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REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORK PLAN
QUANTA RESOURCES SITE
LONG ISLAND CITY, QUEENS, NEW YORK

Prepared for:

Quanta Site Administrative Group

Prepared by:

Golder Associates Inc.
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September 2002 Project No.: 023-6151

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September 19, 2002 Project No.: 023-6151

NY State Dept. of Environmental Conservation
Division of Environmental Remediation
47-40 21st Street
Long Island City, NY 11101

Attn: Vadim Brevdo, P.E. - Project Manager

RE: SUBMITTAL OF REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN
QUANTA RESOURCES SITE
LONG ISLAND CITY, QUEENS, NEW YORK

Dear Mr. Brevdo:

On behalf of the Quanta Site Administrative Group (QSAG), Golder Associates Inc. (Golder) is pleased to submit four copies (one unbound) of the Remedial Investigation/Feasibility Study Work Plan (RI/FS Work Plan) for the Quanta Resources Site (Site). Copies of the RI/FS Work Plan have been sent to Mr. Gary Litwin (NYSDOH), Mr. David Harrington, P.E. (NYSDEC), and Ms. Denise D'Ambrosio, Esq. (NYSDEC) in addition to the others on the distribution below. This RI/FS Work Plan was prepared in accordance with Section II.B.1.(a) of the Order on Consent for the Site (NYSDEC Index No. W2-0915-03-06 for Site No. 2-41-005).

We appreciated the opportunity to meet with NYSDEC on September 5, 2002 to review our approach for the RI/FS. Your comments during the meeting were helpful. In accordance with our meeting discussion, this RI/FS Work Plan presents, amongst other things, a detailed scope of work for Phase I of the Remedial Investigation. As described in the RI/FS Work Plan, the scope of work for the Phase II Remedial Investigation will be proposed to NYSDEC as part of the Phase I Data Summary Report.

In addition, the Sampling and Analysis Plan (SAP), which includes the Quality Assurance Project Plan (QAPP) is referenced in the RI/FS Work Plan as Appendix D. A delay in the final selection of an analytical laboratory has caused a corresponding delay in the submission of the SAP/QAPP as part of this RI/FS Work Plan. Currently, the RI/FS Work Plan includes a Table of Contents of the SAP/QAPP. The QSAG is in the process of selecting an analytical laboratory and, when selected, Golder will complete the SAP/QAPP for insertion into the RI/FS Work Plan. A complete copy of the SAP/QAPP will be submitted to you on or before October 11, 2002.

Please do not hesitate to contact Pete Zimmermann, the Project Coordinator for QSAG, at (212) 308-3800 should any questions arise from your or your colleagues' review of this document.

Very truly yours,

GOLDER ASSOCIATES INC.

Randolph S. White, P.E.
Principal
NYS Professional Engineer License Number 062926-1

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LIST OF ACRONYMS AND ABBREVIATIONS (in order of use)

RI/FS	Remedial Investigation/Feasibility Study
Golder	Golder Associates Inc.
QSAG	Quanta Site Administrative Group
NYSDEC	New York State Department of Environmental Conservation
COPC	Constituents of Potential Concern
SCGs	State Standards, Criteria and Guidelines
RAOs	Remedial Action Objectives
LIRR	Long Island Railroad
ROW	Right-of-Way
American	American Agricultural Chemical Company
Triplex Oil	Triplex Oil Refining Company
NYCDEP	New York City Department of Environmental Protection
OHM	OH Materials Corp
LNAPL	Light Nonaqueous Phase Liquid
LMS	Lawler, Matusky & Skelly
ASTs	Aboveground Storage Tanks
bgs	Below Ground Surface
MSL	Mean Sea Level
VOCs	Volatile Organic Compounds
SVOCs	Semi-Volatile Organic Compounds
O&G	Oil and Grease
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
1,2-DCE	1,2-Dichloroethylene
TCE	Trichloroethylene
PCE	Tetrachloroethylene
Al	Aluminum
As	Arsenic
Ba	Barium
Ca	Calcium
Cr	Chromium
Fe	Iron
Pb	Lead
Mn	Manganese
Va	Vanadium
Zn	Zinc
1,1,1-TCA	1,1,1-trichloroethane
CSM	Conceptual Site Model
ARARs/SCGs	Applicable or Relevant and Appropriate Requirements/New York State Standards, Criteria and Guidelines
TBC	To Be Considered
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
TAGM	Technical Assistance Guidance Memoranda
TOGs	Division of Water Technical and Operational Guidance Series
RCRA	Resource Conservation and Recovery Act
HSWA	Hazardous and Solid Waste Amendments
CP	Citizen Participation
HASP	Health and Safety Plan
SAP	Sampling and Analyses Plan
QAPP	Quality Assurance Project Plan

HSA	Hollow Stem Auger
PID	Photo-ionization Detector
USCS	United Soil Classification System
TCL	Target Compound List
TAL	Target Analyte List
TOC	Total Organic Carbon
SOP	Standard Operating Procedure
DUSR	Data Usability Summary Report
QC	Quality Control
PARCC	Precision and Accuracy Criteria
NCP	National Contingency Plan
TTWP	Treatability Testing Work Plan
FS Report	Feasibility Study Report
ELM	Environmental Liability Management
ADT	Aquifer Drilling and Testing Inc.
AOC	Administrative Order on Consent

1.0 INTRODUCTION

This Remedial Investigation/Feasibility Study (RI/FS) Work Plan has been prepared by Golder Associates Inc. (Golder) on behalf of the Quanta Site Administrative Group (QSAG). The RI/FS Work Plan is submitted pursuant to Section II.A, of the Order On Consent (Consent Order) executed by the New York State Department of Environmental Conservation (NYSDEC), NYSDEC Index No. W2-0915-03-06. The property located at 37-80 Review Avenue, Long Island City, New York (the Site), is currently listed in the Registry of Inactive Hazardous Waste Disposal Sites in New York State as Site Number 2-41-005 with a Classification of “2” pursuant to ECL 27-1305.

The objectives of this RI/FS are as follows:

- Determine the nature and extent of constituents of potential concern (COPC) and potential impacts to the public health, welfare, or the environment caused by the release or potential release of COPC at or from the Site by conducting a Remedial Investigation; and,
- Determine and evaluate alternatives for remedial action, if any, to prevent, mitigate, or otherwise respond to or remedy a release or potential release of COPC at or from the Site by conducting a Feasibility Study.

This RI/FS Work Plan provides the framework for the activities to be conducted as part of the RI/FS for the Site as required by the Consent Order and includes the following key elements:

- The technical scoping completed for the preparation of the RI/FS Work Plan is presented in Section 2.0, which includes a description of the Site, its history, previous investigations and remedial actions completed, and its environmental setting and conditions;
- A Conceptual Site Model is presented in Section 3.0;
- Preliminary Applicable or Relevant and Appropriate Requirements/New York State Standards and Guidelines and preliminary Remedial Action Objectives are discussed in Section 4.0;
- The rationale and specific objectives for the RI/FS are discussed in Section 5.0;
- The Scope of Work for the separate RI/FS Work Plan tasks is presented in Section 6.0; and,
- A Project Management Plan is presented in Section 7.0, which includes a schedule of the work to be performed.

2.0 SITE DESCRIPTION [1]

2.1 General Site Description

The Site consists of an approximately 1.8-acre parcel of land at 37-80 Review Avenue, within a highly industrialized area of Long Island City, Queens, New York. Figure 1 provides the location of the Site on a USGS quadrangle map, and Figure 2 shows an aerial photographic map (April 1994) showing the Site and surrounding properties. General zoning in this area is commercial and light industrial.

The Site is bounded on the northeast by Review Avenue and on the southwest by the Southern Line of the Long Island Railroad (LIRR). On the northwest it is bounded by an alley that runs from Review Avenue to the LIRR tracks. On the southeast it is bounded by the property currently owned by Phoenix Beverages (an imported beer distributor). Farther to the northeast, across Review Avenue, is Calvary Cemetery (Cemetery), which covers roughly 175 acres and extends approximately 3,000 feet along Review Avenue across from the Site (see Figures 1 and 2). Farther to the northwest, across the alley, is the “North Capasso” property, occupied by three sister companies, 1) Nanco Contracting, 2) Underground Equipment, and 3) Review Supplies Co. Farther to the southwest, across the LIRR tracks, is the “South Capasso” property. Newtown Creek (Creek) lies beyond the South Capasso property farther to the southeast (see Figure 2).

The Site has been vacated and unused for industrial purposes since 1981. Trespassers have been observed on the Site from time to time over the past few years. On May 24, 2003, the QSAG completed the construction of a 10 to 12 foot high corrugated steel fence which surrounds the Site. To date, this security fence has been effective in eliminating use of the Site by trespassers. Locking gates have been installed to allow access during the RI and other activities. Access will be provided to NYSDEC with prior notice.

The integrity of the fence will be periodically inspected. Inspections will initially be conducted on a weekly basis and fence repairs conducted as necessary. Should trespassers attempt to breach the fence in the future, then reports will be filed with the local Police Department. Inspection frequencies will be reduced when the QSAG is satisfied that this security system is effective for eliminating Site trespassing.

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[1] The RI/FS Work Plan necessarily cites environmental data from previous investigations conducted at the Site as part of the Site description. Although we do not necessarily adopt these findings as reflecting current conditions at the Site, we find it necessary to refer to the findings in preparing this RI/FS Work Plan.

2.2 Site History

2.2.1 Former Operations

According to the available information, the earliest record owner of the Site is American Agricultural Chemical Company ("American"). American transferred the property to Triplex Oil Refining Company ("Triplex Oil") in 1931. Triplex Oil operated the property for approximately 40 years. From approximately 1972 to 1980, the facility was operated by several different owners, including Pentalic Corporation, Sea Lion Corporation, Ag-Met Oil Service, Inc., Hudson Oil Refining Corp, and Portland Holding Corporation. Quanta Resources, which bought the Site from Portland Holding Corporation in July 1980, filed for bankruptcy on October 6, 1981, but still owns the Site.

Sanborn maps (The Sanborn Library, LLC) indicate that historical operations included the refining of used crank case oil. Quanta Resources' operations included recycling, processing and/or storing used and unused oils, solvents and miscellaneous waste materials. The Site was abandoned in October of 1981 after Quanta Resources filed for bankruptcy. Various waste materials were left behind in tanks and related structures leading to an initial investigation and subsequent Removal Action by New York City Department of Environmental Protection (NYCDEP) beginning in the summer of 1982. Figure 3 shows the layout of the Site prior to the Removal Action.

2.2.2 Remedial Action Completed

After the Site was abandoned, NYCDEP and NYSDEC personnel performed an investigation of materials left behind in tanks, vessels, building containment areas, and other structures. Reportedly, the investigations indicated that some of the remaining materials were flammable and that some contained solvents, PCBs, and heavy metals. As a result, in 1982, the NYCDEP contracted CH2M Hill, as the oversight engineer, and OH Materials Corp (OHM) as the remedial contractor to perform a Removal Action.

In total, OHM reported that it removed over 500,000 gallons of liquids and approximately 900 cubic yards of solids (from tanks, containment areas, separators, etc.), portions of which it reported were impacted with PCBs, chlorinated solvents, heavy metals and/or cyanide. OHM emphasized that it had searched for hidden or buried storage tanks that had not been previously discovered by NYCDEP personnel. A magnetometer was used to scan for underground tanks in suspect on-Site areas. A total of 106 aboveground and underground tanks were evaluated as described below. Following the removal, transportation, and off-Site disposal of the liquids and solids, on-Site storage tanks (including aboveground and underground tanks), piping, containment areas, and buildings were reported by OHM to have been emptied and decontaminated. A description of the work completed is presented in the report entitled Engineering Services Report, Quanta Resources Site Cleanup, prepared by CH2M Hill for the NYCDEP, dated December 29, 1982 and summarized below.

All tanks at the Site, including aboveground and underground tanks, were decontaminated and were certified as “gas free” by a licensed Marine Chemist from Marine Chemists Inc. of Hoboken, New Jersey. In addition, the dike areas and separators were decontaminated following the removal of all aqueous liquids, oils, and accumulated sludge. The cleaning and decontamination of the Site’s extensive piping network and appurtenances lasted throughout the duration of the project. The piping was dismantled into workable sections and thoroughly cleaned with potable water using high pressure water lasers. The cleanup and decontamination of Building A required the cleaning of the 14 tanks within the building, decontamination of the walls, floors, and basement areas of the building which had accumulated approximately 3 feet of aqueous/oil waste and sludge. In addition to the 10 tanks within Building F, the floors and walls were decontaminated. The other buildings reportedly did not contain liquid waste materials.

2.2.3 Previous Investigations Completed

At the conclusion of the Removal Action, OHM conducted an environmental investigation on behalf of the NYCDEP and installed four on-Site monitoring wells and collected samples of groundwater, light nonaqueous phase liquid (LNAPL), and composite samples of soil/fill. The activities conducted and findings of the study are presented in the report entitled *Preliminary Hydrogeologic Assessment*, Quanta Resources, New York City, New York, prepared by OHM, January 7, 1983. The sample collection, handling, and analyses procedures were not well documented and the sampling locations are not fully known. Consequently, while these data were useful for scoping the subsequent investigation described below, the OHM data are not appropriate for use in this Remedial Investigation. Only general observations and some limited groundwater/LNAPL measurements from the OHM Study are discussed further in this RI/FS Work Plan.

The firm Lawler, Matusky & Skelly (LMS) conducted a Phase II Investigation from 1988 through 1990 on behalf of NYSDEC (*Engineering Investigations at Inactive Hazardous Waste Site, Phase II Investigation*, Quanta Resources Site No. 241005, May 1990). LMS reported that the soils, LNAPL, and groundwater contained constituents similar to those detected by OHM in the materials removed during the 1982 Removal Action. A summary of the environmental data collected by LMS is presented in Section 2.4.

2.3 Environmental Setting

2.3.1 Site Description

The Site currently exists on a small, approximately 1.8-acre property located in an old, highly industrialized section of Long Island City, Queens, New York. Figure 4 depicts the current condition of the Site. Most of the structures (buildings, tanks, and containment areas) have been demolished since the Site was abandoned in 1981. The remaining structures on the Site include a multi-story building that houses several empty tanks, and one aboveground tank containment area that includes 15 large empty steel aboveground storage tanks (ASTs). During its operation, most of the Site was reportedly covered by asphalt or concrete, and large portions of the southern area of the Site have since been covered with a variably thick layer of post-operational fill and debris. The northern portion of the Site is concurrently covered by asphalt or concrete pavement. A chain link and corrugated steel fence surrounds much of the Site. Piles of construction debris, remnants of buildings and steel tanks and boilers, tires, wood pallets, and associated junk, exists in piles at different areas of the Site including within the existing AST containment area and along the southeast portion of the Site as shown on Figure 4. While these structures and debris piles limit access to certain portions of the Site, there is sufficient access to initiate the Remedial Investigation.

Historically, the properties adjacent to the Site, including the area along Newtown Creek, have been used since the 19th century for a variety of industrial purposes, including coal storage, coal oil production, petroleum storage and refining, chemical and fertilizer production, fat rendering, and other types of industry. Diesel and freight trains have traveled the LIRR tracks along the southeast border of the Site for more than a century.

Newtown Creek is reported to be heavily impacted by historic industrial activities as well as current industrial loading. NYSDEC has issued four permits for Combined Sewer Overflows into the creek and five point source permits within a half-mile of the Site. A New York City Department of Sanitation Report, *Comprehensive Solid Waste Management Plan, Chapter 15: Environmental Review – Review Avenue Site*, October 2000 discusses the environmental condition of Newtown Creek in the vicinity of the Site as follows: "Natural Resources in the form of benthic invertebrates and fish are quite limited in Newtown Creek. Sediment contamination and organic loading prevent the development of a healthy benthic community; the communities present represent the opportunistic species and exhibit low diversity and high concentrations. Low or non-existent dissolved oxygen, particularly during the summer months, combined with lack of food sources, make the waterway unsuitable for passage or survival of most fish species."

The Solid Waste Management Plan, referenced above, identifies the classification of Newtown Creek as "Class SD." According to the New York State Environmental Conservation regulations (Part 701.14), these waters should be suitable for fish survival only, and that because of natural or man-made conditions, cannot meet the requirements for primary and secondary contact recreation and fish propagation.

2.3.2 Site Geology and Hydrogeology

The following presents a summary of the Site geology and hydrogeology. A detailed description of the Site area geology and hydrogeology is presented in Appendix A.

The topography and surficial geology in the vicinity of the Site is largely a reflection of man-made fill (consisting of ash, wood, brick, coal, etc.) that reportedly ranges in thickness from 5 to 19 feet. Unconsolidated deposits beneath the fill are composed primarily of stratified drift (sand and gravel deposits) with some till (an unsorted mixture of clay, silt, sand, gravel, cobbles, and boulders). Underlying these deposits may be proglacial lake deposits consisting of the Gardiners Clay, a confining unit with an average vertical hydraulic conductivity of about 0.001 ft/day. Bedrock is estimated to be between 50 and 100 feet below ground surface (bgs) within the Site area and consists of the Fordham Gneiss.

The Site is located between a local topographic high located northeast of the Site (local groundwater recharge area) and Newtown Creek (a local groundwater discharge area). Groundwater flow, in the relatively flat Site area, under natural conditions, would be expected to flow nearly horizontally south-southwest within the Upper Glacial Aquifer towards Newtown Creek[2]. The Upper Glacial Aquifer is anisotropic with the horizontal hydraulic conductivity estimated to be 10 times greater than the vertical conductivity. Vertical gradients in the vicinity of the Site are expected to be minimal or upward as a result of the high horizontal hydraulic conductivity of the Upper Glacier Aquifer and the presence of a groundwater discharge boundary located approximately 450 feet to the southwest of the Site (Newtown Creek). If vertical gradients are present, they would be expected to be upward, under natural conditions, particularly as groundwater approaches its discharge to Newtown Creek. Figure 5 presents a conceptual hydrogeologic model of the Site.

Public drinking and industrial water supplies for Queens County are supplied primarily by the New York City reservoir system. The area of Queens County that relies on groundwater as its source for potable water is located approximately 6 miles southeast of the Site. A regional groundwater divide is located between the Site and this portion of Queens County. In addition, according to the 1990 LMS report, only a small number of private wells are permitted by the New York City Department of Health for nonpotable uses. Therefore, any groundwater impacts at the Site would be expected to be confined to a thin surficial water bearing unit flowing in a southerly direction toward Newtown Creek, which would not impact any potable water supplies.

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[2] The OHM report discussed that the anticipated horizontal groundwater flow direction would be towards the southwest while the LMS report estimated a groundwater flow direction approximately south. However, these observations were made using fluid levels from wells containing LNAPL. Groundwater levels from wells not impacted by LNAPL are needed during the Remedial Investigation to verify the groundwater flow direction.

2.3.3 Surface Water Hydrology

The Site lies approximately 40 feet above mean sea level (MSL) with its highest elevation along Review Avenue. Calvary Cemetery, located northeast of the Site, on the opposite side of Review Avenue, is locally a topographic high with elevations ranging from approximately 50 to over 70 feet MSL. The area immediately surrounding the Site is relatively flat, having an average southwesterly gradient of approximately 2.5% towards Newtown Creek. Surface water runoff will generally follow topographic gradients, which are to the southwest toward Newtown Creek. Between the Site and Newtown Creek lies the LIRR ROW and industrial properties, which locally affect surface water drainage. Newtown Creek flows west-northwest into the East River.

2.4 Summary of Existing Environmental Data

This section discusses the existing on-Site environmental data primarily as presented in the LMS Phase II Investigation. Only limited information from the Preliminary Hydrogeologic Assessment (OHM, 1982) and available off-Site data were utilized. The relevant data tables and figures from the LMS Phase II Study are presented in Appendix B. A summary of the primary COPC reported by LMS in environmental media is presented on Figure 7.

2.4.1 Soil/Fill

Previous investigations encountered historic fill material across the Site ranging in thickness from 5 to 19 feet. The historic fill material reportedly consists primarily of cinders, wood, brick, coal, and coarse to fine grained sediments. In several areas the historic fill is overlain by a layer of rubble/debris placed subsequent to the termination of historic operations at the Site. Initial observations have indicated that, other than discrete locations of surface staining, this post-operational fill does not reflect characteristics representative of a release of hazardous substances. This observation will be confirmed as part of the Remedial Investigation.

Four surface samples of soil/fill or accumulated solids (SS-1 through SS-4) were collected by LMS at the approximate locations shown on Figure 7. Sample locations SS-1 and SS-4 were collected from solids accumulated within AST containment areas that, as LMS indicated, may have concrete bases and thus not represent actual soil conditions. Sample SS-3 was collected by LMS off-Site within the LIRR (ROW) materials.

The only on-Site surface soil/fill sample was collected by LMS at location SS-2 in an unpaved area of the Site. A summary of the primary COPC reportedly detected in LMS's samples is shown on Figure 7. LMS collected sample SS-2 from an area with characteristics differing from that for samples SS-1 and SS-4: thus direct comparison and interpretation of the reported concentrations was not appropriate. However, it is worth noting that the volatile organic compound (VOC) and semi-volatile organic compound (SVOC) constituents LMS reported in SS-1 and SS-4 were similar to those it reported in SS-2. These same constituents were also generally detected by LMS in LNAPL on-Site (see Section 2.4.2). PCBs were not detected by LMS in SS-1 or in its LNAPL samples, but were detected by LMS in soil collected from SS-2 and SS-4. Given the operational history and time frame for the Site and related potential release mechanisms for COPC reported by LMS, it is reasonable to conclude that investigation of soil/fill representative of the historical operation time frame should be sampled at selected locations across the Site to confirm the presence/absence of these COPC as originally reported by LMS.

Sample SS-3, collected by LMS off-Site within the LIRR ROW, differed from the on-Site samples by the type and magnitude of constituents reported. VOCs and SVOCs were reported by LMS in SS-3 at lower concentrations and PCBs were reported by LMS at a much higher concentration (60 mg/kg). The source(s) of these reported off-Site constituents is (are) unknown. However, it should be noted that railroad tracks in older industrial areas have been shown to be commonly contaminated with VOCs, SVOCs, metals and PCBs. Therefore, the detection of VOCs, SVOCs, and PCBs within the LIRR ROW is not necessarily connected to the Site.

The types and relative concentrations of metals detected in on-Site samples by LMS, while limited and not directly comparable, were generally similar; again indicating the potential for occurrence of these COPC across the Site. The sample results at off-Site sample SS-3 were considerably lower and somewhat disproportionate to the on-Site sample results.

Similar to the conclusion drawn with respect to VOCs, SVOCs and PCBs, the above findings and the historical use of the Site support the development of a Remedial Investigation scope that will assess the potential Site-wide distribution of COPC. The Remedial Investigation should also confirm the presence of historic fill placed at the Site.

2.4.2 Light Nonaqueous Phase Liquid

To confirm the presence of LNAPL identified during the OHM investigation, LMS installed three monitoring wells GW-1, GW-2, and GW-3 at the locations shown on Figure 7. While no soil boring or well construction logs were available, the following construction summary was taken from the text of the LMS report.

	LMS Monitoring Well No.		
LMS Measurements	**GW-1**	**GW-2**	**GW-3**
Depth of Fill	19 ft.	5 ft.	11 ft.
Bottom Depth of Borehole	39 ft.	29 ft	28 ft.
Evidence of LNAPL in Soil	6 ft, 24 to 29 ft. (1)	14 to 28 ft. (1)	14 to 16, 19 to 21 ft.
Bottom of Screen Interval	38 ft.	28 ft.	27 ft.
Top of Screen Interval	28 ft.	18 ft.	17 ft.
Top of LNAPL Layer	---	14.19 ft.	12.46 ft.
Top of LNAPL/Groundwater Interface	22.61 ft.	21.39 ft.	19.82 ft.
Apparent LNAPL Thickness (2)	Sheen(3)	7.20 ft.	7.36 ft.

(1) Drilling may have dragged or allowed LNAPL to penetrate depths below groundwater table.
(2) "Apparent" LNAPL thickness (not actual in-situ thickness of saturated/mobile LNAPL fraction) as reported by LMS.
(3) While no measurable thickness was reported, LMS inferred 2.61 ft. of LNAPL in well GW-1.

Studies conducted subsequent to the LMS Phase II Investigation (DMJ Associates, October 2000) identified the LNAPL as consisting of a "weathered, viscous, 10 weight lubricating oil."

Apparent Thickness

The measurements made by LMS indicate apparent LNAPL thicknesses of approximately 7 feet in wells GW-2 and GW-3. LMS stated that the measured apparent thickness approximated the actual thickness due to the observed coarse-grained nature of the sediments. However, grain size analyses were not performed to quantify the observations. Notably, USEPA states that LNAPL thickness measured in a monitoring well has been reported to typically exceed the actual LNAPL saturated formation thickness (i.e., potentially mobile fraction of LNAPL) by a factor of between approximately 2 and 10 (USEPA, *Groundwater Issues, Light Nonaqueous Phase Liquids*, EPA/540/5-95/5000). So while the LMS data indicate the presence of LNAPL, its actual saturated thickness and volume is in question and should be assessed as part of the Remedial Investigation. More important than thickness, however, is the mobility, distribution, and chemical make-up of the LNAPL. These parameters require examination during the Remedial Investigation in order to assess the potential risks that LNAPL might pose and, thus, the degree to which LNAPL needs to be addressed.

Mobility and Distribution

Any potential LNAPL releases to the subsurface at the Site (to the extent that they came from the Site) are likely to have ended at least 20 years ago as a result of the Removal Action completed by OHM in 1982 (CH2M Hill, 1982). Eventually, if it has not occurred already, the LNAPL will cease to move laterally as the resistive forces in the water-wet subsurface soils (within the saturated zone and capillary fringe) balance the lateral driving forces of the LNAPL lens. In addition, fluctuations in groundwater elevations will smear LNAPL vertically throughout the range of hydraulic variation, thus further trapping LNAPL via capillary forces in residual zones of saturation both above and below the groundwater surface. This, in turn, further decreases LNAPL mobility and migration potential (USEPA540/5-95-500). When immobile, the residual LNAPL presents a potential concern only as a source of dissolved groundwater and vapor-phase constituents. For the biodegradable components of the LNAPL (e.g., VOCs), the dissolved phase impacts will extend to the point where the rate of dissolution of the LNAPL components equilibrates with the rate of biodegradation. For the non-biodegradable components (e.g., metals), the downgradient extent is determined by the equilibrium between rate of dissolution and dispersion (*Evaluating Hydrocarbon Removal from Source Zones: Tools to Asses Concentration Reduction,* Report sponsored by The American Petroleum Institute, January 2001).

A preliminary assessment of the distribution of LNAPL at the Site has been made based on the data reported from studies conducted on adjacent properties.[3] While LNAPL has been detected in off-Site monitoring wells installed sidegradient to the reported south to southwest direction of groundwater flow (i.e., MW-4 on the adjacent west property and MW-8 on the adjacent east property, as shown on Figure 6), it has not been determined whether or not this off-Site LNAPL originated from former operations at the Site. Importantly, however, data from three monitoring wells installed hydraulically downgradient of the Site, i.e., MW-3, MW-3R, and MW-7 (see Figure 6), indicate that LNAPL has not migrated appreciably downgradient from the Site. Monitoring well MW-3 (installed by ERM in 1992) and replacement well MW-3R (installed by Haley and Aldrich in 2000) appear to be located approximately 100 feet (and possibly closer) from the southern Site boundary. LNAPL has reportedly not been detected in either of these two monitoring wells. Additionally, the monitoring well data from MW-7 (Haley and Aldrich, 2000 and DMJ Associates, 2000) also did not show the presence of LNAPL. Taken together, the

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[3] Studies conducted on adjacent properties include the following: ERM, 1990; ERM, 1992; Analytical Results Summary, Haley and Aldrich, Inc. by Chemtech, Project No. L1640LP, 2000; Analytical Results for Triegel and Associates, Inc. by IGLA Laboratories, project No. 9959, 2000; and Haley and Aldreich Inc., DMJ Data Summaries (Water Level Elevations, LNAPL Analyses and LNAPL Measurements), Fall 2000.

available data indicate that the on-Site LNAPL has not migrated far (or possibly not at all) from the Site towards Newtown Creek.

LNAPL Chemistry

Samples of the LNAPL were collected from monitoring wells GW-2 and GW-3 during the LMS investigation and were analyzed for VOCs and SVOCs, PCBs, metals, EP toxicity metals, oil and grease (O&G), and ignitibility. Samples from both the upper and lower portions of the LNAPL column were collected. A summary of the LMS findings is presented below.

- **VOCs -** The VOCs detected in the LMS LNAPL samples were similar to those detected in their soil/fill solids samples (Section 2.4.1) and groundwater samples (Section 2.4.3) and primarily consisted of benzene, toluene, ethylbenzene, and xylene (BTEX) compounds with lower concentrations of chlorinated VOCs (1,2-Dichloroethylene (1,2-DCE), chloroethane, and vinyl chloride). Noticeably absent were trichloroethylene (TCE) and tetrachloroethylene (PCE) as these compounds were detected by LMS in soil and are typically encountered in solvent waste materials particularly when potential biodegradation daughter products are detected (e.g., 1,2-DCE and vinyl chloride). Moreover, TCE and PCE were also not detected by LMS in the groundwater samples while (as with the LNAPL) potential biodegradation daughter products were detected. These findings indicate that either TCE or PCE were not initially present within LNAPL or that natural biological degradation processes had reduced their concentrations to non-detectable levels. The Remedial Investigation will confirm the absence/presence of PCE and TCE and assess natural biotransformations.

- **SVOCs -** The SVOCs detected by LMS in LNAPL were similar to those reported in groundwater and consist primarily of PAHs.

- **Inorganics -** Several metals were detected in the LMS LNAPL samples and include aluminum (Al), arsenic (As), barium (Ba), calcium (Ca), chromium (Cr), iron (Fe), lead (Pb), manganese (Mn), vanadium (Va), and zinc (Zn). The metals having the highest reported concentrations were Al, Ba, Ca, Fe, and Zn. The EP toxicity test results for As, Ba, Cr, Pb, and Hg (not detected) were all less than the regulatory limits by at least one order of magnitude. Cyanide was not detected in any of the LMS LNAPL samples.

- There does not appear to be separate phases of LNAPL as VOCs, SVOCs, and metal concentrations in the upper LNAPL portion were similar to those detected by LMS in the lower LNAPL portion. The marginal differences in concentration reported by LMS between the lower and upper LNAPL portions were likely due to age and weathering differences, not separate phase materials. In addition, while there were some differences in the concentrations of VOCs detected by LMS in LNAPL samples from GW-2 and GW-3, these differences are out-weighed by the similarities, which indicate that the LNAPL at both locations were similar in nature and were likely from related, commingled sources.

- **PCBs -** Low concentrations of PCBs were detected by LMS in the GW-3 LNAPL sample. PCBs were not detected by LMS in the GW-2 LNAPL sample.

- **Oil and Grease -** The oil and grease component of the LNAPL in GW-3 was reported by LMS to be 30%. The oil and grease analysis was not run for the GW-2 sample due to laboratory mishandling.

- **Ignitibility -** All LMS LNAPL samples exhibited a flash point greater than 212^{o}F further indicating the LNAPL was of similar character.

2.4.3 Groundwater

As discussed previously, LNAPL was detected by LMS in all groundwater wells (reportedly, GW-1 had a sheen and GW-2 and GW-3 had approximately 7 feet of LNAPL). While it is assumed that the LMS sampling and laboratory protocols would have attempted to minimize the impact of LNAPL on the groundwater samples, it is possible that some degree of LNAPL impact inadvertently occurred. As a result, analytical results reported by LMS may overstate the concentration of constituents that had actually dissolved in groundwater. Therefore, one of the objectives of the Remedial Investigation is to install monitoring wells that allow collection of representative groundwater samples. A brief summary of the groundwater sample analyses results reported by LMS is provided below. Figure 7 shows the location of the LMS wells and a summary of the constituents detected by LMS.

- ***VOCs*** - Not surprisingly, the VOCs detected by LMS in groundwater were similar to those detected by LMS in LNAPL and included BTEX compounds and chlorinated VOCs. The chlorinated VOCs were typical daughter products from biological reductive dechlorination of PCE, TCE, and 1,1,1-trichloroethane (1,1,1-TCA), which were not detected by LMS in groundwater nor in LNAPL. As stated in Section 2.4.2, the reported absence of PCE, TCE, and 1,1,1-TCA is surprising and may indicate they had attenuated to not detectable levels. In addition, the reported dissolved phase concentrations of VOCs were several orders of magnitude lower than the concentrations of the same VOCs measured by LMS in LNAPL samples. This large concentration reduction from LNAPL to the dissolved phase was likely a result of the low effective solubility of the VOCs held within the hydrophobic LNAPL and/or the rapid biodegradation of VOCs once they become bioavailable (dissolved) in groundwater.

- ***SVOCs* –** Similar to the LMS LNAPL results, the primary SVOCs detected in groundwater were PAHs. The potential for LNAPL to have been inadvertedly collected in the LMS groundwater samples may have contributed to these PAH levels.

- ***Pesticides/PCBs*** - Neither pesticides nor PCBs were detected in any of the groundwater samples.

- ***Inorganics*** - The primary metals detected by LMS in groundwater were antimony, barium, iron, and manganese.

As stated in the LMS report, the highest concentrations of iron and manganese reported in the 1990 data occurred in the upgradient well GW-1 indicating a non-Site-specific source and/or natural conditions. Cyanide was not detected by LMS in any of the monitoring well samples.

3.0 CONCEPTUAL SITE MODEL

The Conceptual Site Model (CSM) ties together relevant factors and existing data identified in Section 2.0. Based on these factors and data, there is a low probability that exposure pathways extend beyond the Site boundary to any potential receptors. This analysis is the rationale for conducting the first phase of the Remedial Investigation on the Site. The CSM was prepared in accordance with NYSDEC guidance and further details this rationale along with the discussion below.

The entire Site and surrounding properties have been used for a variety of industrial purposes since the late 19th century. The Site overlies glacial deposits and a mixture of man-made historic fill (ranging in thickness from 5 to 19 feet). Sands with some limited fine texture deposits dominate the glacial deposits near the surface at the Site and throughout most of Queens County. The Jameco gravel unit may be present locally beneath the glacial sand unit. Proglacial lake deposits consisting of the Gardiners Clay possibly underlie the near surface sands and overlie the Fordham Gneiss bedrock. Only the near surface glacial deposits are considered in detail in the CSM because of the limited potential for downward hydraulic gradients that would be predicted, given the high horizontal hydraulic conductivity and close proximity of the Site to a major groundwater discharge point, Newtown Creek. Also, there have been no reported observations of DNAPL at the Site. Newtown Creek is approximately 450 feet southwest of the Site.

As a result of NYCDEP Removal Action activities at the Site, all primary sources have reportedly been removed. Secondary sources are primarily limited to the relatively low concentrations of COPC in oil residuals that are adsorbed to soils/fill and distributed as LNAPL in the vicinity of the water table across portions of the Site. These secondary sources may pose no significant threat to human health or ecological receptors based on the lack of exposure points, the lack of mobility of the secondary sources, and current or anticipated land use. However, additional data will be collected to characterize potential direct contact exposure scenarios and volatilization risks from VOC movement into commercial/industrial buildings, as part of the assessment of future Site use risks. Figure 8 presents a graphical depiction of the CSM.

Groundwater is not known to be used for any purpose in the vicinity of the Site. Based on the LMS study results, minimal leaching of COPC to groundwater has occurred. In addition, the extended period that the Site has been inactive has provided a significant time period for natural attenuation processes to reduce and sequester the potentially mobile chemicals at the Site.

Considerable natural attenuation is predicted based on the relatively high degradability of the organic COPC beneath the Site. These factors support the preliminary view that Site-related COPC are likely limited to the soils and shallow groundwater beneath the Site area and do not pose a significant threat to off-Site human or ecological receptors.

Off-Site, differential infiltration of water and contaminants from other downgradient sources, along the rail lines and other properties likely influence off-Site groundwater flow and water quality. In addition, Newtown Creek has been significantly degraded by many decades of past-unpermitted discharges upstream and downstream of the Site. Consequently, further characterization and assessment of Site-related COPC (horizontally and vertically) is needed to further confirm the CSM and establish the gradients of decline of COPC concentrations from the Site prior to undertaking any off-Site assessment.

4.0 PRELIMINARY ARARS/SCGS AND REMEDIAL ACTION OBJECTIVES

The selection of potential Applicable or Relevant and Appropriate Requirements/New York State Standards, Criteria and Guidelines (ARARs/SCGs), and criteria To Be Considered (TBCs) for the Site will be consistent with the requirements of the National Contingency Plan (Section 300.400(g)) and EPA Guidance (CERCLA Compliance with Other Laws Manual: Interim Final, August 1988). In addition, New York State regulatory guidance such as relevant Technical Assistance Guidance Memoranda (TAGM - 6NYRR Chapter IV, Part 375) and the Division of Water Technical and Operational Guidance Series (TOGs - 6NYRR Chapter 10), will also be included in the evaluation/selection process. This information will be evaluated in a manner consistent with the National Contingency Plan (NCP) (Sections 300.400(g) and 300.430(f)) and relevant USEPA and NYSDEC guidance.

The approach for identifying the potential ARARs/SCGs begins during the Remedial Investigation. ARARs/SCGs can be categorized as chemical-specific, action-specific, or location-specific requirements. Chemical-specific ARARs/SCGs are health-based or risk-based numerical values that may define acceptable exposure levels and be used in establishing remediation goals. Based on the information available at the Site, potential chemical specific ARARs/SCGs may include standards developed under the Resource Conservation and Recovery Act (RCRA), the Clean Water Act, or the Toxic Substances Control Act for the treatment or disposal of VOCs, SVOCs, PCBs, or metals reportedly found in soils and groundwater.

Location-specific ARARs/SCGs are restrictions based on the concentrations of hazardous substances or the conduct of activities in a specific area. Potential location-specific requirements can be established under a number of different environmental statutes, such as RCRA or CWA. For example, certain limitations on on-Site treatment, storage or disposal may be required under RCRA or the Hazardous and Solid Waste Amendments (HSWA) may be identified as potential ARARs/SCGs.

Action-specific ARARs/SCGs are technology- or activity-based requirements or limitations on actions to be taken with respect to hazardous substances. These requirements are triggered by particular cleanup activities selected as the remedy. A preliminary list of action-specific requirements will be developed according to the type of remedial technologies that are evaluated throughout the RI/FS.

Because of the iterative nature of the RI/FS process, the identification of ARARs/SCGS, TBCs and remedial technologies will continue throughout the RI/FS as a better understanding of the Site conditions, COPC, and potential remedial technologies evolve. Using this approach, appropriate risk-based remedial action objectives for soils and groundwater at the Site will be determined.

5.0 WORK PLAN RATIONALE

5.1 Remedial Investigation Approach

5.1.1 Phased Approach

The Remedial Investigation will be conducted in a phased manner. The Phase I Remedial Investigation will initiate the characterization of on-Site conditions and will assess the condition and availability of off-Site monitoring points for use in the next phase. A review of available off-Site data will also be conducted during the Phase I Remedial Investigation. The Phase II Remedial Investigation will be designed to complete the on-Site characterization as well as assess off-Site impacts (if any) and potential off-Site exposure pathways indicated by the Phase I results. The Phase II Remedial Investigation will utilize appropriate off-Site data and the sampling of off-Site monitoring wells. The scope of the Phase II Remedial Investigation will be determined at the conclusion of the Phase I Remedial Investigation.

5.1.2 Investigation Rationale

A review of historical operations at the Site (see Section 2.2), the Site environmental setting (see Section 2.3), and the previously reported distribution of COPC at the Site (see Section 2.4) has been completed as part of the Scope of Work development. This work has indicated the following general characteristics:

- As shown on Figure 3, former operations at the Site were complex and crowded onto a small approximately 1.8-acre property. Numerous tanks, vessels, buildings, separators, and appurtenances were operated in overlapping areas across the Site.

- COPC at the Site have potentially commingled as a result of past practices as well as more recent disturbances. Similar constituents occur in all Site media and may have been dispersed across the Site by former operations and subsequent Site grading activities;

- Site decontamination/decommissioning activities conducted by OHM on behalf of the NYCDEP reportedly removed hazardous substances from all operational tanks, vessels, piping, buildings, etc. In addition, the majority of the Site structures have been removed; and,

- Historic fill is present across the Site that potentially contains COPC.

Based on the above, the Remedial Investigation will focus on defining the essential characteristics and extent of the LNAPL mass, which has apparently been detected at the Site, and the COPC in impacted soil/fill, groundwater, as well as LNAPL at the Site. In all cases, the investigation program and subsequent results will be evaluated with respect to relevant current and potential future exposure pathways. The specific objectives of the work with respect to the foregoing rationale are provided below.

As a practical matter, it is proposed that the Remedial Investigation should be managed in a Site-wide manner that encompasses potential operations that may have impacted soil/fill and groundwater. This Site-wide Remedial Investigation approach is not only necessitated by the conditions described above, but is consistent with the Site risk management and redevelopment strategy.

5.2 RI/FS Objectives

This section lists specific objectives of the RI/FS for the Site. The following objectives are based on the relevant factors associated with the Site conditions, the CSM and preliminary ARARs/SCGs presented herein:

- Objective 1: Estimate spatial distribution, mobility, and perform a chemical characterization of LNAPL.
- Objective 2: Establish concentration distribution and gradient of COPC within soil, groundwater, and LNAPL along exposure pathways.
- Objective 3: Define important hydrogeologic parameters needed to assess COPC fate and transport, such as groundwater flow direction and gradients.
- Objective 4: Assess COPC fate and transport based on empirical data and literature.
- Objective 5: Assess potential contributions of COPC from other properties to groundwater (upgradient, sidegradient and downgradient areas).
- Objective 6: Determine potential exposure pathways and potential receptors to COPC originating from the Site.
- Objective 7: Evaluate potential threats to human health and the environment.
- Objective 8: Identify a range of remedial alternatives that eliminate the significant threats to human health and the environment in accordance with 6 NYCRR Part 375-1.4(b)(1)-(13) and evaluate those remedial alternatives in the context of the Site setting and redevelopment options.

6.0 RI/FS TASKS

This section presents the scope of work for the various tasks proposed to complete the RI/FS at the Site.

6.1 Task 1: Scoping the RI/FS

The scoping process, conducted for the purpose of identifying and defining the specific RI/FS tasks described below, has been completed and consisted of the following activities:

- Visits to the Site and surrounding areas;
- Review of the Consent Order requirements and relevant State and Federal guidance documents;
- Compilation of existing studies and information on the Site, adjacent properties and surrounding area; and,
- Evaluation of the compiled available data.

The information used during the scoping process is referenced throughout this Work Plan and is listed in Section 8.0.

6.2 Task 2: Citizen Participation Plan

A Citizen Participation (CP) Plan will be followed in accordance with New York Environmental Conservation Law, hazardous waste site regulations (6 NYCRR Part 375) and Citizen's Participation in New York's Hazardous Waste Site Remediation Program: A Guidebook (NYSDEC, DER, 1998). The overall objectives of the Citizen Participation Plan, as stated in the NYSDEC guidebook, are as follows:

- Inform the affected/interested public about the Site, its environmental impacts, and planned and ongoing actions to investigate or remediate the Site;
- Establish opportunities for the public to provide meaningful input into the Site's remedial decision making process; and
- Help to factor the public's input, as appropriate, into remedial decisions.

The QSAG understands the following actions will be undertaken by NYSDEC during the RI/FS to meet the requirements of the NYSDEC Citizen Participation Program:

- Citizen Participation Record This document will list the required CP activities and identify issues and information that are important to the community. The record will also help to identify any additional CP activities that might be necessary.

- Contact List This list will include contact information for any residents that are adjacent to the Site, government officials, local media, businesses, or other groups or organizations affected by or interested in the Site.

- Document Repository A document repository will be set up in the NYSDEC Region II office in Hunter's Point Plaza in Long Island City. An additional repository will be set up in a publicly accessible location (such as a library) near the Site.

- Fact Sheet A fact sheet will be prepared and mailed to all parties listed on the Contact List. The fact sheet will announce the availability of the final draft RI/FS Work Plan and will provide a brief summary of information and the decision process at various milestones reached during the project such as at the conclusion of the Remedial Investigation and during the evaluation and selection of remedial alternatives.

6.3 Task 3: Phase I Environmental Investigation

This section discusses the proposed scope of work for the Phase I Remedial Investigation. As discussed in Sections 5.1.1 and 6.6, the scope of the Phase II Remedial Investigation will be developed at the conclusion of the Phase I Remedial Investigation and will be proposed to NYSDEC as part of the Phase I Data Summary Report.

6.3.1 Task 3.1: Field Investigation

Field work will be performed in accordance with the requirements and protocols described in the Health and Safety Plan (HASP) provided in Appendix C. All field sampling and laboratory analyses will be performed in accordance with the requirements and protocols described in the Sampling and Analyses Plan (SAP), which includes a Quality Assurance Project Plan (QAPP) provided in Appendix D.

6.3.1.1 Soil/Fill Investigation

The specific objectives of the soil/fill investigation are:

- Determine the magnitude and distribution of COPC in surface and subsurface soil/fill;

- Assess physical characteristics of the soil/fill;

- Assist in the assessment of the distribution of LNAPL; and,
- Assess the distribution, and characteristics of historic fill placed at the Site.

In order to meet these objectives, a total of ten soil borings, SB-05 through SB-14, are proposed at the approximate locations shown on Figure 9. The locations of the borings were selected to provide a spatial distribution across the Site with adjustments considering physical access, locations where COPC were previously reported, and areas of previous industrial activity. In addition, three borings used to install the proposed monitoring wells (described in Section 6.3.1.2) will be incorporated into the soil/fill investigation (i.e., SB-01 through SB-03). Further, the off-Site boring, which will be used to install the upgradient monitoring well (SB-04), will be used for the collection of background data. In summary, the soil/fill investigation will include a total of 13 on-Site borings and one off-Site boring.

The borings will be advanced using hollow stem auger (HSA) drilling methods with continuous split spoon sampling (as per ASTM D-1586-84). The borings will extend through the LNAPL smear zone (where present) and down to the phreatic surface. Monitoring of VOCs in the breathing zone during drilling will be performed using a photo-ionization detector (PID). Each soil/fill split spoon sample will be visually examined and classified with respect to the United Soil Classification System (USCS) and described in regards to the sample texture, composition, color, consistency, percent recovery and moisture content. Additionally, the potential presence of odors, staining, and LNAPL will be noted.

Samples for physical and analytical testing will be collected from each of the ten boreholes and four monitoring well borings at 5-foot intervals (0 to 2 feet, 5 to 7 feet, 10 to 12 feet, and 15 to 17 feet) as follows. Samples from all of 5 to 7 foot and 10 to 12 foot intervals in each boring will be submitted for laboratory analyses. A 0 to 2 foot surface soil sample will not be analyzed at locations where there is obvious fill/debris that had been placed subsequent to the termination of Site-related operations (i.e., post-operational fill) or where the surface debris will likely be moved/removed at a future date and thus not represent future direct contact exposures. It is estimated that these conditions will exist in about half of the soil borings. Samples deeper than the 10 to 12 foot interval will be collected to provide vertical delineation if field screening impacts are observed at or below the 10-12-foot interval (substantial staining, odors or PID readings). Similar to the collection of surface soil samples, it its assumed that samples deeper than the 10 to 12 foot interval will be collected in about one half of the on-Site borings.

Background soil samples will be collected for laboratory analyses from the off-Site boring at the following intervals; 0 to 2 feet below pavement structure, 5 to 7 feet, 10 to 12 feet, and 15 to 17 feet (if above groundwater).

Notably, continuous split-spoon soil sampling will be conducted in each of the soil borings to provide a continuous log of physical characteristics, soil descriptions, and field screening results. Three-inch split spoons will be utilized to improve sample recovery, particularly within the historic fill. Soil/fill samples for laboratory analysis will be collected at predetermined intervals in order to provide a consistent cross-sectional interpretation of subsurface soil impacts.

Samples will be analyzed in a laboratory for Target Compound List (TCL) organic compounds (minus pesticides) and Target Analyte List (TAL) inorganic constituents. Pesticides are not included as they have not been identified in previous reports as COPC at the Site. In addition, a total of ten samples will be tested for grain size distribution and total organic carbon (TOC) to physically characterize subsurface materials. Table 1 provides a summary of the soil sampling program.

6.3.1.2 Groundwater Investigation

The specific objectives of the groundwater investigation are:

- Install monitoring wells screened below the LNAPL smear zone in order to collect representative shallow groundwater samples and to provide an accurate measurement of the phreatic surface;
- Assess the presence and magnitude of COPC dissolved in groundwater;
- Assess the biological and abiotic natural attenuation of dissolved groundwater COPC;
- Determine aquifer parameters such as hydraulic conductivity, gradients, and estimates of porosity; and,
- Assess the usability of existing on-Site and off-Site monitoring wells.

In order to meet these objectives, three on-Site groundwater monitoring wells (GA-1, GA-2 and GA-3) will be screened below the LNAPL smear zone and one off-Site monitoring well (GA-4) will be installed upgradient at the approximate locations shown on Figure 9. Off-Site access will be required for upgradient well GA-4 that will likely be located in the sidewalk on the opposite side of Review Avenue (north of the Site).

The monitoring wells will be installed using HSA drilling techniques. Soil samples will be collected from each well boring as described above for the soil/fill investigation. If LNAPL is observed, double casing will be installed to the base of the LNAPL smear zone to minimize potential groundwater impacts. The top of the well screens will be installed approximately 10 feet below the LNAPL smear zone to isolate the screen interval from potential LNAPL impacts due to future groundwater fluctuations. Once the LNAPL zone is cased off, the monitoring wells will be cased and screened using flush joint threaded 2-inch diameter schedule 40 PVC with 0.020 slot screen. Each well screen will be 10 feet in length.

Following installation, each well will be surveyed by a NYS licensed surveyor. The wells will be developed no sooner than 24-hours after installation as per NYSDEC guidance and sampled no sooner than seven days upon completion of development. All wells will be purged and sampled following the USEPA Region II procedure for Low Flow Purge and Sampling (USEPA Region II, March 1998). Prior to sampling, a round of water levels will be collected from all on-Site wells and the off-Site background well. The groundwater samples will be analyzed for TCL organic compounds (minus pesticides), TAL metals and the following natural attenuation parameters; light hydrocarbons, chloride, alkalinity, TOC, DOC, TDS, nitrate, sulfate, and CO_2. Table 1 provides a summary of the groundwater sampling program.

In addition to the activities described above, an assessment of existing on-Site and nearby off-Site monitoring wells will be conducted. Off-Site access agreements will need to be obtained for the inspection of off-Site monitoring wells. If present and if access is granted, each will be inspected and sounded. Existing on-Site wells will be surveyed. Consideration will be given to surveying off-Site wells if detailed logs are not available. A well search (1/2 mile) will be conducted to assess whether or not any potential anthropogenic hydrogeologic stresses exist nearby and whether any other nearby monitoring wells exist.

A short-term (1-hour or less), constant low rate pump test (including recovery) and/or slug tests (analyzed using the van der Kamp method for high conductivity aquifer conditions) will be conducted at two locations to determine the hydraulic conductivity of the Upper Glacial Aquifer at the Site. The specific method will be based on the field conditions encountered. This testing approach will minimize the potential to lower the LNAPL (if present) into the well screen. Transducers will be installed in two monitoring wells to assess potential tidal effects on water levels. The transducers will be placed in the wells approximately one week prior to the pump/recovery tests.

6.3.1.3 Light Nonaqueous Phase Liquid Investigation

The specific objectives of the LNAPL investigation are:

- Install monitoring wells specifically designed to monitor LNAPL;
- Assess the physical characteristics of subsurface materials at the groundwater/LNAPL interface;
- Assess LNAPL physical characteristics;
- Assess thickness, distribution, and mobility of the LNAPL; and,
- Determine the presence and magnitude of COPC within the LNAPL.

The extent of LNAPL on the Site will be initially assessed as part of the soil boring and monitoring well installation programs described above. A total of three on-Site LNAPL monitoring wells, GA-5, GA-6 and GA-7, will be installed using HSA drilling methods at the locations and depths selected based on the findings of these investigations. Preliminary locations of the LNAPL motoring wells are shown on Figure 9. The approximate mid-point of the well screens will be installed across the groundwater/LNAPL interface. This configuration may vary depending on the location of the groundwater/LNAPL interface versus the thickness and position of the smear zone. The monitoring wells will be cased and screened using 4-inch diameter schedule 40 flush-joint threaded PVC with 0.020 slot screen. Each well screen will be 10 feet in length. Longer screen lengths may be used depending on the height of the LNAPL smear zone.

Following installation of the LNAPL wells, an oil-water interface probe will be used to measure apparent LNAPL thickness and the groundwater/LNAPL interface. A bail down test will be conducted in each on-Site LNAPL well to help assess the LNAPL thickness, mobility and effective conductivity. Samples of the LNAPL will be collected and analyzed in the laboratory for TCL VOCs, SVOCs, PCBs, TAL metals, chemical fingerprint, and select conventional parameters (specific gravity, viscosity, total organic halides (TOX), sulfur, % solids, flash point, and BTU) as summarized in Table 1. Pesticides and cyanide were not detected by LMS in LNAPL. Samples of the subsurface sediments in the vicinity of the groundwater/LNAPL interface will be collected for possible grain size distribution analysis.

