFLUENCE

VAPOR EXTRACTION SUMP PROFILES

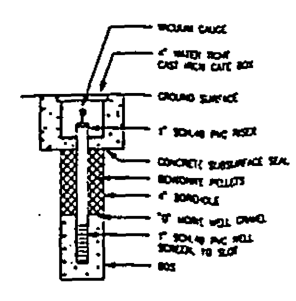


VAPOR EXTRACTION WELL PROFILE & SCHEDULE



WELL #	NORTHING	EASTING	GSE	BOS
VS101	768541.67	674122.70	1499.13	1492.13
VS102	768559.45	674295.05	1498.53	1491.53
VS103	768464.77	674172.88	1498.54	1491.54
VS104	768431.79	674392.76	1497.74	1490.74
VS105	768337.34	674270.31	1498.85	1491.85
VS106	768326.23	674484.92	1498.39	1491.39
VS107	768304.46	674686.99	1498.89	1491.89
VS108	768233.13	674352.04	1499.68	1492.68
VS109	768212.12	674563.86	1498.35	1491.35
VS110	768117.73	674443.21	1499.13	1492.13
VS111	768108.46	674643.03	1499.42	1492.42
VS112	768012.68	674523.68	1498.80	1491.80

VACUUM MONITORING POINT PROFILE & SCHEDULE



WELL #	NORTHING	EASTING	GSE	BOS
VMPS-11	768553.37	674119.74	1498.48	1494.48
VMPS-12	768575.31	674114.42	1498.55	1494.55
VMPS-13	768595.28	674110.35	1498.58	1494.58
VMPS-14	768616.76	674105.92	1498.75	1494.75
VMPS-15	768637.56	674100.42	1498.82	1494.82
VMPS-16	768543.30	674141.15	1498.66	1494.66
VMPS-17	768547.13	674160.50	1498.68	1494.68
VMPS-18	768550.38	674180.79	1498.51	1494.51
VMPS-19	768554.87	674203.45	1498.68	1494.68
VMPS-110	768558.37	674220.74	1498.51	1494.51
VMPS-21	768245.89	674349.59	1499.56	1495.56
VMPS-22	768268.05	674344.89	1499.31	1495.31
VMPS-23	768288.47	674339.07	1499.13	1495.13
VMPS-24	768308.87	674331.91	1499.02	1495.02
VMPS-25	768331.24	674329.51	1498.80	1494.80
VMPS-26	768237.73	674368.84	1499.74	1495.74
VMPS-27	768240.59	674388.42	1499.64	1495.64
VMPS-28	768243.15	674411.84	1498.46	1494.46
VMPS-29	768247.81	674433.05	1497.80	1493.80
VMPS-210	768251.53	674450.87	1499.97	1495.97

AS-BUILT

NO	DRWN	DATE	REVISION	CHK'D	DATE	APPV'D	DATE
3	RCW	11-95	AS-BUILT FINAL				
2	BCV	3-95	AS-BUILT				
1	BCV	9-23-94	DETAILED SUMP SYSTEM ALONG HEADER				
0	BCV	06/29/94	100% DESIGN - ISSUE TO AGENCY				

REFERENCE DWG DESCRIPTION

ARCO

SINCLAIR REFINERY SITE
OPERABLE UNIT 2
1-1658

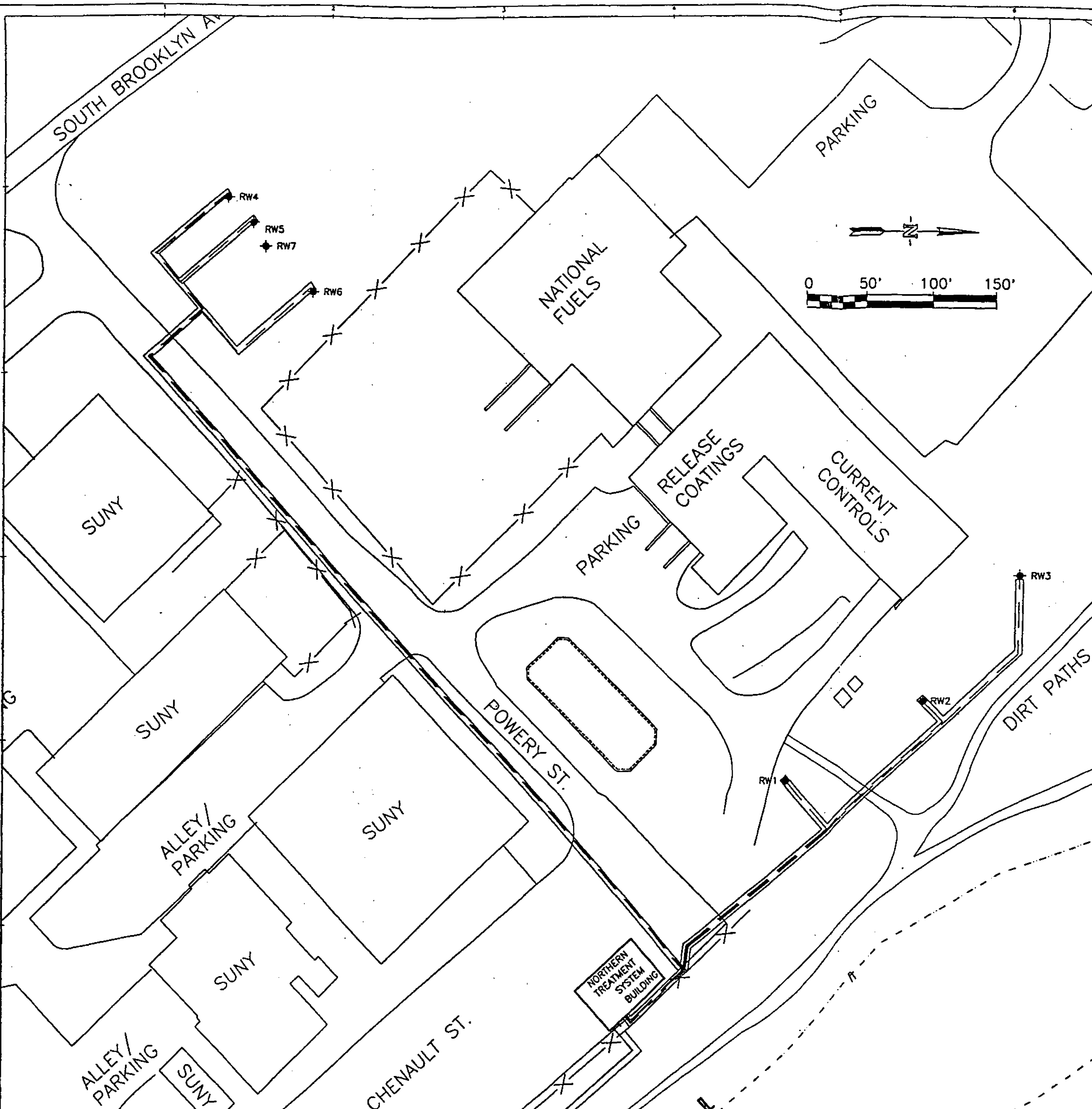
CURRENT DATE: 11-95

SOUTHERN AREA
VAPOR EXTRACTION SYSTEM LAYOUT

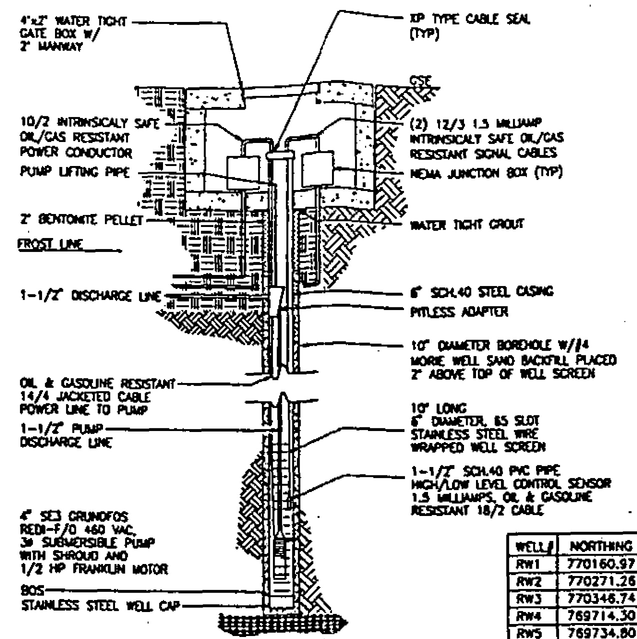
WELLSVILLE, NY

REMEDIATION TECHNOLOGIES INC

S-10 13



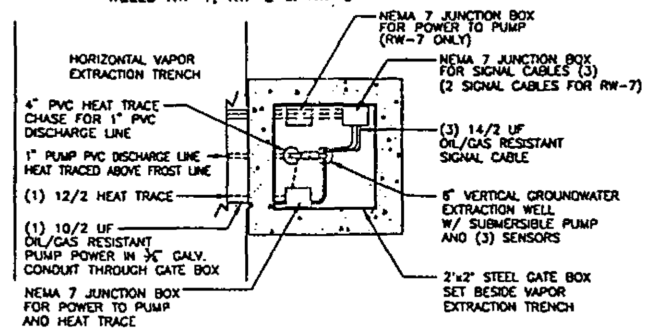
GROUNDWATER EXTRACTION WELLS

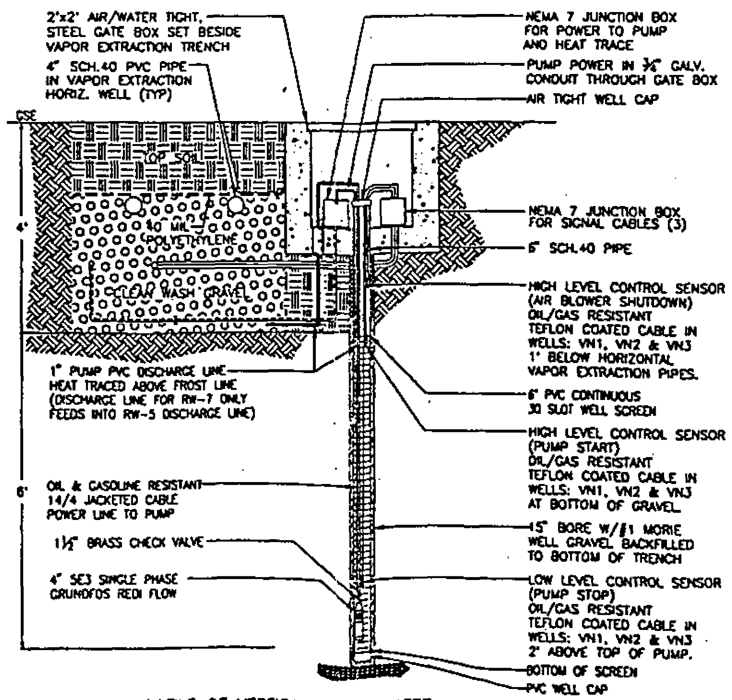


PROFILE OF GROUNDWATER EXTRACTION WELLS RW-1, RW-2 & RW-3 N.T.S.

SCHEDULE

WELL#	NORTHING	EASTING	GSE	BOS	TOC
RW1	770160.97	673348.10	1496.75	1471.75	1470.35
RW2	770271.26	673286.21	1496.43	1471.43	1471.43
RW3	770346.74	673188.20	1495.71	1474.71	1472.71
RW4	769714.30	672896.25	1496.37	1486.37	1487.87
RW5	769734.80	672915.70	1495.95	1485.55	1485.95
RW6	769782.83	672968.61	1495.69	1485.69	NA
RW7	769744.63	672933.92	1495.82	1482.82	NA





PROFILE OF VERTICAL GROUNDWATER EXTRACTION WELLS RW4, RW5 & RW6 N.T.S.

AS-BUILT

REFERENCE DWG	DESCRIPTION	NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
10775A01	RETECs 100% DESIGN								
		3	EAP	7/98	AS-BUILT - ADDITIONAL PUMPING WELL RW-7				
		2	RCW	11-95	AS-BUILT FINAL				
		1	BcV	3-95	AS-BUILT				
		0	BcV	8-29-94	100% DESIGN - ISSUE TO AGENCY				

ARCO

SINCLAIR REFINERY SITE
OPERABLE UNIT 2
1-1658

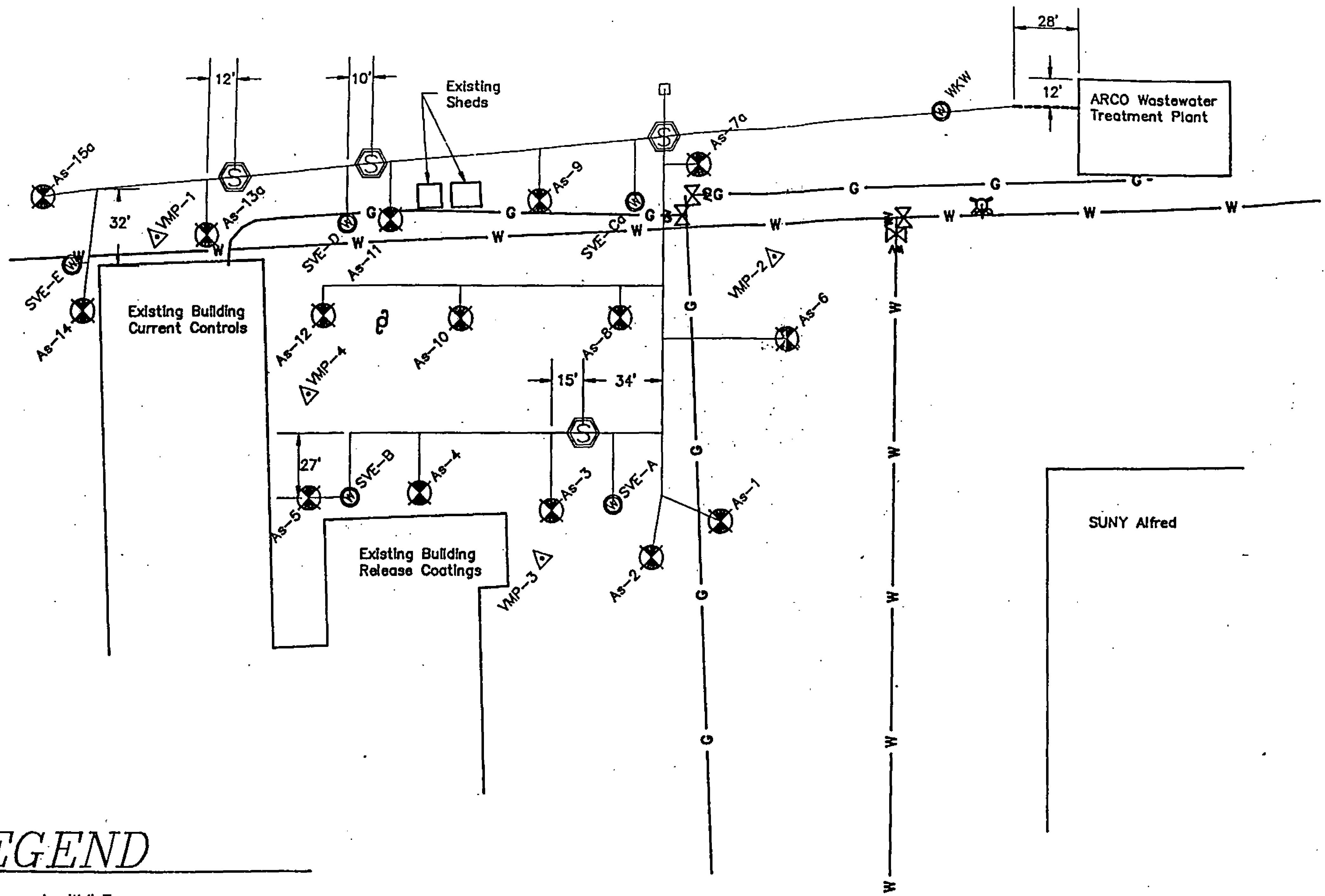
CURRENT DATE: 7/15/98 CAD FILE 16585002.DWG

NORTHERN AREA
GROUNDWATER EXTRACTION SYSTEM LAYOUT

WELLSVILLE, NY

RETEC REMEDIATION TECHNOLOGIES INC

DRAWING NO. S-11 REV. 3



LEGEND

- As-Well Typ.
- Sve-Well Typ.
  Wkw-Well Typ.
- Sump Typ.
- G — Gas Line Typ.
- W — Water Line Typ.
- GV Gas Valve Typ.
- WV Water Valve Typ.
- Vapor Monitoring Point Typ.
- Utility Pole Typ.

AS-BUILT PLAN

GRAPHIC SCALE

50 0 25 50 100 200

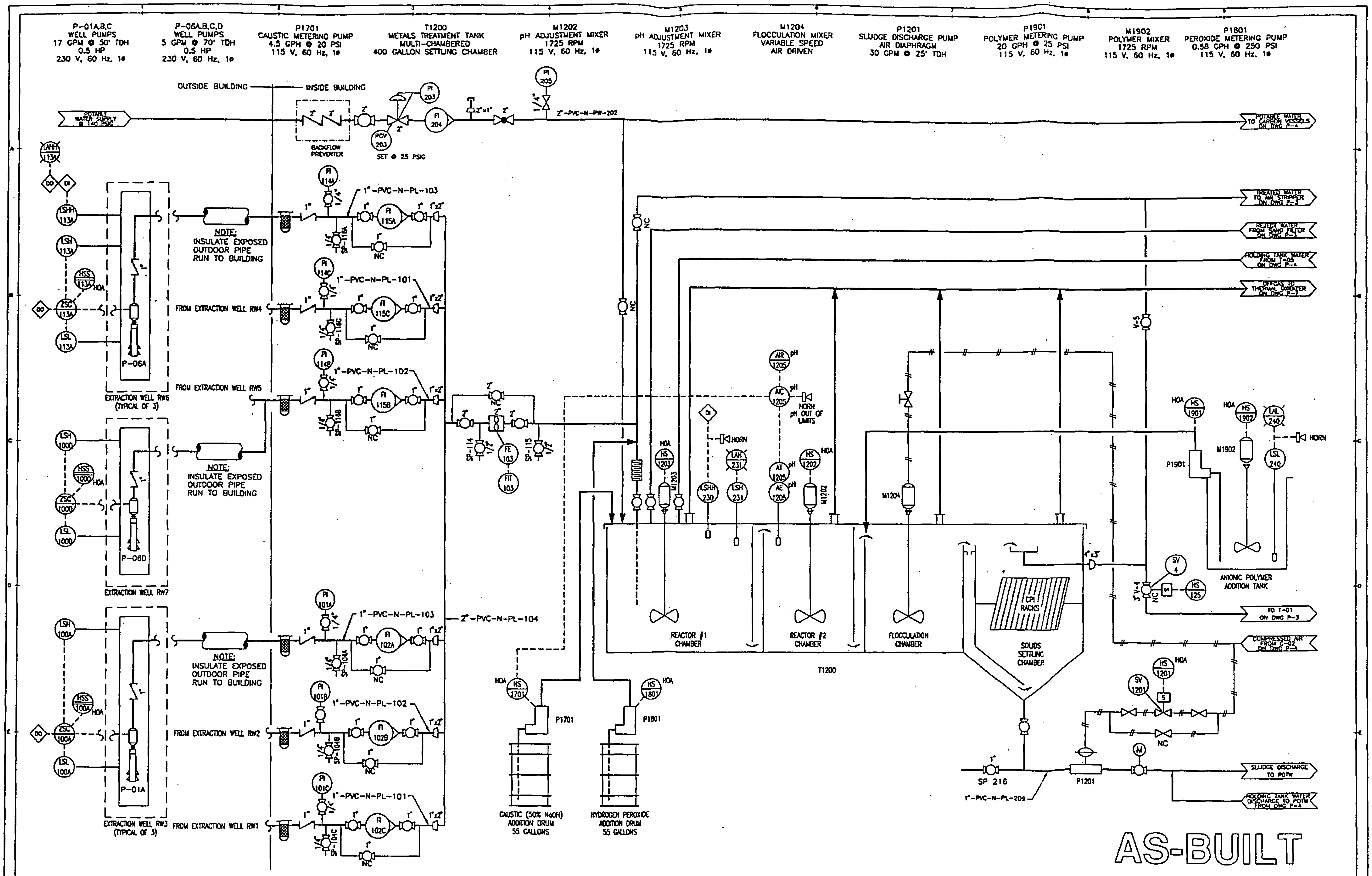
(IN FEET)
1 inch = 50 ft.

CME Associates, Inc.
Construction Materials Evaluation
P.O.Box 554 Central Square
New York 13036-0554
[315] 668-3866 FAX: [315] 676-3150

ARCO INC.
GROUNDWATER REMEDIATION
SYSTEM EXPANSION
WELLSVILLE, ALLEGHANY COUNTY, N.Y.

SHEET NO.
EXP-1

1'=50'
8/7/97
01-L287-15
R.ROBERTS



REFERENCE DWG	DESCRIPTION	NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
		0	EAP	7/96	AS-BUILT METALS TREATMENT ADDITION & WELL RW7 ADDITION				

ARCO

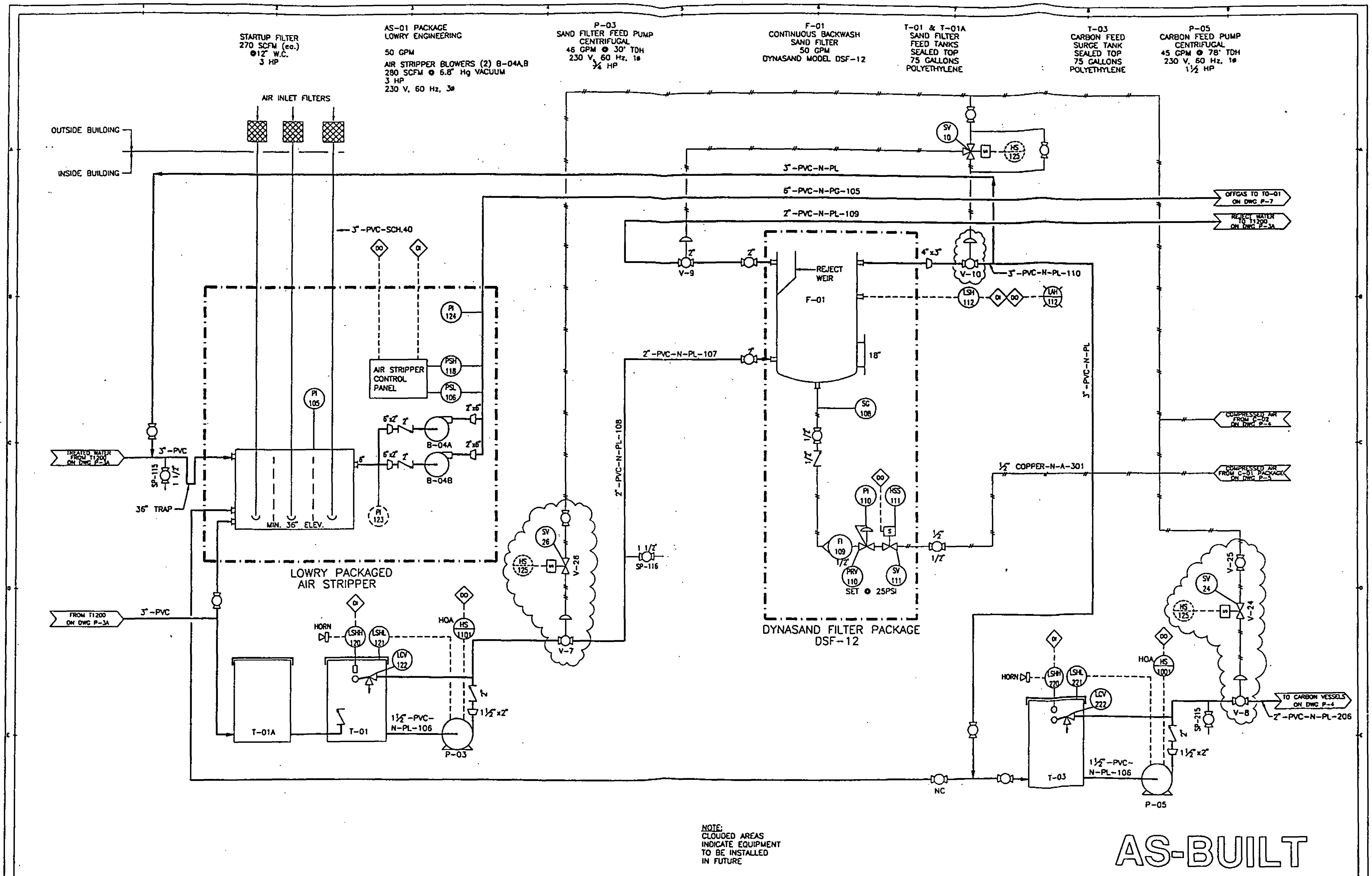
SINCLAIR REFINERY SITE
OPERABLE UNIT 2
1-1658

CURRENT DATE: 7/96 CAD FILE 1658P03A

NORTHERN GROUNDWATER TREATMENT SYSTEM
PIPING & INSTRUMENTATION DIAGRAM
WELLSVILLE, NY

RETEC REMEDIATION TECHNOLOGIES INC

DRAWING NO. P-3A REV 0



REFERENCE DWG	DESCRIPTION	NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
		5	EAP	7/96	AS-BUILT METALS TREATMENT SYSTEM MODIFICATIONS				
		4	BcV	3/96	CONSTRUCTION COMPLETION REPORT AS-BUILT				
		3	RCW	11-95	AS-BUILT FINAL				
		2	BcV	3-95	AS-BUILT				
		1	BcV	10-94	ISSUED FOR CONSTRUCTION				
		0	BcV	08/29/94	100% DESIGN - ISSUE TO AGENCY				

ARCO

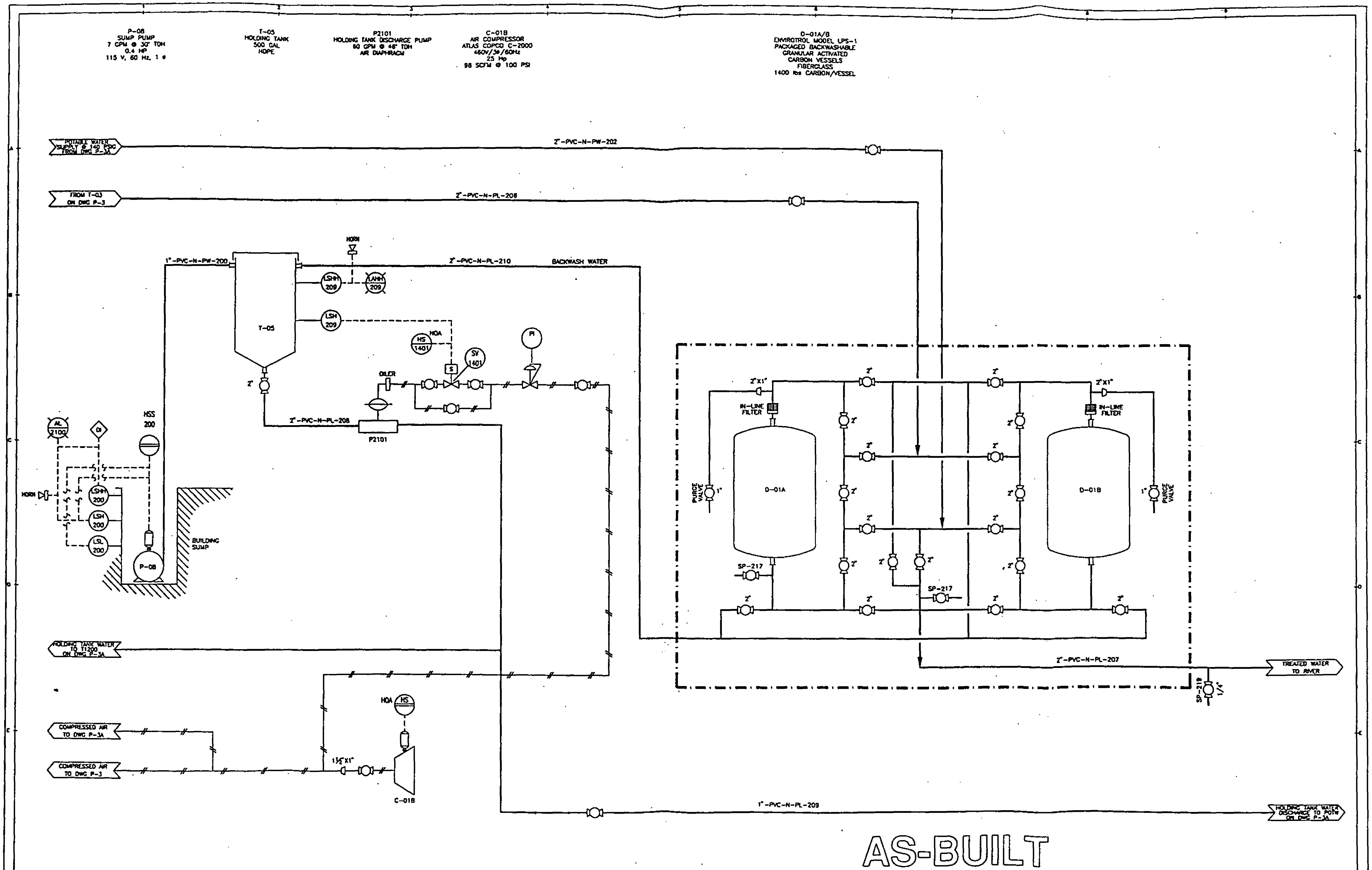
SINCLAIR REFINERY SITE
OPERABLE UNIT 2
1-1658

CURRENT DATE: 7/96 CAD FILE 1658P038

NORTHERN GROUNDWATER
TREATMENT SYSTEM
PIPING & INSTRUMENTATION DIAGRAM
WELLSVILLE, NY

RETEC REMEDIATION TECHNOLOGIES INC

DRAWING NO. REV 5



AS-BUILT

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
5	EAP	7/96	AS-BUILT METALS TREATMENT SYSTEM MODIFICATIONS				
4	BcV	3/96	CONSTRUCTION COMPLETION REPORT AS-BUILT				
3	RCW	11-95	AS-BUILT FINAL				
2	BcV	3-95	AS-BUILT				
1	BcV	10-94	ISSUED FOR CONSTRUCTION				
0	BcV	08/29/94	100% DESIGN - ISSUE TO AGENCY				

REFERENCE DWG | DESCRIPTION

ARCO

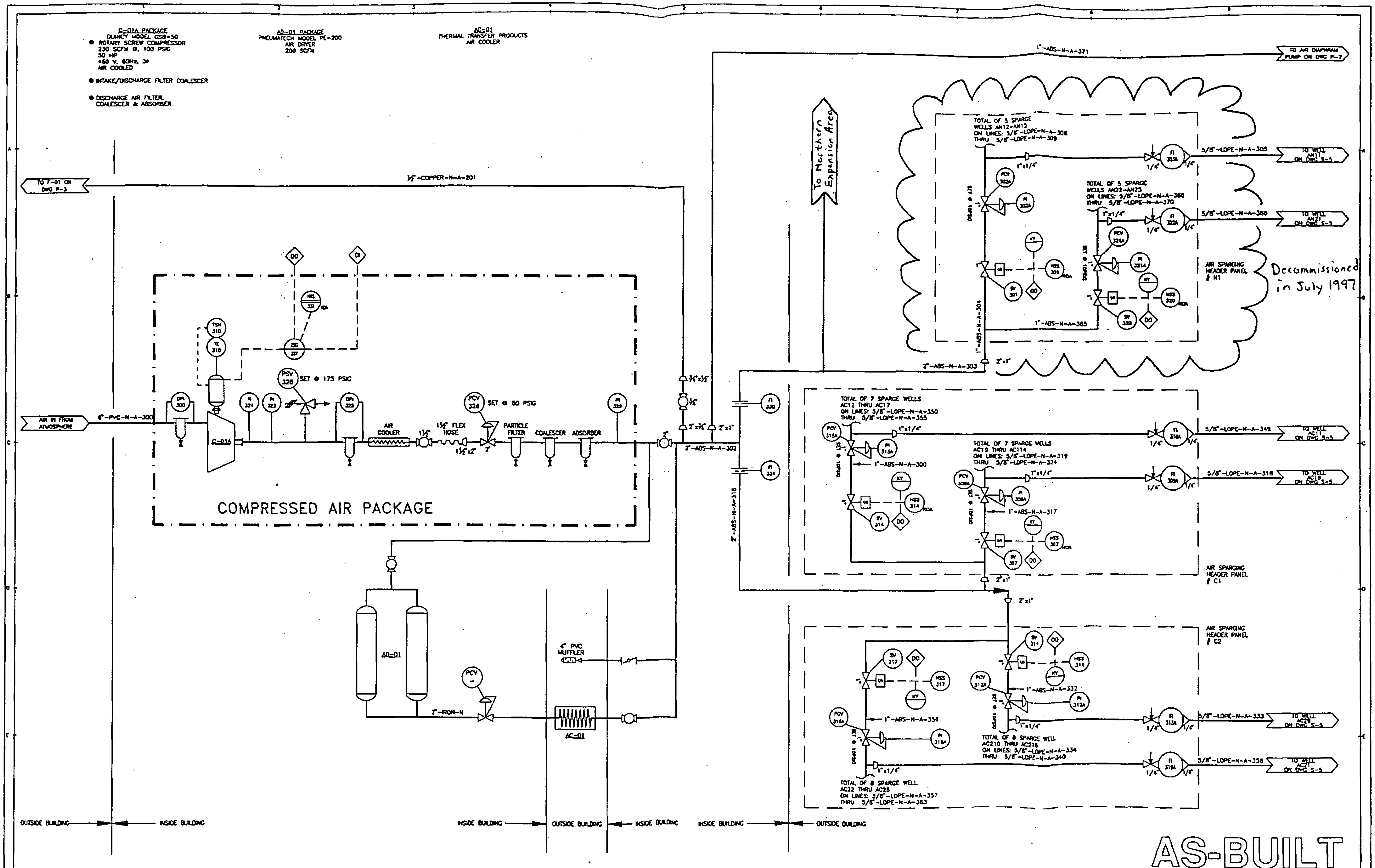
SINCLAIR REFINERY SITE
OPERABLE UNIT 2
1-1658

CURRENT DATE: 7/16/96 CAD FILE 1658P004

NORTHERN GROUNDWATER
TREATMENT SYSTEM
PIPING & INSTRUMENTATION DIAGRAM
WELLSVILLE, NY

REMEDIATION TECHNOLOGIES INC

DRAWING NO. P-4 REV. 5



NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
5	EAP	7/96	AS BUILT - AIR DRYER MODIFICATION				
4	BcV	6/96	CONSTRUCTION COMPLETION REPORT AS-BUILT				
3	RCW	11-95	AS-BUILT FINAL				
2	BcV	3-95	AS-BUILT				
1	BcV	10-94	ISSUE FOR CONSTRUCTION				
0	BcV	08/29/94	100% DESIGN - ISSUE TO AGENCY				

REFERENCE DWG | DESCRIPTION

ARCO

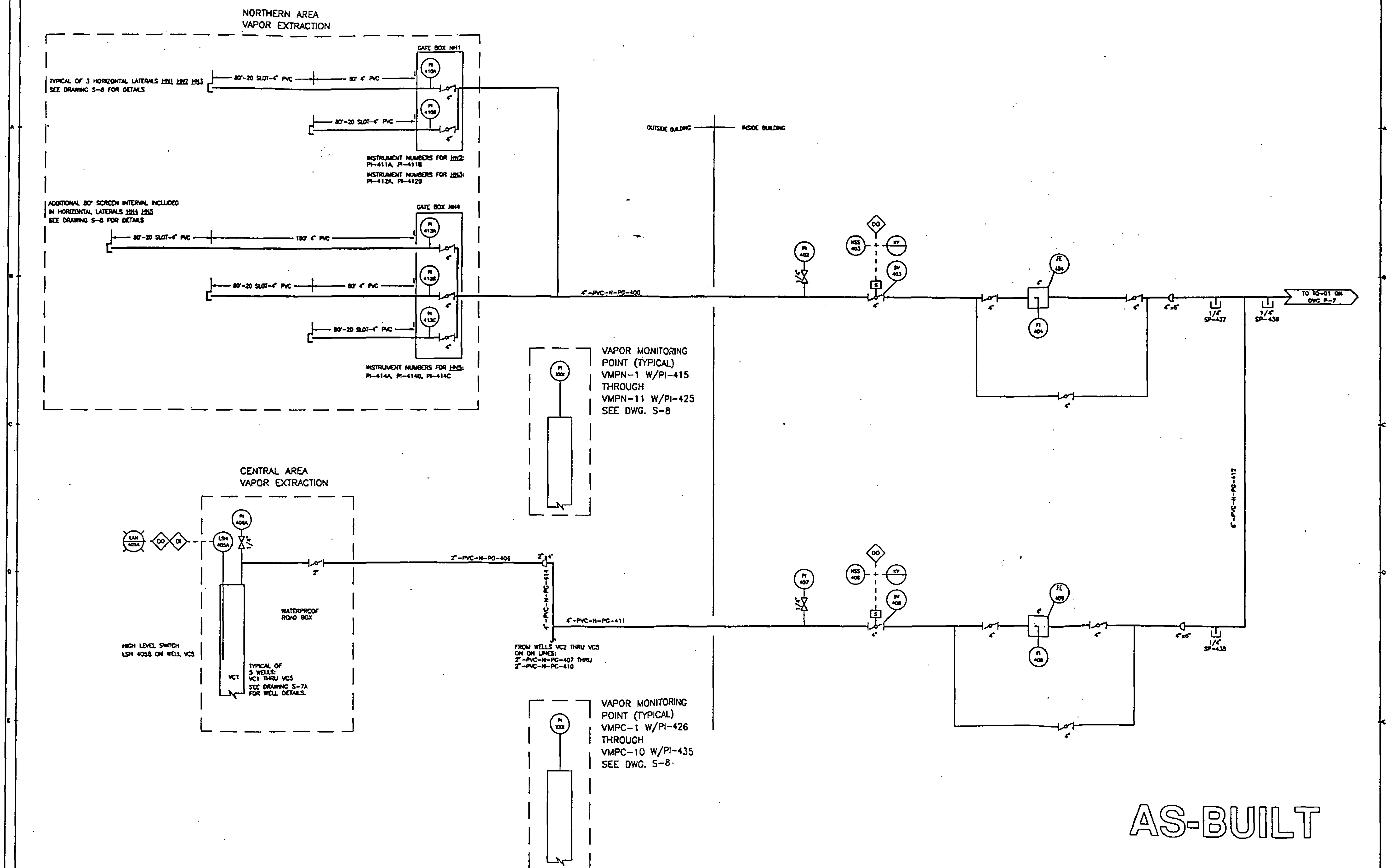
SINCLAIR REFINERY SITE
OPERABLE UNIT 2
1-1658

CURRENT DATE: 7/96 CAD FILE 1658P005.DWG

NORTHERN AND CENTRAL AREAS
AIR SPARGING SYSTEM
PIPING AND INSTRUMENTATION DIAGRAM
WELLSVILLE, NY

RETEC REMEDIATION TECHNOLOGIES INC

DRAWING NO. P-5 REV 5



AS-BUILT

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
5	EAP	7/96	AS-BUILT - METALS TREATMENT SYSTEM MODIFICATIONS				
4	BCV	3/96	CONSTRUCTION COMPLETION REPORT AS-BUILT				
3	RCW	11-95	AS-BUILT FINAL				
2	BCV	3-95	AS-BUILT				
1	BCV	10-94	ISSUE FOR CONSTRUCTION				
0	BCV	08/29/94	100% DESIGN - ISSUE TO AGENCY				

REFERENCE DWG | DESCRIPTION

ARCO

SINCLAIR REFINERY SITE
OPERABLE UNIT 2
1-1658

CURRENT DATE: 7/96 CAD FILE 1658P006

NORTHERN & CENTRAL AREA
VAPOR EXTRACTION SYSTEMS
PIPING & INSTRUMENTATION DIAGRAM
WELLSVILLE, NY

RETEC REMEDIATION TECHNOLOGIES INC

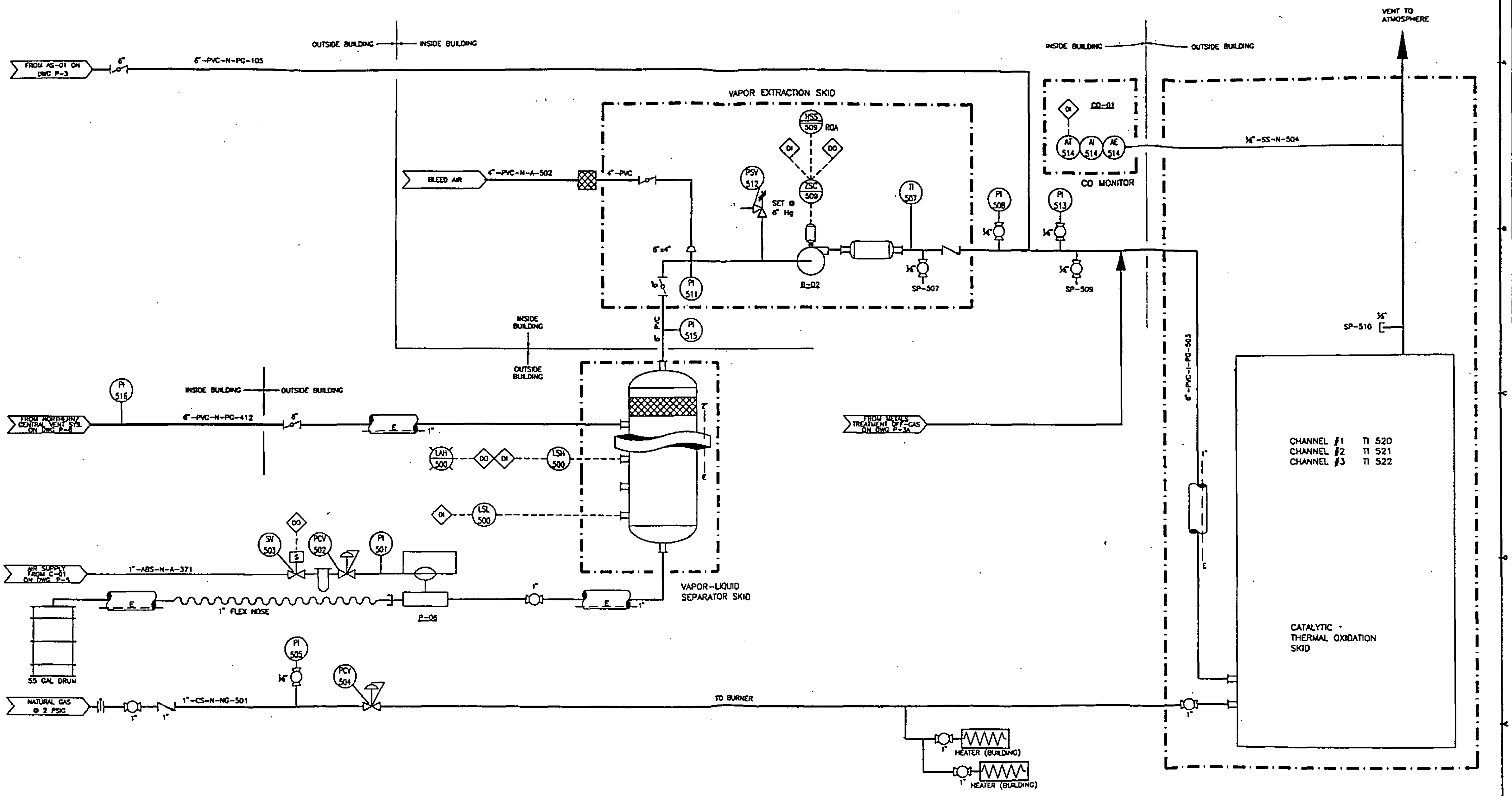
DRAWING NO. P-6 REV 5

P-08
AIR OPERATED DOUBLE DIAPHRAM PUMP
ARO MODEL 666053-344
5 GPM @ 50 FT TDH
TEFLON DIAPHRAM

VACUUM EXTRACTION PACKAGE
GLOBAL MODEL 15 VACUUM EXTRACTION MODULE
B-02
SUTORBUILD MODLE LS BLOWER
460 V, 60 Hz, 3ø,TEFC
DISCHARGE SILENCER
INLET FILTER
VACUUM RELIEF

CO-01
CARBON MONOXIDE MONITOR
LAND COMBUSTION
FGA 930

TO-01
CATALYTIC OXIDIZER
GLOBAL MODEL 5 VTM REMEDI-CAT
1000 SCFM
FAN: 460 V, 7.5 HP, 3ø TEFC
BURNER RATING: 325,000 BTU/HR



NOTE:
ALL NORTHERN & CENTRAL SYSTEM PLC INPUTS AND OUTPUTS CONNECT TO AN EXPANDED PLC LOCATED ON THERMAL OXIDIZER TO-01

AS-BUILT

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
5	EAP	7/96	AS-BUILT - METALS TREATMENT SYSTEM MODIFICATIONS				
4	BCV	3/96	CONSTRUCTION COMPLETION REPORT AS-BUILT				
3	ACW	11-95	AS-BUILT FINAL				
2	BCV	3-95	AS-BUILT				
1	BCV	10-94	ISSUED FOR CONSTRUCTION				
0	BCV	08/28/94	100% DESIGN - ISSUE TO AGENCY				

REFERENCE DWG | DESCRIPTION

ARCO

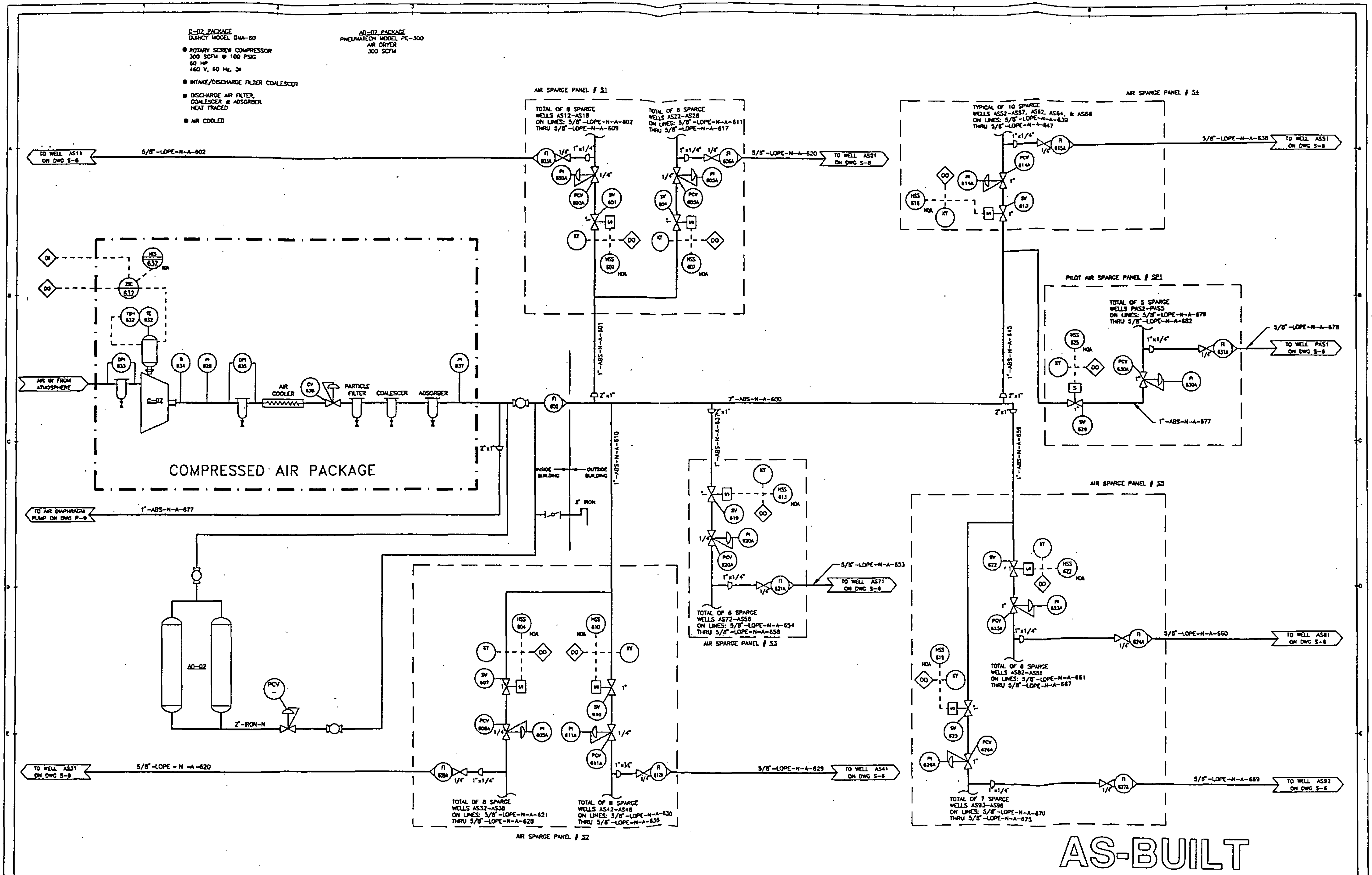
SINCLAIR REFINERY SITE
OPERABLE UNIT 2
1-1658

CURRENT DATE: 7/96 CAD FILE 1658P007

NORTHERN AND CENTRAL
THERMAL OXIDATION SYSTEM
PIPING & INSTRUMENTATION DIAGRAM
WELLSVILLE, NY

REMEDIATION TECHNOLOGIES INC

DRAWING NO. P-7 REV 5



AS-BUILT

NO	DRWN	DATE	REVISION	CHKD	DATE	APPVD	DATE
5	EAP	7/96	AS-BUILT ~ AIR DRYER MODIFICATIONS				
4	BCV	3/96	CONSTRUCTION COMPLETION REPORT AS-BUILT				
3	RCW	11-95	AS-BUILT FINAL				
2	BCV	3-95	AS-BUILT				
1	BCV	10-94	ISSUE FOR CONSTRUCTION				
0	BCV	06/29/94	100% DESIGN - ISSUE TO AGENCY				

REFERENCE DWG | DESCRIPTION

ARCO

SINCLAIR REFINERY SITE
OPERABLE UNIT 2
1-1658

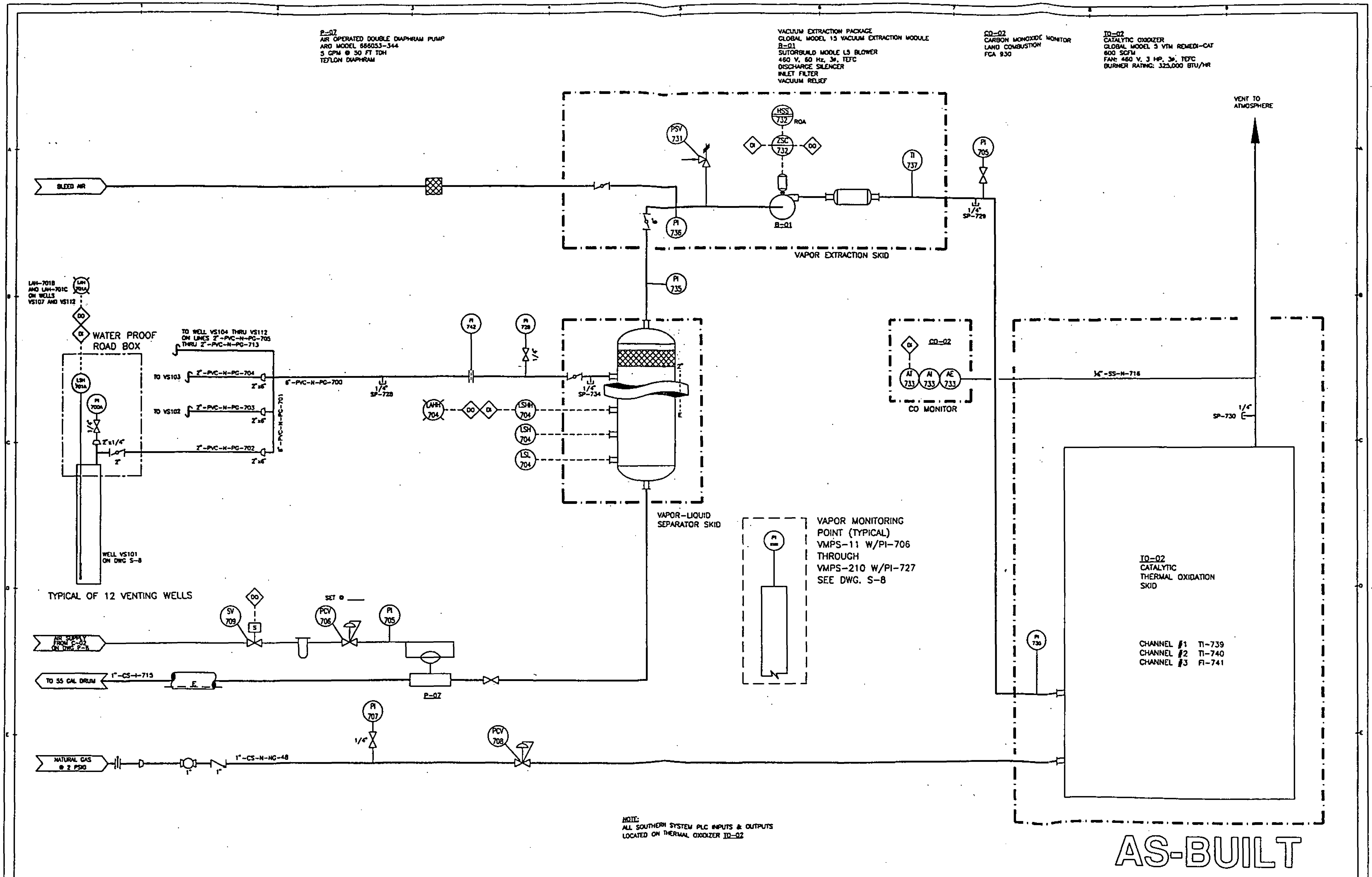
CURRENT DATE: 7/96 | CAD FILE 1658P006

SOUTHERN AIR SPARGING SYSTEM
PIPING & INSTRUMENTATION DIAGRAM

WELLSVILLE, NY

RETEC
REMEDIATION TECHNOLOGIES INC

DRAWING NO. P-8 | REV 5



NO	DRWN	DATE	REVISION
5	EAP	7/96	AS-BUILT - METALS TREATMENT SYSTEM MODIFICATIONS
4	BcV	3/96	CONSTRUCTION COMPLETION REPORT AS-BUILT
3	RCW	11-95	AS-BUILT FINAL
2	BCV	3-95	AS-BUILT
1	BcV	10-94	ISSUED FOR CONSTRUCTION
0	BcV	08/29/94	100% DESIGN - ISSUE TO AGENCY

