Civil Surveying

1.0 PURPOSE

This procedure describes methods and equipment commonly used by a Registered Land Surveyor when compiling by survey the vertical and horizontal locations of on-site test pits, hand auger borings, and other site structures, and topographic features associated with landfill cap design.

2.0 SCOPE

The information presented in this Standard Operating Procedure (SOP) is generally applicable to all locations, except where state-specific requirements differ concerning certifications, licenses and registrations.

Specific surveying problems encountered by the survey crew may require the adaptation of existing equipment or design of new equipment. Such innovations shall be documented in the survey crew's field logbook.

3.0 DEFINITIONS

Rhode Island State Plane Coordinates – The standard northing and easting coordinates datum in the State of Rhode Island.

National Geodetic Vertical Datum (NGVD) – The vertical-control datum used (1980 and later) by the National Geodetic Survey for vertical control.

Horizontal Control – Horizontal location of an object from surveyed corners or other features on permanent land monuments in the immediate site area. Will be based on North American Datum (NAD).

Vertical Control – Vertical location of an object compared to the adjacent ground surface.

Bench Mark – Precisely determined elevation above or below sea level. May also have horizontal control (northing, easting) determined for location.

4.0 RESPONSIBILITIES

The surveyor shall take all reasonable precautions to prevent damage to public and private property, and shall restore the site to the condition existing prior to the surveyor's entry.

All work shall be completed under the direction of a registered Professional Land Surveyor. All work shall be conducted using, equipment, personnel, and procedures that will insure compliance with the accuracy standards as defined below. It is the responsibility of the supervising land surveyor to ensure that all work under this agreement complies with all state and local regulations. All documents submitted shall bear the surveyor's seal, signature, and a certificate that all work was done under the surveyor's supervision and that all information contained in the document is true and is accurately shown.

Project Manager – The Project Manager is responsible for ensuring that project-specific plans are in accordance with acceptable surveying practices as required by the state in which the work is performed.

Field Team Leader – The Field Team Leader is responsible for ensuring that procedures are implemented in the field and that personnel performing surveying activities have been briefed and trained to execute these procedures.

5.0 PROCEDURES

A Registered Land Surveyor will be subcontracted to determine by survey the elevations and horizontal locations of topographic features associated with the remedial design. The services shall include photogrammetry and related survey field work for the development of base mapping to include 1-foot contour intervals and associated site features.

Specifically, Berger requires the following:

- Delineate the horizontal location of each of the survey points to an accuracy of 0.1 foot, referenced to the Rhode Island State Plane Coordinate System. All permanent points established during control traverses shall be shown.

- Research of existing utilities and the addition and edit of the utilities (includes obtaining copies of plans from utility companies) into the base mapping,

- Location of wetland stakes.

All survey points will be based on the Rhode Island State Plane Coordinate System for horizontal control and NGVD for vertical control.

The survey subcontractor shall provide Berger with a letter report containing all relevant survey information along with one legible copy of the field survey notes recorded when determining the surveyed elevations and any requested topographic information.

5.1 ACCURACY STANDARDS

The following are minimum standards:

1. All horizontal traverses shall have a minimum ratio of closure of 1:10,000. The ratio closure shall be calculated after angles are balanced and before coordinates are adjusted. All traverses shall have azimuth closures.
2. All vertical control and auxiliary stations established shall have closures of 0.05 times the square root of the number of miles of the level run. All leveling shall be checked by running closed loops, by taking readings on previously established turning points or benchmarks (or by some other acceptable checking procedure).
3. All spot elevations shall be accurate to within +/-0.01 ft. on hard surfaces (asphalt, concrete, utilities, etc.) and +/-0.10 ft. on all other surfaces.
4. Surface water points will be shown within +/-0.01 ft. of their true horizontal location and all other physical features shall be shown to within +/0.5 ft. of their true horizontal location.

5. All topographic and cultural features shall be tied in a manner to enable the calculation of coordinates of each feature shown on the site map (unless otherwise noted).

