PROPOSED REMEDIAL ACTION PLAN
Ward Products Site
City of Amsterdam, Montgomery County, New York
Site No. 429004

January 2007

Prepared by:

Division of Environmental Remediation
New York State Department of Environmental Conservation

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SECTION 1: SUMMARY AND PURPOSE OF THE PROPOSED PLAN

The New York State Department of Environmental Conservation (the Department), in consultation with the New York State Department of Health (NYSDOH), is proposing a remedy for the Ward Products site. The presence of hazardous waste has created significant threats to human health and/or the environment that are addressed by this proposed remedy. As more fully described in Sections 3 and 5 of this document, manufacture of automobile antennas has resulted in the disposal of hazardous wastes, including chlorinated solvents and electroplating wastes. These wastes have contaminated the on-site and off-site sediments and groundwater, and on-site soil, and have resulted in:

- a significant threat to human health associated with current and potential exposure to soil, sediments, groundwater, and soil vapor intrusion into indoor air.

- a significant environmental threat associated with the potential impacts of contaminants to fish and sediment-dwelling biota in the Mohawk River and two small tributaries to it.

To eliminate or mitigate these threats, the Department proposes in situ chemical oxidation supplemented by extraction and treatment for the groundwater. Contaminated sediments would be excavated and disposed off-site. An environmental easement would be placed on the property restricting groundwater use and requiring a site management plan. The existing sub-slab depressurization system should continue operating whenever the Ward Products building is occupied.

The proposed remedy, discussed in detail in Section 8, is intended to attain the remediation goals identified for this site in Section 6. The remedy must conform with officially promulgated standards and criteria that are directly applicable, or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, criteria and guidance are hereafter called SCGs.

This Proposed Remedial Action Plan (PRAP) identifies the preferred remedy, summarizes the other alternatives considered, and discusses the reasons for this preference. The Department will select a final remedy for the site only after careful consideration of all comments received during the public comment period.

The Department has issued this PRAP as a component of the Citizen Participation Plan developed pursuant to the New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375. This document is a summary of the information that can be found in greater detail in the May 2005 "Revised Remedial Investigations Report" (RI), the September 2006 "Feasibility Study Report and Risk Assessment" (FS), and other relevant documents. The public is encouraged to review the project documents, which are available at the following repositories:

Amsterdam Free Library
Reference Desk
28 Church Street

Amsterdam NY 12010
Hours: M, Th - 10 a.m. to 8 p.m.; Tu, W, F - 10 a.m. to 5:30 p.m.; Sa - 10 a.m. to 4 p.m.
Phone: (518) 842-1080

NYSDEC Region 4 Office
1130 North Westcott Road
Schenectady, NY 12306
Hours: Monday - Friday 8:30 - 4:00
Appointment requested; contact Allan Geisendorfer at (518) 357-2390

NYSDEC Central Office
625 Broadway, 12th Floor
Albany, NY 12233-7013
Hours: Monday - Friday 8:30 - 4:30
Appointment requested; contact Larry Alden, Project Manager, at (518) 402-9818

The Department seeks input from the community on all PRAPs. A public comment period has been set from February 2, 2007 to March 3, 2007 to provide an opportunity for public participation in the remedy selection process. A public meeting is scheduled for February 13, 2007 at the Amsterdam City Hall beginning at 7:00 p.m..

At the meeting, the results of the RI/FS will be presented along with a summary of the proposed remedy. After the presentation, a question-and-answer period will be held, during which verbal or written comments may be submitted on the PRAP. Written comments may also be sent to Mr. Alden at the above address through March 3, 2007.

The Department may modify the proposed remedy or select another of the alternatives presented in this PRAP, based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives identified here.

Comments will be summarized and addressed in the responsiveness summary section of the Record of Decision (ROD). The ROD is the Department's final selection of the remedy for this site.

SECTION 2: SITE LOCATION AND DESCRIPTION

Ward Products manufactures automobile antennas at an 8.6-acre property located in the City of Amsterdam, Montgomery County near the eastern corporate boundary with the Town of Amsterdam (see Figure 1), in the Edson Street Industrial Park. The property overlooks the Mohawk River Valley and consists of a 70,000 square foot manufacturing facility, a large parking lot, small areas of open woods to the north, and mowed lawn to the east. The Mohawk River is located approximately 3,000 feet to the southwest. The land slopes gently from north to south and an intermittent stream runs in a ditch along the eastern property line (see Figure 2). The area of disposal at the site encompasses approximately one acre.

Fiber Glass Industries (FGI), a manufacturer of fiberglass insulation, occupies the property adjacent to the site to the east. A custom millwork business, UCMI, is located across Edson Street to the south. A business dealing in custom horse clothing and accessories is to the west, and undeveloped land lies to the north. Other commercial businesses are located in the industrial park in the general vicinity of the site.

A small, intermittent tributary begins uphill of the Ward Products building and flows in the ditch on the eastern property line. In the past, this drainage way split into two branches, which flowed to the Mohawk River. Subsequent development of the UCMI buildings across Edson Street in the 1980s channeled drainage from the Ward Products building into one branch.

Soil at the site consists of glacial till atop Chuctanunda Creek dolostone bedrock. The till layer is only about two feet thick near the north end of the Ward Products building but it increases to over fifty feet thick on the UCMI property to the south. There is very little groundwater in the glacial till geological unit, and thus only a few overburden wells have been placed on the site. Bedrock groundwater is largely contained in fractures and joints in the shallow bedrock. Groundwater flow is generally to the south. With the exception of some past industrial use of groundwater, the nearest drinking water wells are located 2,600 feet southeast of the site.

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History

The facility was constructed in 1957 and occupied by the Gabriel Corporation, which manufactured antennas. Ward Products purchased Gabriel's operation in 1959. As part of the manufacturing process, small metal parts were cleaned with solvents (vapor degreasing) prior to electroplating operations using nickel/chromium, zinc/cyanide, and cadmium/cyanide lines.

Between 1957 and 1973, untreated electroplating bath solutions containing chromium, zinc, cadmium, and nickel, plus the degreasing solvent trichloroethene (TCE), were discharged to the nearby drainage ditch east of the Ward Products building. From 1973 through 1985, Ward pretreated the plating solutions from the nickel/chromium line and dried the resulting sludge on an outdoor concrete pad prior to removal for off-site disposal. The spent cadmium/cyanide plating solution was discharged to an outdoor tank for both natural and mechanical evaporation, with off-site disposal of the remaining sludges. The zinc/cyanide line was discontinued in 1973.

Ward Products connected to Amsterdam's sewer system in 1983 and discontinued the vapor degreasing system. In 1985, all electroplating operations ended at the site. In 1988 and 1989, the plant expanded with a new grinding shop built over the former sludge-drying pad and a new warehouse area built to the north. During the expansion, the hillside to the north of the plant was excavated and soil was pushed up the hill behind the facility. Soil around the sludge drying pad was excavated and stockpiled nearby.

3.2: Remedial History

In 1985, the Department first listed the site as a Class 2a site in the Registry of Inactive Hazardous Waste Disposal Sites in New York (the Registry). Class 2a was a temporary classification assigned to a site that had inadequate and/or insufficient data for inclusion in any of the other classifications. The first hydrogeologic investigations of the site took place in 1986 and 1988. The 1988 investigation included excavation of test pits east and southeast of the former electroplating and treatment operations. Surface water and sediment samples were collected from the drainage ditch. Shallow soil samples were also collected from beneath the sludge drying pad and analyzed for metals and VOCs. In 1989, the Department listed the site as a Class 2 site in the Registry. A Class 2 site is a site where hazardous waste presents a significant threat to the public health or the environment and action is required. Further hydrogeologic investigation of the site occurred in 1996, when four groundwater monitoring wells were installed and additional sediment samples were collected from the drainage ditch.

SECTION 4: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers.

The Department and Ward Products, Inc. entered into a Consent Order on April 10, 1997. The Order obligates the responsible parties to implement a remedial investigation and feasibility study remedial program. After the remedy is selected, the Department will approach the PRPs to implement the selected remedy under an Order on Consent.

SECTION 5: <u>SITE CONTAMINATION</u>

A remedial investigation/feasibility study (RI/FS) has been conducted to evaluate the alternatives for addressing the significant threats to human health and the environment.

5.1: <u>Summary of the Remedial Investigation</u>

The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site. The RI was conducted between August 1997 and May 2005. The field activities and findings of the investigation are described in the RI report.

Soil samples (Figure 3) were collected from extensive areas of the Ward Property from both the surface and subsurface. Surface water samples were collected from the intermittent drainage, and sediment samples (Figures 4, 5, and 6) were collected from the site down to the Mohawk River, located over 3,000 feet away. Groundwater monitoring wells (see Figure 2) were installed and sampled, and the quality of the air inside the Ward Products building was tested.

5.1.1: <u>Standards, Criteria, and Guidance (SCGs)</u>

To determine whether the soil, groundwater, surface water, sediment, and indoor air contain contamination at levels of concern, data from the investigation were compared to the following SCGs:

- Groundwater, drinking water, and surface water SCGs are based on the Department's "Ambient Water Quality Standards and Guidance Values" and Part 5 of the New York State Sanitary Code.

- Soil SCGs are based on the Department's Cleanup Objectives ("Technical and Administrative Guidance Memorandum [TAGM] 4046; Determination of Soil Cleanup Objectives and Cleanup Levels") and the Department's Remedial Program Soil Cleanup Objectives found in 6 NYCRR Part 375.

- Sediment SCGs are based on the Department's "Technical Guidance for Screening Contaminated Sediments".

- Concentrations of volatile organic compounds (VOCs) in air were evaluated using the air guidelines provided in the NYSDOH guidance document titled "Guidance for Evaluating Soil Vapor Intrusion in the State of New York," dated October 2006. Air Matrix 1 was referenced for TCE guidelines.

Based on the RI results, in comparison to the SCGs and potential public health and environmental exposure routes, certain media and areas of the site require remediation. These are summarized in Section 5.1.2. More complete information can be found in the RI report.

5.1.2: <u>Nature and Extent of Contamination</u>

This section describes the findings of the investigation for all environmental media that were investigated.

As described in the RI report, many soil, groundwater, surface water, and sediment samples were collected to characterize the nature and extent of contamination. As seen in Figures 7 through 17, the main categories of contaminants that exceed their SCGs are VOCs and inorganics (metals). For comparison purposes, where applicable, SCGs are provided for each medium.

Chemical concentrations are reported in parts per billion (ppb) for water and parts per million (ppm) for soil and sediment. Air samples are reported in micrograms per cubic meter ($\mu g/m^3$).

Figures 7 through 17 summarize the degree of contamination for the contaminants of concern in soil, groundwater, sediment, and indoor air and compare the data with the SCGs for the site. The following are the media which were investigated and a summary of the findings of the investigation.

Background Soil

During early investigations of the site, soil samples collected for background samples were found to contain elevated levels of electroplating metals and cyanide. This was the first indication that contamination extended beyond the area around the former sludge-drying pad. Subsequent soil samples collected from the site were checked and considered to be background samples if they did not have any detectable cadmium, hexavalent chromium, or cyanide - compounds which were not commonly found in uncontaminated soil. Twenty-three soil samples met that criterion, and the results were averaged to determine representative site background concentrations for the electroplating-related inorganics. Those values are shown in Table 1.

Surface Soil

Surface soil was collected from over 90 locations across the site (see Figure 3), generally from a depth of 0-2 inches, but sometimes from 0-6 inches. In areas affected by past disposal activities, the contaminants found above recommended soil cleanup objectives consisted of inorganics associated with electroplating: cadmium, chromium, cyanide, lead, nickel, and zinc. In addition, PCBs were found at concentrations up to 11 ppm in the vicinity of large transformers located on the east side of the building. Fifteen cubic yards of PCB-contaminated soil were removed in October and November 1999 as an Interim Remedial Measure (IRM).

The soil around the northeast corner of the Ward Products building exhibited extensive contamination. This is where the sludge-drying pad was located, and where soil was stockpiled when the facility expanded in 1988-89. It also appears that during the building expansion, contaminated soil may have been spread onto the lawn area east of the property and up the small hill to the north. Alternately, these areas were contaminated during regular operation of the plant before the facility expansion.

Total cadmium concentrations ranged from <0.25 ppm to less than 90 ppm. The recommended soil cleanup objective for cadmium is 1 ppm (TAGM 4046). Chromium concentrations (cleanup objective is the site background of 17 ppm) ranged from the background level to 810 ppm. Cyanide (cleanup objective of <1 ppm) was detected in a few samples, up to 24 ppm. The cleanup objective for lead is the site background concentration of 6.6 ppm. Lead was found at concentrations up to 330 ppm.

Nickel was detected from below the site background concentration (and the cleanup objective, 16 ppm) up to a high of 1,780 ppm. Total zinc concentrations ranged from below the cleanup objective and site background concentration (46 ppm) to 2,020 ppm. Figures 7 through 11 show the concentration contours of the five metals discussed above. The detections of cyanide were too sporadic to map.

The Department's regulations (6 NYCRR Part 375) promulgated soil cleanup objectives based on the use of the site. The soil cleanup objectives in Part 375 are as follows. For industrial use: cadmium - 60 ppm, chromium (hexavalent) - 800 ppm, chromium (trivalent) - 6,800 ppm, lead - 3,900 ppm, nickel - 10,000 ppm, and zinc - 10,000 ppm. For commercial use: cadmium - 9.3 ppm, chromium (hexavalent) - 400 ppm, chromium (trivalent) - 1,500 ppm, lead - 1,000 ppm, nickel - 310 ppm, and zinc - 10,000 ppm. The cleanup objective for protection of groundwater for hexavalent chromium is 19 ppm.

Soil was analyzed for total concentrations of metals and also for Toxic Characteristic Leaching Procedure (TCLP), which examines the leachability of contaminants. Soil exceeding standards set for TCLP are considered hazardous waste. In TCLP testing, several metals were found at concentrations below their standards, but cadmium frequently exceeded the TCLP standard of 1 ppm.

In 2004, some of the most contaminated soil was removed in an IRM. After performing numerous TCLP analyses on soil samples, a *total* cadmium concentration of 30 ppm was set as a cleanup objective. This concentration was selected based on site-specific analytical data showing soil with cadmium below this value would not be expected to exceed the TCLP standard. In addition, areas with total chromium concentrations above 450 ppm were also targeted for removal. This chromium concentration in industrial soil was the USEPA Preliminary Remediation Goal for protection of human health. Areas meeting either of these criteria also had high concentrations of nickel, lead, or zinc, as can be seen in Figures 7 through 11. The areas excavated are shaded in Figures 7 through 11, and the pre- and post-IRM results are found in Table 2. At the northeast corner of the building, soil was removed in many places down to the underlying bedrock. In a few locations, post-excavation cadmium concentrations were higher than the cleanup level, but TCLP analysis revealed that the standard for leachable cadmium in those areas was not met. Areas that were excavated were backfilled to the original elevation with clean soil, graded, and seeded.

The completion of this IRM removed the most highly contaminated soil from the site, including soil which could have been classified as hazardous waste. However, some soil with metals concentrations above the recommended soil cleanup objectives still remains on-site. Consequently, surface soil contamination identified during the RI/FS will be addressed in the remedy selection process.

Specific areas of surface soil contamination identified during the RI/FS were addressed during the 2004 IRM described in Section 5.2.

Subsurface Soil

As with surface soil, subsurface soil was collected from over 90 locations across the site (Figure 3). These samples generally were from a depth of 2-12 inches, but at times went down to a depth of three feet, depending on overlying contamination or depth of soil overlying bedrock. Electroplating-related metals concentrations were generally lower than in the overlying surface soil.

Contaminated subsurface soil was removed during the 2004 IRM. This IRM did not discriminate between surface and subsurface soil, but removed all soil with cadmium concentrations greater than 30 ppm or chromium greater than 450 ppm.

Soil samples collected from beneath the building slab in the areas of the former sludge drying pad and the vapor degreaser had elevated concentrations of electroplating-related inorganics and low levels of TCE (below the soil cleanup objective). TCLP levels of cadmium were above the standard of 1 ppm.

As with the surface soil, specific subsurface soil contamination identified during the RI/FS was addressed during the 2004 IRM described in Section 5.2, and remaining subsurface soil contamination identified during the RI/FS will be addressed in the remedy selection process.

Groundwater

Twenty-two groundwater monitoring wells were installed as part of the remedial investigation of this site. Groundwater beneath the Ward Products property is contaminated with total chromium above the standard of 50 ppb (0.05 ppm). Historically, the chromium concentration has been as high as 33 ppm in one of the monitoring wells, but on-site concentrations have decreased since 1997, when the first wells were sampled. Concentrations are now usually measured below 0.5 ppm on-site. Figures 12 and 13 show the chromium concentrations in relation to time in the seven monitoring wells that have exceeded the groundwater standard of 0.05 ppm. All of these wells are located on the Ward Products property (see Figure 2). Chromium in the groundwater is primarily in the hexavalent form, which is more mobile in water with a pH greater than 7, a condition which exists at the site.

Chromium in off-site groundwater has not been detected above the standard. Other electroplating-related metals were not found in the groundwater above the standards. This is a result of the carbonate content and high pH of the soil, which limits the migration of these metals into the groundwater by chemically binding them into insoluble forms.

On-site and off-site groundwater is contaminated with TCE and, to a lesser extent, its breakdown products (i.e., 1,1-dichloroethene, cis-1,2-dichloroethene, and trans-1,2-dichloroethene). The groundwater standard for each of these chlorinated solvents is 5 ppb. TCE has been found at the site at concentrations as high as 140 ppm (140,000 ppb) in one of the monitoring wells near the outfall pipe. Due to the nature of the groundwater at the site (i.e., occurring in joints and fractures in the bedrock), contaminant concentrations in one monitoring well can be quite different than those in an adjacent well, depending on which fractures are intercepted. TCE concentrations exceed the groundwater standard beyond the Ward Products property boundary. Figure 14 shows the limits of TCE in the groundwater downgradient of the site.

