

GROUNDWATER SAMPLING USING WESTBAY[®] SYSTEM

Purpose This Water Quality and Hydrology Group (ENV-WQH) procedure describes field procedures for groundwater sampling using Westbay[®] systems.

Scope This procedure applies to all ENV-WQH staff, contract personnel, and students who conduct groundwater sampling with the Westbay[®] systems.

In this procedure This procedure addresses the following major topics:

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Who Requires Training to This Procedure	2
Preparations for Sampling	6
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Sample Collection Using Westbay [®] System	11
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Integrated Work Management The work specified in this procedure shall be conducted in accordance with applicable Integrated Work Documents, in accordance with LANL IMP 300-00-00, Integrated Work Management for Work Activities.

Signatures

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CONTROLLED DOCUMENT

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General Information About This Procedure

Attachments This document has the following attachments:

Number	Attachment Title	No. of pages
1	Equipment and Supplies Checklist for Sampling the Westbay® MP System	1
2	Water Quality Sampling Record for Westbay® Wells	3
3	Westbay® Pressure QA/QC Check Record	1
4	Groundwater Sampling Field Data Sheet	1

History of revision

This table lists the revision history and effective dates of this procedure.

Revision	Date	Description Of Changes
0	10/03	New document.
1	7/04	Added procedural steps.
2	8/04	Level 2 Resumption walkdown changes: Conduct sampling steps 1, 2, 5, and 20; HCP hazard mitigations
3	12/05	Added procedural steps and general editing; made recommended changes as a result of 7/05 procedural walk down; removed HCP attachment; added requirements for spotter for winch operation.

Who requires training to this procedure

The following personnel require training before implementing this procedure:

All ENV-WQH staff, contract personnel, and students who conduct groundwater sampling using the Westbay® system.

Training method

The training method for this procedure is “self-study” (reading) and is documented in accordance with the procedure for training (ENV-WQH-QP-024, *Personnel Training*). In addition, mentoring by a previously trained individual is required.

General Information About This Procedure, continued

Prerequisites In addition to training to this procedure, personnel performing this procedure must:

- Be Westbay® certified, OR
- Conduct sampling with a Westbay® certified person, OR
- Be trained by a Westbay® certified person and able to demonstrate proficiency in conducting sampling.

Comprehension of and authorization to the following documents is required:

- RRES-ES-Field, *General Field Work for All*
 - RRES-ES-Driving, *Driving, Towing, and Winching for All*
 - ENV-DO-201, *Pressure Transducer Installation, Removal, and Maintenance*
 - ENV-DO-206, *Sample Containers and Preservation*
 - ENV-DO-207, *Handling, Packaging, Transporting Field Samples*
 - ENV-DO-203, *Field Water Quality Analyses*
 - ENV-WQH-SOP-066, *Chemical Preservation of Water Samples (in draft)*
 - RRES-WQH-QP-029, *Generating and Maintaining Chain of Custody*
-

Definitions to this procedure Electrical conductivity (EC): A measure of the ease with which an electric current flows through a substance. When measured in water, it is dependent upon the presence of dissolved ions and temperature. It is the reciprocal of the resistance (R) in ohms between the opposite faces of a 1 cm cube of water at a specific temperature. Because R has units of ohm meters (Ω cm), EC has units of $(\Omega \text{ cm})^{-1}$, called siemens (S). Most natural waters have low conductivities, so EC is generally measured in microsiemens per centimeter ($\mu\text{S/cm}$).

Groundwater: Subsurface water in the saturated zone from which wells and springs are supplied.

Hydrogen-ion activity (pH): The effective negative \log_{10} of hydrogen ion activity. A measure of how acidic or basic a solution (numerically equal to seven for neutral solutions, increasingly basic above and acidic below that value).

Personal protective equipment (PPE): Clothing worn by workers to minimize the potential for contamination to skin or personal clothing. Also referred to as anti-contamination clothing or anti-C's. The degree of protective clothing required depends on the work area and nature of the job.

