ON THE LEVEL

Water Monitoring News and Updates

Solinst®

High Quality Groundwater and Surface Water Monitoring Instrumentation

IN THIS ISSUE

Spring 2016

Which Flat Tape Water Level Meter is Right For You?

Solinst now offers three different versions of a Flat Tape Water Level Meter, each with unique features and benefits.

So, how do you choose the one that's right for you?

Sorting through specifications to make the best selection, can be simplified by answering a few basic questions:

To what depths are you measuring?

If you are measuring beyond 1000 ft. (300 m), you need a Model 101 P7. The Model 101 P7 is available in lengths up to 5000 ft. (1500 m). The PVDF tape is higher in electrical efficiency, and is therefore better for longer lengths of tape.

Are you looking to minimize costs?

The Model 101B is very affordable. Just remember you are limited in length options, the tape markings, and sensitivity adjustment. However, the 101B is built to be robust, and with fewer components that may need repair in the future, costs are kept down for the lifetime of the 101B.

Other considerations are the accuracy you require, the water quality and conductivity range you are expecting to encounter, and the diameter of the well or tube you are measuring in.

For a full explanation of the differences between the Model 101 P7, 101 P2, and 101B Water Level Meters, including tape and probe designs, see the full story on our ON THE LEVEL blog.

Levelogger Edge Data Verified in Harsh Conditions of Antarctic Tidal Study

For eight months, a Levelogger Edge was used in a tidal study to monitor sea level fluctuations in the Davis Sea, Antarctica.

A unique monitoring setup was used for the successful installation of the Levelogger Edge in the extreme climatic conditions.

A monitoring shaft was created in the shore ice just off the coast of Antarctica. A special insulated housing was constructed over the shaft, which contained a support beam and a heating element (see Figure 1). The Levelogger was suspended inside a protective pyramid, which was tethered to the support beam in the housing (see Figure 2).

Figure 1: sea level monitoring station created in the shore ice of the Davis Sea, Antarctica.

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Levelogger Edge Data Verified in Antarctic Tidal Study

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A weight was connected to the rope that supported the pyramid, to help hold the pyramid in place at the bottom of the sea (approximately 3-4 meters deep) during monitoring.

Transmission cable from the shore provided power to the heating element in the housing. A flexible heating element extended from the housing, along the length of the support rope, to the installed pyramid. The heating element protected the rope and weight from underwater ice build-up over the monitoring period.

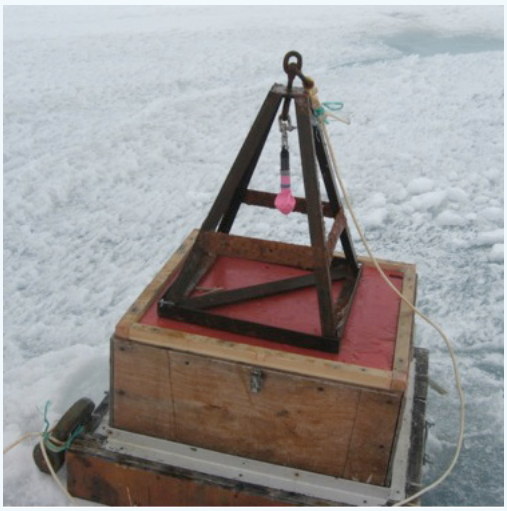


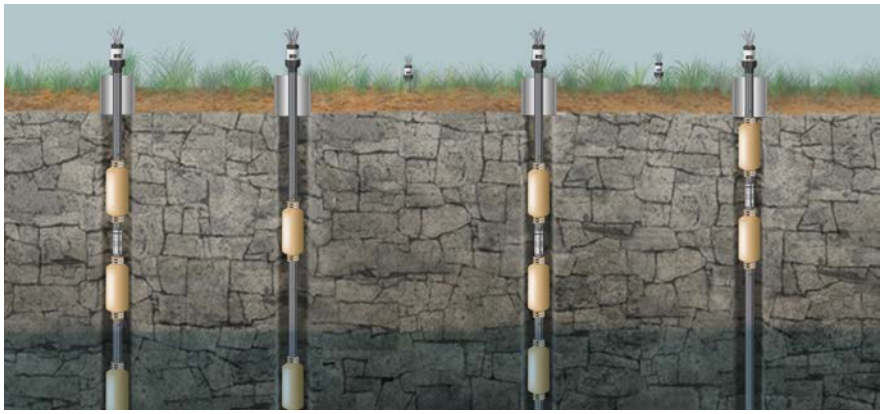
Figure 2: Levelogger Edge installation weight with pressure sensor protected by balloon filled with ethyl alcohol solution. This assembly rests on the sea floor under the ice.

Eight months later, on December 20, 2013, the Levelogger was removed and the final data downloaded. The water level readings were compensated using hourly sea level barometric data obtained from a nearby weather station.

A separate tidal gauge was used to concurrently record the water level fluctuations. When the data from the tidal gauge and the Levelogger Edge were compared, the correlation was excellent. The extent of tidal fluctuations could be clearly seen from the documented data.