In 2004, the Department became aware of the existence of two production wells at the FGI facility east of the site. At the time, only one well was being used on a limited basis. When the wells were first sampled in December 2004, the one closer to Ward Products was found to be contaminated with TCE at a concentration of 440 ppb. Both wells were resampled in May 2005, when water was being pumped from the well farther from Ward Products. The results showed TCE in both wells, with a concentration of 1,100 ppb in the closer well. The wells were again sampled in September 2005, when FGI had ceased pumping from them. Once pumping stopped, TCE concentrations dropped dramatically. Figure 14 shows the concentration of TCE in the groundwater in September 2005, when FGI was not using their wells. It is apparent that a hydraulic connection exists between the contaminated areas on the Ward property and the two FGI wells. The FGI wells probably intercept the same large fracture, and facilitate the flow of contaminated groundwater away from the site toward the wells when they are pumped. These wells are reportedly no longer being used.

Groundwater contamination identified during the RI/FS will be addressed in the remedy selection process.

Surface Water

Surface water at the site is intermittent in the drainage ditch, generally occurring only during rain events or as spring runoff. A few surface water samples had concentrations of chromium which exceeded the surface water standard, but this likely reflected suspension of sediment. With the removal of areas of surface soil and sediments with high chromium or cadmium concentrations, surface water has not shown any further exceedences.

No site-related surface water contamination of concern was identified during the RI/FS. Therefore, no remedial alternatives need to be evaluated for surface water.

Sediments

As a result of years of discharging electroplating wastes into the ditch, concentrations of chromium, cadmium, zinc, lead, nickel, and cyanide in on-site sediment (in the drainage ditch) exceeded the sediment guidance levels. Figures 4 through 6 show the locations where sediment was sampled during the investigation of the site. Three hundred fifty tons of sediments with cadmium concentrations above 50 ppm were removed from the on-site drainage ditch and downstream in 2004. This concentration was selected based on site-specific analytical data showing sediment with cadmium below this value would not be expected to exceed the TCLP standard. Pre- and post-IRM metals concentrations in the sediment can be found in Table 2.

Sediment downstream of the site is also contaminated, although concentrations of cyanide, lead, and zinc drop below guidance levels within a few hundred feet of the property line. Higher concentrations of cadmium, chromium, and nickel, however, continue downstream along the drainage ways, sometimes as far as the Mohawk River. Figures 15 and 16 show the sediment concentrations of various metals in the downstream drainages relative to the distance downstream from the site.

Sediment contamination identified during the RI/FS will be addressed in the remedy selection process. Areas with the highest levels of sediment contamination identified during the RI/FS were addressed during the 2004 soil and sediment removal IRM described in Section 5.2.

Soil Vapor/Sub-Slab Vapor/Air

Figure 14 shows that contaminated groundwater exists beneath the Ward Products building. In addition, contaminated soil in the location of the machine shop underlies the concrete slab constructed during the building expansion of 1988-89. Therefore, air from inside the Ward Products building was sampled and compared to soil vapor collected from beneath the concrete slab and outdoor air. For the indoor air, TCE was detected at concentrations ranging from 6.4 to 13 $\mu g/m^3$, exceeding the New York State Department of Health's guidance level of 5 $\mu g/m^3$. Sub-slab concentration of TCE ranged from 1,500 to 1,800 $\mu g/m^3$, and cis-1,2-dichloroethene was found at 940 $\mu g/m^3$. Figure 17 shows the sampling locations and TCE concentrations detected in both indoor air and sub-slab vapor.

Indoor air contamination identified during the RI/FS was addressed during the 2005 indoor air IRM described in Section 5.2.

5.2: <u>Interim Remedial Measures</u>

An interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before completion of the RI/FS.

In 1997, Ward Products removed thirty cubic yards of contaminated soil stockpiled during the plant expansion of 1988-89. This soil exceeded the TCLP standard for cadmium (defining it as hazardous waste) and contained high concentrations of other electroplating-related metals.

In 1999, fifteen cubic yards of soil were excavated from next to the Ward Products building in the vicinity of the fenced-in transformers. This soil contained low concentrations of polychlorinated biphenyls (PCBs, highest concentration of 11 ppm) as well as electroplating metals.

Since the plant connected to the municipal sewer in 1983, the main outflow pipe, previously used to discharge plant effluent to the ditch on the eastern property line, has been used to direct stormwater runoff from the roof away from the building. However, examination of the inside of the pipe revealed sediment deposits which contained significantly elevated metals and VOC concentrations. This sediment was removed in an IRM performed in 2000. In addition, a poorly-constructed pipe junction was replaced with a manhole at that time.

Seven hundred tons of contaminated soil around the Ward Products building and 350 tons of sediments from the on-site and off-site drainage ditch were removed in 2004. Most of the material removed had cadmium concentrations which could have exceeded the TCLP standard if it had been tested. The cleanup objectives for this IRM were 30 ppm cadmium for soil and 50 ppm cadmium for sediment. Soil and sediment removed during this IRM also had elevated concentrations of chromium, cyanide, lead, nickel, and zinc. In addition to areas adjacent to the site, the PRP excavated two downstream depositional areas located upstream of where the drainages enter culverts under Sam Stratton Road. The residual contaminated sediments in the drainage ditch and depositional areas are capped with armor stone (i.e., large, angular rocks).

Finally, mitigation measures were taken at the Ward Products building in 2005 to address current human exposures (via inhalation) to volatile organic compounds associated with soil vapor intrusion. A sub-slab depressurization system was installed to create a negative pressure gradient below the slab, thus minimizing infiltration into the building. The locations of all these IRMs are shown on Figure 18.

5.3: <u>Summary of Human Exposure Pathways</u>:

This section describes the types of human exposures that may present added health risks to persons at or around the site. A more detailed discussion of the human exposure pathways can be found in Section 3.2 of the FS report. An exposure pathway describes the means by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: [1] a contaminant source, [2] contaminant release and transport mechanisms, [3] a point of exposure, [4] a route of exposure, and [5] a receptor population.

The source of contamination is the location where contaminants were released to the environment (any waste disposal area or point of discharge). Contaminant release and transport mechanisms carry contaminants from the source to a point where people may be exposed. The exposure point is a location where actual or potential human contact with a contaminated medium may occur. The route of exposure is the manner in which a contaminant actually enters or contacts the body (e.g., ingestion, inhalation, or direct contact). The receptor population is the people who are, or may be, exposed to contaminants at a point of exposure.

An exposure pathway is complete when all five elements of an exposure pathway exist. An exposure pathway is considered a potential pathway when one or more of the elements currently does not exist, but could in the future.

Potential pathways of exposure to site-related contaminants include:

- ingestion of contaminated groundwater, soils and sediments;
- direct contact with contaminated soils and sediments;
- inhalation of contaminated indoor air resulting from soil vapor intrusion; and
- inhalation of contaminated particulates during intrusive activities.

Two groundwater wells located on an adjacent property have historically been used for industrial process water and not for potable purposes. These wells are no longer in use. In addition, the area around this facility and the site is supplied by the City of Amsterdam's municipal water system. Therefore, ingestion of contaminated groundwater is unlikely.

Ingestion of contaminated on-site soils and sediments is possible. The completion of an IRM has resulted in the removal and off-site disposal of the most contaminated material. The current and future use of the property is commercial/industrial and much of the site is grass-covered, lightly forested, or covered by buildings or parking lots. Residual contamination remains in on-site soil, however it is generally inaccessible due to depth of contamination or its location beneath the on-site building.

A 2004 sediment IRM removed the most contaminated sediments from on- and some off-site drainage-ways. The residual contaminated sediments are capped with armor stone, thus eliminating potential ingestion and/or dermal contact to residual contamination in these areas. A potential exposure pathway exists in some off-site drainageways not covered in armor stone. Exposure to these sediments could occur during drainageway maintenance and/or remediation. Appropriate health and safety measures to prevent these exposures should be followed during drainageway maintenance and/or remediation. Contaminated Mohawk River sediment is not readily accessible due to the depth and location of the contamination. Therefore, this exposure pathway is not complete.

Inhalation of contaminated particulates is a potential exposure pathway during remediation activities. However, proper implementation of the Community Air Monitoring Plan during the remedial activities should prevent these exposures.

The implemented IRM of the installation and continued operation of a sub-slab depressurization system in the on-site building has eliminated the potential for building occupant inhalation exposures to contaminated indoor air via soil vapor intrusion in the building.

5.4: Summary of Environmental Assessment

This section summarizes the assessment of existing and potential future environmental impacts presented by the site. Environmental impacts include existing and potential future exposure pathways to fish and wildlife receptors, as well as damage to natural resources such as aquifers and wetlands.

The Fish and Wildlife Impact Analysis, which was submitted separately from the RI report, presents a detailed discussion of the existing and potential impacts from the site to fish and wildlife receptors.

The following environmental exposure pathways and ecological risks have been identified:

- Sediment in the drainages and in the Mohawk River contained levels of metals that are known to affect the survival of benthic organisms and to bioaccumulate in fish, mink, etc. This results in reduced availability of food for forage species and in reproductive effects in fish, terrestrial wildlife, and birds.

Site contamination has also impacted the groundwater resource in the bedrock.

SECTION 6: SUMMARY OF THE REMEDIATION GOALS

Goals for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375. At a minimum, the remedy selected must eliminate or mitigate all significant threats to public health and/or the environment presented by the hazardous waste disposed at the site through the proper application of scientific and engineering principles.

The remediation goals for this site are to eliminate or reduce to the extent practicable:

- exposures of persons at or around the site to electroplating-related metals in soil and sediments;
- exposures of persons at or around the site to chromium, or trichloroethene and other VOCs in groundwater;
- environmental exposures of flora or fauna to electroplating-related metals in soil and sediments;
- the release of contaminants from soil into groundwater that may create exceedances of groundwater quality standards; and
- the release of contaminants from subsurface soil under buildings into indoor air through soil vapor intrusion.

Further, the remediation goals for the site include attaining to the extent practicable:

- ambient groundwater quality standards and
- lowest effect level (LEL) sediment guidance values in the NYSDEC “Technical Guidance for Screening Contaminated Sediments.”

SECTION 7: SUMMARY OF THE EVALUATION OF ALTERNATIVES

The selected remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. Potential remedial alternatives for the Ward Products Site were identified, screened and evaluated in the FS report which is available at the document repositories established for this site.

A summary of the remedial alternatives that were considered for this site is discussed below. The present worth represents the amount of money invested in the current year that would be sufficient to cover all present and future costs associated with the alternative. This enables the costs of remedial alternatives to be compared on a common basis. As a convention, a time frame of 30 years is used to evaluate present worth costs for alternatives with an indefinite duration. This does not imply that operation, maintenance, or monitoring would cease after 30 years if remediation goals are not achieved.

7.1: Description of Remedial Alternatives

The following potential remedies were considered to address the contaminated soil, sediment, groundwater, and soil vapor at the site.

Alternative S-1, SED-1, GW-1: No Action

Present Worth: *$0*

The No Action Alternative is evaluated for soil, sediments, and groundwater as a procedural requirement and as a basis for comparison. This alternative would leave the site in its present condition and would not provide any additional protection to human health or the environment.

Alternative S-2: Environmental Easement and Site Management Plan

Present Worth: *$80,000*
Capital Cost: *$35,000*
Annual Costs:
(Years 1-30): *$2,000*

An environmental easement would be placed on the Ward Products property, restricting future land use to industrial uses. The easement would also require adherence to a site management plan which would describe maintenance procedures and proper management of any soil excavated from the site in the future. Periodic certification that the institutional and engineering controls remain in place would also be required. This alternative could be implemented in a few months.

Alternative S-3: Surface Excavation and Cap

Present Worth: *$580,000*
Capital Cost: *$515,000*
Annual Costs:
(Years 1-30): *$3,000*

With this alternative, six inches of surface soil would be stripped off of approximately 110,000 square feet of area in the lawn and north of the manufacturing building. The soil in the area which would be addressed has electroplating-related metals concentrations above the soil cleanup objectives. The soil would be disposed offsite at a licensed disposal facility. The area would then be capped with twelve inches of topsoil and seeded. Areas already capped during the 2004 IRM would not be addressed. This alternative could be designed and implemented in approximately six months. Full excavation of all contaminated soil was screened out in the Feasibility Study.

Alternative SED-2: Monitoring

Present Worth: *$27,000*
Capital Cost: *$0*
Annual Costs:
(Years 1-30): *$1,200*

Annual sediment monitoring would occur at three downstream depositional areas, where fine-grained sediment would naturally collect. This sediment could be contaminated with electroplating-related metals washing down from upstream areas (but downstream from the site). The sediments with the highest concentrations of metals were removed from the drainage ditch during the 2004 IRM. This alternative could be implemented immediately.

Alternative SED-3: Limited Excavation

Present Worth: *$220,000*
Capital Cost: *$190,000*
Annual Costs:
(Years 1-30): *$1,200*

The limited excavation alternative would remove approximately 200 cubic yards of contaminated sediments from three areas where the stream velocity slows and fine-grained deposits occur, upstream of where the drainages enter a culvert or detention basin. Sediment would be disposed in a licensed disposal facility. Monitoring would continue following construction. This alternative could be designed and implemented in a few months.

Alternative SED-4: Intermediate Excavation

Present Worth: *$1,020,000*
Capital Cost: *$990,000*
Annual Costs:
(Years 1-30): *$1,200*

This alternative would consist of removal of 400 cubic yards of sediment from a 600-foot section (the lower portion south of the railroad tracks) of the eastern branch of the tributary to the Mohawk River, excavation of sediments in the Mohawk (700 cubic yards), and construction of two sedimentation basins along that branch (an additional 200 cubic yards, see Figure 19). The targeted sediment exceeds the Lowest Effects Levels (LEL) of metals set in the Department's "Technical Guidance for Screening Contaminated Sediments." Excavated sediments would be disposed off-site in a licensed disposal facility.

The excavation of sediments from the Mohawk River would involve diversion of surface water from the east tributary branch and installation of temporary sheet piling in the river. It is assumed that sediment removal in the Mohawk would take place during the winter months, when the elevation in the Barge Canal is lowered.

Following the sediment removal, the sediment basins would be monitored for contaminated sediment washed in from upstream sources not addressed in this alternative. A contingency amount for a one-time re-excavation of the settling basins is included. This alternative could be designed and implemented in about twelve months. This time line assumes that access negotiations and permit acquisition would take at least six months.

Alternative SED-5: Full Excavation

Present Worth: *$2,200,000*
Capital Cost: *$2,200,000*
Annual Costs:
(Years 1-30): *$0*

Alternative 5 would be similar to Alternative 4, but would remove a total of 4,300 cubic yards of sediment with metals concentrations above the LEL from along the entire length of both branches of the tributary and from the Mohawk River. At the end of the full excavation alternative, no monitoring or sedimentation basins would be necessary because all sediments of concern would be removed. This alternative could be designed and implemented in about eighteen months.

Alternative GW-2: Environmental Easement and Monitoring

Present Worth: *$280,000*
Capital Cost: *$20,000*
Annual Costs:
(Years 1-4): *$24,000*
(Years 5-30): *$9,000*

An environmental easement would be placed on the Ward Products property to restrict future groundwater use. This alternative would also continue monitoring of the existing network of groundwater monitoring wells for four years. Years 5 to 30 would require a scaled-down monitoring program to follow the migration of contaminated water. The easement would require periodic certification that the institutional controls remain in place. This alternative could be implemented in a few months.

<u>The following groundwater alternatives would all require placement of the environmental easement and monitoring</u>. The cost for this is included.

Alternative GW-3: Extraction and Treatment with an Air Stripper at Source Area

Present Worth: *$620,000*
Capital Cost: *$180,000*
Annual Costs:
(Groundwater system O&M, Years 1-10): *$20,000*
(Current monitoring program, Years 1-4): *$24,000*
(Scaled-down monitoring program, Years 5-30): *$9,000*

Groundwater would be pumped at a rate of five to ten gallons/minute from a central recovery well. Water would be treated on-site with an air stripper to remove VOCs. Treated water would be discharged to the Amsterdam sewage treatment plant via the sanitary sewer or re-injected into the bedrock. This alternative assumes extraction and treatment would occur for a period of ten years, with monitoring for thirty years. Also, this alternative assumes that the chromium concentration in the recovered water would be low enough that treatment before discharge into the sewer would not be required. The design and implementation for this alternative would take approximately six months. It is not expected that this alternative would attain the goal of meeting drinking water standards in the near future.

Alternative GW-4: In Situ Bioremediation

Present Worth: *$550,000*
Capital Cost: *$290,000*
Annual Costs:
(Current monitoring program, Years 1-4): *$24,000*
(Scaled-down monitoring program, Years 5-30): *$9,000*

For this alternative, natural degradation of chlorinated solvents by microorganisms would be enhanced by injection of a hydrogen-releasing compound or an edible oil substrate into the bedrock. A treatability study and pilot study would be required before full-scale operation. Full-scale operation would entail placement of injection points distributed in the area with the highest TCE concentrations. There would be three applications over a four-year period. The design for this alternative would take approximately six months.

Construction and pilot testing would take an additional six months. It is not expected that this alternative would attain the goal of meeting drinking water standards in the near future.

Alternative GW-5: In Situ Chemical Oxidation

Present Worth: *$520,000*
Capital Cost: *$260,000*
Annual Costs:
(Current monitoring program, Years 1-4): *$24,000*
(Scaled-down monitoring program, Years 5-30): *$9,000*

Groundwater would be treated under this alternative via in situ chemical oxidation. Several chemical oxidants are commercially available for use with this technology, for example, potassium permanganate. When a chemical oxidant comes into contact with organic compounds such as TCE and its daughter products, an oxidation reaction occurs breaking down the organic compounds to relatively benign compounds such as carbon dioxide and water.

