2017 RCRA Permit Application

Section C

Appendix 4 – Groundwater Sampling and Analysis Plan

Hercules LLC/Pinova - Brunswick, GA

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Antea Group Project No. 190106854A
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1.0 INTRODUCTION

This Groundwater Sampling and Analysis Plan ("SAP") provides the sampling and analysis procedures for groundwater monitoring at the industrial facility located at 2801 Cook Street in Brunswick, Georgia (the "Facility" or "Site"), portions of which are owned by Hercules LLC ("Hercules") and portions of which are owned by Pinova, Inc. ("Pinova"). The groundwater monitoring activities will be used to meet requirements under Permit No. HW-052(D&S) as issued and renewed by the Georgia Department of Natural Resources, Environmental Protection Division ("EPD"). The SAP describes the proper preparation, sample collection, sample handling, preservation and shipment, and quality assurance/quality control procedures, chain of custody control, and analytical methods for sampling groundwater at the Facility. The intent of this SAP is to ensure that plant and contract personnel produce consistent and reliable groundwater monitoring data. The procedures described herein have been taken from two source documents:

1) United States Environmental Protection Agency ("USEPA") Region IV; SESD Operating Procedure for Groundwater Sampling, April 26, 2017.
2) USEPA Region IV; SESD Operating Procedure Field Equipment Cleaning and Decontamination, December 18, 2015

The procedures described herein will be updated as appropriate and necessary to reflect future updates by USEPA Region IV to the two source documents listed above.

2.0 HEALTH AND SAFETY PLAN

Hercules Contractor Site Rules and Pinova/DRT Contractor Site Rules will be used to address personnel safety while performing groundwater sampling at the Facility. All contractors are required to attend a site safety orientation, are advised of the site hazards and safety rules, and are provided with emergency phone numbers and job specific precautions associated with the plant and other hazards. All contractors are required to watch the contractor safety video and pass the written exam based on the contractor safety video prior to entrance to the Facility.

3.0 PREPARATION FOR SAMPLING

A series of preparation procedures will be performed prior to groundwater sampling. These procedures will include the following:

- Reviewing Hercules' Contractor Site Rules, Pinova/DRTs' Contractor Site Rules and attending an on-site contractor safety orientation;
- Reviewing the Sampling and Analysis Plan requirements, including ordering and preparing sample bottles, labels and reviewing analytical requirements (in conjunction with Hercules and laboratory personnel);
- Preparing appropriate equipment and supplies for taking field measurements and collection of samples;
- Decontaminating equipment;
- Calibrating equipment for field measurements;

- Inspecting the monitoring wells, including identifying the top of casing (datum) measuring point;
- Measuring the depth to groundwater (and total well depth if not determined within the prior two years); and
- Purging of wells to be sampled.

The following sections provide a detailed description of each of these procedures. All observations will be entered into a field logbook.

3.1 Review of Health and Safety Plan

All personnel shall review the Site Specific Rules for health and safety that is maintained at the Site. A site contractor safety orientation, for all personnel new to the Site, will be conducted by the Hercules Contractor Coordinator prior to beginning work.

3.2 Review of Monitoring Requirements

Prior to collection of field measurements and samples, the sampling team will review the monitoring well location plan to identify the wells to be sampled. The job instructions must specify:

- Which monitoring wells, piezometers and/or recovery wells will be measured for water levels and/or sampled;
- The frequency of sampling events; and
- Constituents for which analyses will be performed.

The sampling team leader will review the list of wells and list of analytes to be sampled with Hercules, Pinova and the laboratory prior to sample collection.

3.3 Equipment and Supplies

The following is a list of equipment and supplies that are required to obtain measurements and collection of groundwater samples.

- Keys to wells and wrenches for flush-mounted lids;
- Electronic water level indicator graduated in 0.01 foot increments (Solinst water level indicator or equivalent);
- Oil-water interface probe when measurement of an immiscible phase is planned;
- Disposable latex and nitrile gloves;
- Bagged ice;
- Phosphate-free laboratory soap (Liquinox or equivalent), plastic buckets, brushes, sprayers, aluminum foil, isopropanol alcohol (pesticide grade), table for equipment, distilled or deionized water, and plastic sheeting;

- Paper towels, paper cups, plastic zip-loc bags, and plastic trash bags;
- Well Inspection Form (Figure 2);
- Field Sampling Form (Figure 3) and/or Field Logbook, and Chain of Custody forms;
- Waterproof-ink pens and felt-tip pens;
- Daily Instrument Calibration Check Sheet (Figure 1);
- Purging equipment such as bailers, pumps, tubing, and plastic buckets;
- Field filters for groundwater samples to be analyzed for dissolved metals;
- Temperature, pH, Conductivity, Dissolved Oxygen and Turbidity Meters;
- Sample bottles, labels, custody seals and custody tape, coolers, and chain of custody record forms (Figure 4); and
- Drums and labels for decontamination and purge water containerization.

3.4 Equipment Decontamination

All field sampling equipment will be cleaned appropriately using the procedures described in the USEPA Region IV SESD Operating Procedure for Field Equipment Cleaning and Decontamination, December 18, 2015 (SESDPROC-205).

