

**APPENDIX E – WESTBAY SYSTEM DEVELOPMENT, SAMPLING
AND DECONTAMINATION PROCEDURES**

WESTBAY MP SYSTEM WELL DEVELOPMENT PROCEDURES

The Westbay MP System is a multi-level sampling system that allow discrete groundwater samples to be collected from multiple intervals within a single well. Each interval is isolated with the use of packers to seal the well annulus between the monitoring zones. Each monitoring interval contains a measurement port and a pumping port.

1.0 Westbay MP System Well Development Procedures

- 1.1 The Westbay MP System will be installed in each borehole within 24-hours of the completion of primary borehole/well installation and development. The primary development will utilize a submersible pump to purge groundwater from each 10-foot screened section of the steel casing. Water will be pumped to a temporary storage container prior to discharge to the on-site treatment system. Primary development will be considered complete when discharge water has a turbidity of less than 10 NTU and field measurements indicate near-asymptotic levels of the tracer used in the drilling fluids. Records of development activities and purge volumes will be maintained.
- 1.2 Final well development will be completed for each Westbay monitoring interval to ensure that water from each discrete monitoring interval is representative of water from that portion of the formation.
- 1.3 The following is a list of equipment required for final development of each Westbay MP System monitoring zone (Site-specific conditions may warrant the addition or deletion of some equipment):
 - Multi-parameter meter or individual meters capable of measuring the following field parameters:
 - pH
 - Specific conductance
 - Temperature
 - Oxidation-reduction potential (ORP)
 - Turbidity
 - Bromide meter
 - Field meter calibration standards
 - Field logbook and/or development form
 - Distilled water
 - Large capacity temporary water storage containers

- 1.4 Calibrate the field meters according to manufacturer's specifications at the beginning of every day. Re-calibrate the meters during the day if readings become unstable or the sampling technician believes there is any need for re-calibration. Each calibration event should be logged in the field book or field form, along with a description of standards used, the model/serial number of the instrument used, and any slope or other resulting calibration output from the meter. The meters should be rinsed with distilled water prior to calibration events. The meters and probes should be stored according the manufacturer's specifications when not in use.
- 1.5 Each MP System monitoring zone will be purged separately for the final development. Westbay's as-built well diagrams will be reviewed to determine the depths of each monitoring zone and associated purging ports. The final development process is described below:
- Development of each monitoring zone requires opening the purging port associated with that monitoring zone. The port is opened using a Westbay open/close tool, which lowered into the well on a wireline. The tool should be operated by a qualified individual. The open/close tool is used to pull upward on the pumping port coupling, and expose the screen which is open to the formation. The tool is then removed from the well. The distance the pumping port coupling is moved while opening should be measured and recorded for use as a reference when closing the port after completion of development at each zone.
 - Waterra pumps (or equivalent inertial pump) will be used for final development of the MP System. This includes lowering into the well an appropriate length of properly size HDPE tubing with adequate rigidity to withstand the reciprocating action of the pump, with a foot valve secured the end of the tubing. To avoid potential damage to the Westbay system components, attention should be paid so the valve on the end of the tubing is not placed at a depth where a MP System purging or measurement port is located.
 - The inertial pump will be operated so that a minimum of 3 casing volumes of water are removed from the pumping port of each monitoring zone. The water shall be pumped to a temporary storage container. During the development, field measurements will be collected from the purge water. The data recorded shall include pH, specific conductance, temperature, ORP, and turbidity. Development will continue beyond the

3 casing volumes until the field parameters stabilize to within 10-percent of the previous reading. In addition, field measurements of bromide will be recorded along with cumulative purge volume and other notes of interest (odor, color, etc.)

- Following purging of the appropriate volume of groundwater, the inertial pump tubing will be removed from the well. The Westbay open/close tool will then be used to close the pumping port coupling by the distance measured when opening the port. To ensure the pumping port coupling is completely closed, the water level inside the MP System well will be checked. Approximately 1 gallon of store-bought drinking water (distilled or deionized water are not recommended) will be poured into the well. Adequate time will be allowed for “sheeting” effects of the water running down the inside of the well. The water level will then be checked again, and an increase in the height of the water column inside the well should be noted. If an increase in the water column height is not noted, the pumping port coupling has not been adequately closed. If the water level has risen inside the well, the new level will be noted. After waiting a minimum of 15 minutes, the water level will be checked again. Any decrease in the water level from the previous reading indicates the pumping port coupling is not completely closed.
- In instances where the pumping port coupling was determined not to be adequately closed, the Westbay open/close tool should be used again to close the port. The steps above should then be repeated to ensure the port is properly closed.

WESTBAY MP SYSTEM SAMPLING AND DECONTAMINATION PROCEDURES

The Westbay MP System is a multi-level sampling system that allow discrete groundwater samples to be collected from multiple intervals within a single well. Each interval is isolated with the use of packers to seal the well annulus between the monitoring zones. Each monitoring interval contains a measurement port and a pumping port. Sampling should be performed by a qualified individual trained in the operation of the Westbay sampling system.