As discussed in Section 6.3.1.2 above, a Site reconnaissance will be initially conducted in an attempt to locate and assess the condition of previously installed LNAPL monitoring wells (e.g., GW-1, GW-2, and/or GW-3). If these wells are located and are found to be in good condition, then the wells will be surveyed and used as LNAPL observation points (i.e., for the assessment of LNAPL presence/absence and thickness measurements, if present).

The LNAPL data collected during the Phase I RI field investigation (chemical and physical testing of samples collected at GA-5, GA-6, and GA-7, and presence/absence and thickness observations at previously installed wells, if in good condition) will be evaluated and compared to the previously collected LNAPL data (see Section 2.4.2) to assess the variability in LNAPL chemical and physical character. If the degree of variability is determined to be important with respect to the assessment of the nature and extent of impacts or potential remedial options, then LNAPL samples will be collected from the previously installed monitoring wells (found to be in good conditions) for chemical and/or physical testing during the Phase II investigation. In no case will groundwater samples be collected from any newly or previously installed LNAPL monitoring well.

6.3.1.4 Soil Gas

While a soil gas study has not been specifically proposed as part of the Phase I Remedial Investigation, consideration of a soil gas study will be given following the characterization of the LNAPL distribution on the Site. The details of the soil gas study, if appropriate, will be proposed to NYSDEC as part of the Phase I Data Report discussed below.

6.3.1.5 Site Base Map

A base map will be created for the Site. The base map will include topography, key features (i.e., buildings, tanks, and debris piles) and a metes and bounds survey by a NYS licensed surveyor. The location of all boreholes and monitoring wells (including elevations) installed as part of the Phase I Remedial Investigation will be surveyed and included on the base map. Additionally, existing on-Site wells installed during previous investigations (if found and useable) will also be surveyed and included on the base map.

6.3.1.6 Off-Site Source Evaluation

Several properties adjacent to the Site have conducted environmental investigations. While some off-Site study results were viewed as part of the scoping of this RI/FS Work Plan, a more comprehensive review of data collected from these investigations and other investigations, if available, will be conducted to supplement the Phase I Remedial Investigation data, as appropriate. In addition, off-Site monitoring wells will be inspected and sounded for potential use during the Phase II Remedial Investigation.

6.3.1.7 Wastewater Containment Structure and Southern Pipes Evaluation

The concrete wastewater containment structure located at the southwest corner of the Site will be inspected during the Phase I RI field investigation. If residuals associated with the containment structure are observed, a sample of the residual, biased to the area of highest concern, will be collected and analyzed for TCL SVOCs, PCBs, and TAL metals.

Two pipes extended off-site from the rear or southern side of the Site. One of these two pipes is reported to be an 8-inch diameter product delivery line that linked the Quanta Resources facility to barges in Newtown Creek. As described in the LMS Phase II Report (page 4-3, 2nd paragraph), that line has been sealed according to the U.S. Coast Guard. The second pipe (shown on RI/FS Work Plan Figure 3) directed storm water collected in catch basins at the Site to Newtown Creek. These catch basins have since been covered during subsequent Site closure activities.

Based on the available information, both pipes have been isolated from the Site. To verify these findings, it is proposed that further research of the past use and closed condition of the pipes be conducted during the Phase I investigation to assess what additional investigation, if any, is warranted during the Phase II investigation.

6.3.2 Data Analysis and Data Management

All samples will be analyzed in accordance with the analytical methods listed in Table 1. The chemistry data will be transferred by the laboratory and maintained by Golder Associates in database format (i.e., Microsoft Access). The analytical laboratory will provide an Electronic Data Deliverable, which will be uploaded directly into the database without modification. All changes to the database are made in the raw data files as well as the database querying and reporting files. All database reports are version controlled to ensure that only the most up-to-date data are used.

For all analytical samples associated with this project, the laboratory will produce CLP-type or SW846 data packages that will contain all information needed for formal validation of the data. Data validation will be performed on 100% of the data in accordance with the USEPA Region II Standard Operating Procedures (SOPs) HW-6, Revision 11 (TCL Organics data) and HW-2, Revision 11 (TAL Inorganics data). These procedures are specific with regard to evaluation of holding time, surrogate and spike recoveries, precision of duplicate measurements, calibration and instrument performance, blank contamination, compound identification, and compound quantification. Data will be qualified as necessary in accordance with the SOPs and any qualification will be explained in a data usability summary report (DUSR).

Non-TCL/TAL data will be evaluated, using the USEPA data validation SOPs and the appropriate NYSDEC guidance documents, based upon holding times, blank results, and quality control (QC) results assessing accuracy and precision. All analytical data packages will be reviewed for completeness and QC summaries will be evaluated and compared to the appropriate precision and accuracy criteria (PARCC). The PARCC criteria and criteria specified in other applicable guidelines may not always be achievable. Professional judgment, in conjunction with the USEPA data validation SOPs and the appropriate NYSDEC guidance documents, will be used to determine data usability. Any qualification of non-TCL/TAL data will also be explained in the DUSR.

All analytical data will be supplied electronically by the laboratory and will be uploaded directly into a project database. Any qualifiers that are applied to the results during the validation process will be manually entered into the database. Qualified results will be tabulated directly from the database. All results and qualifiers are then checked to confirm accuracy.

6.3.3 Site Characterization Deliverables

Upon completion of the field activities and laboratory analyses, the field data will be compiled, tabulated, and evaluated; laboratory analyses results will be validated and tabulated, and the geologic, hydrogeologic, and CSM will be refined. The results of the validated data will be compared to historical data and NYS SCGs to approximate a spatial and temporal understanding of the nature, extent and fate of COPC. The results of the Phase I Remedial Investigation will be presented in a Phase I Data Summary Report, which will include a proposal for a Phase II Remedial Investigation, for submittal to NYSDEC. The Phase I Data Summary Report will include a discussion of the results sufficient to support the proposal of the proposed Phase II activities. It is envisioned that a comprehensive Remedial Investigation Report would be prepared following the completion of the Phase II Remedial Investigation and would present the results and comprehensive evaluation of both investigations including a human health and environmental exposure assessment.

6.4 Task 4: Sampling and Analysis Plan

The SAP includes the QAPP and is provided in Appendix D.

6.5 Task 5: Health and Safety Plan

The Health and Safety Plan prepared for use during the project is presented in Appendix C.

6.6 Task 6: Evaluation of Data Gaps and Refining RI/FS Objectives

During the course of the RI/FS, the collected project information will be compiled and evaluated to assess whether or not any data gaps remain or new data gaps arise that require additional information to meet the RI/FS objectives. While this is an ongoing task, the first stage of the project where data gaps and RI/FS objectives will be formally assessed is at the conclusion of the Phase I Remedial Investigation activities as currently scoped in this RI/FS Work Plan. As discussed above in Section 6.3.3, the Phase I Remedial Investigation data will be compiled and evaluated and any remaining data gaps (or new data gaps) will be identified and presented in the Phase I Data Summary Report. This report will include a proposal for the collection of additional information during the Phase II Remedial Investigation needed to address these data gaps and meet the RI/FS objectives. This process will be formally repeated at the conclusion of the Phase II Remedial Investigation, and during the preparation of the Final Remedial Investigation Report, which will assess the need to gather additional information or to conduct treatability studies for the purpose of completing the evaluation of remedial alternatives as discussed in Section 6.10 below.

6.7 Task 7: Human Health Risk Assessment

Under NYCRR, Chapter IV, Part 375, remedial action selection must be consistent with the Federal NCP of 1990 and under Part 375-1.4 remedial actions address *significant threats to the* *environment*. In addition, the NYSDEC has issued TAGMs on the determination of soil cleanup objectives and cleanup levels. Similarly for groundwater, NYSDEC Division of Water has issued a TOGs on the determination of groundwater cleanup objectives and levels. Attainment of these generic soil cleanup objectives, for example, will eliminate all significant threats to human health and/or the environment posed by an inactive hazardous waste Site located anywhere in the State of New York (TAGM #4046). However, the NYSDEC recognizes that final Site-specific soil and groundwater cleanup levels are subject to Site-specific factors that are evaluated in part during the Remedial Investigation and in detail in the Feasibility Study.

To evaluate potential risks posed by residual COPC and LNAPL at the Site, the following steps will be employed:

1. Preparation and refinement of the Site Conceptual Model, emphasizing the identification of potentially complete exposure pathways and potential exposure points.
2. Identification of COPC based on the TAGM soil criteria and additional toxicity assessment if needed.
3. Completion of a Site-specific Exposure Assessment, based on empirical data, fate and transport evaluation and vapor intrusion modeling, as necessary.
4. Preparation of an Exposure Assessment Report, including a risk characterization of COPC and identification of significant threats to the environment (NYCRR Part 375-1.4).

All work will be conducted in a manner consistent with the NCP and relevant CERCLA guidance. The Exposure Assessment Report and the significant threats identified in the report will be the basis of the risk analysis in the subsequent FS activities that will be directed at establishing remedial goals. Since there is no groundwater use at the Site, emphasis will be placed on the direct contact threats and vapor intrusion into buildings, on the Site, and surrounding area. Fate and transport modeling and empirical data will be utilized to characterize potential risks to off-Site receptors, if warranted.

6.8 Task 8: Treatability Studies

No treatability studies are envisioned at this time. The need for treatability studies will be reassessed at the conclusion of the Remedial Investigation.

6.9 Task 9: Remedial Investigation Report

Once sufficient information is collected to complete the Remedial Investigation and address the Remedial Investigation objectives as described in Section 5.0, then a Remedial Investigation Report will be prepared and submitted to NYSDEC for review. The Remedial Investigation Report will be prepared in accordance with the Consent Order and with applicable USEPA and NYSDEC guidance.

6.10 Task 10: Feasibility Study

Consistent with the Consent Order, the Feasibility Study will be performed in accordance with USEPA and NYSDEC guidelines. The Feasibility Study will include the development of alternatives that are appropriate for assessment under CERCLAand the NCP and appropriate NYSDEC TAGMS. The Feasibility Study will be performed and submitted in a phased approach as described in the following sections.

6.10.1 Task 10.1: Technical Memorandum

A Technical Memorandum will be prepared and submitted to the NYSDEC for the purpose of obtaining NYSDEC concurrence on a “short-list” of remedial alternatives prior to conducting the detailed analyses. In this manner, Feasibility Study efforts will be streamlined and a decision with respect to a preferred remedial action can be reached in a more efficient manner and a shorter timeframe. RAOs will be established based on the results of the Risk Assessment, the potential future use for the Site, and an analysis of ARARs/New York State SCGs. Based on the results of the Remedial Investigation and using the established RAOs, technologies (including institutional controls) will be identified and screened. The various technologies will then be assembled into combinations of Site-wide remedial alternatives. Once assembled, the potential remedial action alternatives will be screened in accordance with EPA's guidance (based on overall protection, implementability and cost). A “No Action” alternative will be included to comply with the requirements of the NCP. The development of a “short-list” of remedial action alternatives will then be completed selecting the most promising and feasible Site-wide alternatives that are able to provide adequate protection of human health and the environment and able to comply with ARARs/SCGs with or without a justified waiver. The results of this analysis will be presented to NYSDEC in the Technical Memorandum. Notably, NYSDEC TAGM #4030 indicates that when a remedial action alternative is apparent for a site it is not necessarily beneficial to go through the entire remedial alternative selection process. The timing for submittal of the Technical Memorandum may vary depending on the status of the Site characterization and risk assessment.

Requirements for Site-specific treatability studies shall be considered for each technology utilized in the short-list of Site-wide alternatives and if treatability studies are warranted they will be proposed as part of the Technical Memorandum. A Treatability Testing Work Plan (TTWP) together with the required schedule extension, may be completed and submitted to NYSDEC for review and approval, if the most promising candidate technology requires such a study.

6.10.2 Task 10.2: Detailed Analysis of Alternatives

A detailed analysis will be performed for each of the remedial action alternatives identified in the Technical Memorandum. The analysis of each remedial alternative will be based on an evaluation of the nine criteria established in the NCP. Two of the nine NCP criteria (state acceptance and community acceptance) will be evaluated as follows. State acceptance will be achieved based upon NYSDEC's concurrence with the eventual selection of the remedial action. Community acceptance will be evaluated from the public comments received from solicitation of public comment on NYSDEC's recommended alternative as part of the implementation of the Citizens Participation Program (see Section 6.2). The remaining seven criteria that will be used for the detailed analyses of alternatives, in accordance with the NCP and NYSDEC TAGM #4030, are as follows:

- Overall protection of human health and the environment;
- Compliance with ARARs/SCGs;
- Short-term effectiveness and performance;
- Reduction of toxicity, mobility and volume;
- Implementability; and,
- Cost effectiveness.

NYSDEC TAGM #4030 provides a description of each of these criteria. Once the detailed analysis of each alternative is completed, a comparative analysis of all alternatives will be completed. The detailed and comparative analysis of remedial alternatives will focus on the ability of alternatives 1) to provide meaningful risk reduction; 2) to meet ARARs/SCGs and waivers of such ARARs/SCGs appropriate for the Site's environmental setting; 3) to be technically consistent with likely Site beneficial reuse scenarios; and, 4) to have Operation and Maintenance requirements compatible with future Site uses.

6.10.3 Task 10.3: Feasibility Study Report

A Feasibility Study Report (FS Report) will be prepared following completion of the detailed and comparative analysis evaluation of each remedial action alternative. The FS Report will summarize the results of Tasks 10.1 and 10.2 above and will provide detailed information for each alternative to facilitate the identification of a preferred remedial approach for the Site consistent with beneficial Site reuse.

7.0 PROJECT MANAGEMENT PLAN

7.1 Project Organization

Figure 10 presents the RI/FS Organization Chart. The NYSDEC Remedial Project Manager, Vadim Brevdo, will serve as the primary contact with QSAG's Project Coordinator, Peter Zimmermann of Environmental Liability Management, Inc. (ELM). The Project Coordinator will act as a liaison between the Agency and QSAG. Golder Associates Inc. will serve as the RI/FS contractor. Mr. Randolph White, P.E. of Golder Associates Inc. (New York State Licensed Professional Engineer No. 062926-1) will provide overall management of Golder Associates activities related to the RI/FS. Mr. White will be assisted by Mr. Stuart Mitchell and Mr. Robert Illes of Golder Associates who will serve as the Remedial Investigation Task Manager and the Feasibility Study Task Manager, respectively and by Mr. Peter Brussock of ELM who will manage the Risk Assessment task.

Golder Associates will utilize various specialty subcontractors during the Remedial Investigation for surveying, drilling and analytical laboratory services. A New York State certified analytical laboratory will be utilized for all chemical sample analyses, except for light hydrocarbons, which will be analyzed by Microseeps of Pittsburgh, Pennsylvania. Aquifer Drilling and Testing Inc. (ADT) of New Hyde Park, New York will provide well drilling services and the surveying subcontractor will be GEOD Corporation of Newfoundland, New Jersey. Both ADT and GEOD are licensed in the State of New York. Treatability study laboratories/contractors may also be employed should the need arise to conduct treatability studies.

7.2 Project Schedule

The proposed schedule to conduct the Phase I Remedial Investigation is provided on Figure 11. The schedule begins with the submittal of this RI/FS Work Plan and ends at the conclusion of the Phase I Remedial Investigation program (i.e., submittal of the Phase I Data Summary Report and Phase II Remedial Investigation Proposal). Timeframes for NYSDEC review of submittals are not included in the schedule.

Forecasting future RI/FS activities at this stage in the project is neither practical nor beneficial at this time until a better understanding of Site conditions is achieved and the scope of the Phase II Remedial Investigation and Feasibility Study are identified. The schedule will be periodically updated during the project with the first update occurring following the completion of the Phase I Remedial Investigation.

8.0 REFERENCES

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Analytical Results, Triegel and Associates, Inc. by IGLA Laboratories, Project No. 9959, 2000.

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CH2M Hill, 1982. Engineering Services Report, Quanta Resources Site Cleanup, prepared for the NYCDEP, December 29, 1982.

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ERM-Northeast, 1992. Phase II Environmental Assessment, 37-30 Review Avenue, Long Island City, New York, May, 1992.

Haley and Aldreich Inc., DMJ Data Summaries (Water Level Elevations, Tidal Study LNAPL Analyses and LNAPL Measurements), Fall 2000.

Interim Final Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA, October 1988, OSWER Directive #9355.3-01.

New York City Department of Sanitation Comprehensive Solid Waste Management Plan, Chapter 15: Environmental Review – Review Avenue Site, October 2000

Preliminary Hydrogeologic Assessment, Quarter Resources Draft Report, New York City, New York, prepared by O.H. Materials Co., January 7, 1983

Selection of Remedial Actions at Inactive Hazardous Waste Sites, NYSDEC TAGM #4030.

United States Environmental Protection Agency (USEPA) EnviroFacts database, USEPA, Groundwater Issues, Light Nonaqueous Phase Liquids EPA/540/5-95/5000

USEPA, 1983. Brooklyn-Queens Aquifer System (USEPA, Region 2, 1983).

USEPA, 1988, Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA

USEPA, 1998. Region II Procedure for Low Flow Purge and Sampling, March 1998.

USGS, 1999, Simulation of Ground-Water Flow and Pumpage in Kings and Queens Counties, Long Island, New York (Water-Resources Investigation Report 98-4071).

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USGS, 1999, Water-Table and Potentiometric-Surface Altitudes of the Upper Glacial, Magothy, and Lloyd Aquifers on Long Island, New York, in March-April 2000, with a Summary of Hydrogeologic Conditions, Water-Resources Investigations Report, 01-4165.

TABLE 1
REMEDIAL INVESTIGATION SAMPLING AND ANALYSIS PLAN SUMMARY
QUANTA RESOURCES SUPERFUND SITE
LONG ISLAND CITY, QUEENS COUNTY, NEW YORK

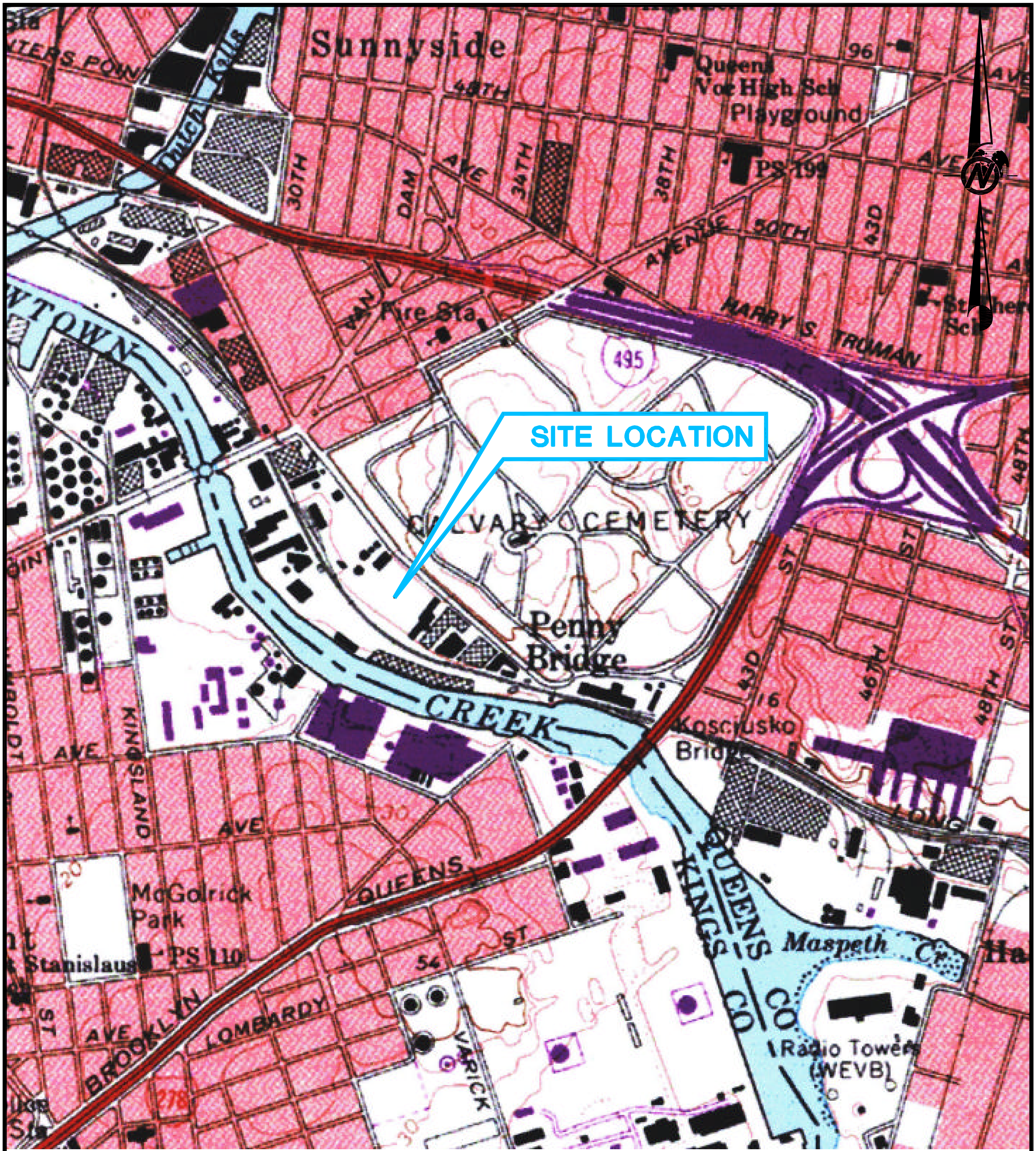
Analysis	Analytical Method	Primary	Field Duplicates	Matrix Spikes	Matrix Spike Dups	Field Blanks	Trip Blanks
SOIL - SB-01 through SB-14 (see Note 1)							
TCL VOCs	SW-846 8260B	42	2	2	2	2	
TCL SVOCs	SW-846 8270C	42	2	2	2	2	
PCBs	SW-846 8082	42	2	2	2	2	
TAL Metals	SW-846 6010B/7471A	42	2	2	2	2	
Cyanide	SW-846 9012A	42	2	2	2	2	
TOC	SW-846 9060	10	1				
Grain Size	ASTM D422	10					
GROUNDWATER - Monitoring Wells GA-1 through GA-4							
TCL VOCs	SW-846 8260B	4	1	1	1	1	1
TCL SVOCs	SW-846 8270C	4	1	1	1	1	
PCBs	SW-846 8082	4	1	1	1	1	
TAL Metals	SW-846 6010B/7470A	4	1	1	1	1	
Cyanide	SW-846 9012A	4	1	1	1	1	
Light Hydrocarbons	AM20GAX (2)	4	1	1	1		
Alkalinity	EPA 310.1	4	1	1	1	1	
TOC	SW-846 9060	4	1	1	1	1	
DOC	SW-846 9060	4	1	1	1	1	
Nitrate	EPA 353.2	4	1	1	1	1	
Sulfate	EPA 375.4	4	1	1	1	1	
CO2	SM4500 CO2D	4	1	1	1	1	
Chloride	SM4500 CLB	4	1	1	1	1	
TDS	EPA 160.1	4	1			1	
LIGHT NON-AQUEOUS PHASE LIQUID (LNAPL)							
TCL VOCs	SW-846 8260B	3	1				1 (3)
TCL SVOCs	SW-846 8270C	3	1				
TAL Metals	SW-846 6010B	3	1				
PCBs	SW-846 8082	3	1				
Sp Gravity	ASTM D1298	3	1				
TOX	SW-846 9020B	3	1				
% Sulfur	ASTM D 4294	3	1				
%Seds	ASTM D 96	3	1				
Viscosity	ASTM D 445	3	1				
Flash point	SW-846 1020A	3	1				
BTU	ASTM D 240	3	1				
GC Fingerprint	SW-846 8015 (modified)	3					

Notes:

(1) A total of 42 primary soil samples will be collected from 14 soil boring locations. Sample depths include the following: 0-2 feet - 6 on-site locations and 1 background location (GA-4); 5-7 feet - 13 on-site and one background; 10-12 feet - 13 on-site and one background; and, below 10-12 feet - 6 on-site locations and one background.

(2) This is a laboratory-specific Standard Operating Procedure.

(3) A trip blank will be shipped along with the LNAPL VOC samples and if any of the samples are less than 10% solid it will be analyzed as an aqueous sample and the trip blank will be analyzed.



REFERENCES

1.) MAP TAKEN FROM U.S.G.S. 7.5 MINUTE QUADRANGLE OF BROOKLYN, NEW YORK, DATED 1979.

1000 0 1000
SCALE FEET

Golder Associates
Philadelphia USA

FILE No. 0236151A002
PROJECT No. 023-6151 REV. 0

SCALE AS SHOWN
DATE 08/28/02
DESIGN AM
CADD AM
CHECK
REVIEW

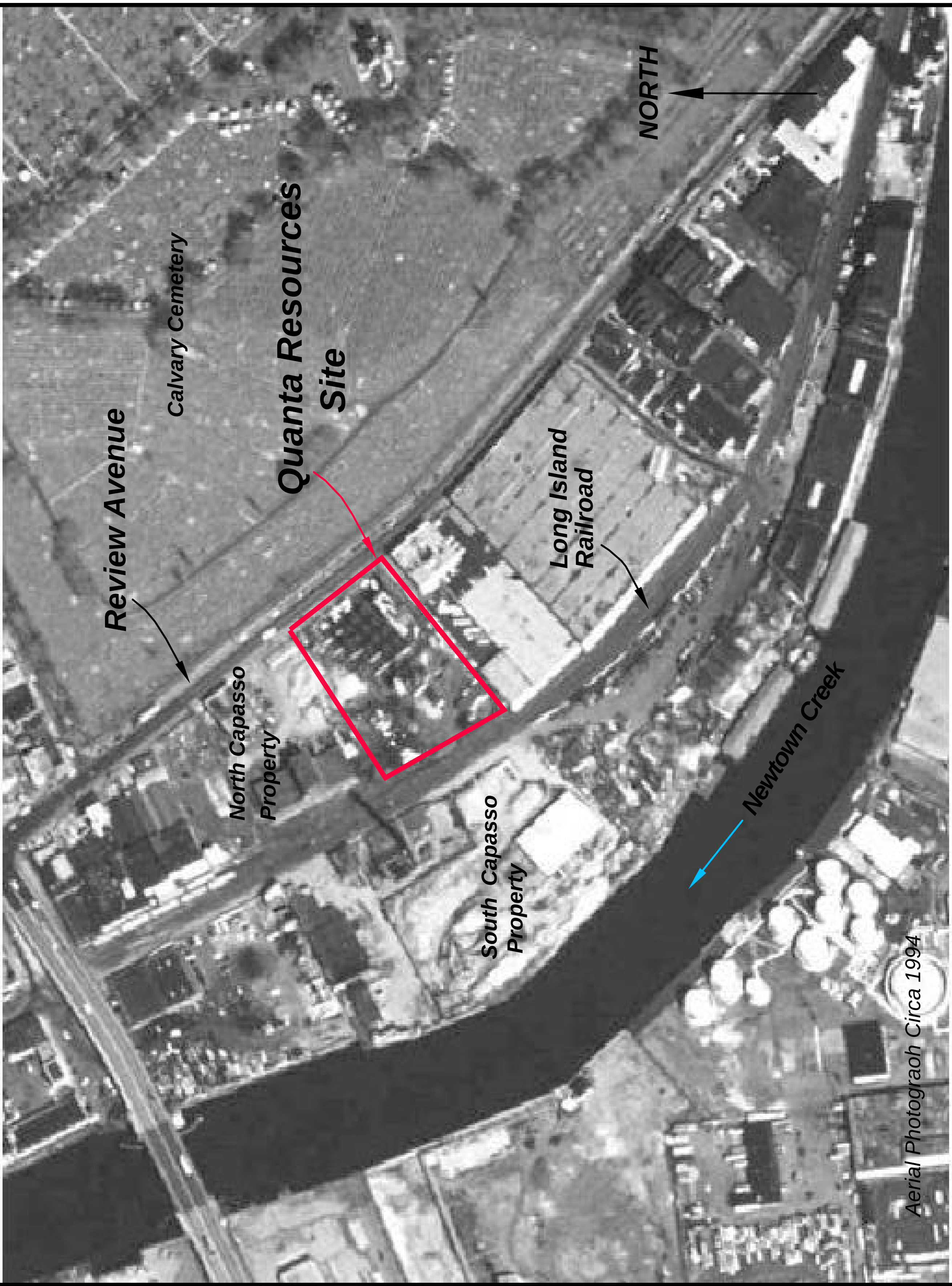
TITLE

SITE LOCATION MAP

QUANTA RESOURCES

FIGURE 1

Drawing file: 0236151A002.dwg Oct 28, 2003 - 10:23am



Drawing file: 0236151A008.dwg Oct 28, 2003 - 10:24am

Golder Associates
Philadelphia USA

FILE No.	0236151A008			SCALE	AS SHOWN
PROJECT No.	023-6151	REV.	0	DATE	09/19/02
				DESIGN	RSW
				CADD	AM
				CHECK	
				REVIEW	

TITLE

QUANTA RESOURCES SITE (1994)

QUANTA RESOURCES

FIGURE 2

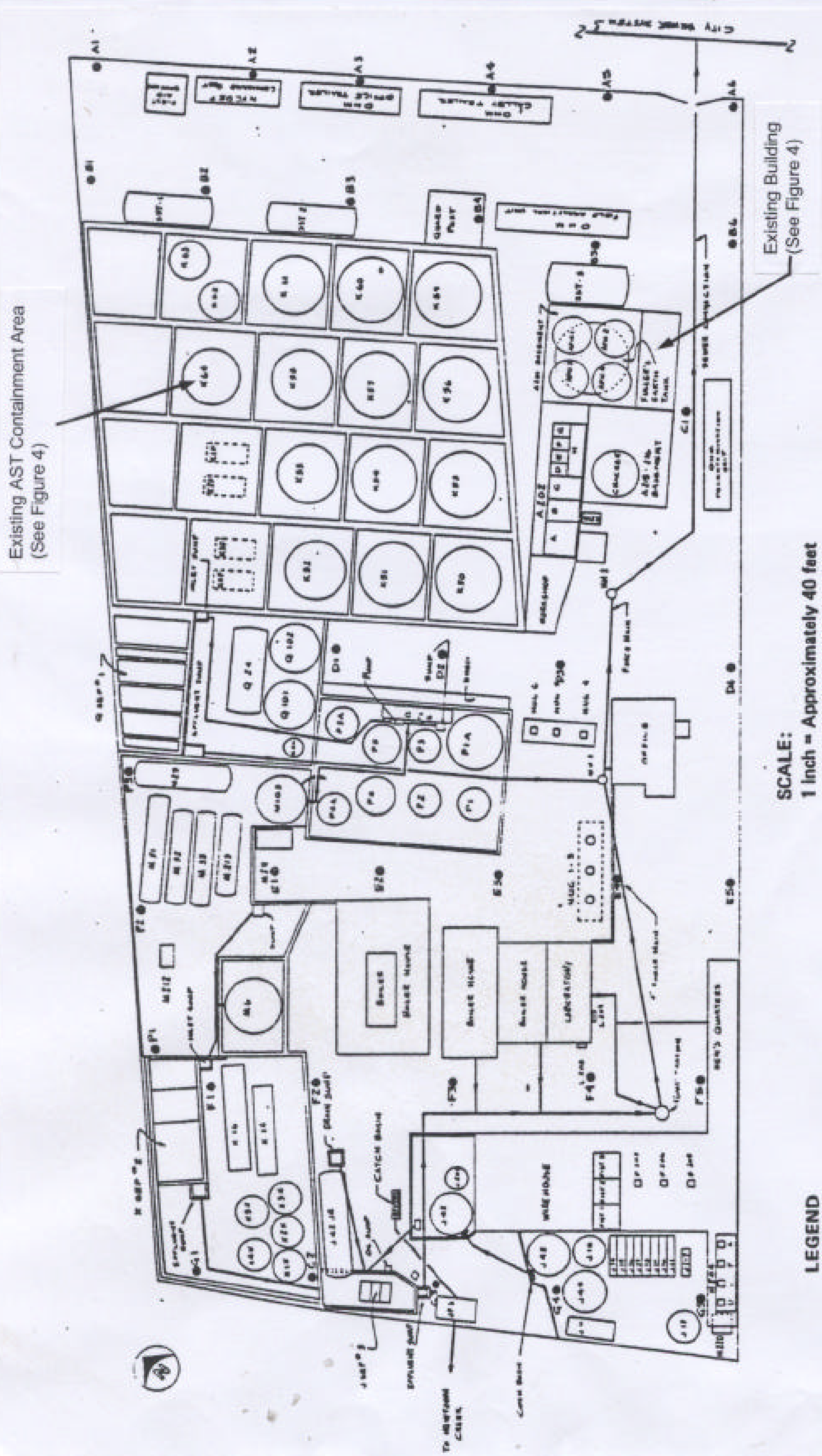


Figure II-2
Quanta Facility Prior to Cleaning Operations

SCALE:
1 inch = Approximately 40 feet

LEGEND

(K50) Tank and Site Identification Number

C1● Air Monitoring Stations

SOURCE: O.H. Materials

REFERENCES

1.) MAP TAKEN FROM FIGURE TITLED "QUANTA FACILITY PRIOR TO CLEANING OPERATIONS", PROVIDED BY OHM.

Drawing file: 0236151A003.dwg Sep 18, 2002 - 1:14pm

Golder Associates
Philadelphia USA

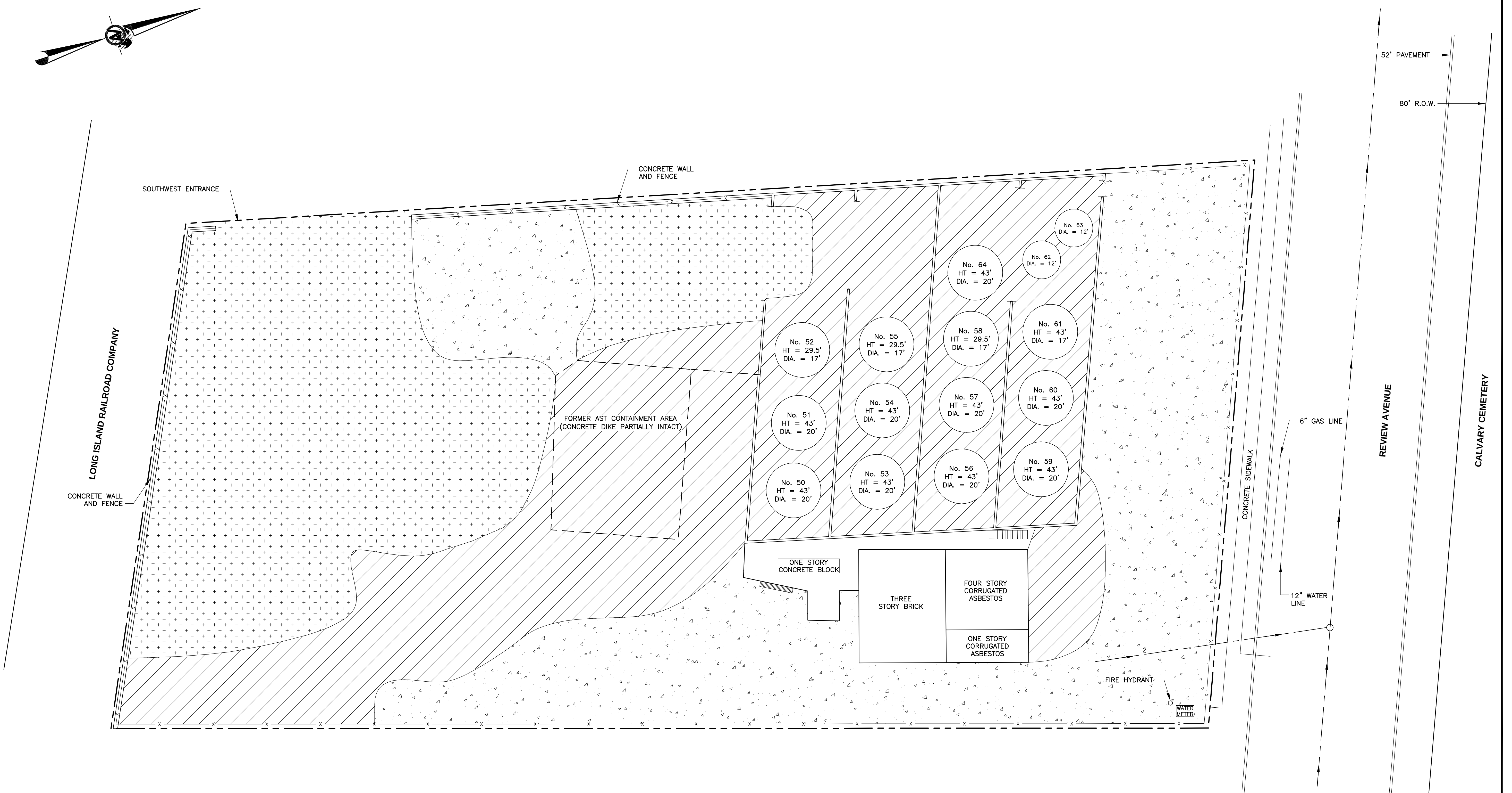
FILE No. 0236151A003
PROJECT No. 023-6151 REV. 0

SCALE AS SHOWN
DATE 09/18/02
DESIGN RSW
CADD AM
CHECK Son 9/19/02
REVIEW RSW 9/19/02

TITLE
LAYOUT OF QUANTA RESOURCES SITE PRIOR TO REMOVAL ACTION

QUANTA RESOURCES

FIGURE 3



LEGEND

▨	DEBRIS, TIRES, REMNANT STRUCTURES, AND/OR POST-OPERATIONAL FILL (PILES OF VARIABLE HEIGHT)
⁘	SMOOTH GRADED POST-OPERATIONAL FILL (THICKNESS VARIABLE)
△	ASPHALT/CONCRETE PAVEMENT ON SURFACE
— — —	APPROXIMATE PROPERTY BOUNDARY
—x—	FENCE LINE

NOTES

1.) LOCATIONS OF GROUND COVER FEATURES ARE APPROXIMATE.

REFERENCES

1.) MAP DIGITIZED FROM FIGURE TITLED " TOPOGRAPHIC SURVEY", PREPARED BY STRAUBING & RUBIN CONSULTING ENGINEERS, DATED 12/29/80 AS EDITED TO SHOW CURRENT CONDITIONS.

16 0 16 32
SCALE FEET

Drawing file: 0236151A001.dwg Oct 28, 2003 – 10:29am

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT
QUANTA RESOURCES
RI/FS WORKPLAN
QUEENS, NEW YORK

TITLE

CURRENT SITE CONDITIONS

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Philadelphia USA

PROJECT No.		023-6151
DESIGN	SDM	08/13/02
CADD	AM	09/18/02
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REVIEW		

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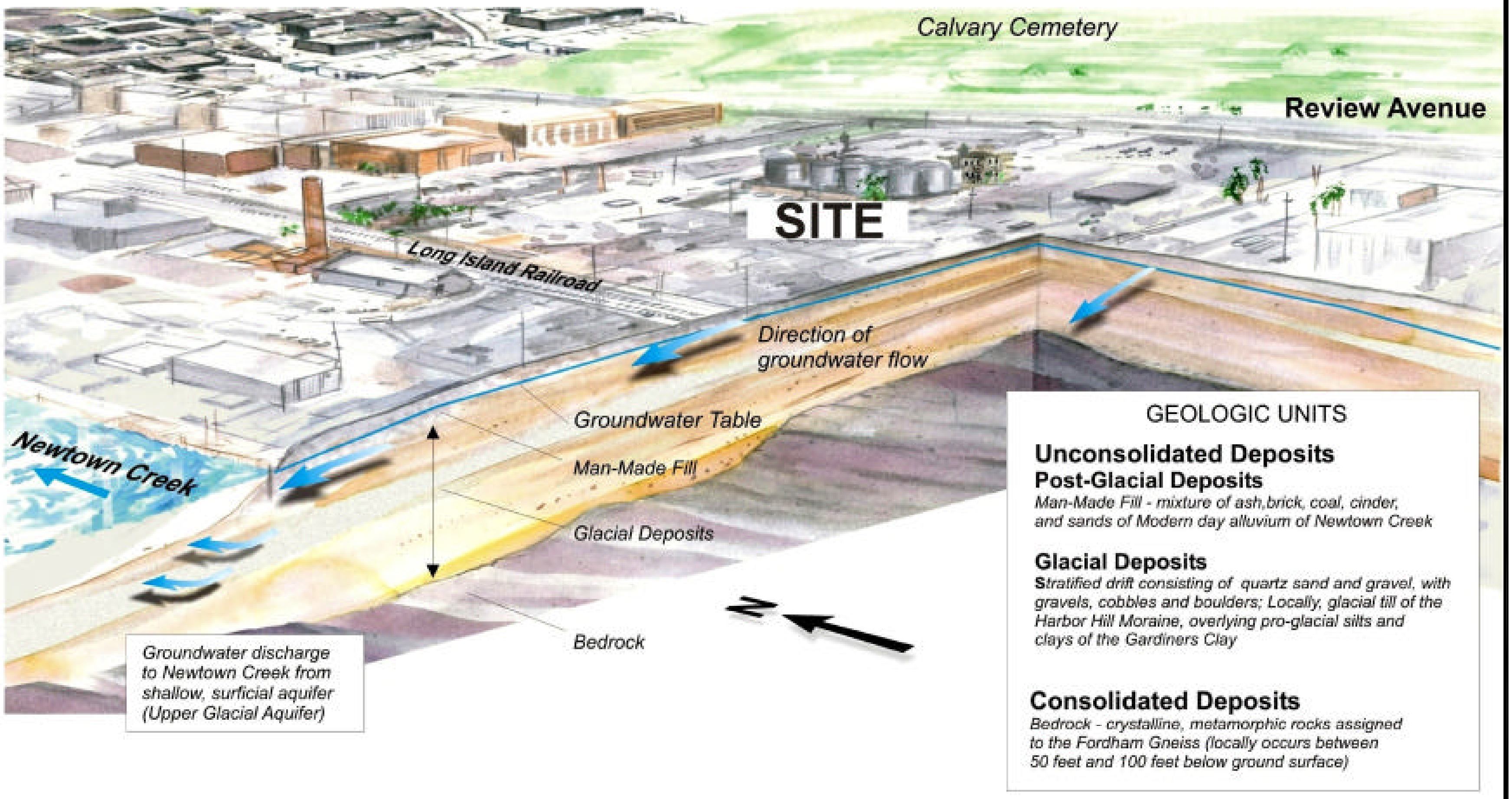
SCALE AS SHOWN REV. 0

FIGURE 4

Drawing file: 0236151A009.dwg Oct 28, 2003 – 10:33am



Groundwater discharge to Newtown Creek from shallow, surficial aquifer (Upper Glacial Aquifer)

GEOLOGIC UNITS

Unconsolidated Deposits

Post-Glacial Deposits

Man-Made Fill - mixture of ash,brick, coal, cinder, and sands of Modern day alluvium of Newtown Creek

Glacial Deposits

Stratified drift consisting of quartz sand and gravel, with gravels, cobbles and boulders; Locally, glacial till of the Harbor Hill Moraine, overlying pro-glacial silts and clays of the Gardiners Clay

Consolidated Deposits

Bedrock - crystalline, metamorphic rocks assigned to the Fordham Gneiss (locally occurs between 50 feet and 100 feet below ground surface)

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PROJECT No.	023–6151
REV.	0
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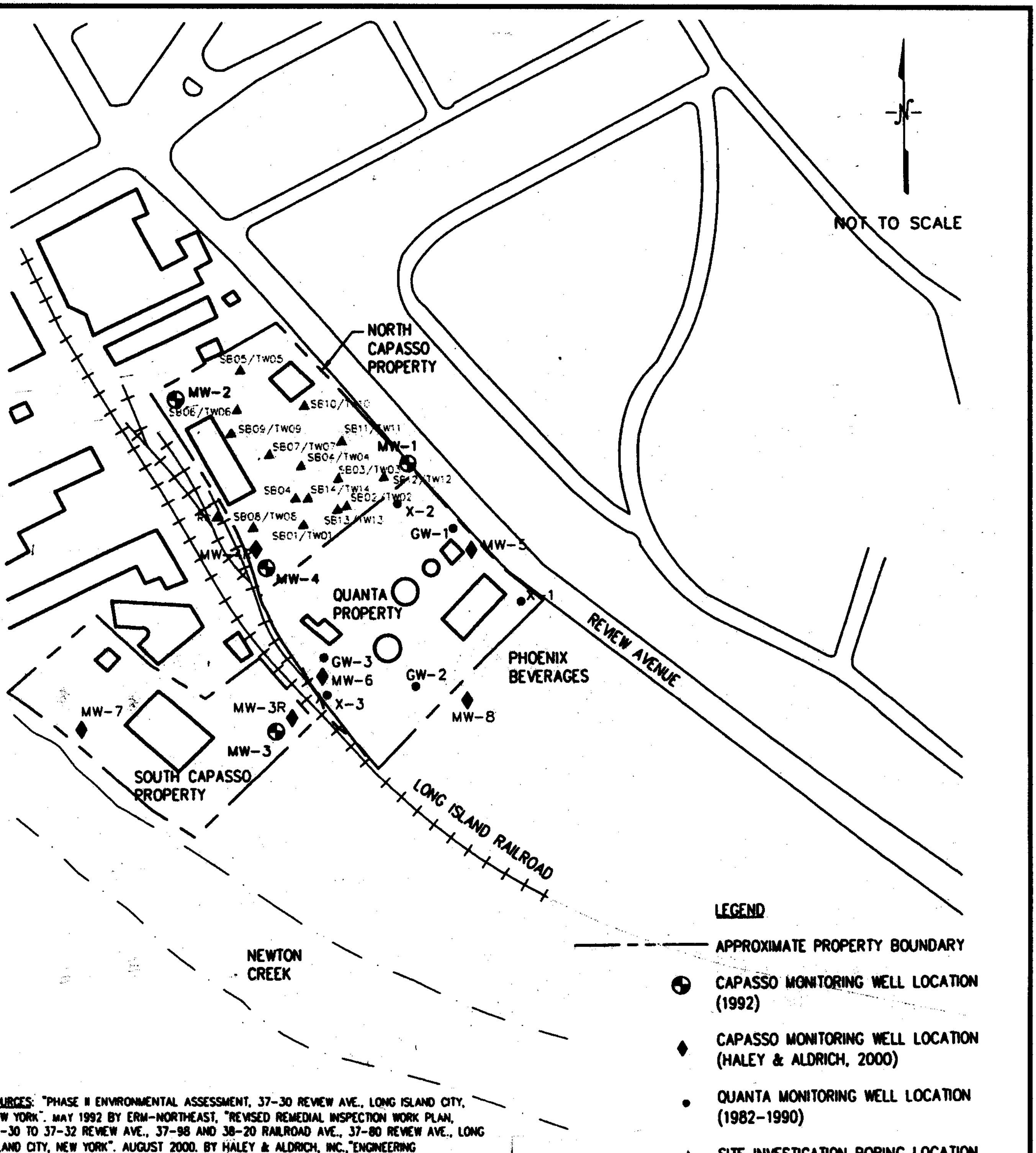
REVIEW	

TITLE

CONCEPTUAL SITE HYDROGEOLOGIC MODEL

QUANTA RESOURCES

FIGURE 5



LEGEND

— — — APPROXIMATE PROPERTY BOUNDARY

⊕ CAPASSO MONITORING WELL LOCATION (1992)

◆ CAPASSO MONITORING WELL LOCATION (HALEY & ALDRICH, 2000)

● QUANTA MONITORING WELL LOCATION (1982-1990)

▲ SITE INVESTIGATION BORING LOCATION (LOCATION APPROXIMATE)

SOURCES: "PHASE II ENVIRONMENTAL ASSESSMENT, 37-30 REVIEW AVE., LONG ISLAND CITY, NEW YORK". MAY 1992 BY ERM-NORTHEAST, "REVISED REMEDIAL INSPECTION WORK PLAN, 37-30 TO 37-32 REVIEW AVE., 37-98 AND 38-20 RAILROAD AVE., 37-80 REVIEW AVE., LONG ISLAND CITY, NEW YORK". AUGUST 2000. BY HALEY & ALDRICH, INC.,"ENGINEERING INVESTIGATIONS AT INACTIVE HAZARDOUS WASTE SITES. PHASE II INVESTIGATION. QUANTA RESOURCES SITE NO. 241005, LONG ISLAND CITY, QUEENS CO." MAY 1990 BY LAWLER, MATUSKY & SKELLY ENGINEERS.

REFERENCES

1.) MAP TAKEN FROM FIGURE TITLED "SITE PLAN WITH SITE INVESTIGATION BORING LOCATIONS", PROVIDED BY ENVIRON, DATED 9/27/00.

NOTES: UP TO EIGHT SOIL BORINGS WILL BE DRILLED AND 4 TO 5 MONITORING WELLS WILL BE INSTALLED. ALL WELL LOCATIONS SHOWN ARE APPROXIMATE.