The chemical oxidant would be applied through injection wells to target groundwater with TCE concentrations in excess of 5,000 ppb.

It is possible that chemical oxidation could change the mobility of the chromium in the groundwater. Prior to the full implementation of this technology, laboratory and on-site pilot scale studies would be conducted to more clearly define design parameters. During implementation, groundwater concentrations and temperatures would be monitored. The design for this alternative would take approximately six months. Construction and pilot testing would take an additional six months. For full-scale implementation, it is estimated that the chemical oxidant would be injected during approximately three separate events over 18-36 months. It is not expected that this alternative would attain the goal of meeting drinking water standards in the near future.

Alternative GW-6: In Situ Chemical Oxidation with Extraction and Treatment

Present Worth: *$770,000*
Capital Cost: *$326,000*
Annual Costs:
(Groundwater system O&M, Years 1-10): *$20,000*
(Current monitoring program, Years 1-4): *$24,000*
(Scaled-down monitoring program, Years 5-30): *$9,000*

This alternative would combine the benefits of Alternatives 3 and 5. Because of the combination of technologies, the chemical oxidation component would be scaled down somewhat from that described in Alternative GW-5. At the same time that an oxidant would be introduced into the bedrock through injection wells installed in the source area, groundwater would be pumped from a recovery well for treatment with an air stripper (see Figure 20 for a conceptual layout). This combination of treatments would not only destroy the contaminants, but would also draw contaminated water from the joints and fractures in the bedrock while drawing oxidant in to react with the remaining contaminants. Treated water would be discharged to the sanitary sewer or re-injected into the bedrock.

This alternative envisions a total of three oxidant injections and a ten-year groundwater extraction and treatment period. It is likely that each injection event would see diminishing returns in terms of decreasing concentrations of VOCs.

As with Alternatives GW-4 and GW-5, the design for this alternative would take approximately six months. Construction and pilot testing would take an additional six months. For full-scale implementation, it is estimated that the chemical oxidant would be injected during approximately three separate events over 18-36 months. It is not expected that this alternative would attain the goal of meeting drinking water standards in the near future.

7.2 Evaluation of Remedial Alternatives

The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375, which governs the remediation of inactive hazardous waste disposal sites in New York. A detailed discussion of the evaluation criteria and comparative analysis is included in the FS report.

The first two evaluation criteria are termed "threshold criteria" and must be satisfied in order for an alternative to be considered for selection.

1. Protection of Human Health and the Environment. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the Department has determined to be applicable on a case-specific basis.

The next five "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

3. Short-term Effectiveness. The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

4. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

5. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site.

6. Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

7. Cost-Effectiveness. Capital costs and annual operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision. The costs for each alternative are presented in Table 3.

This final criterion is considered a "modifying criterion" and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

8. Community Acceptance - Concerns of the community regarding the RI/FS reports and the PRAP are evaluated. A responsiveness summary will be prepared that describes public comments received and the

manner in which the Department will address the concerns raised. If the selected remedy differs significantly from the proposed remedy, notices to the public will be issued describing the differences and reasons for the changes.

SECTION 8: SUMMARY OF THE PROPOSED REMEDY

The Department is proposing Alternative S-2 for the contaminated soil, Alternative SED-4 for sediment, and Alternative GW-6 for groundwater as the remedy for this site. The elements of this remedy are described at the end of this section. The proposed remedy is based on the results of the RI and the evaluation of alternatives presented in the FS.

Alternative S-2, Environmental Easement and Site Management Plan, is being proposed for the contaminated on-site soil because, as described below, it would be protective of human health and the environment and provides the best balance of the primary balancing criteria described in Section 7.2. It would achieve the remediation goals for the site by limiting contact with contaminated soil. With the excavation and off-site disposal of the most contaminated soil during the 2004 IRM, the biggest threat to human exposure has been removed. Continued exposure to the remaining contaminated soil would be limited by the clean soil cover (in areas subject to the 2004 soil removal IRM), existing grass cover, and the proposed easement restricting the property to industrial uses only. Alternative 1 (No Action) would not satisfy the threshold criteria. Alternatives S-2 and S-3 (Surface Excavation and Cap) satisfy the threshold criteria, but Alternative S-3 would be more burdensome and costly than the institutional controls offered by Alternative S-2, while offering no additional protection.

Due to the natural soil composition, it is not expected that selection of Alternative S-2 over S-3 would increase the likelihood that electroplating-related metals in the soil would leach into the groundwater, since this is not occurring now for most metals. Indeed, this is demonstrated in the lack of site-related metals observed in the groundwater, with the exception of chromium.

Alternative SED-4, Intermediate Excavation, is proposed to address contaminated sediment in the tributaries to the Mohawk River as well as in the Mohawk River. Removal of contaminated sediment in these areas would minimize exposure of humans and wildlife to electroplating-related metals. Alternatives 1 (No Action), SED-2 (Monitoring), and SED-3 (Limited Excavation) would not address the sediment with metals concentrations above the Lowest Effects Level already in the lower reaches of the tributaries and in the Mohawk River.

Alternative SED-4 is proposed over SED-5 (Full Excavation) due mostly to the fact that there are limited points where sediment could collect along the steep portion of the tributaries. The slope not only minimizes the volume of sediment, but also significantly increases the effort required to reach that smaller volume. The additional effort required to remove the sediments from the steep slopes would not be cost effective. Since the SED-4 calls for construction of two sediment basins (in addition to the one already south of Sam Stratton Road) where contaminated sediment washing down from above would have a chance to settle out, there would be a means to keep the excavated areas downstream from being re-contaminated.

Alternative GW-6 (In Situ Chemical Oxidation with Extraction and Treatment) is proposed for the groundwater. Alternatives 1 (No Action) and GW-2 (Environmental Easement and Monitoring) alone would not satisfy the threshold criteria. Alternatives GW-3 (Extraction and Treatment), GW-4 (Bioremediation), and GW-5 (Chemical Oxidation) would all address the VOCs in groundwater to some extent, but it is expected that the combination of the two technologies in GW-6 would be better than either of the individual technologies alone. While chemical oxidation would destroy the VOCs in the bedrock groundwater near the injection points, concurrent groundwater extraction would serve to draw the oxidant into the bedrock joints and fractures to react with water that does not readily flow under non-pumping conditions.

By extracting the treated water which may have higher chromium levels, GW-6 would help contain any potential excessive migration of chromium caused by the oxidant.

Alternatives GW-3, GW-4, GW-5, and GW-6 would all have similar short-term effectiveness. Alternatives GW-4, GW-5, and GW-6 would all require a pilot study before implementation of full-scale operation.

GW-4, GW-5, and GW-6 are expected to be more effective than GW-3 in the long term because they would run for a shorter time. However, GW-4 would rely on a biological process which is negatively affected by colder temperatures in this part of the country. GW-6 would permanently reduce more of the contaminant source than the other alternatives. All alternatives beside No Action include long-term monitoring, though this may prove to be unneeded.

In terms of implementability, GW-6 would be slightly more complicated than the other groundwater alternatives because it involves two technologies in concert. GW-3 and GW-6 would both require disposal of the treated groundwater at the Amsterdam wastewater treatment facility, whereas GW-4 and GW-5 rely on in situ technologies. However, because of the expected groundwater flow conditions, the amount of treated water from extraction wells (five to ten gallons/minute) would not be a significant increase in volume for the wastewater treatment facility.

The cost of Alternative GW-6 falls on the high end of the groundwater alternatives. GW-4 and GW-5 would be implemented for a three- or four-year period, then stop (aside from routine monitoring). GW-6 would have a two- to three-year oxidant injection period combined with ten years of extraction and treatment. The cost of GW-3 would be highest because it calls for long-term extraction and treatment. In actuality, continued long-term operation of any treatment system would likely result in diminishing returns due to the nature of the contaminants in the bedrock.

The estimated present worth cost to implement the remedy is $1,870,000. The cost to construct the remedy is estimated to be $1,350,000 and the estimated annual costs for 30 years start at $47,000 and drop to $12,000.

The elements of the proposed remedy are as follows:

1. A remedial design program would be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program. It is likely that pre-design investigations would need to be undertaken to better identify and target the bedrock fractures which are most contaminated. The pre-design investigation would also examine the feasibility of re-injecting the treated water into the bedrock instead of discharging it to the sanitary sewer.

2. Approximately 400 cubic yards of contaminated sediments would be excavated from a 600-foot section (south of the railroad tracks) of the eastern branch of the tributary draining the site. Additionally, 700 cubic yards of contaminated sediment would be excavated from the Mohawk River at the mouth of the eastern branch of the tributary. Two sediment collection basins would be constructed: one immediately north of the CSX railroad tracks on the east branch, and one immediately north of the rail spur (north of Chapman Street) on the west branch. A sediment collection basin already exists on the east branch just south of Sam Stratton Road. The three sediment basins would be periodically sampled to determine if the sediment collecting in them would need to be removed for off-site disposal.

3. A treatability study and/or pilot study would be undertaken to study the effectiveness of injection of an oxidant such as potassium permanganate into the bedrock via an existing monitoring well. Groundwater would be tested immediately before and after the injection. The information gathered during the pilot study would be used to determine the efficacy of the technology and the potential for a full-scale application. The results of the treatability study and/or pilot test will determine the feasibility of this option.

4. A recovery well would be drilled at a central location on the site. Extracted groundwater would be pumped to a heated treatment shed, where the concentrations of VOCs would be reduced through use of an air stripper before the water was discharged to a sanitary sewer or re-injected into the bedrock.

5. Following a successful pilot test, the in situ chemical oxidation would be implemented full scale in conjunction with the extraction and treatment system. The oxidant injections would be repeated as necessary as long as it remains cost effective to do so, though there would probably be no more than three events.

6. Imposition of an institutional control in the form of an environmental easement that would require (a) limiting the use and development of the property to industrial use; (b) compliance with the approved site management plan; (c) restricting the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by NYSDOH; and (d) the property owner to complete and submit to the Department a periodic certification of institutional and engineering controls.

7. Development of a site management plan which would include the following institutional and engineering controls:(a) management of the final cover system to restrict excavation below the soil cover or buildings. Excavated soil would be tested, properly handled to protect the health and safety of workers and the nearby community, and would be properly managed in a manner acceptable to the Department. Entities responsible for maintenance of sediment basins downstream from the site will be notified that sediment collecting in those basins may be contaminated; (b) if contaminated soil beneath the building slab ever becomes accessible, it would be removed and properly managed; (c) continued operation of the sub-slab depressurization system at the Ward Products building whenever it is occupied; (d) soil vapor intrusion evaluations at any buildings located above the contaminated groundwater plume if there is a change in the current use of that building; (e) monitoring of groundwater, sediment, and indoor air; (f) identification of any use restrictions on the site; and (g) provisions for the continued proper operation and maintenance of the components of the remedy.

8. The property owner would provide a periodic certification of institutional and engineering controls, prepared and submitted by a professional engineer or such other expert acceptable to the Department, until the Department notifies the property owner in writing that this certification is no longer needed. This submittal would: (a) contain certification that the institutional controls and engineering controls put in place are still in place and are either unchanged from the previous certification or are compliant with Department-approved modifications; (b) allow the Department access to the site; and (c) state that nothing has occurred that would impair the ability of the control to protect public health or the environment, or constitute a violation or failure to comply with the site management plan unless otherwise approved by the Department.

9. The operation of the components of the remedy would continue until the remedial objectives have been achieved, or until the Department determines that continued operation is technically impracticable or not feasible.

10. Since the remedy would result in untreated hazardous waste remaining at the site, a long-term monitoring program would be instituted. The monitoring well network at the site would be sampled semi-annually to monitor the extent of the groundwater contamination. This program would allow the effectiveness of the oxidant injections and the groundwater extraction and treatment system to be monitored and would be a component of the long-term management for the site. Sediment in the three sediment basins would also be periodically monitored and the results will be sent to the entities responsible for maintenance of the basins.

11. Although the two production wells on the adjacent FGI property are not being used, a formal agreement to abandon these wells permanently would be sought.

TABLE 1 SUMMARY OF BACKGROUND SOIL CONCENTRATIONS FOR INORGANICS AT WARD PRODUCTS CORPORATION, AMSTERDAM, NEW YORK.

Sampling Location	Sampling Depth (Ft.)	Cadmium	Hexavalent Chromium	Total Chromium	Total Cyanide	Lead	Nickel	Zinc
27	0-0.2	<0.25	<0.4	14	<1	6.8	9.9	52
	0.2-1	<0.25	<0.4	20	<1	0.99	22	58
29	0-0.2	<0.25	<0.4	15	<1	4.1	17	54
	0.2-1	<0.25	<0.4	17	<1	3.5	19	53
31	0-0.2	<0.25	<0.4	16	<1	5.2	19	49
	0.2-1	<0.25	<0.4	16	<1	4.3	20	59
33	0-0.2	<0.25	<0.4	15	<1	4.5	17	52
	0.2-1	<0.25	<0.4	14	<1	4.3	20	51
35	0-0.2	<0.25	<0.4	14	<1	4	17	47
	0.2-1	<0.25	<0.4	15	<1	3.6	15	41
36	0-0.2	<0.25	<0.4	4.3	<1	1.5	5.1	18
	0.2-1	<0.25	<0.4	24	<1	4.3	16	41
37	0-0.2	<0.25	<0.4	25	<1	7.2	15	45
39	0.2-1	<0.25	<0.4	17	<1	7	20	50
43	0.2-1	<0.25	<0.4	17	<1	4.6	18	55
48	0-0.2	<0.25	<0.4	11.8	<1	6.35	8.55	28.8
	0.2-1	<0.25	<0.4	16.8	<1	9.65	12.8	34.6
49	0.2-1	<0.25	<0.4	24.9	<1	10.4	24.6	64.8
50	0.2-1	<0.25	<0.4	17.8	<1	12.8	12.6	36.5
51	0-0.2	<0.25	<0.4	13.5	<1	12.8	11.4	32.6
	0.2-1	<0.25	<0.4	22.6	<1	12.9	19.4	53.3
52	0.2-1	<0.25	<0.4	11.3	<1	12.6	10.9	34.3
58	0.2-1	<0.25	<0.4	28.9	<1	7.49	18.5	50.1
	Maximum	<0.25	<0.4	28.9	<1	12.9	24.6	64.8
	Minimum	<0.25	<0.4	4.3	<1	0.99	5.1	18
	Average	<0.25	<0.4	17.0	<1	6.6	16.0	46.1
	Eastern US	0.1-1	NA	1.5-40	NA	4.0-61	0.5-25	9.0-50
	NYSDEC SCO	1	10	10	SS	SB	13	20

Samples collected in 2000 (27 to 43) and 2001 (48 and up), all concentrations in ppm, based on dry weight.
NA - Not Available
SB - Site Background, SS - Site Specific

Analytical and Excavation Summary Table

Selected Soils and Sediments IRM - Ward Products Site, Amsterdam, NY 8/18/04, RETEC

