ON THE LEVEL
Fall 2021

Building Knowledge To Ensure Climate Change Readiness

Detailed water monitoring and planning are required to ensure that communities relying on surface water resources are protected from future climate change impacts.

Significant weather and hydrologic events in the north Kootenay Lake area of British Columbia, Canada spurred citizens in the region to start taking an active role in preparing for a changing climate.

This community concern led to the establishment of Kootenay Watershed Science (KWS) – a community-driven project that has taken the lead in understanding how climate change will impact watersheds in their region.

The monitoring activities now championed by KWS began as an initiative of the Kaslo and District Community Forest Society in 2007. The program has since changed hands a few times and in early 2020 KWS found its new home as part of the Living Lakes Canada portfolio of projects.

The KWS project focuses on collecting and sharing important data on which to base future decisions in land use and development, conservation, emergency preparedness, water supply allocation, and more.

In 2012, Solinst Leveloggers were installed in five KWS hydrometric stations and two more were added at stations in 2017. The Leveloggers are deployed in streams in either a perforated PVC or steel pipe, combined with a staff gauge. The Leveloggers are set to log water level and temperature every 15 minutes, providing a detailed record of water level fluctuations. The frequency allows them to download the data just twice a year.

Paul Saso, Hydrologist with Kootenay Watershed Science, says the original decision to go with Solinst Leveloggers was based on reputation, good accuracy, reasonable price, and reliability. "They have a great reputation and have definitely lived up to it" Paul noted.

Solinst recently donated seven Leveloggers and Barologgers to replace the dataloggers that have been recording for almost 10 years.

The plan is to deploy the additional datalogger in a high alpine lake as part of a high alpine lake monitoring pilot project.

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Solinst®

NEW 4G LevelSender 5 with Built-in SIM Card

Solinst has released a 4G version of our LevelSender 5 telemetry system, featuring a Solinst SIM Card that is activated and pre-installed before shipping to you! The LevelSender 5 is set up for you in advance, simplifying the programming and installation process – it truly is a ready-for-the-field solution for remote water level monitoring.

The Solinst SIM Card gives you access to wider network coverage, as it scans multiple service providers automatically selecting the strongest signal for your location. Eliminate frustrations with other service providers and set up a low-cost, competitive data-only plan managed and billed directly through Solinst – never overpay for unused data again!

5 Tips For Getting the Most Accurate Readings From a Solinst Model 104 Sonic Water Level Meter

How Does A Sonic Water Level Meter Work?

A probe at surface transmits a low frequency sound wave into a pipe, tube, or well, and measures the time it takes for the pulse to return after making contact with water. The depth to water is calculated using the speed of sound and time. Water level is displayed on the LCD screen of the control unit after just a few seconds. The accuracy of the reading depends on the acoustics of the well, how well you know the environment you are monitoring, and if you set up your Sonic Water Level Meter properly.

1) Ensure your well has the proper setup

If the top of your well or pipe is open, then it should be covered with a cap with a hole for the probe to access. Solinst includes a plastic disc with each Sonic Water Level Meter, providing a good option for covering larger well openings. Since the pulse generated from the probe is an air pressure wave/ low frequency sound wave, there should be a good seal to prevent the air pressure from escaping the well, which can result in losing/ weakening the pulse. The seal around the probe does not have to be airtight, but the signal works better when the sound waves cannot escape and it also helps prevent external noise, such as wind, from interfering with the sound wave.

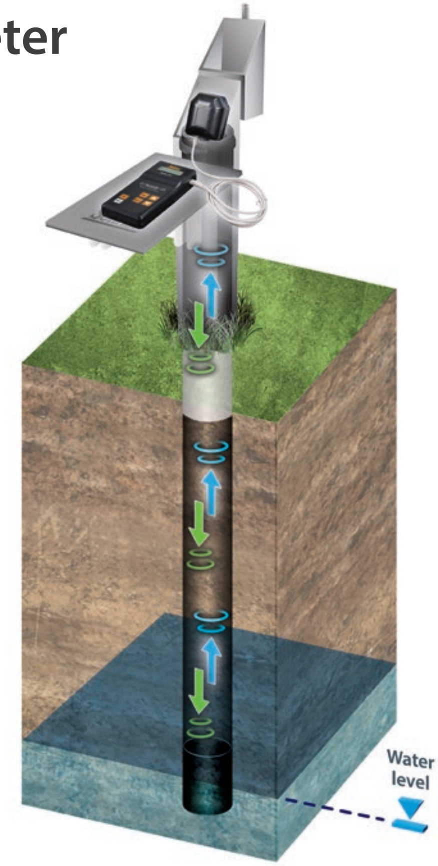
2) Limit and account for the diameter of the well you are measuring in

The Solinst Sonic Water Level Meter works best in wells or pipes with diameters of 8" or less. This is because, as well diameter increases, the strength of the sounds pulse weakens. Therefore, the pulse is more susceptible to pump noise or interference from other imperfections. As such, wells larger than 8" in diameter should use a drop tube from top of well, to below the depth to water for measurement.

