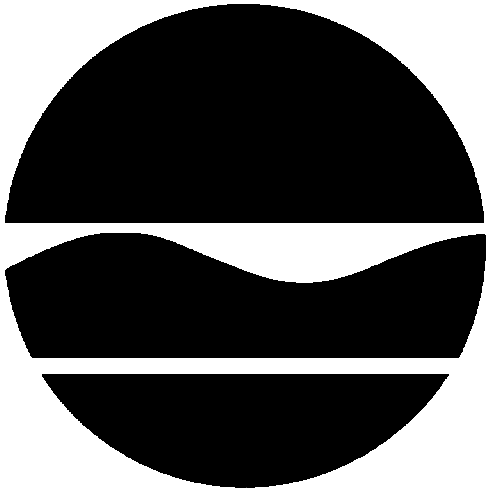
PROPOSED REMEDIAL ACTION PLAN
STERLING DRUG SITE 3
Operable Unit No. 02
East Greenbush, Rensselaer County, New York
Site No. 442011

January 2009



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 Sterling Drug Site 3, Operable Unit No. 02, which encompasses the off-site portion of the groundwater contaminant plume. 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, uncontrolled waste disposal activities have resulted in the migration of hazardous wastes, including volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). These wastes have contaminated the groundwater at the site, and have resulted in:

- a significant threat to human health associated with exposure to contaminated soil vapor and groundwater.
- a significant threat to the groundwater environmental resource associated with it's best use as a Class GA source of drinking water.

To eliminate or mitigate these threats, the Department proposes institutional controls and monitoring as the remedy for this operable unit.

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 following documents: July 1984, "Phase I - Final Report, Preliminary Investigation of Site 3 Sterling Organics, East Greenbush, NY"; Revision of January 1987 of the, "Phase II - Report, Remedial Investigation of Site 3 Sterling Organics, East Greenbush, NY"; February 1992, "Final Draft Feasibility Study Sterling - Site 3 Inactive Landfill, East Greenbush, NY, the draft September 2008, "Focused Feasibility Study (FFS) Report, Sterling Site 3, East Greenbush, NY", and other relevant documents. The public is encouraged to review the project documents, which are available at the following repositories:

NYSDEC Central Office
625 Broadway, 12th Floor
Albany, NY 12233-7013
(518) 402-9767
Contact: Randy Hough, Project Manager.

East Greenbush Community Library
10 Community Way
East Greenbush, NY 12061
(518) 477-7476

The Department seeks input from the community on all PRAPs. A public comment period has been set from January 5, 2009 through February 4, 2009, to provide an opportunity for public participation in the remedy selection process. A public meeting is scheduled for Thursday, January 22, 2009 at the East Greenbush Community Library beginning at 6:30 pm.

At the meeting, the results of the FFS 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. Hough at the above address through February 4, 2009.

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.

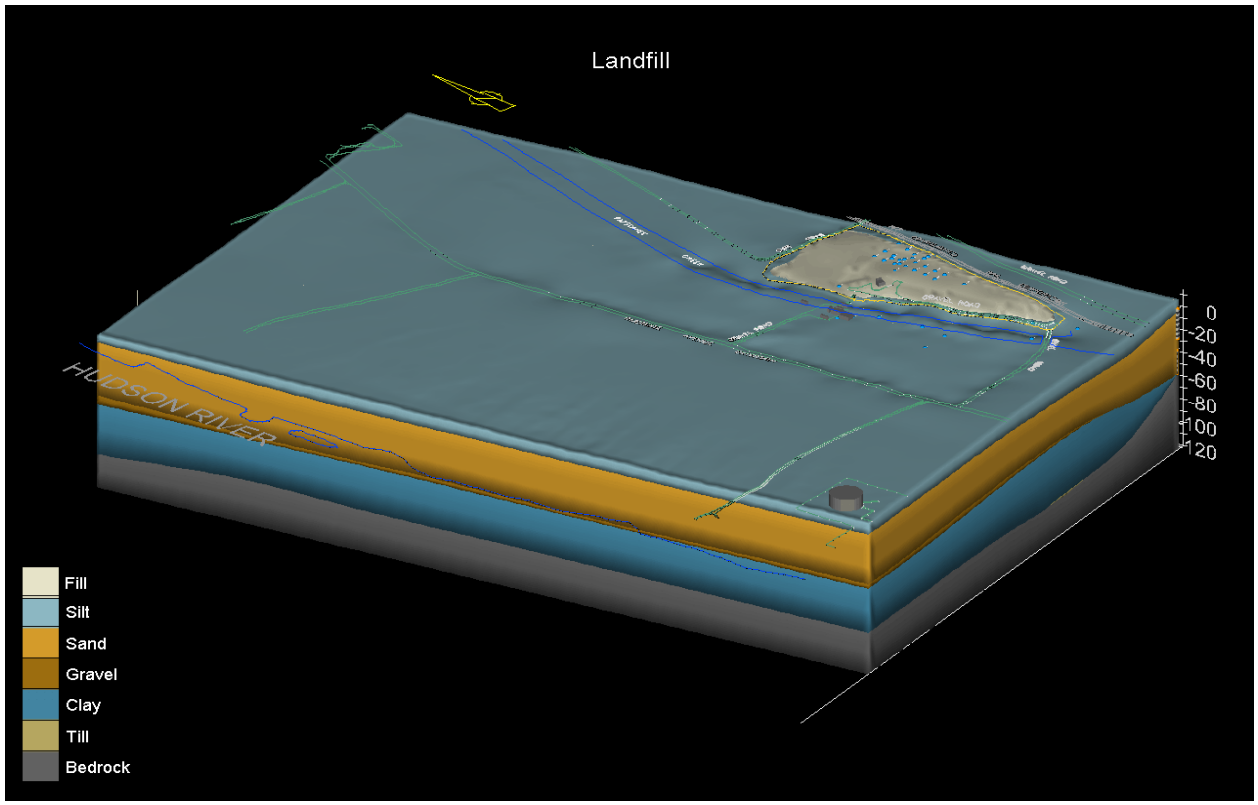
Comments will be summarized and addressed in the responsiveness summary section of the Record of Decision (ROD). The ROD is the Department's final selection of the remedy for this site.