Golder Associates
Philadelphia USA

FILE No. 0236151A004		CHECK SDm 9/19/02	
PROJECT No. 023-6151	REV. 0	REVIEW RSW 9/19/02	

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DATE 08/28/02
DESIGN RSW
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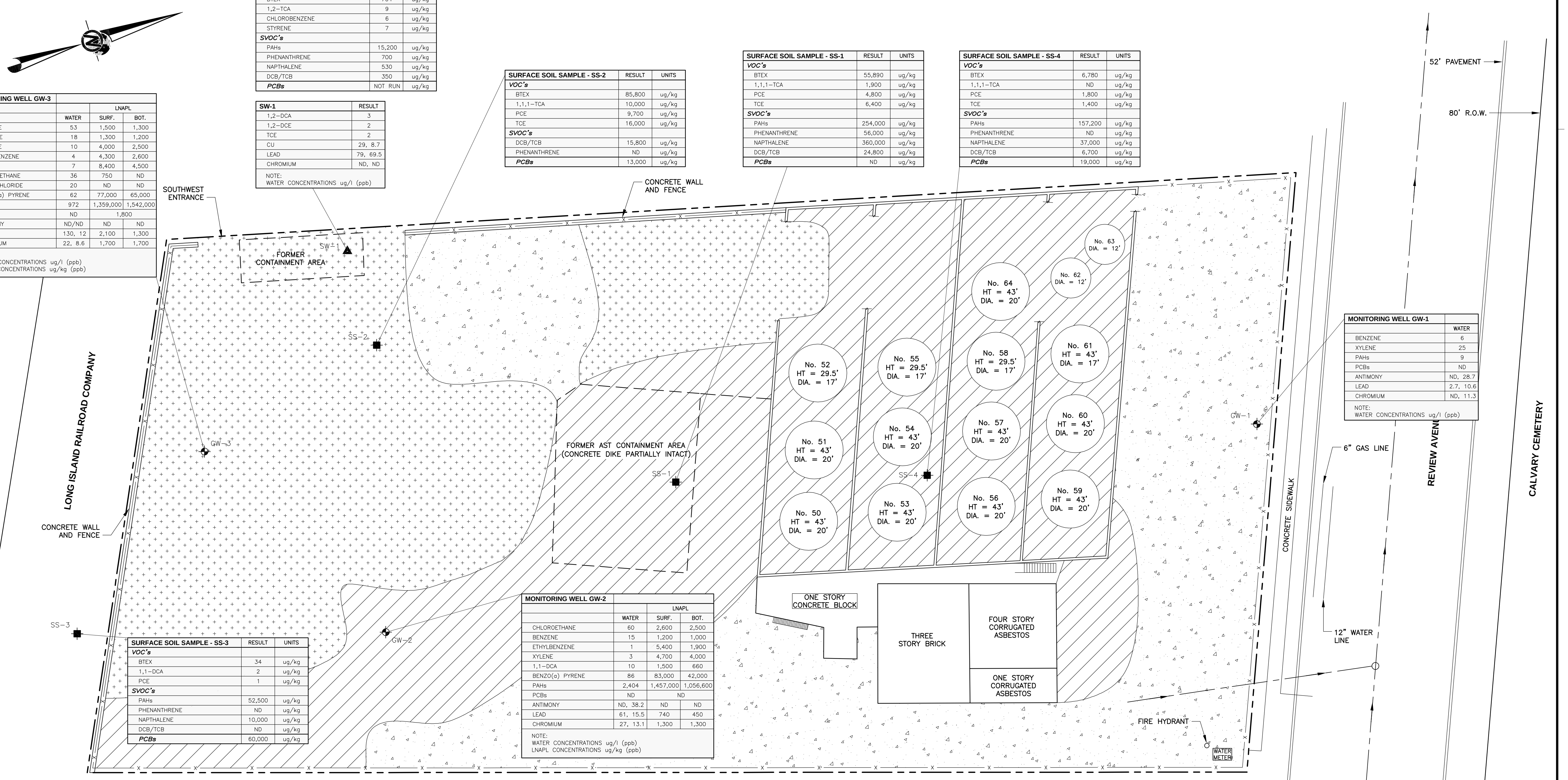
TITLE
ADJACENT PROPERTY MONITORING POINT LOCATIONS

QUANTA RESOURCES

FIGURE 6

Drawing file: 0236151A004.dwg Aug 28, 2002 - 10:32am



MONITORING WELL GW-3			
		LNAPL	
	WATER	SURF.	BOT.
1,2–DCE	53	1,500	1,300
BENZENE	18	1,300	1,200
TOLUENE	10	4,000	2,500
ETHYLBENZENE	4	4,300	2,600
XYLENE	7	8,400	4,500
CHLOROETHANE	36	750	ND
VINYL CHLORIDE	20	ND	ND
BENZO(a) PYRENE	62	77,000	65,000
PAHs	972	1,359,000	1,542,000
PCBs	ND	1,800	
ANTIMONY	ND/ND	ND	ND
LEAD	130, 12	2,100	1,300
CHROMIUM	22, 8.6	1,700	1,700

NOTE:
WATER CONCENTRATIONS ug/l (ppb)
LNAPL CONCENTRATIONS ug/kg (ppb)

SOLIDS SAMPLE - SED-1	RESULT	UNITS
VOC's		
BTEX	704	ug/kg
1,2–TCA	9	ug/kg
CHLOROBENZENE	6	ug/kg
STYRENE	7	ug/kg
SVOC's		
PAHs	15,200	ug/kg
PHENANTHRENE	700	ug/kg
NAPTHALENE	530	ug/kg
DCB/TCB	350	ug/kg
PCBs	NOT RUN	ug/kg

SW-1	RESULT
1,2–DCA	3
1,2–DCE	2
TCE	2
CU	29, 8.7
LEAD	79, 69.5
CHROMIUM	ND, ND

NOTE:
WATER CONCENTRATIONS ug/l (ppb)

SURFACE SOIL SAMPLE - SS-2	RESULT	UNITS
VOC's		
BTEX	85,800	ug/kg
1,1,1–TCA	10,000	ug/kg
PCE	9,700	ug/kg
TCE	16,000	ug/kg
SVOC's		
DCB/TCB	15,800	ug/kg
PHENANTHRENE	ND	ug/kg
PCBs	13,000	ug/kg

SURFACE SOIL SAMPLE - SS-1	RESULT	UNITS
VOC's		
BTEX	55,890	ug/kg
1,1,1–TCA	1,900	ug/kg
PCE	4,800	ug/kg
TCE	6,400	ug/kg
SVOC's		
PAHs	254,000	ug/kg
PHENANTHRENE	56,000	ug/kg
NAPTHALENE	360,000	ug/kg
DCB/TCB	24,800	ug/kg
PCBs	ND	ug/kg

SURFACE SOIL SAMPLE - SS-4	RESULT	UNITS
VOC's		
BTEX	6,780	ug/kg
1,1,1–TCA	ND	ug/kg
PCE	1,800	ug/kg
TCE	1,400	ug/kg
SVOC's		
PAHs	157,200	ug/kg
PHENANTHRENE	ND	ug/kg
NAPTHALENE	37,000	ug/kg
DCB/TCB	6,700	ug/kg
PCBs	19,000	ug/kg

MONITORING WELL GW-1	
	WATER
BENZENE	6
XYLENE	25
PAHs	9
PCBs	ND
ANTIMONY	ND, 28.7
LEAD	2.7, 10.6
CHROMIUM	ND, 11.3

NOTE:
WATER CONCENTRATIONS ug/l (ppb)

SURFACE SOIL SAMPLE - SS-3	RESULT	UNITS
VOC's		
BTEX	34	ug/kg
1,1–DCA	2	ug/kg
PCE	1	ug/kg
SVOC's		
PAHs	52,500	ug/kg
PHENANTHRENE	ND	ug/kg
NAPTHALENE	10,000	ug/kg
DCB/TCB	ND	ug/kg
PCBs	60,000	ug/kg

MONITORING WELL GW-2			
		LNAPL	
	WATER	SURF.	BOT.
CHLOROETHANE	60	2,600	2,500
BENZENE	15	1,200	1,000
ETHYLBENZENE	1	5,400	1,900
XYLENE	3	4,700	4,000
1,1–DCA	10	1,500	660
BENZO(a) PYRENE	86	83,000	42,000
PAHs	2,404	1,457,000	1,056,600
PCBs	ND	ND	
ANTIMONY	ND, 38.2	ND	ND
LEAD	61, 15.5	740	450
CHROMIUM	27, 13.1	1,300	1,300

NOTE:
WATER CONCENTRATIONS ug/l (ppb)
LNAPL CONCENTRATIONS ug/kg (ppb)

LEGEND

▨	DEBRIS, TIRES, REMNANT STRUCTURES, AND/OR POST–OPERATIONAL FILL (PILES OF VARIABLE HEIGHT)
⊞	SMOOTH GRADED POST–OPERATIONAL FILL (THICKNESS VARIABLE)
◬	ASPHALT/CONCRETE PAVEMENT
▬ ‒ ‒ ▬	APPROXIMATE PROPERTY BOUNDARY
── x ──	FENCE LINE
⊕	MONITORING WELL INSTALLED BY LMS (1988–1990)
■	SURFACE SOIL SAMPLE LOCATION BY LMS (1988–1990)
▲	SURFACE WATER AND SEDIMENT SAMPLE LOCATION BY LMS

NOTES

1.) LOCATIONS OF MONITORING POINTS AND GROUND COVER FEATURES ARE APPROXIMATE.

2.) THE PRIMARY LMS DATA ARE SUMMARIZED IN CHEMISTRY BOXES. A COMPLETE LIST OF RESULTS IS PROVIDED IN THE LMS REPORT REFERENCED BELOW AND IN APPENDIX A.

3.) TWO VALUES UNDER METALS FOR METALS WATER RESULTS ARE FOR 12/88 AND 12/90, RESPECTIVELY. THE 12/88 RESULTS FOR LEAD ARE BELIEVED ELEVATED DUE TO QA/QC ISSUES.

4.) METALS RESULTS FOR SOIL ARE NOT SUMMARIZED DUE TO QA/QC XXXXXXXXXX.

REFERENCES

1.) MAP DIGITIZED FROM FIGURE TITLED " TOPOGRAPHIC SURVEY", PREPARED BY STRAUBING & RUBIN CONSULTING ENGINEERS, DATED 12/29/80 AS EDITED TO SHOW CURRENT CONDITIONS.

2.) LOCATIONS OF MONITORING POINTS APPROXIMATED FROM O.H. MATERIALS CO. PRELIMINARY HYDROGEOLOGIC ASSESSMENT REPORT, JANUARY 1983 AND THE LAWLER, MATUSKY AND SKELLY ENGINEERS PHASE II INVESTIGATION REPORT, 1990.

KEY

BTEX – BENZENE, TOLUENE, ETHYLBENZENE AND XYLENE
1,1–DCA – 1,1–DICHLOROETHANE
1,1,1–TCA – 1,1,1–TRICHLOROETHANE
PCE – TETRACHLOROETHYLENE
TCE – TRICHLOROETHYLENE
PAH – POLYNUCLEAR AROMATIC HYDROCARBONS
PCB – POLYCHLORINATED BIPHENYLS
DCB/TCB – DI AND TRI CHLOROBENZENES

16 0 16 32
SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT
QUANTA RESOURCES
RI/FS WORKPLAN
QUEENS, NEW YORK

TITLE
SUMMARY OF ENVIRONMENTAL DATA
FROM LMS PHASE II REPORT

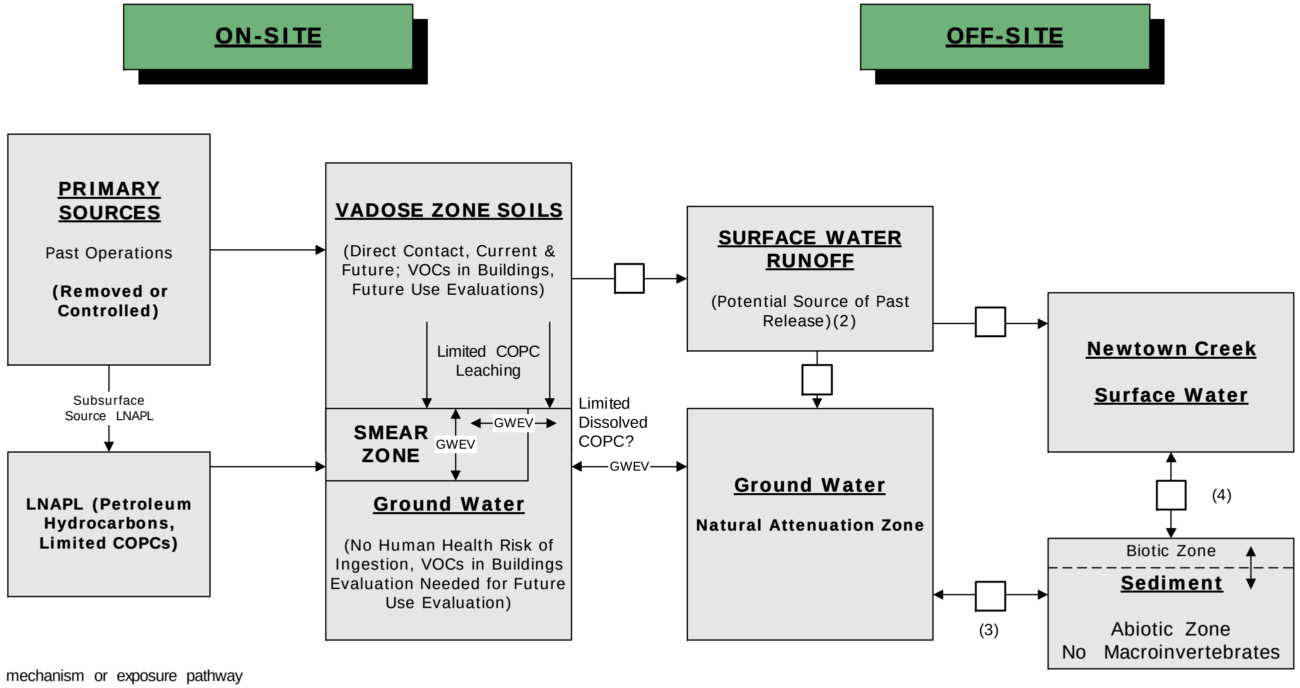
Golder Associates
Philadelphia USA

PROJECT No.		023–6151
DESIGN	SDM	08/13/02
CADD	AM	09/19/02
CHECK		
REVIEW		

FILE No. 0236151A005
SCALE AS SHOWN REV. 0

FIGURE 7

Drawing file: 0236151A005.dwg Oct 28, 2003 - 10:34am



LEGEND

→ Potential transport mechanism or exposure pathway

☐ Indicates that source removed, transport mechanism does not exist or exposure pathway eliminated

COPC = Chemicals of Potential Concern

GWEV = Ground Water Elevation Variation
(Question mark refers to a potential incomplete pathway from the property that requires verification during RI)

NOTES

1) Risks associated with hazardous substances in the environment are dependent upon complete exposure pathways. When the exposure pathway is not complete, there are no risks associated with the hazardous substances for that particular exposure scenario/pathway. Where an exposure pathway is potentially complete, the magnitude of the risks and the need for risk reduction are determined through a more detailed analysis of site-specific factors.

2) Differential infiltration of water and contaminants from other downgradient sources along the rail lines and other properties likely influence off-property ground water flow and water quality.

3) At the Quanta Site, the COPC have a low probability of reaching Newtown Creek and causing adverse ecological impacts.

4) COPC must pass through sediment to reach surface water.

TITLE:
FIGURE 8
GENERALIZED CONCEPTUAL SITE MODEL
QUANTA RESOURCES SITE (1)

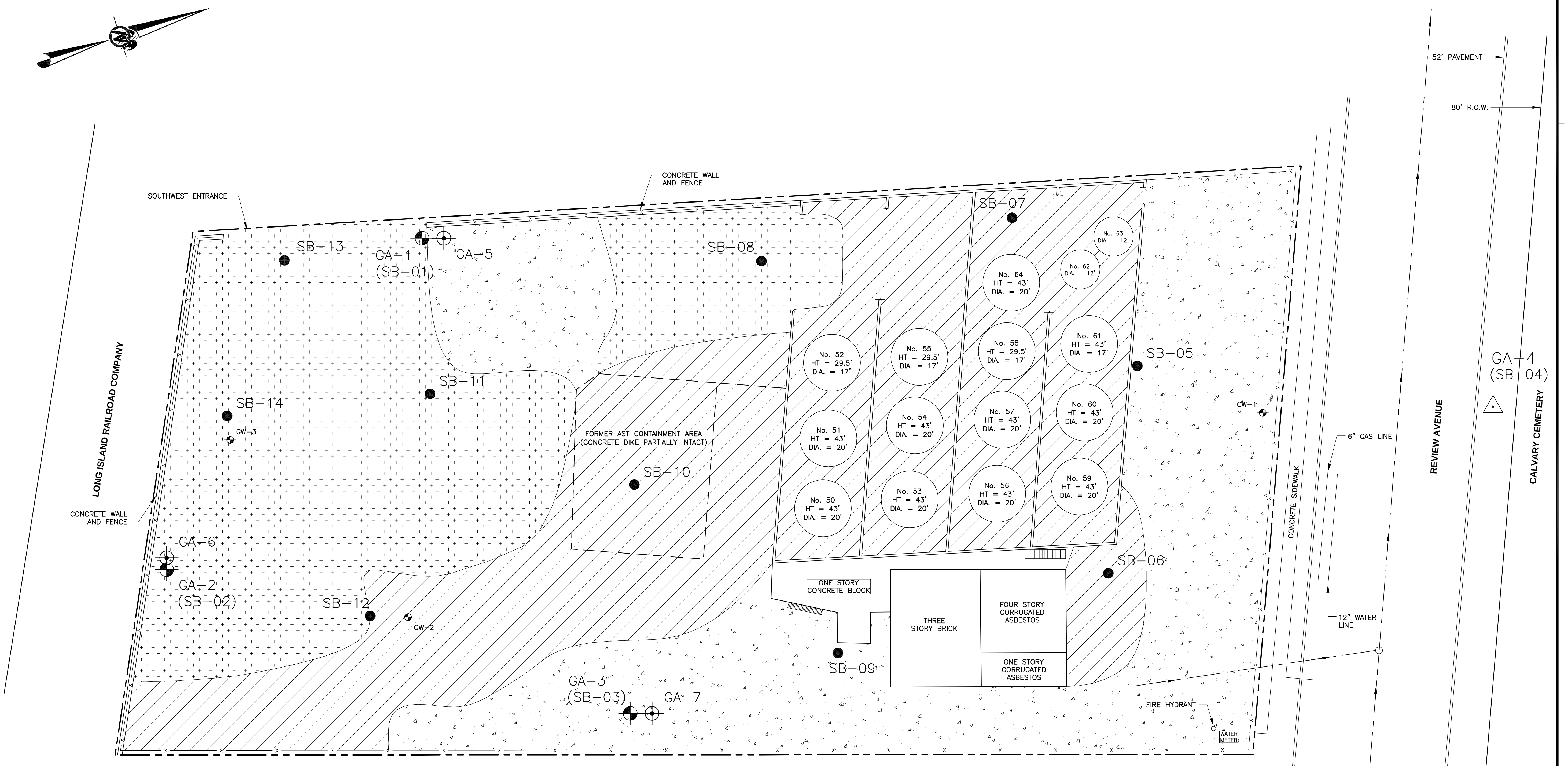
LOCATION:
37- 80 REVIEW AVENUE
LONG ISLAND CITY,
NEW YORK 11101

DATE: 8/28/02

PROJECT NO.: 202160

FILENAME: 202160\CSM\quanta_csm_rev2 .vsd

ENVIRONMENTAL LIABILITY MANAGEMENT, INC.
218 Wall Street, Research Park, Princeton, NJ 08540
4920 York Road, Ste. 2CC2, P.O. Box 306, Holicong, PA 18928
612 Main Street, 2nd Floor, Boonton, NJ 07005



LEGEND

▨	DEBRIS, TIRES, REMNANT STRUCTURES, AND/OR POST-OPERATIONAL FILL (PILES OF VARIABLE HEIGHT)
⊞	SMOOTH GRADED POST-OPERATIONAL FILL (THICKNESS VARIABLE)
◬	ASPHALT/CONCRETE PAVEMENT
— — —	APPROXIMATE PROPERTY BOUNDARY
—x—	FENCE LINE
◕	PROPOSED GROUNDWATER MONITORING WELL LOCATION
⊕	PROPOSED LNAPL MONITORING WELL LOCATION
△	PROPOSED BACKGROUND MONITORING WELL
●	PROPOSED SOIL BORING LOCATION
⊕	EXISTING MONITORING WELL LOCATION (LMS, 1990)

NOTES

1.) LOCATION OF MONITORING POINTS AND PHYSICAL FEATURES ARE APPROXIMATE.

2.) ACCESS FOR GA-4 TO BE DETERMINED.

REFERENCES

1.) MAP DIGITIZED FROM FIGURE TITLED " TOPOGRAPHIC SURVEY", PREPARED BY STRAUBING & RUBIN CONSULTING ENGINEERS, DATED 12/29/80 AS EDITED TO SHOW CURRENT CONDITIONS.

16 0 16 32
SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT
QUANTA RESOURCES
RI/FS WORKPLAN
QUEENS, NEW YORK

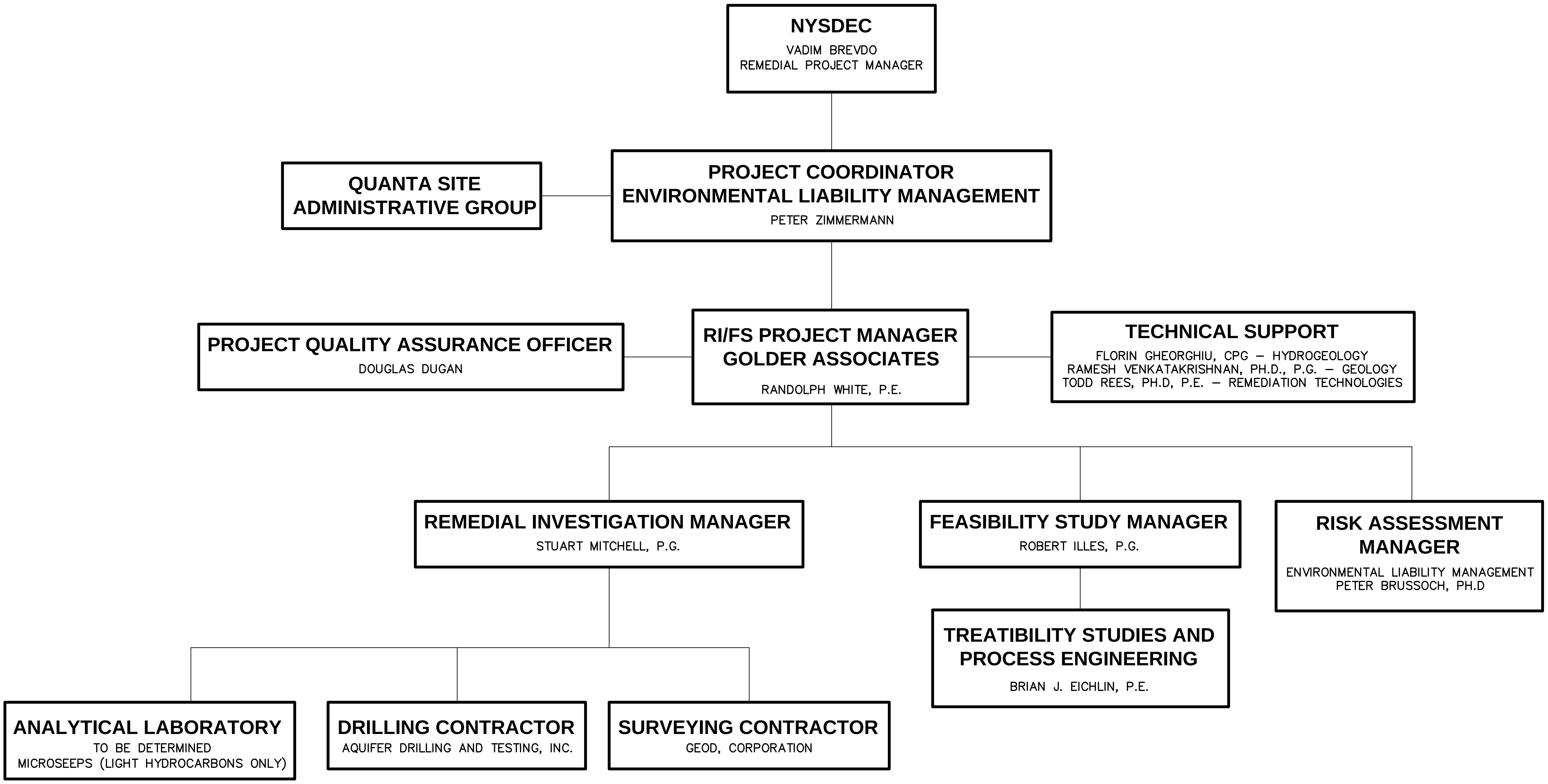
TITLE
PROPOSED REMEDIAL INVESTIGATION MONITORING LOCATIONS

Golder Associates
Philadelphia USA

PROJECT No.		023-6151	FILE No.	0236151A007
DESIGN	SDM	08/13/02	SCALE AS SHOWN	REV. 0
CADD	AM	09/19/02		
CHECK				
REVIEW				

FIGURE 9

Drawing file: 0236151A007.dwg Oct 28, 2003 - 10:48am



NYSDEC
VADIM BREVDO
REMEDIAL PROJECT MANAGER

PROJECT COORDINATOR
ENVIRONMENTAL LIABILITY MANAGEMENT
PETER ZIMMERMANN

QUANTA SITE ADMINISTRATIVE GROUP

RI/FS PROJECT MANAGER
GOLDER ASSOCIATES
RANDOLPH WHITE, P.E.

PROJECT QUALITY ASSURANCE OFFICER
DOUGLAS DUGAN

TECHNICAL SUPPORT
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RAMESH VENKATAKRISHNAN, PH.D., P.G. – GEOLOGY
TODD REES, PH.D, P.E. – REMEDIATION TECHNOLOGIES

REMEDIAL INVESTIGATION MANAGER
STUART MITCHELL, P.G.

FEASIBILITY STUDY MANAGER
ROBERT ILLES, P.G.

RISK ASSESSMENT MANAGER
ENVIRONMENTAL LIABILITY MANAGEMENT
PETER BRUSSOCH, PH.D

TREATIBILITY STUDIES AND PROCESS ENGINEERING
BRIAN J. EICHLIN, P.E.

ANALYTICAL LABORATORY
TO BE DETERMINED
MICROSEEPS (LIGHT HYDROCARBONS ONLY)

DRILLING CONTRACTOR
AQUIFER DRILLING AND TESTING, INC.

SURVEYING CONTRACTOR
GEOD, CORPORATION

JOB No.:	023–6151	SCALE:	AS SHOWN
CAD BY:	AM	DATE:	09/19/02
CHK BY:		FILE No.:	0236151A006
REV BY:		DR SUBTITLE:	A

Golder Associates

RI/FS PROJECT ORGANIZATION CHART

QUANTA RESOURCES

FIGURE 10

FIGURE 11
PROJECTED SCHEDULE - PHASE I REMEDIAL INVESTIGATION (1), (2)
QUANTA RESOURCES SITE
RI/FS WORK PLAN

ID	Task Name	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
1	Submit RI/FS Work Plan	*											
2	Respond to NYSDEC Comments	▨	▨										
3	Phase I RI Field Work (3)			▨	▨	▨							
4	Phase I Laboratory Analyses					▨	▨						
5	Phase I Data Summary Report and Phase II Proposal						▨	▨	▨	▨			

(1) The projected schedule does not include Agency review times.

(2) The schedule for the Phase II Remedial Investigation will be developed at the conclusion of the Phase I Remedial Investigation and will be submitted to NYSDEC as part of the Phase I Date Summary Report and Phase II Proposal. Similarly the schedule for the completion of the Feasibility Study will be provided to NYSDEC as part of the Remedial Investigation Report.

(3) The schedule for completing field related activities is necessarily dependent upon a number of factors outside the control of Golder Associates and QSAG including, but not limited to, weather conditions, access or other unforeseen events.

APPENDIX A

SITE AREA GEOLOGY AND HYDROGEOLOGY

APPENDIX A

SITE AREA GEOLOGY AND HYDROGEOLOGY

This description of the Site area geology and hydrogeology is based on the following published literature:

- Water-Table and Potentiometirc Surface Altitudes of the Upper Glacial, Magothy and Lloyd Aquifers on Long Island, New York in March-April 2000, with a Summary of Hydrogeologic Conditions (USGS, Water Resources Investigation Report 01-4165).
- Simulation of Ground-Water Flow and Pumpage in Kings and Queens Counties, Long Island, New York (USGS, Water-Resources Investigation Report 98-4071); and,
- Brooklyn-Queens Aquifer System (USEPA, Region 2, 1983).

Physiography

The topography and surficial geology in the vicinity of the Site is largely a reflection of man-made fill (reportedly consisting of ash, wood, brick, coal, etc., and ranging in thickness from 5 to 19 feet) and unconsolidated deposits related to the Wisconsin stage glaciation. Two prominent features of Long Island consist of two east-west trending morainal ridges (Ronkonkoma and Harbor Hill moraines). The Site is located just north of the Harbor Hill moraine with surficial deposits composed primarily of stratified drift (sand and gravel deposits) with some till (an unsorted mixture of clay, silt, sand, gravel, cobbles, and boulders). South of the Harbor Hill moraine surficial deposits consist primarily of outwash (sand and gravel). More recent deposits within the Site area consist primarily of man made material (historic fill).

The bedrock in the area was eroded to a peneplain before the overlying Cretaceous sediments were deposited. Bedrock outcrops in northwestern Queens County near the East River and slopes gently southward at about eighty feet per mile. Consequently, the overlying formations form a southward-dipping wedge that attains a maximum thickness of about 1,050 feet in the southeast corner of Queens County (Brooklyn-Queens Aquifer System, USEPA Region 2, 1983). Bedrock is estimated to be between 50 and 100 feet below ground surface within the Site area.

Site Area Stratigraphy

Based on published literature cited above and data collected from previous investigations at the Site, the stratigraphic sequence within the Site area from the youngest to the oldest geologic units can generally be subdivided as follows:

Unconsolidated Deposits

- Post-Glacial Deposits: Man-Made Fill (approximately 5 to 19 feet thick) consisting of a mixture of ash, wood, brick, coal and coarse to fine grained sediments overlying alluvium; and,

- Glacial Deposits: stratified drift consisting of quartzose sand, fine to coarse, and gravel, pebble to boulder size. Some deposits of till (poorly sorted mixture of clay, sand, gravel and boulders) may also be present. On-site these materials have been described as fairly homogenous sands with fine gravel and cobbles relatively free of fine-grained sediments. Underlying these deposits may be proglacial lake deposits consisting of the Gardiners Clay, a confining unit with an average vertical hydraulic conductivity of about 0.001 ft/day.

Consolidated Deposits

- Bedrock: metasedimentary rocks consisting of the Fordham Gneiss.

Site Area Hydrogeology

The Long Island groundwater system consists of three major aquifers (upper glacial, Magothy, and Lloyd aquifers) and two smaller aquifers (Jameco and Port Washington aguifers) of only local importance and two regional confining units (Raritan confining unit and Gardiners clay). Based on published literature cited above, the following unconsolidated hydrogeologic units (from top to bottom) are believed to be present in the Site area:

- Upper Glacial Aquifer: This aquifer is the uppermost unit and contains the water table throughout most of Queens County except where bedrock crops out in northwestern Queens County. In the area of the Site the upper glacial aquifer is believed to consist primarily stratified drift deposits consisting of fine to very coarse quartzose sand and pebbles to boulder-sized gravel. The average horizontal hydraulic conductivity of these deposits is estimated to be approximately 270 ft/day.

- Jameco Aquifer: A relatively thin portion of the Jameco gravel unit may be locally present in the area and would underlie the upper glacial aquifer. This unit generally consists of fine to very coarse sand and pebble size gravel with few layers of clay and silt. The average horizontal hydraulic conductivity is 200 to 300 ft/day.

- Gardiners Clay: A portion of the Gardiners Clay (confining unit) may be present in the Site area. This confining unit consists of clay and silt with few layers of sand and gravel. The average vertical hydraulic conductivity is estimated to be 0.001 ft/day.

The Site is located between a local topographic high, located northeast of the Site (local groundwater recharge area), and Newtown Creek (a regional groundwater discharge area). Groundwater flow, in the relatively flat Site area, under natural conditions, would be expected to flow nearly horizontally south-southwest within the Upper Glacial Aquifer towards Newtown Creek[1]. The Upper Glacial Aquifer is anisotropic with the horizontal hydraulic conductivity estimated to be 10 times greater than the vertical conductivity. Vertical gradients in the vicinity of the Site are expected to be minimal or upward as a result of the high conductivity of the Upper Glacier Aquifer and the presence of a groundwater discharge boundary located approximately 450 feet to the southwest of the Site (Newtown Creek). If vertical gradients are present, they would be expected to be upward, under natural conditions, particularly as groundwater approaches its discharge to Newtown Creek. Figure 5 presents a conceptual hydrogeologic model of the Site.

The Upper Glacial Aquifer was previously the principal source of water supply throughout Long Island. However, chemical impacts in many areas since the 1940's have resulted in this aquifer no longer being used as a water supply for Kings and most of Queens counties (Bursciolano). Public drinking and industrial water supplies for Queens County are supplied primarily by the New York City reservoir system. The area of Queens County that relies on groundwater as its source for potable water is located approximately 6 miles southeast of the Site. A regional groundwater divide is located between the Site and this portion of Queens County. In addition, according to the 1990 LMS report, only a small number of private wells are permitted by the New York City Department of Health for nonpotable uses. Therefore, any groundwater impacts at the Site would be expected to be confined to a thin surficial water-bearing unit flowing in the direction of Newtown Creek, which would not impact any potable water supplies.

Local influences on groundwater flow at the Site potentially could include the following:

- Off-Site Pumping: While it is not expected, at this time, it is not known whether there is any nearby pumping that would influence the direction and gradients of groundwater flow; and,
- Tidal Fluctuations in Newtown Creek: While the LMS Study indicated a potential for tidal effects, a subsequent, more comprehensive study (DMJ Associates, Fall 2000) provided continuous water level data indicating that off-Site wells located between the Site and Newtown Creek (MW-3, MW-3R, and MW-7) as shown on Figure 6 did not reflect any appreciable tidal influence. Furthermore, according to the Comprehensive Solid Waste Management Plan prepared for the New York City Department of Sanitation, the shoreline of Newtown Creek consists almost completely of bulkheads, which would dampen any tidal effects.

---

[1] The OHM report discussed that the anticipated horizontal groundwater flow direction would be towards the southwest while the LMS report calculated a groundwater flow direction approximately south. However, these observations were made using fluid levels from wells containing LNAPL. Groundwater levels from wells not impacted by LNAPL are needed during the Remedial Investigation to verify the groundwater flow direction.

APPENDIX B

ENVIRONMENTAL SAMPLE ANALYSES RESULTS
LMS PHASE II STUDY

TABLE 4-2 (Page 1 of 2)

DECEMBER 1988 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	FIELD BLANK	GW-1	GW-2	GW-3	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STD.	NATURAL GW AMBIENT RANGE (r)
METALS							
Aluminum	[30]	1060	10500	10600	NS	NS	<5.0 - 1000
Antimony	ND	ND	ND	ND	3 GV	NS	-
Arsenic	ND N	[3.6] N	[7.6] N	24 N	25 (d)	50 P (d)	1.0 - 30
Barium	ND	313	928	1260	1000	1000 P	10 - 500
Beryllium	ND	ND	[1.9]	ND	3 GV (a)	NS	<10.0
Cadmium	ND	ND	ND	ND	10 (a)	10 P (a)	<1.0
Calcium	[302]	64800	253000	184000	NS	NS	1000 - 150000
Chromium	ND	ND	27	22	NS	50 P (a)	<1.0 - 5.0
Cobalt	ND	ND	ND	[18]	NS	NS	<10.0
Copper	[8.0] R	20 R	41 R	76 R	1000 (a)	1000 S (a)	<1.0 - 30
Iron	[6.8] R	44000 R	52100 R	54000 R	300	300 S	10.0 - 10000
Lead	79	[2.7]	61	130	25 (a)	50 P (a)	<15.0
Magnesium	ND	18100	41500	47700	35000 GV	NS	1000 - 50000
Manganese	ND	1800	3420	2760	300	300 S	<1.0 - 1000
Mercury	ND	ND	ND	ND	2	2 P	<1.0
Nickel	ND	ND	[31]	[32]	NS	NS	<10.0 - 50.0
Potassium	ND	11000	50400	205000	NS	NS	1000 - 10000
Selenium	ND N	ND N	ND N E	ND N E	20 (a)	10 P (a)	<1.0 - 10
Silver	ND	ND	ND	ND	50	50 P	<5.0
Sodium	ND	28100	140000	197000	NS	NDL S	500 - 120000
Thallium	ND	ND	ND	ND	4 GV (a)	NS	-
Vanadium	ND	[3.6]	[31]	62	NS	NS	<1.0 - 10.0
Zinc	[4.8]	31	112	119	5000 (a)	5000 S (a)	<10.0 - 2000
Cyanide	ND	ND	ND	ND	200	NS	-

All data in ug/l.

[ ] - Greater than or equal to the instrument detection limit, but below contract-required detection limit.

E - Value estimated due to interference.

N - Spiked sample recovery is not within control limits.

ND - Not detected at analytical detection limit; see Appendix I for detection limit.

NS - No standard.

R - Duplicate analysis not within control limits.

(a) - Acid soluble.

(d) - Dissolved.

(r) - Ref. No. 9, Appendix A.

GV - Guidance value.

NDL - No designated limit.

NS - No standard.

P - Primary drinking water standard.

S - Secondary drinking water standard.

TABLE 4-2 (Page 2 of 2)

DECEMBER 1988 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	TRIP BLANK	GW-1	GW-2	GW-3
OIL & GREASE (mg/l)	NR	250	120	NR
SPECIFIC CONDUCTANCE (umhos/cm)	NR	700	2100	2300
PESTICIDES/PCBs (ug/l)	ND	ND	NR	ND

ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NR - Not run due to laboratory mishandling.

TABLE 4-3 (Page 1 of 4)

FEBRUARY 1990 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-1	GW-2	GW-3	FIELD BLANK	TRIP BLANK	METHOD BLANK	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STDS.
VOLATILE ORGANICS								
Vinyl chloride	ND	ND	20	ND	ND	ND	5	2.0
Chloroethane	ND	60	36	ND	ND	ND	NS	5.0
Methylene chloride	3 bj	4 bj	4 j	2 bj	2 bj	2 j	50 GV	5.0
Acetone	ND	ND	9 j	ND	ND	ND	NS	50.0
1,1 Dichloroethane	ND	10	21	ND	ND	ND	50 GV	5.0
1,2 Dichloroethene (total)	3 j	ND	53	ND	ND	ND	NS	5.0
1,2-Dichloropropane	2 j	ND	ND	ND	ND	ND	50 GV	5.0
1,2-Dichloroethane	ND	ND	2 j	ND	ND	ND	0.8 GV	5.0
Benzene	6	15	18	ND	ND	ND	ND	5.0
Toluene	ND	ND	10	ND	ND	ND	50 GV	5.0
Ethylbenzene	ND	1 j	4 j	ND	ND	ND	50 GV	5.0
Total xylenes	25	3 j	7	ND	ND	ND	50 GV	5.0
Tentatively Identified Compounds								
Unknown	ND	6.0 j	ND	ND	ND	ND	NS	50 (c)
Unknown hydrocarbon	ND	ND	15 j	ND	ND	ND	NS	50 (c)
Benzene, 1-ethyl-2-methyl-	7.0 j	9.0 j	ND	ND	ND	ND	NS	50 (c)
Benzene, 1,2,3-trimethyl-	ND	5.0 j	ND	ND	ND	ND	NS	50 (c)
Benzene, propyl-	ND	6.0 j	ND	ND	ND	ND	NS	50 (c)
Propane, 2-(ethylthio)-	7 j	ND	ND	ND	ND	ND	NS	50 (c)
Trimethylbenzene	89 j (2)	ND	ND	ND	ND	ND	NS	50 (c)
Hexane, 2,5-dimethyl-	ND	ND	18 j	ND	ND	ND	NS	50 (c)
Heptane, 3-methyl	ND	ND	23 j	ND	ND	ND	NS	50 (c)
Cyclohexane	20 j	ND	ND	ND	ND	ND	NS	50 (c)
Cyclohexane, ethyl-	12 j	ND	ND	ND	ND	ND	NS	50 (c)
Cyclohexane, methyl-	45 j	12 j	39 j	ND	ND	ND	NS	50 (c)
Cyclohexane, 1,3-dimethyl-,cl	9.0 j	ND	ND	ND	ND	ND	NS	50 (c)
Ethylmethylcyclohexane + unknown	ND	ND	14 j	ND	ND	ND	NS	50 (c)
Substituted cyclohexane	9.0 j	ND	11 j	ND	ND	ND	NS	50 (c)
Nonane, 2,6-dimethyl-	ND	ND	13 j	ND	ND	ND	NS	50 (c)
Nonane, 3-methyl-	ND	ND	15 j	ND	ND	ND	NS	50 (c)
Nonane, 4-methyl-	14 j	ND	25 j	ND	ND	ND	NS	50 (c)
Octane, 2,6-dimethyl-	ND	ND	18 j	ND	ND	ND	NS	50 (c)

All data in ug/l.

( ) - Number of unknown compounds in total.
(c) - The criterion of 50 ug/l is for unspecified organic contaminants (UOC).
b - Found in method blank.
j - Estimated concentration; compound present below method detection limit.
GV - Guidance value.

ND - Not detected at analytical detection limit;
see Appendix I for detection limit.
NS - No standard.

TABLE 4-3 (Page 2 of 4)

FEBRUARY 1990 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-1	GW-1 RE	GW-2	GW-3	GW-3 DL	FIELD BLANK	TRIP BLANK	METHOD BLANK	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STDS.
SEMIVOLATILES					[Dil.: 10.0]					
1,2 Dichlorobenzene	ND	ND	ND	4 J	ND	ND	ND	ND	4.7	50
2-Methylphenol	ND	ND	ND	6 J	ND	ND	ND	ND	NS	50
Naphthalene	ND	ND	ND	29	ND	ND	ND	ND	10 GV	50
2-Methylnaphthalene	3 J	ND	ND	38	22 J	ND	ND	ND	NS	50
Acenaphthene	ND	ND	47	28	21 J	ND	ND	ND	20 GV	50
Fluorene	ND	ND	71	32	37 J	ND	ND	ND	50 GV	50
Phenanthrene	6 J	ND	430	230	160	ND	ND	ND	50 GV	50
Anthracene	3 J	ND	170	58	51 J	ND	ND	ND	50 GV	50
Fluoranthene	4 J	ND	110	100	49 J	ND	ND	ND	50 GV	50
Pyrene	14	3 J	440	310	100	ND	ND	ND	50 GV	50
Benzo(a)anthracene	15	3 J	330	290	170	ND	ND	ND	0.002 GV	50
Chrysene	19	3 J	500	240	220	ND	ND	ND	0.002 GV	50
Bis(2-ethylhexyl)phthalate	6 bJ	4 J	ND	ND	ND	ND	ND	16	4200	50
Benzo(b)fluoranthene	3 Jx	ND	110 x	53 x	51 Jx	ND	ND	ND	0.002 GV	50
Benzo(k)fluoranthene	3 Jx	ND	110 x	53 x	51 Jx	ND	ND	ND	0.002 GV	50
Benzo(a)pyrene	3 J	ND	86	62	62 J	ND	ND	ND	ND	50
Indeno(1,2,3-cd)pyrene	ND	ND	ND	12	ND	ND	ND	ND	0.002 GV	50
Dibenzo(a,h)anthracene	ND	ND	ND	28	ND	ND	ND	ND	NS	50
Benzo(g,h,i)perylene	ND	ND	ND	32	ND	ND	ND	ND	NS	50

All data in ug/l.

b	- Found in method blank.
J	- Estimated concentration; compound present below method detection limit.
x	- Value represents the coelution of indistinguishable isomers.
DL	- Diluted sample analysis.
GV	- Guidance value.
ND	- Not detected at analytical detection limit; see Appendix I for detection limit.
NS	- No standard.
RE	- Reextracted analysis.

TABLE 4-3 (Page 3 of 4)

FEBRUARY 1990 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-1	GW-1 RE	GW-2	GW-3	GW-3 DL	FIELD BLANK	TRIP BLANK	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STDS.
SEMIVOLATILES (con't)					[Dil.: 10.0]				
Tentatively Identified Compounds									
Unknown	408 j (10)	130 j (5)	22600 j (9)	8460 j (9)	21400 j (16)	ND	ND	NS	50 (c)
Solvent contaminant	ND	58 bj (2)	ND	ND	ND	54 bj (2)	ND	NS	50 (c)
VOA TCL	ND	12 j	ND	ND	ND	ND	ND	NS	50 (c)
Unknown hydrocarbon	ND	ND	11000 j (4)	7920 j (6)	3700 j (4)	ND	ND	NS	50 (c)
Unknown cyclic hydrocarbon	32 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Unknown PAH	82 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Caprolactam	110 j	120 j	ND	ND	ND	ND	ND	NS	50 (c)
Dimethyl undecane	ND	ND	ND	560 j	ND	ND	ND	NS	50 (c)
Heptadecane	54 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Dimethyl heptadecane	58 j	ND	15300 j (4)	ND	ND	ND	ND	NS	50 (c)
Trimethyl decane	ND	ND	4400 j	ND	ND	ND	ND	NS	50 (c)
Trimethyl dodecane	66 j	ND	1800 j	760 j	ND	ND	ND	NS	50 (c)
Dimethylnaphthalene	ND	ND	ND	1000 j	ND	ND	ND	NS	50 (c)
Trimethylnaphthalene + unknown	ND	ND	ND	400 j	ND	ND	ND	NS	50 (c)
Methylnaphthalene + unknown	ND	ND	ND	680 j	ND	ND	ND	NS	50 (c)
Methyl anthracene + unknown	ND	ND	2000 j	ND	ND	ND	ND	NS	50 (c)
Methylbenzene acetic acid	ND	80 j (2)	ND	ND	ND	ND	ND	NS	50 (c)
Benzene acetic acid,.alpha.-	66 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Benzene acetic acid + unknown	72 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Alkyl benzene	ND	14 j	ND	ND	ND	ND	ND	NS	50 (c)
Methylpropenylbenzene + unknown	42 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Benzene, 1,2,4-trimethyl-	ND	20 j	ND	ND	ND	ND	ND	NS	50 (c)
Benzene, 1,3,5-trimethyl-	ND	12 j	ND	ND	ND	ND	ND	NS	50 (c)
Trimethylbenzene	28 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
PESTICIDES/PCBs	ND	NR	ND	ND	NR	ND	NR		

All data in ug/l.

( ) - Number of unknown compounds in total.
(c) - The criterion of 50 ug/l is for unspecified organic contaminants (UOC).
b - Found in method blank.
j - Estimated concentration; compound present below method detection limit.
RE - Reextracted analysis.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
DL - Diluted sample analysis.
NR - Not run.
NS - No standard.

TABLE 4-3 (Page 4 of 4)

FEBRUARY 1990 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-1	GW-2	GW-3	FIELD BLANK	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STD.	NATURAL GW AMBIENT RANGE (r)
METALS							
Aluminum	4130	2450	3220	ND	NS	NS	<5.0 - 1000
Antimony	28.7 B	38.2 B	ND	ND	3 GV	NS	
Arsenic	3.7 B N	ND N	3.0 B N	ND N	25 (d)	50 P (d)	1.0 - 30
Barium	200 B	927	881	ND	1000	1000 P	10 - 500
Beryllium	ND	ND	ND	ND	3 GV (a)	NS	<10.0
Cadmium	ND	ND	ND	ND	10 (a)	10 P (a)	<1.0
Calcium	85600	269000	188000	36.3 B	NS	NS	1000 - 150000
Chromium	11.3	13.1	8.6 B	ND	NS	50 P (a)	<1.0 - 5.0
Cobalt	19.8 B	10.4 B	6.0 B	10.7 B	NS	NS	<10.0
Copper	31.7	ND	ND	ND	1000 (a)	1000 S (a)	<1.0 - 30
Iron	62400 R	18400 R	22900 R	20.1 B R	300	300 S	10.0 - 10000
Lead	10.6 N	15.5 N	12.0 SA N	ND N	25 (a)	50 P (a)	<15.0
Magnesium	27100	40000	46700	ND	35000 GV	NS	1000 - 50000
Manganese	2550	2260	2130	3.0 B	300	300 S	<1.0 - 1000
Mercury	ND	ND	ND	ND	2	2 P	<1.0
Nickel	ND	ND	ND	ND	NS	NS	<10.0 - 50.0
Potassium	3030 B	47000	144000	ND	NS	NS	1000 - 10000
Selenium	ND E N	ND E N	ND E N	ND N	20 (a)	10 P (a)	<1.0 - 10
Silver	ND	5.7 B	ND	ND	50	50 P	<5.0
Sodium	42400	89600	147000	ND	NS	NDL S	500 - 120000
Thallium	ND W N	ND N W	ND W N	ND N	4 GV (a)	NS	
Vanadium	21.7 B	23.6 B	21.5 B	8.2 B	NS	NS	<1.0 - 10.0
Zinc	55.3	34.9	44.0	9.9 B	5000 (a)	5000 S (a)	<10.0 - 2000
Cyanide	ND	ND	ND	ND	200	NS	

All data in ug/l.
B - Value is less than the contract-required detection limit, but greater than the instrument detection limit.
E - Value estimated due to interference.
N - Spiked sample recovery is not within control limits.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
R - Duplicate analysis not within control limits.
SA - Value determined by the method of standard addition.
W - Post-digestion spike out of control limits; sample absorbance is less than 50% of spike absorbance.

(a) - Acid soluble.
(d) - Dissolved.
(r) - Ref. No. 9, Appendix A.
GV - Guidance value.
NDL - No designated limit.
NS - No standard.
P - Primary drinking water standard.
S - Secondary drinking water standard.

TABLE 4-2 (P. 1 of 2)

DECEMBER 1988 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	FIELD BLANK	GW-1	GW-2	GW-3	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STD.	NATURAL GW AMBIENT RANGE (r)
METALS							
Aluminum	[30]	1060	10500	10600	NS	NS	<5.0 - 1000
Antimony	ND	ND	ND	ND	3 GV	NS	-
Arsenic	ND N	[3.6] N	[7.6] N	24 N	25 (d)	50 P (d)	1.0 - 30
Barium	ND	313	928	1260	1000	1000 P	10 - 500
Beryllium	ND	ND	[1.9]	ND	3 GV (a)	NS	<10.0
Cadmium	ND	ND	ND	ND	10 (a)	10 P (a)	<1.0
Calcium	[302]	64800	253000	184000	NS	NS	1000 - 150000
Chromium	ND	ND	27	22	NS	50 P (a)	<1.0 - 5.0
Cobalt	ND	ND	ND	[18]	NS	NS	<10.0
Copper	[8.0] R	29 R	41 R	76 R	1000 (a)	1000 S (a)	<1.0 - 30
Iron	[6.8] R	44000 R	52100 R	54000 R	300	300 S	10.0 - 10000
Lead	79	[2.7]	61	130	25 (a)	50 P (a)	<15.0
Magnesium	ND	18100	41500	47700	35000 GV	NS	1000 - 60000
Manganese	ND	1800	3420	2760	300	300 S	<1.0 - 1000
Mercury	ND	ND	ND	ND	2	2 P	<1.0
Nickel	ND	ND	[31]	[32]	NS	NS	<10.0 - 50.0
Potassium	ND	11000	50400	205000	NS	NS	1000 - 10000
Selenium	ND N	ND N	ND N E	ND N E	20 (a)	10 P (a)	<1.0 - 10
Silver	ND	ND	ND	ND	50	50 P	<5.0
Sodium	ND	28100	140000	197000	NS	NDL S	500 - 120000
Thallium	ND	ND	ND	ND	4 GV (a)	NS	-
Vanadium	ND	[3.6]	[31]	62	NS	NS	<1.0 - 10.0
Zinc	[4.8]	31	112	119	5000 (a)	5000 S (a)	<10.0 - 2000
Cyanide	ND	ND	ND	ND	200	NS	-

All data in ug/l.

[ ] - Greater than or equal to the instrument detection limit, but below contract-required detection limit.
E - Value estimated due to interference.
N - Spiked sample recovery is not within control limits.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NS - No standard.
R - Duplicate analysis not within control limits.

(a) - Acid soluble.
(d) - Dissolved.
(r) - Ref. No. 9, Appendix A.
GV - Guidance value.
NDL - No designated limit.
NS - No standard.
P - Primary drinking water standard.
S - Secondary drinking water standard.

TABLE 4-2 (Page 2 of 2)

DECEMBER 1988 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	TRIP BLANK	GW-1	GW-2	GW-3
OIL & GREASE (mg/l)	NR	250	120	NR
SPECIFIC CONDUCTANCE (umhos/cm)	NR	700	2100	2300
PESTICIDES/PCBs (ug/l)	ND	ND	NR	ND

ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NR - Not run due to laboratory mishandling.

TABLE 4-3 (Page 1 of 4)

FEBRUARY 1990 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-1	GW-2	GW-3	FIELD BLANK	TRIP BLANK	METHOD BLANK	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STDS.
VOLATILE ORGANICS								
Vinyl chloride	ND	ND	20	ND	ND	ND	5	2.0
Chloroethane	ND	60	36	ND	ND	ND	NS	5.0
Methylene chloride	3 bJ	4 bJ	4 J	2 bJ	2 bJ	2 J	50 GV	5.0
Acetone	ND	ND	9 J	ND	ND	ND	NS	50.0
1,1 Dichloroethane	ND	10	21	ND	ND	ND	50 GV	5.0
1,2 Dichloroethene (total)	3 J	ND	53	ND	ND	ND	NS	5.0
1,2-Dichloropropane	2 J	ND	ND	ND	ND	ND	50 GV	5.0
1,2-Dichloroethane	ND	ND	2 J	ND	ND	ND	0.8 GV	5.0
Benzene	6	15	18	ND	ND	ND	ND	5.0
Toluene	ND	ND	10	ND	ND	ND	50 GV	5.0
Ethylbenzene	ND J	1 J	4 J	ND	ND	ND	50 GV	5.0
Total xylenes	25	3 J	7	ND	ND	ND	50 GV	5.0
Tentatively Identified Compounds								
Unknown	ND	6.0 J	ND	ND	ND	ND	NS	50 (c)
Unknown hydrocarbon	ND	ND	15 J	ND	ND	ND	NS	50 (c)
Benzene, 1-ethyl-2-methyl-	7.0 J	9.0 J	ND	ND	ND	ND	NS	50 (c)
Benzene, 1,2,3-trimethyl-	ND	5.0 J	ND	ND	ND	ND	NS	50 (c)
Benzene, propyl-	ND	6.0 J	ND	ND	ND	ND	NS	50 (c)
Propane, 2-(ethylthio)-	7 J	ND	ND	ND	ND	ND	NS	50 (c)
Trimethylbenzene	89 J (2)	ND	ND	ND	ND	ND	NS	50 (c)
Hexane, 2,5-dimethyl-	ND	ND	18 J	ND	ND	ND	NS	50 (c)
Heptane, 3-methyl	ND	ND	23 J	ND	ND	ND	NS	50 (c)
Cyclohexane	20 J	ND	ND	ND	ND	ND	NS	50 (c)
Cyclohexane, ethyl-	12 J	ND	ND	ND	ND	ND	NS	50 (c)
Cyclohexane, methyl-	45 J	12 J	39 J	ND	ND	ND	NS	50 (c)
Cyclohexane, 1,3-dimethyl-,cl	9.0 J	ND	ND	ND	ND	ND	NS	50 (c)
Ethylmethylcyclohexane + unknown	ND	ND	14 J	ND	ND	ND	NS	50 (c)
Substituted cyclohexane	9.0 J	ND	11 J	ND	ND	ND	NS	50 (c)
Nonane, 2,6-dimethyl-	ND	ND	13 J	ND	ND	ND	NS	50 (c)
Nonane, 3-methyl-	ND	ND	15 J	ND	ND	ND	NS	50 (c)
Nonane, 4-methyl-	14 J	ND	25 J	ND	ND	ND	NS	50 (c)
Octane, 2,6-dimethyl-	*ND*	*ND*	*18 J*	*ND*	*ND*	*ND*	NS	50 (c)

All data in ug/l.

( ) - Number of unknown compounds in total.

(c) - The criterion of 50 ug/l is for unspecified organic contaminants (UOC).

b - Found in method blank.

J - Estimated concentration; compound present below method detection limit.

GV - Guidance value.

ND - Not detected at analytical detection limit;
see Appendix I for detection limit.

NS - No standard.

