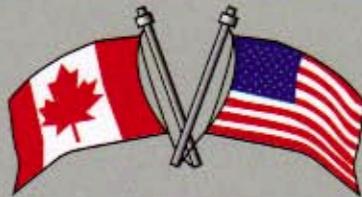


THE INTERNATIONAL JOURNAL ON
**HYDROPOWER
& DAMS**

www.hydropower-dams.com



Volume Nineteen, Issue 4, 2012

HYDRO AND PUMPED STORAGE IN NORTH AMERICA ~ DAM SURVEILLANCE
HYDROLOGICAL DATA MANAGEMENT ~ ELECTRICAL ENGINEERING

Improved software for water data management

E. Quilty, Aquatic Informatics Inc., Canada

Managing vast amounts of water data is complex, and errors in data management and processing can be costly. Recognising the ever increasing demands placed on those responsible for collecting and managing water data, AQUARIUS, a new software program which centralizes the storage and management of water data, has been designed to make documenting and analysing water data more efficient.

Water is the most precious asset for hydropower producers, so it is not surprising that their hydrologists go to great lengths to measure water flow accurately. In today's information age, best practices, industry standards, and technologies for hydrological monitoring have changed substantially. A paradigm shift has occurred, and frequent field visits to wind the recorder clock, flush the intakes, replace the paper chart, and keep the pen ink reservoir full are no longer appropriate. Today's hydropower producers are collecting vast amounts of real-time water data with modern gauging technology, and they are adopting specialized hydrological data management systems to improve the timeliness, reliability, and accuracy of their water information assets.

Hydropower companies like the Northern California Power Agency, Idaho Power, and the Salt River Project have approached Aquatic Informatics to address critical water data management and analysis challenges. They are adopting the company's AQUARIUS, to manage more effectively their valuable water resources. Centralized data management, production, auditing, and powerful analytics help optimize hydropower generation while ensuring operators stay within legislated in-stream flow requirements.

The British Columbia Hydro and Power Authority (BC Hydro), one of the largest electric utilities in North America, most recently selected AQUARIUS.

Stephanie Smith, Manager of Hydrology and Technical Services at BC Hydro, has expressed the company's satisfaction with the software in better managing the water supply and forecasting data, by enabling more frequent updates to the statistical water supply forecasts, and improving the traceability and tracking of forecast changes over the existing system.

BC Hydro will be using AQUARIUS in conjunction with water supply forecasting models that were devel-



Fig. 1. AQUARIUS Field Visit Tool is used to import and centralize environmental data

oped internally. The integration of AQUARIUS into BC Hydro's existing enterprise architecture will be activated based on AQUARIUS' ability to integrate with OGC (Open Geospatial Consortium) web services and OpenMI interfaces.

AQUARIUS is becoming more widely used as a water data management system for hydropower producers because it helps them measure their water assets more accurately. Managing vast amounts of water data to optimize power production and meet regulated flow requirements is complex. Errors in hydrological data management and analysis can be costly. Spilled water is a missed opportunity for the production of green, renewable energy. Mistakes in in-stream flow calculations can lead to regulatory penalties.

Hydropower producers must also effectively manage their water data to meet a number of additional applications, including: water condition management to support aquatic ecology; flood management; dam safety; and, recreational opportunities on river systems. They must balance environmental, social, and economical goals, striking the right balance between competing uses of water, such as: domestic water supply; fish and wildlife; recreation; heritage; and, electrical power needs.

Effective environmental monitoring programs are critical to the success of complex hydropower water management plans. Water resource managers need the right data management tools to store, validate, analyze, and report on growing volumes of hydrological data. AQUARIUS enables water resource managers to centralize and more efficiently manage vast amounts of hydrologic time series data and river gauging measurements. The result is more credible rating curves and higher confidence in calculations of flow.