SECTION 2: SITE LOCATION AND DESCRIPTION

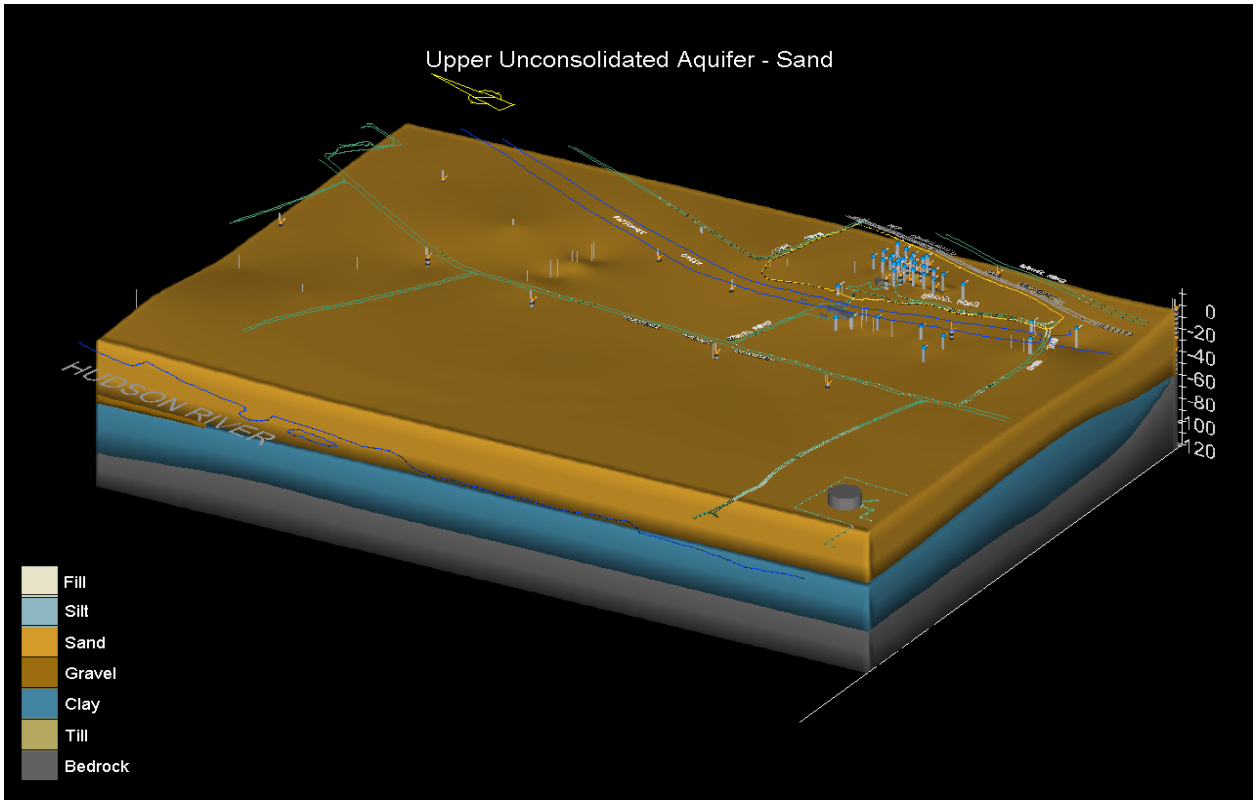
Sterling Drug Site 3 consists of two operable units. Operable Unit (OU) No. 02, which is the subject of this document, includes the off-site contaminated groundwater plume. An operable unit represents a portion of the site remedy that for technical or administrative reasons can be addressed separately to eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination. The remaining operable unit for this site is: Operable Unit No. 01, consists of the inactive landfill area including onsite soils, groundwater, surface water and sediments. Remedial actions at OU-01 have been implemented pursuant to an order on consent which include: a large drum removal program, soil vapor extraction (SVE), groundwater treatment system (GWTS) operation, air sparging, design of the landfill impermeable cap system and environmental monitoring.

The Site is located off of American Oil Road (Riverside Avenue Extension) in the Town of East Greenbush, Rensselaer County, New York. (Figure 1) OU-01, the inactive landfill is approximately 7 acres in size and is situated on a wedged shaped parcel of land between Papscanee Creek to the west and the CSX Transportation railway tracks to the east. OU-02, the groundwater plume, extends within the subsurface from the landfill's western boundary in a northwesterly direction along the line of groundwater flow and is approximately 2,400 feet long and 750 feet wide. The plume has migrated to several of the adjacent and/or nearby individual off-site property parcels. Generally the OU-02 area is relatively flat and is situated within the 100 year floodplain of the Hudson River. The Hudson River is located approximately 2,200 feet west of OU-01. The majority of the immediate surrounding lands are rural in appearance and are either open land or leased for agricultural purposes (row crops). The Sterling Drug Site 2 is located approximately 1.5 miles to the northeast.

Three water-bearing zones have been identified in the vicinity of the Site (see block geology model below). The water-bearing zones from shallowest to deepest are: the upper unconsolidated aquifer at a depth of 10 to 90 feet, which consists of gravel and sand and is overlain by silt; the lower unconsolidated aquifer at a depth of 80 to 100 feet, which consists of till and which is separated from the upper aquifer by a clay aquitard; and the bedrock aquifer at a depth of 45 to 120 feet. The upper unconsolidated aquifer has been impacted by the site (see aquifer model below). Groundwater flow in the upper unconsolidated aquifer is controlled by a geologic trough and flows towards the Hudson River in a northwest direction. The river exerts tidal influence on groundwater of up to 2 feet in the monitoring wells closest to the Hudson, with progressively less influence back towards the landfill. Tidal influence near the landfill has been shown to be approximately 0.08 feet at high tide.



Sterling Drug Site 3 - Block Geology Model (Conestoga Rovers Associates)



Sterling Drug Site 3 - Aquifer Model (Conestoga Rovers Associates)

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History

In 1956, Sterling leased Site 3 from S.A. Graziano for the land disposal of plant wastes. Disposal of wastes began in 1956 and continued until the latter part of 1977. Disposed wastes included pharmaceutical intermediates, finished pharmaceutical products, Sterling Winthrop Research Institute waste, filter cakes, solvents, still bottoms, oils, and wood. An initial estimate was that 2,000 drums containing waste and waste solvents had been disposed of in the northern section of the landfill. In 1977, the landfill was covered with sandy clay and gravel and closed. The site has remained inactive since the termination of landfill activities. An 8 foot chain link security fence was erected around the perimeter of the landfill in January of 1984.

3.2: Remedial History

The site has been the subject of remedial investigations, remedial actions in the form of interim remedial measures (IRMs), feasibility studies and remedial design phases since the early 1980s.

In 1982, the Department listed the site in the Registry of Inactive Hazardous Waste Disposal Sites in New York. In 1983 the site was designated a Class 2 based upon the Department's numerical rankings under the ECL. 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.

Between 1982 and 1987, Phase I and II Remedial Investigations (RI) were conducted which included various field activities along with physical/chemical testing and reporting. The investigations were conducted in order to delineate the nature and extent of the site contamination.

Between 1987 and 1991, various IRMs and remedial actions were implemented in order to address contaminant sources, source areas and to control contaminant migration. Some of these activities included:

- groundwater treatment system design
- drum removal programs (8,452 removed)
- landfill characterization programs
- clay breach area (CBA) source removal pilot tests using air sparging
- additional sampling and analysis of site media (on and off-site)

In 1992 the Record of Decision (ROD) for OU-01 of the site was signed by the Department. The selected remedy for the site included: vacuum extraction of hot-spots identified in the on-site soils, groundwater recovery and treatment of the on-site portion of the contaminant plume, installation of an impermeable landfill cap, site use restrictions and environmental monitoring. The 1992 ROD also included a "Documentation of Significant Changes" between the site PRAP and the finalized remedy. The "Documentation of Significant Changes" section of the ROD recognized the fact that the February 1992, "Final Draft Feasibility Study Sterling - Site 3 Inactive Landfill", adequately addressed the on-site contamination, but did not adequately evaluate remedial alternatives to address the off-site contaminant plume. Based upon this, the Department deferred selecting a remedy for this portion of the site and created a second operable unit (OU-02) under which the off-site contaminant plume would be addressed.

