Environmental Information exchange Network

EN2017

VISUALIZATION OF UPPER KLAMATH LAKE WQX WATER QUALITY DATA

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Megan Skinner, *The Klamath Tribes*

2017 Exchange Network National Meeting

INNOVATION AND PARTNERSHIP

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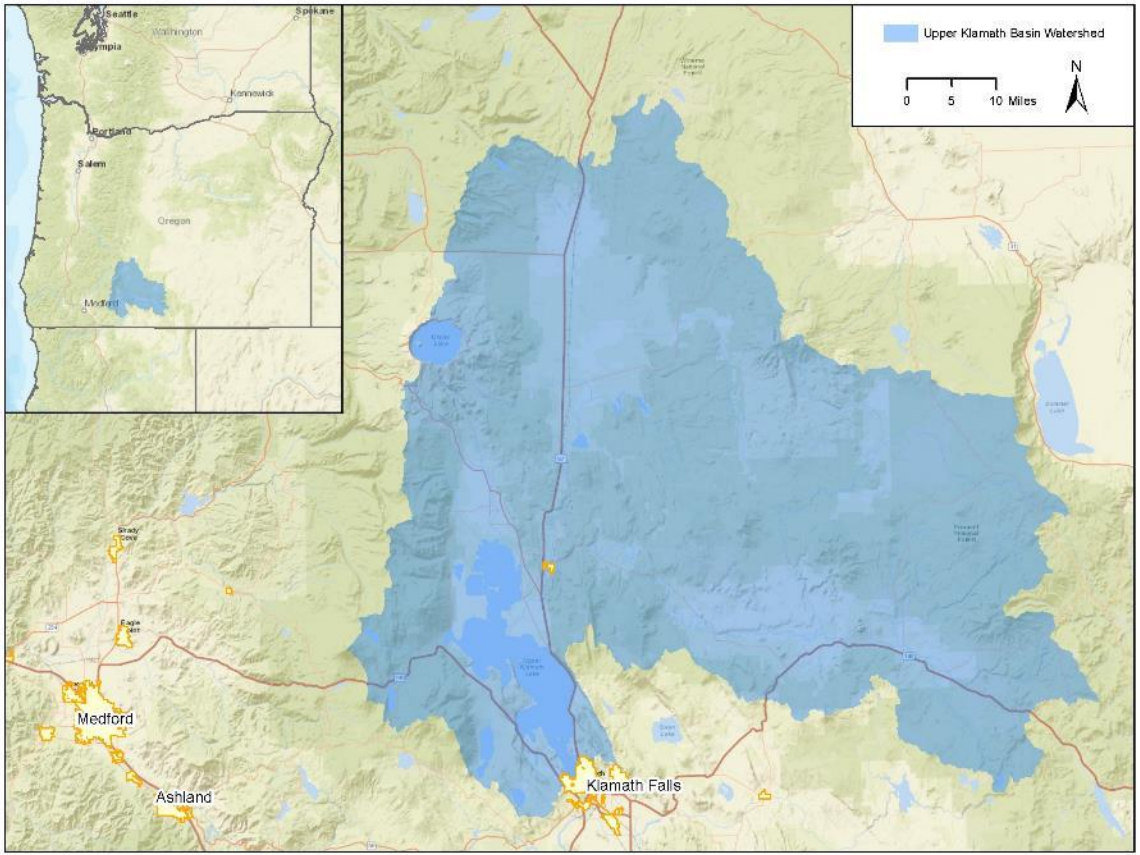
Philadelphia, Pennsylvania

http://www.exchangenetwork.net/en2017

ABSTRACT

The Klamath Tribes have been collecting environmental data in the Upper Klamath Basin for decades. To harness the potential power of the Klamath Tribes' rich collection of water quality data, the Klamath Tribes have developed an Exchange Network Node and a dashboard to visualize and disseminate water quality data to stakeholders and practitioners of ecosystem management in the basin. To facilitate collaboration and analysis of data, the Klamath Tribes developed a Tableau Dashboard for data visualization, exploration, and analysis. This presentation will provide an overview of the work flow to develop the Exchange Network Node, the Klamath Tribes water quality dataset, and of the dashboard for data visualization.