REFERENCE DWG | DESCRIPTION | CHKD | DATE | APPVD | DATE

ARCO

SINCLAIR REFINERY SITE
OPERABLE UNIT 2
1-1658

SOUTHERN VAPOR EXTRACTION AND THERMAL OXIDATION SYSTEM
PIPING & INSTRUMENTATION DIAGRAM
WELLSVILLE, NY

RETEC
REMEDIATION TECHNOLOGIES INC

APPENDIX B

GROUNDWATER ELEVATION MEASUREMENTS

Table #	Title
B-1	Groundwater Elevation (ft.)
B-2	Groundwater Elevation (ft.) in Southern Area

APPENDIX B-1 (1 of 5)
Groundwater Elevation (ft.)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York
ENVIROGEN Project No. 78-014

Sample Date	MW-1	MW-7	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-29
1-Jul-93	1,494.97	1,486.99	1,486.11	1,483.34	1,480.40	1483.77	1,483.02	1,483.53	1,493.02	1,492.69
20-Oct-93	1,495.44	1,487.23	1,486.73	1,483.47	1,481.25	1483.95	1,483.30	1,483.66	1,492.96	1,492.73
11-Nov-95	1,495.65	1,487.60	1,486.75	1,482.40	1,481.71	1,483.01	1,482.17	1,483.66	1,494.12	1,493.81
14-Mar-96	1,498.15	1,488.05	1,487.25	1,482.81	1,481.92	1,483.27	1,482.64	1,483.80	1,493.20	1,495.03
17-Jun-96	1,497.83	1,487.32	1,486.56	1,482.13	1,480.46		1,481.96	1,483.34	1,494.51	1,494.15
28-Aug-96		1,486.78							1,492.30	
24-Sep-96	1,497.70	1,487.79	1,487.16	1,482.95					1,493.70	
29-Oct-96	1,498.32	1,488.31	1,487.42	1,482.59					1,496.03	
1-Nov-96	1,498.32	1,488.31	1,487.42	1,482.59					1,495.93	
19-Nov-96	1,498.43	1,488.37	1,487.43	1,483.11					1,496.14	
16-Dec-96	1,498.86	1,488.71	1,487.55	1,481.99	1,482.46		1,482.33	1,483.78	1,496.27	1,496.12
21-Jan-97	1,497.33	1,487.79	1,487.18	1,481.10					1,494.90	
19-Feb-97	1,497.62	1,487.51	1,487.13	1,481.39	1,481.23				1,494.70	
10-Mar-97						1,483.79				
20-Mar-97	1,499.08	1,488.46	1,487.61						1,496.21	
3-Apr-97				1,483.50	1,483.06		1,483.41			
9-May-97										
20-May-97	1,497.95	1,487.78	1,487.28	1,480.55	1,480.82				1,495.16	
25-Aug-97		1,487.17	1,486.74	1,480.84	1,480.68		1,480.57	1,482.84		
2-Sep-97		1,487.09	1,486.76	1,480.94	1,480.52		1,480.73	1,482.70		
8-Sep-97		1,487.10	1,486.89	1,480.41	1,480.28			1,482.56		
15-Sep-97	1,495.11	1,487.23	1,486.69		1,480.30	1,480.19	1,480.08	1,482.61	1,492.66	1,492.82
20-Oct-97		1,487.17	1,486.71	1,480.07	1,480.26			1,482.57		
10-Nov-97	1,496.30	1,488.09	1,487.12	1,482.12	1,481.52	1,482.33	1,481.99	1,483.03	1,494.03	1,494.09
12-Jan-98	1,499.42	1,489.16	1,487.94	1,483.80	1,483.64	1,484.70	1,483.93	1,484.49	1,496.61	1,496.47
13-Apr-98	1,498.61	1,488.65	1,487.77	1,483.71	1,482.80	1,484.30	1,483.58	1,483.97	1,495.90	1,495.80
6-Jul-98	1,498.65	1,488.58	1,487.70	1,483.58	1,482.58	1,484.12	1,483.45	1,483.93	1,496.23	1,496.00
24-Jul-98		1,488.14	1,487.54	1,481.95	1,481.55		1,481.82	1,483.54		
30-Jul-98		1,487.63	1,487.30	1,481.36	1,481.14		1,481.22	1,483.25		
4-Aug-98		1,487.44	1,487.17	1,481.21	1,480.82		1,481.04	1,483.13		
21-Aug-98		1,487.26	1,487.00	1,482.96	1,480.61		1,482.76	1,483.27		
27-Aug-98	1,495.17	1,487.22	1,486.95	1,482.99	1,480.71	1,483.36	1,482.81	1,483.29	1,493.12	1,492.98
4-Sep-98		1,487.09	1,486.86	1,482.89	1,480.73		1,482.82	1,483.26		
11-Sep-98		1,487.04	1,486.78	1,482.81	1,480.66		1,482.75	1,483.21		
23-Sep-98		1,486.64	1,486.56	1,482.79	1,481.37		1,482.65	1,483.08		
25-Sep-98	1,493.93	1,486.84	1,486.51	1,482.79	1,481.32	1,483.14	1,482.67	1,483.10	***1,492.00***	1,491.96
2-Oct-98		1,486.68	1,486.57	1,482.82	1,481.06		1,482.68	1,483.02		
6-Oct-98	1,493.49	1,486.78	1,484.46	1,482.70	1,481.25	1,483.01	1,482.55	1,483.03		1,491.80
16-Oct-98		1,486.98	1,486.66	1,480.61	1,480.45		1,480.44	1,482.71		
30-Oct-98		1,486.84	1,486.59	1,480.75	1,480.35		1,480.61	1,482.75		
6-Nov-98		1,486.78	1,486.50	1,480.68	1,480.15		1,480.45	1,482.68		
9-Nov-98					1,480.07					
13-Nov-98		1,486.82	1,486.51	1,481.55	1,480.52		1,481.38	1,482.53		
20-Nov-98		1,486.77	1,486.60	1,481.33	1,480.44		1,481.17	1,482.60		
3-Dec-98	1,492.64			1,481.46	1,480.52	1481.44	1,481.29	1,482.64	1,491.63	1,491.56
4-Dec-98		1,486.73	1,486.48							
18-Dec-98		1,486.54	1,486.41	1,480.11	1,480.01			1,482.27		
29-Dec-98								1,482.49		
31-Dec-98		1,486.82	1,486.62		1,480.50		1,481.73	1,482.49		
27-Jan-99	1497.07	1488.71	1487.82	1484.05	1483.46		1483.92	1483.93	1495.36	
19-Feb-99		1488.05	1487.61	1481.85	1481.8		1481.73	1483.47		
26-Apr-99	1499.02	1488.28	1487.69	1482.72	1481.98	1483.23	1482.59	1483.49	1495.48	
28-May-99		1487.38	1487.18	1480.4	1480.46		1480.13	1483.08		

Notes:

Blank indicates that groundwater elevation was not measured.

Values in bold italics have been corrected for free product measured in well. Correction assumed a free product specific gravity of 0.80.

APPENDIX B-1 (2 of 5)
Groundwater Elevation (ft.)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York
ENVIROGEN Project No. 78-014

Sample Date	MW-30	MW-31	MW-32	MW-33	MW-34	MW-35	MW-36	MW-50	MW-52
1-Jul-93	1,491.52	1,490.62	1,486.94	1,486.39	1,491.06	1,490.43	1,493.03	1490.45	1,492.51
20-Oct-93	1,491.55	1,490.65	1,486.77	1,486.64	1,491.92	1,490.47	1,493.38	1490.55	1,492.66
11-Nov-95	1,492.58	1,492.50	1,486.95	1,487.09	1,492.81	1,491.15	1,494.65	1,491.13	1,491.09
14-Mar-96	1,493.39	1,491.88	1,487.18	1,487.14	1,492.93	1,491.21	1,495.83	1,491.48	1,492.67
17-Jun-96	1,492.58	1,491.46	1,486.80	1,486.78	1,491.10	1,490.69	1,494.95	1,491.03	1,492.55
28-Aug-96				1,485.06	1,488.32	1,494.11	1,492.96	1,490.44	1,492.68
24-Sep-96		1,491.90		1,486.77	1,493.73	1,491.41	1,494.96	1,491.35	1,492.57
29-Oct-96		1,492.69		1,484.51	1,493.80	1,490.70	1,496.51	1,492.00	1,492.54
1-Nov-96		1,492.69		1,487.41	1,493.80	1,490.70	1,496.51	1,492.00	1,492.54
19-Nov-96		1,491.79	1,487.29	1,487.75	1,494.12	1,490.70	1,496.56	1,491.52	1,492.50
16-Dec-96	1,494.47	1,492.99		1,487.52	1,494.62	1,491.39	1,496.53	1,492.21	1,493.73
21-Jan-97		1,492.06		1,486.88	1,492.08	1,490.24	1,495.47	1,491.60	1,492.96
19-Feb-97		1,491.84		1,487.02	1,494.47		1,496.46	1,491.29	1,493.16
20-Mar-97		1,492.87		1,487.69	1,494.67		1,496.81	1,492.02	1,493.65
9-May-97									1,493.35
20-May-97		1,491.98		1,486.93	1,492.61		1,495.91	1,491.42	1,493.09
25-Aug-97			1,486.73						
2-Sep-97			1,486.71						
8-Sep-97			1,486.74						
15-Sep-97	1,491.80	1,490.99	1,486.78	1,486.37	1,490.92	1,489.81	1,493.30	1,490.77	1,492.18
20-Oct-97			1,486.78						
10-Nov-97	1,492.83	1,491.79	1,487.18	1,486.64	1,494.09	1,490.53	1,494.52	1,491.44	1,493.33
12-Jan-98	1,494.91	1,493.47	1,487.72	1,488.16	1,494.61	1,491.59	1,497.63	1,492.72	1,493.62
13-Apr-98	1,494.18	1,492.84	1,487.52	1,487.71	1,494.43	1,491.50	1,496.61	1,492.10	1,493.51
6-Jul-98	1,494.40	1,492.92	1,487.50	1,487.72	1,494.27	1,491.47	1,496.92	1,492.12	1,493.41
24-Jul-98			1,487.30						
30-Jul-98			1,487.04						
4-Aug-98			1,486.92						
21-Aug-98			1,486.80						
27-Aug-98	1,492.00	1,491.17	1,486.77	1,486.76	1,491.60	1,490.01	1,493.79	1,490.89	1,492.34
4-Sep-98			1,486.68						
11-Sep-98			1,486.59						
23-Sep-98			1,486.58						
25-Sep-98	1,491.20	1,490.59	1,486.58	1,486.36	1,490.68	1,490.96	1,492.89	1,490.47	1,492.12
2-Oct-98			1,486.57						
6-Oct-98		1,490.51	1,486.52		1,490.68		1,492.63	1,490.40	
16-Oct-98			1,486.68						
30-Oct-98			1,486.61						
6-Nov-98			1,486.48						
13-Nov-98			1,486.57						
20-Nov-98			1,486.58						
3-Dec-98	1,491.88	1,490.37		1,486.00	1,490.43	1,489.39	1,492.45	1,490.34	1,491.60
4-Dec-98			1,486.54						
18-Dec-98			1,486.46						
29-Dec-98				1,486.08					
31-Dec-98			1,486.59						
27-Jan-99		1,492.69	1,487.60				1,495.92	1,492.05	1,493.13
19-Feb-99			1,487.23						
26-Apr-99		1,492.58	1,487.36	1,487.29	1,494.41		1,496.24	1,491.96	1,493.56
28-May-99			1,486.90						

Note:
Blank indicates that groundwater elevation was not measured.

APPENDIX B-1 (3 of 5)
Groundwater Elevation (ft.)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York
ENVIROGEN Project No. 78-014

Sample Date	MW-54	MW-56	MW-57	MW-67	MW-68A	MW-68B	MW-69A	MW-69B	MW-72
1-Jul-93	1,492.78	1,491.02	1,484.40		1,483.57	1,483.59	1,483.24	1,483.20	1,489.94
20-Oct-93	1,492.77			1,483.43	1,483.75	1,483.76	1,483.42	1,483.36	1,490.23
11-Nov-95	1,493.88	1,492.11	1,483.76	1,483.23				1,482.55	
14-Mar-96	1,493.14	1,492.82	1,483.83	1,483.52	1,482.60	1,482.61	1,482.56	1,481.89	1,490.69
17-Jun-96	1,494.18	1,492.04		1,482.84			1,481.90		1,490.36
28-Aug-96		1,490.96							
24-Sep-96		1,492.61		1,483.36			1,482.76		1,490.23
29-Oct-96		1,493.52		1,483.79			1,482.40		1,490.37
1-Nov-96		1,493.52		1,483.79			1,482.40		
19-Nov-96		1,493.75		1,483.77			1,482.87		1,492.03
16-Dec-96	1,496.25	1,493.93		1,483.29			1,482.22	1,481.76	1,490.95
21-Jan-97		1,492.73		1,482.61			1,480.62		1,490.34
19-Feb-97		1,492.58		1,482.98			1,480.95		1,490.52
10-Mar-97			1,484.02		1,483.27	1,483.22			
20-Mar-97		1,493.85							1,491.27
3-Apr-97				1,483.76			1,483.45	1,483.43	
20-May-97		1,492.72	1,482.39	1,482.33			1,479.93		1,490.65
25-Aug-97				1,482.17			1,480.42		
2-Sep-97				1,481.96			1,480.62		
8-Sep-97				1,481.72			1,479.68		
15-Sep-97	1,492.83	1,491.46	1,481.71	1,481.78	1,479.73	1,479.59	1,479.92	1,479.89	1,489.66
20-Oct-97				1,481.66			1,479.52		
10-Nov-97	1,494.13	1,492.38	1,482.82	1,483.52	1,482.13	1,482.13	1,481.91	1,481.89	1,490.08
12-Jan-98	1,496.92	1,494.33	1,484.69	1,484.24	1,484.05	1,481.96	1,484.02	1,482.01	1,490.83
13-Apr-98	1,495.90	1,493.63	1,484.34	1,483.80	1,483.97	1,483.98	1,483.76	1,483.72	1,490.79
6-Jul-98	1,496.16	1,493.84	1,484.24	1,483.70	1,483.56	1,483.39	1,483.56	1,483.51	1,490.75
24-Jul-98				1,482.97			1,481.68		
30-Jul-98				1,482.59			1,481.04		
4-Aug-98				1,482.45			1,480.86		
21-Aug-98				1,482.87			1,482.89		
27-Aug-98	1,493.07	1,491.67	1,483.77	1,482.90	1,483.56	1,483.45	1,482.92	1,482.86	1,489.68
4-Sep-98				1,482.86			1,482.95		
11-Sep-98				1,482.81			1,482.83		
23-Sep-98				1,482.66			1,482.77		
25-Sep-98	1,491.95	1,490.92	1,483.51	1,482.64	1,482.81	1,482.82	1,482.99	1,482.53	1,489.27
2-Oct-98				1,482.55			1,482.71		
6-Oct-98	1,491.81	1,490.84	1,483.50	1,482.56	1,482.97		1,482.63		1,489.12
16-Oct-98				1,481.82			1,480.27		
30-Oct-98				1,481.93			1,480.25		
6-Nov-98				1,481.64			1,480.07		
9-Nov-98							1,480.02		
13-Nov-98				1,481.61			1,481.43		
20-Nov-98				1,481.84			1,481.07		
3-Dec-98	1,501.25	1,490.64	1,482.27	1,481.92	1,481.15	1,481.49	1,481.19	1,481.16	1,488.82
4-Dec-98									
18-Dec-98				1,481.10			1,479.69		
29-Dec-98				1,481.70					
31-Dec-98				1,481.70			1,481.78		
15-Jan-99				1,482.29					
27-Jan-99			1,484.63	1,483.81			1,484.16		
19-Feb-99				1,482.90			1,481.63		
26-Apr-99			1,483.45	1,483.09	1,482.68		1,482.62		1,490.41
28-May-99				1,481.78			1,479.96		

Note:
Blank indicates that groundwater elevation was not measured.

APPENDIX B-1 (4 of 5)
Groundwater Elevation (ft.)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York
ENVIROGEN Project No. 78-014

Sample Date	MW-74	MW-79	MW-80	MW-82	MW-84	MW-85	MW-87	MW-88
1-Jul-93	1,495.87	1,490.94	1,491.17	1,492.28	1,485.34	1,491.67	1,492.46	1,489.50
20-Oct-93	1,496.27	1,491.09	1,491.25	1,492.29	1,485.55	1,491.79	1,492.59	1,489.68
11-Nov-95	1,496.55	1,491.59	1,492.25	1,493.10	1,485.18	1,491.88	1,493.67	1,490.36
14-Mar-96	1,499.52	1,492.05	1,492.99	1,493.92	1,485.06	1,492.51	1,495.08	1,490.98
17-Jun-96	1,498.95	1,491.57	1,492.19	1,493.30		1,492.03	1,494.12	1,490.33
28-Aug-96		1,490.88					1,496.48	1,489.47
24-Sep-96		1,491.84				1,492.41	1,494.29	1,490.56
29-Oct-96		1,492.49				1,492.22	1,495.36	1,491.22
1-Nov-96		1,492.49				1,492.42	1,495.46	1,491.22
19-Nov-96		1,492.43				1,490.82	1,495.56	1,491.54
16-Dec-96	1,499.45	1,492.75	1,494.10	1,494.99		***1,493.11***	1,495.98	1,491.22
21-Jan-97		1,492.12				1,492.20	1,494.41	1,490.62
19-Feb-97		1,491.77					1,494.97	1,491.16
20-Mar-97		1,492.69				***1,493.16***	1,496.04	1,491.67
3-Apr-97								
9-May-97						***1,492.68***		
20-May-97		1,492.07					1,494.95	1,488.77
25-Aug-97								
2-Sep-97								
8-Sep-97								
15-Sep-97	1,496.10	1,491.34	1,491.61	1,492.19		1,491.57	1,492.78	1,489.87
29-Sep-97								
10-Nov-97	1,497.40	1,491.94		1,493.24		1,492.27	1,493.93	1,490.59
12-Jan-98	1,499.82	1,493.38		1,495.55	1,489.08	***1,493.11***	1,496.31	1,492.20
13-Apr-98	1,499.29	1,492.71		1,494.80		1,492.98	1,495.74	1,491.69
6-Jul-98	1,499.20	1,492.69		1,495.09		1,492.94	1,495.86	1,491.68
24-Jul-98								
30-Jul-98								
4-Aug-98								
21-Aug-98								
27-Aug-98	1,496.18	1,491.34		1,492.39		1,491.71	1,492.97	1,490.00
4-Sep-98								
11-Sep-98								
23-Sep-98								
25-Sep-98	1,495.02	1,490.61		1,491.44		***1,491.30***	1,491.98	1,489.44
2-Oct-98								
6-Oct-98	1,494.60	1,490.75						1,489.34
16-Oct-98								
30-Oct-98								
6-Nov-98								
9-Nov-98								
13-Nov-98								
20-Nov-98								
3-Dec-98	1,493.71	1,490.75		1,491.16		1,491.01	1,492.46	1,489.24
4-Dec-98								
18-Dec-98								
29-Dec-98								
31-Dec-98								
27-Jan-99		1,492.62						1,491.68
26-Apr-99	1,499.54	1,492.63					1,495.22	1,491.39

Notes:

Blank indicates that groundwater elevation was not measured.

Values in bold italics have been corrected for free product measured in well. Correction assumed a free product specific gravity of 0.80.

APPENDIX B-1 (5 of 5)
Groundwater Elevation (ft.)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York
ENVIROGEN Project No. 78-014

Sample Date	OW-1	OW-2	OW-4	OW-5	OW-6	OW-7	OW-8	OW-9	OW-10
15-Jan-99	1,480.99	1,481.09	1,484.62	1,486.19	1,483.41	1,481.78	1,487.50	1,483.87	1,485.68
21-Jan-99	1,481.29	1,481.42	1,485.04	1,486.28	1,483.65	1,482.07	1,487.74	1,484.09	1,486.03
27-Jan-99	1,482.21	1,482.47	1,485.73	1,487.09	1,484.52	1,483.07	1,488.45	1,484.80	1,486.82
4-Feb-99	1,481.84	1,482.18	1,485.66	1,487.33	1,484.46	1,482.94	1,488.59	1,484.55	1,486.58
12-Feb-99	1,481.73	1,482.01	1,483.59	1,487.43	1,484.38	1,482.74	1,488.93	1,484.56	1,486.55
18-Feb-99	1,481.53	1,481.86	1,485.50	1,487.36	1,484.26	1,482.50	1,488.92	1,484.46	1,486.45
26-Feb-99	1,480.95	1,481.24	1,485.23	1,487.10	1,484.00	1,482.03	1,488.59	1,484.07	1,485.97
5-Mar-99	1,481.60	1,481.91	1,485.50	1,486.95		1,482.21		1,484.59	1,486.60
12-Mar-99	1,481.16	1,481.43	1,485.38	1,486.89		1,482.13		1,484.40	1,486.37
29-Mar-99	1,482.25	1,482.18	1,485.62	1,487.43	1,484.20	1,482.57	1,489.01	1,484.72	1,486.78
2-Apr-99	1,482.40	1,482.65	1,485.71	1,487.34	1,484.25	1,482.89	1,488.90	1,485.10	1,487.24
8-Apr-99	1,481.68	1,481.95	1,485.53	1,487.36		1,482.48	1,488.89	1,484.58	1,486.59
16-Apr-99		1,481.87	1,485.51	1,487.45	1,484.20	1,482.44	1,488.99	1,484.55	1,486.52
26-Apr-99	1,481.67	1,481.89	1,485.53	1,487.36	1,484.17	1,482.49	1,488.94	1,484.51	1,486.51
7-May-99	1,480.86	1,481.11	1,485.10	1,487.06	1,483.89	1,481.94	1,488.53	1,484.00	1,485.84
14-May-99	1,480.69	1,480.99	1,485.07	1,486.95	1,483.80	1,481.77	1,488.13	1,483.91	1,485.72
21-May-99	1,483.27	1,480.91	1,484.93	1,486.92	1,483.66	1,481.59	1,488.14	1,483.78	1,485.59
28-May-99	1,483.23	1,480.90	1,484.90	1,486.72	1,483.54	1,481.43	1,488.16	1,483.73	1,485.51
4-Jun-99	1,483.19	1,480.87	1,484.76	1,486.56	1,482.59	1,481.33	1,487.82	1,483.60	1,485.41
18-Jun-99	1,480.41	1,480.86	1,484.70	1,486.53	1,483.56	1,481.67	1,487.80	1,483.54	1,485.36
25-Jun-99	1,480.30	1,480.82	1,484.55	1,486.39	1,483.46	1,481.53	1,487.59	1,483.42	1,485.22

Note:
Blank indicates that groundwater elevation was not measured.

APPENDIX B-2 (Page 1 of 4)
Groundwater Elevation (ft.) in the Southern Area
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York
ENVIROGEN Project No. 78-014

Sample Date	MW-8	MW-53	MW-55	MW-76	MW-77	MW-89
1-Jul-93	1,491.94	1,490.58		1,491.69	1,492.80	1,492.87
20-Oct-93	1,492.41	1,491.38	1,489.82	1,491.81	1,491.64	1,492.75
10-Nov-95	1,493.02	1,492.57	1,490.01	1,492.75	1,493.51	1,493.54
13-Mar-96	1,493.92	1,493.18	1,490.16	1,493.52	1,494.24	1,494.39
17-Jun-96	1,493.20	1,492.44	1,489.96	1,492.76	1,493.64	1,493.73
28-Aug-96	1,491.70	1,490.41			1,491.93	
23-Sep-96	1,493.50	1,492.83	1,490.12	1,493.15	1,493.72	1,493.88
29-Oct-96	1,492.66	1,493.86	1,490.38	1,492.24	1,494.92	1,495.09
18-Nov-96	1,494.83	1,493.05	1,490.29	1,494.47	1,494.92	1,495.24
16-Dec-96	1,495.06	1,494.36	1,490.46	1,494.69	1,494.96	1,495.39
20-Jan-97	1,493.72	1,493.13	1,490.29	1,493.39	1,493.94	1,494.08
17-Feb-97	1,493.50	1,492.90	1,490.03	1,494.36	1,494.60	1,495.09
5-Mar-97	1,495.28	1,494.54		1,494.91	1,495.54	1,495.66
18-Mar-97	1,494.97	1,494.22	1,490.30	1,494.63	1,495.20	1,495.35
26-Mar-97	1,495.25	1,494.91		1,494.88	1,495.56	1,495.75
4-Apr-97	1,494.67	1,493.99		1,494.34	1,494.99	1,495.08
9-Apr-97	1,494.11	1,493.49	1,490.17	1,493.80	1,494.48	1,494.57
23-Apr-97	1,494.05	1,493.42		1,493.73	1,494.40	1,494.52
15-May-97	1,494.08	1,493.35	1,490.17	1,493.82	1,494.45	1,494.50
23-May-97	1,493.98	1,493.35	1,490.12	1,493.67	1,494.35	1,494.46
29-May-97	1,494.01	1,493.42	1,490.17	1,493.70	1,494.47	1,494.53
5-Jun-97	1,493.93	1,493.35	1,490.08	1,493.65	1,494.46	1,494.43
12-Jun-97	1,494.22	1,493.56	1,490.15	1,493.91	1,494.56	1,494.70
19-Jun-97	1,494.69	1,494.00	1,490.27	1,494.34	1,495.08	1,495.18
27-Jun-97	1,495.09	1,494.36	1,490.38	1,494.77	1,495.52	1,495.61
3-Jul-97	1,494.48	1,493.76	1,490.07	1,494.10	1,494.96	1,495.07
8-Jul-97	1,493.85	1,493.26		1,493.54	1,494.74	1,494.30
17-Jul-97	1,493.56	1,492.87		1,493.29	1,494.32	1,494.01
23-Jul-97	1,493.63	1,493.10	1,490.06	1,493.34	1,493.96	1,494.14
31-Jul-97	1,493.51	1,493.01	1,489.96	1,493.21	1,493.90	1,494.30
8-Aug-97	1,493.23	1,492.55	1,489.83	1,492.90	1,493.66	1,494.47
18-Aug-97	1,492.56	1,492.02	1,489.92	1,492.46	1,493.21	1,492.86
25-Aug-97	1,492.07	1,491.79	1,489.89	1,491.75	1,492.33	1,492.52
2-Sep-97	1,491.90	1,491.72	1,489.82	1,491.68	1,492.16	1,492.34
8-Sep-97	1,491.92	1,491.67	1,489.83	1,491.61	1,492.11	1,492.28
15-Sep-97	1,492.14	1,491.78	1,489.89	1,491.71	1,492.28	1,492.42
22-Sep-97	1,491.93	1,491.50	1,489.83	1,491.86	1,492.11	1,492.26
29-Sep-97	1,492.20	1,491.76	1,489.90	1,492.00	1,492.30	1,492.56
6-Oct-97	1,492.77	1,492.37	1,490.06	1,492.43	1,492.64	1,493.15
13-Oct-97	1,492.52	1,492.12	1,489.95	1,492.27	1,492.43	1,492.94
20-Oct-97	1,492.19	1,491.85	1,489.90	1,491.97	1,492.08	1,492.52
27-Oct-97	1,491.99	1,491.62	1,489.84	1,491.66	1,492.14	1,492.32

Groundwater Elevation (ft.) in the Southern Area
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York
ENVIROGEN Project No. 78-014

Sample Date	MW-8	MW-53	MW-55	MW-76	MW-77	MW-89
3-Nov-97	1,492.47	1,492.14	1,490.10	1,492.26	1,492.61	1,492.86
10-Nov-97	1,493.18	1,492.74	1,490.19	1,492.97	1,493.33	1,493.57
21-Nov-97	1,493.34	1,492.94	1,490.27	1,493.19	1,493.45	1,493.75
24-Nov-97	1,493.41	1,492.95	1,490.33	1,493.28	1,493.51	1,493.80
1-Dec-97	1,493.53	1,493.04	1,490.34	1,493.33	1,493.67	1,493.92
8-Dec-97	1,493.85	1,493.34	1,490.22	1,493.57	1,494.11	1,494.35
15-Dec-97	1,493.73	1,492.58	1,490.15	1,493.44	1,493.98	1,494.21
22-Dec-97	1,493.79	1,492.60	1,490.18	1,493.48	1,494.00	1,494.30
29-Dec-97	1,494.02	1,493.47	1,490.18	1,493.75	1,494.32	1,494.48
12-Jan-98	1,495.40	1,494.84	1,490.75	1,495.08	1,495.82	1,496.03
19-Jan-98	1,494.55	1,493.92	1,490.33	1,494.27	1,494.45	1,495.08
26-Jan-98	1,493.96	1,493.38	1,490.17	1,493.68	1,493.97	1,494.51
2-Feb-98	1,494.13	1,493.60	1,490.24	1,493.82	1,494.13	1,494.67
9-Feb-98	1,493.73	1,493.27	1,490.14	1,493.42	1,494.00	1,494.30
16-Feb-98	1,493.46	1,493.09	1,490.05	1,493.20	1,493.83	1,493.96
23-Feb-98	1,494.16	1,492.57	1,490.28	1,493.86	1,494.36	1,494.72
28-Feb-98	1,494.16	1,492.57	1,490.28	1,493.86	1,494.36	1,494.72
2-Mar-98	1,494.91	1,494.38	1,490.56	1,494.61	1,495.17	1,495.48
9-Mar-98	1,494.99	1,494.47	1,490.61	1,494.69	1,495.28	1,495.58
16-Mar-98	1,493.99	1,493.52	1,490.21	1,493.70	1,494.29	1,494.58
23-Mar-98	1,494.60	1,494.02	1,490.33	1,494.29	1,494.84	1,495.12
30-Mar-98	1,494.57	1,494.04	1,490.36	1,494.27	1,494.85	1,495.14
6-Apr-98	1,494.19	1,493.64	1,490.24	1,493.88	1,494.47	1,494.75
13-Apr-98	1,494.66	1,494.13	1,490.43	1,494.35	1,494.96	1,495.21
20-Apr-98	1,495.27	1,494.87	1,490.88	1,494.91	1,495.45	1,496.12
27-Apr-98	1,494.68	1,494.13	1,490.48	1,494.37	1,494.93	1,495.27
4-May-98	1,494.21	1,493.68	1,490.29	1,493.89	1,494.45	1,494.80
11-May-98	1,494.55	1,494.06	1,490.51	1,494.23	1,494.96	1,495.16
18-May-98	1,494.47	1,493.96	1,490.43	1,494.16	1,494.92	1,495.10
26-May-98	1,493.91	1,493.53	1,490.19	1,493.72	1,494.45	1,494.68
1-Jun-98	1,493.54	1,493.10	1,490.12	1,493.26	1,494.04	1,494.14
8-Jun-98	1,493.43	1,492.98	1,490.06	1,493.16	1,493.96	1,493.98
12-Jun-98	1,493.35	1,492.90	1,490.07	1,493.08	1,493.88	1,493.88
22-Jun-98	1,493.15	1,492.75	1,490.03	1,492.88	1,493.70	1,493.65
6-Jul-98	1,494.94	1,494.35	1,490.36	1,494.62	1,495.19	1,495.51
13-Jul-98	1,494.71	1,494.12	1,490.30	1,494.40	1,494.99	1,495.28
20-Jul-98	1,493.85	1,493.37	1,490.12	1,493.57	1,494.25	1,494.44
24-Jul-98			1,490.26			
27-Jul-98	1,494.06	1,493.55	1,490.19	1,493.77	1,494.50	1,494.64
30-Jul-98			1,490.12			
3-Aug-98	1,493.41	1,492.98	1,490.06	1,493.15	1,493.85	1,493.97
4-Aug-98			1,490.03			

APPENDIX B-2 (Page 3 of 4)
Groundwater Elevation (ft.) in the Southern Area
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York
ENVIROGEN Project No. 78-014

Sample Date	MW-8	MW-53	MW-55	MW-76	MW-77	MW-89
10-Aug-98	1,493.04	1,492.66	1,490.02	1,492.77	1,493.58	1,493.57
17-Aug-98	1,492.78	1,492.40	1,489.98	1,492.58	1,493.36	1,493.23
21-Aug-98			1,489.94			
24-Aug-98	1,492.55	1,492.08	1,489.92	1,492.35	1,493.65	1,492.90
27-Aug-98	1,492.33	1,492.00	1,489.92	1,492.12	1,492.54	1,492.79
31-Aug-98	1,492.16	1,491.96	1,489.88	1,491.88	1,492.26	1,492.58
4-Sep-98			1,489.85			
7-Sep-98	1,491.82	1,491.74	1,489.85	1,491.88	1,492.03	1,492.32
11-Sep-98			1,489.79			
14-Sep-98	1,491.74	1,491.51	1,489.79	1,491.53	1,491.84	1,492.12
21-Sep-98	1,491.40	1,491.51	1,489.73	1,491.14	1,491.56	1,491.95
23-Sep-98			1,489.72			
25-Sep-98	1,491.44	1,491.26	1,489.72	1,491.24	1,491.58	1,491.76
28-Sep-98	1,491.44	1,491.26	1,489.73	1,491.24	1,491.58	1,491.76
2-Oct-98			1,489.70			
5-Oct-98	1,491.66	1,491.23	1,489.68	1,491.60	1,491.65	1,491.70
6-Oct-98	1,491.51	1,491.15	1,489.71	1,491.34	1,491.49	1,491.67
12-Oct-98	1,491.38	1,491.50	1,489.83	1,491.09	1,492.88	1,491.99
16-Oct-98			1,489.79			
19-Oct-98	1,491.76	1,491.25	1,489.76	1,491.69	1,491.69	1,491.88
30-Oct-98			1,489.69			
2-Nov-98	1,491.46	*1,491.21*	1,489.67	1,491.25	1,491.65	1,491.67
6-Nov-98			1,489.66			
9-Nov-98	1,491.20	1,490.96	1,489.63	1,491.21	1,491.51	1,491.60
13-Nov-98			1,489.63			
15-Nov-98	1,490.90	1,490.73	1,489.60	1,490.58		1,491.57
20-Nov-98			1,489.56			
23-Nov-98	1,491.24	1,491.02	1,489.57	1,490.84	1,491.32	1,491.49
30-Nov-98	1,491.18	1,491.00	1,489.53	1,490.88	1,491.30	1,491.43
3-Dec-98	1,491.14	1,490.99		1,490.89	1,494.25	1,491.44
4-Dec-98			1,489.52			
7-Dec-98	1,491.11	1,490.98	1,489.53	1,491.00	1,491.29	1,491.40
14-Dec-98	1,491.08	1,490.90	1,489.51	1,490.82	1,491.18	1,491.33
18-Dec-98			1,489.49			
30-Dec-98			1,489.62	1,491.40	1,491.82	1,491.96
31-Dec-98	1,491.66	1,491.35	1,489.62			
4-Jan-99	1,491.53	1,491.25	1,489.59	1,491.24	1,491.54	1,491.78
11-Jan-99	1,491.28	1,489.56	1,491.10	1,491.13		1,491.61
18-Jan-99	1,491.28	1,491.19	1,489.58	1,491.08	1,491.43	1,491.53
26-Jan-99	1,495.15	1,493.91	1,490.48	1,493.97	1,494.43	1,494.68
27-Jan-99	1,494.39	1,493.82	1,490.35	1,493.90	1,494.43	1,494.66
1-Feb-99	1,493.83	1,493.43	1,490.15	1,493.56	1,494.00	1,494.30

APPENDIX B-2 (Page 4 of 4)
Groundwater Elevation (ft.) in the Southern Area
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York
ENVIROGEN Project No. 78-014

Sample Date	MW-8	MW-53	MW-55	MW-76	MW-77	MW-89
8-Feb-99	1,494.11	1,493.64	1,490.17	1,493.81	1,494.26	1,494.50
15-Feb-99	1,494.06	1,493.60	1,490.22	1,493.78	1,494.18	1,494.49
19-Feb-99			1,490.18			
22-Feb-99	1,493.58	1,493.17	1,490.08	1,493.34	1,493.83	1,494.06
1-Mar-99	1,493.31	1,493.02	1,490.03	1,493.12	1,493.61	1,493.82
22-Mar-99	1,494.75	1,494.15	1,490.39	1,494.40	1,494.82	1,495.13
29-Mar-99	1,494.14	1,493.65	1,490.40	1,493.87	1,494.38	1,494.59
5-Apr-99	1,494.02	1,493.59	1,490.47	1,493.75	1,494.30	1,494.38
12-Apr-99	1,494.40	1,493.88	1,490.53	1,494.10	1,494.75	1,494.84
19-Apr-99	1,493.96	1,493.48	1,490.29	1,493.68	1,494.34	1,494.29
26-Apr-99	1,494.27	1,493.73	1,490.36	1,493.96	1,494.41	1,494.72
3-May-99	1,493.61	1,493.14	1,490.15	1,493.35	1,493.87	1,494.08
10-May-99	1,493.48	1,493.04	1,490.15	1,493.20	1,493.79	1,493.95
17-May-99	1,493.21	1,492.77	1,490.04	1,492.96	1,493.47	1,493.72
24-May-99	1,493.10	1,492.65	1,490.00	1,492.81	1,493.23	1,493.66
28-May-99			1,489.99			
1-Jun-99	1,492.71	1,492.35	1,489.98	1,492.46	1,492.87	1,493.12
7-Jun-99	1,492.43	1,492.15	1,489.93	1,492.19	1,492.83	1,492.87
14-Jun-99	1,492.16	1,491.88	1,489.84	1,491.94	1,492.28	1,492.51
21-Jun-99	1,491.87	1,491.64	1,489.79	1,491.66	1,491.96	1,492.21
28-Jun-99	1,492.01	1,491.82	1,489.94	1,491.77	1,492.11	1,492.31

Notes:

Blank indicates that groundwater elevation was not measured.

Values in bold italics have been corrected for free product measured in well.

Correction assumed a free product specific gravity of 0.80.

APPENDIX C

LNAPL THICKNESS MEASUREMENTS

APPENDIX C: LNAPL WELL DATA - MW-49
(Page 1 of 2)

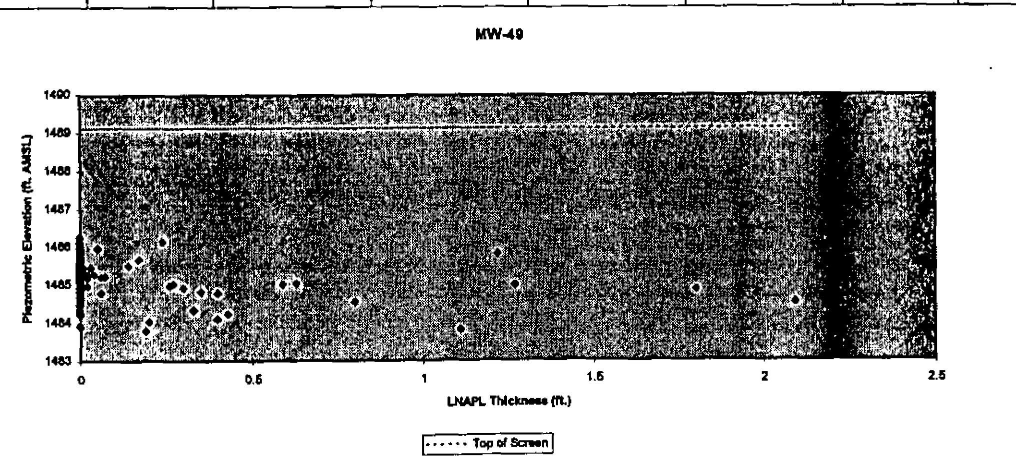
Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-49		Nov-93	1489.13				
	1498.48	Nov-93	1497.13				MW-49 FP
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.	TOS	GW Elev.	LNAPL Elev.
20-Oct-93	12.38	12.38	0	1486.10	1489.13	1486.1	1486.1
10-Nov-95	12.51	12.51	0	1485.97	1489.13	1485.97	1485.97
14-Mar-96	12.54	12.54	0	1485.94	1489.13	1485.94	1485.94
10-Mar-97	12.54	12.3	0.24	1486.14	1489.13	1485.94	1486.18
19-May-97	13.05	13.05	0	1485.43	1489.13	1485.43	1485.43
22-Jul-97	13.04	13.01	0.03	1485.47	1489.13	1485.44	1485.47
15-Sep-97	15.73	13.64	2.09	1484.53	1489.13	1482.75	1484.84
10-Nov-97	15.15	13.35	1.8	1484.88	1489.13	1483.33	1485.13
12-Nov-97	14.57	13.3	1.27	1484.99	1489.13	1483.91	1485.18
12-Nov-97	13.97	13.38	0.59	1485.01	1489.13	1484.51	1485.1
13-Nov-97	13.97	13.34	0.63	1485.05	1489.13	1484.51	1485.14
16-Dec-97	13.19	13.18	0.01	1485.30	1489.13	1485.29	1485.3
17-Dec-97	13.2	13.18	0.02	1485.30	1489.13	1485.28	1485.3
18-Dec-97	13.24	13.22	0.02	1485.26	1489.13	1485.24	1485.26
19-Dec-97	13.27	13.25	0.02	1485.23	1489.13	1485.21	1485.23
22-Dec-97	13.31	13.29	0.02	1485.19	1489.13	1485.17	1485.19
23-Dec-97	13.31	13.24	0.07	1485.23	1489.13	1485.17	1485.24
24-Dec-97	13.31	13.25	0.06	1485.22	1489.13	1485.17	1485.23
29-Dec-97	12.89	12.89	0	1485.59	1489.13	1485.59	1485.59
30-Dec-97	12.86	12.86	0	1485.62	1489.13	1485.62	1485.62
31-Dec-97	12.88	12.88	0	1485.60	1489.13	1485.6	1485.6
2-Jan-98	12.88	12.88	0	1485.60	1489.13	1485.6	1485.6
5-Jan-98	12.83	12.83	0	1485.65	1489.13	1485.65	1485.65
6-Jan-98	12.78	12.78	0	1485.70	1489.13	1485.7	1485.7
7-Jan-98	12.75	12.75	0	1485.73	1489.13	1485.73	1485.73
8-Jan-98	12.6	12.6	0	1485.88	1489.13	1485.88	1485.88
9-Jan-98	12.34	12.34	0	1486.14	1489.13	1486.14	1486.14
12-Jan-98	12.22	12.22	0	1486.26	1489.13	1486.26	1486.26
19-Jan-98	12.47	12.47	0	1486.01	1489.13	1486.01	1486.01
20-Jan-98	12.49	12.49	0	1485.99	1489.13	1485.99	1485.99
21-Jan-98	12.56	12.56	0	1485.92	1489.13	1485.92	1485.92
22-Jan-98	12.64	12.64	0	1485.84	1489.13	1485.84	1485.84
26-Jan-98	12.84	12.84	0	1485.64	1489.13	1485.64	1485.64
27-Jan-98	12.87	12.87	0	1485.61	1489.13	1485.61	1485.61
28-Jan-98	12.88	12.88	0	1485.60	1489.13	1485.6	1485.6
29-Jan-98	12.93	12.93	0	1485.55	1489.13	1485.55	1485.55
6-Feb-98	13.03	13.03	0	1485.45	1489.13	1485.45	1485.45
9-Feb-98	13.01	13.01	0	1485.47	1489.13	1485.47	1485.47
11-Feb-98	13	13	0	1485.48	1489.13	1485.48	1485.48
13-Feb-98	13.13	13.13	0	1485.35	1489.13	1485.35	1485.35
16-Feb-98	13.12	13.12	0	1485.36	1489.13	1485.36	1485.36
18-Feb-98	13.11	13.11	0	1485.37	1489.13	1485.37	1485.37
20-Feb-98	13.11	13.11	0	1485.37	1489.13	1485.37	1485.37
23-Feb-98	13.08	13.08	0	1485.40	1489.13	1485.4	1485.4
25-Feb-98	13.01	13.01	0	1485.47	1489.13	1485.47	1485.47
27-Feb-98	12.96	12.96	0	1485.52	1489.13	1485.52	1485.52
2-Mar-98	12.85	12.85	0	1485.63	1489.13	1485.63	1485.63
4-Mar-98	12.84	12.84	0	1485.64	1489.13	1485.64	1485.64
6-Mar-98	12.83	12.83	0	1485.65	1489.13	1485.65	1485.65
9-Mar-98	12.73	12.73	0	1485.75	1489.13	1485.75	1485.75
11-Mar-98	12.8	12.8	0	1485.68	1489.13	1485.68	1485.68
13-Mar-98	12.88	12.88	0	1485.60	1489.13	1485.6	1485.6
16-Mar-98	13.02	13.01	0.01	1485.47	1489.13	1485.46	1485.47
18-Mar-98	13.04	13.04	0	1485.44	1489.13	1485.44	1485.44
20-Mar-98	12.95	12.95	0	1485.53	1489.13	1485.53	1485.53
23-Mar-98	12.9	12.9	0	1485.58	1489.13	1485.58	1485.58
25-Mar-98	12.89	12.89	0	1485.59	1489.13	1485.59	1485.59
27-Mar-98	12.82	12.82	0	1485.66	1489.13	1485.66	1485.66
30-Mar-98	12.7	12.7	0	1485.78	1489.13	1485.78	1485.78
1-Apr-98	12.65	12.65	0	1485.83	1489.13	1485.83	1485.83
3-Apr-98	12.61	12.61	0	1485.87	1489.13	1485.87	1485.87
8-Apr-98	12.63	12.63	0	1485.85	1489.13	1485.85	1485.85
13-Apr-98	12.55	12.5	0.05	1485.97	1489.13	1485.93	1485.98
23-Apr-98	12.65	12.65	0	1485.83	1489.13	1485.83	1485.83
28-Apr-98	12.65	12.65	0	1485.83	1489.13	1485.83	1485.83
8-May-98	12.94	12.77	0.17	1485.68	1489.13	1485.54	1485.71
15-May-98	12.64	12.64	0	1485.84	1489.13	1485.84	1485.84
22-May-98	13.09	12.95	0.14	1485.51	1489.13	1485.39	1485.53
29-May-98	13.24	13.24	0	1485.24	1489.13	1485.24	1485.24
5-Jun-98	14.02	13.62	0.4	1484.80	1489.13	1484.46	1484.86
12-Jun-98	13.67	13.4	0.27	1485.04	1489.13	1484.81	1485.08
19-Jun-98	13.52	13.51	0.01	1484.97	1489.13	1484.96	1484.97
26-Jun-98	14.61	13.81	0.8	1484.55	1489.13	1483.87	1484.67
6-Jul-98	13.7	12.48	1.22	1485.82	1489.13	1484.78	1486
24-Jul-98	13.22	13.18	0.04	1485.29	1489.13	1485.26	1485.3
31-Jul-98	13.51	13.49	0.02	1484.99	1489.13	1484.97	1484.99
7-Aug-98	13.68	13.68	0	1484.80	1489.13	1484.8	1484.8

APPENDIX C: LNAPL WELL DATA - MW-49
(Page 2 of 2)

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-49		Nov-93	1489.13				
	1498.48	Nov-93	1497.13				MW-49 FP
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.	TOS	GW Elev.	LNAPL Elev.
14-Aug-98	13.32	13.32	0	1485.16	1489.13	1485.16	1485.16
21-Aug-98	13.28	13.28	0	1485.20	1489.13	1485.2	1485.2
27-Aug-98	13.33	13.33	0	1485.15	1489.13	1485.15	1485.15
11-Sep-98	13.38	13.38	0	1485.10	1489.13	1485.1	1485.1
14-Sep-98	13.41	13.41	0	1485.07	1489.13	1485.07	1485.07
21-Sep-98	13.71	13.45	0.26	1484.99	1489.13	1484.77	1485.03
25-Sep-98	13.81	13.51	0.3	1484.93	1489.13	1484.67	1484.97
2-Oct-98	13.95	13.6	0.35	1484.83	1489.13	1484.53	1484.88
6-Oct-98	13.72	13.66	0.06	1484.81	1489.13	1484.76	1484.82
16-Oct-98	14.6	14.17	0.43	1484.25	1489.13	1483.88	1484.31
26-Oct-98	14.42	14.09	0.33	1484.34	1489.13	1484.06	1484.39
5-Nov-98	15.6	14.49	1.11	1483.82	1489.13	1482.88	1483.99
13-Nov-98	14.6	14.4	0.2	1484.05	1489.13	1483.88	1484.08
20-Nov-98	14.23	14.23	0	1484.25	1489.13	1484.25	1484.25
25-Nov-98	14.7	14.3	0.4	1484.12	1489.13	1483.78	1484.18
3-Dec-98	14.22	14.22	0	1484.26	1489.13	1484.26	1484.26
14-Dec-98	14.83	14.64	0.19	1483.81	1489.13	1483.65	1483.84
24-Dec-98	14.56	14.56	0	1483.92	1489.13	1483.92	1483.92
31-Dec-98	14.26	14.26	0	1484.22	1489.13	1484.22	1484.22
18-Jan-99	13.92	13.92	0	1484.56	1489.13	1484.56	1484.56
22-Jan-99	13.76	13.76	0	1484.72	1489.13	1484.72	1484.72
27-Jan-99	12.9	12.9	0	1485.58	1489.13	1485.58	1485.58
4-Feb-99	12.75	12.75	0	1485.73	1489.13	1485.73	1485.73
11-Feb-99	12.91	12.91	0	1485.57	1489.13	1485.57	1485.57
18-Feb-99	13.19	13.19	0	1485.29	1489.13	1485.29	1485.29
25-Feb-99	13.54	13.54	0	1484.94	1489.13	1484.94	1484.94
5-Mar-99	13.56	13.56	0	1484.92	1489.13	1484.92	1484.92
12-Mar-99	13.68	13.68	0	1484.80	1489.13	1484.8	1484.8
29-Mar-99	13.14	13.14	0	1485.34	1489.13	1485.34	1485.34
2-Apr-99	13.21	13.21	0	1485.27	1489.13	1485.27	1485.27
8-Apr-99	13.21	13.21	0	1485.27	1489.13	1485.27	1485.27
16-Apr-99	13.25	13.25	0	1485.23	1489.13	1485.23	1485.23
26-Apr-99	13.17	13.17	0	1485.31	1489.13	1485.31	1485.31
7-May-99	13.65	13.65	0	1484.83	1489.13	1484.83	1484.83
14-May-99	13.84	13.84	0	1484.64	1489.13	1484.64	1484.64
21-May-99	13.98	13.98	0	1484.50	1489.13	1484.5	1484.5
28-May-99	14.12	14.12	0	1484.36	1489.13	1484.36	1484.36
11-Jun-99	13.82	13.82	0	1484.66	1489.13	1484.66	1484.66
18-Jun-99	13.97	13.97	0	1484.51	1489.13	1484.51	1484.51
25-Jun-99	14.2	14.2	0	1484.28	1489.13	1484.28	1484.28
2-Jul-99	13.99	13.99	0	1484.49	1489.13	1484.49	1484.49
8-Jul-99	14.01	14.01	0	1484.47	1489.13	1484.47	1484.47
15-Jul-99	13.96	13.96	0	1484.52	1489.13	1484.52	1484.52
23-Jul-99	13.8	13.8	0	1484.68	1489.13	1484.68	1484.68



