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Site Assessment Work Plan
For
Former Ford Manufacturing Company Mill Site
Village of Waterford, Saratoga County, New York
Site Number 5-46-053
Contract Work Authorization Number: D006132-3

Prepared for

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1.0 Introduction

Shaw Environmental and Infrastructure Engineering of New York, P.C. (Shaw) has prepared this Work Plan for the geophysical survey, excavation of test pits and related soil sampling, removal of a 20,000 gallon underground storage tank (UST), installation of 8 direct-push borings, completion of these borings as monitoring wells and the collection and laboratory analysis of groundwater samples from the 8 monitoring wells at the former Ford Manufacturing Company Mill Site (Site Number 5-46-053) located at 127 2nd Street, Village of Waterford, Saratoga County, New York (**Figure 1**). The proposed scope of work presented herein has been developed in accordance with Work Authorization (WA) D006132-3 provided to Shaw on February 11, 2009 and subsequent meetings and discussions with the New York State Department of Environmental Conservation (NYSDEC).

1.1 Facility Description and Location

The history of the property was developed using information provided by the NYSDEC and Delaware Engineering's October, 2007 Environmental Restoration Program Application.

1.1.1 Site Environmental History and Data

The site once housed the Ford Manufacturing/Reis Knitting Company Mill, a large textile mill complex that primarily manufactured men's knit underwear. The Ford Manufacturing Company, founded on December 15, 1891, was the fourth oldest manufacturing plant in Waterford. It was incorporated by John W. Ford and was first located at 37 Fourth Street. Sometime between 1891 and 1895 the structure burned down and a new factory was built on Second Street in August, 1896. Between the years of 1897 and 1934 the mill underwent a series of changes and expansions including the addition of a dye house in 1909.

Robert Reis and Company bought the Ford Mill in October, 1919 and built a large addition to the south in 1924. Drawings of the mill indicate that the fuel for the complex was coal and the power source was electricity.

Robert Reis and Company were major suppliers for the U.S. Government during WWII using 90% of the plant to produce wool and cotton blend garments for the U.S. Navy. The mill complex was later used for warehouse space. They continued to operate the knitting mill through the 1960's. Portions of the building were demolished in the 1970's. The site was

purchased by the Water Commissioners of the Town of Waterford in 1986 and the remainder of the site was cleared in 1990.

The Town of Waterford intends to construct a new water treatment plant on the site. The town's existing water treatment plant currently occupies the northern portion of the property.

Twelve soil borings were advanced on the site in the summer of 2005 in preparation for construction of the new water treatment plant. Several of these borings encountered black silty sand, fuel oil odor, and coal ash. A 20,000 gallon storage tank (~10 feet in diameter by 36 feet long) that contained approximately 3,000 gallons of fuel oil was discovered. This tank was removed by Town personnel. A second 20,000 gallon tank reportedly exists at the site according to discussions with site personnel and information provided to Shaw.

Test pits were dug on the site in October of 2007 as part of a Supplemental Phase 1B archeological investigation requested by the Office of Parks, Recreation, and Historic Preservation (OPRHP). Areas of fuel oil contamination were discovered at a depth of 5-6 feet south of the previously identified impacts.

1.1.2 Site Geology and Hydrogeology

Site Geology

The site is located along the western shore of the Hudson River. Borings completed on site indicate that the overburden soils consist of river-floodplain sediments comprised mainly of brown, medium to fine grain sands and gravel. Portions of the property have been filled with non-native material (in the areas beneath and adjacent to the former mill foot print) which is characterized of ashes, coal fragments and black silty sand.

Depth to bedrock across the site ranges from approximately 20 feet below ground surface (ft bgs) to outcropping of bedrock along the river's edge. Historic borings indicate that the bedrock is weathered shale, most likely the Canajoharie shale, which can be found across the area.

Site Hydrogeology

Depth to groundwater across the site reportedly ranges from approximately 12 ft bgs along the north to approximately 20 ft bgs in the south and typically flows in a south - easterly direction toward the Hudson River based upon historic information provided to Shaw.

2.0 Scope of Work

The purpose of this project is to identify and characterize existing soil and groundwater quality conditions to facilitate the redevelopment of the site as the new Town of Waterford Water Treatment Plant. The existing plant, located immediately north of and adjacent to the former Ford Manufacturing site, was constructed in 1896 and last upgraded in 1958. Studies completed in 1992 and 2002 for the Water Commissioners of the Town of Waterford recommended replacement of the existing facilities due to their age and condition. The current facilities require a substantial operating and maintenance budget to remain operational, and these costs continue to escalate as aged equipment fails based upon information provided by the Town.

In addition, the existing water treatment facility is under a consent order from the NYSDEC because it discharges untreated settling basin sludge and filter backwash to the Hudson River without a State Pollutant Discharge Elimination System (SPDES) permit. The planned upgrades in the new facility would permit this discharge to be connected to and managed by the municipal sewer system.

Preliminary geotechnical studies completed across the site identified the presence of two buried fuel oil tanks and soil contamination. One of the tanks has been removed; one remains on-site and will be addressed during these assessment activities. Due to the history of this site as a textile mill, there is also the possibility for contamination from dyes and chemicals used in the manufacturing process.

The scope of the investigative phase of this project is to identify the nature and extent of potential soil and groundwater impacts. The existing underground storage tank and some of the impacted soils may be removed. The intent of this work, and any subsequent site remediation, is to render the property suitable for redevelopment as the municipal water treatment plant site.

2.1 Utility Clearance

Shaw will contact the local “one call” agency to schedule the utility mark-outs no later than ten days prior to the start of work. On-site utility mark-out will be coordinated with Town and plant representatives, visual observations or similar utility maps as provided by the tax assessor or site contacts.

2.2 Geophysical Survey

A Ground Penetrating Radar (GPR) survey will be completed across the site on a 10 foot by 10 foot grid. This survey will be conducted to identify the location of the existing underground storage tank and buried debris located on the site. Identified anomalies will be clearly delineated and flagged at the surface. The geophysical subcontractor will generate site maps showing the anomalies detected during the survey. These anomalies will be reviewed with the NYSDEC project manager and evaluated during the exploratory test pit program discussed in **Section 2.3**.

2.3 Exploratory Test Pits

Twelve test pits will be installed in and around all flagged anomalies to allow for visual characterization of site conditions and collection of soil "grab" samples from locations requested by the NYSDEC project manager. Each test pit will be approximately 2 feet wide by 10 feet long by 6 feet deep. Soil removed for the excavation of the test pits will remain on-site, placed on plastic sheeting as directed by the NYSDEC and utilized as backfill. Soils will be stored at appropriate distances from the excavation to maintain compliance with slope stability and the Shaw Health and Safety Plan (HASP). At no time will Shaw or NYSDEC personnel enter any test pit unless all requirements of the HASP have been followed and it has been determined that the activity is necessary.

Head space readings will be collected on each sample using a Photo-Ionization Detector (PID) or HNμ and placed in a sample jar or "zip-lock" bag. These head space results will be used to preliminarily characterize soil impacts to determine if laboratory analyses of the soils are warranted. There will be two samples, one surface and one sub-surface, collected for each test pit, totaling twenty-four samples. All samples collected from each test pit will be forwarded to an approved Environmental Laboratories Approval Program (ELAP)-certified laboratory in accordance with NYSDEC Analytical Services Protocol. The samples will be analyzed for volatile organic compounds via USEPA Method 8260B, Semivolatile organic compounds via USEPA Method 8270C, metals via USEPA Method 6010B/7470/7471/9010B and pesticides/herbicides/PCB's via USEPA Methods 8081A/8082.

The test pit will be backfilled in lifts with the excavated soils as approved by the NYSDEC project manager after the soils in each test pit have been characterized and sampled. The test pits will be compacted using the excavator bucket or "tracked in" by the excavator.

2.4 Underground Storage Tank Removal

Shaw will retain the services of a qualified subcontractor to clean, purge and remove the 20,000 gallon underground storage tank. The subcontractor will also manage soils, backfill and compact the excavation under the supervision of a Shaw site superintendent and NYSDEC project manager.

2.4.1 Tank Cleaning, Purging and Removal

The tank removal contractor will be responsible for the decontamination, cleaning, purging and excavation of the UST. The contractor will be responsible for the health and safety issues associated with the closure of this tank.

The underground storage tank will be removed from the excavation, visible soils scrapped and removed from the exterior and transported for off-site disposal at a licensed disposal facility. A disposal certificate will be provided to Shaw and the NYSDEC by the removal contractor.

2.4.2 Soils Management

Impacted soils surrounding the underground storage tank will be excavated and transported for off-site disposal at the direction of the NYSDEC project manager. Soils will be transported to a licensed and permitted disposal facility by the tank removal contractor. Receipts and manifests documenting the disposal of the soils and UST will be included in the final report submitted to the NYSDEC.

2.4.3 Backfill and Compaction

Bank run gravel or similar material will be used to backfill the excavation. This material will be compacted with an excavator bucket to surface grade. The contractor will provide certification of the source of the material and that the material is considered “clean fill”.

2.5 Direct Push Soil Borings

Eight soil borings will be installed at locations across the site. The proposed locations will be determined in consultation with the NYSDEC project manager. These borings will be located based upon the results of the test pits, geophysical survey and previous investigations completed at this site. Soil borings will be completed as temporary monitoring wells as detailed in **Section 2.6**.

2.5.1 Soil Sampling

A clean sampling probe will be driven into the ground using direct-push techniques. Subsurface soils are continuously extracted, screened, and classified to identify soil types, assess potential impacts and collect representative soil samples from selected depths. Samples will be screened using field instruments (HNμ or PID) and secured for laboratory analysis based upon the following parameters:

1. Intervals that exhibit visual signs of contamination;
2. Soil intervals that exhibit the highest response on the field screening device;
3. The interval above the water table interface (assuming none of the above conditions trigger the need for sample collection);
4. A combination of all of the above as directed by the NYSDEC.