Just as you need to account for larger diameters, you also need to consider that there is a reduced speed of sound in smaller than 2" (5 cm) diameter wells or tubes. To adjust for this, you can enter the drop tube diameter into the Sonic Water Level Meter control unit to compensate for the difference.

3) Know the groundwater/ deep well temperature

Since the speed of sound changes with temperature, there is a temperature sensor in the probe that will account for air temperature at the wellhead. The Solinst Sonic Water Level Meter



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Water Level Data Helps to Understand the Effects of Climate Change on Alpine Lakes

The Canadian Rocky Mountain Parks are designated as UNESCO World Heritage Sites for their "exceptional natural beauty".

But as we hear so often…due to the effects of climate change, these spectacular alpine lakes may also be changing.

Janet Fischer and Mark Olson, professors in the Biology Department at Franklin & Marshall College in Lancaster, Pennsylvania, are leading a research project that focuses on the causes and effects of changes in alpine lake transparency.

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NEW! Multilevel Drive-Point & Deep Groundwater Sampler

The 615ML Multilevel Drive-Point Piezometer system can provide several monitoring zones in one drive location. The 615ML Ports have a dual barbed stem that allows the connection of either 3/8" OD or 1/4" OD tubing to create up to 3 or 6 monitoring zones, respectively, for high-resolution vertical groundwater or soil gas profiling.

The 425-D Deep Sampling Discrete Interval Sampler can sample from submerged depths as much as 1200 m (4000 ft). The 425-D obtains representative samples from a specific zone without the need for purging. The sealed sampler is pressurized at depth allowing water to enter. The sampler is vented and sealed before retrieval to surface, maintaining sample integrity.

Accurate Readings From a Solinst Sonic Water Level Meter

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allows you to manually enter the estimated temperature at the air/water interface of your well. With the air temperature automatically detected by the sensor in the probe, the two temperatures are used to calculate the speed of sound and therefore, the distance/depth to water.

Note: The distance error is small for variations in temperature, about 1% for a 10ºF (5.6 ºC) temperature error.

4) Be familiar with the typical depth to water in your well

In general, knowing the approximate water level before measuring allows you to set a minimum depth to start detecting, and a maximum depth to listen for the returning pulse.

The sound wave loses energy as it travels. Well casing is rough or porous which can absorb some of the sonic pulses. This means weaker, less frequent returning pulses make the sound wave more susceptible to interference.

So, if the approximate depth to water is known, set the maximum range to slightly deeper. Don't set the Solinst Sonic Water Level Meter to listen for the returning pulses longer/deeper than required. Set the minimum range to avoid detecting return pulses from a shallower depth.

For example, if depth to water is usually between 8–9 m, set your minimum to 7 m and your maximum to 10 m for higher accuracy.

5) Know what's down your well!

The maximum and minimum range setting discussed in the previous tip can also be used to help avoid interference from known obstructions in the well.

The sound wave from the probe travels until it is disturbed. Each time it is disturbed by an imperfection in the well, some of the pulse is reflected, making the main pulse a little weaker. Smaller obstructions, like tubing or wires, will not obstruct the pulse enough to affect the water level reading. However, larger interferences such as a small change in casing diameter could reflect enough of the pulse to generate an inaccurate reading.

For example, if you know there is a crack or the well casing ends at 10 m and your water level is below that at about 20 m, then the minimum range could be set to 15 m to ignore any reflection at 10 m.

In another example, if a pump is installed at 50 m, then set a maximum range of less than 50 m to avoid any interference from that depth.

For extra tips and more details, read the full post in our **ON THE LEVEL Blog.**

Check out our Model 104 Sonic Water Level Meter User Tips Video!

A Real-Time Groundwater Observatory Network In California

It is widely understood that to properly and sustainably manage the world's groundwater resources, collecting data on its quantity and quality is essential. Efficient, cost-effective options for accessing, storing, and sharing the data are needed to balance out the increased demand.

Telemetry is one data retrieval method that is used extensively in environmental applications, but it is often seen as an expensive and complicated option for monitoring groundwater levels. However, recent advancements in technologies provide flexible, more affordable options, especially when monitoring at various scales, is required.

The Hydrologic Sciences Graduate Group at the University of California, Davis (UC Davis) has established a low-cost, open source network of on-demand aquifer monitoring sites with the help of Solinst LevelSender telemetry systems.

