Q&As: Why Collect Water Quality Data When All You Need is Flow

Webinar Participant Q&A's – March 2021

(Contact Us With Questions)

Q1: Can you incorporate both flow and water quality instruments into one continuous monitoring station, or do they require separate infrastructure/surface boxes/cabling, etc?

A1: You can incorporate multiple instruments (flow and water quality) into one monitoring station, depending on the type of data logger(s) you choose. The SonTek-SL, SonTek-IQ and EXO sonde support SDI-12, an addressable single wire interface and communications protocol supported by most commercial data loggers that allows for connection to multiple individual sensors. A typical application might have a single data logger connected to a flow sensor, water quality sonde, and an additional met sensor, like a tipping bucket rain gauge, for instance. Higher-end loggers can handle an autosampler along with all that! We have even designed multi-logger systems to handle a heavy sensor payload.

Q2: How long can instruments be set out for continuous monitoring? How much data can you get?

A2: Some sites are more hazardous for sensors due to debris or other extreme conditions and may be in need of more maintenance or repair over time. With the Lilly Center's sites, we are hopeful that the current sensors will be established for 5-10 years or more. We are currently gathering water flow, water velocity, water temperature, system battery voltage, and air temperature data once per hour at our sites, though you can take these points even more often, such as every 15 minutes, for even higher resolution data. For continuous water quality sensors the biggest limitation on deployment time is biofouling, which varies from site to site. With the EXO sonde, however, the central wiper brush can keep the sensors groomed for many months at a time, even in high-fouling marine environments. What we find is that you will probably want to visit a site for routine maintenance anyway before you would run into an instrument-driven limitation on deployment time.

Q3: Do I need to physically go to a site to take a flow or water quality measurement or to download data?

A3: Not necessarily. Depending on the measurement location, equipment budget, etc., you might be able to setup a site for continuous monitoring, where sensors such as the EXO sonde, SonTek-SL, and SonTek-IQ can be connected to a data logger and the data transmitted back to a central office or made available on a website. Other sites you may just visit periodically and make measurements with systems such as the FlowTracker2 Handheld ADV and ProDss.

Q4: What is the easier way to measure bromide ion and bromate?

A4: For a site where bromide is relevant, such as some water treatment processes, YSI's recommendation is that a pH/ORP sensor be used to monitor for significant ORP fluctuations, and that an autosampler like the ProSample is triggered to collect samples based on user-defined ORP thresholds. The samples can then be evaluated with EPA Method 321.8 or similar. YSI's water quality platforms do not presently have a bromide ion selective electrode (ISE) sensor, and reports from the field are that bromide ISE sensors that *are* available do not perform to expectations.

Q5: With instruments located in the field using solar for a power supply, how often do they need to be serviced to maintain clean sensors?

A5: It will depend on the installation site and environmental conditions. The Lilly Center cleans ice and snow off of panels in the winter, but in their 2-3 years since installation, no panels or batteries have required maintenance or replacements.

Q6: Which instrument do you suggest to measure total nitrogen and nitrate in salt water? What about phosphorus?

A6: YSI's NitraLED sensor is not yet redesigned to work in salt water, and we find that the SUNA technology is still the best option available for saltwater applications. The wet chemistry required for phosphorus analyses is also a barrier to a sensor design for that purpose, and we've not been satisfied with the reagent-based systems in the environmental market enough to recommend one. However, we are very excited about recent trials with the Xylem IQ SensorNet Alyza platform that was designed for testing orthophosphate in wastewater. We hope to have more to discuss about that in the future.

Q7: Do you need to create a rating curve of sorts to measure discharge using the SonTek Side Looker?
A7: Many people do create rating curves using the SonTek-SL and SonTek-IQ, but it is not required. Both systems have a "theoretical flow" algorithm based on the geometry of the channel cross section and empirical experiments over the years with the instruments.

Q8: What is the data usage of a sensor out in the field, if one would want to connect it live - with an interval of 10 minutes for a couple of probes?
A8: The data requirements will depend on the number of instruments, the number of parameters being measured in each sample by each instrument, and how often you have the systems configured to collect samples. In the case of the Lilly's Lakes and Stream set-up that we featured during the webinar, our current sensors are continuous flow monitors that are currently set up to take continual readings for a minute, or a couple of minutes, and then the average of all of those measurements (flow, water velocity and depth) at a certain point in time (so say, at noon). You can set up the sensors to take a longer or shorter average collection period, such as every five minutes. This compares to our handhelds instruments like the FlowTracker, where we're taking manual measurements across a stream, we're doing multiple points of transect across the stream (30 sec average per point).

Q9: I notice you have the instruments mounted on wood planks. Would you ever consider switching to all-metal installations, since wood can warp and bend from temp changes, humidity, etc? Could this lead to a potential warp the fiberglass enclosure?
A9: A handful of Lilly Center sites have out-of-stream mounting that utilizes wood, but the rest use metal as their main mounting material. If we notice any issues, we would be able to change to all-metal setups fairly easily!

