

User Guide

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Domain: <https://awqp.erasms.com/>

AWQP Database

Agricultural Water Quality Program Database Webtool



**ONE WATER
SOLUTIONS INSTITUTE**
COLORADO STATE UNIVERSITY

One Water Solutions Institute

Colorado State University



COLORADO
Department of Agriculture

Prepared in cooperation with the Colorado
Department of Agriculture's Agricultural
Water Quality Program

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EXECUTIVE MESSAGE

The [Agricultural Water Quality Program \(AWQP\) Database Webtool](#) has been developed as a web-based platform to facilitate the access and assessment of monitoring data collected by the AWQP at the Colorado Department of Agriculture (CDA). The tool provides great flexibility in selection and drilldown of monitoring data at groundwater and surface water sites of the AWQP as well as basic analyses including statistics, boxplots, histograms, and other data summary mechanisms.

The AWQP Database Webtool is built on the Environmental Risk Assessment and Management System (eRAMS) web tool platform which has been developed by Colorado State University's One Water Solutions Institute (OWSI) over the last decade as an open-source technology that provides cloud-based, geospatially enabled software solutions as online services and a platform for collaboration, development, and deployment of online tools. OWSI has built numerous tools using the eRAMS platform that currently support major collaborative projects, including: USDA-NRCS water supply forecasting, Colorado Department of Public Health and Environment water quality DSS, USACE Missouri River Restoration Program Information Management System (MRRP-IMS), and USGS/USFS Ecological Flows for Riverine EcoSystem Habitats Decision Support Tool (E-FRESH DST).

AWQP Database Webtool (v1.0) aims to recreate the base functionality of the original Groundwater Database Tool, a decade old tool with more limited access to much of the same dataset.

The AWQP Database Webtool was developed at Colorado State University (CSU) under the supervision of Principal Investigators (PI) at CSU, Troy Bauder and Erik Wardle, and Tyler Wible, Assistant Director of Software Innovation at OWSI. Further collaboration was had with AWQP's staff including: Karl Mauch, Groundwater Monitoring Specialist; Rob Wawrzynski, AWQP Manager; and Lucas Howard, Surface Water Monitoring Specialist.

WHO SHOULD USE THIS GUIDE

This guide is a tutorial to get users started using the [AWQP Database Webtool](#) and provides instructions for commonly performed tasks and uses of the tool. This tool is intended for use by landowners, farmers, water resource managers, academic groups, regulatory officials, and consultants as well as state, local, and federal

agencies seeking understanding of the current water quality conditions across Colorado and/or planning for the future of water resources.

NEED HELP?

If users need additional assistance after reviewing the guide, we are here to help! This guide is designed to provide instruction on commonly performed operations and answers to frequently asked questions. If users find any aspect of the tool challenging or find any information that is missing from this guide, please engage an eRAMS expert to guide users through any hurdles. Contact us at eramsinfo@gmail.com

ACKNOWLEDGMENTS

We would like to thank Karl Mauch, Groundwater Monitoring Specialist at the Colorado Department of Agriculture, and Dr. Mazdak Arabi, Borland Endowed Professor of Water Resources at Colorado State University's Department of Civil and Environmental Engineering, for their time, expertise, and contributions as peer reviewers.

PREPARED BY

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SOFTWARE AVAILABILITY

Domain

<https://awqp.erams.com/>

Documentation URLs

https://awqp.erams.com/er2_awqp/download_quick_start/

https://awqp.erams.com/er2_awqp/download_user_guide/

AUTHORIZED USE PERMISSION

The information contained in the AWQP Database Webtool (the "Service") is for general information purposes only. CSU's One Water Solutions Institute ("CSU-

OWSI”) assumes no responsibility for errors or omissions in the contents of the Service. In the Service (<https://awqp.erasms.com/>), users agree to hold neither the creators of the software platform nor CSU-OWSI liable for any action resulting from use or misuse of the Service. In no event shall CSU-OWSI be liable for any special, direct, indirect, consequential, or incidental damages or any damages whatsoever, whether in an action of contract, negligence or other sort, arising out of or in connection with the use of the Service or the contents of the Service. CSU-OWSI reserves the right to make additions, deletions, or modifications to the contents of the Service at any time without prior notice. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by Colorado State University.



USER AND TECHNICAL GUIDE

OVERVIEW

The Agricultural Water Quality Program (AWQP) is head up by the Colorado Department of Agriculture (CDA) and was statutorily established with the responsibility to protect state waters and the environment from impairment or degradation due to the improper use of agricultural chemicals while allowing for their proper and correct use. The AWQP cooperates and collaborates with both the Colorado State University (CSU) Extension office and the Colorado Department of Public Health and Environment (CDPHE) to review the products they produce and their water quality monitoring campaigns. The AWQP initially only disseminated monitoring results through written reports and presentations to its advisory committee. However, in the early 2000's an online database was created to allow better public access to the program's data.



PURPOSE

The initial online database housed only results for groundwater sampling since that was the program's sole focus since starting in 1990. As of 2019, the AWQP program was expanded to include monitoring of surface water systems in 2019. This expansion required updates to the previous webtool to handle both groundwater and surface water data and query summaries. This new tool, the AWQP Database Webtool, was designed to be an internal aid for CDA, CSU, CDPHE, but also an advanced tool for the program's stakeholders. These monitoring results can be grouped by year, geographic location, analyte type (pesticides, inorganic compounds, and more) and produce summary statistics, charts, and raw data tables that can be exported for use outside the webtool.

The new database is design to be deployed as a web-based tool (Figure 1) using the Catena Analytics cloud services and eRAMS platform developed by the project team at OWSI. The tool is organized in two main modules: the Home Page and the Database Query Filters.

QUICK START

The AWQP Database Webtool navigation menu (left panel icons in Figure 1) includes 2 sections as listed below to help users navigate the tool. The [User Guide](#) outlines how to get started using the tool.

1.  [Home Page](#)
 - a. Overview of AWQP Database Webtool
2.  [Database Query Filters](#)
 - a. Data filters and results summary review

SYSTEM REQUIREMENTS

A modern web browser is required to connect and run the AWQP Database Webtool. Minimum supported browser versions include Google Chrome v.69, Mozilla Firefox v.62, Safari v.11.1, and Microsoft Edge v.17.



HOME PAGE

The home page (Figure 1) gives an overview of the AWQP Database Webtool, direct links to its different sections, and various resources available through the AWQP. Scrolling down the home page will provide background information and the purpose of the different analyses and features available in the AWQP Database Webtool.

VQP Database Webtool v. 0.17.2 [Query Database](#)

AGRICULTURAL WATER QUALITY PROGRAM DATABASE

Purpose

This database catalogues all water quality data collected and utilized by the Agricultural Water Quality Program. The program currently monitors all state waters and the results are shown by year and geographic location for pesticides and inorganic compounds including nitrogen and phosphorus nutrient data. Data can be queried using a variety of geographic, temporal, and parameter filters. Groundwater results date from 1980 to present while surface water results date from 2020 to present. Queried results are intended to be viewed online; however, graphics and data tables are downloadable in various formats.

Because the program focuses on geographical areas with known or suspected extensive agricultural chemical usage, the data is not intended to represent typical groundwater quality for the whole of Colorado. The Colorado Department of Agriculture, Colorado State University Extension, and the Colorado Department of Public Health and Environment, are cooperating agencies in the implementation of this program. If you have any questions, please view our publications on our program webpage, or contact us directly.

For more information regarding this dashboard, users are referred to the following references:

- [Quick Start Guide](#)
- [User Manual](#)
- [Agricultural Water Quality Program Website](#)

Program Mission is to protect Colorado's state waters and the environment from impairment or degradation due to the improper use of agricultural chemicals while allowing for their proper and correct use.

Tools & Features

- As of 12/31/2023, this database contains analytical and field measurements from 1,579 groundwater sites and 236 surface water sites with more than 360K observations which include nutrients and other inorganics, parent and degradate pesticide compounds, and field measurements.

