Site Characterization Work Plan

Skidmore College
Mercury Spill Location
NYDEC Spill #0501301
AOC #A4 -0525-0805
Site ID 546051
Saratoga Springs, New York

Prepared on Behalf of:

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For Submission to:

New York State Department of Environmental Conservation
Division of Environmental Remediation
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ECS Project Number 11-204748.00

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TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

Figures

Tables

Appendices

1.0 INTRODUCTION AND PURPOSE

This *Site Characterization Work Plan* is being submitted as required by provision II.B.1.(a) of Consent Order #A4-0525-0805, which was signed by Skidmore College (Skidmore) on August 26, 2005 and by the New York Department of Environmental Conservation (NYDEC) on September 2, 2005, with an effective date of September 12, 2005. This plan supersedes the previous plan submitted on November 10, 2005, which was revised to address the comments provided in NYDEC's letter dated December 22, 2005.

Elemental mercury was discovered in a utility line excavation adjacent to a water pump station on the Skidmore College campus on May 2, 2005. The NYDEC Spill Hotline was notified and spill number 0501301 was assigned. NYDEC subsequently found that the site required investigation to determine whether it should be listed in the *Registry of Inactive Hazardous Waste Sites.* The site was assigned ID# 546051 as a potential registry site. The source of the mercury was not readily apparent at the time of discovery. Immediate response actions were taken from May 2 to 4, 2005. Skidmore College received a letter dated June 10, 2005 from NYDEC on June 15, 2005, advising to halt all work until further notice. The open excavation was temporarily backfilled in July 2005 to eliminate safety hazards, and the drums of excavated soil were properly disposed of. Skidmore and NYDEC subsequently entered into Consent Order #A4-0525-0805.

Based on the findings of our October 11, 2005 *Record Search Report*, the northern portion of the current campus, which includes the mercury spill location, was undeveloped except for a network of trails and carriage roads prior to acquisition by Skidmore in 1961. The pump house was built in 1968. A mercury containing flow meter (estimated to have contained approximately one pound of mercury) was present in the pump house until 1992. No mercury is known to have been present in the pump house since that time. No other potential mercury release sources have been identified in the vicinity of the mercury discovered in May 2005. This *Site Characterization Work Plan* is based on an assumption that the source of the mercury was a spill that occurred while mercury was either being brought into or being taken from the pump house between 1968 and 1992, or that mercury could have been released to floor drains inside the pump house that discharge to a French drain in the vicinity of the location at which the mercury was discovered. One of the purposes of the proposed investigation will be to verify the source of the release.

The consent order requires that Skidmore perform additional investigation and remedial actions to address the discovery of mercury in a utility excavation in May 2005. This work plan provides the rationale and scope of work for an initial site characterization investigation.

The purpose of the proposed site characterization investigation is:

1. to define the nature and extent of contamination, both vertically and horizontally,

2. to confirm the source of the mercury previously discovered in a utility excavation on-site, and

3. to provide data to support the development of a remedial investigation work plan, and/or an interim remedial action work plan.

The work plan was developed by Environmental Compliance Services, Inc. (ECS) on behalf of Skidmore. No further investigation will be performed prior to approval of this plan by NYDEC.

2.0 SITE DESCRIPTION AND HISTORY

2.1 Spill Discovery and NYDEC Notification

Elemental mercury was discovered in a utility line excavation adjacent to a water pump station on the Skidmore College campus on May 2, 2005. The mercury was discovered when it was visually observed by the facility maintenance personnel. The excavation was stopped at that time and the NYDEC Spill Hotline was notified. Spill number 0501301 was assigned. The source of the mercury was not readily apparent at that time. Other than the visible presence of elemental mercury, no other waste materials or other visible evidence of waste disposal was observed in the open excavation.

2.2 Initial Response Actions

Skidmore contracted Clean Harbors to perform immediate response actions on the date of discovery (May 2, 2005). Clean Harbors arrived on-site on May 2, 2005. An initial sample was collected from the open excavation upon arrival on May 2, 2005. Clean Harbors hand excavated twelve drums of mercury impacted soil from May 2 to May 4, 2005. A sampling grid was established and five additional soil samples were collected from the point at which mercury was no longer visible on May 4, 2005. The results of the mercury analyses of the samples collected on May 2 and May 4, 2005 are summarized in Table 1. The analytical data was provided to Andy Frank of the NYDEC Region 5 office on May 16, 2005.

A meeting was held on-site between Skidmore, Clean Harbors and NYDEC staff on May 20, 2005. It was agreed at that time that additional soil sampling would be performed to further evaluate the horizontal and vertical extent of contamination. Clean Harbors returned to the site on May 24, 2005 and collected twelve additional soil samples using hand augers to a maximum depth of five feet below grade. The mercury concentrations in these samples are also summarized in Table 1.

The open excavation was temporarily backfilled in July 2005 to eliminate safety hazards. Twenty-two drums of remedial waste were removed from the site on July 29, 2005 by Precision Industrial Maintenance, Inc. (Precision). Precision collected representative composite samples from each drum for waste characterization analyses prior to transporting them off-site. The waste characterization analyses (which included TCLP metals analyses) determined that nineteen drums could be disposed of as non-hazardous waste since all TCLP metals concentrations (including mercury) were below the hazardous waste thresholds (0.2 mg/l for mercury). The three remaining drums (#13, 16 and 20) were disposed of as hazardous waste (due to TCLP mercury concentrations of 0.287 to 1.0 mg/l).

Upon completion of the sampling on June 10, 2005, Skidmore College instructed Clean Harbors to discontinue further remedial actions until authorized by NYDEC. Skidmore subsequently received a letter from NYDEC on June 15, 2005 directing it to halt the remedial work until further notice. Skidmore and NYDEC subsequently entered into Consent Order #A4-

0525-0805, which was signed by Skidmore on August 26, 2005 and by NYDEC on September 2, 2005, with an effective date of September 12, 2005.

2.3 Previous Investigation and Remediation Reports

No investigation or remediation reports have been prepared. Laboratory data and field notes resulting from the initial response actions were provided in the *Record Search Report* dated September 11, 2005.

2.4 Spill Location and Description

The mercury spill location appears to be centered approximately 12 feet east of the southeastern corner of the water pump station. The impacted area is preliminarily estimated to be no more than ten to fifteen feet in diameter, but its actual extent will be determined during the site characterization investigation. For purposes of this report, the term "site" will be used to pertain to the area within an approximately twenty foot radius of the spill discovery location. The Skidmore College campus includes 650 acres with approximately 50 buildings. The college's mailing address is 815 North Broadway, Saratoga Springs, New York. The campus includes parcels in both the City of Saratoga Springs and the Town of Greenfield. The spill site is located on parcel number 152.00-1-10 in the City of Saratoga Springs. Figure 1 is a site location map that shows the area occupied by the Skidmore College campus. Figure 2 shows the location of the pump house and spill site on the campus. Figure 3 provides details of the spill area.

The pump house is an approximately 500 square foot (20 by 25 foot) masonry building that was constructed in 1968. There is no visible indication of discharges other than water (from condensation and occasional maintenance activities) to floor drains in the pump house. The building contains several pumps that are used to lift potable water from a municipal water tank located 800 feet north of the pump house to a distribution tower on a hilltop approximately 1,000 feet to the northwest. The pump house is heated with an electric heater, and has no potable water or sanitary service. The pumps are electrically operated. No mercury containing switches or instruments are currently present in pump house.

There are two two-inch diameter floor drains inside the pump house. Based on building plans (dated 1968), these drains discharge via two-inch diameter cast iron pipes to a subsurface French drain located immediately east of the building. The plans indicate that the French drain consists of four-inch diameter drain tile surrounded by approximately five cubic yards of crushed stone. The invert of the drain tile is approximately three feet below grade[1]. The French drain

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[1] It is noted that the mercury contamination was first observed at a depth of approximately eighteen inches below grade, which is approximately eighteen inches higher in elevation than the drain tile invert. Since elemental mercury is very dense and no shallow water table is present, it is unlikely that the mercury could have traveled upwards to the depth at which it was first observed. Therefore, it appears more likely that the source was a direct spill at that location,

was constructed over an existing water line trench with an invert depth of 5.5 to 6.0 feet below grade. The location of the French drain is shown on Figure 4.

The pump house has a single door located at the southeastern corner of the building. There is a concrete landing outside the door. The remainder of the area immediately around the pump house is unpaved. A concrete transformer pad is present behind (west of) the building. The transformers provide low voltage electric service for the pump house and at least one other building.

There are no other buildings within 100 feet of the pump house. The nearest buildings are North Hall (Advancement Services and facilities management offices), the Hoge Heating Plant (a central boiler plant), Harter Hall (classrooms and offices) and the Dana Science Center (classrooms and laboratories). Operations in these buildings will be described in Section 2.5

The spill was discovered in an unpaved utility corridor. Underground electrical conduits, water lines, telephone lines, cable television lines, a natural gas line and pump control lines for the pump house are present in this corridor. Based on facility records (to be further discussed in Section 3.6), it appears that the majority of the underground utility lines in this corridor were either installed or relocated between 1995 and 1997, although water lines were shown at this location on a 1968 building plan. Essentially all of these lines appear to be bedded in sand backfill assumed to be from an off-site source.

The spill location is not fenced, but no mercury is known to be exposed on the ground surface at this time. The area surrounding the spill location is used primarily for employee parking and physical plant operations. That area is not routinely used for any purpose, but students and employees may walk over the site on an occasional basis.

2.5 Site Operations

Skidmore is a private, co-education college with approximately 2,400 students. The majority of the campus is used for academic, housing and recreational purposes. Ancillary operations include utility and physical plant services and facility maintenance.

Pump house operations are limited to the operation of electric water pumps. In general, these pumps are automated and/or controlled remotely from a panel in the Hoge Heating Plant (250 feet southeast of the pump house). The only other activity in the pump house is periodic pump maintenance. No significant quantities of hazardous materials are used in the pump house and no hazardous materials are stored there. There are no mercury-containing instruments or switches in the pump house at this time.

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rather than a discharge to the floor drains or French drain. Regardless, the proposed site characterization investigation will evaluate both potential sources.

2.6 Use and Management of Mercury

Mercury was previously used on the Skidmore campus in flow meters, manometers, switches and thermometers. According to maintenance staff, all manufactured articles containing mercury have been removed and none are known to be in use on the campus at this time. A mercury containing flow meter was present in the pump house prior to 1992. The meter reportedly contained approximately one pound of mercury. No mercury containing items are known to have been present in the pump house since that time.

According to senior faculty with the Physics, Chemistry, Biology, Geology, Photography and Graphic Arts departments, no elemental mercury is used for academic purposes, and to the best of their knowledge, no mercury thermometers have been used in the academic labs since at least 1995. The chairman of the Chemistry department verified that she personally reviews all requisitions to purchase chemicals to be used for academic or research purposes, and that no elemental mercury has been requested or purchased in recent years.

2.7 Campus Hazardous Waste Management

Based on facility manifest records, hazardous wastes containing mercury were removed from the site on thirteen occasions from 2000 to 2005 (excluding the twenty-two drums of mercury containing waste resulting from the spill cleanup activities in May 2005). These wastes included thermometers, broken thermometers, manometers and mercury contaminated debris (resulting from the cleaning of mercury spilled from broken thermometers, mercuric chloride and other mercury salts). Essentially all of the waste containing metallic mercury was contained in manufactured articles or spill cleanup materials from broken thermometers except for one ounce of “elemental mercury” that was found and removed from the boiler house on April 2, 2004. In general, the quantities of mercury waste removed from the site varied from one ounce to five pounds, except for a shipment of 32 pounds of “mercury in manufactured articles” on May 9, 2002. All hazardous wastes are stored in a dedicated hazardous waste storage area located more than 250 feet from the mercury spill location.

Skidmore College is a small quantity hazardous waste generator (ID #NYD020670741). Hazardous wastes are generated from both academic (primarily laboratory) activities and facility maintenance. Hazardous wastes are accumulated and stored in a central hazardous waste storage area located in the facility maintenance area, and are periodically removed for disposal off-site by licensed hazardous waste haulers. The primary firms used for hazardous waste removal since 2000 have been Clean Harbors Environmental Services, Inc. (MAD03932225) and Precision Industrial Maintenance, Inc. (ID #NY0001031514). Richard G. Bussert is the primary Skidmore College employee involved with hazardous waste management operations on-site.

2.8 Site History

ECS reviewed municipal records, city directories, Sanborn Fire Insurance Company maps, aerial photographs and historical USGS topographic maps to determine the history of the

Skidmore campus and the spill site. Our findings are documented in our prior *Record Review Report* and are summarized below.

The current Skidmore campus was part of a large residential estate prior to acquisition by Skidmore in 1961. The northern portion of the current campus, which includes the mercury spill location, was undeveloped except for a network of trails and carriage roads prior to that time. The pump house was built by Skidmore in 1968. A mercury containing flow meter (estimated to have contained approximately one pound of mercury) was present in the pump house until 1992. No mercury is known to have been present in the pump house since that time.

Mercury has also been used in the boiler house and in small manufactured articles at various locations throughout the campus. Based on its location, the use of mercury in the boiler house could not have resulted in the contamination discovered adjacent to the pump house in May 2005. The use of mercury containing instruments has been phased out over the last ten years, and none are currently known to be present on-site.

No elemental mercury is known to have been used on-site for academic purposes. All faculty members interviewed stated that no mercury thermometers or other mercury containing instruments have been used in the laboratories for at least the last ten years.

Based on its location (immediately outside the only door to the pump house) and the characteristics of mercury that make it unlikely to migrate (in elemental form) any significant distance laterally through the soil, it is assumed that the discharge point of the mercury must have been proximate to the location at which it was discovered. There appear to be only to mechanisms by which this could have occurred. The first would be that mercury was spilled at or near the point of discovery while it was either being taken into the building or being removed from it. The other is that the mercury could have been discharged to a floor drain that subsequently discharged to the French drain in the utility trench immediately east of the pump house. As previously discussed, it is more likely that the release occurred as the result of a direct spill (rather than a discharge to the floor drain system), but both potential sources will be investigated during the proposed investigation. Since no mercury is known to have been present in the pump house since 1992, it is assumed that the spill must have occurred at or before that time.

2.9 Physical Setting and Potential Receptors

The campus is an approximately 650 acre property, more than half of which is undeveloped. The surface elevation ranges from approximately 380 feet above mean sea level along the southern property line to approximately 500 feet on a hilltop in the central portion of the site. The site itself is at an elevation of approximately 440 feet. There appears to be a drainage divide that bisects the campus from southwest to northeast. The portion of the campus that includes the site drains to the southeast. The nearest permanent surface water in that direction is Loughberry Lake, which is located approximately one-half mile southeast of the site at an elevation of 286 feet (based on USGS topographic maps). Loughberry Lake is used as a water supply reservoir, but there appears to be no potential for impacts to it based on its distance from the site.

The Skidmore campus and the surrounding area are served by a public water supply. The pump house is used to lift potable water from a municipal water tank located 800 feet north of the pump house to a distribution tower on a hilltop approximately 1,000 feet to the northwest. Since both the municipal water tank and the distribution tower are located approximately 60 feet higher than the spill site and the water piping is pressurized, this system would not be impacted by releases at the spill site. No private water supply wells are known to be present within 1,000 feet of the spill site or in the assumed downgradient area (that is, to the southeast between the spill site and Loughberry Lake).

The *Geologic Map of New York – Hudson-Mohawk Sheet* (New York State Museum and Science Service, 1970; reprinted 1995) indicates that the bedrock beneath the site is the Canajoharie Shale of the Lorraine, Trenton and Black River Groups. This is consistent with descriptions provided by facility personnel of bedrock ledge encountered in construction excavations in the vicinity of the site. The *Surficial Geology of New York – Hudson-Mohawk Sheet* (University of the State of New York, 1987) reports the soil as being "bedrock stipple", indicating that the depth to bedrock is typically in the range of 1 to 3 meters, with the primary soil type being glacial till. Facility personnel indicated that bedrock ledge is typically encountered in the vicinity of the site at depths of seven to ten feet below grade. Observations of the soil exposed in open excavations in the vicinity of the site indicate that the soil is primarily till. No groundwater was observed in the excavations examined and no visible indications of seasonal high water tables (such as mottling) were observed.

The depth to the groundwater and the direction of groundwater flow have not been determined. However, facility personnel report that groundwater is seldom encountered in excavations to the depth of the bedrock. Therefore, it is assumed that bedrock monitoring wells will be required for the groundwater investigation proposed in Section 4.5. The depth to groundwater and groundwater flow direction will be verified as part of the site characterization investigation.

The release site is located on a portion of the Skidmore campus that is used primarily by facility maintenance personnel. In general, the only use of that area is for passage to or from the pump house and/or to service the underground utility lines that pass through it. Although the area is not fenced and may occasionally be crossed by students or others, such usage appears to be minimal and the area is not used for any purpose on a regular basis. On this basis, the only significant exposure pathway identified is possible direct contact to impacted soil by construction or maintenance workers. Procedures to minimize such exposures are specified in the Health and Safety Plan provided in Appendix B.

Since the pump house itself is normally unattended, the nearest regularly occupied building is North Hall, which is used primarily for office activities. This building is located approximately 200 feet east of the spill site. There are no indications that the occupants of this building would be exposed to contaminants present at the spill site. The nearest academic building is the Dana Hall addition, which is located approximately 500 feet south of the spill site. The nearest residential buildings are located along North Broadway, approximately 1,000 feet southeast of the spill site.

3.0 CONCEPTUAL SITE MODEL AND DATA QUALITY OBJECTIVES

The site characterization plan is based on a conceptual site model that assumes that the presence of elemental mercury in the soil resulted from a historic spill incident. The only known use of elemental mercury in the vicinity of the discovery was in a flow meter that was removed from the pump house in 1992. Therefore, it is assumed that the spill occurred prior to that date. Potential spill sources could be either spillage while bringing mercury into or taking it out of the building, or a spill to one or both of the floor drains that discharge to the French drain in the utility trench. Impacted media could include the soil, groundwater and/or air. Based on the physical characteristics of elemental mercury, it is assumed that the extent of lateral movement through the soil is limited. Therefore, the site characterization investigation will focus on the area within approximately 20 feet of the area where the mercury contamination was originally detected. Borings will be advanced to the depth of bedrock (which is assumed to be generally in the range of 7 to 10 feet below grade) to define the vertical extent of contamination. Since elemental mercury has only limited solubility in water, and since no groundwater was encountered during recent utility excavations or during immediate response actions in June 2005, extensive groundwater contamination is not expected to be present. Regardless, monitoring wells will be installed at assumed downgradient locations to evaluate impacts on the groundwater. Finally, a field mercury vapor analyzer will be used to determine if the ambient air has been impacted, to field screen soil samples and for worker health and safety purposes.

Since it is assumed that the extent of mercury contamination will be less than 20 feet from the assumed source, and since the nearest property line is more than 1,000 feet from this location, no adverse impact to ambient air quality is anticipated outside the work area. Regardless, ambient air monitoring will be performed within the work area during the investigation using a mercury vapor analyzer and community air monitoring will be performed in accordance with the NYDOH Community Air Monitoring Plan (CAMP). A copy of the CAMP is provided as in Appendix D.

Field investigations will be required to validate or refute the preliminary conceptual model outlined above. The data generated from these investigations will be used for three purposes. The first will be to define the nature and extent of contamination, both vertically and horizontally. This will be performed by collecting and analyzing samples from the location where mercury contamination was previously identified and working radially outward (in three dimensions) until the limits of contamination are established. The second will be to verify the source of the mercury release. This will be performed by collecting soil samples in and around the previously identified area of mercury contamination, and by further investigating the floor drain discharge point. The third will be to collect additional data to support the development of a remedial investigation work plan, and/or an interim remedial action work plan. For purposes of this investigation, it will be assumed that it will be necessary to determine the extent of soil with mercury concentrations greater than the Recommended Soil Cleanup Objective (RSCO) provided in Table 4 of NYDEC Technical and Administrative Guidance Memo #4046 (TAGM 4046). The RSCO for mercury is 0.1 mg/kg. Therefore, laboratory methods will be selected that are reasonably expected to obtain detection limits no higher than 0.01 mg/kg of mercury in soil. USEPA Method 245 is typically capable of attaining detection limits of less than 0.001 mg/kg of mercury in soil, and will be used in the site characterization investigation.

