



STANDARD OPERATING PROCEDURES

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MANUAL WATER LEVEL MEASUREMENTS

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* These sections affected by Revision 1.0

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1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to set guidelines for the determination of the depth to water measurements in an open borehole, a cased borehole, a monitor well, or a piezometer.

Generally, water-level measurement data from boreholes, piezometers, or monitor wells are used to construct water table or potentiometric surface maps, and to determine groundwater flow direction, groundwater level recovery following a pumping event, or to determine other aquifer characteristics. Therefore, all water level measurements at a given site should be collected within a 24-hour period. However, certain situations may produce rapidly changing groundwater levels that necessitate taking measurements within a condensed time frame. Rapid groundwater level changes may occur due to:

- Atmospheric pressure changes;
- Tidal influences;
- Changes in river stage, impoundments levels, or flow in unlined ditches;
- Pumping of nearby wells;
- Precipitation.

2.0 METHOD SUMMARY

A permanent survey mark should be placed on the top of the riser pipe or casing as a reference point for groundwater level measurements. If the lip of the riser pipe is not flat, the reference point may be located on the grout apron or the top of the outer protective casing (if present). If using a measurement reference point, it must be documented in the site logbook, the sampler's personal log book, or on field data sheets (Figure 1, Appendix A). All field personnel must be informed of the measurement reference point used in order to ensure the collection of comparable data. NOTE: All data recorded in the sampler's personal log book must be photocopied and retained in the project files.

Before measurements are made, water levels in piezometers and monitor wells should be allowed to stabilize for a minimum of 24 hours after well construction and development. In low yield situations, recovery of water levels to static equilibrium may take longer. All measurements should be recorded to one hundredth (0.01) of a foot. Water level measuring equipment must be decontaminated prior to and after each use at each measuring location. When possible, measurements should be taken from the least to the most contaminated borehole, well, or piezometer.

Open the well and monitor the head space with an appropriate air monitoring instrument to determine the presence of volatile organic compounds (VOCs). For electrical sounders, ground the measuring equipment, and then lower the water level probe into the well until the water surface is SERAShed, as indicated by a tone or meter deflection. Record the distance from the water surface to the reference point. (Measurement with a chalked tape will necessitate lowering the tape below the water level and holding a convenient foot marker at the reference point. Record the water level as indicated on the chalked tape section and the depth mark held at the reference point. The depth to water is the difference between these two readings.) Remove the water level probe, replace the riser pipe cap, and decontaminate the equipment as necessary. Note: If a separate phase product is present, a product/water interface probe is required for the measurement of product thickness and water level.



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3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

This section is not applicable to this SOP.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

- Cascading water, particularly in open-hole or rock wells and especially during aquifer pumping tests, may interfere with the water level measurement.
- Some older types of electric sounders are only marked at 5-foot intervals. A surveyor's tape is necessary to extrapolate between the 5-foot marks.
- Oil or other product floating on the water column can insulate the contacts of the probe on an electric sounder and give false readings. For accurate level measurements in wells containing separate phase product, a special product/water level indicator is required.
- Tapes (electrical or surveyor) may have damaged or missing sections, or may be spliced inaccurately. Always examine the tape for continuity and completeness.
- An air line may be the only available means to take measurements in sealed production wells, and is not described here. The method is generally accurate to approximately two-tenths (0.2) of a foot.
- When using a chalked steel tape, it is necessary to lower the tape below the water level in order to take a measurement. This method is more successful when the operator has knowledge of the approximate groundwater level.

5.0 EQUIPMENT/APPARATUS

- Electric water level indicator, marked in increments of 0.01-foot
- Steel tape, chalked, marked in increments of 0.01-foot
- Appropriate air monitoring equipment [photoionization detector (PID) and/or flame ionization detector (FID)]
- Product/water interface probe
- Chalk
- Ruler/Measuring tape
- Site logbook, personal logbook, and/or field data sheets
- Decontamination supplies
- Paper towels and trash bags



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6.0 REAGENTS

No chemical reagents are used in this procedure; however, decontamination solutions may be necessary. If decontamination of equipment is required, refer to Environmental Response Team/Scientific, Engineering, Response and Analytical Services (ERT/SERAS) SOP #2006, *Sampling Equipment Decontamination*, and the approved site Work Plan (WP).

7.0 PROCEDURES

7.1 Preparation

1. Determine the number of measurements needed, the methods to be employed, and the equipment and supplies needed.
2. Decontaminate or pre-clean equipment, and ensure that it is in working order.
3. Coordinate sampling schedule with staff, clients, and regulatory agency, if appropriate.
4. If this is an initial visit, perform a general site survey prior to site entry in accordance with the current approved site specific Health and Safety Plan (HASP).
5. Identify sampling locations.