Figure 1: AWQP Database Webtool's Landing Page

DATABASE - SELECT QUERY FILTERS

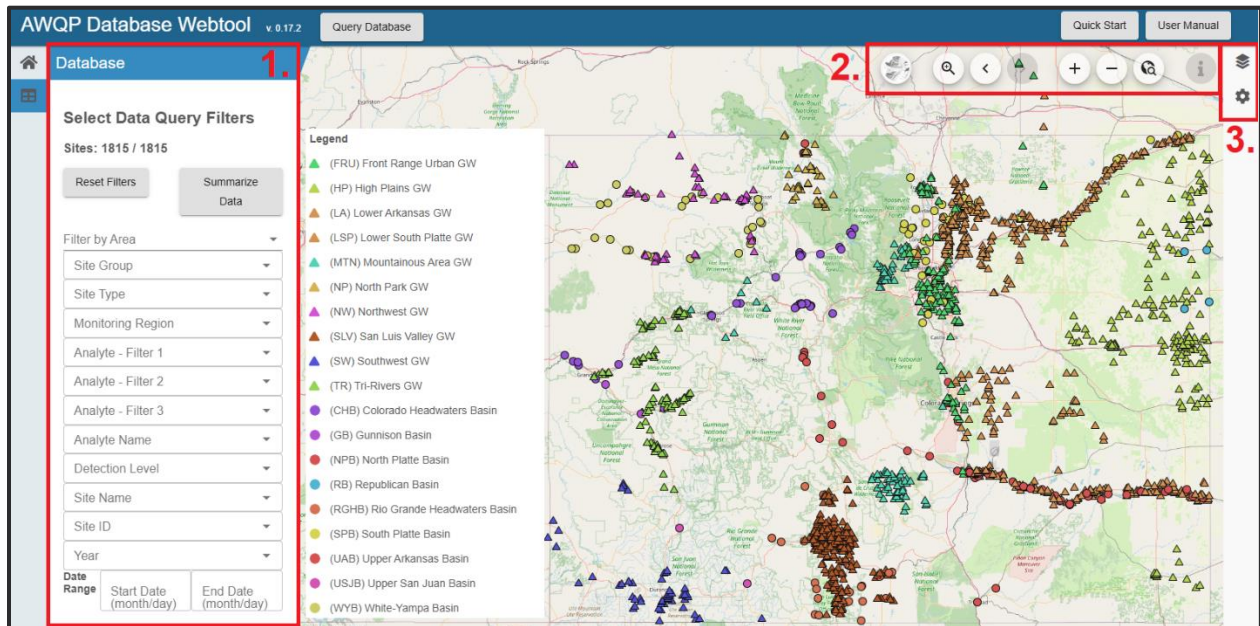


Figure 2: AWQP Database Webtool's Database Query Filters Page

This section of the tool (Figure 2) is dedicated to the selection of any number of data filters both spatial and categorical to streamline grouping and assessment of monitoring data available in the AWQP Database. This section (#1 in Figure 2) allows users to select any number of database filters prior to summary. There are a number of filters available for users to drill into their data of interest (Figure 3) explained below. Additionally, (#2 in Figure 2), there is a map toolbar with a number of options to assist in zooming to an area of interest or previous map extent, as well as (#3 in Figure 2) adjusting the basemap and uploading user layers and other integrated spatial layers for added context on the map.

Once a user has selected the filter(s) of interest for their database query, they can select the "Summarize Data" button to generate a summary of data, explained in the [Database - Query Results](#) section.

The screenshot shows a web interface for the AWQP Database. At the top, there is a blue header with the word "Database". Below this, the main heading is "Select Data Query Filters". Underneath, it displays "Sites: 1815 / 1815". There are two buttons: "Reset Filters" and "Summarize Data". A dropdown menu labeled "Filter by Area" is open, showing a list of filter options: "Site Group", "Site Type", "Monitoring Region", "Analyte - Filter 1", "Analyte - Filter 2", "Analyte - Filter 3", "Analyte Name", "Detection Level", "Site Name", "Site ID", and "Year". At the bottom, there is a "Date Range" section with two input fields for "Start Date (month/day)" and "End Date (month/day)".

Figure 3: AWQP Database Webtool's Database Filter Options

Filter by - Area

This option (Figure 3) shows a map that users can use to zoom into a specific area. Use the drop-down menu to choose how to select an area. Single clicking will move the map until users select a "Filter by Area" option.

Draw a Rectangle

The options for manual selection of the geographic region of interest include the area within a rectangle. This example is shown in Figure 2.

1. Select boundary type
2. Click to start drawing rectangle on desired map location
3. Click to end drawing rectangle

Draw a Line

The options for manual selection of the geographic region of interest include the area within a buffer of a line.

1. Select boundary type
 - Enter desired buffer radius
2. Place point(s) on desired map location

Draw a Point

The options for manual selection of the geographic region of interest include the area within a desired radius of a point (point buffer).

1. Select boundary type
 - Enter desired buffer radius (point or line)
2. Place point(s) on desired map location

Draw a Polygon

The options for manual selection of the geographic region of interest include the area within a free-hand polygon.

1. Select boundary type
2. Place point(s) (single click) on desired map location
3. End drawing and add final point by double click

Draw a circle

The options for manual selection of the geographic region of interest include the area within a desired radius of a hand drawn circle.

1. Select boundary type
2. Place point(s) on desired map location

Known Boundaries

Users can select a region from known boundaries such as states, counties, cities, or hydrological unit codes ([HUCs](#)).

1. Select “Known Boundaries”
2. Select predefined “Type of Boundary” from drop-down list (states, counties, cities, HUC-8, HUC-10 or HUC-12 watersheds)

User-Supplied Layer

Users can upload a layer (shapefile).

1. Select “User-Supplied Layer”
2. Select a shapefile for upload from your device
 - All files associated with a shapefile can be zipped into a ZIP archive (*.zip) then uploaded, or multiple files can be uploaded at the same time outside of a ZIP archive
 - Depending on the size of your file(s), it may take a few minutes to process

Alternatively, the user can specify data filters based on the data types rather than by where the monitoring locations are on the map.

Filter by – Site Group

This option (Figure 3) allows for filtering data results by the group category of the site, i.e. whether it is a groundwater monitoring well or a surface water monitoring location.

Filter by – Site Type

This option (Figure 3) allows for filtering data results by the type of site being monitored. A full list of the types of site can be found below.

- CI: Well – Crop Irrigation
- DI: Irrigation Ditch
- EF: Edge-of-Field
- IC: Canal
- LK: Lake
- PZ: Piezometer
- RS: Reservoir

- SD: Spring Discharge
- ST: Stream
- TD: Tile Drain
- WA: Well - Augmentation
- WC: Well - Commercial
- WD: Well - Domestic
- WF: Well - Fire
- WG: Well - Geothermal
- WI: Well - Industrial
- WL: Well - Livestock
- WM: Well - Monitoring
- WP: Well - Public Supply
- WR: Well - Recreation
- WS: Well - Snowmaking

Filter by – Monitoring Region

This option (Figure 3) allows for filtering data results by the spatial region that the monitoring locations are in, these can be geographic or geologic areas of interest like alluvial or bedrock aquifers or geopolitical regions of interest that have been monitored over the years. Each of these options has a unique color and symbol in the map and is listed in the legend only if sites from that region match the existing set of data queries.

Filter by – Analyte Filter 1

This option (Figure 3) allows for filtering data results by the category of water quality analyte of interest. These options primarily reflect the chemical compound category of the analytes and include the following:

- Inorganics, Metal
- Inorganics, Non-Metal
- Nutrients
- Organics, Other
- Organics, Pesticide
- Physical
- Radiochemical

Filter by – Analyte Filter 2

This option (Figure 3) allows for filtering data results by the sub-category of water quality analyte of interest. Specifically, the type of analyte, i.e. an herbicide vs a minor metal water quality analyte. This list is updated based on any selection of [Analyte Filter 1](#).

Filter by – Analyte Filter 3

This option (Figure 3) allows for filtering data results by the quality of the data analyte, for example dissolved versus total fractions of a particular water quality analyte like nitrogen. This list is updated based on any selection of [Analyte Filter 1](#) or [Analyte Filter 2](#).

Filter by – Analyte Name

This option (Figure 3) allows for filtering data results by the exact name of the water quality analyte of interest. Please note this is a large list of potential water quality analyte from metals to pesticides, and other trace chemicals. This list is updated based on any selection of [Analyte Filter 1](#) or [Analyte Filter 2](#), or [Analyte Filter 3](#). Typing into this entry will begin to auto-complete and minimize the list of options.