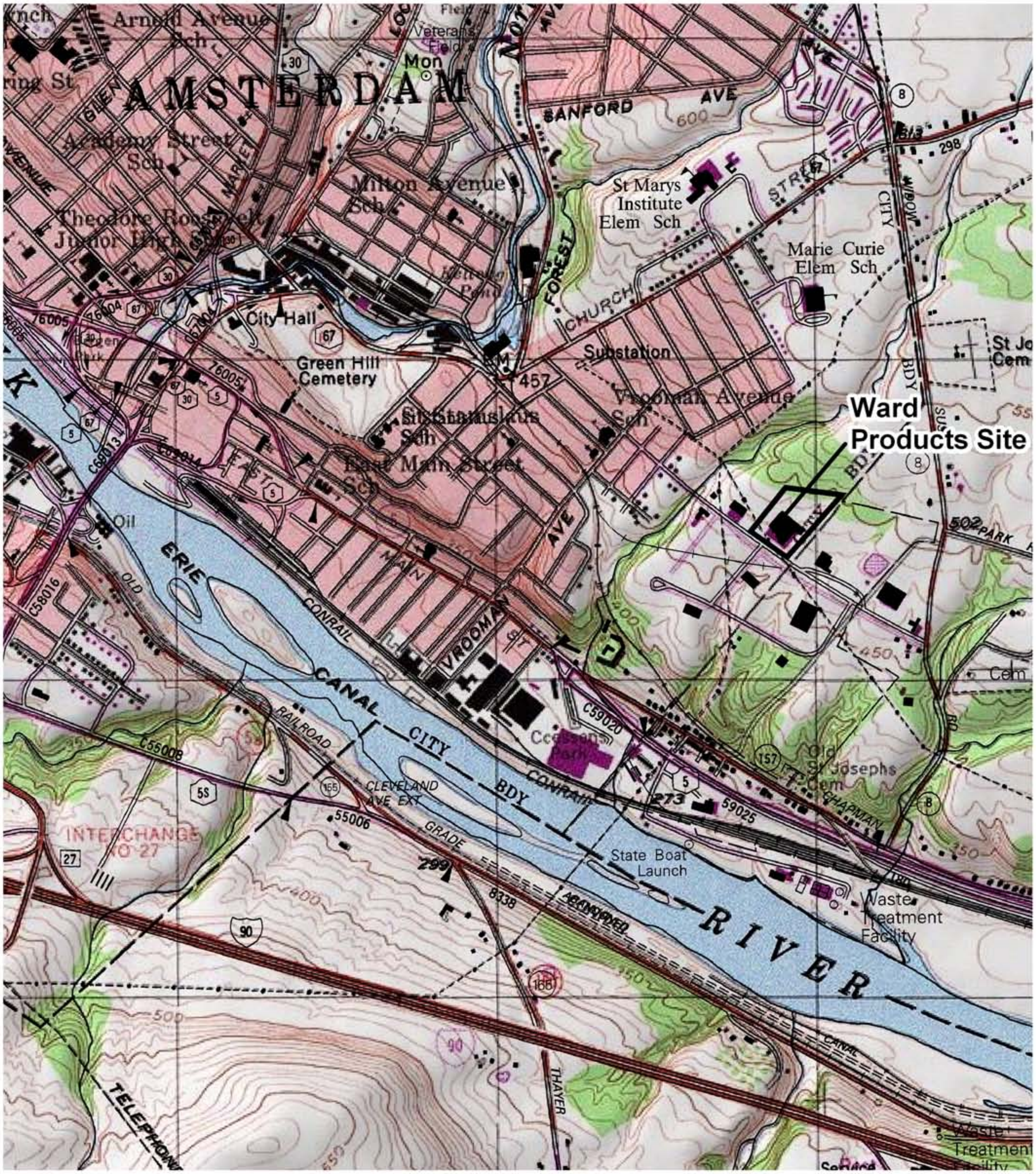
Sample ID		Pre-IRM Sample Depth, or Post-IRM Excavation Depth, feet	Total Cadmium, mg/Kg	Total Chromium, mg/Kg	Total Nickel, mg/Kg	Total Zinc, mg/Kg	Total Cyanide, mg/Kg	TCLP Cadmium, mg/L	Notes
D1	Post-IRM	0.7	20.7	---	---	---	---	---	No Pre-IRM sample.
UPSTREAM	Pre-IRM	0.5	628	3130	3170	1010	47.6	8.35	
D2	Post-IRM	0.7	0.34	24.5	< 2.5	67.7	< 0.5	< 0.05	
D3	Post-IRM	0.7	2.21	---	---	---	---	---	No Pre-IRM sample.
OUTFALL	Pre-IRM	1.0	143	3550	2250	2020	51.7	2.75	
D4	Post-IRM	1.6	2.04	58.5	41.8	55.9	< 0.5	< 0.05	
D5	Post-IRM	1.8	6.85	---	---	---	---	---	No Pre-IRM sample.
D6	Mid-IRM	1.5	62.7	---	---	---	---	1.57	No Pre-IRM sample. Mid sample failed.
D6-B	Post-IRM	2.0	< 0.25	---	---	---	---	---	
MIDPOINT	Pre-IRM	0.5	66.5	587	396	241	3.35	1.32	
D7	Mid-IRM	1.0	209	---	---	---	---	---	Mid sample failed.
D7-B	Post-IRM	2.2	4.87	42.6	68.4	35.9	< 0.5	0.22	
D8	Post-IRM	1.9	7.11	---	---	---	---	---	No Pre-IRM sample.
D9	Mid-IRM	1.0	155	---	---	---	---	---	No Pre-IRM sample. Mid sample failed.
D9-B	Post-IRM	1.7	< 0.25	---	---	---	---	---	
UPSTREAM CULVERT	Pre-IRM	0.5	165	1730	1600	607	19.7	1.57	
D10	Mid-IRM	0.8	45.2	---	---	---	---	---	Mid sample passed but location re-graded.
D10-B	Post-IRM	1.1	12.2	148	193	76.6	< 0.5	0.24	
DOWNSTREAM CULVERT	Pre-IRM	1.0	149	1360	1580	808	10.3	1.77	
D11	Post-IRM	1.6	14.8	97.9	22.2	53.9	< 0.5	0.38	
D12	Post-IRM	1.4	0.92	---	---	---	---	---	No Pre-IRM sample.
DOWNSTREAM 50'	Pre-IRM	1.0	61.6	313	349	183	6.94	1.15	
D13	Post-IRM	1.2	< 0.25	17	< 2.5	46.3	< 0.5	< 0.05	
D14	Post-IRM	0.7	< 0.25						No Pre-IRM sample.
EB CULVERT	Pre-IRM	1.0	71	660	605	209	6.5	---	
EC1	Mid-IRM	1.5	67.4	---	---	---	---	---	Mid sample failed.
EC2	Mid-IRM	1.5	80	---	---	---	---	---	Mid sample failed.
EC1-B	Post-IRM	3.5	10.2	84.8	48.9	37.4	< 0.5	0.05	
EC2-B	Post-IRM	3.5	4.69	45.9	21.6	32.2	< 0.5	0.08	
WB CULVERT	Pre-IRM	0.5	31.8	700	210	130	< 1.0	---	
WC1	Post-IRM	0.5	4.16	191	12.9	58.4	< 0.5	0.08	
S9	Pre-IRM	1.0	54.5	---	---	---	---	---	
S9-B	Mid-IRM	0.5	< 0.25	---	---	---	---	---	Insufficient initial depth, re-excavated.
S9-C	Post-IRM	1.2	< 0.25	---	---	---	---	---	
S10	Pre-IRM	1.0	60.5	---	---	---	---	---	Excavation went to visually clean bedrock, no sample collected.
---	Post-IRM	1.2	*rock*	---	---	---	---	---	
S11	Pre-IRM	1.3	50	---	---	---	---	---	Excavation went to visually clean bedrock, no sample collected.
---	Post-IRM	1.2	*rock*	---	---	---	---	---	
S12	Pre-IRM	2.5	42.7	---	---	---	---	---	Excavation went to visually clean bedrock, no sample collected.
---	Post-IRM	2.4	*rock*	---	---	---	---	---	
S13	Pre-IRM	0.5	7.8	---	---	---	---	---	Excavation went to visually clean bedrock, no sample collected.
---	Post-IRM	0.9	*rock*	---	---	---	---	---	
S13A	Pre-IRM	0.2	46.2	---	---	---	---	---	
S13A-B	Post-IRM	0.6	1.0	---	---	---	---	---	
S14A	Pre-IRM	1.0	87	---	---	---	---	---	
S14A-B	Post-IRM	1.1	11.4	---	---	---	---	---	
S15A	Pre-IRM	1.0	66	---	---	---	---	---	Excavation went to visually clean bedrock, no sample collected.
---	Post-IRM	1.5	*rock*	---	---	---	---	---	
S16A	Pre-IRM	1.0	61	---	---	---	---	---	Excavation went to visually clean bedrock, no sample collected.
---	Post-IRM	0.9	*rock*	---	---	---	---	---	
S17A	Pre-IRM	1.0	44.4	---	---	---	---	---	Excavation went to visually clean bedrock, no sample collected.
---	Post-IRM	0.9	*rock*	---	---	---	---	---	
S40	Pre-IRM	1.0	47	---	---	---	---	---	
S40-B	Post-IRM	1.3	15.3	---	---	---	---	---	
S42	Pre-IRM	0.2	263	---	---	---	---	---	
S42-B	Mid-IRM	0.5	111	---	---	---	---	---	Mid sample failed.
S42-C	Post-IRM	1.9	< 0.25	---	---	---	---	---	
S46	Pre-IRM	1.0	38	---	---	---	---	---	
S46-B	Post-IRM	1.4	53.5	---	---	---	---	0.33	High Total Cd but acceptable TCLP Cd.
S47	Pre-IRM	1.0	44.7	---	---	---	---	---	
S47-B	Post-IRM	1.8	4.71	---	---	---	---	---	
S53	Pre-IRM	0.2	52.2	---	---	---	---	---	
S53-B	Post-IRM	0.5	28.7	---	---	---	---	---	
S82	Pre-IRM	1.0	47.5	---	---	---	---	---	
S82-B	Post-IRM	1.5	30.2	---	---	---	---	0.24	High Total Cd but acceptable TCLP Cd.
C2	Pre-IRM	1.0	150	---	---	---	---	---	Location C2 (under 12" clean topsoil) was resampled by hand auger w/o excavation. High Total Cd but acceptable TCLP Cd.
C2-A	Post-IRM	1.0 - 2.0	---	---	---	---	---	< 0.05	
S14	Pre-IRM	0.5	---	510	---	---	---	---	
S14-B	Post-IRM	1.1	---	164	---	---	---	---	
S54	Pre-IRM	1.0	---	463	---	---	---	---	
S54-B	Post-IRM	1.0	---	94.2	---	---	---	---	
Clean-Up Criteria, Ditchs/Culverts		Per Design	< 50	< 450	na	na	na	< 1.0	
Clean-Up Criteria, On-Site Soils		Per Design	< 30	< 450	na	na	na	< 1.0	

Post-IRM excavation depths surveyed or measured by RETEC.
--- No sample taken.

Table 3
Remedial Alternative Costs

Remedial Alternative	Capital Cost ($)	Annual Costs ($)	Total Present Worth ($)
No Action	0	0	0
S-2 (Easement and Monitoring)	35,000	2,000	80,000
S-3 (Surface Excavation and Cap)	515,000	3,000	580,000
SED-2 (Monitoring)	0	1,200	27,000
SED-3 (Limited Excavation)	190,000	1,200	220,000
SED-4 (Intermediate Excavation)	990,000	1,200	1,020,000
SED-5 (Full Excavation)	2,200,000	0	2,200,000
GW-2 (Easement and Monitoring)	20,000	9,000 to 24,000	280,000
GW-3 (Extraction and Treatment)	180,000	9,000 to 44,000	620,000
GW-4 (Bioremediation)	290,000	9,000 to 24,000	550,000
GW-5 (Chemical Oxidation)	260,000	9,000 to 24,000	520,000
GW-6 (ChemOx with Extraction)	326,000	9,000 to 44,000	770,000

Proposed Remedial Alternative	Capital Cost ($)	Annual Costs ($)	Total Present Worth ($)
S-2 + SED-4 + GW-6	1,350,000	12,000 to 47,000	1,870,000



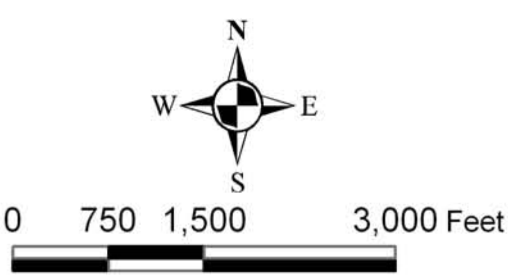


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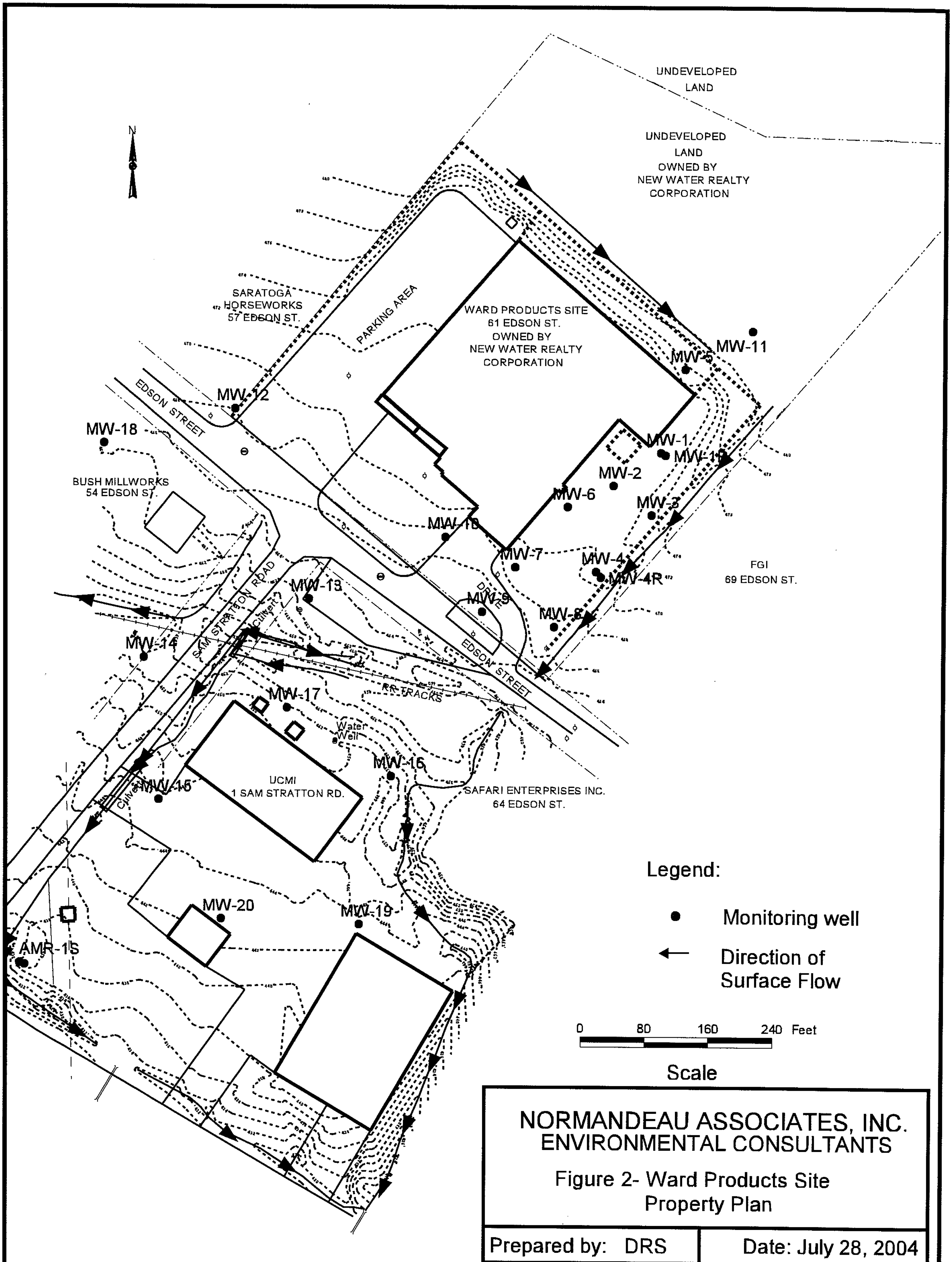
Figure 1 : Location Map for
Ward Products Site
61 Edson St. Amsterdam, NY

Prepared by: DRS	Date: July 12, 2004



NORMANDEAU ASSOCIATES, INC.
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Figure 2- Ward Products Site Property Plan