3.5 Field Equipment Calibration Procedures and Frequency

A calibration program will be used to ensure that routine calibration is performed on all field instruments per manufacturers' recommendations. The field instruments that will be used during groundwater sampling activities include pH, temperature, specific conductivity, dissolved oxygen and turbidity meter(s). Sampling team members will have access to the instrument manuals that come with each instrument and will be familiar with the calibration and operation of the field instruments as described in the manufacturers' manuals. At a minimum, daily calibrations will be completed on each field instrument used to analyze the groundwater samples for the field parameters. Such calibrations will be recorded on the daily calibration form (Figure 1) or in the sampler's field logbook.

3.6 Monitoring Well Inspection and Datum Identification

The locations of the monitoring wells and piezometers to be monitored and/or sampled will be determined from the monitoring plan and the corresponding identification numbers recorded. Semi-annual water depth measurements and quarterly well condition surveys for each monitoring well will be conducted and recorded in the Facility's operating record. All observations concerning the condition of each monitoring well and the measured water depths will be noted on the Well Inspection Log (Figure 2). An electronic copy will be provided to contractors and shall be submitted promptly after demobilization. The Well Inspection Logs will be maintained in the Environmental Department files at the Hercules Brunswick facility. Any defects found during the monitoring well inspections will be either corrected at the time of inspection or reported to supervision for corrective action. The date and nature of the corrective action performed will be documented on the Well Inspection Log.

During the inspections conducted by Hercules and any sampling conducted by a third party, each well lock is to be removed carefully to avoid causing foreign material to enter the well. The surveyed top of casing elevation datum will then be identified. If a piezometer or monitoring well has been installed below grade inside a watertight manhole, the cap and lock is to be removed only after any standing water is evacuated from the manhole using a paper cup, paper towels and/or sponge. Water level measurements are then to be obtained from the surveyed datum marked on the top of the well casing.

3.7 Depth to Groundwater Measurements

The depth to the top of the groundwater surface of each well (or piezometer) is to be measured using an electric water level indicator. Measurements are to obtained from the point marked on the well casing. The water level indicator is to be slowly lowered into the well casing until it penetrates the groundwater surface. The cable shall then be held at an appropriate marked footage mark and placed adjacent to the top of the well casing datum point. The footage mark is then recorded in the "top of casing" column of the Field Sampling Form (Figure 3) or in the field logbook. All measurements are to be recorded to the nearest 0.01 foot. The depth to groundwater shall then be subtracted from the well casing datum elevation to determine the groundwater elevation.

3.8 Depth of Well Measurement Procedures

The total depth of the monitoring well (or piezometer), or the depth of the top of the sediment within the monitoring well, is to be determined by lowering the electronic water level indicator to the bottom of the well. The total depth shall then be recorded to the nearest 0.01 foot as total depth on the Field Sampling Form or in the field logbook. Should sediment be present, it should be noted on the form or logbook. If sediment in a monitoring well is detected with a thickness of greater than one inch, then that well may need to be redeveloped. The total depth of each monitoring well that is part of the monitoring well network will be measured at least once every two years to evaluate potential sediment accumulation.

3.9 Sampling/Detection of Immiscible Phases in a Monitoring Well

Immiscible free product may be present in wells near some operating units. An oil-water interface probe may be used to measure either a light non-aqueous phase immiscible liquid (floater) or a dense non-aqueous phase immiscible liquid (sinker). The following procedures should be used when necessary to measure free product in a well.

1. Remove the protective cap;

2. Sample the air in the well using a photoionization detector ("PID") or an organic vapor analyzer ("OVA") and record the measurement in the field logbook or Field Sampling Form;

3. Lower the interface probe into the well to detect the presence of immiscible layers, light and/or dense;

4. Record depth and thickness of any immiscible layer(s) to the nearest 0.01 foot and record in the field logbook or Field Sampling Form;

5. Decontaminate equipment before using at the next well using procedures for decontaminating the interface probe described in Section 3.4.

3.10 Monitoring Well Purging

Monitoring wells shall be purged before sample collection in order to ensure that a representative groundwater sample is being collected. To achieve this objective, a minimum of three well volumes can be evacuated from the monitoring wells using either: (1) a bailer (as described in Section 3.10.1), or (2) a submersible, centrifugal or a peristaltic pump (as described in Section 3.10.2). Alternatively, to minimize the amount of investigation-derived waste generated during traditional multiple volume purging, wells can be sampled using lowflow methodology using a submersible or peristaltic pump (as described in Section 3.10.3). Bailers are not the preferred method for purging or sampling wells and will only be used when the ability to use a submersible, centrifugal or a peristaltic pump is not reasonably feasible. For consistency, the sampling method at a given well should not change from one method to another without appropriate cause.

Follow the steps are outlined below to measure groundwater and total well depth and to calculate the proper amount of groundwater to be purged prior to sampling using traditional multiple volume purging methodologies.

1. Record the well number, time, and date and all other applicable information on the Field Sampling Form or in the field logbook.

2. Measure the depth to groundwater and the total depth of the well to the nearest 0.01 foot with a sounding device. Record the measurements. Record total thickness of immiscible layers, if present.

3. Calculate the volume of water in the well and calculate the volume of water required for sufficient purging using the following equation.

$$V = 0.041d^2h$$

V = one volume of water contained in the well (gallons)
d = diameter of well (inches)
h = height of water column (feet) = td - dg
td = total depth of the well (feet)
dg = depth to groundwater (feet)

4. Multiply "V" by the required number of well volumes (3-5) to determine the volume required for complete well purging. Record the required volume necessary for purging on the Field Sampling Form or in the field logbook.

New plastic sheeting shall be placed on the ground surface around the well casing to prevent contamination of equipment such as pumps, hoses, and ropes in the event they need to be placed on the ground during the purging process or they accidentally come into contact with the ground surface.

3.10.1 Monitoring Well Purging Using a Bailer

When purging a monitoring well using a bailer, the following procedures are to be followed:

1. Use a decontaminated stainless steel or Teflon® bailer or a new, disposable polyethylene bailer and a new section of nylon rope to purge the monitoring well for each sampling event.

2. Begin purging the well with the bailer and properly containerize the purge water in a graduated plastic bucket. The purge water will then be placed in 55-gallon drums for appropriate disposal. Each drum shall be labeled to identify its contents when water is first put in it.

3. Monitoring well purging using a bailer is performed by lowering the bailer into the well until the groundwater surface is encountered and slowly removing the bailer when it is full. The water is poured into a graduated plastic bucket to determine the volumes of water removed. Purging operations are repeated until the standard three to five well volumes have been removed (and indicator parameters must show that groundwater conditions have stabilized).

3.10.2 Monitoring Well Purging Using a Pump

When suction lift or centrifugal pumps are used for purging a monitoring well, only the intake line or hose or tubing is placed into the water column. To minimize cross contamination between wells, no more than three to five feet of hose or tubing should be lowered into the water column. The hose or tubing placed into the water shall be new or dedicated Teflon®.

When submersible pumps (such as bladder, turbine, and displacement pumps) are used, the pump itself is lowered into the water column. The pump must be cleaned as specified in Section 3.4. The pump/hose assembly used in purging should be lowered into the top of the standing water column and not deep into the water column. This is done so that the purging will "pull" water from the formation into the screened area of the well and up through the casing so that the entire static volume can be removed. If the pump is placed at the top of the water column, the standard three to five well volumes must be purged (and indicator parameters must show that groundwater conditions have stabilized). Low flow purging cannot be used with the pump at the top of the water column.

The Hercules' Project Manager must approve any submersible pumps that have been exposed to oily compounds before they are used to purge wells. It may be difficult to adequately decontaminate contaminated pumps under field conditions. When these type wells are encountered, alternative purging methods, such as bailers, should be considered.

When using a peristaltic pump for purging, the following procedures should be used:

Purging with a Peristaltic Pump

1. Cut a length of standard-cleaned (SESD Operating Procedure for Field Equipment Cleaning and Decontamination at the FEC(SESDPROC-206) Teflon® tubing, equal to the well depth plus an additional five to ten feet, in a standard cleaned bucket or box which has been lined with clean plastic sheeting or a garbage bag. Enough tubing is needed to run from the ground surface up to the top of the well casing and back down to the bottom of the well. This will allow for operation of the pump at all possible water level conditions in the well.

2. Place one end of the tubing into the vacuum side of the peristaltic pump head. Proper sizing of the Teflon® tubing should allow for a snug fit of the Teflon® tubing inside the flexible tubing mounted in the pump head.

3. Run a short section of tubing (does not have to be Teflon®) from the discharge side of the pump head to a graduated bucket.

4. Place the free end of the Teflon® tubing into the well until the end of the tubing is just below the surface of the water column.

5. Secure the Teflon® tubing to the well casing or other secure object using electrical tape or other suitable means. This will prevent the tubing from being lost in the well should the tubing detach from the pump head.

6. Turn on the pump to produce a vacuum on the well side of the pump head and begin the purge. Observe the pump direction to ensure that a vacuum is being applied to the sample/purge line. If the sample/purge line is being pressurized, either switch the tubing at the pump head or reverse the polarity of the cables on the pump or on the battery.

7. Purge the well according to the criteria described in Section 3.10 of this SAP. If the pumping rate exceeds the recovery rate of the well, continue to lower the tubing into the well several feet at a time, as needed, until the drawdown stabilizes or the well is evacuated to dryness.

8. For wells which cannot be evacuated to dryness, particularly those with recovery rates equal to or very nearly equal to the purge rate, there may not be complete exchange and removal of stagnant water in that portion of the water column above the tubing intake. For this reason, it is important that the tubing be placed in the uppermost portion of the water column while purging. Standard field measurements should frequently be taken during this process to verify adequacy of the purge.

9. When purging and sampling is complete, the tubing should be placed in a sanitary plastic bag and stored for reuse. If the tubing is believed to not be reusable, then it should be discarded.

When using a submersible pump for purging, the following procedures should be used:

Purging with a Submersible Pump

When a submersible pump is used for well purging, the pump itself is lowered into the water column. The pump must be cleaned as specified in SESD Operating Procedure for Field Equipment Cleaning and Decontamination (SESDPROC-205).

The pump/hose assembly used in purging should be lowered into the top of the standing water column and not deep into the water column. This is done so that the purging will "pull" water from the formation into the screened area of the well and up through the casing so that the entire static volume can be removed. If the pump is placed deep into the water column, the water above the pump may not be removed, and the subsequent samples, particularly if collected with a bailer, may not be representative of the aquifer conditions. It is recommended that the pump not be lowered more than three to five feet into the water column. If the recovery rate of the well is faster than the pump rate and no observable draw down occurs, the pump should be raised until the intake is within one foot of the top of the water column for the duration of purging. If the pump rate exceeds the recovery rate of the well, the pump will have to be lowered, as needed, to accommodate the drawdown. After the pump is removed from the well, the hose and the pump should be cleaned as described in SESD Operating Procedure for Field Equipment Cleaning and Decontamination (SESDPROC-205).

3.10.3 Low Flow Purging

Low flow purging is conducted by pumping groundwater from a well at a low, constant rate. For wells where the screened interval is well below the groundwater surface, the pump (tubing) intake will be set slightly above the middle of the screened interval of the well. For wells where the screened interval is near or at the groundwater surface, the pump (tubing) intake will be set just below the groundwater surface. The purge rate will be between 100 ml and 1000 ml per minute depending on the rate of recharge within each well. During low flow purging, water level drawdown in the well being sampled should be less than 0.5 feet. An adequate purge will be achieved when water quality parameters (pH, conductivity, and turbidity) have stabilized (as described in Section 3.11).

Water quality parameters will be measured using a YSI 556 multiparameter meter (or equivalent) equipped with a flow through cell. Following removal of an amount of water equal to one equipment volume (including the tubing, pump and flow through cell volumes), readings will be taken approximately every 3 to 5 minutes until stabilization is achieved or five well volumes are purged from the well.

3.11 Field Measurements During Purging

Field measurements of indicator parameters will be collected during the purging process. In particular, pH, specific conductance, dissolved oxygen and turbidity will be monitored during purging. Groundwater temperature will be measured at the time of collecting groundwater samples and may be measured during the purging process. The appropriate meter for monitoring each parameter as identified in the table below will be used.

Parameter	Equipment (or equivalent)
pH	YSI Model 556 Handheld Multiparameter instrument or equivalent
Specific Conductance	YSI Model 556 Handheld Multiparameter instrument or equivalent
Dissolved Oxygen	YSI Model 556 Handheld Multiparameter instrument or equivalent
Turbidity	LaMotte 2020WE Turbidity meter or equivalent

A minimum of four measurements should be taken for each parameter recorded immediately during well purging with the first measurements collected upon the first discharge. Each of the four field measurements should be recorded on the Field Sampling Form or in the field logbook. Each parameter should stabilize before well purging is completed.

Stabilization is defined as three consecutive readings meeting the following criteria:

- pH measurements remain constant to within 0.1 standard unit; and
- Conductivity does not vary more than 5 percent; and
- Turbidity stabilizes below 10 Nephelometric Turbidity Units ("NTUs") or three consecutive readings within 10% of each other (efforts should be made to reduce turbidity to below 10 NTUs; additional water volume should be purged before using the three consecutive readings within 10%) ; and
- Dissolved oxygen changes less than 0.2 mg/liter or 10%, whichever is greater, between readings.

If all indicator parameters have not stabilized after purging three well volumes, purging should continue until all indicator parameters have stabilized or until five well volumes have been purged. If all parameters have not stabilized after purging five well volumes, it will be assumed that the changes in parameters represent migration of different quality water towards the well under influence of purging, and purging will be terminated. In this case, the Hercules' Project Manager shall be notified before proceeding with groundwater sampling activities. Purged groundwater will be collected in drums, and the drums will be labeled and disposed of appropriately. If the monitoring wells are purged dry prior to removing three well volumes, additional purging will not be required prior to obtaining a groundwater sample. Temperature will not be used as an indicator parameter. Temperature will be measured and recorded at the time of sampling. Even though temperature is not used to determine stability, the temperature of purge water may be recorded as temperature readings are often used in the interpretation of other parameters.

4.0 SAMPLE COLLECTION

Groundwater samples will be collected as part of the groundwater monitoring program pursuant to the renewed hazardous waste permit for the Facility. The groundwater monitoring program will identify the monitoring wells to be sampled, the frequency of sampling, and the analyses to be performed. Groundwater sample collection activities shall proceed progressively from the least suspected contaminated area to the most suspected contaminated area if sampling devices are to be reused. The standard procedure will be to collect unfiltered groundwater samples. The following section describes the procedures that will be used to obtain groundwater samples at the Facility.