W.A.C. Bennett Dam & Williston Reservoir (BC Hydro)

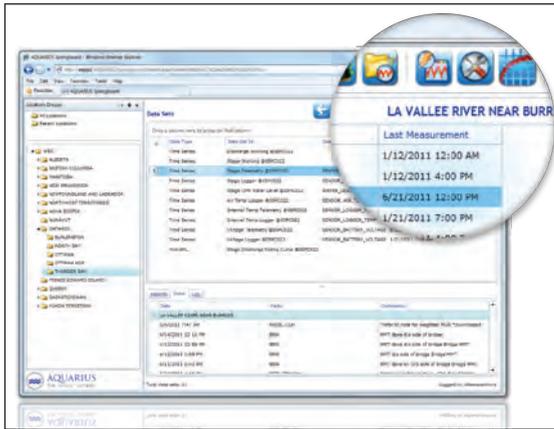


Fig 2. AQUARIUS Springboard enables streamlining data production in a simple web-based user environment

1. Centralized hydrological data

With all the types of data that hydrologists handle, it is common to find laboratory data in Excel, time series in CSV, gauging data in vendor software, and station data in GIS. AQUARIUS makes it easy to import, upload, and centralize hydrological data in one place, so it can be managed as a consolidated coherent collection. Hydrologists can easily import data logger files such as Sutron, PDAS, Vedas and YSI as necessary, and they can automate data imports or integrate AQUARIUS with external sources. All of the data (including meteorological, groundwater, surface water, fish counts and benthic invertebrate counts, kW and kWh) are then stored on the AQUARIUS server.

2. Access anytime and anywhere

With its web-based user interface, AQUARIUS gives hydrologists full secure access to their data management system from anywhere at anytime, increasing professional effectiveness and collaboration in the field. Relevant water data can be shared more easily across departments, while access to specialized data can be restricted.

3. Data editing and correcting

Records from remote environmental monitoring stations usually contain at least some anomalous or erroneous data, for example from sensor calibration drifting. To ensure the highest quality water data, these anomalous records need to be quality controlled. Water resource managers can achieve the highest qual-



Fig 3. AQUARIUS Location Manager provides centralized and optimized location management

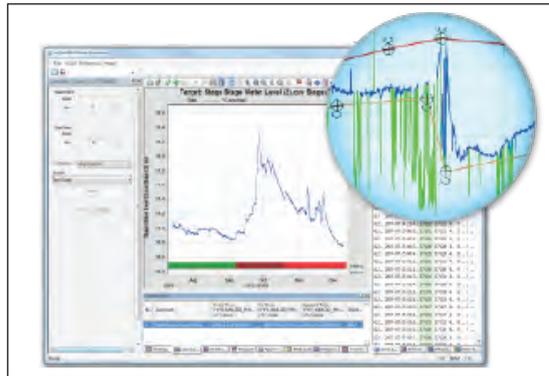


Fig 4. AQUARIUS Data Corrections allows data to be easily defended.

ity data with its intuitive quality control and editing tools. AQUARIUS can also automatically find anomalous or erroneous data. Spike removal, drift adjustment, pro-rated per cent correction, and recession curves are just a few of the many data correction tools available. Hydrologists can further manage their data processing activities with data grades and approval codes.

4. Data defensibility and regulatory compliance

If environmental data are ever put under scrutiny, hydropower producers need to ensure that all their water data processing steps are documented. By automatically building an auditable and defensible data processing, correction, and editing log, AQUARIUS provides the transparency needed to defend published water data legally. AQUARIUS maintains a permanent record of all original data, tracks all processing steps (who did what, when, and why), and provides fast access to its audit log, which makes reporting on and defending data for minimum flow requirements easier.

5. Credible rating curve development

Building and shifting rating curves has an enormous impact on computed streamflow data. AQUARIUS is used by hydropower producers around the world and by national agencies like the US Geological Survey (USGS) to develop accurate and legally defensible ratings.

The science and art of drawing rating curves has been fine-tuned over the last 100 years through the dedicated work of the world's leading hydrometric agencies. AQUARIUS was developed to match the international standards that have been developed and published by the International Organization for Standardization

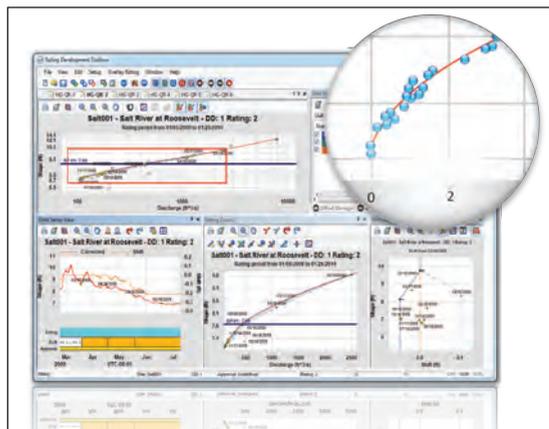


Fig 5. AQUARIUS Rating Development builds improved rating curves.