Prepared by: DRS	Date: July 28, 2004

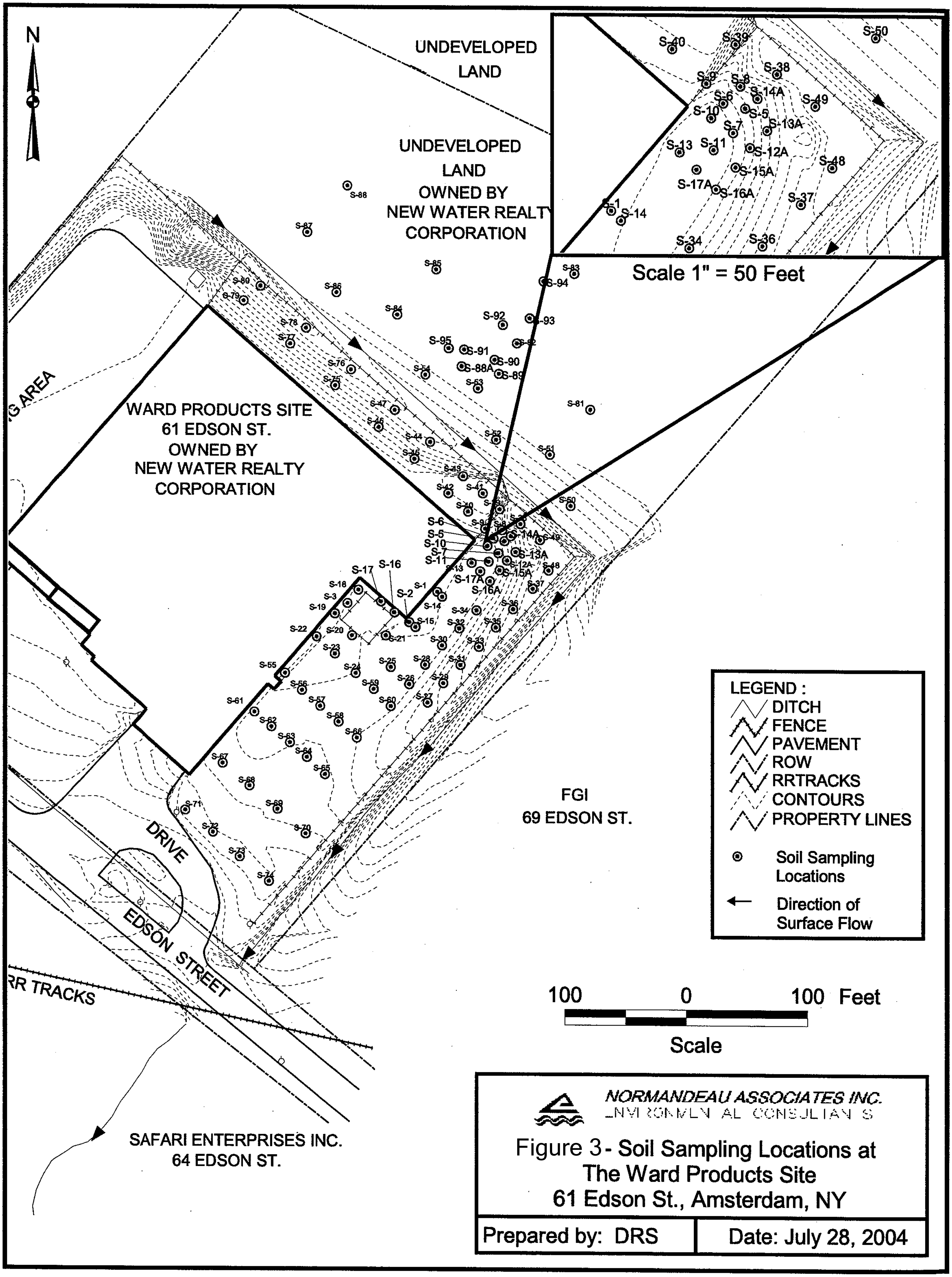
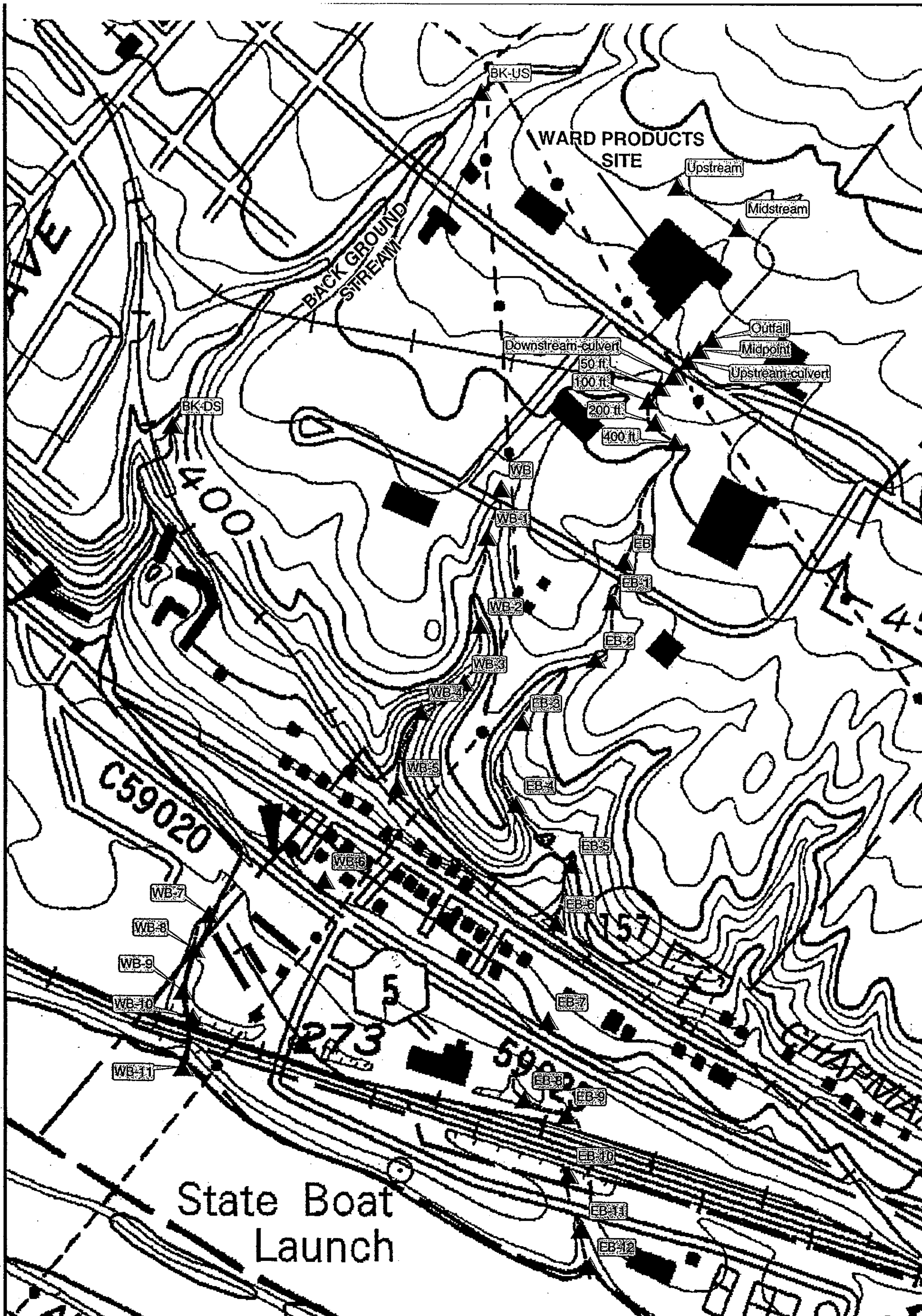


Figure 3 - Soil Sampling Locations at The Ward Products Site 61 Edson St., Amsterdam, NY

Prepared by: DRS | Date: July 28, 2004



N
W E
S

400 200 0 400 Feet

LEGEND: ▲ SEDIMENT SAMPLING LOCATION

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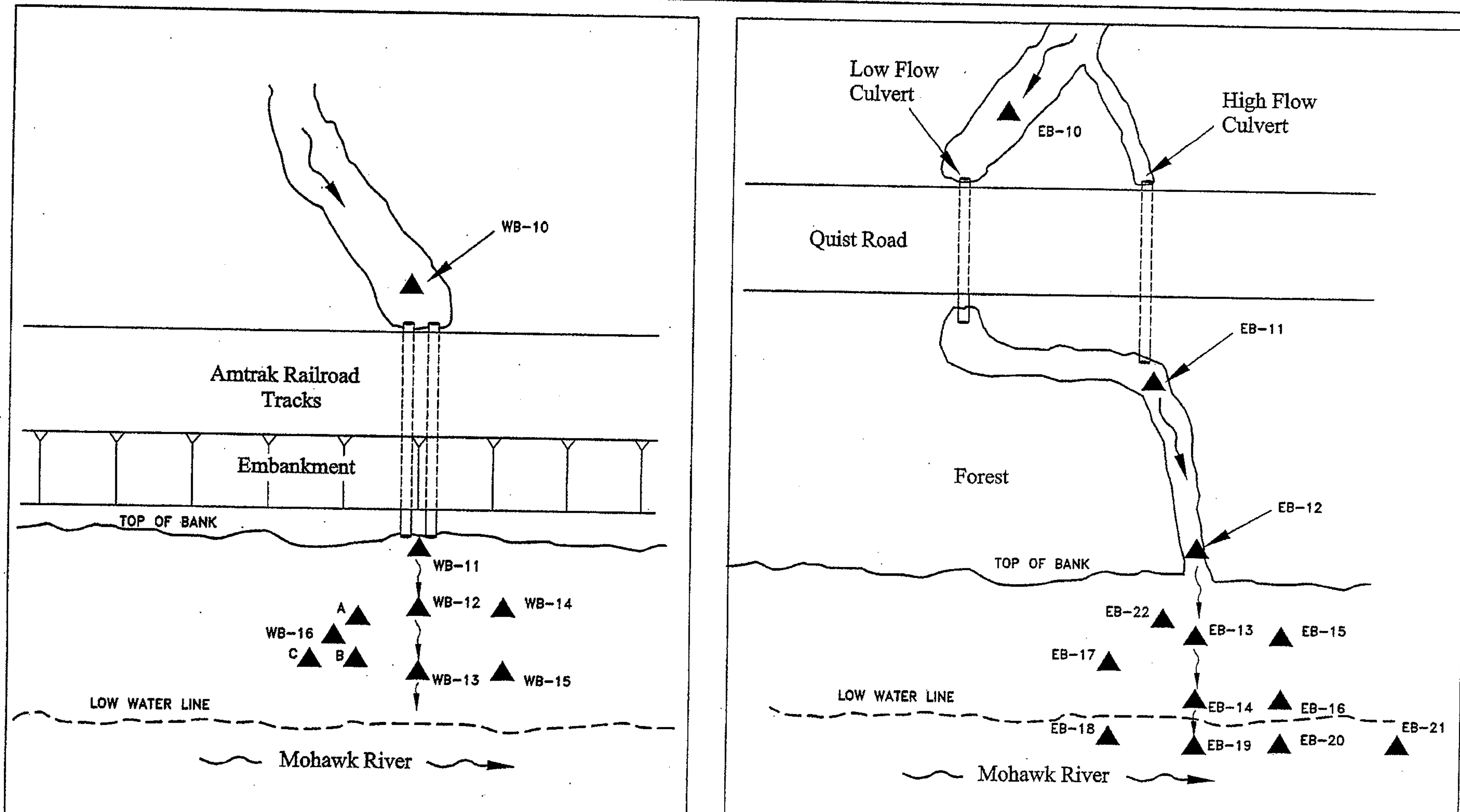
ENVIRONMENTAL CONSULTANTS

Figure 4 Sediment Sampling Location Map
Ward Products Site
61 Edson St. Amsterdam, NY

Prepared by: DRS	Date: July 12, 2004



A) West Branch Drainage

B) East Branch Drainage

▲EB-19 Sediment sampling location

Active Channel

Samples EB-10 collected in Jan. 2002
Samples WB-10 to WB-15, EB-11 to 17 collected Dec. 2002
Samples WB-16A to C, EB-18 to 22 collected April 2003

Drawing is not to scale.

Prepared By: NORMANDEAU ASSOCIATES INC. ENVIRONMENTAL CONSULTANTS 25 Nashua Road Bedford, New Hampshire 03110-5500

Project: 19279.005

DATE: 05/08/03

Title:

Figure5: Sediment Sampling Locations for East and West Drainages and the Mohawk River, Amsterdam,NY.

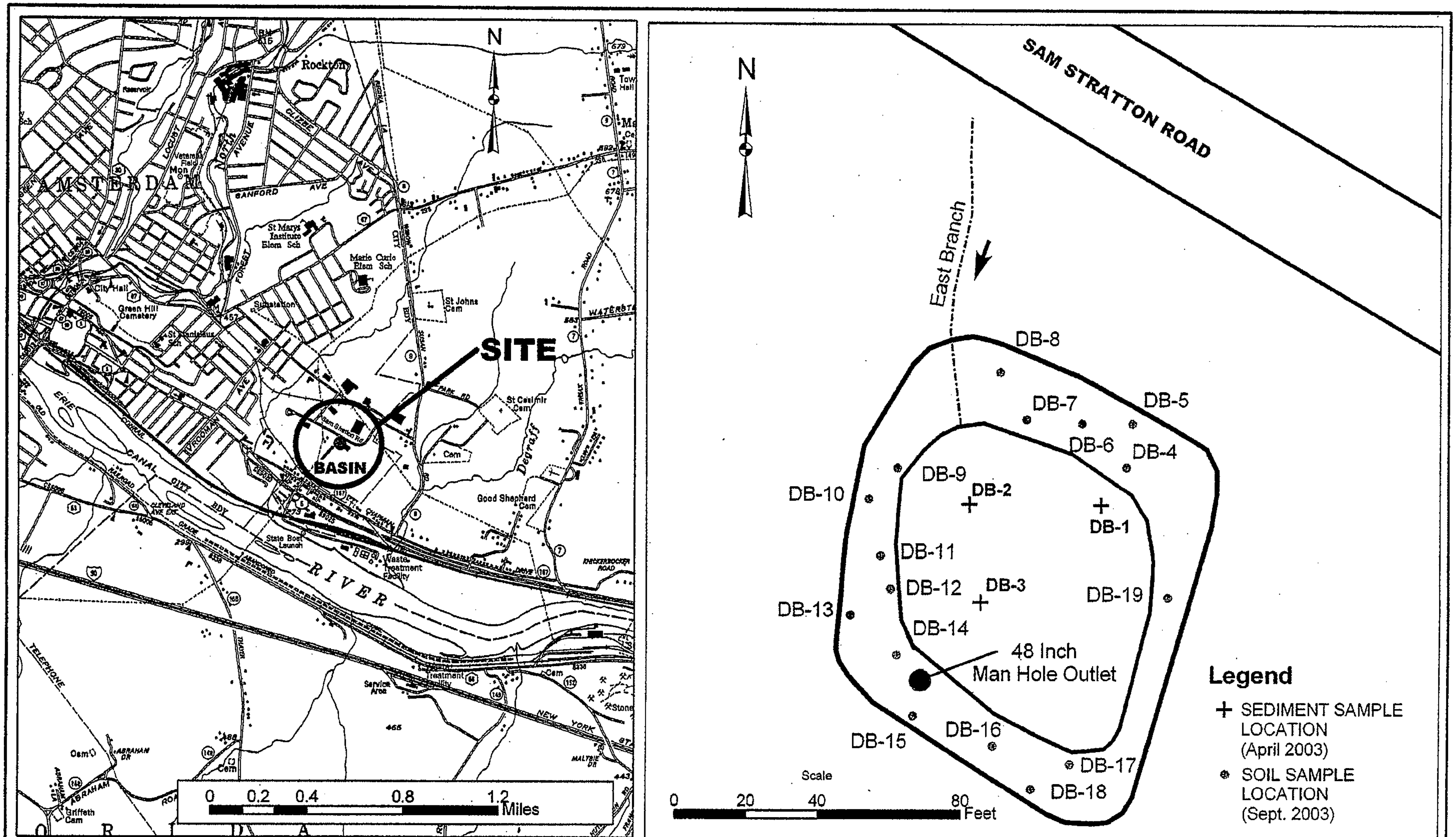
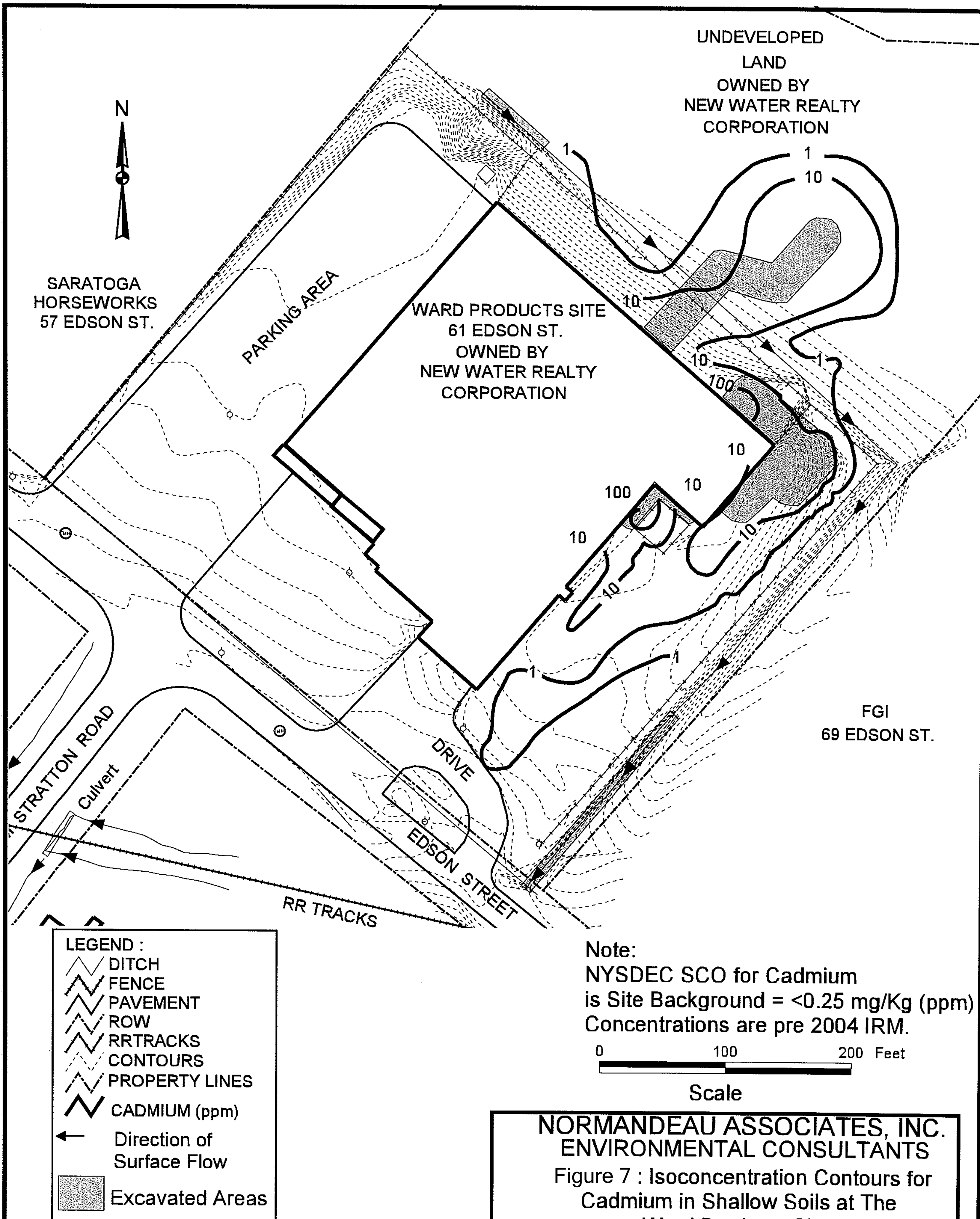


Figure 6 : Sediment and Soil Sampling Locations in Detention Basin South of Sam Stratton Road, Amsterdam, NY.

Prepared By: NORMANDEAU ASSOCIATES INC. ENVIRONMENTAL CONSULTANTS



Note:
NYSDEC SCO for Cadmium
is Site Background = <0.25 mg/Kg (ppm)
Concentrations are pre 2004 IRM.