It is assumed that the primary criteria used to evaluate the groundwater data will be the GA Groundwater Quality Standard provided in 6 NYCRR 703.5 (0.7 ug/l for mercury). Therefore, laboratory analytical methods for groundwater sample analyses that will be selected are reasonably expected to obtain detection limits no higher than 0.7 ug/l of mercury in groundwater samples. USEPA Method 245.2/7470A is typically capable of attaining detection limits in the range of 0.2 ug/l for mercury and will be used in the site characterization investigation. The monitoring wells will be developed to reduce turbidity to the extent possible and low flow purging and sampling procedures will be used to collect the groundwater samples to ensure that the samples are representative of actual conditions.

There are no universally accepted thresholds for protection of the public health from airborne mercury concentrations. OSHA standards and NIOSH guidelines will be used for worker protection, but these do not specifically apply to the general public. Air monitoring will be performed with a mercury vapor analyzer capable of detecting mercury concentrations down to ambient background levels. Therefore, a mercury vapor analyzer with the lowest readily available detection limits (in the range of 0.003 mg/m^3) will be used. Additional parameters will be monitored in accordance with the NYSDOH CAMP, a copy of which is provided in Appendix D.

4.0 FIELD SAMPLING PLAN

4.1 Pre-Boring Tasks

Underground electrical conduits, water lines, telephone lines, cable television lines, a natural gas line and pump control lines are present in the work area and around the pump house. These lines will be located prior to subsurface investigation using the following methods:

- The proposed boring locations will be staked and/or marked with white paint a minimum of five days prior to subsurface investigation.

- Dig Safely – New York will be notified and requested to have any public utility lines in or near the work area marked.

- Facility plans (including all available utility plans) will be reviewed by an ECS engineer.

- Facility maintenance personnel with knowledge of the locations of underground utility line locations will be interviewed.

- A ground penetrating radar survey, accompanied by other geophysical techniques (such as inductive pipe tracing or magnetometer surveys) will be used to further verify the locations of underground utility lines in the work area.

The proposed boring and monitoring well locations will be relocated as necessary to avoid any subsurface hazards identified.

4.2 Boring Procedures

Sixteen borings will be performed to delineate the extent and magnitude of soil contamination. The proposed boring locations were selected to include locations within the assumed source area, in and around the utility trenches in and around the French drain and at other locations around the pump house. The proposed boring locations are shown on Figure 4.

Soil samples will be collected with Geoprobe^{tm} equipment using 48” by 1.5” macro-core samplers. Prior to use of the Geoprobe, hand boring and/or manual probing will be performed to below the depth of all suspected utility lines at all boring locations within five feet of any identified or suspected underground utility line.

4.3 Soil Sampling Procedures

Soil samples will be collected continuously from the surface to bedrock refusal or to a depth of 12 feet below grade (whichever is encountered first) in accordance with ECS SOP #5.30. A new clear PVC liner will be used for each sample and the macro-core samplers will be decontaminated between samples using the procedures specified in ECS SOP #10.00 (including the 10% nitric acid rinse).

At a minimum, soil samples will be collected from all borings from depths of 0, 2, 4, 6, 8 and 12 feet, unless refusal is encountered at depths less than twelve feet. Additional samples will be collected if field screening indicates the presence of significantly higher mercury concentrations at other depths.

4.4 Field Screening Procedures

The soil in each macro-core sampler will be field screened immediately upon opening using a Jerome 431-X (or equivalent) Mercury Vapor Analyzer (MVA) and visually examined for the presence of elemental mercury. The Jerome 431-X MVA has a detection limit of 0.003 mg/m^3. All MVA readings and field observations will be recorded in a field log.

4.5 Monitoring Well Installation

Four monitoring wells will be installed at the locations shown on Figure 4. The well locations were selected to provide data upgradient and downgradient of the source area, based on assumed groundwater flow directions. The wells will be screened within the uppermost water bearing zone, which is assumed to be in the upper portion of the bedrock. The wells will be constructed with two-inch nominal inside diameter PVC casing and well screen, an appropriately sized sand pack, a bentonite annulus seal and a gasketed, flush-mounted steel protective casing set in a grout collar. Other well construction details will be established upon determination of the actual depth to bedrock and the actual characteristics of the formation in which groundwater is encountered. The field construction and data recording procedures in ECS SOP #2.00 will be used.

All well installation will be performed using conventional hollow-stem auger equipment. Air rotary equipment will not be used to ensure that mercury is not inadvertently volatilized.

4.6 Well Development

The monitoring wells will be developed prior to sampling in accordance with ECS SOP #3.00.

4.7 Groundwater Sampling

The four monitoring wells will be sampled using low flow purging and sampling techniques, in accordance with ECS SOP #8.30. A minimum seven day equilibration period will be provided between the completion of the well installation and development and the date of the initial sampling. The groundwater samples will not be filtered prior to analysis.

4.8 Groundwater Flow Determination

Relative wellhead elevations will be determined using standard differential leveling procedures to a minimum accuracy of +/- 0.01 feet. The elevations will be referenced to an arbitrary on-site datum. Depth to groundwater measurements will be performed prior to purging or sampling the wells using a calibrated electronic probe in accordance with ECS SOP #9.00.

4.9 Field Decontamination Procedures

Macro-core samplers and other direct contact sampling equipment will be decontaminated between samples using the procedures specified in ECS SOP #10.00, including the optional 10% nitric acid rinse. The samplers will be field screened prior to use with the MVA to verify the effectiveness of the decontamination. In addition, at least one rinsate blank will be collected from a field decontaminated sampler per day of field sampling for laboratory analysis.

Geoprobe rods and any other non-disposable equipment will be decontaminated between borings (prior to moving the rig to the new location) and any gross contamination will be removed as necessary.

4.10 Waste Management Procedures

All wastes resulting from equipment decontamination, used disposable personal protective equipment and any soil from the borings that exhibits mercury vapor concentrations greater than ambient levels (to be defined in the field) will be collected in appropriate containers (typically 55-gallon steel drums). Upon the completion of the investigation, the drummed wastes will be appropriately labeled and moved to a secure location until it can be transported off-site[2]. The wastes will be stored in accordance with all applicable state and federal regulations while on-site. Waste characterization analyses will be performed which will include TCLP metals analyses (of all wastes), pH (of all liquid wastes) and other analyses that may be required to obtain off-site disposal approvals. All wastes generated from this investigation will be removed from the site within 90 days of generation.

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[2] Skidmore's existing hazardous waste storage area has insufficient capacity to store the drums to be generated during this investigation, therefore, it will be necessary to establish an alternative on-site storage area for them. Attempts will be made to remove them as soon as possible upon completion of the investigation.

5.0 ANALYTICAL PLAN

Mercury is the primary contaminant of concern. All soil and groundwater samples will be analyzed for mercury. A minimum of one soil sample per boring and all groundwater samples will also be analyzed for other metals, cyanides, volatile organic compounds, semi-volatile organic compounds, PCBs, pesticides and herbicides to verify the absence of significant concentrations of other compounds. The specific laboratory methods, container types, preservative and holding time requirements for each media are specified in Table 4. The sample to be selected for analysis of the full analyte list from each boring will be from the depth indicated to be the most heavily contaminated (based on field observations and/or field screening data) or, if there are no field indications of contamination, from a depth of six feet below grade (the estimated invert depth of the utility trench and French drain). If significant concentrations of compounds other than mercury are identified in one or more samples, additional samples will be analyzed for such compounds to the extent necessary to delineate the extent and magnitude of those compounds (vertically and horizontally).

Minimum detection limits less than the corresponding RSCO (for soil samples) and the Part 703.5 GA Groundwater Quality Standard (for groundwater samples) will be requested for all analytes. USEPA Method 5035 procedures will be used in the collection of soil samples for volatile organic compound analysis. All groundwater samples will be preserved as specified in USEPA Publication SW-846. The groundwater samples will not be field filtered. Low flow purging and sampling techniques will be used to ensure that the results are not unduly influenced by turbidity or suspended soils in the samples.

The laboratory analyses will be performed by a New York State Department of Health ELAP CLP-tier certified laboratory for all analyses specified above. NYDEC Analytical Services Protocol Category B Data Deliverables will be provided. Additional QA/QC requirements will be discussed in the following section.

6.0 QUALITY ASSURANCE PROJECT PLAN

6.1 Purpose and Objective

The primary purpose of this project is to delineate the extent and magnitude of soil contamination in and around the suspected source area. Secondary objectives include verification of the source of the mercury, verification that no other contaminants of concern are present (or the identification of such contaminants, if present) and a determination as to whether the air or groundwater have been impacted by the presence of mercury in the soil. Data quality objectives were discussed in Section 3.0.

6.2 Project Organization

Michael E. Hopkins, PE, LEP, LSP will serve as both the Project Manager and Quality Assurance Officer. Mr. Hopkins has twenty five years of professional environmental assessment and remediation experience. He is a Principal with ECS, in addition to managing its New York Branch Office. His resume is provided as Appendix B.

6.3 Sampling Procedures and Equipment Decontamination

Standard operating procedures for field operations, including sampling, sample management and equipment decontamination are provided as Appendix A. The mercury vapor analyzer will be operated and calibrated in accordance with the manufacturer's recommendations.

6.4 Site Map and Sampling Locations

Site maps are provided as Figures 1, 2, 3 and 4. The sampling locations are shown on Figure 4.

6.5 Analytical Methods and Quality Assurance

Tables 3 and 4 summarize the analytical and quality assurance procedures to be used.

6.6 Laboratory Requirements

All laboratory analyses will be provided by a NYDOH ELAP CLP-certified laboratory. The laboratory will be certified in all appropriate laboratory categories. The specific laboratory to be used has not yet been selected, but NYDEC will be notified of which laboratory will be used at least 14 days prior to the initiation of investigative activities. NYDEC ASP Category B laboratory deliverables will be provided for all analyses performed under this work plan.

6.7 Data Validation

The analytical data will be validated in accordance with the following standards and guidelines:

- NYDEC Analytical Services Protocol (ASP), June 2000
- USEPA Publication SW-846 (for the specific analytical methods used)
- USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, Publication 9240.1-05, EPA-540/R-94/012, OSWER February 1993
- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, Publication 9240.1-05-01, EPA-540/R-94/013, PB-963502, OSWER February 1994

Analytical data validation will be documented and summarized in accordance with Division of Environmental Remediation Data Usability Summary Report (DUSR) guidelines. The DUSR will be prepared by Michael E. Hopkins of ECS.

6.8 Blank and Duplicate Sample Analyses

The following duplicate and blank samples will be collected and analyzed for quality control/quality assurance purposes:

- Duplicate soil samples will be collected at a frequency of one for every twenty soil samples, with a minimum number of one per day on which soil sampling is performed.

- One duplicate groundwater sample will be collected and analyzed for all specified analytes.

- One equipment rinsate blank will be collected and analyzed for each day on which soil samples were collected.

- One trip blank will be provided for each day on which samples are collected for volatile organic compound analyses.

- Field blanks will be prepared and analyzed at a frequency of one for every twenty soil samples collected, with a minimum of one per day.

7.0 HEALTH AND SAFETY

A site specific health and safety plan has been prepared and is provided as Appendix C. All work will be performed in accordance with OSHA requirements, including those pertaining to construction work on uncontrolled hazardous waste sites. Based on the anticipated mercury concentrations in the soil, and the potential for inhalation of mercury contaminated dust or mercury vapors, work will be performed in “Level C” protective equipment. Work area air monitoring will be performed with a Jerome 431-X (or equivalent) Mercury Vapor Analyzer. The NIOSH 8-hour time weighted average concentration for mercury is 0.05 mg/m^3. The OSHA permissible exposure limit (PEL) for mercury is 0.1 mg/m^3. NIOSH guidelines allow for the use of cartridge-type air purifying respirators in atmospheres with mercury vapor concentrations up to 0.5 mg/m^3. Work will be temporarily suspended if mercury vapor concentrations greater than 0.5 mg/m^3 are detected in the breathing zone air.

Access to the work area will be restricted to authorized personnel with proper training. All workers will have completed an OSHA accredited hazardous waste operations (“HAZWOPER”) health and safety course, and have completed all required annual refresher courses. All personnel will be briefed on the contents of the health and safety plan prior to starting work. An ECS health and safety officer will be present whenever subsurface sampling, decontamination, equipment removal or excavation is in progress.

8.0 REPORTING AND SCHEDULE

Due to the need to perform manual excavation and or manual probing prior to advancing borings in the vicinity of the underground utility lines, it will not be possible to perform the field activities in conditions when the ground is frozen. Since it is likely that the ground will be frozen when this work plan is approved by NYDEC, it is assumed that it will not be possible to initiate work immediately upon approval. Therefore, Skidmore proposes to initiate field operations as soon as possible in the spring of 2006 (assuming that the plan is approved prior to that time).

The NYDEC will be notified a minimum of seven days prior to performing field activities. Monthly status reports will be provided to the NYDEC beginning 30 days after approval of this plan.

It is anticipated that one week (five working days) will be required to perform the pre-boring tasks, borings, soil sampling and monitoring well installation. The monitoring wells would be sampled two weeks after installation. Four additional weeks would be required for laboratory turnaround, data interpretation, QA/QC review and report preparation. On this basis, the *Site Characterization Report* would be submitted within 60 days of the initiation of field activities.

TABLES

Table 1

Summary of Mercury Analytical Results

Date	Grid Location	Sample Depth (ft)	Mercury Concentration (mg/kg)
5/13/05	A		5.5
5/13/05	C		24
5/13/05	H		18
5/13/05	J		251
5/13/05	O		0.275
5/20/05	A		7.84
5/20/05	C		1.14
5/20/05	H		49.8
5/20/05	J		7080
5/20/05	O		ND
5/24/05	A	3	1.02
5/24/05	A	5	7.95
5/24/05	C	3	3.24
5/24/05	C	5	2.35
5/24/05	H	3	17.4
5/24/05	H	5	1.86
5/24/05	J	3	16.1
5/24/05	J	5	1040
5/24/05	O	3	3.98
5/24/05	1	3	23.6
5/24/05	1	5	8.13
5/24/05	3	3	1.33
5/24/05	3	5	1.49
5/24/05	5	3	4.25
5/24/05	5	5	5.32
5/24/05	8	3	1.27
5/24/05	M	3	0.380

Date	**Grid Location**	**Sample Depth (ft)**	**Mercury Concentration (mg/kg)**
5/24/05	N	3	10.3
5/24/05	9	3	ND
5/24/05	9	5	226
5/24/05	I	3	1.07
5/24/05	K	3	ND
5/24/05	K	5	0.433
5/24/05	15	3	0.481
5/24/05	Q	3	0.286
5/24/05	N	5	0.785

Table 2
Analytical Parameter Matrix

Analytical Parameter	B-1						B-2						B-3						B-4					
Depth (feet below grade)	0	2	4	6*	8	12**	0	2	4	6*	8	12**	0	2	4	6*	8	12**	0	2	4	6*	8	12**
Purpose	Horizontal/Vertical Delineation						Horizontal/Vertical Delineation						Horizontal/Vertical Delineation						Horizontal/Vertical Delineation					
Mercury	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Other Inorganics				**X**						**X**						**X**						**X**		
Volatile Organic Compounds				**X**						**X**						**X**						**X**		
Semi-Volatile Organic Compounds				**X**						**X**						**X**						**X**		
Pesticides				**X**						**X**						**X**						**X**		
Herbicides				**X**						**X**						**X**						**X**		
PCBs				**X**						**X**						**X**						**X**		

* Full characterization parameters are will be performed on samples collected six feet below grade in all borings (the assumed invert depth of the utility trench and French drain, unless field observations or field screening indicate the presence of higher concentrations at other depths. In such cases, the sample to be analyzed for full characterization parameters will be performed on samples from the depth at which the higher indications are indicated.

** If boring refusal is encountered at a depth less than 12 feet, a sample will be collected from the terminus of the boring rather than at 12 feet below grade.

Table 2
Analytical Parameter Matrix
(continued)

Analytical Parameter	B-5						B-6						B-7						B-8					
Depth (feet below grade)	0	2	4	6*	8	12**	0	2	4	6*	8	12**	0	2	4	6*	8	12**	0	2	4	6*	8	12**
Purpose	Source Area Confirmation/Delineation						Source Area Confirmation/Delineation						Source Area Confirmation/Delineation						Horizontal/Vertical Delineation					
Mercury	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Other Inorganics				**X**						**X**						**X**						**X**		
Volatile Organic Compounds				**X**						**X**						**X**						**X**		
Semi-Volatile Organic Compounds				**X**						**X**						**X**						**X**		
Pesticides				**X**						**X**						**X**						**X**		
Herbicides				**X**						**X**						**X**						**X**		
PCBs				**X**						**X**						**X**						**X**		

* Full characterization parameters are will be performed on samples collected six feet below grade in all borings (the assumed invert depth of the utility trench and French drain, unless field observations or field screening indicate the presence of higher concentrations at other depths. In such cases, the sample to be analyzed for full characterization parameters will be performed on samples from the depth at which the higher indications are indicated.

** If boring refusal is encountered at a depth less than 12 feet, a sample will be collected from the terminus of the boring rather than at 12 feet below grade.

Table 2
Analytical Parameter Matrix
(continued)

Analytical Parameter	B-9						B-10						B-11						B-12					
Depth (feet below grade)	0	2	4	6*	8	12**	0	2	4	6*	8	12**	0	2	4	6*	8	12**	0	2	4	6*	8	12**
Purpose	Horizontal/Vertical Delineation						Horizontal/Vertical Delineation						Source Area Confirmation/Delineation						Source Area Confirmation/Delineation					
Mercury	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Other Inorganics				**X**						**X**						**X**						**X**		
Volatile Organic Compounds				**X**						**X**						**X**						**X**		
Semi-Volatile Organic Compounds				**X**						**X**						**X**						**X**		
Pesticides				**X**						**X**						**X**						**X**		
Herbicides				**X**						**X**						**X**						**X**		
PCBs				**X**						**X**						**X**						**X**		

* Full characterization parameters are will be performed on samples collected six feet below grade in all borings (the assumed invert depth of the utility trench and French drain, unless field observations or field screening indicate the presence of higher concentrations at other depths. In such cases, the sample to be analyzed for full characterization parameters will be performed on samples from the depth at which the higher indications are indicated.

** If boring refusal is encountered at a depth less than 12 feet, a sample will be collected from the terminus of the boring rather than at 12 feet below grade.

Table 2
Analytical Parameter Matrix
(continued)

Analytical Parameter	B-13						B-14						B-15						B-16					
Depth (feet below grade)	0	2	4	6*	8	12**	0	2	4	6*	8	12**	0	2	4	6*	8	12**	0	2	4	6*	8	12**
Purpose	Assumed Upgradient/Background						Assumed Upgradient/Background						Assumed Upgradient/Background						Horizontal/Vertical Delineation					
Mercury	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Other Inorganics				**X**						**X**						**X**						**X**		
Volatile Organic Compounds				**X**						**X**						**X**						**X**		
Semi-Volatile Organic Compounds				**X**						**X**						**X**						**X**		
Pesticides				**X**						**X**						**X**						**X**		
Herbicides				**X**						**X**						**X**						**X**		
PCBs				**X**						**X**						**X**						**X**		

* Full characterization parameters are will be performed on samples collected six feet below grade in all borings (the assumed invert depth of the utility trench and French drain, unless field observations or field screening indicate the presence of higher concentrations at other depths. In such cases, the sample to be analyzed for full characterization parameters will be performed on samples from the depth at which the higher indications are indicated.

** If boring refusal is encountered at a depth less than 12 feet, a sample will be collected from the terminus of the boring rather than at 12 feet below grade.

Table 3
Summary of Quality Assurance Samples

Sample Type	Number to be Provided (by analyte group)	Criteria/Comments
Soil		
Number of Samples to be Analyzed	80 for mercury 16 for full analyte list	Additional samples may be collected if indicated by field conditions; excludes blanks, duplicates and performance evaluation samples
Number of Field Blanks	Full analyte list: 4 Mercury only: 4	One per twenty samples with a minimum of one per day of sampling[1]
Number of Trip Blanks	Full analyte list: 4	One per day on which VOC samples are collected
Number of Duplicates	Full analyte list: 4 Mercury only: 4	One per twenty samples with a minimum of one per day of sampling
Number and Type of Performance Evaluation Samples	Laboratory Blank Laboratory Control Sample Laboratory Control Sample Duplicate Matrix Spike Matrix Duplicate	As specified by laboratory (not less than one per twenty samples of each media)
Groundwater		
Number of Samples to be Analyzed	4	Excluding blanks, duplicates and performance evaluation samples
Number of Field Blanks	1	Minimum one per day of sampling
Number of Trip Blanks	1	Minimum one per day of sampling
Number of Duplicates	1	Minimum one per day of sampling
Number and Type of Performance Evaluation Samples	Laboratory Blank Laboratory Control Sample Laboratory Control Sample Duplicate Matrix Spike Matrix Duplicate	As specified by laboratory (not less than one per twenty samples of each media)

---

[1] Assumes that the borings and soil sampling will require four days to complete. The actual number of QA samples may be increased or decreased if the actual sampling time is more or less than estimated.