APPENDIX C: LNAPL WELL DATA - MW-51
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Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-51							
GW Elev.	1499.59						LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
20-Oct-93	10.24	9.35	0.89	1490.11	1491.01	1489.35	1490.24
10-Nov-95	8.54	8.54	0	1491.05	1491.01	1491.05	1491.05
13-Mar-96	9.83	7.74	2.09	1491.54	1491.01	1489.76	1491.85
17-Jun-96	9.94	8.56	1.38	1490.82	1491.01	1489.65	1491.03
16-Dec-96	10	6.79	3.21	1492.32	1491.01	1489.59	1492.8
9-May-97	9.57	7.57	2	1491.72	1491.01	1490.02	1492.02
15-Sep-97	10.03	9	1.03	1490.44	1491.01	1489.56	1490.59
10-Nov-97	9.72	8.12	1.6	1491.23	1491.01	1489.87	1491.47
11-Nov-97	9.72	8.16	1.56	1491.20	1491.01	1489.87	1491.43
11-Nov-97	8.37	8.32	0.05	1491.26	1491.01	1491.22	1491.27
12-Nov-97	8.37	8.32	0.05	1491.26	1491.01	1491.22	1491.27
2-Dec-97	8.12	7.6	0.52	1491.91	1491.01	1491.47	1491.99
2-Dec-97	7.7	7.65	0.05	1491.93	1491.01	1491.89	1491.94
16-Dec-97	7.97	7.97	0	1491.62	1491.01	1491.62	1491.62
17-Dec-97	7.97	7.97	0	1491.62	1491.01	1491.62	1491.62
18-Dec-97	8.03	8.03	0	1491.56	1491.01	1491.56	1491.56
19-Dec-97	8.03	8.03	0	1491.56	1491.01	1491.56	1491.56
22-Dec-97	8.06	8.06	0	1491.53	1491.01	1491.53	1491.53
23-Dec-97	8.1	8.1	0	1491.49	1491.01	1491.49	1491.49
24-Dec-97	8.08	8.08	0	1491.51	1491.01	1491.51	1491.51
29-Dec-97	7.77	7.64	0.13	1491.93	1491.01	1491.82	1491.95
30-Dec-97	7.71	7.71	0	1491.88	1491.01	1491.88	1491.88
31-Dec-97	7.88	7.88	0	1491.71	1491.01	1491.71	1491.71
2-Jan-98	7.94	7.94	0	1491.65	1491.01	1491.65	1491.65
5-Jan-98	7.24	7.24	0	1492.35	1491.01	1492.35	1492.35
6-Jan-98	7.14	7.12	0.02	1492.47	1491.01	1492.45	1492.47
7-Jan-98	7.17	7.17	0	1492.42	1491.01	1492.42	1492.42
8-Jan-98	5.77	5.71	0.06	1493.87	1491.01	1493.82	1493.88
9-Jan-98	5.7	5.62	0.08	1493.96	1491.01	1493.89	1493.97
12-Jan-98	6.54	6.46	0.08	1493.12	1491.01	1493.05	1493.13
19-Jan-98	7.27	7.1	0.17	1492.46	1491.01	1492.32	1492.49
20-Jan-98	7.43	7.18	0.25	1492.37	1491.01	1492.16	1492.41
21-Jan-98	7.38	7.28	0.1	1492.30	1491.01	1492.21	1492.31
22-Jan-98	7.47	7.35	0.12	1492.22	1491.01	1492.12	1492.24
26-Jan-98	7.81	7.61	0.2	1491.95	1491.01	1491.78	1491.98
27-Jan-98	7.7	7.63	0.07	1491.95	1491.01	1491.89	1491.96
28-Jan-98	7.71	7.64	0.07	1491.94	1491.01	1491.88	1491.95
29-Jan-98	7.91	7.63	0.28	1491.92	1491.01	1491.68	1491.96
6-Feb-98	7.8	7.73	0.07	1491.85	1491.01	1491.79	1491.86
9-Feb-98	7.91	7.91	0	1491.68	1491.01	1491.68	1491.68
11-Feb-98	7.89	7.89	0	1491.70	1491.01	1491.7	1491.7
13-Feb-98	8.01	8.01	0	1491.58	1491.01	1491.58	1491.58
16-Feb-98	8.08	8.08	0	1491.51	1491.01	1491.51	1491.51
18-Feb-98	7.51	7.51	0	1492.08	1491.01	1492.08	1492.08
20-Feb-98	7.49	7.49	0	1492.10	1491.01	1492.1	1492.1
23-Feb-98	7.51	7.51	0	1492.08	1491.01	1492.08	1492.08
25-Feb-98	7.5	7.5	0	1492.09	1491.01	1492.09	1492.09
27-Feb-98	7.36	7.36	0	1492.23	1491.01	1492.23	1492.23
2-Mar-98	6.88	6.88	0	1492.71	1491.01	1492.71	1492.71
4-Mar-98	7.1	7.1	0	1492.49	1491.01	1492.49	1492.49
6-Mar-98	7.31	7.31	0	1492.28	1491.01	1492.28	1492.28
9-Mar-98	7.26	7.26	0	1492.33	1491.01	1492.33	1492.33
11-Mar-98	7.34	7.34	0	1492.25	1491.01	1492.25	1492.25
13-Mar-98	7.4	7.4	0	1492.19	1491.01	1492.19	1492.19
16-Mar-98	7.67	7.67	0	1491.92	1491.01	1491.92	1491.92
18-Mar-98	7.49	7.49	0	1492.10	1491.01	1492.1	1492.1
20-Mar-98	7.39	7.39	0	1492.20	1491.01	1492.2	1492.2
23-Mar-98	7.12	7.12	0	1492.47	1491.01	1492.47	1492.47
25-Mar-98	7.15	7.15	0	1492.44	1491.01	1492.44	1492.44
27-Mar-98	7.08	7.08	0	1492.51	1491.01	1492.51	1492.51

APPENDIX C: LNAPL WELL DATA - MW-51

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-51							
GW Elev.	1499.59						LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
30-Mar-98	7.23	7.23	0	1492.36	1491.01	1492.36	1492.36
1-Apr-98	7.35	7.35	0	1492.24	1491.01	1492.24	1492.24
3-Apr-98	7.4	7.4	0	1492.19	1491.01	1492.19	1492.19
8-Apr-98	7.67	7.67	0	1491.92	1491.01	1491.92	1491.92
13-Apr-98	5.72	5.72	0	1493.87	1491.01	1493.87	1493.87
23-Apr-98	6.81	6.81	0	1492.78	1491.01	1492.78	1492.78
28-Apr-98	7.21	7.21	0	1492.38	1491.01	1492.38	1492.38
8-May-98	7.3	7.3	0	1492.29	1491.01	1492.29	1492.29
15-May-98	7.08	7.08	0	1492.51	1491.01	1492.51	1492.51
22-May-98	7.61	7.61	0	1491.98	1491.01	1491.98	1491.98
29-May-98	8.11	8.11	0	1491.48	1491.01	1491.48	1491.48
5-Jun-98	7.92	7.92	0	1491.67	1491.01	1491.67	1491.67
12-Jun-98	8.44	8.42	0.02	1491.17	1491.01	1491.15	1491.17
19-Jun-98	8.21	8.21	0	1491.38	1491.01	1491.38	1491.38
26-Jun-98	6.9	6.87	0.03	1492.72	1491.01	1492.69	1492.72
6-Jul-98	7.21	7.05	0.16	1492.52	1491.01	1492.38	1492.54
24-Jul-98	8.57	8.57	0	1491.02	1491.01	1491.02	1491.02
31-Jul-98	8.25	8.21	0.04	1491.37	1491.01	1491.34	1491.38
7-Aug-98	8.51	8.51	0	1491.08	1491.01	1491.08	1491.08
14-Aug-98	8.54	8.54	0	1491.05	1491.01	1491.05	1491.05
21-Aug-98	8.82	8.82	0	1490.77	1491.01	1490.77	1490.77
27-Aug-98	8.98	8.98	0	1490.61	1491.01	1490.61	1490.61
11-Sep-98	9.31	9.31	0	1490.28	1491.01	1490.28	1490.28
14-Sep-98	9.35	9.35	0	1490.24	1491.01	1490.24	1490.24
25-Sep-98	9.58	9.56	0.02	1490.03	1491.01	1490.01	1490.03
2-Oct-98	9.66	9.65	0.01	1489.94	1491.01	1489.93	1489.94
16-Oct-98	9.71	9.46	0.25	1490.09	1491.01	1489.88	1490.13
26-Oct-98	9.59	9.59	0	1490.00	1491.01	1490	1490
30-Oct-98	9.59	9.59	0	1490.00	1491.01	1490	1490
5-Nov-98	10.72	10.7	0.02	1488.89	1491.01	1488.87	1488.89
13-Nov-98	9.79	9.79	0	1489.80	1491.01	1489.8	1489.8
20-Nov-98	9.77	9.77	0	1489.82	1491.01	1489.82	1489.82
25-Nov-98	9.8	9.8	0	1489.79	1491.01	1489.79	1489.79
3-Dec-98	9.79	9.79	0	1489.80	1491.01	1489.8	1489.8
14-Dec-98	9.87	9.87	0	1489.72	1491.01	1489.72	1489.72
24-Dec-98	9.51	9.5	0.01	1490.09	1491.01	1490.08	1490.09
31-Dec-98	9.4	9.4	0	1490.19	1491.01	1490.19	1490.19
8-Jan-99	9.52	9.52	0	1490.07	1491.01	1490.07	1490.07
18-Jan-99	9.63	9.63	0	1489.96	1491.01	1489.96	1489.96
22-Jan-99	9.52	9.38	0.14	1490.19	1491.01	1490.07	1490.21
4-Feb-99	7.25	7.25	0	1492.34	1491.01	1492.34	1492.34
11-Feb-99	7.37	7.37	0	1492.22	1491.01	1492.22	1492.22
18-Feb-99	7.61	7.61	0	1491.98	1491.01	1491.98	1491.98
25-Feb-99	7.9	7.9	0	1491.69	1491.01	1491.69	1491.69
5-Mar-99	7.7	7.7	0	1491.89	1491.01	1491.89	1491.89
12-Mar-99	7.81	7.81	0	1491.78	1491.01	1491.78	1491.78
29-Mar-99	7.41	7.41	0	1492.18	1491.01	1492.18	1492.18
2-Apr-99	7.53	7.53	0	1492.06	1491.01	1492.06	1492.06
8-Apr-99	7.55	7.55	0	1492.04	1491.01	1492.04	1492.04
16-Apr-99	7.47	7.47	0	1492.12	1491.01	1492.12	1492.12
26-Apr-99	7.43	7.43	0	1492.16	1491.01	1492.16	1492.16
7-May-99	8.13	8.13	0	1491.46	1491.01	1491.46	1491.46
14-May-99	8.2	8.2	0	1491.39	1491.01	1491.39	1491.39
21-May-99	8.38	8.38	0	1491.21	1491.01	1491.21	1491.21
28-May-99	8.53	8.53	0	1491.06	1491.01	1491.06	1491.06
11-Jun-99	8.95	8.95	0	1490.64	1491.01	1490.64	1490.64
18-Jun-99	8.17	8.16	0.01	1491.43	1491.01	1491.42	1491.43
25-Jun-99	9.36	9.32	0.04	1490.26	1491.01	1490.23	1490.27
2-Jul-99	8.91	8.76	0.15	1490.81	1491.01	1490.68	1490.83
8-Jul-99	9.4	9.17	0.23	1490.39	1491.01	1490.19	1490.42

APPENDIX C: LNAPL WELL DATA - MW-51
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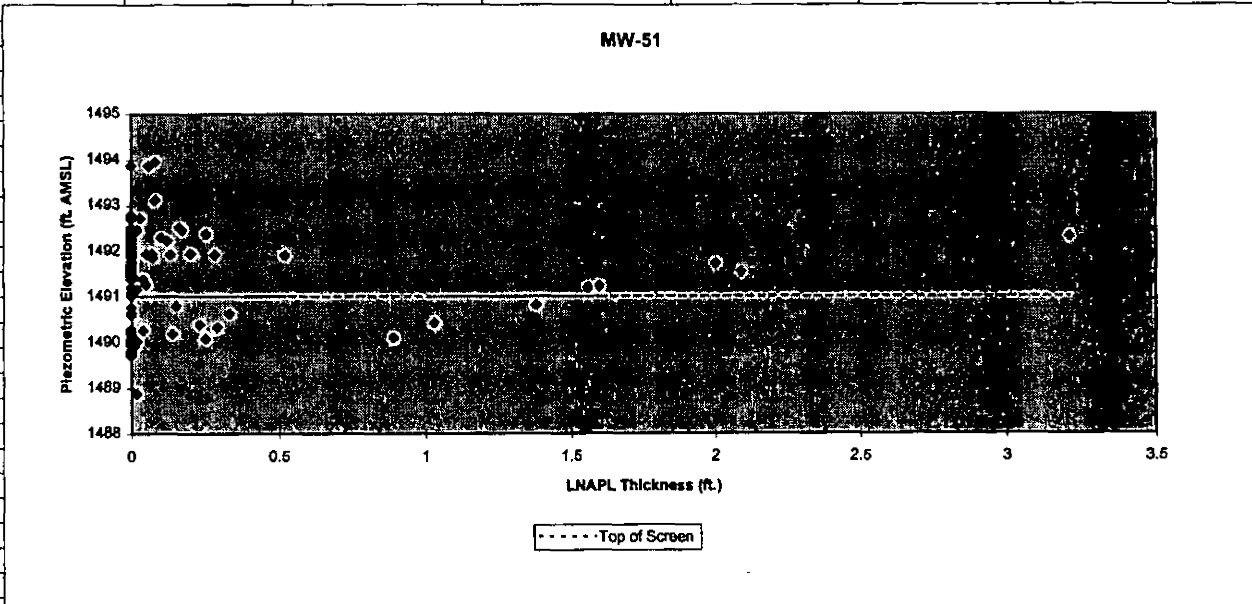
Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-51							
GW Elev.	1499.59						LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
15-Jul-99	9.25	8.92	0.33	1490.62	1491.01	1490.34	1490.67
23-Jul-99	9.51	9.22	0.29	1490.33	1491.01	1490.08	1490.37



APPENDIX C: LNAPL WELL DATA - MW-70
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Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-70							
GW Elev.	1495.3	1497.82					LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
20-Oct-93	15.63	15.63	0	1482.19	1483.67	1482.19	1479.67
10-Nov-95	13.02	13.02	0	1482.28	1483.67	1482.28	1482.28
14-Mar-96	12.33	12.33	0	1482.97	1483.67	1482.97	1482.97
17-Jun-96	13.27	13.27	0	1482.03	1483.67	1482.03	1482.03
28-Aug-96	10.23	10.23	0	1485.07	1483.67	1485.07	1485.07
23-Sep-96	12.71	12.71	0	1482.59	1483.67	1482.59	1482.59
29-Oct-96	11.95	11.95	0	1483.35	1483.67	1483.35	1483.35
30-Oct-96	11.95	11.95	0	1483.35	1483.67	1483.35	1483.35
19-Nov-96	12.13	12.13	0	1483.17	1483.67	1483.17	1483.17
16-Dec-96	12.61	12.61	0	1482.69	1483.67	1482.69	1482.69
21-Jan-97	13.12	13.12	0	1482.18	1483.67	1482.18	1482.18
19-Feb-97	13.97	13.97	0	1481.33	1483.67	1481.33	1481.33
20-Mar-97	13.04	13.04	0	1482.26	1483.67	1482.26	1482.26
20-May-97	14.12	14.12	0	1481.18	1483.67	1481.18	1481.18
22-Jul-97	14.35	14.27	0.08	1481.02	1483.67	1480.95	1481.03
25-Aug-97	14.6	14.5	0.1	1480.79	1483.67	1480.7	1480.8
3-Sep-97	14.72	14.57	0.15	1480.71	1483.67	1480.58	1480.73
11-Sep-97	14.69	14.58	0.11	1480.70	1483.67	1480.61	1480.72
15-Sep-97	14.68	14.49	0.19	1480.78	1483.67	1480.62	1480.81
29-Sep-97	14.44	14.34	0.1	1480.95	1483.67	1480.86	1480.96
10-Oct-97	14.51	14.36	0.15	1480.92	1483.67	1480.79	1480.94
20-Oct-97	14.64	14.52	0.12	1480.76	1483.67	1480.66	1480.78
31-Oct-97	14.7	14.56	0.14	1480.72	1483.67	1480.6	1480.74
10-Nov-97	13.31	13.31	0	1481.99	1483.67	1481.99	1481.99
1-Dec-97	12.52	12.52	0	1482.78	1483.67	1482.78	1482.78
16-Dec-97	13.98	13.92	0.06	1481.37	1483.67	1481.32	1481.38
17-Dec-97	13.98	13.95	0.03	1481.35	1483.67	1481.32	1481.35
18-Dec-97	14.04	14.01	0.03	1481.29	1483.67	1481.26	1481.29
19-Dec-97	14.14	14.01	0.13	1481.27	1483.67	1481.16	1481.29
22-Dec-97	14.17	14.12	0.05	1481.17	1483.67	1481.13	1481.18
23-Dec-97	14.12	14.08	0.04	1481.21	1483.67	1481.18	1481.22
24-Dec-97	14.11	14.07	0.04	1481.22	1483.67	1481.19	1481.23
29-Dec-97	13.74	13.74	0	1481.56	1483.67	1481.56	1481.56
30-Dec-97	13.72	13.72	0	1481.58	1483.67	1481.58	1481.58
31-Dec-97	13.71	13.71	0	1481.59	1483.67	1481.59	1481.59
2-Jan-98	13.04	13.04	0	1482.26	1483.67	1482.26	1482.26
5-Jan-98	12.28	12.28	0	1483.02	1483.67	1483.02	1483.02
6-Jan-98	12.27	12.27	0	1483.03	1483.67	1483.03	1483.03
7-Jan-98	12.37	12.37	0	1482.93	1483.67	1482.93	1482.93
8-Jan-98	9.08	9.08	0	1486.22	1483.67	1486.22	1486.22
9-Jan-98	9.38	9.38	0	1485.92	1483.67	1485.92	1485.92
12-Jan-98	12.04	12.04	0	1483.26	1483.67	1483.26	1483.26
19-Jan-98	13.08	13.08	0	1482.22	1483.67	1482.22	1482.22
20-Jan-98	13.18	13.18	0	1482.12	1483.67	1482.12	1482.12
21-Jan-98	13.29	13.29	0	1482.01	1483.67	1482.01	1482.01
22-Jan-98	13.38	13.38	0	1481.92	1483.67	1481.92	1481.92
26-Jan-98	13.65	13.65	0	1481.65	1483.67	1481.65	1481.65
27-Jan-98	13.74	13.74	0	1481.56	1483.67	1481.56	1481.56
28-Jan-98	13.81	13.81	0	1481.49	1483.67	1481.49	1481.49
29-Jan-98	13.84	13.84	0	1481.46	1483.67	1481.46	1481.46
6-Feb-98	14.03	14.03	0	1481.27	1483.67	1481.27	1481.27
9-Feb-98	14.1	14.1	0	1481.20	1483.67	1481.2	1481.2
11-Feb-98	14.06	14.06	0	1481.24	1483.67	1481.24	1481.24
13-Feb-98	13.9	13.9	0	1481.40	1483.67	1481.4	1481.4
16-Feb-98	14.1	14.1	0	1481.20	1483.67	1481.2	1481.2
18-Feb-98	13.49	13.49	0	1481.81	1483.67	1481.81	1481.81
20-Feb-98	12.78	12.78	0	1482.52	1483.67	1482.52	1482.52
23-Feb-98	13.24	13.24	0	1482.06	1483.67	1482.06	1482.06
25-Feb-98	13.34	13.34	0	1481.96	1483.67	1481.96	1481.96
27-Feb-98	13.23	13.23	0	1482.07	1483.67	1482.07	1482.07
2-Mar-98	12.39	12.39	0	1482.91	1483.67	1482.91	1482.91
4-Mar-98	12.42	12.42	0	1482.88	1483.67	1482.88	1482.88
6-Mar-98	13.04	13.04	0	1482.26	1483.67	1482.26	1482.26
9-Mar-98	13.01	13.01	0	1482.29	1483.67	1482.29	1482.29
11-Mar-98	13.24	13.24	0	1482.06	1483.67	1482.06	1482.06

APPENDIX C: LNAPL WELL DATA - MW-70
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Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-70							
GW Elev.	1495.3	1497.82					LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
13-Mar-98	13.22	13.22	0	1482.08	1483.67	1482.08	1482.08
16-Mar-98	13.45	13.45	0	1481.85	1483.67	1481.85	1481.85
18-Mar-98	13.53	13.53	0	1481.77	1483.67	1481.77	1481.77
20-Mar-98	13.5	13.5	0	1481.80	1483.67	1481.8	1481.8
23-Mar-98	13.2	13.2	0	1482.10	1483.67	1482.1	1482.1
25-Mar-98	13.23	13.23	0	1482.07	1483.67	1482.07	1482.07
27-Mar-98	12.78	12.78	0	1482.52	1483.67	1482.52	1482.52
30-Mar-98	12.97	12.97	0	1482.33	1483.67	1482.33	1482.33
1-Apr-98	13.15	13.15	0	1482.15	1483.67	1482.15	1482.15
3-Apr-98	13.19	13.19	0	1482.11	1483.67	1482.11	1482.11
6-Apr-98	13.4	13.4	0	1481.90	1483.67	1481.9	1481.9
8-Apr-98	13.54	13.54	0	1481.76	1483.67	1481.76	1481.76
13-Apr-98	12.8	12.8	0	1482.50	1483.67	1482.5	1482.5
20-Apr-98	10.98	10.98	0	1484.32	1483.67	1484.32	1484.32
27-Apr-98	12.61	12.61	0	1482.69	1483.67	1482.69	1482.69
4-May-98	12.91	12.91	0	1482.39	1483.67	1482.39	1482.39
8-May-98	13.43	13.43	0	1481.87	1483.67	1481.87	1481.87
11-May-98	12.51	12.51	0	1482.79	1483.67	1482.79	1482.79
15-May-98	12.61	12.61	0	1482.69	1483.67	1482.69	1482.69
18-May-98	12.59	12.59	0	1482.71	1483.67	1482.71	1482.71
22-May-98	12.65	12.65	0	1482.65	1483.67	1482.65	1482.65
26-May-98	12.87	12.87	0	1482.43	1483.67	1482.43	1482.43
29-May-98	14.25	14.25	0	1481.05	1483.67	1481.05	1481.05
1-Jun-98	14.23	14.23	0	1481.07	1483.67	1481.07	1481.07
8-Jun-98	14.21	14.21	0	1481.09	1483.67	1481.09	1481.09
12-Jun-98	14.44	14.42	0.02	1480.88	1483.67	1480.86	1480.88
19-Jun-98	14.36	14.36	0	1480.94	1483.67	1480.94	1480.94
22-Jun-98	14.46	14.44	0.02	1480.86	1483.67	1480.84	1480.86
26-Jun-98	11.97	11.97	0	1483.33	1483.67	1483.33	1483.33
6-Jul-98	13.27	13.27	0	1482.03	1483.67	1482.03	1482.03
13-Jul-98	13.54	13.54	0	1481.76	1483.67	1481.76	1481.76
20-Jul-98	14.19	14.19	0	1481.11	1483.67	1481.11	1481.11
24-Jul-98	13.48	13.48	0	1481.82	1483.67	1481.82	1481.82
27-Jul-98	14.29	14.29	0	1481.01	1483.67	1481.01	1481.01
30-Jul-98	14.36	14.34	0.02	1480.96	1483.67	1480.94	1480.96
31-Jul-98	14.38	14.36	0.02	1480.94	1483.67	1480.92	1480.94
3-Aug-98	14.49	14.49	0	1480.81	1483.67	1480.81	1480.81
4-Aug-98	14.49	14.49	0	1480.81	1483.67	1480.81	1480.81
7-Aug-98	14.49	14.49	0	1480.81	1483.67	1480.81	1480.81
14-Aug-98	14.49	14.49	0	1480.81	1483.67	1480.81	1480.81
21-Aug-98	14.5	14.5	0	1480.80	1483.67	1480.8	1480.8
27-Aug-98	14.51	14.51	0	1480.79	1483.67	1480.79	1480.79
4-Sep-98	14.56	14.56	0	1480.74	1483.67	1480.74	1480.74
11-Sep-98	14.62	14.58	0.04	1480.71	1483.67	1480.68	1480.72
14-Sep-98	14.65	14.65	0	1480.65	1483.67	1480.65	1480.65
21-Sep-98	14.69	14.61	0.08	1480.68	1483.67	1480.61	1480.69
23-Sep-98	14.69	14.61	0.08	1480.68	1483.67	1480.61	1480.69
25-Sep-98	14.71	14.64	0.07	1480.65	1483.67	1480.59	1480.66
28-Sep-98	14.71	14.64	0.07	1480.65	1483.67	1480.59	1480.66
2-Oct-98	14.69	14.63	0.06	1480.66	1483.67	1480.61	1480.67
6-Oct-98	14.7	14.7	0	1480.60	1483.67	1480.6	1480.6
16-Oct-98	14.7	14.7	0	1480.60	1483.67	1480.6	1480.6
30-Oct-98	14.89	14.71	0.18	1480.56	1483.67	1480.41	1480.59
5-Nov-98	14.9	13.81	1.09	1481.33	1483.67	1480.4	1481.49
6-Nov-98	14.9	13.81	1.09	1481.33	1483.67	1480.4	1481.49
13-Nov-98	14.82	14.81	0.01	1480.49	1483.67	1480.48	1480.49
20-Nov-98	14.85	14.77	0.08	1480.52	1483.67	1480.45	1480.53
25-Nov-98	14.85	14.85	0	1480.45	1483.67	1480.45	1480.45
3-Dec-98	14.81	14.78	0.03	1480.52	1483.67	1480.49	1480.52
14-Dec-98	14.9	14.84	0.06	1480.45	1483.67	1480.4	1480.46
18-Dec-98	14.84	14.84	0	1480.46	1483.67	1480.46	1480.46
24-Dec-98	14.44	14.44	0	1480.86	1483.67	1480.86	1480.86
31-Dec-98	14.46	14.46	0	1480.84	1483.67	1480.84	1480.84
15-Jan-99	14.25	14.25	0	1481.05	1483.67	1481.05	1481.05
22-Jan-99	13.9	13.9	0	1481.40	1483.67	1481.4	1481.4

APPENDIX C: LNAPL WELL DATA - MW-70
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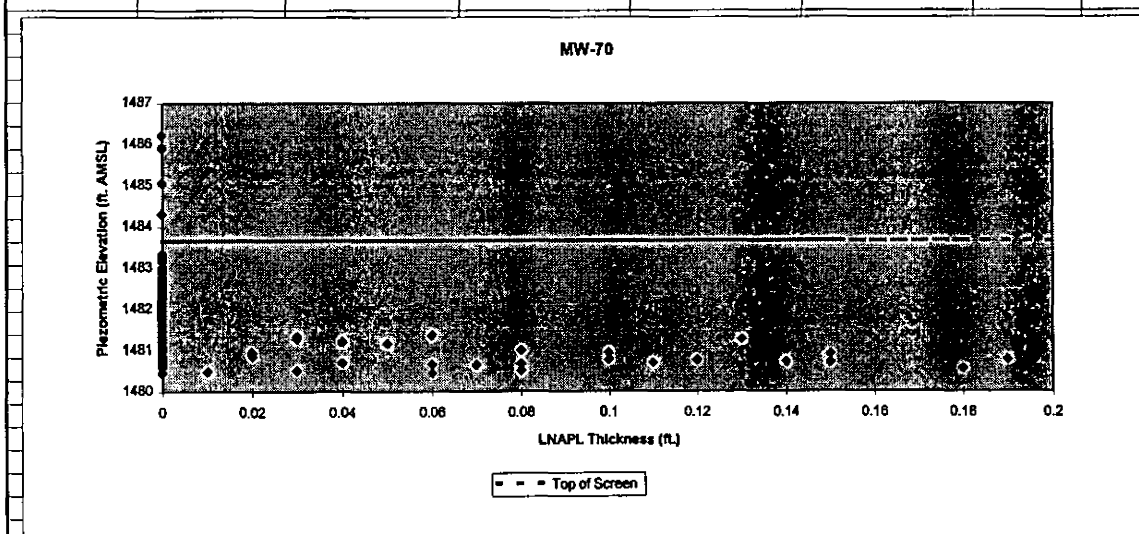
Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-70							
GW Elev.	1495.3	1497.82					LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
27-Jan-99	12.73	12.73	0	1482.57	1483.67	1482.57	1482.57
4-Feb-99	12.98	12.98	0	1482.32	1483.67	1482.32	1482.32
11-Feb-99	13.38	13.38	0	1481.92	1483.67	1481.92	1481.92
15-Feb-99	13.38	13.38	0	1481.92	1483.67	1481.92	1481.92
18-Feb-99	13.35	13.35	0	1481.95	1483.67	1481.95	1481.95
19-Feb-99	13.35	13.35	0	1481.95	1483.67	1481.95	1481.95
22-Feb-99	13.35	13.35	0	1481.95	1483.67	1481.95	1481.95
25-Feb-99	13.96	13.96	0	1481.34	1483.67	1481.34	1481.34
5-Mar-99	13.34	13.34	0	1481.96	1483.67	1481.96	1481.96
12-Mar-99	13.85	13.85	0	1481.45	1483.67	1481.45	1481.45
29-Mar-99	13.05	13.05	0	1482.25	1483.67	1482.25	1482.25
5-Apr-99	12.6	12.6	0	1482.70	1483.67	1482.7	1482.7
8-Apr-99	13.3	13.3	0	1482.00	1483.67	1482	1482
16-Apr-99	13.37	13.37	0	1481.93	1483.67	1481.93	1481.93
26-Apr-99	13.33	13.33	0	1481.97	1483.67	1481.97	1481.97
7-May-99	14.17	14.17	0	1481.13	1483.67	1481.13	1481.13
14-May-99	14.32	14.32	0	1480.98	1483.67	1480.98	1480.98
21-May-99	14.49	14.49	0	1480.81	1483.67	1480.81	1480.81
28-May-99	14.52	14.52	0	1480.78	1483.67	1480.78	1480.78
11-Jun-99	14.56	14.56	0	1480.74	1483.67	1480.74	1480.74
14-Jun-99	14.62	14.62	0	1480.68	1483.67	1480.68	1480.68
18-Jun-99	14.63	14.63	0	1480.67	1483.67	1480.67	1480.67
25-Jun-99	14.71	14.71	0	1480.59	1483.67	1480.59	1480.59
2-Jul-99	14.59	14.59	0	1480.71	1483.67	1480.71	1480.71
8-Jul-99	14.66	14.66	0	1480.64	1483.67	1480.64	1480.64
15-Jul-99	14.61	14.61	0	1480.69	1483.67	1480.69	1480.69
23-Jul-99	14.65	14.65	0	1480.65	1483.67	1480.65	1480.65
26-Jul-99	14.36	14.36	0	1480.94	1483.67	1480.94	1480.94
4-Aug-99	14.68	14.68	0	1480.62	1483.67	1480.62	1480.62



APPENDIX C: LNAPL WELL DATA - MW-71
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Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-71							
GW Elev.	1499.19						LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
20-Oct-93	14.6	14.31	0.29	1484.84	1486.08	1484.59	1484.88
10-Nov-95	14.85	14.35	0.5	1484.77	1486.08	1484.34	1484.84
13-Mar-96	14.36	14.05	0.31	1485.09	1486.08	1484.83	1485.14
17-Jun-96	14.71	14.61	0.1	1484.57	1486.08	1484.48	1484.58
28-Aug-96	15.4	15	0.4	1484.13	1486.08	1483.79	1484.19
23-Sep-96	14.41	14.41	0	1484.78	1486.08	1484.78	1484.78
29-Oct-96	13.72	13.72	0	1485.47	1486.08	1485.47	1485.47
30-Oct-96	13.72	13.59	0.13	1485.58	1486.08	1485.47	1485.6
19-Nov-96	13.85	13.85	0	1485.34	1486.08	1485.34	1485.34
16-Dec-96	13.67	13.59	0.08	1485.59	1486.08	1485.52	1485.6
21-Jan-97	14.24	14.05	0.19	1485.11	1486.08	1484.95	1485.14
19-Feb-97	14.62	14.31	0.31	1484.83	1486.08	1484.57	1484.88
20-Mar-97	13.94	13.82	0.12	1485.35	1486.08	1485.25	1485.37
9-May-97	14.37	14.17	0.2	1484.99	1486.08	1484.82	1485.02
20-May-97	14.1	14.08	0.02	1485.11	1486.08	1485.09	1485.11
22-Jul-97	14.75	14.42	0.33	1484.72	1486.08	1484.44	1484.77
25-Aug-97	14.88	14.6	0.28	1484.55	1486.08	1484.31	1484.59
3-Sep-97	14.91	14.59	0.32	1484.55	1486.08	1484.28	1484.6
11-Sep-97	14.72	14.53	0.19	1484.63	1486.08	1484.47	1484.66
15-Sep-97	14.99	14.57	0.42	1484.56	1486.08	1484.2	1484.62
29-Sep-97	13.91	13.89	0.02	1485.30	1486.08	1485.28	1485.3
10-Oct-97	14.69	14.44	0.25	1484.71	1486.08	1484.5	1484.75
20-Oct-97	15.09	14.57	0.52	1484.54	1486.08	1484.1	1484.62
31-Oct-97	14.89	14.59	0.3	1484.56	1486.08	1484.3	1484.6
10-Nov-97	14.05	13.91	0.14	1485.26	1486.08	1485.14	1485.28
11-Nov-97	14.05	13.98	0.07	1485.20	1486.08	1485.14	1485.21
11-Nov-97	14.13	13.98	0.15	1485.19	1486.08	1485.06	1485.21
12-Nov-97	14.22	14.04	0.18	1485.12	1486.08	1484.97	1485.15
1-Dec-97	13.61	13.57	0.04	1485.61	1486.08	1485.58	1485.62
16-Dec-97	14.15	14.15	0	1485.04	1486.08	1485.04	1485.04
17-Dec-97	14.16	14.16	0	1485.03	1486.08	1485.03	1485.03
18-Dec-97	14.2	14.2	0	1484.99	1486.08	1484.99	1484.99
19-Dec-97	14.19	14.19	0	1485.00	1486.08	1485	1485
9-Jan-98	11.98	11.98	0	1487.21	1486.08	1487.21	1487.21
12-Jan-98	13.32	13.32	0	1485.87	1486.08	1485.87	1485.87
19-Jan-98	13.85	13.85	0	1485.34	1486.08	1485.34	1485.34
20-Jan-98	13.88	13.88	0	1485.31	1486.08	1485.31	1485.31
21-Jan-98	13.95	13.95	0	1485.24	1486.08	1485.24	1485.24
22-Jan-98	13.97	13.97	0	1485.22	1486.08	1485.22	1485.22
26-Jan-98	14.05	14.05	0	1485.14	1486.08	1485.14	1485.14
27-Jan-98	14.07	14.07	0	1485.12	1486.08	1485.12	1485.12
28-Jan-98	14.09	14.09	0	1485.10	1486.08	1485.1	1485.1
29-Jan-98	14.09	14.09	0	1485.10	1486.08	1485.1	1485.1
6-Feb-98	14.14	14.14	0	1485.05	1486.08	1485.05	1485.05
9-Feb-98	14.2	14.2	0	1484.99	1486.08	1484.99	1484.99
11-Feb-98	14.71	14.71	0	1484.48	1486.08	1484.48	1484.48
13-Feb-98	14.09	14.09	0	1485.10	1486.08	1485.1	1485.1
16-Feb-98	14.19	14.19	0	1485.00	1486.08	1485	1485
18-Feb-98	13.64	13.64	0	1485.55	1486.08	1485.55	1485.55
20-Feb-98	13.61	13.61	0	1485.58	1486.08	1485.58	1485.58
25-Feb-98	13.81	13.81	0	1485.38	1486.08	1485.38	1485.38
27-Feb-98	13.42	13.42	0	1485.77	1486.08	1485.77	1485.77
2-Mar-98	13.4	13.4	0	1485.79	1486.08	1485.79	1485.79
4-Mar-98	13.45	13.45	0	1485.74	1486.08	1485.74	1485.74
6-Mar-98	13.73	13.73	0	1485.46	1486.08	1485.46	1485.46
9-Mar-98	13.69	13.69	0	1485.50	1486.08	1485.5	1485.5
11-Mar-98	13.79	13.79	0	1485.40	1486.08	1485.4	1485.4
13-Mar-98	13.78	13.78	0	1485.41	1486.08	1485.41	1485.41
16-Mar-98	13.92	13.92	0	1485.27	1486.08	1485.27	1485.27
18-Mar-98	13.87	13.87	0	1485.32	1486.08	1485.32	1485.32
20-Mar-98	13.79	13.79	0	1485.40	1486.08	1485.4	1485.4
23-Mar-98	13.72	13.72	0	1485.47	1486.08	1485.47	1485.47

APPENDIX C: LNAPL WELL DATA - MW-71
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Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-71							
GW Elev.	1499.19						LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
25-Mar-98	13.79	13.79	0	1485.40	1486.08	1485.4	1485.4
27-Mar-98	13.57	13.57	0	1485.62	1486.08	1485.62	1485.62
30-Mar-98	13.69	13.69	0	1485.50	1486.08	1485.5	1485.5
1-Apr-98	13.74	13.74	0	1485.45	1486.08	1485.45	1485.45
3-Apr-98	13.77	13.77	0	1485.42	1486.08	1485.42	1485.42
6-Apr-98	13.91	13.91	0	1485.28	1486.08	1485.28	1485.28
8-Apr-98	13.99	13.99	0	1485.20	1486.08	1485.2	1485.2
13-Apr-98	13.67	13.67	0	1485.52	1486.08	1485.52	1485.52
20-Apr-98	12.66	12.66	0	1486.53	1486.08	1486.53	1486.53
27-Apr-98	13.58	13.58	0	1485.61	1486.08	1485.61	1485.61
4-May-98	13.86	13.86	0	1485.33	1486.08	1485.33	1485.33
8-May-98	13.93	13.93	0	1485.26	1486.08	1485.26	1485.26
11-May-98	13.38	13.38	0	1485.81	1486.08	1485.81	1485.81
15-May-98	13.6	13.6	0	1485.59	1486.08	1485.59	1485.59
18-May-98	13.48	13.48	0	1485.71	1486.08	1485.71	1485.71
22-May-98	13.65	13.65	0	1485.54	1486.08	1485.54	1485.54
26-May-98	13.82	13.82	0	1485.37	1486.08	1485.37	1485.37
29-May-98	14.33	14.33	0	1484.86	1486.08	1484.86	1484.86
1-Jun-98	14.15	14.15	0	1485.04	1486.08	1485.04	1485.04
8-Jun-98	14.39	14.39	0	1484.80	1486.08	1484.8	1484.8
12-Jun-98	14.33	14.33	0	1484.86	1486.08	1484.86	1484.86
19-Jun-98	14.38	14.38	0	1484.81	1486.08	1484.81	1484.81
22-Jun-98	14.45	14.45	0	1484.74	1486.08	1484.74	1484.74
26-Jun-98	12.98	12.98	0	1486.21	1486.08	1486.21	1486.21
6-Jul-98	14.08	14.08	0	1485.11	1486.08	1485.11	1485.11
13-Jul-98	14.23	14.23	0	1484.96	1486.08	1484.96	1484.96
20-Jul-98	14.45	14.45	0	1484.74	1486.08	1484.74	1484.74
24-Jul-98	14.2	14.2	0	1484.99	1486.08	1484.99	1484.99
27-Jul-98	14.42	14.42	0	1484.77	1486.08	1484.77	1484.77
30-Jul-98	14.47	14.46	0.01	1484.73	1486.08	1484.72	1484.73
31-Jul-98	14.57	14.51	0.06	1484.67	1486.08	1484.62	1484.68
3-Aug-98	14.6	14.6	0	1484.59	1486.08	1484.59	1484.59
4-Aug-98	14.6	14.6	0	1484.59	1486.08	1484.59	1484.59
7-Aug-98	14.6	14.6	0	1484.59	1486.08	1484.59	1484.59
14-Aug-98	14.61	14.61	0	1484.58	1486.08	1484.58	1484.58
21-Aug-98	14.65	14.65	0	1484.54	1486.08	1484.54	1484.54
27-Aug-98	14.67	14.67	0	1484.52	1486.08	1484.52	1484.52
4-Sep-98	14.7	14.7	0	1484.49	1486.08	1484.49	1484.49
11-Sep-98	14.73	14.73	0	1484.46	1486.08	1484.46	1484.46
14-Sep-98	14.77	14.77	0	1484.42	1486.08	1484.42	1484.42
21-Sep-98	14.85	14.85	0	1484.34	1486.08	1484.34	1484.34
23-Sep-98	14.93	14.92	0.01	1484.27	1486.08	1484.26	1484.27
25-Sep-98	15.03	15.02	0.01	1484.17	1486.08	1484.16	1484.17
28-Sep-98	15.03	15.02	0.01	1484.17	1486.08	1484.16	1484.17
2-Oct-98	14.97	14.95	0.02	1484.24	1486.08	1484.22	1484.24
6-Oct-98	15.05	15	0.05	1484.18	1486.08	1484.14	1484.19
16-Oct-98	14.78	14.73	0.05	1484.45	1486.08	1484.41	1484.46
30-Oct-98	14.89	14.84	0.05	1484.34	1486.08	1484.3	1484.35
5-Nov-98	14.98	14.88	0.1	1484.30	1486.08	1484.21	1484.31
6-Nov-98	14.98	14.88	0.1	1484.30	1486.08	1484.21	1484.31
13-Nov-98	14.79	14.79	0	1484.40	1486.08	1484.4	1484.4
20-Nov-98	14.82	14.82	0	1484.37	1486.08	1484.37	1484.37
25-Nov-98	14.86	14.86	0	1484.33	1486.08	1484.33	1484.33
3-Dec-98	14.88	14.88	0	1484.31	1486.08	1484.31	1484.31
14-Dec-98	14.94	14.94	0	1484.25	1486.08	1484.25	1484.25
18-Dec-98	14.87	14.87	0	1484.32	1486.08	1484.32	1484.32
24-Dec-98	14.52	14.52	0	1484.67	1486.08	1484.67	1484.67
31-Dec-98	14.6	14.6	0	1484.59	1486.08	1484.59	1484.59
8-Jan-99	14.78	14.78	0	1484.41	1486.08	1484.41	1484.41
15-Jan-99	14.64	14.64	0	1484.55	1486.08	1484.55	1484.55
22-Jan-99	14.17	14.17	0	1485.02	1486.08	1485.02	1485.02
27-Jan-99	13.66	13.66	0	1485.53	1486.08	1485.53	1485.53

APPENDIX C: LNAPL WELL DATA - MW-71
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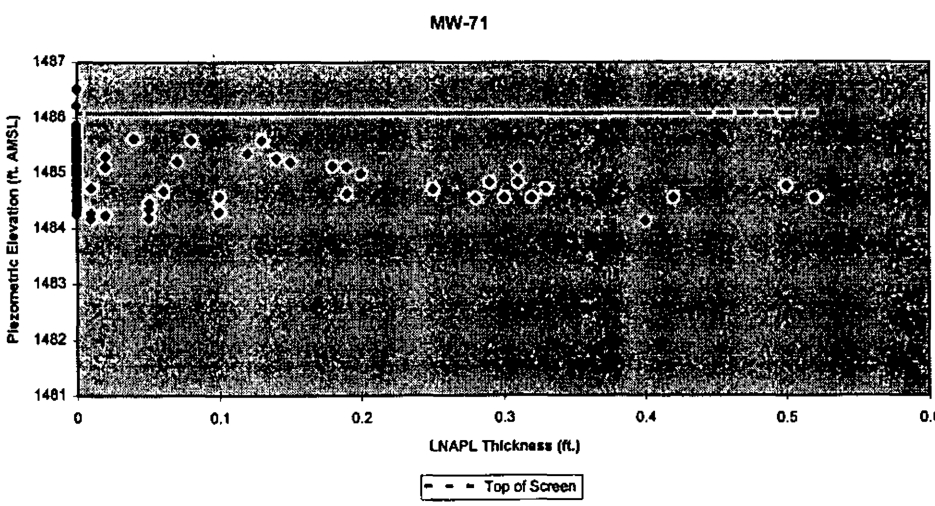
Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-71							
GW Elev.	1499.19						LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
4-Feb-99	13.7	13.7	0	1485.49	1486.08	1485.49	1485.49
11-Feb-99	13.91	13.91	0	1485.28	1486.08	1485.28	1485.28
18-Feb-99	13.84	13.84	0	1485.35	1486.08	1485.35	1485.35
19-Feb-99	13.84	13.84	0	1485.35	1486.08	1485.35	1485.35
22-Feb-99	13.84	13.84	0	1485.35	1486.08	1485.35	1485.35
25-Feb-99	14.1	14.1	0	1485.09	1486.08	1485.09	1485.09
5-Mar-99	13.79	13.79	0	1485.40	1486.08	1485.4	1485.4
12-Mar-99	13.89	13.89	0	1485.30	1486.08	1485.3	1485.3
29-Mar-99	12.68	12.68	0	1486.51	1486.08	1486.51	1486.51
2-Apr-99	13.51	13.51	0	1485.68	1486.08	1485.68	1485.68
5-Apr-99	13.51	13.51	0	1485.68	1486.08	1485.68	1485.68
8-Apr-99	13.79	13.79	0	1485.40	1486.08	1485.4	1485.4
16-Apr-99	13.81	13.81	0	1485.38	1486.08	1485.38	1485.38
26-Apr-99	13.81	13.81	0	1485.38	1486.08	1485.38	1485.38
7-May-99	14.22	14.22	0	1484.97	1486.08	1484.97	1484.97
14-May-99	14.28	14.28	0	1484.91	1486.08	1484.91	1484.91
21-May-99	14.43	14.43	0	1484.76	1486.08	1484.76	1484.76
28-May-99	14.45	14.45	0	1484.74	1486.08	1484.74	1484.74
11-Jun-99	14.63	14.63	0	1484.56	1486.08	1484.56	1484.56
14-Jun-99	14.69	14.69	0	1484.50	1486.08	1484.5	1484.5
18-Jun-99	14.68	14.68	0	1484.51	1486.08	1484.51	1484.51
25-Jun-99	14.9	14.9	0	1484.29	1486.08	1484.29	1484.29
2-Jul-99	14.51	14.51	0	1484.68	1486.08	1484.68	1484.68
8-Jul-99	14.68	14.68	0	1484.51	1486.08	1484.51	1484.51
15-Jul-99	14.79	14.79	0	1484.40	1486.08	1484.4	1484.4
23-Jul-99	14.76	14.76	0	1484.43	1486.08	1484.43	1484.43
26-Jul-99	14.32	14.32	0	1484.87	1486.08	1484.87	1484.87
4-Aug-99	14.88	14.88	0	1484.31	1486.08	1484.31	1484.31



APPENDIX C: LNAPL WELL DATA - MW-73
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Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-73							
GW Elev.	1496.24		0.3				LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
20-Oct-93	2.57	2.57	0	1493.67	1493.58	1493.67	1493.67
10-Nov-95	2.96	2.96	0	1493.28	1493.58	1493.28	1493.28
14-Mar-96	2.24	2.24	0	1494.00	1493.58	1494	1494
17-Jun-96	2.12	2.1	0.02	1494.14	1493.58	1494.12	1494.14
24-Sep-96	2.15	2.15	0	1494.09	1493.58	1494.09	1494.09
29-Oct-96	2.5	2.49	0.01	1493.75	1493.58	1493.74	1493.75
19-Nov-96	2.27	2.27	0	1493.97	1493.58	1493.97	1493.97
16-Dec-96	1.67	1.67	0	1494.57	1493.58	1494.57	1494.57
22-Jan-97	2.3	2	0.3	1494.20	1493.58	1493.94	1494.24
20-Feb-97	1.7	1.7	0	1494.54	1493.58	1494.54	1494.54
21-Mar-97	1.52	1.51	0.01	1494.73	1493.58	1494.72	1494.73
9-May-97	0.76	0.7	0.06	1495.53	1493.58	1495.48	1495.54
21-May-97	1.85	1.82	0.03	1494.42	1493.58	1494.39	1494.42
22-Jul-97	2.12	2.08	0.04	1494.15	1493.58	1494.12	1494.16
15-Sep-97	2.68	2.6	0.08	1493.63	1493.58	1493.56	1493.64
10-Nov-97	2.21	2.12	0.09	1494.11	1493.58	1494.03	1494.12
1-Dec-97	1.89	1.81	0.08	1494.42	1493.58	1494.35	1494.43
16-Dec-97	2	2	0	1494.24	1493.58	1494.24	1494.24
17-Dec-97	2.04	2.04	0	1494.20	1493.58	1494.2	1494.2
18-Dec-97	2.11	2.1	0.01	1494.14	1493.58	1494.13	1494.14
19-Dec-97	2.11	2.11	0	1494.13	1493.58	1494.13	1494.13
22-Dec-97	2.1	2.1	0	1494.14	1493.58	1494.14	1494.14
23-Dec-97	2.06	2.06	0	1494.18	1493.58	1494.18	1494.18
24-Dec-97	2.07	2.07	0	1494.17	1493.58	1494.17	1494.17
29-Dec-97	1.82	1.81	0.01	1494.43	1493.58	1494.42	1494.43
30-Dec-97	1.78	1.78	0	1494.46	1493.58	1494.46	1494.46
31-Dec-97	2.01	2.01	0	1494.23	1493.58	1494.23	1494.23
2-Jan-98	2.03	2.03	0	1494.21	1493.58	1494.21	1494.21
5-Jan-98	1.66	1.66	0	1494.58	1493.58	1494.58	1494.58
6-Jan-98	1.66	1.65	0.01	1494.59	1493.58	1494.58	1494.59
7-Jan-98	1.64	1.64	0	1494.60	1493.58	1494.6	1494.6
8-Jan-98	1.09	1.09	0	1495.15	1493.58	1495.15	1495.15
9-Jan-98	1.12	1.12	0	1495.12	1493.58	1495.12	1495.12
12-Jan-98	1.15	1.15	0	1495.09	1493.58	1495.09	1495.09
19-Jan-98	1.74	1.74	0	1494.50	1493.58	1494.5	1494.5
20-Jan-98	1.78	1.78	0	1494.46	1493.58	1494.46	1494.46
21-Jan-98	1.85	1.85	0	1494.39	1493.58	1494.39	1494.39
22-Jan-98	1.85	1.85	0	1494.39	1493.58	1494.39	1494.39
26-Jan-98	1.88	1.88	0	1494.36	1493.58	1494.36	1494.36
27-Jan-98	1.83	1.83	0	1494.41	1493.58	1494.41	1494.41
28-Jan-98	1.78	1.78	0	1494.46	1493.58	1494.46	1494.46
29-Jan-98	1.82	1.82	0	1494.42	1493.58	1494.42	1494.42
6-Feb-98	1.88	1.88	0	1494.36	1493.58	1494.36	1494.36
9-Feb-98	1.95	1.95	0	1494.29	1493.58	1494.29	1494.29
11-Feb-98	1.85	1.85	0	1494.39	1493.58	1494.39	1494.39
13-Feb-98	2	2	0	1494.24	1493.58	1494.24	1494.24
16-Feb-98	1.99	1.99	0	1494.25	1493.58	1494.25	1494.25
18-Feb-98	1.58	1.58	0	1494.66	1493.58	1494.66	1494.66
20-Feb-98	1.67	1.67	0	1494.57	1493.58	1494.57	1494.57
23-Feb-98	1.72	1.72	0	1494.52	1493.58	1494.52	1494.52
25-Feb-98	1.87	1.86	0.01	1494.38	1493.58	1494.37	1494.38
27-Feb-98	1.61	1.61	0	1494.63	1493.58	1494.63	1494.63
2-Mar-98	1.45	1.45	0	1494.79	1493.58	1494.79	1494.79
4-Mar-98	1.65	1.65	0	1494.59	1493.58	1494.59	1494.59
6-Mar-98	1.71	1.71	0	1494.53	1493.58	1494.53	1494.53
9-Mar-98	1.51	1.51	0	1494.73	1493.58	1494.73	1494.73