Between 1994 and 2000, various remedial actions selected in the remedy for the on-site area (OU-01) and outlined in the 1992 ROD were implemented. Some of these actions included:

- full-scale air sparging and vapor extraction treatment system operation,
- full-scale groundwater extraction and treatment system operation,
- preliminary landfill cap design, and
- sampling and analysis of site media (on and off-site)

The remedial objectives outlined in the 1992 ROD for the contaminated subsurface soils at OU-01specified that the vapor extraction treatment system (and subsequent air sparging system) would operate until specific contaminant levels were achieved or until performance data indicates that the system was no longer

effective. Once it was determined that a significant mass of contamination had been removed, the containment portion (landfill capping) of the selected alternative for OU-01 would be implemented. This determination was made in November of 2007, at which time the Department directed that the landfill capping phase of the remedy be implemented.

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 Sterling Drug, Inc. entered into a Agreement and Determination (Index #437T072382) on August 6, 1982. The Agreement and Determination obligated the responsible parties to implement a investigative remedial program. In 1986, an Amendment (Index # T061485) to the Agreement and Determination was implemented which required Sterling Drug, Inc. to perform a Remedial Investigation/Feasibility Study (RI/FS) of the site, as well as interim remedial measures as appropriate. In March of 1993, the Department executed an Order on Consent (Index # A4-0281-92-04) with Sterling Winthrop, Inc. which required the development of remedial design work plans, a remedial design and for the remedial design implementation and reporting, for Operable Unit 01 of the site. At the time of execution of the 1993 order, Sterling was a subsidiary of the Eastman Kodak Company. In 1994, Kodak sold the stock of Sterling but retained the environmental liabilities obligations. In May of 2000, the Department executed an Order on Consent (Index # A4-0404-9911) with 360 North Pastoria Environmental Corporation (NPEC), a wholly owned subsidiary of the Eastman Kodak Company. This Order on Consent included the following statement: "whereby NPEC will become a named Respondent for this Site and thereby assume the remedial obligations with respect to the Site". Since execution of this Order on Consent, NPEC has been responsible for the all remedial aspects of the Sterling Drug Site 3, including both operable units.

SECTION 5: SITE CONTAMINATION

A focused feasibility study (FFS) has been conducted to evaluate the alternatives for addressing the significant threats to human health and the environment.

5.1: Summary of the Remedial Investigation

The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site. The initial RI was conducted in two phases between 1982 and 1987 and included investigations of both the landfill (OU-01) and the off-site plume (OU-02) areas. The field activities and findings of the investigation are described in the RI reports. In addition, up to date environmental data has been collected on an on-going basis, during the monitoring programs (semi-annual and biennial) required as part of the remedy for OU-01. These programs include activities which monitor the off-site OU-02 plume area.

5.1.1: Standards, Criteria, and Guidance (SCGs)

To determine whether the groundwater contains contamination at levels of concern, data from the investigation were compared to the following SCGs:

- the best usage of water resources as outlined in 6NYCRR Part 701, "Classifications - Surface Waters and Groundwaters";

- groundwater, drinking water, and surface water quality standards are based on 6NYCRR Part 703, covering the Department's "Ambient Water Quality Standards and Guidance Values" and Part 5 of the New York State Sanitary Code for Unspecified Organic Contaminants (UOCs).

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 reports.

5.1.2: Nature and Extent of Contamination

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

The disposal activities at the site (OU-01) resulted in a variety of wastes being disposed within the landfill. These included pharmaceutical intermediates, finished pharmaceutical products, Sterling Winthrop Research Institute waste, filter cakes, solvents, still bottoms, oils, and wood. The primary contaminants of concern identified from the waste disposal included VOCs such as, benzene, toluene, ethyl ether, methylene chloride, acetone, methyl thiophene, 1,2-dichloroethane, trichloroethene and chloroform, and SVOC pharmaceutical type compounds such as, talbutal, lidocane, mephobarbital, phenobarbital, hexobarbital and pentazocine.

As described in the RIs and on-going monitoring reports, many groundwater samples have been collected to characterize the nature and extent of contamination. As seen in Figures 2 and 3, the main categories of contaminants that exceed their SCGs at OU-02 are volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs). For comparison purposes, where applicable, SCGs are provided for each medium.

Chemical concentrations are reported in parts per billion (ppb) for water. Figure(s) 2 and 3 summarize the degree of contamination for the contaminants of concern in groundwater and compare the data with the SCGs for the site. The following are the media which were investigated for OU-02 and a summary of the findings of the investigation.

Groundwater

The impacts to groundwater from the majority of the contaminants disposed at OU-01 have been reduced and controlled by the treatment systems (air sparging, SVE and GWTS) at the landfill. A groundwater plume (OU-02) consisting primarily of ethyl ether and some of the SVOC pharmaceutical compounds above SCGs, has migrated from the former landfill within the upper unconsolidated aquifer some 2,400 feet to the northwest. The groundwater plume has impacted a number of off-site private property parcels at concentrations above the NYSDOH Part 5, Drinking Water, Unspecified Organic Contaminant (UOC) standard of 50 ppb (ug/l) for these chemicals. The presence of the UOC contamination on these off-site private property parcels has impacted the best usage of the groundwater resource as source of drinking water in these areas. Figure 2 shows the ethyl ether contamination trends overtime in terms of isoconcentrations within the sand and gravel unit of the upper unconsolidated aquifer. Figure 3 shows the locations and estimated concentrations of SVOC pharmaceutical compounds detected in the groundwater plume at two monitoring points above the UOC drinking water standard of 50 ppb.

Groundwater contamination identified during the remedial investigations and on-going monitoring programs, as well as in the FFS, will be addressed in the remedy selection process.

Soil Vapor/Sub-Slab Vapor/Air

No site-related soil vapor/sub-slab vapor/air sampling and analysis was conducted during the RI based upon the fact that there are no continuously occupied structures that exist on the site or on the OU-02 off-site properties. However, provisions for the evaluation of the potential for vapor intrusion and vapor exposures within any future buildings developed on the OU-02 properties, including provisions for mitigating any impacts identified, will be addressed in the remedy selection process.

5.2: Interim Remedial Measures

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.

There were no IRMs performed to address OU-02 of this site during the RIs.

5.3: Summary of Human Exposure Pathways:

This section describes the types of human exposures that may present added health risks to persons at or around the site. Additional discussion of the human exposure pathways can be found in Section 4 of the FFS. 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.

Currently there are no known exposure pathways which exist at the site. The potential exposure pathways which could exist in the future include the following:

- inhalation of vapors from contaminants in the groundwater for construction workers involved in future excavation activities.

- inhalation of vapors accumulating in the indoor air via the vapor intrusion pathway into structures constructed on-site in the future.

- ingestion, dermal contact and/or inhalation of vapors from contaminated groundwater if drinking water or irrigation wells are installed on-site in the future.

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.

Site contamination has impacted the groundwater resource in the upper unconsolidated aquifer, above the maximum contaminant levels (MCLs) as outlined in Part 5 of the New York State Sanitary Code for certain unspecified organic contaminants (UOCs). Contamination has migrated with the groundwater in this aquifer from the landfill area (OU-1) to various off-site properties (OU-02).