1.0 Westbay MP System Sampling Procedures

- 1.1 The sampling procedures outlined in this section are the same for each monitoring zone in every well. Within each monitoring interval, a measurement port is installed as part of the MP System. The measurement ports incorporate a valve in the wall of the coupling, with an alignment notch on the opposite, inside wall of the coupling.
- 1.2 The Westbay sampling probe (currently the MOSDAX Sampler Probe Model 2531), the Westbay MOSDAX Automated Groundwater Interface (MAGI), Westbay sample bottles, and laboratory supplied sample bottles are required to perform the sampling.
- 1.3 Review Westbay's as-built well diagrams to determine the depths of each monitoring zone and associated measurement ports for the well being sampled.
- 1.4 Assemble the tripod and wireline cable reel above the well, and attach the evacuation port coupling to the top of the MP System. Designate a location with a clean stable surface for handling the sample bottle string such that the bottles do not come in contact with the ground surface.
- 1.5 Using new disposable gloves, assemble the sample bottles (maximum of 4) using the wrenches provided in the Westbay kit to snug the connections between the sample bottles and the connector tubing. Confirm that the o-rings on the connector tubing are present and intact. Replace o-rings if necessary. Using the valve tool, close the valve on the bottom sampling tube, and open the valves between each bottle.

- 1.6 The sample bottles can now be attached to the sampling probe. The MAGI also needs to be connected to the sampling probe. Lastly, attach the MAGI to the battery source by clipping the red lead to the positive battery terminal and the black lead to the negative battery terminal. NOTE: It is important to connect the sampling probe to the MAGI prior to connecting the MAGI to the power source to avoid the potential for an electric shock to the sampling technician or an electrical surge to the MAGI.
- 1.7 The sampling probe and bottles are now ready to be placed in the well. Ensure the cable reel brake is on, and there is adequate slack in the wireline cable to maneuver the sampling train into the well without kinking the cable. Using the MAGI, activate the location arm on the sampling probe so it is in the extended position (the MAGI display should indicate 15 to 16 revolutions). Carefully lift the sampling train into the well, paying special attention to the connection between the wireline and sampling probe so as not to kink the wireline. Lower the sample bottles and probe until the location arm is firmly seated in the alignment notch of the evacuation collar.
- 1.8 Remove the slack from the wireline cable, and zero the reel counter.
- 1.9 With the sampling probe seated in the evacuation collar, the following Westbay surface function checks must be performed and recorded on the groundwater sampling form:
 - Record the ambient pressure indicated by the MAGI. This pressure reading is required once per well, unless the well is being sampled over multiple days, in which case the ambient pressure should be recorded at the start of sampling on subsequent days.
 - Activate the shoe. The shoe should extend and the MAGI display should indicate 16 to 19 revolutions (23 revolutions in open air outside of the evacuation collar).
 - Close the sampler valve. The motor should run for approximately 5 seconds, and the MAGI display will indicate 1 revolution.
 - Attach the vacuum pump to the fitting on the vacuum coupling. Note the pressure reading on the MAGI. Begin applying a vacuum with the vacuum pump. The MAGI display should maintain a constant pressure. If the pressure reading begins decreasing, inspect for leaks at the face seal of the probe, the connection to the pump, and the connection at the probe sampling valve. Repeat procedure as necessary to ensure seals and connections are secure.
 - Open the sampler valve.

- Use the vacuum pump to apply a vacuum to the sample bottles. The vacuum should be applied until the pressure inside the sample bottles is below 4 pounds per square inch (psi) as displayed on the MAGI.
- Close the sampler valve. A vacuum has now been applied to the sample bottles.
- Retract the shoe.
- Confirm the cable reel brake is on and the reel counter has been zeroed. Retract the location arm.

1.10 The sampling probe and bottles can then be lowered into the MP System well. The sampling train should be lowered to the approximate sample depth, until the MAGI beeps indicating the sampling probe has reached the magnetic reference installed on the MP System (note that the beep system is not always reliable, so the depth readings should be monitored). Raise the sampling probe approximately 3 feet to ensure the sampling probe location arm is above the measurement port.

1.11 The location arm should then be activated, and the sampling probe and bottles can be lowered until the location arm is secured in the measurement port alignment notch. The depth on the wireline reel counter should be checked against the Westbay as-built well diagram to verify the sample probe and bottles are at the correct measurement port.

1.12 When the sample probe and bottles are located at the correct measurement port, the following steps are required, including recording data on the groundwater sampling form:

- Tighten the brake on the cable reel.
- Record the pressure reading inside the casing as displayed on the MAGI.
- Activate the shoe, noting that a pressure change on the MAGI display should occur indicating a connection with the formation when the shoe is fully extended.
- Record the pressure reading of the formation as displayed on the MAGI.
- Open the sampler valve. NOTE: the pressure displayed on the MAGI will jump to a significantly lower reading due to the vacuum applied to the sample bottles. The pressure will then begin to climb as the sample bottles are filled with groundwater.
- Allow the sample bottles to fill with groundwater until the pressure displayed on the MAGI is the same as the formation pressure noted prior to opening the sampler valve. NOTE: The Westbay MOSDAX Sampler Probe Model 2531 pressure transducer has a reported accuracy of $\pm 0.25\%$.