0 100 200 Feet

Scale

NORMANDEAU ASSOCIATES, INC.
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Figure 7 : Isoconcentration Contours for Cadmium in Shallow Soils at The Ward Products Site
61 Edson St. Amsterdam, NY

Prepared by: DRS	Date: July 28, 2004

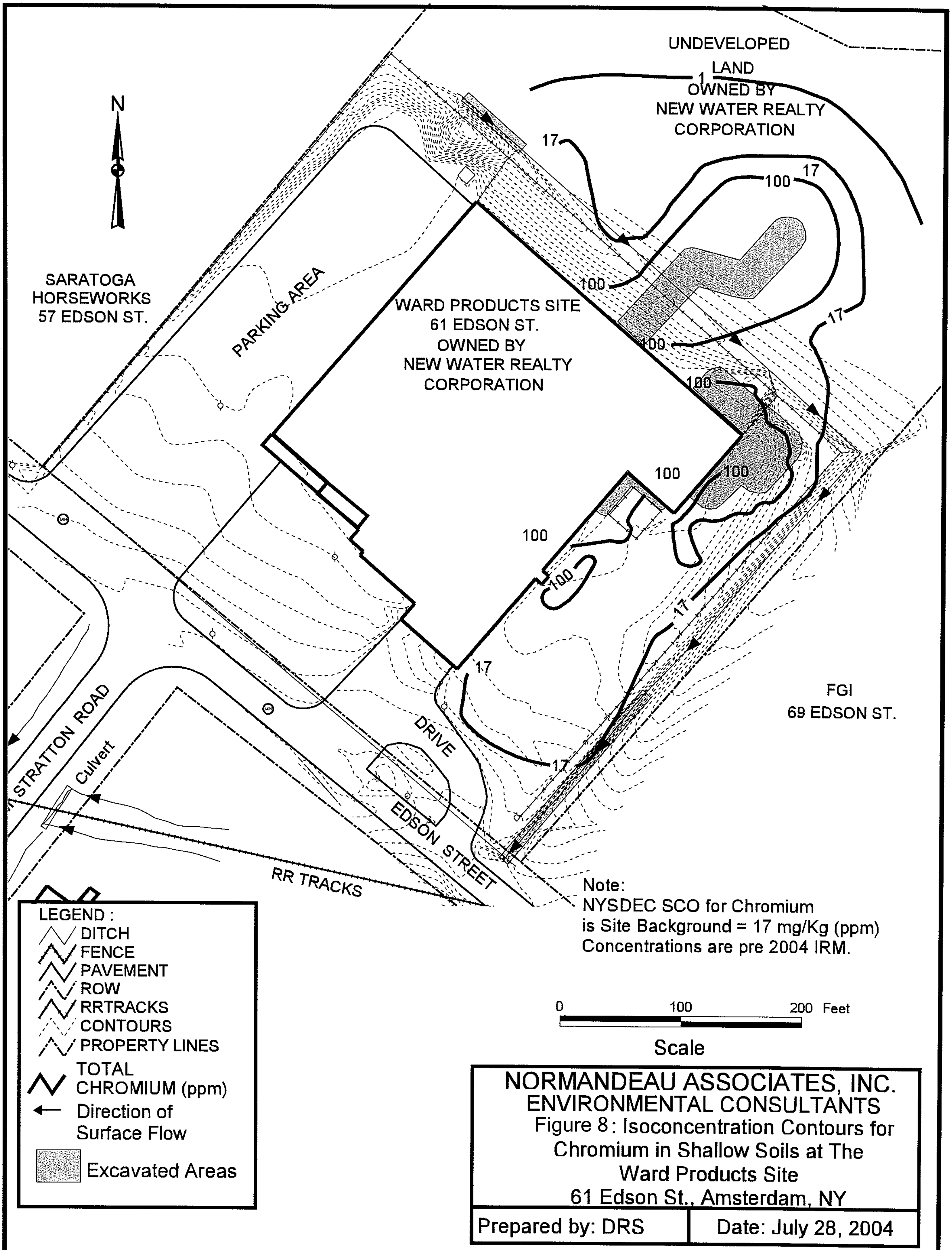

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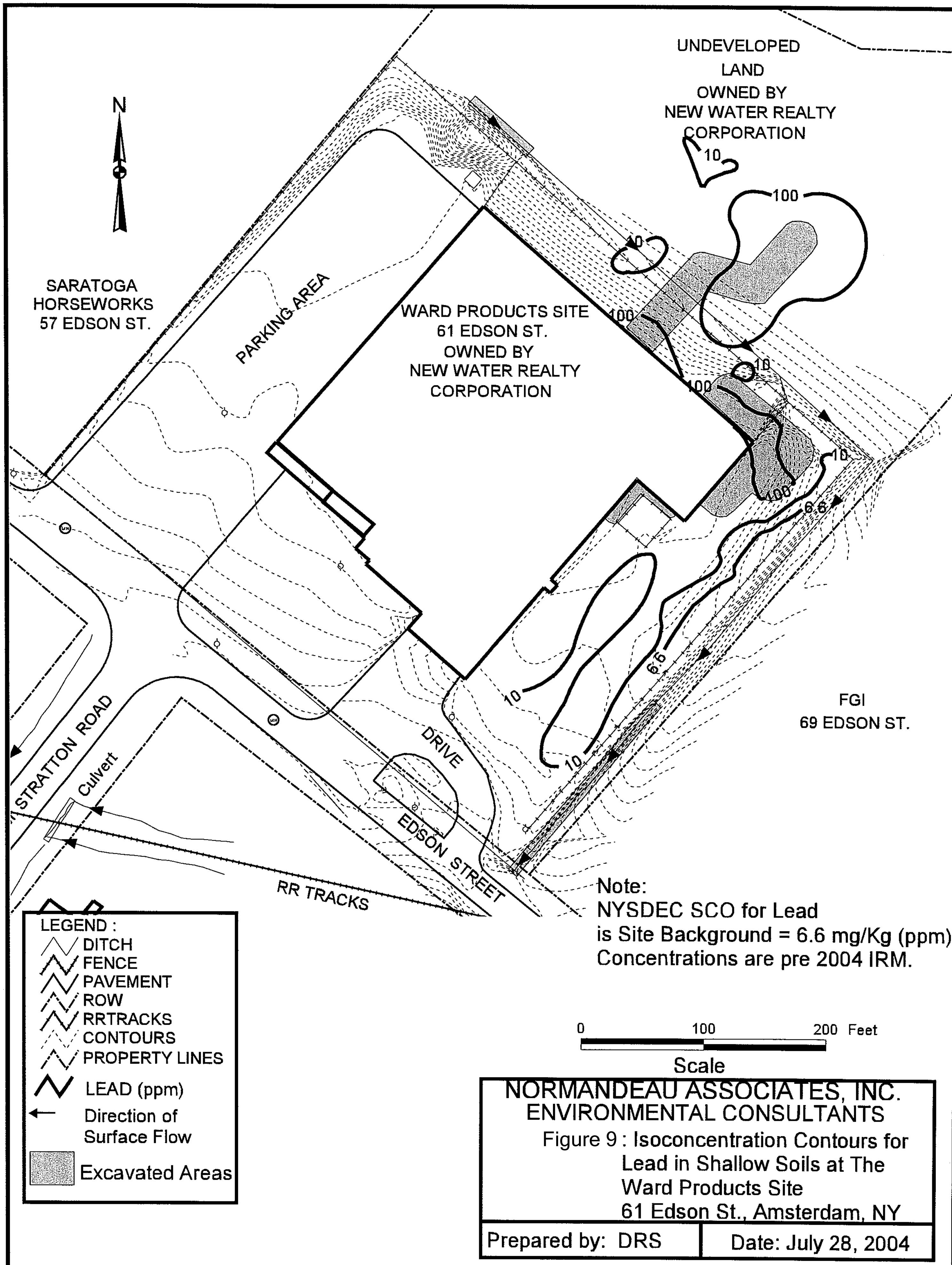
Figure 8: Isoconcentration Contours for Chromium in Shallow Soils at The Ward Products Site
61 Edson St., Amsterdam, NY

Prepared by: DRS	Date: July 28, 2004



Note:
NYSDEC SCO for Lead
is Site Background = 6.6 mg/Kg (ppm)
Concentrations are pre 2004 IRM.

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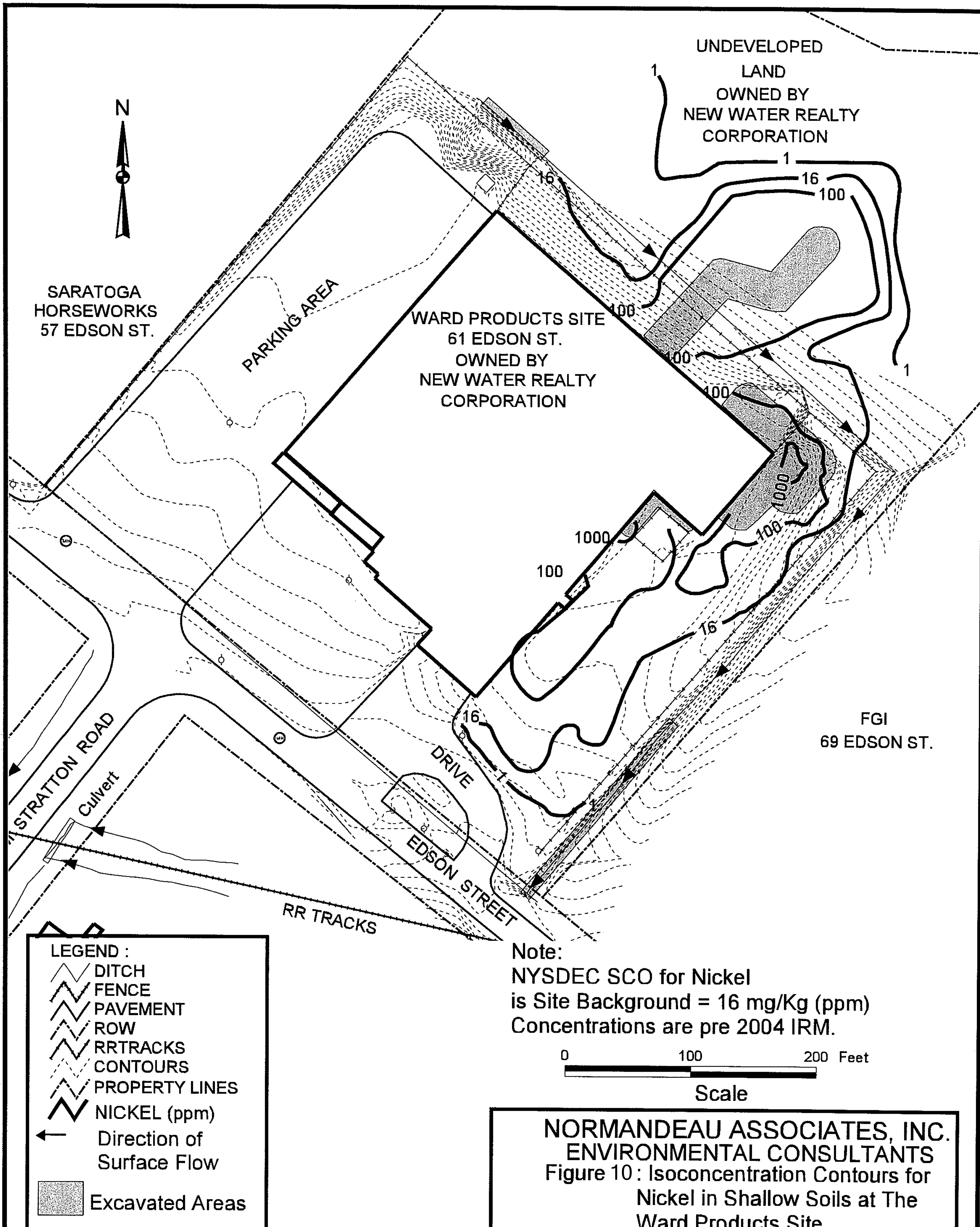
Figure 9 : Isoconcentration Contours for Lead in Shallow Soils at The Ward Products Site 61 Edson St., Amsterdam, NY

Prepared by: DRS	Date: July 28, 2004



Note:
NYSDEC SCO for Nickel
is Site Background = 16 mg/Kg (ppm)
Concentrations are pre 2004 IRM.

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Figure 10 : Isoconcentration Contours for Nickel in Shallow Soils at The Ward Products Site
61 Edson St., Amsterdam, NY

Prepared by: DRS	Date: July 28, 2004

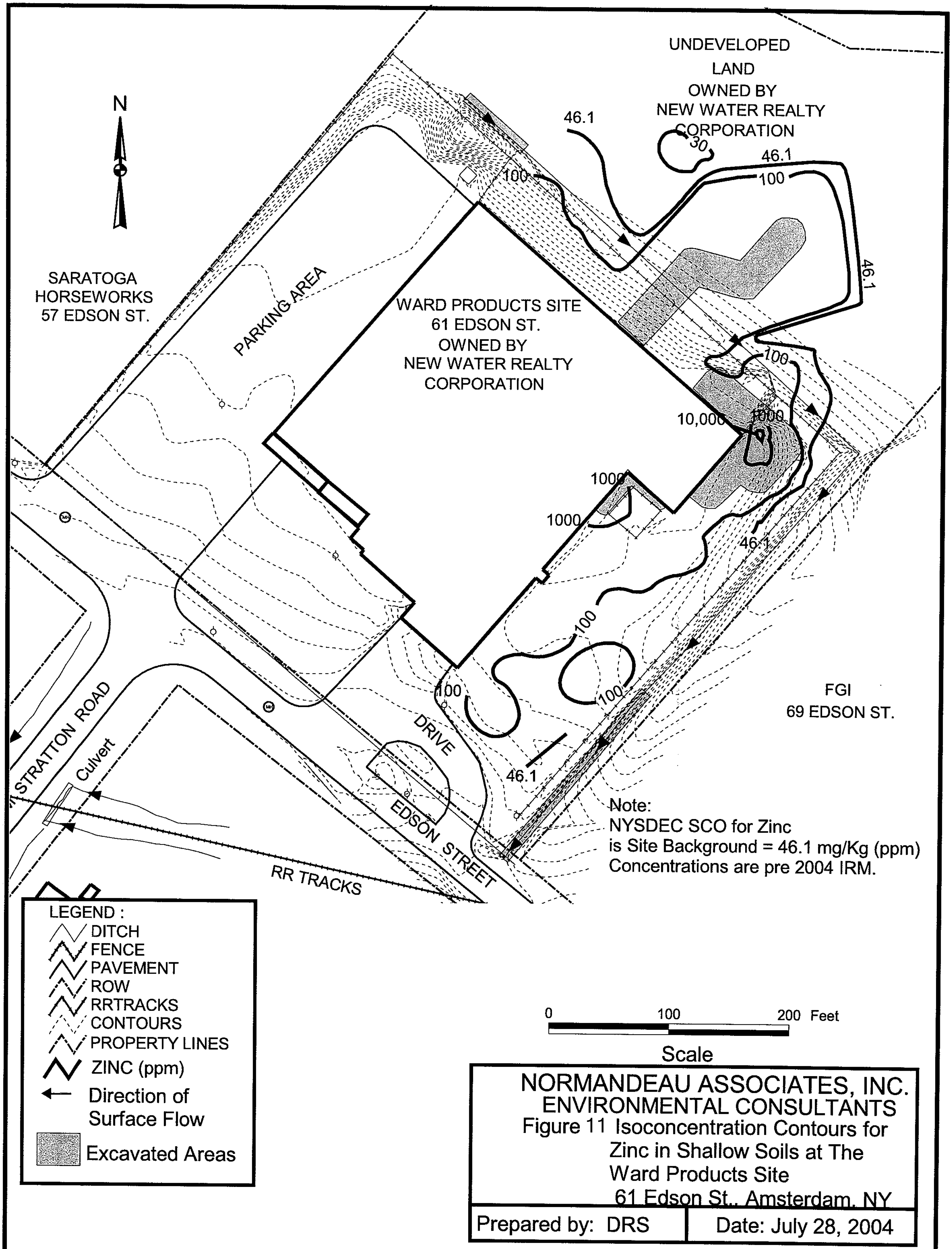

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Figure 11 Isoconcentration Contours for Zinc in Shallow Soils at The Ward Products Site
61 Edson St., Amsterdam, NY