5.2 RECORDS – FIELD NOTES AND SURVEY STATIONS

All field notes shall be kept in bound books. Information on weather (wind speed/wind direction, cloud cover, etc.) and on other site conditions shall also be entered in the notes. Graphite pencils or waterproof ballpoint pens shall be used. Erasing is not acceptable; use a single-strike-thorough and initial it. The note keeping format should conform to the *Handbook of Survey Note Keeping* by William Afford. Field notes shall be neat and legible, complete and self explanatory, and self checking. Field notes shall include but not be limited to:

Complete index:

1. Date of field work
2. Names of crew members
3. Description of controlling survey stations
4. Recovery description of all stations and temporary bench marks set
5. sketches of work were applicable
6. Recovery description of all control stations.
7. If electronic data collection is used, raw field data output shall be provided, along with sketches and descriptions.

All horizontal traverse stations and temporary benchmarks shall be set at locations using materials that can be expected to remain stable, undisturbed, recoverable, and reference. All horizontal stations shall be marked with two guard stakes, with identifying markings, within one foot and on opposite sides of each station. Each temporary benchmark shall be clearly marked with identifying numbers.

1. Horizontal stations shall be marked using a permanent marker (iron rod and cap, nail in pavement, chiseled "X" in concrete, etc.)
2. Temporary benchmarks shall be a spike in a tree, or utility pole or a chiseled "X" in concrete, or some other convenient substantial feature. (Horizontal traverse stations will not be considered as temporary benchmarks).

5.3 SITE MAP AND WORK PLOT

Maps and work plots shall be based on the following criteria:

1. The plot shall be computer plotted on mylar/vellum sheets.
2. The plot scale shall be 1"=40' with a contour interval of 1 foot.
3. The plot shall show all spot elevations necessary.
4. Spot elevations shall be identified with a brief description and a means to refer back to field notes (computer identification numbers).
5. The plot shall include the addition and edit of existing utilities.
6. Show north arrow and scale.
7. The plot shall show all horizontal survey stations used for this survey, existing or set.
8. The plot shall show all temporary benchmarks established and all benchmarks used on this survey.
9. The plot shall show all horizontal control points set.

10. Each plot shall have horizontal datum grid ticks.
11. Each plot shall have horizontal datum coordinate annotations on at least two grid ticks on each sheet.
12. The plot shall have a legend that will include all abbreviations and symbols shown on the map.
13. The plot shall indicate the horizontal and vertical datum.

The survey subcontractor shall perform these services in accordance with standard, acceptable surveying practices as required by the state in which the work is performed and all work shall be conducted under the supervision of a Registered Land Surveyor, duly licensed to work in the State of Rhode Island.

6.0 HEALTH AND SAFETY

The survey subcontractor is to provide for and assume responsibility for adequate health and safety protection for on-site personnel. Field activities are to be performed in accordance with the requirements of the Health and Safety Plan.

7.0 QUALITY ASSURANCE RECORDS

The field log book shall serve as the quality assurance record for on-site surveying activities.

Surface Water, Leachate and Sediment Sampling

1.0 PURPOSE

The purpose of this procedure is to provide guidelines for obtaining surface water samples. This procedure describes methods and equipment to be used during surface water sampling. The information presented in this SOP is generally applicable to all locations

2.0 EQUIPMENT AND MATERIALS

- Rubber boots and/or rubberized waders.
- Personal protective clothing and equipment as required in the site-specific HASP.
- Decontamination equipment and supplies.
- Temperature probe or thermometers, pH meter, conductivity meter as required by the QAPP.
- Appropriate sample containers (some will be pre-preserved) and labels.
- Bound field logbook.
- Hard plastic cooler with ice.
- Filters as required.

3.0 PROCEDURES AND GUIDELINES

At the time of sample collection, the following procedures will be employed:

- Samples will be collected from downstream locations first, moving upstream as sampling progresses so that any disturbance to the stream sediments as a result of sampling is not reflected in subsequently collected samples.
- At each location, the surface water sample will be collected first so that any disturbance of the sediments as a result of sediment sampling is not reflected in the surface water sample for that location.
- All surface water and sediment sampling will be conducted on the same day so as not to be influenced by precipitation or other changes to site conditions over time.
- All sampling locations will be clearly marked in the field and recorded in field notebooks so that the same locations can be revisited for subsequent quarterly and post-construction sampling.