APPENDIX C: LNAPL WELL DATA - MW-73
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Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-73							
GW Elev.	1496.24		0.3				LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
11-Mar-98	1.66	1.66	0	1494.58	1493.58	1494.58	1494.58
13-Mar-98	1.68	1.68	0	1494.56	1493.58	1494.56	1494.56
16-Mar-98	1.81	1.8	0.01	1494.44	1493.58	1494.43	1494.44
18-Mar-98	1.58	1.57	0.01	1494.67	1493.58	1494.66	1494.67
20-Mar-98	1.59	1.58	0.01	1494.66	1493.58	1494.65	1494.66
23-Mar-98	1.59	1.58	0.01	1494.66	1493.58	1494.65	1494.66
25-Mar-98	1.52	1.51	0.01	1494.73	1493.58	1494.72	1494.73
27-Mar-98	1.48	1.48	0	1494.76	1493.58	1494.76	1494.76
30-Mar-98	1.55	1.55	0	1494.69	1493.58	1494.69	1494.69
1-Apr-98	1.61	1.61	0	1494.63	1493.58	1494.63	1494.63
3-Apr-98	1.64	1.64	0	1494.60	1493.58	1494.6	1494.6
8-Apr-98	1.65	1.65	0	1494.59	1493.58	1494.59	1494.59
13-Apr-98	1.58	1.53	0.05	1494.70	1493.58	1494.66	1494.71
23-Apr-98	1.37	1.37	0	1494.87	1493.58	1494.87	1494.87
28-Apr-98	1.63	1.61	0.02	1494.63	1493.58	1494.61	1494.63
8-May-98	1.65	1.64	0.01	1494.60	1493.58	1494.59	1494.6
15-May-98	1.53	1.52	0.01	1494.72	1493.58	1494.71	1494.72
22-May-98	1.6	1.57	0.03	1494.67	1493.58	1494.64	1494.67
29-May-98	1.96	1.94	0.02	1494.30	1493.58	1494.28	1494.3
5-Jun-98	1.94	1.92	0.02	1494.32	1493.58	1494.3	1494.32
12-Jun-98	1.97	1.96	0.01	1494.28	1493.58	1494.27	1494.28
19-Jun-98	1.91	1.9	0.01	1494.34	1493.58	1494.33	1494.34
26-Jun-98	1.32	1.32	0	1494.92	1493.58	1494.92	1494.92
6-Jul-98	1.68	1.64	0.04	1494.59	1493.58	1494.56	1494.6
24-Jul-98	0.78	0.72	0.06	1495.51	1493.58	1495.46	1495.52
31-Jul-98	2.09	2.06	0.03	1494.18	1493.58	1494.15	1494.18
7-Aug-98	2.25	2.25	0	1493.99	1493.58	1493.99	1493.99
14-Aug-98	2.16	2.16	0	1494.08	1493.58	1494.08	1494.08
21-Aug-98	2.32	2.32	0	1493.92	1493.58	1493.92	1493.92
27-Aug-98	2.42	2.41	0.01	1493.83	1493.58	1493.82	1493.83
11-Sep-98	2.61	2.59	0.02	1493.65	1493.58	1493.63	1493.65
14-Sep-98	2.79	2.77	0.02	1493.47	1493.58	1493.45	1493.47
25-Sep-98	2.88	2.87	0.01	1493.37	1493.58	1493.36	1493.37
2-Oct-98	3.08	3.06	0.02	1493.18	1493.58	1493.16	1493.18
16-Oct-98	3.04	3.03	0.01	1493.21	1493.58	1493.2	1493.21
26-Oct-98	3.01	2.99	0.02	1493.25	1493.58	1493.23	1493.25
5-Nov-98	3.21	3.19	0.02	1493.05	1493.58	1493.03	1493.05
13-Nov-98	3.28	3.26	0.02	1492.98	1493.58	1492.96	1492.98
20-Nov-98	3.23	3.23	0	1493.01	1493.58	1493.01	1493.01
25-Nov-98	3.29	3.29	0	1492.95	1493.58	1492.95	1492.95
3-Dec-98	3.28	3.28	0	1492.96	1493.58	1492.96	1492.96
14-Dec-98	3.52	3.52	0	1492.72	1493.58	1492.72	1492.72
24-Dec-98	3.08	3.08	0	1493.16	1493.58	1493.16	1493.16
31-Dec-98	3.11	3.11	0	1493.13	1493.58	1493.13	1493.13
18-Jan-99	3.16	3.16	0	1493.08	1493.58	1493.08	1493.08
22-Jan-99	2.68	2.68	0	1493.56	1493.58	1493.56	1493.56
27-Jan-99	1.77	1.77	0	1494.47	1493.58	1494.47	1494.47
4-Feb-99	1.59	1.59	0	1494.65	1493.58	1494.65	1494.65
11-Feb-99	1.79	1.79	0	1494.45	1493.58	1494.45	1494.45
18-Feb-99	1.85	1.85	0	1494.39	1493.58	1494.39	1494.39
25-Feb-99	1.95	1.95	0	1494.29	1493.58	1494.29	1494.29
29-Mar-99	1.71	1.7	0.01	1494.54	1493.58	1494.53	1494.54
2-Apr-99	1.77	1.77	0	1494.47	1493.58	1494.47	1494.47
8-Apr-99	1.73	1.73	0	1494.51	1493.58	1494.51	1494.51
16-Apr-99	1.65	1.64	0.01	1494.60	1493.58	1494.59	1494.6
26-Apr-99	1.63	1.59	0.04	1494.64	1493.58	1494.61	1494.65

APPENDIX C: LNAPL WELL DATA - MW-73
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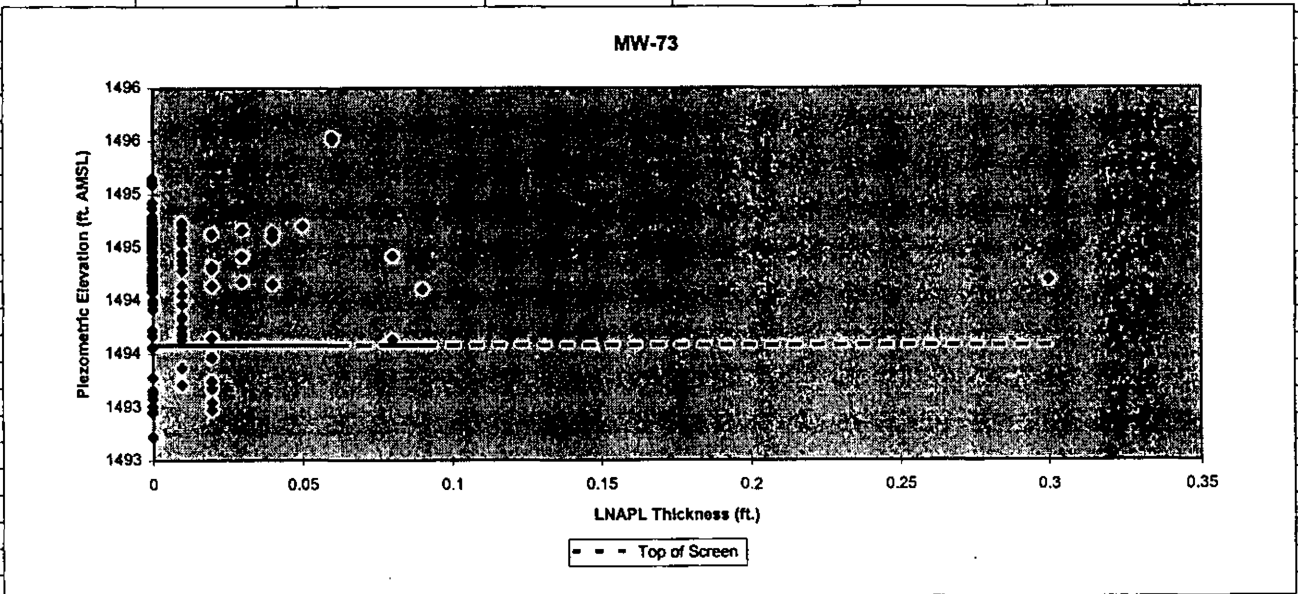
Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-73							
GW Elev.	1496.24		0.3				LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
7-May-99	1.93	1.93	0	1494.31	1493.58	1494.31	1494.31
14-May-99	2.02	2.02	0	1494.22	1493.58	1494.22	1494.22
21-May-99	2.07	2.07	0	1494.17	1493.58	1494.17	1494.17
28-May-99	2.2	2.19	0.01	1494.05	1493.58	1494.04	1494.05
11-Jun-99	2.4	2.39	0.01	1493.85	1493.58	1493.84	1493.85
18-Jun-99	2.56	2.55	0.01	1493.69	1493.58	1493.68	1493.69
25-Jun-99	2.62	2.61	0.01	1493.63	1493.58	1493.62	1493.63
2-Jul-99	2.29	2.28	0.01	1493.96	1493.58	1493.95	1493.96
8-Jul-99	2.58	2.57	0.01	1493.67	1493.58	1493.66	1493.67
15-Jul-99	2.51	2.5	0.01	1493.74	1493.58	1493.73	1493.74
23-Jul-99	2.52	2.52	0	1493.72	1493.58	1493.72	1493.72



APPENDIX C: LNAPL WELL DATA - MW-75
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Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-75							
GW Elev.	1496.68						LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
20-Oct-93	7.81	7.69	0.12	1488.97	1490.68	1488.87	1488.99
10-Nov-95	7.9	7.34	0.56	1489.26	1490.68	1488.78	1489.34
14-Mar-96	6.1	6.1	0	1490.58	1490.68	1490.58	1490.58
17-Jun-96	8.25	7.94	0.31	1488.69	1490.68	1488.43	1488.74
26-Sep-96	8.22	7.71	0.51	1488.89	1490.68	1488.46	1488.97
29-Oct-96	7.78	7.31	0.47	1489.30	1490.68	1488.9	1489.37
1-Nov-96	7.6	7.3	0.3	1489.34	1490.68	1489.08	1489.38
18-Nov-96	7.48	7.15	0.33	1489.48	1490.68	1489.2	1489.53
16-Dec-96	7.55	7.12	0.43	1489.50	1490.68	1489.13	1489.56
21-Jan-97	9.36	7.93	1.43	1488.54	1490.68	1487.32	1488.75
21-Mar-97	7.28	7.01	0.27	1489.63	1490.68	1489.4	1489.67
9-May-97	8.04	7.6	0.44	1489.01	1490.68	1488.64	1489.08
15-Sep-97	10.29	8.31	1.98	1488.07	1490.68	1486.39	1488.37
10-Nov-97	8.71	7.81	0.9	1488.74	1490.68	1487.97	1488.87
11-Nov-97	8.36	7.75	0.61	1488.84	1490.68	1488.32	1488.93
11-Nov-97	8.07	7.77	0.3	1488.87	1490.68	1488.61	1488.91
12-Nov-97	8.12	7.71	0.41	1488.91	1490.68	1488.56	1488.97
2-Dec-97	8.19	7.5	0.69	1489.08	1490.68	1488.49	1489.18
16-Dec-97	7.58	7.53	0.05	1489.14	1490.68	1489.1	1489.15
17-Dec-97	7.68	7.63	0.05	1489.04	1490.68	1489	1489.05
18-Dec-97	7.91	7.71	0.2	1488.94	1490.68	1488.77	1488.97
19-Dec-97	7.95	7.74	0.21	1488.91	1490.68	1488.73	1488.94
22-Dec-97	8.04	7.83	0.21	1488.82	1490.68	1488.64	1488.85
23-Dec-97	8.06	7.87	0.19	1488.78	1490.68	1488.62	1488.81
24-Dec-97	8.05	7.86	0.19	1488.79	1490.68	1488.63	1488.82
29-Dec-97	7.16	7.11	0.05	1489.56	1490.68	1489.52	1489.57
30-Dec-97	7.27	7.27	0	1489.41	1490.68	1489.41	1489.41
31-Dec-97	7.34	7.34	0	1489.34	1490.68	1489.34	1489.34
2-Jan-98	7.3	7.3	0	1489.38	1490.68	1489.38	1489.38
5-Jan-98	6.8	6.8	0	1489.88	1490.68	1489.88	1489.88
6-Jan-98	6.72	6.72	0	1489.96	1490.68	1489.96	1489.96
7-Jan-98	6.98	6.98	0	1489.70	1490.68	1489.7	1489.7
12-Jan-98	6.73	6.73	0	1489.95	1490.68	1489.95	1489.95
19-Jan-98	6.75	6.75	0	1489.93	1490.68	1489.93	1489.93
20-Jan-98	6.85	6.85	0	1489.83	1490.68	1489.83	1489.83
21-Jan-98	6.88	6.88	0	1489.80	1490.68	1489.8	1489.8
22-Jan-98	6.91	6.91	0	1489.77	1490.68	1489.77	1489.77
26-Jan-98	6.85	6.85	0	1489.83	1490.68	1489.83	1489.83
27-Jan-98	7.01	7.01	0	1489.67	1490.68	1489.67	1489.67
28-Jan-98	6.99	6.99	0	1489.69	1490.68	1489.69	1489.69
29-Jan-98	7	7	0	1489.68	1490.68	1489.68	1489.68
6-Feb-98	7.38	7.38	0	1489.30	1490.68	1489.3	1489.3
9-Feb-98	7.33	7.33	0	1489.35	1490.68	1489.35	1489.35
11-Feb-98	7.5	7.5	0	1489.18	1490.68	1489.18	1489.18
13-Feb-98	7.73	7.73	0	1488.95	1490.68	1488.95	1488.95
16-Feb-98	7.84	7.84	0	1488.84	1490.68	1488.84	1488.84
23-Feb-98	7.39	7.39	0	1489.29	1490.68	1489.29	1489.29
2-Mar-98	6.95	6.95	0	1489.73	1490.68	1489.73	1489.73
4-Mar-98	7.18	7.18	0	1489.50	1490.68	1489.5	1489.5
6-Mar-98	7.28	7.28	0	1489.40	1490.68	1489.4	1489.4
13-Mar-98	7.24	7.24	0	1489.44	1490.68	1489.44	1489.44
16-Mar-98	7.46	7.46	0	1489.22	1490.68	1489.22	1489.22
20-Mar-98	7.21	7.21	0	1489.47	1490.68	1489.47	1489.47
23-Mar-98	7.02	7.02	0	1489.66	1490.68	1489.66	1489.66
25-Mar-98	7.04	7.04	0	1489.64	1490.68	1489.64	1489.64
27-Mar-98	6.61	6.61	0	1490.07	1490.68	1490.07	1490.07
30-Mar-98	7.02	7.02	0	1489.66	1490.68	1489.66	1489.66
3-Apr-98	7.13	7.13	0	1489.55	1490.68	1489.55	1489.55
8-Apr-98	7.32	7.32	0	1489.36	1490.68	1489.36	1489.36
13-Apr-98	7.05	7.05	0	1489.63	1490.68	1489.63	1489.63
23-Apr-98	6.85	6.85	0	1489.83	1490.68	1489.83	1489.83
28-Apr-98	7.61	7.61	0	1489.07	1490.68	1489.07	1489.07
15-May-98	6.99	6.99	0	1489.69	1490.68	1489.69	1489.69
22-May-98	6.8	6.8	0	1489.88	1490.68	1489.88	1489.88
29-May-98	6.81	6.71	0.1	1489.96	1490.68	1489.87	1489.97
5-Jun-98	6.8	6.65	0.15	1490.01	1490.68	1489.88	1490.03
12-Jun-98	8.95	8.8	0.15	1487.86	1490.68	1487.73	1487.88
19-Jun-98	7.89	7.8	0.09	1488.87	1490.68	1488.79	1488.88
26-Jun-98	7.15	7.15	0	1489.53	1490.68	1489.53	1489.53

APPENDIX C: LNAPL WELL DATA - MW-75
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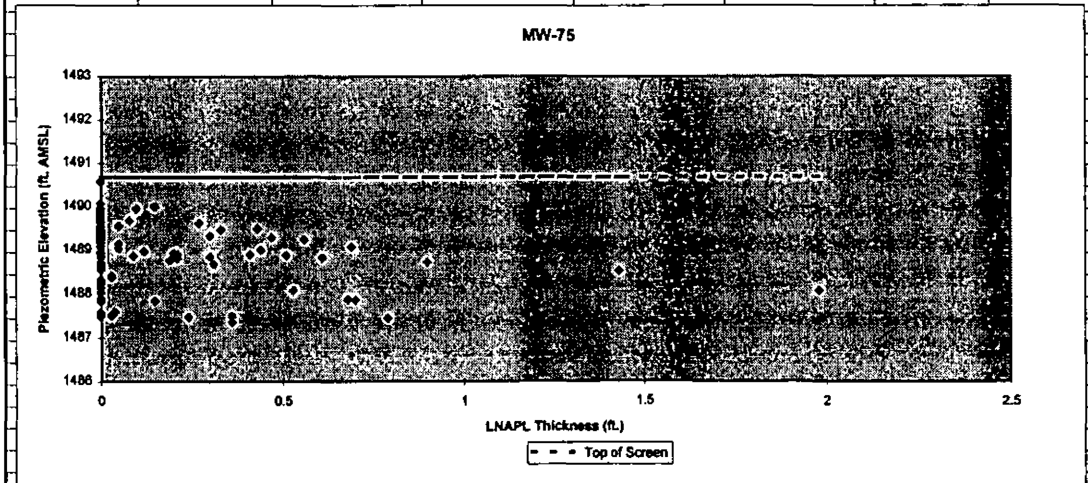
Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-75							
GW Elev.	1496.68						LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
6-Jul-98	7.07	6.99	0.08	1489.68	1490.68	1489.61	1489.69
24-Jul-98	7.27	7.27	0	1489.41	1490.68	1489.41	1489.41
31-Jul-98	7.72	7.72	0	1488.96	1490.68	1488.96	1488.96
7-Aug-98	8.02	8.02	0	1488.66	1490.68	1488.66	1488.66
14-Aug-98	7.96	7.96	0	1488.72	1490.68	1488.72	1488.72
21-Aug-98	8.1	8.1	0	1488.58	1490.68	1488.58	1488.58
27-Aug-98	8.12	8.12	0	1488.56	1490.68	1488.56	1488.56
11-Sep-98	8.32	8.29	0.03	1488.39	1490.68	1488.36	1488.39
25-Sep-98	9.04	8.51	0.53	1488.09	1490.68	1487.64	1488.17
6-Oct-98	9.37	8.69	0.68	1487.89	1490.68	1487.31	1487.99
26-Oct-98	9.41	8.71	0.7	1487.87	1490.68	1487.27	1487.97
13-Nov-98	9.47	9.11	0.36	1487.52	1490.68	1487.21	1487.57
20-Nov-98	9.89	9.1	0.79	1487.46	1490.68	1486.79	1487.58
25-Nov-98	9.2	9.17	0.03	1487.51	1490.68	1487.48	1487.51
3-Dec-98	9.4	9.16	0.24	1487.48	1490.68	1487.28	1487.52
14-Dec-98	9.61	9.25	0.36	1487.38	1490.68	1487.07	1487.43
24-Dec-98	9.18	9.18	0	1487.50	1490.68	1487.5	1487.5
31-Dec-98	9.1	9.1	0	1487.58	1490.68	1487.58	1487.58
18-Jan-99	9.11	9.07	0.04	1487.60	1490.68	1487.57	1487.61
22-Jan-99	8.84	8.84	0	1487.84	1490.68	1487.84	1487.84
27-Jan-99	7.76	7.76	0	1488.92	1490.68	1488.92	1488.92
4-Feb-99	7.36	7.36	0	1489.32	1490.68	1489.32	1489.32
18-Feb-99	7.43	7.43	0	1489.25	1490.68	1489.25	1489.25
25-Feb-99	7.82	7.82	0	1488.86	1490.68	1488.86	1488.86
29-Mar-99	7.26	7.26	0	1489.42	1490.68	1489.42	1489.42
2-Apr-99	7.51	7.51	0	1489.17	1490.68	1489.17	1489.17
8-Apr-99	7.58	7.58	0	1489.10	1490.68	1489.1	1489.1
16-Apr-99	7.5	7.5	0	1489.18	1490.68	1489.18	1489.18
26-Apr-99	7.5	7.5	0	1489.18	1490.68	1489.18	1489.18
7-May-99	8.05	8.05	0	1488.63	1490.68	1488.63	1488.63
14-May-99	8.1	8.1	0	1488.58	1490.68	1488.58	1488.58
21-May-99	7.22	7.22	0	1489.46	1490.68	1489.46	1489.46
28-May-99	8.35	8.35	0	1488.33	1490.68	1488.33	1488.33
11-Jun-99	8.54	8.54	0	1488.14	1490.68	1488.14	1488.14
18-Jun-99	8.64	8.64	0	1488.04	1490.68	1488.04	1488.04
25-Jun-99	8.78	8.78	0	1487.90	1490.68	1487.9	1487.9
2-Jul-99	8.4	8.4	0	1488.28	1490.68	1488.28	1488.28
8-Jul-99	8.45	8.45	0	1488.23	1490.68	1488.23	1488.23
15-Jul-99	8.29	8.26	0.03	1488.42	1490.68	1488.39	1488.42
23-Jul-99	8.31	8.28	0.03	1488.40	1490.68	1488.37	1488.4



APPENDIX C: LNAPL WELL DATA - MW-81
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Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-81							
GW Elev.	1500.88						LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
20-Oct-93	8.6	8.6	0	1492.28	1498.38	1492.28	1492.28
10-Nov-95	7.58	7.57	0.01	1493.31	1498.38	1493.3	1493.31
13-Mar-96	6.55	6.52	0.03	1494.36	1498.38	1494.33	1494.36
17-Jun-96	7.34	7.34	0	1493.54	1498.38	1493.54	1493.54
16-Dec-96	5.58	5.52	0.06	1495.35	1498.38	1495.3	1495.36
15-Sep-97	8.71	8.6	0.11	1492.26	1498.38	1492.17	1492.28
10-Nov-97	7.5	7.42	0.08	1493.45	1498.38	1493.38	1493.46
1-Dec-97	7.51	7.49	0.02	1493.39	1498.38	1493.37	1493.39
16-Dec-97	6.83	6.83	0	1494.05	1498.38	1494.05	1494.05
17-Dec-97	6.91	6.91	0	1493.97	1498.38	1493.97	1493.97
18-Dec-97	6.98	6.98	0	1493.90	1498.38	1493.9	1493.9
19-Dec-97	6.99	6.99	0	1493.89	1498.38	1493.89	1493.89
22-Dec-97	6.72	6.72	0	1494.16	1498.38	1494.16	1494.16
23-Dec-97	7.07	7.07	0	1493.81	1498.38	1493.81	1493.81
24-Dec-97	7.06	7.06	0	1493.82	1498.38	1493.82	1493.82
29-Dec-97	6.46	6.46	0	1494.42	1498.38	1494.42	1494.42
30-Dec-97	6.52	6.52	0	1494.36	1498.38	1494.36	1494.36
31-Dec-97	6.82	6.82	0	1494.06	1498.38	1494.06	1494.06
2-Jan-98	6.83	6.83	0	1494.05	1498.38	1494.05	1494.05
5-Jan-98	5.98	5.98	0	1494.90	1498.38	1494.9	1494.9
6-Jan-98	5.9	5.9	0	1494.98	1498.38	1494.98	1494.98
7-Jan-98	5.85	5.85	0	1495.03	1498.38	1495.03	1495.03
8-Jan-98	4.71	4.71	0	1496.17	1498.38	1496.17	1496.17
9-Jan-98	4.39	4.39	0	1496.49	1498.38	1496.49	1496.49
12-Jan-98	5.05	5.05	0	1495.83	1498.38	1495.83	1495.83
19-Jan-98	5.94	5.94	0	1494.94	1498.38	1494.94	1494.94
20-Jan-98	6.1	6.1	0	1494.78	1498.38	1494.78	1494.78
21-Jan-98	6.19	6.19	0	1494.69	1498.38	1494.69	1494.69
22-Jan-98	6.31	6.31	0	1494.57	1498.38	1494.57	1494.57
26-Jan-98	6.55	6.55	0	1494.33	1498.38	1494.33	1494.33
27-Jan-98	6.53	6.53	0	1494.35	1498.38	1494.35	1494.35
28-Jan-98	6.53	6.53	0	1494.35	1498.38	1494.35	1494.35
29-Jan-98	6.56	6.56	0	1494.32	1498.38	1494.32	1494.32
6-Feb-98	6.01	6.01	0	1494.87	1498.38	1494.87	1494.87
9-Feb-98	6.83	6.83	0	1494.05	1498.38	1494.05	1494.05
11-Feb-98	6.77	6.77	0	1494.11	1498.38	1494.11	1494.11
13-Feb-98	6.97	6.97	0	1493.91	1498.38	1493.91	1493.91
16-Feb-98	7.05	7.05	0	1493.83	1498.38	1493.83	1493.83
18-Feb-98	6.48	6.48	0	1494.40	1498.38	1494.4	1494.4
20-Feb-98	6.24	6.24	0	1494.64	1498.38	1494.64	1494.64
23-Feb-98	6.25	6.25	0	1494.63	1498.38	1494.63	1494.63
25-Feb-98	6.41	6.41	0	1494.47	1498.38	1494.47	1494.47
27-Feb-98	6.03	6.03	0	1494.85	1498.38	1494.85	1494.85
2-Mar-98	5.51	5.51	0	1495.37	1498.38	1495.37	1495.37
4-Mar-98	5.56	5.56	0	1495.32	1498.38	1495.32	1495.32
6-Mar-98	6.03	6.03	0	1494.85	1498.38	1494.85	1494.85
9-Mar-98	5.88	5.88	0	1495.00	1498.38	1495	1495
11-Mar-98	5.9	5.9	0	1494.98	1498.38	1494.98	1494.98
13-Mar-98	6.4	6.4	0	1494.48	1498.38	1494.48	1494.48
16-Mar-98	6.48	6.48	0	1494.40	1498.38	1494.4	1494.4
18-Mar-98	6.26	6.26	0	1494.62	1498.38	1494.62	1494.62
20-Mar-98	6.07	6.07	0	1494.81	1498.38	1494.81	1494.81
23-Mar-98	5.82	5.82	0	1495.06	1498.38	1495.06	1495.06
25-Mar-98	5.81	5.81	0	1495.07	1498.38	1495.07	1495.07
27-Mar-98	5.69	5.69	0	1495.19	1498.38	1495.19	1495.19
30-Mar-98	5.82	5.82	0	1495.06	1498.38	1495.06	1495.06
1-Apr-98	5.98	5.98	0	1494.90	1498.38	1494.9	1494.9

APPENDIX C: LNAPL WELL DATA - MW-81
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Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-81							
GW Elev.	1500.88						LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
3-Apr-98	6.02	6.02	0	1494.86	1498.38	1494.86	1494.86
8-Apr-98	6.38	6.38	0	1494.50	1498.38	1494.5	1494.5
13-Apr-98	5.74	5.74	0	1495.14	1498.38	1495.14	1495.14
23-Apr-98	5.27	5.27	0	1495.61	1498.38	1495.61	1495.61
28-Apr-98	5.85	5.85	0	1495.03	1498.38	1495.03	1495.03
8-May-98	6.25	6.25	0	1494.63	1498.38	1494.63	1494.63
15-May-98	5.58	5.58	0	1495.30	1498.38	1495.3	1495.3
22-May-98	5.87	5.87	0	1495.01	1498.38	1495.01	1495.01
29-May-98	6.92	6.92	0	1493.96	1498.38	1493.96	1493.96
1-Jun-98	6.81	6.81	0	1494.07	1498.38	1494.07	1494.07
5-Jun-98	6.81	6.81	0	1494.07	1498.38	1494.07	1494.07
12-Jun-98	7.24	7.24	0	1493.64	1498.38	1493.64	1493.64
19-Jun-98	7.22	7.22	0	1493.66	1498.38	1493.66	1493.66
26-Jun-98	6.35	6.35	0	1494.53	1498.38	1494.53	1494.53
6-Jul-98	5.58	5.58	0	1495.30	1498.38	1495.3	1495.3
24-Jul-98	6.15	6.15	0	1494.73	1498.38	1494.73	1494.73
31-Jul-98	7.04	7.04	0	1493.84	1498.38	1493.84	1493.84
7-Aug-98	7.5	7.5	0	1493.38	1498.38	1493.38	1493.38
21-Aug-98	8.12	8.12	0	1492.76	1498.38	1492.76	1492.76
27-Aug-98	8.39	8.35	0.04	1492.52	1498.38	1492.49	1492.53
11-Sep-98	9.12	8.87	0.25	1491.97	1498.38	1491.76	1492.01
14-Sep-98	9.01	9.01	0	1491.87	1498.38	1491.87	1491.87
25-Sep-98	9.29	9.25	0.04	1491.62	1498.38	1491.59	1491.63
2-Oct-98	9.51	9.37	0.14	1491.49	1498.38	1491.37	1491.51
6-Oct-98	9.46	9.46	0	1491.42	1498.38	1491.42	1491.42
16-Oct-98	9.28	9.28	0	1491.60	1498.38	1491.6	1491.6
30-Oct-98	9.42	9.42	0	1491.46	1498.38	1491.46	1491.46
5-Nov-98	8.52	8.44	0.08	1492.43	1498.38	1492.36	1492.44
13-Nov-98	9.56	9.56	0	1491.32	1498.38	1491.32	1491.32
20-Nov-98	9.65	9.65	0	1491.23	1498.38	1491.23	1491.23
25-Nov-98	9.63	9.63	0	1491.25	1498.38	1491.25	1491.25
3-Dec-98	9.74	9.66	0.08	1491.21	1498.38	1491.14	1491.22
14-Dec-98	9.83	9.75	0.08	1491.12	1498.38	1491.05	1491.13
24-Dec-98	9.06	9.06	0	1491.82	1498.38	1491.82	1491.82
31-Dec-98	9.13	9.13	0	1491.75	1498.38	1491.75	1491.75
8-Jan-99	9.36	9.35	0.01	1491.53	1498.38	1491.52	1491.53
18-Jan-99	9.58	9.52	0.06	1491.35	1498.38	1491.3	1491.36
22-Jan-99	9.25	9.19	0.06	1491.68	1498.38	1491.63	1491.69
27-Jan-99	6.24	6.24	0	1494.64	1498.38	1494.64	1494.64
4-Feb-99	6.14	6.14	0	1494.74	1498.38	1494.74	1494.74
11-Feb-99	6.24	6.24	0	1494.64	1498.38	1494.64	1494.64
18-Feb-99	6.62	6.62	0	1494.26	1498.38	1494.26	1494.26
25-Feb-99	7.07	7.07	0	1493.81	1498.38	1493.81	1493.81
5-Mar-99	6.71	6.71	0	1494.17	1498.38	1494.17	1494.17
12-Mar-99	6.8	6.8	0	1494.08	1498.38	1494.08	1494.08
29-Mar-99	6.32	6.32	0	1494.56	1498.38	1494.56	1494.56
2-Apr-99	6.52	6.52	0	1494.36	1498.38	1494.36	1494.36
8-Apr-99	6.51	6.51	0	1494.37	1498.38	1494.37	1494.37
16-Apr-99	6.32	6.32	0	1494.56	1498.38	1494.56	1494.56
26-Apr-99	6.2	6.2	0	1494.68	1498.38	1494.68	1494.68
7-May-99	7.11	7.11	0	1493.77	1498.38	1493.77	1493.77
14-May-99	7.19	7.19	0	1493.69	1498.38	1493.69	1493.69
21-May-99	7.43	7.43	0	1493.45	1498.38	1493.45	1493.45
28-May-99	7.71	7.71	0	1493.17	1498.38	1493.17	1493.17
11-Jun-99	8.42	8.4	0.02	1492.48	1498.38	1492.46	1492.48
18-Jun-99	8.74	8.74	0	1492.14	1498.38	1492.14	1492.14
25-Jun-99	9	8.99	0.01	1491.89	1498.38	1491.88	1491.89

APPENDIX C: LNAPL WELL DATA - MW-81
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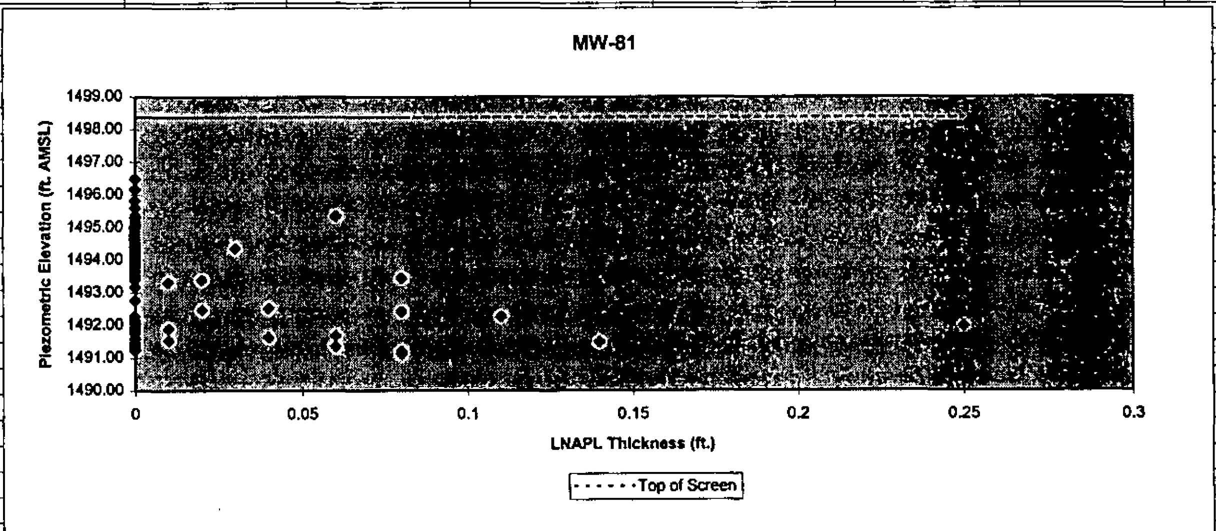
Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-81							
GW Elev.	1500.88						LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
2-Jul-99	8.61	8.61	0	1492.27	1498.38	1492.27	1492.27
8-Jul-99	8.82	8.82	0	1492.06	1498.38	1492.06	1492.06
15-Jul-99	8.81	8.81	0	1492.07	1498.38	1492.07	1492.07
23-Jul-99	8.95	8.95	0	1491.93	1498.38	1491.93	1491.93



APPENDIX C: LNAPL WELL DATA - MW-85
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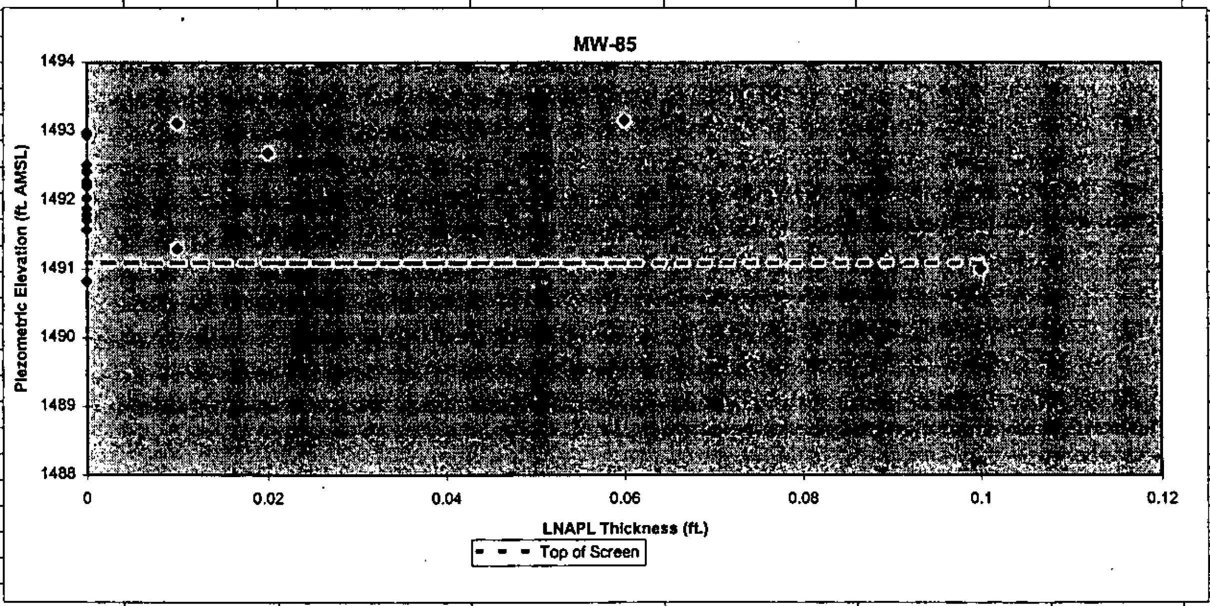
Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-85							
GW Elev.	1494.72						LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
20-Oct-93	2.93	2.93	0	1491.79	1491.09	1491.79	1491.79
10-Nov-95	2.84	2.84	0	1491.88	1491.09	1491.88	1491.88
14-Mar-96	2.21	2.21	0	1492.51	1491.09	1492.51	1492.51
17-Jun-96	2.69	2.69	0	1492.03	1491.09	1492.03	1492.03
24-Sep-96	2.31	2.31	0	1492.41	1491.09	1492.41	1492.41
29-Oct-96	2.5	2.5	0	1492.22	1491.09	1492.22	1492.22
31-Oct-96	2.3	2.3	0	1492.42	1491.09	1492.42	1492.42
19-Nov-96	3.9	3.9	0	1490.82	1491.09	1490.82	1490.82
16-Dec-96	1.62	1.61	0.01	1493.11	1491.09	1493.1	1493.11
22-Jan-97	2.52	2.52	0	1492.20	1491.09	1492.2	1492.2
19-Mar-97	1.61	1.55	0.06	1493.16	1491.09	1493.11	1493.17
9-May-97	2.06	2.04	0.02	1492.68	1491.09	1492.66	1492.68
15-Sep-97	3.15	3.15	0	1491.57	1491.09	1491.57	1491.57
10-Nov-97	2.45	2.45	0	1492.27	1491.09	1492.27	1492.27
12-Jan-98	1.62	1.61	0.01	1493.11	1491.09	1493.1	1493.11
13-Apr-98	1.74	1.74	0	1492.98	1491.09	1492.98	1492.98
6-Jul-98	1.78	1.78	0	1492.94	1491.09	1492.94	1492.94
27-Aug-98	3.01	3.01	0	1491.71	1491.09	1491.71	1491.71
25-Sep-98	3.43	3.42	0.01	1491.30	1491.09	1491.29	1491.3
3-Dec-98	3.8	3.7	0.1	1491.01	1491.09	1490.92	1491.02
26-Apr-99	6.76	6.74	0.02	1487.98	1491.09	1487.96	1487.98



APPENDIX C: LNAPL WELL DATA - MW-86
(Page 1 of 3)

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-86							
GW Elev.	1497.66						LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
20-Oct-93	7.27	7.27	0	1490.39	1495.17	1490.39	1490.39
11-Nov-95	6.55	6.13	0.42	1491.47	1495.17	1491.11	1491.53
14-Mar-96	6.85	6.26	0.59	1491.31	1495.17	1490.81	1491.4
17-Jun-96	7.09	6.96	0.13	1490.68	1495.17	1490.57	1490.7
24-Sep-96	6.9	6.68	0.22	1490.95	1495.17	1490.76	1490.98
29-Oct-96	6.77	6.62	0.15	1491.02	1495.17	1490.89	1491.04
30-Oct-96	6.77	6.62	0.15	1491.02	1495.17	1490.89	1491.04
20-Nov-96	6.79	6.65	0.14	1490.99	1495.17	1490.87	1491.01
16-Dec-96	6.51	6.29	0.22	1491.34	1495.17	1491.15	1491.37
21-Jan-97	7.55	7.21	0.34	1490.40	1495.17	1490.11	1490.45
20-Feb-97	6.87	6.47	0.4	1491.13	1495.17	1490.79	1491.19
21-Mar-97	6.41	6.26	0.15	1491.38	1495.17	1491.25	1491.4
9-May-97	6.72	6.57	0.15	1491.07	1495.17	1490.94	1491.09
21-May-97	6.75	6.65	0.1	1491.00	1495.17	1490.91	1491.01
22-Jul-97	7.01	6.81	0.2	1490.82	1495.17	1490.65	1490.85
15-Sep-97	7.65	7.3	0.35	1490.31	1495.17	1490.01	1490.36
10-Nov-97	6.91	6.75	0.16	1490.89	1495.17	1490.75	1490.91
12-Nov-97	6.67	6.49	0.18	1491.14	1495.17	1490.99	1491.17
12-Nov-97	6.38	6.26	0.12	1491.38	1495.17	1491.28	1491.4
13-Nov-97	6.52	6.39	0.13	1491.25	1495.17	1491.14	1491.27
2-Dec-97	6.79	6.66	0.13	1490.98	1495.17	1490.87	1491
16-Dec-97	6.62	6.62	0	1491.04	1495.17	1491.04	1491.04
17-Dec-97	6.72	6.72	0	1490.94	1495.17	1490.94	1490.94
18-Dec-97	6.86	6.86	0	1490.80	1495.17	1490.8	1490.8
19-Dec-97	6.85	6.85	0	1490.81	1495.17	1490.81	1490.81
22-Dec-97	6.92	6.92	0	1490.74	1495.17	1490.74	1490.74
23-Dec-97	6.87	6.87	0	1490.79	1495.17	1490.79	1490.79
24-Dec-97	6.86	6.86	0	1490.80	1495.17	1490.8	1490.8
29-Dec-97	6.11	5.95	0.16	1491.69	1495.17	1491.55	1491.71
30-Dec-97	6.34	6.34	0	1491.32	1495.17	1491.32	1491.32
31-Dec-97	6.36	6.36	0	1491.30	1495.17	1491.3	1491.3
2-Jan-98	6.31	6.31	0	1491.35	1495.17	1491.35	1491.35
5-Jan-98	5.54	5.48	0.06	1492.17	1495.17	1492.12	1492.18
6-Jan-98	5.48	5.48	0	1492.18	1495.17	1492.18	1492.18
7-Jan-98	6.11	6.11	0	1491.55	1495.17	1491.55	1491.55
8-Jan-98	3.21	3.21	0	1494.45	1495.17	1494.45	1494.45
9-Jan-98	3.79	3.79	0	1493.87	1495.17	1493.87	1493.87
12-Jan-98	5.99	5.94	0.05	1491.71	1495.17	1491.67	1491.72
19-Jan-98	5.78	5.78	0	1491.88	1495.17	1491.88	1491.88
20-Jan-98	5.85	5.85	0	1491.81	1495.17	1491.81	1491.81
21-Jan-98	5.85	5.85	0	1491.81	1495.17	1491.81	1491.81
22-Jan-98	5.85	5.85	0	1491.81	1495.17	1491.81	1491.81
26-Jan-98	5.9	5.9	0	1491.76	1495.17	1491.76	1491.76
27-Jan-98	5.61	5.61	0	1492.05	1495.17	1492.05	1492.05
28-Jan-98	5.61	5.61	0	1492.05	1495.17	1492.05	1492.05
29-Jan-98	5.61	5.61	0	1492.05	1495.17	1492.05	1492.05
6-Feb-98	6.21	6.21	0	1491.45	1495.17	1491.45	1491.45
9-Feb-98	6.1	6.1	0	1491.56	1495.17	1491.56	1491.56
11-Feb-98	6.24	6.24	0	1491.42	1495.17	1491.42	1491.42
13-Feb-98	6.24	6.24	0	1491.42	1495.17	1491.42	1491.42
16-Feb-98	6.24	6.24	0	1491.42	1495.17	1491.42	1491.42
18-Feb-98	5.84	5.76	0.08	1491.89	1495.17	1491.82	1491.9
20-Feb-98	6.15	6.15	0	1491.51	1495.17	1491.51	1491.51
23-Feb-98	5.95	5.95	0	1491.71	1495.17	1491.71	1491.71
25-Feb-98	6.4	6.4	0	1491.26	1495.17	1491.26	1491.26
27-Feb-98	6.16	6.15	0.01	1491.51	1495.17	1491.5	1491.51
2-Mar-98	6	5.92	0.08	1491.73	1495.17	1491.66	1491.74

APPENDIX C: LNAPL WELL DATA - MW-86
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Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-86							
GW Elev.	1497.66						LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
4-Mar-98	6.35	6.35	0	1491.31	1495.17	1491.31	1491.31
6-Mar-98	6.51	6.51	0	1491.15	1495.17	1491.15	1491.15
9-Mar-98	6.04	6.03	0.01	1491.63	1495.17	1491.62	1491.63
11-Mar-98	6.17	6.15	0.02	1491.51	1495.17	1491.49	1491.51
13-Mar-98	6.46	6.39	0.07	1491.26	1495.17	1491.2	1491.27
16-Mar-98	6.67	6.67	0	1490.99	1495.17	1490.99	1490.99
18-Mar-98	6.27	6.16	0.11	1491.48	1495.17	1491.39	1491.5
20-Mar-98	6.23	6.23	0	1491.43	1495.17	1491.43	1491.43
23-Mar-98	6.11	6.09	0.02	1491.57	1495.17	1491.55	1491.57
25-Mar-98	5.98	5.98	0	1491.68	1495.17	1491.68	1491.68
27-Mar-98	6.1	6.1	0	1491.56	1495.17	1491.56	1491.56
30-Mar-98	6.18	6.18	0	1491.48	1495.17	1491.48	1491.48
1-Apr-98	6.18	6.18	0	1491.48	1495.17	1491.48	1491.48
3-Apr-98	6.27	6.27	0	1491.39	1495.17	1491.39	1491.39
8-Apr-98	6.41	6.41	0	1491.25	1495.17	1491.25	1491.25
13-Apr-98	6.28	6.19	0.09	1491.46	1495.17	1491.38	1491.47
23-Apr-98	6.11	5.87	0.24	1491.75	1495.17	1491.55	1491.79
28-Apr-98	6.36	6.36	0	1491.30	1495.17	1491.3	1491.3
8-May-98	6.29	6.29	0	1491.37	1495.17	1491.37	1491.37
15-May-98	6.2	6.03	0.17	1491.60	1495.17	1491.46	1491.63
22-May-98	6.29	6.05	0.24	1491.57	1495.17	1491.37	1491.61
29-May-98	6.69	6.69	0	1490.97	1495.17	1490.97	1490.97
5-Jun-98	6.32	6.32	0	1491.34	1495.17	1491.34	1491.34
12-Jun-98	6.54	6.54	0	1491.12	1495.17	1491.12	1491.12
19-Jun-98	6.61	6.58	0.03	1491.08	1495.17	1491.05	1491.08
26-Jun-98	5.21	5.1	0.11	1492.54	1495.17	1492.45	1492.56
6-Jul-98	6.32	6.07	0.25	1491.55	1495.17	1491.34	1491.59
24-Jul-98	6.32	6.25	0.07	1491.40	1495.17	1491.34	1491.41
31-Jul-98	6.79	6.77	0.02	1490.89	1495.17	1490.87	1490.89
7-Aug-98	7.08	7.08	0	1490.58	1495.17	1490.58	1490.58
14-Aug-98	7.06	7.06	0	1490.60	1495.17	1490.6	1490.6
21-Aug-98	7.19	7.19	0	1490.47	1495.17	1490.47	1490.47
27-Aug-98	7.31	7.31	0	1490.35	1495.17	1490.35	1490.35
11-Sep-98	7.49	7.49	0	1490.17	1495.17	1490.17	1490.17
14-Sep-98	7.4	7.36	0.04	1490.29	1495.17	1490.26	1490.3
25-Sep-98	7.64	7.51	0.13	1490.13	1495.17	1490.02	1490.15
2-Oct-98	7.89	7.71	0.18	1489.92	1495.17	1489.77	1489.95
16-Oct-98	7.85	7.85	0	1489.81	1495.17	1489.81	1489.81
26-Oct-98	7.69	7.67	0.02	1489.99	1495.17	1489.97	1489.99
5-Nov-98	7.97	7.91	0.06	1489.74	1495.17	1489.69	1489.75
13-Nov-98	8.26	8.26	0	1489.40	1495.17	1489.4	1489.4
20-Nov-98	8.07	7.95	0.12	1489.69	1495.17	1489.59	1489.71
25-Nov-98	8.08	8.08	0	1489.58	1495.17	1489.58	1489.58
3-Dec-98	8.06	8	0.06	1489.65	1495.17	1489.6	1489.66
14-Dec-98	8.3	8.19	0.11	1489.45	1495.17	1489.36	1489.47
24-Dec-98	7.89	7.89	0	1489.77	1495.17	1489.77	1489.77
31-Dec-98	7.96	7.96	0	1489.70	1495.17	1489.7	1489.7
18-Jan-99	6.73	6.73	0	1490.93	1495.17	1490.93	1490.93
22-Jan-99	7.37	7.35	0.02	1490.31	1495.17	1490.29	1490.31
27-Jan-99	6.26	6.22	0.04	1491.43	1495.17	1491.4	1491.44
4-Feb-99	6.13	6.12	0.01	1491.54	1495.17	1491.53	1491.54
11-Feb-99	6.33	6.31	0.02	1491.35	1495.17	1491.33	1491.35
18-Feb-99	6.52	6.51	0.01	1491.15	1495.17	1491.14	1491.15
25-Feb-99	6.87	6.85	0.02	1490.81	1495.17	1490.79	1490.81
5-Mar-99	6.67	6.67	0	1490.99	1495.17	1490.99	1490.99
12-Mar-99	6.72	6.72	0	1490.94	1495.17	1490.94	1490.94
29-Mar-99	6.28	6.27	0.01	1491.39	1495.17	1491.38	1491.39

APPENDIX C: LNAPL WELL DATA - MW-86
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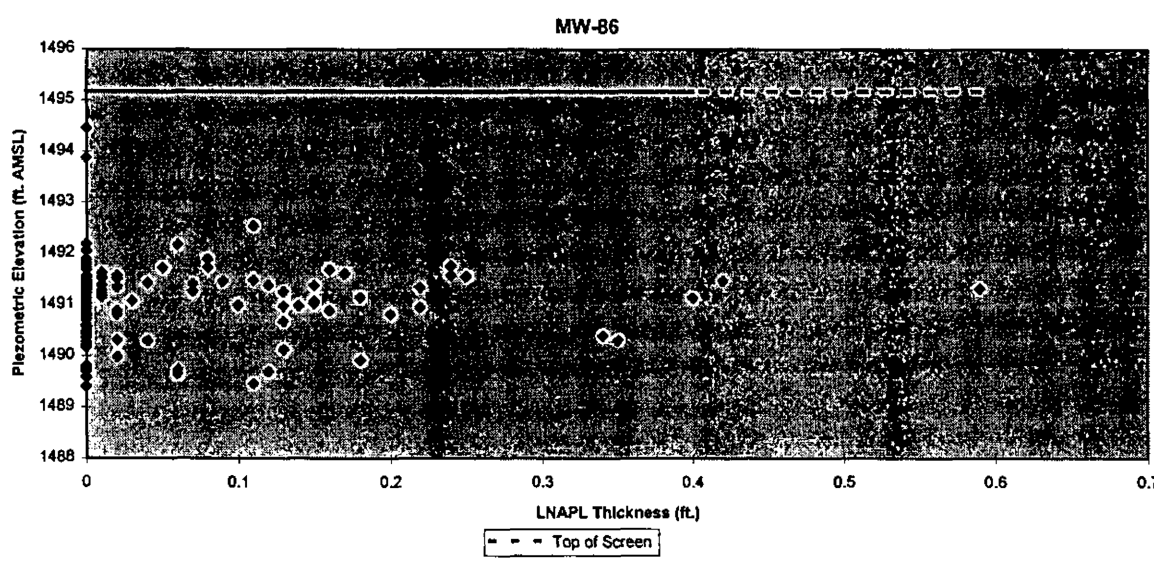
Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

MW-86							
GW Elev.	1497.66						LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
2-Apr-99	6.45	6.44	0.01	1491.22	1495.17	1491.21	1491.22
8-Apr-99	6.46	6.45	0.01	1491.21	1495.17	1491.2	1491.21
16-Apr-99	6.38	6.37	0.01	1491.29	1495.17	1491.28	1491.29
26-Apr-99	6.45	6.45	0	1491.21	1495.17	1491.21	1491.21
7-May-99	6.82	6.82	0	1490.84	1495.17	1490.84	1490.84
14-May-99	6.93	6.93	0	1490.73	1495.17	1490.73	1490.73
21-May-99	6.96	6.96	0	1490.70	1495.17	1490.7	1490.7
28-May-99	7.07	7.07	0	1490.59	1495.17	1490.59	1490.59
11-Jun-99	7.24	7.24	0	1490.42	1495.17	1490.42	1490.42
18-Jun-99	7.38	7.38	0	1490.28	1495.17	1490.28	1490.28
25-Jun-99	7.44	7.44	0	1490.22	1495.17	1490.22	1490.22
2-Jul-99	6.43	6.43	0	1491.23	1495.17	1491.23	1491.23
8-Jul-99	7.18	7.18	0	1490.48	1495.17	1490.48	1490.48
15-Jul-99	7.07	7.07	0	1490.59	1495.17	1490.59	1490.59
23-Jul-99	7.12	7.12	0	1490.54	1495.17	1490.54	1490.54



APPENDIX C: LNAPL WELL DATA - OW-3
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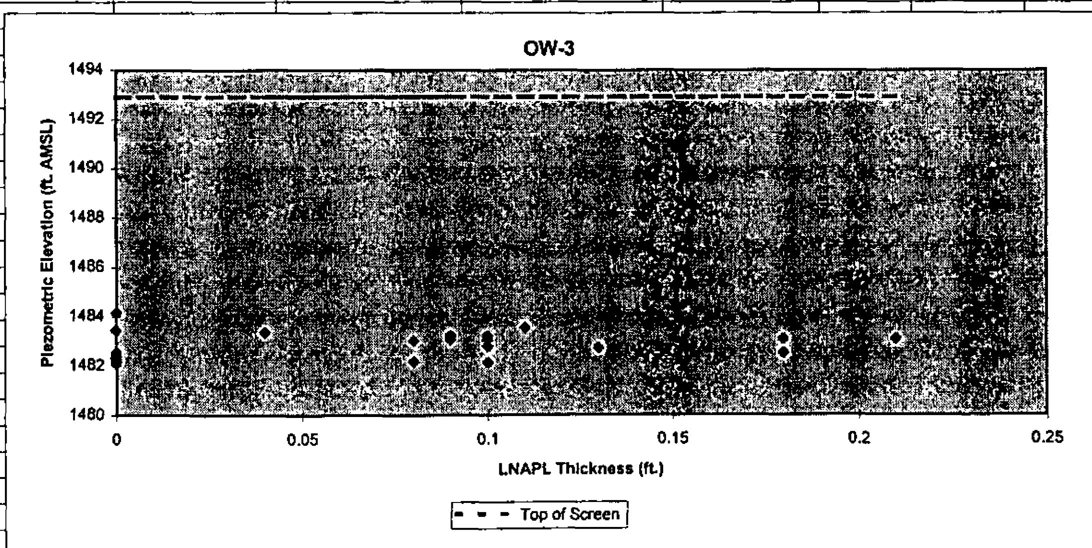
Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

