Alaska North Slope Water Quality Monitoring

Real-Time Water Quality Data

The University of Michigan’s Marine Hydrodynamics Laboratories, in partnership with Michigan Technological University, have designed and fabricated two prototype ALWAS (Automated Lagrangian Water-Quality Assessment System) buoys.

The buoys have three propulsion modes; drift with current, wind power (sail), and radio controlled jet drive. Each buoy contains a YSI multi-probe sensor package for measuring temperature, conductivity, salinity, TDS, turbidity, pH, ORP, DO, nitrates, and chlorophyll. An acoustic depth sensor and GPS are housed to record the time, position, and the full navigation suite at user-selectable time integrals. The data collected is both stored internally and transmitted in real-time via spread spectrum radio link. All ALWAS buoy data is instantly GIS compatible.

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YSI RELEASES LEVEL SCOUT FOR GROUNDWATER MONITORING

There are many applications requiring accurate, dependable level measurements. From monitoring wells for long-term groundwater studies or aquifer testing to surface water monitoring for watershed management or gaging stations, the Level Scout products are designed to measure level and temperature accurately. Data is recorded (along with time stamp) at user-selectable rates.

The new YSI Level Scout instruments provide extremely accurate data with easy-to-use data management software. The products are extremely rugged stainless steel or titanium absolute or vented instruments with field-proven connectors. An internal field-replaceable battery powers the Level Scout and provides years of data logging capabilities. Data logging modes include linear, non-linear, linear averaging, event triggered, and logarithmic sampling.

Manage Level Scout data with Data Scout Advanced desktop software (included with instruments). There is no need for custom software with Data Scout Advanced. Run and monitor from one to sixteen transducers and communicate a serial interface or multi-drop network. View graphical and tabular data, export to spreadsheets, display in real-time, configure Auto-log tests, and much more.

This past summer, the buoys were rigorously field-tested in Alaska, while providing valuable data for two distinct projects. At the terminus of the Bering Glacier in southwest Alaska, ALWAS was deployed in 11 separate locations in Vitus and Berg Lakes, as well as the Seal River, where the free-floating buoys were used to characterize water quality and movement. The data collected was used to better understand how changes in the glacier’s hydrologic balance affect the ecological environment. This determines the habitat of the flora and fauna that defines the unique ecology of the region.

In collaboration with the Bureau of Land Management, Department of Energy, ConocoPhillips, and the North Slope Science Initiative, the buoys were also deployed in 16 surface lakes and the Coleville River located in North Slope, AK. The buoys were deployed by helicopter on the upwind area of the surface lakes and allowed to sail downwind, where they were later retrieved. This method allowed for data collection over a distance of 75 miles in just a few days. The data will be used to determine the impact of the construction and usage of ice roads on the surface tundra lakes of the Alaska North Slope.
Pennsylvania College Enhances Learning Experience with Real-Time Environmental Data System

The Abernathy Field Station (AFS) is located just five miles from Washington and Jefferson College. This ideal outdoor classroom encompasses many different ecosystems including mixed deciduous forest, a stand of conifers, several spring seeps, two larger perennial streams, a wetland, and a mowed field. These habitats support diverse assemblages of birds, salamanders, fish, small mammals, white-tailed deer, insects, and a wide variety of plant life. Faculty and students are able to study the structure and function of the ecosystems at AFS through both coursework and independent research projects.

To enhance the learning experience and provide background data for research, a NexSens real-time weather station and stream monitoring system sends data to campus, where it is made available to students and faculty on the Biology Department website. For more information, contact Dr. James March.

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Low-Flow Sampling of Water Quality Parameters Used in Determining Groundwater Stability

The US EPA Office of Research and Development, Office of Solid Waste and Emergency Response, developed and published a document entitled Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures (Publication EPA540/S-95/504). The use of low-flow sampling in groundwater has increasingly been used to support site assessment and remedial performance monitoring objectives.

The document states that “the most common groundwater purging and sampling methodology is to purge wells using bailers or high speed pumps to remove 3-5 casing volumes followed by sample collection”. Adverse impacts can occur through this method affecting sample quality by increasing levels of turbidity. An overestimation of certain analytes – namely metals or hydrophobic organic compounds – may affect results with this method through the inclusion of otherwise immobile artifactual particles. Filtration of these turbid particles has proved undesirable in rectifying the turbidity problem and may, in fact, bias the results of contaminant concentration on the low side by potentially removing mobile (contaminant-associated) particles. These problems can often be mitigated by using low-flow purging and sampling to reduce sampling-induced turbidity.