One sample will be secured for laboratory analysis as detailed in **Section 2.5.2**. All soil borings will be classified and logged according to the Unified Soil Classification System. Information including the field description of soil quality conditions, classification, sampling interval, HNμ/PID reading, and other field observations will be recorded on a soil boring log form.

A field blank, duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples will also be collected. All sample bottles will labeled, handled and packaged in a cooler set at 4°C or colder and shipped to the laboratory within 24 hours of collection.

2.5.2 Soil Analysis

Soil samples secured for laboratory analysis will be sent to an approved New York State Department of Health (NYSDOH) ELAP-certified laboratory for analysis of volatile organic compounds via USEPA Method 8260B, Semivolatile organic compounds via USEPA Method 8270C, metals via USEPA Method 6010B/7470/7471/9010B and pesticides/herbicides/PCB's via USEPA Methods 8081A/8082.

Soil boring samples will be labeled as follows:

Example: SB-09 (18-20')
SB = Soil Boring
09 = Boring Identification
(18-20') = Sample Interval in feet below ground surface

Soils generated during the advancement of the direct push bit will be used to backfill the boring (assuming the point is not required to remain open for additional sampling exercises). Soils exhibiting "gross" contamination (i.e. staining, separate-phase product, visual, olfactory, evidence of impact or high HNμ/PID screening) will not be placed back into the boring but will be staged onsite until an appropriate disposal procedure has been approved by the NYSDEC. Bentonite pellets may be used to backfill the boring if the extracted soils are not acceptable.

2.6 Monitoring Well Installation and Construction

Eight monitoring wells will be constructed within the soil borings. Each well will be 25 feet in depth and completed with a 10 foot screen interval. The screens will be made of 2-inch diameter Schedule-40 Polyvinyl Chloride (PVC) 0.010-slots. The annular space will be backfilled with sand to approximately 2 feet above the screen interval and a bentonite seal will be placed from the top of the sand to the ground surface to complete the monitoring well.

All wells will originally be completed as temporary "stick ups" with no concrete aprons. It is anticipated that some points may be removed, closed and/or completed as "flush mount" points once analytical results have been reviewed. This will be determined in consultation with the NYSDEC project manager.

2.6.1 Well Development

All monitoring wells will be developed by the drilling subcontractor and/or Shaw personnel. The wells will be developed to remove any drilling fluids or sediment that may have entered the well during installation and to "settle" the filter pack.

Monitoring wells will be developed using surging and/or pumping techniques. Well development will be considered complete when either 10 well volumes have been removed, the well has been purged "dry", or field readings of temperature, conductivity, and pH have stabilized and a turbidity of less than 50 nephelometric turbidity units (NTU) has been achieved. Development water will be discharged to the ground surface, away from the well, or containerized if separate-phase product, odor or similar field issues are encountered.

The wells will be allowed to stabilize for at least 2 weeks following the development and prior to collecting samples.

2.6.2 Monitoring Well Closure and Abandonment

If it has been determined necessary to close a temporary monitoring well, the PVC casing will be removed and the boring may be backfilled with soil or bentonite and marked with a stake/flag or similar device as directed by the NYSDEC. The location will be labeled and identified on the site map so that it can be located at a later date. Borings installed in paved or concrete areas will be backfilled and refinished at the ground surface with concrete or asphalt cold patch.

2.7 Groundwater Monitoring and Sampling

2.7.1 Groundwater Purging

The monitoring wells will be purged prior to sampling. "Low-flow" purging techniques will be used in order to minimize purge water volume and groundwater samples will be collected using "low-flow" sampling procedures unless insufficient well volume exists or directed otherwise by the NYSDEC project manager. First, a PID reading will be recorded from the well head along with the measurement of the static water level and the total well depth. Sufficient well water volume will be removed, using a peristaltic pump with dedicated polyethylene tubing from each well such that field parameters stabilize as detailed below:

- Consecutive pH readings are ±0.2 pH units of each other
- Consecutive water temperatures are ±0.5°C of each other
- Consecutive measured specific conductance is ±10 percent of each other.

Field readings will be recorded in a log book or field sheet.

Depending upon site hydrogeologic conditions, flow rates of the water from the wells using the peristaltic pump could range from 0.1 liters per minute to 0.5 liters per minute. If the well goes "dry" before the required volumes are removed, the well may be sampled when it recovers 80% of the initial static volume. If these parameters are not met the NYSDEC will be contacted to determine the appropriate actions(s).

Purge water will be discharged to the ground surface away from the well unless otherwise noted by the NYSDEC. If non-aqueous phase liquid or an odor is observed, the purge water will be containerized, handled, and disposed of as detailed in Section 2.12 of the Shaw Environmental and Infrastructure of New York, P.C. Field Activities Plan (FAP) **Appendix A**)).

Groundwater samples will be collected once the groundwater parameters have stabilized, or the well goes "dry" and then recovers 80% of its initial static volume. The first samples to be taken from each well will be the VOCs, followed by SVOC samples using the appropriate sample bottles provided by the laboratory. The remaining samples will be collected as well as a field blank, duplicate and matrix spike/matrix spike duplicates (MS/MSD). All sample bottles will labeled, handled and packaged in a cooler set at 4°C or colder and shipped to the laboratory within 24 hours of collection. All non-dedicated sampling equipment will be decontaminated as detailed in **Section 2.8**.

2.7.2 Groundwater Analysis

Groundwater samples secured for laboratory analysis will be sent to an approved NYSDOH ELAP-certified laboratory for volatile organic compounds via USEPA Method 8260B, Semivolatile organic compounds via USEPA Method 8270C, metals via USEPA Method 6010B/7470/7471/9010B and pesticides/herbicides/PCB's via USEPA Methods 8081A/8082.

Groundwater samples will be labeled as follows:

Example: MW-02
MW = Monitoring Well
02 = Monitoring Well Number

2.8 Decontamination

All non-dedicated or non-disposable equipment that may come in contact with the samples, interior of a borehole or well, or other equipment that has entered the borehole or well (including such items as the drill rods, bits, miscellaneous sampling equipment, and tools) will be thoroughly cleaned using an alconox solution and potable water rinse prior to reuse as detailed in the FAP. Additional cleaning of the equipment may be necessary under some circumstances. Decontamination fluids will be discharged to the ground surface unless a visible sheen is noted or an odor is detected, at which time the decontamination water will be containerized and staged for proper disposal as outlined in section 2.12 of the FAP (**Appendix A**).

2.9 Surveying

A detailed topographic base map of the site, pertinent site features and immediate area (such as property boundaries) will be developed by a licensed New York State surveyor. All relevant features of the site and adjacent areas will be plotted. The survey will include all soil boring,

monitoring well, former UST pit and test pit locations. The site map will also include site-specific features associated with the assessment activities and potential areas of concern to the NYSDEC. Contours will be plotted at 1-5 foot intervals and the elevations of all monitoring wells will be established within +/- 0.01 foot based on the National Geodetic Vertical Datum.

The site tax number will also be identified. The tax maps will be reviewed and the property lines of the parcels will be plotted on the base map.

3.0 Summary Reporting

The results of site investigative activities will be summarized in a report provided to the NYSDEC. This summary report will discuss all site investigative activities, analytical data, site observations and related field activities. Recommendations specific to site conditions will be included in this report. Pertinent field notes, well development logs, soil, test pit and monitoring well logs, photographs and analytical data will be included as appendices to this report.

4.0 Schedule

Field work will commence within 90 days of submission of the Draft Work Plan to the NYSDEC. Upon approval of the work plan by the NYSDEC, Shaw will schedule the field work with the approved direct push subcontractor and coordinate activities with the NYSDEC project manager. The following schedule is proposed:

- Utilities will be cleared at least one week prior to the initiation of site assessment activities;
- The Geophysical survey will require 3 days;
- Test pits will be completed in 4 days;
- The removal of the UST is anticipated to take 3 days;
- Shaw will work with the direct push subcontractor to coordinate the contractor's schedule to minimize the impact to site operations and expedite the sampling effort. It is anticipated that the actual field efforts can be completed in five (5) 10-hour days. The work start time will be determined by the Shaw site supervisor and may vary depending upon weather, site conditions and the NYSDEC schedule;
- Monitoring well purging and sampling will be completed in three (3) 10-hour business days;
- Analytical results will be received from the ELAP-approved laboratory in a Category B deliverable format within 28 days of sample receipt;
- All samples collected during the site investigation will be submitted to an approved third party validator. The validator will provide a data validation/usability report within 30 days of receipt of analytical results;
- The results of these investigative activities will be included in a draft summary report discussing all analytical data and field investigative activities. The report will include tabulated data, figures, boring logs and site maps. Three copies of the draft report will be submitted to the NYSDEC for review and comment within 90 days after completion of field work; and
- Shaw will revise the draft letter according to the comments provided by the NYSDEC. The final report will be submitted in both hard copy and electronic format. In addition an electronic data deliverable (EDD) will be submitted along with the report for use by the NYSDEC. The report and EDD will be provided to the NYSDEC and NYSDOH within 30 days after receipt of comments.

A site-specific project schedule with dates and milestones will be provided to the NYSDEC as requested.

FIGURES

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
ALBANY, NY	04/09/09	K. HRACS	S. SHKOLNIK			134685A1

NOT TO SCALE

REFERENCE:
MAP FROM www.google.com

Shaw Environmental, Inc.