OW-3							
GW Elev.	1498.2						LNAPL Elev.
Date	Depth to water	Depth to product	LNAPL Thickness	Piezom. Elev.		GW Elev.	FP Elev.
29-Dec-98	16.15	16.05	0.1	1482.14	1492.90	1482.05	1482.15
15-Jan-99	16.08	16	0.08	1482.19	1492.90	1482.12	1482.2
21-Jan-99	15.83	15.65	0.18	1482.52	1492.90	1482.37	1482.55
27-Jan-99	14.75	14.64	0.11	1483.54	1492.90	1483.45	1483.56
4-Feb-99	14.88	14.84	0.04	1483.35	1492.90	1483.32	1483.36
12-Feb-99	15.06	14.97	0.09	1483.22	1492.90	1483.14	1483.23
18-Feb-99	15.31	15.1	0.21	1483.07	1492.90	1482.89	1483.1
26-Feb-99	15.58	15.45	0.13	1482.73	1492.90	1482.62	1482.75
5-Mar-99	15.28	15.1	0.18	1483.07	1492.90	1482.92	1483.1
12-Mar-99	15.5	15.4	0.1	1482.79	1492.90	1482.7	1482.8
29-Mar-99	15.07	14.97	0.1	1483.22	1492.90	1483.13	1483.23
2-Apr-99	14.75	14.75	0	1483.45	1492.90	1483.45	1483.45
8-Apr-99	15.22	15.12	0.1	1483.07	1492.90	1482.98	1483.08
16-Apr-99	15.25	15.17	0.08	1483.02	1492.90	1482.95	1483.03
26-Apr-99	15.2	15.11	0.09	1483.08	1492.90	1483	1483.09
7-May-99	15.65	15.65	0	1482.55	1492.90	1482.55	1482.55
14-May-99	15.72	15.72	0	1482.48	1492.90	1482.48	1482.48
21-May-99	15.85	15.85	0	1482.35	1492.90	1482.35	1482.35
28-May-99	15.91	15.91	0	1482.29	1492.90	1482.29	1482.29
4-Jun-99	15.98	15.98,	0	1482.22	1492.90	1482.22	1482.22
18-Jun-99	16.01	16.01	0	1482.19	1492.90	1482.19	1482.19
25-Jun-99	16.08	16.08	0	1482.12	1492.90	1482.12	1482.12
2-Jul-99	14.04	14.04	0	1484.16	1492.90	1484.16	1484.16
8-Jul-99	15.9	15.9	0	1482.30	1492.90	1482.3	1482.3
16-Jul-99	15.82	15.82	0	1482.38	1492.90	1482.38	1482.38
23-Jul-99	15.88	15.88	0	1482.32	1492.90	1482.32	1482.32
4-Aug-99	15.88	15.88	0	1482.32	1492.90	1482.32	1482.32



APPENDIX D

GROUNDWATER GEOCHEMICAL MEASUREMENTS

Table #	Title
D-1	Groundwater pH
D-2	Groundwater RedOx Potential
D-3	Groundwater Dissolved Oxygen Concentrations
D-4	Groundwater Conductivity
D-5	Groundwater Temperature
D-6	Groundwater Turbidity

APPENDIX D-1 (Page 1 of 4)
Groundwater pH
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-29	MW-31	MW-32
21-Oct-93	6.98	6.66			6.62		6.54						6.99
07-May-94	5.99		6.21	6.91					6.49			6.31	7.10
18-Aug-94	6.77		6.55	6.51	6.73				6.72			6.74	6.76
30-Nov-95	8.28	6.54	6.52	6.29	6.00							7.03	
18-Mar-96	9.04	4.18	4.68	4.29	9.73							4.66	
18-Jun-96	6.46	6.49	6.41	6.55	6.67							6.55	
28-Aug-96	6.99	6.61	6.06							6.21			
26-Sep-96	7.27	6.62	6.33	6.64	6.77					12.79		6.82	
01-Nov-96	6.66	6.50	6.35	6.51	6.73					6.58		6.67	
18-Nov-96		6.60	6.19	6.56	6.52					6.12		6.43	
17-Dec-96	6.96	6.67	6.33	6.51	6.20					6.54		6.92	
21-Jan-97	6.58	6.44	6.31	6.41	6.27					5.99		6.41	
19-Feb-97	6.92	7.02	6.79	6.71	6.61	6.69				6.52		6.92	
Mar-97	7.26	7.09	6.59	6.62	6.99	6.71	6.95	6.89		6.81		7.22	
May-97	7.49	6.93	6.90	6.35	6.98	6.85				6.67		7.02	
July-97	7.53	6.95	5.97	7.43	7.50	7.31				6.34		6.92	
Sep-97	6.92	6.41	6.45	6.20	6.61	6.52			6.55	5.98		6.57	
Nov-97	7.30	6.77	6.92	6.68	7.45	7.42		6.51		6.30		6.92	
Jan-98	7.07	6.50	6.61	6.50	6.67	6.51	6.81	6.68	6.71	6.45		6.82	
Apr-98	6.60	6.48	6.37	5.89	6.37	6.42	5.99	6.64	6.46	6.39		6.80	
Jul-98	7.03	6.84	6.65	6.23	6.59	6.13	6.26		6.30	6.32	7.29	6.82	7.12
Oct-98	7.23	6.52		6.42	6.33		6.56	6.57			6.95	6.61	
Dec-98									6.34				
Jan-99		6.27	3.63	6.35	6.03	5.59				5.49		6.65	6.45
Apr-99*	6.98	6.34	6.47	5.98	6.50	6.54	6.37	6.61	6.81	6.40		6.42	6.51

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX D-1 (Page 2 of 4)
Groundwater pH
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-33	MW-34	MW-35	MW-36	MW-49	MW-50	MW-51	MW-52	MW-53	MW-54	MW-55	MW-56	MW-57
21-Oct-93	6.57	6.64		7.29	6.73				6.49		6.90		
07-May-94	6.36	7.31		7.48		7.09			6.53		6.94		
18-Aug-94	6.60	7.25		7.20	6.74	6.63			6.57		6.82		6.75
30-Nov-95	5.55			10.48		7.03			7.54		7.82		
18-Mar-96	8.94			4.18	4.68	4.28					4.23		4.73
18-Jun-96	6.59			7.07		6.23			6.27		6.69		
28-Aug-96	6.65	7.00	6.82	6.90		6.59		7.09	6.59			6.10	
26-Sep-96	6.56	6.84	6.98	6.84		6.67		6.97	6.66		6.65	7.26	
01-Nov-96	6.64	6.45	6.87	6.39		6.38		6.87	6.44		6.50	6.60	
18-Nov-96	6.67	6.68	6.79	6.77		6.20		6.54	6.24		6.66	6.49	
17-Dec-96	6.77	6.83	6.82	6.53		6.73		6.82	6.68		6.87	6.48	
21-Jan-97	6.35	6.45	6.41	6.77		6.36		6.48	6.31		6.52	6.34	
19-Feb-97	6.59	6.83		7.14		6.82		6.89	6.76		6.99	6.72	
Mar-97	6.97	7.15		7.30	7.14	6.96		7.14	6.98		7.19	7.21	7.21
May-97	7.18	7.22		7.08	6.77	6.76		7.28	6.87		6.96	6.77	7.31
July-97	6.87	8.07		7.32	7.28	7.04		7.80	6.93		7.30	6.31	6.92
Sep-97	6.55	6.81		6.90		6.27		6.74	6.70		6.45	6.48	6.72
Nov-97	6.78	6.77	6.98	7.50	7.16	6.73		7.31	6.74		7.63	6.81	7.41
Jan-98	6.64	7.11	7.01	7.21	6.83	6.55		6.81	6.54		6.71	6.53	6.81
Apr-98	6.18	6.71		7.04	5.90	6.50	6.71	6.45	6.59		6.74	6.15	5.56
Jul-98	6.64	6.43	7.03	7.36	6.53	6.42	6.34		6.38	6.65	6.81	6.66	6.18
Oct-98		6.80		6.96	6.66	6.34			6.47		6.52		6.90
Dec-98	6.55												
Jan-99				7.68							6.01		6.35
Apr-99*	6.58	6.69		6.76	8.39	6.52	6.68				6.70		7.05

Notes:
Blank indicates that well was not sampled.
* - Sampling occurred from April 27 through May 10, 1999.
The value indicated for MW-36 on the 18-Nov-96 measurement
is the average of two readings on consecutive days, 7.03 and 6.5.

APPENDIX D-1 (Page 3 of 4)
Groundwater pH
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-67	MW-68A	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74	MW-75	MW-76	MW-77
21-Oct-93	6.82					6.59			6.92	6.37		6.76	6.51
07-May-94	6.54					6.90		7.12	7.24	6.49	6.69	6.40	6.70
18-Aug-94	6.77			6.59		6.58		6.98	7.00	6.30		6.86	6.45
30-Nov-95	5.76					6.06	6.44	5.40	5.97		10.15	7.25	10.56
18-Mar-96	4.25			9.67		4.29	4.30	6.80	9.30		8.95	4.68	4.18
18-Jun-96	6.77			6.53		6.50	6.38	6.67	6.88		6.69	6.59	
28-Aug-96						6.50	6.58						5.99
26-Sep-96	6.83			6.67		6.54	6.40	6.85	6.99		6.75	6.56	6.26
01-Nov-96	6.76			6.78		6.59	5.80	6.83	6.96		6.80	6.71	6.29
18-Nov-96	6.81			6.40		6.38	5.11	6.62	6.69		6.38	6.56	5.90
17-Dec-96	6.76			6.89		6.34	4.97	6.66	6.99		6.78	6.96	6.03
21-Jan-97	6.49			6.34		6.10	5.83	6.47	6.81		6.36	6.46	6.13
19-Feb-97	6.86			6.93		6.61	6.34	6.99	7.24				6.47
Mar-97	7.01	6.98	7.22	6.78	6.99	6.93	6.58	7.31	7.58		7.28	7.30	6.87
May-97	6.67			7.25		6.75	6.48	7.35	7.65				6.69
July-97	8.33			7.43		7.86	7.86	7.40	8.03				6.52
Sep-97	6.72			6.73		6.32	6.17	6.80	6.75			6.54	6.33
Nov-97	6.85			6.61		7.17	6.47	7.35	7.22			7.00	6.25
Jan-98	6.68	6.75	6.92	6.72	6.90	6.50	5.43	6.96	7.26		6.78	6.72	6.55
Apr-98	6.75	5.97		6.49		5.96	5.84	6.64	7.23	6.46	6.18	6.52	6.52
Jul-98	6.48	6.25		6.43		6.40	6.07	6.49	7.09	6.33	6.74	6.71	6.54
Oct-98		6.28		6.57						6.68	6.87	6.48	6.36
Dec-98	6.28					6.31	6.14						
Jan-99				5.58					7.03	6.63			5.24
Apr-99*	9.65	6.20		7.08		6.65	5.80	6.63	6.60	6.36	7.44		6.43

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX D-1 (Page 4 of 4)
Groundwater pH
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-78	MW-79	MW-81	MW-85	MW-86	MW-87	MW-88	MW-89	OW-1	OW-3	OW-4	OW-6	OW-8
21-Oct-93								6.36					
07-May-94		6.82		7.10	6.50			6.05					
18-Aug-94		6.39		6.78				6.55					
30-Nov-95		7.02		5.88	5.39			7.38					
18-Mar-96		4.19		9.49	9.15			4.68					
18-Jun-96		6.29		6.56	6.72			2.00					
28-Aug-96		6.50				6.25	6.63						
26-Sep-96		6.35		6.78	6.94	6.21	6.62	5.71					
01-Nov-96		6.40		6.74	6.82	6.12	6.55	6.11					
18-Nov-96		6.22		6.69	6.73	6.63	6.54	6.06					
17-Dec-96		6.67		6.68	6.88	6.14	6.45	6.40					
21-Jan-97		6.36		6.39	6.21	5.93	6.16	6.04					
19-Feb-97		6.81			7.16	6.28	6.71						
Mar-97	6.95	6.99		7.28	7.07	6.50	7.10	6.69					
May-97		6.80			7.07	6.54	6.82						
July-97		6.90			7.57	6.16	6.65						
Sep-97		6.31		6.46	6.41	6.07	6.53	6.30					
Nov-97		6.54			6.87	6.60	7.41	4.45					
Jan-98	6.52	6.48		6.86	6.72	6.26	6.59	5.96					
Apr-98	5.57	6.50	6.18	6.73	5.89	5.84	6.75	5.14					
Jul-98	5.42	6.27		6.55	6.57		6.62	6.19					
Oct-98	6.35	6.46	6.26				6.39	6.18					
Dec-98									6.67	6.53	6.04	6.35	6.22
Jan-99	5.32	5.40			6.66								
Apr-99*	6.39	6.26	6.65	6.70	7.00	6.15	6.35	5.15	6.73	6.29	5.36	6.65	6.58

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX D-2 (Page 1 of 4)
Groundwater Redox Potential (mV)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-29	MW-31	MW-32
21-Oct-93													
07-May-94													
18-Aug-94	2		16	23	0				-14			7	14
30-Nov-95	-4	47	55	27	13							23	
18-Mar-96	101	22	18	9	15							-19	
18-Jun-96	23	21	25	19	10							18	
28-Aug-96	-8	7	39							30			
26-Sep-96	-29	7	24	2	-2					15		-5	
01-Nov-96	18	29	39	29	14					23		19	
18-Nov-96		26	47	30	31					51		33	
17-Dec-96	-1	13	36	22	0.38					25		4	
21-Jan-97	1	31	48	37	25							49	
19-Feb-97	-89	-59	13	-57	-79	-106				47		4	
Mar-97	-70	-86	-57	-48	-110	-70	-107	-82		-58		-82	
May-97	103	-45	-37	-31	-55	-43				-37		-36	
July-97	-116	-32	-137	0.026	-80	-89				-140		-137	
Sep-97	-56	-53	-67	-36	-162	-151			-149	-47		-32	
Jan-98	-108	-157	-29	-162	-108	-95	-146	-146	56	2		4	
Apr-98	-49.7	-0.1	-92.4	52.6	79.5	-69.3	-80.5	-87.1	-20.9	-35.8		-75.4	-46.6
Jul-98	-67.5	-85.6	-113.1	-25.8	-84.9	16.4	-31.5		-75.4	-41.9	-74.9	-116.6	-113.4
Oct-98	-158.8	103.5		76.9	-82.4		101.2	75.3			-94.5	-108.5	
Dec-98													
Jan-99		99.8	433.4	85.1	82.1	213.0				129.8		51.9	92.2
Apr-99*	150.2	-17.5	119.7	-46.0	-81.0	183.9	77.8	-68.9	-37.2	61.6		-67.7	-12.7

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX D-2 (Page 2 of 4)
Groundwater Redox Potential (mV)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-33	MW-34	MW-35	MW-36	MW-49	MW-50	MW-51	MW-52	MW-53	MW-54	MW-55	MW-56	MW-57
21-Oct-93													
07-May-94													
18-Aug-94	-3	11			-6	17			14		9		-13
30-Nov-95	27			-6		27			23		15		
18-Mar-96	-2			43	6	39			5		19		-12
18-Jun-96	13			-9		34			33		10		
28-Aug-96	5	-12	-4	-8		11		-18	9			31	
26-Sep-96	9	-6	-14	-7		3		-14	3		4	-29	
01-Nov-96	13	20	7	26		35		7	33		29	23	
18-Nov-96	20	23	15	17		49		29	44		22	30	
17-Dec-96	9	2	5	22		14		4	17		5	28	
21-Jan-97	19	11	5	1		45		27	46		42	43	
19-Feb-97	-131	-48		-113		-53		-89	13		-58	13	
Mar-97	-102	-5		-55	-76	-75		-82	-49		-23	-57	-81
May-97	-94	50		-7	-79	-36		-15	-34		-40	-45	-137
July-97	-149	-96		-47	98	-34		-114	-4		-27	-145	-106
Sep-97	-159	-185		-71		-27		-25	-159		-42	-50	-121
Jan-98	47	-51	88	62	88	24		44	21		-154	17	36
Apr-98	-87.1		-16	-87.7	-52.3	-30.7	-37.4	-81.5	-40		-40.1	-52.5	-74.9
Jul-98	-120.6	-38.9	-88.1	-161.9	-87.2	-81.8	-74.3		-83.9	-12.9	-56.6	-90.8	-63.9
Oct-98		-137.1		-119.5	-85.0	-88.0			-101.6		-97.8		-121.6
Dec-98	-132.0												
Jan-99				-49.5							109.8		7.8
Apr-99*	-71.1	-36.5		-90.4	344.1	-34.1	-11.1				-36.8		-404.8

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

The value indicated for MW-36 on the 18-Nov-96 measurement is the average of two readings (2 and 32) on consecutive days.

APPENDIX D-2 (Page 3 of 4)
Groundwater Redox Potential (mV)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-67	MW-68A	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74	MW-75	MW-76	MW-77
21-Oct-93													
07-May-94													
18-Aug-94	12			4		1		16	35	13		0.1	
30-Nov-95	10					27	38	21	12			12	36
18-Mar-96	27			2		8	20	10	10		53	-25	45
18-Jun-96	4			18		21	26	11	0		8	16	
28-Aug-96						15	10						44
26-Sep-96	-5			3		10	20	-4	-17		-1	3	28
01-Nov-96	14			15		23	71	9	3		5	18	34
18-Nov-96	14			38		39	116	26	21		37	24	65
17-Dec-96	6			-1		33	111	14	-5		7	1	51
21-Jan-97	19			34		28	31	18	4		18	40	22
19-Feb-97	-112			-115		-96	-102	-86	-95				-78
Mar-97	-99	-93	-131	-82	-106	-53	-28	-89	-9		-22	-45	-62
May-97	-23			-59		-40	-31	61	-41				-28
July-97	-33			-91		-33	-121	-114	-120				-77
Sep-97	-112			-127		-13	-28	-106	67			-72	-44
Jan-98	-146	-136	-127	-113	-122	-159	-220	89	30		90	-52	93
Apr-98	-51.9	-42.7		-97.1		-34	42.5	17.4	-73.6	213	-54.6	-103.4	6.9
Jul-98	102.6	-56.3		-94.6		-57.8	-3.2	-93.6	-137.2	213.1	-91.4	-123.5	-70.6
Oct-98		-62.6		-86.1						31.5	-109.3	-88.1	-75.4
Dec-98	-58.1					7.0	-45.6						
Jan-99				109.0					8.0	286.3			163.1
Apr-99*	-42.7	-11.3		401.7		-44.2	68.9	170.5	252.4	14.9	-21.9		-17.7

Notes:

Blank indicates that well was not sampled.

* - *Sampling occurred from April 27 through May 10, 1999.*

APPENDIX D-2 (Page 4 of 4)
Groundwater Redox Potential (mV)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-78	MW-79	MW-81	MW-85	MW-86	MW-87	MW-88	MW-89	OW-1	OW-3	OW-4	OW-6	OW-8
21-Oct-93													
07-May-94													
18-Aug-94		4		11				21					
30-Nov-95		31		24	16			35					
18-Mar-96		53		42	82			-86					
18-Jun-96		33		0.18	8			26					
28-Aug-96		14				29	8						
26-Sep-96		24		-2	-11	30	6	59					
01-Nov-96		35		14	11	45	25	52					
18-Nov-96		47		21	20	24	27	54					
17-Dec-96		18		11	2	44	26	32					
21-Jan-97		57		36	22	51	31	73					
19-Feb-97		-49			-60	43	-96						
Mar-97	-104	-57		-47	-61	76	-72	-60					
May-97		-4			-33	116	-48						
July-97		-29			-125	43	-60						
Sep-97		-37		61	-132	-72	-151	-77					
Jan-98	-76	41		-37	112	-83	-9						
Apr-98	58	-8.7	-38.5	-33.4	-34.4	159.1	-69.6	34.1					
Jul-98	127.7	61.8		-65.8	-48.9		-104.7	-38.6					
Oct-98	-80.3	-87.1	-83.0				-91.0	-135.2					
Dec-98									-89.5	-50.8		127.4	
Jan-99	255.0	193.7			158.4								
Apr-99*	136.3	-46.1	53.4	-4.7	-29.8	69.6	-39.1	213.6	-83.8	-48.6	83.5	-94.0	-66.6

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX D-3 (Page 1 of 4)
Groundwater Dissolved Oxygen Concentrations (mg/L)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-29	MW-31	MW-32
21-Oct-93	1.47	2.11											
07-May-94	2.53		1.55	1.20					2.41			1.97	1.28
18-Aug-94	1.12		0.43	0.39	1.93				0.91			0.23	0.44
30-Nov-95	2.30	0.90	1.20	1.10	0.70							1.80	
18-Mar-96	4.30	3.10	2.40	2.00	3.40							1.80	
18-Jun-96	1.80	0.30	0.20	0.30	0.60					0.40		0.50	
28-Aug-96		1.30	1.00							1.70			
26-Sep-96	1.30	1.50	2.20	1.90	1.80					0.30		1.60	
01-Nov-96	1.70	1.60	0.40	1.90	2.10					0.90		0.80	
18-Nov-96		0.00	0.90	1.00	2.20							1.20	
17-Dec-96	3.40	4.60	7.70	5.80	12.70					8.10		6.10	
21-Jan-97	2.21	2.97	2.39	3.80	2.47					2.00		1.89	
19-Feb-97	0.70	1.66	0.02	0.58	3.55	0.23				0.05		0.31	
Mar-97	0.61	0.31	0.09	1.47	0.07	0.22	0.08	0.38		0.02		0.21	
May-97	0.46	0.07	0.02	0.16	0.02	0.06				0.05		0.06	
July-97	0.68	0.02	0.06	0.11	0.07	3.41				0.02		0.13	
Sep-97	0.39	0.18	0.08	0.16	0.03	1.69			0.58	0.53		0.37	
Nov-97	1.90	2.80	0.96	2.90	0.81	1.53		0.80		0.90		0.87	
Jan-98	1.35	2.39	0.83	3.32	1.78	1.82	0.66	0.89	0.97	1.16		1.05	
Apr-98	2.66	1.31	0.75	4.83	1.61	0.84	0.99	3.70	4.16	1.34		0.57	
Jul-98	1.11	0.78	0.92	1.43	0.68	1.15	1.09		1.87	1.23	0.35	0.87	0.63
Oct-98	-0.80	0.36			-0.73		10.48				11.75	1.61	
Dec-98													
Jan-99		1.99	2.12	2.60	1.67	4.00				3.70		1.15	1.24
Apr-99*	3.18	0.78	0.90	1.41	0.70	0.79	1.34	11.20	3.20	0.44		0.44	0.54

<u>Notes:</u>
Blank indicates that well was not sampled.
* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX D-3 (Page 2 of 4)
Groundwater Dissolved Oxygen Concentrations (mg/L)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-33	MW-34	MW-35	MW-36	MW-49	MW-50	MW-51	MW-52	MW-53	MW-54	MW-55	MW-56	MW-57
21-Oct-93	0.59	2.42		9.00	0.34						3.42		
07-May-94	0.50	2.20		1.69		2.19			1.03		0.52		
18-Aug-94	0.34	1.05		0.49	1.09	1.92			0.25		0.25		0.46
30-Nov-95	0.90			1.40		1.70			1.80		2.80		
18-Mar-96	1.10			2.00	4.00	2.30			2.00		1.80		1.70
18-Jun-96	1.20			2.10		0.60			0.60		0.90		
28-Aug-96	0.50	1.60	0.60	0.80		1.00		0.10	0.90			1.90	
26-Sep-96	0.90	2.50	0.80	0.50		2.90		1.70	2.20		1.80	2.00	
01-Nov-96	1.40	8.40	2.20	1.10		0.90		1.30	0.60		1.10	0.80	
18-Nov-96	1.00	3.80	0.00	1.15		0.00		1.10	1.10		0.00	0.60	
17-Dec-96	2.10	12.60	2.60	2.40		5.40		3.40	6.10		9.20	8.50	
21-Jan-97	1.59	3.80	2.85	1.90		1.92		1.95	1.97		1.96	2.11	
19-Feb-97	4.00	5.68		2.17		0.28		8.53	1.12		0.64	0.44	
Mar-97	0.10	2.25		10.00	0.85	0.09		0.90	24.00		0.34	0.63	0.29
May-97	0.12	2.96		0.15	0.45	0.05		0.26	0.19		0.24	0.00	0.01
July-97	0.01	0.99		0.06	0.09	0.21		0.13	0.11		1.15	0.05	0.05
Sep-97	0.01	1.83		0.11		0.38		0.59	0.89		0.41	0.80	0.13
Nov-97	0.10	0.80	4.68	0.00	1.52	1.29		1.30	0.94		0.90	0.87	1.31
Jan-98	0.66	2.77	0.92	2.80	0.70	1.23		0.86	0.71		1.60	1.68	0.85
Apr-98	1.16	1.08		0.47	1.18	2.62	1.16	2.09	1.29		1.47	1.80	0.68
Jul-98	1.12	1.17	1.04	0.42	1.21	1.58	1.35		1.68	1.11	1.57	0.78	1.37
Oct-98		1.42		1.64	10.01	0.42			0.62		3.06		13.94
Dec-98	1.51												
Jan-99											2.28		
Apr-99*	0.95	1.27		0.68	1.42	1.27	0.79				4.73		0.57

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

The value indicated for MW-36 on the 18-Nov-96 measurement is the average of two readings (0.8 and 1.5) on consecutive days.

Groundwater Dissolved Oxygen Concentrations (mg/L)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-67	MW-68A	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74	MW-75	MW-76	MW-77
21-Oct-93	2.00					1.56			0.51	5.00		0.94	0.19
07-May-94	1.14					1.88		1.42	0.17	1.13	0.35	1.01	1.01
18-Aug-94	0.68			0.35		0.49		0.20	0.29	0.56		0.54	0.35
30-Nov-95	1.40					1.20	1.00	1.40	0.50		2.60	1.00	3.20
18-Mar-96	2.30			1.50		1.30	1.20	0.70	1.40		1.70	1.90	2.60
18-Jun-96	0.70			0.50		0.70	0.00	1.40	0.40		1.60	0.40	
28-Aug-96						0.90	1.80						0.90
26-Sep-96	2.00			1.30		2.60	1.80	0.60	0.20		0.70	0.10	0.10
01-Nov-96	1.90			2.10		1.80	1.50		1.40		0.70	0.50	1.00
18-Nov-96	1.40			1.30		0.90	2.60	1.10	0.70		1.40	0.70	1.40
17-Dec-96	8.90			7.20		6.80	4.60	1.80	4.00		2.00	8.90	2.50
21-Jan-97	3.25			3.40		6.00	3.25	1.92	1.27		2.53	2.04	1.13
19-Feb-97	1.16			0.97		0.19	0.17	0.09	3.02				1.96
Mar-97	0.68	0.26	0.06	0.47	1.15	0.20	0.69	0.15	0.24		0.88	0.10	0.23
May-97	0.34			0.97		0.05	0.09	0.09	0.04				0.05
July-97	0.23			0.43		2.38	0.15	0.08	0.01				0.12
Sep-97	2.23			1.37		0.67	0.61	0.08	1.21			0.13	1.07
Nov-97	2.36			0.90		0.88	4.70	1.29	0.65			0.91	1.10
Jan-98	2.10	0.96	0.81	1.00	1.29	1.29	2.52	0.87	0.32		2.75	1.08	0.86
Apr-98	1.81	1.09		1.05		0.83	1.33	2.77	1.11	1.46	0.64	0.59	1.34
Jul-98	0.95	1.40		1.23		1.14	1.05	1.41	1.00	1.61	1.03	0.92	0.59
Oct-98		19.32		1.66						11.56	1.86	7.24	0.90
Dec-98							3.85						
Jan-99				2.32						4.01			1.39
Apr-99*	3.11	11.12		1.96		1.05	0.94	0.77	1.24	0.78	2.95		0.76

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX D-3 (Page 4 of 4)
Groundwater Dissolved Oxygen Concentrations (mg/L)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-78	MW-79	MW-81	MW-85	MW-86	MW-87	MW-88	MW-89	OW-1	OW-3	OW-4	OW-6	OW-8
21-Oct-93								1.58					
07-May-94		2.59		0.80	1.07			2.08					
18-Aug-94		0.90		0.01				0.58					
30-Nov-95		4.00		1.30	1.00			0.70					
18-Mar-96		1.80		1.60	2.30			2.10					
18-Jun-96		1.30		1.10	0.70			0.20					
28-Aug-96		1.30				1.10	1.00						
26-Sep-96		0.90		0.30	0.50	0.50	2.10	2.00					
01-Nov-96		1.20		1.20	1.40	0.60	0.80	0.50					
18-Nov-96		0.00		0.70	0.80	0.00	1.00	1.00					
17-Dec-96		5.50		3.50	1.70	2.40	2.30	8.30					
21-Jan-97		1.93		3.49	4.71	1.68	1.91	3.85					
19-Feb-97		0.94			6.78	0.11	0.03						
Mar-97	0.05	0.14		2.19	0.19	0.18	0.13	2.61					
May-97		0.13			0.29	0.22	0.04						
July-97		0.16			0.05	0.46	0.13						
Sep-97		0.21		0.22	0.23	0.50	0.05	0.43					
Nov-97		1.90			0.89	2.10	2.27	2.90					
Jan-98	1.07	1.02		0.64	1.98	1.15	1.10	1.07					
Apr-98	5.09	1.60	0.81	0.88	1.47	0.90	0.62	3.56					
Jul-98	1.21	2.39		1.58	1.39		0.75	1.19					
Oct-98	10.77	1.52	1.87				1.67	1.42					
Dec-98									4.32	2.28			
Jan-99	3.44	3.42			1.86								
Apr-99*	1.09	1.26	0.46	2.08	2.83	0.90	0.15	1.83	0.71	0.87	0.68	0.65	0.56

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX D-4 (Page 1 of 4)
Groundwater Conductivity (microsiemens)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-29	MW-31	MW-32
21-Oct-93	1,510	5,290			581		861		860				467
07-May-94	1,630		350	738					840			400	311
18-Aug-94	770		357	399	664				809			380	360
30-Nov-95	1,002	566	996	983	626							337	
18-Mar-96	189	53	75	145	102							54	
18-Jun-96	200	360	250	1,050	610							200	
28-Aug-96	1,510	383	298							181			
26-Sep-96	1,239	375	751	766	565					200		286	
01-Nov-96	945	389	597	919	601					187		307	
18-Nov-96		475	882	1,753	913					226		400	
17-Dec-96	1,367	450	795	1,660	789					181		384	
21-Jan-97	1,604	450	425	2,030	764					169		414	
19-Feb-97	1,230	430	383	1,450	720	380				160		370	
Mar-97	1,370	410	536	1,800	740	420	1,130	620		166		380	
May-97	1,620	389	339	1,510	693	326				153		347	
July-97	1,760	458	384	1,360	786	354				155		376	
Sep-97	1,810	441	389	1,230	784	381			840	167		374	
Jan-98	1,450	503	455	1,360	787	465	1,060	753	934	194		379	
Apr-98	894	279	232	807		220	686	465	549	100		231	244
Jul-98	715	287	285	945	631	243	594		648	129	227	291	253
Oct-98	1,375	322		1,170	623		708	835			355	272	
Dec-98									1,010				
Jan-99		345	1,562	808	654	338				166		270	325
Apr-99*	1,368	474	471	1,167	945	461	1,010	930	1,310	168		321	513

Notes:
Blank indicates that well was not sampled.
* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX D-4 (Page 2 of 4)
Groundwater Conductivity (microsiemens)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-33	MW-34	MW-35	MW-36	MW-49	MW-50	MW-51	MW-52	MW-53	MW-54	MW-55	MW-56	MW-57
21-Oct-93	1,110	466		330	616				350		483		
07-May-94	1,200	415		284		440			330		380		
18-Aug-94	1,090	540		290	619	380			304		370		608
30-Nov-95	641			240		389			314		372		
18-Mar-96	165			40	91	52			58		50		33
18-Jun-96	860			250		360			190		290		
28-Aug-96	1,025	485	655	295		348		736	305			345	
26-Sep-96	783	368	593	257		360		624	272		336	355	
01-Nov-96	765	405	609	310		402		689	455		375	406	
18-Nov-96	1,381	491	822	911		485		766	671		460	489	
17-Dec-96	1,099	433	757	325		517		724	677		456	436	
21-Jan-97	1,090	448	755	300		558		605	615		491	431	
19-Feb-97	1,110	423		290		530		630	545		430	410	
Mar-97	1,270	410		320	570	510		722	498		400	270	850
May-97	1,180	456		120	576	464		664	391		362	362	596
July-97	1,310	537		287	653	493		717	438		380	384	687
Sep-97	1,290	503		299		445		558	535		405	401	665
Jan-98	1,200	362	723	322	727	505		684	490		457	369	737
Apr-98	735	238		182	394	314	260	497	297		267	221	454
Jul-98	862	418	489	204	488	375	342		323	155	265	293	519
Oct-98		546		324	629	384			353		382		505
Dec-98	729												
Jan-99				356							338		782
Apr-99*	1,158	402		326	683	744	509				473		773

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

The value indicated for MW-36 on th 18-Nov-96 measurement
is the average of two readings on consecutive days, 1454 and 368.

APPENDIX D-4 (Page 3 of 4)
Groundwater Conductivity (microsiemens)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-67	MW-68A	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74	MW-75	MW-76	MW-77
21-Oct-93	822			625		998			439	481		340	288
07-May-94	807					830		528	358	539	689	312	207
18-Aug-94	732			615		811		495	379	605		297	211
30-Nov-95	671					757	1,253	360	61		456	306	254
18-Mar-96	92			97		123	167	538	52		115	41	34
18-Jun-96	510			530		850	1,100	460	330		670	200	
28-Aug-96						958	884						268
26-Sep-96	591			535		750	853	393	315		619	246	280
01-Nov-96	641			505		716	1,021	460	359		575	309	315
18-Nov-96	884			704		1,084	2,000	587	436		1,002	423	363
17-Dec-96	846			579		850	1,640	523	418		806	413	311
21-Jan-97	557			538		987	1,645	497	365		810	393	260
19-Feb-97	741			563		1,060	1,590	520	370				260
Mar-97	820	600	670	590	550	990	1,640	535	390		990	361	293
May-97	780			586		1,000	1,380	512	321				237
July-97	772			551		1,060	1,430	532	343				252
Sep-97	684			529		980	1,210	533	352			360	301
Jan-98	930	790	750	645	550	950	1,510	690	418		846	368	320
Apr-98	549	510		459		614	879	361	214	245	471	236	167
Jul-98	724	764		593		620	981	460	288	427	601	280	225
Oct-98		519		676						418	837	394	369
Dec-98	1,020					1,030	651						
Jan-99				589					699	179			286
Apr-99*	1,000	960		905		1,050	1,120	597	407	239	948		315

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX D-4 (Page 4 of 4)
Groundwater Conductivity (microsiemens)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-78	MW-79	MW-81	MW-85	MW-86	MW-87	MW-88	MW-89	OW-1	OW-3	OW-4	OW-6	OW-8
21-Oct-93								376					
07-May-94		440		463	810			310					
18-Aug-94		626		500				300					
30-Nov-95		797		353	302			428					
18-Mar-96		66		71	71			43					
18-Jun-96		310		490	690			190					
28-Aug-96		466				923	344						
26-Sep-96		727		442	537	860	345	704					
01-Nov-96		589		452	615	802	363	562					
18-Nov-96		693		622	775	1,369	486						
17-Dec-96		684		604	674	1,336	445	515					
21-Jan-97		630		528	743	1,318	445	338					
19-Feb-97		540			510	1,260	457						
Mar-97	430	520		510	640	1,410	425	335					
May-97		412			662	1,260	389						
July-97		1,070			839	1,110	406						
Sep-97		618		830	798	944	404	169					
Jan-98	496	669		611	650	1,320	429	441					
Apr-98	215	325	187	328	435	734	258	206					
Jul-98	253	777		457	576		329	308					
Oct-98	492	270	256				317	144					
Dec-98									550	676	1,270	1,190	960
Jan-99	419	525			1,860								
Apr-99*	702	397	347	629	755	1,227	347	401	1,000	1,082	1,520	1,157	998

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX D-5 (page 1 of 4)
Groundwater Temperature (degr. C)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-29	MW-31	MW-32
21-Oct-93	15.0	11.4			15.6		14.4		12.1				10.6
07-May-94	7.2		7.7	8.9					9.7			7.5	6.9
18-Aug-94	13.0		13.6	13.4	11.2				12.7			13.4	10.8
30-Nov-95	14.0	14.8	15.6	16.1	13.9							15.2	
18-Mar-96													
18-Jun-96	5.0	14.7	15.1	18.6	17.7							18.4	
28-Aug-96	17.6	15.6	17.8							15.9			
26-Sep-96	12.2	12.9	15.6	15.3	14.7					1.7		14.0	
01-Nov-96	15.0	12.3	12.9	14.7	14.3					13.7		13.2	
18-Nov-96		11.3	13.1	12.9	9.9					11.1		11.9	
17-Dec-96	9.3	9.3	10.7	12.3	8.8					8.6		9.9	
21-Jan-97	9.4	8.0	8.4	10.8	10.0					7.0		7.5	
19-Feb-97	8.6	10.8	8.2	12.8	11.1	8.9				6.4		6.8	
Mar-97	7.8	6.9	7.7	9.4	9.4	4.7	8.3	8.8		5.9		7.0	
May-97	8.2	7.7	8.5	10.8	9.8	7.3				7.2		8.8	
July-97	10.2	10.9	12.0		11.3	9.2				11.1		13.3	
Sep-97	11.9	12.3	13.5	15.6	13.2	11.6			14.7	13.3		15.3	
Nov-97	9.9	11.2	12.2	13.7	10.9	9.5		11.2		10.0		11.8	
Jan-98	10.2	8.8	9.4	12.2	11.5	9.3	10.8	12.0	11.6	7.6		8.4	
Apr-98	9.6	9.6	9.6	13.8	13.0	9.6	10.6	12.5	13.7	8.4		9.3	8.9
Jul-98	13.9	14.1	13.3	16.1	15.2	13.0	15.8		14.1	13.1	12.7	15.5	13.3
Oct-98	15.6	14.1		14.5	17.1		16.5	13.4			12.3	15.6	
Dec-98									10.8				
Jan-99		9.6	11.1	11.3	13.0	10.4				6.5		9.9	10.7
Apr-99*	11.3	11.4	9.4	14.7	14.7	10.3	12.7	12.9	10.9	9.2		10.9	9.5

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX D-5 (page 2 of 4)
Groundwater Temperature (degr. C)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-33	MW-34	MW-35	MW-36	MW-49	MW-50	MW-51	MW-52	MW-53	MW-54	MW-55	MW-56	MW-57
21-Oct-93	14.7	16.7		12.5	16.1				13.0		9.9		
07-May-94	9.5	8.9		8.6		8.3			8.1		10.6		
18-Aug-94	13.3	17.6		11.5	14.1	13.4			13.4		12.8		13.7
30-Nov-95	12.6			13.1		14.9			14.1		13.9		
18-Mar-96													
18-Jun-96	16.7			15.0		17.6			18.3		16.2		
28-Aug-96	18.3	14.9	16.3	15.5		14.7		16.4	16.4			15.3	
26-Sep-96	14.3	15.9	14.7	13.6		13.4		15.8	14.7		11.9	15.2	
01-Nov-96	13.1	12.1	15.1	8.9		11.3		13.1	10.3		9.0	14.2	
18-Nov-96	12.3	9.1	9.9	9.8		11.3		9.0	10.8		9.5	11.4	
17-Dec-96	10.9	7.7	9.0	8.6		9.5		8.6	8.7		10.1	8.8	
21-Jan-97	11.0	7.1	9.0	9.2		7.7		8.3	7.5		9.3	7.4	
19-Feb-97	11.2	6.3		9.0		7.5		8.3	6.4		10.4	6.0	
Mar-97	10.4	7.3		8.2	8.2	7.3		5.4	7.3		10.3	6.3	8.9
May-97	11.5	9.2		9.8	13.1	7.6		8.2	8.5		10.0	9.3	9.5
July-97	11.2	15.5		9.7	12.2	13.0		14.5	12.9		12.9	13.7	10.8
Sep-97	13.2	20.2		13.2		13.6		17.4	16.0		5.9	15.2	13.5
Nov-97	11.4	7.3	8.9	8.0	11.2	11.7		6.6	11.5		11.1	9.8	10.5
Jan-98	11.5	6.2	9.3	9.4	9.8	8.6		7.5	8.2		10.2	7.3	11.6
Apr-98	11.6	9.7		9.5	9.7	9.5	9.6	10.4	10.4		5.9	9.4	10.8
Jul-98	14.3	20.1	16.0	12.0	15.3	15.1	18.4		15.0	16.4	15.3	16.4	15.5
Oct-98		15.1		13.7	15.9	14.9			15.0		13.2		16.7
Dec-98	13.0												
Jan-99				8.1							10.0		10.6
Apr-99*	12.6	21.0		11.8	8.7	10.7	9.1				16.5		11.7

Notes:
Blank indicates that well was not sampled.
* - Sampling occurred from April 27 through May 10, 1999.
The value indicated for MW-36 on th 18-Nov-96 measurement
is the average of two readings (9.8 and 9.8) on consecutive days.

APPENDIX D-5 (page 3 of 4)
Groundwater Temperature (degr. C)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-67	MW-68A	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74	MW-75	MW-76	MW-77
21-Oct-93	12.0			14.3		11.2			13.8	13.0		12.5	13.7
07-May-94	9.1					8.6		8.7	10.5	7.5	9.2	8.5	7.8
18-Aug-94	14.4			11.8		14.9		19.2	10.1	17.5		11.4	15.4
30-Nov-95	12.8					13.2	14.0	11.1	10.4		12.1	14.7	12.2
18-Mar-96								9.0					
18-Jun-96	19.0			18.4		18.4	17.1	16.1	15.2		18.2	14.8	
28-Aug-96						16.1	16.5						20.3
26-Sep-96	14.3			14.0		14.8	16.3	18.4	15.3		15.0	15.4	16.9
01-Nov-96	12.2			13.7		14.7	15.5		12.6		12.3	14.1	11.0
18-Nov-96	10.0			9.3		10.9	13.1	11.6	8.9		12.1	13.0	9.5
17-Dec-96	9.2			9.6		9.6	12.5	9.0	7.3		9.6	11.6	7.2
21-Jan-97	9.1			8.2		8.4	10.5	7.5	6.8		9.7	10.0	7.2
19-Feb-97	8.4			9.5		10.5	11.7	6.2	6.7				5.7
Mar-97	7.3	8.9	10.1	9.2	8.9	7.4	8.3	5.7	6.7		8.1	9.4	6.0
May-97	12.1			14.2		8.9	10.4	9.6	8.5				7.7
July-97	12.6			11.2		15.2	14.0	16.0	14.1				14.5
Sep-97	17.9			12.6		13.6	15.1	17.2	13.8			13.4	16.4
Nov-97	8.4			9.7		10.9	10.6	11.5	8.2			12.1	8.1
Jan-98	10.5	11.4	11.5	10.0	10.5	9.6	10.8	8.0	6.6		9.6	9.9	7.0
Apr-98	11.8	12.7		11.7		10.8	11.3	9.4	8.6	8.7	10.3	9.9	8.5
Jul-98	14.3	16.1		16.3		16.6	15.3	17.4	14.6	17.1	17.0	14.6	16.0
Oct-98		17.2		16.9						12.6	15.4	17.6	18.0
Dec-98	10.4					9.1	13.5						
Jan-99				13.2					4.7	5.6			8.3
Apr-99*	9.9	11.7		5.9		11.3	11.6	11.2	8.9	10.5	10.9		12.1

Notes:

Blank indicates that well was not sampled.

* - *Sampling occurred from April 27 through May 10, 1999.*

APPENDIX D-5 (page 4 of 4)
Groundwater Temperature (degr. C)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-78	MW-79	MW-81	MW-85	MW-86	MW-87	MW-88	MW-89	OW-1	OW-3	OW-4	OW-6	OW-8
21-Oct-93								13.3					
07-May-94		7.1		10.2	6.9			6.8					
18-Aug-94		15.7		14.4				13.9					
30-Nov-95		14.9		7.9	13.7			15.5					
18-Mar-96													
18-Jun-96		20.2		15.2	18.2			15.8					
28-Aug-96		19.2				16.7	19.2						
26-Sep-96		15.2		15.5	14.7	13.1	16.2	16.3					
01-Nov-96		12.2		10.8	14.9	13.7	14.0	16.5					
18-Nov-96		11.0		9.5	10.4	10.8	12.1	11.8					
17-Dec-96		9.0		8.2	9.6	10.7	8.3	6.1					
21-Jan-97		6.8		7.9	8.5	9.5	7.0	6.0					
19-Feb-97		6.9			7.2	9.7	6.7						
Mar-97	6.9	5.5		7.5	7.3	8.5	6.6	5.1					
May-97		6.7			7.8	9.1	8.9						
July-97		14.3			12.9	13.5	14.6						
Sep-97		16.3		14.2	15.9	15.8	16.9	16.8					
Nov-97		12.3			10.4	10.3	9.7	13.4					
Jan-98	8.8	8.0		7.9	7.5	10.4	7.7	8.1					
Apr-98	9.2	8.9	8.8	9.5	10.2	11.4	9.7	8.5					
Jul-98	14.8	19.9		14.5	16.6		16.9	16.9					
Oct-98	15.4	17.5	17.4				17.8	17.7					
Dec-98									14.4	12.5	13.0	11.1	13.0
Jan-99	10.2	8.7			7.3								
Apr-99*	10.6	11.4	10.9	9.0	10.7	12.4	11.1	10.3	12.3	11.3	10.8	12.1	11.4

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX D-6 (Page 1 of 4)
Groundwater Turbidity (NTU)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-29	MW-31	MW-32
21-Oct-93	64	107			6								0
07-May-94	182		178	12					8			3	9
18-Aug-94	159		7	8	1,000				9			6	2
30-Nov-95	16	16	15	17	17							7	
18-Mar-96	200	40	45	101	200							4	
18-Jun-96	71	33	8	20	131							10	
28-Aug-96	7,200	12	9							15			
26-Sep-96	7	2	8	17	49					2		2	
01-Nov-96	6	6	6	15	9					8		4	
18-Nov-96		8	5	16	6					2		2	
17-Dec-96	13	1	4	9	9					2		1	
21-Jan-97	30	0	1	21	9					0		5	
19-Feb-97	14	16	10	23	10	10				0		3	
Mar-97	100	10	7	8	0	0	1	268		2		4	
May-97	21	3	9	161	14	0				0		0	
July-97	36	6	7	106	50	2				1		6	
Sep-97	76	8	3	5	4	1			52	0		3	
Jan-98	89	2	2	51	70	2	0	2	246	1		0	
Apr-98	4	26	0	63	21	941	2	138	434	0		50	15
Jul-98	300	5	0	9	0	0	4		5	0	495	9	1
Oct-98	10	1		62	4		100	36			102	0	
Dec-98									92				
Jan-99		0	38	256	0	1				5		1	19
Apr-99*	7.5	0	0.2	131.9	0	2.3	0.52	74	151	0.5		0	0

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX D-6 (Page 2 of 4)
Groundwater Turbidity (NTU)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-33	MW-34	MW-35	MW-36	MW-49	MW-50	MW-51	MW-52	MW-53	MW-54	MW-55	MW-56	MW-57
21-Oct-93	83	86		0	670				0		60		
07-May-94	6	70		2		38			73		10		
18-Aug-94	210	2		0	45	1			8		0		10
30-Nov-95	7			7		15			17		17		
18-Mar-96	6			2	27	15			9		11		33
18-Jun-96	11			6		22			79		42		
28-Aug-96	10	67	200	2		11		200	35			3	
26-Sep-96	4	46	187	3		41		200	30		2	26	
01-Nov-96	6	4	21	3		5		200	10		5	34	
18-Nov-96	2	12	99	10		4		200	5		6	3	
17-Dec-96	2	12	69	0		2		102	4		26	4	
21-Jan-97	1	9	142	1		1		999	2		2	0	
19-Feb-97	10	2		10		5		280	44		15	4	
Mar-97	0	2		0	65	1		196	4		10	75	59
May-97	1	18		7	3	19		628	53		142	14	1
July-97	7	17		0	34	5		303	88		17	35	1
Sep-97	1	18		2		0		325	68		2	14	1
Jan-98	1	2	699	1	4	3		999	16		3	2	3
Apr-98	15	60		50	7	127	485				335	0	2
Jul-98	2	9	154	20	0	10	0		33	999		0	99
Oct-98		48		0	290	97			147		3		4
Dec-98	1												
Jan-99				5							0		0
Apr-99*	0	3.19		1.2	10	55	0				133		5

Notes:
Blank indicates that well was not sampled.
* - Sampling occurred from April 27 through May 10, 1999.
The value indicated for MW-36 on the 18-Nov-96 measurement
is the average of two readings (18.1 and 1.8) on consecutive days.

APPENDIX D-6 (Page 3 of 4)
Groundwater Turbidity (NTU)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-67	MW-68A	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74	MW-75	MW-76	MW-77
21-Oct-93	162			952		27			161	409		478	0
07-May-94	43					12		5	68	5	252	37	1
18-Aug-94	30			19		6		0	582	5		12	4
30-Nov-95	17					14	17	14	18		16	16	6
18-Mar-96	85			200		5	59	67	200		101	200	35
18-Jun-96	169			166		56	28	35	200		20	200	
28-Aug-96						52	194						57
26-Sep-96	4			5		7	3	3	200		3	200	3
01-Nov-96	4			10		8	7	3	200		7	29	5
18-Nov-96	3			5		6	23	3	200		2	70	3
17-Dec-96	16			8		18	12	1	93		2	15	1
21-Jan-97	53			2		70	2	11	467		0	15	0
19-Feb-97	2			363		10	13	1	514				2
Mar-97	7	16	4	18	8	5	10	5	999		0	12	1
May-97	10			43		1	0	1	511				3
July-97	1			320		74	66	3	141				6
Sep-97	5			745		461	2	1	170			40	30
Jan-98	3	6	0	35	1	0	5	14	999		5	9	1
Apr-98	184	124		24		18	0	2	165		11	3	2
Jul-98	5	150		50		5	0	0	372	0	2	30	0
Oct-98		2		999						799	340	55	150
Dec-98	179					175	1						
Jan-99				38					200	1			6
Apr-99*	130	777		0		0	0.7	0.47	11	0	935		0

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX D-6 (Page 4 of 4)
Groundwater Turbidity (NTU)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-78	MW-79	MW-81	MW-85	MW-86	MW-87	MW-88	MW-89	OW-1	OW-3	OW-4	OW-6	OW-8
21-Oct-93								72					
07-May-94		1,000		273	56			42					
18-Aug-94		1,000		9				0					
30-Nov-95		18		16	17			4					
18-Mar-96		200		26	144			28					
18-Jun-96		200		96	39			34					
28-Aug-96		16				27	30						
26-Sep-96		41		3	13	8	2	7					
01-Nov-96		8		5	8	12	4	7					
18-Nov-96		3		4	9	26	2	19					
17-Dec-96		2		1	3	12	2	2					
21-Jan-97		3		0	5	1	0	-10					
19-Feb-97		3			445	2	3						
Mar-97	1	10		5	7	2	50	2					
May-97		13			442	12	6						
July-97		3			10	22	6						
Sep-97		71		4	11	13	1	3					
Jan-98	2	9		1	21	2	0	3					
Apr-98	5	150		88	260	0	50	1					
Jul-98	14	0		2	2		0	2					
Oct-98	143	5	10				4	10					
Dec-98									4	141	166	524	71
Jan-99	17	40			990								
Apr-99*	3.8	0	0	3	29.5	0.9	0	1.3	0	0	13	50	4.2

Notes:

Blank indicates that well was not sampled.

* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX E

GROUNDWATER MICROBIOLOGICAL ANALYSES

Table #	Title
E-1	Groundwater PLFA Analytical Results
E-2	Groundwater Total Heterotrophic Bacteria Plate Counts
E-3	Groundwater Specific Heterotrophic Bacteria Plate Counts

TABLE E-1
Groundwater PFLA Analytical Results
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Parameter	Monitoring Well							
	MW-85				MW-1			
	March, 1996	June, 1996	December, 1996	March, 1997	March, 1996	June, 1996	December, 1996	March, 1997
Cell Count per mL	1.64E+05	1.20E+06	6.54E+04	2.60E+03	3.97E+05	1.05E+06	1.33E+05	1.37E+04
Growth Phase	stationary	log	stationary	stationary	stationary	log	log	stationary
Environmental Stress	none	none	none	none	none	low	none	none
Gram Negative Bacteria	predominant	predominant	predominant	predominant	predominant	predominant	predominant	predominant
Gram Positive Bacteria	some	some	none	some	some	some	some	some
Eukaryotes	significant	significant	significant	some	significant	significant	significant	some
Sulfate Reducing Bacteria	yes	yes	no	yes	yes	yes	yes	yes
Sulfate/Iron Reducing Bacteria	yes	yes	no	no	yes	yes	yes	yes
Fungi & Protozoa	yes	yes	yes	yes	yes	yes	yes	yes

Parameter	Monitoring Well							
	MW-9				MW-53			
	March, 1996	June, 1996	December, 1996	March, 1997	March, 1996	June, 1996	December, 1996	March, 1997
Cell Count per mL	5.21E+05	1.88E+06	2.29E+04	3.98E+03	8.59E+06	8.21E+06	2.46E+05	5.85E+04
Growth Phase	stationary	stationary	stationary	stationary	stationary	log	stationary	stationary
Environmental Stress	none	low	none	none	none	none	yes	yes
Gram Negative Bacteria	predominant	predominant	significant	some	predominant	predominant	predominant	significant
Gram Positive Bacteria	some	some	some	some	some	some	some	some
Eukaryotes	significant	some	predominant	some	some	some	significant	some
Sulfate Reducing Bacteria	yes	yes	yes	yes	yes	yes	yes	yes
Sulfate/Iron Reducing Bacteria	yes	yes	yes	yes	yes	yes	yes	yes
Fungi & Protozoa	yes	yes	yes	yes	yes	yes	yes	yes

Parameter	August, 1996										
	South							Central			
	MW-7	MW-8	MW-50	MW-53	MW-77	MW-79	MW-36	MW-33	MW-70	MW-71	MW-87
Cell Count per mL	3.90E+06	1.90E+04	8.30E+04	3.50E+06	6.30E+04	2.40E+05	2.10E+03	1.10E+05	2.20E+05	5.10E+05	1.50E+04
Growth Phase	stationary	stationary	stationary	log	stationary	stationary	stationary	stationary	stationary	stationary	stationary
Environmental Stress	none	none	none	none	none	none	none	none	none	none	yes
Gram Negative Bacteria	predominant	predominant	predominant	predominant	predominant	predominant	predominant	predominant	predominant	predominant	some
Gram Positive Bacteria	some	some	some	some	some	some	some	some	some	some	some
Eukaryotes	some	some	some	some	significant	significant	significant	some	some	some	predominant
Sulfate Reducing Bacteria	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	none
Sulfate/Iron Reducing Bacteria	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	none
Fungi & Protozoa	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Cell count per mL is an estimate of the total number of viable cells based on the quantity of phospholipid fatty acids (PLFA) measured in the sample.

TABLE E-2
Groundwater Total Heterotrophic Bacteria Plate Counts
Phase I Completion Report

Fomer Sinclair Refinery Superfund Site (OU2), Wellsville, NY

	Mean Plate Count Values (colony forming units/mL)					
	Apr-96	Jun-96	Jul-96	Aug-96	Dec-96	Mar-97
MW-1	8.10E+04	7.40E+03			4.83E+05	6.00E+03
MW-7	3.00E+04		5.00E+03	4.67E+03	7.83E+06	1.10E+03
MW-8	1.82E+04	8.40E+03		5.17E+05	1.02E+06	2.20E+04
MW-9	1.01E+04	1.90E+03			6.83E+06	8.50E+03
MW-10	1.04E+05	2.80E+02			4.00E+07	6.60E+03
MW-20		8.70E+03				
MW-29		2.10E+05				
MW-31	2.66E+04	1.70E+02			8.83E+05	6.50E+03
MW-33	2.29E+04	4.00E+02		6.57E+03	8.50E+05	2.02E+04
MW-36	1.19E+05	2.50E+04		2.22E+04	1.30E+08	2.00E+05
MW-49	1.31E+05					8.50E+04
MW-50	5.40E+04	2.70E+04		3.00E+04	5.83E+06	1.99E+03
MW-53	2.54E+05	6.10E+04		1.45E+05	5.83E+06	5.50E+03
MW-55	4.77E+03	3.60E+03			6.83E+06	7.83E+02
MW-57	4.03E+03					6.83E+04
MW-67	8.37E+03	2.50E+03			1.28E+06	9.00E+03
MW-69A	8.03E+04	3.20E+03			4.33E+05	1.52E+04
MW-70	2.05E+05			8.33E+04	1.08E+07	4.67E+04
MW-71	1.90E+04	2.20E+03		4.17E+04	9.50E+05	2.00E+04
MW-72	4.90E+04	4.80E+04			9.17E+06	3.50E+04
MW-73	1.72E+03	2.60E+03			4.33E+06	3.33E+03
MW-75	8.30E+03	1.10E+03			4.17E+06	4.17E+04
MW-76	5.17E+04	7.50E+02			7.83E+06	1.23E+04
MW-77	1.06E+06	3.60E+03		1.83E+04	1.17E+08	4.50E+05
MW-79	7.73E+04			5.67E+03	5.00E+06	7.17E+03
MW-85	7.87E+03	4.30E+05			5.83E+07	9.50E+03
MW-86	6.77E+04		4.10E+06		5.33E+06	6.67E+04
MW-87				4.00E+03		
MW-89	5.83E+04	5.30E+03			1.15E+06	2.18E+05

Reported values are a estimate of the number viable heterotrophic bacteria capable of forming colonies on a nutrient medium per mL of groundwater sampled.

TABLE E-3
Groundwater Specific Heterotrophic Bacteria Plate Counts (cfu/ml)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, NY

Well #	Sampling Date	BTEX Degraders	Nitrobenzene Degraders
MW-10	9/18/97	NA	100 U
MW-11	9/16/97	100 U	NA
MW-27	9/18/97	1,400	180
MW-36	9/17/97	100 U	NA
MW-49	9/18/97	870	NA
MW-50	9/17/97	2,200	NA
MW-52	9/17/97	2,000	NA
MW-53	9/18/97	360	NA
MW-55	9/17/97	100 U	NA
MW-57	9/18/97	100 U	NA
MW-67	9/16/97	100 U	100 U
MW-69A	9/18/97	950	NA
MW-70	9/18/97	250	190
MW-71	9/17/97	100 U	100 U
MW-72	9/19/97	3,000	NA
MW-73	9/19/97	1,900	NA
MW-76	9/16/97	140	NA
MW-77	9/17/97	1,600	NA

Notes:

U - Compound not detected using detection limit shown

NA - Not Anaylzed

APPENDIX F

GROUNDWATER BTEX ANALYTICAL RESULTS

Table #	Title
F-1	Groundwater Benzene Concentrations
F-2	Groundwater Toluene Concentrations
F-3	Groundwater Ethylbenzene Concentrations
F-4	Groundwater Total Xylene Concentrations
F-5	Groundwater Total BTEX Concentrations

TABLE F-1 (page 1 of 2)
Groundwater Benzene Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-29	MW-30	MW-31	MW-32	MW-33
01-Mar-85	ND	100	54	130	760	140									
12-Dec-86							106		48	ND	ND	ND	5	8	330
29-Nov-88	5 U	7		100	620	51			5 U	5 U			5U	5 U	81
01-Mar-93	5 U			400		13			120	5 U		5 U	28		750
01-Jul-93	5 U	13	88	180	330	18	220	390	49	5 R	5 U	5 U	18	5 U	84
22-Oct-93	5 U	9	66		350				31					2	63
20-Aug-94	5 U	33	28	190	260				32				14	5 U	6
30-Nov-95	4 U	27	20	137	39								52		6
18-Mar-96	4 U	21	27	130	75								57		4 U
20-Jun-96	4 U	32	23	133	84								35		4
29-Aug-96		8	12							1					60
18-Dec-96	2	15	6	6	30					2 U			11		3
Mar-97	3	18	6	10	25	4.4 U	182	16		4			9		4.4 U
Sep-97	5 U	5 U	5 U	5 U	29	5 U			11	5 U			5		5 U
Apr-98	5U	10	5U	8	44	5U	180	140	39	5U			9	5	5U
Jul-98		8	5U	10	16	5U	68		30	5U			5	5U	5U
Oct-98	5U	5U		5U	19		150	28J					5U		
Dec-98									9						5U
Jan-99		11	5U	5U	5U	5U				5U			5U	5U	
Apr-99*	1U	15	4.4	1.8	24	2.0	110	14	72	1U			2.2	12	1.4

Sample Date	MW-34	MW-35	MW-36	MW-49	MW-50	MW-51	MW-52	MW-53	MW-54	MW-55	MW-56	MW-57	MW-67	MW-68A
01-Mar-85														
12-Dec-86	ND	130	ND	420	180	15	140	110	ND	61	15	530		
29-Nov-88		200	4		160	95	1,200	96	5 U	11		630		
01-Mar-93	5 U	210	23		160	25,000 U	1,500	66		57		430		
01-Jul-93	5 U	190	18	240	110	22	1,500	99	5 U	45	11	640	5 U	430
22-Oct-93	5 U		18	240				90		36			5 U	
20-Aug-94	5 U		7	170	48			120		77		150	5 U	
30-Nov-95			34		148			81		42			2	
18-Mar-96			25	204	149			141		47		253	3	
20-Jun-96			26		144			93		59			4	
29-Aug-96	2	161	25		91		1,020	56			10			
18-Dec-96	3		26		96		1,260	41		46	13		7	
Mar-97	1		24	164	101		1,210	48		45	9	149	8	265
Sep-97	14		18	160	62		890	35		29	6	210	5 U	
Apr-98	14		23	200	72	23	910	27		35	7	210	20	110
Jul-98	7		19	190	50	23		26		31	5U	140	20	56
Oct-98	5U		26	180	27			15		14		100		18
Dec-98													5U	
Jan-99			26							29		110		
Apr-99*	10		32	170	58	32				27		100	30	29

Notes:
Blank indicates that well was not sampled.
ND - Compound not detected (Detection Limit Unavailable)
U - Compound not detected using detection limit shown
J - estimated value
R - Results Invalid
* - Sampling occurred from April 27 through May 10, 1999.

Groundwater Benzene Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74	MW-75	MW-76	MW-77	MW-78	MW-79	MW-80
01-Mar-85														
12-Dec-86														
29-Nov-88														
01-Mar-93														
01-Jul-93	310	470	480	53	95	200	91	5 U	5 R	23	71	270	62	140
22-Oct-93		560			19		130	5 U	5 U	5	140			
20-Aug-94		310		46	98	160	180	5 U	5 U	22	75		44	
30-Nov-95				28	16	186	160		20 U	10	166		53	
18-Mar-96		230		47	16	203	231		4 U	28	60		47	
20-Jun-96		481		66	9	196	170		4 U	4	34		24	
29-Aug-96				56	2						19		10	
18-Dec-96		33		61	4.4 U	187	560		4.4 U	4	34		21	
Mar-97	149	103	63	37	4.4 U	166	579		4.4 U	4	34	38	22	
Sep-97		75		86	5 U	190	100		5 U	5	14		6	
Apr-98		200		34	5U	150	390		5U	5U	26	21	37	
Jul-98		79		27	5U	140	450		5U	5U	28	16	5U	
Oct-98		52							5U	5	5U	50	5U	
Dec-98				240	5U									
Jan-99		33					110				5U	22	5U	
Apr-99*		35		34	1U	170	280		1U		19	20	10	

Sample Date	MW-81	MW-82	MW-83	MW-84	MW-85	MW-86	MW-87	MW-88	MW-89	OW-1	OW-3	OW-4	OW-6	OW-8
01-Mar-85														
12-Dec-86														
29-Nov-88														
01-Mar-93														
01-Jul-93	5 U	51	230	200	91	210	5 U	35	28					
22-Oct-93									29					
20-Aug-94					360	10			63					
30-Nov-95					162	84			71					
18-Mar-96					207	40 U			39					
20-Jun-96					111	37			27					
29-Aug-96							2	23						
18-Dec-96					189	44	2	44	17					
Mar-97					135	13	0.2 U	38	19					
Sep-97					57	69	5 U	20	13					
Apr-98	25U				100	30	5U	25	15					
Jul-98					63	13		16	13					
Oct-98	5U							11	5U					
Dec-98										73	37	5U	36	150
Jan-99						6								
Apr-99*	1U				67	34		24	1.6	28	22	1U	28	130

Notes:
Blank indicates that well was not sampled.
ND - Compound not detected (Detection Limit Unavailable)
U - Compound not detected using detection limit shown
R - Results Invalid
* - Sampling occurred from April 27 through May 10, 1999.

TABLE F-2 (page 1 of 2)
Groundwater Toluene Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-29	MW-30	MW-31	MW-32	MW-33
01-Mar-85	ND	8	11	7	81	19									
12-Dec-86							18		ND	ND	ND	ND	ND	ND	ND
29-Nov-88	1 U	1 U		16	84	1 U			25	1 U			1 U	1 U	3
01-Mar-93	5 U			42		8			14	ND		5 U	7		12
01-Jul-93	5 U	5 U	21	17	65	8	84	130	16	5 U	5 U	5 U	5 U	1	3
22-Oct-93	5 U	3	16		41				14					2	4
20-Aug-94	5 U	4	8	31	37				14				3	1	2
30-Nov-95	6 U	5	6	21	9								10		7
18-Mar-96	11	5	5	6	18								12		5
20-Jun-96	6 U	6	12	5	22								9		3
29-Aug-96		6	5												2
18-Dec-96	3	5	2	2	14								4		2
Mar-97	3	4	6 U	6 U	10	1	54	6					6 U		6 U
Sep-97	5 U	5 U	5 U	5 U	14	5 U			22	5 U			5 U		5 U
Apr-98	5U	6	5U	9	16	5U	65	70	10	5U			5U	5U	5U
Jul-98		5U	5U	5U	10U	5U	13		11	5U			5U	5U	5U
Oct-98	5U	5U		5U	5U		16	6.2J					5U		
Dec-98									35						5U
Jan-99		7	5U	5U	5U	5U				5U			5U	5U	
Apr-99*	5U	5U	5U	5U	6	5U	24	5U	24	5U			5U	5U	5U

Sample Date	MW-34	MW-35	MW-36	MW-49	MW-50	MW-51	MW-52	MW-53	MW-54	MW-55	MW-56	MW-57	MW-67	MW-68A
01-Mar-85														
12-Dec-86	ND	18	28	ND	ND	ND	7	ND	ND	ND	2	530		
29-Nov-88		49	3		23	1 U	1 U	17	1 U	5		390		
01-Mar-93	5 U	70	12		28	25,000 U	130	21		29		200		
01-Jul-93	5 U	68	9	28	21	5 R	140	50 U	5U	25	5 R	300	5 U	54
22-Oct-93	3		7	24				20		15			5 U	
20-Aug-94	5 U		5	23	23			18		14		93	5 U	
30-Nov-95			10	24	22			15		15			2	
18-Mar-96			8		23			21		19		136	3	
20-Jun-96			31		23			14		27			7	
29-Aug-96			4		12			11						
18-Dec-96			8		14			6		19			2	
Mar-97			9	20	15			396		18		18	6 U	73
Sep-97	5 U		6	25 U	8		91	5 U		13	5 U	23	5 U	
Apr-98	20		9	25	11	5U	97	6		17	5	120	5U	28
Jul-98	5		7	20	9	5U		5		13	5U	64	5U	21
Oct-98	5U		9	26	5U			5U		5		18		5U
Dec-98													5U	
Jan-99			7							16		9		
Apr-99*	15		9	20	7	5U				8		10	5U	5U

Notes:
Blank indicates that well was not sampled.
ND - Compound not detected (Detection Limit Unavailable)
U - Compound not detected using detection limit shown
J - estimated value
R - Results Invalid
* - Sampling occurred from April 27 through May 10, 1999.

TABLE F-2 (page 2 of 2)
Groundwater Toluene Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74	MW-75	MW-76	MW-77	MW-78	MW-79	MW-80
01-Mar-85														
12-Dec-86														
29-Nov-88														
01-Mar-93														
01-Jul-93	27	220	270	50	15	36	730	5 U	5 R	10 U	31	88	31	10 U
22-Oct-93		200			6		670	5 U	5 U	10 U	34			
20-Aug-94		160		55	6	32	840	5 U	5 U	4	25		22	
30-Nov-95				66	3	41	1,150		30 U	4	42		17	
18-Mar-96		77		109	2	46	2,580		3	5	26		13	
20-Jun-96		165		91	3	80	1,040		2	5	31		11	
29-Aug-96				83	7						11		4	
18-Dec-96		9		108	6 U	42	710		1	2	15		4	
Mar-97	40	49	27	74	6 U	41	604		6 U	6 U	30 U	26	6	
Sep-97		46		62	5 U	39	170		5 U	5 U	13 U		5 U	
Apr-98		89		56	8	32	430		5U	5U	11	11	10	
Jul-98		39		54	5U	31	370		5U	5U	5U	10	5U	
Oct-98		16							5U	5U	11	16	5U	
Dec-98				35	5U									
Jan-99		8					210				25U	6	5U	
Apr-99*		9		73	10U	38	420		5U		13U	6	5U	

Sample Date	MW-81	MW-82	MW-83	MW-84	MW-85	MW-86	MW-87	MW-88	MW-89	OW-1	OW-3	OW-4	OW-6	OW-8
01-Mar-85														
12-Dec-86														
29-Nov-88														
01-Mar-93														
01-Jul-93	5 U	17	30	17	43	60	5 U	5 R	19					
22-Oct-93									21					
20-Aug-94					73	8			14					
30-Nov-95					38	24			12					
18-Mar-96					45	60 U			9					
20-Jun-96					31	27			11					
29-Aug-96							3							
18-Dec-96					36	12			3					
Mar-97					32	9			6 U					
Sep-97					30	11	5 U	5 U	5 U					
Apr-98	25U				24	10	5U	5U	5U					
Jul-98					18	5U		13U	5U					
Oct-98	5U							5U	5U					
Dec-98										13	57	5U	27	5U
Jan-99						5U								
Apr-99*	5U				24	10		5U	5U	5U	75	5U	18	5U

Notes:
Blank indicates that well was not sampled.
ND - Compound not detected (Detection Limit Unavailable)
U - Compound not detected using detection limit shown
J - estimated value
R - Results Invalid
* - Sampling occurred from April 27 through May 10, 1999.

TABLE F-3 (page 1 of 2)
Groundwater Ethylbenzene Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-29	MW-30	MW-31	MW-32	MW-33
01-Mar-85	ND	ND	140	7	44	24									
12-Dec-86							37		ND	7	ND	ND	ND	44	ND
29-Nov-88	5 U	5 U		9	83	30			5 U	46			13	5 U	1
01-Mar-93	5 U			22		38			2	30		5 U	32		9
01-Jul-93	1	5 R	250	7	140	2	340	220	5 U	30	5 U	5 U	15	5 U	5 U
22-Oct-93	5 U	10 U	210		100				1					2	10 U
20-Aug-94	5 U	7	100	19	90				5 U				19	5 U	5 U
30-Nov-95	7 U	40 U	91	15	18								59		6
18-Mar-96	7	4	88	5	21								82		7.2 U
20-Jun-96	5	10	115	9	40								47		10
29-Aug-96		3	45												7.2 U
18-Dec-96	5	7.2 U	44	7.2 U	12								29		7.2 U
Mar-97	3	7.2 U	50	7.2 U	11	12	176	15					43		7.2 U
Sep-97	5 U	5 U	26	17	10	5 U			5 U	21			21		5 U
Apr-98	5U	5	25	13	17	13	230	94	9	20			44	6	5U
Jul-98		5U	27	37	13	8	20		5U	18			22	5U	5U
Oct-98	5U	5U		31	5U		11	13J					10		
Dec-98									5U	9				5U	5U
Jan-99		8	17	6	5U	8							11		
Apr-99*	5U	5U	41	5U	5U	5U	32	5U	5U	19			18	5U	5U

Sample Date	MW-34	MW-35	MW-36	MW-49	MW-50	MW-51	MW-52	MW-53	MW-54	MW-55	MW-56	MW-57	MW-67	MW-68A
01-Mar-85														
12-Dec-86	ND	ND	ND	ND	160	ND	6	830	26	ND	35	110		
29-Nov-88		4	5 U		170	8	5 U	50	51	11		5 U		
01-Mar-93	5 U	13	35		340	25,000 U	110	430		120		280		
01-Jul-93	5 U	15	36	10 U	190	5 U	86	350	5 U	63	46	430	5 U	220
22-Oct-93	3		26	25 U				310		14			5 U	
20-Aug-94	5 U		20	5 U	100			240		5 U		140	5 U	
30-Nov-95			7 U		180			150		49			7	
18-Mar-96			11	36 U	263			406		53		183	7.2 U	
20-Jun-96			31		237			230		90			10	
29-Aug-96			17		58			210						
18-Dec-96			5		120			71		55			7.2 U	
Mar-97			13	7.2 U	193			216		50		36 U	7.2 U	117
Sep-97	5 U		13	25 U	13		110	58		9	19	10 U	5 U	
Apr-98	18		12	10U	130	13	130	67		40	26	96	6	67
Jul-98	5U		10	5U	48	5U		54		46	15	24	5	36
Oct-98	5U		8	5U	5U			18		5U		11		5
Dec-98													5U	
Jan-99			5U							28		5U		
Apr-99*	14		8	5U	150	6				32		5U	5U	5U

Notes:
Blank indicates that well was not sampled.
ND - Compound not detected (Detection Limit Unavailable)
U - Compound not detected using detection limit shown
R - Results invalid
J - estimated value
* - Sampling occurred from April 27 through May 10, 1999.

TABLE F-3 (page 2 of 2)
Groundwater Ethylbenzene Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74	MW-75	MW-76	MW-77	MW-78	MW-79	MW-80
01-Mar-85														
12-Dec-86														
29-Nov-88														
01-Mar-93														
01-Jul-93	35	580	460	42	5 U	3	510	5 U	5 R	83	570	360	390	240
22-Oct-93		560			10 U		620	5 U	5 U	13	620			
20-Aug-94		330		44	5 U	3	490	5 U	5 U	14	390		290	
30-Nov-95				36	7 U	8	653		4 U	4	516		197	
18-Mar-96		178		51	7.2 U	18 U	920		7.2 U	60	334		202	
20-Jun-96		360		44	5	16	359		7	23	268		106	
29-Aug-96				38	3						129		52	
18-Dec-96		7.2 U		49	7.2 U	6	698		7.2 U	7.2 U	262		47	
Mar-97	41	192	87	35	7.2 U	4	539		7.2 U	7	290	137	72	
Sep-97		170		55	5 U	5	320		5 U	5 U	160		22	
Apr-98		200		33	9	6	410		5	10	210	36	75	
Jul-98		130		26	5U	5U	380		5U	5	190	18	9	
Oct-98		95							50U	5U	220	56	33	
Dec-98				33	5U									
Jan-99		72					320				130	19	24	
Apr-99*		89		34	10U	5U	450		25U		130	50	25	

Sample Date	MW-81	MW-82	MW-83	MW-84	MW-85	MW-86	MW-87	MW-88	MW-89	OW-1	OW-3	OW-4	OW-6	OW-8
01-Mar-85														
12-Dec-86														
29-Nov-88														
01-Mar-93														
01-Jul-93	49	320	10 U	17	14	31	5 U	5 R	190					
22-Oct-93									210					
20-Aug-94					200	32			150					
30-Nov-95					10	73			137					
18-Mar-96					8	72 U			160					
20-Jun-96					5	30			135					
29-Aug-96							6							
18-Dec-96					5	28			64					
Mar-97					5.6 J	22			94					
Sep-97					19	31	5 U	5 U	83					
Apr-98	28				7	44	6	9	57					
Jul-98					5U	25		13U	39					
Oct-98	11							5U	19					
Dec-98										15	16	5U	16	5U
Jan-99						16								
Apr-99*	23				5	12		5U	9	6.6	27	5U	11	5.9

Notes:
Blank indicates that well was not sampled.
ND - Compound not detected (Detection Limit Unavailable)
U - Compound not detected using detection limit shown
J - estimated value
R - Results invalid
* - Sampling occurred from April 27 through May 10, 1999.

TABLE F-4 (page 1 of 2)
Groundwater Total Xylene Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-29	MW-30	MW-31	MW-32	MW-33
01-Mar-85	ND	15	2,536	199	640	205									
12-Dec-86							200		ND	34	ND	ND	ND	170	150
29-Nov-88	5 U	1		160	440	58			10	220			42	5 U	81
01-Mar-93	5 U			350		9			9	170		5 U	86		320
01-Jul-93	5 U	12	730	140	580	7	1,200	910	7	110	5 U	5 U	37	5 U	71
22-Oct-93	2	4	460		160				8					9	43
20-Aug-94	2	6	230	270	210				8				42	1	28
30-Nov-95	10	100 U	67	139	62								145		65
18-Mar-96	52	8	88	26	61								204		34
20-Jun-96	12	31	86	37	102								98		29
29-Aug-96		18	24												10
18-Dec-96	24	8	10	5	51								20		17
Mar-97	11	8	16	3	27	5	587	36					23		4
Sep-97	5 U	8	11	10	23	5 U			12	11			8		5 U
Apr-98	8	26	15	57	40	7	755	402	27	43			21	28	11
Jul-98		8	14	27	49	13	85		10	19			28	6	6
Oct-98	5U	5U		5U	5U		59	5U					5U		
Dec-98									10						5U
Jan-99		42	11	24	5U	7				5U			11	22	
Apr-99*	5U	17	9	5U	5	5U	62	5U	6	27			5U	7	8

Sample Date	MW-34	MW-35	MW-36	MW-49	MW-50	MW-51	MW-52	MW-53	MW-54	MW-55	MW-56	MW-57	MW-67	MW-68A
01-Mar-85														
12-Dec-86	ND	170	ND	ND	270	ND	170	1,100	52	ND	23	ND		
29-Nov-88		320	5 U		120	19	440	74	84	5 U		1,500		
01-Mar-93	5 U	370	150		550	25,000 U	650	680		370		1,800		
01-Jul-93	5 U	350	150	67	260	10	730	520	38	260	12	3,000	5 U	340
22-Oct-93	19			53				480		62			5 U	
20-Aug-94	5 U		120	42 U	300			380		150		980	1	
30-Nov-95			37		214			226		115			3	
18-Mar-96			76	59	388			510		176		1,356	14	
20-Jun-96			181		442			289		280			45	
29-Aug-96			65		32			285						
18-Dec-96			53		34			26		152			5	
Mar-97			92	45	47			988		154		59	10 U	499
Sep-97	21		67	33	32		470	20		57	5	74	5 U	
Apr-98	93		71	58	45	26	650	42		136	32	590	16	104
Jul-98	21		62	54	28	15		36		130	5	289	24	61
Oct-98	5U		43	31	6			37		10		118		5U
Dec-98													5U	
Jan-99			12							78		12		
Apr-99*	62		41	26	17	5				36		14	5U	5U

Notes:

Blank indicates that well was not sampled.

ND - Compound not detected (Detection Limit Unavailable)

U - Compound not detected using detection limit shown

J - estimated value

R - Results invalid

* - Sampling occurred from April 27 through May 10, 1999.

TABLE F-4 (page 2 of 2)
Groundwater Total Xylene Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74	MW-75	MW-76	MW-77	MW-78	MW-79	MW-80
01-Mar-85														
12-Dec-86														
29-Nov-88														
01-Mar-93														
01-Jul-93	140	2,900	2,400	260	17	110	3,200	5 U	52 U	190	2,900	1,300	1,200	280
22-Oct-93		2,700			8		3,300	5 U	5 U	33	3,300			
20-Aug-94		1,600		250	6 U	94	3,300	5 U	5 U	37	1,400		780	
30-Nov-95				121	13	140	4,416		100 U	17	2,987		304	
18-Mar-96		615		287	6	135	6,430		8	76	1,898		328	
20-Jun-96		1,410		258	23	212	2,750		18	30	1,203		93	
29-Aug-96				241	19						564		43	
18-Dec-96		103		260	10 U	137	4,512		11	4	987		21	
Mar-97	204	579	206	235	10 U	146	3,154		3	6	1,361	443	23	
Sep-97		374		345	6	120	1,800		5 U	5 U	720		8	
Apr-98		762		175	43	101	2,350		17	8	995	77	58	
Jul-98		330		155	12	89	2,140		6	10	890	58	21	
Oct-98		103							50U	5U	1,126	59	7	
Dec-98				160	5U									
Jan-99		94					1,959				600	24	9	
Apr-99*		99		168	8	105	2,510		25U		600	24	5U	

Sample Date	MW-81	MW-82	MW-83	MW-84	MW-85	MW-86	MW-87	MW-88	MW-89	OW-1	OW-3	OW-4	OW-6	OW-8
01-Mar-85														
12-Dec-86														
29-Nov-88														
01-Mar-93														
01-Jul-93	34	1,200	55	39	310	390	5 U	9	520					
22-Oct-93									700					
20-Aug-94					1,200	220			290					
30-Nov-95					263	472			82					
18-Mar-96					216	59			183					
20-Jun-96					115	172			223					
29-Aug-96							8							
18-Dec-96					119	124			80					
Mar-97					113	142			117					
Sep-97					151	172	5 U	5 U	54					
Apr-98	30				95	169	20	18	68					
Jul-98					70	146		13U	16					
Oct-98	5U							5U	9					
Dec-98										8	20	5U	71	18
Jan-99						70								
Apr-99*	7				100	35		5U	5	5U	32	5U	9.9	40

Notes:
Blank indicates that well was not sampled.
ND - Compound not detected (Detection Limit Unavailable)
U - Compound not detected using detection limit shown
J - estimated value
R - Results Invalid
* - Sampling occurred from April 27 through May 10, 1999.

TABLE F-5 (page 1 of 2)
Groundwater Total BTEX Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-29	MW-30	MW-31	MW-32	MW-33
01-Mar-85	ND	123	2,741	344	1,525	388									
12-Dec-86							361		48	41	ND	ND	5	222	480
29-Nov-88	ND	8		285	1,227	139			35	266			55	ND	166
01-Mar-93	ND			814		68			145	200		ND	153		1,091
01-Jul-93	1	25	1,089	344	1,115	35	1,844	1,650	72	140	ND	ND	70	1	158
22-Oct-93	2	16	752		651				54					15	110
20-Aug-94	2	50	366	510	597				54				78	2	36
30-Nov-95	10	32	184	311	129								266		84
18-Mar-96	70	37	208	167	176								355		39
20-Jun-96	17	79	236	184	248								188		45
28-Aug-96		35	86							1					72
17-Dec-96	33	28	61	12	107					ND			64		22
Mar-97	20	30	72	14	73	18	998	73		4			76		4
Sep-97	ND	8	37	27	76	ND			45	33			34		ND
Apr-98	8	47	40	87	117	20	1,230	706	85	63			74	39	11
Jul-98		16	41	74	78	21	186		51	37			55	6	6
Oct-98	ND	ND		31	19		236	47					10		
Dec-98									54						ND
Jan-99		69	28	30	ND	15				9			22	22	
Apr-99*	ND	32	54	1.8	35	2	248	14	102	46			20	19	9

Sample Date	MW-34	MW-35	MW-36	MW-49	MW-50	MW-51	MW-52	MW-53	MW-54	MW-55	MW-56	MW-57	MW-67	MW-68A
01-Mar-85														
12-Dec-86	ND	318	28	420	610	15	322	2,040	78	61	75	1,170		
29-Nov-88		573	7		473	122	1,640	237	135	27		2,520		
01-Mar-93	ND	663	220		1,078	ND	2,390	1,197		576		2,710		
01-Jul-93	ND	623	213	335	581	32	2,456	969	38	393	69	4,370	ND	1,044
22-Oct-93	25		51	317				900		127			ND	-
20-Aug-94	ND		152	193	471			758		241		1,363	1	
30-Nov-95			81	24	563			472		222			14	
18-Mar-96			120	263	823			1,078		294		1,928	19	
20-Jun-96			269		846			627		455			67	
28-Aug-96	2	161	112		192		1,020	562			10			
17-Dec-96	3		92		264		1,260	144		272	13		14	
Mar-97	1		137	228	356		1,210	1,648		266	9	226	15	954
Sep-97	35		105	193	53		1,561	113		108	30	307	ND	
Apr-98	145		116	283	258	62	1,787	142		228	70	1,016	42	309
Jul-98	33		98	264	135	38		121		220	20	517	49	174
Oct-98	ND		86	237	33			70		29		247		23
Dec-98													ND	
Jan-99			45							151		131		
Apr-99*	101		89	216	232	43				103		124	30	29

Notes:
Blank indicates that well was not sampled.
ND - Compound not detected. See Tables B.2 through B.5 for detection limits of individual compounds.
Shaded values are for wells where quarterly sampling and analysis is performed for benzene only. Values represent benzene concentrations only.
* - Sampling occurred from April 27 through May 10, 1999.

TABLE F-5 (page 2 of 2)
Groundwater Total BTEX Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74	MW-75	MW-76	MW-77	MW-78	MW-79	MW-80
01-Mar-85														
12-Dec-86														
29-Nov-88														
01-Mar-93														
01-Jul-93	512	4,170	3,610	405	127	349	4,531	ND	ND	296	3,572	2,016	1,683	660
22-Oct-93		4,020			33		4,720	ND	ND	51	4,094			
20-Aug-94		2,400		395	104	289	4,810	ND	ND	77	1,890		1,136	
30-Nov-95				250	33	374	6,379		ND	35	3,711		571	
18-Mar-96		1,100		493	24	384	10,161		10	169	2,338		590	
20-Jun-96		2,416		459	40	504	4,319		26	61	1,534		234	
28-Aug-96				417	31						723		110	
17-Dec-96		145		477	ND	371	6,480		12	10	1,298		92	
Mar-97	434	922	382	379	ND	358	4,876		3	17	1,684	644	123	
Sep-97		665		548	6	354	2,390		ND	5	894		36	
Apr-98		1,251		298	60	289	3,580		22	18	1,242	145	179	
Jul-98		578		262	12	260	3,340		6	15	1,108	102	30	
Oct-98		266							ND	5	1,357	181	40	
Dec-98				468	ND									
Jan-99		207					2,599				730	71	33	
Apr-99*		232		309	8	313	3,660		ND		749	100	35	

Sample Date	MW-81	MW-82	MW-83	MW-84	MW-85	MW-86	MW-87	MW-88	MW-89	OW-1	OW-3	OW-4	OW-6	OW-8
01-Mar-85														
12-Dec-86														
29-Nov-88														
01-Mar-93														
01-Jul-93	83	1,588	315	273	458	691	ND	44	757					
22-Oct-93									960					
20-Aug-94					1,833	270			517					
30-Nov-95					473	653			302					
18-Mar-96					475	59			391					
20-Jun-96					262	265			395					
28-Aug-96							19	23						
17-Dec-96					349	209	2	44	163					
Mar-97					286	185	ND	38	230					
Sep-97					257	277	ND	20	150					
Apr-98	58				225	252	26	52	145					
Jul-98					151	184		16	68					
Oct-98	11							11	28					
Dec-98										128	240	ND	150	168
Jan-99						92								
Apr-99*	30				196	91		24	16	40	173	ND	107	176

__Notes:__
Blank indicates that well was not sampled.
ND - Compound not detected. See Tables B.2 through B.5 for detection limits of individual compounds.
Shaded values are for wells where quarterly sampling and analysis is performed for benzene only. Values represent benzene concentrations only.
* - Sampling occurred from April 27 through May 10, 1999.

APPENDIX G

GROUNDWATER METALS ANALYTICAL RESULTS

Table #	Title
G-1	Groundwater Total Arsenic Concentrations
G-2	Groundwater Dissolved Arsenic Concentrations
G-3	Groundwater Total Iron Concentrations
G-4	Groundwater Dissolved Iron Concentrations
G-5	Groundwater Total Chromium Concentrations
G-6	Groundwater Dissolved Chromium Concentrations
G-7	Groundwater Total Lead Concentrations
G-8	Groundwater Dissolved Lead Concentrations

TABLE G-1 (page 1 of 2)
Groundwater Total Arsenic Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-29	MW-30	MW-31	MW-32	MW-33
1-Mar-85	5 U	12	29	8	110	110									
12-Dec-86							35		25	6	22	15	28	51	30
29-Nov-88	10 U	155		30	248	884			544	170			217	79	365
1-Mar-93	10 U			23		106			61	15		53	170		390
1-Jul-93	10 U	169	51	28	95	125	204	165	10 U	225	49	40	110	41	116
22-Oct-93	10 U	120	62		104				70					59	173
20-Aug-94	10 U		59	29	354				65				231	59	666
30-Nov-95	4	20	14	20	170								99		140
18-Mar-96	8 U	20	33	15	170								89		150
20-Jun-96	8 U	28	18	11	140								96		110
29-Aug-96		27	32							28					110
18-Dec-96	8 U	17	39	12	140					9			79		120
Mar-97	8 U	17	43	7	140	74	140	130		5			63		130
Sep-97	10 U	26	70	10 U	120	154			53	10 U			89		125
Apr-98	12	28	67	12	133	85	158	146	85	10 U			77	41	135
Jul-98		29	63	15	129	33	124			12			86	49	118
Oct-98	21	66		71	146		191						93		
Dec-98									95						140
Jan-99		28	30	30	126	45				16			75	52	
Apr-99*	10U	28	50	10U	128	134	93	117	139	10U			82	48	285

Sample Date	MW-34	MW-35	MW-36	MW-49	MW-50	MW-51	MW-52	MW-53	MW-54	MW-55	MW-56	MW-57	MW-67	MW-68A
1-Mar-85														
12-Dec-86	ND		21	35	28	5	ND	19	6	24	15	241		
29-Nov-88	83	15			277			277	29	55				
1-Mar-93	98	89	138		36	27	197	38		54		145		
1-Jul-93	71	75	147	102	50	235	109	72	16	54	54	167	95	98
22-Oct-93	42	76	181	102				45		128			111	
20-Aug-94			166	108	58			41		39		166	102	
30-Nov-95			170		31			42		65			110	
18-Mar-96			180	70	42			180		79		100	94	
20-Jun-96			130		54			140		62			84	
29-Aug-96	120	100	13		35		31	31			110			
18-Dec-96	200		150		21		23	22		52	13		76	
Mar-97	12		180	86	16		16	15		63	17	58	100	120
Sep-97	120		361	117	41		15	10 U		61	27	188	127	
Apr-98	47		162	86	30	41	55	31		67	30	133	83	94
Jul-98	23		176	108	29			25		89	33	107	95	104
Oct-98	119		190	122	44			31		53		189		70
Dec-98													136	
Jan-99			190							53		124		
Apr-99*	24		210	110	23	21				69		108	114	176

Notes:
Blank indicates that well was not sampled.
ND - Compound not detected (Detection Limit Unavailable)
U - Compound not detected using detection limit shown.
* - Sampling occurred from April 27 through May 10, 1999.

TABLE G-1 (page 2 of 2)
Groundwater Total Arsenic Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74	MW-75	MW-76	MW-77	MW-78	MW-79	MW-80
1-Mar-85														
12-Dec-86														
29-Nov-88														
1-Mar-93														
1-Jul-93	140	143	177	48	13	77	96	51	70	87	41	166	27	46
22-Oct-93		161		42	52		110	10 U	24	93	41			
20-Aug-94		234		34	21	104	120	10 U	35	90	62		50	
30-Nov-95				27	11	72	40 U		17	100	31		40	
18-Mar-96		150		28	11	40	36		16	130	26		23	
20-Jun-96		160		28	8	50	99		11	93	19		31	
29-Aug-96				34	27						31		33	
18-Dec-96		160		28	8 U	52	56		10	96	24		22	
Mar-97	160	180	210	30	7	43	73		12	86	22	110	19	
Sep-97		204		45	12	91	114		20	117	31		14	
Apr-98		183		38	23	70	82		15	108	29	34	18	
Jul-98		169		42	15	100	93		18	100	35	14	10U	
Oct-98		238							37	146	31	120	19	
Dec-98				65	20									
Jan-99		159					86				27	27	26	
Apr-99*		199		44	27	70	81	10U	38		27	74	15	

Sample Date	MW-81	MW-82	MW-83	MW-84	MW-85	MW-86	MW-87	MW-88	MW-89	OW-1	OW-3	OW-4	OW-6	OW-8
1-Mar-85														
12-Dec-86														
29-Nov-88														
1-Mar-93														
1-Jul-93	19	33	73	133	32	69	10 U	62	18					
22-Oct-93									20					
20-Aug-94					48	32			31					
30-Nov-95					15	51			63					
18-Mar-96					37	16			58					
20-Jun-96					28	21			49					
29-Aug-96							2	81						
18-Dec-96					37	48	8 U	40	51					
Mar-97					33	20	8 U	45	33					
Sep-97					48	36	10 U	60	17					
Apr-98	30				39	33	13	49	36					
Jul-98					37	17		62	70					
Oct-98	29							64	28					
Dec-98										72	32	24	59	27
Jan-99						13								
Apr-99*	20				52	27		33	16	101	42	10U	44	10U

Notes:
Blank indicates that well was not sampled.
U - Compound not detected using detection limit shown.
* - Sampling occurred from April 27 through May 10, 1999.

TABLE G-2 (page 1 of 2)
Groundwater Dissolved Arsenic Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-29	MW-30	MW-31	MW-32	MW-33
29-Nov-88	10 U	32		13	115	462			130	22			141	69	128
1-Mar-93	10 U			25		107			57	10 U		44	82		80
1-Jul-93	10 U	29	57	30	90	172	238	178	59	26	49	42	88	43	89
22-Oct-93	10 U	10 U	65		132				66					56	101
20-Aug-94	10 U		51	28	138				59				87	43	94
30-Nov-95	3	19	16 U	18	150								78		94
18-Mar-96	8 U	3	8	8 U	21								5		11
20-Jun-96	8 U	2	5	8 U	3								3		4
29-Aug-96		29	30							13					99
18-Dec-96	8 U	17	39	9	120					12			67		120
Mar-97	8 U	19	41	6	150	67	110	130		4			66		130
Sep-97	10 U	26	73	10 U	133	140			62	10 U			98		123
Apr-98	10U	25	64	14	129	82	156	138	76	14			74	35	121
Jul-98		27	66	18	125	32	131			10			87	49	106
Oct-98	24	63		62	141		194						96		
Dec-98									88						130
Jan-99		27	27	27	123	38				14			78	41	
Apr-99*	10U	38	51	10U	125	129	79	90	75	11			30	44	126

Sample Date	MW-34	MW-35	MW-36	MW-49	MW-50	MW-51	MW-52	MW-53	MW-54	MW-55	MW-56	MW-57	MW-67	MW-68A
29-Nov-88		66						30	10 U	54				
1-Mar-93	19	77	158		37	41	62	34		59		154		
1-Jul-93	25	82	142	102	50	10 U	36	38	10 U	59	48	171	94	84
22-Oct-93	18		173	108				41		10 U			114	
20-Aug-94	61		149	110	66			39		34		149	93	
30-Nov-95			160		27			24		52			110	
18-Mar-96			19	6	4			3		5		10	4	
20-Jun-96			13		8 U			4		3			2	
29-Aug-96	13	86	170		34		10	17			58			
18-Dec-96	11	65	170		24		7	18		56	12		85	
Mar-97	9		170	77	16		6	14		64	13	52	94	110
Sep-97	11		178	108	36		10 U	22		56	29	186	120	
Apr-98	31		147	85	26	41	15	27		69	28	136	86	93
Jul-98	21		147	105	31			25		61	36	105	102	99
Oct-98	11		169	79	38			10U		50		181		69
Dec-98													24	
Jan-99			20							53		17		
Apr-99*	18		154	84	23	26				60		116	102	38

Notes:
Blank indicates that well was not sampled.
U - Compound not detected using detection limit shown.
* - Sampling occurred from April 27 through May 10, 1999.

TABLE G-2 (page 2 of 2)
Groundwater Dissolved Arsenic Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74	MW-75	MW-76	MW-77	MW-78	MW-79	MW-80
29-Nov-88														
1-Mar-93														
1-Jul-93	136	174	194	44	12	93	105	10 U	32	105	42	178	33	53
22-Oct-93		190		45	10 U		119	10 U	24	100	44			
20-Aug-94		138		36	15	94	124	10 U	12	83	61		37	
30-Nov-95				38	8	32	98		17	77	32		39	
18-Mar-96		7		8 U	3	5	6		3	4	2		3	
20-Jun-96		6		2	8 U	10	7		8 U	8 U	4		8 U	
29-Aug-96				27	28						73		32	
18-Dec-96		160		24	8 U	54	71		9	82	24		22	
Mar-97	150	170	190	31	6	42	71		13	98	23	91	15	
Sep-97		184		35	12	89	99		18	112	32		15	
Apr-98		173		39	22	65	77		15	101	27	29	19	
Jul-98		164		44	15	84	90		19	105	38	18	10U	
Oct-98		51							10U	127	24	115	21	
Dec-98				26	23									
Jan-99		144					21				21	24	24	
Apr-99*		206		52	18	68	80	10U	10U		21	67	12	

Sample Date	MW-81	MW-82	MW-83	MW-84	MW-85	MW-86	MW-87	MW-88	MW-89	OW-1	OW-3	OW-4	OW-6	OW-8
29-Nov-88														
1-Mar-93														
1-Jul-93	19	29	85	141	36	77	10 U	73	15					
22-Oct-93									19					
20-Aug-94					41	11			28					
30-Nov-95					34	11			79					
18-Mar-96					9	5			8					
20-Jun-96					4	3			15					
29-Aug-96							8 U	67						
18-Dec-96					34	52	8 U	42	48					
Mar-97					33	19	8 U	39	33					
Sep-97					59	37	10 U	11	14					
Apr-98	28				35	30	10U	52	27					
Jul-98					36	22		63	65					
Oct-98	27							66	27					
Dec-98										73	13	20	13	26
Jan-99						15								
Apr-99*	23				30	22		76	16	99	35	10U	40	10U

Notes:
Blank indicates that well was not sampled.
U - Compound not detected using detection limit shown.
* - Sampling occurred from April 27 through May 10, 1999.

TABLE G-3 (page 1 of 2)
Groundwater Total Iron Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-29	MW-30	MW-31	MW-32	MW-33
1-Mar-85															
12-Dec-86										15,544	10,106	21,688			42,600
29-Nov-88	234,000	153,000		128,000	112,000	119,000			68,100	61,200			46,000	110,000	73,900
1-Mar-93	12,300			53,400		44,900			40,500	15,800		20,300	41,800		64,400
1-Jul-93	52,200	328,000	39,900	53,700	60,700	49,600	84,100	50,100	45,300	136,000	24,100	24,100	43,300	20,900	56,800
22-Oct-93	34,400	73,200	50,100		94,400				39,300					20,200	57,300
20-Aug-94	13,700	41,400	38,300	45,800	93,800				34,300				37,100	18,500	52,000
30-Nov-95	167,000	58,100	111,000	78,200	38,000								41,000		66,700
18-Mar-96	84,000	49,000	58,900	212,000	52,400								37,000		75,700
20-Jun-96	71,800	48,100	31,600	88,100	73,500								31,300		56,900
29-Aug-96		48,600	36,500												69,800
18-Dec-96	12,400	38,000	107,000	272,000	35,200								38,000		60,100
Mar-97	9,900	44,800	87,600	480,000	34,100	44,100	66,500	39,400					48,100		69,900
Sep-97	7,180	47,000	51,200	85,900	36,700				46,000				44,400		65,200
Apr-98	6,270	46,900	47,200	383,000	40,600	39,600	65,300	40,100	49,900	14,900			42,800	29,600	56,600
Jul-98		43,900	43,800	129,000	41,200	27,500	33,500			13,000			38,000	23,700	56,200
Dec-98									51,700						55,800
Apr-99*	29,400	51,000	56,000	135,000	41,700	44,800	30,600	38,700	60,500	13,200			48,700	34,800	60,100

Sample Date	MW-34	MW-35	MW-36	MW-49	MW-50	MW-51	MW-52	MW-53	MW-54	MW-55	MW-56	MW-57	MW-67	MW-68A
1-Mar-85														
12-Dec-86	6,134	10,248				25,700			22,163					
29-Nov-88		67,500			42,500			280,000	53,300	80,600				
1-Mar-93	89,900	40,600	12,900		51,700	39,000	189,000	38,700		26,200		45,000		
1-Jul-93	13,100	40,700	13,200	36,900	43,500	64,700	131,000	45,500	111,000	28,100	30,600	39,800	36,600	256,000
22-Oct-93	89,000		13,100	27,000				42,600		49,000			36,100	
20-Aug-94	39,800		10,900	25,400	25,500			33,700		41,100		29,600	33,900	
30-Nov-95			14,400		50,400			51,000		29,400			38,600	
18-Mar-96			13,200	30,500	55,600			78,300		29,500		32,900	48,800	
20-Jun-96			12,900		47,100			85,200		29,200			43,000	
29-Aug-96			12,900		45,000			52,400						
18-Dec-96			12,200		55,800			87,100		31,100			42,700	
Mar-97			13,400	26,400	61,800			87,300		27,200		20,500	44,200	41,200
Sep-97			13,900	26,800	59,500			65,500		31,300		40,800	52,900	
Apr-98	16,900		13,500	29,700	62,400	48,400	107,000	77,400		28,300	30,400	41,000	45,800	47,000
Jul-98	11,600		13,000	31,100	54,900			61,600		28,300	29,300	37,400	56,100	63,400
Dec-98													107,000	
Apr-99*	16,500		14,200	34,800	76,000	46,000				28,900		41,400	73,300	89,700

Notes:
Blank indicates well was not sampled.
U - Compound not detected using detection limit shown.
* - Sampling occurred from April 27 through May 10, 1999.

TABLE G-3 (page 2 of 2)
Groundwater Total Iron Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74	MW-75	MW-76	MW-77	MW-78	MW-79	MW-80
1-Mar-85														
12-Dec-86														
29-Nov-88														
1-Mar-93														
1-Jul-93	52,500	75,200	53,600	394,000	32,600	17,000	36,300	191,000	733,000	58,200	34,300	86,800	50,800	60,500
22-Oct-93		67,300		48,300	173,000		18,000	12,700	72,900	47,600	34,100			
20-Aug-94		67,900		33,500	36,500	13,700	12,400	424	32,000	32,400	25,500		44,100	
30-Nov-95				34,800	92,800	17,100	55,400		13,500	52,000	39,300		84,700	
18-Mar-96		72,900		45,300	86,800	16,000	49,200		26,100	68,200	35,500		36,800	
20-Jun-96		92,300		46,200	66,300	18,800	104,000		19,600	48,800	31,100		45,300	
29-Aug-96				55,900	56,300						31,500		22,700	
18-Dec-96		48,800		33,700	103,000	15,800	25,300		15,300	45,700	28,400		18,300	
Mar-97	45,700	55,000	42,700	42,500	89,600	16,400	31,600		17,700	54,200	28,800	48,200	16,000	
Sep-97		71,700		48,700	77,900	17,000	15,600		14,400	49,900	28,900		17,800	
Apr-98		76,600		44,200	78,000	17,700	16,900		12,000	52,200	26,500	27,300	20,500	
Jul-98		74,100		41,400	79,700	17,800	21,000	100U	9,460	48,800	23,500	11,000	718	
Dec-98				48,800	47,300									
Apr-99*		103,000		44,200	54,200	17,600	21,300	100U	49,700		25,300	73,500	11,300	

Sample Date	MW-81	MW-82	MW-83	MW-84	MW-85	MW-86	MW-87	MW-88	MW-89	OW-1	OW-3	OW-4	OW-6	OW-8
1-Mar-85														
12-Dec-86														
29-Nov-88														
1-Mar-93														
1-Jul-93	23,500	68,400	16,700	57,900	22,300	32,100	15,300	64,700	16,100					
22-Oct-93									19,100					
20-Aug-94					12,400	3,040			16,800					
30-Nov-95					14,400	10,500			53,000					
18-Mar-96					16,700	2,200			30,900					
20-Jun-96					18,000	14,900			22,500					
29-Aug-96							7,200							
18-Dec-96					15,100	9,400			61,700					
Mar-97					13,000	4,900			41,400					
Sep-97					18,800	15,200			13,300					
Apr-98	30,600				12,900	6,750	1,050	45,700	41,300					
Jul-98					13,500	7,130		45,600	49,400					
Dec-98										17,000	27,800	63,200	68,200	37,200
Apr-99*	32,100				14,900	6,550	1,300	48,400	22,600	47,400	45,100	92,300	66,500	38,700

Notes:
Blank indicates well was not sampled.
U - Compound not detected using detection limit shown.
* - Sampling occurred from April 27 through May 10, 1999.