Table 4

Summary of Analytical Procedures and Sample Requirements

Description	**Method**[1]	**Matrix**	**Sample Container**	**Preservative**	**Prep/Analysis Holding Time**	**Volume**
Mercury	245.2 (CVAA)	Soil	Plastic with acid wash	Cool 4°C	28 days	100 g or 8 oz jar
TAL metals (other than Hg)	200.7/200.8	Soil	Plastic with acid wash	Cool 4°C	6 months	100 g or 8 oz jar
VOCs	8260B (sampled per Method 5035)	Soil	Glass vial with Teflon lined screw cap (2/ sample)	Cool 4°C Sodium Bisulfate (<200 ug/kg) or methanol (>200 ug/kg)	14 days	40 ml
SVOCs	8270C	Soil	Amber Glass w/Teflon cap	Cool 4°C	14/40 days	100 g or 8 oz jar
Pesticides	8081A	Soil	Amber Glass w/Teflon cap	Cool 4°C	14/40 days	100 g or 8 oz jar
Herbicides	8051A	Soil	Amber Glass w/Teflon cap	Cool 4°C	14/40 days	100 g or 8 oz jar
PCBs	8082	Soil	Amber Glass w/Teflon cap	Cool 4°C	14/40 days	100 g or 8 oz jar

---

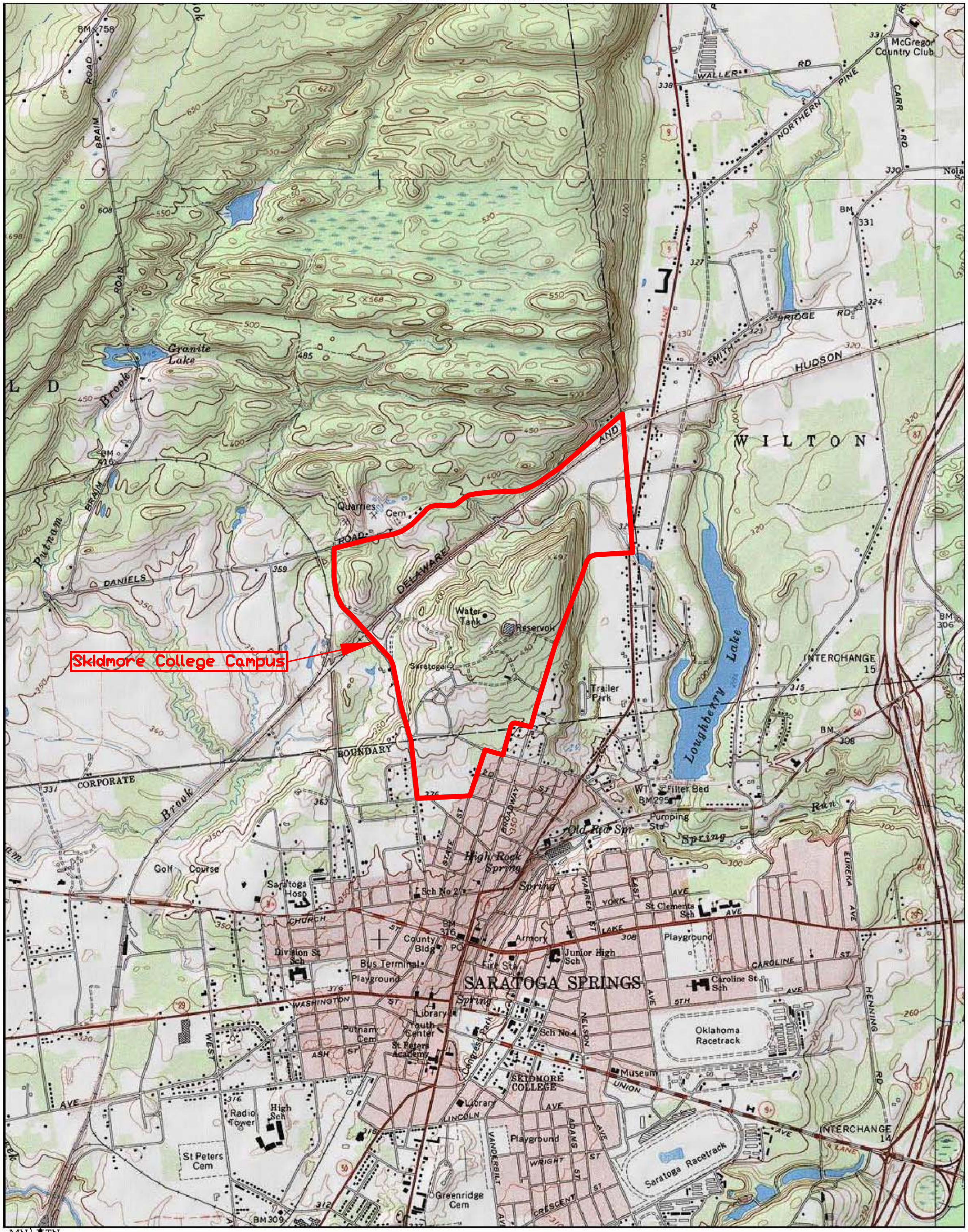
[1] All methods specified are per USEPA Publication SW-846 unless otherwise indicated.

Table 4
(continued)

Description	Method	Matrix	Sample Container	Preservative	Prep/Analysis Holding Time	Volume
Mercury	245.2 (CVAA)	Groundwater	Plastic	Cool 4^{o}C HNO^3 to ph<2	28 days	250 ml
TAL metals (other than Hg)	200.7/200.8	Groundwater	Plastic	Cool 4^{o}C HNO^3 to ph<2	6 months	250 ml
Cyanide, total	SM 4500 CN-	Groundwater	Plastic	Cool 4^{o}C NaOH to pH > 12	14 days	500 ml
VOCs	8260B	Groundwater	Glass vial with Teflon lined screw cap (2 per sample)	Cool 4^{o}C HCl to ph<2	14 days	40 ml
SVOCs	8270C	Groundwater	Glass	Cool 4^{o}C	7/40 days	1 Liter
Pesticides	8081A	Groundwater	Glass	NaOH or H^2SO^4 to pH 5 to 9	7/40 days	1 Liter
Herbicides	8051A	Groundwater	Glass	NaOH or H^2SO^4 to pH 5 to 9	7/40 days	1 Liter
PCBs	8082	Groundwater	Glass	NaOH or H^2SO^4 to pH 5 to 9	7/40 days	1 Liter

FIGURES

Figure 1 - Site Location Map



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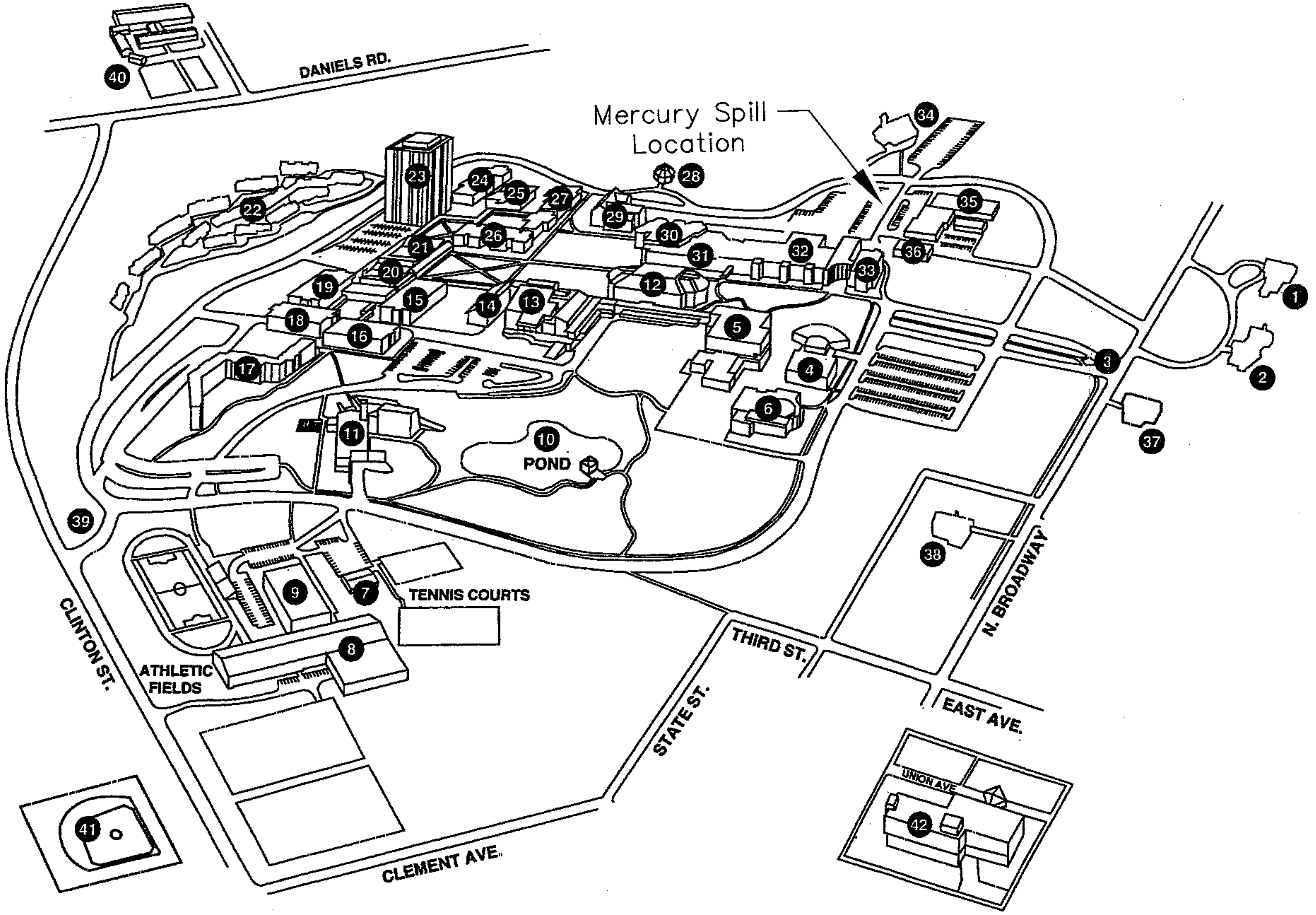
SKIDMORE
COLLEGE



Key

Barrett Center (25)
Bernhard Theater (6)
Bolton Hall (31)
Case Center (13)
Castle Baseball Diamond/Ingram Park (41)
Clinton Street Entrance (39)
Colton House (37)
Dana Science Center (32)
Dance Center (9)
Eissner Admissions Center (1)
Falstaff's (34)
Filene Music Building (4)
Greenberg Child Care Center (7)
Harder Hall (33)
Haupt Pond/South Park (10)
Hoge Heating Plant (36)
Howe Hall (26)
Jonsson Tower (23)
Kimball Hall (19)
Ladd Hall (14)
Main Entrance (3)
McClellan Hall (16)
Moore Hall (42)
Murray and Aikins Dining Halls (21)
North Hall (35)
Palamountain Hall (30)
Penfield Hall (18)
Rounds Hall (27)
Saisselin Art Building (5)
Scribner House (38)
Scribner Library (12)
Scribner Village Apartments (22)
Skidmore Hall (17)
Sports and Recreation Center (8)
Starbuck Center (20)
Surrey Williamson Inn (2)
Tang Teaching Museum and Art Gallery (11)
Tisch Learning Center (29)
Van Lennep Riding Center (40)
Wait Hall (24)
Wilmarth Hall (15)
Wilson Memorial Chapel (28)

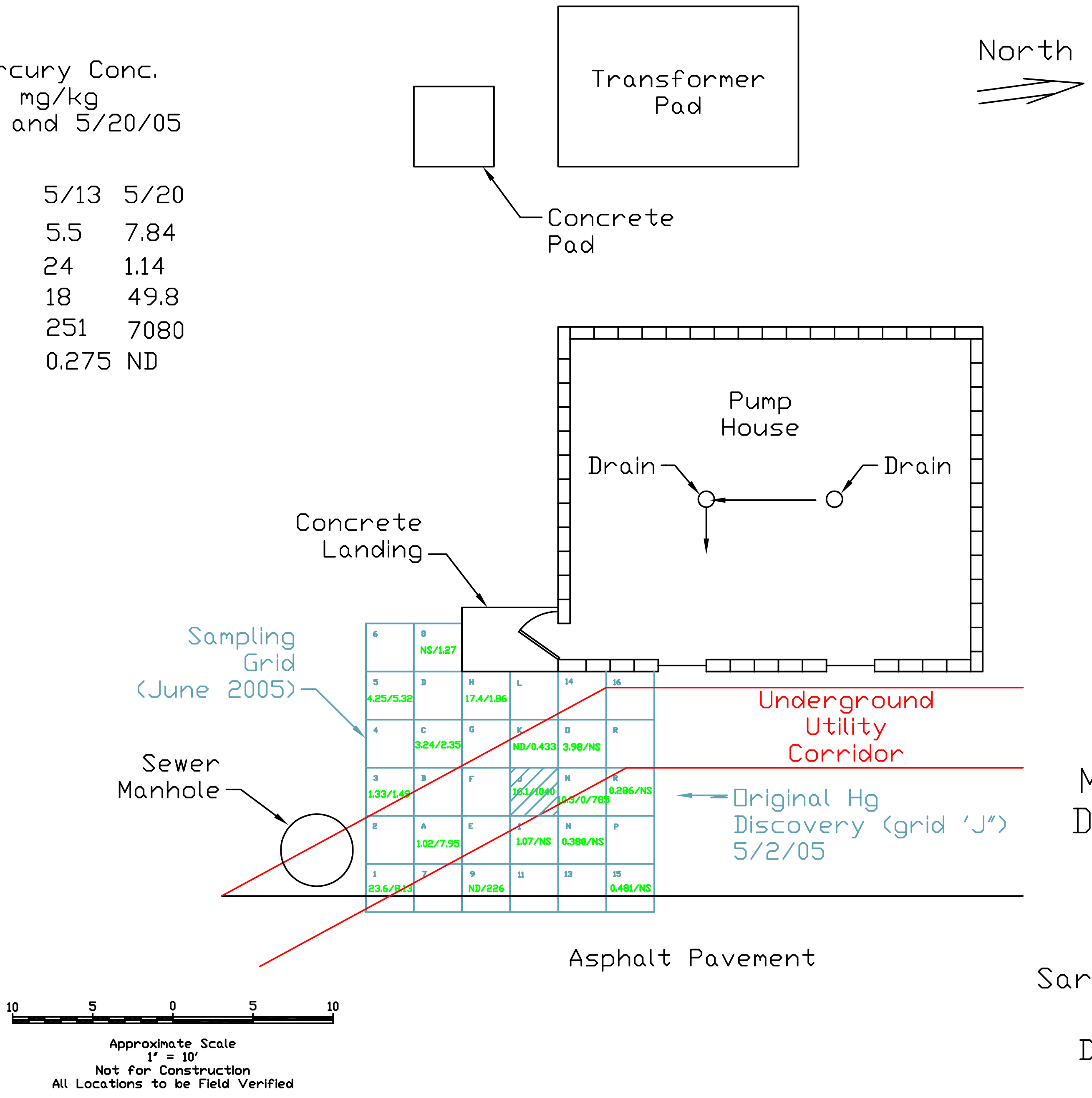
Visitors Directory

Admissions - Eissner Admissions Center (1)
Alumni Affairs - North Hall (35)
Auditoriums - Palamountain Hall (30)
Bookstore - Case Center (13)
Business Affairs - Barrett Center (25)
Development Office - North Hall (35)
Facilities Services - North Hall (35)
Health Services - Jonsson Tower (23)
Human Resources - Barrett Center (25)
Information Desk - Case Center (13)
Master's Program - Ladd Hall (14)
Post Office - Case Center (13)
President's Office - Palamountain Hall (30)
Purchasing - Dana Science Center (32)
Schick Gallery - Saisselin Art Building (5)
Security - Jonsson Tower, lower level (23)
Spa Snack Bar - Case Center (13)
Special Programs Office - Palamountain Hall (30)
Student Affairs - Case Center (13)
Student Services - Starbuck Center (20)
  Career Services
  Dean of Studies
  Higher Education Opportunity Program
  International Programs
  Registrar
  Residential Life
  Student Aid and Family Finance
Surrey Williamson Inn (2)
Tang Teaching Museum and Art Gallery (11)
University Without Walls - Ladd Hall (14)

Figure 2
Mercury Spill Location

Mercury Conc.
mg/kg
5/13 and 5/20/05

Grid	5/13	5/20
A	5.5	7.84
C	24	1.14
H	18	49.8
J	251	7080
O	0.275	ND



Mercury Conc.
mg/kg
5/25/05

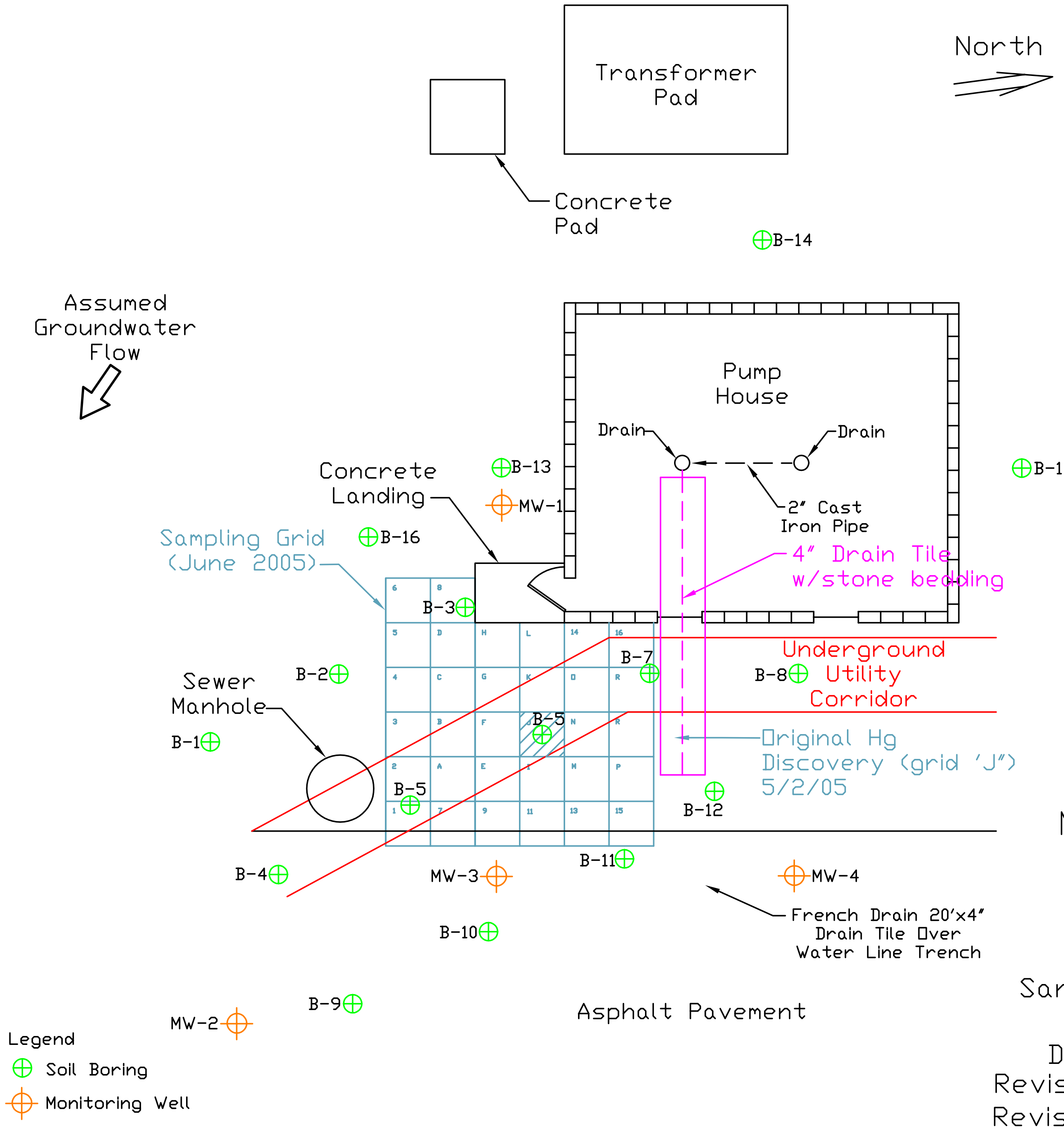
Grid	Depth 3'	Depth 5'
A	1.02	7.95
C	3.24	2.35
H	17.4	1.86
J	16.1	1040
O	3.98	---
1	23.6	8.13
3	1.33	1.49
5	4.25	5.32
8	1.27	---
M	0.38	---
N	10.3	---
9	ND	226
I	1.07	---
K	ND	0.43
15	0.48	---
Q	0.29	---
N	0.79	---

Figure 3

Mercury Spill Area Details and Initial Sampling Data

Skidmore College
Saratoga Springs, New York

Drawing Date: 9/28/05



10 5 0 5 10

Approximate Scale

Not for Construction 1" = 10'
All Locations to be Field Verified

Figure 4

Mercury Spill Area Proposed Sample Locations

Skidmore College
Saratoga Springs, New York

Drawing Date:	Nov. 2005
Revision #1:	Feb 26, 2006
Revision #2:	Mar 30, 2006

APPENDIX A

STANDARD OPERATING PROCEDURES

Standard Operating Procedure Addendum

For purposes of this project, the attached Standard Operating Procedures (ECS SOPs 2.00, 3.00, 5.30, 8.30, 9.00 and 10.00) will be modified as follows:

- In all cases where air monitoring, field screening and or other measurements are specified using a photoionization detector, flame ionization detector or other organic vapor monitoring instrument, mercury vapor screening, monitoring and/or measurements are to be made in parallel using a Jerome 431-X (or equivalent) Mercury Vapor Analyzer (MVA) and all media encountered will be visually examined for the presence of elemental mercury. The Jerome 431-X MVA has a detection limit of 0.003 mg/m^3. All MVA readings and field observations will be recorded in a field log. The MVA will be operated and calibrated in accordance with all manufacturers recommended procedures and all calibration and quality assurance data will be recorded in the field log.