Appropriate QA/QC samples will be collected, including one trip blank for each day of sampling for VOCs, one field blank for every 20 samples, one duplicate sample for every 10 samples, and one matrix spike and matrix spike duplicate for every 20 samples. Samples will be collected, preserved, and containerized in appropriate containers specified as part of the EPA laboratory method for each sample. The samples will be placed on ice and transported to a qualified laboratory for chemical analyses in accordance with EPA specified methodologies.

The following steps will be taken when collecting samples of surface water for VOC and TAL inorganics analyses:

1. Slowly submerge unpreserved one-liter amber glass-capped bottle (SVOA) completely into the water. Open and fill bottle from below the water surface. If wading is required, approach the sample site from downstream and do not enter the actual sample area. Do not disturb bottom sediments. Open-end of the bottle should be pointed at approximately 90° to the upstream direction, in undisturbed gently flowing water. This procedure will be performed to minimize the effects due to high turbulence and aeration, or if surface scum is prevalent.
2. Collect a sufficient volume of water to fill all sample containers.
3. For VOA analyses, slowly pour surface water sample into pre-preserved 40 ml VOA vials taking care not to let it over flow and lose preservative. Place cap with Teflon septum on each vial as filled. Turn the vial upside down and check for air bubbles. Tap the bottom of the VOA vials to dislodge any bubbles that may have formed around the cap or sides. If bubbles are present, discard vial and re-sample using new VOA vial.
4. For TAL metals, slowly pour surface water sample into pre-preserved 500 ml plastic container to sufficiently fill the container. Surface water samples may be collected as totals (unfiltered) or dissolved (filtered).
5. Seal sample container.
6. Place labeled sample container(s) into a sample cooler with ice. A small plastic temperature blank will be filled with water and placed in the cooler with the samples. The temperature of the samples will be determined at the laboratory by measuring the temperature of the temperature blank. The sample temperature should be a maximum of 4 degrees Celsius (°C).
7. Record samples (e.g., sample ID, location, method, etc…) in the field logbook.
8. Collect an additional grab sample in an unpreserved sample container and measure and record field parameters in the log book or on sampling sheets.

The following steps will be followed when collecting surface water samples for SVOCs and PCBs.

1. Slowly submerge capped sample containers completely into the water. Open and fill containers from below the water surface. If wading is required, approach the sample site from downstream and do not enter the actual sample area. Do not disturb underlying sediments. Open end of the containers should be pointed at approximately 90° to the upstream direction in undisturbed, gently flowing water. This procedure will be performed to minimize the effects due to high turbulence and aeration, or if surface scum is prevalent.
2. Collect a sufficient volume of water to fill all sample containers.
3. Seal sample container.
4. Place labeled sample container(s) into a sample cooler containing ice and temperature blank.
5. Record samples (e.g., sample ID, location, method, etc…) in the field logbook.
6. Collect an additional grab sample in an unpreserved sample vial and measure and record field parameters in the log book or on sampling sheets.

The following steps will be followed when collecting sediment samples from below a surface water body. When collecting a sample from below moving water care should be taken to keep fine grained material from being washed away.

1. Stake the sampling locations presented in QAPP.

2. In shallow water (< 2 feet), collect sediments directly into sample containers by submerging containers to the steam bed and scooping sediment directly into containers. In deeper water, use a sediment sampling device (e.g., hand corer, Ekman Dredge, or Encore sampler) to collect a sample for transfer into appropriate soil jars. If sediment is collected in an Encore sampler, transfer is not needed in the field. This will be performed by the laboratory.
3. Top off sample containers with additional sediments using a stainless steel spoon as required to obtain sufficient volume to ensure that the sample contains a minimum of 30 percent solids.
4. Immediately secure caps on the sample container.
5. Label container.
6. Pack sample in cooler with ice, and include temperature blank.