NYSDEC

FIGURE 1

SITE LOCATION MAP
FORMER FORD MANUFACTURING MILL
127 SECOND STREET
VILLAGE OF WATERFORD, NEW YORK

L:\project\134685\FORD MILL\134685A1.dwg
Plot Date/Time: 04/09/09 11:02am Xref: .
Plotted by: Samuil.Shkolnik Image: 134685

APPENDIX A

SHAW ENVIRONMENTAL AND INFRASTRUCTURE ENGINEERING OF NEW YORK, P.C.

FIELD ACTIVITES PLAN (FAP)

Shaw Environmental & Infrastructure Engineering of New York, P.C.

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FIELD ACTIVITIES PLAN
Contract Number D006132

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December 2008

Reviewed/Approved By:

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Senior Project Manager

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1.0 Introduction

Shaw Environmental and Infrastructure of New York, P.C. (Shaw) has prepared this Field Activities Plan (FAP) to outline the typical field activities that Shaw personnel may be asked to complete as part of work assignments issued by the New York State Department of Environmental Conservation (NYSDEC) under Superfund Standby Contract No. D006132.

The elements of this FAP have been prepared in accordance with the most recent and applicable guidelines and requirements of the NYSDEC and the New York State Department of Health (NYSDOH) and Shaw Standard Operating Procedures (SOP). We understand that site specific work plans will be developed for each Work Assignment as directed by the NYSDEC project manager. Every effort will me made to rely upon the work elements discussed herein to expedite the approval process and minimize costs to the Department.

2.0 Anticipated Field Activities

The primary field work assignments anticipated to be completed under this term contract include the assessment and evaluation of soil, groundwater and air quality conditions to evaluate the potential impact to human health and the environment and determine whether remedial activities are required at each site. Shaw anticipates that the following field tasks will be completed during site investigative phases of this contract. The work elements have been taken from the final contract and example work plans provided by the NYSDEC.

2.1 Direct-Push Soil Borings

Direct-push borings are used to continuously collect subsurface soil samples from each soil boring. These boring are commonly used to classify shallow overburden soils, collect soil samples, quickly and cost effectively delineate potential impacts and facilitate the installation of temporary monitoring wells, piezometers and/or soil vapor points.

A clean sampling probe is driven into the ground using vibratory techniques. Subsurface soils are continuously extracted, screened, and classified to identify soil types, assess potential impacts (both visually and through the use of field instruments) and collect representative soil samples from selected depth intervals. The selection of subsurface soils for laboratory analysis will be made in consultation with a NYSDEC project manager and or clearly determined in site specific work plans.

Typically, samples are secured for laboratory analysis based upon the following parameters:

1. Intervals that exhibit visual signs of contamination;
2. Soil intervals that exhibit the highest response on the field screening device;
3. The interval above the water table interface (assuming none of the above conditions trigger the need for sample collection);
4. A combination of all of the above as directed by the NYSDEC project or field manager.

All soil borings will be classified and logged according to the Unified Soil Classification System. Information including the field description of soil quality conditions, classification, sampling

interval, PID reading, and other field observations will be recorded on a soil boring log form or field notebook. An example of the typical soil boring log is provided in **Appendix A**.

Soil samples secured for laboratory analysis will be sent to an approved NYSDOH Laboratories Approval Program (ELAP)-certified laboratory for analytical analysis using the U.S. Environmental Protection Agency (USEPA) methods specified by the approved work assignment. Samples will be managed in accordance with Section 2.0 of Shaw's Quality Assurance Project Plan (QAPP).

Soils extracted during the advancement of the direct push bit will be used to back fill the boring (assuming temporary monitoring points are not completed or the point is required to remain open for additional sampling exercises). Soils exhibiting "gross contamination" (i.e. staining, separate-phase product, visual, olfactory, evidence of impact or high PID screening) will not be placed back into the boring, but will be managed in accordance with the Waste Storage practices proposed in **Section 2.12** of this document, after consultation with and approvals by the NYSDEC project manager. Bentonite pellets may be used to backfill the boring if the extracted soils are not acceptable.

2.2 Monitoring Well Installation and Construction

Monitoring wells will be installed and constructed to define geologic and hydrogeologic characteristics of a project site. The ultimate goal in the installation of these wells is to accurately characterize groundwater quality conditions, delineate any contaminant plume(s) that may exist at the site and determine the potential for offsite migration of any groundwater contaminants. Monitoring wells will be installed at locations determined in consultation with the NYSDEC project manager. These locations will be based upon experience, anticipated regional or site specific groundwater conditions, existing information gathered during previous site investigative activities, knowledge of the existing contaminate distribution or impacts, historical data and other information provided by the NYSDEC.

2.2.1 Types of Monitoring Wells

Permanent or temporary monitoring wells will be installed depending upon site-specific conditions and the request of the NYSDEC project manager. Permanent wells would be proposed at locations requiring long term monitoring; temporary wells would be installed at locations requiring cursory or short term monitoring. Completed well depth will be dependent

upon groundwater monitoring objectives, anticipated site specific conditions, contaminant behavior and site geology.

All monitoring wells will be designated as "MW-#". Shallow, intermediate, or deep depth wells will be identified with an "S", "I", or "D" that is immediately preceded by the well number (e.g., "MW-#I").

Shallow monitoring wells will be installed to assess the uppermost water bearing zone and or "perched aquifers" that are of concern to the NYSDEC. Intermediate and deep monitoring wells will be installed in consultation with the NYSDEC; these wells will typically be used to evaluate vertical hydraulic gradient and contaminant distribution within complex geologic formations or to assess regional water bearing zones of particular concern or interest. The monitoring wells will be installed by a licensed and qualified well drilling contractor and supervised and documented by a field geologist according to the procedures described in Sections 2.2.2 and 2.2.3.

2.2.2 Temporary Monitoring Well Construction

Temporary monitoring wells will be installed using direct-push techniques to the appropriate depth, assuming that the site conditions are amenable to direct-push methodology. The applicability of this technique to site conditions will be discussed with the NYSDEC project manager prior to implementation.

The temporary wells will be completed using 1-inch diameter Schedule 40 PVC 0.010-slot screen and an appropriate length of Schedule 40 PVC riser to the ground surface. The slot screen size may be changed based upon site specific geologic conditions. The screened interval will be installed at depths to capture groundwater from the predetermined zone. The riser will extend above ground surface unless directed otherwise by the project manager. The annular space will be backfilled with sand to approximately 2 feet above the screen interval and a bentonite seal will be placed from the top of the sand to the ground surface to complete the temporary monitoring well. No casing or similar steel protective device will be installed around the temporary points unless directed by the NYSDEC Project Manager.

When it has been determined that it is necessary to "close" a temporary monitoring well, the PVC casing will be removed from the ground and the boring may be backfilled with drill

cuttings or bentonite and marked with a stake/flag or similar device as directed by the NYSDEC. The location will be labeled and identified on the site map so that it can be located at a later date. Borings installed in paved or concrete areas will be backfilled and refinished at the ground surface with concrete or asphalt cold patch.

2.3 Permanent Monitoring Well Construction

Permanent monitoring wells will likely be installed in two types of materials: overburden or bedrock. The following sections detail the installation procedures for each type of monitoring well.

2.3.1 Overburden Wells

Overburden monitoring wells will typically be installed using hollow-stem augering techniques. A 4-1/4 inch (ID) hollow-stem auger will typically be employed to install 2-inch diameter wells while a 6-1/4 inch (ID) hollow-stem auger will be used to install 4-inch diameter wells. Split spoon samplers will be used to secure samples for classification and laboratory analysis at intervals determined by field screening or other means. Boreholes will typically extend at least 5 feet into the groundwater table or to a depth directed by the NYSDEC. Monitoring wells will be constructed with a ten foot section of proper slot sized well screen (as determined by site conditions) and the appropriate length of schedule 40 PVC flush-joint casing to ground surface. Alternative well materials (i.e. stainless steel or similar) may be employed as directed by the NYSDEC. The annular space between the boring wall and the PVC riser will be backfilled with appropriate size Morie Sand or equivalent. The sandpack will be extended at least 2 feet above the screened interval and at least two feet of bentonite chips will be placed above the sandpack and hydrated. The remaining annular space will be backfilled with drill cuttings and/or a cement/bentonite grout mixture as directed by the NYSDEC project manager.

Monitoring wells will be completed at the ground surface (as flushmounts) or will extend approximately 3 feet above the ground surface. If the wells are extended above ground surface a steel protective casing (and possibly bollards) will be used to adequately protect the well depending upon well location and/or direction from the NYSDEC representative. Each well will have a cap and a locking cover. A concrete pad will be installed around each well casing and a weep hole will be drilled in the protective casing to allow any water between the inner and outer casing to drain.

Alternative drilling methods will be discussed and addressed, as needed, in site specific work plans.

2.3.2 Bedrock Monitoring Wells

Bedrock monitoring wells will be installed using a combination of hollow-stem augering and rock coring/air rotary drilling. Borings will be advanced through the overburden material using 6-1/4 inch inside diameter (I.D.) hollow-stem augers or similar equipment dictated by site conditions. Split spoon samplers will be used to collect soil samples from the overburden material if warranted.

Once bedrock is encountered, a 6- inch "rock socket" will be installed into the competent rock, assuming that rock cores are not to be collected. If rock cores are to be collected, the bedrock will be NX or HQ cored to a site-specific depth below ground surface.

Monitoring wells will be constructed with at least a ten foot section of appropriate slot size well screen and schedule 40 PVC flush-joint casing to ground surface. The length and slot size of the well screen will be determined by site specific geologic conditions and the zones from which samples will be taken.

The annular space between the boring wall and the PVC riser pipe will be backfilled with the appropriately sized Morie Sand or similar materials to at least 2 feet above the top of the screened interval. A two foot layer of bentonite chips will be placed on top of the sandpack and hydrated. The remaining annular space will be backfilled with a cement/bentonite grout mixture and/or drill cuttings to the ground surface.