NOTE: It is worth noting that when users make a selection with one of the above analyte filters, there may be a short lag in the resolving of the other three filters.

Filter by – Detection Level

This option (Figure 3) allows for filtering data results by the quality of the result, was the analyte detected, not-detected, or at/above the water quality standard for that analyte, or above some user-defined level.

NOTE: The use of “At or Above Standard” will search results in the database against any official U.S. EPA primary or secondary drinking water standards or health advisory levels. If no such standard exists for the user-selected parameter, the database will not return a result.

Filter by – Site Name

This option (Figure 3) allows for filtering data results by the name of the monitoring location. Some sites have short ID-based names while others, mostly surface water monitoring sites, have longer names that describe the water body being monitored (i.e. the South Platte River) and adjacent nearby landmarks like a bridge where

sampling was taken. Typing into this entry will begin to auto-complete and minimize the list of options.

Filter by – Year

This option (Figure 3) allows for filtering data results by the year in which they were collected. Multiple selection is allowed so that both annual and period-of-interest summaries can be generated.

Filter by – Date Range (month/day)

This option (Figure 3) allows for filtering data results to between two user-specified month/day sample collection dates.



DATABASE - QUERY RESULTS

Once “Summarize Data” is selected for the selected data filter(s), that query will be performed against the database results and summarized in the bottom panel (#2 in Figure 4) of the interface that will automatically popup and cover a portion of the map. The remainder of the map (#1 in Figure 4) is updated to reflect the sites meeting the data filters and is zoomed-to them with an updated legend as well ().

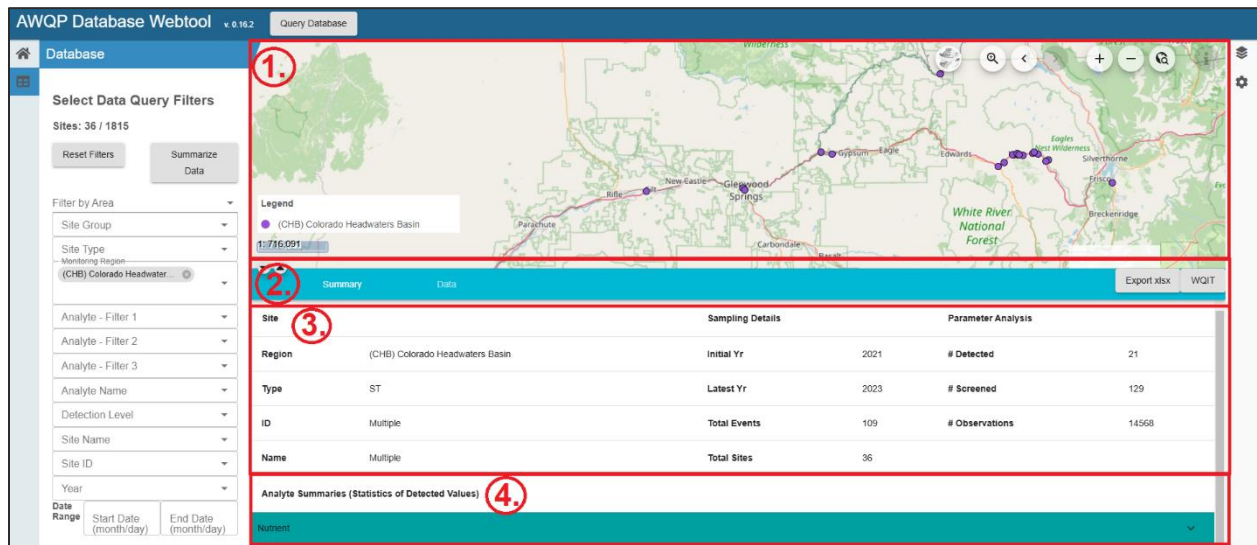


Figure 4: AWQP Database Query Results Overview

In the top right of the banner (#2 in Figure 4) of the results panel, there are two options for expanded assessment of the data in this tool. The first, “Export xlsx” is an export option to export the raw data in the [Result Tab - Data](#) section into a Microsoft Excel (.xlsx) file format. The second, “WQIT”, opens a new webpage showing the [Water Quality Interpretation Tool](#) (WQIT), developed by Colorado State Extension. This tool is intended to provide context to understanding the various ranges of water quality analytes and drinking, livestock, and irrigation water quality standards.

NOTE: Currently, the WQIT requires manual entry of parameter values. Future versions of the AWQP Database Webtool plan to create a path where, for a single sampling event and site, results are automatically populated into the tool – saving the user time and minimizing entry errors.

Result Tab - Summary

This tab provides a 2-part summary of the database query. First, (#3 in Figure 4) it summarizes the metadata and some summary statistics of the resulting data query.

This includes metadata about the monitoring stations fitting the data filter like the region, site type(s), ID, and Name. It also includes a summary of the sampling data (initial and last sampled year, number of sampling events, number of monitoring sites) as well as an overview of the data available at that site (# of detected parameters, # of parameters that were screened for, and the total number of observations).

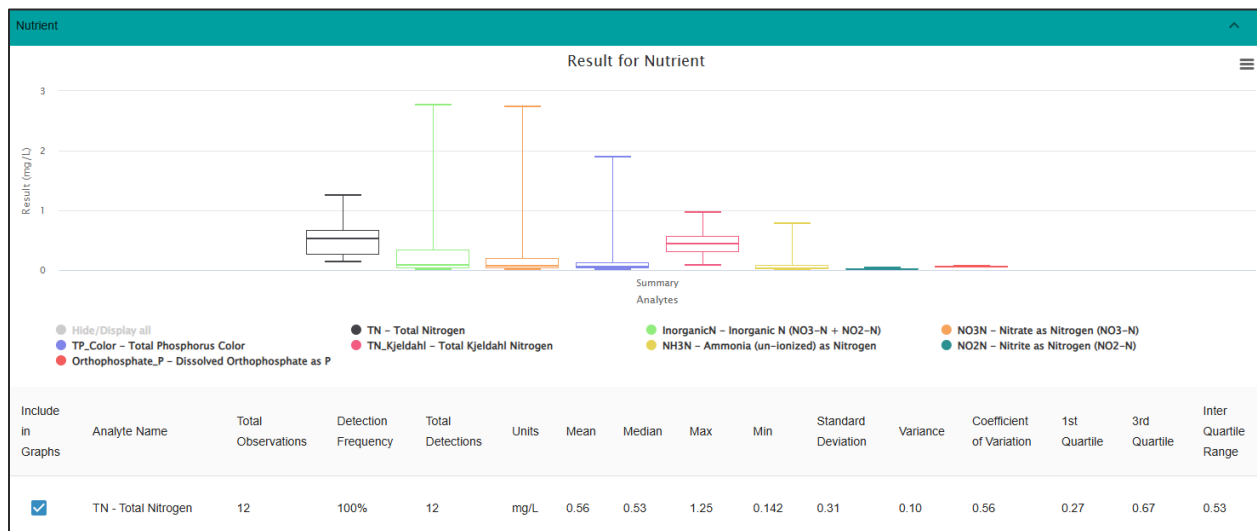


Figure 5: AWQP Database Webtool's Analyte Summary for the Nutrient sub-category

The second part of this tab (#4 in Figure 4, expanded in Figure 5) provides a summary boxplot by water quality analyte within its major category ([Analyte Filter 1](#)) of data type (i.e. nutrient data like nitrogen versus physical data like temperature). These boxplots are interactive (selectable, on-hover content).

The summary table below the boxplot includes an overview, per analyte, of the data quality (# of observation, detection frequency, total detections) as well as a basic statistics summary of the query for that analyte. If one or more of these analytes are selected from the summary table, additional result tabs will be generate, [Time Series](#), [Histogram](#), [Monthly](#), and [Annual](#), containing those summaries of that data.

NOTE: The resulting data summaries and graphs are reflective of the data filters applied and may not be a summary of, or inclusive of, all the data that is available for a particular region or parameter in the AWQP Database. Interpretation of rendered results should consider how the database may have been restricted due to utilization of the data filters.

Result Tab - Data

The Data tab of the result section contains a verbose summary of all of the monitoring data fitting the selected query filters. The bulk of the Export xlsx file download is this file including the summary metadata.

AWQP Database Webtool v. 0.16.2 Query Database

Database Summary Data Time Series Histogram Monthly Export xlsx WQIT

Select Data Query Filters

Sites: 36 / 1815

Reset Filters Summarize Data

Filter by Area

- Site Group
- Site Type
- Monitoring Region (CHB) Colorado Headwater...
- Analyte - Filter 1
- Analyte - Filter 2
- Analyte - Filter 3
- Analyte Name
- Detection Level
- Site Name
- Site ID
- Year

Date Range Start Date (month/day) End Date (month/day)

Date	Site ID	Site Group	Site Type	Site Name	Monitoring Region	Primary Use	Analyte Name
2023-06-07 00:00:00	CHB23ST115L	Surface Water	ST	Blue River above Dillon Reservoir	(CHB) Colorado Headwaters Basin	TN - Total Nitrogen	
2023-07-11 00:00:00	CHB23ST115L	Surface Water	ST	Blue River above Dillon Reservoir	(CHB) Colorado Headwaters Basin	TN - Total Nitrogen	
2023-09-07 00:00:00	CHB23ST115L	Surface Water	ST	Blue River above Dillon Reservoir	(CHB) Colorado Headwaters Basin	TN - Total Nitrogen	
2021-08-11 00:00:00	CHB21ST50L	Surface Water	ST	Colorado River @ Loma	(CHB) Colorado Headwaters Basin	TN - Total Nitrogen	
2021-10-12 00:00:00	CHB21ST50L	Surface Water	ST	Colorado River @ Loma	(CHB) Colorado Headwaters Basin	TN - Total Nitrogen	
2021-12-07 00:00:00	CHB21ST50L	Surface Water	ST	Colorado River @ Loma	(CHB) Colorado Headwaters Basin	TN - Total Nitrogen	
2022-06-27 00:00:00	CHB21ST50L	Surface Water	ST	Colorado River @ Loma	(CHB) Colorado Headwaters Basin	TN - Total Nitrogen	
2022-08-17 00:00:00	CHB21ST50L	Surface Water	ST	Colorado River @ Loma	(CHB) Colorado Headwaters Basin	TN - Total Nitrogen	
2022-10-11 00:00:00	CHB21ST50L	Surface Water	ST	Colorado River @ Loma	(CHB) Colorado Headwaters Basin	TN - Total Nitrogen	
2023-06-14 00:00:00	CHB21ST50L	Surface Water	ST	Colorado River @ Loma	(CHB) Colorado Headwaters Basin	TN - Total Nitrogen	
2023-08-10 00:00:00	CHB21ST50L	Surface Water	ST	Colorado River @ Loma	(CHB) Colorado Headwaters Basin	TN - Total Nitrogen	
2023-10-11 00:00:00	CHB21ST50L	Surface Water	ST	Colorado River @ Loma	(CHB) Colorado Headwaters Basin	TN - Total Nitrogen	
2023-07-19 00:00:00	CHB23ST18	Surface Water	ST	Big Salt Wash @ Fruita / HWY 50 Bridge	(CHB) Colorado Headwaters Basin	InorganicN - Inorganic N (N	
2023-08-31 00:00:00	CHB23ST18	Surface Water	ST	Big Salt Wash @ Fruita / HWY 50 Bridge	(CHB) Colorado Headwaters Basin	InorganicN - Inorganic N (N	
2023-11-07 00:00:00	CHB23ST18	Surface Water	ST	Big Salt Wash @ Fruita / HWY 50 Bridge	(CHB) Colorado Headwaters Basin	InorganicN - Inorganic N (N	
2021-07-13 00:00:00	CHB21ST10	Surface Water	ST	Black Gore Creek @ Black Gore Drive	(CHB) Colorado Headwaters Basin	InorganicN - Inorganic N (N	
2021-09-23 00:00:00	CHB21ST10	Surface Water	ST	Black Gore Creek @ Black Gore Drive	(CHB) Colorado Headwaters Basin	InorganicN - Inorganic N (N	
2023-07-13 00:00:00	CHB23ST08A	Surface Water	ST	Blue River @ mouth near Kremmling	(CHB) Colorado Headwaters Basin	InorganicN - Inorganic N (N	
2023-08-23 00:00:00	CHB23ST08B	Surface Water	ST	Blue River @ Trough Road	(CHB) Colorado Headwaters Basin	InorganicN - Inorganic N (N	
2023-11-01 00:00:00	CHB23ST08B	Surface Water	ST	Blue River @ Trough Road	(CHB) Colorado Headwaters Basin	InorganicN - Inorganic N (N	
2023-06-07 00:00:00	CHB23ST115L	Surface Water	ST	Blue River above Dillon Reservoir	(CHB) Colorado Headwaters Basin	InorganicN - Inorganic N (N	
2023-07-11 00:00:00	CHB23ST115L	Surface Water	ST	Blue River above Dillon Reservoir	(CHB) Colorado Headwaters Basin	InorganicN - Inorganic N (N	
2023-09-07 00:00:00	CHB23ST115L	Surface Water	ST	Blue River above Dillon Reservoir	(CHB) Colorado Headwaters Basin	InorganicN - Inorganic N (N	
2021-07-13 00:00:00	CHB21ST11	Surface Water	ST	Booth Creek @ I-70 Frontage Rd	(CHB) Colorado Headwaters Basin	InorganicN - Inorganic N (N	

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Figure 6: AWQP Database Webtool's Data Tab

Note, that this table is sortable by column header. Clicking a column header once will sort the content of that table by minimum to maximum and include a black line above that column name to reflect this sorting (Figure 7). Clicking the same column header a second time will sort the content of the table by maximum to minimum of that column and include a black line below that column name to reflect this sorting (Figure 8).

Data		
BDL Indicator	Result	Status
0	0.696	Final
0	2.6	Final
0	3.12	Final

Figure 7: AWQP Database Webtool's Data Tab - Sort Minimum to Maximum

Data		
BDL Indicator	Result	Status
0	17.4	Final
0	8.81	Final
0	8.59	Final

Figure 8: AWQP Database Webtool's Data Tab - Sort Maximum to Minimum

Result Tab – Time Series

The Time Series tab of the results section contains a simple interactive chart (hovered and zoom in) on for the monitoring data fitting the selected query filters over time. If multiple analytes are selected on the Summary page, this tab will contain a graph for each analyte.

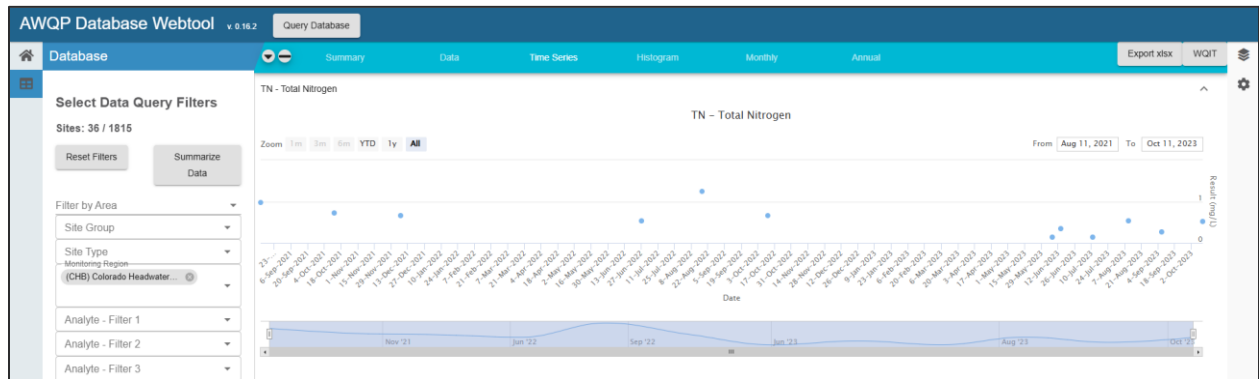


Figure 9: AWQP Database Webtool's Time Series Tab

Result Tab - Histogram

The Histogram tab of the results section contains a simple histogram bar chart of the monitoring data fitting the selected query filters, regardless of timing of the sample. If multiple analytes are selected on the Summary page, this tab will contain a graph for each analyte. This graph type can be downloaded as a graphic file.