TABLE 4-3 (Page 2 of 4)

FEBRUARY 1990 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-1	GW-1 RE	GW-2	GW-3	GW-3 DL	FIELD BLANK	TRIP BLANK	METHOD BLANK	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STDS.
SEMIVOLATILES					[Dil.: 10.0]					
1,2 Dichlorobenzene	ND	ND	ND	4 J	ND	ND	ND	ND	4.7	50
2-Methylphenol	ND	ND	ND	6 J	ND	ND	ND	ND	NS	50
Naphthalene	ND	ND	ND	29	ND	ND	ND	ND	10 GV	50
2-Methylnaphthalene	3 J	ND	ND	38	22 J	ND	ND	ND	NS	50
Acenaphthene	ND	ND	47	28	21 J	ND	ND	ND	20 GV	50
Fluorene	ND	ND	71	32	37 J	ND	ND	ND	50 GV	50
Phenanthrene	6 J	ND	430	230	160	ND	ND	ND	50 GV	50
Anthracene	3 J	ND	170	58	51 J	ND	ND	ND	50 GV	50
Fluoranthene	4 J	ND	110	100	49 J	ND	ND	ND	50 GV	50
Pyrene	14	3 J	440	310	100	ND	ND	ND	50 GV	50
Benzo(a)anthracene	15	3 J	330	290	170	ND	ND	ND	0.002 GV	50
Chrysene	19	3 J	500	240	220	ND	ND	ND	0.002 GV	50
Bis(2-ethylhexyl)phthalate	6 bJ	4 J	ND	ND	ND	ND	ND	16	4200	50
Benzo(b)fluoranthene	3 Jx	ND	110 x	53 x	51 Jx	ND	ND	ND	0.002 GV	50
Benzo(k)fluoranthene	3 Jx	ND	110 x	53 x	51 Jx	ND	ND	ND	0.002 GV	50
Benzo(a)pyrene	3 J	ND	86	62	62 J	ND	ND	ND	ND	50
Indeno(1,2,3-cd)pyrene	ND	ND	ND	12	ND	ND	ND	ND	0.002 GV	50
Dibenzo(a,h)anthracene	ND	ND	ND	28	ND	ND	ND	ND	NS	50
Benzo(g,h,i)perylene	ND	ND	ND	32	ND	ND	ND	ND	NS	50

All data in ug/l.

b	- Found in method blank.
J	- Estimated concentration; compound present below method detection limit.
x	- Value represents the coelution of indistinguishable isomers.
DL	- Diluted sample analysis.
GV	- Guidance value.
ND	- Not detected at analytical detection limit; see Appendix I for detection limit.
NS	- No standard.
RE	- Reextracted analysis.

TABLE 4-3 (Page 3 of 4)

FEBRUARY 1990 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-1	GW-1 RE	GW-2	GW-3	GW-3 DL	FIELD BLANK	TRIP BLANK	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STDS.
SEMIVOLATILES (con't)					[Dil.: 10.0]				
Tentatively Identified Compounds									
Unknown	408 J (10)	130 J (5)	22600 J (9)	8460 J (9)	21400 J (16)	ND	ND	NS	50 (c)
Solvent contaminant	ND	58 bJ (2)	ND	ND	ND	54 bJ (2)	ND	NS	50 (c)
VOA TCL	ND	12 J	ND	ND	ND	ND	ND	NS	50 (c)
Unknown hydrocarbon	ND	ND	11000 J (4)	7920 J (6)	3700 J (4)	ND	ND	NS	50 (c)
Unknown cyclic hydrocarbon	32 J	ND	ND	ND	ND	ND	ND	NS	50 (c)
Unknown PAH	82 J	ND	ND	ND	ND	ND	ND	NS	50 (c)
Caprolactam	110 J	120 J	ND	ND	ND	ND	ND	NS	50 (c)
Dimethyl undecane	ND	ND	ND	560 J	ND	ND	ND	NS	50 (c)
Heptadecane	54 J	ND	ND	ND	ND	ND	ND	NS	50 (c)
Dimethyl heptadecane	58 J	ND	15300 J (4)	ND	ND	ND	ND	NS	50 (c)
Trimethyl decane	ND	ND	4400 J	ND	ND	ND	ND	NS	50 (c)
Trimethyl dodecane	66 J	ND	1800 J	760 J	ND	ND	ND	NS	50 (c)
Dimethylnaphthalene	ND	ND	ND	1000 J	ND	ND	ND	NS	50 (c)
Trimethylnaphthalene + unknown	ND	ND	ND	400 J	ND	ND	ND	NS	50 (c)
Methylnaphthalene + unknown	ND	ND	ND	680 J	ND	ND	ND	NS	50 (c)
Methyl anthracene + unknown	ND	ND	2000 J	ND	ND	ND	ND	NS	50 (c)
Methylbenzene acetic acid	ND	80 J (2)	ND	ND	ND	ND	ND	NS	50 (c)
Benzene acetic acid,.alpha.-	66 J	ND	ND	ND	ND	ND	ND	NS	50 (c)
Benzene acetic acid + unknown	72 J	ND	ND	ND	ND	ND	ND	NS	50 (c)
Alkyl benzene	ND	14 J	ND	ND	ND	ND	ND	NS	50 (c)
Methylpropenylbenzene + unknown	42 J	ND	ND	ND	ND	ND	ND	NS	50 (c)
Benzene, 1,2,4-trimethyl-	ND	20 J	ND	ND	ND	ND	ND	NS	50 (c)
Benzene, 1,3,5-trimethyl-	ND	12 J	ND	ND	ND	ND	ND	NS	50 (c)
Trimethylbenzene	28 J	ND	ND	ND	ND	ND	ND	NS	50 (c)
PESTICIDES/PCBs	ND	NR	ND	ND	NR	ND	NR		

ll data in ug/l.
( ) - Number of unknown compounds in total.
c) - The criterion of 50 ug/l is for unspecified organic contaminants (UOC).
- Found in method blank.
- Estimated concentration; compound present below method detection limit.
RE - Reextracted analysis.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
DL - Diluted sample analysis.
NR - Not run.
NS - No standard.

TABLE 4-3 (Page 4 of 4)

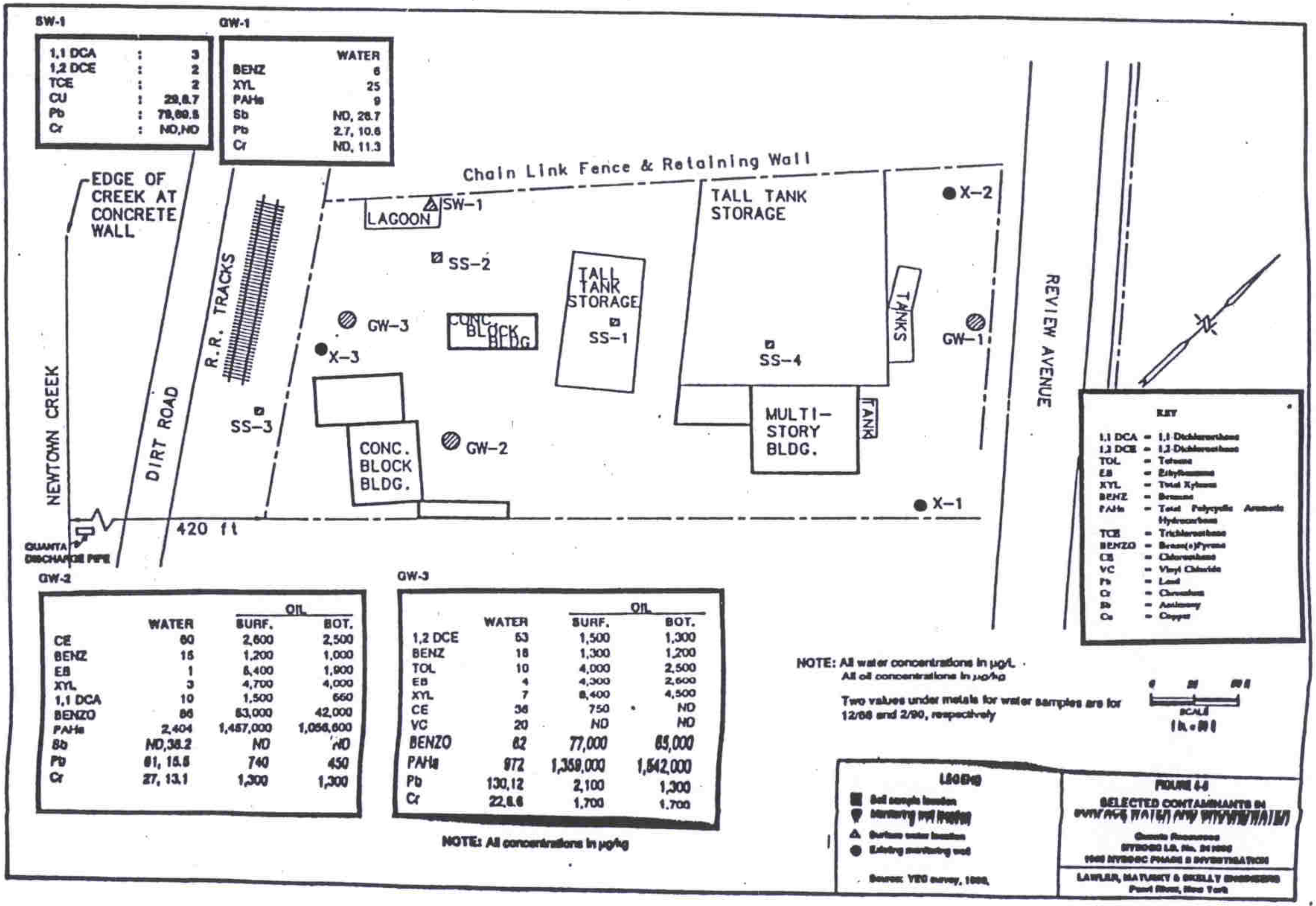
FEBRUARY 1990 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-1	GW-2	GW-3	FIELD BLANK	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STD.	NATURAL GW AMBIENT RANGE (r)
METALS							
Aluminum	4130	2450	3220	ND	NS	NS	<5.0 - 1000
Antimony	28.7 B	38.2 B	ND	ND	3 GV	NS	
Arsenic	3.7 B N	ND N	3.0 B N	ND N	25 (d)	50 P (d)	1.0 - 30
Barium	200 B	927	881	ND	1000	1000 P	10 - 600
Beryllium	ND	ND	ND	ND	3 GV (a)	NS	<10.0
Cadmium	ND	ND	ND	ND	10 (a)	10 P (a)	<1.0
Calcium	85600	269000	188000	36.3 B	NS	NS	1000 - 150000
Chromium	11.3	13.1	8.6 B	ND	NS	50 P (a)	<1.0 - 5.0
Cobalt	19.8 B	10.4 B	6.0 B	10.7 B	NS	NS	<10.0
Copper	31.7	ND	ND	ND	1000 (a)	1000 S (a)	<1.0 - 30
Iron	62400 R	18400 R	22900 R	20.1 B R	300	300 S	10.0 - 10000
Lead	10.6 N	15.5 N	12.0 SA N	ND N	25 (a)	50 P (a)	<15.0
Magnesium	27100	40000	46700	ND	35000 GV	NS	1000 - 60000
Manganese	2550	2260	2130	3.0 B	300	300 S	<1.0 - 1000
Mercury	ND	ND	ND	ND	2	2 P	<1.0
Nickel	ND	ND	ND	ND	NS	NS	<10.0 - 50.0
Potassium	3030 B	47000	144000	ND	NS	NS	1000 - 10000
Selenium	ND E N	ND E N	ND E N	ND N	20 (a)	10 P (a)	<1.0 - 10
Silver	ND	5.7 B	ND	ND	50	50 P	<5.0
Sodium	42400	89600	147000	ND	NS	NDL S	500 - 120000
Thallium	ND W N	ND N W	ND W N	ND N	4 GV (a)	NS	
Vanadium	21.7 B	23.6 B	21.5 B	8.2 B	NS	NS	<1.0 - 18.5
Zinc	55.3	34.9	44.0	9.9 B	5000 (a)	5000 S (a)	<10.0 - 2000
Cyanide	ND	ND	ND	ND	200	NS	

All data in ug/l.

B	- Value is less than the contract-required detection limit, but greater than the instrument detection limit.
E	- Value estimated due to interference.
N	- Spiked sample recovery is not within control limits.
ND	- Not detected at analytical detection limit; see Appendix I for detection limit.
R	- Duplicate analysis not within control limits.
SA	- Value determined by the method of standard addition.
W	- Post-digestion spike out of control limits; sample absorbance is less than 50% of spike absorbance.
(a)	- Acid soluble.
(d)	- Dissolved.
(r)	- Ref. No. 9, Appendix A.
GV	- Guidance value.
NDL	- No designated limit.
NS	- No standard.
P	- Primary drinking water standard.
S	- Secondary drinking water standard.



SW-1

1,1 DCA	:	3
1,2 DCE	:	2
TCE	:	2
CU	:	29,8.7
Pb	:	79,69.5
Cr	:	ND,ND

GW-1

	WATER
BENZ	6
XYL	25
PAHs	9
Sb	ND, 26.7
Pb	2.7, 10.6
Cr	ND, 11.3

GW-2

		OIL	
	WATER	SURF.	BOT.
CE	60	2,600	2,500
BENZ	15	1,200	1,000
EB	1	6,400	1,900
XYL	3	4,700	4,000
1,1 DCA	10	1,500	660
BENZO	86	63,000	42,000
PAHs	2,404	1,457,000	1,056,600
Sb	ND,38.2	ND	ND
Pb	61, 15.5	740	450
Cr	27, 13.1	1,300	1,300

GW-3

		OIL	
	WATER	SURF.	BOT.
1,2 DCE	63	1,500	1,300
BENZ	18	1,300	1,200
TOL	10	4,000	2,500
EB	4	4,300	2,600
XYL	7	8,400	4,500
CE	36	750	ND
VC	20	ND	ND
BENZO	62	77,000	65,000
PAHs	972	1,359,000	1,542,000
Pb	130,12	2,100	1,300
Cr	22,6.6	1,700	1,700

NOTE: All concentrations in µg/kg

KEY

1,1 DCA = 1,1-Dichloroethane
1,2 DCE = 1,2-Dichloroethene
TOL = Toluene
EB = Ethylbenzene
XYL = Total Xylenes
BENZ = Benzene
PAHs = Total Polycyclic Aromatic Hydrocarbons
TCE = Trichloroethene
BENZO = Benzo(a)Pyrene
CE = Chloroethane
VC = Vinyl Chloride
Pb = Lead
Cr = Chromium
Sb = Antimony
Cu = Copper

NOTE: All water concentrations in µg/L
All oil concentrations in µg/kg

Two values under metals for water samples are for 12/88 and 2/90, respectively

LEGEND

- ■ Soil sample location
- ▼ Monitoring well location
- △ Surface water location
- ● Existing monitoring well

Source: YEC survey, 1988.

FIGURE 4-[illegible]

SELECTED CONTAMINANTS IN SURFACE WATER AND GROUNDWATER

Quanta Resources
NYSDEC I.D. No. [illegible]
1990 NYSDEC PHASE II INVESTIGATION

LAWLER, MATUSKY & SKELLY ENGINEERS
Pearl River, New York

TABLE 4-4

DECEMBER 1988 SURFACE WATER SEDIMENT, OIL, AND DRUM SAMPLES DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SED-1	GW-2 OIL	GW-3 OIL	DRUM CUT	DRUM DECON	EPA MAXIMUM CONCENTRATION
EP TOXICITY METALS (ug/l)						
Arsenic, total	[3]	[6.3]	11	31	NR	5,000
Barium, total	[161]	[133]	[171]	233	NR	100,000
Chromium, total	ND	ND	ND	47	NR	1,000
Lead, total	429	[1.9]	[1.9]	281	NR	5,000
Mercury, total	ND	ND	ND	0.71	NR	5,000
OIL & GREASE (mg/kg)	NR	NR	300,000	NR	NR	
IGNITABILITY (deg. F)	NR	>212 •	>212 •	>212 •	NR	
PCB (ug/kg)						
Aroclor-1242	NR	ND	1800	ND	ND	

> - Greater than instrument detection limit.
[ ] - Greater than or equal to the instrument detection limit but below contract-required detection limit.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NR - Not run due to laboratory mishandling.

TABLE 4-5 (Page 1 of 3)

FEBRUARY 1990 OIL SAMPLE DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-2 P BOTTOM	GW-2 P SURFACE	GW-2 P SURFACE RE	GW-3 P BOTTOM	GW-3 P BOTTOM MS	GW-3 P BOTTOM MSD	GW-3 P SURFACE	GW-3 P SURFACE RE
VOLATILE ORGANICS								
Chloroethane	2500	2900	2600	ND	ND	ND	790 J	750 J
Methylene chloride	470 bJ	350 bJ	2700 b	1500 b	1600 b	1600 b	1200 bJ	1000 bJ
Acetone	ND	ND	1100 J	ND	ND	ND	ND	ND
1,1 Dichloroethane	660 J	1500	1500	740 J	1200 J	1200 J	780 J	640 J
1,2 Dichloroethene (total)	ND	ND	ND	1300	2000	2200	1900	1500
Trichloroethene	ND	ND	ND	ND	ND	ND	320 J	ND
Benzene	1000 J	1200 J	1200 J	1200 J	ND	ND	1700	1300
Tetrachloroethene	ND	ND	ND	ND	ND	ND	300 J	270 J
Toluene	500 J	830 J	720 J	2500	ND	ND	5700	4000
Ethylbenzene	1900	7200	5400	2600	4200	4700	5100	4300
Total xylenes	4000	6200	4700	4500	7200	7900	10000	8400
Tentatively Identified Compounds								
Unknown	24000 J (2)	57000 J (2)	13000 J	54000 J (3)	NR	NR	30000 J	105000 J (4)
Unknown alkane	ND	17000 J	ND	ND	NR	NR	ND	ND
Unknown alkene	9300 J	ND	ND	ND	NR	NR	ND	ND
Unknown hydrocarbon	21000 J	ND	15000 J	17000 J	NR	NR	ND	ND
Hydrocarbon + unknown	ND	ND	14000 J	ND	NR	NR	ND	ND
Substituted benzene	ND	ND	ND	ND	NR	NR	35000 J (2)	ND
Benzene, propyl-	15000 J	30000 J	21000 J	18000 J	NR	NR	ND	23000 J
Ethylmethylbenzene	28000 J (2)	38000 J (2)	26000 J (2)	ND	NR	NR	ND	ND
Trimethylbenzene	15000 J	18000 J	13000 J	ND	NR	NR	ND	ND
Hexane, 2,5-dimethyl-	ND	ND	ND	ND	NR	NR	21000 J	21000 J
Hexane, 3-methyl-	ND	ND	ND	ND	NR	NR	23000 J	ND
Cyclohexane, ethyl-	35000 J	38000 J	30000 J	48000 J	NR	NR	50000 J	55000 J
Cyclohexane, methyl-	28000 J	24000 J	19000 J	45000 J	NR	NR	50000 J	43000 J
Cyclohexane, 1-ethyl-4-methyl	ND	ND	ND	ND	NR	NR	ND	28000 J
Cyclohexane, 1,3-dimethyl-,cl	ND	ND	ND	ND	NR	NR	25000 J	ND
Dimethylcyclohexane	ND	ND	ND	24000 J	NR	NR	ND	ND
Ethylmethylcyclohexane	ND	23000 J	21000 J	ND	NR	NR	ND	ND
Ethylmethylcyclohexane + unknown	ND	ND	ND	24000 J	NR	NR	ND	ND
Cyclohexane, propyl-	ND	ND	ND	ND	NR	NR	ND	38000 J
2-Hexene,3,4,4-trimethyl-	ND	ND	ND	ND	NR	NR	18000 J	ND
Heptane	ND	ND	ND	15000 J	NR	NR	16000 J	ND

All data in ug/kg.

( ) - Number of unknown compounds in total.
b - Found in method blank.
J - Estimated concentration; compound present below method detection limit.
MS - Matrix spike.
MSD - Matrix spike duplicate.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NR - Not run.
RE - *Reextracted analysis; initial analysis outside QA/QC limits.*

TABLE 4-5 (Page 3 of 3)

FEBRUARY 1990 OIL SAMPLE DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-2 P BOTTOM	GW-2 P BOTTOM DUP.	GW-2 P SURFACE	GW-3 P BOTTOM	GW-3 P SURFACE
METALS					
Aluminum	8.5 B	9.7 B	7.6 B	12.7 B	9.9 B
Antimony	ND	ND	ND	ND	ND
Arsenic	1.2 B W	1.6 B	1.8 B SA	ND SA	1.7 B SA
Barium	1.0 B	1.2 B	1.3 B	3.2 B	4.2 B
Beryllium	ND	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND	ND
Calcium	33.4 B	18.0 B	20.9 B	39.7 B	43.3 B
Chromium	1.3 B	ND	1.3 B	1.7 B	1.7 B
Cobalt	ND	ND	ND	ND	ND
Copper	ND	ND	ND	ND	ND
Iron	12.1 B	8.5 B	7.8 B	13.2 B	13.4 B
Lead	0.45 B W	0.49 B	0.74	1.3	2.1
Magnesium	ND	ND	ND	ND	ND
Manganese	0.36 B	0.57 B	ND	1.9 B	2.1 B
Mercury	ND N	ND	ND N	ND N	ND N
Nickel	ND	ND	ND	ND	ND
Potassium	ND	ND	ND	ND	ND
Selenium	ND E N	ND	ND E N	ND E N	ND E N
Silver	ND	ND	ND	ND	ND
Sodium	ND	ND	ND	ND	ND
Thallium	ND	ND	ND W	ND	ND
Vanadium	2.8 B	2.8 B	3.0 B	2.1 B	3.3 B
Zinc	4.3	4.9	3.3 B	7.2	4.7
Cyanide	ND	ND	ND	ND	ND

All data in mg/kg.

B - Value is less than the contract-required detection limit, but greater than the instrument detection limit.
E - Value estimated due to interference.
N - Spiked sample recovery is not within control limits.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
SA - Value determined by the method of standard addition.
W - Post-digestion spike out of control limits; sample absorbance is less than 50% of spike absorbance.

TABLE 4-6 (Page 2 of 2)

DECEMBER 1988 SURFACE WATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SW-1	SW-1 MS	SW-1 MSD
OIL & GREASE (mg/l)	1.3	NR	NR
SPECIFIC CONDUCTANCE (umhos/cm)	470	NR	NR
PESTICIDES/PCBs (ug/l)	ND	ND	ND

MS - Matrix spike.
MSD - Matrix spike duplicate.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NR - Not run.

TABLE 4-7 (Page 1 of 2)

FEBRUARY 1990 SURFACE WATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SW-1	SW-1 MS	SW-1 MSD	CLASS SD SW STDS.
VOLATILE ORGANICS				
Methylene chloride	ND	ND	1 j	NS
Acetone	6 j	5 j	5 j	NS
1,1 Dichloroethane	3 j	3 j	3 j	NS
1,2 Dichloroethene (total)	2 j	2 j	2 j	NS
Trichloroethene	2 j	ND	ND	NS
Tentatively Identified Compounds	ND	NR	NR	-
SEMIVOLATILES				
Benzoic acid	ND	ND	10 j	NS
Bis(2-ethylhexyl)phthalate	3 bj	ND	2 bj	NS
Tentatively Identified Compounds				
Solvent contaminant	ND	NR	NR	NS
Unknown	8 j	NR	NR	NS
PESTICIDES/PCBs	ND	ND	ND	-

All data in ug/l.

b	- Found in method blank.
j	- Estimated concentration; compound present below method detection limit.
MS	- Matrix spike.
MSD	- Matrix spike duplicate.
ND	- Not detected at analytical detection limit; see Appendix I for detection limit.
NR	- Not run.
NS	- No standard.

TABLE 4-7 (Page 2 of 2)

FEBRUARY 1990 SURFACE WATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SW-1	SW-1 DUP.	CLASS SD SW STDS.
METALS			
Aluminum	475	447	NS
Antimony	ND	ND	NS
Arsenic	ND N	ND	120
Barium	101 B	98 B	NS
Beryllium	ND	ND	NS
Cadmium	ND	ND	NS
Calcium	88300	87700	NS
Chromium	ND	ND	NS
Cobalt	3.3 B	ND	NS
Copper	8.7 B	ND	3.2
Iron	1140 R	852 R	NS
Lead	69.5 SA N	61.9	220
Magnesium	8760	8700	NS
Manganese	27.4	25.7	NS
Mercury	ND	ND	NS
Nickel	ND	ND	140
Potassium	23000	20600	NS
Selenium	ND W N	ND	NS
Silver	ND	ND	2.3
Sodium	14200	13700	NS
Thallium	ND W N	ND	NS
Vanadium	4.1 B	ND	NS
Zinc	113	123	170
Cyanide	ND	ND	1.0

All data in ug/l.

B - Value is less than the contract-required detection limit, but greater than the instrument detection limit.
N - Spiked sample recovery is not within control limits.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NS - No standard.
R - Duplicate analysis not within control limits.
SA - Value determined by the method of standard addition.
W - Post-digestion spike out of control limits; sample absorbance is less than 50% of spike absorbance.

TABLE 4-8 (Page 1 of 4)

DECEMBER 1988 SEDIMENT AND SOIL DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SED-1	SS-1	SS-2	SS-2 MS	SS-2 MSD	SS-3	SS-3 MS	SS-3 MSD	SS-4	BACKGROUND SOIL DATA (g)
VOLATILE ORGANICS										
Methylene chloride	44 b	1500 bJ	1200 b	950 b	940 b	13 b	17 b	18 b	720 bJ	BU
Acetone	210 b	ND	1000 bJ	1200 J	1400 J	55 b	78 b	67 b	ND	BU
Carbon disulfide	5 J	ND	ND	ND	ND	ND	ND	ND	ND	BU
1,1-Dichloroethane	9 J	ND	1300	1000	1200	2 J	2 J	2 J	ND	BU
1,2-Dichloroethene (total)	ND	ND	650 J	570 J	600 J	ND	ND	1 J	ND	BU
Chloroform	ND	ND	ND	ND	ND	2 J	1 J	1 J	ND	BU
2-Butanone	ND	ND	ND	ND	ND	ND	12	ND	ND	BU
1,1,1 Trichloroethane	ND	1900 J	10000	8500	9100	ND	ND	ND	ND	BU
Trichloroethene	ND	6400	16000	ND	ND	ND	ND	ND	1400	BU
Benzene	4 J	890 J	600 J	ND	ND	2 bJ	ND	ND	220	BU
4-Methyl-2-pentanone	ND	ND	13000	9700	11000	ND	ND	ND	ND	BU
Tetrachloroethene	ND	4800	9700	8900	9900	1 J	2 J	2 J	1800	BU
Toluene	9 J	11000	32000	ND	ND	4 J	ND	ND	1400	BU
Chlorobenzene	6 J	ND	ND	ND	ND	3 J	ND	ND	ND	BU
Ethylbenzene	340	11000	9200	8200	8900	3 J	4 J	3 J	560 J	BU
Styrene	7 J	76000	ND	ND	ND	ND	ND	ND	ND	BU
Total xylenes	360	33000	44000	37000	40000	25	32	32	4600	BU
Tentatively Identified Compounds										
Unknown cyclic alkane	ND	ND	1000 J	NR	NR	ND	NR	NR	ND	BU
Unknown	ND	ND	6500 J	NR	NR	ND	NR	NR	4400 J (2)	BU
Ethane, 1,1,2-trichloro-1,2,2-trifluoro-	ND	ND	830 J	NR	NR	ND	NR	NR	ND	BU
Unknown alcohol	ND	ND	1000 J	NR	NR	ND	NR	NR	ND	BU
Instrument artifact	ND	ND	4000 J	NR	NR	ND	NR	NR	4000 J	BU
Ethane,1,2-dichloro-1,1,2-trifluoro-	29 J	ND	ND	NR	NR	ND	NR	NR	ND	BU

All data in ug/kg.

( ) - Number of unknown compounds in total.
(g) - Ref. 9, Appendix A.
b - Found in method blank.
J - Estimated concentration; compound present below method detection limit.
BU - Background unknown; in general, natural soils would not have organic contamination.
MS - Matrix spike.
MSD - Matrix spike duplicate.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NR - Not run.

TABLE 4-8 (Page 2 of 4)

DECEMBER 1988 SEDIMENT AND SOIL DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SED-1	SED-1 MS	SED-1 MSD	SS-1	SS-2	SS-2 MS	SS-2 MSD	SS-3	SS-4	SS-4 RE (f)	BACKGROUND SOIL DATA (g)
SEMIVOLATILES											
Phenol	ND	ND	ND	42000	ND	ND	ND	ND	ND	ND	BU
1,2-Dichlorobenzene	350 J	550 J	420 J	17000 J	11000 J	10000 J	9700 J	ND	9800 J	6700 J	BU
4-Methylphenol	ND	590 J	ND	14000 J	ND	ND	ND	ND	ND	ND	BU
Benzoic acid	ND	310 J	1200 J	ND	ND	ND	ND	ND	ND	ND	BU
1,2,4-Trichlorobenzene	ND	ND	ND	7800 J	4000 J	ND	ND	ND	3800 J	ND	BU
Naphthalene	530 J	900 J	700 J	110000	58000	47000	48000	5000 J	24000 J	16000 J	BU
2-Methylnaphthalene	360 J	630 J	460 J	250000	71000	50000	60000	5000 J	49000	21000 J	BU
Acenaphthylene	ND	ND	210 J	8300 J	3500 J	ND	ND	ND	11000 J	9600 J	BU
Acenaphthene	ND	ND	ND	14000 J	30000	ND	ND	6400 J	5300 J	ND	BU
Dibenzofuran	ND	ND	ND	11000 J	14000 J	9900 J	11000 J	ND	3600 J	ND	BU
Fluorene	ND	350 J	380 J	25000 J	21000	11000 J	13000 J	6200 J	10000 J	8100 J	BU
Phenanthrene	700 J	1300 J	830 J	58000	59000	38000	34000	5700 J	29000 J	27000 J	BU
Anthracene	ND	ND	310 J	ND	17000 J	9300 J	8100 J	ND	8400 J	10000 J	BU
Di-n-butyl phthalate	ND	ND	ND	6200 J	ND	ND	ND	3900 J	ND	4800 J	BU
Fluoranthene	1500 J	2200	1800 J	22000 J	32000	20000 J	21000 J	5800 J	12000 J	11000 J	BU
Pyrene	2600	ND	ND	24000 J	21000 J	ND	ND	10000 J	16000 J	14000 J	BU
Benzo (a) anthracene	860 J	1100 J	1200 J	10000 J	ND	8700 J	7900 J	ND	13000 J	7700 J	BU
Chrysene	1300 J	1800 J	2500 J	20000 J	16000 J	11000 J	9900 J	4400 J	13000 J	12000 J	BU
bis(2-ethylhexyl)phthalate	14000 J	19000 b	19000	61000	ND	61000	75000	16000 J	29000 J	15000 J	BU
Di-n-octyl phthalate	ND	400 J	ND	ND	ND	ND	8900 J	ND	ND	ND	BU
Benzo(b)fluoranthene	2500 J	4200 x	5300 x	22000 Jx	8500 Jx	9700 Jx	9700 Jx	7000 Jx	19000 Jx	7200 Jx	BU
Benzo(k)fluoranthene	2500 J	4200 x	5300 x	22000 Jx	8500 Jx	9700 Jx	9700 Jx	7000 Jx	19000 Jx	7200 Jx	BU
Benzo(a)pyrene	1100 J	1900	1100 J	13000 J	8700 J	4900 J	5200 J	ND	13000 J	6400 J	BU
Indeno(1,2,3-cd)pyrene	880 J	1200 J	740 J	6500 J	ND	ND	ND	ND	ND	ND	BU
Dibenzo(a,h)anthracene	ND	640 J	470 J	ND	ND	ND	ND	ND	ND	ND	BU
Benzo(g,h,i)perylene	1600 J	2100	1200 J	10000 J	ND	ND	ND	ND	ND	4000 J	BU

All data in ug/kg.

(f) - Results of the reextraction and reanalysis of SS-4 due to a failed acid surrogate recovery (below 10%).

(g) - Ref. 9, Appendix A.

b - Found in method blank.

J - Estimated concentration; compound present below method detection limit.

x - Coelution of isomers.

BU - Background unknown; in general, natural soils would not have organic contamination.

MS - Matrix spike.

MSD - Matrix spike duplicate.

ND - Not detected at analytical detection limit; see Appendix I for detection limit.

RE - Reextracted analysis.

TABLE 4-8 (Page 3 of 4)

DECEMBER 1988 SEDIMENT AND SOIL DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SED-1	SS-1	SS-2	SS-2 MS	SS-2 MSD	SS-3	SS-3 MS	SS-3 MSD	SS-4	SS-4 RE	BACK-GROUND SOIL DATA
SEMIVOLATILES (con't)											
Tentatively Identified										(f)	(g)
Compounds											
1-Octanol, 2-butyl-	ND	ND	ND	NR	NR	ND	NR	NR	ND	280000 J	BU
Benzene, 1,1'-(1,2-cyclobuta	ND	680000 J	ND	NR	NR	ND	NR	NR	ND	ND	BU
Bicyclo [4.2.0] octa-1,3,5-tri	ND	370000 J	ND	NR	NR	ND	NR	NR	ND	ND	BU
Decane, 2,3,4-trimethyl-	ND	ND	ND	NR	NR	ND	NR	NR	ND	300000 J	BU
Docosane	ND	ND	ND	NR	NR	ND	NR	NR	ND	170000 J	BU
Dodecane, 2,6,11-trimethyl-	ND	ND	ND	NR	NR	ND	NR	NR	ND	220000 J	BU
Heptadecane	ND	ND	ND	NR	NR	ND	NR	NR	110000 J	ND	BU
Heptadecane, 2,6-dimethyl-	ND	1020000 (3)	ND	NR	NR	ND	NR	NR	ND	ND	BU
Hexatriacontane	ND	ND	ND	NR	NR	ND	NR	NR	230000 J	ND	BU
Naphthalene, 1,8-dimethyl-	ND	110000 J	ND	NR	NR	ND	NR	NR	ND	ND	BU
Pentacosane	ND	1420000 J (3)	ND	NR	NR	ND	NR	NR	ND	ND	BU
Pentane, 3-ethyl-2, 3-dimethyl	ND	ND	ND	NR	NR	ND	NR	NR	ND	160000 J	BU
Tetradecane	ND	140000 J	ND	NR	NR	ND	NR	NR	230000 J	ND	BU
Undecane, 3,9-dimethyl-	ND	ND	ND	NR	NR	ND	NR	NR	ND	160000 J	BU
Undecane, 4,7-dimethyl-	ND	ND	ND	NR	NR	ND	NR	NR	ND	160000 J	BU
Unknown	1773000 J (14)	580000 J	2040000 J (12)	NR	NR	1751000 J (18)	NR	NR	4340000 J (17)	3330000 J (13)	BU
Unknown aromatic	ND	2520000 J (4)	ND	NR	NR	ND	NR	NR	ND	ND	BU
Unknown hydrocarbon	790000 J (6)	2250000 J (5)	1180000 J (8)	NR	NR	109000 J (2)	NR	NR	ND	ND	BU
PESTICIDES/PCBs											
Aroclor-1260	NR	ND	13000 c	18000	20000	(a)	(a)	(a)	19000 c	ND	BU

All data in ug/kg.

( ) - Number of unknown compounds in total.
(a) - Data unusable due to QA/QC reasons; see Appendix J.
(f) - Results of the reextraction and reanalysis of SS-4 due to a failed acid surrogate recovery (below 10%).
(g) - Ref. 9, Appendix A.
c - Value confirmed by GC/MS analysis.
J - Estimated concentration; compound present below method detection limit.
BU - Background unknown; in general, natural soils would not have organic contamination.
MS - Matrix spike.
MSD - Matrix spike duplicate.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NR - Not run.
RE - Reextracted analysis.

TABLE 4-8 (Page 4 of 4)

DECEMBER 1988 SEDIMENT AND SOIL DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SED-1	SS-1	SS-2	SS-3	SS-4	BACKGROUND SOIL DATA (g)
METALS						
Aluminum	7,930	18,800	9,490	4,190	9,320	10,000-300,000
Antimony	ND N	ND N	ND N	ND N	[17] N	0.6-10
Arsenic	8.9	[17]	[16]	29	[23]	1.0-40
Barium	655 N	1,570 N	1,650 N	768 N	3,490 N	100-3500
Beryllium	[1.6]	[0.52]	[0.94]	[0.88]	[0.63]	0.01-40
Cadmium	5.6 N	14 N	11 N	5.3 N	12 N	0.01-7.0
Calcium	110,000	13,500	129,000	28,900	161,000	100-400,000
Chromium	138	108	417	35	96	5.0-3000
Cobalt	[11]	[12]	19	[9.0]	[10]	1.0-40
Copper	254 E	1,070	561	312	634	2.0-100
Iron	18,900	48,000	23,500	18,000	24,200	7000-550,000
Lead	8,000 R	116,000 R	27,000 R	2,000 R	16,600 R	2.0-200
Magnesium	8,490 E	1,750 E	10,300 E	13,700 E	11,700 E	600-6000
Manganese	282 N	197 N	315 N	125 N	201 N	100-4000
Mercury	0.62 N	1.9 N	0.74 N	1.1 N	1.6 N	0.01-0.08
Nickel	84	65	188	28	55	5.0-1000
Potassium	[1,800]	ND	3,340	ND	ND	400-30,000
Silver	ND	ND	[2.0]	ND	ND	0.1-5.0
Sodium	ND	ND	[514]	ND	ND	750-7500
Thallium	[1.2]	ND	[1.0]	ND	[2.0]	0.1-12
Vanadium	41	143 E	51 E	52 E	37 E	20-500
Zinc	1,050	2,270	2,190	988	1,170	10-300
Cyanide	NR	2.2 R N	4.8 R N	ND R N	5.0 R N	
Percent solids (%)	35	76	75	86	63	

All data in mg/kg.

[ ] - Greater than or equal to the instrument detection limit but below contract-required detection limit.
(g) - Ref. 9, Appendix A.
E - Value estimated due to interference.
N - Spiked sample recovery is not within control limits.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NR - Not run.
R - Duplicate analysis not within control limits.

TABLE 4-9

FEBRUARY 1990 SEDIMENT AND SOIL SAMPLE DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SED-1	SED-1 MS	SED-1 MSD	SS-3
PESTICIDES/PCBs				
Aroclor-1260	6700	51000	43000	60000 c

All data in ug/kg.
c - Value confirmed by GC/MS analysis.
MS - Matrix spike.
MSD - Matrix spike duplicate.

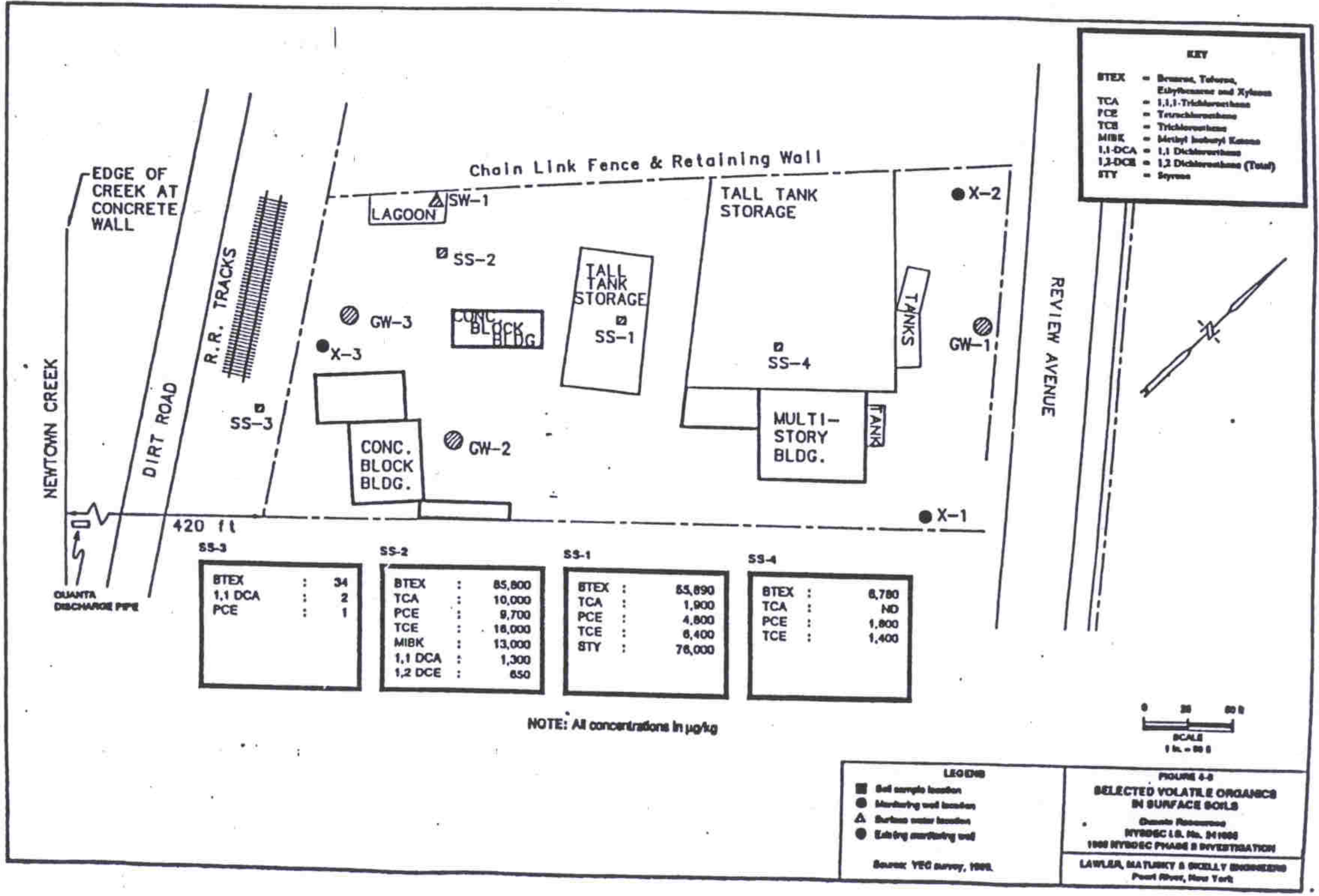
TABLE 4-9

FEBRUARY 1990 SEDIMENT AND SOIL SAMPLE DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SED-1	SED-1 MS	SED-1 MSD	SS-3
PESTICIDES/PCBs				
Aroclor-1260	6700	51000	43000	60000 c

All data in ug/kg.
c - Value confirmed by GC/MS analysis.
MS - Matrix spike.
MSD - Matrix spike duplicate.



KEY

BTEX = Benzene, Toluene, Ethylbenzene and Xylenes
TCA = 1,1,1-Trichloroethane
PCE = Tetrachloroethene
TCE = Trichloroethene
MIBK = Methyl Isobutyl Ketone
1,1-DCA = 1,1 Dichloroethane
1,2-DCE = 1,2 Dichloroethene (Total)
STY = Styrene

SS-3

BTEX :	34
1,1 DCA :	2
PCE :	1

SS-2

BTEX :	85,800
TCA :	10,000
PCE :	9,700
TCE :	18,000
MIBK :	13,000
1,1 DCA :	1,300
1,2 DCE :	650

SS-1

BTEX :	55,890
TCA :	1,900
PCE :	4,800
TCE :	6,400
STY :	76,000

SS-4

BTEX :	6,780
TCA :	ND
PCE :	1,800
TCE :	1,400

NOTE: All concentrations in µg/kg

LEGEND

- ■ Soil sample location
- ● Monitoring well location
- △ Surface water location
- ● Existing monitoring well

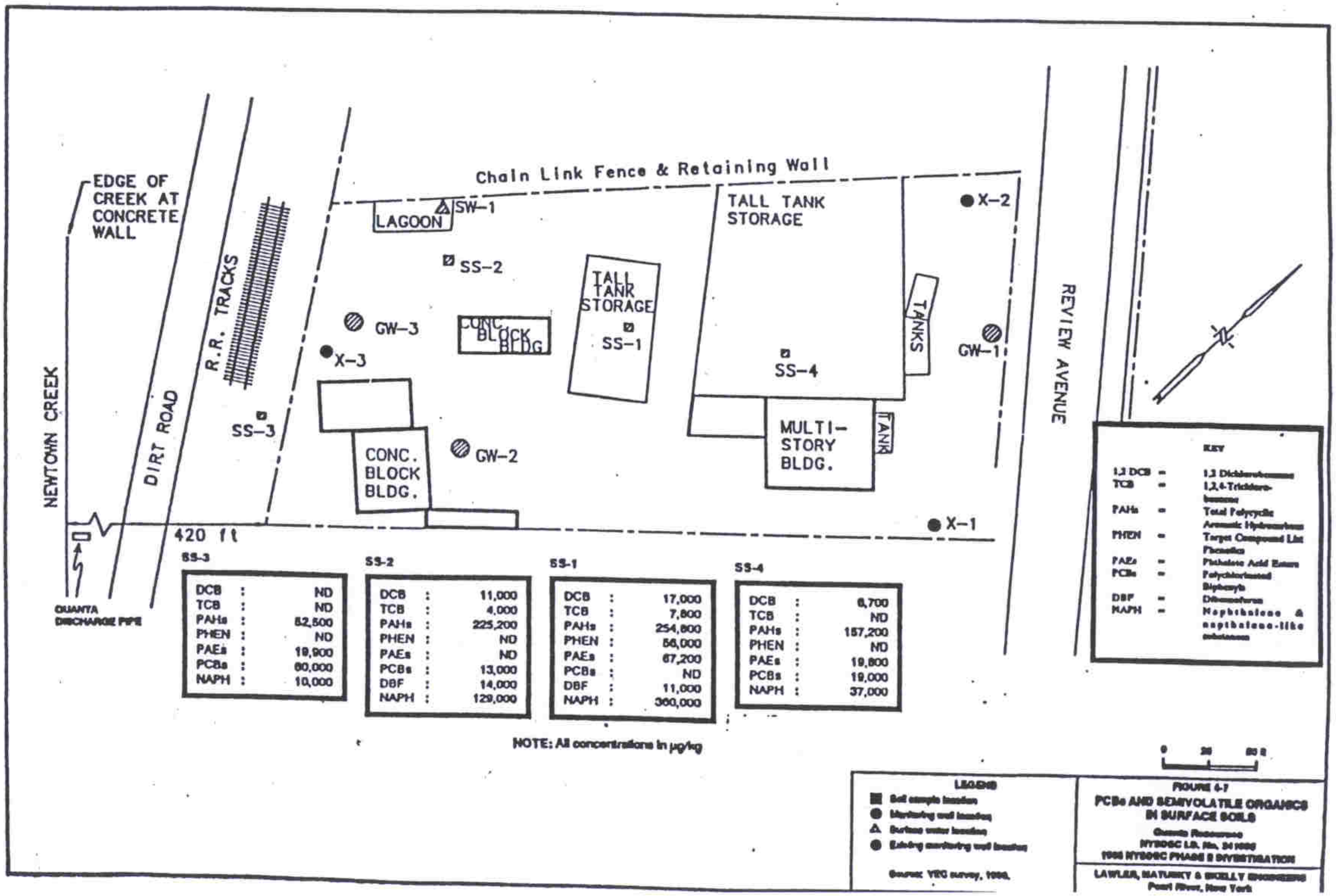
Source: YEC survey, 1990.

FIGURE 4-8

SELECTED VOLATILE ORGANICS IN SURFACE SOILS

Quanta Resources
NYSDEC I.D. No. 241005
1990 NYSDEC PHASE II INVESTIGATION

LAWLER, MATUSKY & SKELLY ENGINEERS
Pearl River, New York



SS-3

DCB	:	ND
TCB	:	ND
PAHs	:	52,500
PHEN	:	ND
PAEs	:	19,900
PCBs	:	60,000
NAPH	:	10,000

SS-2

DCB	:	11,000
TCB	:	4,000
PAHs	:	225,200
PHEN	:	ND
PAEs	:	ND
PCBs	:	13,000
DBF	:	14,000
NAPH	:	129,000

SS-1

DCB	:	17,000
TCB	:	7,800
PAHs	:	254,800
PHEN	:	56,000
PAEs	:	67,200
PCBs	:	ND
DBF	:	11,000
NAPH	:	360,000

SS-4

DCB	:	6,700
TCB	:	ND
PAHs	:	157,200
PHEN	:	ND
PAEs	:	19,800
PCBs	:	19,000
NAPH	:	37,000

NOTE: All concentrations in µg/kg

KEY

1,2 DCB	=	1,2 Dichlorobenzene
TCB	=	1,2,4-Trichlorobenzene
PAHs	=	Total Polycyclic Aromatic Hydrocarbons
PHEN	=	Target Compound List Phenolics
PAEs	=	Phthalate Acid Esters
PCBs	=	Polychlorinated Biphenyls
DBF	=	Dibenzofuran
NAPH	=	Naphthalene & napthalene-like substances

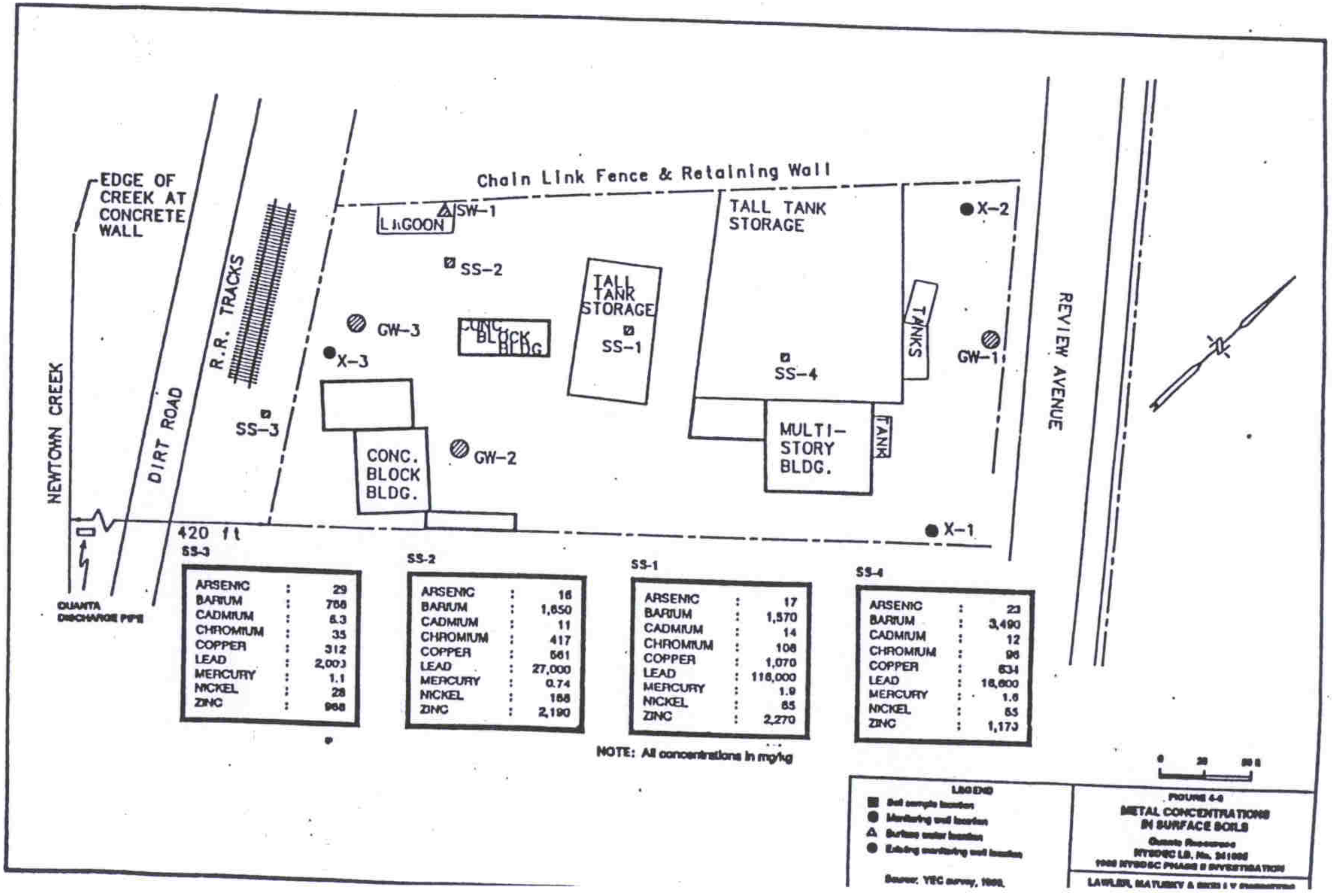
LEGEND

- ■ Soil sample location
- ● Monitoring well location
- △ Surface water location
- ● Existing monitoring well location

Source: YEC survey, 1996.

FIGURE 4-7
PCBs AND SEMIVOLATILE ORGANICS
IN SURFACE SOILS
Quanta Resources
NYSDEC I.D. No. 241005
1996 NYSDEC PHASE 2 INVESTIGATION

LAWLER, MATUSKY & SKELLY ENGINEERS
Pearl River, New York



	SS-3	SS-2	SS-1	SS-4
ARSENIC	29	16	17	23
BARIUM	768	1,650	1,570	3,490
CADMIUM	6.3	11	14	12
CHROMIUM	35	417	108	96
COPPER	312	561	1,070	634
LEAD	2,003	27,000	116,000	16,600
MERCURY	1.1	0.74	1.9	1.6
NICKEL	28	188	65	55
ZINC	968	2,190	2,270	1,173

NOTE: All concentrations in mg/kg

LEGEND
- ■ Soil sample location
- ● Monitoring well location
- △ Surface water location
- ● Existing monitoring well location

Source: YEC survey, 1995.

FIGURE 4-6
METAL CONCENTRATIONS IN SURFACE SOILS
Quanta Resources
NYSDEC I.D. No. 241005
1995 NYSDEC PHASE II INVESTIGATION
LAWLER, MATUSKY & SKELLY ENGINEERS

APPENDIX C

HEALTH AND SAFETY PLAN

APPENDIX C

HEALTH AND SAFETY PLAN
FOR THE
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN
QUANTA RESOURCES SITE
LONG ISLAND CITY, QUEENS, NEW YORK

Prepared for:

Quanta Site Administrative Group

Prepared by:

Golder Associates Inc.
1951 Old Cuthbert Road, Suite 301
Cherry Hill, New Jersey 08034

September 2002 Project No.: 023-6151

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ACRONYMS AND DEFINITIONS

Terms used in the HASP, are as follows:

ACGIH - American Conference of Governmental Industrial Hygienists

Authorized Personnel - Person, including task-specific personnel, project personnel, oversight personnel, contractors and consultants whose presence is authorized.

Breathing Zone - The worker's breathing zone is an imaginary sphere of 2-foot radius surrounding the head.

Contamination-Reduction Zone - The area designated as required for removal of contaminants from personnel and equipment. This area is adjacent to the Exclusion Zone.

Contaminant of Potential Concern – The constituents that have been identified at the Site that are expected to cause the greatest concern for chemical safety risks.

Contractor/Consultant - Person or firm, retained or hired by the Client and/or their contractors, to carry out and/or supervise portions of the activities conducted at the Site.

CPR – Cardiopulmonary Resuscitation

Exclusion Zone - The area to which all personnel entering must be directly involved in the ongoing work, have designated personal protective equipment (PPE), and meet training and medical monitoring requirements. The Exclusion Zone will be defined as required by an approximate 25-foot radius around the work area, which will be suitably marked.

FS – Feasibility Study

HASP - Health and Safety Plan

HSC – On-Site Health and Safety Coordinator

HSO - Health and Safety Officer

IDLH - Immediate Danger to Life and Health

IDW – Investigation Derived Waste

MSDS - Material Safety Data Sheets, which provide information on the physical, chemical, and hazardous properties of chemical compounds.

NBR – Nitrile butadiene rubber

NIOSH - National Institute of Occupational Safety and Health

NYSDEC – New York State Department of Conservation

OSHA - Occupational Safety and Health Administration

Oversight Personnel - Any person, designated by the state or federal government, who is assigned to carry out oversight work.

PEL - Permissible Exposure Limit

PID – Photoionization Detector

PPE - Personal Protective Equipment

PPM - Parts per million; expressed as ppm(v) for gases and vapors.

REL - Recommended Exposure Limit

RI – Remedial Investigation

RI/FS Work Plan – Remedial Investigation/Feasibility Study Work Plan

SAP - Sampling and Analysis Plan

Site - The Lightman Drum Company Superfund Site in Winslow Township, New Jersey.

Support Zone - The area outside the Exclusion Zone that is considered clean for the purpose of the HASP. It is used for transfer of equipment and materials into the work Site (i.e., support) and providing communications between the various zones.

SVOCs – Semi-Volatile Organic Compounds

TLV - Threshold Limit Value

USCG – United States Coast Guard

VOCs – Volatile Organic Compounds

C.1.0 GENERAL INFORMATION AND SCOPE OF WORK

C.1.1 Project Description

This Health and Safety Plan (HASP or Plan) has been prepared in support of the Remedial Investigation/Feasibility Study Work Plan (RI/FS Work Plan) for performance of the Remedial Investigation (RI) and Feasibility Study (FS) on behalf of the Quanta Site Administrative Group (QSAG). This Plan was prepared in accordance with “Guidance for Conducting Remedial Investigations and Feasibility Studies (RI/FS) under CERCLA” and the NIOSH/OSHA/USCG/EPA “Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities” as well as 29 CFR 1910.120, 29 CFR 1926 and applicable Federal and state regulations and guidelines. The Plan will be reviewed as appropriate when field and/or laboratory data becomes available and amended to maintain the proper level(s) of protection. This Plan covers projected RI/FS field activities including drilling, hydrogeologic testing, and soil, groundwater and light non-aqueous liquids (LNAPL) sampling and applies to all on- and off-Site activities as described in the RI/FS Work Plan.

C.1.2 General Site Description

Section 2.0 of the RI/FS Work Plan provides a description of the Site.

For the purpose of preparing this Plan, we have assumed the accuracy of prior reports that volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), metals, and cyanide have been detected during previous investigations at the Site (see Section 2.0 of the RI/FS Work Plan) in Site soil, groundwater and LNAPL. Golder Associates Inc. (Golder) has been retained to implement a Remedial Investigation designed to, amongst other things, characterize the nature and extent of these constituents.

C.1.3 Project Safety Requirements

The level of protection and the procedures specified in this HASP are based on the information currently available and represent the minimum health and safety requirements to be observed by all Site personnel engaged in the RI. Unknown conditions at the Site may exist and known conditions may change. Should any situation arise which is beyond the scope of the personal protection and decontamination procedures specified herein, work activities shall be immediately halted pending discussion between the on-Site Health and Safety Coordinator (HSC), the Health and Safety Officer (HSO), and/or Project Manager, and revision of the specified health and safety procedures, as needed. Any revision of the health and safety procedures will be recorded in the Field Procedure Change Authorization Form, shown in Attachment C-1, and will require authorization from the HSO and the Project Manager.

All Site personnel engaged in any of the project activities listed in Section B.1.1 must read this HASP and relevant portions of the RI/FS Work Plan carefully and complete the Site Health and Safety Plan Acknowledgement Form in Attachment C-2. Personnel who have any questions or concerns regarding implementation of this Plan are encouraged to request clarification from the HSO or HSC. All personnel must follow the designated health and safety procedures, be alert to the hazards associated with working close to vehicles and equipment, and above all else, use common sense and exercise reasonable caution at all times.

C.1.3.1 Designated Safety Personnel and Chain of Command

Currently designated personnel responsible for implementing this HASP include the following:

Timothy Richards	Golder Associates On-Site Health and Safety Coordinator
Douglas Dugan	Golder Associates Cherry Hill, New Jersey Office Health and Safety Officer
Charles C. Haury, CIH, CSP	Golder Associates Corporate Health and Safety Officer
Stuart D. Mitchell, P.G.	Remedial Investigation Manager
Randolph White, P.E.	Golder Associates Project Manager

Each subcontractor will have a designated HSC. HSCs are responsible for assuring that the designated procedures are implemented in the field. The Golder Associates HSC is responsible for coordinating Site safety activities and has the authority to stop work for health and safety reasons.

The HSO has overall responsibility for establishing appropriate health and safety procedures for the project and will have the requisite authority to implement those procedures including, if necessary, the authority to temporarily suspend field activities for health and safety reasons.

The Project Manager also has the authority to take whatever actions may be necessary, based on the advice and direction of the HSC and/or HSO, to provide a safe working environment for all project personnel.

The ultimate responsibility for the health and safety of the individual employee rests with the employee, and his or her colleagues. Each employee is responsible for exercising the utmost care and good judgment in protecting his or her own health and safety and that of fellow employees. Should any employee observe a potentially unsafe condition or situation, it is the responsibility of that employee to immediately bring the observed condition to the attention of the appropriate health and safety personnel as designated above, and to follow-up the verbal notification by completing the "Unsafe Conditions and Practices" report form provided in Attachment C-3.

Should an employee find himself or herself in a potentially hazardous situation, the employee should immediately discontinue the hazardous procedure(s) and either personally affect appropriate preventive or corrective measures, or immediately notify the HSC or Project Manager of the nature of the hazard. In the event of an immediately dangerous or life-threatening situation, any employee always has "stop work" authority.

Unsafe work practices or procedures are never justified by "extenuating circumstances" such as budget or time constraints, equipment breakdown, changing or unexpected conditions, etc. In fact, the opposite is true. Under stressful circumstances all project personnel must be mindful of the potential to consciously or unconsciously compromise health and safety standards, and be especially safety conscious. All Site personnel are required to consider "safety first" at all times.

C.1.3.2 Medical Surveillance and Training

All personnel engaged in field activities on this project must have baseline physical examinations and be participants in their employer's medical surveillance program. This program meets, at a minimum, the requirements of 29 CFR 1910.120(f). Procedures beyond baseline physical and routine medical surveillance are not planned for the tasks listed in Section B.1.1 of this HASP.

All project personnel, who have potential to contact contaminated soil, water, and/or air, must be trained in hazardous waste site investigation health and safety in accordance with 29 CFR 1910.120(e) including respiratory protection, personal protective clothing, decontamination, hazard recognition and the proper calibration and use of a photoionization detector (PID), and colorimetric detector tubes. Personnel must have appropriate refresher courses as detailed in 29 CFR 1910.120(e).

Personnel who operate specialized equipment (e.g., drill rigs, forklifts) shall be trained by their employer(s) to operate such equipment.

These training requirements apply to all employees unless the employer can demonstrate that the operation does not involve employee exposure, or the reasonable possibility for employee exposure, to safety and health hazards. Some non-intrusive activities (e.g. supply delivery, limited surveying activities) may meet this exemption. In that Site conditions are subject to change, the training requirements for non-intrusive activities will be reviewed on a case-by-case basis. The HSC will make the determination on the case by case basis and will consult the HSO as necessary.

C.1.3.3 First Aid

A first aid kit shall be available in all field vehicles and in the Site trailer, if applicable, during all Site activities. This kit shall be of an appropriate size in relation to the number of personnel on-Site and shall include at a minimum two pairs of latex gloves, CPR barrier and eye wash solution, in addition to first aid supplies (e.g., bandages, first aid cream, antiseptic). See Section B.5.1 of this document for emergency response procedures.

C.1.3.4 Communications

Mobile phones will be located in all field vehicles. All mobile phones will be checked for coverage at the beginning of each phase of the project to ensure good satellite coverage. Note that mobile phones operating outside of their original territory may not contact the proper (i.e., local) emergency response authorities. Mobile phone users would be better served by dialing the full appropriate emergency response numbers listed in Table C-1.

Additionally, if field operations require that two or more field teams work at the Site, but beyond visual/aural range, the “Buddy System” will be used. Workers or field teams that are not in the line of sight of each other may be equipped with two-way radios to maintain communication. Workers will also provide each other with assistance in checking the integrity of each other’s personnel protective equipment (PPE), and will notify the HSO in case of emergency.

The protective equipment requirements for some tasks may necessitate the use of respiratory protection, which could adversely affect communications. In such instances, the field team will review basic hand signal communications during a safety briefing prior to donning respiratory protection equipment.

C.1.4 General Hygiene and Conduct Guidelines

The following general personal hygiene and work practice guidelines are intended to prevent injuries and adverse health effects. These guidelines represent the minimum standard procedures for reducing potential risks associated with various aspects of this project and are to be followed by all Site personnel at all times.

- If the HSC deems that a respirator is necessary, any facial hair that would interfere with the proper fit of such equipment will not be worn.
- A multi-purpose dry chemical fire extinguisher, a complete field first aid kit, and a bottle of emergency eye wash solution shall be maintained in every field vehicle.
- Do not handle waste samples or any other potentially contaminated items unless wearing NBR (nitrile butadiene rubber) or neoprene rubber gloves, or equivalent, as a minimum. Employees should treat all unknown soil and water as if it were contaminated. Always make an effort to approach any potentially contaminated feature from upwind.
- Thoroughly wash hands and face before eating or putting anything in your mouth (i.e., avoid hand to mouth contamination).
- Eating, drinking, chewing gum or tobacco and smoking are permitted only in areas designated by the HSC. Under no circumstances will these activities be permitted in the immediate vicinity of any intrusive activities (e.g., drilling).
- Be alert to potentially changing exposure conditions, for example, as evidenced by perceptible odors or oily sheen on water.
- Do not, under any circumstances, enter or ride in or on any backhoe bucket, materials hoist, or any other similar device not specifically designed for carrying human passengers.
- Be alert to the symptoms of fatigue and heat/cold stress and their affects on the normal caution and judgment of personnel.
- Noise may pose a health and safety hazard, particularly during drilling and construction activities. A good rule of thumb is if it is necessary to shout to communicate at a distance of three feet in steady state (continuous) noise, hearing protection should be worn. Likewise, any impact noises from activities (e.g., driving casing on a drilling operation), which is loud enough to cause discomfort, would also indicate the need for hearing protection. Hearing protection is available and is included in the standard field kit along with hardhat and safety glasses.
- Always use an appropriate level of personal protection. Reduced levels of protection can result in preventable exposure; excessive levels of safety equipment can impair efficiency and increase the potential for accidents to occur.

- Be aware of the effect that inclement weather (rain, snow, ice, lightning) has on Site safety. Be prepared to suspend activities as conditions warrant.

- Extreme caution must be used when drilling, or other activities, that occur near overhead utility lines. The National Drilling Federation recommends a minimum distance of 20 feet between the lines and drill rig. Contact the local power company if you have any questions regarding utility line status or voltage. In addition, underground utilities <u>must</u> be positively located and marked prior to intrusive activities.

- All personnel are required to wear orange colored vests when working in the proximity of public rights-of-way and/or parking areas. Additionally, traffic cones and other warning devices may be required if the public rights-of-way are obstructed.

C.1.5 Site Safety Meetings

The HSC shall conduct a Site safety briefing for all personnel and subcontractors directly involved in implementing the RI field activities on their initial arrival at Site. Personnel will be required to read this HASP and will be required to sign the declaration in Attachment C-2 before conducting any work on-Site. The HSC shall indicate where the Material Safety Data Sheets (MSDS) will be located during Site activities so that they are readily available to the Site field investigation team and subcontractors.

The HSC or his/her designee shall conduct and document the date, time, content and attendees of these meetings, which will be held as needed. The topics to be covered are determined by the task activities, and should include:

- Weather and traffic related safety issues.
- Hazards specific to the task(s) and protective equipment.
- Unusual Site conditions/areas.
- Safety problems and issues.
- Changes to the materials being used by Site field investigation team or subcontractors (i.e., additional MSDS available).
- Changes in the HASP.

C.2.0 HAZARD EVALUATION

Potential Site hazards include chemical hazards, physical hazards, and biological hazards. Each of these groups of potential hazards is addressed in Table C-2.

C.2.1 Potential Chemical Hazards

Results of previous investigations at the Site indicate that there are chemical impacts to the soil groundwater and LNAPL. Table C-3 lists the Chemicals of Potential Concern (COPC) selected for the Site and associated exposure hazard information. The COPC selected include VOCs, SVOCs, PCBs, and metals based on their reported detection (by others at the Site) and their potential toxicity. Table C-4 summarizes the airborne exposure limits for these COPC. The chemical hazard associated with the reported chemical concentrations in the groundwater and soil is toxicity. Potential hazards include:

(1) Inhalation of organic vapors due to the presence of VOCs in the soil and groundwater;

(2) Inadvertent ingestion of potentially toxic substances via hand to mouth contact or deliberate ingestion of materials inadvertently contaminated with potentially toxic materials; and,

(3) Dermal exposure and possible percutaneous (skin) absorption of certain lipophilic (readily absorbed through the skin) organic chemicals including benzene.

Exposure via the ingestion route can be controlled effectively by the means of good personal hygiene habits, and prohibition of smoking, eating, drinking and chewing in contaminated areas. Similarly, good personal hygiene and appropriate clothing can control dermal exposure. Inhalation hazards are addressed in Section B.4.3.

C.2.2 Potential Physical Hazards

C.2.2.1 Heat Stress

Working in protective clothing can greatly increase the likelihood of developing heat stress. Heat stress can result in health effects ranging from transient heat fatigue to serious illness or death. The signs and symptoms of heat stress are presented in Section B.2.4. Workers shall monitor themselves and others for signs of heat stress when ambient temperatures exceed 70°F.

C.2.2.2 Cold Stress

Personnel exposed to cold temperatures (especially during windy conditions) may be subjected to cold stress in the form of frost nip, frostbite or hypothermia. Signs and symptoms of cold stress are described in Section B.2.4. Workers shall monitor themselves and others for signs of cold stress when ambient temperatures are 40°F or less. Extra caution will be exercised when working in windy conditions and/or when clothing becomes wet.

C.2.2.3 Confined Space Hazards

No confined space work is anticipated during the RI. Should such work become necessary, a Confined Space Entry Permit will be completed and an addendum to this HASP will be prepared. Written authorization by the Project Manager will be required prior to conducting any confined space work. The Project Manager will consult with the HSO prior to providing written authorization.

C.2.2.4 Other Physical Hazards

Under no circumstance shall any Field personnel enter any building, tank, or structure at the Site unless given written authorization from the Golder Site HSC.

All Field personnel must take note of physical hazards which are identified during Site safety briefings. These hazards include, but are not limited to: steep slopes, soft sediments, muck, creeks (trips, falls, and drowning); sharp debris from underbrush or debris scattered around the Site (puncture wound); overhead utilities, public traffic, over-exposure to the sun and slippery and/or congested walking surfaces (falls). Orange vests will be worn when working near public rights-of-way. Work areas such as drilling must be delineated using high visibility caution tape.

During drilling activities no more than two lengths of drill rod may extend above the top of the rig derrick at any time.

Field personnel must be alert to the hazards associated with Site vehicles, drill rig operation, heavy equipment, and powered hand-held equipment operations. These hazards include noise, crushing injuries, overhead hazards, and pinch points. Personnel must be alert to weather-related hazards (e.g., lightning) or the possibility of increased hazard due to weather (e.g., slipping on mud or ice).

C.2.3 Potential Biological Hazards

Contact with waste materials can lead to infected cuts. Personnel shall follow the guidelines for general hygiene in Section B.1.4 and follow first aid procedures for disinfection of cuts and abrasions in Section B.5.3.

The Site area may contain ticks, which can transmit Rocky Mountain Spotted Fever and Lyme Disease. During tick season (March to November), Site employees will check for ticks. Light colored clothing should be worn and any openings (shirt and pant cuffs) should be secured to inhibit tick movement from clothing to skin. The use of insect repellents should be considered if its use will not interfere with sampling activities. Personnel must check with their Project Manager before using repellents. Field personnel will acquaint themselves with the symptoms of tick-borne diseases detailed below and will contact a physician as well as the HSO if a disease is suspected.

The Site area may contain poison ivy, that can be recognized by an oily sheen on the leaf and/or three leaflets together, or similar vegetation. The active substances can be transmitted by direct skin contact and via contact with contaminated clothing. Field personnel should avoid contact with any vegetation that can irritate the skin.

C.2.4 Signs and Symptoms of Exposure

C.2.4.1 Chemical Exposure

The health effects associated with the COPC reportedly present at the Site are varied. Personnel who experience any of the following symptoms should report the occurrence to the HSC promptly:

- skin, eye, or respiratory system irritations;
- skin rashes/burns;
- headaches/dizziness;
- nausea/gastrointestinal tract problems;
- muscle spasms/tremors;
- chills; and/or
- fatigue.

Note that the above symptoms are not necessarily caused by chemical exposure. Any serious medical problem should be promptly referred to professional medical care. If personnel experience any of the above symptoms, the HSC shall evacuate the area (upwind if possible) if necessary and evaluate affected personnel for signs and symptoms of exposure. Appropriate first aid measures shall be taken. The activity will not resume until the atmospheric conditions are evaluated using monitoring instruments by personnel wearing Level C (or B, if Level C was utilized when the incident occurred) PPE. Atmospheric conditions will be evaluated by monitoring for concentrations of VOCs and dust (as necessary) as described in Section B.3.0.

C.2.4.2 Physical Exposure

The signs of heat fatigue are as follows:

- Heat rash may result from continuous exposure to heat or humid air.
- Heat cramps caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:
    - ◊ muscle spasms; and
    - ◊ pain in hands, feet, and abdomen.

Heat exhaustion results from increased stress on various body organs, including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include:

- pale, cool, moist skin;
- heavy sweating;
- dizziness;
- nausea; and
- fainting.

Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms are:

- red, hot, usually dry skin;
- lack of or reduced perspiration;
- nausea;
- dizziness and confusion;
- strong, rapid pulse; and
- coma.

Working in protective clothing can greatly increase the likelihood of heat fatigue, heat exhaustion, and heat stroke, the latter being a life threatening condition. When working in ambient temperatures greater than 70°F, employees shall use the ‘buddy system’ to monitor each other’s pulse rate at the start of each rest period. A rest period shall consist of a continuous time period of at least five (5) minutes preferably in a shaded area. The personnel will not be assigned to other work during this rest period. If the pulse rate exceeds 110 beats per minute, the employee shall take his or her oral temperature with a clean disposable calorimetric oral thermometer. If the oral temperature exceeds 99.6°F, the next work period shall be shortened by one third. The pulse rate and oral temperature shall be monitored again at the beginning of the next rest period; and if the oral temperature exceeds 99.6°F, the work period shall again be shortened by one third, etc., until the oral temperature is below 99.6°F.

All employees are to be alert to the possibility and symptoms of heat stress. If heat stress is suspected the employee will leave the work area, rest, cool off, and drink plenty of cool water/Gatorade/Squelcher or equivalent. Sufficient cool potable water and clean disposable cups shall be maintained at all times on-Site. If the symptoms do not subside after a reasonable rest period, the employee shall notify the HSC and seek medical assistance.

Signs of cold stress include yellow or white patches of skin on the fingertips, nose and ears. These areas will be numb. The affected parts will be rewarmed gently and the patient will not return to work until additional protection (e.g., gloves, hard hat liner) is obtained. It is essential to prevent frostbite, as the person may become susceptible to future cold-related medical problems. Personnel are encouraged to change into dry socks after the lunch break as perspiration held by the socks prompts cooling of the feet. Should clothing become wet, it is imperative that the people change into dry clothes before resuming work. Wet clothing can lead to hypothermia. Symptoms of hypothermia include uncontrollable shivering, decreased physical and mental capabilities, and lowered body temperature. Persons exhibiting symptoms of cold stress or hypothermia will not return to work without the approval of the HSC.

C.2.4.3 Biological Exposure

Since the bite of a tick has the potential to cause Rocky Mountain Spotty Fever, personnel should be aware that the symptoms include fever chills, headache, abdominal, muscle pain, and nausea. A red rash develops at the wrist and ankles two to five days after exposure. Symptoms develop two to fourteen days after exposure.

Also spread by ticks is Lyme Disease. Symptoms include fatigue, stiffness (particularly in the neck). There may be a red circular rash. Fever may be present. Symptoms develop a few days to two years after exposure.

Personnel exhibiting symptoms of Rocky Mountain Spotted Fever or Lyme Disease should consult a medical professional immediately. Personnel bitten by a snake or any other wildlife will immediately clean the wound and proceed to the hospital for medical evaluation.

Skin-sensitizing (poisonous) vegetation produces a bumpy, swollen rash at the point of contact. This rash is easily spread if the oil gets on the fingers. Wash affected area(s) including tools, as soon as possible. Use over-the-counter medications to reduce the irritation. Avoid scratching the rash. Cover the affected area(s) with clean dressings. Severe exposure may necessitate evaluation by a medical professional.

If personnel are in need of immediate first aid, the guidelines outlined in Section B.5.1 for emergency medical procedures will be followed.

C.2.5 Task Risk Analysis

Table C-5 presents a comparative risk analysis based on anticipated field activities and hazards. All personnel will be aware that specific hazards and the associated potential severity may be influenced by weather, season, and fatigue.

C.3.0 SITE MONITORING AND ACTION LEVELS

Air monitoring is required during intrusive tasks. The requirements for air monitoring and associated action levels for each Site activity are detailed in Table C-6. The monitoring methods involved and their interpretation are discussed in the following sections. Intrusive activities have the potential for exposures to VOCs.

C.3.1 VOC Monitoring

VOCs that are of most concern from an inhalation standpoint are those that are moderately to highly toxic and have odor thresholds higher than their corresponding TLV. Vinyl chloride falls into this category. Since benzene is the COPC that has the lowest OSHA PEL (TWA 0.1 ppm), and since the ionization potentials for this compound is 9.24 eV, the Photo Ionization Detector (PID) that is used to monitor air quality will be equipped with at least a 10.6 eV lamp to detect for the presence of these compounds.

The designated HSC shall have a PID on-Site at all times during intrusive and groundwater sampling activities until such time it can be demonstrated that such monitoring is not necessary. Calibration of the instrument must be checked daily prior to each day of use and then at least every four hours during use by introducing a known concentration of isobutylene gas in accordance with the manufacturer’s instructions. Background levels must be established well upwind of any excavation, borehole, spoils pile, etc. During drilling/split spoon activity, the HSC shall monitor the borehole, split spoon samples, and employee breathing zone initially at the start of each task, then periodically as indicated by initial results, or whenever there is any indication that concentrations may have changed (odors, visible gases, appearance of drill cuttings, etc.) since the last measurement.

If a constant reading of >1 and $\leq$ 5 ppm above background level is detected for more than 5 minutes in the breathing zone, a detector tube for benzene shall be used to determine airborne concentrations. If the benzene concentration is less than 1 ppm in the breathing zone, and the total VOC concentration does not exceed 5 ppm for more than five minutes in the breathing zone, the PPE shall be Level “D”. If a consistent reading > 5 ppm above background is detected for more than 5 minutes in the breathing zone or any peak > 25 ppm above background level in the breathing zone is detected, the PPE shall be upgraded to Level “C”. If at any time the concentration of benzene exceeds 1 ppm in the breathing zone, the level of PPE shall be upgraded to Level “C”. Furthermore, PPE should be upgraded to Level “B” if PID readings are consistently greater than 25 ppm, readings show frequent peaks greater than 50 ppm, or the concentration of benzene exceeds 100 ppm[1] in the breathing zone. Engineering or administrative control such as portable fans may be used to reduce exposure to or generation of VOC concentrations and possibly eliminate the need for respiratory protection. The HSO must be advised of conditions that warrant a change in the level of PPE and approve the revised procedures.

Given the rapid “break through” time of some substances, cartridges will be replaced after each day of use or immediately upon an indication of “break through” (perceptible odors inside of the mask), whichever is less. High humidity situations (>80% relative humidity) may require cartridge replacement at a more frequent rate (every 4 hours).

Engineering controls such as positioning activities upwind, covers, or additional ventilation may be used in place of respiratory protection if it is demonstrated through monitoring that the engineering controls are effective in reducing airborne concentrations.

C.3.2 Nuisance Dust Monitoring

Nuisance dust and metals have the potential for becoming a problem during disruptive or intrusive activities such as drilling. The specific metal concentrations are variable through the Site. Activities that could generate dust may require engineering controls (e.g., water misting of the air and surrounding soil) before and during the activities. The on-Site HSC will require that Level C respiratory protections be utilized should engineering controls be ineffective as evidenced by chronic visible airborne dust. Additionally, real time aerosol monitoring using an MIE PDM-3 miniram or equivalent will be conducted and the airborne metal concentration will be estimated using prior worst case soil concentration data for metals. The MIE PDM-3 miniram will be calibrated according to manufacturer’s instructions prior to field use. Calibration will be performed at least weekly, or before and after sampling each day that the instrument is used if high concentrations of dusts are being measured.

When collecting measurements using the MIE PDM-3 miniram or equivalent, the readings will be taken over a minimum period of ten minutes in an area or areas representative of worker’s

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[1] Concentration based on a qualitative respirator fit test and the use of full-face respirator.

When collecting measurements using the MIE PDM-3 miniram or equivalent, the readings will be taken over a minimum period of ten minutes in an area or areas representative of worker's breathing zone. The HSC will record the average result for the interval. This strategy accounts of variability in the concentration with time and avoids the situation where a decision to change PPE is made based on one instantaneous measurement.

C.3.3 Perimeter Air Monitoring

Based on prior experience on similar sites and the scale and nature of the proposed Phase I RI field activities, i.e., soil borings and well installations, ambient air quality should not be adversely impacted outside of the immediate area where investigation activities will be conducted. In addition, due to the highly industrialized surrounding area and the absence of residential communities adjacent to or near the Site, the RI activities should not adversely affect off-site receptors. As described in Sections C.3.1 and C.3.2 above, air monitoring for organic vapors and particulates will be conducted during intrusive field activities to assess the adequacy of site worker respiratory protection. In addition, these monitoring procedures have been enhanced to provide a perimeter air monitoring program as described below:

- Continuous VOC monitoring will be performed within the exclusion area during all intrusive activities as discussed in Section C.3.0 of the HASP. This monitoring includes the use of a PID (with 10.6 eV lamp) for VOCs that will be calibrated prior to use each day. When chronic visible airborne dust is present, an MIE PDM-3 Miniram or equivalent will be used to measure particulate concentrations. The particulate monitor will also be calibrated according to the manufacturer's instructions prior to field use. Action levels for establishing worker protection are summarized in Table C-5 of the HASP.

- Where worker health and safety monitoring (Section C.3.0 of HASP) detects sustained (15 minute) VOC readings greater than 5 ppm above background and/or chronic visible airborne dust, then additional VOC readings and/or dust observations will be taken at the downwind perimeter of the exclusion zone (an approximate 25-foot radius around the work area) or at the property boundary (whichever is closer to the intrusive activity). If VOC readings persist at greater than 5 ppm above background (or spike above 25 ppm) or visible airborne dust persists, then corrective actions will be taken (such as containerizing or covering drill cuttings and/or wetting the ground surface).

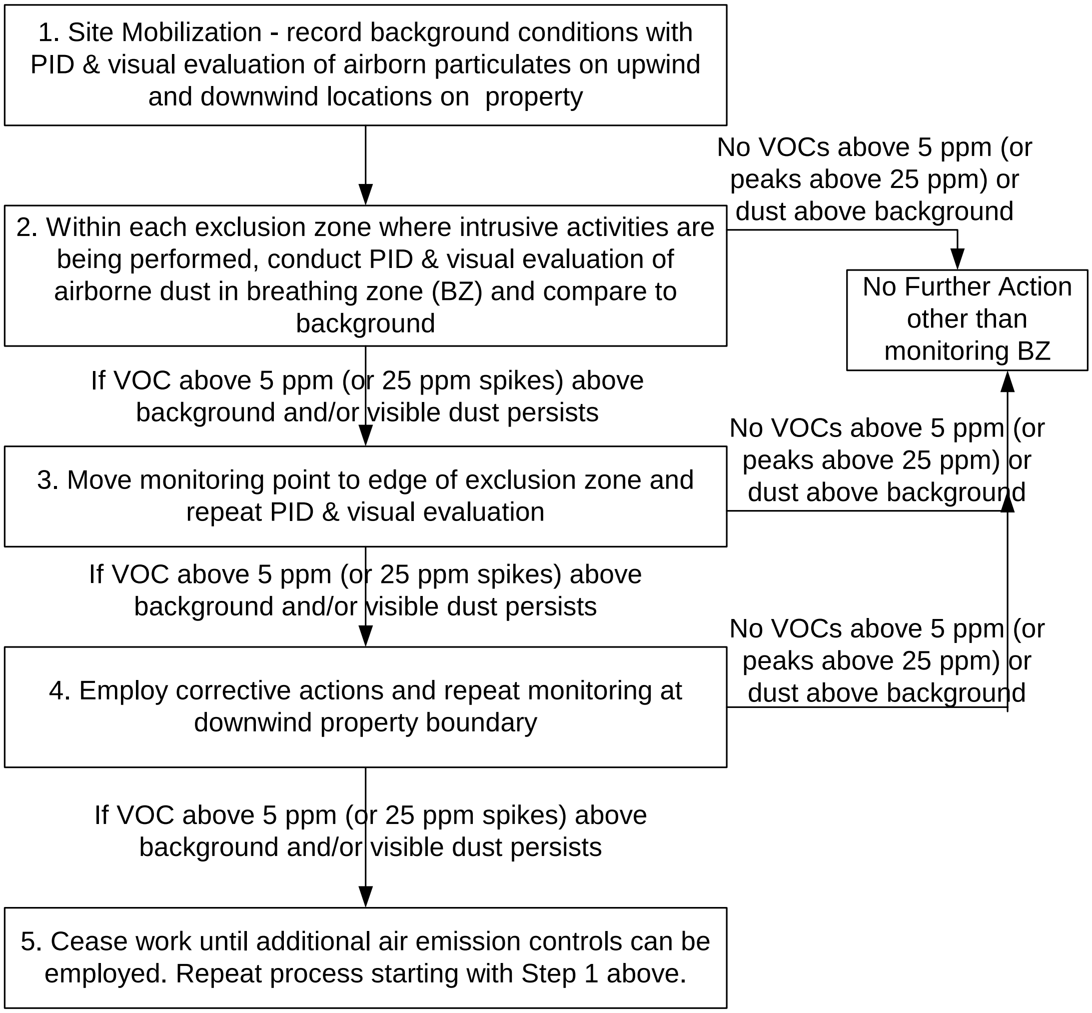
- Monitoring will then be repeated to assess the effectiveness of the corrective measures taken. Should VOC levels persist at concentrations greater than 5 ppm above background (or spikes above 25 ppm) or visible dust persists, then the monitoring point will be moved further downgradient to the property boundary.

- Should monitoring at the property boundary detect VOCs greater than 5 ppm above background (or spikes greater than 25 ppm) or visible airborne dust, then the work will cease and alternate investigation and/or corrective action procedures implemented in consultation with the Department.

- Monitoring records will be recorded in field notebooks.

An air monitoring decision tree is provided below to illustrate the perimeter air monitoring approach.

Air Monitoring Plan Decision Tree *
Phase I Remedial Investigation
Quanta Resources Site



*Assumes engineering controls and standard management practices for worker health and safety will control potential sources of off-property releases of particulates and VOCs given the limited nature of the Phase I field investigation activities.

C.4.0 ON-SITE CONTROL

C.4.1 Site Communication System

Personnel will operate using the “buddy system.” No Field personnel will work alone at the Site. Each individual shall maintain visual/aural contact with another individual or group at all times. If more than one group is working at a facility and the groups are not within visual/aural communication range, two-way radios may be necessary to maintain communications.

C.4.2 Site Safety Zone and Access Control

No on-Site safety zones are required for non-intrusive activities. During intrusive activities (e.g., drilling), an Exclusion Zone will be established by the on-Site HSC, as required. The Exclusion Zone will generally be a 25-foot radius from the boreholes. Monitoring will be periodically conducted at the downwind perimeters to assure that the concentrations are similar to background concentrations. If perimeter concentrations are greater than background concentrations for more than five minutes, the downwind perimeter shall be extended, where practical, or engineering controls will be implemented such that downwind and background concentrations are similar. Exposed materials such as cuttings will be contained or covered and perimeter monitoring will continue until ambient air concentrations upwind and downwind of the Exclusion Zone are equal. The limits of the Exclusion Zone will be marked with high visibility flagging tape or four or more traffic cones or similar devices.

The Exclusion Zone will be accessed through a marked Contamination Reduction Zone (CRZ). The CRZ shall be used for gross decontamination of both personnel and equipment items. It shall be configured to allow the decontamination of the field crew while upwind of the Exclusion Zone. The HSC or his/her designee will assure that all personnel entering the Exclusion Zone wear the required protective equipment and that upgraded level of protection equipment is readily available.

A temporary decontamination area will be set up at the Site (as needed) where intrusive sampling activities will be performed. All decontamination materials and liquids from all areas will be properly collected until proper disposal occurs.

C.4.3 Personal Protective Clothing and Respiratory Protection

The following scheme will be used to designate the required level(s) of personal protective equipment and respiratory protection: the alphabetical designations “B”, “C”, and “D” shall refer specifically to levels of respiratory protection, namely pressure-demand air supplying respirators with escape provisions, air purifying respirators, and no respiratory protection, respectively. Since potential dermal exposure hazards may require a wide variety of personal protective clothing without regard to the required level of respiratory protection, the numerical designations “1”, “2”, and “3” will be used to specify the level of protective clothing that is to be employed in addition to the designated level of respiratory protection as described below (i.e., the level of protective equipment can be completely defined by a designation of “D-1”, “D-2”, etc.). The required levels of protective equipment and upgrade criteria for each work task are specified in Table C-6. All equipment and clothing shall be inspected by the wearer prior to use. All suspect protective equipment will be rejected and disposed of as non-contaminated waste.

The initial level of personal protective clothing required during Site activities will be D-1 which consists of the following:

LEVEL D-1, PROTECTIVE CLOTHING

1. Standard work clothes (long pants and sleeved shirt);
2. Steel-toed boots;
3. Safety glasses;
4. Orange safety vests (when working near public traffic);
5. Hard hats (when an overhead hazard is possible) and;
6. Hearing protection (during drilling and other noise producing activities).

Protective clothing will be upgraded during sampling activities and will consist of the following:

LEVEL D-1, MODIFIED PROTECTIVE CLOTHING

1. Level 1 protective clothing;
2. Inner latex gloves; and
3. Outer NBR gloves.

LEVEL D-2, PROTECTIVE CLOTHING

1. Level 1 protective clothing;
2. Inner latex gloves;
3. Outer NBR gloves; and
4. Polycoated Tyvek or Tyvek coveralls with taped openings.

LEVEL C PROTECTION

1. Full face air-purifying respirator[2];
2. Polycoated tyvek;
3. Boots: chemical protective, steel toed;
4. Chemical protective inner and outer gloves; and,
5. Hardhat (when overhead hazard is possible).

LEVEL B PROTECTION

1. Level C protective clothing; and,
2. Supplied air (open or closed circuit).

Field personnel may upgrade to Polycoated Tyvek or Tyvek coveralls (D-2) where it is probable that there will be substantial contact with subsurface soils or groundwater containing elevated levels of COPC. Polycoated Tyvek or Tyvek coveralls might also be worn when working in muddy conditions.

If conditions are found which are beyond the required Level(s) of Protection, personnel are to leave the area immediately and obtain the required protective equipment. Should the personnel suspect an inhalation hazard (e.g., unusual and continuous odors, dizziness, or respiratory irritation), they are to immediately move upwind from the area and promptly notify the HSC. Work will not proceed in these areas until air monitoring has assessed the nature of the hazard and additional protective measures are employed to the satisfaction of the HSC. Re-entry will be from an upwind position (when possible). Monitoring will precede re-entry. Personnel who experienced symptoms will not re-enter the area until symptoms have subsided and additional equipment/precautions are employed as determined by the monitoring. An examination by a physician may be prudent depending on the symptoms and duration.

C.4.4 Decontamination

Decontamination will involve two phases. Gross decontamination of personnel and equipment, comprising removal of mud by dry brushing or scraping, will take place in the CRZ established at the Site of each intrusive activity. Soil removed in this way will be backfilled into the borehole or collected and secured in a fenced storage area. All personnel and equipment will undergo gross decontamination prior to moving to a new investigation location. Prior to leaving the Site,

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[2] Prior to use, Site personnel must have a qualitative respirator fit test.

personnel and equipment will undergo full decontamination at the temporary decontamination pad.

Decontamination Procedures

All personnel involved in intrusive activities and/or contaminated personnel shall decontaminate prior to leaving the Site. The Decontamination Pad area shall have plastic sheeting on the ground of sufficient size to contain the personnel, hand held equipment and decontamination materials required. A typical Decontamination Area will require:

- 2 wash tubs (1 wash, 1 rinse);
- several scrub brushes;
- disposable towels and plastic bags;
- decontamination solution (e.g. Alconox);
- hand soap;
- skin wash water source; and
- special rinse solutions for hand sampling tools (see SAP).

Personnel will follow the decontamination procedure below. At a minimum all personnel will wash their hands and face prior to eating, smoking or leaving the Site. The HSC shall inspect personnel and non-disposable protective equipment for cleanliness prior to release from the Site.

Step 1: Equipment Drop
Deposit equipment used on-Site (hand tools, sampling devices and containers, monitoring instruments, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool down station may be set up.

Step 2: Outer Garment, Boots, and Gloves Wash and Rinse
Scrub boots, outer gloves and splash garments (if worn) with decontamination solution. Rinse off with water.

Step 3: Outer Glove Removal
Remove outer gloves (if worn). Deposit in container with plastic liner.

Step 4: Cartridge or Respirator Change (if applicable)
If worker leaves exclusion zone to change cartridges (or respirator), this is the last step in the decontamination procedure. Worker’s canister is exchanged, new outer gloves donned, joints taped, and worker returns to duty.

Step 5: Boot, Gloves and Inner Garment Removal (if applicable)
Boots, protective suit, inner gloves (if worn) removed and deposited in disposal containers.

Step 6: Respirator Removal (if applicable)
Respirator is removed. Avoid touching face with fingers, respirator deposited on plastic sheet.

Step 7: Field Wash
Hands and face are thoroughly washed. Shower as soon as possible.

Monitoring equipment and hand tools shall be retrieved and decontaminated using methods appropriate for the type of equipment. The HSC shall inspect the equipment for cleanliness.

Certain sampling equipment (e.g., hand sampling tools) may require specific decontamination procedures and/or chemicals. Site personnel are to refer to the SAP for this information.

All chemicals brought to the Site will have the appropriate MSDS provided to the HSC. This requirement also applies to drilling materials. The MSDS will be maintained in the field files at a location accessible to the Site field investigation team members and subcontractors. Any additional materials brought on Site will be accompanied by the appropriate MSDS, which will be provided to the HSC.

All disposable personal protective equipment will be double bagged in plastic bags and disposed of as municipal wastes. All decontamination materials will be drummed in 55-gallon drums. The solids and liquids will be separated and subsequently disposed as Investigation Derived Waste (IDW).

C.5.0 CONTINGENCY AND EMERGENCY RESPONSE PLANS

If an unanticipated, potentially hazardous situation arises as indicated by visible contamination, unusual or excessive odors, Site personnel shall temporarily cease operations, move away to a safe area, and contact the HSC. The following procedures have been established to deal with emergency situations that might occur during field activities. Prior to starting work at the Site, the local emergency response services will be contacted and informed that field activities will be in progress. Site personnel will familiarize themselves with the location of the nearest pay phones (in case there is no satellite coverage for mobile phones) and medical facilities on arrival at the Site. In the event of a serious emergency situation (e.g. medical problems beyond routine first aid, explosive gas concentrations, or fire beyond incipient stage), Site personnel shall contact the New York City Police Department, inform them of the nature of the emergency, and then notify the HSO. When help arrives, Site personnel shall defer all emergency response authority to appropriate responding agency personnel. Emergency notification information is summarized in Table C-1.

C.5.1 Medical Emergency Response Plan

The nature of chemical contamination on this project is not anticipated to present an immediate threat to human health. Other than removal of outer protective garments and gross contamination (e.g., mud), immediate emergency treatment of injuries should therefore generally take precedence over personal decontamination.

Should any person be injured or become ill during implementation of the field activities, initiate the following emergency response plan and notify the HSC as soon as possible:

1. If able, the injured person should proceed to the nearest available source of first aid. If the injured party is extremely muddy, remove outer garments and if necessary, wash the injured area with soap and water. If the "injury" involves a potential overexposure to hazardous gases or vapors, (headache, dizziness, nausea, disorientation), get the victim to fresh air and take him or her to New York City Woodhull Medical Center, 706 Broadway Brooklyn, New York 11206, for a complete physical examination as soon as possible. Figure C-2 provides directions from the Site to the hospital.

   If the injury involves foreign material in the eyes, immediately flush the eyes with emergency eye wash solution and/or rinse with copious amounts of potable water. Obtain or administer first aid as required. If further medical treatment is required, seek professional medical assistance as discussed below.

Appropriate measures should be taken to protect the privacy of workers in connection with putting on and taking off of protective clothing. First aid providers shall wear latex gloves when providing <u>any</u> first aid. Severe injuries involving large quantities of blood require that first aid providers don Tyvek coveralls and safety glasses in addition to gloves.

2. If the victim is unconscious or unable to move, or if there is any evidence of spinal injury, <u>do not move the injured person unless absolutely necessary to save his or her life</u>, until the nature of the injury has been determined. Administer rescue breathing using a CPR barrier if the victim is not breathing, control severe bleeding and <u>immediately</u> seek medical assistance as discussed below.

3. If further medical treatment is required and

   a. <u>the injury is not severe</u>, contact New York City Woodhull Medical Center at (718) 963-8000 and take the injured party to the hospital by private automobile.

      Directions to the Hospital from the Site (see Figure C-2):
      - Make left out of Site onto Review Ave
      - Turn left onto Greenpoint Ave
      - Turn left onto McGuiness Ave
      - Bear right onto Humboldt St
      - Bear right onto Sumner Pl
      - Make left onto Broadway
      - Arrive 760 Broadway

   b. If <u>the injury is severe</u>, immediately call the 78th Precinct of the New York City Police Department at (718) 636-6411 or 911 using a standard phone.

   In both cases, if decontamination is not undertaken, appropriate precautions should be taken to avoid transfer of contaminants to vehicles and other facilities. This can be done by using plastic sheeting or the exposure blanket contained in the first aid kit.

4. Any injured person taken to the hospital shall be accompanied by an individual designated by the HSC to ensure prompt and proper medical attention. After proper medical treatment has been obtained, the designated companion should notify the HSO and prepare a written report. Site personnel shall maintain their medical insurance identification whenever they are on Site.

   In the event that any personnel are injured at a particular facility during any phase of the Investigation, all available technical information and supporting documentation shall be provided to any treating physicians, or treating health care workers or facilities.

C.5.2 Fire and Explosions

Dry chemical fire extinguishers are effective for fires involving ordinary combustibles such as wood, grass, flammable liquids, and electrical equipment. They are appropriate for small, localized fires such as a drum of burning refuse, a small burning gasoline spill, a vehicle engine fire, etc. No attempt should be made to use these extinguishers for well established fires or large areas or volumes of flammable liquids.

In the case of fire, prevention is the best contingency plan. There will be no smoking at the Site except in pre-designated areas. In the event of a fire, personnel shall attempt to extinguish the fire with on-Site fire extinguishers. If a fire cannot be controlled in this manner, personnel shall notify the HSC and follow the procedure outlined below.

Catalytic converters on the underside of vehicles are sufficiently hot to ignite dry grass. Personnel should avoid driving over dry grass that is higher than the ground clearance of the vehicle, and be aware of the potential fire hazard posed by the catalytic converter, at all times. Never allow a running vehicle to sit in a stationary position over dry grass or other combustible materials.

In the event of a fire or explosion:

1. If the situation can be readily controlled with available resources without jeopardizing the health and safety of Site personnel, take immediate action to do so. If not:
2. Isolate the fire to prevent spreading, if possible.
3. Clear the area of all personnel working in the immediate vicinity.
4. Immediately notify Site emergency personnel and the New York City Fire Department by dialing 911 using a standard phone.

C.5.3 Chemical Exposure First Aid

In an event of exposure to chemicals through inhalation:

1. Move the victim to an up-wind location for fresh air.
2. Signal for help.
3. Initiate CPR to revive the victim, if necessary.
4. Contact the Cheiselhurst Police Department, if necessary.

For exposure through dermal route (including eyes):

1. Wash the affected area with copious fluids for at least fifteen (15) minutes (Signal for help if necessary).
2. If irritation persists, seek professional medical care.

For ingestion:

1. Drink a large amount of water to dilute the contaminant(s).
2. Transport the victim to the hospital. Take a copy of this HASP to the hospital.

If decontamination is not undertaken prior to transporting the victim to the hospital, appropriate precautions should be taken to avoid transfer of contaminants to vehicles and other Site.

C.5.4 Unforeseen Circumstances

The health and safety procedures specified in this Plan are based on the information available at the time. Unknown conditions may exist, and known conditions may change. This plan cannot account for every unknown or anticipate every contingency. Should personnel suspect or encounter areas of substantially higher levels of contamination, or should any situation arise which is obviously beyond the scope of the safety procedures specified herein, work activities shall be modified (such as by moving to another location) or halted pending discussions with the HSO and implementation of appropriate protective measures.

C.5.5 Accident and Incident Reports

If an incident or accident occurs, the HSO and Project Manager shall be notified and the Incident Report (shown in Attachment C-4) shall be completed. The report shall be completed by an eye witness (if possible) along with assistance from the HSC. The report will be forwarded to the HSO as soon as possible for further investigation or follow-up.

C.5.6 Emergency Contacts

Emergency notification information is summarized in Table C-1.

TABLE C-1

EMERGENCY RESPONSE NUMBERS

Golder Associates Inc	856-616-8166
Site Location Address	37-80 Review Ave, Long Island City, Queens, NY
Mobile telephone located in	Field vehicles

Emergency (New York City PD)	(718) 636-6411 or 911 using a standard phone
Ambulance (New York City FD)	(718) 636-6411 or 911 using a standard phone
Fire (New York City FD)	911 if using standard phone
Police (New York City PD)	(718) 636-6411 or 911 using a standard phone
Hospital Name	New York Woodhull Medical Center
Hospital Phone Number	(718) 963-8000
Golder Project Manager	Randolph S. White, P.E. (856-616-8166 ext. 1477)
Golder Site Health and Safety Coordinator	Timothy Richards (973-621-0777 ext 1454)
Golder Health and Safety Officer	Douglas Dugan (856-616-8166 ext. 1458)
Client Contact (Project Coordinator)	Pete Zimmerman (ELM) (212-308-3800)
State Agency, NYSDEC Spill Hot Line	800-457-7362
Poison Control Center	800-962-1253

TABLE C-2

POTENTIAL SITE HAZARDS *

Hazard	Drilling	Site Walk	Groundwater/ Sampling	Soil Sampling	LNAPL Sampling
Contaminants of Potential Concern Exposure	X		X	X	X
Mechanical Equipment/Construction	X	X	X	X	X
Lifting and Material Handling	X		X	X	X
Slip/Trip/Fall	X	X	X	X	X
Electrical	X		X	X	X
Fire and Explosion	X	X	X	X	X
Heat/Cold Stress	X	X	X	X	X
Vehicular Traffic	X	X	X	X	X
Noise	X				
Exposure to sun	X	X	X	X	X
Poisonous Plants	X	X	X	X	X
Snakes/Spiders/Insects	X	X	X	X	X

* No field personnel shall enter any on-site structure, building, or tank for any reason.

Table C-3
Airborne Exposure Limits

	NIOSH REL		OSHA PEL				ACGIH TLV	IDLH	Ionization Potential
Chemical	**TWA**	**STEL**	**TWA**	**STEL**	**Ceiling**	**max peak**			**(eVolts)**
Benzene	0.1 ppm*	1 ppm	1 ppm	5ppm	NE	NE	0.5 ppm (TWA)	500 ppm*	9.24
Ethylbenzene	100 ppm	125 ppm	100 ppm	NE	NE	NE	100 ppm (TWA)/125 ppm (STEL)	800 ppm	8.76
Toluene	100 ppm	150	200 ppm	NE	300 ppm	500 ppm (10 min)	50 ppm (TWA)	500 ppm	8.82
Xylenes	100 ppm	150	100 ppm	NE	NE	NE	100 ppm (TWA)/150 ppm (STEL)	900 ppm	8.56
Lead	0.05 mg/m3	NE	0.05 mg/m3	NE	NE	NE	0.05 mg/m3 (TWA)	100 mg/m3	NA

Notes:

All concentrations are expressed in ppm with the exception of IP which is presented in eV.

NIOSH REL - National Institute of Occupational Safety and Health Recommended Exposure Limit

NIOSH TWA - refers to the Time weighted average concentrations for up to a 10-hour workday during a 40-hour work week.

OSHA PEL - Occupational Safety and Health Adminstration Permissable Exposure Limit

OSHA TWA - refers to concentrations that must not be exceeded during any 8-hour workshift of a 40-hour workweek.

STEL - for both NIOSH and OSHA refers to the short-term exposure limit 15-minute TWA exposure that should not be exceeded at any time during a workday

max peak - refers to the amount of exposure above the ceiling value that is acceptable for the indicated time in minutes within a established period of time in a 8-hour workday. The amount of exposure should never exceed the maximum peak.

Ceiling REL - refers to the exposure concentration that should not be exceeded at any time.

ACGIH TLV - American Conference of Governmental Industrial Hygienists Threshold Limit Value

IDLH - Immediately Dangerous to Life or Health concentrations

minimize - minimize exposure to the lowest achievable concentration.

*** or Ca** - indicates that NIOSH considers the chemical to be a potential occupational carcinogen and the exposure limit is considered the lowest achievable exposure.

NE - none established

Table C-4
Comparative Risk Analysis

This table details site activities and anticipated associated risks by class: Biologial, Chemical, or Physical. Personal Protective Equipment level, weather, air temperature and season may effect the magnitude of some types of risk. Site personnel shall use prudent judgement at all times.