7.2 Water Level Determination

1. If possible, and when applicable, measure those wells that are least contaminated and proceed to those most contaminated.
2. Clean all the equipment used to measure water levels (which enters the well) by the following decontamination procedure:
 - Rinse equipment with deionized water.
 - Wash the equipment with an Alconox solution, followed by a deionized water rinse.
 - Rinse the equipment with an appropriate solvent suitable for the type and material composition (e.g., methanol, isopropyl alcohol, acetone) as per the WP, if organic contamination is suspected.
 - Triple rinse the equipment with deionized water.
 - Place the equipment on clean surface such as a Teflon or polyethylene sheet to air dry.
3. Remove the (locking) well cover, note the well identification (ID), the date and time of day, and the participating field personnel in the site logbook, a personal logbook, and/or on a field data sheet.



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4. Remove well cap.
5. If organic contaminants are suspected, monitor the head space of the well with a photoionization detector (PID) or flame ionization detector (FID). Record the results in the site logbook, personal logbook, and/or on a field data sheet.
6. Lower a water-level measuring device into the well. Electrical tapes are lowered to the water surface. Chalked steel tapes are lowered generally a foot or more below the water surface; steel tapes are generally chalked so that a 1- to 5-foot long section will fall below the expected water level. Record all measurements in the site logbook, the sampler's personal log book, and/or on field data sheets. NOTE: All data recorded in a personal log book must be photocopied and retained in the project files.
7. For electrical tapes, record the distance from the water surface, as determined by the audio signal or meter, to the reference measuring point. For chalked tapes, an even foot mark is held at the reference point, once the chalked section of the tape is below the water level. Both the water level on the tape and the foot mark held at the reference point is recorded. The depth to the water is the difference between the two readings. In addition, note the reference point used (top of the outer casing, top of the riser pipe, ground surface, or some other permanent reproducible position on the well head). Repeat the measurement to ensure reproducibility and accuracy. Preferably the same person and level measurement equipment should be used to eliminate any sources of error related to the measurement readings.
8. Remove all water level measuring equipment, replace the well cap and the locking steel caps.
9. Decontaminate all equipment as outlined in Step 2 (above), and store for transport to the next sampling location.
10. Note any physical changes, such as erosion or cracks in protective concrete pad or variation in the total depth of the well, in a site logbook, a personal logbook, and/or on a field data sheet.

8.0 CALCULATIONS

To determine groundwater elevation above mean sea level, use the following equation:

$$E_w = E - D$$

where:

- E_w = Elevation of water above mean sea level (feet) or local datum
 E = Elevation above sea level or local datum at point of measurement (feet)
 D = Depth to water (feet)

9.0 QUALITY ASSURANCE/QUALITY CONTROL

The following general quality assurance/quality control (QA/QC) procedures apply:



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1. All data must be documented in site logbooks, personal logbooks, and/or field data sheets.
2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the WP.
3. Each well must be tested at least twice in order to compare results. If results do not agree within 0.02 of a foot, a third measurement must be taken and the readings averaged. Consistent failure of consecutive readings to agree suggests that levels are changing because of one or more conditions, as indicated in Section 1.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potential hazardous materials, follow U.S. EPA, Occupational Safety and Health Administration (OSHA) and corporate health and safety procedures.

If the FID/PID results obtained while monitoring the head space and breathing zones indicate that VOCs are present, the personal protection level may need to be upgraded from that denoted in the HASP.

12.0 REFERENCES

Driscoll, F.G. 1986. *Groundwater and Wells. Collection and Analysis of Pumping Test Data.* 2nd ed. Chapter 16. St. Paul, Minnesota: Johnson Filtration Systems Inc. pp 534-579.

U.S. Environmental Protection Agency, 1986. *RCRA Groundwater Monitoring Technical Enforcement Guidance Document.* p. 207.

U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. 1987. *A Compendium of Superfund Field Operations Methods.* EPA/540/p-87/001.



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APPENDIX A
Example Field Data Sheet
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FIGURE 1. EXAMPLE FIELD DATA SHEET

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SITE NAME: _____ LOGGER NAME: _____
 SITE LOCATION: _____ ERTC WAM: _____
 LOG DATE: _____ WBS #: RIA _____

Well I.D.	Time	Elevation of well ⁽¹⁾ (TOC)	Depth to bottom of well (feet)	Depth to Water (feet)	Depth to product (feet)	COMMENTS (pH, temperature, specific conductance)

TOC: top of casing (1) feet above mean sea level

MEASUREMENT REFERENCE POINT FROM _____ GROUND SURFACE OR _____ TOP OF CASING

Weather Conditions: Temperature (°C): _____ Rain: Heavy: ____ Medium: ____ Light: ____ (Circle one)

Other significant observations: