

# AQUARIUS Urban Water Resources Data Management Case Study

## The City of Bellingham Modernizes Its Hydrology & Water Quality Data Management System

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“As our urban water resource data management platform, AQUARIUS is enabling the City of Bellingham to efficiently produce water data of the highest standards. Timely, accurate information results in better decisions to effectively manage drinking water resources for use now and to produce better plans for its protection for future generations.”

Michelle Evans, Water Quality Specialist  
Public Works/Operations/Laboratory, City of  
Bellingham

City of  
**Bellingham**  
WASHINGTON

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## About the City of Bellingham

On the shores of Bellingham Bay with Mount Baker as its backdrop, Bellingham is the last major city before the Washington coastline meets the Canadian border. The City of Bellingham serves approximately 88,000 water customers. Lake Whatcom, with 36 tributaries, is used as the City's main drinking water supply. On occasion, water from the Middle Fork of the Nooksack River is diverted into Lake Whatcom to augment supply. The Bellingham Public Works team operates a state-accredited laboratory, where drinking water quality monitoring is performed daily to ensure the safety of the public. The Lab adopted AQUARIUS Time-Series Software to more efficiently process water data, to ensure data quality of the highest standards, and to meet the needs of stakeholders for timely, accurate hydrological information.

## Challenges: Inefficient Water Quality Data Management Tools

The City of Bellingham Water Quality Laboratory is part of the Public Works Operations Division. Its qualified water and wastewater utility professionals are dedicated to providing customers with the best quality water possible. The primary function of the city's water quality lab is to provide city staff and citizens with the accurate data needed to ensure the safety of the water supply, to make informed decisions, and to maintain regulatory compliance for drinking water, wastewater, stormwater, environmental resources, and air quality.

Prior to deploying AQUARIUS, the lab used complex spreadsheets and a separate statistical analysis program to store, process, analyze, and report on water quality data. "Performing simple summary statistics was awkward, time consuming, and prone to mistakes," admitted Michelle Evans. "Having to deal with issues such as leap years and different number of days each month made analysis difficult. Spreadsheets are not database software. Character limits were exceeded so quickly with time series data, and appending data caused 'glitches' with the program. I frequently experienced error messages and spreadsheet locks ups. Then, converting data from spreadsheets to the statistical program simply took too much time."

## Solution: AQUARIUS Time-Series

To meet its mandate and operational goals, the City of Bellingham collects continuous and discrete water quality data in Lake Whatcom, key tributaries into the watershed, and within the Middle Fork Nooksack River diversion system. Urban streams are outfitted with stream gaging stations. Equipment includes sondes, bubblers, and data loggers. With its comprehensive environmental monitoring network, the City is collecting massive volumes of continuous and discrete sample data needed to ensure safe drinking water for its citizens. The Lab needed better tools to process the large volumes of raw data and to produce timely, actionable information.

When the City of Bellingham Water Quality Laboratory chose to modernize its data management system, it selected AQUARIUS. "With AQUARIUS, water quality data management activities are completed much more efficiently," reported Michelle Evans. "I'm not only saving time, but I can also ensure that I provide end users with the highest quality data. I'm better able to meet their needs for timely, accurate information."

AQUARIUS is used by the lab for water quality data management. There is no longer a need to switch between spreadsheets and statistical software. Hydrological data is stored and processed on one platform, ensuring a consistent data format throughout the data production lifecycle.

## Accurate Rating Curves & Automation

"The Rating Development Tool provides an excellent solution for managing ratings," explained Michelle Evans. "For sites with multiple ratings, the rating period manager is a great feature to keep track of historical ratings, as well as for sites that have two conditions that occur periodically within a water year like dam operations. I can easily toggle between two conditions by simply entering the date and time that the dam gates were installed or taken out, instead of having to scroll through a spreadsheet to find the correct date and time and change the equation."



Modernizing to AQUARIUS has automated previously manual, time consuming data processing steps. Data is now automatically appended using hot folders, eliminating previous cut and paste errors. "I'm also saving time in calculating stream discharge," added Michelle Evans. "Once I've set up a rating curve, any data I append or corrections I make to the associated dataset are automatically updated in my discharge results."

## Timely, Defensible Ratings & Water Quality Data

AQUARIUS allows the City of Bellingham to effectively meet its many operational and data dissemination requirements. "When we used spreadsheets, I always sent the entire dataset to the end user, but too much information is not useful," admitted Michelle Evans.

AQUARIUS keeps a copy of all original data and builds an audit log of all changes made as data is corrected and processed. AQUARIUS tracks how the data was edited, when, by whom, and why. It provides the transparency needed to produce defensible ratings and water quality data.

"Now I can select only what is requested by the end user from the database. Raw data, corrected data, metadata, and any accompanying notes and data grades are easily exported into a spreadsheet as requested. We are now better able to meet the actual needs of end users of our data, whether they require daily, hourly, or other statistics."

## Improved Watershed Management, Planning, & Protective Measures

AQUARIUS is used by the City of Bellingham to assist in its water resource management decisions. Automation and integrated features for tracking data quality and validation in the data production process ensure that quality controlled data is available in a timely manner. Customized reporting ensures that the right information is available to the right people, at the right time to better manage the City of Bellingham urban water resources.

Hydrological time series and water quality data have been used in the following City of Bellingham projects:

- Restoration project design
- Biological studies, primarily for salmonids
- Culvert sizing
- Sediment transport studies
- Water quality assessments/loading, usually for TMDL purposes
- Comprehensive plan - City wide model
- Floodplain proofing
- Stormwater modeling
- Lake Whatcom watershed model

# Results

AQUARIUS has enabled the City of Bellingham to better:

- Manage growing volumes of real-time water quality & flow data
- Improve data management efficiencies, resulting in faster turn-around times
- Produce hydrometric data that is of the highest quality in less time
- Meet the end user needs for timely, defensible, & accurate water information