MONITORING WELL CONSTRUCTION PROCEDURE

The following Monitoring Well construction procedures are based on standard methods found in the Massachusetts Department of Environmental Protection (DEP) “Standard References for Monitoring Wells “ (WSC-310-91) and the United States Environmental Protection Agency (EPA) “Subsurface Characterization and Monitoring Techniques: Volume 1” (EPA/625/R-93/00300)

1. MONITORING WELL MATERIALS

All materials used in the completion of monitoring wells shall be in good condition and free of any signs of possible contamination. The following materials may be used in the completion of monitoring wells.

- Schedule 40, flush-joint threaded PVC slotted well screen and solid riser
- Clean silica sand (graded appropriately for site-specific formation; No. 2 typical)
- Bentonite pellets and grout
- Portland Cement
- Flush-mounted curb box or vented steel locking aboveground protective well-casing and lock.

The attached Figure depicts a typical well construction schematic.

2. PROCEDURES

- Upon establishing the bottom elevation of the monitoring well, followed by the placement of a specified length of well screen and riser within the drill casing. If warranted, filter fabric may be placed on the screen prior to insertion into the drill casing to facilitate filtration. The sand pack will then be continuously added to the annular space as the drill casing are withdrawn. The drill casing will not be pulled above the sand as it is added, ensuring the placement of a continuous sand pack. A weighted tape will be used to continuously monitor the sand pack elevation relative to the auger bottom to ensure the screen has been fully covered. Unless otherwise specified, the sand pack will be placed to an elevation of two feet above the top of the well screen.
- A one-foot (or greater if specified) thick bentonite seal composed of pellets or chips will be added to the annular space. If the seal is placed above the water table, the pellets will be hydrated with potable water. A weighted tape will be used to assure that the bentonite is placed at the proper elevation, is the proper thickness, and is not hung up in the borehole. The drill casing will be withdrawn from above the elevation of the bentonite seal and the natural materials will be allowed to collapse, if specified. If natural materials are not collapsing, clean native materials or No. 2 silica sand will be used to fill the voids.

- From the top of the bentonite seal to two feet below grade, the annular space will be backfilled with natural materials unless other materials are specified.

- If well is to be screened below the water table, the annular space above the bentonite seal is to backfilled with a cement/bentonite grout, mixed according to a ratio of approximately 20:1 cement to bentonite (not less than 5:1, if porous formations require more bentonite), with a maximum of 8 gallons of water per 94-pound bag of cement. Grout to be put in place with a sideways or upwards discharging tremie pipe.

- Each well will be completed with either a flush mount or elevated locking, protective casing as specified. Any asphalt or concrete surface will be square-cut. The flush mount casings will be set in Portland cement that extends from the top of the native fill to ground surface. The cement seal shall be a minimum of 2 feet in diameter. The top of the cement surface will be tapered outward to drain water away from the well.

- A vent hole will be placed near the top of a solid riser. On wells with a flush mount protective casing, a vented, locking compression cap will be used to plug the PVC riser. The wells requiring an aboveground protective casings will be completed with a vented slip-on PVC cap and locking metal cover.

WELL DEVELOPMENT PROCEDURES

Fine-grained materials are often smeared on the sides of the borehole during drilling reducing the hydraulic conductivity of the materials opposite the screened portion of the well. These fine-grained materials must be removed from the well and well borehole in order to enhance the hydraulic connection between the well and the aquifer. Undeveloped wells may produce groundwater samples containing suspended sediments that will clog field filtering equipment and bias the chemical analysis. Well development procedures are based on the Massachusetts DEP guidelines (MADEP, 1991) and ASTM Designations D 5092 - 90 and D 4750 - 87 (References).

Well Development will be completed by (1) surging and bailing; or (2) mechanical surging and pumping, as specified.

The surging will start with a slow pace near the top of the water column and progress to a faster pace near the well screen. Care will be taken during well development to avoid entrapping air in the aquifer formation or plugging the well screen with fine-grained materials. All equipment placed in the monitoring well for development will be either dedicated to each well or decontaminated following specified or standard operating procedures. Decontamination will occur between each well location. In cases of gross contamination, rinse water will be drummed and disposed of according to applicable municipal, state, and federal regulations.

1. SURGING AND BAILING

Decontaminated stainless-steel bailers will be used to surge and bail the wells. Surging will be performed to first loosen the fine materials and draw them through the well screen followed by bailing to remove the sediment-laden water from the well. This procedure will be continued until the turbidity of the water is reduced and the water appears clear.

2. MECHANICAL SURGING AND PUMPING

OPTION 1: Wells can be developed using a QED Environmental Systems, Inc. Sample Pro 2-inch Well Development Pump or equivalent. This device combines mechanical surging (to loosen fine materials and draw them through the well screen) and pumping (to remove sediment laden materials from the well). Flexible wipers (Buna-N) are attached to the pump with a small clearage between the wiper and the walls of the well. As the pump is lowered into the well the wipers create a surging action forcing water within the well out through the well screen into the aquifer formation. As the pump is moved up, the water is pulled back through the screen into the well along with fine-grained materials. The QED pump will pump the sediment laden water from the well at an average flow of 5 gallons per minute during development. This procedure will be continued until the turbidity of the water is reduced and the water appears clear.

OPTION 2: Wells can be developed using a Waterra™ check valve attached to polyethylene tubing, which is then inserted to the screened portion of the well, and then gently pumped up and down. The pumping action of the check valve will both surge the filter pack and surrounding formation, while at the same time remove sediment and water. When operated by hand, a pumping rate of at least 0.5 gallons per minute can be achieved over a short period of time. A higher pumping rate (up to 4 gallons per minute) for longer periods can be achieved with a power-actuated tubing pump. This procedure will be continued until the turbidity of the water is reduced and the water appears clear.

SUBSURFACE SOIL SAMPLE COLLECTION USING AN EARTHPROBE™

The following applicable procedures will be performed during collection of soil samples using a 48-inch macro-core sampler:

- Representative subsurface soil samples will be collected in 4-foot intervals by direct push using a clean, decontaminated 48-inch long, 2-inch outside diameter, nickel-plated macro-core sampler containing a dedicated 45-inch long by 1.5-inch inside diameter PETG clear plastic liner. Samples obtained from the macro-core sampler are suitable for physical and chemical analysis.

- Other equipment used during sampling such as mixing bowls and sampling tools will be made of stainless steel.

- The macro-core sampler will be advanced from the surface to a depth of 4 feet. In order to collect samples below four feet, the soil above the sampling interval must be removed. If the borehole remains open samples can be collected continuously to the desired depth.

- Careful visual inspection of the sample will be performed to identify different soil in the top of the sampler that may have been caused by soil sloughing into the open borehole. In this case the judgment of the sampler must be used before completing boring logs or collecting representative soil sample. If the borehole does not stay open or if the sloughing of soils is excessive, the integrity of the soil samples is jeopardized and the 24-inch large bore sampler should be used for sampling below the initial 0- to 4-foot interval.

- Upon retrieval of the macro-core sampler, the following applicable procedures will be followed:

    - The liner will be removed from the sampler and cut open with a pre-decontaminated knife. The soil will be scanned for total volatile organic vapors using a PID or FID and the length of recovery will be measured. This information will be recorded on a boring log. **Alternative:** A hole will be drilled through the side of the liner, allowing for the collection of a sub-sample using a stainless steel syringe.

    - Soil will be described and logged according to a modified Burmister system. The soil description will be given in the following format: soil name; sorting and plasticity; particle size distribution, shape, and angularity; color; moisture content; density or consistency. This information will be recorded in a field book and/or on a boring log.

    - Duplicate samples for field screening for total organic vapors will be collected by filling two 8-ounce glass soil jars half full with soil and covering the jar with a double layer of aluminum foil and securing the lid over the foil. One sample will be collected from the top portion of the recovered soil and one from the bottom portion. The sample will be screened by using a PID or FID according to the Jar Headspace Analytical Screening Procedure found in the Massachusetts Department of Environmental Protection (DEP)

Interim Remediation Waste Management Policy for Petroleum Contaminated Soils #WSC-94-400. **Alternative:** If a sample is collected with a stainless steel syringe, this sub-sample can be placed into a 40-ml VOA vial, filling the vial 1/2 full, and then covering the vial with foil prior to capping with the teflon-lined cap.

- Samples for analysis for volatile organic compounds (VOCs and VPH) will be collected directly from the liner using a decontaminated stainless steel tool. No mixing of the soil sample will occur.

- Representative samples shall be transferred by clean spoon to 15 ml of MeOH contained in 40ml amber VOAs with teflon septum. The level of MeOH prior to sample addition shall be marked. Soil shall be added to at least this line on the VOA. A duplicate VOA shall be collected and submitted for each sample as standard procedure. Additional soil from the sample location shall be submitted in a separate container (2-4 oz glass jar) without preservation solution for dry weight determination purposes for each set of MeOH preserved VOAs.

- Loose soil will be removed from the glass threads of the vial with a paper towel to ensure a good seal. The cap will be secured tightly. The sample containers will immediately be placed in a chilled, thermally insulated container. The container will include a trip blank consisting of methanol in a 40-ml vial.

- Grab samples of soils collected from the sampler for laboratory analysis for semivolatile organic compounds, PCBs, pesticides, TPH, EPH, and inorganics will be composited by homogenized by mixing the soil in a stainless steel bowl or a polyethylene bag, or by the following method, if specified. The soil will be placed on a 1-meter square piece of polyethylene sheeting and rolled backward and forward by lifting and releasing the corners of the sheet. The sample will be spread out on the sheet and divided into quarters. Soil will be collected from each quarter consecutively until the sample containers are full. The container lid will be secured tightly. No chemical preservation is necessary.

- Sample containers will be checked to see that a Teflon liner is present in the cap prior to filling. ECS Standard Operating Procedure (SOP) # 4.00 should be referenced for selection of proper sample containers and preservation methods for each analytical method.

- All sample containers will be labeled with the following information: site; project number; earth probe number; sample interval or depth; sample matrix; date; time of collection; testing parameters; grab or composite sample; initials of sampling personnel.

- Sample containers will be capped immediately after filling and cooled to 4°C by placing them into a chilled, thermally insulated container for transport to the laboratory.

- All equipment used to collect samples for analysis will be either decontaminated before each use or dedicated to a particular sample location after initial decontamination according to the attached procedures.

GROUNDWATER SAMPLE COLLECTION PROCEDURES USING LOW FLOW SAMPLING METHODOLOGY

The following groundwater sampling protocols are based on the USEPA Region 1 Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells (July 30, 1996, Revision 2) (Region 1 Low Flow SOP #: GW 0001) with the following modifications.

1.0 MATERIALS

The following equipment and materials may be used during groundwater sampling. Not all material and equipment is necessary all of the time.

- health and safety equipment;
- map of well locations;
- well construction data;
- field data from last sampling and/or gauging event;
- well keys;
- interface probe;
- electronic water level indicator;
- PID or FID;
- a multiprobe water quality monitoring system (pH, specific conductivity, temperature, ORP, and optional dissolved oxygen)-i.e. Geotech Multiprobe Sampling System™ or YSI Model 3560 Water Quality Monitoring System™
- field book;
- adjustable rate peristaltic pump;
- 3/16-inch inside diameter and ¼-inch outside diameter polyethylene tubing;
- ¼-inch inside diameter silicone tubing;
- cable ties;
- folding table;
- disposable gloves;
- bucket (calibrated in gallons);
- sample containers and labels;
- chain-of-custody forms;
- cooler and ice;
- decontamination equipment;
- polyethylene sheeting;
- field filtering apparatus.

In order to ensure the collection of groundwater samples representative of the aquifer, stabilization of groundwater parameters must occur prior to sampling. Note: Depth to water level measurements will be performed in each monitoring well prior to purging and sampling (see Water-Level Measurement Procedures).

2.0 WELL PURGING

An electronic water level indicator will be lowered slowly to the air-water interface and the depth to water will be recorded. Care should be taken such that any particulates in the water column are not mobilized. Depth of the well should be based on previous sampling logs or measurements made after the collection of the groundwater sample. If the presence of a free phase product (light non-aqueous phase liquid - LNAPL) is suspected, an interface probe will be lowered to the product-water interface and the thickness of the product will be measured. If LNAPL is present, the well will not be sampled using the low flow sampling procedure.

- If no free phase product is present in the well purging will begin.
  - Purging of each well prior to sampling is conducted using an adjustable rate peristaltic pump in line with a multiprobe water quality monitoring system. This instrument allows for the visual monitoring of five parameters (temperature, pH, specific conductivity, dissolved oxygen and Eh -- oxidation-reduction potential) simultaneously in real time. This system uses an adjustable rate peristaltic pump system to collect the purge water directly into a flow-through chamber assembly containing the parameter probes.
  - A dedicated polyethylene tubing of 3/16-inch inside diameter and ¼-inch outside diameter is tied flush with the tip of a water-level measurement indicator using a plastic cable tie and is lowered into the well casing until it is at the mid-point of the saturated screen length and at least 2 feet from the bottom of the well.
  - A dedicated section, approximately one foot long, of ¼-inch inside diameter silicone tubing is fit through the peristaltic pump. The silicone tubing connects the dedicated polyethylene tubing from the well to a small piece of polyethylene tubing (approximately 24-inch), which attaches to the flow-through chamber of the multiprobe water quality monitoring system.
  - The pump is started at its lowest speed setting and slowly increased until the purge water is directly discharged into the chamber. Once the chamber is filled with purge water, the multiprobe meter displays are turned on and the initial stabilization parameter measurements should be recorded. The volume of purge water will be measured by pumping groundwater directly into a container of known volume.
  - The pumping rate is adjusted until there is little or no water level drawdown. Any adjustments made should be recorded. During the initial pump start-up, the drawdown may exceed 0.3 feet as pump flow adjustments are made and the water level stabilizes. If the minimal drawdown possible exceeds 0.3 feet but remains stable, continue purging at the stabilized groundwater drawdown level.
  - If drawdown exceeds 0.3 feet and does not stabilize, sampling should proceed.
  - The water level inside the well casing is monitored every three to five minutes or approximately every 0.25 to 0.5 gallons during purging. Drawdown of less than 0.3

feet during purging is desirable but not mandatory. The volume of water purged from the well, field measurement data (temperature, pH, specific conductance, ORP/Eh and dissolved oxygen if available) along with observations of color, odor and turbidity are recorded during the purging process every three to five minutes or as appropriate. An example of the ECS Low Flow Groundwater Sampling Log is attached.

- Purging is complete when stabilization of the groundwater parameters has been reached and the volume purged exceeds the stabilized groundwater drawdown volume plus the extraction tubing volume (approximately 0.014 gallons per 10 feet of tubing). Stabilization is achieved when three consecutive readings, taken at 3 to 5 minute intervals, are within the following limits: within +/- 0.5 degrees Celsius; within +/- 0.1 pH units; within +/- 10 μmhos/cm (or μS/cm) specific conductance or within 3% if specific conductance is greater than 300 μmhos/cm (or μS/cm); within +/- 10mV ORP/Eh.

- The amount of dissolved oxygen in the groundwater should be measured in each well after stabilization.

- A turbidity reading will be taken before the collection of the groundwater sample and the value will be recorded on the sampling log. Turbidity levels of less than 5 NTU are desirable but not mandatory.

- All measuring equipment will be decontaminated between uses (See Decontamination Protocols). The groundwater measuring equipment will be calibrated daily prior to use and in the field if field personnel suspect a problem with the calibration.

- Groundwater collected during purging and sampling of groundwater monitoring wells will be discharged to the subsurface at the point of withdrawal in accordance with Massachusetts General Law Chapter 21E and 310 CMR 40.0056 of the Massachusetts Contingency Plan. If purge water is grossly contaminated (i.e. contains free phase product) this water will be drummed and disposed of according to applicable municipal, state, and federal regulations (See Disposal Procedures).

3.0 GROUNDWATER SAMPLING PROTOCOL USING THE PERISTALTIC PUMP

- Once stabilization of the groundwater parameters occurs, the sampling of the groundwater from the well begins. The following SOP describes groundwater sampling using peristaltic pump, the dedicated section of silicon tubing, and the dedicated section of polyethylene tubing in the well.

- Immediately prior to sampling, the polyethylene tube leading to the flow-through chamber of the multiprobe water quality monitoring system is disconnected so that the groundwater flows directly from the ¼-inch silicone tubing into the sample vials.

- The location of the sampling point (or position of the end of the dedicated in-well tubing) will be the same location as it was during the purging process.

- If drawdown increases such that the recharge rate of the well is less than the slowest possible extraction rate, the well should be sampled as soon as the water level has recovered sufficiently to collect the appropriate volume needed for all required samples even though the parameters have not stabilized. The intake should not be lowered during the recovery period.

- Water samples for the analysis of volatile organic compounds (VOCs) and volatile petroleum hydrocarbons (VPH) will be collected first from the tubing in the water column in the well.

- Groundwater samples collected for the analysis of VOCs will be collected in duplicate 40-milliliter glass vials with zero headspace. Vials will be pre-preserved with hydrochloric acid to a pH of <2. The vial will be uncapped carefully in order to avoid contact with the Teflon septum. The vial will be filled slowly taking care not to agitate the sample which may mean slowing down the rate of the peristaltic pump. Each vial will be filled until there is a meniscus over the lip of the vial. If no meniscus forms, a sample of water will be collected in the cap and poured slowly into the vial to create a meniscus. The Teflon-faced septum will be placed on the convex meniscus and the cap screwed down. The vial will be inverted and tapped to check for the presence of air bubbles. If air bubbles are present, the sample will be discarded and another vial will be selected and filled.

- Groundwater samples for analysis for PCBs, pesticides, total petroleum hydrocarbons, extractable petroleum hydrocarbons (EPH), semivolatiles organic compounds, metals, other inorganic compounds, and general chemical parameters will be collected last but immediately after collecting groundwater samples for analysis of VOCs.

- Groundwater samples for the analysis for dissolved (soluble) metals will be collected by connecting a dedicated 0.45 micron filter in-line to the ¼-inch silicone tubing. Care will be taken to adjust the pumping rate, in order to avoid any potential failure of the cartridge filter. The sample will be collected directly in a 1-liter HDPE bottle pre-preserved with nitric acid to achieve a pH <2.