- Close the sampler valve.
 - Retract the shoe.
 - Record the pressure reading inside the casing as displayed on the MAGI. The pressure reading should be similar to the original casing pressure recorded prior to activating the shoe.
 - Ensure there is no slack in the wireline cable, and the cable reel brake is applied. Retract the location arm, and retrieve the sample probe and bottles.
- 1.13 When the sampling probe reaches the top of the MP System, activate the location arm and seat the probe in the alignment notch of the evacuation coupling. Provide adequate slack in the cable so the probe will reach the designated bottle handling area without kinking the cable.
- 1.14 Paying special attention not to kink the wireline cable at the connection to the sampling probe, remove the sample probe and bottles from the well and lay out the unit on a split PVC casing or other clean, level surface.
- 1.15 Close each of the valves connecting the sample bottles. Each of the bottles can then be separated from the sampling train.
- 1.16 The sample bottles can then be used to fill laboratory-prepared sample containers. Hold the sample bottle vertically over the laboratory sample container, with the top of the bottle pointed away from the sampler's face. Slowly open the top valve to release the pressure from within the bottle. Close the top valve once the pressure has been released. The bottom valve can then be opened and the groundwater can be directed into the laboratory container.
- 1.17 Ice should be present during each sampling event, and samples are to be placed in a cooler with ice immediately after the samples are transferred from the Westbay bottles to the laboratory supplied bottles. In the event a laboratory bottle is only partially filled with the sample collected on a particular run, the laboratory bottle should be closed and placed in a cooler with ice until subsequent runs with the Westbay sampling probe and bottles are performed to complete the sample collection.
- 1.18 In the event multiple runs with the Westbay sampling probe and bottles are required to collect the full sample volume from a particular monitoring zone, the Westbay sampling

equipment does not need to be decontaminated between runs. Each run with the sampling probe and bottles should be recorded and performed as described above in Sections 1.6 and 1.9.

- 1.19 Each sample will be appropriately labeled, logged on the chain-of-custody, and packaged in a cooler with ice for delivery to the laboratory.

2.0 Westbay Sampling Probe and Bottles Decontamination Procedures

- 2.1 The Westbay sampling probe and bottles must be decontaminated prior to moving between each monitoring zone (but not for multiple use within a single zone). Before disconnecting the sampling probe and bottles from the MAGI, activate the shoe so it is extended out from the sampling probe and open the sampling port valve. The decontamination process includes the following:

- The equipment decontamination wash solution will consist of Liquinox (or equivalent) and store-bought distilled water. The equipment rinse solution will consist of store-bought distilled water. The wash and rinse process can be performed in clean 5-gallon plastic buckets.
- Ensure that all the valves between sample bottles are open. Separate the sample bottles from their end caps (valves and connection lines between sample bottles).
- Wash the Westbay sample bottles in the wash solution by using a brush to scrub the inside and outside of the sample bottle. The bottle should then be rinsed by pouring distilled water over the outside and through the inside of the sample bottle.
- Disconnect the sample bottle end caps (valves) from the connection lines. Swirl the end caps in the wash solution and use a dedicated wash squirt bottle to direct a spray of wash solution through the valve. Rinse with distilled water, including using a dedicated rinse squirt bottle to rinse the valve.
- Use a dedicated wash squirt bottle to direct a spray of wash solution through the connector line. Use a dedicated rinse squirt bottle to rinse the connector lines with distilled water. Inspect o-rings for damage or wear, and replace if necessary.
- The sampling probe should NOT be completely submerged in the wash solution. A scrub brush saturated in the wash solution may be used to scrub the exterior of the probe. The sample tool must be disconnected from the MAGI prior to cleaning. To clean the sample tool, use the dedicated wash squirt bottle to direct a spray of wash

solution through the sampling port of the extended shoe. The wash solution will run through the inside of the tool, and exit through the bottom of the sampling probe. Use the dedicated rinse squirt bottle to rinse the sampling probe with distilled water by directing a spray of distilled water through the sampling port of the extended shoe. Finally, rinse the exterior of the sampling probe with distilled water. Visually inspect the sampling port o-ring (seal) for damage or wear and replace as necessary to ensure a seal between the sample tool and sample port.

- 2.2 Following decontamination, the Westbay sampling probe and bottles should be either returned to the storage container, or assembled for additional sampling on a split PVC casing or other clean, level surface.
- 2.3 Reference the Westbay Operations Manual for complete instructions on care, storage, and use of the sampling probe and bottles. Among the details noted in the manual, it is extremely important that the sampling probe is NOT exposed to below freezing temperatures or the pressure transducer could be damaged.