4.0 RECORD KEEPING

Sampling technicians will utilize field notebooks to record relevant information prior to and during sampling events to include the following minimum information: temperature, pH and conductivity.

5.0 KEY CHECKS AND PREVENTIVE MAINTENANCE

Field activities are to be completed in accordance with the requirements of the Health and Safety Plan.

Equipment Decontamination

1.0 PURPOSE

Decontamination of field equipment is necessary to ensure the quality of samples by preventing cross-contamination. In addition, decontamination reduces health hazards and prevents the spread of contaminants off-site.

2.0 EQUIPMENT AND MATERIALS

Large/heavy Equipment (i.e., Drill rigs, backhoes, augers, drill pipe, bits, casing, and screen):

- High-pressure pump with steam-spray unit.
- Stiff-bristle brushes.

Small/sampling Equipment (i.e., Split spoons, bailers, bowls, and pumps):

- Soap
- Polyethylene sheeting
- Stiff-bristle brushes.
- Wash bottles or manual pump sprayer.
- 10% methanol solution (optional)
- Distilled water
- Tap water

3.0 PROCEDURES AND GUIDELINES

The following steps will be followed when decontaminating large/heavy equipment:

1. The drilling contractor will construct a decontamination area at a designated area on site of 6-mil polyethylene, large enough to capture decontamination fluids. Decontamination of drilling equipment will be performed over the decontamination pad. Depending on site contaminants, drilling equipment may be decontaminated at each drilling location and decon water allowed to infiltrate into site soils.
2. Drill rigs and tools will be cleaned between each location and prior to the initiation of any sampling. Steam-cleaning/pressure washing water will be allowed to soak back into the ground.
3. Spray areas (rear of rig or backhoe) exposed to contaminated soils using steam or high-pressure sprayer. Be sure to spray down all surfaces, including the undercarriage.

Document that decontamination was performed in the appropriate logbook.

The following steps will be followed when decontaminating sampling equipment including split-spoons, spatulas, and hand tools that directly contact samples.

1. Set up a decontamination line. The decontamination line should progress from "dirty" to "clean", with an area for drying decontaminated equipment. The decontamination line should be set up on polyethylene sheeting.
2. Wash the item thoroughly in a bucket of soapy water (tap water). Use a stiff-bristle brush to dislodge any clinging dirt. Disassemble any items that might trap contaminants internally before washing. Do not reassemble until decontamination is complete.
3. Rinse the item in a bucket containing clear tap water. Rinse water should be replaced as needed.
4. Document that decontamination was performed in the appropriate logbook.
5. Disposable items will be bagged for disposal as general refuse.
6. Decontamination water will be discarded to ground surface.

The following steps will be followed when decontaminating pumps.

1. Pumps should be set-up in the same configuration as for sampling. Flush the pump with potable water.
2. Submerge pump intake (or pump if submersible) and all downhole wetted parts (tubing, piping, foot valve) in soapy water. Pump a minimum of three pump assembly volumes of soapy water through the entire assembly. Note: If dedicated tubing is used for monitoring wells, the tubing will not need to be decontaminated.
3. Replace soapy water with potable water. All downhole wetted parts must be immersed in the potable water rinse. Pump a minimum of three pump assembly volumes of clean water through the entire assembly.
4. Document that decontamination was performed in the groundwater sampling log book.
5. All fluids used in the decontamination process will be allowed to soak into the ground.

4.0 KEY CHECKS AND PREVENTIVE MAINTENANCE

The SSO or designated alternate will oversee decontamination procedures to ensure that they have been completed according to the procedures outlined above. Equipment blanks will be collected and analyzed throughout the program to determine the effectiveness of decontamination procedures. Blank number and frequencies are presented in the QAPP.

APPROVAL FORM

I have reviewed the Quality Assurance Project Plan for the Remedial Design of the Rose Hill Landfill Cap Design and find it to be complete and acceptable in all areas pertaining to the quality assurance and quality control for the sampling and non-analytical testing as described herein.

Christopher Feeney, P.E. Date
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