- The sample containers for groundwater samples collected for all analyses other than VOCs will be filled to 90% capacity. Care will be taken so that no portion of the sample comes in contact with the sampler's gloves. ECS Standard Operating Procedure (SOP) # 4.00 should be referenced for selection of proper sample containers and preservation methods for each analytical method.

- Duplicate samples, field blanks, and equipment rinsate blanks will be collected according to specified QA/QC frequency

- A trip blank consisting of deionized hydrocarbon-free laboratory water in a 40-milliliter Teflon-septum vial, prepared prior to sampling, will be present with the volatile samples at all times during sampling and transportation to the analytical laboratory, and will be subjected to the same analyses as the samples.

- All sample containers will be capped immediately after filling. The exterior of the container will be rinsed with deionized water and dried with paper towels. All sample containers will be labeled immediately upon collection with the following information: site; project number; well number; date; time of collection; testing parameters; initials of sampling personnel.

- All groundwater samples will be cooled to 4°C by placing them immediately in a chilled, thermally insulated container with ice and submitted as soon as possible to a Massachusetts-certified analytical laboratory under Chain of Custody protocol. Information regarding sample holding times is found in Table 1. Information regarding Chain of Custody protocol is found in the Sample Custody Procedure.

- All equipment used to collect samples for analysis will be either decontaminated before each use or dedicated to a particular sample location after initial decontamination.

- Based on the results of previous sampling and analysis, sampling will progress from the least contaminated well to the most contaminated well.

WATER-LEVEL MEASUREMENT PROCEDURES

Depth to water-level measurements are taken to determine the elevation of the potentiometric surface. Water level measurements will be performed in each monitoring well prior to sampling. Because of fluctuating groundwater levels, all wells will be measured prior to sampling and within the same day, if possible. If the presence of NAPL is suspected, measurements will be made with an oil/water interface probe, otherwise, an electronic water level indicator will be used. These instruments are accurate to 0.01 feet. The following procedures are based on Massachusetts DEP guidelines (DEP, 1991) and ASTM Designations D 5092 - 90 and D 4750 - 87.

- The measuring instrument will be decontaminated prior to use and between wells according to the standard decontamination procedures.

- Measurements will progress from the least contaminated wells to the most contaminated wells.

- The well casing will be opened and the headspace will be monitored for total organic vapors using a PID or FID. If a reading of 5 ppm or greater is detected, the well will be allowed to vent for 5 to 10 minutes. If after this time the reading is 5 ppm or greater, a determination regarding the level of personal protective equipment needed will be made before sampling continues. If specified, PID or FID readings for well casing headspace will be recorded for each well.

- An interface probe will be lowered to the air-water interface and the depth to water will be recorded. The interface probe will be lowered to the bottom of the well to measure the depth of the well and in wells where chlorinated hydrocarbons were detected to determine if dense non-aqueous phase liquid (DNAPL) is present. If the presence of a free phase product (LNAPL) is indicated, the probe will be lowered to the product-water interface and the thickness of the product will be recorded but the depth of the well will not be measured.

- One water-level measurement will be made from a reference point on the PVC well riser pipe and another from the top of the protective well casing at the surface elevation. The reference point on the PVC will be a V-notch cut into the top edge of the riser pipe at the highest point. This will be the surveyed point on the riser. The reference point on the well riser is preferred for determining depth to water-level due to its stability. The protective well casing is more susceptible to movement through settling, frost heaving, or displacement by impact.

- The volume of standing water in the well (static volume) will be calculated and used during well purging prior to sampling.

- The total depth of the well, depth to product, depth to water, standing water height, and static volume will be recorded on the groundwater sampling log (attached).

DECONTAMINATION

Decontamination will be performed in order to: minimize the spread of contaminants on the Site and from one sampling location to another; reduce the potential exposure of field personnel to contaminants; and to ensure good data quality and reliability. Decontamination of all field analytical testing and sampling equipment will be performed according to the following procedures. These procedures are based on ASTM Designation D 5088-90, USEPA CERCLA QAPP Review Guidance, 1987, and Massachusetts DEP Standard Reference for Monitoring Wells, 1991.

Equipment cleaning procedures include pre-field, field, and post-field decontamination. Non-disposable equipment will be decontaminated after completing each sampling event. In cases of gross contamination (free phase product), rinse water will be contained for proper disposal according to municipal, state, and federal regulations. Decontamination procedures will be monitored through sampling and analysis when quality assurance/quality control checks are necessary.

Equipment will be dedicated to each sampling point and decontamination will be performed at the off-site facility as much as possible.

Decontaminated equipment will be rested on polyethylene sheeting at each sampling point.

Samplers will use new disposable gloves at each sampling point.

Potable water from the public water supply will be used for control rinse water.

A certified laboratory supply of deionized water will be used for decontamination of field testing and sampling equipment and for the collection of rinsate blanks. Deionized water will be stored in Nalgene, glass, or Teflon containers. The storage area containing the deionized water will be separated from the storage area for solvents.

Equipment rinsate blanks will be collected when a quality control check of the decontamination procedure is necessary. This check will not be performed if dedicated equipment is used. One blank will be collected at least once during a sampling event for each different piece of sampling equipment used. Rinsate blanks will be prepared by pouring deionized water over the decontaminated piece of equipment and collecting it in the sample container. The equipment rinsate blank will be analyzed for the same analytes as the samples that have been collected with that piece of equipment.

1.0 MATERIALS

- health and safety equipment;
- laboratory-supplied deionized water;
- phosphate-free detergent (Alconox, Liquinox);
- potable water (municipal water source);
- methanol;
- Hexane;
- Acetone;
- nitric acid rinse solution;
- wash basins;
- inert brushes;
- polyethylene sheeting;
- large heavy duty garbage bags;
- spray bottles;
- zip-lock bags;
- paper towels/Handiwipes;
- disposable gloves.

2.0 DECONTAMINATION PROCEDURES

- Stainless steel bailers will be disassembled, soaked in hot potable water and scrubbed with a brush in "Alconox" detergent and potable water , and rinsed with clean potable water at the company's facility. Bailers will be allowed to air dry in a vertical position in a contaminant-free environment.

- Prior to the sampling event, bailers used for the collection of samples which will undergo analysis for total petroleum hydrocarbons and volatile organic compounds will be rinsed with hot potable water followed by a 10% methanol solution of pesticide grade methanol and deionized water, followed by a final rinse with deionized water. The volume of deionized water will be at least five times the volume of the methanol. Bailers used for the collection of samples which will undergo analysis for semi-volatile organic compounds, PCBs, and pesticides will be rinsed with a technical grade acetone followed by a pesticide grade hexane, and a final deionized water rinse as above. Bailers used for the collection of groundwater samples which will undergo analysis for metals will be rinsed with 10 per cent nitric acid solution prepared from reagent grade nitric acid and deionized water followed by a potable water rinse, and a final deionized water rinse.

- Bailers will be wrapped in an inert material (i.e. plastic bags) and stored in a clean environment during transport to the Site.

- Following sample collection, the stainless-steel bailers will be rinsed with clean potable water and placed in a plastic bag for transport to the company's facility where decontamination will take place.

- Soil and sediment sampling equipment (stainless steel sampling scoop, tool, and bowl, split-spoon and macro-core sampler, knife) will be decontaminated in the field after each use.

- Soil and sediment sampling equipment will be decontaminated as follows: scrubbed with inert brushes in a bucket containing phosphate-free detergent and potable water; rinsed with potable water; rinsed with pesticide grade methanol; and finally rinsed with deionized water. The final potable water and deionized water rinse volumes will equal 5 times the volume of the methanol rinse. The equipment will be allowed to air dry and will be stored in a clean environment until reused.

- Non-dedicated field equipment used for the collection of samples to be analyzed for metals and filtering apparatus will be cleaned prior to each use by using a phosphate-free detergent solution, a potable water rinse, followed by a 10 percent nitric acid rinse solution prepared from reagent grade nitric acid and deionized water, a potable water rinse, and a final rinse with deionized water. Used filters will be properly disposed of.

- The YSI Water Quality Monitoring System™, Geotech Multi Parameter™ meter, interface probe, down-hole slug test equipment, QED Water Wizard well development equipment, and other measuring instruments will be decontaminated between uses by rinsing with Alconox or Liquinox, followed by potable water and deionized water rinses. A methanol rinse will be utilized prior to the deionized water rinse in the event of gross contamination such as contact with free-phase product.

- The drill rig and earthprobe and all drilling equipment and associated tools, including but not limited to augers, drill casing, drill rods, sampling equipment, and wrenches, will be steam cleaned prior to beginning the drilling on the Site. This cleaning will consist of using a high pressure detergent steam cleaning equipment, followed by a nanograde methanol swabbing if gross contamination was present. This will be followed by a controlled water rinse. Any down-hole equipment (auger flights, rods, sampling equipment, etc.) coming in contact with gross contamination (i.e. free phase product) will be steam-cleaned between uses. Otherwise equipment will be scrubbed manually with potable water and Alconox as needed to remove soil between uses.

- Sampling equipment and probes will be decontaminated in an area covered by polyethylene sheeting adjacent to the sampling location.

- In cases of gross contamination (i.e. free phase product) rinse water will be collected for proper disposal according to municipal, state or federal regulations. Contaminated solids (disposable gloves, clothing, polyethylene tubing and sheeting, etc.) will be collected and characterized for proper disposal.

- Decontamination procedures will be fully documented in the field notebook. The following information should be recorded: Site location, date, time and weather; sample location where equipment used; location where decontamination was performed; field personnel performing the decontamination; decontamination procedures; disposal of rinse water if necessary; samples collected for QA/QC and analytical results.

- Health and safety procedures associated with decontamination are found in the Health and Safety Plan.

APPENDIX B

RESUME OF MICHAEL E. HOPKINS, PE

MICHAEL E. HOPKINS, P.E., LSP, LEP
Principal/New York Branch Manager/Director of Due Diligence Services

EDUCATION

State University of New York at Buffalo
B.S. Civil Engineering, 1981

SUNY College of Environmental Science and Forestry (in conjunction with Syracuse University)
B.S. Forest Engineering, 1980

PROFESSIONAL EXPERIENCE

Environmental Compliance Services, Inc., January 1, 2000 to present
Principal/New York Branch Manager/Director of Due Diligence Services

Hopkins Environmental Management, Inc., 1991 to 1999
President

C/P Utility Services Company, Inc., 1990 to 1991
Manager of Environmental Engineering

Environmental Risk Limited, 1989 to 1990
Senior Associate

Niagara County (New York), Health Department, 1981 to 1989
Public Health Engineer/Supervising Public Health Engineer

PROJECT EXPERIENCE

Remediation

- Performed remedial investigations, developed work plans, interpreted data and designed various remediation systems.
- Projects have included soil removal, capping, groundwater recovery and treatment, sparging, soil vapor extraction, free product recovery, drum removal, building decontamination, asbestos abatement, and complex, multi-phased remediation projects.
- Managed all phases of remedial projects including initial assessments, detailed remedial investigations, cost estimates, negotiations with regulatory agencies, permitting, remedial system design, plan implementation, system start-up and operations, and professional engineering certifications.
- Managed more than 200 remediation projects with budgets up to $3 million dollars.

MICHAEL E. HOPKINS, P.E., LSP, LEP

Principal/New York Branch Manager/Director of Due Diligence Services

Environmental Site Assessments

- Corporate Director of Due Diligence Services. Manages and directs more than 500 phase I, II and III assessments per year, including personally reviewing and approving all final reports.
- Conducted environmental site assessments for more than 2,000 properties in 35 states, and managed more than 6,000 assessment projects.
- Assessment clients have included financial institutions, government agencies, attorneys, industries, developers, investment firms, municipalities, property owners and potential buyers.
- Conducted assessments of properties valued up to $600 million.
- Peer reviewed and evaluated more than 1,400 assessment reports prepared by other firms.
- Routinely provides second opinions and independent peer reviews of environmental site assessments, risk assessments and remedial cost estimates.

Hydrogeology/Site Investigation

- Worked as a hydrogeologist, chief investigator, technical supervisor, project engineer and project manager on soil and groundwater contamination studies, aquifer characterization projects, hydrogeologic investigations, and remedial investigations.
- Has substantial experience in interpreting hydrogeologic and groundwater quality data.

Engineering

- Licensed Professional Engineer with experience as a project, remedial, public health and design engineer.
- Managed engineering groups of up to twelve professionals for consulting firms and a government agency.
- Designed groundwater collection, wastewater treatment, spill contaminant and tank systems.
- Provided professional engineering evaluations and certifications for a variety of projects.
- Prepared bid specifications and technical contract documents for various projects.

Regulatory Compliance

- Has enforcement and regulatory experience in solid and hazardous waste management, underground storage tank compliance, water pollution control, air pollution control, and public health regulations.
- Worked as a review engineer, regulatory analyst, technical supervisor and program manager.
- Acted as a consultant to a variety of companies to audit regulatory compliance, to develop compliance programs and as a day-to-day advisor on compliance matters.
- Has managed solid and hazardous waste, wastewater discharge and air emission source permitting projects.

MICHAEL E. HOPKINS, P.E., LSP, LEP
Principal/New York Branch Manager/Director of Due Diligence Services

Environmental Auditing/Risk Management

- Skilled environmental auditor with experience in conducting both internal and third party audits.
- Developed protocols, policy guidance and screening procedures for use by a major international insurance company in conjunction with underwriting underground storage tank insurance policies, and coordinated field investigations of more than 600 claims for that client.
- Developed environmental risk management programs for clients including banks, an insurance company, manufacturers, numerous small businesses, and an electric utility company.

Data Validation/Quality Assurance

- Prepared more than 200 sampling plans, Quality Assurance Project Plans, Quality Assurance/Quality Control Plans and similar documents for inclusion in Site Characterization Work Plans, Remedial Investigation Work Plans and other field investigation plans.
- Routinely develops scopes of work, including specifying analytical methods, sampling procedures and quality assurance procedures for site investigation and site remediation projects.
- Peer reviewed more than 200 sampling and/or quality assurance/quantity control plans prepared by other firms.
- Has more twenty five year of environmental data interpretation experience including a wide range of analytical methods, all types of media, and reviews such data on a nearly daily basis.
- Has completed professional short courses and seminars in data validation, analytical methods, sampling procedures and quality control/quality assurance procedures
- Formal education includes 28 hours of college level chemistry courses, including general chemistry, organic chemistry, physical chemistry and wastewater chemistry.

Miscellaneous

- Acted as on-site technical assessment officer at more than 600 hazardous material emergency response incidents.
- Provided expert opinions in hazardous waste management enforcement and public health assessment cases.
- Was implemental in remedial actions and public health assessment activities at the Love Canal (1981-1988). Acted as Niagara County spokesman with respect to Love Canal communications (1984 -1988).

PROFESSIONAL CERTIFICATIONS AND LICENSES

Licensed Professional Engineer, Connecticut and New York
Connecticut Licensed Environmental Professional (#153)
Massachusetts Licensed Site Professional (#9599)

APPENDIX C

SITE SPECIFIC HEALTH AND SAFETY PLAN

Health and Safety Plan
Site Characterization Activities

Skidmore College
Mercury Spill Location
NYDEC Spill #0501301
AOC #A4 -0525-0805
Saratoga Springs, New York

Prepared on Behalf of:

Skidmore College
815 North Broadway
Saratoga Springs, NY 12866

For Submission to:

New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau A
625 Broadway
Albany, NY 1223307015

Prepared by:

Environmental Compliance Services, Inc.
252 David Parkway
Ontario, NY 14519

ECS Project Number 11-204748.00

June 7, 2006

TABLE OF CONTENTS

ATTACHMENTS:

Attachment I	Hospital Directions
Attachment II	Site Plan
Attachment III	NIOSH Air Sampling Methods
Attachment IV	Training Materials
Attachment V	Summary of Available Soil Sampling Data
Attachment VI	NYDOH Community Air Monitoring Plan

1.0 INTRODUCTION

This site specific Health and Safety Plan (HASP) provides guidance to authorized personnel engaged in subsurface investigation activities in area potentially impacted by mercury and other contaminants at Skidmore College. The scope of the site investigation activities is as specified in the Site Characterization Work Plan by Environmental Compliance Services, Inc. dated November 9, 2005.

Michael E. Hopkins, PE, LEP, LSP of Environmental Compliance Services, Inc. (ECS) will act as Health and Safety Officer on this project. Dan Rodecker of Skidmore College will act as the primary client contact.

1.1 Background

This project involves the borings, monitoring well installation, soil sampling, groundwater sampling and surveying in an area assumed to be contaminated with elemental mercury. Mercury concentrations up to 7,080 mg/kg were previously detected in subsurface soil samples in this area. The impacted area is assumed to be no more than approximately 20 feet in diameter, but a full delineation has not yet been performed. Figure 1 (Attachment II) shows the general layout of the suspected spill site and the proposed sampling locations. No other contaminants are expected to be present at concentrations that would pose a risk to workers or the public.

1.2 Available Soil Analysis

Elemental mercury may be presence as visible droplets in the soil in the work area. Mercury has been detected in prior soil samples from this area at concentrations ranging from less than 0.2 mg/kg to more than 7,000 mg/kg. The available data is summarized in Table 1 in Attachment V. Laboratory reports were provided in a report entitled Record Review Report by ECS dated October 11, 2005. The possibility of higher concentrations being present cannot be precluded at this time. The only other metals identified in prior soil samples were barium and silver (in one sample only). The concentrations of these metals were low and do not warrant implementing health and safety procedures beyond those required by the presence of mercury. No organic compound analyses have been performed, but there are no indications that significant concentrations of organic contaminants are present. The need to be revise this plan will be re-evaluated whenever additional data is received, and the HASP will be updated or revised as appropriate in light of such data.

1.3 Assumptions

- Work activities involving contact with soil or groundwater on this site are considered controlled activities until a negative exposure determination can be made through an appropriate industrial hygiene assessment.

- At all times basic personal hygiene requirements must be followed. This consists of prohibitions on eating, drinking, smoking within the work area and hand and face washing prior to eating, breaking or leaving site. The work area will be clearly defined by the Health and Safety Office using one or more of the following items; caution tape, signs, flags and or snow fences prior to the initiation of subsurface activities.

- Work plans are designed to prevent or minimize worker contact with contaminated media. Industrial hygiene monitoring in compliance with OSHA's hazardous substance rules will be performed to verify occupational exposures are not occurring.

- Only limited contact with mercury contaminated soil is expected to occur during the Site Characterization Investigation. Regardless, work will be performed in "Level D" or "Level C" personal protective equipment (as will be defined later in this HASP), depending or the results of mercury vapor monitoring. This provides additional worker protection by reducing requirements for physical contact.

2.0 DESCRIPTION OF PROJECT

Project Name:	Skidmore College – Mercury Remediation Site ECS Project No. 11-202748.00
Location:	814 North Broadway, Saratoga Springs, New York 12866
Project Start:	June 2006 (pending NYDEC approval of Site Characterization Work Plan)
Project Finish:	July 2006 (estimated duration of field activities is six working days over a three week period)
Working Hours (normal)	Monday through Friday – 6:30 am to 5:00 pm
Dig Safe Number:	To be obtained prior to field activities

Title/Trade	**Name/Address**	**Contact/Phone**
Facility Manager/ Primary Client Contact	Dan Rodecker Assistant Facility Director 815 North Broadway Saratoga Springs, NY 12866	Work (518) 580-5000
Project Manager	Michael Hopkins, PE, LEP, LSP ECS 252 David Parkway Ontario, NY 14519	Work (585) 216-9681 Cell (585-259-5769) Fax (585) 216-9332
Health and Safety Officer	Michael Hopkins, PE, LEP, LSP ECS 252 David Parkway Ontario, NY 14519	Work (585) 216-9681 Cell (585-259-5769) Fax (585) 216-9332
Geoprobe and Operator	John Neidjelsky/Amy Ringette ECS 588 Silver Street Agawam, MA 01001	Work (413) 786-7887
Hollow Stem Auger and Crew	John Neidjelsky/Amy Ringette ECS 588 Silver Street Agawam, MA 01001	Work (413) 786-7887
Environmental Technician	Amy Butler ECS 252 David Parkway Ontario, NY 14519	Work (585) 216-9681 Cell (585-259-5769) Fax (585) 216-9332

General Operations: (Note to User – See Site Characterization Work Plan)

The scope of work includes sixteen Geoprobe^{tm} borings to a maximum depth of twelve feet, the collection of soil samples at various depths, field screening using a mercury vapor analyzer, installation of four monitoring wells using hollow-stem auger equipment, groundwater sampling and surveying.