Upper Klamath Basin



Klamath Tribes

The Klamath Tribes
Natural Resources Department

- The Klamath Tribes of Oregon
  - Klamaths
  - Modocs
  - Yahooskin
- Have lived in the Klamath Basin of Oregon, from time beyond memory
- The Klamath Tribes' Aquatics Program has been monitoring lake and river water quality since 1990
- Since 2006, the Sprague River Water Quality Lab (SRWQL) has analyzed all water nutrient and algal toxin samples in-house

FlowWest

- Technology consultant for water quality data management, synthesis, and visualization
- Worked with the Klamath Tribes to develop the Upper Klamath Lake Water Quality Database and visualization dashboard

Problem

- The Klamath Tribes have been collecting environmental data for decades, but needed to develop a data management, sharing, and analysis framework

- A rapid and collaborative workflow was needed for the more efficient and effective integration, management, quality assurance, and sharing of water quality data

- Needed to enhance and streamline the Tribes' ability to share data to enhance ecosystem restoration and management

Solution

- Develop Klamath Basin Environmental Data Exchange Network and visualization tools

- Implement systems and tools to efficiently acquire, manage, assure quality, share, and collaboratively analyze environmental data in the Upper Klamath Basin

- Enhance and streamline the Tribes' ability to share data with collaborators for ecosystem restoration

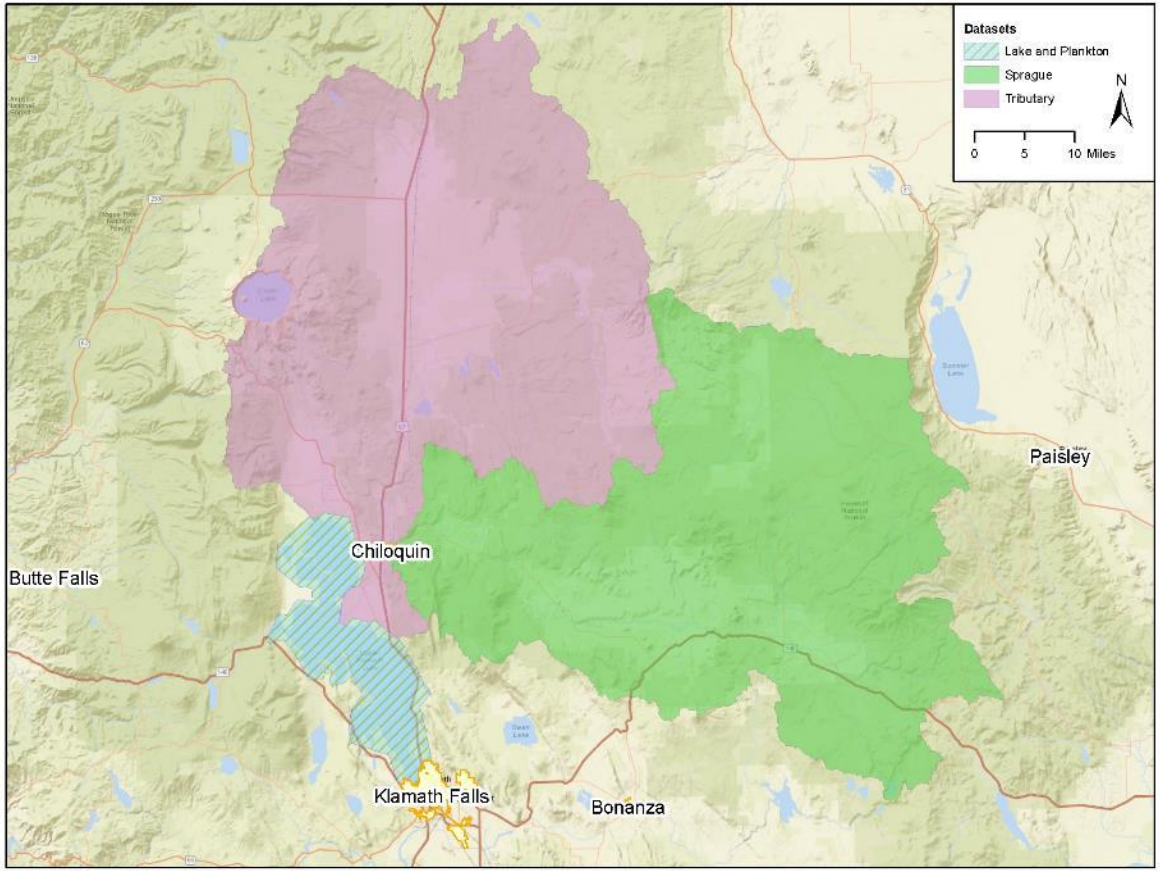
Datasets

Dataset	Period of Record	Geographic Extent	Sampling Sites (#)	Sampling Type
Lake	1990-2015	Upper Klamath Lake & Agency Lake	11	Water Quality
Tributary	2001-2015	Tribs to Upper Klamath Lake	6	Water Quality
Sprague River	2001-2015	Sprague, Sycan, Whiskey Ck	9	Water Quality
Phytoplankton	1990-2013	Upper Klamath Lake & Agency Lake	11	Phytoplankton
Zooplankton	1990-2013	Upper Klamath Lake & Agency Lake	11	Zooplankton