The Hudson River is another environmental resource located near the OU-02 area. The river is approximately 500 feet west of the furthest OU-02 down-gradient groundwater monitoring point. Based upon the concentration of contamination in the plume, the relatively low volume of potential groundwater contamination emerging to this surface water body and the river's waste assimilation capacity, viable exposure pathways to fish and wildlife receptors from discharges to the Hudson are not a concern for OU-02.

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:

- the ingestion of groundwater with contaminant levels exceeding drinking water standards;
- the contact with volatiles and/or semi-volatiles, or inhalation of volatiles, from contaminated groundwater;

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

- drinking water standards, based upon the potential to use groundwater as a drinking water source, for the site specific, regulated, unspecified organic contaminants (UOCs);
- restoration of the groundwater aquifer for the Sterling Drug Site 3 related contaminants.

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 Sterling Drug Site 3, OU-02 were identified, screened and evaluated in the FFS 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. In order to compare the costs of alternatives G4 and G5 it was assumed that these remedies would operate over a two year period.

7.1: Description of Remedial Alternatives

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

Alternative G1: No Action

The No Action Alternative is evaluated as a procedural requirement and as a basis for comparison. It requires continued monitoring and inspections only, allowing the site to remain in an unremediated state. This alternative would leave the site in its present condition and would not provide any additional protection to human health or the environment. This alternative could be implemented immediately.

Present Worth: *$175,000*
Capital Cost: *$0*
Annual Costs:
(Years 1-30): *$14,000*

Alternative G2: Institutional Controls

Under this alternative the contaminated groundwater would not be actively remediated and the site conditions would remain the same. Institutional controls (ICs) would be utilized to provide protection of human health and the environment. The ICs would be enforced through the execution of an environmental easement between NPEC and the Department for the site. The ICs applicable to the site would include an environmental easement which would require the following items:

- development and compliance with an approved site management plan (SMP);

- if groundwater is to be utilized at the site for drinking water or process water, then an acceptable water supply alternative or the necessary water quality treatment as determined by NYSDOH for the Sterling Drug Site 3 related contaminants of concern would be provided; and

- periodic certification of the institutional controls and engineering controls would be completed and submitted to the Department.

The site management plan would include the following items:

- management of the final engineering controls;

- in the event of development of the impacted property(s), then NPEC would provide for the continued evaluation of the potential for vapor intrusion for any buildings developed on the property(s), including provisions for mitigating any impacts identified;

- if groundwater is to be utilized at the impacted off-site property(s) for drinking water or process water, then an acceptable water supply alternative or the necessary water quality treatment as determined by NYSDOH for the Sterling Drug Site 3 related contaminants of concern would be provided;

- provide for the ability to access site properties in order to design and implement a remedial monitoring program for soil, soil vapor, air and groundwater;

- provide for the identification of any use restrictions on the site; and

- provide provisions for the continued proper operation and maintenance of the components of the remedy.

This alternative would meet the remediation goals for the site in terms of protection of human health by controlling the groundwater and soil vapor exposure pathways utilizing wellhead treatment for the site related contaminants or alternative potable water sources and by mitigation respectively, in the event of property development. The groundwater resource would eventually be restored through the site specific attenuation processes. Periodic certifications would be required in order to ensure that all the institutional controls put in place are still in place, are effective and that they are unchanged from the previous certification. Monitoring of the site related contaminants of concern would be performed at upgradient, source area (OU-01) and at downgradient (OU-02) monitoring locations. The existing monitoring network would be supplemented with additional points. This alternative could be implemented within 6 months.

Present Worth: *$430,000*
Capital Cost: *$14,000*
Annual Costs:
(Years 1-30): *$33,000*

Alternative G3: Monitored Natural Attenuation

Under this alternative the contaminated groundwater would not be actively remediated and the site conditions would remain the same. The natural attenuation processes on-going at the site would be allowed to determine the fate and transport of the contamination at OU-02 and to achieve the remedial objectives by removing the contaminants via these processes in a time period that is reasonable. Natural attenuation is a set of physical/mechanical, chemical and/or biological processes which may include such things as biodegradation, chemical transformation, volatilization, adsorption, dispersion and dilution. Monitoring of natural attenuation indicator parameters would be performed at upgradient, source area (OU-01) and at downgradient (OU-02) monitoring locations. The existing monitoring network would be supplemented with additional groundwater sample collection points in order to effectively natural attenuation processes.

Institutional controls (ICs) in the form of an environmental easement made between NPEC and the Department, such as outlined for alternative G2 would be implemented under this alternative. This alternative

would require the development and compliance with an approved site management plan (SMP), including continued site monitoring and inspections. This alternative could be implemented within 6 months.

Present Worth: *$450,000*
Capital Cost: *$36,000*
Annual Costs:
(Years 1-30): *$33,000*

Alternative G4: In-situ Chemical Oxidation

Alternative G4 would involve the subsurface injection of a chemical oxidant which would react with the groundwater and result in the oxidation (destruction) of the site contaminants. The chemicals would be applied in the subsurface (in-situ) by methodologies which would allow them to react as directly as possible with the existing contamination. In-situ groundwater treatment would occur over a two year period. The remediation goals for the site would be met by the elimination of the organic contaminants of concern. This alternative would include the following items:

- a treatability study would be conducted during design in order to;
    - determine the optimum chemical oxidant for the site, based upon the existing contamination and background conditions;
    - determine the number of injection points required; and
    - determine the volume of oxidant to be injected per point;
- injections of chemical oxidant;
- post-injection media monitoring of the on and off-site groundwater;
- evaluation of remedy effectiveness and re-injections if required;
- development and compliance with an approved site management plan (SMP); and
- institutional controls similar to those listed in alternative G2.

The time required to design and implement alternative G4 would be approximately one (1) year. After two years the effectiveness of the alternative will be evaluated and re-injections of chemical oxidant would be continued if warranted.

Present Worth: *$3,700,000*
Capital Cost: *$290,000*
Annual Costs: Groundwater Injections (Years 1-2): *$1,700,000*
Annual Costs:
(Years 1-30): *$24,000*

Alternative G5: Ex-situ Carbon Adsorption

Alternative G5 would involve the extraction of the contaminated groundwater and processing it through a on-site treatment works (ex-situ), which would utilize carbon adsorption to capture the contaminants of concern. The treated groundwater would then be discharged in accordance with an approved plan and the adsorbent materials would be regenerated, replaced and/or disposed of as required. The remediation goals for the site would be met by the elimination of the organic contaminants of concern from the groundwater through the treatment process. This alternative would include the following items:

- a modeling study would be conducted during design in order to;
    - determine the optimum carbon adsorbent to be used, based upon the existing contamination and background conditions;

    - the number of carbon adsorbent units required; and
    - the need for groundwater pretreatment, such as filtration;
- construction of the treatment works;
- continuous evaluation of treatment efficiency;
- development and compliance with an approved site management plan (SMP); and
- institutional controls similar to those listed in alternative G2.

The time required to design and implement alternative G5 would be approximately one (1) year. The system would be operated and monitored for a period of two years. After two years of operation and monitoring the effectiveness of the alternative will be evaluated and the remedy continued and/or modified if needed.