The network of LevelSender systems is set up as part of a pilot study for real-time groundwater monitoring on a Subbasin scale (the South American Subbasin Groundwater Observatory).

The group began by installing a number of LevelSender systems in the South American Subbasin between the American and Cosumnes Rivers, in California. Several stakeholders and landowners in the region have allowed access to their wells as part of the program. Currently, there are ten LevelSender systems providing data to the Groundwater Observatory.

About half of the LevelSender devices are installed in 2" diameter groundwater monitoring wells. The compact LevelSender units sit inside the casing at the top of the well.

The other LevelSender systems are deployed adjacent to wells (some agricultural pumping wells) on stakes or in a casing with connection cables running along the ground in protective pipes. The connected Leveloggers are installed through small access points to the well.

Each LevelSender system has one connected Levelogger water level datalogger.

The LevelSender units collect hourly water level and temperature readings from the connected Leveloggers. The LevelSenders then report the accumulated data once per day to the Home Station email. The dataloggers themselves record data internally as a backup if circumstances require it.

The group at UC Davis is using the groundwater data sent to the SQLite database on their Home Station computer to post to a web dashboard. The data is available for anyone to view.

The online Groundwater Observatory allows researchers, water managers, and all stakeholders in the region to access up-to-date water level data. The source of continuous data also provides a better understanding of the long-term trends in groundwater level changes in the basin. This better equips those in the region to make appropriate decisions on groundwater management.

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Water Level Data Helps to Understand the Effects of Climate Change on Alpine Lakes

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Water transparency is a measure of how deeply light penetrates and affects water temperature, algal growth, and exposure of organisms to potentially damaging UV radiation. Water transparency depends on the amount of particles in the water – the more particles, the less transparent.

Glacial melt, snow melt, and rainfall are responsible for how the particles reach the lakes. As climate changes, temperatures are rising and precipitation patterns are shifting, inevitably leading to altered rates of material inputs. Climate change is accelerating glacial melt and vegetation advance, changing the alpine landscapes, and also the types and amounts of transparency-regulating materials entering the lakes.

The study includes a set of five lakes located in Banff and Yoho National Parks. The lakes share many attributes, but represent different phases of glacial loss and vegetation advance. As part of the project, Solinst Leveloggers were placed in the study lakes, with additional Leveloggers installed in the outflow streams of a subset of the lakes.

Janet notes, "The size, ease of deployment, durability, and logging capabilities matched our needs perfectly."

The Leveloggers are deployed in stilling wells in the lakes. The Leveloggers are set to measure surface water levels over the course of a season, as well as short-term response to meteorological conditions (e.g. precipitation events and temperature changes)

Leveloggers record data every 30 minutes. After downloading data, the measurements are averaged to daily means to match the time scale of meteorological measurements. Leveloggers help document lake level

responses to rainfall events and warm spells that accelerate glacial melt. This allows the researchers to observe the connection between meteorological conditions and the changes in dissolved organic matter or turbidity.

Overall, their continued research will help provide a predictive understanding of the effects of climate change on alpine lakes. This will help give a picture of what these pristine lakes may look like in the future.

For more details, read the full post in our **ON THE LEVEL Blog.**

Solinst thanks Janet Fischer, professor at Franklin & Marshall College for providing the details of this project.

Climate Change Readiness

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Levelogger water level data is used to calculate discharge in the streams. The data collected is made available on the Columbia Basin Water Hub, which provides quality-controlled water-related data via an open-source database developed and formally launched in 2021 by Living Lakes Canada. KWS also has a partnership with Aquatic Informatics for processing, storing, and distributing data online.

The data collected will ultimately help evaluate how the watersheds in the region will respond to different hydrological flows– especially in times of high precipitation and low water supply. The data will help predict the risk, frequency and outcome of more catastrophic events brought on by climate change, such as flooding and landslides. Making the data available to decision-makers will allow for appropriate water budgeting and watershed management into the future, ensuring communities are supported and ecosystems remain functioning.

For more details, read the full post in our **ON THE LEVEL Blog.**

Solinst thanks Paul Saso, Hydrologist with Kootenay Watershed Science, for providing the details of this project.

Groundwater Network in California

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The group notes that the primary advantage of the network of telemetry systems is automating the retrieval of data, which greatly reduces field visits and allows data visualization when weather or field conditions do not permit sites visits.

Each report from a LevelSender contains diagnostic information including battery level. This allows the staff to monitor the system status remotely. The systems reduce the number of wells that need to be visited on actual field days, and provide more immediate updates on water levels, which are useful to plan when future site visits are required.

For more details, read the full post in our **ON THE LEVEL Blog.**

Solinst thanks Andrew Calderwood and Alysa Yoder, of UC Davis, for providing the details of the project.

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