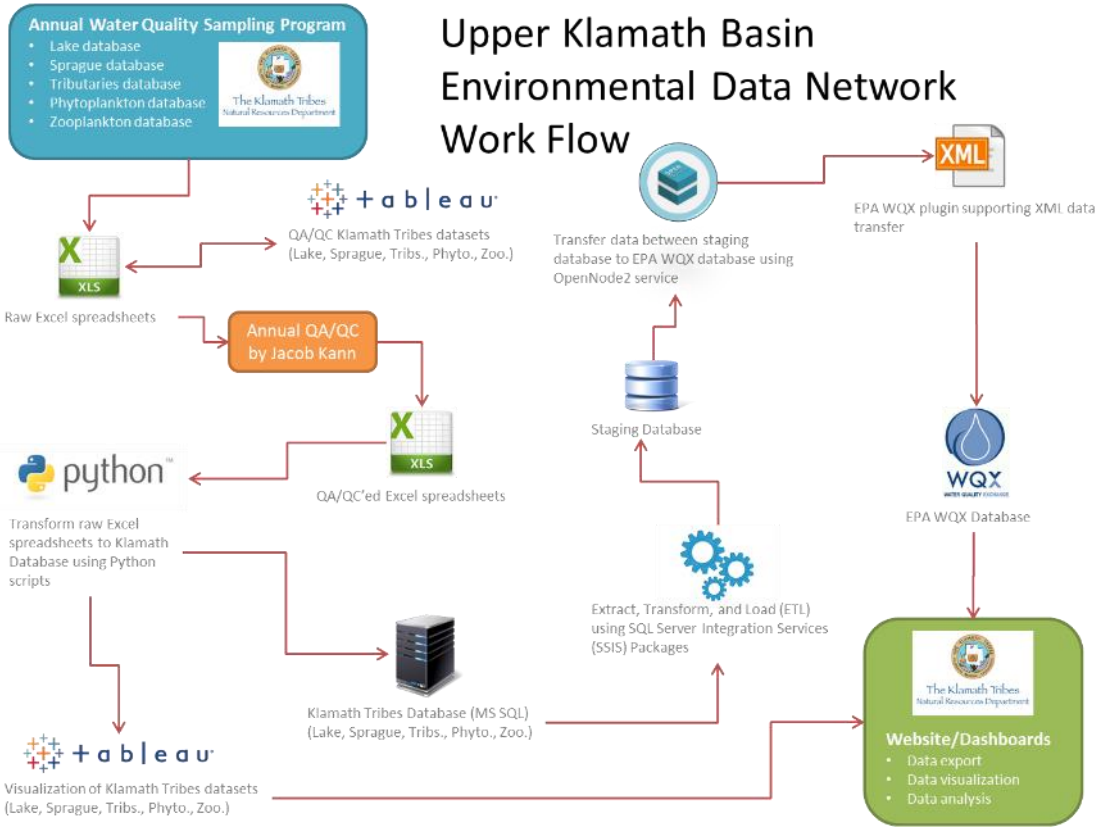
Datasets

Dataset	Sampling Type	Parameters
Lake	Water Quality	Max. depth, Secchi depth, profile depth, photosynthetically active radiation, temp., conductivity, DO, pH, % DO saturation, oxidation-reduction potential, total phosphorus, phosphate as soluble reactive phosphorus, ammonium nitrogen, nitrate nitrogen, nitrate+nitrite nitrogen, total nitrogen, silica, chlorophyll a, phaeophytin
Tributary	Water Quality	Discharge, depth, temp., conductivity, DO, pH, % DO saturation, total phosphorus, phosphate as soluble reactive phosphorus, ammonium nitrogen, nitrate nitrogen, nitrate+nitrite nitrogen, total nitrogen, silica, total suspended solids, turbidity
Sprague River	Water Quality	Discharge, depth, temp., conductivity, DO, pH, % DO saturation, total phosphorus, phosphate as soluble reactive phosphorus, ammonium nitrogen, nitrate nitrogen, nitrate+nitrite nitrogen, total nitrogen, chloride, silica, total suspended solids, turbidity
Phytoplankton	Phytoplankton	Genus, species, biovolume std, percent biovolume standardized, cell density std, % cell density std, natural unit density, % natural unit density
Zooplankton	Zooplankton	Genus, species, biomass, percent biomass, abundance, percent abundance