This application demonstrates that the Levelogger Edge can be successfully used in extreme climate conditions – when the proper precautions and careful design considerations are followed.

Solinst thanks Gennady Rogovsky from LNDC Company and Vasily Leontiyevich Kuznetsov of the Arctic and Antarctic Research Institute for sharing the details of this project.



High-Resolution Site Characterization with Multilevel Systems

Within the last few years, the U.S. EPA added a new focus area on high-resolution site characterization (HRSC) to their Contaminated Site Clean-Up Information (CLU-IN) website.

The U.S. EPA's definition of HRSC is: "High-resolution site characterization (HRSC) strategies and techniques use scale-appropriate measurement and sample density to define contaminant distributions, and the physical context in which they reside, with greater certainty, supporting faster and more effective site cleanup."

In other words, the more spatially and temporally diverse your data sets are, the more representative they are of actual site conditions. Using technologies that collect data from zones that are more closely spaced together provides a higher resolution picture of the subsurface. This gives a better understanding of how to go about remediating a contaminated site.

The HRSC section is very helpful – it describes what HRSC is, why it should be used, and how it is conducted. It offers tools and techniques, case study examples, and training and support options.

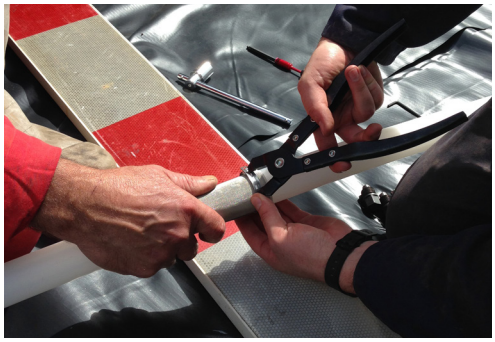
However, it is missing what many in the hydrogeological industry would consider an important part of the tools and techniques discussion… *Multilevel Systems (MLS).*

Multilevel Systems, also referred to as engineered nested wells, are installed in a single borehole, but are constructed with multiple ports to provide samples and hydraulic head measurements from many isolated depths. With a series of MLS, a contaminated site's groundwater can be assessed on a 4D scale: level, type, and lateral and vertical extent of contamination – *this is high-resolution site characterization!*

These multi-port systems are engineered with hydraulically isolated short-screened intervals. The seals between zones are reliable, overcoming issues of cross-contamination between aquifers or between different layers within the same aquifer (which are noted issues with cluster and nested wells). The shorter screened intervals provide the true groundwater chemistry at each zone and eliminate the issue of chemistry and head being averaged across long screens (typical of conventional wells).

When considering how to perform high-resolution site characterization, the CLU-IN site provides these criteria when deciding on the tools/techniques to use; *Multilevel Systems meet all of the criteria:*

- Short monitoring zones: Multilevel Systems have vertically short screened intervals – one port installed per each zone of interest
- Small vertical spacing between sample locations: Multilevel Systems have multiple sampling ports in one well
- Minimized spacing between borings: Multilevel Systems are as narrow as 1.1" dia.
- Borings organized along transects oriented perpendicular to the hydraulic gradient: MLS are especially suited for providing transects of data



CMT Multilevel Systems Successfully Installed in Challenging Geology

A facility in Wales, UK was once the location of a plastic forming plant. Over time, chemicals produced were lost into the groundwater beneath the facility, creating a large contaminant plume.

Years later it was determined that the plume is migrating off site. In order to intercept the plume and establish a remedial plan, the plume needs to be characterized. Solinst CMT Multilevel Monitoring Systems were selected as a solution to provide depth-discrete groundwater data.

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Deep Groundwater and Dissolved Gas Sampling with Double Valve Pumps

Sampling groundwater from deep wells is a challenge on its own, but add to that the need for accurate dissolved gas analysis, and the task gets that much harder.

HydroTerra, a leading Australian company, and exclusive distributor of Solinst products, have developed a method of low flow sampling that uses the Solinst Model 408 1.66" diameter Double Valve Pump, to depths of up to 1,200 m (3,900 ft).

In order for Double Valve Pumps to reach these depths, HydroTerra use specially designed weights that fit to the bottom of the standard pumps. These weights counteract the buoyancy caused by the very long drive and sample tubing lengths. In addition, HydroTerra have designed custom-built wellheads to ensure an organized and secure setup for various diameter wells.

As part of their methodology, HydroTerra recommends dedicating one Double Valve Pump to each well, especially when sampling to these depths. They suggest dedication for the following reasons:

- Saves time setting-up and lowering the pump for future sampling events, and prevents tubing or pump from getting stuck
- Ensures representative, repeatable sample collection
- No decontamination required between sampling rounds

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Waterloo Emitters Used for Bioremediation Study in High Temperature Saline Groundwater

A study was undertaken to determine the success for aerobic bioremediation of aromatic hydrocarbons in high temperature, saline groundwater. The study included laboratory microcosm experiments, as well as a field trial in Saudi Arabia, in which Solinst Waterloo Emitters were used.

The seven-month field trial aimed to test the effectiveness of enhanced insitu aerobic bioremediation in a high temperature, high salinity aquifer.