Task/Activity	**Hazard**		
	Biological	**Chemical**	**Physical**
Walk Through	L-M	L-M	L-H *
Groundwater Sampling	L-M	L-M	L-M
Soil Sampling	L-M	L-M	L-M
Free Phase Liquid Sampling	L-M	M	L-M
Drilling	L-M	L-M	L-H

Many of the chemicals identified in the on site media can enter through the skin.
This route of entry must be protected whenever skin contact is probable.

L: Low
M: Moderate
H: High
* No field personnel shall enter any structure, building, or tank for any reason.

Table C-5
Air Monitoring and Associated Action Level Requirements

Task	Initial Level of Protection	Air Monitoring Equipment	Upgrade Criteria	Upgraded Level of Protection	Remarks (See footnote 1)
Walk Through	D-1	NA	Condition Dependent	Condition Dependent	
Soil Sampling **Groundwater Sampling** **Free Phase Liquid Sampling**	Modified D-1 or D-2(2)	PID	VOCs continuously > than 5 ppm for more than 5 minutes above background or any peak > than 25 ppm above background	C	**Section B3.3**
		PID/Draeger Tube - Benzene	VOCs continuously > 1 ppm and < or = to 5 ppm above background level for more than 5 minutes, a detector tube for benzene shall be used to determine airborne concentrations.	Benzene > 1ppm Temporarily cease work until concentration subsides and evacuate immediate area or C2	
		PID/Draeger Tube - Benzene	Continuously greater than 25 ppm, or frequent peaks > than 50 ppm, or benzene concentrations > 100 ppm	Temporarily cease work until concentration subsides and evacuate immediate area or B2	
Drilling/Well Installation and Development	D-1 or D-2(2)	PID	VOCs continuously > than 5 ppm for more than 5 minutes above background or any peak > than 25 ppm above background	C	**Section B3.3**
		PID/Draeger Tube - Benzene	VOCs continuously > 1 ppm and < or = to 5 ppm above background level for more than 5 minutes, a detector tube for benzene shall be used to determine airborne concentrations.	Benzene > 1ppm Temporarily cease work until concentration subsides and evacuate immediate area or C	
		PID/Draeger Tube - Benzene	Continuously greater than 25 ppm, or frequent peaks > than 50 ppm, or benzene concentrations > 100 ppm	Temporarily cease work until concentration subsides and evacuate immediate area or B	
		MIE PDM-3 miniram (or equivalent)	<2 mg/m^3 above background	Wear Level D-1(2) PPE	
			>2mg/m^3 to 100 mg/m^3 sustained for 10 minutes or peaks > 25 mg/m^3	Use wet methods (water spray) or other engineering controls to reduce levels	
				Use Level C PPE if water spray fails to reduce dust concentrations	
			> 100 mg/m^3 peak or sustained	Cease work and contact the HSO	
Drill Rig/ Equipment Decontamination	D-2	NA	NA	NA	

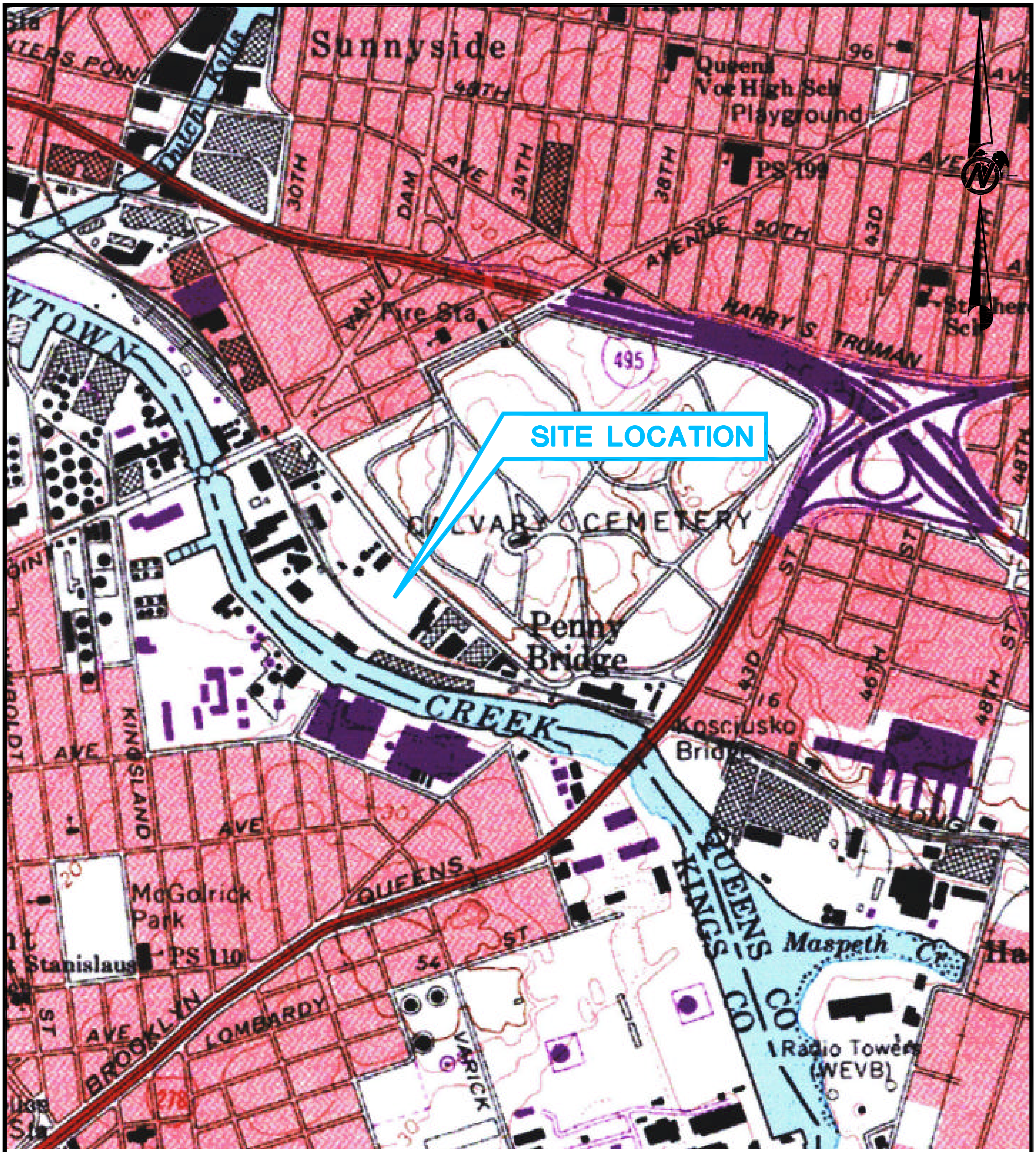
Notes:

(1) **The HSO must be advised of conditions that warrant a change in PPE and approve the revised procedure.**

(2) Field personnel may upgrade to polycoated Tyvek or Tyvek coveralls where it is probable that there will be substantial contact with subsurface soils or groundwater containing elevated levles of site-related constituents.

Condition Dependent: Personnel are to use prudent judgement and select additional PPE based on current Site conditions (e.g., wet or muddy) to prevent unnecessary contamination.

Site personnel are permitted, with HSO approval , to substitute protective aprons and/or gauntlets when exposure to water/sediment samples is readily controlled. This substitution is permitted to reduce the possibility of heat stress caused by working in full coverall protection.



REFERENCES

1.) MAP TAKEN FROM U.S.G.S. 7.5 MINUTE QUADRANGLE OF BROOKLYN, NEW YORK, DATED 1979.

1000 0 1000
SCALE FEET

Golder Associates
Philadelphia USA

SCALE	AS SHOWN
DATE	09/19/02
DESIGN	AM
CADD	AM
CHECK	
REVIEW	

FILE No. 0236151A010
PROJECT No. 023–6151 REV. 0

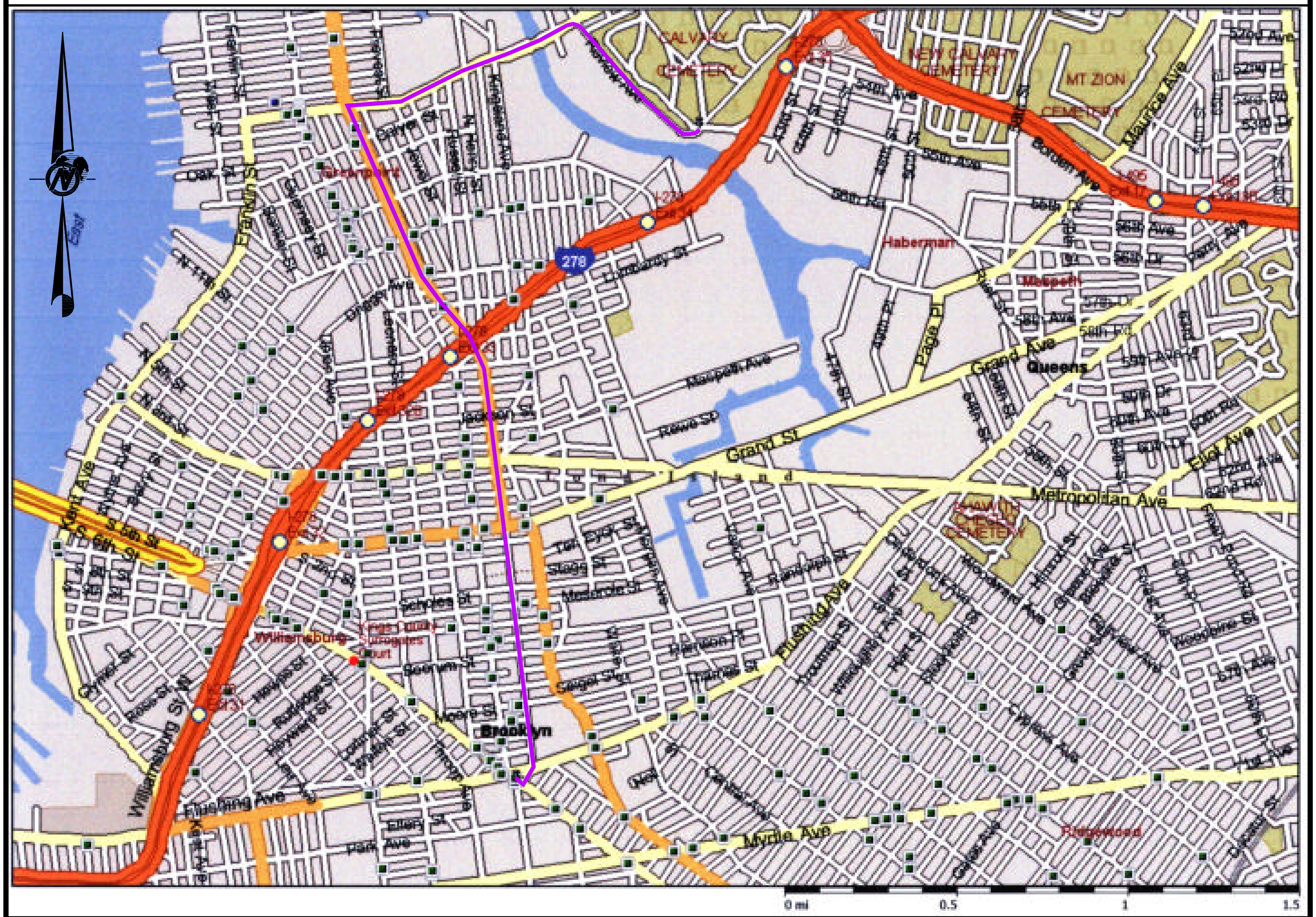
TITLE

SITE LOCATION MAP

QUANTA RESOURCES

FIGURE **C-1**

Drawing file: 0236151A010.dwg Oct 28, 2003 – 11:21am



DIRECTIONS

1.) DEPART SITE AND MAKE LEFT ONTO REVIEW AVE.

2.) TURN LEFT ONTO GREENPOINT AVE.

3.) TURN LEFT ONTO McGUINESS BLVD.

4.) BEAR RIGHT ONTO HUMBOLDT ST.

5.) BEAR RIGHT ONTO SUMNER PL.

6.) ARRIVE 760 BROADWAY

REFERENCES

1.) MAP TAKEN FROM MICROSOFT STREETS & TRIPS.

Golder Associates
Philadelphia USA

SCALE	AS SHOWN
DATE	09/19/02
DESIGN	AM
CADD	AM
CHECK	
REVIEW	
FILE No.	0236151A011
PROJECT No.	023–6151
REV.	0

TITLE

HOSPITAL ROUTE MAP

QUANTA RESOURCES

FIGURE C-2

Drawing file: 0236151A011.dwg Oct 29, 2003 – 7:59am

ATTACHMENT C-1

FIELD PROCEDURE CHANGE AUTHORIZATION FORM

ATTACHMENT C-1

FIELD PROCEDURES CHANGE AUTHORIZATION

Instruction Number: ______ Date:________

Duration of Authorization Requested ___ Today only

___ Duration of Task

Description of Procedures Modification:

Justification:

Person Requesting Change: Verbal Authorization Received From:

Name	Name	Time
Title	Title	
Signature	Approved By	

(Signature of person named above to be obtained
within 48 hours of verbal authorization)

ATTACHMENT C-2

SITE HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT

ATTACHMENT C-2

SITE HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT

I have read understand and agree to follow the provisions detailed in the Health and Safety Plan for the Quanta Resources Site.

I am aware of emergency procedures, equipment locations, and emergency telephone numbers.

I understand that my failure to comply with these provisions may lead to disciplinary actions and/or my dismissal from the Site.

Printed Name	Organization	Signature	Date

This form is to be kept on file on Site. Copies should be made available to personnel from all companies involved with Site work.

ATTACHMENT C-3

REPORT FORM FOR UNSAFE CONDITIONS AND PRACTICES

ATTACHMENT C-3

REPORT FORM FOR UNSAFE CONDITIONS AND PRACTICES

DESCRIPTION OF UNSAFE CONDITION OR PRACTICE ________________________

____

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____

____

DESCRIPTION OF CIRCUMSTANCES SURROUNDING UNSAFE CONDITION OR PRACTICE ____

____

____

____

____

IS THIS AN EXISTING CONDITION OR POTENTIAL HAZARD? __________________

REPORTED TO ____

REPORTED BY _____________________ **DATE** _____________________

COMMENTS ____

____

____

____

____

REPORT RECEIVED BY _____________________________**(Health and Safety Officer)**

DATE __________________ ____

(Signed)

ATTACHMENT C-4

INCIDENT REPORT FORM

ATTACHMENT C-4

INCIDENT REPORT FORM

In the event of any injury, accident or illness requiring medical attention beyond minor first aid, please complete this form. Retain two copies for your files and send the original to Linda Laganella in the Cherry Hill, NJ office.

Employee's office mailing address: Location of office (if different):

__________________________________ _______________________________________

__________________________________ _______________________________________

__________________________________ _______________________________________

__________________________________ _______________________________________

EMPLOYEE INFORMATION:

Employee's name:____

Length of time with Employer:____________________________________

S.S.#:______-______-______ Sex: M F Birth Date:___________________________

Home address:

____

____

____

Occupation:____

Department or group:____

PROJECT INFORMATION:

Project Manager: _______________________

Field Supervisor: _______________________

Project Description (briefly describe the project, location, employee's role, etc.):

____

____

____

____

____

ACCIDENT/EXPOSURE INFORMATION:

Description of accident/incident (briefly describe how the accident/incident occurred, what task the employee was working on at the time, working conditions, etc.)

____

____

____

____

____

INJURY/ILLNESS INFORMATION:

Description of injury/illness (please describe the nature of the injury/illness, body part(s) affected, and the object/agent which caused the injury/illness):

____

____

____

____

____

Name and address of attending physician:

____

____

____

____

Name and address of hospital (if admitted):

____

____

____

____

Report prepared by:____

Title:____

Date:______________________________

APPENDIX D

SAMPLING AND ANALYSIS PLAN
(INCLUDES QUALITY ASSURANCE PROJECT PLAN)

APPENDIX D

SAMPLING AND ANALYSIS PLAN
FOR THE
REMEDIAL INVESTIGATION / FEASIBILITY STUDY WORK PLAN
QUANTA RESOURCES SITE
LONG ISLAND CITY, NY

November 2002

Revision #0

Signature Date

RI Consultant Project Manager ______________________________

RI Consultant Project QA Manager ______________________________

NYSDEC Project Manager ______________________________

DISTRIBUTION LIST

6 Copies	New York State Department of Environmental Conservation
1 Copy	New York State Department of Health
7 Copies	Quanta Site Administrative Group
1 Copy	McCusker, Anselmi, Rosen, Carvelli & Walsh
1 Copy	Environmental Liability Management, Inc.
2 Copies	Golder Associates Inc.

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D.1.0 PROJECT MANAGEMENT

D.1.1 Project Background

This Sampling and Analysis Plan (SAP), which includes a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP), has been prepared by Golder Associates Inc. (Golder Associates) on behalf of the Quanta Site Administrative Group (QSAG). The SAP was prepared as part of the Remedial Investigation/Feasibility Study Work Plan (RI/FS Work Plan) for the Quanta Resources Superfund Site (Site) and addresses remedial investigation activities for groundwater and soil required under the Order On Consent (Consent Order or CO) entered into by the QSAG and the New York State Department of Environmental Conservation (NYSDEC), NYSDEC Index No. W2-0915-03-06. This SAP supports the RI/FS Work Plan by providing information regarding field, sampling, analytical and quality assurance/quality control (QA/QC) procedures for remedial investigation field activities.

This SAP was prepared in accordance with the CO for the Site, USEPA and State of New York guidance documents specified below:

1. Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (EPA/540/G-89/004), dated October, 1988;
2. EPA NEIC Policies and Procedures Manual (EPA 330/9-78-001-R) dated May 1978, revised May 1986;
3. A Compendium of Superfund Field Operations Methods (OSWER Directive 9355-0-14), December 1987;
4. Field Methods Compendium (OSWER Directive 9285-2-11), August 1996;
5. Guidance for the Data Quality Objective Process, EPA QA/G-4 (EPA/600/R-96/055), dated August 2000;
6. EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations (EPA QA/R-5), Interim Final, dated November 1999;
7. EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5), March 2001;
8. Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (OSWER Directive 9355.3-01) and,
9. Region II CERCLA Quality Assurance Manual, Revision 1, EPA Region 2 (October 1989).

The format of this SAP follows that of guidance Document No. 7, which specifies four groups of elements containing a total of twenty-five essential elements to be included in a SAP. The four groups are Project Management, Measurement/Data Acquisition, Assessment/Oversight, and Data Validation/Usability. The first three elements of the Project Management Group (Title Page including provision for approval signatures, the Table of Contents, and the Distribution List) are included in the front of this document. The remaining four Project Management elements are discussed in this section. The remaining three groups of elements are presented in Sections D.2 through D.4, respectively.

This SAP describes general QA/QC procedures that will be used during sample collection and handling in the field and in the laboratory. Laboratory QA procedures regarding personnel, management structure, analytical equipment, and data management are contained in the laboratory's Quality Assurance Manual (QAM). A copy of the laboratory QAM is referenced as Attachment D-1 and has been provided under separate cover. Any substantive revisions to this SAP will be submitted to NYSDEC for approval prior to implementation.

Many of the quality assurance procedures to be used for this project are described in the following documents:

1. Sampling Guidelines and Protocols, New York State Department of Environmental Conservation, September 1992;
2. Contract Laboratory Program Statement of Work for Organics Analysis, OLM04.2;
3. Contract Laboratory Program Statement of Work for Inorganics Analysis, ILM04.1;
4. Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846, Third Edition, November 1986; Update III, December 1996;
5. Methods for Chemical Analysis of Water and Wastes (EPA-600/4-79-020), USEPA, 1979, revised 1983;
6. Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992, APHA-AWWA-WPCF;
7. EPA Region II Contract Lab Program Organics Data Review and Preliminary Review, Standard Operating Procedures #HW-6, Revision 12;
8. Evaluation of Metals Data for the Contract Laboratory Program, Standard Operating Procedure #HW-2, Revision 11; and,
9. Annual Book of ASTM Standards, Volume 4.08, April 1999.

The text of this document, which presents each of the four elements of the SAP, refers to the above listed documents, as appropriate. The signatures on the cover sheet of this SAP demonstrate the review, approval, acceptance and responsibility for the QA/QC procedures specified herein by the project team. A list of key project personnel thus far identified for this project is presented in Table D-1 of this SAP.

D.1.2 Project Organization

The project team organization is shown on Figure D-1. Contact information for the project team members are provided in Table D-1. Notably, the listed project team members have primary responsibility for the project, although other individuals within their respective organizations will be involved.

The lead regulatory Agency for the Site is NYSDEC. Mr. Vadim Brevdo is NYSDEC's Remedial Project Manager. Mr. Brevdo will serve as the primary contact with QSAG's Project Coordinator, Peter Zimmermann of Environmental Liability Management (ELM). The Project Coordinator will act as a liaison between NYSDEC and QSAG. Golder Associates will serve as the RI/FS contractor. Mr. Randolph White, P.E. of Golder Associates (New York State Licensed Professional Engineer No. 062926-1) will provide overall management of Golder Associates activities related to the RI/FS. Mr. White will be assisted by Mr. Stuart Mitchell of Golder Associates who will serve as the Remedial Investigation Task Manager. Quality Assurance/Quality Control (QA/QC) of sampling, sample analyses, and data management will be provided by the Golder Associates QA Manager, Douglas Dugan, or his designee.

Severn Trent Laboratories, Inc. of Edison, New Jersey (STL-E) will provide analytical services for sampled media. STL-E is certified by NYSDEC. Microseeps, Inc. of Pittsburgh, Pennsylvania (Microseeps) will provide analytical services for select parameters (i.e., light hydrocarbons). Aquifer Drilling and Testing Inc. (ADT) of New Hyde Park, New York will provide well drilling services and the surveying subcontractor will be GEOD Corporation of Newfoundland, New Jersey. Both ADT and GEOD are licensed in the State of New York. If at any time during this project, the identity or role of any of these key organizations or personnel changes, NYSDEC would be notified.

D.1.3 Project Description

The Site consists of an approximately 1.8-acre parcel of land at 37-80 Review Avenue, within a highly industrialized area of Long Island City, Queens, New York. According to the available information, "the earliest record owner of the Site is American Agricultural Chemical Company ("American"). American transferred the property to Triplex Oil Refining Company ("Triplex Oil") in 1931. Triplex Oil operated the property for approximately 40 years; its operations included refining used crank case oil. From approximately 1972 to 1980, the facility was operated by several different owners, including Pentalic Corporation, Sea Lion Corporation, Ag-Met Oil Service, Inc., Hudson Oil Refining Corp., and Portland Holding Corporation. Quanta Resources, which bought the Site from Portland Holding Corporation in July 1980, filed for bankruptcy on October 6, 1981 and ceased operations at the Site at or about the same time.

Quanta Resources operations included recycling, processing and/or storing used and unused oils, solvents, and miscellaneous waste materials. The Site has been abandoned since Quanta Resources filed for bankruptcy. Beginning in the summer of 1982, the New York City Department of Environmental Protection (NYCDEP) and NYSDEC personnel performed an investigation of materials left behind in tanks, vessels, building containment areas, and other structures. The investigations indicated that some of the remaining materials were flammable and that some contained solvents, PCBs, and heavy metals. As a result, in 1982, the NYCDEP contracted CH2M Hill, as the oversight engineer, and OH Materials Corp. (OHM) as the remedial contractor to perform a Removal Action.

In total, OHM reported that it removed over 500,000 gallons of liquids and approximately 900 cubic yards of solids (from tanks, containment areas, separators, etc.), portions of which it reported were impacted with PCBs, chlorinated solvents, heavy metals and/or cyanide. Emphasis was placed on the search for hidden or buried storage tanks that had not been previously discovered by NYCDEP personnel. A magnetometer was used to scan for buried tanks in suspect on-site areas. A total of 106 aboveground or underground tanks were evaluated and decontaminated as described below. Following the removal, transportation, and off-site disposal of the liquids and solids, on-site storage tanks (including above ground and underground tanks), piping, containment areas, and buildings were reported by OHM to have been emptied and decontaminated. A description of the work completed is presented in the report entitled Engineering Services Report, Quanta Resources

Site Cleanup, prepared by CH2M Hill for the NYCDEP, dated December 29, 1982 and summarized below.

All tanks at the Site, including aboveground and underground tanks, were decontaminated and were certified as “gas free” by a licensed Marine Chemist from Marine Chemists Inc. of Hoboken, New Jersey. In addition, the dike areas and separators were decontaminated following the removal of all aqueous liquids, oils, and accumulated sludge. The cleaning and decontamination of the facility’s extensive piping network and appurtenances lasted throughout the duration of the project. The piping was dismantled into workable sections and thoroughly cleaned with potable water using high-pressure water lasers. The cleanup and decontamination of Building A required the cleaning of the 14 tanks within the building, decontamination of the walls, floors, and basement areas of the building which had accumulated approximately 3 feet of aqueous/oil waste and sludge. In addition to the 10 tanks within Building F, the floors and walls were decontaminated. The other buildings did not contain liquid waste materials.

At the conclusion of the Removal Action, OHM conducted an environmental investigation on behalf of the NYCDEP and installed four on-site monitoring wells and collected samples of groundwater, light nonaqueous phase liquid (LNAPL), and composite samples of soil/fill. The activities conducted and findings of the study are presented in the report entitled *Preliminary Hydrogeologic Assessment*, Quanta Resources, New York City, New York, (OHM, January 7, 1983). The sample collection, handling, and analyses procedures are not well documented and the sampling locations are not fully known. Consequently, while these data were useful for scoping the subsequent investigation described below, the OHM data are not appropriate for use in this Remedial Investigation. Only general observations and some limited groundwater/LNAPL measurements from the OHM Study are discussed in the RI/FS Work Plan.

The firm Lawler, Matusky & Skelly (LMS) conducted a Phase II Investigation from 1988 through 1990 on behalf of NYSDEC (*Engineering Investigations at Inactive Hazardous Waste Site, Phase II Investigation*, Quanta Resources Site No. 241005, May 1990). LMS reported that the soils, LNAPL, and groundwater contained constituents similar to those detected in the materials removed during the 1981 Removal Action.

The purpose of this SAP is to describe the sampling and analysis activities, which will be conducted to gather information needed to address the data gaps identified in the RI/FS Work Plan. Sampling programs to be performed under this SAP are summarized in Table D-2. Figure 11 of the RI/FS Work Plan provides a schedule of remedial investigation activities. The overall objectives of the RI/FS are as follows:

- Determine the nature and extent of constituents of potential concern (COPC) and potential impacts to the public health, welfare, or the environment caused by the release or potential release of COPC at or from the Site by conducting an RI; and,
- Determine and evaluate alternatives for remedial action, if any, to prevent, mitigate, or otherwise respond to or remedy a release or potential release of COPC at or from the Site by conducting a Feasibility Study.

The specific objectives of the RI/FS are:

- Objective 1: Estimate spatial distribution, mobility, and perform a chemical characterization of LNAPL.
- Objective 2: Establish concentration distribution and gradient of COPC within soil, groundwater, and LNAPL along exposure pathways.
- Objective 3: Define important hydrogeologic parameters needed to assess COPC fate and transport, such as groundwater flow direction and gradients.
- Objective 4: Assess COPC fate and transport based on empirical data and literature.
- Objective 5: Assess potential contributions of COPC from other properties to groundwater (upgradient, sidegradient and downgradient areas).
- Objective 6: Determine potential exposure pathways and potential receptors to COPC originating from the Site.
- Objective 7: Evaluate potential threats to human health and the environment.
- Objective 8: Identify a range of remedial alternatives that eliminate the significant threats to human health and the environment in accordance with 6 NYCRR Part 375-1.4(b)(1)-(13) and evaluate those remedial alternatives in the context of the Site setting and redevelopment options.

D.1.4 Quality Assurance Objectives for Measurement

The USEPA Data Quality Objectives (DQO) Guidance document specifies that the sampling program be designed in order to meet the requirements of the investigation and achieve the DQOs. Part of this process is to determine what data is being collected and how it will be used in assessing Site conditions. For the purposes of this project, two types of data will be produced. Definitive data will be collected from samples that are submitted to an approved laboratory for analysis. Screening data will be produced using field measurement instruments for determining parameter stabilization during well purging activities and field analysis of VOCs for health and safety monitoring.

As part of the evaluation component of the QA program, results are compared with certain data quality indicators. These data quality indicators are part of the overall DQOs for the project. DQOs for field and laboratory analysis are provided in Table D-2. Tables D-3 through D-8 provide details regarding the planned chemical analyses and the quality criteria used to assess the data.

QA program objectives for the analytical laboratory are in the laboratory's QAM. In general, data quality indicators include precision, accuracy, representativeness, completeness, and comparability (PARCC). Each indicator may be defined as follows:

1. Precision is the agreement or reproducibility among individual measurements of the same property, usually made under the same conditions;
2. Accuracy is the degree of agreement of a measurement with the true or accepted value;
3. Representativeness is the degree to which a measurement accurately and precisely represents a characteristic of a population, parameter, or variations at a sampling point, a process condition, or an environmental condition;
4. Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under correct normal conditions; and,
5. Comparability is an expression of the confidence with which one data set can be compared with another data set in regard to the same property.

QA objectives vary according to the specific objectives of each analysis. The *accuracy, precision* and *representativeness* of data will be functions of the sample origin, analytical procedures and the specific sample matrices. QC practices used to evaluate these data quality indicators include use of accepted analytical procedures, adherence to hold time, and analysis of QC samples such as blanks, replicates, spikes, calibration standards and reference standards. Tables D-3 through D-8 summarize the PARCC criteria for groundwater, soil, and light non-aqueous phase liquids (LNAPL) samples.

For each parameter analyzed, quantitative QA objectives for precision, accuracy and sensitivity (detection limits) were established in accordance with the specific analytical method employed, published historical data, laboratory method validation studies, and laboratory experience with similar samples. A list of the Reporting Limits for the TCL/TAL analytes is provided as Table D-9. It should be noted that these reporting limits are the minimum reporting limits appropriate for undiluted, relatively unimpacted samples. However, the reporting limits may be elevated due to constituent concentrations in excess of the method calibration range, the sample matrix, and percent moisture adjustment for soil samples.

Representativeness is a non-quantitative (qualitative) characteristic that primarily addresses proper design of a sampling program in terms of number and location of samples and sample collection techniques. The rationale for the number and location of samples for this project is discussed in the RI/FS Work Plan and the sampling procedures are described in Section D.2 of this SAP. The representativeness of the analytical data is also a function of the procedures used to process the samples. Standard USEPA or USEPA-accepted analytical procedures will be followed.

Completeness is a quantitative characteristic that is defined as the fraction of valid data obtained from a measurement system (sampling and analysis) compared to that which was planned. Completeness can be less than 100 percent due to low sample recovery, sample damage, or disqualification of results that are outside of control limits due to laboratory error or matrix-specific interference. Completeness is documented by including sufficient information in the laboratory reports to allow the data user to assess the quality of the results. For this project, an attempt will be made to attain 85 percent completeness or better (field and laboratory) where chemical analysis is required. The completeness goal for laboratory measurements will be 90 percent.

Comparability is a qualitative characteristic that allows for comparison of analytical results with those obtained by other laboratories. This may be accomplished through the use of standard accepted methodologies, traceability of standards to National Bureau of Standards (NBS) or USEPA sources, use of appropriate levels of quality control, reporting results in consistent, standard units of measure and participation in inter-laboratory studies designed to evaluate laboratory performance.

Samples collected during the project will be analyzed for the parameters outlined in Tables D-2, D-3, D-5, D-7 and D-9. The DQOs, as summarized by the PARCC criteria in Tables D-3 through D-8, may not always be achievable. The USEPA Region II data validation guidelines provide direction for the determination of data usability. Qualified data can often provide useful information, although the degree of certainty associated with the results may not be as planned. Professional judgment will be used to determine data usability with respect to project goals.

D.1.5 Training Requirements/Certifications

Samples will be collected by personnel trained in the use of the sampling equipment. Training will include use of proper sampling protocols as well as Health and Safety procedures. Laboratory personnel will have been trained in the analysis of samples and the review of analytical data. Personnel performing the remedial investigation activities will be required to present documentation of OSHA 40-hour HAZWOPER training and annual updates prior to actively performing intrusive work activities at the Site.

D.1.6 Documentation and Records

All field records will be compiled and retained in the RI Consultant's project files. Field parameter data collected during the remedial investigation will be included in the Remedial Investigation Report. Analytical data packages will contain all information necessary for data validation, if data validation should be required. At a minimum, the following information is needed as appropriate to the analytical methodology:

- Case narrative;
- Chain of Custody (COC) records;
- QC summaries;
- Analytical data report;
- Calibration information;
- Chromatograms;
- Quantitation reports;
- Spectra;

- Analytical sequence logs; and,
- Sample preparation logs.

The laboratory will keep sample evidence files containing the following items:

- COC records;
- Sample log-in information (if applicable);
- Copies of laboratory records and notebook pages;
- Copies of laboratory bench data sheets;
- Instrument raw data, both hardcopy and electronic;
- Chromatograms;
- Pertinent correspondence memoranda; and,
- Final report file.

The Remedial Investigation Consultant will retain relevant and appropriate project information in project files. The information contained in these files includes, but is not limited to, the following items:

- COC records;
- Field notes and information;
- Correspondence and telephone memoranda;
- Meeting notes;
- Laboratory information;
- Data validation information;
- Reference information;
- Audit information; and,
- Copies of reports.

These files will be retained for a minimum of 10 years following commencement of construction of the Remedial Action. If the laboratory cannot retain its records for the 10-year period, all laboratory records will be provided to the Remedial Investigation Consultant or the Group for retention.

D.2.0 MEASUREMENT/DATA ACQUISITION

D.2.1 Remedial Investigation Activities

This section presents a description of the Remedial Investigation activities as described in Section 6.0 of the RI/FS Work Plan. Specific sections of the RI/FS Work Plan are referenced below to avoid potential conflicts with the RI/FS Work Plan text:

- The soil/fill investigation is described in Section 6.3.1.1 of the RI/FS Work Plan main text.
- The groundwater investigation is described in Section 6.3.1.2 of the RI/FS Work Plan main text.
- The LNAPL investigation is described in Section 6.3.1.3 of the RI/FS Work Plan main text.

D.2.2 Monitoring Well Survey

In addition to the investigation activities listed above, an assessment of existing on-site and nearby off-site monitoring wells will be conducted. The inspection of nearby off-site monitoring wells will be conducted only if access agreements are obtained. If present, and if Site access is granted, each existing well will be inspected, water levels measured, sounded and surveyed. Consideration will be given to surveying off-site wells if detailed logs are not available. A well integrity survey of existing monitoring wells will also be conducted in conjunction with the water level measurements. The well integrity survey will include:

- Visual inspection of the exterior of the well to assess the condition of the external casing, lock and surface seal;
- Visual inspection of the internal casing for damage (i.e., free of kinks and bends) and that it is secure (i.e., not loose);
- Visual inspection of the annulus between outer and inner casing for excess water accumulation, animals, and debris; and,
- Sound bottom of well to check for kinks or bends in the casing or excessive accumulation of sediment.

D.2.3 Soil/Fill Investigation

A total of ten (10) soil borings, SB-1 through SB-10, are proposed at the approximate locations shown on Figure D-2. In addition, three borings used to install the on-site groundwater monitoring wells (described in Section 6.3.1.2 of the RI/FS Work Plan) and the one off-site groundwater monitoring well will be incorporated into the soil/fill investigation. At each location, hollow stem auger-drilling rig methods will be used to advance the soil boring. Procedures used to collect the soil samples from each boring are described below.

D.2.3.1 Soil Borings

The soil borings will be advanced using hollow stem auger (HSA) drilling methods with continuous split spoon sampling (as per ASTM D-1586-84) at the approximate locations shown on Figure D-2. The borings will extend through the LNAPL smear zone (where present) and down to the groundwater phreatic surface. A photo-ionization detector (PID) will be used to monitor VOCs in the breathing zone during drilling. The soil samples will be classified using the Unified Soil Classification System (USCS) and a representative sample will be retained from each different soil horizon. Additionally, the potential presence of odors, staining, and LNAPL will be noted.

Soil core samples for physical and analytical testing will be collected from each of the ten boreholes and four monitoring well borings at 5-foot intervals (0 to 2 feet, 5 to 7 feet, 10 to 12 feet, and 15 to 17 feet) as follows. Samples from all of 5 to 7 foot and 10 to 12 foot intervals in each boring will be submitted for laboratory analyses. A 0 to 2 foot surface soil sample will not be analyzed at locations where there is obvious fill/debris that had been placed subsequent to the termination of Site related operations (i.e., post-operational fill) or where the surface debris will likely be moved/removed at a future date and thus not represent future direct contact exposures. Samples deeper than the 10 to 12 foot interval will be collected to provide vertical delineation if field screening impacts are observed at the 10-12-foot interval (substantial staining, odors or PID readings). Background soil samples will be collected for laboratory analyses from the off-site boring at the following intervals; 0 to 2 feet below pavement structure, 5 to 7 feet, 10 to 12 feet, and 15 to 17 feet if above groundwater. All recovered soil cores will be field screened using a PID by slightly scoring the surface of the soil core with a stainless steel knife and immediately running the PID probe along the scored section of the core. Field screening shall be performed at a location shielded from the wind.

Each soil sample will be analyzed for TCL VOCs, SVOCs, PCBs, TAL metals, and cyanide as shown in Table D-9. In addition, a total of ten samples will be analyzed for Total Organic Carbon (TOC) using USEPA SW846 Method 9060 and for Grain Size using ASTM D-422. Table D-11 provides information regarding sample collection requirements and holding times.

D.2.3.2 Soil Sampling Procedures

The following describe the equipment and procedures that will be used to collect soil samples.

Equipment includes:

- PID;
- latex and/or nitrile gloves;
- COC form;
- Field notebook
- Stainless steel knife;
- Stainless steel mixing bowls and spoons;
- Appropriate sample bottles;
- Temperature blank; and,
- Cooler with ice.

For samples being analyzed for TCL SVOCs and PCBs, TAL metals and cyanide, and TOC, a core of soil from the desired depth will be removed from the ground and split open using a decontaminated, stainless steel knife. Soil will be collected for TCL VOCs using a decontaminated stainless steel spoon and will be placed into a 2-oz glass jar with minimal headspace. Soil for all other parameters will be placed into a decontaminated stainless steel mixing bowl and homogenized.

The VOC sample will be collected from the 6-inch interval with the highest PID reading. If no PID readings are observed, the sample will be collected from the top 6-inch interval of the split spoon sample.

Homogenization of the soil will be performed in the stainless steel mixing bowl. Large rocks, twigs, roots, and leaves will be removed. The soil will be homogenized with a decontaminated stainless steel spoon according to the procedure below:

- The sample will be scraped from the sides, bottom, and any corners of the bowl and rolled into the middle of the mass using the stainless steel spoon.

- The mass of the sample will be mixed thoroughly. The sample will then be divided into four quarters, which will be moved to separate parts of the bowl. Each quarter will be individually mixed. Then the four quarters will be recombined and the entire sample mass mixed again.

- Sample jars for non-VOC parameters will be filled following homogenization.

Required amounts of sample are listed in Table D-11. The appropriate amount of soil for each parameter will be placed into sampling jars. The jars will then be labeled and put into a cooler with ice. All samples will be stored and shipped at 4^{o} C. A laboratory-supplied temperature blank will be included in each cooler so that the laboratory can perform a temperature check upon receipt.

For samples being analyzed for grain-size, a sufficient volume of the remaining soil core will be placed in a large labeled zip-lock bag and sent to Golder Associates' soils laboratory in Cherry Hill, New Jersey. No refrigeration or other special handling/preservation procedures are required.

D.2.4 Groundwater Investigation

The three on-site groundwater monitoring wells (GA-1, GA-2 and GA-3) will be installed and screened below the LNAPL smear zone (if present) and one off-site groundwater monitoring well (GA-4) will be installed upgradient (background well) at the approximate locations shown on Figure D-2.

At each location, hollow stem auger-drilling rig methods will be used to advance the borehole to the required depth. Six (6) inch diameter boreholes will be drilled for the purpose of installing 2-inch groundwater monitoring wells. Soil samples will be collected from each well boring as described in section D.2.8.1 for the soil boring and soil sampling. If LNAPL is observed, double casing will be installed beyond the base of the LNAPL smear zone to minimize potential cross contamination of deeper groundwater. The top of the well screens will be installed approximately 10 feet below the LNAPL smear zone to isolate the screen interval from potential LNAPL impacts due to future groundwater fluctuations. Once the LNAPL zone is cased off, the monitoring wells will be cased and screened using flush joint threaded 2-inch diameter schedule 40 PVC with 0.020 slot screen. Typical monitoring well construction detail is provided on Figure D-3.

D.2.4.1 Well Construction

Well Screen and Casing Placement

The well casings should be secured to the well screen by flush-jointed threads and placed into the borehole. Before the well screen and casings are placed on the bottom of the borehole, at least 6 inches of filter material (such as #00 silica sand) should be placed at the bottom of the borehole to serve as a firm footing of the well screen/casing. The string of well screen and casings should then be placed into the borehole, centered and plumbed.

No lubricating oils or grease should be used on casing threads. Teflon tape can be used to wrap the threads to insure a tight fit and minimize leakage. No glue of any type should be used to secure casing joints. Teflon "O" rings can also be used to insure a tight fit and minimize leakage; however, "O" rings made of other materials are not acceptable.

Filter Pack Placement

When placing the filter pack into the borehole, a minimum of 6 inches of the filter pack material should be placed below the bottom of the well screen to provide a firm footing and an unrestricted flow under the screened area. A #1 silica sand will be used as the well filter pack material and should extend a minimum of 1 foot above the top of the well screen. An additional 2 feet of #0 silica sand should be placed on top of the #1 sand filter pack prior to grouting. The filter pack should be placed by carefully pouring the sand in the annulus between the well and borehole wall and occasionally measured during placement.

Grouting the Annular Space

The annular space between the casing and the borehole wall should be filled with a cement/bentonite grout. The grout should be placed into the borehole, by the tremie method (side discharge), from the top of the #0 sand to within 2 feet of the ground surface or below the frostline, whichever is greater. The tremie tube should have a side discharge port to minimize damage to the filter pack during grout placement. The grout should be allowed to cure for a minimum of 12 hours before the concrete surface pad is installed and the well is developed.

Cement grouts should be mixed using 6.5 to 7 gallons of water per 94-lb bag of Type 1 Portland cement. The addition of bentonite (5 to 10 percent) to the cement grout is generally used to delay the "setting" time and may not be needed in all applications. Any other types of cement and/or grout proposed for use should be evaluated on a case-by-case basis by a senior field geologist.

Above Ground Riser Pipe and Outer Protective Casing

The inner well casing, when installed and grouted, should extend above the ground surface a minimum of 2.5 feet. A vent hole should be drilled into the top of the well casing cap to permit pressure equalization, if applicable. An outer protective casing (“stick-up casing”) should be installed into the borehole after the annular grout has cured for at least 24 hours. The outer protective casing should be of steel construction with a locking cap. Generally, outer protective casings used over 2-inch well casings are 4 inches square (or round) by 5 feet long and fitted with a locking lid. All protective casings should have sufficient clearance around the inner well casings, so that the outer protective casings will not come into contact with the inner well casings after installation. The outer protective casing should have a minimum of two weep holes for drainage. These weep holes should be a minimum 1/4-inch in diameter and drilled into the protective casings just above the top of the concrete surface pads to prevent water from standing inside of the protective casings. Protective casings made of aluminum or other soft metals are normally not acceptable because they are not strong enough to resist tampering. The protective casing is installed by pouring concrete into the borehole on top of the grout. The protective casing is then pushed into the wet concrete a minimum of 2 feet into the borehole. Extra concrete may be needed to fill the inside of the protective casing so that the level of the concrete inside of the protective casing is at or above the level of the surface pad. The protective casing should extend approximately 3 feet above the ground surface.

Flushmount Well

If it is determined during the field work that any particular well should not be constructed with an outer protective “stick-up” type casing, then the well will be finished as a flushmount well. At such locations, the well casing, when installed and grouted, should extend only to approximately two inches to four inches below ground surface. A watertight, monitoring well manhole (“flushmount box”) should be installed into the borehole after the annular grout has cured for at least 24 hours. The manhole should be of one-piece steel construction. Generally, flushmount boxes used over 2-inch well casings are 9 inches in diameter by 8 inches deep and fitted with a bolted and gasketed cover. As the covers typically cannot be locked, a locking well cap should be used on the inner well casing. All flushmount boxes should have sufficient clearance around the inner well casings so that the sides of the box will not come into contact with the casing after installation. Flushmount boxes made of aluminum or other soft metals are normally not acceptable as they are not strong enough to resist tampering or withstand any vehicular traffic. A flushmount box is installed by pouring concrete into the borehole on top of the grout. The flushmount box is then pushed into the wet concrete until the top of the manhole cover is level with the ground surface. In areas without vehicular traffic, it may be advantageous to raise the manhole cover approximately 1 inch above grade to reduce the possibility of water and sediment entering the box.

Concrete Surface Pad

A concrete surface pad should be installed around each well at the same time as the outer protective casing or flushmount box is being installed. The surface pad should be formed around the well casing or flushmount box. Concrete should be placed into the formed pad and into the borehole (on top of the grout) in one operation making a contiguous unit. The stick-up protective casing or flushmount box is then installed into the concrete as described above. For stick-up protective casing, the finished pad should be sloped so that drainage will flow away from the protective casing and off of the pad. For flushmount boxes, the pad should be level with the ground surface. In addition, a minimum of 3 inches of the finished pad should be below grade or ground elevation to prevent washing and undermining by soil erosion. All locks on the outer protective casings, or inner well casing, should be keyed alike.

D.2.4.2 Well Construction Materials

Well construction materials are chosen based on the goals and objectives of the proposed program and the geologic conditions at the site(s). For this program, the types of material used are discussed below.

Well Screen and Casing Materials

The monitoring wells will be cased and screened using flush joint threaded 2-inch diameter schedule 40 PVC. Screen lengths are estimated to be 10 feet for each new monitoring well. Well screen openings will be 0.020 inches.

Filter Pack Materials

The filter pack materials should consist of clean, rounded to well-rounded, hard, #1 and #00, silica sands. Filter pack materials should not be acceptable unless accompanied by proper analyses documentation.

D.2.4.3 Well Development

The newly completed well should not be developed for at least 24 hours after the surface pad and outer protective casing are installed. This will allow sufficient time for the well materials to cure before development procedures are initiated. The main purpose of developing new wells is to remove the residual materials remaining in the wells after installation has been completed, and to attempt to re-establish the natural hydraulic flow condition of the formation which may have been disturbed by well construction, around the immediate vicinity of each well. New wells will be developed until the column of water in the well is relatively turbid-free, and the pH, temperature, and specific conductivity have stabilized.

The following development procedures may be used to develop the wells:

1. Pumping;
2. Compressed air (with the appropriate organic filter system);
3. Bailing;
4. Surging;
5. Backwashing ("rawhiding"); and
6. Jetting.

The newly installed wells will not be sampled until at least 7 days after the completion of well development to allow for the formation to restabilize to pre-well construction conditions. The selected development method(s) will be approved by a field geologist/hydrogeologist before any well development activities are initiated.

D.2.4.4 Aquifer Performance Testing

To further refine the Site hydrogeologic model, a slug test will be conducted at two locations to estimate the hydraulic conductivity of the Upper Glacial Aquifer. Slug testing procedures are described below.

1. An In-Situ TROLL^{TM} transducer/datalogger (or equivalent) will be installed in two wells, one week prior to testing to provide baseline data and monitor potential tidal effects on groundwater levels;

2. Prior to each slug test, the static water level will be measured using a water level probe;

3. A data collection test will be set up at each of the two In-Situ TROLL^{TM} transducer/dataloggers (or equivalent) to record water level fluctuations during the slug test. The minimum data collection interval will be 3 seconds, and the data will be collected using a logarithmic collection interval;

4. Either a Grundfos submersible pump or stainless steel slug will be lowered into the well and the water level allowed to return to static conditions prior to starting the test;

5. The test will be initiated by either removing a slug of water (rising head test) using a submersible pump or by removing the stainless steel slug (rising head test) in order to create an instantaneous change in head (lowering of the water level in the monitoring well). If a stainless steel slug is determined to provide the best method to create a sufficient instantaneous change in head, then both a rising and falling head test will be completed;

6. Upon completion of the slug removal (or addition of a slug) the recovery will be monitored for approximately 1 hour or when the water level has returned to within at least 90% of the static level; and,

7. Once a clear understanding of aquifer response is obtained, then the applicable data analysis method will be selected. Slug tests in highly permeable aquifers, such as the Upper Glacial Aquifer, produce in general sinusoidal fluctuation of the water levels in the test well following the removal or addition of a slug. This particular response can be can be analyzed using the Van der Kamp test analysis method specifically developed for highly permeable aquifer conditions (ASTM Method D5785-95). Another analysis of slug tests in formations of high hydraulic conductivity is the high-K Bouwer and Rice (Butler, J.J., and E. J. Garnett. 2000, Simple Procedures for Analysis of Slug Tests in Formations of High Hydraulic Conductivity using Spreadsheet and Scientific Graphics Software. *Kansas Geological Survey, Open-file Report 2000-40*), which accounts for slug tests performed in wells that partially penetrate an unconfined formation.

D.2.4.5 Groundwater Sampling Method Requirements/Procedures

The ultimate accuracy of any data generation begins with a sampling and measurement procedure that is well conceived and carefully implemented. The details of the sampling protocols are provided in this section, which presents the procedures with which samples will be acquired or measurements made during the execution of the project. The laboratory methods referenced in this plan are consistent with the NYSDEC Analytical Services Protocol (ASP). In general, the sampling procedures discussed below address the following items as they have been determined thus far:

- A description of the planned sampling locations for collection of soil, groundwater and LNAPL samples;

- A description of the sampling devices and procedures to be used;

- A description of containers, procedures, reagents, etc., used for sample collection, preservation, transport and storage;

- A description of sample preservation methods;

- A discussion of the time considerations for shipping samples promptly to the laboratory;

- Examples of the custody procedures and forms (Figure D-4);

- A description of the forms, notebooks, and procedures to be used to record sample history, sampling conditions, and analyses to be performed; and,

- A discussion of field QC checks such as field blanks, trip blanks, and field duplicates.

The following general procedures shall be considered during field work and sampling:

- To prevent cross-contamination in the field, new gloves will be worn by the sampling team members each time a new soil sample is collected or a different well is sampled.

- The laboratory will provide certified clean glassware for sample collection that conforms to all guidelines specified in *Specification and Guidance for Obtaining Contaminant-Free Sample Containers*, EPA 540/R-93/051 and OSWER Directive 9240.0-05A (EPA, 1992b).

- Sampling information will be recorded in field notebooks and/or on sample collection information sheets, as appropriate. If possible, one member of the field team will complete sample documentation while the other member performs the sample collection.

- Sample collection activities should proceed progressively from the least contaminated area to the most contaminated area (if this information is known).

The following discusses the sample collection procedures to be employed and the equipment needed for collecting representative groundwater samples.

Prior to sampling, all monitoring wells will be inspected for signs of damage, tampering, and access. Sampling of all newly installed and developed wells will occur after a stabilization period of a minimum of 7 days. All groundwater samples will be analyzed for TCL VOCs, SVOCs and PCBs, TAL metals, and the Natural Attenuation Parameters (NAPs) indicated in Tables D-2, D-3, and D-10. Information about sample handling, preservation and hold times is included in Table D-10.

Groundwater Sampling - Low Flow Purging and Sampling Using Submersible Pump Equipment

Groundwater sampling equipment will be constructed of inert materials such as stainless steel or Teflon. Proper equipment decontamination procedures will be followed to minimize the potential for cross-contamination. The following equipment may be required:

- Grundfos Redi-Flow II submersible pump (or equivalent);
- Teflon-lined polyethylene tubing (recommended for low flow purge and sampling technique);
- Latex and/or nitrile gloves;
- Generator;
- 55-gallon drums (to containerize water);
- Field Meter(s) capable of in-line measurements for pH, specific conductance, dissolved oxygen (DO), temperature, turbidity, and oxidation-reduction potential (ORP or Eh);
- Groundwater Sample Field Information Form/COC form;
- Sample bottles and preservatives;
- Cooler with ice;
- Water level meter; and,
- Sample location map.

***Procedure*[1]**

Prior to purging the monitoring well, a water level meter will be used to measure the depth from top of the well casing to the top of water surface to the nearest 0.01 feet. The water level meter will be cleaned prior to each measurement in accordance with the equipment decontamination procedures included in Section D.2.7. The depth to the bottom of the existing wells will be measured to confirm the construction details. In order to minimize potential cross-contamination and disturbance to sediments, which may have accumulated in the bottom of the well, well depth measurements will only be taken after the groundwater samples have been collected.

The monitoring wells will be purged and sampled with a stainless steel Grundfos Redi-Flo 2 submersible pump (or equivalent). The decontamination procedure for the submersible pump is described in Section D.2.7. The low flow purge and sampling procedures are described below.

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[1] The procedures to be used for sampling monitoring wells are based upon the USEPA Region II document entitled “Groundwater Sampling Procedure Low Stress Purging and Sampling” dated March 16, 1998.