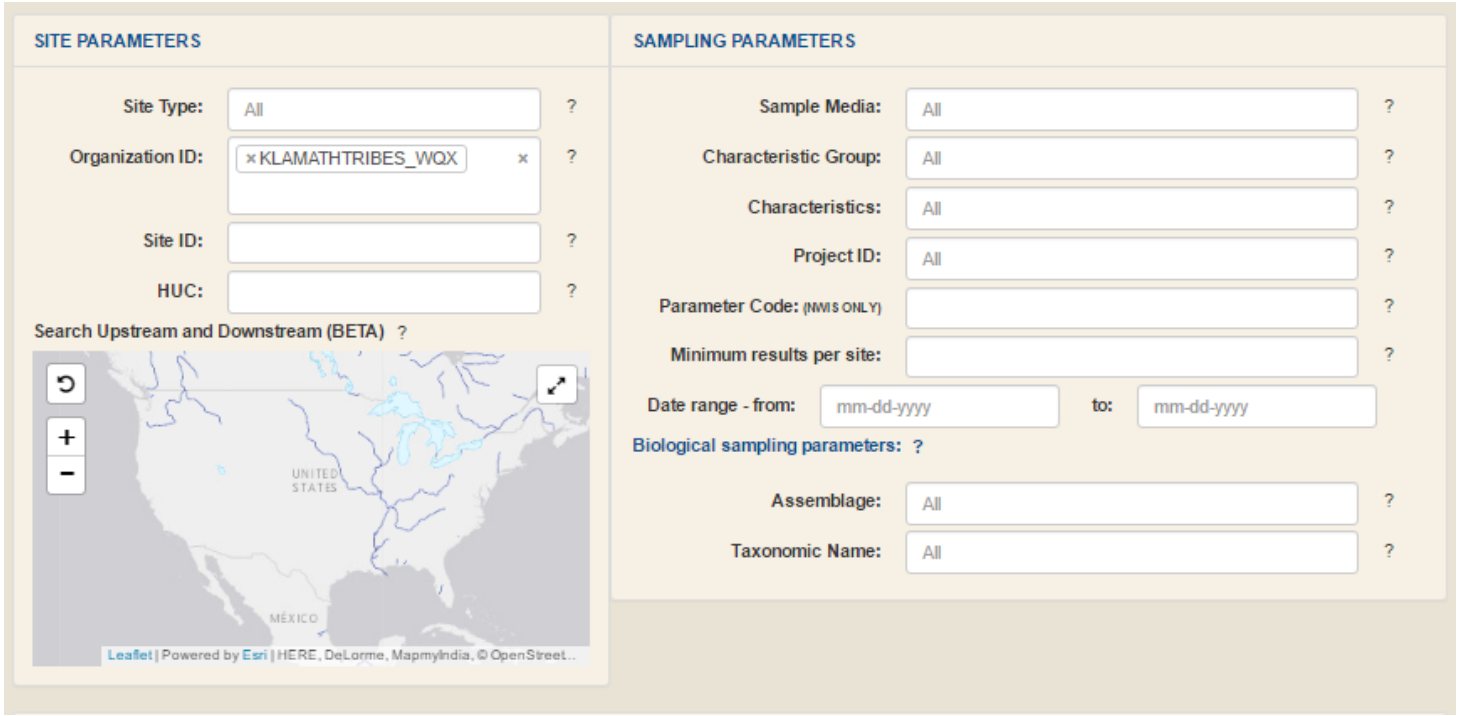
Dataset Extents



Work Flow


Annual Water Quality Sampling Program
Lake database
Sprague database
Tributaries database
Phytoplankton database
Zooplankton database
The Klamath Tribes
Natural Resources Department
Upper Klamath Basin
Environmental Data Network
Work Flow
tableau
QA/QC Klamath Tribes datasets
(Lake, Sprague, Tribs., Phyto., Zoo.)
XLS
Raw Excel spreadsheets
Annual QA/QC
by Jacob Kann
XLS
QA/QC'ed Excel spreadsheets
python
Transform raw Excel
spreadsheets to Klamath
Database using Python
scripts
tableau
Visualization of Klamath Tribes datasets
(Lake, Sprague, Tribs., Phyto., Zoo.)
Klamath Tribes Database (MS SQL)
(Lake, Sprague, Tribs., Phyto., Zoo.)
Extract, Transform, and Load (ETL)
using SQL Server Integration Services
(SSIS) Packages
Staging Database
Transfer data between staging
database to EPA WQX database using
OpenNode2 service
XML
EPA WQX plugin supporting XML data
transfer
WQX
EPA WQX Database
The Klamath Tribes
Natural Resources Department
Website/Dashboards
Data export
Data visualization
Data analysis