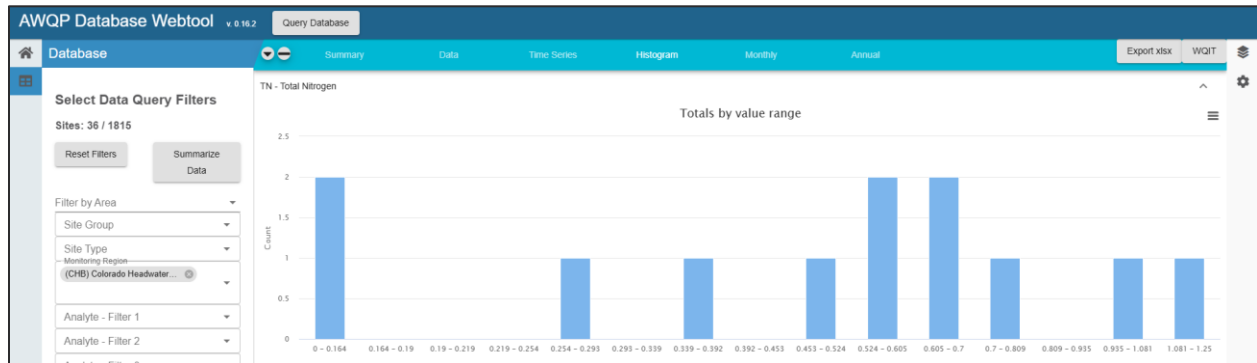


Figure 10: AWQP Database Webtool's Histogram Tab

Result Tab – Monthly

The Monthly tab of the results section contains a monthly boxplot of the monitoring data fitting the selected query filters, regardless of year of sampling event. This summary is useful for examining seasonal trends in data, if present. If multiple analytes are selected on the Summary page, this tab will contain a graph for each analyte. This graph type can be downloaded as a graphic file.

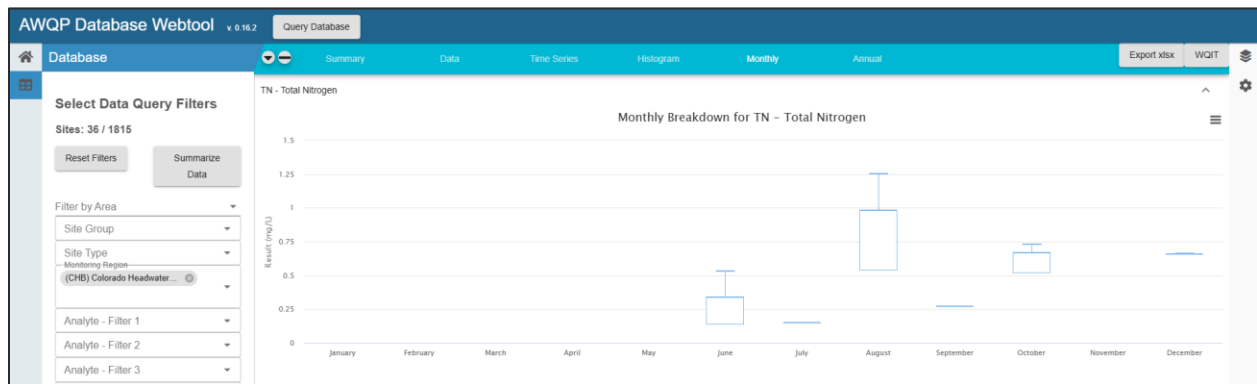


Figure 11: AWQP Database Webtool's Monthly Tab

Result Tab - Annual

The Annual tab of the results section contains an annual boxplot of the monitoring data fitting the selected query filters, regardless of day/month of sampling event. This summary is useful for examining reductions or increases in analytes over large

time scales. If multiple analytes are selected on the Summary page, this tab will contain a graph for each analyte. This graph type can be downloaded as a graphic file.

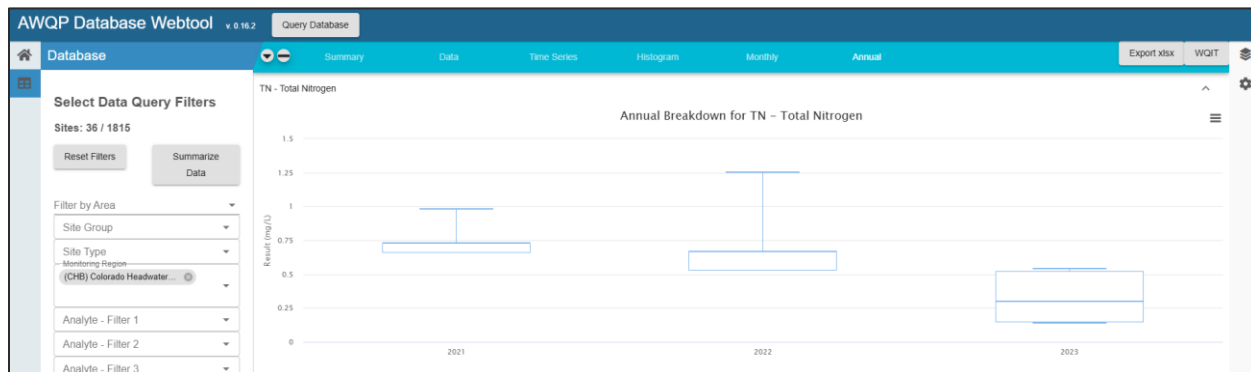


Figure 12: AWQP Database Webtool's Annual Tab

NOTE: The annual breakdown of each parameter does not take into account differences in seasonality (sampling at different times of the hydrologic year) or the potential for different years to consist of results of differing numbers of samples (unless the data query is inclusive of specific sites that are known to have been consistently sampled within the selected date range). These are important factors to consider when interpreting whether a parameter is seeing a long-term result trend.

SUMMARY

Development of the AWQP Database Webtool through the eRAMS platform harnesses open-source technologies providing project data management, geospatial data analysis, management of time series data, data processing, visualization, and presentation, including collaboration features for sharing natural resource and environmental inventories and assessments. The AWQP Database Webtool not only supports the data and analyses of the CDA's AWQP, but it also provides a tool for water quality resource managers, planners, decision makers, and stakeholders.

User defined interpretation of the data within the AWQP Database Webtool may or may not align with the AWQP's understanding of the results. The AWQP publishes annual reports in collaborative with their technical partners at CDPHE for all of its monitoring activities. Such reports consider idiosyncrasies of lab results, sampling protocols, and study design factors, which are not items that can be inferred solely through querying the AWQP Database Webtool. If obtained query results are not clear or appear suspect, it is advised that the user reach out to AWQP staff for clarification.



APPENDIX A – USE CASE EXAMPLES

There are several nuances to diving into the agricultural water quality monitoring dataset; this section is intended to provide a few detailed examples of various use-cases of the tool for various audience types.

Single Site Analysis – Site Owner Specific Results

- Case Objective: A cooperating domestic well owner seeks to see all the results from past sampling events conducted by AWQP.
- Steps to Take:
 - The well owner should have obtained an email or postcard indicating their well's specific Site ID or Site Name. This info is critical for getting results specific to the owner's well.
NOTE: to preserve cooperator anonymity on this public-facing database webtool, decimal-degree coordinates are limited to the 2nd decimal place. While this preserves anonymity, it may also make it difficult for a well owner to home in on the specific map symbol that represents their location. Therefore, use of the Site ID/Site Name in the query filters is more effective in searching for their results.
 - Select the specific Site Name you are interested in retrieving data for.
 - As soon as you enter this information, the map viewer will focus in on the approximate location of the site.
 - At this point you can select "Summarize Data" to see all data for this site or select other filters for a specific analyte or year prior to doing so.
 - For example, Site Name = SL-D-001, will show that there has been 39 detected parameters out of 171 screened parameters over seven sampling events conducted between 2009 and 2023.
 - The user can then see the increasing trend for NO₃-N over time by reviewing the "Annual" graph (Figure 11) for the parameter "Nitrate as Nitrogen (NO₃-N)" by following the guidance in Database Query – Results section above.