**Benefits of low-flow sampling:**

- Samples which are representative of the mobile load of contaminants present (dissolved and colloid-associated)
- Minimal disturbance of the sampling point thereby minimizing sampling artifacts
- Less operator variability and greater control
- Reduced stress on the formation (minimal drawdown)
- Less mixing of stagnant casing water with formation water
- Reduced need for filtration and therefore less time required by the operator
- Smaller purging volumes decrease potential disposal costs
- Better sampling consistency

In order to minimize the hydraulic stress placed on an aquifer during purging and sampling, the technique of using low flow sampling is recommended. This is typically done through the use of an adjustable rate pump to remove water from the screened zone at a rate that will cause minimal drawdown of the water level in the well. Drawdown is measured in the well concurrent with pumping using a water level meter. Low-flow sampling does not require a specific flow rate or purge volume. “Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen. Water level drawdown provides the best indication of the stress imparted by a given flow rate for a given hydrological situation” Typical flow rates on the order of 0.1-0.5 L/min are used, but this depends on site-specific hydrogeology. Low-flow sampling relies on the ability to collect samples after water level and measured field parameters stabilize over three consecutive readings taken three to five minutes apart.

It’s important to note that, “parameter selection in monitoring program design is most often dictated by the regulatory status of the site. However, background water quality constituents, purging indicator parameters, and contaminants all represent targets for data collection programs. The tools and procedures used in these programs should be equally rigorous and applicable to all categories of data, since all may be needed to determine or support regulatory action”.

**Parameter Stabilization**

It is recommended that water quality parameters be used to determine purging needs prior to sample collection in each well. Stabilization of parameters such as pH, specific conductance, dissolved oxygen (DO), oxidation-reduction potential (ORP), temperature, and turbidity should be used to determine when formation water is accessed during purging. In general, the order of stabilization is pH, temperature, and specific
conductance, followed by ORP, DO, and turbidity. Performance criteria for determination of stabilization should be based on water-level drawdown, pumping rate, and equipment specifications for measuring indicator parameters. Instruments such as the YSI 556 multi-parameter instrument can simultaneously measure parameters while utilizing a flow cell to give continuous data.

The document also states, "It should be noted that turbidity is a very conservative parameter in terms of stabilization. Turbidity is always the last parameter to stabilize. Excessive purge times are invariably related to the establishment of too stringent turbidity stabilization criteria. It should be noted that natural turbidity levels in groundwater may exceed 10 nephelometric turbidity units (NTU)."

"In-line water quality indicator parameters should be continuously monitored during purging". Water level drawdown should also be checked periodically as a guide to flow rate adjustment with the goal being minimal drawdown (<0.1 m) during purging. "Measurements of water quality parameters should be taken every three minutes if the above suggested rates are used. Stabilization is achieved after all parameters being measured have stabilized for three successive readings. In lieu of measuring all five parameters, a minimum subset would include pH, conductivity, and turbidity or DO. Three successive readings should be within + 0.1 for pH, + 3% for conductivity, + 10 mV for ORP, and + 10% for turbidity and DO. These guidelines are provided for rough estimates".

Many state agencies encourage the use of low-flow sampling because it's designed to collect a sample that most truly represents the water in the screened section of the aquifer surrounding the monitoring well. It does not come from water that is mixed within the well by a bailer or inertial sampler, nor does it come from an average of water that flew the full length of a long screened interval.

**Conclusion**

The low-flow sample can most often be trusted to best represent the contamination or lack thereof in the aquifer because it was produced by a process that minimizes stress on the aquifer or well. Low-flow sampling also reduces the variability in sampling technique that is inherent in traditional bailing and purging procedures. In summary, low-flow reduces the physical and chemical stresses, reduces the variability in sample procedures, increases the ability to determine well stabilization by continuously monitoring water quality parameters, and reduces the chance that changes in chemical concentrations are induced by the sampling technique.

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Ashtabula River Dredging

Project Overview
The Ashtabula River is located in northeast Ohio and flows into Lake Erie’s central basin at the city of Ashtabula. From the 1940’s to the late 1970’s, the area surrounding the mouth of the river experienced significant development from various industries. Throughout this time frame, unregulated discharges into the river and mismanagement of hazardous waste from local industries prompted the International Joint Commission to label the river an Area of Concern.