Present Worth: *$1,400,000*

Capital Cost: *$290,000*

Annual Costs: Groundwater Treatment System Operation (Years 1-2): *$470,000*

Annual Costs:

(Years 1-30): *$24,000*

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 discussion of the evaluation criteria and comparative analysis is included in the FFS report and in Section 8 which follows.

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-Effectivness. 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 1.

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 RIs and FFS 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 G2, Institutional Controls (ICs) as the remedy for this site. The proposed remedy is based on the results of the RIs, the historical monitoring of the site area and the evaluation of alternatives presented in the FFS. The elements of this remedy are described at the end of this section. In the event that an element(s) of the proposed remedy cannot be implemented, then alternative G5 would be implemented as the contingency remedy.

The focused feasibility study suggests Alternative G3 - Monitored Natural Attenuation as the preferred remedy for the contaminant plume, however the Department is proposing Alternative G2 based upon the evaluation criteria and comparative analysis as discussed in the following parts of this section.

The "no action" alternative (G1) would not be protective of human health and/or the environment. It would not address the potential exposure pathways in the event of development of the impacted properties.

Alternative G2, Institutional Controls is being proposed because, as outlined below, it satisfies the threshold criteria and provides an acceptable balance of the primary balancing criteria described in Section 7.2. The remediation goals would be met by implementing institutional controls which would eliminate and/or control the two pathways of potential exposure at the site. In the event of future development of the site (groundwater used as drinking water and structures built) and if determined that completed exposure pathways exists, the remediation goals would be achieved by, providing an alternative water source or point of use treatment for the contaminated groundwater and by mitigating contaminated soil vapor intrusion to indoor air. The institutional controls, along with the source containment provided by the installation of the landfill impermeable cap (OU-01 remedial action), along with the elimination of the secondary source of the ethyl ether (discharge to groundwater from the OU-01 GWTS above standards) and the natural physical and

mechanical attenuation processes (dilution and dispersion) on-going within the upper unconsolidated aquifer at the site, would address the threats posed by the groundwater contamination.

Alternatives G3, G4, and G5 would also comply with the threshold selection criteria through remedial actions and with the implementation of the institutional controls as outlined in alternative G2.

Because alternatives G2, G3, G4, and G5 satisfy the threshold criteria, the five balancing criteria are particularly important in selecting a final remedy for the site.

Both alternatives G4 (in-situ chemical oxidation) and G5 (ex-situ carbon adsorption) have been utilized successfully at other inactive hazardous waste sites. However, there may be short-term impacts associated with the construction of these two remedies which may affect the impacted properties. These could include, the installation and operation of chemical oxidant injection wells for G4 and the installation of groundwater extraction wells, a forcemain and an associated culvert system for G5. Alternative G4 may also pose some short term risks due to the need to handle and inject the reactive chemicals into the subsurface. Alternatives G2 and G3 would not have any short term impacts.

Achieving long-term effectiveness and permanence is best accomplished by destruction of the groundwater contamination (G4) or by removing and capturing the contamination (G5) on an adsorbent ex-situ and discharging the treated water. However, the control and elimination of the contaminant source areas (landfill and groundwater discharge) will allow the physical natural attenuation processes to reduce the groundwater contamination concentrations over time. Institutional controls (G2) would also provide permanence in that the requirements to address the two exposure pathways would remain in effect as long as contamination levels at the impacted properties are above standards. Additionally, the ICs would be structured to run with the land - in other words, to remain in force despite changes in ownership. Alternative G3 would not provide any additional long-term effectiveness and permanence beyond what alternative G2 would provide. Alternative G3 does not provide any enhancement of the on-going natural attenuation processes affecting the groundwater on the impacted properties. In addition, ethyl ether does not degrade by biological natural attenuation, thus alternative G3 is essentially the same as alternative G2. The monitoring activities associated with alternative G2 would provide the data needed to assess the on-going effects of the attenuation processes (dilution, dispersion, volatilization) which may be occurring at the site.

Alternatives G2, G3, G4 and G5 would, to various degrees, reduce the toxicity, mobility and volume of the contaminants in the site groundwater. Alternative G2 would over time, reduce the toxicity of the contaminants in the site groundwater through dilution, dispersion and volatilization. Alternative G4 would permanently reduce the volume of contaminants through oxidative destruction, once the contamination is physically reacted with the treatment chemicals. Alternative G5 would provide reduction in the volume of contaminants overtime and may positively affect contaminant mobility by changing the site hydraulic gradients through extraction well placement and the associated zones of influence. Alternative G5 would however, generate quantities of carbon adsorbent treatment residuals which would have to be regenerated or replaced and disposed of.

Alternatives G2, G3, G4, and G5 are all technically feasible from the perspective that they have been implemented as remedial actions at other sites. However, at the Sterling Drug Site 3, the three alternatives differ in terms of implementability. Alternative G2, would involve minor technical issues associated with the wellhead treatment of the drinking water and vapor mitigation systems if needed, both of which could be readily managed. In addition, from a technical perspective, its feasible to provide uncontaminated drinking water from wells installed into the lower unconsolidated aquifer or from an alternative municipal source. The implementability of alternative G4 is less certain, in that the destruction of the contaminants would only occur by direct contact with the oxidizing chemicals. While the treatment technology of in-situ chemical oxidation has been used successfully at other sites, it has been primarily utilized to treat halogenated and petroleum related VOCs. The technology is less proven to treat the site related non-

halogenated ethyl ether and the pharmaceutical SVOCs. The reliability of the G4 alternative is also highly dependant upon utilizing sufficient mass of treatment chemicals to both come in direct contact with and then react with, the site contamination. Factors such as, injection point locations, soil permeability and naturally occurring background interferences are important technical considerations. The Hudson River tidal influence on the western portions of the operable unit, may also impact the chemical oxidant dispersion in this area. An in-depth treatability study, considering each of these site specific factors would be required in order to effectively design and implement the remedy. Alternative G5 is technically feasible in terms of construction and operation, as has been shown through the operation of the groundwater treatment system (GWTS) utilized at OU-01. However, operation of this system has shown that the proper selection of the carbon adsorption media is critical to the effective removal of the ethyl ether contamination. The aquifer transmissivity at the site provides for adequate water volumes for operation of an ex-situ treatment system. A thorough modeling study would be required in order to determine the type of granular activated carbon adsorbent which would be most effective for removing the ethyl ether, the number of adsorption units required, as well as the necessity to pretreat the groundwater, to remove such things as iron, which may foul the treatment works. A permitted discharge point would be required for the treated effluent. Both alternatives G4 and G5 may require that the existing property access agreements (easements) with the impacted property owners be modified to allow for the construction and operational activities associated with the active groundwater treatment remedies.

Alternatives G2, G3, G4, and G5 are all administratively feasible. There are no limitations on the activities needed to coordinate with local, state and federal offices and/or agencies. The services and materials necessary to implement the groundwater treatment alternatives, such disposal facilities, chemical suppliers and well drillers are readily available.