Q10: Our salmon study program monitors conductivity in several local urban streams. I want to learn if the effort needed to get discharge curves for flow data is worth it?
A10: There are various levels of "effort" involved in measuring discharge, and depends on your requirement for accuracy, data frequency, and how you would like to use the flow data in your salmon study program. Discharge data can be as simple as installing a continuous-monitoring acoustic device (SonTek-SL or SonTek-IQ) and turning on the theoretical flow calculations after entering the channel cross section. Or, it can be more involved when you create a rating curve, and go back periodically to verify discharge against the rating with instruments like the RiverSurveyor M9, RS5, or FlowTracker2.

Q11: Are they using the Flowtracker2 to QA/QC the data collected from the continuous IQ instruments?
A11: Yes, the Lilly Center checks flow readings with a Flowtracker2 for comparison occasionally. A Flowtracker2 was also used during the installation process to check that the system was functioning well.

Q12: Are rating curves established at all sensor stations and are shifts applied to the flow data resulting from parameters such as dam operations, accumulation of leaves, etc. Also, are the sensor data compared to data collected manually, such as using more traditional discharge measurement techniques?

A12: For the Lilly Center's sites, rating curves were only established at the two lowest-flow sites, which use Amazon Bubblers instead of IQ's or SL's. Bubblers use water pressure to calculate stream depth, and then we created a rating curve using manual flow data. Those sites now have the rating curve integrated into the system such that we get a flow estimation on our website just like our other sites. Like Dr. Xue Fan mentioned on the webinar, we could chose to create rating curves for our other sites if deemed beneficial.

Q13: When you measure for example chlorophyll a by using EXO probe, do you also combine this with laboratory measurements?
A13: We typically do not, because our aim in using the sensor is to detect changes in algal populations, specifically cyanobacterial populations, using relative fluorescence units (RFU). However, if one is more interested in µg/L of chlorophyll, we recommend building a site-specific correlation between sensor reading for that unit and grab samples that are analyzed via extraction. For many sites this correlation is very strong, but for some it is not. Another good way to use the sensor is to use it to drive your sampling regime for extractive analyses, in which case, yes, you would combine use of the sensor with laboratory measurements.

Q14: If we're using a Total Algae sensor on an EXO3, but are not able to collect concurrent water samples to send off to a chem lab for [chl a] analysis, what is the recommended parameter to sample (and report) with the Total Algae probe (raw engineering units, chl a, RFU, etc.)? Should we refer to this a "RELATIVE" chl a?
A14: I (Dr. Smith, here!) really like your idea of using a "relative" chl a unit! We have played with the idea of delivering a *f*chl unit, meaning fluorescence from chlorophyll. In the end, however, RFU is what makes the most sense anyway, because the sensor is used to measure gross population changes. For more insight on that, take a look at this blog from 2019!

Q15: How often do you calibrate and change the probes on the YSI unit?
A15: We calibrate monthly for most probes when functioning normally, including an annual pH probe replacement.

Q16: Is there any lab calibration/validation for the nutrient measurements?
A16: Lilly Center nutrient samples are analyzed at a professional laboratory that has calibration/validation protocols for each of their methods. Our QA/QC protocols also involve regularly sending duplicate samples for analysis.

Q17: Are the side beam sonars measuring depth/flow or water speed? If water speed, how are you using the data?
A17: The side-looking SonTek-SL systems measure both water velocity and water level. For water level, the SonTek-SL has both a vertical acoustic beam as well as a pressure sensor. During the instrument setup, the user enters information regarding the channel geometry and the instrument's location in the channel, and then for the flow calculation the system uses the channel geometry and measured water level to calculate the channel area. The channel area and the velocity data are then used to calculate instantaneous discharge as well as total volume.

Q18: Did you have the SL and IQ instruments installed at the same locations, or did you alternate?
A18: Instrument type was based on that site's characteristics, and there is one instrument per Lilly Center sampling site. The SL was better suited for our wider streams, the IQ for our smaller, shallower streams, and bubblers for our smallest seasonal streams.

Q19: Did you run into problems in cold conditions? Did the SonTek sensors function consistently?
A19: In the 2-3 years these sensors have been installed, the sensors have functioned consistently in spite of cold/freezing conditions. The potential exists that in-stream mounting equipment could be damaged by ice, but that hasn't occurred even when the streams have fully frozen over. Battery voltage has slowly declined

when solar panels were covered with snow for a few days, but sweeping the snow off returned battery voltage to normal.

Q20: I want to purchase everything mentioned in your presentation (thank you!) but of course that is unrealistic. If I have a single stream where I want to begin combined flow/wq, what can you recommend I use to start?
A20: We always hesitate to make recommendations with limited information, because our aim is to always offer only what is needed to suit the application. However, a simple basic setup that we see a lot of is to pair an EXO3 sonde with a SonTek-SL, communicating to a Storm3 datalogger equipped with cellular telemetry. The Lily Center also provided a great example—pairing the SonTek FlowTracker2 with a ProDSS at some of their sites, especially when they were starting out.