4.1 Obtaining Groundwater Samples from Monitoring Wells

Groundwater sampling will be conducted immediately following the purging of the monitoring wells. In an effort to obtain a sediment free groundwater sample, a quiescent method of sampling in each monitoring well will be employed. Sampling using a bailer is accomplished by slowly lowering the bailer into the monitoring well until it is completely submerged beneath the groundwater surface. The bailer is then slowly removed from the monitoring well so that only minimal surging of the well occurs. A peristaltic pump can also be used for sample collection. Groundwater samples that will be analyzed for volatile organic compounds ("VOCs") should be collected using a bailer or by filling the Teflon® tubing, by one of two methods, and allowing it to drain into the sample vials. After the initial water is discharged through the pump head, the tubing is quickly removed from the pump and a gloved thumb placed on the tubing to stop the water from draining out. The tubing is then removed from the well and the water allowed to either gravity drain or be reversed, by the pump, into the sample vials. (Note: When reversing the pump, make sure the discharge tubing is not submerged in purge water.) Alternatively, the tubing can be lowered into the well to the desired depth and a gloved thumb placed over the end of the tubing. The tubing can then be removed from the well and the water collected by draining the contents of the tubing into the sample vials. Under no circumstances should the sample for analysis of VOCs be collected from the content of any other previously filled container. When sampling for other non-volatile organic compounds, it is also permissible to collect the sample directly from the pump discharge tubing after an adequate purge has been demonstrated. Submersible pump samples may be collected directly from the pump discharge tubing.

Water samples from the bailer/pump will be gently poured into the appropriately preserved sample containers in the sequential order prescribed in Table 1 (see specific procedures for VOC sample collection using a peristaltic pump). Table 2 lists the sample containers and preservatives to be used for each type of analysis. Filtered samples will only be collected in conjunction with un-filtered samples as provided for in the groundwater monitoring program. If the volume within the bailer is insufficient to fill the necessary sample containers, the bailer will be lowered again into the monitoring well and more groundwater will be obtained until the required sample containers are completely filled. Only new sample containers will be used.

5.0 SAMPLE HANDLING AND PRESERVATION

5.1 Sample Containers and Preservation

During groundwater sample collection activities, steps will be taken to ensure that the pump discharge line or the bailer does not touch the sample container. The sample containers will be placed immediately into a cooler containing ice. Each groundwater sample will be placed into an appropriate, labeled container. Groundwater samples collected for analysis of VOCs must not have any headspace. All other sample containers must be filled with an allowance for ullage. All samples requiring preservation must be preserved as soon as practically possible, ideally immediately at the time of sample collection. All chemical preservatives will be stored in individual single-use vials that will also serve as the sample container. The required sample containers, preservatives, and holding times are summarized in Table 2.

6.0 SAMPLE DOCUMENTATION AND IDENTIFICATION

6.1 Chain of Custody

A Chain of Custody form is a legal written record, which traces possession and handling of the sample from collection through laboratory analysis and final recording of results. Chain of Custody Record forms must be accurate and kept with the sample coolers at all times. An example of a Chain of Custody form is presented in Figure 4.

The most practical way to minimize Chain of Custody problems is to involve the fewest people possible in preparing Chain of Custody forms and to use standardized documentation. The activities associated with establishing and maintaining a Chain of Custody form are summarized as follows:

A sample will be considered to be in the custody of a person if it is in that person's possession or sight or secured by that person in an approved location accessible only to authorized personnel.

The Chain of Custody record will begin with the shipment of sample containers from the laboratory. For all sampling, appropriately prepared containers and blank water will be shipped in custody-sealed containers with a Chain of Custody form. When overnight couriers are utilized, the air or ground bill will become part of the Chain of Custody record. The receiver will verify that all custody seals are intact. Any shipping containers that show evidence of tampering will be returned unused to the shipper. Any deviations from the original shipment documents will be noted on the Chain of Custody form and the receiver will accept custody for all or part of the shipment by an exchange of signatures with the delivering agent. Containers will then be secured in an approved location accessible only to authorized personnel until they are needed in the field.

When a sample has been taken in the field, the sampler will complete the Chain of Custody form provided. The sample will be secured in a shipping container by the sampler and must remain in the sampling team's possession until it is secured in an approved location accessible only to authorized personnel or until custody is transferred by an exchange of signatures to another person.

6.2 Sample Labels

Each sample container will be identified by fixing a pressure sensitive adhesive label on the container. The label will contain the sample identification number (“I.D No.”), date, time, and initials of the sampler using a waterproof pen or felt-tip pen. An example of the label is presented in Figure 5. Each sample will be uniquely identified on its container. The labels for volatile organic analysis (“VOA”) vials are 2-7/8 by 2-1/8 inches, a size that will fit short VOA vials, which are the smallest vials that are normally used. The labels are printed on waterproof, self-adhesive stock. All labels in a set have the same ID No. Labels with the same ID No. will be used on the various bottles that usually constitute a single sample.

The following are definitions for some of the terms on the labels:

·ID No. This field consists of a distinctive identification number, which allows for clear and precise identification of the sample. All labels in a set have the same ID No. The label set will be applied to each bottle within one sample and to the corresponding forms or notebooks. The purpose of the ID No. is to provide a single, unique identifier to distinguish the sample from all other samples and to simplify data management. Because the ID No. is dependent on the sample sequence number, if two or more sampling crews are used to collect samples on the sample day, each crew should be given a range of sequence numbers to use for that date so that unique ID Nos. are maintained.

· Site The site is the name of the overall area from which the sample was taken. It is the largest area of concern in a project (i.e., it is the name used for the area of the entire project). A single name or abbreviation will be used by samplers.

6.3 Sample Seal

Field personnel will place a sample seal around the cap of each individual sample container and around each shipping cooler to prevent tampering.