In 2006, a large US consulting firm was contracted to dredge contaminated sediment out of the river. The consulting firm chose NexSens buoy-based cellular data logging systems to monitor this process and ensure that the contaminated sediment levels do not exceed specified ranges.

System Description
Surrounding the dredging operation, three NexSens data buoys were strategically located to monitor the suspended solids generated from dredges. The rugged buoy platforms are constructed of an inner core of cross-linked polyethylene foam with a tough polymer skin coating. The topside instrument mast houses the cellular data logger, solar panel, antenna and navigational beacon. Top and bottom mounted stainless steel eye-nuts accommodate moorings and lifting rigs for quick and easy deployments.

YSI 600 OMS (Optical Monitoring System) sondes with optical turbidity probes were chosen to sense turbid water. The YSI 6136 turbidity probe features a self-cleaning wiper to provide accurate turbidity measurement in fresh, brackish, and sea water. Before taking a reading, the mechanical wiper cleans the sensing optics to ensure that the measurement is not affected by fouling, sediment, or debris. All YSI 6-Series instruments facilitate direct connection to NexSens data loggers via MS-8 connector on the bottom of the NEMA 4X enclosure.

Further upstream, a remote stream gauging system was installed to monitor changes in river water level. This system consisted of a YSI 600LS vented level sonde connected to a NexSens 3100-iSIC cellular data logging system.

During dredging operations, all data from the NexSens systems is sent in real-time to a PC running NexSens iChart software. iChart serves as the centralized database for all incoming data. In addition, it features ‘Alarm Notification’ to quickly notify project members if turbidity levels exceed a specified range.

The NexSens WQData 3 web datacenter is automatically generated from iChart software, and provides an online interface for viewing data. The datacenter allows all project team members to view data, as well as facilitate direct communication using the online forum.

With this system in place, dredge operators can be notified immediately of high turbidity levels and slow down or alter the dredging operation until levels fall back within range. Additionally, the historical data can be tracked and correlated to dredge operations so that the consulting firm can improve upon future dredging operations.

To learn more about turbidity dredge monitoring, contact a NexSens applications engineer at 937-426-2703 or visit: www.nexsens.com/ashtabula.htm.
HIGH ACCURACY WEATHER DATA WITH THE WXT510

The demand for accurate and reliable weather data extends beyond professional meteorologists. Increasingly, businesses are finding the need to monitor weather conditions on-site, as many workplace responsibilities tend to be weather-dependent. To meet this growing need, many organizations are turning to the Vaisala WXT510 - a compact, state-of-the-art multi-parameter weather sensor at an affordable price.

The WXT510 measures the six most essential weather parameters: wind speed and direction, liquid precipitation (rainfall, intensity, and duration), barometric pressure, air temperature, and relative humidity, all in one compact, lightweight instrument. Designed for easy set up in automated weather stations, the WXT510 needs minimal effort for installation, integration, and maintenance. The multi-parameter sensor is commonly integrated with NexSens data logging and telemetry systems. This provides users with automatic data collection and the option of real-time data posting through the internet.

Wind speed and direction are measured ultrasonically with Vaisala’s advanced WINDCAP sensor, which eliminates nearly all problems common to mechanical sensors. Rainfall, intensity, and duration are measured with the Vaisala RAINCAP sensor, which is the only maintenance-free precipitation sensor on the market. Barometric pressure, temperature, and relative humidity sensors are housed in a ventilated chamber.

These sensors rely on Vaisala’s proven technology and experience, and provide highly accurate and stable readings for two years without any required maintenance. The unit is easy to remove for calibration, or replacement if needed. Please call Fondriest Environmental at 888-426-2151 for more information on the Vaisala WXT510 and integrating the sensor with NexSens data logging and telemetry products.

NATIONWIDE EVENTS

March 20-21
Michigan Ground Water Association: DeVos Place Amway Grand Plaza in Grand Rapids, MI

March 27-31
WQA Aquatech USA 2007: Orange County Convention Center in Orlando, FL

March 29-31
NSTA Conferences on Science Education: America’s Center in St. Louis, MO

April 2–6
USGS National Surface Water Conference: Millennium Hotel in St. Louis, MO

April 10–11
YSI 6-Series Sonde Training: YSI in Yellow Springs, OH

April 17–19
Tennessee Water Resources USGS: Montgomery Bell State Park in Burns, TN

April 29–May 3
2007 Groundwater Summit (NGWA): Albuquerque Convention Center in Albuquerque, NM

May 15–19
World Environmental & Water Resources Conference: Marriott Waterside in Tampa, FL

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