TABLE G-4 (page 1 of 2)
Groundwater Dissolved Iron Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-29	MW-30	MW-31	MW-32	MW-33
1-Mar-85															
12-Dec-86															
29-Nov-88	548	47,900		45,700	52,600	73,300			36,000	16,600			36,500	35,700	56,700
1-Mar-93	3,410			52,200		45,900			40,800	13,100		24,800	42,500		59,200
1-Jul-93	3,400	78,000	33,900	53,500	32,400	49,600	68,800	47,900	40,200	212	21,100	23,500	42,800	21,400	56,700
22-Oct-93	5,300	19,800	45,300		54,100				39,600				41,104	20,800	57,700
20-Aug-94	6,280	36,400	36,500	44,600	26,400				34,400				36,600	17,200	47,200
30-Nov-95	38,000	60,000	123,000	74,800	41,200								40,900		64,400
18-Mar-96	80	19,100	72,500	39,400	9,400								17,500		29,500
20-Jun-96	60 U	19,600	18,100	34,400	2,400								8,100		23,800
29-Aug-96		46,500	35,100												69,400
18-Dec-96	7,700	47,200	94,800	300,000	36,100								36,500		58,600
Mar-97	6,900	44,400	88,900	193,000	37,000	45,800	70,400	42,900					46,200		67,820
Sep-97	6,710	45,500	52,600	80,100	31,700				44,900				41,500		60,400
Apr-98	6,420	46,400	45,000	324,000	39,700	38,200	67,200	39,700	47,200	13,900			41,800	25,900	55,800
Jul-98		44,000	46,500	130,000	40,700	27,000	34,900			14,300			40,300	24,700	47,200
Dec-98									47,600						54,300
Apr-99*	6,800	50,400	54,000	99,600	41,800	44,600	28,800	32,300	45,700	12,300			47,900	32,600	55,400

Sample Date	MW-34	MW-35	MW-36	MW-49	MW-50	MW-51	MW-52	MW-53	MW-54	MW-55	MW-56	MW-57	MW-67	MW-68A
1-Mar-85														
12-Dec-86														
29-Nov-88		16,600						33,100	29,600	25,900				
1-Mar-93	44,600	21,100	12,800		53,400	44,300	24,000	38,800		26,400		46,800		
1-Jul-93	53,500	22,900	13,700	22,900	43,900	10,500	30,600	38,900	184,000	30,300	31,700	38,500	34,000	41,000
22-Oct-93	62,400		13,600	27,400				41,200		3,710			36,000	
20-Aug-94	25,800		10,800	26,400	27,500			33,700		37,400		31,200	32,200	
30-Nov-95			13,000		48,700			48,100		28,800			35,100	
18-Mar-96			640	8,100	21,400			26,200		7,100		10,700	6,100	
20-Jun-96			81		15,300			28,200		10,900			60 U	
29-Aug-96			13,200		43,600			44,000						
18-Dec-96			13,900		52,000			83,100		29,400			43,100	
Mar-97			14,300	23,600	55,600			84,500		23,900		16,400	46,600	37,900
Sep-97			12,200	26,100	52,600			64,800		29,900		39,100	52,400	
Apr-98	9,490		12,500	30,600	61,200	49,200	46,400	68,600		28,900	32,600	42,300	46,400	46,300
Jul-98	11,300		12,400	30,100	54,700			60,400		25,400	29,800	37,100	61,100	60,500
Dec-98													9,810	
Apr-99*	11,900		13,800	29,400	87,700	50,400				31,200		41,200	55,600	46,400

Notes:
Blank indicates well was not sampled.
U - Compound not detected using detection limit shown.
* - Sampling occurred from April 27 through May 10, 1999.

TABLE G-4 (page 2 of 2)
Groundwater Dissolved Iron Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74	MW-75	MW-76	MW-77	MW-78	MW-79	MW-80
1-Mar-85														
12-Dec-86														
29-Nov-88														
1-Mar-93														
1-Jul-93	48,100	52,500	51,400	46,300	30,600	16,000	14,500	1,530	17,800	38,800	32,900	75,300	52,000	38,400
22-Oct-93		54,700		45,000	23,200		16,200	1,430	16,000	38,900	35,300			
20-Aug-94		50,800		31,900	23,600	13,200	14,300	100 U	8,770	31,500	24,400		21,600	
30-Nov-95				36,100	81,400	15,900	38,700		14,400	38,300	40,300		51,700	
18-Mar-96		28,800		16,600	53,600	2,900	7,800		670	17,100	12,100		13,400	
20-Jun-96		19,000		27,700	42,000	850	860		600	45	8,200		75	
29-Aug-96				53,200	45,600						27,300		20,800	
18-Dec-96		47,500		37,800	100,000	18,100	17,900		16,700	43,600	30,300		18,500	
Mar-97	46,600	61,600	46,200	43,100	85,700	16,600	16,300		16,400	51,200	29,700	56,100	15,000	
Sep-97		44,700		46,800	79,500	16,400	13,600		13,200	50,000	28,900		18,100	
Apr-98		73,700		47,700	79,400	17,600	13,900		12,900	51,600	24,800	25,700	20,800	
Jul-98		73,200		43,500	81,900	15,200	13,000	10U	9,600	50,900	24,400	11,100	155	
Dec-98				32,400	48,000									
Apr-99*		110,000		49,200	50,600	17,200	14,900	127	30,200		24,800	70,800	22,100	

Sample Date	MW-81	MW-82	MW-83	MW-84	MW-85	MW-86	MW-87	MW-88	MW-89	OW-1	OW-3	OW-4	OW-6	OW-8
1-Mar-85														
12-Dec-86														
29-Nov-88														
1-Mar-93														
1-Jul-93	22,500	39,100	16,300	43,400	14,300	19,400	795	45,300	15,500					
22-Oct-93									19,100					
20-Aug-94					11,600	926			16,600					
30-Nov-95					13,800	10,700			50,600					
18-Mar-96					2,800	39			18,700					
20-Jun-96					2,500	2,100			9,000					
29-Aug-96							770							
18-Dec-96					16,500	10,300			60,500					
Mar-97					12,000	4,600			39,200					
Sep-97					18,900	14,000			13,000					
Apr-98	33,400				12,700	7,620	949	47,700	43,200					
Jul-98					12,900	6,930		46,700	48,000					
Dec-98										17,600	5,600	60,300	8,210	36,400
Apr-99*	31,700				12,400	5,840	721	47,300	22,200	49,100	41,600	91,800	61,900	38,300

Notes:
Blank indicates well was not sampled.
U - Compound not detected using detection limit shown.
* - Sampling occurred from April 27 through May 10, 1999.

TABLE G-5 (page 1 of 2)
Groundwater Total Chromium Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-31
20-Aug-94	10 U	10 U	10 U	10 U	10 U				10 U		18
30-Nov-95	18	10 U	2.5	3.0	10 U						2.2
18-Mar-96	25	9	2.4	51	73						9.6
20-Jun-96	39	20	7.5	5.3	62						2.6
29-Aug-96		2.2	3.2								
18-Dec-96	10 U	10 U	4.2	10 U	10 U						5.3
Mar-97	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U			10 U
Sep-97	10 U	10 U	10 U	10 U	10 U				10 U		10 U
Apr-98	10 U	10 U	10 U	10 U	10 U		10 U				10 U
Jul-98		10 U	10 U	10 U	10 U	10 U				10 U	10 U

Sample Date	MW-32	MW-33	MW-34	MW-36	MW-49	MW-50	MW-53	MW-55	MW-56	MW-57
20-Aug-94	10 U	184	10 U	10 U	10 U	10 U	10 U	10 U		10 U
30-Nov-95		16		10 U		2.6	9.0	2.3		
18-Mar-96		3.6		6.7	11	10	68	8.0		13
20-Jun-96		10		5.9		15	77	11		
29-Aug-96		10 U		7.1		3.6	7.6			
18-Dec-96		10 U		5.4		4.4	10 U	10 U		
Mar-97		10 U		8.5	10 U	10 U	10 U	10 U		10 U
Sep-97		10 U		10 U	10 U	10 U	10 U	10 U		10 U
Apr-98		10 U		10 U	10 U	10 U	10 U	10 U		10 U
Jul-98		10 U		10 U	10 U	10 U	10 U	12	10 U	10 U

Notes:
Blank indicates that well was not sampled.
U - Compound not detected using detection limit shown.

TABLE G-5 (page 2 of 2)
Groundwater Total Chromium Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-67	MW-68A	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74
20-Aug-94	10 U			10 U		10 U	10 U	10 U	10 U	10 U
30-Nov-95	3.1					4.8	4.6	2.7	7.6	
18-Mar-96	44			33		14	15	10	32	
20-Jun-96	80			58		13	2.2	16	57	
29-Aug-96						27	20			
18-Dec-96	3.6			5.7		8.1	ND	ND	6.3	
Mar-97	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	7.3	
Sep-97	10 U			10 U		10 U	10 U	10 U	10 U	
Apr-98	10 U			10 U		10 U	10 U	10 U	10 U	
Jul-98	10 U			10 U		10 U	10 U	10 U	10 U	

Sample Date	MW-75	MW-76	MW-77	MW-78	MW-79	MW-85	MW-86	MW-87	MW-88	MW-89
20-Aug-94	20.1	10 U	10 U		14.3	10 U	10 U			10 U
30-Nov-95	3.3	11	10 U		25	10 U	4.0			2.1
18-Mar-96	22	37	9.1		22	12	27			9.1
20-Jun-96	8.8	21	12		90	8.9	26			11
29-Aug-96			4.4		6.0			3.4		
18-Dec-96	10 U	10 U	10 U		10 U	10 U	6.9			2.2
Mar-97	10 U	10 U	10 U	10 U	10 U	10 U	10 U			10 U
Sep-97	10 U	10 U	10 U		10 U	10 U	10 U			10 U
Apr-98	10 U	10 U	10 U		10 U	10 U	10 U			10 U
Jul-98			10 U		10 U		10 U		10 U	10 U

Notes:
Blank indicates that well was not sampled.
U - Compound not detected using detection limit shown.

TABLE G-6 (page 1 of 2)
Groundwater Dissolved Chromium Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-31
20-Aug-94	10 U	10 U	10 U	10 U	10 U				10 U		10 U
30-Nov-95	10 U	10 U	10 U	10 U	6.2						10 U
18-Mar-96	9.1	11.0	10 U	5.1	5.8						4.2
20-Jun-96	10 U	5.8	4.5	10 U	4.2						10 U
29-Aug-96		10 U	10 U								
18-Dec-96	10 U	10 U	10 U	10 U	10 U						8.8
Mar-97	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U		10 U
Sep-97	10 U	10 U	10 U	10 U	10 U						10 U
Apr-98	10 U	10 U	10 U	10 U	10 U		10 U				10 U
Jul-98		10 U	10 U	10 U	10 U	10 U				10 U	10 U

Sample Date	MW-32	MW-33	MW-34	MW-36	MW-49	MW-50	MW-53	MW-55	MW-56	MW-57
20-Aug-94	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U		10 U
30-Nov-95		3.3		2.1		10 U	10 U	2.2		
18-Mar-96		5.7		2.9	5.2	4.1	4.7	4.2		7.5
20-Jun-96		10 U		11		10 U	10 U	13		
29-Aug-96		10 U		2.9		10 U	10 U			
18-Dec-96		10 U		10 U		4.6	2.6	3.0		
Mar-97		10 U		10 U	10 U	10 U	10 U	10 U		10 U
Sep-97		10 U		10 U	10 U	10 U	10 U	10 U		12.6
Apr-98		10 U		10 U	10 U	10 U	10 U	10 U		10 U
Jul-98		10 U		10 U	10 U	10 U	10 U	10 U	10 U	10 U

Notes:
Blank indicates that well was not sampled.
U - Compound not detected using detection limit shown.

TABLE G-6 (page 2 of 2)
Groundwater Dissolved Chromium Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-67	MW-68A	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74
20-Aug-94	10 U			10 U		10 U	10 U	10 U	10 U	10 U
30-Nov-95	10 U					10 U	10 U	4.9	2.3	
18-Mar-96	14			7.0		3.7	ND	6.9	9.1	
20-Jun-96	10 U			8.9		10	6.2	6.5	9.0	
29-Aug-96						10 U	10 U			
18-Dec-96	10 U			17.0		10 U	10 U	10 U	10 U	
Mar-97	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	
Sep-97	10 U			17.0		10 U	10 U	10 U	10 U	
Apr-98	10 U			10 U		10 U	10 U	10 U	10 U	
Jul-98	10 U			10 U		10 U	10 U	10 U	10 U	

Sample Date	MW-75	MW-76	MW-77	MW-78	MW-79	MW-85	MW-86	MW-87	MW-88	MW-89
20-Aug-94	10 U	10 U	10 U		10 U	10 U	10 U			10 U
30-Nov-95	2.6	10 U	10 U		2.2	2.6	5.0			2.7
18-Mar-96	8.4	4.1	10 U		4.5	7.9	10 U			10 U
20-Jun-96	10 U	13	2.9		10 U	4.5	6.1			10 U
29-Aug-96			3.5		10 U			3.9		
18-Dec-96	10 U	9.8	10 U		4.1	10 U	10 U			2.1
Mar-97	10 U	10 U	10 U	10 U	10 U	10 U	10 U			6.5
Sep-97	10 U	10 U	10 U		10 U	10 U	10 U			10 U
Apr-98	10 U		10 U		10 U	10 U	10 U			10 U
Jul-98			10 U		10 U		10 U		10 U	10 U

Notes:
Blank indicates that well was not sampled.
U - Compound not detected using detection limit shown.

TABLE G-7 (page 1 of 2)
Groundwater Total Lead Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-31
20-Aug-94	3 U		3 U	3 U	24				3 U		59
30-Nov-95	4.0	1.5	3.4	5 U	9.3						12
18-Mar-96	5.5	5.2	5 U	6.4	22						22
20-Jun-96	2.4	12	5 U	1.8	48						4.2
29-Aug-96		5 U	1.6								
18-Dec-96	5 U	5 U	5 U	5 U	5 U						5 U
Mar-97	13	5 U	4.3	5 U	5 U	5 U	5 U	5 U			9.4
Sep-97	5 U	5 U	5 U	5 U	5 U				5 U		6.56
Apr-98		5 U	5 U	5.62	5 U		5 U				5 U
Jul-98		5 U	5 U	5 U	5 U	5 U				5 U	6

Sample Date	MW-32	MW-33	MW-34	MW-36	MW-49	MW-50	MW-53	MW-55	MW-56	MW-57
20-Aug-94	12	112	3 U	3 U	5.9	3 U	3 U	3 U		3 U
30-Nov-95		26		5 U		5 U	1.5	5 U		
18-Mar-96		7.6		5 U	1.4	5 U	25	5 U		32
20-Jun-96		5 U		1.2		5 U	37	5.0		
29-Aug-96		5 U		3.0		1.0	3.4			
18-Dec-96		5 U		5 U		5 U	5 U	5 U		
Mar-97		5 U		3.9	2.9	5 U	5 U	5 U		5 U
Sep-97		5 U		5 U	9.28	5 U	5 U	5 U		5 U
Apr-98		5 U		5 U		5 U	5 U	5 U		5 U
Jul-98		5 U		5 U	5 U	5 U	5 U	5 U	5 U	5 U

Notes:
Blank indicates that the well was not sampled.
U - Compound not detected using detection limit shown.

TABLE G-7 (page 2 of 2)
Groundwater Total Lead Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-67	MW-68A	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74
20-Aug-94	3 U			5.6		3 U	13.4	3 U	7.5	3 U
30-Nov-95	1.3					4.9	6.6	5 U	28	
18-Mar-96	14			22		5 U	4.6	5 U	34	
20-Jun-96	19			45		1.5	1.0	2.9	110	
29-Aug-96						3.3	13			
18-Dec-96	5 U			5 U		5 U	8.8	5 U	14	
Mar-97	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	17	
Sep-97	5 U			3.64		5 U	5 U	5 U	5 U	
Apr-98	5 U			5 U		5 U	5 U	5 U	5 U	
Jul-98	5 U			5		5 U	5 U	5 U	5 U	

Sample Date	MW-75	MW-76	MW-77	MW-78	MW-79	MW-85	MW-86	MW-87	MW-88	MW-89
20-Aug-94	100 U	3 U	5.3		37	9.1	155			3 U
30-Nov-95	1.7	16	5 U		26	5 U	5			5 U
18-Mar-96	13	58	3.7		15	3.1	49			4.1
20-Jun-96	5.2	32	9.4		39	17	9.4			4.3
29-Aug-96			1.5		3.4			3.5		
18-Dec-96	5 U	5 U	5 U		5 U	5 U	5 U			5 U
Mar-97	5 U	2.9	3.4	5 U	5 U	5 U	5 U			5 U
Sep-97	5 U	5 U	5 U		5 U	5 U	5 U			5 U
Apr-98	5 U	5 U	5 U		5 U	5 U	5 U			5 U
Jul-98			5 U		5 U		5 U		5 U	5 U

Notes:
Blank indicates that the well was not sampled.
U - Compound not detected using detection limit shown.

TABLE G-8 (page 1 of 2)
Groundwater Dissolved Lead Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-1	MW-7	MW-8	MW-9	MW-10	MW-11	MW-25	MW-26	MW-27	MW-28	MW-31
20-Aug-94	3 U		3 U	3 U	3 U				3 U		3 U
30-Nov-95	5 U	5 U	5 U	5 U	5 U						3.1
18-Mar-96	5 U	5 U	5 U	5 U	6.9						5 U
20-Jun-96	5 U	1.7	2.5	1.1	1.9						5 U
29-Aug-96		22	5 U								
18-Dec-96	5 U	5 U	5 U	5 U	5 U						5 U
Mar-97	5 U	5 U	2.7	5 U	5 U	5 U	5 U	5 U			5 U
Sep-97	5 U	5 U	5 U	5 U	5 U				5 U		5 U
Apr-98	5 U	5 U	5 U	5 U	5 U		5 U				5 U
Jul-98		5 U	5 U	5 U	5 U	5 U				5 U	5 U

Sample Date	MW-32	MW-33	MW-34	MW-36	MW-49	MW-50	MW-53	MW-55	MW-56	MW-57
20-Aug-94	3.2	3 U	3 U	3 U	3 U	3 U	3 U	3 U		3 U
30-Nov-95		5 U		5 U		5 U	5 U	5 U		
18-Mar-96		5 U		5 U	2.3	5 U	5 U	5 U		4.4
20-Jun-96		5 U		5 U		5 U	5 U	1.5		
29-Aug-96		5 U		1.8		5 U	5 U			
18-Dec-96		5 U		5 U		1.6	1.1	2.0		
Mar-97		5 U		3.1	5 U	5 U	2.8	5 U		5 U
Sep-97		5 U		5 U	5 U	5 U	5 U	5 U		5 U
Apr-98		5 U		5 U	5 U	5 U	5 U	5 U		5 U
Jul-98		5 U		5 U	5 U	5 U	5 U	5 U	5 U	5 U

Notes:
Blank indicates that well was not sampled.
U - Compound not detected using detection limit shown.

TABLE G-8 (page 2 of 2)
Groundwater Dissolved Lead Concentrations (ppb)
Phase I Completion Report

Former Sinclair Refinery Superfund Site (OU2), Wellsville, New York

Sample Date	MW-67	MW-68A	MW-68B	MW-69A	MW-69B	MW-70	MW-71	MW-72	MW-73	MW-74
20-Aug-94	3 U			3 U		3 U	3 U	3 U	3.2	3 U
30-Nov-95	1.3					5 U	1.9	5 U	16	
18-Mar-96	5 U			4.7		5 U	5 U	5 U	3.2	
20-Jun-96	2.1			1.4		1.3	5 U	5 U	2.9	
29-Aug-96						5 U	1.7			
18-Dec-96	7.9			5 U		5 U	5 U	5 U	5 U	
Mar-97	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	3.3	
Sep-97	5 U			5 U		5 U	5 U	5 U	5 U	
Apr-98	5 U			5 U		5 U	5 U	5 U	5 U	
Jul-98	5 U			5 U		5 U	5 U	5 U	5 U	

Sample Date	MW-75	MW-76	MW-77	MW-78	MW-79	MW-85	MW-86	MW-87	MW-88	MW-89
20-Aug-94	3 U	3 U	3 U		3 U	3 U	3 U			3 U
30-Nov-95	5 U	5 U	5 U		5 U	5 U	5 U			1.3
18-Mar-96	5 U	5 U	5 U		5 U	5 U	4			5 U
20-Jun-96	5 U	1.9	2.9		5 U	5.0	3.2			2.0
29-Aug-96			2.1		2.5			5.0		
18-Dec-96	5 U	4.3	5 U		5 U	5 U	5 U			5 U
Mar-97	5 U	3.1	3	5 U	5 U	5 U	5 U			2.8
Sep-97	5 U	5 U	5 U		5 U	5 U	5 U			5 U
Apr-98	5 U		5 U		5 U	5 U	5 U			5 U
Jul-98			5 U		5 U		5 U		5 U	5 U

Notes:

Blank indicates that well was not sampled.

U - Compound not detected using detection limit shown.

APPENDIX H

LNAPL CHROMATOGRAMS FOR MONITORING WELLS

FILE

LNAPL Well Samples

PRELIMINARY

GC/FID SCANS -

Qual. Analy.

Analytical Report

Prepared For

Lab ID

1241

Samples Received

5/9/97

Report Date

21-May-97

NJDEP Certified Lab ID 11001

Table Of Contents

Section	Topic
1.0	Chain of Custody
2.0	Methodology Review
3.0	Laboratory Chronicle
4.0	Analytical Results Summary
5.0	Comparison Standard Chromatograms

Prepared by:

George Latham — Date
Analytical Laboratory Supervisor
Envirogen
Lawrenceville, NJ 08648

Reviewed by:

5-21-94

Allen Thomas — Date
Laboratory Director
Envirogen
Lawrenceville, NJ 08648

10 Chain of Custody

(1241-7)

ON-SITE HEALTH & SAFETY SERVICES, INC.

2324 Hanover Hill Rd. • P.O. Box 54
Wellsville, NY 14895

CHAIN-OF-CUSTODY RECORD
Analytical Request

Client: Arco / ON Site
Address: 2530 S. Brooklyn
Wellsville, NY 14895
Phone: 716-593-7069

Report To: Ken Sperry
Bill To: ENVIROGEN
P.O. # / Billing Reference: 78014
Project Name / No.: JEG/ARCO

Client No.:
Project Manager: MATT WAlsh
Project No.: 78014
*Requested Due Date: ASAP

Sampled By (PRINT): John A DeBeau
Sampler Signature: John A DeBeau
Date Sampled: 5-9-97

	ITEM NO.	SAMPLE DESCRIPTION	TIME	MATRIX	PACE NO.	NO. OF CONTAINERS	UNPRESERVED	H_2SO_4	HNO_3	VOA	HCl	ANALYSES REQUEST: VOC (624) (15)	REMARKS
01	1	MW-85	11:05	Aq/oil		1	X					Free product scan	*Most Likely Diesel fuel May Also Contain Chlorinated Solvents
02	2	MW-51	1030			1	X						
03	3	MW-86	1135			1	X						
04	4	MW-75	11:50			1	X						
05	5	MW-73	1125			1	X						
06	6	MW-71	10:15			1	X						
	7												
07	8	MW-52		Aq.		2					X	X	Analysis Not Performed (mw)

COOLER NOS.	BAILERS	SHIPMENT METHOD OUT DATE	RETURNED DATE
1		5-9-97	

ITEM NUMBER	RELINQUISHED BY / AFFILIATION	ACCEPTED BY / AFFILIATION	DATE	TIME
1	John A DeBeau O/S	Fed EX Air Bill # 1234661164	5-9	

Additional Comments

Free product samples
5-9-97

	Depth to Product	Depth to water	Oil in Bailer
MW-51	7.57'	Undetermined	Full
MW-71	14.17'	14.37'	1/16"
MW-85	2.04'	2.06'	1/16"
MW-52	N/A	4.53'	N/A
MW-73	.70'	.76'	1/16"
MW-86	6.57'	6.72'	1/4"
MW-75	7.60'	8.04'	1/4"

INTERNAL CHAIN OF CUSTODY

Lab ID 1241-7

Date Received 5/12/97

Sample ID	Parameter	Bottle Type	Preservative	Date Removed	Time Removed	Initials
01	VOCs ~~EPA 624~~ 8015	250 G-	unpres	5/9/5/13	09:00/1310	Ce
02	〃	〃	〃	〃	〃	〃
03	〃	〃	〃	〃	〃	〃
04	〃	〃	〃	〃	〃	〃
05	〃	〃	〃	〃	〃	〃
06	〃	〃	〃	〃	〃	〃
07	〃	〃	〃	〃	〃	〃

2.0 Methodology Review

A modified method 8015 was used to determine the hydrocarbon profile of the samples submitted on 5/9/1997.

3.0 Laboratory Chronicle

1. See Sample injection log. (attached)

The log was verified and corrected for accurate sample injection sequence.

5-21-97

Allen F. Thomas　　　　Date

Samples were received 5/9/97 and analyzed 5/9 and 13/1997, within the established holding times for EPA method 8015.

4.0 Analytical Results Summary

Samples 1214-1,2,4 and 5 can't be accurately determined against the targeted petroleum fractions listed in the profile section. In these samples is a combination of both gasoline and a #2 fuel or Kerosine product.

Sample 3 is weathered gasoline. Sample 6 is Kerosine.

Lab ID	Sample ID	Product
1241- 1	MW-85	*Unidentified
1241- 2	MW-51	*Unidentified
1241- 3	MW-86	Weathered Gasoline
1241- 4	MW-75	*Unidentified
1241- 5	MW-73	*Unidentified
1241- 6	MW-71	Kerosine

* A combination of Gasoline, and #2 fuel or Kerosine.

5-21-97

Allen F. Thomas　　Date

Laboratory Director

MW-85

Title : 8015 Analysis
Run File : C:\STAR\MODULE18\cre112.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : 1241-1 .0025 g/ml

Injection Date: 9-MAY-97 0:38 AM Recalculation Date: 9-MAY-97 4:43 AM

Operator : G. Latham
Workstation: MS-DOS_5
Instrument : Varian Star #1
Channel : B = FID

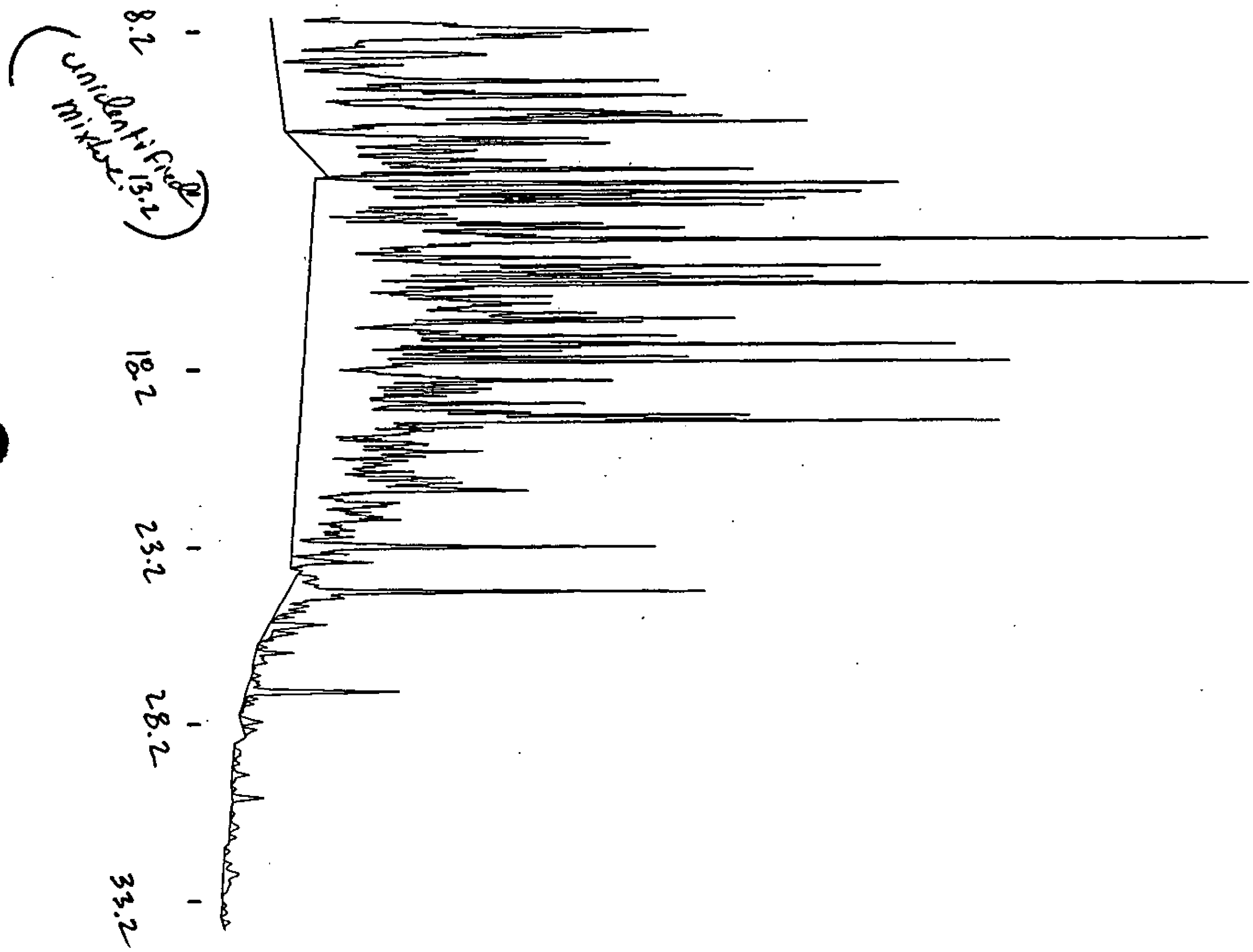
Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 34.002 min

*********** Varian GC Star Workstation ************ Version A2 *****************

Chart Speed = 0.50 cm/min
Start Time = 8.200 min

Attenuation = 624
End Time = 34.000 min

Zero Offset = 18%
Min / Tick = 5.00



Title : 8015 Analysis
Run File : C:\STAR\MODULE18\cre112.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : 1241-1 .0025 g/ml

ection Date: 9-MAY-97 0:38 AM Recalculation Date: 9-MAY-97 4:43 AM

Operator : G. Latham
Workstation: MS-DOS_5
Instrument : Varian Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 34.002 min

*********** Varian GC Star Workstation ************ Version A2 ****************

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Retention Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)
	Totals:	100.0000		0.000	21817834		

Total Unidentified Counts : 21817834 counts

Detected Peaks: 228 Rejected Peaks: 7 Identified Peaks: 0

Amount Standard: 1.000000 Multiplier: 1.000000 Divisor: 1.000000

se: 1 microVolts/sec Baseline Offset: 60 microVolts

Error Log:

3400 GC:

ADC Board:

****

MW-51

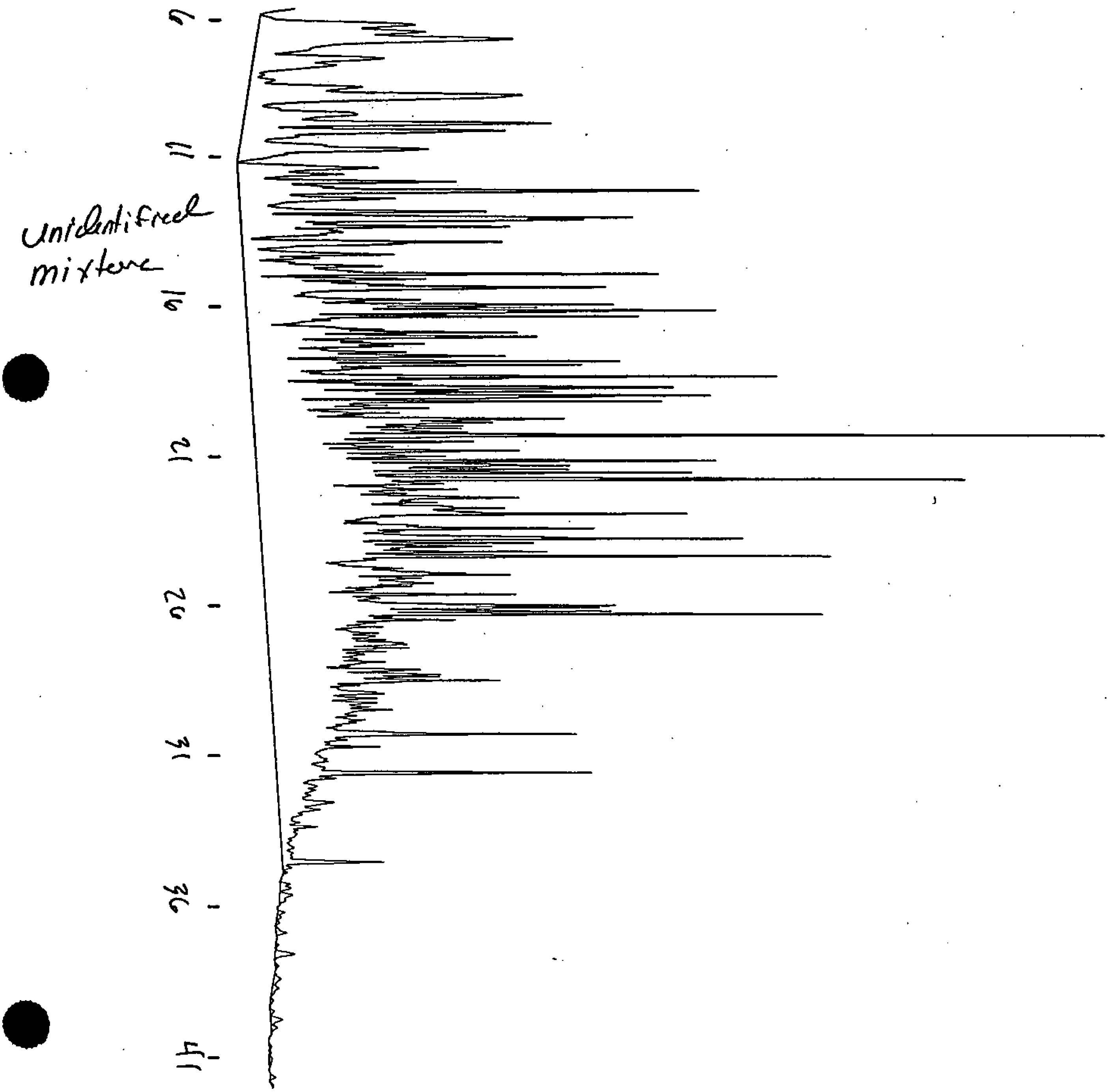
```
Title          : 8015 Analysis
Run File       : C:\STAR\MODULE18\atph009.RUN
Method File    : C:\STAR\TPH.MTH
Sample ID      : 1241-2 .0025 g/ml
```

ection Date: 13-MAY-97 4:29 PM   Recalculation Date: 14-MAY-97 10:06 AM

```
Operator     : G. Latham            Detector Type: ADCB (1 Volt)
Workstation: MS-DOS_5?              Bus Address   : 18
Instrument  : Varian Star #1        Sample Rate   : 10.00 Hz
Channel       : B = FID             Run Time      : 42.002 min
```

*********** Varian GC Star Workstation ************ Version A2 *****************

```
Chart Speed =   0.50 cm/min    Attenuation =    747        Zero Offset = 28%
Start Time  =   6.000 min      End Time    =  42.000 min   Min / Tick  = 5.00
```



Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph009.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : 1241-2 .0025 g/ml

ection Date: 13-MAY-97 4:29 PM Recalculation Date: 14-MAY-97 10:06 AM

Operator : G. Latham
Workstation: MS-DOS_5?
Instrument : Varian Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 ****************

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Retention Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)
	Totals:	100.0000		0.000	38172420		

Total Unidentified Counts : 38172420 counts

Detected Peaks: 232 Rejected Peaks: 0 Identified Peaks: 0

Amount Standard: 1.000000 Multiplier: 1.000000 Divisor: 1.000000

se: 6 microVolts/sec Baseline Offset: -144 microVolts

Error Log:

3400 GC:

ADC Board:

****

Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph010.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : 1241-3 .0025 g/ml

mw-86

Injection Date: 13-MAY-97 5:18 PM Recalculation Date: 14-MAY-97 10:07 AM

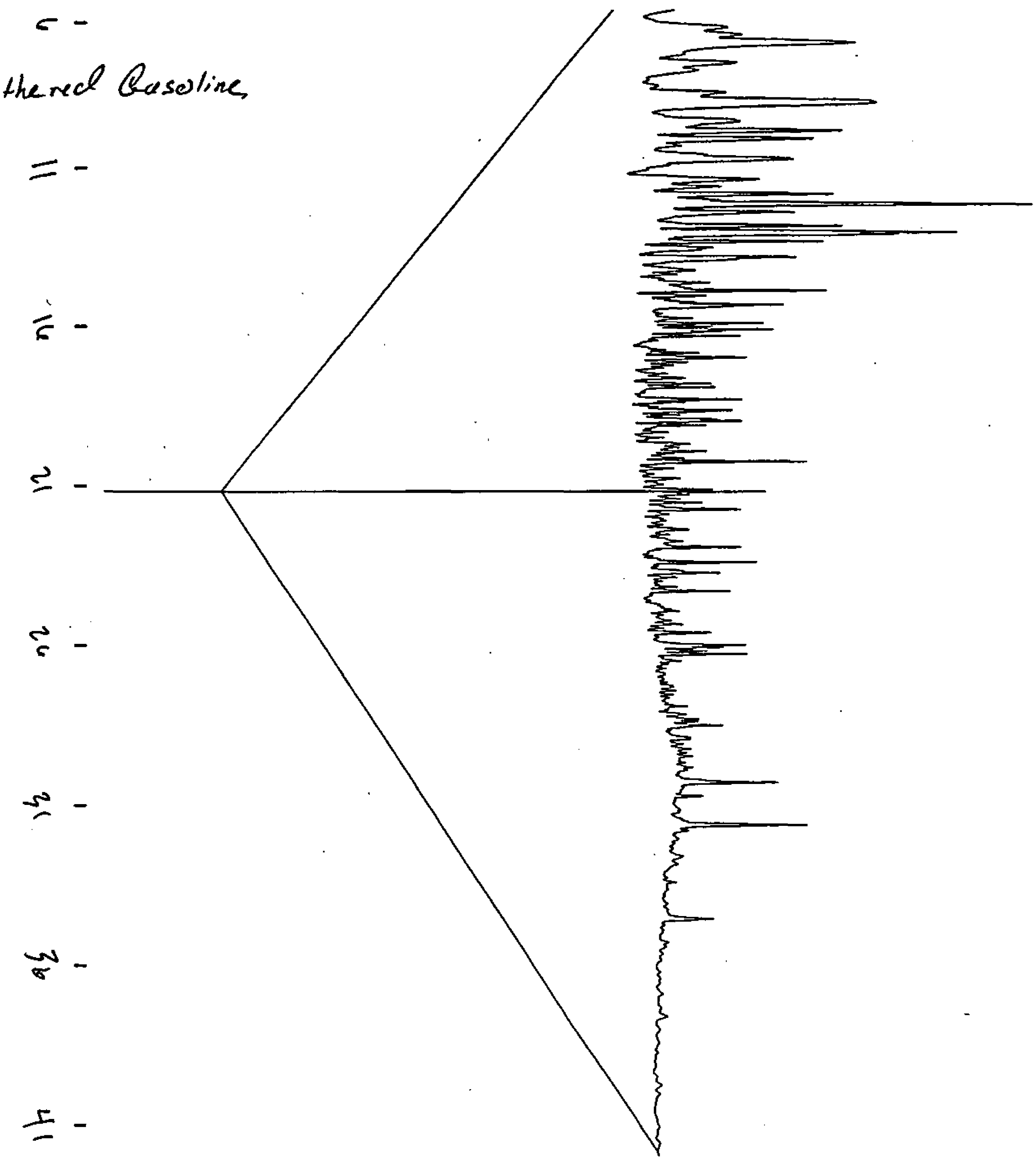
Operator : G. Latham
Workstation: MS-DOS_5?
Instrument : Varian Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 *****************

Chart Speed = 0.50 cm/min Attenuation = 1455 Zero Offset = 64%
Start Time = 6.000 min End Time = 42.000 min Min / Tick = -5.00

weathered Gasoline



Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph010.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : 1241-3 .0025 g/ml

ection Date: 13-MAY-97 5:18 PM Recalculation Date: 14-MAY-97 10:07 AM

Operator : G. Latham
Workstation: MS-DOS_5?
Instrument : Varian Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 ****************

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Retention Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)
	Totals:	100.0000		0.000	185879360		

Total Unidentified Counts : 185879360 counts

Detected Peaks: 228 Rejected Peaks: 0 Identified Peaks: 0

Amount Standard: 1.000000 Multiplier: 1.000000 Divisor: 1.000000

se: 3 microVolts/sec Baseline Offset: -136 microVolts

Error Log:

3400 GC:

ADC Board:

****

Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph011.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : 1241-4 .0025 g/ml

mw-75

Injection Date: 13-MAY-97 6:07 PM Recalculation Date: 14-MAY-97 10:08 AM

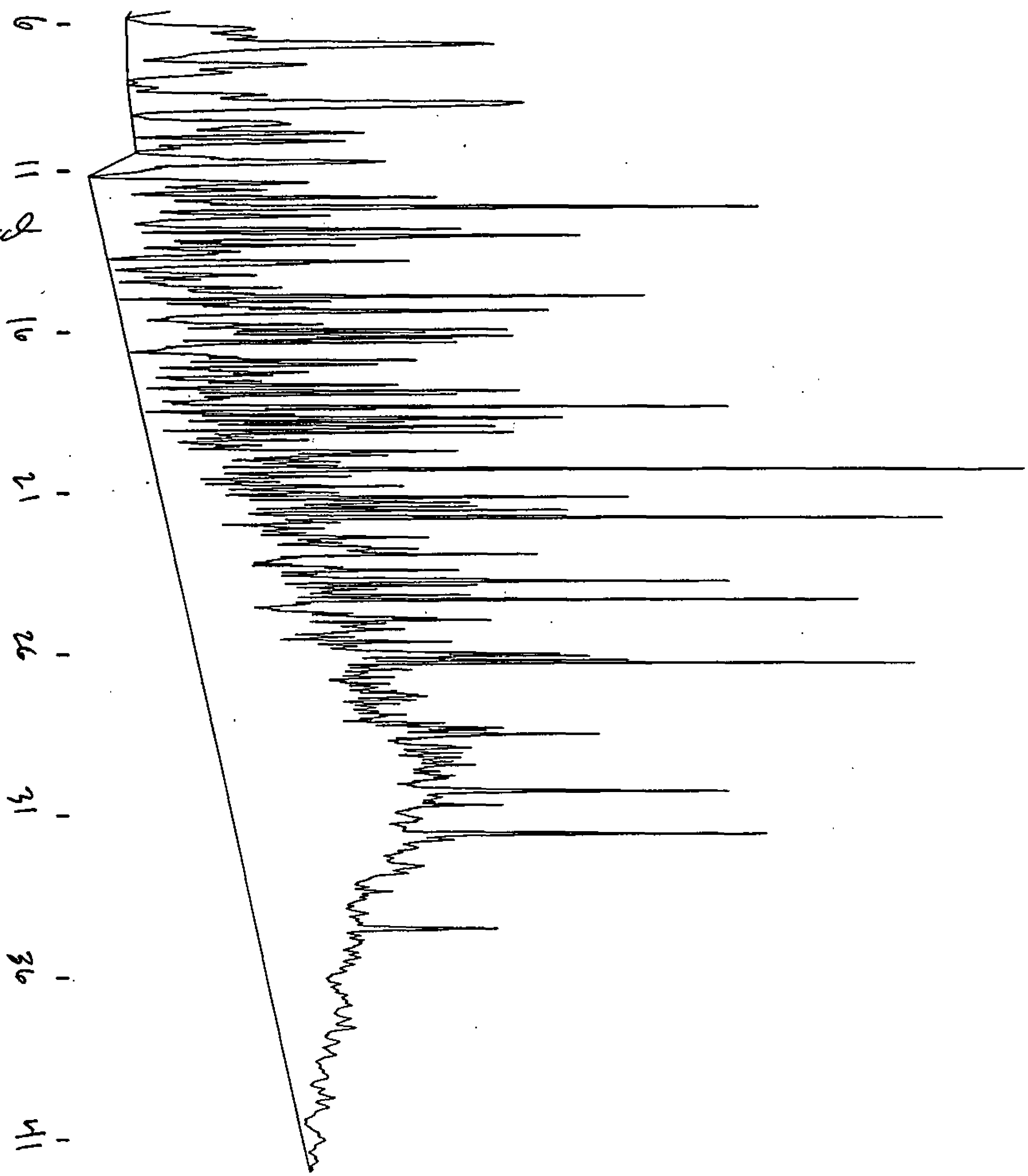
Operator : G. Latham
Workstation: MS-DOS_5
Instrument : Varian Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 *****************

Chart Speed = 0.50 cm/min Attenuation = 283 Zero Offset = 59%
Start Time = 6.000 min End Time = 42.000 min Min / Tick = 5.00

unidentified mixture



Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph011.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : 1241-4 .0025 g/ml

Injection Date: 13-MAY-97 6:07 PM Recalculation Date: 14-MAY-97 10:08 AM

Operator : G. Latham
Workstation: MS-DOS_5
Instrument : Varian Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 ****************

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Retention Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)
	Totals:	100.0000		0.000	19184930		

Total Unidentified Counts : 19184930 counts

Detected Peaks: 229 Rejected Peaks: 0 Identified Peaks: 0

Amount Standard: 1.000000 Multiplier: 1.000000 Divisor: 1.000000

Noise: 3 microVolts/sec Baseline Offset: -98 microVolts

Error Log:

3400 GC:

ADC Board:

****

```
Title         : 8015 Analysis
Run File      : C:\STAR\MODULE18\atph012.RUN
Method File   : C:\STAR\TPH.MTH
Sample ID     : 1241-5 .025 g/ml
```

mw-73

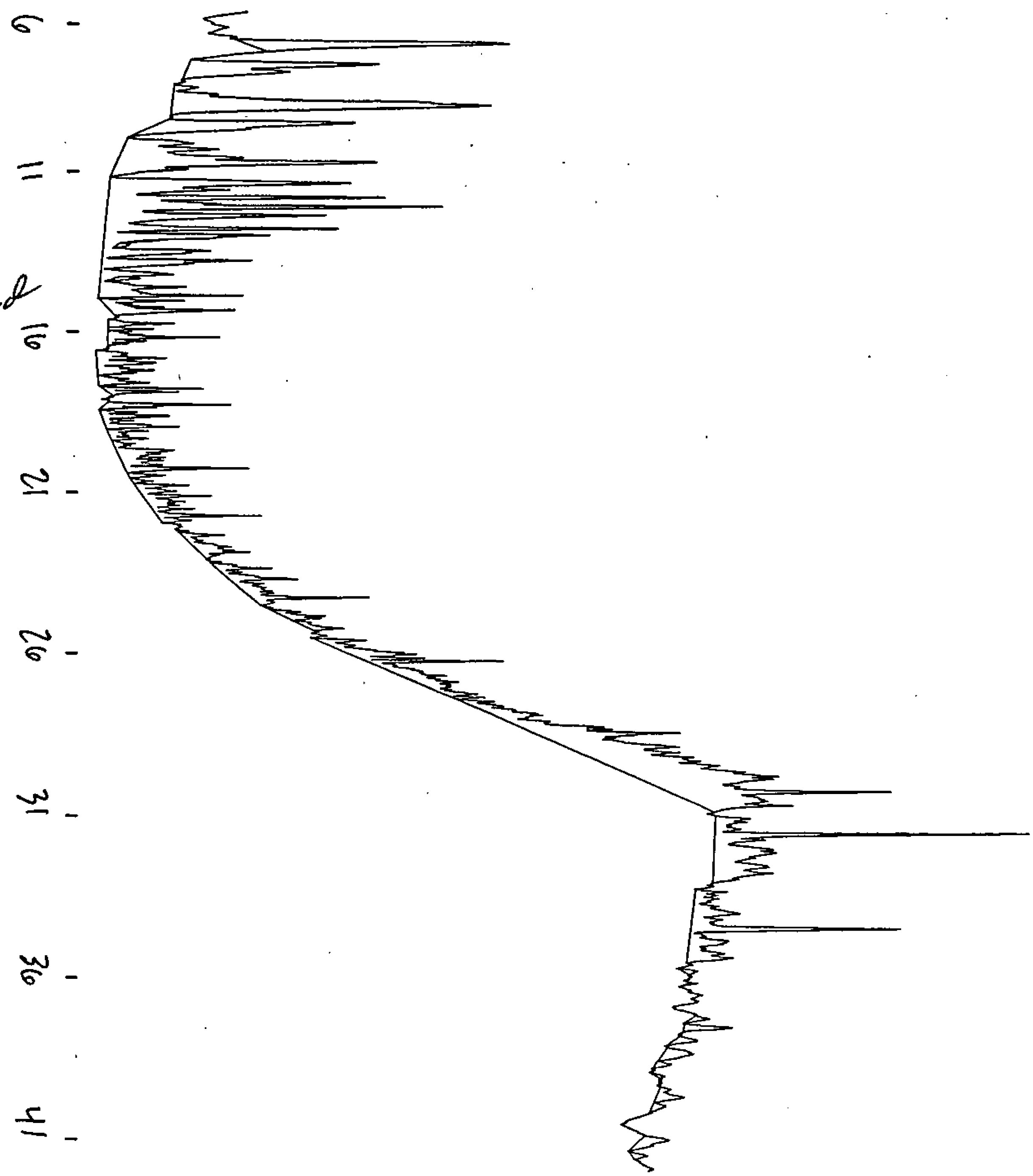
```
ection Date: 13-MAY-97 6:56 PM   Recalculation Date: 14-MAY-97 10:09 AM

Operator     : G. Latham              Detector Type: ADCB (1 Volt)
Workstation: MS-DOS_5                 Bus Address   : 18
Instrument  : Varian Star #1          Sample Rate   : 10.00 Hz
Channel      : B = FID                Run Time      : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 *****************

Chart Speed =    0.50 cm/min   Attenuation =     108       Zero Offset = 162%
Start Time  =   6.000 min      End Time     =  42.000 min  Min / Tick  = 5.00
```

unidentified mixture



Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph012.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : 1241-5 .025 g/ml

Injection Date: 13-MAY-97 6:56 PM Recalculation Date: 14-MAY-97 10:09 AM

Operator : G. Latham
Workstation: MS-DOS_5
Instrument : Varian Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 ****************

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Retention Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)
	Totals:	100.0000		0.000	2118719		

Total Unidentified Counts : 2118719 counts

Detected Peaks: 186 Rejected Peaks: 0 Identified Peaks: 0

Amount Standard: 1.000000 Multiplier: 1.000000 Divisor: 1.000000

Noise: 5 microVolts/sec Baseline Offset: -123 microVolts

Error Log:

3400 GC:

ADC Board:

****

Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph013.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : 1241-6 .025 g/ml

MW-71

ection Date: 13-MAY-97 7:45 PM Recalculation Date: 14-MAY-97 10:10 AM

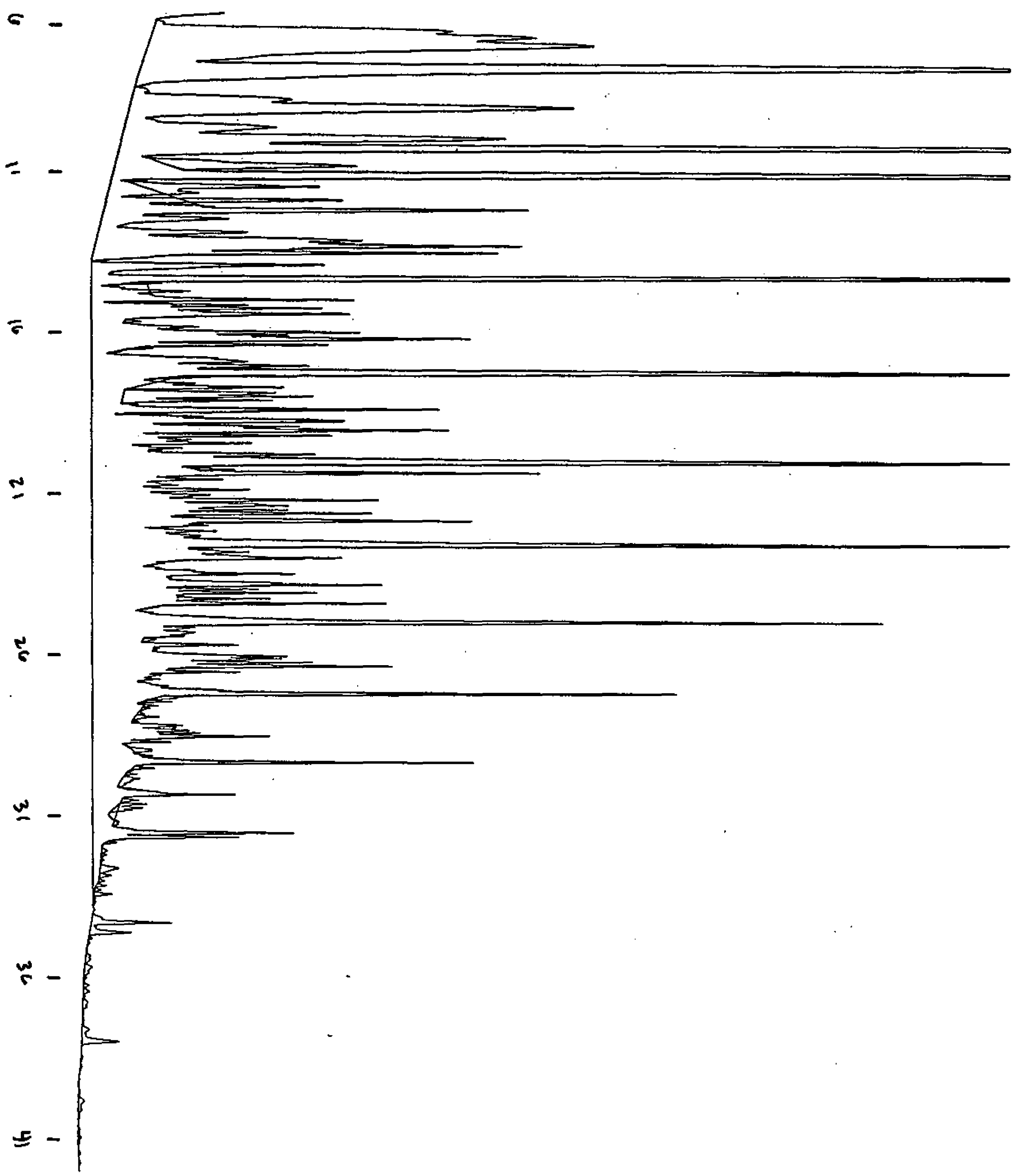
Operator : G. Latham
Workstation: MS-DOS_5
Instrument : Varian Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 *****************