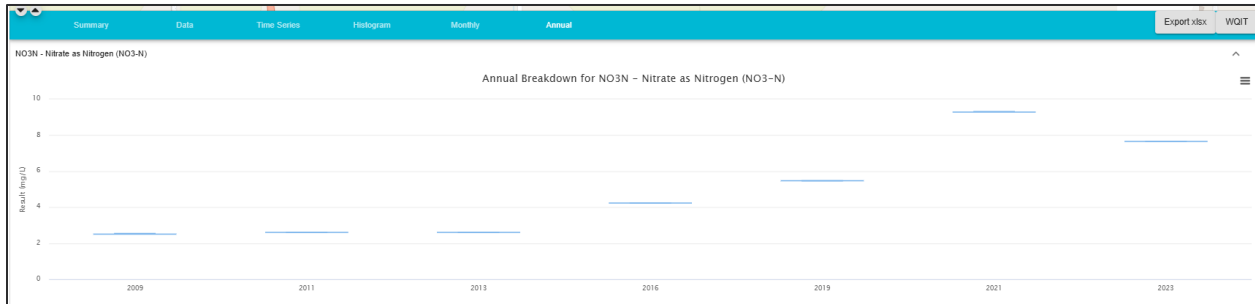


Figure 13 Screenshot of resulting Annual Breakdown graph of nitrate-N.

Annual Analysis of Parameter Exceeding a Standard

- Case Objective: To obtain data and site locations specific to groundwater monitoring wells having detected nitrate-N (NO₃-N) above the EPA standard of 10.0 mg/L in the year 2019.
- Steps to Take:
 - Set the following filters:
 - “Site Group” = **Groundwater**
 - “Site Type” = **WM - Well Monitoring**
 - “Analyte Name” = **NO₃N - Nitrate as Nitrogen (NO₃-N)**
 - “Detection Level” = **At or Above Standard**
 - “Year” = **2019**
 - After entering the above parameters, the map viewer will resolve to show the locations relevant to the query inputs. For this specific example, monitoring wells that are in the (LSP) Lower South Platte GW region should be showing.
 - Click on “Summarize Data”
 - This should open the 50/50 split showing the map viewer window seen in Figure 4 of the Database Query – Results section above.
 - Summary & Data Window
 - The initial Summary shows Site, Sampling Details, and Parameter Analysis for the sites involved in the query.
 - Sampling Details are associated with the sites resulting from the query inputs. The above filter settings rendered 26 locations in 2019 that saw NO₃-N at or above 10.0 mg/L. The Initial & Latest Years (1992 and 2023 for this example) are indicating the time period over which 472 Total Events (sampling events) have been

- Click on “Data” next to “Summary”

Summary					Data	Time Series
Date	Site ID	Site Group	Site Type	Site Name		
2019-09-05 00:00:00	LSP18WM26	Groundwater (WM) Well - Monitoring	LSP-M-026			
2019-08-01 00:00:00	LSP08WM100	Groundwater (WM) Well - Monitoring	SP-M-100			
2019-08-01 00:00:00	LSP08WM103	Groundwater (WM) Well - Monitoring	SP-M-103			
2019-09-05 00:00:00	LSP18WM106	Groundwater (WM) Well - Monitoring	SP-M-106			
2019-09-05 00:00:00	LSP18WM107	Groundwater (WM) Well - Monitoring	SP-M-107			

Figure 15 Screenshot showing "Data" in the blue banner.

- This provides you with a data table of all the results relevant to the query inputs. For this example, there are 26 NO3-N results.
 - A user can click on any field heading in the table to sort the data. For this example, clicking the “Result” field will sort the results from a low of 10.6 mg/L to a high of 61.7 mg/L. Please refer to additional detail about sorting around Figure 7 and Figure 8 in the [Result Tab - Data](#) section of the tool.
 - Clicking on “Export xlsx” will download the data table for external use.
- This was a relatively simple example with only one parameter and a single year. The next example shows how the AWQP database can effectively display bigger data queries.

Regional Evaluation of Pesticides Discovered in Groundwater

- Case Objective: Evaluate all data available for sampling of monitoring wells in the (FRU) Front Range Urban GW region in 2008, 2010, 2013, and 2016.

NOTE: This query is summarizing all data for the Front Range Urban monitoring well network that was mostly established in 2008 and sampled three additional times. As discussed earlier, some of the graphs and summary statistics shown in the query results may not identify a difference in sample counts in any given year. It is possible that not all sites within a region are sampled every year. A more in-depth analysis across only consistently sampled sites is better conducted by the user exporting the data table to an Excel .xlsx file.

- Set Filters as Shown (Figure 14):
 - Site Group = Groundwater
 - Site Type = WM – Well Monitoring
 - Monitoring Region = (FRU) Front Range...
 - Year: 2008, 2010, 2013, 2016
- Click “Summarize Data”
 - As with the previous example, this will create a 50/50 split between the map viewer and the Summary & Data windows.
 - A total of 73 monitoring wells have been sampled one or more times across the four years selected.
- The Summary & Data window now shows several Analyte Summary categories: Nutrient, Organic, Inorganic, Physical, Organic-ND
 - Select Organic and then select the Maximize Panel button to the left of “Summary” at the top of the Summary & Data window (Figure 15).
 - This will expand the window to show something like Figure 16 below.

Figure 16 Screenshot showing filter selections for the current query example.

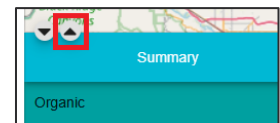


Figure 17 Screenshot showing Min/Max buttons.

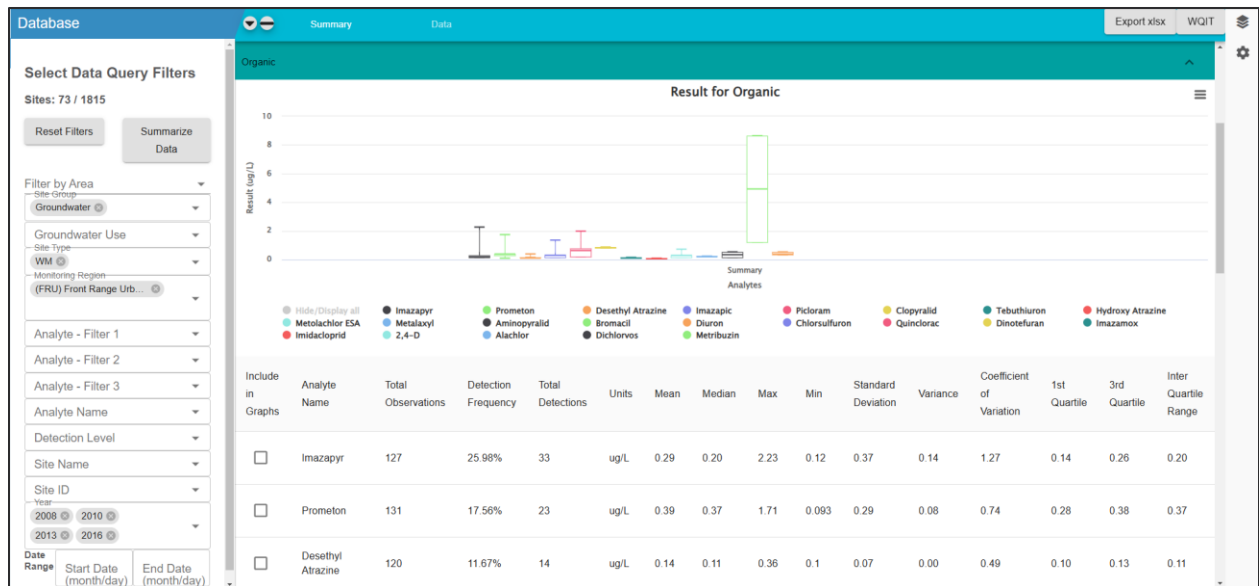


Figure 18 Screenshot showing example output of query results.