6.4 Field Documentation

Important information and data prior to and during the sampling event will be recorded on the Field Sampling Form or in the field logbook. Each page of the logbook or field sampling form will be initialed and dated.

6.4.1 Field Logbook

Information pertinent to the investigation and sampling event will be recorded in field logbook(s). These will be bound books, with consecutively numbered pages. All pages will be dated and initialed by the person recording information. Any blank spaces in the books will be crossed through. Any works, sketches, or phrases that are recorded but deemed incorrect will be marked through in such a way to be legible, yet obviously struck from the text. All mark-throughs will be initialed and dated by the person striking the item.

Each person heading a sampling team will be issued a field logbook by the Project Manager. That person will be responsible for maintaining the logbook. The field book will be collected and copied for the file at the Facility prior to being returned to the Project Manager.

The sampling team is to record the following information each day of sampling as appropriate in the field logbook:

- Day/date/time/weather conditions;
- Approximate air temperature;
- Sampling team members;
- Calibration of equipment
- Type of sampling equipment used;

- Physical properties of the sample including color, odor, and PID readings (if collected). These properties may be indicated on the field sampling form in lieu of the field book, if appropriate;

- Types of sample jars and preservatives used; and

- Decontamination and cleaning procedures for equipment.

6.4.2 Field Sampling Form

At each sampling location, a Field Sampling Form will be completed. The Field Sampling Form to be used is illustrated in Figure 3. The form is to be completed in its entirety and initialed and dated by the sampling team member(s).

6.5 Sample Shipping

Prior to sealing the sample cooler, the Chain of Custody forms will be signed by the sampler(s) relinquishing custody. Samples will be properly packaged and dispatched as soon as possible to the laboratory for analysis. Proper packing includes placing the Chain of Custody form in a zip-lock plastic bag and placing it into the cooler, placing sample containers and VOA vials in appropriate bubble packaging to prevent breakage, and icing down samples. Copies of all Chain of Custodies used for the shipment of samples to the desired laboratory are to be returned to the Facility in Brunswick.

7.0 QUALITY ASSURANCE/QUALITY CONTROL MEASURES

7.1 Field QA/QC Program

A number of quality assurance/quality control ("QA/QC") samples will be collected as part of the groundwater monitoring program to ensure that the results are precise, accurate, complete and representative. The type and number of field QA/QC samples are described below.

7.1.1 Trip Blanks

A water trip blank will be used to assist in the detection of sources of purgeable volatile organic compound cross-contamination that may occur at various points in the process of sampling, transporting, storing, and analyzing the samples. Trip blanks can assist in the detection of interference derived from improper sample container cleaning and preparation, contaminated source blank water, sample cross-contamination during transportation and storage, and extreme environmental conditions affecting the sampling event. A water sample VOC trip blank is required for every study where water samples are collected for VOC analysis. Sealed preserved (or unpreserved, if unpreserved vials were used during the investigation) 40-ml VOC vials will be transported to the field. Two sealed VOC vials will be submitted per trip blank sample. At least one trip blank sample will be submitted per sample shipment. Trip blanks will be prepared by laboratory personnel. Investigators should submit their request for trip blanks at least one week in advance of scheduled field investigations and inspections and never (except in emergency situations) less than two days in advance of scheduled field investigations and inspections. These samples should not be picked up earlier than the morning of departure for the scheduled inspection/investigation. These trip blanks will be handled and treated in the same manner as the water samples collected for volatile organic compounds analysis on that particular study. These samples will be clearly identified on sample labels and Chain of Custody Records as trip blanks.

7.1.2 Ambient (Field) Blanks

A field blank is a sample that is prepared in the field to evaluate the potential for contamination of a sample by site contaminants from a source not associated with the sample collected (for example air-borne dust or organic vapors which could contaminate a soil sample). Organic-free water is taken to the field in sealed containers or generated on-site. The water is poured into the appropriate sample containers at pre-designated locations at the site of sampling activities. Field blanks should be collected in dusty environments and/or from areas where volatile organic contamination is present in the atmosphere and originating from a source other than the source being sampled.

7.1.3 Equipment Rinsate Blanks

Equipment rinsate blanks will be collected whenever field decontamination of equipment to be re-used in sampling activities is performed. When field cleaning of equipment is required during a sampling investigation, a piece of the field-cleaned equipment will be selected for collection of a rinsate blank. At least one rinsate blank will be collected during each week of sampling operations. After the piece of equipment has been field cleaned and prior to its being used for sample operations, it will be rinsed with organic free water. The rinse water will be collected and submitted for analyses of all constituents for which normal samples collected with that piece of equipment are being analyzed.

7.1.4 Duplicate Sample

Duplicate samples consist of the collection of two or more samples from the same source under identical conditions simultaneously into separate containers. One duplicate sample of all analytes should be collected for every twenty samples collected. At a minimum, one duplicate sample should be collected if less than twenty samples are collected. Each duplicate sample will have a unique sample number similar to those used for other samples.

7.1.5 Temperature Blank

A temperature blank is a container of water shipped with each cooler of samples requiring preservation by cooling to 4 degrees Celsius (ice). The temperature of the blank is measured at the time of sample receipt by the laboratory. No temperature blank is necessary for waste samples since waste samples do not require ice for preservation.