General Information About This Procedure, continued

**Definitions to
this
procedure,
continued**

Pi: Pressure inside the Westbay[®] casing. Pi measured above the deionized water column in the Westbay[®] casing is equal to atmospheric pressure at a given port elevation; calculated piezometric elevation will approximate the elevation of the port. Pi measured below the deionized water level inside the Westbay[®] casing will be the pressure head of the deionized water column; calculated piezometric elevation will be that of the elevation of the top of the deionized water column. See ENV-WQH-SOP-062, *Groundwater Level Data Processing, Review, and Validation*.

Po: Pressure in the formation outside the Westbay[®] casing at a specific monitoring port. Po of ‘dry’ monitoring ports will approximate Pi at that port if the port is above the DI water column. Po of ‘wet’ monitoring ports should not normally equal the Pi of the port. Review past field notes if they exist. Calculated piezometric elevation represents the piezometric water level at the location of the monitoring port. See ENV-WQH-SOP-062, *Groundwater Level Data Processing, Review, and Validation*.

Specific conductance: The electrical conductance that would occur between the faces of a 1 cm cube of water at 25 °C. Since EC is temperature sensitive, it is commonly corrected to its equivalent value at 25 °C for data comparison. Some equipment makes this conversion automatically, in which case the readings should be noted as “at 25 °C.” Otherwise, the water temperature at the time of reading should always be recorded along with the conductivity measurement so that the measurement can later be corrected to 25 °C.

Turbidity: Refers to inorganic solids and organic matter suspended in water. Turbidity, in nephelometric turbidity units (NTU), is measured as the intensity of light scattered by the suspended particulates in a water sample relative to a standard reference suspension.

Volatile organic compounds (VOCs): A class of chemical compounds, predominantly hydrocarbons and halogenated hydrocarbons, with low molecular weights and low boiling points that are insoluble or slightly soluble in water.

Dissolved oxygen: The amount of oxygen dissolved in water in parts per million (ppm) by weight or in milligrams per liter (mg/L).

General Information About This Procedure, continued

References

Westbay® Manuals to Reference:

MOSDAX Sampler Probe-Model 2532, Operations Manual R1.0
MOSDAX Handheld Controller-Model 2525, Operations Manual R1.2
MOSDAX Datalogger-Model 2524A, Operations Manual R1.0
Nonvented Sample Bottles-Model 2532, Operations Manual R1.0
Well Completion Reports – MP Casing Log, Depths of Key Items Table

Other Manual to Reference:

Mount Sopris, MX Winch and Controller, *Operations Manual, 1998*
Mount Sopris, 5MDA-100 MX Winch Depth Display, *Operations Manual, 1999*
Minarik, Regenerative Speed Controller-Models RG310A, RG310UA, RG300A, RG300UA, RG400A, RG400UA, *Users Manual*

Note

Actions specified within this procedure, unless preceded with “should” or “may,” are to be considered mandatory actions (i.e., “shall”).

Preparations for Sampling

**Analytical
Request
documenta-
tion**

Generate an Analytical Request (reference ENV-WQH-QP-029, *Generating and Maintaining Chain of Custody*).

**Equipment
needed**

Assemble the equipment needed for sampling event. Reference Attachment 1, Equipment and Supplies Checklist for Sampling Westbay® MP System.

**Calibrate field
instruments**

A **field team member** shall calibrate instruments to be used for water quality readings. Refer to ENV-DO-203, *Field Water Quality Analyses*.

Record calibration and instrument model information in field logbook or Water Quality Sampling Record for Westbay® Wells (Attachment 2) and/or WQH Meter Calibration Logbooks located in Storm Water Lab.

Preparations for Sampling, continued

Calibration and maintenance of Westbay® Sampler Probes

Sampler probe equipment will be properly maintained and calibrated according to manufacturer instructions. Maintenance and calibration records will be maintained to insure the quality of data from sampler probe equipment. Westbay® sampler probes are factory calibrated by Westbay® personnel.