Monitoring wells will be completed at the ground surface (as flushmounts) or will extend approximately 3 feet above the ground surface. If the wells are extended above ground surface a steel protective casing and possibly bollards will be used to adequately protect the well depending upon well location and/or direction from the NYSDEC representative. Each well will have a cap and a locking cover. A concrete pad will be installed around each well casing and a weep hole will be drilled in the protective casing to allow any water between the inner and outer casing to drain.

2.4 Monitoring Well Development

All monitoring wells will be developed by the drilling subcontractor and/or Shaw personnel. The wells will be developed to remove any drilling fluids or sediment that may have entered the well during installation and to "settle" the filter pack. For best results, monitoring wells should be developed no sooner than 48-hours following installation, assuming that schedule and budget allows.

Monitoring wells will be developed using surging and/or pumping techniques. Well development will be considered complete when either 10 well volumes have been removed, the well has been purged "dry", or field readings of temperature, conductivity, and pH have stabilized and a turbidity of less than 50 nephelometric turbidity units (NTU) has been achieved (whichever comes first). Development water will be discharged to the ground surface, away from the well, or containerized if separate-phase product, odor or similar field issues are encountered. If the development water is containerized, it will be handled and disposed off in accordance with **Section 2.12**.

The wells will be allowed to stabilize for at least 2 weeks after development prior to collecting samples for analysis as dictated by groundwater recharge, project schedule or NYSDEC requests.

2.5 Groundwater Monitoring and Sampling

2.5.1 Groundwater Monitoring and Sampling Procedures

Prior to sampling, groundwater monitoring wells will be purged unless insufficient well volume exists or directed otherwise by the NYSDEC project manager. The wells will be purged as discussed in **Section 2.5.3**.

Field sampling procedures will include the collection of water level measurements, purging of static water within the wells, collection of field groundwater chemistry measurements, and sample collection at each monitoring well location. A copy of the field purging and sampling log form used to record well volumes, field water quality measurements, and sampling flow rates is included in **Appendix A**.

Water levels will be measured in all site monitoring wells prior to purging or sampling. All water level measurements will be collected using an oil/water interface probe to allow for the

measurement of product thickness (if any) in the groundwater monitoring wells. This information will eventually be used to prepare a groundwater contour map and evaluate groundwater flow patterns at the site.

Groundwater samples will be analyzed by USEPA methods in accordance with the NYSDEC Analytical Services Protocol (ASP) during sampling events. Samples will be handled, managed and labeled as detailed in Shaw's December, 2008 Quality Assurance/Quality Control Plan for this contract.

2.5.2 Groundwater Sampling-Temporary Monitoring Wells

Temporary monitoring wells may or may not be purged prior to sampling as directed by the NYSDEC. If the wells will be purged, the purging will be completed in accordance with **Section 2.5.3** below. Groundwater samples will be collected from temporary monitoring wells using a disposable bailer or a peristaltic pump with clean, dedicated polyethylene tubing. The groundwater sample will be collected using the procedures outlined **Section 2.5.3.3.**

2.5.3 Groundwater Purging and Sampling – Permanent Monitoring Wells

2.5.3.1 Field Analytical, Purging and Sampling Equipment

Field equipment that will typically be used at the site will include submersible pumps, peristaltic pumps, and /or disposable polyethylene bailers; electronic oil/water interface probe (IP) with an accuracy of +/-0.01 feet, and a multiparameter water quality meter (which includes probes for measurement of pH, turbidity, dissolved oxygen, temperature, and conductivity). Additionally, a PID instrument (mini RAE or similar) will be used to measure the potential for VOC's within the well head as required by the site-specific Health and Safety Plan (HASP). Each piece of equipment will be checked and calibrated as outlined in the QAPP. Prior to each use, field analytical equipment probe(s) will be decontaminated.

2.5.3.2 Purging and Sampling Procedures

Groundwater samples will be collected from each well a minimum of 2 weeks following monitoring well installation and development. The following procedures will be used for monitoring well groundwater sampling:

- Wear appropriate personal protective equipment as specified in the site-specific Health and Safety Plan (HASP) and the HASP Addendum.
- Unlock and remove the well cap.
- Obtain PID readings at the well head and record them in the field logbook.
- Measure the static water level in the well with an IP. The IP must be washed with Alconox detergent and water, then triple rinsed with deionized water between individual wells to prevent cross-examination.
- Calculate the volume of water in the well using the measurements shown on field visit forms (**Appendix A**). Well volume must be documented on the same forms.
- Place polyethylene sheeting near the well casing (but out of walk ways to avoid slip, trip and fall hazards) to prevent contact of sampling equipment with the ground in the event sampling equipment is dropped.
- Purge the well using one of the methods described below. Purged water must be managed separately from decontamination fluids unless otherwise directed by the NYSDEC.
  - Purge 3-5 well volumes with a dedicated, disposable polyethylene bailer.
  - Purge 3-5 well volumes with a centrifugal or a submersible pump using new dedicated polyethylene tubing in each well.
  - Use "low-flow" purging techniques to minimize purge water volume. Remove sufficient well volume such that field parameters stabilize as detailed below.
- Allow field parameters (i.e. pH, dissolved oxygen, specific conductivity, and temperature) to stabilize before collecting groundwater samples. Purging will be considered "complete" if the following conditions are met:
  - Consecutive pH readings are ±0.2 pH units of each other
  - Consecutive water temperatures are ±0.5°C of each other
  - Consecutive measured specific conductance is ±10 percent of each other.

If the well goes "dry" before the required volumes are removed, the well may be sampled when it recovers 80% of the initial static volume.

If these parameters are not met after purging a volume equal to 3-5 times standing water volume in the well, the NYSDEC and Shaw Project Manager will be contacted to determine the appropriate action(s).

- Obtain sample from well with a bailer suspended on new, clean nylon twine or using low flow sampling techniques using care to not agitate the sample. Dedicated bailers or polyethylene tubing must be used in each well.
- Collect VOC sample first followed by semi-volatile organic sample. Carefully pour directly into the appropriate sample bottles. Sample bottles must be obtained from the laboratory.
- Place analytical samples in cooler and chill to at least 4°C. Samples must be shipped or delivered to the analytical laboratories within 24 hours of collection.
- Decontaminate any sample pumps between each well following the procedure in Section 2.9; the polyethylene tubing and twine must be properly discarded.
- Re-lock well cap.
- Complete field logbook, sample sheet, custody seals, and pertinent chain-of-custody forms.

Groundwater samples will be placed in appropriate sample containers, sealed, and submitted to the laboratory for analysis. The samples will be labeled, handled, and packaged following the procedures described in the approved Quality Assurance Project Plan (QAPP). Quality assurance/quality control samples will be collected at the frequency detailed in the site-specific QAPP and workplans. Groundwater samples will be analyzed by an approved ELAP-certified laboratory in accordance with NYSDEC Analytical Services Protocol.

Purge water will be discharged to the ground surface away from the well unless otherwise directed by the NYSDEC. If non-aqueous phase liquid or an odor is observed, or if directed by NYSDEC, the purge water must be containerized, handled, and disposed of as detailed in **Section 2.12**.

2.6 Groundwater Sampling Using Low Flow Sampling Technique

Low flow purging/sampling is a method of collecting groundwater samples from a monitoring well that does not require the removal of large volumes of water and therefore does not overly agitate the water column and suspended solids or potentially volatize VOCs present in the water during evacuation. This method removes water directly from the monitoring well's screen interval without disturbing any stagnant water above the screen by pumping the groundwater at a low enough flow rate to maintain minimal drawdown of the water column. Typically flow rates for this method range from 0.1 liters/minute (L/min) to 0.5 L/min depending on site hydrogeologic conditions.

2.6.1 Low Flow Purging/Sampling Equipment

Monitoring wells will be purged and sampled using the following equipment:

- A peristaltic pump with dedicated polyethylene tubing for each individual monitoring well;
- Electronic oil/water interface probe with an accuracy of +/-0.01 ft;
- PID instrument (MiniRAE or similar) to monitor vapor concentrations within the well prior to and during purging and sampling as required by the site-specific Health and Safety Plan (HASP);
- A graduated cylinder (unit of measure = Liters) or similar measuring device;
- A multi-parameter meter to measure pH, turbidity, dissolved oxygen, temperature, and conductivity of the purged groundwater; and
- Associated field forms (**Appendix A**).

Field equipment to be used at the site will be checked and calibrated as outlined in the QAPP prior to each use. In addition all down-hole, non-dedicated sampling equipment will be decontaminated using an Alconox/deionized rinse between each monitoring well location.

2.6.2 Low Flow Purging Procedures

Groundwater samples will be collected from each well a minimum of 2 weeks following monitoring well installation and development. The following procedures will be used for low-flow monitoring well groundwater purging:

- Wear appropriate personal protective equipment as specified in the site-specific Health and Safety Plan (HASP) and the HASP Addendum issued for each work assignment.
- Unlock and remove the well cap.
- Obtain PID readings at the well head and record them in the field logbook or field sampling form.
- Measure both the static water level and the total well depth in the monitoring well with an IP and record them in the field logbook or field form. The IP must be washed with Alconox detergent and water and rinsed with deionized water between individual wells to prevent cross-examination.
- Place polyethylene sheeting near the well casing (but out of walk ways to avoid slip, trip and fall hazards) to prevent contamination of sampling equipment in the event sampling equipment is dropped.

- Slowly lower the dedicated polyethlylene tubing down the monitoring well into the screen interval.
- Connect the tubing to the peristaltic pump and begin to purge the well using the lowest flow rate/frequency on the pump control. Adjust the flow rate to ensure a rate of between 0.1 to 0.5 L/min. Purge water must be managed separately from decontamination fluids unless otherwise directed by the NYSDEC.
- Direct the purge water thru the multi-parameter meter and allow field parameters (i.e. pH, dissolved oxygen, specific conductivity, and temperature) to stabilize before collecting groundwater samples. Purging will be considered "complete" if the following conditions are met:

  - Consecutive pH readings are ±0.2 pH units of each other
  - Consecutive water temperatures are ±0.5°C of each other
  - Consecutive measured specific conductance is ±10 percent of each other.