The work at the Skidmore Mercury Remediation Site poses a potential hazard to workers due to exposures to mercury. In addition, the potential exists (in an uncontrolled workplace) for the migration of the mercury off the site via worker clothing or equipment.

Industrial hygiene sampling will be performed to verify that personnel are not at risk of occupational exposure to target contaminants. This includes monitoring the breathing zone air quality of the workers performing various tasks. This monitoring will be performed with a Mercury Vapor Analyzer with a detection limit of 0.003 mg/m^3 or less. The proposed activities are not expected generate significant quantities of dust[1] and no contaminants other than mercury are expected to be present, regardless organic vapor monitoring and particulate (PM-10) monitoring will be performed in accordance with the NYDOH Community Air Monitoring Plan (CAMP). Sampling of various work surfaces and materials may also be performed to verify site control. This plan makes use of engineering controls and hygiene practices to control worker exposures. Work will proceed with the limited controls specified in this plan.

Workers operating within the scope of this plan must have at least the following minimum training:

1. Hazard Communication Training in accordance with 29 CFR 1926.59/29 CFR 1910.1200 and;
2. Safety Training and Education as required by 29 CFR 1926.21. This includes training in the recognition and avoidance of unsafe conditions.
3. Personal Protective Equipment – 29 CFR 1926.93-106

Additionally, site specific training on the contents of this plan is required prior to conducting work.

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[1] Air rotary drilling equipment will not be used. Neither Geoprobe nor hollow stem auger drilling are expected to generate significant quantities of dust.

3.0 CONTROLLED WORK AREA ACTIVITY SUMMARY AND HAZARD ASSESSMENT

The following work practices will be used for all work within the work area.

Included Tasks: Hand boring, Geoprobe boring, hollow-stem auger boring, soil sampling, monitoring well installation, groundwater sampling and surveying

Potential Impacted Media: Soil, air and groundwater

Primary Contaminant of Concern: Mercury

Expected Contaminant Concentration Range: Mercury at <0.2 to >7,000 mg/kg in soil; elemental mercury droplets may be present in the soil; mercury concentrations in groundwater have not been determined, but are expected to be minimal; no impact on ambient air is expected, but will be verified as part of the monitoring specified in this plan.

Worker Exposure Limits: PEL-OSHA - 0.1 mg/m^3 (8 hour time weighted average)

TLV-ACGIH: 0.025 mg/m^3 (8 hour time weighted average)

Protective Practices to be Employed:

1) Breathing zone air to be monitored using a mercury vapor analyzer with minimum detection level of 0.003 mg/m^3

2) Level D Personal Protective Equipment (with chemically resistant coveralls) to be used.

3) Upgrade to Level C Personal Protective Equipment (with air purifying respirator) if mercury concentrations in the breathing zone exceed 0.05 mg/m^3 (50% of PEL for three or more consecutive readings. Note: NIOSH allows the use of air purifying respirators in atmospheres with mercury concentration up to 0.5 mg/m^3

4) All work to be stopped immediately if mercury concentrations in breathing zone air exceed Worker Exposure Limits

5) Work Area to be defined and access controlled

6) Community air monitoring to be performed in accordance with NYDOH CAMP

7) Personal and equipment decontamination procedures to be used (see Sections 10 and 11)

8) Standard hazardous waste site work practices to be followed

4.0 WORKER AND ENVIRONMENTAL MONITORING

Air Contaminants	**Equipment/ Method**	**QA/QC**	**Use/Frequency**
Mercury-Elemental/ Inorganic	NIOSH Method 6009 or equal	As Specified	8-hour TWA (time weighted average) of 25% of workers assigned to tasks identified in Section 3. Sampling results < 50% worker exposure limits is the target. Attempts will be made to ensure sample quantity sufficient for 95% confidence.
Refer to Enclosed Sampling Methods for specific details.			
Comments: **Air sampling data is collected for each of the tasks identified in Section 3. As appropriate, environmental sampling of soils and various work surfaces may also be conducted to verify site control. Documentation pertaining to NIOSH Method 6009 is provided in Attachment III.**			

Persons authorized to conduct air sampling:

Michael E. Hopkins – Health and Safety Officer - ECS
Amy Butler – Technician - ECS

Sampling Summary – the data below represent maximum exposures measured on each task or group of tasks. Based on this summary, requirements of this plan may be amended or suspended.

Task	Sample	Maximum Exposure > PEL/TLV	Tasks Combined? Y or N	Date (mg/m^3)/(ppm) Y or N

5.0 SITE CONTROL MEASURES (CHECK ALL THAT APPLY)

Dust Suppression Techniques		No significant dust generation anticipated; monitoring will be performed.
	Wet Methods	
	Vacuum Equipment	
	Manual Methods	
Vapor Suppression Techniques		Mercury vapor monitoring will be performed and work will be stopped if PEL is exceeded, but no vapor suppression activities are practical in this case.
	Wet Methods	
	Vacuum Equipment	
	Manual Methods	
Site Security Measures		
X	Controlled Access	The project perimeter will be marked. Site personnel must be authorized and logged in.
X	Designated Decontamination	Decontamination methods are established in this plan.
	Temporary Fencing or Barriers	
	Perimeter Security Fencing	
	Danger or Warning Signs/Tape	Activity areas will be marked and maintained.
	Traffic Control Plan	No formal plan is necessary. Cones and/or barricades will be used to prevent vehicle entry into the work area as necessary.
	Police/Security Detail	

6.0 PERSONAL PROTECTIVE EQUIPMENT

Level A: **N/A**	Full face-piece self-contained breathing apparatus (SCBA) Totally encapsulating chemical protective suits Coveralls Long underwear Gloves (outer–chemical resistant) Gloves (inner-chemical resistant) Boots (chemical resistant & steel toe and shank) Hard Hat Disposable protective suit, gloves, and boots
Level B: **N/A**	Full face-piece self-contained breathing apparatus (SCBA) Hooded chemical resistant clothing Coveralls Long underwear Gloves (outer-chemical resistant) Gloves (inner-chemical resistant) Boots (outer-chemical resistant: disposable) Hard Hat Face shield
Level C: **To be used mercury vapor >.05 mg/m3 (50% PEL) are present for three consecutive readings**	Full face or half-mask, air purifying respirators, (NIOSH approved) Hooded chemical resistant clothing Coveralls Gloves (outer-chemical resistant) Gloves (inner-chemical resistant) Boots (outer-chemical resistant steel toe and shank Boot-covers, outer, chemical resistant (disposable) Eye Protection (Safety glasses or chemical splash goggles). Ear Protection Safety shoes with lugged soles and leather uppers. Hard Hat
Level D: **Minimum PPE requirement for work within the work area.**	Standard coveralls or work clothing. Hooded chemical resistant clothing Coveralls Gloves (outer-chemical resistant) Gloves (inner-chemical resistant) Boots (outer-chemical resistant steel toe and shank Boot-covers, outer, chemical resistant (disposable) Hard Hat Eye Protection (Safety glasses or chemical splash goggles). Ear Protection Face shield (available for use as necessary)
Comments: It is the responsibility of the foreman of each contractor/subcontractor to ensure each work crew's usage of Personal Protective Equipment (PPE) on the work site. At a minimum, Level D will be implemented during on-site activities regarding oil and/or Hazardous materials if encountered.	

7.0 PERSONNEL DECONTAMINATION

Level A	Not Applicable	Segregated equipment drop; buddy inspection for contaminants; exterior suit wash/rinse; boot cover and glove wash; boot cover and glove rinse; tape removal; boot cover removal; outer glove removal; suit removal; SCBA backpack removal, inner glove removal; inner clothing removal, field wash, redress.
Level B	Not Applicable	Segregated equipment drop; buddy inspection for contaminants; boot cover and glove wash; boot cover and glove rinse; tape removal; boot cover removal; outer glove removal; suit and hard hat removal; SCBA backpack removal; inner glove wash and rinse; inner glove removal. (Optional) Inner clothing removal, field wash, redress
Level C	Applicable	Segregated equipment drop; buddy inspection for contaminants; boot cover and glove wash; boot cover and glove rinse; tape removal; boot cover removal; outer glove removal; suit/safety boot and hard hat removal; respirator removal; cartridge removal; inner glove wash; inner glove removal. (Optional) Inner clothing removal, field wash, redress
Level D	Applicable	Remove dirt from clothing and boots. Do not use compressed air. Use waterless cleaner or suitable hygiene facilities to wash hands and face when leaving the immediate work area for any reason. Dispose of work gloves daily.
Notes: * Depending on results of sampling, Level D may be amended to include site dedicated work clothing.		

8.0 EQUIPMENT DECONTAMINATION – Necessary if worker exposure to oils or hazardous materials exceeds project limits

Tools & Materials	Clean tools with garden sprayer filled with detergent and water. Provide plastic ground cover and then rinse tools. Collect and dispose of plastic.
Vehicles & Heavy Equipment	Avoid direct contact on wheels or exterior. If gross contamination occurs, vehicles set up a dedicated wash area. The area should be underlain by geotechnical membrane or similar and diked on each side to prevent liquid runoff. Use low-pressure sprayers and brushes to remove sediments. Personnel should wear full body rain gear and a face shield when washing the vehicle.
Sampling Equipment	Decontaminated with alconox scrub; potable water rinse; methanol spray; potable water rinse; 10% nitric acid rinse; final potable water rinse. Equipment decontamination will be conducted in washtub separate from any used for personal contamination.
Sample Containers	Sample containers will be securely sealed and wiped clean of liquid and solid material using a clean paper towel or wipe (moistened with field blank water if necessary)
Monitoring Equipment	Monitoring equipment should not be allowed to contact contaminated media (if such contact occurs, notify the equipment manager). Monitoring equipment is wiped down in the field.
Personal Equipment	Overboots, overgloves, and inner gloves will be washed in the field (water and alconox followed by a clean water rinse) and stored in sealed plastic bags.
Decontaminated Waste	Decontaminated waste including but not limited to PPE and cleaning materials will be drummed and properly disposed of in accordance with state and federal regulations. Quantitative laboratory analysis will be determined by the Site Supervisor/Site Competent Person.

9.0 HAZARDOUS MATERIAL HANDLING AND SPILL CONTAINMENT[1]

Contaminated Soil (release to non impacted area of the site or release of Hazardous Materials brought onto the site)	1. Excavate soil by hand and/or equipment. 2. Transfer excavated materials to the stockpiling site if necessary. 3. Keep vehicle traffic in designated areas. Do not leave the project zone. 4. Stockpile in a location designated by the Facility Manager. 5. Stockpiles will be covered to prevent storm water runoff or wind action on fines.
Contaminated Liquid Spills	1. Evaluate nature and extent of spill and apply immediately available containment measures. 2. Notify on-site contact. 3. Notify emergency personnel is spill poses a threat of fire or explosion, is substantial or not easily contained, if any off-site property is or could be impacted, or if utilities are/may be impacted; 4. Effect containment using materials and equipment at hand (sand, dirt, plastic sheeting, etc.) 5. Guard against releases to utilities, contain releases to utilities if possible; contain release on impervious surface; 6. Stabilize situation if possible; 7. Notify NYDEC.
Drums and Containers[2]	1. Hazardous substances, contaminated soils, liquids, and other residues should be handled, transported, labeled, and disposed of in accordance with DOT, OSHA, EPA, and NYSED regulations. 2. Dumpsters, dump truck bodies and other similar containers will be lined with polyethylene sheeting if necessary to prevent contamination migration. 3. Drums and containers will be inspected and their integrity shall be assured prior to being moved. 4. Media in unlabeled drums and containers should be considered hazardous and handled accordingly until properly identified. 5. Site operations shall be organized to minimize the amount of drum or container movement.
Sample Materials	1. Excess sample materials (soil/surface water) will be disposed of onsite in the immediate vicinity of the sample location. 2. Separate-phase product will be drummed on site for subsequent off-site disposal. (i.e. gasoline, fuel oil) 3. Groundwater resulting from well development and/or well purging will be drummed and managed in accordance with waste management regulations.

Comments:

1. Application: No conditions Immediately Dangerous to Life or Health exist, or are likely or possible. No personal injury or uncontrolled hazards are involved.

2. Containers include roll-off dumpsters and dump trucks.

10.0 CONTROLLED AREAS – SITE CONTROL PROCEDURES

Applicability	The following conditions require establishing controlled areas. 1. Established project boundaries. 2. Identification of hazardous materials in unknown concentrations. 3. Hazardous materials exceeding or likely to exceed worker exposure limits. 4. Uncontrolled releases of hazardous materials. 5. Other hazards relating to the work which can't be controlled.
Site Safety Briefing	HSO conducts site safety briefing prior to commencement of field activities. Persons needing to work on the site must attend the briefing. Additional briefings are conducted during progress of work at the site if conditions on site change, additional contaminants or hazards are recognized, or if tasks change. The site safety briefing includes: 1. The scope and reason for the work to be performed. 2. The history of the site with regard to the present work. 3. The tasks to be performed; the locations of the work areas, and the specific hazards or potential hazards anticipated. 4. The means to be used to perform the anticipated tasks. 5. Information on the types of hazards present. 6. The initial proposed locations and approximate dimensions of the exclusion, decontamination, and support zone.
Exclusion Zone (EZ)	Establish exclusion zones in the work area using caution tape, fencing, signs, or other conspicuous markings. The exclusion area should include: 1. Areas within the swing of the crane/excavator/backhoe arm plus 10'; 2. Areas in the vicinity of drilling rigs within the maximum length of rods plus 10' 3. Open excavations 4. Areas of contaminated surface "soil" 5. Contaminated **"soil"** stockpiles Within the exclusion zone: 1. Unauthorized personnel are prohibited 2. Control of hot work and ignition sources 3. No eating, drinking, or smoking 4. Use of proper PPE and work practices are required 5. No entry after daylight hours without adequate artificial lighting.
Contamination Reduction Zone (CRZ)	Separately mark the CRZ. The CRZ is used for decontamination. Locate the CRZ upwind or crosswind from the area of operation in the exclusion zone and outside of the swing of heavy equipment or the fall or rods. The CRZ should be away from and upwind of excavations, areas of contaminated surface soil, and soil stockpiles. Within the decontaminant area: 1. Unauthorized personnel are prohibited 2. Control of hot work and ignition sources 3. No eating, drinking, or smoking 4. Use of proper PPE and work practices are required. 5. No entry after daylight hours without adequate artificial lighting.

Support Zone (SZ)	Locate the SZ outside and upwind of the EZ and CRZ. Mark and define the SZ from the surrounding site area. The SZ goes into the CRZ. The CRZ goes into the EZ. The SZ should be from and upwind of excavations, areas of contaminated surface soil, and soil stockpiles.

SITE SPECIFIC MARKING AND ADDITIONAL INSTRUCTION	
TASK	DESCRIPTION

11.0 EMERGENCY RESPONSE PLAN

Personal Injury	1. Evaluate injury. 2. Delegate personnel to notify emergency personnel. 3. Apply Emergency First Aid. 4. Decontaminate injured personnel as necessary. 5. Wait for emergency personnel or transport to hospital, as necessary.
Chemical Spill	Immediately Dangerous to Life or Health (actual or potential); 1. Evacuate area; 2. Roll-call of personnel on-site; 3. Notify site contact and emergency personnel; Notify off-site personnel if off-site impacts are possible. 4. Notify CTDEP. If personal injury is involved: 1. Follow procedure above: 2. Notify emergency personnel; 3. Immediate containment (using materials and equipment at hand (sand, dirt, plastic sheeting, etc.). Stabilize situation if possible. Release of Gas or consequent Fire: 1. Evacuate area; 2. Roll-call of personnel on-site; 3. Notify site contact and emergency personnel; Notify off-site personnel if off-site impacts are possible. 4. Notify CTDEP. Not Immediately Dangerous to Life or Health (actual or potential): 1. Notify emergency personnel and on-site contact if release poses any threat of fire or explosion, is 2. substantial, if off-site property is or is likely to be impacted, or if utilities are or may be impacted: 3. Immediate containment (using materials and equipment at hand (sand, dirt, plastic sheeting, etc.) ; 4. Guard against releases to utilities, contain releases to utilities if possible; contain release on impervious surface; 5. Stabilize situation if possible; 6. Notify CTDEP.
Utility-Related	Unknown utility, possible release of gas; or possible release of oil, hazardous, or flammable liquid; 1. Evacuate area 2. Roll-call of personnel on-site; 3. Notify site contact and emergency personnel; 4. Notify off-site personnel if off-site impacts are possible; 5. Notify utilities; 6. Notify CTDEP. Electrical 1. Isolate area, establish safety perimeter (i.e. work zone); 2. Notify emergency personnel; 3. Notify on-site personnel; 4. Notify utility;

	5. Notify agency Known, non flammable or hazardous material; 1. Evaluate nature of release; 2. Notify utility operator. 3. Notify on-site personnel; 4. Notify utility; 5. Notify agency
Comments:	

12.0 EMERGENCY RESPONSE CONTACT LIST

Police, Fire, Emergency	911
HOSPITAL	St. Peter's Hospital 315 South Manning Boulevard Albany, NY 12208 Phone: (518) 525-1315
NYDEC Emergency Spill Reporting (24 Hour)	1-800-457-7362
NYDEC Region 5 Office	(518) 897-1200
CBYD (Call Before You Dig)	1-800-962-7962
	Comments: Record CBYD authorization number(s) in Section 2 of this plan.
NRC (National Response Center)	1-800-424-8802
General Contractor Project Manger	
Health and Safety	ECS – Office: (585) 216-9681
Electric Utility	
Water Utility	
Gas Utility	
Other	

Directions to St. Peter's Hospital are provided in Attachment I.

13.0 AUTHORIZED PERSONNEL

The undersigned have read and understand the requirements of this Health and Safety Plan. This plan is intended to prevent worker and environmental exposure to hazardous levels of fly ash in impacted soils. Only persons trained on this plan may enter Controlled Work Zones.

TITLE/ORGANIZATION	NAME	SIGNATURE	PHONE
Skidmore Facility Manager	Don Allen		(585) 580-5000
ECS Project Manager	Mike Hopkins		(585) 216-9681
ECS Technician	Amy Butler		(585) 216-9681
ECS Driller - Geoprobe			
ECS Driller – Hollow stem			
ECS Driller's Assistant			
Health and Safety Consultant	Joe Knapik, CIH ECS		(413) 789-3530
Other			
Other			

14.0 TRAINING REQUIREMENTS

Employees of employers working on this site must provide Skidmore with verification of prior training as listed below or attend training at the site:

- Hazard Communication – 29 CFR 1926.59/29 CFR 1910.1200
- Safety Training and Education– 29 CFR 1926.21
- Personal Protective Equipment – 29 CFR 1926.93-106

Site specific training required prior to conducting site operations:

- contents of this plan

Title/Organization	Employee Name	Verification Received

IMPORTANT DEFINITIONS PERTAINING TO THIS PLAN

1. **ACGIH** is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

2. **Authorized Person** means a person approved or assigned by the employer to perform a specific type of duty or duties or to be at a specific location or locations at the job site. This person has been trained, and has authorization to work in the controlled areas.

3. **Coal tar pitch volatiles (CTPVs)** are composed of various chemical vapors that become airborne during the heating of coal tar pitch. Coal tar pitch is usually a thick, black or dark-brown liquid or semisolid that has a smoky odor. Other names for coal tar pitch volatiles include coal tar pitch, pitch, pitch oil, topped coal tar, coal tar pitch >351ºC (AWPI), and creosote.

4. **DEP** is the Connecticut Department of Environmental Protection.

5. **EPA is** the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

6. **Exposure**: Contact with a substance through inhalation, ingestion or some other means for a specific period of time.

7. **Heavy Metal (RCRA Metals) -** A common hazardous waste; can damage organisms at low concentrations and tends to accumulate in the food chain. Examples are Lead, Chromium, Cadmium, and Mercury

8. **mg/m^3** means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

9. **NIOSH** is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

10. **OSHA** is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

11. **Particulates:** Fine liquid or solid particles such as dust, smoke, mist, fumes or smog, found in the air or emissions.

12. **PEL** is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

13. **ppm** means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

14. **Resource, Conservation, and Recovery Act (RCRA)** – RCRA gave EPA authority to control hazardous waste from “cradle-to-grave.” This includes the minimization, generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also set forth a framework for the management of non-hazardous solid wastes. RCRA focuses only on active and future facilities and does not address abandoned or historical sites.

15. **Semi-Volatile Organic Compounds (SVOCs) -** are indicative of petroleum, are byproducts of combustion, and some examples include; wood products, coal, coal ash, coal tar, and asphalt.