Sampler probe maintenance

Perform routine maintenance as specified in MOSDAX owners manual each time a sampler probe is used at a well site. To conduct routine maintenance, perform the following steps:

Step	Action
1	Check/lubricate O-rings, and change if necessary.
2	Check cables.
3	Perform surface check of probe arm and shoe functions.
4	Ensure equipment is clean, work area uncluttered.
5	Follow manufacturer decontamination procedures and wipe dry before storing in case.
6	Cap all connections after wiping dry to prevent damage from rust and corrosion.
7	Document sampler probe maintenance in field logbook.

At the first sampling event of the month, perform once a month maintenance:

- Unscrew cable head and check the cable connection to the epoxyed nut for rust or other damage. Rehead the cable if damage is found.
- Record any maintenance problems in the field logbook.

Sampler probe calibration

A sampler probe may be considered to be properly calibrated as long as the probe returns values that are within pre-determined measurement precision specifications. The measurement precision of a Westbay® MOSDAX sampler probe is 0.1% of the pressure rating. How long a sampler probe will maintain calibrated depends on the amount of regular use the probe has experienced, whether or not the probe was exposed to environmental extremes, and how the probe was handled during use, transportation, and storage. Sampler probe calibration is performed only by the manufacturer. Sampler probes should be returned to the manufacturer once a year for factory calibration or the calibration period can be extended to two years or more if on-site calibration performance checks are conducted on a regular basis.

Preparations for Sampling, continued

Calibration and maintenance of Westbay® Sampler Probes cont.

Calibration checks before mobilizing to the field - To conduct a calibration performance check on the Westbay® MP System Sampler Probe, bench check barometric pressure measurements of each sampler probe by comparing probe barometric pressure measurements with a local meteorological station. This check must be done at the TA-64 ENV-WQH compound, using meteorological data from the TA-6 meteorological station, to get an accurate result. Other locations must be evaluated prior to use.

Step	Action
1	Record the Time of Probe Reading and the Probe Barometric Reading in psia on the <u>Westbay® Pressure QA/QC Check Record (Attachment 3)</u> .
2	Record the Date, Met Station, Time of Met Station Barometric Reading, and Barometric Pressure at Met Station (mb) on the <u>Westbay® Pressure QA/QC Check Record (Attachment 3)</u> . The barometric pressure recorded at TA-6 can be found on the LANL weather web page, http://weather.lanl.gov/data_request.asp . (Measurements are not available on the web site for one to two hours after being recorded.) Convert pressure in millibars (mb) to psi by multiplying the pressure in mb by 0.01450 psi/mb. Record the Barometric Pressure at Met Station (psi) on the <u>Westbay® Pressure QA/QC Check Record (Attachment 3)</u> .
3	Determine the error tolerance of the sampler probe by multiplying the pressure rating of the probe (psi) by 0.1%. Record the error tolerance on the <u>Westbay® Pressure QA/QC Check Record (Attachment 3)</u> .
4	Determine the acceptable range of barometric pressure measurements by adding/subtracting the error tolerance determined in Step 3 to/from the atmospheric pressure obtained from the meteorological station. Record the Acceptable Range on the <u>Westbay® Pressure QA/QC Check Record (Attachment 3)</u> .
5	<p>Compare the Barometric Pressure Reading measured by the sampler probe with the acceptable range.</p> <p>Verify that measurements are within the acceptable range and Yes or No in the Passed field on the <u>Westbay® Pressure QA/QC Check Record (Attachment 3)</u>.</p> <p>If barometric pressure measurements do not compare with meteorological values,</p> <ul style="list-style-type: none"> • Recheck the pressure measurements. • If necessary, return sampler probe to manufacturer for calibration and/or repair.

Preparations for Sampling, continued

Mobilize trailer to site Refer to RRES-ES-Driving, *Driving, Towing, and Winching for All*, when moving and hitching and unhitching the field trailer. Once on site, follow the field trailer owner's manual for leveling the trailer, turning on the propane and water valves, the and electric generator.

Sample Control and Field Documentation

Sample identification Adhesive barcode labels are used for sample identification that establishes an ownership to a particular analysis and sample station.

A label is used for every sample container. Apply the same sample number to each container of the same sample set.

Sealing and transporting samples Seal the lid of every sample container with a custody seal (i.e., custody tape) to ensure that samples are not tampered with.