- The submersible pump, with dedicated Teflon lined polyethylene tubing, will be carefully lowered into the well to the midpoint of the well screen or open interval. In instances where the screened or open interval is not completely saturated, the pump will be lowered to the midpoint of the saturated interval where possible. Care will be taken to collect representative samples by placing the pump adjacent to a water-bearing zone.

- Each well will be purged at a rate of between approximately 200 and 500 milliliters per minute. The water level in the well will be monitored during pumping, and ideally the pumping rate should equal the well recharge rate with little or no water level drawdown in the well (drawdown of 0.3 feet or less). Best efforts should be made in order to minimize well drawdown by adjusting the flow when necessary and frequently monitoring the water level during purging. There will be at least 1 foot of water over the pump intake so there is no risk of the pump suction being broken, or entrainment of air in the sample. The pumping rate adjustments and depth(s) to water shall be recorded in the logbook.

- During purging, the field parameters (temperature, pH, turbidity, specific conductance, oxidation-reduction potential (ORP), and dissolved oxygen (DO)) will be monitored with a Horiba U-22 instrument (or equivalent) approximately every 5 minutes until the parameters have stabilized. Stabilization is considered achieved if pH is within +/- 0.1, conductivity is within 3%, ORP is within 10 mV, and turbidity and DO are within 10% (or is less than 50 NTU) over three consecutive readings. Readings will be taken in a clean container, rinsed with distilled water prior to each use, and the monitoring instrument allowed to stabilize before collection of the next sample. Measurements will be taken with a flow-through cell so that they are recorded prior to the sample being exposed to the atmosphere. All measurements will be recorded in field notebooks.

- The pump flow rate will be reduced to approximately 100 milliliters per minute during collection of samples for VOCs and appropriate gas-sensitive parameters and as high as approximately 250 milliliters per minute for other parameters depending on the well yield and turbidity of the sample. Once the field parameters have stabilized, record the final measurements and collect the samples directly from the end of the tubing. Samples for VOC and appropriate gas sensitive parameters must be collected first. The bottles will be preserved according to the specifications in the Section D.2.9.2. All sample bottles will be filled by allowing the pump discharge to flow gently down the inside of the bottle with minimal turbulence. Cap each bottle as it is filled. For VOCs and appropriate gas-sensitive parameters, steps will be taken to eliminate headspace in the 40-milliliter (ml) vial. Such steps may include adding several drops of the sample to the cap before screwing on and inverting the vial once it has been filled to check for air bubbles. If bubbles are observed, the sampler will attempt to add sample volume to the vial to remove the bubbles. If that proves to be unsuccessful, the sample will be discarded and a new sample collected.

- Immediately after sample collection, sample bottles will be placed on ice and maintained at approximately 4° Celsius (C). Further information on sample handling is included in Section D.2.9.1.

- The following information will be recorded in the Groundwater Sample Field Information Form (Figure D-5) for each monitoring well sampled:

- Before Purging:
    - Date, time, and weather conditions;
    - Well ID;
    - PID readings taken from the well immediately after the cap is removed; and,
    - Depth to water.

- Purging:
    - Start and end time for purging;
    - Purge method;
    - Purge rate;
    - Depth to water; and,
    - pH, ORP, temperature, specific conductance, turbidity and dissolved oxygen (every 5 minutes).

- Sampling:
    - Start and end time for sampling;
    - Sampling method; and,
    - Pertinent observations regarding sample characteristics (turbidity, color, etc.).

- Quality-Control samples will be used to monitor sampling and laboratory performance and will include duplicates, spikes, and blanks. Quality control and quality assurance (QA/QC) procedures are described in Section D.2.11.

D.2.5 LNAPL Investigation

The extent of LNAPL on the Site will be initially assessed as part of the soil boring and monitoring well installation programs described above. A total of three (3) on-site LNAPL monitoring wells, GA-5, GA-6 and GA-7, will be installed using HSA drilling methods at the locations and depths selected based on the findings of these investigations. Preliminary locations of the LNAPL monitoring wells are shown on Figure D-2. Typical monitoring well detail is provided on Figure D-3.

The LNAPL monitoring wells will be installed using the same techniques and materials for groundwater well installation, except as stated below. The approximate mid-point of the well screens will be installed across the groundwater/LNAPL interface. This configuration may vary depending on the location of the groundwater/LNAPL interface versus the thickness and position of the smear zone, as determined from the soil boring logs. The monitoring wells will be cased and screened using 4-inch diameter schedule 40 flush-joint threaded PVC with 0.020 slot screen. Each well screen will be 10 feet in length. Longer screen lengths will be considered depending on the thickness of the smear zone/LNAPL.

Following installation of the LNAPL wells, an oil-water interface probe will be used to measure apparent LNAPL thickness and the groundwater/LNAPL interface. After a minimum of 24 hours following construction, a bail down test will be conducted in each on-site LNAPL well to help assess the LNAPL thickness mobility and true thickness. Samples of the LNAPL will be collected and analyzed in the laboratory for TCL VOCs, SVOCs, PCBs, TAL metals, chemical fingerprint (GC/library search to assess LNAPL type), and select conventional parameters (specific gravity, viscosity, TOX, sulfur, % solids, flash point, and BTU) as described in Section D.2.5.2 below. Samples of the subsurface sediments in the vicinity of the groundwater/LNAPL interface will be collected for possible grain size distribution analysis.

As discussed in Sections 6.3.1.2 and 6.3.1.3 of the RI/FS Work Plan, a site reconnaissance will be initially conducted to locate and assess the condition of existing monitoring wells. One or more of the proposed LNAPL wells may not be installed if previously installed monitoring wells (e.g., GW-1, GW-2, and/or GW-3) are located and are useable for LNAPL evaluation.

D.2.5.1 LNAPL Bail Down Testing

The following bail down testing equipment may be required:

- Weighted bottom filled bailer (clear);
- Several buckets of known volume;
- Oil-water interface probe;
- Timer;
- Sample location map; and,
- Field book

Prior to performing the bail down test, an oil-water interface probe will be used to measure depth to LNAPL (DTL), depth to water (DTW) and LNAPL thickness (LT) to the nearest 0.01 feet. The oil-water interface probe will be cleaned prior to each test in accordance with the equipment decontamination procedures included in Section D.2.9. The bail down test procedure is described below:

1. Measure and record the static liquid levels; DTW, DTL, and LT;
2. Record time and commence with bailing well;
3. Bail well until either all LNAPL is removed or no further reduction in LNAPL thickness has been accomplished with 5 consecutive bails;
4. Last bail is elapsed time “0”; an initial reading will shall be taken as quickly as possible but no later than 1 minute from cessation of bailing;
5. Following the last bail, record liquid level recovery data (DTW and DTL) on the following schedule:

   - every 30 seconds through 5 minutes
   - every 1 minute through 10 minutes
   - every 10 minutes through 100 minutes
   - every 20 to 30 minutes thereafter, as required.

6. Record amounts of LNAPL and water bailed from well.

Investigative derived waste generated from the bail down tests will be handled as described in Section D.2.7.3.

D.2.5.2 LNAPL Sampling

Prior to sampling, LNAPL thickness will be measured using an electronic oil-water interface probe to determine DTL and DTW. The difference between the two measurements is the measured (apparent) LNAPL thickness. Due to soil capillary pressure, water level fluctuations, and other factors, there often is a significant difference between the actual thickness of a free phase liquid on the water table and the measured thickness in a well penetrating the free phase liquid. Typically, the actual thickness in the ground is much less than the thickness measured in wells (i.e., there is an “overaccumulation” in the well). Therefore, the actual thickness usually cannot be directly measured, but can be estimated using various field methods such as a bail-down test (see Section D.2.5.1).

Following the thickness measurement, LNAPL samples will be collected by slowly lowering a new, clear, bottom-filling, Teflon bailer down the well until it is just through the floating layer, but not down into the underlying groundwater. After the bailer has filled, it will be slowly brought to the surface. Care will be taken so that the bailer is gently inserted and removed from the water, to prevent degassing or volatilization. The bailer will be covered with aluminum foil to prevent infiltration of ambient air and it will be placed on plastic sheeting against the well to allow any inadvertently collected water to separate.

When separation has occurred, the supernatant will be slowly poured down the inside of the laboratory-provided sample bottles. Each sample bottle will be capped after it is filled. Samples will be collected in the following order:

- TCL VOCs;
- GC Fingerprint
- TCL SVOCs;
- TCL PCBs;
- TAL Metals; and
- Physical properties.

Logbook documentation, sample bottle filling and preservation, and shipping will all be conducted in accordance with the procedures specified in Sections D.2.8 and D.2.9. QA/QC samples, including field duplicates, trip blanks, rinsate blanks, and MS/MSD, will be collected with the primary samples at the frequency identified in Section D.2.11.

D.2.6 Field Measurement Procedures

The following sections describe procedures to be followed for collection of field measurements.

D.2.6.1 Water Level/LNAPL Measurements

Groundwater level measurements will be collected prior to purging the well and during the low flow purge process to monitor well drawdown.

Equipment

The following equipment and materials are required to perform this procedure:

- Electronic water level meter or an oil-water interface probe;
- Distilled or de-ionized water;
- Groundwater Sample Field Information Form; and,
- Field notebook.

Water Level/LNAPL Measurement Procedure

The well identification number, measuring device type and serial number, date and time will be recorded prior to each day water level or LNAPL measurements are obtained. The water level meter or oil/water interface probe will be decontaminated in accordance with the procedures described in Section D.2.9 prior to each use. The water level meter or oil-water interface probe will be turned on and the battery checked prior to each water level measurement. The wire will be lowered into the monitoring well and stopped at the depth where the meter indicates a completed circuit. Depth to water and LNAPL measurements will be made relative to an established surveyed reference point on the well casing and recorded to the nearest 0.01 foot.

Total Well Depth Measurement Procedures

The bell sounder, weighted tape, or electronic water level indicators can be used to determine the total well depth. This is accomplished by lowering the tape or cable until the weighted end is felt resting on the bottom of the well. Because of tape buoyancy and weight effects encountered in deep wells with long water columns, it may be difficult to determine when the tape end is touching the bottom of the well. Care must be taken in these situations to ensure accurate measurements. Total well depth measurements will be made relative to an established reference point on the well casing and recorded to the nearest 0.1 foot. In all instances, the instrument used to measure well depth should be decontaminated prior to and after use in accordance with the procedures outlined in Section D.2.9.

D.2.6.2 Groundwater Field Parameter Measurements

These procedures should be used to obtain representative field measurements of temperature, specific conductance, pH, ORP, turbidity and DO.

Equipment

The following equipment and materials are required to perform this procedure:

- An in-line, flow through sampling chamber;
- Calibration Standards;
- An instrument capable of measuring temperature, specific conductance, pH, ORP, turbidity, and DO;
- Groundwater Sample Field Information Form; and,
- Field notebook.

Procedure

All field measurements should be made where they are shielded from the wind and direct sunlight (if possible), away from electrical systems, motors, pumps, wires, etc. which might induce stray electrical currents in the instrument or its probe, and with the probe and calibration standards temperature equilibrated with the water to be tested. Samples for field measurements should never be filtered or preserved.

After the meter has been calibrated according to manufacturer specifications and Section D.2.13.1.2, sample measurements can be taken. Place the container to be used as the sampling chamber in line before purging of the well begins. For groundwater samples collected using low flow purge technique, insert the instrument/probe into a flow-through cell. Position the instrument/probe so that it will measure the influent sample to the chamber. Record field parameter measurements, date, time, volume of water removed, and flow rate at uniform increments of approximately 5 minutes.

- Temperature should be recorded to the nearest 0.1 degrees Celsius;
- Specific conductance units are measured in micromhos per centimeter (µmohs/cm) or microsiemens (µS/cm) corrected for 25°C. Results should be reported to the nearest ten (10) units for readings below 1,000 µmohs/cm @ 25°C and to the nearest one hundred (100) units for reading above 1,000 µmohs/cm @ 25°C;
- pH measurements will be recorded to the nearest 0.1 standard pH units (SU);
- Turbidity measurements will be recorded to the nearest whole number nephelometric turbidity units (NTUs);
- DO measurements will be recorded to the nearest 0.1 milligrams per liter (mg/l);
- ORP measurements will be recorded to the nearest 0.1 millivolts (mV);
- The VOC vapor result will be recorded to the nearest 0.1 ppm; and,
- Groundwater will be measured to the nearest 0.01 feet (ft).

D.2.6.3 VOC Vapor Measurements

These procedures should be used when making field measurements of VOC vapors.

Equipment

The following equipment and materials are required to perform this procedure:

- PID (with moisture protection disc);
- Stainless steel knife; and,
- Field notebook.

Procedure

The PID should be calibrated in accordance with manufactures' instructions. See Section D.2.13.1.1 for further information regarding instrument calibration. After the split spoon has been removed form the borehole and opened, the soil core will be scored, approximately 6 inches at a time, with a decontaminated stainless steel knife. The PID will be slowly waved over the freshly exposed surface, at a distance of approximately 4 to 6 inches. The PID will be held over the soil core for at least one minute to allow time for the vapor to be pumped into the instrument. If the PID indicated the presence of target compounds, the instrument will be held in the same spot until all of the vapor has reached the detector in the instrument (i.e. the result on the display has reached it's highest point). The peak result will be recorded in the field notebook. Odor and visual characteristics will also be recorded.

D.2.7 Decontamination

Decontamination procedures in this section are intended for use by field personnel for cleaning sampling, drilling and other equipment in the field. Deviations from these procedures should be documented in the field records and investigative reports. The procedures described in this section are consistent with *Sampling Guidelines and Protocols* (NYSDEC, 1992). Specifications for standard decontamination materials follow. These materials will be used, as appropriate, for non-dedicated equipment used during sample collection (e.g., stainless steel bowls, spoon, knife).

- Soap shall be a phosphate-free laboratory detergent such as Liquinox® or Alconox®. Use of other detergent must be documented in the field logbooks and investigative reports.

- Solvent shall be pesticide-grade isopropanol. Use of a solvent other than pesticide-grade isopropanol for equipment cleaning purposes must be justified and documented in field logbooks and investigation reports.

- Tap water may be used from any municipal water treatment system. Use of an untreated potable water supply is not an acceptable substitute for tap water.

- Deionized water is tap water that has been run through a standard deionizing resin column. It is commercially available. The deionized water should contain no heavy metals or other inorganic compounds (i.e., at or above the analytical detection limits) as defined by a standard analytical method inductively coupled Argon Plasma Spectrophotometer (ICP) scan or any justified equivalent method.

- Distilled water is tap water that has been distilled. It is commercially available.

- Analyte free water is tap water that has been treated with activated carbon and a standard deionizing resin column. At a minimum, the finished water should contain no constituents above the laboratory reporting limits that are being analyzed for as part of the remedial investigation.

- Other solvents may be substituted for a particular purpose if required. For example, removal of concentrated waste materials may require the use of either pesticide-grade hexane or petroleum ether. After the waste material is removed, the equipment must be subjected to the standard cleaning procedure. Because these solvents are not miscible with water, the equipment must be completely dry prior to use.

Solvents, laboratory detergent, and rinse waters used to clean equipment shall not be reused during field decontamination and shall be stored in DOT-approved 55-gallon drums. These materials will be treated as investigation derived waste (IDW). See Section D.2.7.3 for proper handling and disposal of these materials. The brushes used to clean equipment as outlined in the following sections shall not be of the wire-wrapped type.

D.2.7.1 Drilling Equipment

The procedures in this section are to be used for all non-dedicated drilling equipment. All decontamination procedures in this section will be performed on a decontamination pad, constructed to the specifications in this section.

Decontamination Pad Specifications

Decontamination pads constructed for field cleaning of sampling and drilling equipment should meet the following minimum specifications:

- The pad should be constructed in an area known or believed to be free of surface contamination.

- Ideally, the pad should be located very close to a potable water source.

- The pad should not leak excessively.

- If possible, the pad should be constructed on a level, paved surface and should facilitate the removal of wastewater. This may be accomplished by either constructing the pad with one corner lower than the rest, or by creating a sump or pit in one corner or along one side. Any sump or pit should also be lined. It will be constructed of impermeable material and be of sufficient dimension to address the access, egress needs of the equipment and decontamination activities.

- Water should be removed from the decontamination pad as needed.
- A temporary pad should be lined with a water impermeable material. This material should be either easily replaced (disposable) or repairable.

At the completion of site activities, the decontamination pad should be deactivated. The pit or sump should be backfilled with the appropriate material designated by the site project field leader. No solvent rinsates will be placed on the pad. Solvent rinsates should be collected in separate containers for proper disposal.

The drill rig will be high pressure, steam cleaned prior to arrival at the Site and departure from the Site, as well as upon completion at each boring/monitoring well installation. All drilling equipment including augers, tools, well screens, and riser pipe, split-spoons (not used for collecting chemical samples), etc., will also be decontaminated by pressure washers. All activities shall be performed at the Site's designated decontamination pad.

D.2.7.2 Sampling Equipment

The procedures in this section are to be used for all non-dedicated sampling equipment used to collect groundwater or for collection/homogenization of soil samples.

1. Clean with tap water and soap using a brush to remove obvious particulate matter and surface films;
2. Rinse thoroughly with tap water;
3. If sampling for inorganic constituents rinse equipment with a 10% nitric acid solution (nitric acid is not to be run through the Grundfos pump);
4. Rinse thoroughly with deionized or distilled water;
5. Rinse thoroughly with solvent (pesticide-grade isopropanol) unless made of PVC or plastic. These items are not to be solvent rinsed;
6. Rinse thoroughly with analyte free water. If analyte free water is not available, equipment should be allowed to completely dry;
7. Equipment should be wrapped in aluminum foil until needed for sampling. If possible please allow equipment to air dry before wrapping in aluminum.

D.2.7.2.1 Groundwater Sampling Equipment (Non-Dedicated Submersible Pump)

Non-dedicated groundwater sampling equipment used for the low flow purging and sampling technique (such as the submersible pump) will be decontaminated prior to sampling each well. The submersible pump will not be removed from the well between purging and sampling operations. The pump and tubing (including support cable and electrical wires that are in contact with the sample) will be decontaminated by the procedure described below. It should be noted that the outside of the pump will be decontaminated consistent with the procedure in Section D.2.9. In addition, decontamination fluids will be pumped from buckets through the pump as follows:

1. Flush the pump with tap water to remove any sediment that may be trapped in the pump;
2. Flush the pump with a weak, non-phosphate detergent solution (approximately 5 gallons);
3. Flush the pump with tap water to remove all the detergent solution. Generous amounts of tap water (at least 3 pump volumes) should be used to ensure that detergent and any sediment that may be trapped in the pump does not remain in the pump;
4. Flush the pump with deionized or distilled water;
5. Flush the pump with isopropyl alcohol. Use sparingly to minimize presence of this decontamination fluid in the samples; and,
6. Flush the pump with analyte free water. Generous amounts of water (at least three pump volumes) should be used to remove as much of the isopropyl alcohol as practical.

D.2.7.2.2 pH, ORP, Temperature, Specific Conductance, Dissolved Oxygen, Turbidity, Depth to Water Probes, and Total Well Depth Recorders

All pH, ORP, temperature, specific conductance, DO, turbidity, and depth to water/oil-water probes will be washed with laboratory detergent and tap water, rinsed with tap water, and then rinsed thoroughly with distilled or deionized water prior to each use.

D.2.7.3 Investigation Derived Waste

IDW generated during remedial investigation field activities include: soil, decontamination water and solvent, purge water, well development/purge water, LNAPL, and PPE. Each type of IDW will be handled as described below:

- ***Soil*** **-** All excess soil generated from sampling and drilling activities will be retained in DOT-approved 55-gallon drums and labeled as "Drill Cuttings" or placed in an appropriately sized, lined, roll-off container. Once a drum has been filled, it will be sealed, dated, and numbered, and recorded in the Field notebook.

- ***Water*** **-** All decontamination, purge, and well development water will be retained in 55-gallon drums and labeled or placed in an appropriately sized container. Once a drum has been filled, it will be sealed, dated, and numbered, and recorded in the Field notebook.

- ***LNAPL*** **–** LNAPL collected as part of the LNAPL baildown testing will be retained in 55-gallon drums and labeled or placed in an appropriately sized container. Once a drum or appropriate container is filled, it will be sealed, dated, and numbered, and recorded in the Field notebook.

- ***PPE*** **-** All PPE generated during the remedial investigation will be retained in containers and labeled "PPE". Once a drum has been filled, it will be sealed, dated and numbered, and recorded in the Field notebook.

The drums will be staged on-site. At the end of the field activities, IDW will be characterized and disposed of in accordance with all applicable local, state and federal regulations. Records and/or manifests regarding IDW disposal will be maintained by QSAG.

D.2.8 Field Documentation

In order to ensure that all pertinent information and data collected during the performance evaluation are documented completely and correctly, the following procedures and protocols described in the following sections will be implemented.

D.2.8.1 Field Notebooks

All information pertinent to the field investigation will be recorded in bound and numbered field notebooks. All field notes must be legible and a waterproof pen shall be used to make entries. Any errors should be crossed out with a single line and initialed. Field records should at a minimum contain the following information:

- Date;
- Project or site name;
- Time of each data entry;
- Description of work being performed that day;
- Names and affiliations of personnel at location;
- Weather conditions on site;
- Location and type of activity;

- Visual observations;
- Pertinent field data (and any other measurements);
- Serial numbers, if any, on seals, and transportation cases, and equipment;
- Name of field custodian; and,
- Photographs taken, including date, time, direction faced, description of subject or activity, sequential number of the photo and film roll number will be recorded in the field notebook.

Specific sample information will be compiled into the field notebook and/or COC. All field notebooks will be standard engineering hardbound books. All field notebooks will be photocopied so that copies of field notes can be kept in appropriate project files.

D.2.8.2 Field Meters

Calibration of field meters should be documented in the field notebooks, including:

- Analysts' name;
- Date and time of calibration;
- Date and time and results of calibration checks;
- Instrument type, model number, and serial number (if present); and,
- Manufacturer, concentration, and lot number of calibration standards which are used.

D.2.8.3 Photo-Documentation

When photographs are taken, field personnel will record time, date, site location, general direction faced, sequential number of photograph and roll number, and brief description of the subject in a field notebook. This information will be transcribed onto the back of the photographs after they have been developed.

D.2.8.4 Correspondence/Communications

Correspondence received or sent from the field will be dated and labeled with a project filing identification number. Telephone conversations will be documented and filed.

D.2.8.5 Changes in Procedures

Approval from the NYSDEC Remedial Project Manager will be obtained as needed prior to implementation for major changes in sampling procedures as outlined in this SAP. Minor procedural changes will be made by Golder Associates' personnel, and if present, with the concurrence of the on-site NYSDEC representative. Changes will be documented in the field notebooks.

D.2.9 Sample Handling and Custody Requirements

D.2.9.1 Sample Handling

The methods and references for collecting samples are previously provided in this section. The laboratory supplies appropriately prepared sample containers, reagents, preservation procedures and analytical holding times will be in accordance with the published analytical methods and NYSDEC and USEPA Region II guidelines.

D.2.9.2 Sample Preservation

The specific requirements for sample container preparation, sample preservation, and holding times, and any special sample handling requirements are listed in Tables D-10 through D-12. Sample containers will be kept closed until the time each set of sample containers are to be filled. After filling, the containers will be securely closed, residue wiped from the sides of the containers, and immediately placed in a cooler. Samples will be kept chilled and will generally be shipped on the day of sample collection to the laboratory if an overnight courier is being used. The following procedure should be followed to the extent possible to preserve environmental samples for laboratory analysis such that the integrity of the sample is maintained prior to analysis.

D.2.9.2.1 Equipment

The following equipment and materials are required for sample preservation:

- Frozen blue packs or wet ice;
- Zip locked bags;
- Temperature blank;
- Spare sample bottles;
- Several eye droppers (if bottles are not pre-preserved);
- pH test strip paper; and,
- Appropriate preservatives (i.e., HCl, HNO_3, NaOH, etc.).

D.2.9.2.2 Procedure

Sample preservation requirements are given for aqueous, soil and LNAPL samples in Tables D-10 through D-12. For aqueous samples, be certain that the proper chemical preservative is added to each jar. In general, the only preservation procedure required for soil and LNAPL samples is cooling to 4°C immediately after collection. This temperature should be maintained for the samples during storage and shipment to the laboratory. Samples collected for TCL VOC analysis will be preserved by the laboratory upon receipt in accordance with SW846 Method 5035.

VOC Sample Preservation

- An extra aqueous VOC sample vial should be filled at each sample location to be used as a pH check. The preservation procedure for aqueous VOC samples is given below, *if vials are not already pre-preserved*:

    - ◊ The extra sample vial will be used to determine the number of drops of HCl required to attain a pH less than 2;
    - ◊ Initially, six drops of HCl should be added;
    - ◊ The vial cap should be replaced and the vial inverted several times to mix the sample;
    - ◊ The cap should be removed and a pH indicator strip dipped into the vial;
    - ◊ The color of the strip should be compared to the color chart provided with the strips;
    - ◊ Repeat the above procedure until a pH less than 2 has been attained. HCl should be added one drop at a time;
    - ◊ Discard the test vial, and carefully add the same number of drops of acid to the other sample vials;
    - ◊ Fill the vial with sample and place the cap such that no headspace is present in the vial;
    - ◊ If the sample effervesces upon addition of the acid, the sample should be submitted to the laboratory without the addition of HCl, but it should be cooled to 4°C. The lack of preservative, and the consequent 7 day technical holding time, should be specified in the comments section of the COC;
    - ◊ If the behavior of the samples at specific locations is known, then pre-preserved VOC vials may be used for sample collection; and
    - ◊ If the pH of the samples is >2 for samples collected in pre-preserved VOC vials, the consequent 7 day technical holding time should be specified in the comments section of the COC along with a note about inadequate preservation.

Non-VOC Sampling Preservation

- Non-VOC aqueous samples should also be checked to assess the required amount of chemical preservation to attain the pH specified in Table D-10.
- Separate sample bottles are not required to check pH because non-VOC sample bottles are permitted to contain headspace. The preservation procedure is given below *if bottles are not already pre-preserved*.

- ◊ Initially, four drops of preservative should be added;
- ◊ The cap should be replace and the bottle inverted several times to mix the sample;
- ◊ A few milliliters of sample should be poured into a separate container (e.g., an unused sample jar cap) and the pH checked using indicator paper;
- ◊ Additional preservative should be added two drops at a time and the above procedure repeated until the specified pH is attained; and,
- ◊ After some of the initial samples have been preserved, the sampler can increase the initial number of drops added if necessary based upon the approximate amount of sample required for other locations.

D.2.9.3 Sample Identification

All samples shall be adequately marked for identification from the time of collection and packaging through shipping and storage. Marking shall be on a sample label attached to the sample container. Sample identification shall include, as a minimum:

- Project name and/or code;
- Sample identification number;
- Analysis requested;
- Chemical preservatives added to the sample container;
- Sample date and time; and,
- Initials of the individual performing the sampling (samples for chemical analysis).

Each sample will be assigned a unique sample identification number to be recorded on the sample label. Each sample identification number will be recorded in the field notebook a Groundwater Sample Field Information Form and, as applicable, on chain-of-custody documentation. Designations for sample identification numbers for this project are described below.

Equipment

- Water proof marking pen;
- Sample jar labels;
- Transparent tape; and,
- Site base map with designated sampling locations.

Procedure

Sample labels should be marked with the sample ID, the analytes to be tested, the initials of the sampler, and the date of sample collection. The labels should be affixed to the sample jars and, if necessary, secured with tape. The corresponding sample ID should be marked on the Site base map for correlation during report preparation.

During sample collection, a system for assignment of sample identification (ID) numbers will be used for new sampling points to distinguish between different media and different quality control samples. Samples from soil borings will have a suffix indicating the bottom depth interval from which the sample was collected.

For primary samples, the two characters will indicate the matrix of the sample as follows:

SB	Soil sample from a soil or well boring;
GW	Groundwater; and,
LN	LNAPL.

For groundwater, the monitoring well ID will be used for the next portion of the ID (e.g., GWGA1 or LNGA1).

For soil samples, the third and fourth characters will be a sequential number starting at 01 and continuing until sampling is complete. The fifth and sixth characters will indicate the bottom of the sample interval (in feet) from which the sample was collected.

For QC samples, the first digit indicates the type of QC sample, if applicable, as follows:

T	trip blank;
R	rinsate blank; and
D	field duplicate.

The second character will indicate the matrix as follows:

W	Groundwater
S	Soil
L	LNAPL

Rinsate blanks will be identified as sequential numbers such as RS01 (soil borings) or RW01 (groundwater samples). Trip blanks will only be collected for aqueous samples with sequential Ids beginning with 01 (i.e., TW01, TW02, etc.).

Samples that are chosen for field duplicate analysis will have the same ID as the primary sample except that the prefix D will be used. Samples that are chosen for MS/MSD will be collected with triple volume, but the ID will remain the same as the primary sample. The sampler will note on the COC that triple volume was collected for QA/QC purposes.

D.2.9.4 Sample Custody

Samples are physical evidence collected from a facility or the environment. Sample data generated during this project may be used as evidence in NYSDEC enforcement proceedings. In support of potential litigation, COC procedures have been established to ensure sample traceability from the time of collection through completion of analysis.

The National Enforcement Investigations Center (NEIC) of USEPA considers a sample to be in custody under the following conditions:

1. It is in your possession; or
2. It is in your view after being in your possession; or
3. It was in your possession and you locked it up; or
4. It is in a designated secure area.

D.2.9.4.1 Field Sample Custody

All environmental samples will be handled under strict COC procedures beginning in the field. Figure D-4 is an example COC. The following procedure should be used to maintain COC of environmental samples.

Equipment

The following equipment and materials are needed to perform COC procedures:

- Chain-of-custody forms;
- Chain-of-custody seals; and,
- A secure (locked) vehicle or building.

Procedures

COC is usually initiated in the field by the sampling team. When COC is initiated at the laboratory, the laboratory personnel responsible for shipping sampling containers will have initialed and signed the COC form and sealed the shipping container with a COC seal. It is preferable for the custody seal to be signed and dated by the laboratory and to have a unique serial number that is recorded on the COC by the lab. In such cases, field staff should check this information to assess the potential for tampering with sample containers prior to receipt in the field. The field staff should acknowledge receipt and container integrity by signing the COC form, and noting any discrepancies.

Samples and sample containers must be kept under proper COC during field sampling. If custody of the samples (and sample bottles) is exchanged during field sampling, such transfer must be documented on the COC form. The departing field staff should sign indicating the custody has been relinquished, and the arriving field staff should sign indicating responsibility for the custody of the samples. Each sample bottle label should include:

- Project (site) name;
- Sample point identification number;
- Chemical preservative added to the bottle;
- Sample collection date and time, sampler's initials; and
- Analytical method to be performed.

The COC form and Field notebook should include:

- Sample identification number and matrix;
- Project or site name or number;
- Sampler's name or initials;
- Sample collection date and time (military time);
- Designation as a grab or composite sample;
- Requested analysis;
- Any special comments (i.e. 7 day hold time for unpreserved VOCs); and,
- Any preservatives added to the sample.

When shipping samples to the laboratory, all sample bottles and requested analyses should be noted on the COC form. Where multiple analytical methods are available for a particular analysis, the specific method number should be listed on the COC form. For example, soil samples for TCL VOC analysis could be performed by USEPA 8260, or CLP. The specific method should be referenced.

One member of the sampling team should sign the COC form relinquishing custody to the laboratory. If using an overnight courier service, record the tracking number on the COC. The COC form should be sealed inside the shipping container with the samples. The paperwork should be sealed inside a plastic bag to prevent damage from water condensation. The courier does not need to sign the COC form if it is sealed within the shipping container using custody seals. If the samples are hand delivered to the laboratory by field staff, the COC form should be signed at the laboratory when the samples are delivered and the shipping container does not need to be sealed as long as it is kept under proper COC until delivered to the laboratory. If possible, COC seals should be signed and dated, and the serial numbers listed on the COC form. At least two seals should be used on each shipping container.

D.2.9.4.2 Laboratory Custody

Once samples are transported to the analytical laboratory, custodial responsibility is transferred to the Laboratory Sample Manager to assure that the procedures presented in the laboratory's QAM and the appropriate analytical method are followed. The laboratory QAM will contain a detailed description of the laboratory chain-of-custody procedures, including receipt of samples, designation of a sample custodian, custody within the laboratory and laboratory storage, and disposal procedures. The laboratory chosen for this project will be furnished a copy of this SAP, which has been prepared in accordance with NYDEC and USEPA guidelines and specifications

D.2.9.5 Sample Packaging and Shipment

The following procedure is to be used to enhance successful shipping of samples to the laboratory.

Equipment

The following equipment and materials are required to perform this procedure:

- Overnight courier airbills and courier phone number (if applicable);
- Fiber reinforced strapping tape or duct tape;
- Cushion material such as bubble wrap or vermiculite;
- Address labels; and,
- Laboratory address and phone number.

Procedure

Samples should be packed into a shipping container (usually a cooler) in a manner that will minimize potential breakage of sample bottles. This might include use of laboratory-supplied bubble wrap designed to fit the particular bottle, polystyrene chips, or vermiculite. If wet ice is used for preservation, make sure that it is securely placed in zip locked bags and cannot leak. If the bottles sit in standing water, the sample integrity may be compromised. Plastic bags, such as zip-lock bags, should be used to prevent cross-contamination when small sample containers (e.g., VOAs) are placed in shipping containers. The sample coolers must contain enough frozen blue ice packs or wet ice to maintain a temperature of 4^{o}C before and during transport to the laboratory. A temperature blank should be placed in each cooler being returned to the laboratory. Samples must be shipped to the laboratory within 24 hours of collection.

Samples will be packaged into coolers on a matrix-specific basis to avoid possible cross-contamination.

D.2.10 Analytical Method Requirements

Most samples collected during this project will be analyzed by analytical methods from the following documents:

1. Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846, Third Edition, November 1986; Update III, December 1996 (consistent with NYSDEC ASP);
2. Methods for Chemical Analysis of Water and Wastes (EPA-600/4-79-020), USEPA, 1979, revised 1983;
3. Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992, APHA-AWWA-WPCF; and,
4. Annual Book of ASTM Standards, Volume 4.08, April 1999.

Method references for the analyses to be performed for this project are summarized in Tables D-3, D-5 and D-7. These chosen methods are deemed suitable for achieving the project DQOs. Information regarding the laboratory's equipment and capability in performing the analytical methodologies are contained in the laboratory QAM. All methods will be verified for conformity to the NYSDEC Analytical Services Protocols.

D.2.11 Quality Control Requirements

This section describes the various QA/QC samples that will be collected in the field and analyzed in the laboratory and the frequency at which they will be performed. QA/QC samples that will be collected will consist of field blanks, field duplicates, and matrix spike/matrix spike duplicates (MS/MSD). These QA/QC samples are described briefly in the following sections. The QA/QC procedures described in this plan are consistent with those described in *Sampling Guidelines and Protocols* (NYSDEC, 1992).

D.2.11.1 Trip Blanks

Trip blanks will be collected for VOC analysis at a frequency of one per day of sampling for aqueous VOCs. The trip blanks must be placed in each cooler containing VOCs. In order to avoid collection and analysis of an excessive number of QC samples, the sampling team should endeavor to pack all VOC vials in one cooler. Trip blanks are prepared in the field using laboratory supplied demonstrated analyte free water. The trip blank vials travel to the Site with the sample bottles. The trip blank vials are prepared each morning by the field crew and carried along while sampling, then submitted to the laboratory for analysis with the aqueous samples.

D.2.11.2 Field Rinsate Blanks

Field rinsate blanks will be collected for all required analyses at a frequency of one per day per type of decontamination event where non-dedicated equipment is used. Field rinsate blanks are prepared in the field using lab supplied demonstrated analyte free water. The water is poured over and through each type of sampling equipment and submitted to the laboratory for analysis of target analytes.

D.2.11.3 Field Duplicates

Field duplicates will be collected for all required analyses at a frequency of one per 20 primary samples per matrix. Field duplicates are collected by sampling the same location twice, but the field duplicate is assigned a unique sample identification number (see Section D.2.9.3).

D.2.11.4 MS/MSD

MS/MSD samples will be collected for all required analyses at a frequency of one per 20 primary samples per matrix. Additional sample volume is collected from a location and submitted to the laboratory for analysis. The laboratory will use the additional volume to prepare spiked samples to assess accuracy and precision.

D.2.11.5 Internal QC Samples

Internal QC checks have been developed to help ensure accuracy and precision during field sampling and measurement as well as laboratory analysis. Field checks will be performed regularly. Laboratory QC checks will be performed in accordance with the specific analytical methods.

Field measurements will be made in duplicate at a frequency of one in twenty measurements taken. These duplicate measurements should agree ±20 percent. If the duplicate measurements do not meet this criterion, the instrument will be recalibrated and the measurements will be retaken. All field measurements will be recorded in the field notebooks and later entered into summary tables.

The laboratory will have an established quality control check program utilizing procedural (method) blanks, laboratory control spikes, matrix spikes, and duplicates. Details of the internal QC checks utilized by the laboratory will be found in the laboratory QAM and the published analytical methods. Laboratory QC samples will be analyzed at a frequency of one per twenty analytical samples or at a frequency dictated by the methods. These QC samples will be used to determine if results may have been affected by field activities or procedures used in sample transportation or if matrix interferences are an issue. Assessment of laboratory QC will take into account the PARCC criteria specified for this project as shown in Tables D-3 through D-8. The individual methods and Section D.4 of this SAP discuss procedures to be used to calculate QC data.

Split samples may be accepted by a NYSDEC or USEPA contractor during the project. These samples will be collected separately and analyzed by a laboratory other than the laboratory identified for this project at a later time. Comparison of the split sample results will demonstrate how well the results reported by two different laboratories are replicated. The comparison will be expressed in terms of precision using the relative percent difference calculations shown in Section D.4.

D.2.12 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Preventive maintenance of equipment is essential if project resources are to be utilized in a cost-effective manner. Preventive maintenance will ensure accuracy of measurement systems, minimize downtime, and provide inventory control of critical spare parts, back up systems, and other necessary equipment. The field sampling team will maintain an inventory of replacement parts for field instruments, and will routinely perform preventive maintenance or repair. Spare parts that often require replacement will be kept on hand at the Site during field activities. The preventive maintenance approach for equipment used in the field for sampling, monitoring, and testing includes checking batteries and electrodes, checking condition of meters, checking sample bottles for cleanliness and breakage, and ensuring that a reasonable supply of bottles, batteries, probes, calibration solution, and supplies are on-hand to avoid unnecessary delays in the field.

Preventive maintenance of laboratory equipment and hardware will be described in specific sections of the laboratory QAM. More than one instrument is generally available for each type of analysis in case the initial instrument malfunctions or does not meet the required measurement criteria. Laboratory personnel or qualified manufacturer representatives will perform preventive maintenance and repair. The laboratory will retain logbooks documenting preventative maintenance and repair for each instrument.

D.2.13 Instrument Calibration and Frequency

D.2.13.1 Field Calibration

The calibration and maintenance of field equipment will be the responsibility of the field sampling team. Field instruments, such as meters for measuring field parameters, will be standardized/ calibrated in accordance with the manufacturers' recommendations against NBS traceable standards, where appropriate. During sampling, calibration checks will occur at a minimum of three times a day (beginning of each day and at least every four hours of operation with the final check at the end of the work shift). Duplicate field measurements will be performed at a frequency of once per twenty samples. Tables D-3, D-5 and D-7 provide precision criteria for field precision measurements. Appropriate calibration records will be maintained in project field notebooks or Groundwater Sample Field Information Forms. The field team leader is responsible for ensuring that calibrations are properly performed at the appropriate frequency.

D.2.13.1.1 Photoionization Detector

The results of the previous investigations indicated that the surface and subsurface soils contained various concentrations of TCL VOCs. These volatiles are a mixture of compounds that have varying ionization potentials (IP). Since there were many aromatics previously detected at the Site, a 10.6 eV lamp will be used on the PID as gross screen for VOCs since, most of the VOCs on this project have good responses to the 10.6 eV lamp. The PID cannot be used to identify unknown substances, it can only quantify/estimate VOC vapors. Winds and high humidity will affect measurement readings. Foggy or high humidity conditions can cause condensation on the lamp, thus affecting measurements.

The PID instrument will be calibrated in accordance with manufacturer's recommendations.

D.2.13.1.2 pH/ ORP/Temperature/Conductivity/Turbidity/Dissolved Oxygen Meter

Calibration is performed in accordance with the manufacturer's specifications. Calibration is performed at the beginning of each day and checked at least every four hours during sampling. The following information is documented in the field notebook:

- Date and time;
- Meter identification (make, model, serial number);
- Calibration results including source and lot number of standards; and,
- Sampler's initials.

D.2.13.2 Laboratory Calibration

Instrumentation calibration procedures are established in manufacturer's specifications and in the analytical methodologies. Trained personnel, using the approved written procedures, will perform instrument calibration. Calibration procedures and frequency will be described in the laboratory's QAM and in the specific analytical methodologies. These instruments include GC/MS, ICPs, analytical balances, syringes, thermometers, etc.

All sample results should be within the calibration range of the instrument. Samples which do not contain concentrations of target analytes that exceed the instrument calibration range should be analyzed undiluted to achieve the lowest possible reporting limits. However, samples containing elevated levels of target analytes cannot be analyzed undiluted because the calibration range of the method would be exceeded. Such samples will require analysis at dilutions which would result in elevated reporting limits.

The major chemical analytical equipment used for this project will be described in the laboratory QAM (contained under separate cover in Attachment D-1) and the individual analytical methods. The laboratory QAM provides information regarding types of equipment used by the laboratory facility. Calibration procedures will follow published analytical methodologies. The laboratory

QAM references the specific methodologies or laboratory standard operating procedures (SOPs) for calibration procedures. The laboratory will document sources for calibration material; for example, USEPA repository, NBS, Supelco© or equivalent. The laboratory QAM describes traceability of all stock solutions and working standards back to the neat materials. The laboratory QAM also describes the procedures used to document equipment repair and maintenance.

D.2.14 Inspection/Acceptance Requirements for Supplies and Consumables

All sampling equipment will be inspected prior to use to ensure proper operation and create a safe working environment. The laboratory chosen for this project will have preventative maintenance and health and safety programs to ensure proper execution of project work.

D.2.15 Data Acquisition Measurements (non-direct measurements)

Non-direct means of data acquisition refers to the use of non-measurement sources such as computer databases, spreadsheets, programs and literature files. To ensure confidence in the data generated from these sources, computer programs used for this project will be within the public domain and, as such, accepted by the industry. Historical data generated from samples collected and analyzed with approved NYSDEC methodologies will be used to scope the elements of the RI/FS Work Plan. Only data that have been evaluated and/or validated or accepted into the project record by NYSDEC will be used to determine the nature and extent of contamination. Validated data will be accepted on their merit. Professional judgment must be used, however, as necessary and appropriate to disregard any of the data generated from previous sampling events.

Any literature references used to scope the Remedial Investigation must have been through the peer review process and/or have been published in periodicals commonly known to the environmental industry. References that have not been substantiated in this way will be deemed unreliable and will not be used.

D.2.16 Data Management

Data collection during this project will be retained in both hardcopy and electronic format. Data collected in the field will be transcribed from field forms or notebooks and tabulated, as appropriate, using a spreadsheet or database program. Data entry will be checked to ensure no transcription errors occurred. Tabulated data will be provided in the remedial investigation reports.

Analytical data packages from the laboratory will contain the information listed in Section D.1.6. Electronic files containing the analytical results will be provided by the laboratory and down loaded into the project database. Any qualifiers resulting from data validation will also be entered into the database. Database entries will be checked for correctness and completeness. The Remedial Investigation Report will contain the tabulated analytical results.

D.3.0 ASSESSMENT/OVERSIGHT

D.3.1 Assessments and Response Actions

Performance of activities or procedures will be the responsibility of the personnel performing such activities and procedures. For field measurements, the field team leader will be responsible for performance while the analyst and sample custodian will be responsible for performance within the laboratory. The performance of activities or procedures must comply with those specified in this SAP. The responsible personnel must be prepared to justify that the specified procedure or reference method was implemented properly. Deviations of a technical procedure or reference method must be noted within the appropriate logbook and, for laboratory analyses, in the Case Narrative of the analytical report.

Performance will be monitored in the field through the use of QC checks as previously discussed in Section D.2.11.5. Performance will be monitored in the laboratory through the use of QC checks discussed in the laboratory QAM and the PARCC criteria presented in Table D-3 through D-8.

As described in the guidance documents, assessment includes surveillance, peer review, management systems review, readiness review, technical systems audit, performance evaluation, data quality audit, and data quality assessment. For performance monitoring, the following assessment activities are planned:

- Surveillance;
- Peer review;
- Technical systems audit; and,
- Data quality assessment

D.3.1.1 Surveillance

It is anticipated that the NYSDEC will provide oversight for specific activities. This oversight may include sample collection to assess that sampling procedures are properly executed in accordance with the SAP. It has been assumed that the NYSDEC will provide feedback to the sampling team, the Remedial Investigation Consultant, and the QSAG regarding any issues arising from oversight.

D.3.1.2 Peer Review

Throughout the project, the Remedial Investigation Consultant will maintain a system of peer review by which data generated can be checked and verified. Data that is transcribed and tabulated will be checked for accuracy and completeness.

D.3.1.3 Audits

The QA/QC audit is an independent systematic on-site review of facilities, equipment, training procedures, record keeping, data validation, data management, and reporting aspects of the field and laboratory QA/QC program. It is Golder's policy to conduct QA/QC field audits. Areas reviewed during audits may include field operations and sampling procedures, laboratory analyses and documentation.

D.3.1.3.1 Field/Sampling Audit

The Remedial Investigation Consultant field team leader will be responsible for ensuring that the applicable quality assurance procedures described in this SAP are followed. An on-site NYSDEC representative may audit field activities, with respect to the technical requirements, procedures, and protocols established in the SAP. Activities that may be audited are described below.

- Field sampling activities;
- Documentation of activities (logbooks, etc.);
- Equipment decontamination;
- Use of proper sampling equipment;
- Proper sample identification;
- Sample preservation;
- Sample packaging;
- Sample shipment; and,
- Chain-of-custody.

D.3.1.3.2 Laboratory Audits

The laboratory is expected to have a QA program whereby the QA department will routinely conduct internal audits. The laboratory QAM discusses internal laboratory audits. If an external audit is deemed necessary by the NYSDEC, then the Remedial Project Manager will consult with the QSAG and the Remedial Investigation Consultant regarding an appropriate approach.

D.3.1.4 Data Quality Assessment

Analytical data will be assessed through a series of evaluation procedures. The details regarding data evaluation and validation are discussed in Section D.4.

D.3.1.5 Corrective Actions

If through the data assessment process problems are identified, corrective actions will be initiated. All identified QA problems and corrective actions will be documented to provide a complete record of QA activities and help identify needed long-term corrective actions. The need for corrective action is based upon predetermined limits of acceptability for all aspects of data collection and measurement, such as PARCC criteria (Tables D-3 through D-8), historical data, laboratory control spike sample results, and experience using the analytical procedures. Following standard QA/QC procedures will help detect erroneous data. The need for corrective action may be determined by the samplers, analysts, supervisors, quality assurance personnel, laboratory managers or Project Managers.

The detection of system and performance problems and the corrective actions procedures used in the field during monitoring and sample collection will be documented in the field notebooks or Sample Collection Forms with copies placed in the Remedial Investigation Consultant’s project files. Any problems that cannot be resolved by the sampler or Field Sampling Team Leader will be brought to the attention of the Remedial Investigation Consultant’s Project Manager. The Remedial Investigation Consultant’s Project Manager and ELM, QSAG and the NYSDEC Project Manager (if necessary) will determine the corrective action to be taken, if any.

The laboratory QAM describes the Corrective Action procedures and documentation used by the laboratory. Any problems which cannot be resolved by the analysts, laboratory managers or laboratory quality assurance officers will be brought to the attention of the Remedial Investigation

Consultant’s Project Manager and Project Quality Assurance Manager. The Remedial Investigation Consultant’s Project Manager and ELM, QSAG, and NYSDEC Project Manager (if necessary) will determine the corrective action to be taken, if any.

The laboratory personnel will assess laboratory QC samples and re-analyze stored samples that do not meet QC criteria prior to expiration of hold times. Corrective actions may include re-analysis, or resampling and analysis. Laboratory personnel will use corrective action reporting forms to document identification and resolution of significant defects. These report forms will be kept on file in the laboratory QA files.

If a system or performance audit identifies a situation requiring corrective action, the corrective action will be initiated upon approval of the responsible supervisor. Documentation of corrective actions will be made in a report to the Remedial Investigation Consultant’s Project Manager. Corrective actions will be reported as appropriate to the Project QA Manager, and, if necessary, the NYSDEC Remedial Project Manager.

D.3.2 Reports to Management

Timely Quality Assurance reports are necessary to the successful completion of this project. Quality assurance deficiencies in the field must be reported to the field team leader and the Remedial Investigation Consultant QA and project managers. Quality assurance deficiencies in the laboratory must be reported in a timely manner to laboratory and project management personnel. The laboratory's policies and procedures for reporting quality assurance activities to management are included in their QAM and/or SOPs. Corrective actions for field and laboratory activities will be reported to the Remedial Investigation Consultant’s QA and Project Manager, and, if necessary, the NYSDEC Project Manager.

D.4.0 DATA VALIDATION AND USABILITY

D.4.1 Data Review, Validation, and Verification Requirements

Accurate data reduction, validation and reporting methods will support decision analysis. Data reduction techniques for both field and laboratory activities are described in this section. In addition, the laboratory chosen for this project will have further data reduction, validation and reporting procedures which will be described in the laboratory QAM or SOPs.

In general, data reduction of field measurements will not be necessary because all readings will be recorded in field notebooks or Groundwater Sample Field Information Forms directly from the field instruments. Field measurements will be tabulated using spreadsheet or data base software. Field measurements are anticipated to be recorded as follows:

- VOC vapors are to be recorded to the nearest 0.1 ppm;
- DO is to be recorded to the nearest 0.1 ppm;
- pH is to be recorded to the nearest 0.1 std pH units;
- Turbidity is to be recorded to the nearest 1 NTU;
- ORP is to be recorded to the nearest 0.1 mV;
- Specific conductance is to be recorded to the nearest 10 microsiemens/centimeter (or µmhos/cm) for results less than 1000 µS/cm or 100 µS/cm for results greater than 1000 µS/cm;
- Temperature is to be recorded to the nearest 0.1^{o}C; and,
- Groundwater is to be recorded to the nearest 0.01ft.

The laboratory will perform data reduction in accordance with the individual analytical methodologies used for this project. The laboratory QAM or SOPs will have more detailed information regarding the laboratory data reduction procedures.

The laboratory will attempt to achieve the target reporting limits and units for each parameter of interest as provided in the analytical methods and as summarized on Table D-9. The equations and procedures used to calculate concentrations are specified in the individual methodologies (refer to

Tables D-10 through D-12 for method numbers and references). Given the conditions under which samples will be collected and analyzed, the laboratory may not always be able to achieve the target reporting limits. For example, due to insufficient sample volume or elevated concentrations of target compounds, the samples may be diluted prior to analysis, thereby elevating the reporting limits. The laboratory will provide a narrative in the data package to explain the reasons for elevated reporting limits.

Assessment of accuracy, precision and completeness of both field and laboratory measurements is based upon the acceptable results from QC samples. Where appropriate these may include blanks, duplicate samples, laboratory control spiked samples or matrix spike/matrix spike duplicate samples.

Method and field/rinsate are not expected to contain any target analytes with concentrations greater than the reported detection limit with the possible exception of common laboratory contaminants (i.e., methylene chloride, acetone, 2-butanone, and phthalate esters).

Field and laboratory duplicate results are assessed based upon relative percent difference (RPD) between values, using the following equation:

$$\text{RPD} = \frac{(D1 - D2)}{(D1 + D2)/2} \times 100\%$$

where, D1 = Primary sample result; and,
D2 = Duplicate sample result.

Laboratory control spiked samples are assessed based upon the percent recovery (%R) of spiked analytes. The percent recovery is calculated using the following equation:

$$\%R = \frac{X}{TV} \times 100\%$$

where, X = observed value of measurement; and,
TV = "true" value of spiked analyte.

Matrix spike/matrix spike duplicate (MS/MSD) data are assessed based upon the percent recovery of spiked analytes using the following equation:

$$\% R = \frac{(SSR - SR)}{SA} \times 100\%$$

where, SSR = Spiked sample result for analyte x;
SR = Sample result for analyte x; and,
SA = Spike added of analyte x.

The relative percent difference between the MS/MSD results is calculated using the RPD equation presented above.

Data completeness is assessed based upon the amount of valid data obtained from a particular measurement system (sampling and analysis). It may be quantitatively expressed using the following equation:

$$\text{Completeness} = \frac{N1}{N2} \times 100\%$$

where, N1 = number of valid measurements obtained; and,
N2 = number of valid measurements expected.

The laboratory will assess all quality control data with regard to precision and accuracy. Corrective actions are initiated as necessary.

D.4.2 Data Validation and Verification Methods

D.4.2.1 Data Validation

Data validation techniques include screening, accepting, rejecting or qualifying data on the basis of specific quality control criteria for holding times, calibration, blank results, spike results, surrogates, and field duplicates. Data validation is a process whereby erroneous data may be identified prior to entering the project record. Validation of field measurements will be performed by field personnel in consultation with technical supervisors. Field personnel will validate the field data through review of calibration and duplicate data readings. The data will be reviewed to determine if there are any anomalous readings. Anomalies will be resolved immediately by means such as re-calibration or re-acquisition of the measurement.

For all analytical samples associated with this project, the laboratory will produce data packages that will contain all information needed for formal validation of the data. Data validation will be performed in accordance with the USEPA Region II Standard Operating Procedures (SOPs) HW-6, Revision 12 (TCL Organics data) and HW-2, Revision 11 (TAL Inorganics data) allowing for differences between the CLP and SW846 methodologies. These procedures are specific with regard to evaluation of holding time, surrogate and spike recoveries, precision of duplicate measurements, calibration and instrument performance, blank contamination, compound identification, and compound quantification. Data will be qualified as necessary in accordance with the SOPs and any qualification will be explained in a data validation narrative.

Non-TCL/TAL data will be evaluated based upon holding times, blank results, and QC results assessing accuracy and precision. All analytical data packages will be reviewed for completeness and QC summaries will be evaluated and compared to precision and accuracy criteria in Tables D-3 through D-8. If necessary, data will be qualified using the logic specified in the validation guidelines. All data review required for this project will be performed under the direction of the data validation specialist and Quality Assurance Manager identified in Table D-1.

Julie Lehrman, the data validation specialist identified in Table D-1, will perform all the data validation associated with this project. Ms. Lehrman has a Bachelors of Science degree in Chemistry from the University of Massachusetts, Amherst (summa cum laude) and a Masters of Science degree in Chemistry from the University of Virginia. Ms. Lehrman has five years experience as a laboratory analyst, field chemist and data validation specialist. All data validation and data management will be supervised by the Quality Assurance Officer listed in Table D-1, Douglas Dugan. Mr. Dugan holds a Bachelors of Arts degree in Biology from Drew University and has over ten years of experience as a laboratory analyst and quality assurance professional.

Qualified results will be reported for all validated samples on the analytical reporting forms provided in the data packages or as data summary tables accompanying the laboratory deliverable package. Qualified results, data packages and analytical results will be stored in the Remedial Investigation Consultant’s project files and will also be entered into the Remedial Investigation Consultant’s project database.

The PARCC criteria and criteria specified in applicable guidelines may not always be achievable. The data validation guidelines provide directions for the determination of data usability. Qualified data can often provide useful information, although the degree of certainty associated with the result may not be as planned. Professional judgment, in conjunction with USEPA guidance documents, will be used to determine data usability.

D.4.2.2 Data Reporting

Field measurements recorded during field activities will be tabulated using standard spreadsheet or database software. The resulting summary tables will be reviewed and verified and data will be provided in the remedial investigation reports.

Laboratory data will be reported by the laboratory in a validatable package. Data summary tables containing the reviewed data will be prepared and these tables will be provided in the Remedial Investigation Report.

D.4.3 Reconciliation With User Requirements

Throughout the Remedial Investigation, the Remedial Investigation Consultant will determine if project DQOs are being met and assess whether the data being collected is sufficient and appropriate. Periodic evaluations of the monitoring program will be made to determine if a change in frequency or analytical parameters is appropriate. Individuals making measurements throughout the process will also make assessments of whether the DQOs are being met.

Individuals making field measurements will determine whether or not field quality control criteria were met. The field QA/QC will be overseen by the field team leader. Corrective actions will be initiated in the field as necessary. This corrective action may include recalibration of instruments, obtaining a replacement instrument, or use of a different type of instrument.

The analysts in the laboratory will determine if analytical QC criteria are achieved. Corrective action in the form of re-analysis or re-calibration may be warranted. Laboratory analytical data and field data will be assessed by a data validation specialist under the direction of the person identified in Table D-1 to determine usability with regard to the DQOs. As mentioned, USEPA Region II guidelines, individual methodologies and SOPs and the PARCC criteria presented in Tables D-3 through D-8 will be used to evaluate all data deliverables.

As noted in the data validation guidelines, data may not always meet precision and accuracy requirements but may still be considered usable. The data will be assessed with regard to the project DQOs, and professional judgment used in conjunction with guidance documents will determine data usability. A data usability summary report (DUSR) will be prepared and included in the Remedial Investigation Report along with the data validation narratives.

TABLE D-1
PROJECT PERSONNEL
QUANTA RESOURCES RI/FS WORK PLAN
SAMPLING AND ANALYSIS PLAN

NYSDEC Remedial Project Manager:	Vadim Brevdo, P.E. Division of Environmental Remediation NYSDEC 47-40 21st Street Long Island City, NY 11101 Telephone: (717) 482-4891
Project Coordinator:	Mr. Peter Zimmermann Environmental Liability Management c/o FSM East River Associates 375 Park Avenue New York, NY 10152 Telephone: (212) 308-3800 Facsimile: (212) 308-3847 Email: pzimmermann@elminc.com
RI Consultant Project Manager:	Mr. Randolph S. White, P.E. Golder Associates Inc. 1951 Old Cuthbert Road, Suite 301 Cherry Hill, NJ 08034 Telephone: (856) 616-8166 Facsimile: (856) 616-1874 Email: randy_white@golder.com
RI Manager:	Mr. Stuart D. Mitchell, P.G. Golder Associates Inc. 1951 Old Cuthbert Road, Suite 301 Cherry Hill, NJ 08034 Telephone: (856) 616-8166 Facsimile: (856) 616-1874 Email: stuart_mitchell@golder.com
RI Quality Assurance Manager and Site Health and Safety Coordinator:	Mr. Douglas Dugan Golder Associates Inc. 1951 Old Cuthbert Road, Suite 301 Cherry Hill, NJ 08034 Telephone: (856) 616-8166 Facsimile: (856) 616-1874 Email: doug_dugan@golder.com

TABLE D-1
PROJECT PERSONNEL
QUANTA RESOURCES RI/FS WORK PLAN
SAMPLING AND ANALYSIS PLAN

RI Laboratory Coordinator and Data Validator:	Ms. Julie Lehrman Golder Associates Inc. 1951 Old Cuthbert Road, Suite 301 Cherry Hill, NJ 08034 Telephone: (856) 616-8166 Facsimile: (856) 616-1874 Email: julie_lehrman@golder.com
STL-Edison Project Manager: Alternate Laboratory Project Manager:	Deanna Doster Kim Norton 777 New Durham Road Edison, NJ 08817 Telephone: (732) 549-3900 Facsimile (732) 549-3679 Email: ddoster@stl-inc.com knorton@stl-inc.com
STL-Edison Quality Assurance Director:	Madhuri Dave 777 New Durham Road Edison, NJ 08817 Telephone: (732) 549-3900 Facsimile (732) 549-3679 Email: mdave@stl-inc.com
Microseeps, Inc. Project Manager Alternate Laboratory Project Manager	Debbie Hallo Rebecca Hans 220 William Pitt Way Pittsburgh, PA 15238 Telphone: (800) 659-2887 Facsimile: (412) 826-3433 Email: dhallow@microseeps.com bhaas@microseeps.com
Drilling Services:	Len Rexrod Aquifer Drilling & Testing, Inc. 150 Nassau Terminal Road New Hyde Park, NY 11040 Telephone: (516) 616-6026 Facsimile: (516) 616-6194
Surveyor:	GEOD 18-24 Kanouse Road Newfoundland, NJ 07436 Telephone: (973) 697-2122 Facsimile: (973) 838-6433

TABLE D-2
PROPOSED REMEDIAL INVESTIGATION DATA QUALITY OBJECTIVES
QUANTA RESOURCES RI/FS WORK PLAN

Remedial Investigation Activity	Matrix	Number of Samples	Parameters of Interest	Frequency of Monitoring	Purpose/Objective of Activity
Soil/Fill	Soil/Fill	42 at 14 soil boring locations (see note 6)	TCL VOCs, TCL SVOCs, PCBs, TAL Metals, and Cyanide	Once	Collect definitive data to define nature and extent of impacts.
	Soil/Fill	10	TOC, Grain Size	Once	Collect definitive data to define the physical characteristics of the soil.
Groundwater	Groundwater	3 new on-site wells and 1 new off-site upgradient well	TCL VOCs, SVOCs, PCBs, TAL Metals, Natural Attenuation parameters, and field parameters	Once	Collect definitive data to define nature and extent of impacts, and evaluate potential for Natural Attenuation processes. Collect screening level data to assess conventional groundwater quality characteristics.
Hydrogeologic Testing	Groundwater	2 on-site wells	Horizontal hydraulic Conductivity	Once	Collect definitive data to characterize aquifer hydraulic parameters needed to assess COPC fate and transport.
LNAPL Delineation	LNAPL	3 new on-site wells (see note 7)	LNAPL thickness and location of groundwater/LNAPL interface	Once	Collect definitive date to assess the thickness and distribution of the LNAPL on-site.
LNAPL Testing	LNAPL	3 new on-site wells and 1 existing on-site well (see note 7)	TCL VOCs, TCL SVOCs, TAL Metals, PCBs, GC Fingerprint, specific gravity, viscosity, TOX, % Sulfur, % solids, flash point, BTU.	Once	Collect definitive data to define nature and extent of COPC impacts within LNAPL, and determine LNAPL physical characteristics and mobility to evaluate current and potential future exposure pathways.
Surveying	NA	All soil boring locations, on-site well locations, and 1 new off-site well (upgradient well)	Elevations, northings and eastings	Once	Verify existing well elevations and provide accurate location and elevation data for new borings and wells

Notes:

1. The Target Compound List (TCL) VOC, SVOC, and PCB lists are defined in CLP Statements of Work OLM04.2. The Target Analyte List (TAL) parameters are listed in CLP Statement of Work ILM04.1.
2. The methodologies that will be used for analysis are listed in SAP Tables D-3, D-5 and D-7.
3. Natural Attenuation parameters to be analyzed include: Total Alkalinity, Chloride, Sulfate, Nitrate, Light Hydrocarbons (methane, ethane, ethene), Total Organic Carbon (TOC), Dissolved Organic Carbon (DOC), Total Dissolved Solids (TDS), and CO2.
4. Quality control samples will be collected per matrix at the following frequency : 1 field duplicate per twenty primary samples; 1 MS/MSD pair per twenty primary + field duplicate samples; 1 rinsate blank per day per type of decontamination event where non-dedicated equipment is used; and 1 trip blank per day when aqueous VOC samples are collected.
5. Field Parameters for groundwater monitoring include: pH, Temperature, Specific Conductivity, Turbidity, Dissolved Oxygen, and Oxidation-Reduction Potential. Field parameters for soil screening include: VOC vapors and visual characteristics.
6. Number of samples is approximate. Actual number of samples will be based on the number of samples collected from the 0 - 2 ft level and 15 - 17 ft bgs level as described in the RI/FS Work Plan.
7. One or more of the proposed LNAPL wells may not be installed if existing monitoring wells are located and usable. LNAPL thickness will be measured in each on-site well that is usable.

TABLE D-3
PARCC DATA FOR AQUEOUS SAMPLES
QUANTA RESOURCES RI/FS WORK PLAN
SAMPLING AND ANALYSIS PLAN

MEASUREMENT PARAMETER	METHOD REFERENCE	LABORATORY PRECISION	FIELD & LABORATORY PRECISION	ACCURACY	COMPLETENESS (c)
TCL Volatile Organics	SW-846 8260B	see Table D-4	±50%	see Table D-4	85%
TCL Semi-Volatile Organics	SW-846 8270C	see Table D-4	±50%	see Table D-4	85%
TCL PCBs	SW-846 8082	see Table D-4	±50%	see Table D-4	85%
TAL Metals	SW-846 6010B/7470	see Table D-4	±50%	see Table D-4	85%
Light Hydrocarbons	SW846 8015M (a)	±20%	±50%	75%-125%	85%
Alkalinity	EPA 310.1	±20%	±50%	75%-125%	85%
Total Organic Carbon	SW-846 9060	±20%	±50%	75%-125%	85%
Dissolved Organic Carbon	SW-846 9060	±20%	±50%	75%-125%	85%
Nitrate	EPA 353.2	±20%	±50%	75%-125%	85%
Sulfate	EPA 375.4	±20%	±50%	75%-125%	85%
Carbon Dioxide	EPA 310.1	±20%	±50%	75%-125%	85%
Chloride	SM4500 CLB	±20%	±50%	75%-125%	85%
Total Dissolved Solids	EPA 160.1	±20%	±50%	75%-125%	85%
Turbidity	Electrode	NA	±20%	NA (b)	85%
Oxidation-Reduction Potential	Electrode	NA	±20%	NA (b)	85%
Dissolved Oxygen	Electrode	NA	±20%	NA (b)	85%
Specific Conductance	Electrode	NA	±20%	NA (b)	85%
pH	Electrode	NA	±0.5 std pH units	NA (b)	85%
Temperature	Electrode	NA	±0.5 deg C	NA (b)	85%

NOTES:

(a) If Method SW846 8015M is not routinely performed by the laboratory, then an equivalent method will be used.

(b) Accuracy goals that can not be defined as matrix spikes will not be performed.

(c) While the goal for completeness of laboratory measurements is 90%, the goal for total completeness (sampling and analytical) is 85%.

(d) Field meters will be standardized/calibrated daily and checked every four hours at a minimum.

1. NA = Not applicable
2. TCL = CLP Target Compound List, see CLP Statement of Work OLM04.2; TAL = CLP Target Analyte List, see CLP Statement of Work ILM04.1. See Table D-9
3. Light hydrocarbons = methane, ethane, ethene.
4. Precision expressed as either percent relative standard deviation (%RSD) or relative percent difference (%RPD).
5. Accuracy expressed as percent recovery of matrix spike or laboratory control sample.
6. Precision and accuracy for TCL/TAL parameters provided in Table D-4.
7. Representativeness and Comparability are non-quantitative parameters.
8. Accuracy and precision criteria for laboratory measurements will be consistent with the criteria cited in the individual methodologies for the natural attenuation parameters.

TABLE D-4
LABORATORY PRECISION AND ACCURACY CRITERIA FOR AQUEOUS TCL/TAL SAMPLES
QUANTA RESOURCES RI/FS WORK PLAN
SAMPLING AND ANALYSIS PLAN

VOLATILE ORGANICS:	**QC LIMITS**	
Target Spike Compound	**% Recovery**	**% RPD**
1,1-Dichloroethene	65%-125%	0%-40%
Trichloroethene	71%-123%	0%-40%
Benzene	76%-120%	0%-40%
Toluene	72%-125%	0%-40%
Chlorobenzene	72%-129%	0%-40%
Surrogate Compound		
Toluene-d8	58%-141%	Not Applicable
Bromofluorobenzene	56%-147%	Not Applicable
1,2-Dichloroethane-d4	60%-155%	Not Applicable
SEMI-VOLATILE ORGANICS:	**QC LIMITS**	
Target Spike Compound	**% Recovery**	**% RPD**
Phenol	16%-54%	0%-40%
2-Chlorophenol	57%-97%	0%-40%
N-Nitroso-di-n-propylamine	58%-111%	0%-40%
4-Chloro-3-methylphenol	61%-115%	0%-40%
Acenaphthene	65%-115%	0%-40%
4-Nitrophenol	16%-57%	0%-40%
2,4-Dinitrotoluene	78%-124%	0%-40%
Pentachlorophenol	51%-132%	0%-40%
Pyrene	29%-152%	0%-40%
Surrogate Compound		
Nitrobenzene-d5	78%-117%	Not Applicable
2-Fluorobiphenyl	76%-105%	Not Applicable
Terphenyl-d14	82%-123%	Not Applicable
Phenol-d5	4%-43%	Not Applicable
2-Fluorophenol	7%-59%	Not Applicable
2,4,6-Tribromophenol	32%-163%	Not Applicable
POLYCHLORINATED BIPHENYLS:	**QC LIMITS**	
Target Spike Compound	**% Recovery**	**% RPD**
Aroclor 1016	71%-147%	0%-28%
Aroclor 1260	63%-153%	0%-25%
Surrogate Compound		
Decachlorobiphenyl	30%-126%	Not Applicable
TARGET ANALYTE LIST:	**QC LIMITS**	
Target Spike Compound	**% Recovery**	**% RPD**
Metals	75%-125%	±20%
Cyanide	80%-122%	10%

NOTES:

1. VOC and SVOC accuracy and precision criteria based upon laboratory estabished Limits.
2. PCB accuracy and precision criteria based upon laboratory established limits.
3. TAL accuracy and precison criteria based upon laboratory established limits
4. Precision criteria for metals is ±CRDL (reporting limit) for results less than 5xCRDL.

TABLE D-5
PARCC DATA FOR SOIL SAMPLES
QUANTA RESOURCES RI/FS WORK PLAN
SAMPLING AND ANALYSIS PLAN

MEASUREMENT PARAMETER	METHOD REFERENCE	LABORATORY PRECISION	FIELD & LABORATORY PRECISION	ACCURACY	COMPLETENESS (b)
TCL Volatile Organics	SW-846 8260B	see Table D-6	±100%	see Table D-6	85%
TCL Semi-Volatile Organics	SW-846 8270C	see Table D-6	±100%	see Table D-6	85%
TCL PCBs	SW-846 8082	see Table D-6	±100%	see Table D-6	85%
TAL Metals	SW-846 6010B	see Table D-6	±100%	see Table D-6	85%
Cyanide	SW-846 9012	see Table D-6	±100%	see Table D-6	85%
TOC	SW-846 9060	±50%	±100%	75%-125%	85%
Grain Size Analysis	ASTM D422	NA (a)	NA (a)	NA (a)	85%

NOTES:

(a) NA - Not applicable. Precision and accuracy goals that can not be defined as matrix spikes and duplicates will not be performed on geotechnical analyses.

(b) While the goal for completeness of laboratory measurements is 90%, the goal for total completeness (sampling and analytical) is 85%.

1. NA = Not applicable
2. TCL = CLP Target Compound List, see CLP Statement of Work OLM04.2; TAL = CLP Target Analyte List, see CLP Statement of Work ILM04.1. See Table D-9
3. Precision expressed as either percent relative standard deviation (%RSD) or relative percent difference (%RPD).
4. Accuracy expressed as percent recovery of matrix spike or laboratory control sample.
5. Precision and accuracy for TCL/TAL parameters provided in Table D-6.
6. Representativeness and Comparability are non-quantitative parameters.

TABLE D-6
LABORATORY PRECISION AND ACCURACY CRITERIA FOR SOIL TCL/TAL SAMPLES
QUANTA RESOURCES RI/FS WORK PLAN
SAMPLING AND ANALYSIS PLAN

VOLATILE ORGANICS:	**QC LIMITS**	
Target Spike Compound	**% Recovery**	**% RPD**
1,1-Dichloroethene	72%-120%	0%-40%
Trichloroethene	78%-121%	0%-40%
Benzene	79%-122%	0%-40%
Toluene	76%-120%	0%-40%
Chlorobenzene	79%-121%	0%-40%
Surrogate Compound		
Toluene-d8	58%-142%	Not Applicable
Bromofluorobenzene	58%-135%	Not Applicable
1,2-Dichloroethane-d4	56%-141%	Not Applicable
SEMI-VOLATILE ORGANICS:	**QC LIMITS**	
Target Spike Compound	**% Recovery**	**% RPD**
Phenol	74%-122%	0%-40%
2-Chlorophenol	82%-123%	0%-40%
N-Nitroso-di-n-propylamine	55%-115%	0%-40%
4-Chloro-3-methylphenol	77%-131%	0%-40%
Acenaphthene	84%-118%	0%-40%
4-Nitrophenol	73%-131%	0%-40%
2,4-Dinitrotoluene	80%-120%	0%-40%
Pentachlorophenol	40%-122%	0%-40%
Pyrene	61%-156%	0%-40%
Surrogate Compound		
Nitrobenzene-d5	40%-124%	Not Applicable
2-Fluorobiphenyl	55%-115%	Not Applicable
Terphenyl-d14	59%-138%	Not Applicable
Phenol-d5	16%-133%	Not Applicable
2-Fluorophenol	16%-120%	Not Applicable
2,4,6-Tribromophenol	45%-117%	Not Applicable
POLYCHLORINATED BIPHENYLS:	**QC LIMITS**	
Target Spike Compound	**% Recovery**	**% RPD**
Aroclor 1016	68%-135%	0%-28%
Aroclor 1260	68%-147%	0%-34%
Surrogate Compound		
Decachlorobiphenyl	66%-146%	Not Applicable
TARGET ANALYTE LIST:	**QC LIMITS**	
Target Spike Compound	**% Recovery**	**% RPD**
Metals	75%-125%	±20%
Cyanide	60%-133%	±22%

NOTES:

1. VOC and SVOC accuracy and precision criteria based upon laboratory estabished Limits.
2. PCB accuracy and precision criteria based upon laboratory established limits.
3. TAL accuracy and precison criteria based upon laboratory established limits
4. Precision criteria for metals is ±CRDL (reporting limit) for results less than 5xCRDL.

TABLE D-7
PARCC DATA FOR LNAPL SAMPLES
QUANTA RESOURCES RI/FS WORK PLAN
SAMPLING AND ANALYSIS PLAN

MEASUREMENT PARAMETER	METHOD REFERENCE	LABORATORY PRECISION	FIELD & LABORATORY PRECISION	ACCURACY	COMPLETENESS (b)
TCL Volatile Organics	SW-846 8260B	see Table D-8	±100%	see Table D-8	85%
TCL Semi-Volatile Organics	SW-846 8270C	see Table D-8	±100%	see Table D-8	85%
TCL PCBs	SW-846 8082	see Table D-8	±100%	see Table D-8	85%
TAL Metals	SW-846 6010B	see Table D-8	±100%	see Table D-8	85%
Specific Gravity	ASTM D854	20%	±100%	NA	85%
TOX	SW-846 9020	50-150%	±100%	50-150%	85%
% Sulfur	ASTM D 129 (or equivalent)	20%	±100%	NA (a)	85%
% Sediment	ASTM D 1796 (or equivalent)	20%	±100%	NA (a)	85%
Viscosity	ASTM D 445 (or equivalent)	20%	±100%	NA (a)	85%
Flash Point	SW-846 1010	20%	±100%	NA (a)	85%
BTU	ASTM D 240 (or equivalent)	20%	±100%	NA (a)	85%
GC Fingerprint	SW-846 8015 (modified)	50-150%	NA	50-150%	85%

NOTES:

(a) Accuracy goals that can not be defined as matrix spikes will not be performed.

(b) While the goal for completeness of laboratory measurements is 90%, the goal for total completeness (sampling and analytical) is 85%. This goal may not be achievable due to the difficulties associated with the analysis of LNAPL and the elevated levels of COPC that the LNAPL is expected to contain.

1. NA = Not applicable
2. TCL = CLP Target Compound List, see CLP Statement of Work OLM04.2; TAL = CLP Target Analyte List, see CLP Statement of Work ILM04.1. See Table D-9
3. Precision expressed as either percent relative standard deviation (%RSD) or relative percent difference (%RPD).
4. Accuracy expressed as percent recovery of matrix spike or laboratory control sample.
5. Precision and accuracy for TCL/TAL parameters provided in Table D-8.
6. Representativeness and Comparability are non-quantitative parameters.

TABLE D-8
LABORATORY PRECISION AND ACCURACY CRITERIA FOR LNAPL TCL/TAL SAMPLES
QUANTA RESOURCES RI/FS WORK PLAN
SAMPLING AND ANALYSIS PLAN

VOLATILE ORGANICS:	**QC LIMITS**	
Target Spike Compound	**% Recovery**	**% RPD**
1,1-Dichloroethene	72%-120%	0%-40%
Trichloroethene	78%-121%	0%-40%
Benzene	79%-122%	0%-40%
Toluene	76%-120%	0%-40%
Chlorobenzene	79%-121%	0%-40%
Surrogate Compound		
Toluene-d8	58%-142%	Not Applicable
Bromofluorobenzene	58%-135%	Not Applicable
1,2-Dichloroethane-d4	56%-141%	Not Applicable
SEMI-VOLATILE ORGANICS:	**QC LIMITS**	
Target Spike Compound	**% Recovery**	**% RPD**
Phenol	55%-122%	0%-40%
2-Chlorophenol	63%-125%	0%-40%
N-Nitroso-di-n-propylamine	0%-59%	0%-40%
4-Chloro-3-methylphenol	61%-121%	0%-40%
Acenaphthene	66%-126%	0%-40%
4-Nitrophenol	0%-170%	0%-40%
2,4-Dinitrotoluene	57%-111%	0%-40%
Pentachlorophenol	0%-144%	0%-40%
Pyrene	54%-143%	0%-40%
Surrogate Compound		
Nitrobenzene-d5	62%-134%	Not Applicable
2-Fluorobiphenyl	66%-134%	Not Applicable
Terphenyl-d14	56%-130%	Not Applicable
Phenol-d5	55%-125%	Not Applicable
2-Fluorophenol	55%-120%	Not Applicable
2,4,6-Tribromophenol	21%-136%	Not Applicable
POLYCHLORINATED BIPHENYLS:	**QC LIMITS**	
Target Spike Compound	**% Recovery**	**% RPD**
Aroclor 1016	56%-188%	0%-9%
Aroclor 1260	62%-189%	0%-13%
Surrogate Compound		
Decachlorobiphenyl	50%-152%	Not Applicable
TARGET ANALYTE LIST:	**QC LIMITS**	
Target Spike Compound	**% Recovery**	**% RPD**
Metals	75%-125%	±20%
Cyanide	60%-133%	±22%

NOTES:

1. VOC and SVOC accuracy and precision criteria based upon laboratory estabished Limits.
2. PCB accuracy and precision criteria based upon laboratory established limits.
3. TAL accuracy and precison criteria based upon laboratory established limits
4. Precision criteria for metals is ±CRDL (reporting limit) for results less than 5xCRDL.

TABLE D-9
TARGET COMPOUNDS/ANALYTES OF INTEREST
QUANTA RESOURCES RI/FS WORK PLAN
SAMPLING AND ANALYSIS PLAN

TARGET PARAMETERS FOR RI	AQUEOUS REPORTING LIMITS [ug/l]	SOIL REPORTING LIMITS [ug/kg]	LNAPL REPORTING LIMITS [ug/kg]
Volatile Organic Compounds			
Dichlorodifluoromethane	5	5	2,500
Chloromethane	5	5	2,500
Bromomethane	5	5	2,500
Vinyl chloride	5	5	2,500
Chloroethane	5	5	2,500
Trichlorofluoromethane	5	5	2,500
1,1,2-Trichloro-1,2,2-trifluoroethane	5	5	2,500
Methyl acetate	5	5	2,500
Methylene chloride	3	3	1,500
Acetone	5	5	2,500
Carbon disulfide	5	5	2,500
tert -Butyl methyl ether	5	5	2,500
1,1-Dichloroethene	2	2	1,000
1,1-Dichloroethane	5	5	2,500
cis -1,2-Dichloroethene	5	5	2,500
trans -1,2-Dichloroethene	5	5	2,500
Chloroform	5	5	2,500
1,2-Dichloroethane	2	2	1,000
2-Butanone	5	5	2,500
Bromochloromethane	5	5	2,500
1,1,1-Trichloroethane	5	5	2,500
Cyclohexane	5	5	2,500
Carbon Tetrachloride	2	2	1,000
Bromodichloromethane	1	1	500
1,2-Dichloropropane	1	1	500
cis -1,3-Dichloropropene	5	5	2,500
Trichloroethene	1	1	500
Methylcyclohexane	5	5	2,500
Dibromochloromethane	5	5	2,500
1,1,2-Trichloroethane	3	3	1,500
Benzene	1	1	500
trans -1,3-Dichloropropene	5	5	2,500
Bromoform	4	4	2,000
4-Methyl-2-pentanone	5	5	2,500
2-Hexanone	5	5	2,500
Tetrachloroethene	1	1	500
Isopropylbenzene	5	5	2,500
1,1,2,2-Tetrachloroethane	1	1	500
1-2-Dibromoethane	5	5	2,500
Toluene	5	5	2,500
Chlorobenzene	5	5	2,500

TABLE D-9
TARGET COMPOUNDS/ANALYTES OF INTEREST
QUANTA RESOURCES RI/FS WORK PLAN
SAMPLING AND ANALYSIS PLAN

TARGET PARAMETERS FOR RI	AQUEOUS REPORTING LIMITS [ug/l]	SOIL REPORTING LIMITS [ug/kg]	LNAPL REPORTING LIMITS [ug/kg]
Ethylbenzene	4	4	2,000
Styrene	5	5	2,500
Xylenes (total)	5	5	2,500
1,3-Dichlorobenzene	5	5	2,500
1,4-Dichlorobenzene	5	5	2,500
1,2-Dichlorobenzene	5	5	2,500
1,2-Dibromo-3-chloropropane	5	5	2,500
1,2,4-Trichlorobenzene	5	5	2,500
Semi-Volatile Organic Compounds			
Benzaldehyde	10	330	50,000
Phenol	10	330	50,000
bis -(2-Chloroethyl)ether	1	33	5,000
2-Chlorophenol	10	330	50,000
2-Methylphenol	10	330	50,000
2,2'-oxybis(1-Chloropropane)	10	330	50,000
Acetophenone	10	330	50,000
4-Methylphenol	10	330	50,000
N-Nitroso-di-n-propylamine	1	33	5,000
Hexachloroethane	1	33	5,000
Nitrobenzene	1	33	5,000
Isophorone	10	330	50,000
2-Nitrophenol	10	330	50,000
2,4-Dimethylphenol	10	330	50,000
bis-(2-Chloroethoxy) methane	10	330	50,000
2,4-Dichlorophenol	10	330	50,000
Naphthalene	10	330	50,000
4-Chloroaniline	10	330	50,000
Hexachlorobutadiene	2	67	10,000
Caprolactam	10	330	50,000
4-Chloro-3-methylphenol	10	330	50,000
2-Methylnaphthalene	10	330	50,000
Hexachlorocyclopentadiene	10	330	50,000
2,4,6-Trichlorophenol	10	330	50,000
2,4,5-Trichlorophenol	10	330	50,000
1,1'-Biphenyl	10	330	50,000
2-Chloronaphthalene	10	330	50,000
2-Nitroaniline	20	670	100,000
Dimethylphthalate	10	330	50,000
2,6-Dinitrotoluene	2	67	10,000
Acenaphthylene	10	330	50,000
3-Nitroaniline	20	670	100,000
Acenaphthene	10	330	50,000
2,4-Dinitrophenol	40	1300	200,000
4-Nitrophenol	40	1300	200,000
Dibenzofuran	10	330	50,000
2,4-Dinitrotoluene	2	67	10,000
Diethylphthalate	10	330	50,000
Fluorene	10	330	50,000
4-Chlorophenyl-phenyl ether	10	330	50,000
4-Nitroaniline	20	670	100,000
4,6-Dinitro-2-methylphenol	40	1300	200,000
N-Nitroso-diphenylamine	10	330	50,000

TABLE D-9
TARGET COMPOUNDS/ANALYTES OF INTEREST
QUANTA RESOURCES RI/FS WORK PLAN
SAMPLING AND ANALYSIS PLAN

TARGET PARAMETERS FOR RI	**AQUEOUS REPORTING LIMITS [ug/l]**	**SOIL REPORTING LIMITS [ug/kg]**	**LNAPL REPORTING LIMITS [ug/kg]**
4-Bromophenyl-phenyl ether	10	330	50,000
Hexachlorobenzene	1	33	5,000
Atrazine	10	330	50,000
Pentachlorophenol	40	1300	200,000
Phenanthrene	10	330	50,000
Anthracene	10	330	50,000
Carbazole	10	330	50,000
Di-n-butyl phthalate	10	330	50,000
Fluoranthene	10	330	50,000
Pyrene	10	330	50,000
Butylbenzyl phthalate	10	330	50,000
3,3'-Dichlorobenzidine	20	670	100,000
Benzo(a)anthracene	1	33	5,000
Chrysene	10	330	50,000
bis -(2-Ethylhexyl) phthalate	*10*	330	50,000
Di-n-octylphthalate	10	330	50,000
Benzo(b)fluoranthene	1	33	5,000
Benzo(k)fluoranthene	1	33	5,000
Benzo(a)pyrene	1	33	5,000
Indeno(1,2,3-cd)pyrene	1	33	5,000
Dibenzo(a,h)anthracene	1	33	5,000
Benzo(g,h,I)perylene	10	330	50,000
PCBs			
Aroclor-1016	0.5	67.0	1,000
Aroclor-1221	0.5	67.0	1,000
Aroclor-1232	0.5	67.0	1,000
Aroclor-1242	0.5	67.0	1,000
Aroclor-1248	0.5	67.0	1,000
Aroclor-1254	0.5	67.0	1,000
Aroclor-1260	0.5	67.0	1,000

TABLE D-9
TARGET COMPOUNDS/ANALYTES OF INTEREST
QUANTA RESOURCES RI/FS WORK PLAN
SAMPLING AND ANALYSIS PLAN

TARGET PARAMETERS FOR RI	AQUEOUS REPORTING LIMITS [ug/l]	SOIL REPORTING LIMITS [ug/kg]	LNAPL REPORTING LIMITS [ug/kg]
Target Analyte List	**[ug/l]**	**[mg/kg]**	**[mg/kg]**
Aluminum	200	40	40
Antimony	10	2	2
Arsenic	4	1	1
Barium	200	40	40
Beryllium	2	0.4	0.4
Cadmium	4	1	1
Calcium	5,000	1,000	1,000
Chromium	10	2	2
Cobalt	50	10	10
Copper	25	5	5
Iron	150	30	30
Lead	3	1	1
Magnesium	5,000	1,000	1,000
Manganese	15	3	3
Mercury	0.2	0.033	0.033
Nickel	40	8	8
Potassium	5,000	1,000	1,000
Selenium	5	1	1
Silver	10	2	2
Sodium	5,000	1,000	1,000
Thallium	10	2	2
Vanadium	50	10	10
Zinc	30	6	6
Cyanide	10	0.5	0.5

NOTES:

1. VOC, SVOC and PCB Lists from CLP SOW OLM04.2
2. TAL Metals List from CLP SOW ILM04.1
3. The Reporting Limits shown for the Target Analyte List are the minimum reporting limits that may be used for an undiluted sample. The laboratory will report results to the Instrument Detection Limit (IDL) which are generated every quarter. Reporting Limits will be modified on an individual sample basis depending upon dilution, percent solids, and sample matrix considerations.
4. The majority of the reporting limits are equal to or below the soil cleanup levels and groundwater effluent limitations (Class GA) contained in the NYSDEC Technical and Administrative Guidance. All laboratory Method Detection Limits (MDLs) are below the applicable criteria and results between the MDL and reporting limit will be reported as estimated (J).

TABLE D-10
ANALYTICAL METHODS, SAMPLE CONTAINERS, PRESERVATION AND ANALYTICAL HOLD TIMES FOR AQUEOUS SAMPLES
QUANTA RESOURCES RIFS WORK PLAN
SAMPLING AND ANALYSIS PLAN

PARAMETER	METHODOLOGY	CONTAINER(1)	MINIMUM SAMPLE	PRESERVATION (a)	HOLD TIME (b)
TCL Volatile Organics	SW-846 8260B	3-40 ml G	3 - 40 ml	Cool 4 ^{o}C;HCl,pH<2	14 days (c)
TCL Semi-Volatile Organics	SW-846 8270C	2-1000ml G	1000ml	Cool 4^o C	7 days (e)
TCL PCBs	SW-846 8082	2-1000ml G	1000ml	Cool 4^o C	7 days (e)
TAL Metals	SW-846 6010B	1-500 ml P	250 ml	Cool 4^o C; HNO_3, pH<2	180 days (f)
Cyanide	SW-846 7470	1-1000 P	250 ml	Cool 4^o C; NaOH, pH>12	14 days
Light Hydrocarbons	SW846 8015M(g)	3-40ml G (h)	3-40ml	Cool 4^o C	14 days (i)
Alkalinity	EPA 310.1	1-500 ml P	100 ml	Cool 4^o C	14 days
Total Organic Carbon	SW-846 9060	250 l G	50 ml	Cool 4^o C; H_2SO_4, pH<2	28 days
Dissolved Organic Carbon	SW-846 9060	250 l G	50 ml	Cool 4^o C; H_2SO_4, pH<2	28 days
Nitrate	EPA 353.2	1-500 ml P	25 ml	Cool 4^o C	48 hours
Sulfate	EPA 375.4	1-500 ml P	250 ml	Cool 4^o C	28 days
Carbon Dioxide	SM4500CO2D	350 ml G (h)	250 ml	Cool 4^o C	8 hrs
Chloride	SM4500 CLB	500 ml	100 ml	Cool 4^o C	28 days
Total Dissolved Solids	EPA 160.1	1-500 ml P	100 ml	Cool 4^o C	7 days
Turbidity	Electrode	NA	NA	None	Field Measurement(d)
Oxidation-Reduction Potential	Electrode	NA	NA	None	Field Measurement(d)
Dissolved Oxygen	Electrode	NA	NA	None	Field Measurement(d)
Specific Conductance	Electrode	NA	NA	None	Field Measurement(d)
pH	Electrode	NA	NA	None	Field Measurement(d)
Temperature	Electrode	NA	NA	None	Field Measurement(d)

Notes:

(a) Sample preservation is performed by sampler immediately upon sample collection.

(b) Hold time based upon day of sample collection not Verified Time of Sample Receipt.

(c) If sample is not preserved, unpreserved sample will be analyzed within 7 days.

(d) Field measurements will be collected using a flow-through cell equipped with a field meter and parameter specific electrodes.

(e) Hold time is 7 days until start of sample extraction, 40 days following extraction for analysis.

(f) Hold Time for metals is 180 days, except for Mercury which is 28 days.

(g) If Method SW846 8015M is not routinely performed by the laboratory, then an equivalent method will be used.

(h) Vials that have specially designed, teflon lined septa to prevent loss of volatiles will be used.

(i) There is not technical holding time for these analytes. 14 days is a laboratory specific and advisory guideline.

1. P indicates that a Plastic bottle should be used and G indicates that a Glass bottle should be used.

TABLE D-11
ANALYTICAL METHODS, SAMPLE CONTAINERS, PRESERVATION AND ANALYTICAL HOLD TIMES FOR SOIL SAMPLES
QUANTA RESOURCES RI/FS WORK PLAN
SAMPLING AND ANALYSIS PLAN

PARAMETER	METHODOLOGY	CONTAINER	MINIMUM SAMPLE	PRESERVATION [(a)]	HOLD TIME [(b)]
TCL Volatile Organics	SW-846 8260B	2 oz G	10 gm	Cool 4 °C	14 days
TCL Semi-Volatile Organics	SW-846 8270C	4 oz G	30 gm	Cool 4 °C	14 days [(c)]
TCL Pesticides/PCBs	SW-846 8082	4 oz G	30 gm	Cool 4 °C	14 days [(c)]
TAL Metals	SW-846 6010/7471	4 oz G	30 gm	Cool 4 °C	180 days [(d)]
Cyanide	SW-846 9012	4 oz G	30 gm	Cool 4 °C	14 days
Total Organic Carbon	SW-846 9060	4 oz G	100 gm	Cool 4 °C	28 days
Grain Size Analysis	ASTM D422	16 oz G	1000 gm	None	None

Notes:

(a) Sample Preservation is performed by sampler immediately upon sample collection except for VOCs which is performed by laboratory upon receipt.

(b) Hold time based upon day of sample collection not Verified Time of Sample Receipt.

(c) Hold Time for SVOCs, Pesticides/PCBs is 14 days for extraction and 40 days for analysis.

(d) Hold Time for metals is 180 days, except for Mercury which is 28 days.

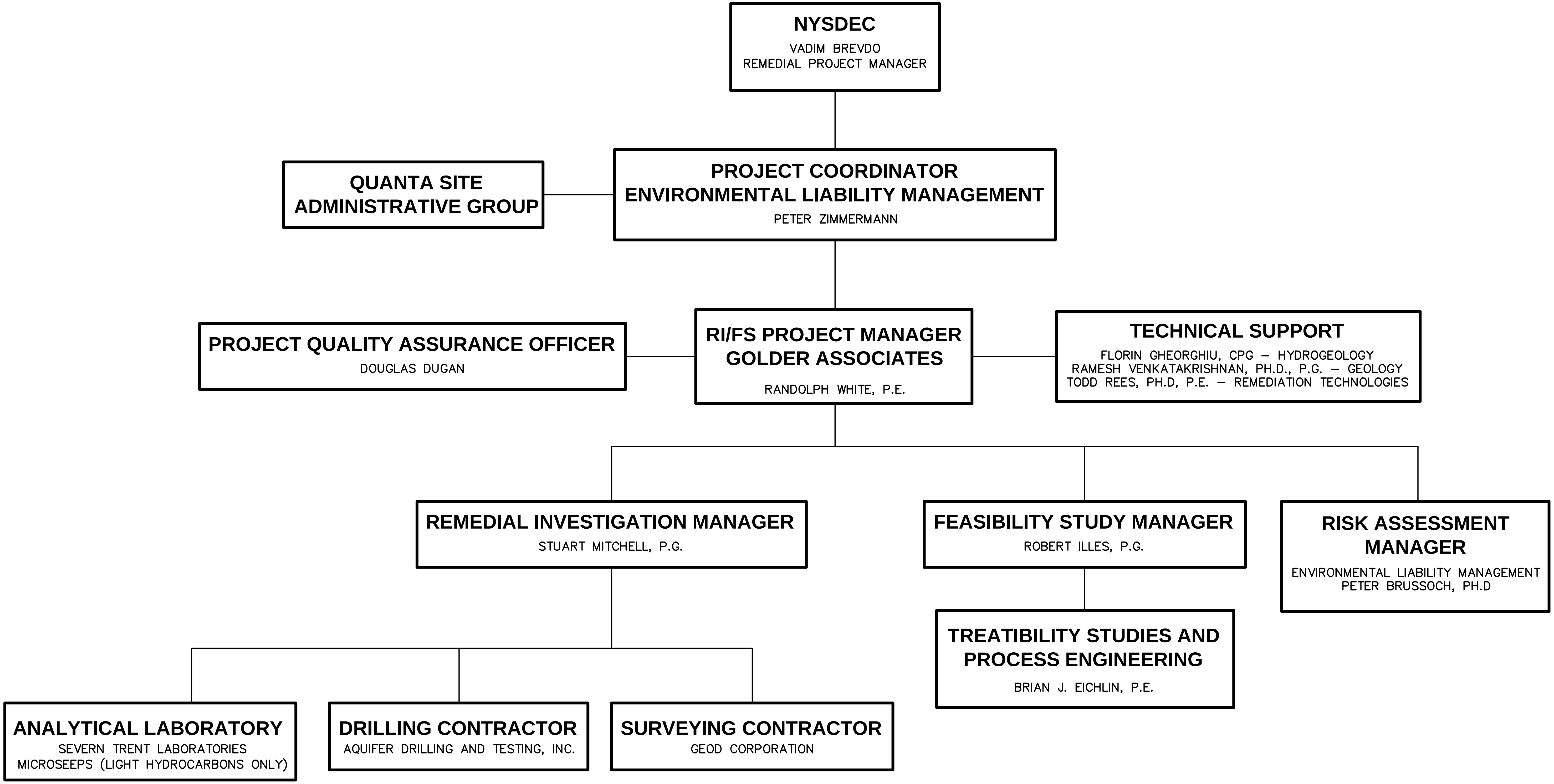
1. G indicates that a Glass bottle should be used.

TABLE D-12
ANALYTICAL METHODS, SAMPLE CONTAINERS, PRESERVATION AND ANALYTICAL HOLD TIMES FOR LNAPL SAMPLES
QUANTA RESOURCES RIFS WORK PLAN
SAMPLING AND ANALYSIS PLAN

PARAMETER	METHODOLOGY	CONTAINER(1)	MINIMUM SAMPLE	PRESERVATION (a)	HOLD TIME (b)
TCL Volatile Organics	SW-846 8260B	3-40 ml G	3 - 40 ml	Cool 4 °C	14 days
TCL Semi-Volatile Organics	SW-846 8270C	2-1000ml G	1000ml	Cool 4° C	14 days
TCL PCBs	SW-846 8082	2-1000ml G	1000ml	Cool 4° C	14 days
TAL Metals	SW-846 6010B	1-500 ml P	250 ml	Cool 4° C	180 days (d)
Specific Gravity	ASTM D1298	1-200 ml G	100 ml	Cool 4° C	none
TOX	SW-846 9020	1-500 ml P	250 ml	Cool 4° C	14 days
% Sulfur	ASTM D 4294 (or equivalent)	1-250 ml G	25 ml	Cool 4° C	none
% Sediment	ASTM D 96 (or equivalent)	1-250 ml G	100 ml	Cool 4° C	none
Viscosity	ASTM D 445 (or equivalent)	1-250 ml G	50 ml	Cool 4° C	none
Flash Point	SW-846 1010	1-500 ml P	20 ml	Cool 4° C	14 days
BTU	ASTM D 1020A (or equivalent)	1-125 ml G	10 ml	Cool 4° C	none
GC Fingerprint	SW-846 8015 (modified)	1-1000ml G	500ml	Cool 4° C	14 days

Notes:

(a) Sample preservation is performed by sampler immediately upon sample collection.
(b) Hold time based upon day of sample collection not Verified Time of Sample Receipt.
(c) Hold time is 7 days until start of sample extraction, 40 days following extraction for analysis.
(d) Hold Time for metals is 180 days, except for Mercury which is 28 days.
1. P indicates that a Plastic bottle should be used and G indicates that a Glass bottle should be used.



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ANALYTICAL LABORATORY
SEVERN TRENT LABORATORIES
MICROSEEPS (LIGHT HYDROCARBONS ONLY)

DRILLING CONTRACTOR
AQUIFER DRILLING AND TESTING, INC.

SURVEYING CONTRACTOR
GEOD CORPORATION

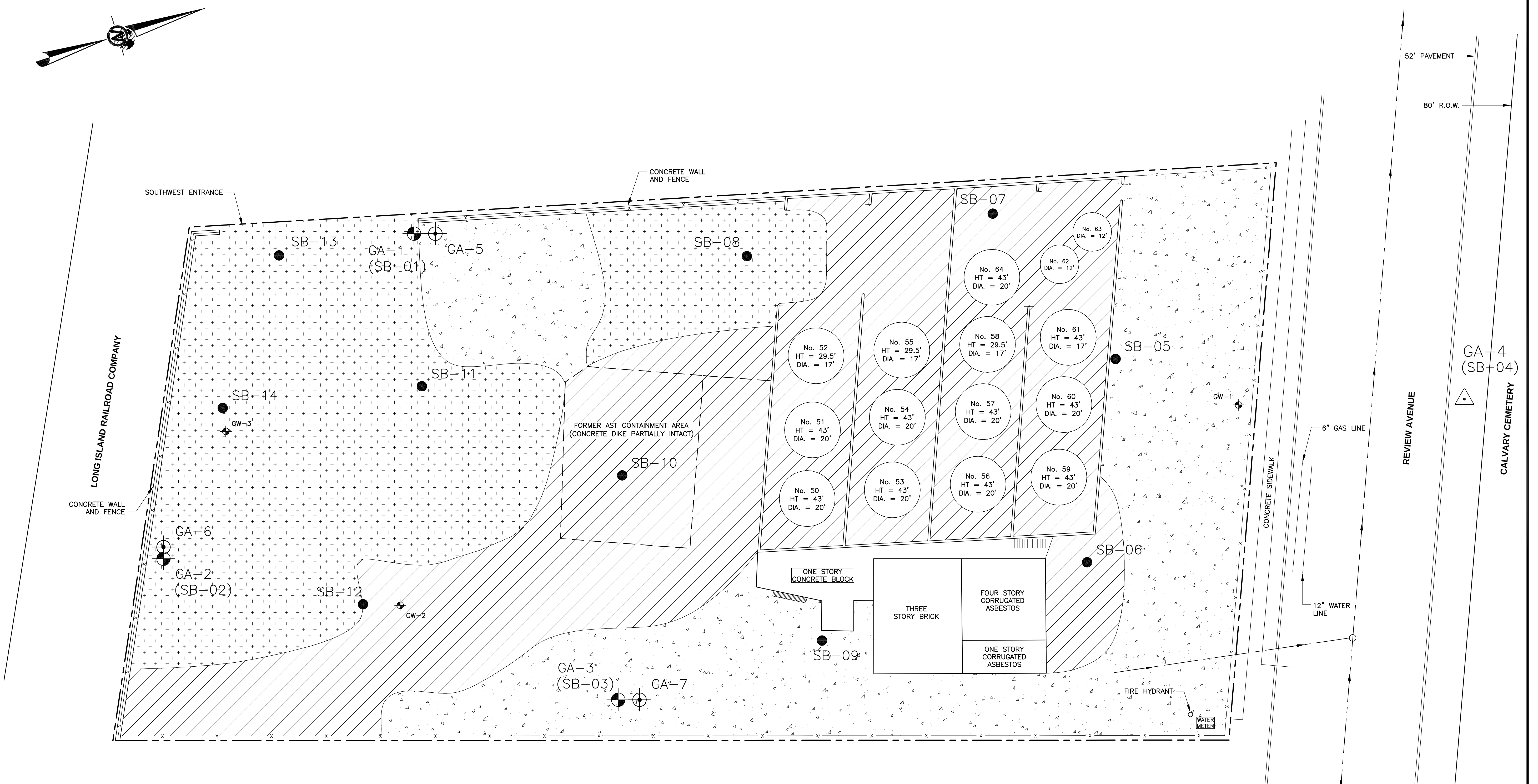
JOB No.:	023–6151	SCALE:	AS SHOWN
CAD BY:	MJS	DATE:	11/20/02
CHK BY:		FILE No.:	0236151A012 REV 1
REV BY:		DR SUBTITLE:	A

Golder Associates

RI/FS PROJECT ORGANIZATION CHART

QUANTA RESOURCES

FIGURE D-1



LEGEND

▨	DEBRIS, TIRES, REMNANT STRUCTURES, AND/OR POST-OPERATIONAL FILL (PILES OF VARIABLE HEIGHT)	⌖	PROPOSED LNAPL MONITORING WELL LOCATION
⊞	SMOOTH GRADED POST-OPERATIONAL FILL (THICKNESS VARIABLE)	△	PROPOSED BACKGROUND MONITORING WELL
☐	ASPHALT/CONCRETE PAVEMENT	●	PROPOSED SOIL BORING LOCATION
— — —	APPROXIMATE PROPERTY BOUNDARY	⊕	EXISTING MONITORING WELL LOCATION (LMS, 1990)
——x——	FENCE LINE		
◐	PROPOSED GROUNDWATER MONITORING WELL LOCATION		

NOTES

1.) LOCATION OF MONITORING POINTS AND PHYSICAL FEATURES ARE APPROXIMATE.

2.) ACCESS FOR GA-4 TO BE DETERMINED.

REFERENCES

1.) MAP DIGITIZED FROM FIGURE TITLED " TOPOGRAPHIC SURVEY", PREPARED BY STRAUBING & RUBIN CONSULTING ENGINEERS, DATED 12/29/80 AS EDITED TO SHOW CURRENT CONDITIONS.

16 0 16 32
SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT
QUANTA RESOURCES
RI/FS WORKPLAN
QUEENS, NEW YORK

TITLE

PROPOSED REMEDIAL INVESTIGATION MONITORING LOCATIONS

Golder Associates
Philadelphia USA

PROJECT No.		023-6151	FILE No. 0236151A014
DESIGN	SDM	08/13/02	SCALE AS SHOWN REV. 0
CADD	AM	11/25/02	
CHECK			
REVIEW			

FIGURE D-2

Drawing file: 0236151A014.dwg Oct 28, 2003 - 11:23am

EXAMPLE CHAIN OF CUSTODY RECORD

PROJ. NO.	**PROJECT NAME**				**NO. OF CONTAINERS**	**CONTAINER TYPE**						**REMARKS**
SAMPLERS:												
SAMPLE	**DATE**	**TIME**	**MATRIX**	**SAMPLE LOCATION**								

RELINQUISHED BY: (Signature)	Date / Time	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature)	Date / Time	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	Date / Time	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature)	Date / Time	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	Date / Time	RECEIVED FOR LABORATORY BY:	Date / Time	REMARKS:	

Figure D-4

GROUNDWATER SAMPLE FIELD INFORMATION FORM

Site:
Location:
Project Number:

MONITORING WELL ID:
Depth to Water Prior to Purging [ft-btoc]:
Well Casing Diameter [in]:
Start Time (purging):
Purging Device:
Well Depth [ft-btoc]:
Weather Conditions:

Sampling Date/Time:
Sampler (s):
Sampling Device:
Sample Characteristics:
Analytical Parameters:

Ferrous Iron [ppm]:

FIELD PARAMETERS

Time [hh:mm]	Temperature [°C]	pH [std]	Specific Conductance [mS/cm or uS/cm]	Turbidity [ntu]	Dissolved Oxygen [mg/l]	Redox Potential [mV]	Depth To Water [ft-btoc]	Volume Purged [liters]	Approximate Purge Rate [ml/min]

Comments:

Figure D-5