16. **"Soil"** consists of ash, cinders, concrete, pulp, paper residue, and clay as well as native soils.

17. **TLV** is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

18. **Volatile Organic Compounds (VOCs):** Carbon-containing compounds that evaporate into the air (with a few exceptions). VOCs contribute to the formation of smog and / or may themselves be toxic. VOCs often have an odor, and some examples include gasoline, alcohol, and the solvents used in paints. Many volatile organic chemicals are also hazardous air pollutants; for example, benzene causes cancer.

MSDSs for:	**PEL (8-hr TWA)**	**TLV (8-hr TWA)**
Metals		
• Arsenic (As)	0.010 mg/m^3	0.01 mg/m^3
• Barium (Ba)	0.5 mg/m^3	0.5 mg/m^3
• Cadmium (Cd)	0.005 mg/m^3	0.002 mg/m^3 (respirable fraction)
• Chromium (Cr)	1 mg/m^3	0.5 mg/m^3
• Mercury (Hg)	0.1 mg/m^3 (vapor)	0.025 mg/m^3 (vapor)
• Nickel (Ni)	1 mg/m^3	1.5 mg/m^3
• Lead (Pb)	0.05 mg/m^3	0.05 mg/m^3
• Antimony (Sb)	0.5 mg/m^3	0.5 mg/m^3
• Selenium (Se)	0.2 mg/m^3	0.2 mg/m^3
• Vanadium (V)	0.5 mg/m^3 (respirable dust)	0.05 mg/m^3
• Zinc (Z) (oxide dust)	5 mg/m^3 respirable dust)	10 mg/m^3 dust
VOC's		
• Acetone	1.000 ppm	500 ppm
• 1,2-Dichloropropane	N/A	N/A
• Methylene Chloride	25 ppm	50 ppm
• Naphthalene	10 ppm	10 ppm
• Toluene	200 ppm	50 ppm
SVOCs		
• Acenaphthylene	N/A	N/A
• Anthracene	0.2 mg/m^3 (coal tar pitch volatiles)	0.2 mg/m^3 (coal tar pitch volatiles)
• Benz(a)anthracene	N/A	N/A
• Benzo(a)pyrene	0.2 mg/m^3 (coal tar pitch volatiles)	N/A
• Benzo(b)fluoranthene	0.2 mg/m^3 (coal tar pitch volatiles)	0.2 mg/m^3 (coal tar pitch volatiles)
• Benzo(k)fluoranthene	N/A	N/A
• Benzo(ghi)perylene	N/A	N/A
• Chrysene	0.2 mg/m^3 (coal tar pitch volatiles)	N/A
• 1,2-Dichlorobenzene	N/A	N/A
• Fluoranthene	N/A	N/A
• Fluorene	N/A	N/A

• Indeno(123-cd)pyrene	N/A	N/A
• 2-Methylnaphthalene	N/A	N/A
• Naphthalene	10 ppm	10 ppm
• Phenanthrene	0.2 mg/m^3 (coal tar pitch volatiles)	0.2 mg/m^3 (coal tar pitch volatiles)
• Pyrene	0.2 mg/m^3 (coal tar pitch volatiles)	N/A
DIESEL FUEL	N/A	N/A
FLY ASH	N/A	N/A
HYDRAULIC OIL	N/A	N/A
SILICA	Table Z-3 in 29 CFR 1910.1000	TLV = 0.1 mg/m^3

* DO NOT CITE – REFER DIRECTLY TO LISTED PUBLICATIONS

ATTACHMENT I

HOSPITAL DIRECTIONS

Yahoo! My Yahoo! Mail

YAHOO! LOCAL Maps **Sign In** New User? Sign Up

Search the Web

Maps Home - M

Yahoo! Driving Directions

Maps | **Driving Directions** MY YAHOO!

Starting from: A 714 N Broadway, Saratoga Springs, NY 12866-1622 Save Address

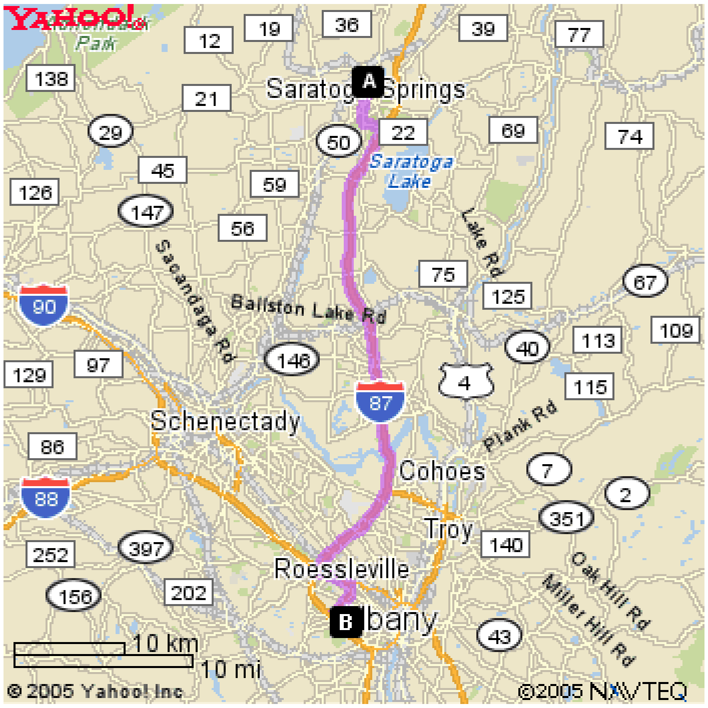
Arriving at: B St Peter's Hospital 315 S Manning Blvd, Albany, NY 12208-1707
(518) 525-1550 Save Address

Distance: 36.1 miles **Approximate Travel Time:** 51 mins

Get Reverse Directions

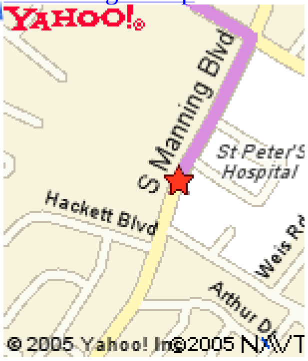
New Send to Phone Text Only | Printable Version | Email Directions

Your Full Route
Zoom In - 1st.3city567state910- Zoom Out



○ Zoom in & Re-Center ○ Re-Center only

Your Destination
View Larger Map



Traffic
Traffic info is not yet available for this area.

Find traffic for another ar
SmartView ™
See locations on this map

- Restaurants
- Hotels
- ATMs
- Gas Stations
- More

What's this?

Directions

Show Turn by Turn Maps

1. Start at **714 N BROADWAY, SARATOGA SPRINGS** going toward **1ST ST** - go **0.4** mi
2. Continue on **BROADWAY[US-9]** - go **1.3** mi
3. Continue on **S BROADWAY[US-9]** - go **0.6** mi
4. Turn Ⓛ on **CRESCENT AVE** - go **1.1** mi
5. Bear Ⓡ onto **I-87 SOUTH** - go **26.9** mi
6. Take exit **#1** onto **I-90 EAST** toward **ALBANY/BOSTON** - go **2.6** mi
7. Take exit **#4** onto **RT-85 SOUTH** toward **VOORHEESVILLE/SLINGERLANDS** - go **2.0** mi
8. Take the **MARIA COLLEGE/KRUMKILL RD** exit toward **BUCKINGHAM DR** - go **0.2** mi
9. Turn Ⓛ on **BUCKINGHAM DR** - go **0.5** mi
10. Turn Ⓛ on **NEW SCOTLAND AVE** - go **0.4** mi
11. Turn Ⓡ on **S MANNING BLVD** - go **0.2** mi
12. Arrive at **315 S MANNING BLVD, ALBANY,** on the Ⓛ

Get New Driving Directions

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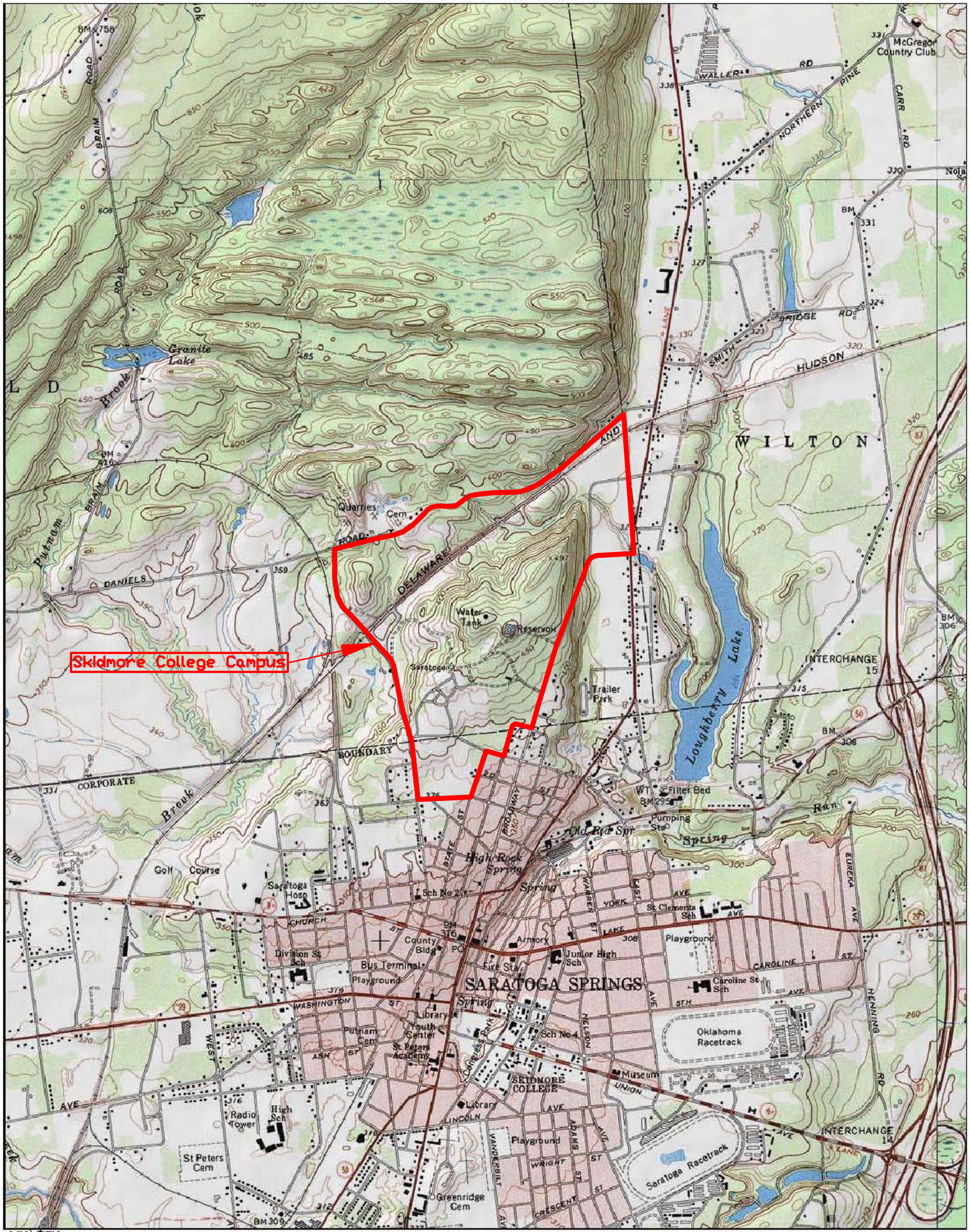
ATTACHMENT II

SITE PLAN

Figure 1 - Site Location Map



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SKIDMORE
COLLEGE

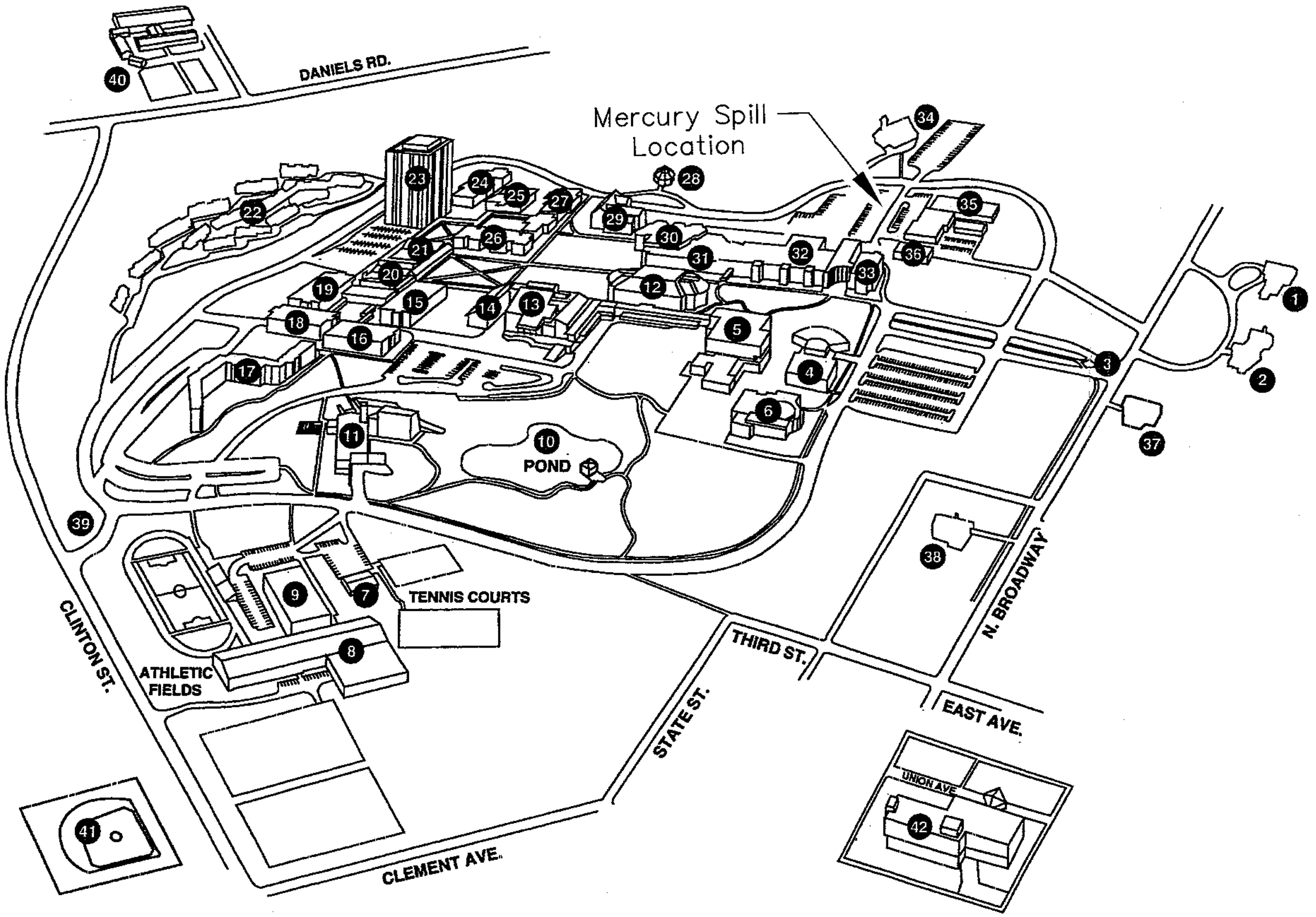


Figure 2
Mercury Spill Location

Key

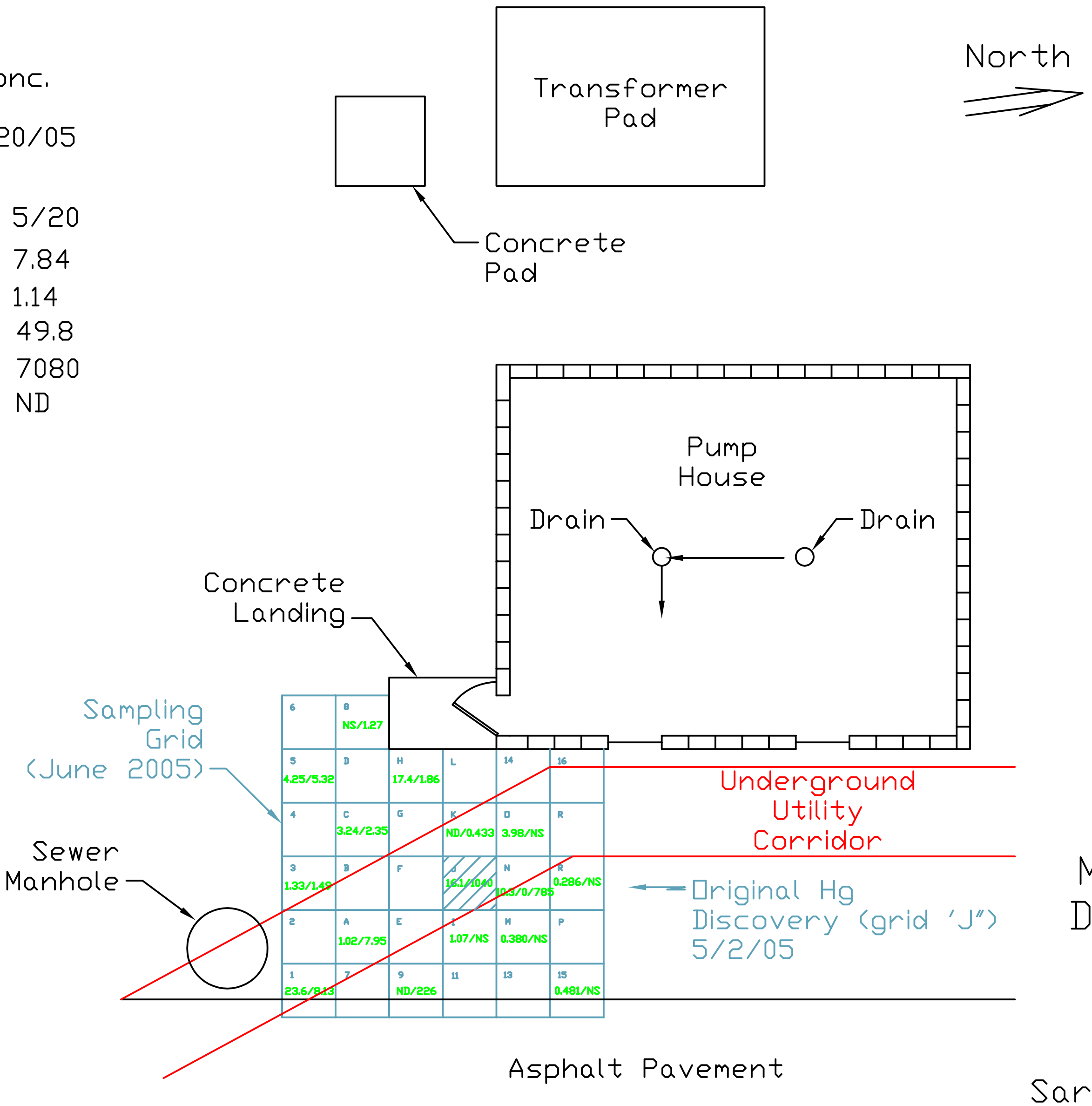
Barrett Center (25)
Bernhard Theater (6)
Bolton Hall (31)
Case Center (13)
Castle Baseball Diamond/Ingram Park (41)
Clinton Street Entrance (39)
Colton House (37)
Dana Science Center (32)
Dance Center (9)
Eissner Admissions Center (1)
Falstaff's (34)
Filene Music Building (4)
Greenberg Child Care Center (7)
Harder Hall (33)
Haupt Pond/South Park (10)
Hoge Heating Plant (36)
Howe Hall (26)
Jonsson Tower (23)
Kimball Hall (19)
Ladd Hall (14)
Main Entrance (3)
McClellan Hall (16)
Moore Hall (42)
Murray and Aikins Dining Halls (21)
North Hall (35)
Palamountain Hall (30)
Penfield Hall (18)
Rounds Hall (27)
Saisselin Art Building (5)
Scribner House (38)
Scribner Library (12)
Scribner Village Apartments (22)
Skidmore Hall (17)
Sports and Recreation Center (8)
Starbuck Center (20)
Surrey Williamson Inn (2)
Tang Teaching Museum and Art Gallery (11)
Tisch Learning Center (29)
Van Lennep Riding Center (40)
Wait Hall (24)
Wilmarth Hall (15)
Wilson Memorial Chapel (28)