The estimated costs for alternatives G2 and G3 are roughly the same, $450,000. Whereas the costs for alternative G4 is approximately $3,700,000 and that of alternative G5 is $1,400,000. The groundwater injection treatment costs associated with the in-situ chemical oxidation represent a significant portion of the costs of this alternative. Utilization of portions of the on-site existing GWTS works for alternative G5 would be required in order to meet the estimated capital costs of this remedy.

As outlined above, alternatives G2, G3, G4 and G5 differ in respect to the way and the degree to which they meet the primary balancing criteria. They also differ significantly in terms of cost effectiveness. The alternatives that actively treat the groundwater would present short term impacts and be more difficult to implement since they would require more complex treatment systems. The nature of the site's geology and hydrogeology (large volume of groundwater to be treated) could necessitate the need for repeated chemical treatments in the case of alternative G4 and for long term pumping and ex-situ treatment for alternative G5. Each of the active groundwater treatment alternatives would require that institutional controls be implemented in order to be protective during the time period from remedy design to the point at which the remediation goals are achieved.

Based upon the above, the fact that the sources of the contamination would be eliminated and/or controlled and because alternatives G4 and G5 may only provide an indeterminately shorter time interval in which the remediation goals are met, compared to that which may be achieved through the natural attenuation processes, the active treatment of the groundwater in general would not be particularly cost effective. Therefore, the contaminated groundwater and potential soil vapor intrusion can be addressed through institutional controls, and the Department is proposing Alternative G2 to address these threats.

The estimated present worth cost to implement the remedy is $430,000. The cost to construct the remedy is estimated to be $14,000 and the estimated average annual costs for 30 years is $33,000.

The elements of the proposed remedy are as follows:

1. A remedial design program would be implemented to provide the details necessary to determine the exact location and number of area properties impacted above the applicable SCGs and to provide additional information for the design of the monitoring program element of the proposed remedy.

2. Imposition of an institutional control (ICs) in the form of an environmental easement that would require (a) development and compliance with an approved site management plan (SMP); (b) if groundwater is to be utilized at the site for drinking water or process water, then an acceptable water supply alternative or the necessary water quality treatment as determined by NYSDOH for the Sterling Drug Site 3 related contaminants of concern would be provided; and (c) the responsible party (NPEC) to complete and submit to the Department a periodic certification of the institutional and engineering controls.

3. Development of a site management plan which would include the following institutional and engineering controls: (a) management of the final cover system; (b) continued evaluation of the potential for vapor intrusion for any buildings developed on the site or impacted off-site property(s), including provision for mitigation of any impacts identified; (c) if groundwater is to be utilized at the off-site impacted property(s) for drinking water or process water, then an acceptable water supply alternative or the necessary water quality treatment as determined by NYSDOH for the Sterling Drug Site 3 related contaminants of concern would be provided; (d) monitoring of groundwater and soil vapor; (e) identification of any use restrictions on the site; (f) controlling site access where warranted; (g) provisions for the continued proper operation and maintenance of the components of the remedy.

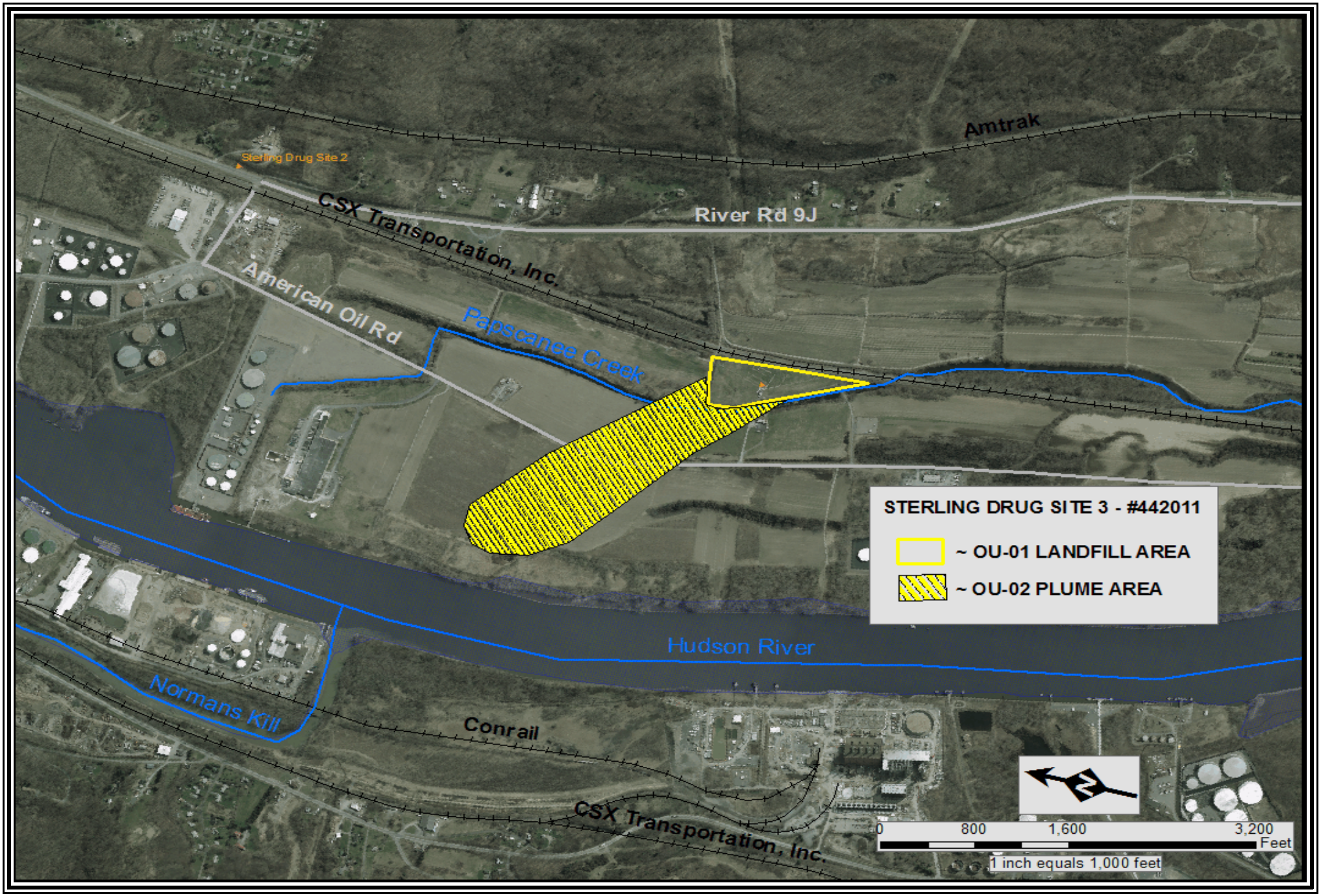
4. The responsible party (NPEC) would provide a periodic certification of institutional and engineering controls, prepared and submitted by a professional engineer or such other expert acceptable to the Department, until the Department notifies NPEC in writing that this certification is no longer needed. 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.

5. 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.