- The colored boxplot graph shows data for all the pesticides compounds with detections within the set filter criteria. The default order is based on Detection Frequency from highest to lowest which can be seen in the table down below the boxplots.
 - For this query example, Imazapyr has been detected 33 times across 127 samples for a detection frequency of 26%.
- The boxplot graph itself is interactive:

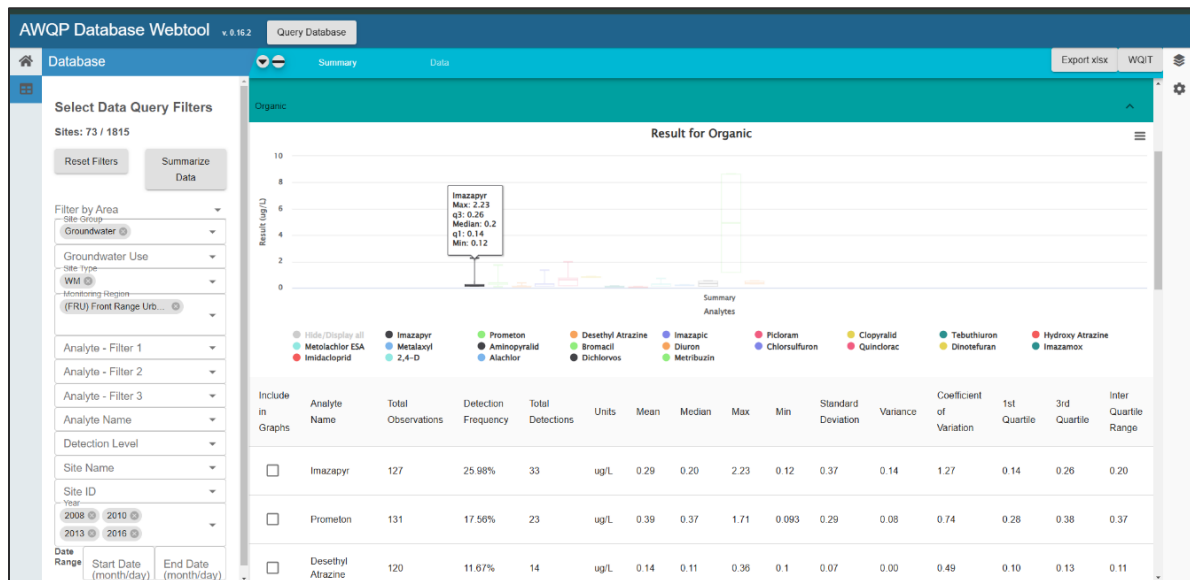


Figure 19 Screenshot showing hover on information displayed in Boxplot graph.

- You can hover over a specific boxplot and it will show the summary statistics for that specific parameter (Figure 17).
- Viewing multiple boxplots across a wide range of scales can cause some of the plots to compress, the interactive functionality allows the user to turn off specific parameters by clicking on them in the graph legend. You can also select “Hide/Display All” and then turn on just the parameter(s) you’d like to see the boxplot of. For example, only Imazapyr and Prometon are shown below in Figure 18.

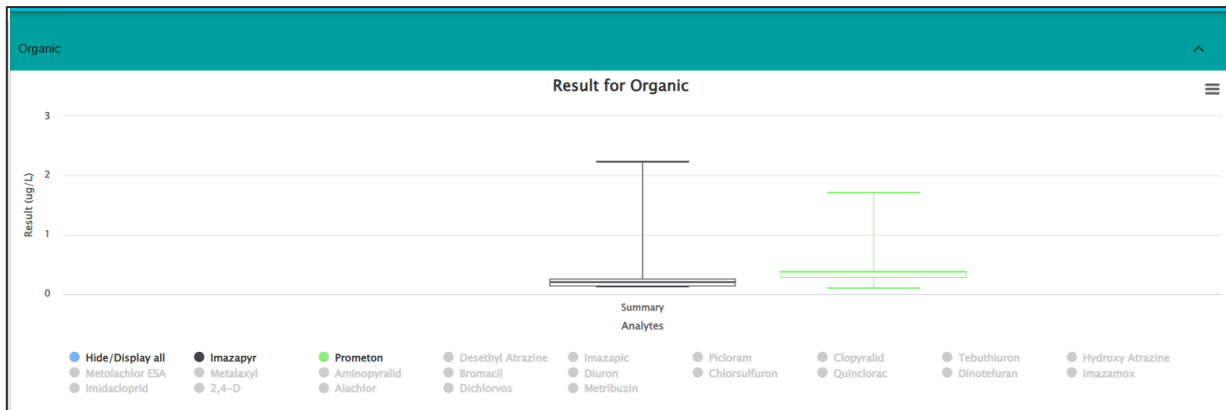


Figure 20 Screenshot showing result of selecting specific parameters in the legend which affects which graphs are visible.

- Under “Include in Graphs” select the box next to Imazapyr.
 - The “Time Series” and “Annual” graphs for Imazapyr will show the concentration differences between the different sampling events.
 - You will see that no data is available for the 2008 sampling year which is because the first screening for Imazapyr at CDA’s lab did not happen until 2010.
- Deselect Imazapyr in the Organic Analyte Summary and select NO3-N in the Nutrient Analyte Summary
 - The “Time Series” and “Monthly” graphs show the concentration distribution over each year sampling occurred (Figures 19 & 20). NOTE: This is where it would be important to understand which of the 73 sites were or were not sampled as that can have an effect on the summary. The “Annual” boxplot shows how the

NO₃-N concentrations for the sampled network are similar between years (Figure 21).

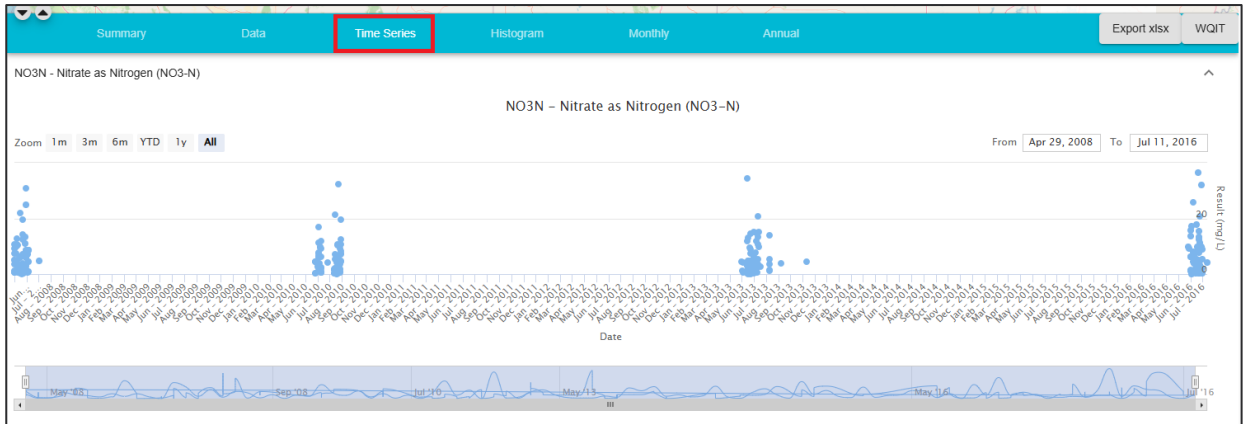


Figure 19 Screenshot of Time Series graph for NO₃-N as a result of the query example.

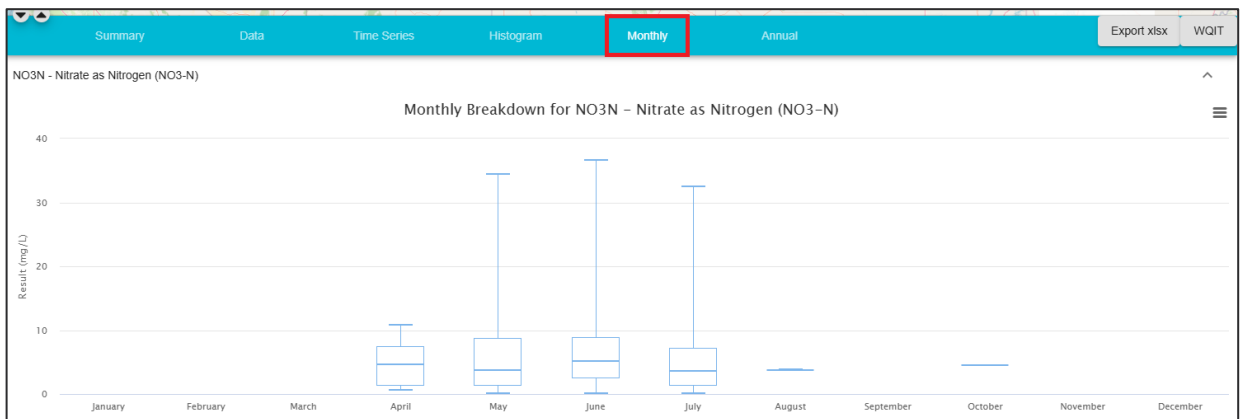


Figure 20 Screenshot of Monthly graph for NO₃-N as a result of the query example.