Transport all sealed sample containers directly, and as promptly as possible, to the ECR Sample Management Office (SMO).

Package, store, and transport samples in accordance with ENV-DO-207 *Handling, Packaging and Transporting Samples*.

Completing Analytical Request/Chain of Custody forms Complete Analytical Request/Chain of Custody (AR/CoC) forms. Reference ENV-WQH-QP-029, *Generating and Maintaining Chain of Custody*, for further guidance.

Documenting chain of custody To document the chain of custody, record the sample location, sample ID number, field parameters, date and time of sample collection, and participants on sampling team in the field logbook.

Sample Collection Using Westbay® System

Background The Westbay® MP System is a modular multi-level groundwater monitoring device using a single closed access tube with valved ports. The valved ports are used to provide access to several different levels of a borehole through a single well casing. The modular design permits as many monitoring zones to be established as desired during well completion. This system also allows for sampling without purging the zone under normal aquifer conditions and takes samples at an in-situ pressure.

The Westbay® MP System consists of casing components which are permanently installed in the borehole, portable pressure measurement and sampling probes, and specialized tools.

Set up equipment for sampling

To set up equipment for sampling, perform the following steps:

Step	Action
1	Setup sampler winch and connect cables if not already connected (MOSDAX Sampler Probe Manual, Mount Sopris Manual).
2	Extend sections of Westbay® mast and lock into place with pins. Adjust height of mast plate to match height of well riser plate and bolt mast to well riser plate. NOTE: Steps 2 and 3 may be done in reverse order.
3	Route communication cable through mast.
4	Connect sampler probe and stainless steel sample bottles. NOTE: Always have a spotter outside trailer to help winch operator when raising sample string to ensure sample string is not raised within 3 inches below the mast wheel.
5	Turn on power to communication cable and trailer.

Sample Collection Using Westbay® System, continued

Conduct sampling

To collect a groundwater sample using a Westbay® system, perform the following steps:

Step	Action
1	Perform surface function tests.
2	Land sampler probe on well head and document surface function tests on the <u>Groundwater Sampling Field Data Sheet</u> (Attachment 4).
3	Evacuate air from stainless steel sample bottles with a vacuum pump to 2-4 psi. Document vacuum pressure in Column H on the <u>Groundwater Sampling Field Data Sheet</u> (Attachment 4).
4	Trip in sampler probe and bottles using the MP Casing Log and Depths of Key Items Table as reference. If the digital counter is not functional, use the Collar Detect Command and count the magnetic collars to locate the desired port.
5	Land sampler probe at desired port. Document location of sampler probe and the Pi inside the MP casing in Column K on the <u>Groundwater Sampling Field Data Sheet</u> (Attachment 4). Landing the sampler probe can be accomplished using only the winch or landing by hand (MOSDAX Sampler Probe Manual).
6	Attach sampler probe to monitoring port. Record the zone pressure (Po) in Column M on the <u>Groundwater Sampling Field Data Sheet</u> (Attachment 4).
7	Collect water sample at port by opening sampler valve. When the pressure stabilizes, record the Po with the valve open in Column O on the <u>Groundwater Sampling Field Data Sheet</u> (Attachment 4).
8	Close the sampling valve and retract the shoe. Record the Pi in Column R on the <u>Groundwater Sampling Field Data Sheet</u> (Attachment 4).
9	Slowly raise the sampler probe and retract the landing arm. Trip out sampler probe and stainless steel sample bottles. NOTE: Always have a spotter outside trailer to help winch operator when raising sample string to ensure sample string is not raised within 3 inches below the mast wheel.

Table continued on next page.