If the well goes dry before the required purge volumes are removed, the well may be sampled when it recovers 80% of its initial static volume.

If these parameters are not met the NYSDEC and Shaw Project Manager will be contacted to determine the appropriate action(s).

Purge water will be discharged to the ground surface away from the well unless otherwise directed by the NYSDEC. If non-aqueous phase liquid or an odor is observed, or if directed by NYSDEC, the purge water must be containerized, handled, and disposed of as detailed in **Section 2.12**.

2.6.3 Low Flow Sampling Procedures

Once the groundwater parameters have stabilized (or the well goes "dry" and recovers 80% of its initial static volume) the following procedures should be completed for sample collection:

- Retrieve the sample bottles required for sample analysis.
- Don a pair of clean nitrile gloves.
- Remove the pump effluent tubing from the multi-parameter meter and prepare for sample collection.

- Collect VOC sample first followed by semi-volatile organic sample. Carefully pour directly into the appropriate sample bottles. Sample bottles must be obtained from the laboratory.
- Place analytical samples in cooler and chill to at least 4°C. Samples must be shipped or delivered to the analytical laboratories within 24 hours of collection.
- Any sample pumps must be decontaminated between each well following the procedure in Section 2.9; the polyethylene tubing and twine must be properly discarded.
- Re-lock well cap.
- Complete field logbook, sample sheet, custody seals, and pertinent chain-of-custody forms.

Groundwater samples will be placed in appropriate sample containers, sealed, and submitted to the laboratory for analysis. The samples will be labeled, handled, and packaged following the procedures described in the approved Quality Assurance Project Plan (QAPP). Quality assurance/quality control samples will be collected at the frequency detailed in the site-specific QAPP and workplans. Groundwater samples will be analyzed by an approved ELAP-certified laboratory in accordance with NYSDEC Analytical Services Protocol.

2.7 Exploratory Test Pits

Test pits will be excavated at locations outlined in the Work Plan. Test pits will allow for visual characterization of site conditions and collection of soil "grab" samples. These locations will be determined based upon site conditions and historic site usage. At no time will Shaw or NYSDEC personnel enter any test pit unless all requirements of the HASP have been followed and it has been determined that this activity is necessary.

Excavated soil will remain on site, placed on plastic sheeting (as appropriate) and utilized to backfill the test pits. Soils must be stored at appropriate distances from the excavation to maintain compliance with slope stability and HASP.

Prior to soil sampling, head space readings will be collected on each sample using a PID and soil placed in a sample jar or zip lock bag. These head space results will be used to preliminarily characterize soil impacts to determine if laboratory analyses of the soils are warranted. All samples collected from each test pit will be forwarded to an approved ELAP-certified laboratory

in accordance with NYSDEC Analytical Services Protocol. All samples will be labeled, handled, and packaged following the procedures described in the QAPP. Quality assurance/quality control samples will be collected at the frequency detailed in the Generic QAPP and the site-specific project Work Plan.

After the soils in each test pit have been characterized and sampled, the test pit will be backfilled with the excavated soils. Test pits will be backfilled in lifts and compacted with the bucket of the excavator/backhoe.

2.8 Surface Water Sampling

Following identification and photographing of the surface water sampling locations, field personnel will collect the sample using a sample container, clean dipper, beaker, or pond sampler. The number of samples to be collected will be specified in the work plan.

The approximate location of the sample will be photographed, as appropriate, and noted in the field logbook. Field measurement of pH, dissolved oxygen, temperature, and specific conductivity will be obtained and recorded in the field logbook as requested by the NYSDEC. The field sampling crew will record visual observations (sample color, any unusual characteristics [odor, staining, etc.]) in the field notebook and/or the field sampling form. All equipment used in sample collection will be decontaminated between locations to prevent cross-contamination.

Surface water samples will be placed in appropriate containers, sealed, and submitted to an approved ELAP-certified laboratory in accordance with NYSDEC Analytical Services Protocol.

The samples will be labeled, handled, and packaged following the procedures described in the QAPP. Quality assurance/quality control samples will be collected at the frequency detailed in the QAPP and/or the site-specific project Work Plan.

2.9 Sediment Sampling

Proposed sampling locations will be photographed, noted on a site map and flagged to facilitate their location at a later date.

Surficial (0-6 in.) sediment samples will be collected using a clean, stainless steel coring device, a stainless steel hand auger, or a stainless steel scoop as appropriate for the sediment conditions. Dedicated sampling equipment will be used (when possible) to prevent cross-contamination and to minimize decontamination requirements.

Samples will be placed into a clean stainless steel bowl or directly into the sampling jar as directed by the NYSDEC.

The sampler will examine the sediment samples and record visual observations (sample color, texture, any unusual characteristics [odor, staining, etc.]) in the field notebook and on the field record of sediment sampling. The sampling tools and field instruments will be decontaminated between locations to prevent cross-contamination.

Sediment samples will be analyzed by an approved ELAP-certified laboratory in accordance with NYSDEC Analytical Services Protocol. All samples collected will be labeled, handled, and packaged following the procedures described in the QAPP. Quality assurance/quality control samples will be collected at the frequency detailed in the QAPP and the site-specific project Work Plan.

2.10 Soil Vapor Point Installation and Sampling

Soil vapor points may be required to assess soil vapor impacts with the vadose zone. This sampling will be completed pursuant to the October 2006 *NYSDOH Guidance Document for Evaluating Soil Vapor Intrusion in the State of New York.*

2.10.1 Soil Vapor Point Installation

All soil vapor points will be flagged and labeled with the relevant sample location identification. Each pin flag will include sample identification information that can be used by NYSDEC staff during a subsequent site survey. Sample locations will be photographed and marked on a site map.

Soil vapor points will be installed using a direct-push device to install stainless steel drive points to a specified depth. Once the sampling depth is reached, the drive point rods will be retracted, leaving the drive point at the base of the interval. The 6-inch stainless steel sampling screen will

be fitted with a dedicated section of 0.25-inch diameter Teflon or Teflon-lined tubing (laboratory or food grade) to collect the soil vapor samples.

The borehole will then be backfilled with sand/glass beads to a minimum of 6 inch above the screened interval. Granular bentonite pellets will be placed from approximately 6 inches above the screened interval to the ground surface hydrating concurrently with placement. Sufficient time (at least 24 hours) will then be provided to allow the bentonite to "cure". Soil cuttings will be used to backfill the points unless a visible sheen or odor is evident, in which case the cuttings will be drummed and disposed of in accordance with **Section 2.16**.

2.10.2 Soil Vapor Point Sampling

Soil vapor samples will be collected as detailed below:

- Samples will not be collected until at least 24 hours after the temporary soil vapor points have been installed; 2-3 implant volumes (i.e., the volume of the sample probe and tube) will be purged prior to collecting the samples to ensure that representative samples are collected.
- Flow rates for both purging and sample collection will not exceed 0.2 liters per minute.
- Samples will be collected using conventional sampling methods and appropriate containers (ie., low flow rate; Summa® canisters, which are certified clean by the laboratory, using an appropriate USEPA Method). The sample duration for these samples will be specified by the work plan and could range up to 24 hours.
- A tracer gas (e.g., helium, butane, or sulfur hexafluoride) will be used at each location before collecting soil vapor samples to verify that adequate sampling techniques are being implemented (i.e., to verify infiltration of outdoor air is not occurring). Once verified, continued use of the tracer gas may be reconsidered.

The following issues (that may influence interpretation of the results) will be noted to document site conditions during sampling:

- Sample location including the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site), outdoor ambient air sample locations (if applicable), and compass orientation (north).
- Weather conditions (e.g., precipitation, outdoor temperature, barometric pressure, wind speed, and direction) for the past 24-48 hours.

- Any pertinent observations such as odors and readings from field instrumentation.

The field sampling team will maintain a sample log sheet (Appendix A) summarizing the following:

- Sample identification
- Date and time of sample collection
- Sampling depth
- Identity of samplers
- Sampling methods and devices
- Purge volumes
- Volume of soil vapor extracted
- Canister and associated regulator identification
- Helium leak test results
- Vacuum before and after samples collected
- Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone
- Chain-of-custody protocols and records used to track samples.

After the sample collection period, the Summa® Canisters will be sent for laboratory analysis by an approved ELAP-certified laboratory in accordance with NYSDEC Analytical Services Protocol. A minimum reporting limit of 1 microgram per cubic meter (µg/m) will be achieved for all analytes unless otherwise directed by the NYSDEC or NYSDOH.

Upon completion of the sampling, the sample tubing will be removed and the temporary soil vapor point location will be backfilled with soil cuttings and /or bentonite and marked with a stake/flag that will be labeled with the proper sample identification and illustrated on the site map such that it can be located by the site surveyor. Borings installed in paved or concrete areas will be backfilled and finished at the ground surface with concrete or cold patch.

2.11 Indoor Air Monitoring

Indoor air sampling programs will be completed in accordance with the NYSDOH Indoor Air Sampling and Guidance document. The protocol for any indoor air monitoring program will

follow *NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York,* October 2006.

Indoor air sampling and analysis will be performed at locations identified by the NYSDEC and NYSDOH. Notices to participate in the indoor air monitoring program and scheduling of appointments will be completed by and be the responsibility of the NYSDEC and NYSDOH. The NYSDEC Project Manager will provide Shaw with a copy of the correspondence and indoor air sampling schedule.