Chart Speed = 0.50 cm/min Attenuation = 5886 Zero Offset = 19%
Start Time = 6.000 min End-Time = 42.000 min Min / Tick = 5.00

Kerosine



Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph013.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : 1241-6 .025 g/ml

Injection Date: 13-MAY-97 7:45 PM Recalculation Date: 14-MAY-97 10:10 AM

Operator : G. Latham
Workstation: MS-DOS_5
Instrument : Varian_Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 ****************

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Retention Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)
	Totals:	100.0000		0.000	361042656		

Total Unidentified Counts : 361042656 counts

Detected Peaks: 244 Rejected Peaks: 5 Identified Peaks: 0

Amount Standard: 1.000000 Multiplier: 1.000000 Divisor: 1.000000

Noise: 5 microVolts/sec Baseline Offset: -81 microVolts

Error Log:

3400 GC:

ADC Board:

****

5.0 Comparison Standard Chromatograms

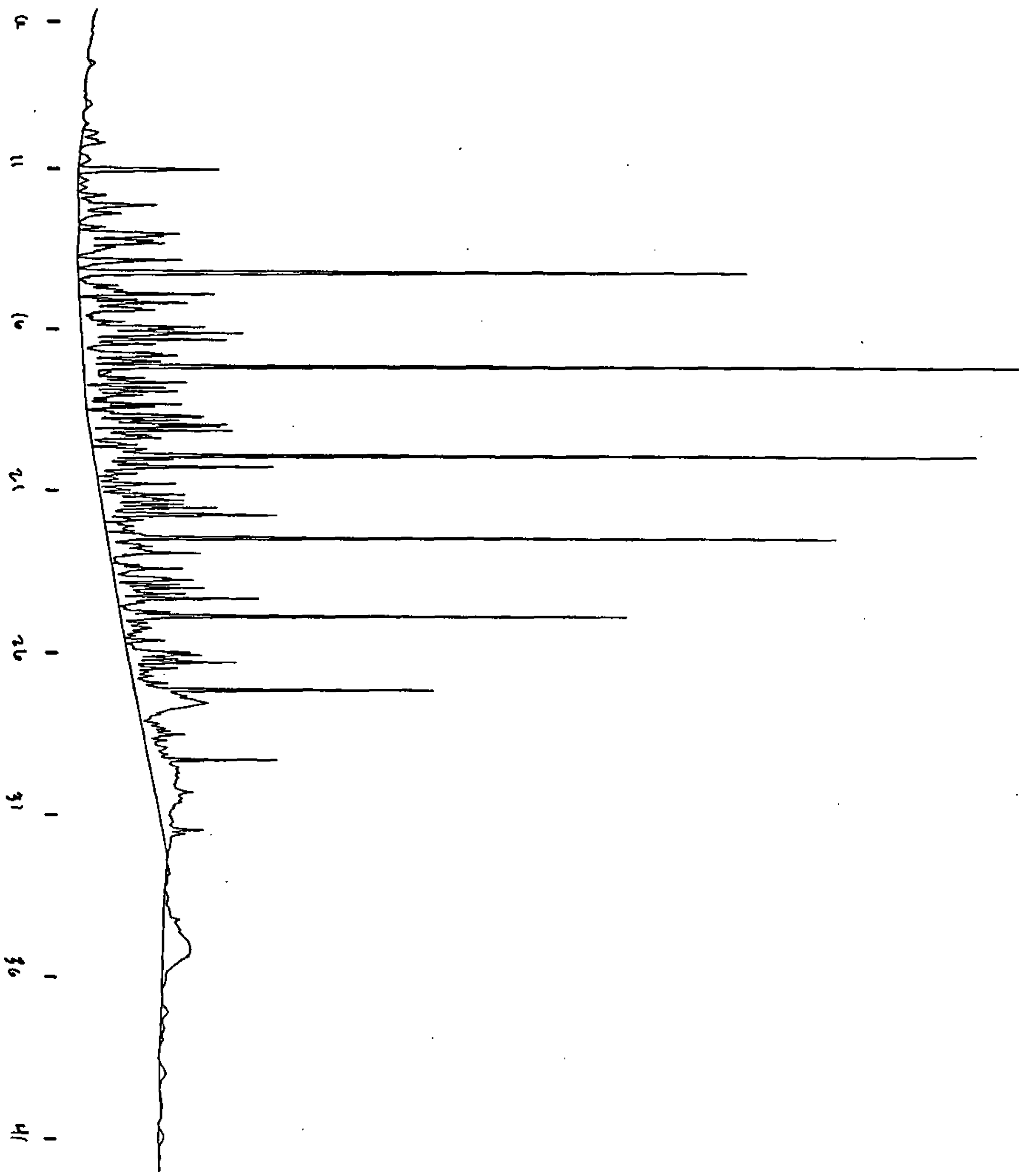
Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph003.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : Kerosine 1000 ppm

Injection Date: 13-MAY-97 11:32 AM Recalculation Date: 14-MAY-97 10:00 AM

Operator	: G. Latham	Detector Type	: ADCB (1 Volt)
Workstation	: MS-DOS_5	Bus Address	: 18
Instrument	: Varian Star #1	Sample Rate	: 10.00 Hz
Channel	: B = FID	Run Time	: 42.002 min

*********** Varian GC Star Workstation ************ Version A2 *****************

Chart Speed =	0.50 cm/min	Attenuation =	499	Zero Offset =	36%
Start Time =	6.000 min	End Time =	42.000 min	Min / Tick =	5.00



Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph003.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : Kerosine 1000 ppm

Injection Date: 13-MAY-97 11:32 AM Recalculation Date: 14-MAY-97 10:00 AM

Operator : G. Latham
Workstation: MS-DOS_5
Instrument : Varian_Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 ****************

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Retention Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)
	Totals:	100.0000		0.000	6096144		

Total Unidentified Counts : 6096144 counts

Detected Peaks: 166 Rejected Peaks: 1 Identified Peaks: 0

Amount Standard: 1.000000 Multiplier: 1.000000 Divisor: 1.000000

Noise: 3 microVolts/sec Baseline Offset: -128 microVolts

Error Log:

3400 GC:

ADC Board:

****

Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph004.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : #2 fuel 1000 ppm

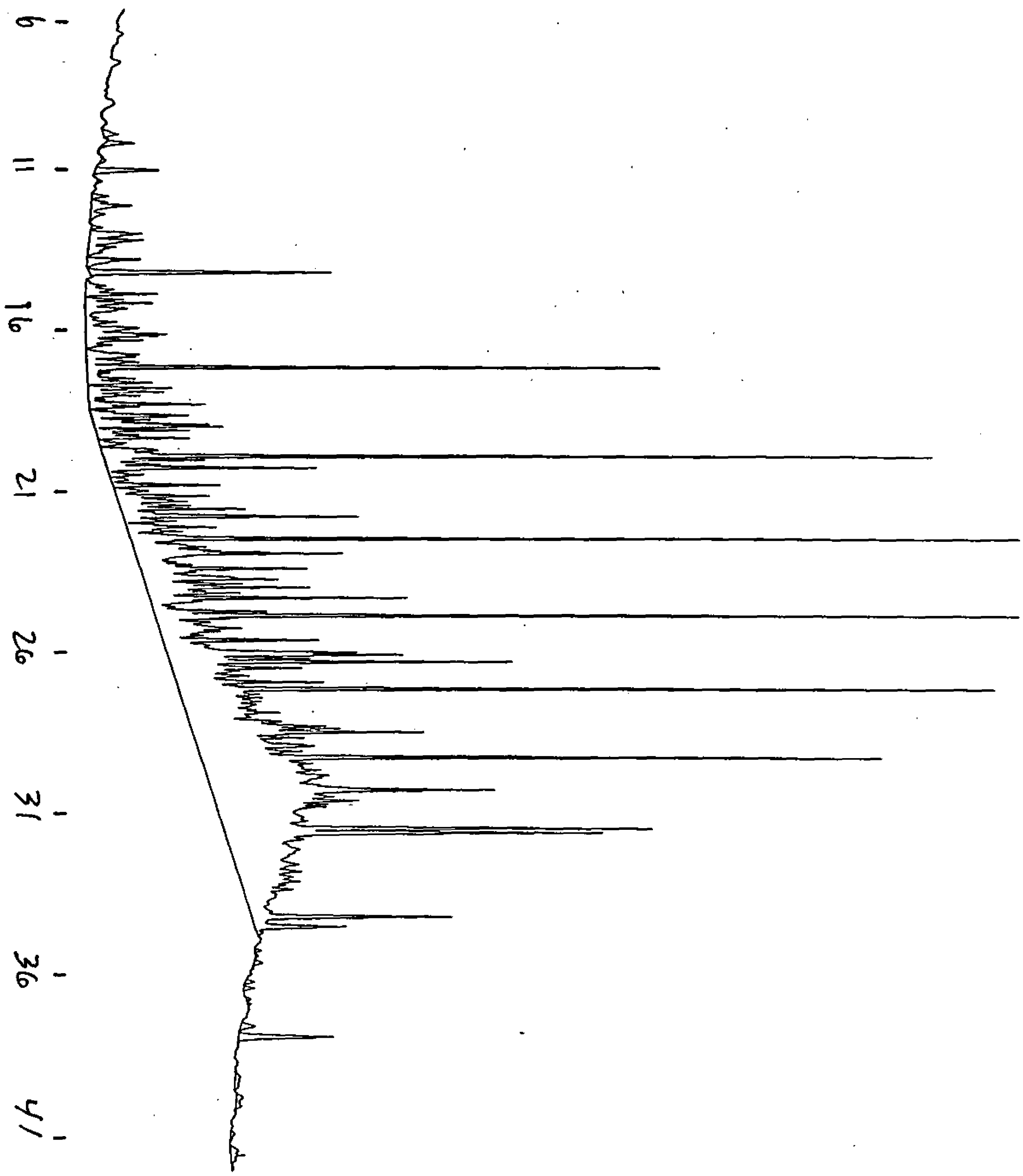
Injection Date: 13-MAY-97 12:22 PM Recalculation Date: 14-MAY-97 10:01 AM

Operator : G. Latham
Workstation: MS-DOS_5
Instrument : Varian Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 *****************

Chart Speed = 0.50 cm/min Attenuation = 254 Zero Offset = 70%
Start Time = 6.000 min End Time = 42.000 min Min / Tick = 5.00



Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph004.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : #2 fuel 1000 ppm

Injection Date: 13-MAY-97 12:22 PM   Recalculation Date: 14-MAY-97 10:01 AM

Operator : G. Latham
Workstation: MS-DOS_5
Instrument : Varian Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 ****************

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Retention Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)
	Totals:	100.0000		0.000	5282835		

Total Unidentified Counts : 5282835 counts

Detected Peaks: 196   Rejected Peaks: 3   Identified Peaks: 0

Amount Standard: 1.000000   Multiplier: 1.000000   Divisor: 1.000000

Noise: 3 microVolts/sec   Baseline Offset: -121 microVolts

Error Log:

3400 GC:

ADC Board:

****

Title   : 8015 Analysis
Run File   : C:\STAR\MODULE18\atph005.RUN
Method File   : C:\STAR\TPH.MTH
Sample ID   : #4 fuel 1000 ppm

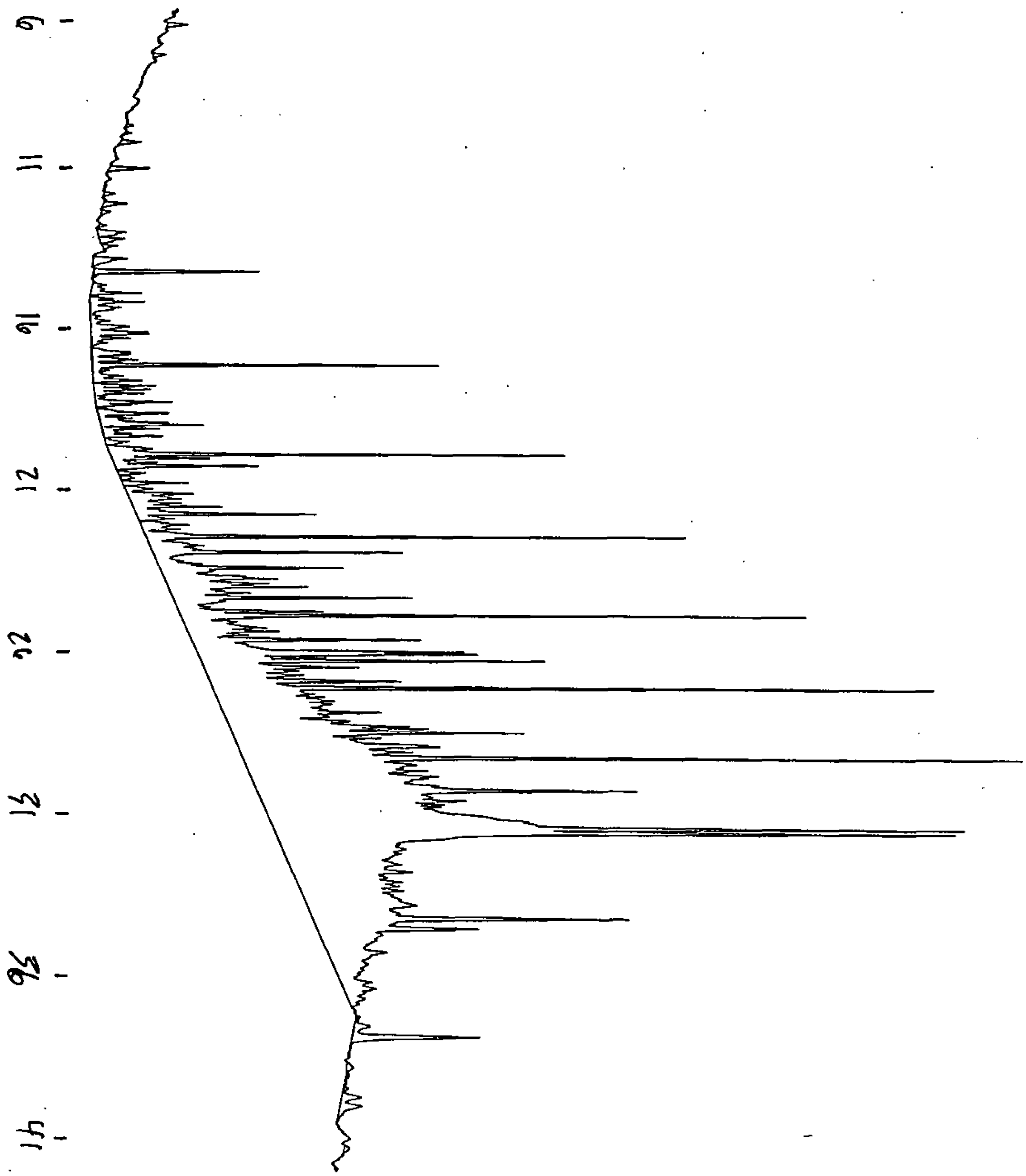
jection Date: 13-MAY-97 1:12 PM   Recalculation Date: 14-MAY-97 10:02 AM

Operator   : G. Latham
Workstation: MS-DOS_5
Instrument : Varian Star #1
Channel   : B = FID

Detector Type: ADCB (1 Volt)
Bus Address   : 18
Sample Rate   : 10.00 Hz
Run Time   : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 *****************

Chart Speed =   0.50 cm/min   Attenuation =   147   Zero Offset = 118%
Start Time = 6.000 min   End Time   = 42.000 min   Min / Tick = 5.00



Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph005.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : #4 fuel 1000 ppm

Injection Date: 13-MAY-97 1:12 PM Recalculation Date: 14-MAY-97 10:02 AM

Operator : G. Latham
Workstation: MS-DOS_5
Instrument : Varian Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 ****************

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Retention Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)
	Totals:	100.0000		0.000	4171242		

Total Unidentified Counts : 4171242 counts

Detected Peaks: 181 Rejected Peaks: 1 Identified Peaks: 0

Amount Standard: 1.000000 Multiplier: 1.000000 Divisor: 1.000000

Noise: 3 microVolts/sec Baseline Offset: -134 microVolts

Error Log:

3400 GC:

ADC Board:

****

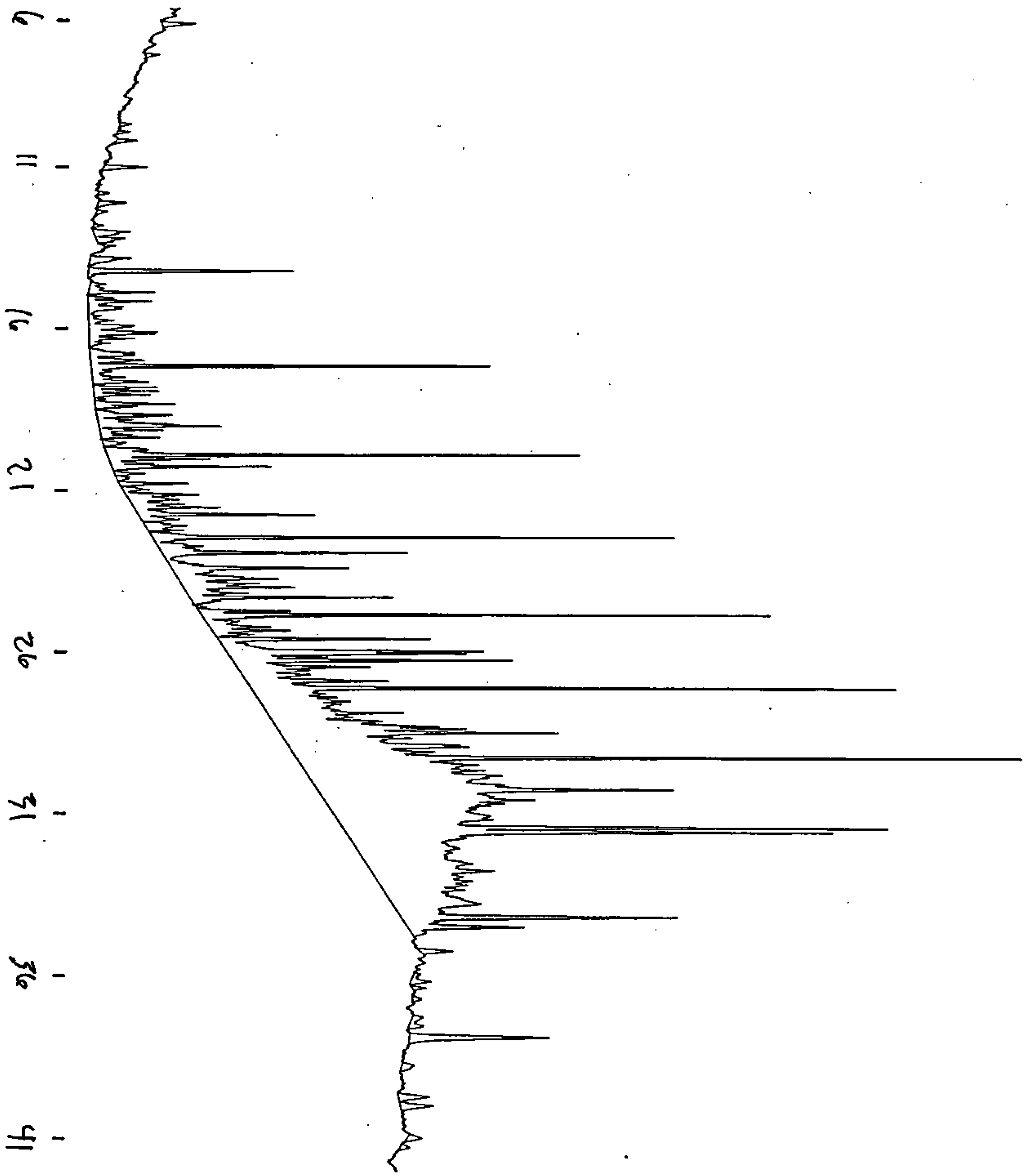
```
Title          : 8015 Analysis
Run File       : C:\STAR\MODULE18\atph006.RUN
Method File    : C:\STAR\TPH.MTH
Sample ID      : #5 fuel 1000 ppm

ection Date: 13-MAY-97 2:01 PM  Recalculation Date: 14-MAY-97 10:03 AM

Operator    : G. Latham                  Detector Type: ADCB (1 Volt)
Workstation: MS-DOS_5?                   Bus Address  : 18
Instrument : Varian Star #1              Sample Rate  : 10.00 Hz
Channel     : B = FID                    Run Time     : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 *****************

Chart Speed =    0.50 cm/min   Attenuation =     103        Zero Offset = 169%
Start Time  =    6.000 min     End Time    =  42.000 min    Min / Tick  = 5.00
```



Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph006.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : #5 fuel 1000 ppm

ection Date: 13-MAY-97 2:01 PM Recalculation Date: 14-MAY-97 10:03 AM

Operator : G. Latham
Workstation: MS-DOS_5?
Instrument : Varian Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

************ Varian GC Star Workstation ************ Version A2 ****************

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Retention Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)
	Totals:	100.0000		0.000	2529601		

Total Unidentified Counts : 2529601 counts

Detected Peaks: 173 Rejected Peaks: 1 Identified Peaks: 0

Amount Standard: 1.000000 Multiplier: 1.000000 Divisor: 1.000000

se: 3 microVolts/sec Baseline Offset: -131 microVolts

Error Log:

3400 GC:

ADC Board:

****

Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph007.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : #6 fuel 1000ppm

Injection Date: 13-MAY-97 2:51 PM Recalculation Date: 14-MAY-97 10:04 AM

Operator : G. Latham
Workstation: MS-DOS_5
Instrument : Varian Star #1
Channel : B = FID

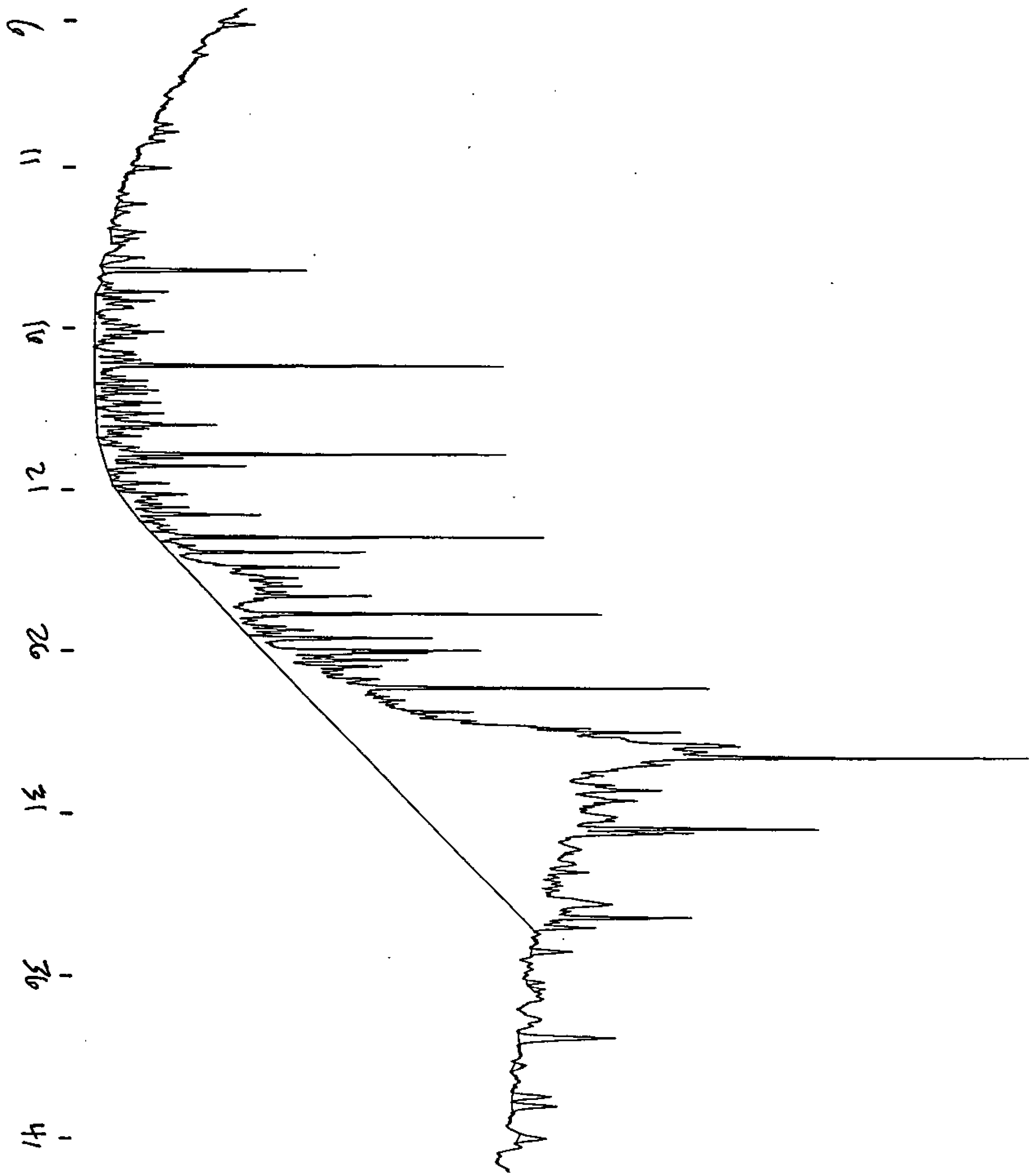
Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 *****************

Chart Speed = 0.50 cm/min
Start Time = 6.000 min

Attenuation = 71
End Time = 42.000 min

Zero Offset = 253%
Min / Tick = 5.00



Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph007.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : #6 fuel 1000ppm

Injection Date: 13-MAY-97 2:51 PM Recalculation Date: 14-MAY-97 10:04 AM

Operator : G. Latham
Workstation: MS-DOS_5
Instrument : Varian_Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 ****************

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Retention Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)
	Totals:	100.0000		0.000	1939496		

Total Unidentified Counts : 1939496 counts

Detected Peaks: 154 Rejected Peaks: 1 Identified Peaks: 0

Amount Standard: 1.000000 Multiplier: 1.000000 Divisor: 1.000000

Noise: 3 microVolts/sec Baseline Offset: -7 microVolts

Error Log:

3400 GC:

ADC Board:

****

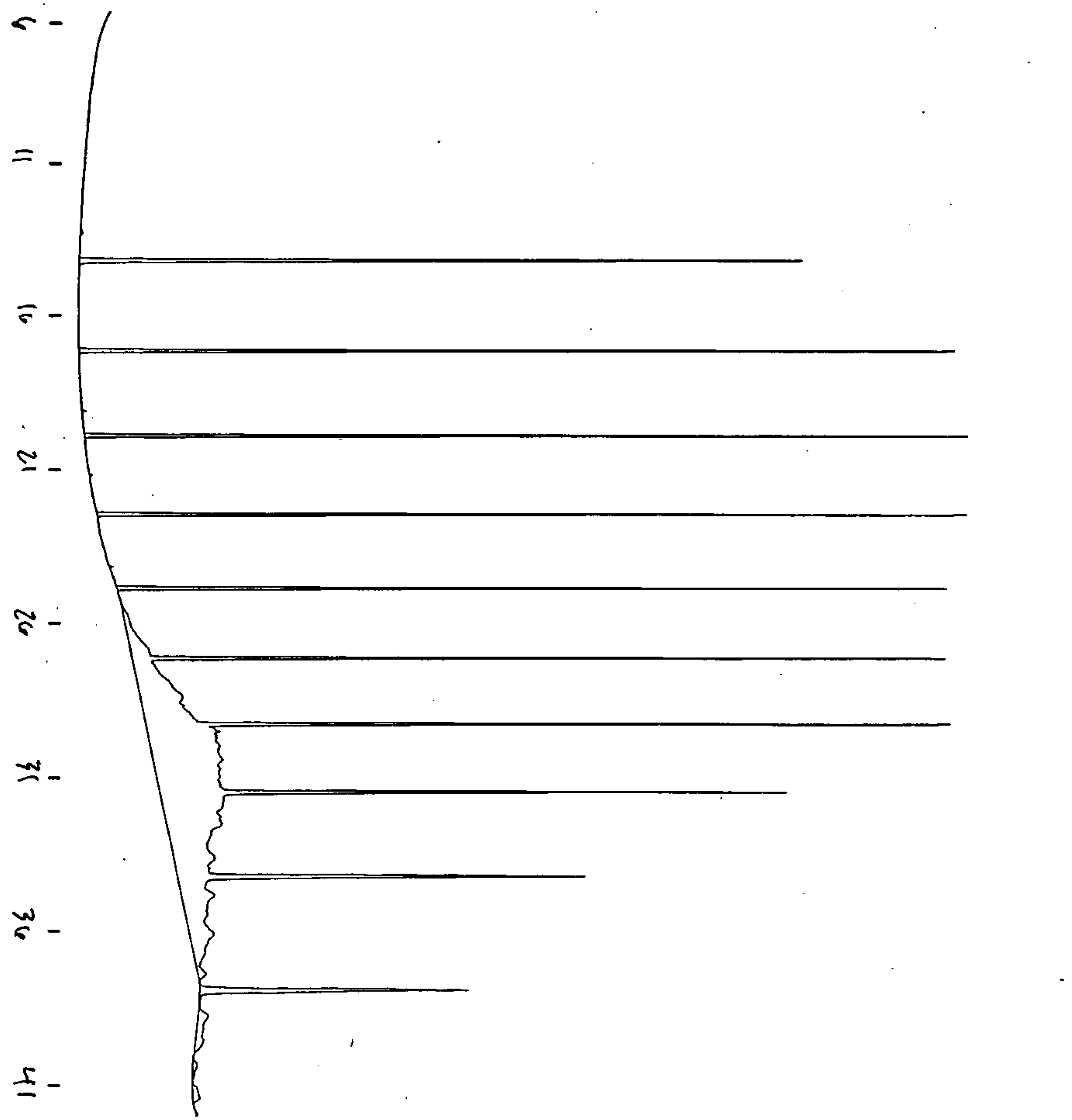
```
Title        : 8015 Analysis
Run File     : C:\STAR\MODULE18\atph001.RUN
Method File  : C:\STAR\TPH.MTH
Sample ID    : Dro 50 ppm

Injection Date: 13-MAY-97 9:54 AM  Recalculation Date: 14-MAY-97 9:58 AM

Operator    : G. Latham              Detector Type: ADCB (1 Volt)
Workstation: MS-DOS_5                Bus Address  : 18
Instrument : Varian Star #1          Sample Rate  : 10.00 Hz
Channel     : B = FID                Run Time     : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 *****************

Chart Speed =    0.50 cm/min   Attenuation =      489      Zero Offset = 39%
Start Time  =   6.000 min      End Time    =  42.000 min   Min / Tick  = 5.00
```



Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph001.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : Dro 50 ppm

[illegible]ection Date: 13-MAY-97 9:54 AM Recalculation Date: 14-MAY-97 9:58 AM

Operator : G. Latham
Workstation: MS-DOS_5
Instrument : Varian Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 ****************

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Retention Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)
	Totals:	100.0000		0.000	6021088		

Total Unidentified Counts : 6021088 counts

Detected Peaks: 103 Rejected Peaks: 3 Identified Peaks: 0

Amount Standard: 1.000000 Multiplier: 1.000000 Divisor: 1.000000

N[illegible]e: 2 microVolts/sec Baseline Offset: 77 microVolts

Error Log:

3400 GC:

ADC Board:

****

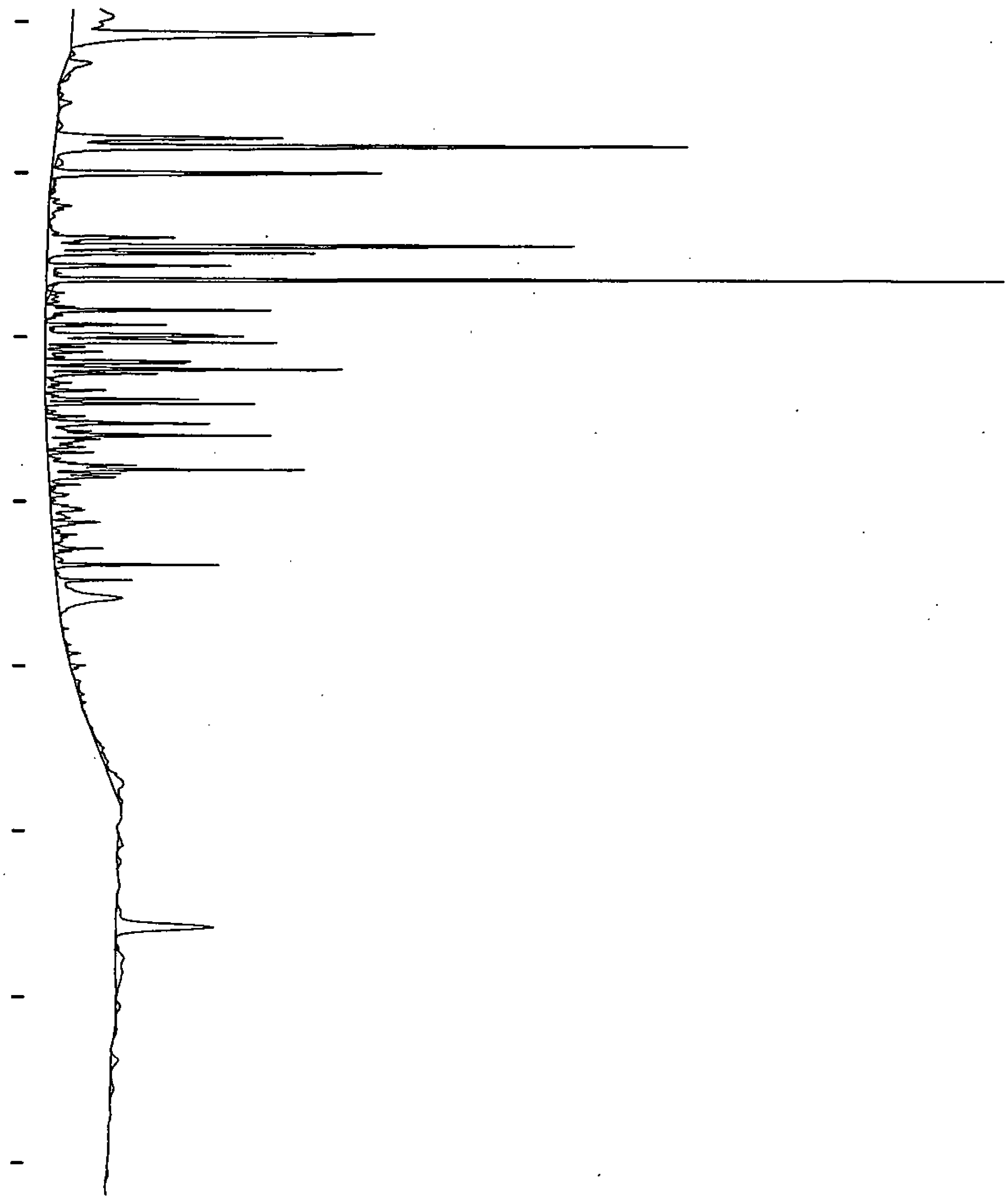
Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph002.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : 1000 ppm gasoline

Injection Date: 13-MAY-97 10:43 AM   Recalculation Date: 14-MAY-97 9:59 AM

Operator : G. Latham   Detector Type: ADCB (1 Volt)
Workstation: MS-DOS_5?   Bus Address : 18
Instrument : Varian Star #1   Sample Rate : 10.00 Hz
Channel : B = FID   Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 *****************

Chart Speed = 0.50 cm/min   Attenuation = 708   Zero Offset = 26%
Start Time = 6.000 min   End Time = 42.000 min   Min / Tick = 5.00



Title : 8015 Analysis
Run File : C:\STAR\MODULE18\atph002.RUN
Method File : C:\STAR\TPH.MTH
Sample ID : 1000 ppm gasoline

Injection Date: 13-MAY-97 10:43 AM Recalculation Date: 14-MAY-97 9:59 AM

Operator : G. Latham
Workstation: MS-DOS_5?
Instrument : Varian_Star #1
Channel : B = FID

Detector Type: ADCB (1 Volt)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 42.002 min

*********** Varian GC Star Workstation ************ Version A2 ****************

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Retention Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)
	Totals:	100.0000		0.000	7410368		

Total Unidentified Counts : 7410368 counts

Detected Peaks: 150 Rejected Peaks: 1 Identified Peaks: 0

Amount Standard: 1.000000 Multiplier: 1.000000 Divisor: 1.000000

Noise: 3 microVolts/sec Baseline Offset: -123 microVolts

Error Log:

3400 GC:

ADC Board:

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APPENDIX I

MAIN DRAINAGE SWALE SAMPLING LOCATIONS AND RESULTS (RI & RDI)

Analyte	Outfall Soil RI - Phase I	
	SP-33	SP-35
Total Arsenic	52	18
Total Lead	263	180
Total Zinc	745	112
Benzene	NA	NA
Ethylbenzene	ND	ND
Toluene	ND	ND
Xylenes	NA	NA

Analyte	Pool / Seep Soil RI - Phase I			
	SP-25	SP-27	SP-29	SP-34
Total Arsenic	572	37	271	17
Total Cadmium	7U	4U	3	ND
Total Lead	59	116	18	100
Total Zinc	141	165	119	94
Benzene	NA	NA	NA	NA
Ethylbenzene	ND	ND	ND	ND
Toluene	ND	ND	ND	960
Xylenes	NA	NA	NA	NA
1,3,5-trimethylbenzene	ND	ND	ND	1
Total Cyclohexanes	4,000	ND	ND	11,940
Non-Priority TICs	2,880	ND	ND	10,710

Analyte	Swale Bank Soil RI - Phase IIA			
	SS-21	SS-22	SS-23	SS-24
Total Arsenic	6	6	7	7
Total Lead	23	57	ND	677
Total Zinc	46	44	54	56
Benzene	2E	ND	2E	3E
Ethylbenzene	NA	NA	NA	NA
Toluene	2E	ND	ND	ND
Xylenes	NA	NA	NA	NA
2-Butanone	13	ND	ND	16
Carbon Disulfide	36	ND	3E	ND
Priority TICs	803E	189E	1,003E	1,334E
Non-Priority TICs	3,856E	3,070E	3,700E	8,330E

Analyte	Swale Sediment RI - Phase IIA		Swale Sediment RI - Phase IIB		
	RS-10	RS-11	AB-66 (0-0.5')	AB-67 (0-0.5')	AB-68 (0-0.5')
Total Arsenic	NA	NA	2U	46J	45J
Total Barium	NA	NA	131	187	174
Total Cadmium	22	ND	1U	1U	1U
Total Iron	NA	NA	13,400	33,900	40,300
Total Lead	802	17	22	9	19J
Total Manganese	NA	NA	810J	2,670J	1,900J
Total Zinc	159	172	62	26	52
Benzene	5	120	5U	5U	36
Ethylbenzene	NA	NA	5U	5U	5U
Toluene	NA	NA	1U	1U	1U
Xylenes	NA	NA	5U	5U	5U
Chlorobenzene	ND	31	5U	5U	5U
2-Hexanone	ND	51	10U	10U	10U
2-Butanone	33	74	17R	18R	71R
1,1,2,2-Tetrachloroethane	ND	31	5U	5U	5U
Carbon Disulfide	ND	68	5U	5U	5U
Total Cyclohexanes	ND	56E	ND	32	2,790
Total Alkanes	NA	NA	17,140	2,469	20,315
Priority TICs	1,510	5,063E	ND	122	3,089
Non-Priority TICs	10,424	7,644	25,060	16,830	218,100

Analyte	Swale Soil RI - Phase IIB					
	AB-66 (2-4')	AB-66 (8-10')	AB-67 (2-4')	AB-67 (8-10')	AB-68 (2-4')	AB-68 (8-10')
Total Arsenic	4	12	8	8	8J	14J
Total Barium	63	80	50	50M	80	49M
Total Iron	15,300	26,400	11,700	19,500	17,800	18,900
Total Lead	12	11	8	12	25J	10J
Total Manganese	208J	514J	573J	515J	276J	395J
Total Zinc	37	64	38	48	39	41
Benzene	5U	5U	5U	5U	5U	5U
Ethylbenzene	5U	5U	5U	5U	5U	5U
Toluene	1U	1U	1U	1U	1U	1U
Xylenes	5U	5U	5U	5U	5U	5U
Acetone	10U	13U	10U	10U	10U	18
Total Alkanes	5,630	ND	1,630	1,310	ND	ND
Non-Priority TICs	9,070	1,810	1,630	1,310	14,730	3,860

ND - compound not detected

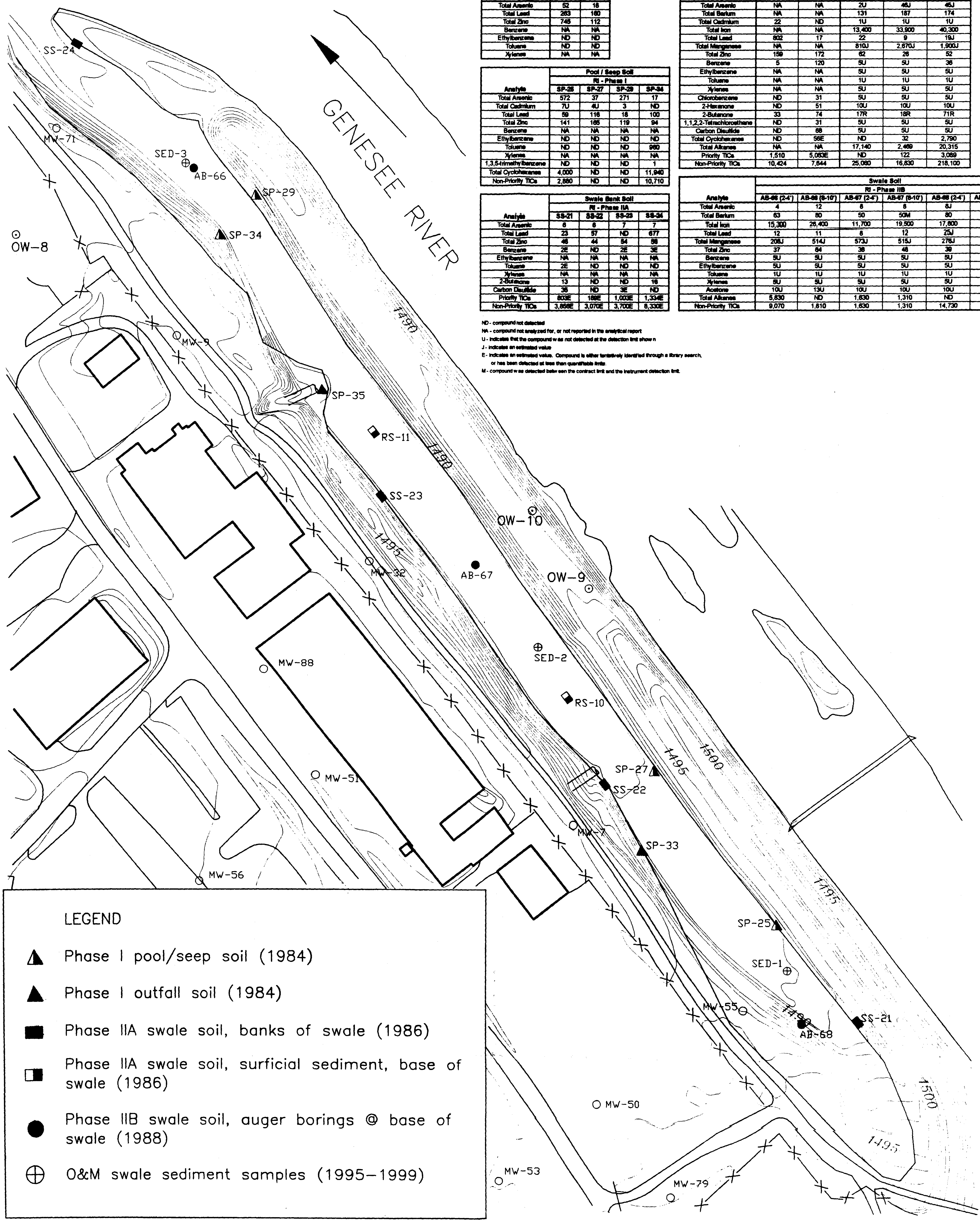
NA - compound not analyzed for, or not reported in the analytical report

U - indicates that the compound was not detected at the detection limit shown

J - indicates an estimated value

E - indicates an estimated value. Compound is either tentatively identified through a library search, or has been detected at less than quantifiable limits.

M - compound was detected between the contract limit and the instrument detection limit.



LEGEND

- Phase I pool/seep soil (1984)
- Phase I outfall soil (1984)
- Phase IIA swale soil, banks of swale (1986)
- Phase IIA swale soil, surficial sediment, base of swale (1986)
- Phase IIB swale soil, auger borings @ base of swale (1988)
- O&M swale sediment samples (1995–1999)

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SWALE SEDIMENT SAMPLE DATA 1984 THROUGH 1999

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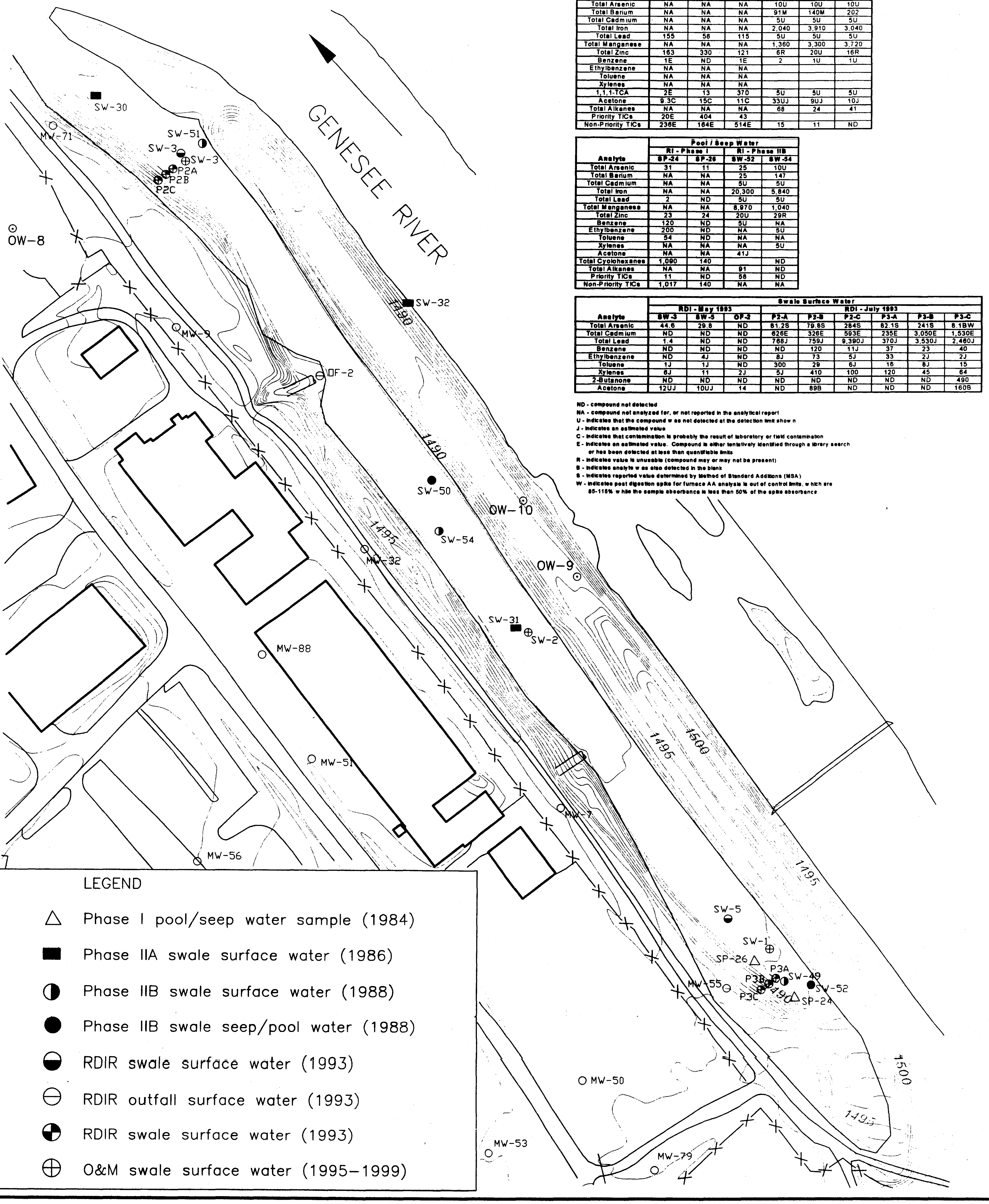

	Swale Surface Water					
	RI - Phase IIA			RI - Phase IIB		
Analyte	SW-30	SW-31	SW-32	SW-49	SW-50	SW-51
Total Arsenic	NA	NA	NA	10U	10U	10U
Total Barium	NA	NA	NA	91M	140M	202
Total Cadmium	NA	NA	NA	5U	5U	5U
Total Iron	NA	NA	NA	2,040	3,910	3,040
Total Lead	155	58	115	5U	5U	5U
Total Manganese	NA	NA	NA	1,360	3,300	3,720
Total Zinc	163	330	121	6R	20U	16R
Benzene	1E	ND	1E	2	1U	1U
Ethylbenzene	NA	NA	NA			
Toluene	NA	NA	NA			
Xylenes	NA	NA	NA			
1,1,1-TCA	2E	13	370	5U	5U	5U
Acetone	9.3C	15C	11C	33UJ	9UJ	10J
Total Alkanes	NA	NA	NA	68	24	41
Priority TICs	20E	404	43			
Non-Priority TICs	236E	164E	514E	15	11	ND

	Pool / Seep Water			
	RI - Phase I		RI - Phase IIB	
Analyte	SP-24	SP-26	SW-52	SW-54
Total Arsenic	31	11	25	10U
Total Barium	NA	NA	25	147
Total Cadmium	NA	NA	5U	5U
Total Iron	NA	NA	20,300	5,840
Total Lead	2	ND	5U	5U
Total Manganese	NA	NA	8,970	1,040
Total Zinc	23	24	20U	29R
Benzene	120	ND	5U	NA
Ethylbenzene	200	ND	NA	5U
Toluene	54	ND	NA	NA
Xylenes	NA	NA	NA	5U
Acetone	NA	NA	41J	
Total Cyclohexanes	1,090	140		ND
Total Alkanes	NA	NA	91	ND
Priority TICs	11	ND	58	ND
Non-Priority TICs	1,017	140	NA	NA

	Swale Surface Water								
	RDI - May 1993			RDI - July 1993					
Analyte	SW-3	SW-5	OF-2	P2-A	P2-B	P2-C	P3-A	P3-B	P3-C
Total Arsenic	44.6	29.8	ND	81.2S	79.8S	284S	82.1S	241S	8.1BW
Total Cadmium	ND	ND	ND	626E	326E	593E	235E	3,050E	1,530E
Total Lead	1.4	ND	ND	768J	759J	9,390J	370J	3,530J	2,460J
Benzene	ND	ND	ND	ND	120	11J	37	23	40
Ethylbenzene	ND	4J	ND	8J	73	5J	33	2J	2J
Toluene	1J	1J	ND	300	29	6J	16	8J	15
Xylenes	6J	11	2J	5J	410	100	120	45	64
2-Butanone	ND	ND	ND	ND	ND	ND	ND	ND	490
Acetone	12UJ	10UJ	14	ND	89B	ND	ND	ND	160B

ND - compound not detected
NA - compound not analyzed for, or not reported in the analytical report
U - indicates that the compound was not detected at the detection limit shown
J - indicates an estimated value
C - indicates that contamination is probably the result of laboratory or field contamination
E - indicates an estimated value. Compound is either tentatively identified through a library search or has been detected at less than quantifiable limits
R - indicates value is unusable (compound may or may not be present)
B - indicates analyte was also detected in the blank
S - indicates reported value determined by Method of Standard Additions (MSA)
W - indicates post digestion spike for furnace AA analysis is out of control limits, which are 85-115% while the sample absorbance is less than 50% of the spike absorbance

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SWALE SURFACE WATER SAMPLE DATA 1984 THROUGH 1999

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