Sample Collection Using Westbay® System, continued

**Conduct
sampling,
continued**

To collect a groundwater sample using a Westbay® system, perform the following steps:

Step	Action										
10	Disconnect sample bottles from sample probe. Excess pressure can be vented from the last bottle in the string.										
11	Transfer water to sample containers. Record the volume of sample retrieved in Column S on the <u>Groundwater Sampling Field Data Sheet</u> (Attachment 4). Provide pertinent information about the sampling run in the comment field. Collect the non-filtered samples by filling the bottles in the order of expected most volatile to least volatile constituents. If a priority list has been established, collect the samples in that order.										
12	Collect a sample for volatile organic compound analysis by performing the following steps: <table border="1" data-bbox="527 919 1425 1371"> <thead> <tr> <th>Step</th> <th>Action</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Open the valve on the bottom of the Westbay® sample bottle.</td> </tr> <tr> <td>2</td> <td>Adjust the flow to slowly fill the vial until a reverse meniscus forms above the top of the sample vial.</td> </tr> <tr> <td>3</td> <td>Screw on the cap, invert, and tap the sample vial to check for presence of air bubbles.</td> </tr> <tr> <td>4</td> <td>If air bubbles are present due to collection technique, repeat steps 1 through 3 above. If bubbles are present due to off-gassing of samples water, document on the CoC and the Field Log Book.</td> </tr> </tbody> </table>	Step	Action	1	Open the valve on the bottom of the Westbay® sample bottle.	2	Adjust the flow to slowly fill the vial until a reverse meniscus forms above the top of the sample vial.	3	Screw on the cap, invert, and tap the sample vial to check for presence of air bubbles.	4	If air bubbles are present due to collection technique, repeat steps 1 through 3 above. If bubbles are present due to off-gassing of samples water, document on the CoC and the Field Log Book.
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4	If air bubbles are present due to collection technique, repeat steps 1 through 3 above. If bubbles are present due to off-gassing of samples water, document on the CoC and the Field Log Book.										
13	Repeat sampling steps 1 through 12 as needed to collect appropriate volume of water for sampling requirements from each monitoring port.										

Table continued on next page.

Sample Collection Using Westbay® System, continued

Conduct
sampling,
continued

Step	Action
14	<p>Collect filtered samples using a 0.45µm pore size filter.</p> <p>Notes:</p> <ul style="list-style-type: none"> • The filter may be a flat membrane supported by a filter-holder assembly or an in-line cartridge filter. If the filter-holder assembly is used, field personnel must ensure that it was thoroughly cleaned and decontaminated. Filters coarser than 0.45µm may be used to pre-filter, however, the final size must be 0.45µm. • Use an appropriate container when collecting water to be filtered. For example, water to be packaged in glass should be collected in glass before filtering. • Do not use the same container that sample was filtered from as the final container shipped to the analytical laboratory. <p>When collecting for humic acid analysis, a silver membrane 0.45µm pore size filter must be used to preserve the sample.</p>
15	<p>Perform field chemistry measurements or field parameters on each run. Record the information on the <u>Water Quality Sampling Record for Westbay® Wells</u> (Attachment 2) and any other information as needed. Reference ENV-DO-203, <i>Field Water Quality Analyses</i>. Discard water used for field measurements upon completion. DO NOT use for analytical sample.</p>
16	<p>Apply Chain of Custody tape.</p>
17	<p>Label, preserve, package and store samples in accordance with ENV-WQH-SOP-066, <i>Chemical Preservation of Water Samples</i>; ENV-DO-206, <i>Sample Containers Preservation</i>; ENV-DO-207 <i>Handling, Packaging, and Transporting Field Samples</i>.</p>
18	<p>Complete the chain of custody form for each sample set collected. Include the following information:</p> <ul style="list-style-type: none"> • station name • barcode number • collection date and time • names of the sampling team members • data, and time samples are relinquished • signature of relinquishing team member and receiving party • comments/special guidance on handling of sample/observations

Table continued on next page.

Sample Collection Using Westbay® System, continued

Conduct sampling, continued

Step	Action
19	Submit original AR/CoC forms with the samples to the ECR-SMO.
20	Maintain a duplicate AR/CoC form for WQH group records. The ECR-SMO will keep the original.