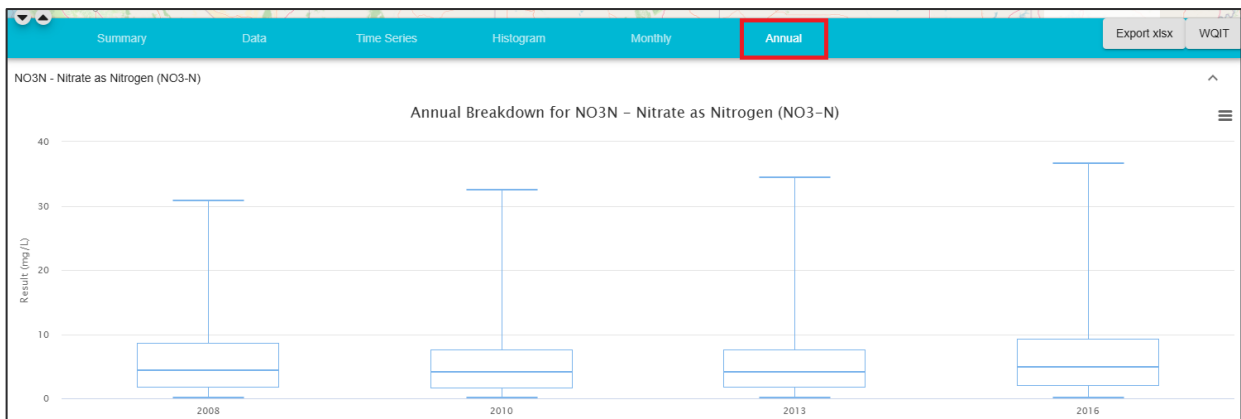


Figure 21 Screenshot of Annual graph for NO₃-N as a result of the query example.

- Let's say a user wants to focus their investigation on a particular subset of wells that are part of the larger query result. For example, we could use the "Filter by Area – Draw a Polygon" tool to select just the wells in the Fort Collins portion of the Front Range Urban region.
 - After placing a boundary around the desired wells you can select "Summarize Data" and it will resolve the previous query results for 73 sites down to the 14 sites that are in Fort Collins (Figure 22).

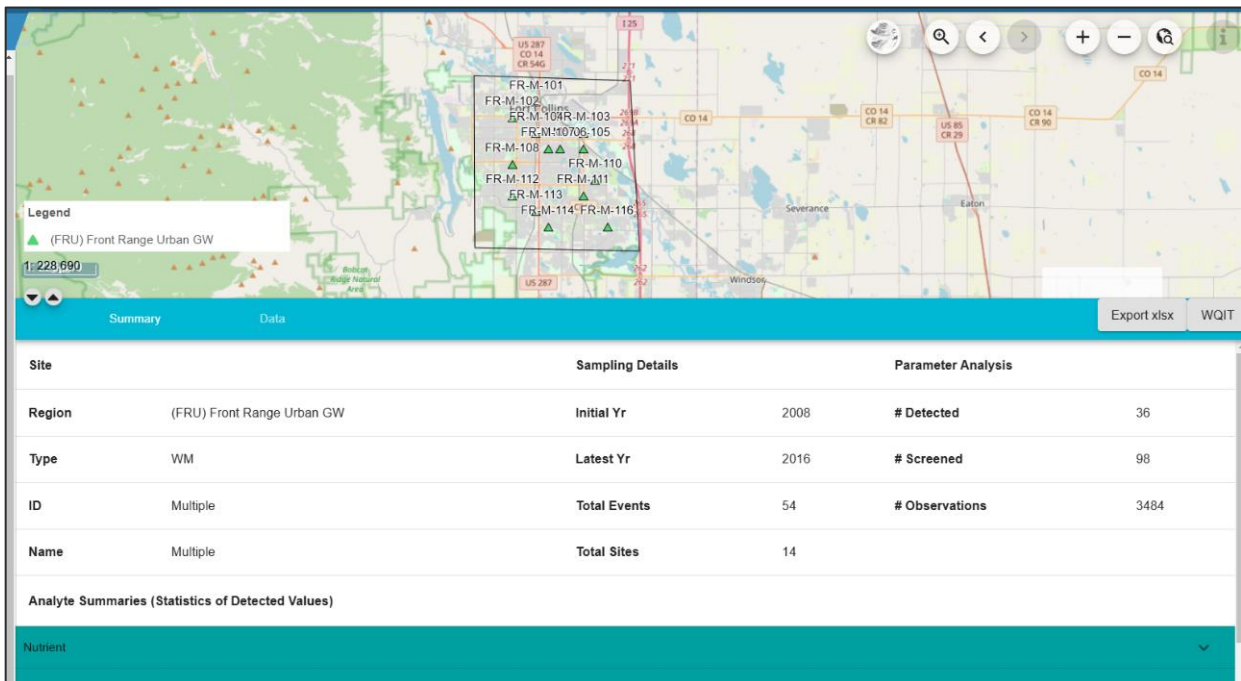


Figure 22 Screenshot showing execution of using a drawn boundary to restrict previous query to a subset of sites.

- Now all the results in Analyte Summaries and the "Data" table are restricted to just those observations from the sampling events conducted on the 14 monitoring wells in Fort Collins over the four years queried.
- When a boundary is drawn around a subset of sites, each of those sites are listed in the "Site Name" and "Site ID" filters. This will allow the user to easily remove unwanted sites and then redo the "Summarize Data" so results will be further focused.

- For example, I can reduce the 14 sites down to just four sites that are known to be along the Spring Creek alluvium flow path through Fort Collins (Figure 23).

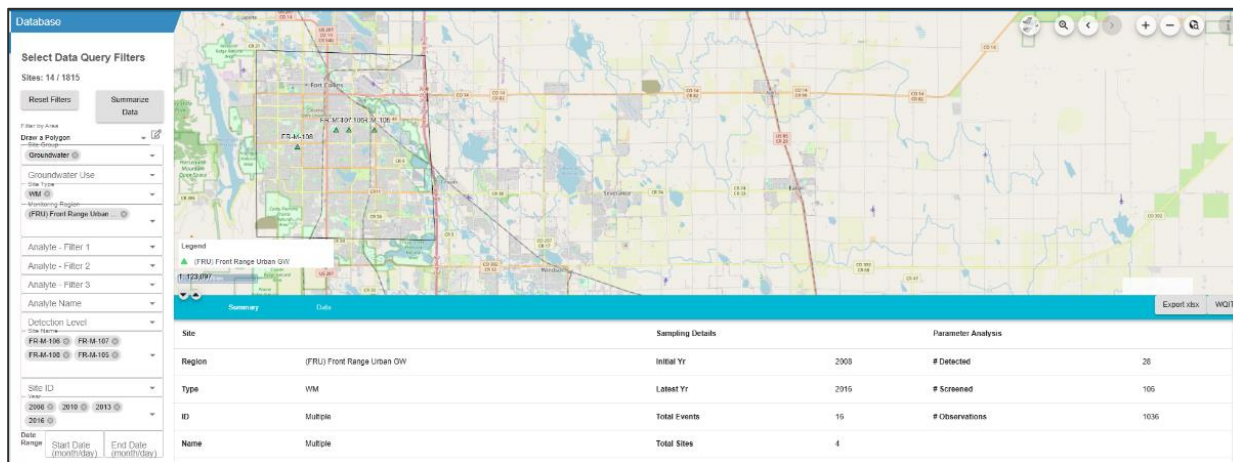


Figure 223 Screenshot showing further restriction of a queried result by de-selecting sites in Site Name.

- This allows the user to come to an eventual conclusion that only two of the 22 pesticides seen in shallow groundwater across the greater Front Range Urban region since 2008 have ever been seen in the Spring Creek alluvium where sampled.

Many more case examples could be shown, but with limited space, those just described should introduce the user to the filtering capability and quality/extent of results achievable in this webtool. If you have any questions on executing a specific query please reach out to AWQP staff. If you have any suggestions on added capabilities that would be worth implementing on the AWQP Database Webtool for the benefit of the larger user base, do not hesitate to reach out to OWSI staff.