Visitors Directory

Admissions - Eissner Admissions Center (1)
Alumni Affairs - North Hall (35)
Auditoriums - Palamountain Hall (30)
Bookstore - Case Center (13)
Business Affairs - Barrett Center (25)
Development Office - North Hall (35)
Facilities Services - North Hall (35)
Health Services - Jonsson Tower (23)
Human Resources - Barrett Center (25)
Information Desk - Case Center (13)
Master's Program - Ladd Hall (14)
Post Office - Case Center (13)
President's Office - Palamountain Hall (30)
Purchasing - Dana Science Center (32)
Schick Gallery - Saisselin Art Building (5)
Security - Jonsson Tower, lower level (23)
Spa Snack Bar - Case Center (13)
Special Programs Office - Palamountain Hall (30)
Student Affairs - Case Center (13)
Student Services - Starbuck Center (20)
  Career Services
  Dean of Studies
  Higher Education Opportunity Program
  International Programs
  Registrar
  Residential Life
  Student Aid and Family Finance
Surrey Williamson Inn (2)
Tang Teaching Museum and Art Gallery (11)
University Without Walls - Ladd Hall (14)

Mercury Conc.
mg/kg
5/13 and 5/20/05

Grid	5/13	5/20
A	5.5	7.84
C	24	1.14
H	18	49.8
J	251	7080
O	0.275	ND



Mercury Conc.
mg/kg
5/25/05

Grid	Depth 3'	5'
A	1.02	7.95
C	3.24	2.35
H	17.4	1.86
J	16.1	1040
O	3.98	---
1	23.6	8.13
3	1.33	1.49
5	4.25	5.32
8	1.27	---
M	0.38	---
N	10.3	---
9	ND	226
I	1.07	---
K	ND	0.43
15	0.48	---
Q	0.29	---
N	0.79	---

10 5 0 5 10

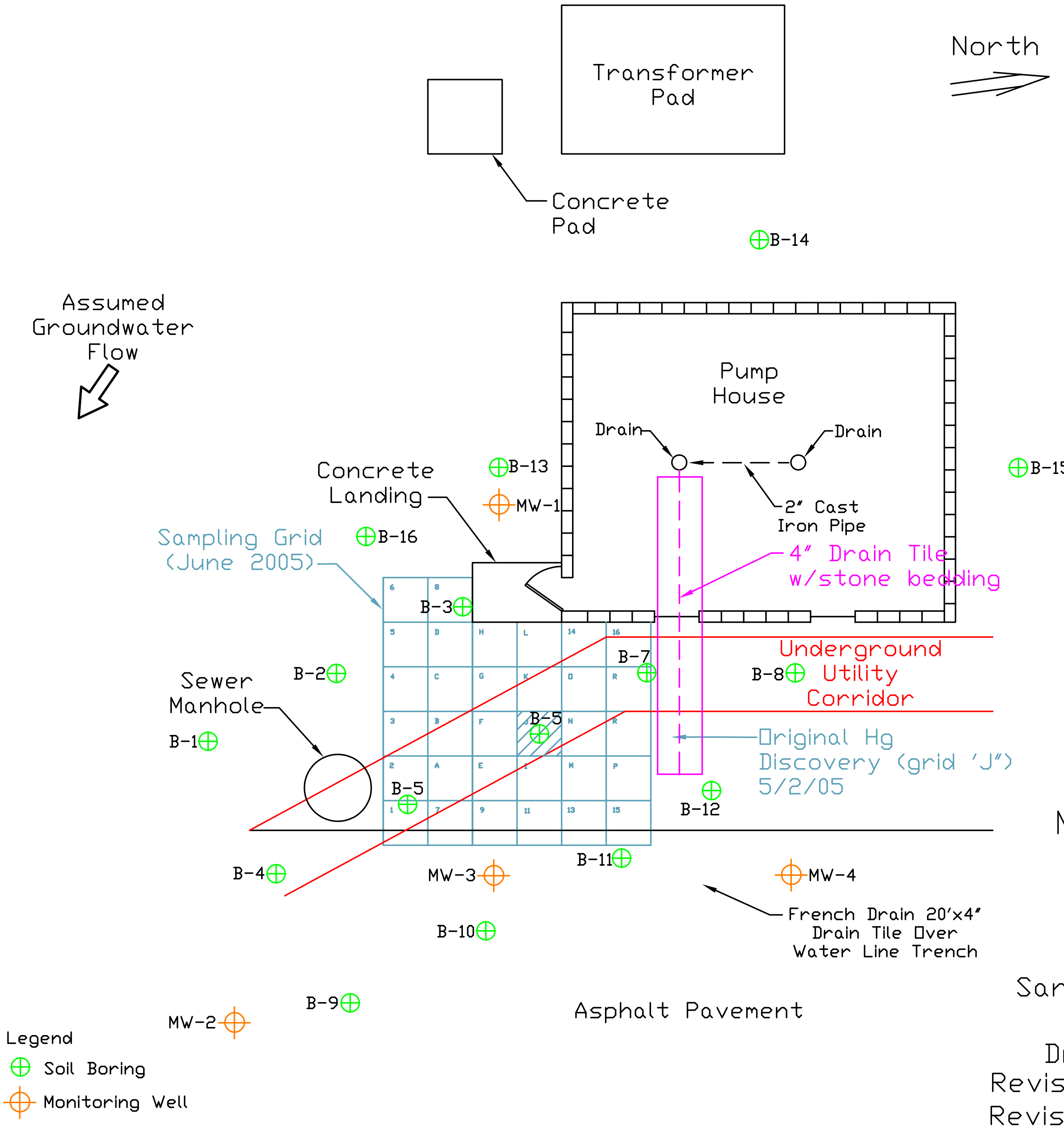
Approximate Scale
1" = 10'
Not for Construction
All Locations to be Field Verified

Figure 3

Mercury Spill Area Details and Initial Sampling Data

Skidmore College
Saratoga Springs, New York

Drawing Date: 9/28/05



Legend
- ⊕ Soil Boring
- ⊕ Monitoring Well

10 5 0 5 10

Approximate Scale

Not for Construction 1' = 10'
All Locations to be Field Verified

Figure 4

Mercury Spill Area
Proposed Sample
Locations

Skidmore College
Saratoga Springs, New York

Drawing Date:	Nov. 2005
Revision #1:	Feb 26, 2006
Revision #2:	Mar 30, 2006

ATTACHMENT III

NIOSH AIR SAMPLING METHODS

MERCURY 6009

Hg MW: 200.59 CAS: 7439-97-6 RTECS: OV4550000

METHOD: 6009, Issue 2 **EVALUATION: PARTIAL**

Issue 1: 15 May 1989
Issue 2: 15 August 1994

OSHA : C 0.1 mg/m^3 (skin)
NIOSH: 0.05 mg/m^3 (skin)
ACGIH: 0.025 mg/m^3 (skin)

PROPERTIES: liquid; d 13.55 g/mL @ 20 °C; BP 356 °C; HP -39 °C; VP 0.16 Pa (0.0012 mm Hg; 13.2 mg/m^3) @ 20 °C; Vapor Density (air=1) 7.0

SYNONYMS: quicksilver

SAMPLING

SAMPLER:	SOLID SORBENT TUBE (Hopcalite in single section, 200 mg)
FLOW RATE:	0.15 to 0.25 L/min
VOL-MIN:	2 L @ 0.5 mg/m^3
-MAX:	100 L
SHIPMENT:	routine
SAMPLE STABILITY:	30 days @ 25 °C [1]
FIELD BLANKS:	2 to 10 field blanks per set
MEDIA BLANKS:	at least 3 per set

ACCURACY

RANGE STUDIED:	0.002 to 0.8 mg/m^3 [2] (10-L samples)
BIAS:	not significant
OVERALL PRECISION ($\hat{S}_{rT}$):	not determined
ACCURACY:	not determined

MEASUREMENT

TECHNIQUE:	ATOMIC ABSORPTION, COLD VAPOR
ANALYTE:	elemental mercury
DESORPTION:	conc. HNO_3/HCl @ 25 °C, dilute to 50 mL
WAVELENGTH:	253.7 nm
CALIBRATION:	standard solutions of Hg^{2+} in 1% HNO_3
RANGE:	0.1 to 1.2 µg per sample
ESTIMATED LOD:	0.03 µg per sample
PRECISION ($\bar{S}_r$):	0.042 @ 0.9 to 3 µg per sample [4]

APPLICABILITY: The working range us 0.01 to 0.5 mg/m^3 for a 10-L air sample. The sorbent material irreversibly collects elemental mercury. A prefilter can be used to exclude particulate mercury species from the sample. The prefilter can be analyzed by similar methodology. The method has been used in numerous field surveys [3].

INTERFERENCES: Inorganic and organic mercury compounds may cause a positive interference. Oxidizing gases, including chlorine, do not interfere.

OTHER METHODS: This replaces method 6000 and its predecessors, which required a specialized desorption apparatus [4,5,6]. This method is based on the method of Rathje and Marcero [7] and is similar to the OSHA method ID 145H [2].

REAGENTS:

1. Water, organics-free, deionized.
2. Hydrochloric acid (HCl), conc.
3. Nitric acid (HNO_3), conc.
4. Mercuric oxide, reagent grade, dry.
5. Calibration stock solution, Hg^{2+}, 1000 µg/mL. Commercially available or dissolve 1.0798 g of dry mercuric oxide (HgO) in 50 mL of 1:1 hydrochloric acid, then dilute to 1 L with deionized water.
6. Intermediate mercury standard, 1 µg/mL. Place 0.1 mL 1000 µg/mL stock into a 100 mL volumetric containing 10 mL deionized water and 1 mL hydrochloric acid. Dilute to volume with deionized water. Prepare fresh daily.
7. Stannous chloride, reagent grade, 10% in 1:1 HCl. Dissolve 20 g stannous chloride in 100 mL conc. HCl. Slowly add this solution to 100 mL deionized water and mix well. Prepare fresh daily.
8. Nitric acid, 1% (w/v). Dilute 14 mL conc. HNO_3 to 1 L with deionized water.

EQUIPMENT:

1. Sampler: glass tube, 7 cm long, 6-mm OD, 4-mm ID, flame sealed ends with plastic caps, containing one section of 200 mg Hopcalite held in place by glass wool plugs (SKC, Inc., Cat. #226-17-1A, or equivalent).
   NOTE: A 37-mm, cellulose ester membrane filter in a cassette preceding the sorbent may be used if particulate mercury is to be determined separately.
2. Personal sampling pump, 0.15 to 0.25 L/min, with flexible connecting tubing.
3. Atomic absorption spectrophotometer with cold vapor generation system (see Appendix) or cold vapor mercury analysis system.*
4. Strip chart recorder, or integrator.
5. Flasks, volumetric, 50-mL, and 100-mL.
6. Pipet, 5-mL, 20-mL, others as needed.
7. Micropipet, 10- to 1000-µL.
8. Bottles, biological oxygen demand (BOD), 300-mL.

* See SPECIAL PRECAUTIONS

SPECIAL PRECAUTIONS: Mercury is readily absorbed by inhalation and contact with the skin. Operate the mercury system in a hood, or bubble vented mercury through a mercury scrubber.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Break ends of sampler immediately prior to sampling. Attach sampler to pump with flexible tubing.
3. Sample at an accurately known rate of 0.15 to 0.25 L/min for a total sample size between 2 and 100 L.
   NOTE: Include a minimum of three unopened sampling tubes from the same lot as the samples for use as media blanks.
4. Cap sampler and pack securely for shipment.

SAMPLE PREPARATION:

5. Place the Hopcalite sorbent and the front glass wool plug from each sampler in separate 50-mL volumetric flasks.
6. Add 2.5 mL conc. HNO_3 followed by 2.5 mL conc. HCl.
   NOTE: The mercury must be in the oxidized state to avoid loss. For this reason, the nitric acid must be added first.
7. Allow the sample to stand for 1 h or until the black Hopcalite sorbent is dissolved. The solution will turn dark brown and may contain undissolved material.
8. Carefully dilute to 50 mL with deionized water. (Final solution is blue to blue-green).
9. Using a volumetric pipet, transfer 20 mL of the sample to a BOD bottle containing 80 mL of deionized water. If the amount of mercury in the sample is expected to exceed the standards, a smaller aliquot may be taken, and the volume of acid adjusted accordingly. The final volume in

the BOD bottle must be 100 mL. To prevent possible loss of mercury during transfer, place the pipet tip below the surface of the liquid in the BOD bottle.

CALIBRATION AND QUALITY CONTROL:

10. Prepare a minimum of two series (six levels each) of working standards covering the range 0.01 to 0.5 µg Hg per aliquot by adding known amounts of the intermediate standard to BOD bottles containing enough 1% nitric acid to bring the final volume to 100 mL.
11. Analyze the working standards together with the samples and blanks (steps 13 through 16). Analyze full set of standards at the beginning of the run, and a second set at the end of the run. Additional standards may be run intermediately during the analysis to confirm instrument response.
12. Prepare calibration graph (peak height vs. solution concentration, µg/sample).

MEASUREMENT:

13. Zero the spectrophotometer by removing the bubbler from the BOD bottle, allowing the baseline on the recorder to stabilize.
14. Place the bubbler in a BOD bottle containing 0.5 µg mercury in 100 mL 1% nitric acid. Adjust the spectrophotometer so that it will give a 75% to full-scale deflection of the recorder.
15. Vent the mercury vapor from the system.
16. Analyze standards, samples and blanks (including media blanks).
    a. Remove the bubbler from the BOD bottle.
    b. Rinse the bubbler with deionized water.
    c. Allow the recorder tracing to establish a stable baseline.
    d. Remove the stopper from the BOD bottle containing the next sample to be analyzed. Gently swirl the BOD bottle.
    e. Quickly add 5 mL 10% stannous chloride solution.
    f. Quickly place the bubbler into the BOD bottle.
    g. Allow the spectrophotometer to attain maximum absorbance.
    h. Vent the mercury vapor from the system.
    i. Place the bubbler into an empty BOD bottle. Continue venting the mercury until a stable baseline is obtained.
    j. Close the mercury vent.

CALCULATIONS:

17. Calculate the amount of mercury in the sample aliquot (W, µg) from the calibration graph.
18. Calculate the concentration C (mg/m ^{3}), of mercury in the air volume sampled, V (L):

$$C = \frac{W \cdot \frac{V_s}{V_a} - B}{V}.$$

Where: Vs = original sample volume (step 8; normally 50 mL)
Va = aliquot volume (step 9; normally 20 mL)
B = average amount of mercury present in the media blanks

EVALUATION OF METHOD:

Rathje and Marcero originally used Hopcalite (MSA, Inc.) as the sorbent material [7]. Later, Hopcalite was shown superior to other methods for the determination of mercury vapor [8]. Atmospheres of mercury vapor for the study were dynamically generated in the range 0.05 to 0.2 mg/m^3 and an adsorbent tube loading of 1 to 7 µg was used. The Hydrar material sometimes used is similar to Hopcalite. No significant difference in the laboratory analysis of mercury collected on the two sorbent materials was observed [9]. OSHA also validated a method for mercury using Hydrar [2]. An average 99% recovery, with $\bar{S}_r = 0.042$, was seen for 18 samples with known amounts (0.9 to 3 µg) of mercury added (as $Hg(NO_3)_2$) [10]. No change in recovery was seen for samples stored up to 3 weeks at room temperature or up to 3 months at -15 °C; longer storage times were not investigated [10].

REFERENCES:

[1] Evaluation of Mercury Solid Sorbent Passive Dosimeter, Backup Data Report. Inorganic Section, OSHA Analytical Laboratory, Salt Lake City, Utah, 1985.
[2] Mercury in Workplace Atmospheres (Hydrar Tubes). Method ID 145H, Inorganic Section, OSHA Analytical Laboratory, Salt Lake City, UT, 1987.
[3] NIOSH/MRSB. Reports for analytical Sequence Nos. 5854, 5900, 6219, and 6311, NIOSH (Unpublished, 1987-1988).
[4] NIOSH Manual of Analytical Methods, 3rd. ed., Method 6000. (1984).
[5] NIOSH Manual of Analytical Methods. 2nd. ed., V. 4, S199, U.S. Dept. of Health. Education, and Welfare Publ. (NIOSH) 79-141 (1979).
[6] Ibid., V. 5, P&CAM 175, Publ. (NIOSH) 79-141 (1979).
[7] Rathje, A.O., Marcero, D.H. Improved hopcalite procedure for the determination of mercury in air by flameless atomic absorption, Am. Ind. Hyg. Assoc. J. 37, 311-314 (1976).
[8] McCammon, C.S., Edwards, S.L., Hull, R.D., Woodfin, W.J., A comparison of four personal sampling methods for the determination of mercury vapor, Am. Ind. Hyg. Assoc. J., 41, 528-531 (1980).
[9] Internal Methods Development Research, DataChem Laboratories, Inc., Salt Lake City, UT (1982).
[10] Eller, P.M., NIOSH, unpublished data (1987-88).

METHOD WRITTEN BY:

Keith R. Nicholson and Michael R. Steele, DataChem Laboratories, Inc., Salt Lake City, Utah, under NIOSH contract No. 200-87-2533.

APPENDIX: COLD VAPOR MERCURY ANALYSIS SYSTEM

1. The valve should direct the vented vapors to a hood or to a mercury scrubber system.
2. When the valve is opened to "Vent" the peristaltic pump should draw room air. Place a Hopcalite tube in the air intake to eliminate any mercury that may be present.
3. Adjust the peristaltic pump to a flow that will create a steady stream of bubbles in the BOD bottle, but not so great that solution droplets enter the tubing to the quartz cell.
4. If water vapor condenses in the quartz cell, heat the cell slightly above room temperature by wrapping it with a heating coil and attaching a variable transformer.
5. The bubbler consists of a glass tube with a bulb at the bottom, slightly above the bottom of the BOD bottle. The bulb contains several perforations to allow air to escape into the solution (in a stream of small bubbles). A second tube is provided to allow the exit of the vapor. The open end of the second tube is well above the surface of the liquid in the bottle. The two tubes are fixed into a stoppering device (preferably ground glass) which fits into the top of the bottle. A coarse glass frit can be used in place of the bulb on the first tube. However, it is more difficult to prevent contamination when a frit is used.
6. Replace the flexible tubing (Tygon or equivalent) used to connect the bubbler, cell, and pump periodically to prevent contamination from adsorbed mercury.

ATTACHMENT IV

TRAINING MATERIALS

Training documentation for all project staff will be provided and included in this section prior to the initiation of on-site work.

ATTACHMENT V

SUMMARY OF AVAILABLE SOIL SAMPLING DATA

Table 1

Summary of Mercury Analytical Results

Date	Grid Location	Sample Depth (ft)	Mercury Concentration (mg/kg)
5/13/05	A		5.5
5/13/05	C		24
5/13/05	H		18
5/13/05	J		251
5/13/05	O		0.275
5/20/05	A		7.84
5/20/05	C		1.14
5/20/05	H		49.8
5/20/05	J		7080
5/20/05	O		ND
5/24/05	A	3	1.02
5/24/05	A	5	7.95
5/24/05	C	3	3.24
5/24/05	C	5	2.35
5/24/05	H	3	17.4
5/24/05	H	5	1.86
5/24/05	J	3	16.1
5/24/05	J	5	1040
5/24/05	O	3	3.98
5/24/05	1	3	23.6
5/24/05	1	5	8.13
5/24/05	3	3	1.33
5/24/05	3	5	1.49
5/24/05	5	3	4.25
5/24/05	5	5	5.32
5/24/05	8	3	1.27
5/24/05	M	3	0.380

Date	**Grid Location**	**Sample Depth (ft)**	**Mercury Concentration (mg/kg)**
5/24/05	N	3	10.3
5/24/05	9	3	ND
5/24/05	9	5	226
5/24/05	I	3	1.07
5/24/05	K	3	ND
5/24/05	K	5	0.433
5/24/05	15	3	0.481
5/24/05	Q	3	0.286
5/24/05	N	5	0.785

ATTACHMENT VI
NYDOH COMMUNITY AIR MONITORING PLAN

New York State Department of Health
Generic Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical-specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored **continuously** at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (DEC and DOH) personnel to review.

June 20, 2000

P:\Bureau\Common\CommunityAirMonitoringPlan (CAMP)\GCAMPR1.DOC

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a **continuous** basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

APPENDIX D

NYSDOH COMMUNITY AIR MONITORING PLAN

New York State Department of Health
Generic Community Air Monitoring Plan

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Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

Continuous monitoring will be required for all <u>ground intrusive</u> activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

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Particulate concentrations should be monitored **continuously** at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (DEC and DOH) personnel to review.

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Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a **continuous** basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.