Take down equipment

To take down system and secure site, perform the following steps:

1	Turn off power to the sampler probe and trailer.								
2	When sampling has been completed at a port, decontaminate all sampling equipment by performing the following steps: <table border="1" data-bbox="516 772 1427 1066"> <thead> <tr> <th>Step</th> <th>Action</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Rinse the sample probe around the face seal and the bottom connector using Alconox and at least three rinses of DI water</td> </tr> <tr> <td>2</td> <td>With the sampler valve open, flush the interior of the sample probe from the bottom connector.</td> </tr> <tr> <td>3</td> <td>In a similar fashion, clean the interconnected hoses and stainless steel sample bottles..</td> </tr> </tbody> </table>	Step	Action	1	Rinse the sample probe around the face seal and the bottom connector using Alconox and at least three rinses of DI water	2	With the sampler valve open, flush the interior of the sample probe from the bottom connector.	3	In a similar fashion, clean the interconnected hoses and stainless steel sample bottles..
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1	Rinse the sample probe around the face seal and the bottom connector using Alconox and at least three rinses of DI water								
2	With the sampler valve open, flush the interior of the sample probe from the bottom connector.								
3	In a similar fashion, clean the interconnected hoses and stainless steel sample bottles..								
3	Take down Westbay® mast.								
4	Secure sampling winch and field equipment.								
5	Secure well casing and vault if necessary.								
6	Restore the site to its pre-sampling condition. Secure the site upon departure.								

Waste Disposal

Check WQH records for a Notice of Intent (NOI) for each well to be sampled. NOI's generally allow purge water and decontamination water to be disposed of on the well gravel pad. Samplers will use the appropriate waste disposal path for all other generated wastes.

Records Resulting from this Procedure

Records

The following records are generated as a result of this procedure and shall be permanently stored with ENV-WQH:

- Westbay® Pressure QA/QC Check Record (Attachment 3)
- Water Quality Sampling Record for Westbay® Wells (Attachment 2)
- Groundwater Sampling Field Data Sheet (Attachment 4)
- Field Logbook
- Other significant information

[Click here to record self-study training to this document.](#)

Equipment and Supplies Checklist for Sampling the Westbay® MP System

- Monitoring Equipment (turbidity, pH, ORP (if called for), alkalinity kit, conductivity, dissolved oxygen and temperature)
- Spectrophotometer w/ ampoules and sulfide solution
- MOSDAX Sampler Probe
- MOSDAX Handheld Controller
- 4 Non-vented Sample Bottles
- Sample containers
- Preservatives
- Coolers and Blue Ice (or equivalent)
- Roll up tables
- GeoPump and tubing
- Filters (if required) 0.45 μ and silver
- Field logbook
- Chain-of-Custody/Request-for-Analysis Forms
- Sample Collection Log forms
- Sample Labels
- Custody Seals
- Any PPE required (e.g. nitrile gloves, glasses, leather gloves, etc.)
- Small container for field parameter collection
- Vacuum Pump
- Tubing and attachments for Vacuum Pump
- Well Specific Attachments
- Tool kit and replacement parts
- Electrical cables w/ GFCI
- Alconox® and De-ionized water for decontamination
- Paper towels, pH paper, batteries, trash bags, squirt bottles
- Sampling Trailer w/ winch and generator
- Monopod and wheel attachments including safety cones
- Well key (401)
- Radio and government cell phone
- MSDS sheets
- MOSDAX Manuals and Mount Sopris Manuals
- Westbay® Completion Log w/ Depth of Key Items table
- Eye wash
- First aid kit
- Fire extinguisher
- IWD or other safety documents

Water Quality Sampling Record for Westbay® Wells

Date _____

Page 1 of 2

Project _____

Field Team Member Signature _____
(Print name and title, then sign)

WATER SAMPLED:

Well Number: _____ Sample Type _____

Zone Number: _____

Depth: _____

Sampling Period: Start _____ Complete _____

SAMPLING INFORMATION

Sampler probe _____

Filter Size _____

Thermometer ID _____

EC Meter ID _____

pH Meter ID _____

ORP Meter ID _____

Alkalinity Kit ID _____

Turbidity Kit ID _____

Dissolved O₂ Meter ID _____

Sample Types

F – Field

EQB – Equipment Blank

FD – Filed Duplicate

PEB – Performance Equipment Blank

FTB – Field Trip Blank

FB – Field Blank