2.11.1 Indoor Air Sample Collection

An inspection of general site conditions will be performed at each property location as part of the air sampling. The inspection will include the following activities:

- Completion of the NYSDOH Indoor Air Quality Questionnaire and Building Inventory included in Indoor Air Sampling and Analysis Guidance. A sample of the questionnaire will be provided in the site-specific Work Plan and is include in **Appendix A**.
- Documentation of exterior weather conditions and inside temperature.
- Ambient air (indoor and outdoor) screening using field equipment (i.e., parts per billion photoionization detector or similar).
- Selection of air sampling locations in consultation with NYSDEC and NYSDOH personnel.

Air samples will be collected from three locations per structure including the first floor, basement and the sub-slab environment. A section of Teflon or Teflon-lined tubing that is identified as laboratory or food grade will be extended from the Summa® canister to collect the ambient air sample from the breathing zone at approximately 3 to 5 feet above ground surface. Laboratory certified Summa® canisters, regulated for a 24-hour sample collection, will be used to evaluate the indoor air and sub-slab soil vapor conditions unless otherwise directed by the NYSDEC/NYSDOH.

2.11.1.1 Sub-Slab Sample Procedures

The following procedures will be used for all sub-slab sampling:

- Visually assess the condition of the floor. Select an area for sampling that is out of the line of traffic and away from major cracks and other floor penetrations (sumps, pipes, floor drains, etc.) and confirm sampling location with NYSDEC/NYSDOH personnel.
- Drill a hole through the concrete floor slab at the selected location using an electric hammer drill.
- Sweep concrete dust away from the drill hole and wipe the floor with a dampened towel.
- Insert the Teflon-lined polyethylene tubing into the hole drilled in the floor, extending no further than 2 inch below the bottom of the floor slab.
- Pour melted beeswax and/or non-toxic modeling clay around the tubing at the floor penetration, packing it in tightly around the tubing.
- Conduct helium leak detection test to insure that seal is "tight"
- Place a 6-L Summa® canister (provided by an independent laboratory) with a vacuum gauge and flow controller on the floor adjacent to the sample tube. The canister must be "certified clean" in accordance with USEPA Method TO-15 and under a vacuum pressure of no more than -30 in. of mercury in Hg. Flow controllers must be set for a 24-hour collection period unless requested otherwise.
- Record the serial number of the canister and associated regulator on the chain-of-custody (COC) form and field notebook/sample form. Assign sample identification on the canister identification tag and record this on COC and field notebook/sample form. For the property owner's privacy, do not use a sample identifier containing the name of the property owner or the address of the property.
- Record the gauge pressure; the vacuum gauge pressure must read -25 in Hg or less, or the canister cannot be used.
- Record the sample start time on the air sampling form (**Appendix A**) and take a digital photograph of canister setup and surrounding area.

2.11.1.2 Termination of Sample Collection

The following procedures will be used for terminating sample collection:

- Close the canister valve; record the stop time on the sample form.
- Record the final gauge pressure and disconnect the sample tubing and the pressure gauge/flow controller from the canister, if applicable.
- Install the plug on the canister inlet fitting and place the sample container in the original box.
- Complete the sample collection log with the appropriate information, and log each sample on the COC form.

- Remove the temporary subsurface probe and properly seal the hole in the slab with hydraulic cement or similar material. Photograph the repair if possible and retain in project file.

Field quality control samples will include duplicates and trip blanks. Field duplicates will be collected at the rate of 1 duplicate per 20 original samples (20 percent). Field duplicates will be collected by installing an in-line "tee," which will split the flow to 2 canisters set up adjacent to each other and each collecting vapors at identical flow rates. One trip blank will be analyzed and shipped to the laboratory with the final set of sample canisters.

2.11.2 Outdoor Air Sample Collection

Outdoor ambient air samples will be collected in addition to the indoor air samples. Ambient air samples will be collected during the same 24-hour period as the indoor air samples; these samples will presume to be representative of outdoor air conditions for the entire sampling area. The ambient air samples will be collected in a laboratory certified Summa® canister, regulated for a 24-hour sample collection or a duration specified by the NYSDEC/NYSDOH. A section of Teflon or Teflon-lined tubing (laboratory or food grade) will be extended from the Summa® canister to the breathing zone at approximately 3 to 5 feet above ground surface. The influent rate of the outdoor air sample must be less than 0.2 L per minute. Outdoor ambient air samples will be collected at a minimum of one (1) per day during the indoor air monitoring program or as directed by the NYSDEC project manager.

2.11.3 Laboratory Analysis of Air Samples

Air samples will be analyzed by an ELAP-certified laboratory. Detection limits for the analyzed compound list will be defined by the NYSDEC and NYSDOH prior to sample submittal and outlined in the site-specific work plan. For specific parameters identified by NYSDOH, where the selected parameters may have a higher detection limit (e.g., acetone), the higher detection limits will be designated by NYSDOH.

2.12 Storage and Disposal of Waste

Shaw is responsible for the proper storage, handling, and disposal of investigative-derived waste including personal protective equipment (PPE) and solids and liquids generated during the well drilling, well development and sampling activities. All drummed materials will be clearly

labeled as to their contents and origin. All investigative derived waste will be managed in accordance with NYSDEC-DER Technical and Administrative Guidance Memorandum 4032.

Accordingly, handling and disposal will be as follows:

- Liquids generated from contaminated equipment decontamination that exhibit visual staining, sheen, or discernable odors will be collected in drums or other containers at the point of generation. They will be stored in a designated staging area as directed by the NYSDEC. A waste subcontractor will then remove the drums and dispose at an offsite location.
- Liquids generated during well purging or a decontamination activity that does not exhibit visible staining, sheen, or discernable odors will be discharged to an unpaved area on the site where it can percolate into the ground as approved by the NYSDEC.
- Concrete dust will be collected in shop vacuums and disposed of as non-regulated solid waste, unless photoionization detector readings or visual indications of contamination are noted during field operations.
- Soil and rock cuttings from drilling operations that do not exhibit visible staining, sheen, or discernable odors will be disposed of onsite or used to backfill temporary borings, wells or test pits.
- Soil and rock cuttings from drilling operations that exhibit visible staining, sheen or discernable odors will be staged onsite until an appropriate treatment/disposal procedure has been approved by the NYSDEC.
- Excavated soils from test pits will be used to backfill the excavation.
- Used protective clothing and equipment that is suspected to be contaminated with hazardous waste will be placed in plastic bags, packed in 55-gal ring-top drums and transported to the drum staging area for proper disposal.
- Non-contaminated trash and debris and protective equipment will be placed in a trash dumpster and disposed of by a local garbage hauler as appropriate or warranted at each site. Alternative disposal arrangements will be discussed with the NYSDEC.

2.13 Site Survey and Base Map Preparation

A detailed topographic base map of the site and immediate vicinity will be developed by a New York State licensed surveyor. All relevant features of the site and adjacent areas will be plotted. A site survey will incorporate all soil boring locations, monitoring well locations, test pit locations, soil vapor point locations, and surface water/sediment sampling locations, performing

a topographic survey, and preparation of a site map (typically based upon a previous base map or site control markers).

The site map will also include site-specific features associated with the assessment activities and potential areas of concern to the NYSDEC. Contours will be plotted at 1-ft intervals. The elevations of all monitoring well casings will be established to within +/-0.01 ft based on the National Geodetic Vertical Datum.

The site tax map number will also be identified. The tax maps will be reviewed and the property lines of the parcels will be plotted on the base map.

2.14 References

Shaw, December, 2008. "Quality Assurance Project Plan for Work Assignments". Prepared by Shaw for the NYSDEC.

New York State Department of Health *Guidance for Evaluating Soil Vapor Intrusion in the State of New York*. New York State Department of Health, Division of Environmental Health Assessment, Center for Environmental Health. October, 2006.

Appendix A

Field Forms

Drilling Log

Monitoring Well **MW -**

Page: 1 of 1

Project *Site Name* Owner *NYSDEC*

Location *City, New York* Proj. No. *Shaw Project ID*

Surface Elev. *NA* Total Hole Depth *24.0 ft.* North ____ East ____

Top of Casing *NA* Water Level Initial *NA* Static *NA* Diameter ____

Screen: Dia *NA* Length *NA* Type/Size *NA*

Casing: Dia *NA* Length *NA* Type *NA*

Fill Material ____ Rig/Core ____

Drill Co. ____ Method ____

Driller ____ Log By ____ Date ____ Permit # *NA*

Checked By ____ License No. ____

COMMENTS

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic descriptions are based on ASTM Standard D 2487-93 and the USCS.
0						
2						
4						
6						
8						
10						
12						
14						
16						
18						
20						
22						
24						

IT_COMMERCIAL Rev: 12/6/99 DEC TEMP.GPJ IT_CORP.GDT 12/18/08

Shaw® Shaw Environmental, Inc.		Project Name:	
		Date:	
		Sampler(s):	
Sample Location Information:			
Sample ID:		Address/Location:	
PID Meter Used:	He Detector Used:	Weather Conditions:	
	Soil Gas	**Ambient Air**	**Comments**
SUMMA CANISTER RECORD			
Canister Serial Number:			
Flow Controller Number:			
Start Date / Time:			
Stop Date / Time:			
Duplicate Sample ID:			
Sample ID Category:			
Sample Depth:			
Approximate GW Depth:			
Air Temperature:			
Direction/Distance from any Structure:			
Distance to Roadway:			
Any noticeable odor?			
PID Reading (ppb):			
He Detector Reading (ppm):			
Consituents Sampled:			
Container Description:			
Checked Seals:	☐ Yes	☐ No	
Tracer Gas Test:	☐ Successful	☐ Unsuccessful	
Sample:	☐ Duplicate	☐ Matrix Spike Duplicate	☐ Matrix Spike ☐ Analysis
Photo Taken:	☐ Yes	☐ No	

Shaw Environmental, Inc.
Monitoring Well Development Field Data Sheet

Project Name: Project Number:

Water Level Data

Date: ____________ Start Time: ___________ **Well ID:** ___________

Initial Total Casing Length__________________________ (feet)

Depth to Water (from top of casing)_________________ (feet)

a) Height of Water Column_________________________ (feet)

*Volume Factors:
2-inch well = 0.163 gal/ft
4-inch well = 0.653 gal/ft
6-inch well = 1.468 gal/ft

Well Volume ([a] x volume factor *) = ______ (feet) x ______ gallons/foot = _______ gallons

Development Data

Date: ____________ Time:______________ (start) ____________ (finish)

Method: ____
(Waterra, bailer, submersible pump, etc.)