7.2 Laboratory Quality Assurance/Quality Control Procedures

The contract laboratory must have Standard Operating Procedures ("SOPs") that include a Quality Assurance/Quality Control Program. The laboratory shall provide Hercules and Pinova with its Quality Manual that documents its QA/QC program. The following Data Quality Objectives should be discussed:

- Confirm or deny the possibility of Constituents of Concern ("COCs") at levels greater than risk based criteria or maximum contaminant levels ("MCLs").

- Quantification of COCs to the practical quantitation limit ("PQL").
- Measurement and goals of the following parameters:
  - Precision, accuracy, completeness, and representativeness of results.

The groundwater quality samples must be analyzed using procedures described in the latest edition of the USEPA document "Test Methods for Evaluating Solid Waste", SW-846 and all validated updates. The current procedures to be used for various parameters are presented on **Table 2**.

8.0 REPORTING

The results of the groundwater sampling and analyses will be reported to Hercules in a format suitable for submittal to the Georgia EPD in accordance with applicable requirements. The contract laboratory shall be certified as required by Section 391-3-26.05(2) of the Rules of the Georgia Department of Natural Resources. The laboratory shall submit a certification page with each analytical data package. The laboratory shall report quantification or detection limits for each constituent as appropriate as well as the name of the analyst running the required analyses.

As required by 40 C.F.R. § 270.30(j)(3), the records from all groundwater monitoring wells and associated groundwater surface elevations will be maintained in the operating record of the Facility. The records for monitoring information will include:

- The date, exact place, and time of sampling or measurements;
- The individual(s) who performed the sampling or measurements;
- The date(s) analyses were performed;
- The individual(s) who performed the analyses;
- The analytical techniques or methods used; and
- The results of such analyses.

TABLE 1
COLLECTION ORDER OF GROUNDWATER PARAMETERS
HERCULES BRUNSWICK GEORGIA

1. Volatile Organics – 8260
   - (See specific procedures for VOC sample collection using a peristaltic pump in Section 4.1)
2. Semi-volatiles and Dioxin/Furans – 8270/8290
3. Organochlorine Pesticides and Polychlorinated Biphenyls – 8081
4. Herbicides – 8151
5. Total Metals – 6020
6. Dissolved Metals (field-filtered) 0.45um filter – 6020
7. Cyanide – 9012
8. Formaldehyde – 8315
9. Sulfide – 376.1

TABLE 2
RECOMMENDED SAMPLE CONTAINERS, PRESERVATION TECHNIQUES AND HOLDING TIMES FOR GROUNDWATER SAMPLES

ANALYTES	SW-846 METHOD	SAMPLE CONTAINERS	PRESERVATIVES	HOLDING TIMES
VOCs	8260B	3 x 40 ml Glass, Teflon lined septum	4 ° C - HCl	7 Days
SVOCs	8270D	2 x 1 L Amber Glass, Teflon lined cap	4 ° C - None	7 Days
Dioxins/Furans	8290A	2 x 1 L Amber Glass, Teflon lined cap	4 ° C - None	30 Days
Pesticides and PCBs	8081B_8082A	2 x 250 mL Amber Glass, Teflon lined cap	4 ° C - None	7 Days
Herbicides	8151A	2 x 1 L Amber Glass, Teflon lined cap	4 ° C - None	7 Days
Metals	6020A	1 x 250 mL Plastic	4 ° C – HNO_3	6 Months
Cyanide	9012B	1 x 250 mL Plastic	4 ° C – NaOH	14 Days
Formaldehyde	8315A	1 x 125 mL Amber Glass, Teflon lined cap	4 ° C - None	3 Days
Sulfide	376.1	2 x 250 mL Plastic	4 ° C – $ZnC_4H_6O_4$ & NaOH	7 Days

Source: US EPA SW 846 (Methods used will to match latest SW-846 updates as they are released)

FIGURE 1
Daily Instrument Calibration Check Sheet

Date	Instrument	Serial No.	Calibration Method	Calibrated By	Remarks

FIGURE 2
Well Inspection Log

Inspection Point	Well ID visible	Concrete pad intact	Well cap intact and water-tight	Water in Vault	Well locked or bolted down	TOC Mark Visible	Well casing in good condition	Comments
UP-1S								
UP-1D								
POC-1S								
POC-1D								
POC-2S								
POC-2D								
POC-3S								
POC-3D								
MW-1S								
MW-1D								
MW-2S								
MW-2D								
MW-3S								
MW-3D								
MW-4								
MW-5S								
MW-5I								
MW-7								
MW-8								
MW-9S								
MW-9D								
MW-10S								
MW-10D								
MW-11S								
MW-11D								
MW-12S								
MW-12D								
MW-13								
MW-14S								
MW-14D								

Inspection Point	Well ID visible	Concrete pad intact	Well cap intact and water-tight	Water in Vault	Well locked or bolted down	TOC Mark Visible	Well casing in good condition	Comments
MW-15S								
MW-15D								
MW-16S								
MW-16D								
MW-17S								
MW-17D								
MW-18								
MW-19S								
MW-19I								
MW-19D								
MW-20S								
MW-20I								
MW-20D								
MW-21								
MW-22								
MW-23								
MW-24								
MW-25S								
MW-25D								
MW-26S								
MW-26D								
MW-27D								
MW-28D								
MW-29I								
MW-29D								
MW-30S								
MW-30D								
MW-31D								
MW-32D								
MW-33								
MW-34								
MW-35D								
MW-36D								
MW-37S								
MW-37I								