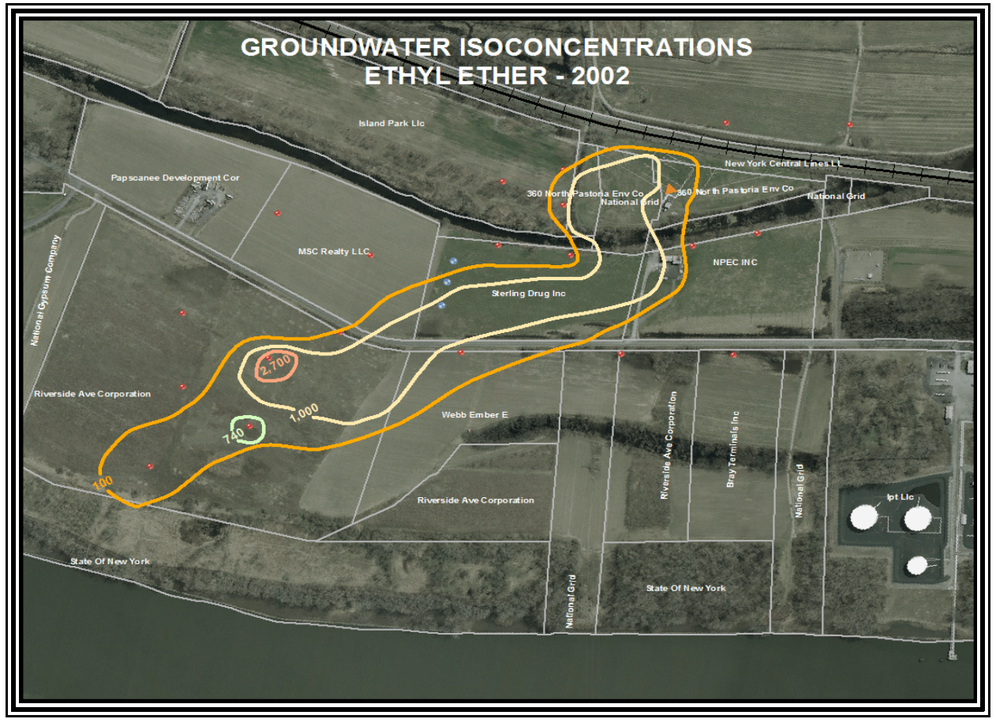
Since the remedy results in untreated hazardous waste remaining at the site, a long-term monitoring program would be instituted. This program would provide the data and other information required to monitor the localized contaminant concentrations as well as the area wide contaminant migration and thus the need for groundwater point of use treatment and/or soil vapor mitigation. The monitoring program would be a component of the long-term management for the site.

Table 1
Remedial Alternative Costs

Remedial Alternative	Capital Cost ($)	Annual Costs ($)	Total Present Worth ($)
G1: No Action	0	14,000	175,000
G2: Institutional Controls	14,000	33,000	430,000
G3: Monitored Natural Attenuation	36,000	33,000	450,000
G4: In-situ Chemical Oxidation	280,000	1,990,000	3,700,000
G5: Ex-situ Carbon Adsorption	290,000	760,000	1,400,000

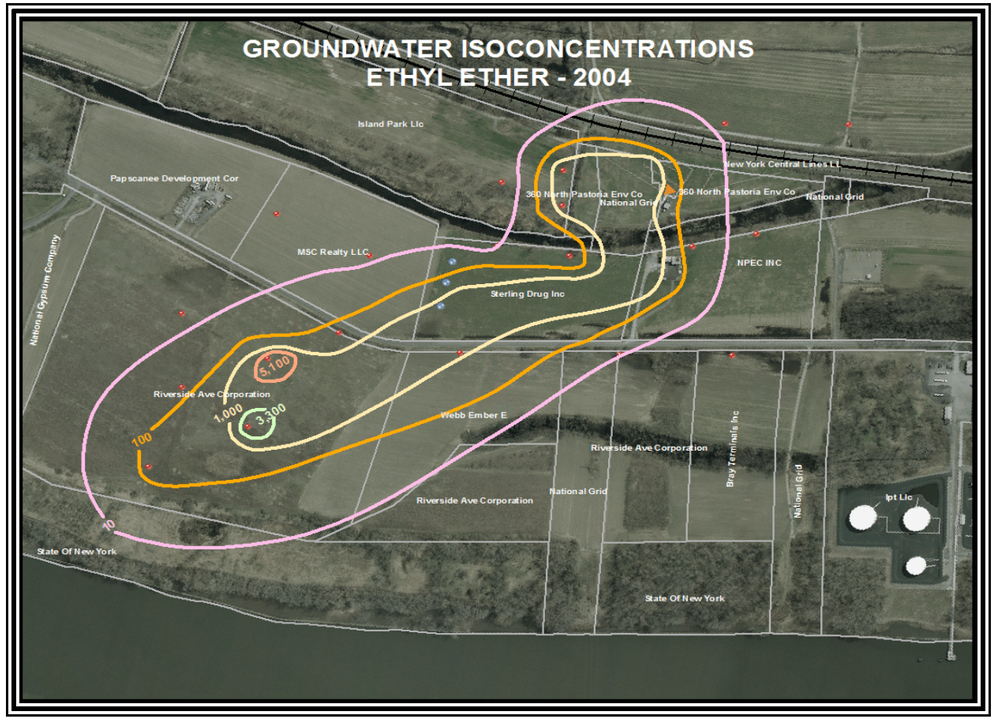


STERLING DRUG SITE 3	SITE LOCATION MAP	FIGURE 1



ISOCONCENTRATIONS ARE IN ppb (ug/l)