Time							
Specific Conductivity							
pH							
Turbidity							
Temperature							
ORP							
DO							

Time							
Specific Conductivity							
pH							
Turbidity							
Temperature							
ORP							
DO							

Time							
Specific Conductivity							
pH							
Turbidity							
Temperature							
ORP							
DO							

Did well dry out? (If yes, how many times) Actual Volume Removed________ (gallons)

Personnel:____

COMMENTS:

Shaw Environmental, Inc.
Groundwater Sample Event Field Data Sheet

Project Name: Project Number:

Water Level Data

Date: _____ Start Time: _____ **Well ID:** _____

Initial Total Casing Length_____ (feet)

Depth to Water (from top of casing)_____ (feet)

a) Height of Water Column_____ (feet)

*Volume Factors:
1-inch well = 0.041 gal/ft
1.5-inch well = 0.092 gal/ft
2-inch well = 0.163 gal/ft
3-inch well = 0.367 gal/ft
4-inch well = 0.653 gal/ft
6-inch well = 1.468 gal/ft

Well Volume ([a] x volume factor *) = _____ (feet) x _____ gallons/foot = _____ gallons

Purge Data

Date: _____ Time:_____ (start) _____ (finish)

Method:
(Waterra, bailer, submersible pump, etc.)

Purge Volume (if applicable): _____

Time							
Volume							
Specific Conductivity							
pH							
Turbidity							
Temperature							
ORP							
DO							

Did well dry out? (If yes, how many times) Actual Volume Removed_____ (gallons)

Sampling Data

Sample Date: _____ Sample Time: _____
Appearance (visual) _____ Color _____ Odor _____
Sampling Method:

Constituents Sampled	Container Discription	Perservative

Personnel:
COMMENTS:

NEW YORK STATE DEPARTMENT OF HEALTH
INDOOR AIR QUALITY QUESTIONNAIRE AND BUILDING INVENTORY
CENTER FOR ENVIRONMENTAL HEALTH

This form must be completed for each residence involved in indoor air testing.

Preparer's Name _____ Date/Time Prepared _____

Preparer's Affiliation _____ Phone No._____

Purpose of Investigation_____

1. OCCUPANT:

Interviewed: Y / N

Last Name: _____ First Name: _____

Address: _____

County: _____

Home Phone: _____ Office Phone: _____

Number of Occupants/persons at this location _____ Age of Occupants _____

2. OWNER OR LANDLORD: (Check if same as occupant ___)

Interviewed: Y / N

Last Name: _____First Name: _____

Address: _____

County: _____

Home Phone: _____ Office Phone: _____

3. BUILDING CHARACTERISTICS

Type of Building: (Circle appropriate response)

Residential	School	Commercial/Multi-use
Industrial	Church	Other: _____

If the property is residential, type? (Circle appropriate response)

Ranch	2-Family	3-Family
Raised Ranch	Split Level	Colonial
Cape Cod	Contemporary	Mobile Home
Duplex	Apartment House	Townhouses/Condos
Modular	Log Home	Other:_____

If multiple units, how many? _____

If the property is commercial, type?

Business Type(s) _____

Does it include residences (i.e., multi-use)? Y / N If yes, how many? _____

Other characteristics:

Number of floors_____ Building age_____

Is the building insulated? Y / N How air tight? Tight / Average / Not Tight

4. AIRFLOW

Use air current tubes or tracer smoke to evaluate airflow patterns and qualitatively describe:

Airflow between floors

_____

_____

_____

Airflow near source

_____

_____

_____

Outdoor air infiltration

_____

_____

_____

Infiltration into air ducts

_____

_____

_____

5. **BASEMENT AND CONSTRUCTION CHARACTERISTICS** (Circle all that apply)

a. Above grade construction:	wood frame	concrete	stone	brick
b. Basement type:	full	crawlspace	slab	other _____
c. Basement floor:	concrete	dirt	stone	other _____
d. Basement floor:	uncovered	covered	covered with _____	
e. Concrete floor:	unsealed	sealed	sealed with _____	
f. Foundation walls:	poured	block	stone	other _____
g. Foundation walls:	unsealed	sealed	sealed with _____	
h. The basement is:	wet	damp	dry	moldy
i. The basement is:	finished	unfinished	partially finished	
j. Sump present?	Y / N			
k. Water in sump?	Y / N / not applicable			

Basement/Lowest level depth below grade: _____(feet)

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

_____

_____

6. **HEATING, VENTING and AIR CONDITIONING** (Circle all that apply)

Type of heating system(s) used in this building: (circle all that apply – note primary)

Hot air circulation	Heat pump	Hot water baseboard	
Space Heaters	Stream radiation	Radiant floor	
Electric baseboard	Wood stove	Outdoor wood boiler	Other _____

The primary type of fuel used is:

Natural Gas	Fuel Oil	Kerosene
Electric	Propane	Solar
Wood	Coal	

Domestic hot water tank fueled by: _____

Boiler/furnace located in:	Basement	Outdoors	Main Floor	Other_____
Air conditioning:	Central Air	Window units	Open Windows	None

Are there air distribution ducts present? Y / N

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

_____

_____

_____

_____

7. OCCUPANCY

Is basement/lowest level occupied? Full-time Occasionally Seldom Almost Never

Level	**General Use of Each Floor (e.g., familyroom, bedroom, laundry, workshop, storage)**
Basement	_____
1st Floor	_____
2nd Floor	_____
3rd Floor	_____
4th Floor	_____

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage? Y / N

b. Does the garage have a separate heating unit? Y / N / NA

c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, atv, car) Y / N / NA Please specify_____

d. Has the building ever had a fire? Y / N When?_____

e. Is a kerosene or unvented gas space heater present? Y / N Where?_____

f. Is there a workshop or hobby/craft area? Y / N Where & Type? _____

g. Is there smoking in the building? Y / N How frequently? _____

h. Have cleaning products been used recently? Y / N When & Type? _____

i. Have cosmetic products been used recently? Y / N When & Type? _____

j. Has painting/staining been done in the last 6 months? Y / N Where & When? _____

k. Is there new carpet, drapes or other textiles? Y / N Where & When? _____

l. Have air fresheners been used recently? Y / N When & Type? _____

m. Is there a kitchen exhaust fan? Y / N If yes, where vented? _____

n. Is there a bathroom exhaust fan? Y / N If yes, where vented? _____

o. Is there a clothes dryer? Y / N If yes, is it vented outside? Y / N

p. Has there been a pesticide application? Y / N When & Type? _____

Are there odors in the building? Y / N
If yes, please describe: _____

Do any of the building occupants use solvents at work? Y / N
(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist

If yes, what types of solvents are used? _____

If yes, are their clothes washed at work? Y / N

Do any of the building occupants regularly use or work at a dry-cleaning service? (Circle appropriate response)

Yes, use dry-cleaning regularly (weekly) No
Yes, use dry-cleaning infrequently (monthly or less) Unknown
Yes, work at a dry-cleaning service

Is there a radon mitigation system for the building/structure? Y / N Date of Installation: _____
Is the system active or passive? Active/Passive

9. WATER AND SEWAGE

Water Supply: Public Water Drilled Well Driven Well Dug Well Other: _____

Sewage Disposal: Public Sewer Septic Tank Leach Field Dry Well Other: _____

10. RELOCATION INFORMATION (for oil spill residential emergency)

a. Provide reasons why relocation is recommended: _____

b. Residents choose to: remain in home relocate to friends/family relocate to hotel/motel

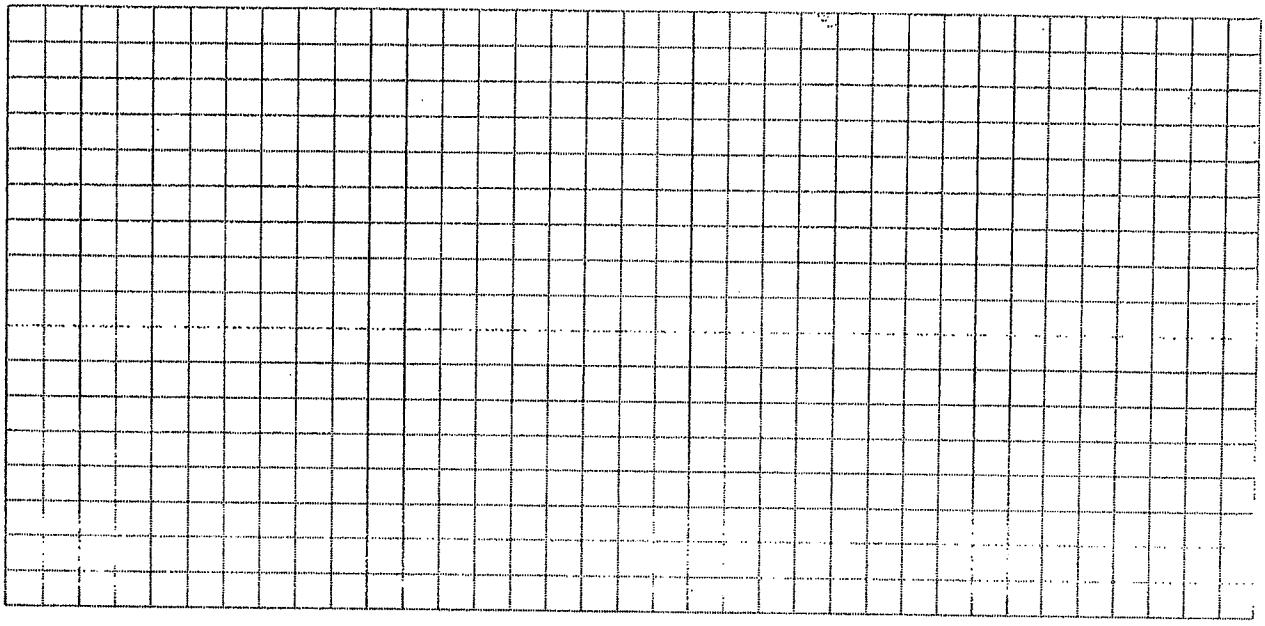
c. Responsibility for costs associated with reimbursement explained? Y / N