The aquifer contains a plume of BTEX (benzene, toluene, ethylbenzene, xylenes), MTBE and other aromatic hydrocarbons. The temperature of the aquifer varied from 30 – 37.4°C during the study period, with an electrical conductivity of 6.1 mS/cm.

To stimulate aerobic conditions, Waterloo Emitters were selected to diffuse dissolved oxygen into the groundwater. They were chosen because of their low maintenance and operational costs, which are ideal for the desert conditions. They require few components to operate (or replace), which is also ideal for the location.

Ten Waterloo Emitters were installed in a series, perpendicular to groundwater flow, creating a reactive zone. The 3.8" diameter Emitters with LDPE (low density polyethylene) diffusive tubing, were installed in 4" diameter monitoring wells. Oxygen cylinders were used to supply the Emitters.

Groundwater samples were taken from monitoring wells upgradient and downgradient of the Waterloo Emitter reactive zone. Two sampling rounds were performed to obtain baseline values, and six subsequent sampling rounds were performed during the study period.

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Deep Groundwater and Dissolved Gas Sampling with Double Valve Pumps

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In addition to using the Double Valve Pumps for deep groundwater sampling, HydroTerra, in conjunction with their project partners, have combined them to create a customized equipment setup that allows the collection of dissolved gases. The water/gas separator chamber eliminates the problem of off-gassing as the groundwater samples depressurize on the way to the surface.

HydroTerra and partners, have developed a standard operating procedure that uses the water/gas separation vessel to collect the groundwater sample obtained using a Double Valve Pump. The water/gas separator fills to a known volume; it is then sparged with a burst of nitrogen gas. The nitrogen strips the sample water of dissolved gasses, which are collected in a Summa canister, and sent to a laboratory for analysis.

HydroTerra recently helped complete an extensive deep groundwater sampling project. Using the unique methodology and custom-designed equipment, they successfully conducted numerous groundwater-sampling rounds to depths in excess of 1 kilometer.

Solinst Thanks Richard Campbell of HydroTerra for providing the details about this project.

Waterloo Emitters in Field Study

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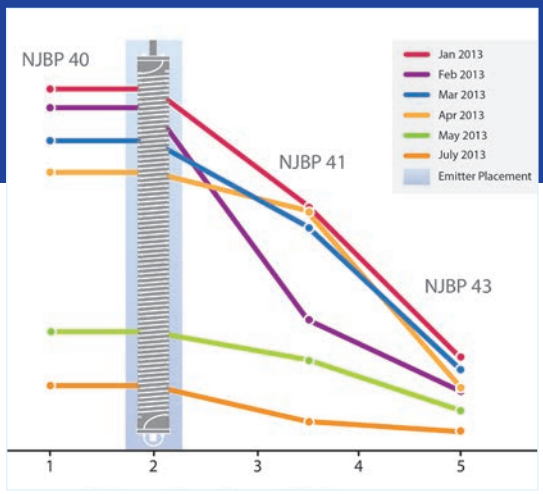
The results showed significant reduction in the concentrations of aromatic hydrocarbons, as the impacted groundwater flowed through the reactive Emitter zone. The mass removal value of the BTEX compounds was greater than 80% and 40% for MTBE.

The results indicated that with the addition of oxygen to the subsurface, bacterial populations went from a diverse mix of anaerobic and aerobic microorganisms, to a population that was more dominant in aerobic bacteria.

Overall, the experiments prove that natural attenuation of aromatic hydrocarbons is possible in high temperature, high salinity environments, under aerobic conditions. The Waterloo Emitter provided a low cost, low maintenance option that successfully stimulated aerobic bioremediation in these very specific conditions.



BTEX Concentration is Shown to Significantly Reduce Over Time

Solinst thanks Rick McGregor, of InSitu Remediation Services Ltd., for providing the details of this study.

CMT Systems in Challenging Geology

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A company specializing in sonic drilling was contracted to complete the CMT installations. RS Hydro, exclusive distributor of Solinst products in the UK, took on the task of training the company during the initial installs. RS Hydro provided two days of on-site training.

There were some challenges. The first was logistics - all CMT installations were done indoors at the main facility, having to bore through the building's foundation. The second was the difficult geology.

The wells were typically drilled to 30 meter depths. The sticky clay-like geology made both the drilling and installation tricky. However, a fast turnaround time can be attributed to the sonic drill rig used. In all, nineteen CMT Multilevel Systems were completed within only two weeks.

Seven channel CMT Multilevel Systems were selected for the job. Standard bentonite pellets were used to seal off each zone. All seven channels in each system are being utilized to gain water level measurements and obtain groundwater samples from each discrete zone.

Solinst Model 102 Water Level Meters are used to measure depth to water, and Model 408M Micro Double Valve Pumps are used to obtain samples of the groundwater. Inertial pumps are used in wells where the static water level is higher.

Today, all the CMT Multilevel Systems are still in place, and are sampled weekly with no issues.

Solinst thanks Ryan Cox of RS Hydro for providing the details of the project.

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