ETHYL ETHER SCG IS 50 ppb



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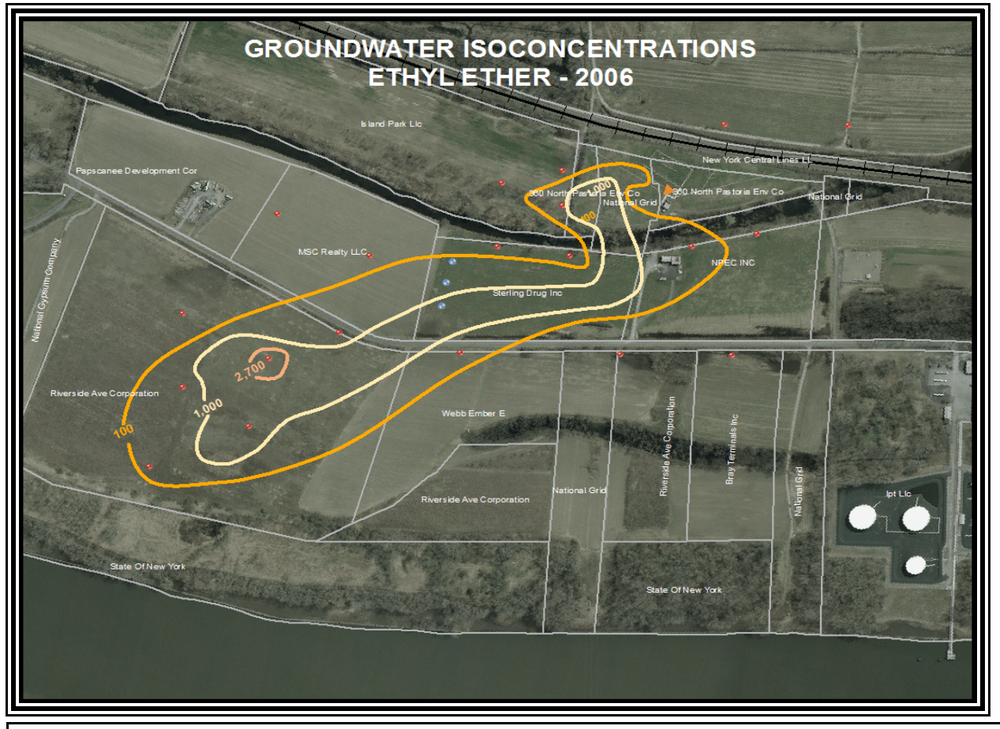
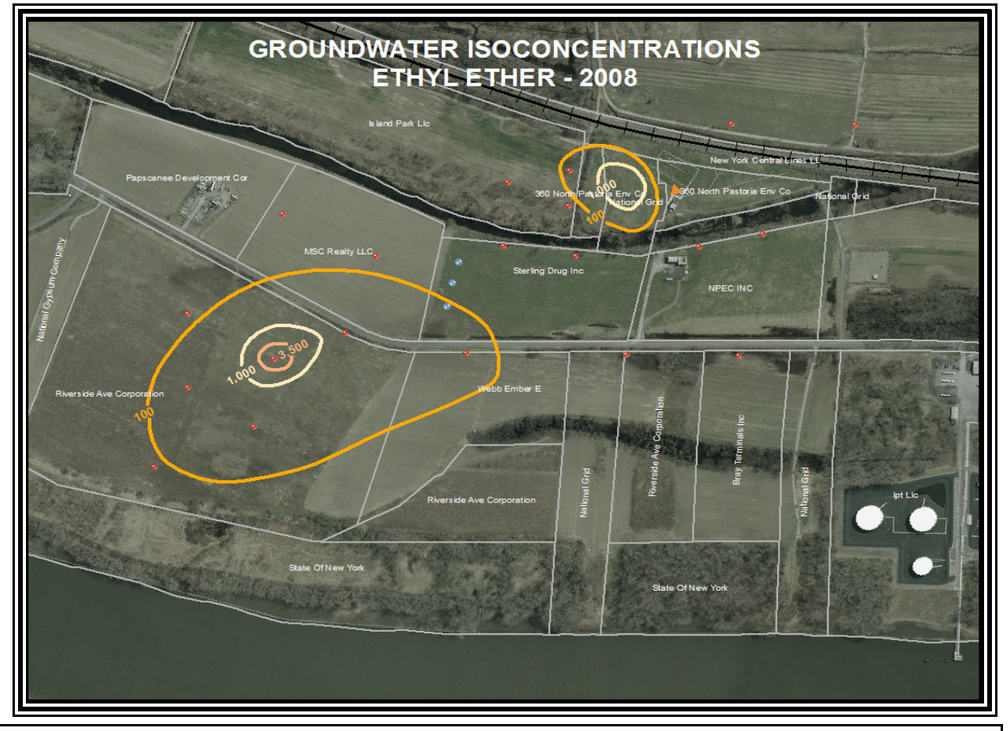
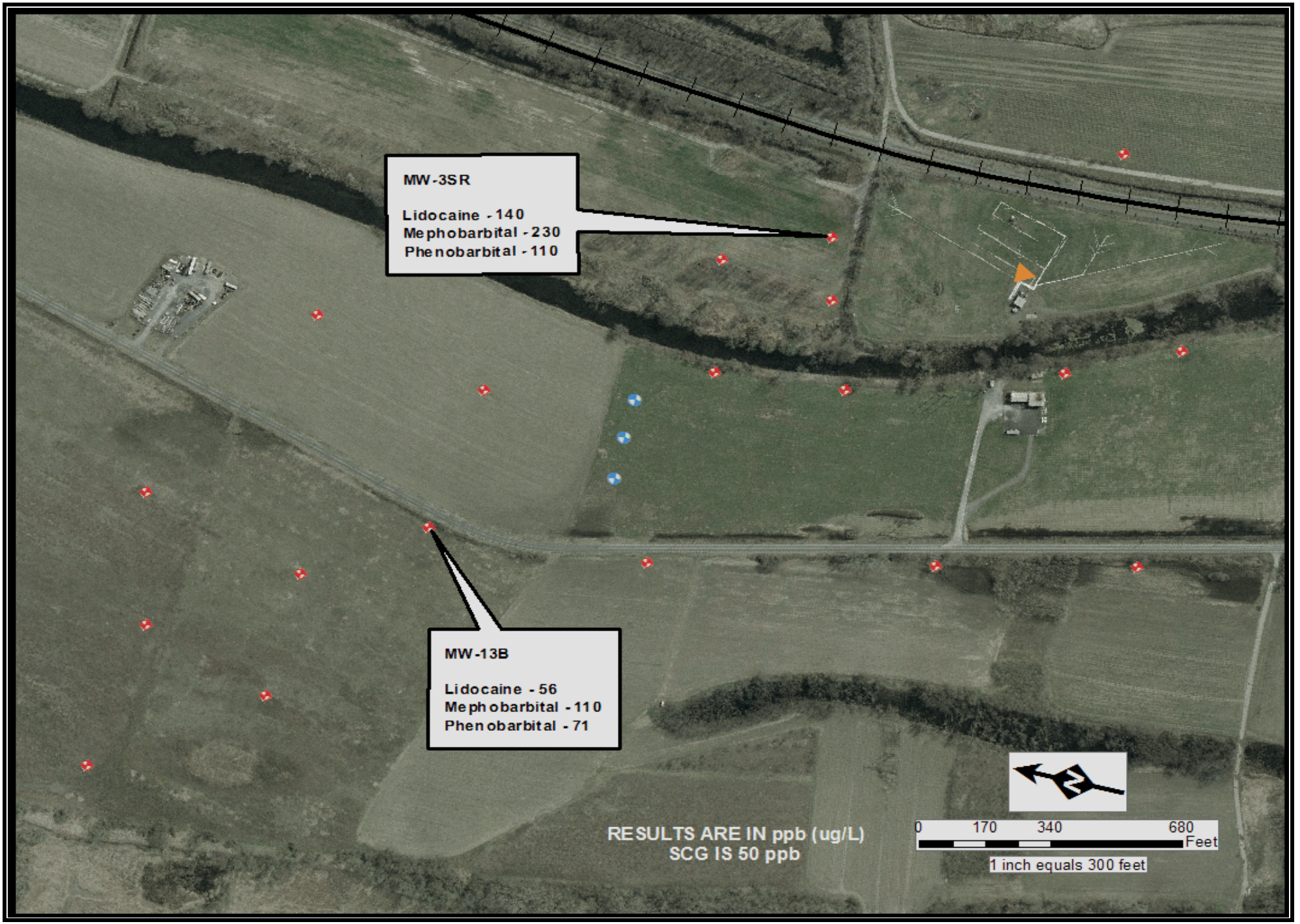


GROUNDWATER FLOW DIRECTION



STERLING DRUG SITE 3, OU-02 | HISTORICAL ETHYL ETHER CONTAMINATION TRENDS | FIGURE 2



STERLING DRUG SITE 3	SVOC CONTAMINATION	FIGURE 3