d. Relocation package provided and explained to residents? Y / N

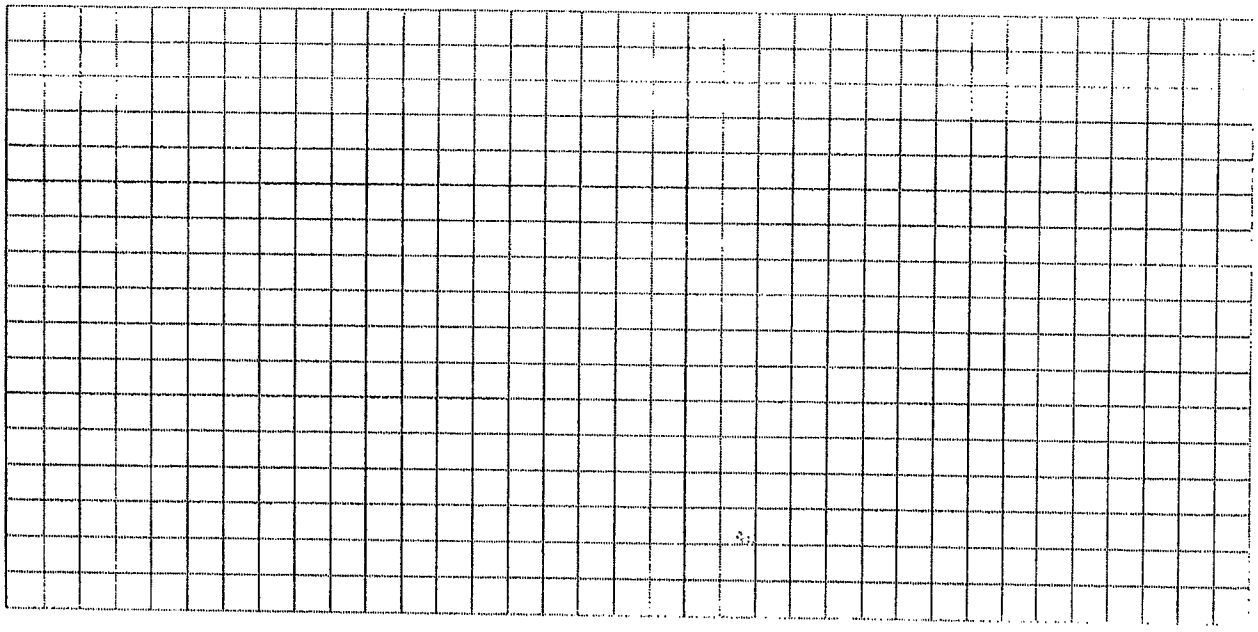
11. FLOOR PLANS

Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

Basement:



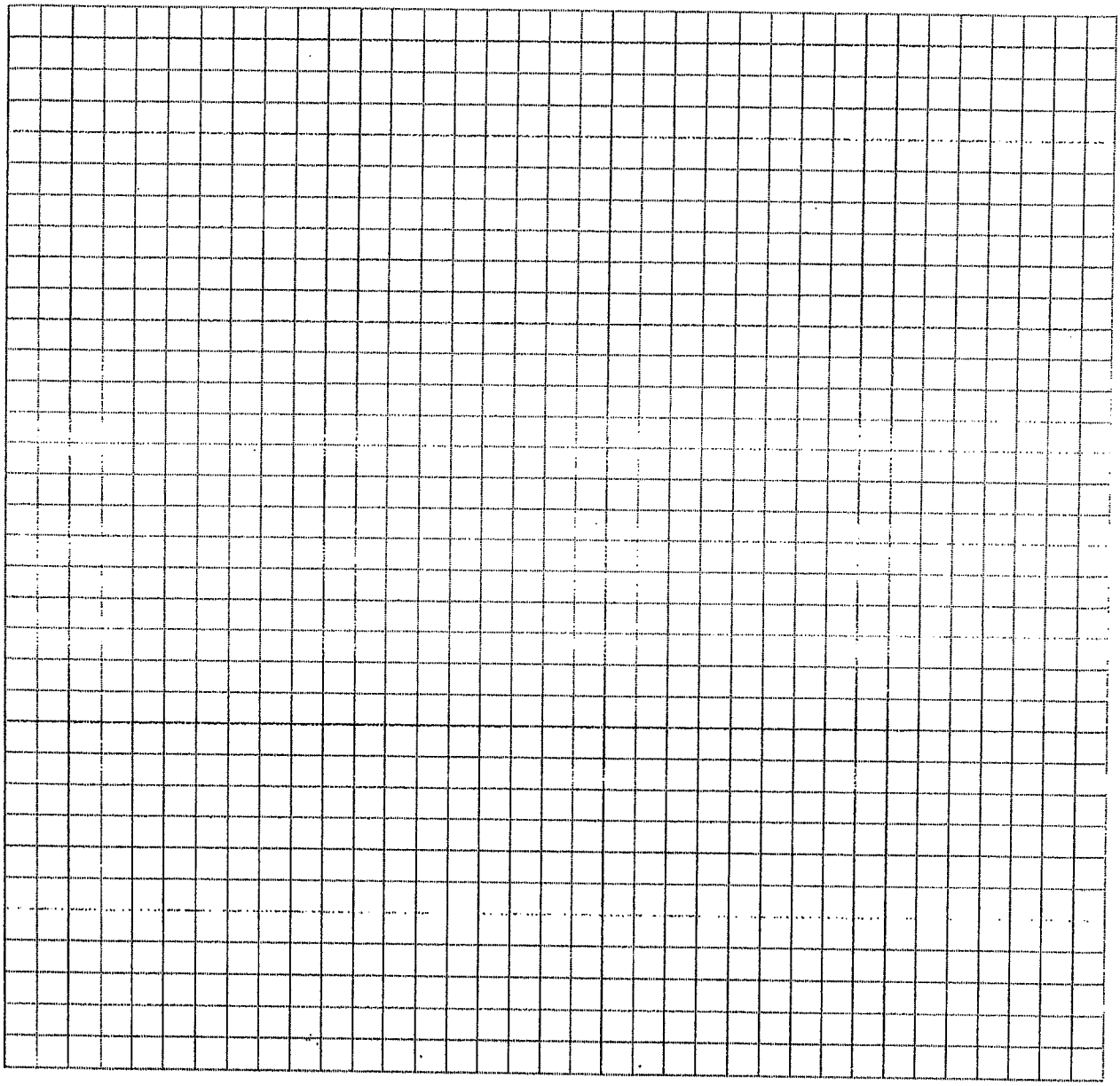
First Floor:



12. OUTDOOR PLOT

Draw a sketch of the area surrounding the building being sampled. If applicable, provide information on spill locations, potential air contamination sources (industries, gas stations, repair shops, landfills, etc.), outdoor air sampling location(s) and PID meter readings.

Also indicate compass direction, wind direction and speed during sampling, the locations of the well and septic system, if applicable, and a qualifying statement to help locate the site on a topographic map.



13. PRODUCT INVENTORY FORM

Make & Model of field instrument used: _____

List specific products found in the residence that have the potential to affect indoor air quality.

Location	Product Description	Size (units)	Condition*	Chemical Ingredients	Field Instrument Reading (units)	Photo ** Y / N

* Describe the condition of the product containers as **Unopened (UO), Used (U),** or **Deteriorated (D)**
** Photographs of the **front and back** of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

Shaw® Shaw Environmental, Inc.			Project Name:		
			Date:		
			Sampler(s):		
Sample Location Information:					
Sample ID:			Address/Location:		
PID Meter Used:		He Detector Used:	Weather Conditions:		
	Indoor Air		**Substructure**	**Ambient Air**	**Comments**
	Basement Ambient	First Floor Ambient	**Soil Vapor**		
SUMMA CANISTER RECORD					
Canister Serial Number:					
Flow Controller Number:					
Start Date / Time:					
Stop Date / Time:					
Start Pressure (inches Hg):					
Stop Pressure (inches Hg):					
Duplicate Sample ID:					
Sample Height/Depth:					
Room:			NA	NA	
Approximate GW Depth:	NA	NA		NA	
Air Temperature:					
Direction/Distance from any Structure:					
Distance to Roadway:	NA	NA	NA		
Any noticeable odor?					
PID Reading (ppb):					
He Detector Result:	NA	NA		NA	
Consituents Sampled:	TO - 15	TO - 15	TO - 15	TO - 15	
Container Description:	6 Liter Summa	6 Liter Summa	6 Liter Summa	6 Liter Summa	
Checked Seals:		☐ Yes	☐ No		
Tracer Gas Test:		☐ Successful	☐ Unsuccessful		
Photo Taken:					