Inspection Point	Well ID visible	Concrete pad intact	Well cap intact and water-tight	Water in Vault	Well locked or bolted down	TOC Mark Visible	Well casing in good condition	Comments
MW-37D								
MW-38S								
MW-38I								
MW-38D								
MW-39S								
MW-39I								
MW-39D								
MW-40S								
MW-40I								
MW-40D								
MW-41I								
MW-42S								
MW-=42I								
MW-42D								
MW-43S								
MW-43I								
MW-44S								
MW-44I								
MW-44ID								
MW-44D								
MW-45I								
MW-46I								
MW-48S								
MW-48I								
MW-48D								
MW-49S								
MW-49I								
MW-49D								
MW-50S								
MW-50I								
MW-50D								
MW-51S								
MW-51I								
MW-51D								
MW-52S								

Inspection Point	Well ID visible	Concrete pad intact	Well cap intact and water-tight	Water in Vault	Well locked or bolted down	TOC Mark Visible	Well casing in good condition	Comments
MW-52I								
MW-52D								
MW-53S								
MW-54S								
MW-54I								
MW-55I								
MW-55D								
MW-56D								
MW-57D								

Inspected By: Dates:
Corrective action(s) required? (Y/N): ___

If yes, describe necessary corrective actions: ______________________________

____
____
____

Description/Date of Corrective Action(s) Performed: ______________________________

____
____
____
____

Piezometer Inspection Log

Inspection Point		Well ID visible	Concrete pad intact	Well cap intact and water-tight	Water in Vault	Well locked or bolted down	Comments
PZ-14	by U Well						
PZ-16	SE of CMC office						
PZ1-2							
PZ1-6							

Inspected By: Dates:

Corrective action(s) required? (Y/N): ___

If yes, describe necessary corrective actions: ______________________________

Description/Date of Corrective Action(s) Performed: ______________________________

FIGURE 3
Groundwater Field Sampling Form

GROUNDWATER SAMPLING LOG

SITE NAME: Former Hercules Facility	SITE LOCATION: Brunswick, GA
WELL ID:	DATE:

PURGING DATA

WELL DIAMETER (inches):	TOTAL WELL DEPTH: ______ feet WELL SCREEN INTERVAL DEPTH: feet to feet	STATIC DEPTH TO WATER (feet):	PURGE PUMP TYPE OR BAILER (circle one): Peristaltic / Stainless Submersible / Bailer

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= ______ liters + (______ liters/foot X ______ feet) + ______ liters = ______ liters

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (______ feet – ______ feet) X ______ gallons/foot = ______ gallons

TIME	VOLUME PURGED (liters)	CUMUL. VOLUME PURGED (liters)	PURGE RATE (L/min)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (μmhos/cm or μS/cm)	DISS. OXYGEN (mg/L)	TURBIDITY (NTUs)	OXYGEN REDUCTION POTENTIAL (mV)

TUBING INSIDE DIA. CAPACITY (Liters/Ft.): **1/8"** = 0.0024; **3/16"** = 0.0054; **1/4"** = 0.0097; **5/16"** = 0.0151; **3/8"** = 0.0217; **1/2"** = 0.0386; **5/8"** = 0.0603

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION:	SAMPLER(S) SIGNATURES:	SAMPLING TIME:
FIELD DECONTAMINATION: Y N	FIELD-FILTERED: Y N FILTER SIZE: ____ μm Filtration Equipment Type: ______	DUPLICATE: Y N

SAMPLE CONTAINER SPECS			SAMPLE PRESERVATION	INTENDED ANALYSIS AND/OR METHOD
Included for analyses?	# Bottles	VOLUME		
REMARKS:				

NOTES: 1. STABILIZATION CRITERIA FOR THREE CONSECUTIVE WATER QUALITY READINGS

Turbidity: <10 NTU or 3 Consecutive readings within 10% of each other following removal of additional volume
pH: <0.1 SU
Specific Conductance: 5%
Drawdown: <0.5 ft from Initial
Dissolved Oxygen: <0.2 mg/L or 10%, whichever is greater

FIGURE 4
Example Chain of Custody

Chain of Custody Record

Client Contact	Project Manager:	Site Contact:	Date:	COC No:
	Tel/Fax:	Lab Contact:	Carrier:	______ of ______ COCs
	Analysis Turnaround Time			Job No.
	Calendar (C) or Work Days (W) __________			
	TAT if different from Below __________			SDG No.
Project Name:	☐ 2 weeks			
Site:	☐ 1 week ☐ 2 days			
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample									Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ____________

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☐

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For __________ Months*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

FIGURE 5
Example Sample Label

Groundwater Sample

Sample ID: ___________________
Location: ____________________
Date: ________________________
Time: ________________________
Sampled By: __________________
Preservative Used: _____________
Filtered / Unfiltered
Temperature Storage: 4°C
Comments: ____________________
____