Fig 6. AQUARIUS Data Portal allows QA/QC of data in real-time.



(ISO), the World Meteorological Organization (WMO), and in USGS Technical References.

Hydrologists can turn their AquaCalcs, FlowTracker, and RDI ADCP files into curves, apply appropriate hydrologic and hydraulic computations, and update their rating curves quickly with shift adjustments. They can easily apply their hydrological and engineering judgment by building rating curves that take into account the hydrological conditions in the field, like scour, fill or weed growth, ice formations, or variable backwater from beaver dams downstream. As a result, water resource managers can be more confident in their calculations of flow, and they can produce more accurate forecasts.

6. Data QA/QC in real-time

Hydrologists are under increasing pressure to provide real-time data, often without adequate consideration for data quality. However, accurate water data are critical to the operations of hydropower producers. With continuous data, AQUARIUS can automatically remove non-physical values and set up on-going corrections for any monitoring site or location. Automated hydrometric data processing keeps water data up to date with event-driven computations. Automated quality control means hydropower producers can produce high quality data in real-time.

7. Automated reporting and publishing

AQUARIUS allows water resource managers to report and publish water data based on a large list of industry standard best practice templates, or they can customize reports to match specific operational needs and regula-

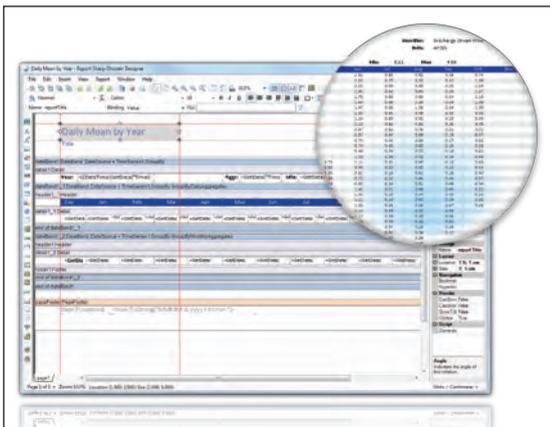


Fig 7. AQUARIUS Reporting reports and publishes faster.

tory compliance requirements. Reports can be produced as needed or programmed to run for regular reporting.

Many hydropower operators recognize that accurate water data management and effective analysis are critical in meeting their operational goals and regulatory compliance requirements. Leaving their water resource managers and hydrologists to depend on spreadsheet tools and legacy systems is too risky. With these tools, they cannot manage growing volumes of water data without introducing processing errors. Hydropower producers are turning to modern hydrologic information systems like AQUARIUS to manage water supply and forecasting data better. AQUARIUS allows them to meet the evolving needs of their hydrologists and to support current industry standards for water information management. Hydropower operators are able to measure lake and reservoir levels more accurately, to calculate water balances for total inflows and outflows more easily, and to manage both relative and absolute water level information. AQUARIUS helps hydroelectric utilities determine the hydro production potential of their reservoirs more precisely. ◇



E. Quilty

Ed Quilty is President and CEO of Aquatic Informatics Inc. He is the founder of the company, and has worked in the water industry since 1992. He has specialized in automated monitoring, data management and assessment, and environmental impact assessments. Prior to founding Aquatics in 2003, Ed was principal of QA Environmental Consulting, a regional firm focused on designing and managing hydrometric networks. He is a registered professional biologist with the British Columbia College of Applied Biology, a Director of the Canadian Water Resource Association, and a member of the Canadian Meteorological and Oceanographic Society and the American Water and Wastewater Association. He is also an active member of ACETECH and BCTIA, technology associations focused on rapidly growing British Columbia companies.