Prepared by: DRS	Date: July 28, 2004

Figure 12 - Total Chromium in Ground Water at MW-1, 2 & 4
1996 -2004

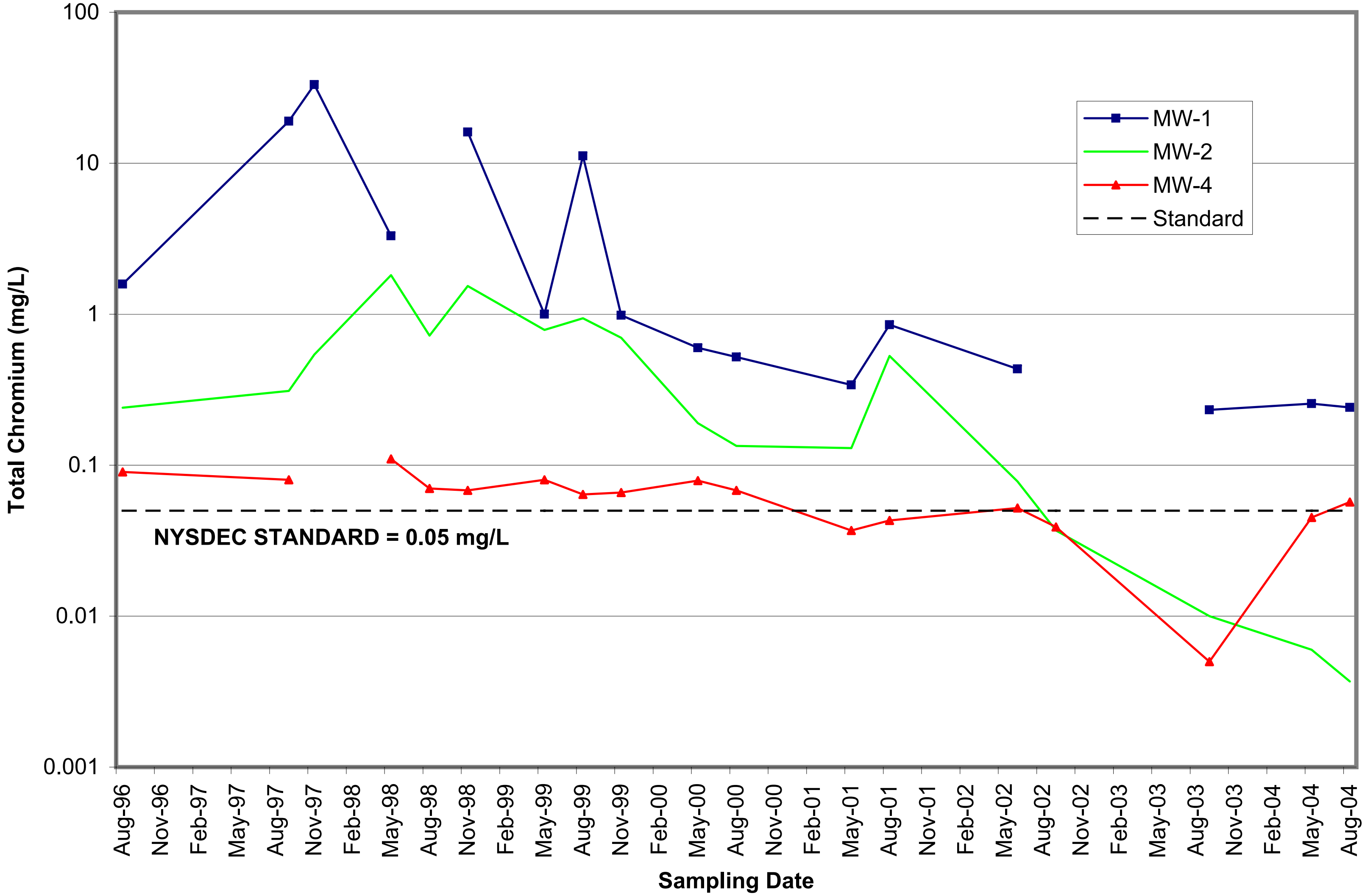
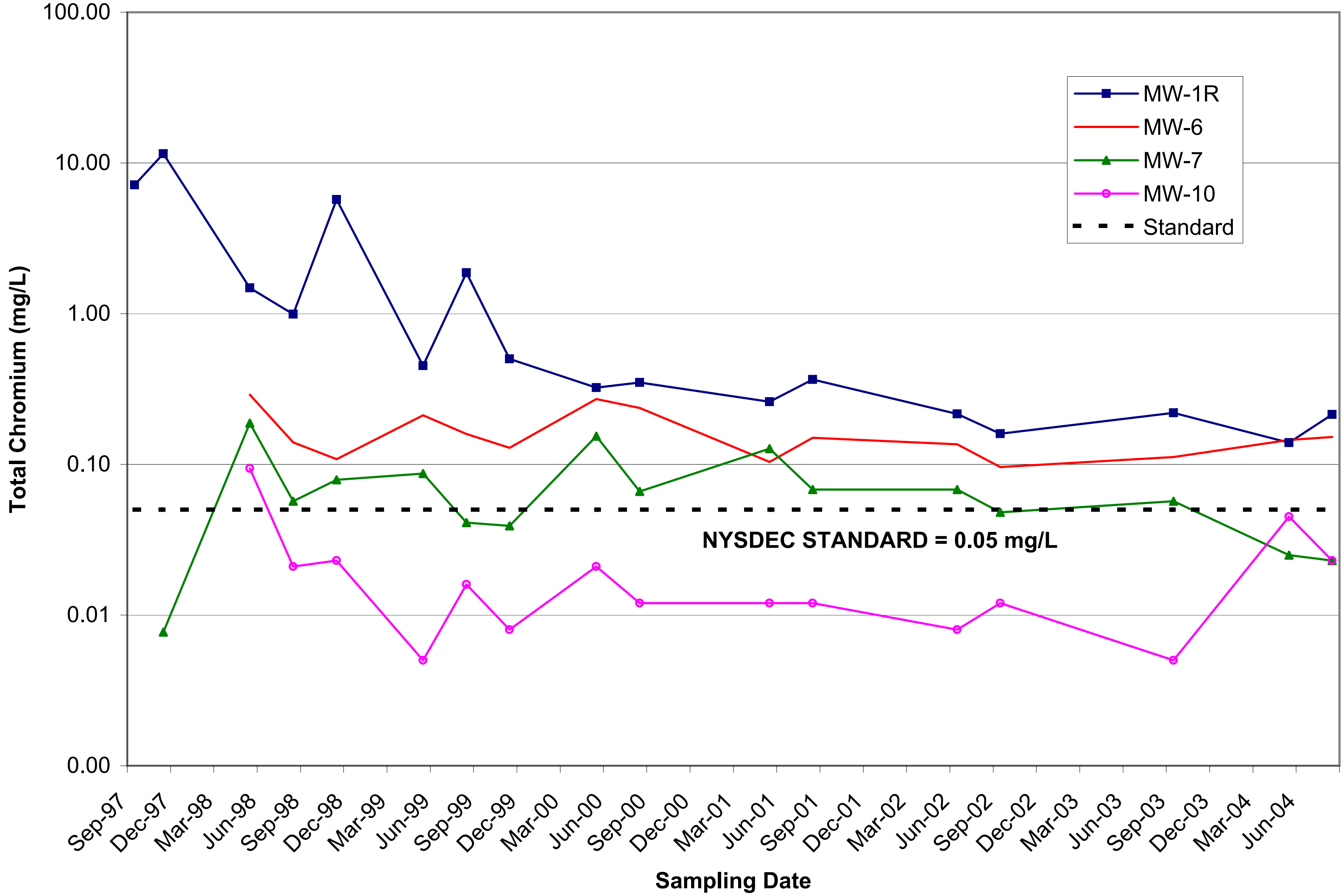
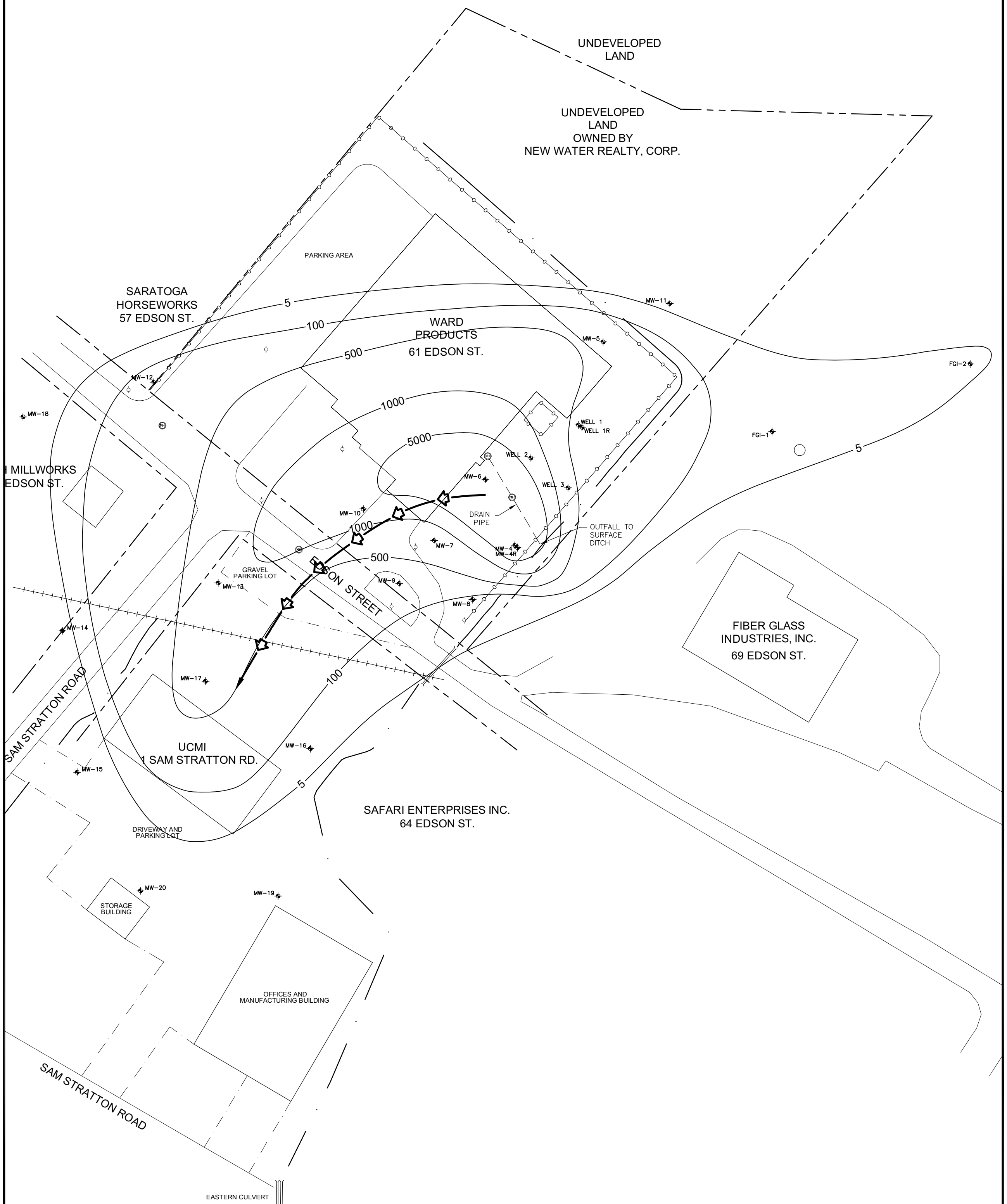


Figure 13 - Total Chromium at MW-1R, 6, 7 & 10
1997 to 2004



File: J:\15852\400\SCG_GW_EXCEED_REV.dwg Layout: ANSI_BVI-LJ User: mwilliamson Plotted: Sep 21, 2006 - 8:38am Xref's:



NOTES:
1. FIGURE BASED ON LETTER REPORT BY NORMANDEAU ASSOCIATES, DECEMBER 2005.
2. MW-1, MW-2, MW-3 AND MW-4 ARE OVERBURDEN WELLS. ALL OTHERS ARE BEDROCK WELLS.
3. FIGURE SHOWS ONLY TCE CONCENTRATIONS IN BEDROCK GROUNDWATER.
4. OVERBURDEN EXCEEDANCES OF TCE (NOT SHOWN) ARE LIMITED TO MW-1 AND MW-4.
5. EXCEEDANCES OF CHROMIUM (NOT SHOWN) ARE LIMITED TO MW-1, MW-1R AND MW-2.

N

60 0 120

1"=120'

LEGEND

SURFACE DITCH
CHAINLINK FENCE
PROPERTY LINE
5 — TCE CONCENTRATIONS IN GROUNDWATER, µg/L, SEPTEMBER 2005
GROUNDWATER FLOW DIRECTION
MW-18 — MONITORING WELL

RETEC

WARD PRODUCTS SITE
AMSTERDAM, NEW YORK
NWR01-15852-400

LOCATIONS OF SCG EXCEEDANCES IN GROUNDWATER

DATE: 9/25/06 | DRWN: MAW/BIL

FIGURE 14

Figure 15 - Concentration of Cadmium, Chromium and Nickel in Sediment Samples Collected from the East Branch Drainage

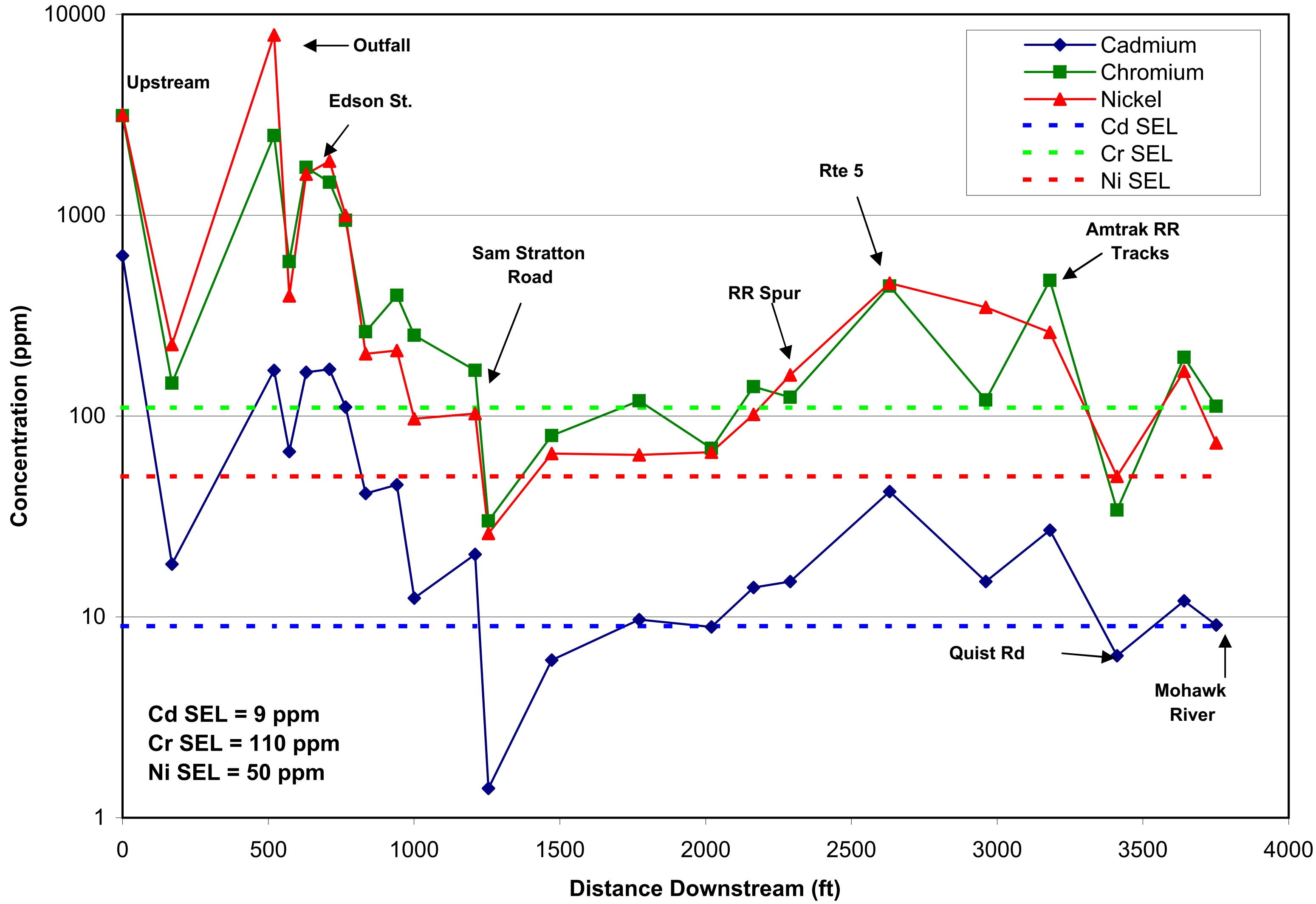
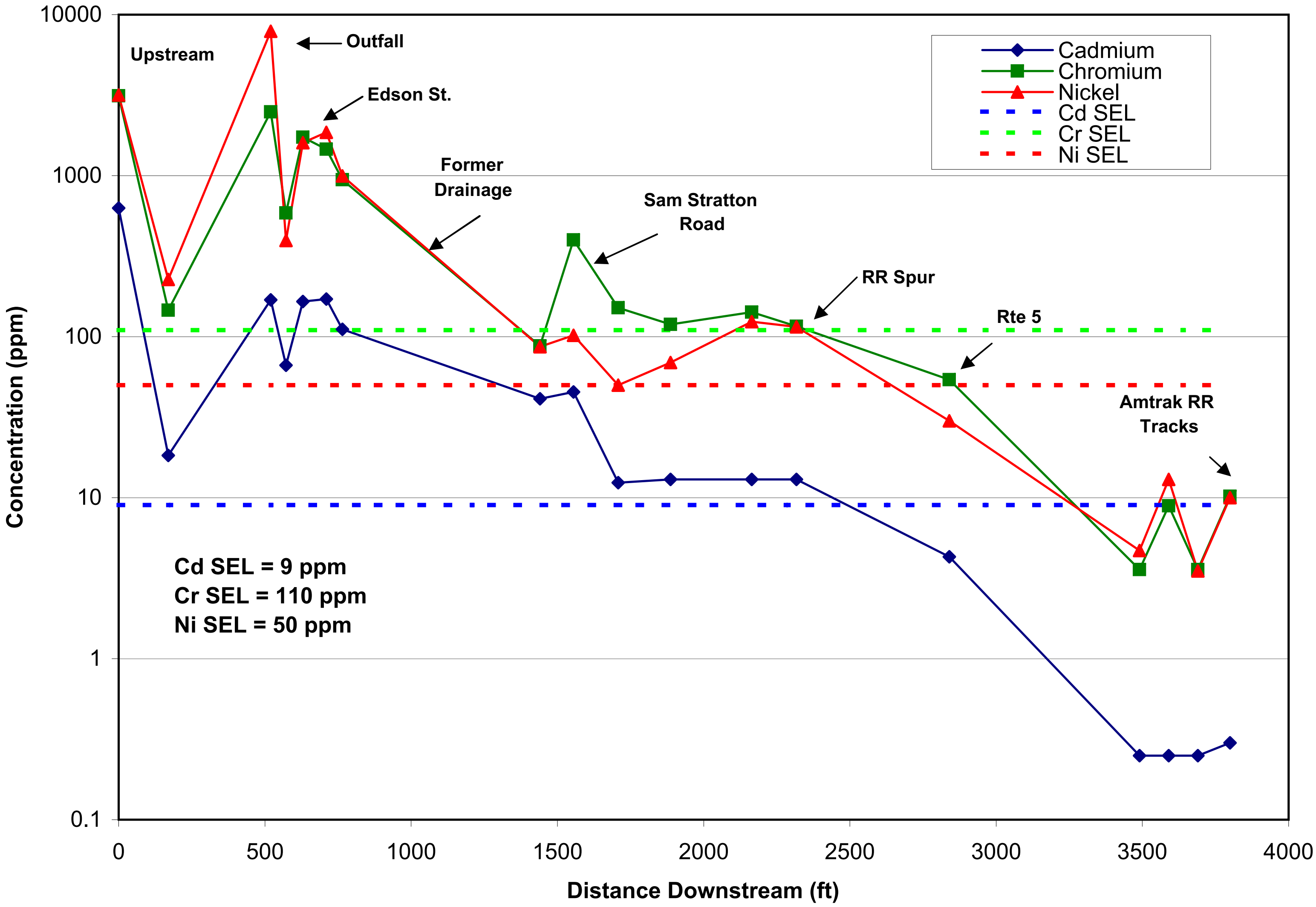
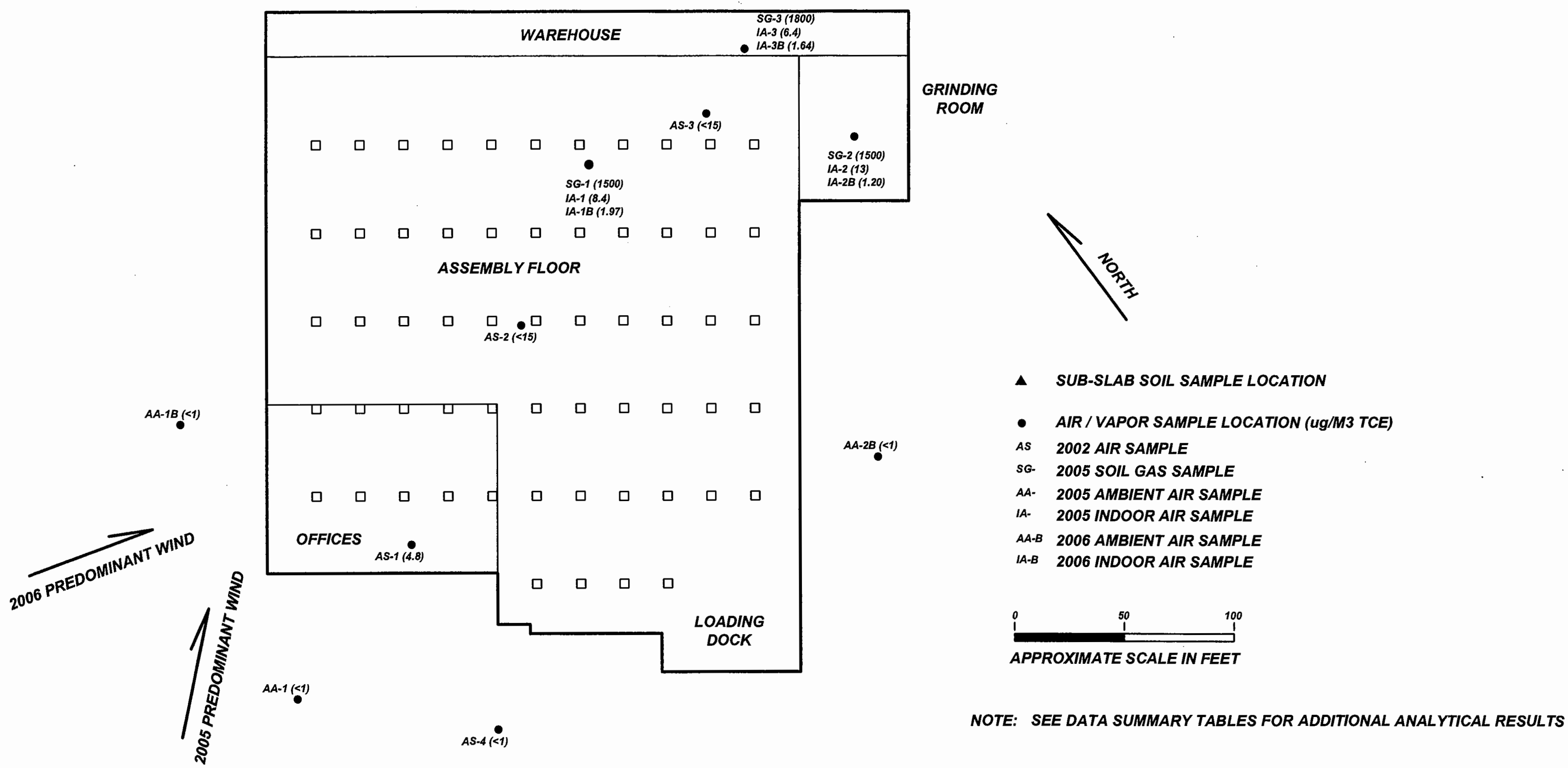


Figure 16 - Concentration of Cadmium, Chromium and Nickel in Sediment Samples Collected from the West Branch Drainage

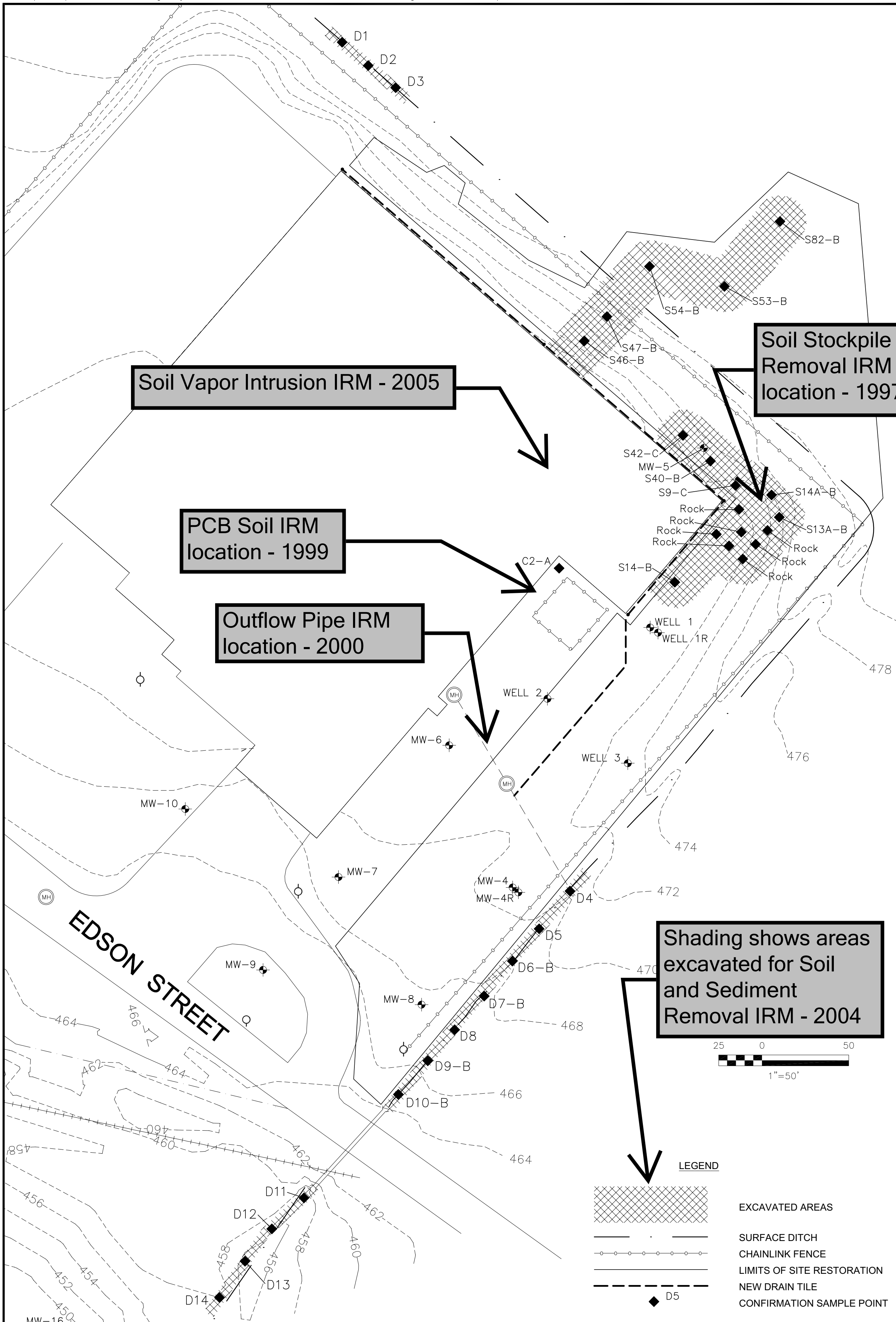




NOTE: SEE DATA SUMMARY TABLES FOR ADDITIONAL ANALYTICAL RESULTS

RETEC

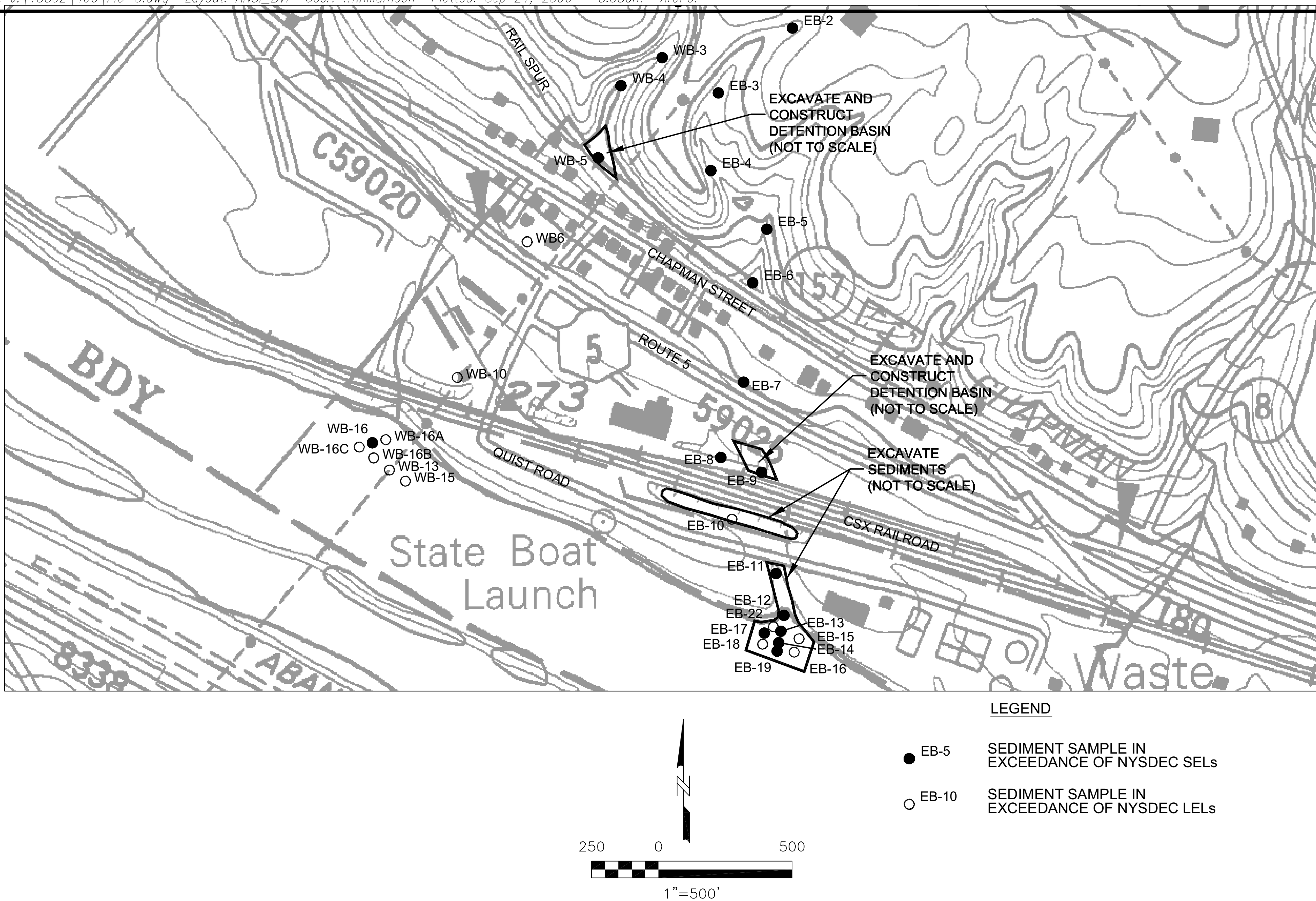
Ward Products Site Amsterdam, NY NWR0-15852-300			INDOOR AIR, SOIL VAPOR, AND SUB-SLAB SOIL SAMPLING LOCATIONS	
DATE: 02/28/06	DRWN: MRH	FILE:	LAYOUT:	FIGURE 17



RETEC

WARD PRODUCTS SOIL AND SEDIMENT IRM AMSTERDAM, N.Y. NWR01-15853-600	AS-BUILT ON-SITE DETAIL
DATE: 8/12/04 DRWN: MAW/BIL	**FIGURE** 18

File: J:\15852\400\FIG-5.dwg Layout: ANSI_BVI User: mwilliamson Plotted: Sep 21, 2006 - 8:38am Xref's:



RETEC

WARD PRODUCTS SITE
AMSTERDAM, NEW YORK

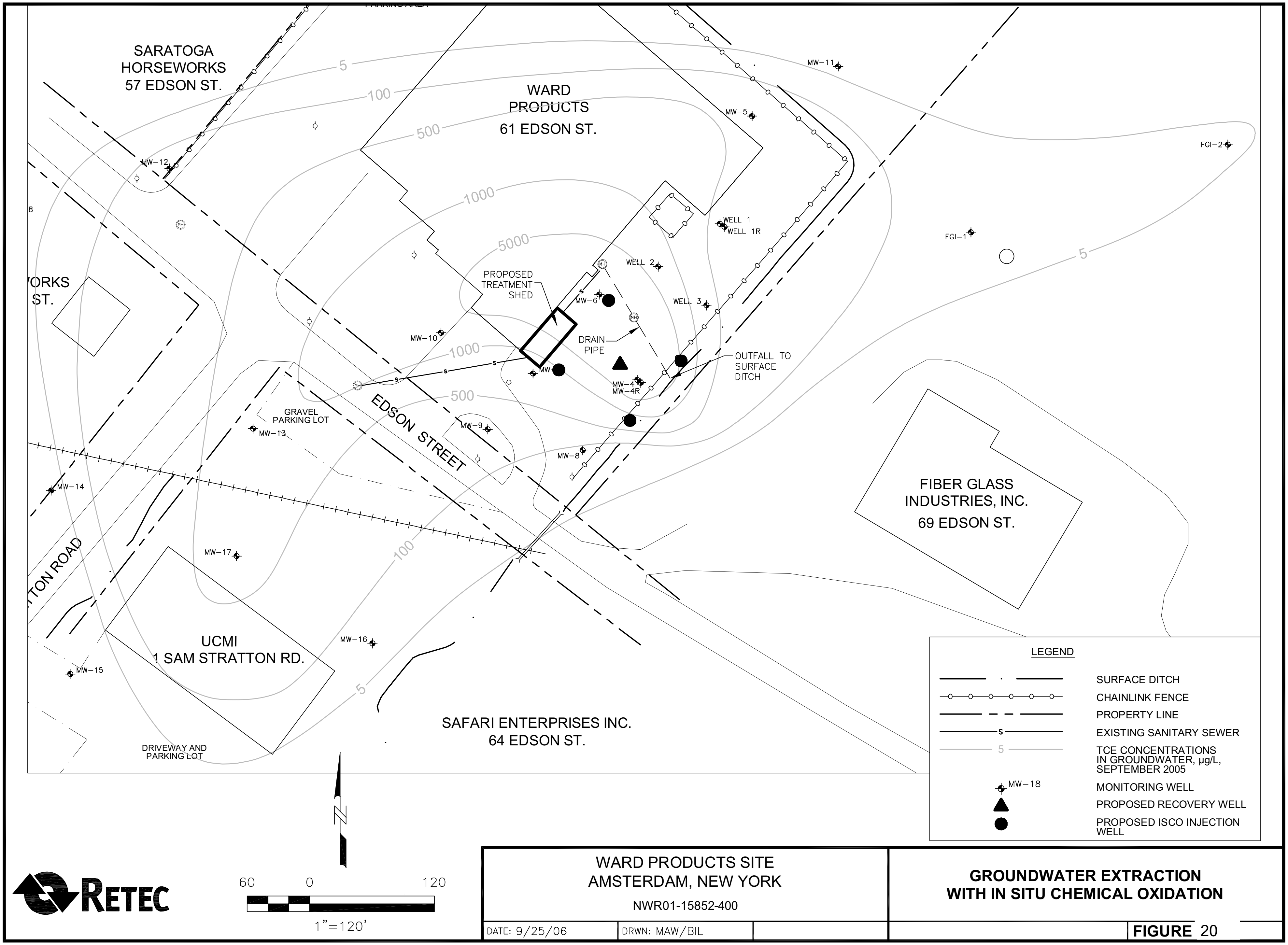
NWR01-15852-400

INTERMEDIATE SEDIMENT EXCAVATION

DATE: 9/25/06 | DRWN: MAW/BIL

FIGURE 19

File: J:\15852\400\FIG-6.dwg Layout: ANSI_BVI User: mwilliamson Plotted: Sep 21, 2006 - 8:41am Xref's:



RETEC

WARD PRODUCTS SITE
AMSTERDAM, NEW YORK
NWR01-15852-400

GROUNDWATER EXTRACTION WITH IN SITU CHEMICAL OXIDATION

DATE: 9/25/06 | DRWN: MAW/BIL

FIGURE 20