Data in WQX



https://www.waterqualitydata.us/portal/

Big Data Analytics & Visualization

- Data Integration

- Work Flow
- Knowledge Management

Google

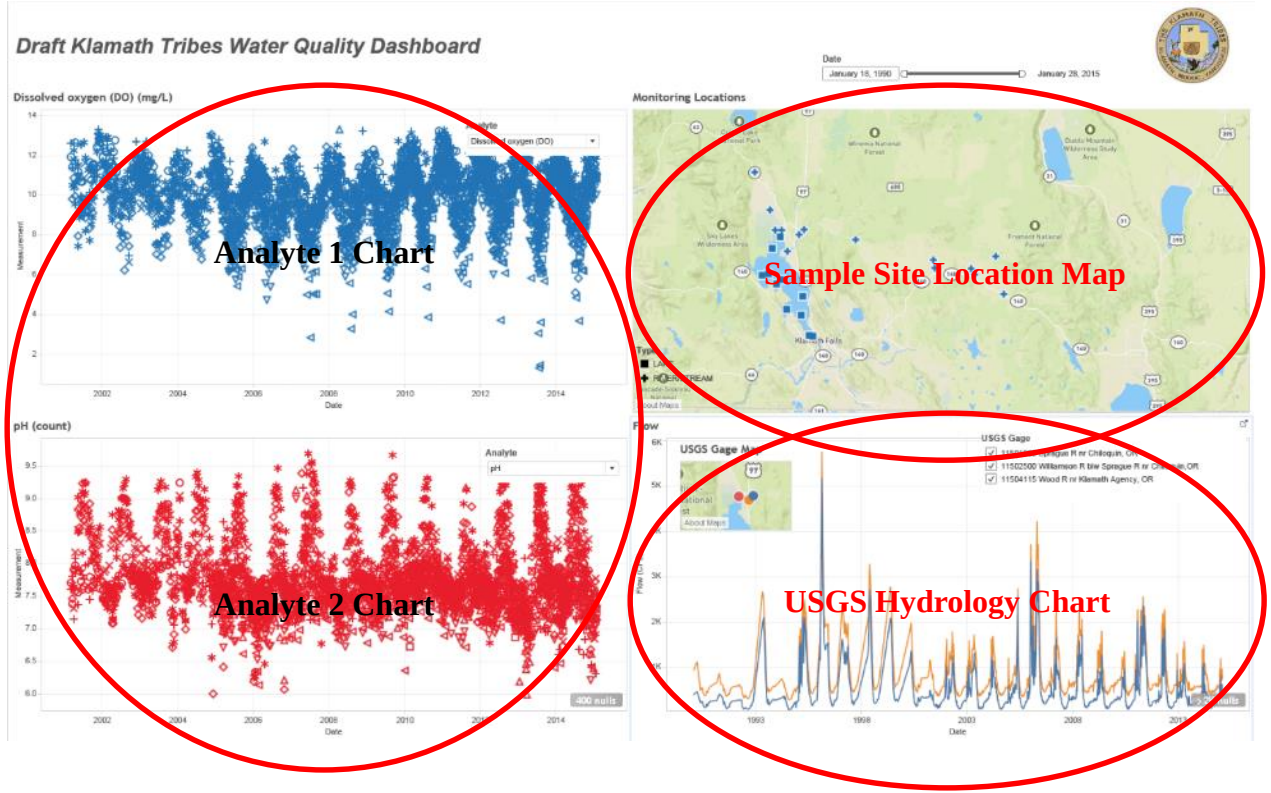
Just *try* using another search engine.

- Tableau is a leader in the field of data visualization and produces a family of interactive data visualization products

- Interactive Tableau dashboard allows for the visualization of the water quality data that
  - goes beyond static charts to create multi-faceted views of data
  - explores relationships between different analytes and data collected at different sample sites

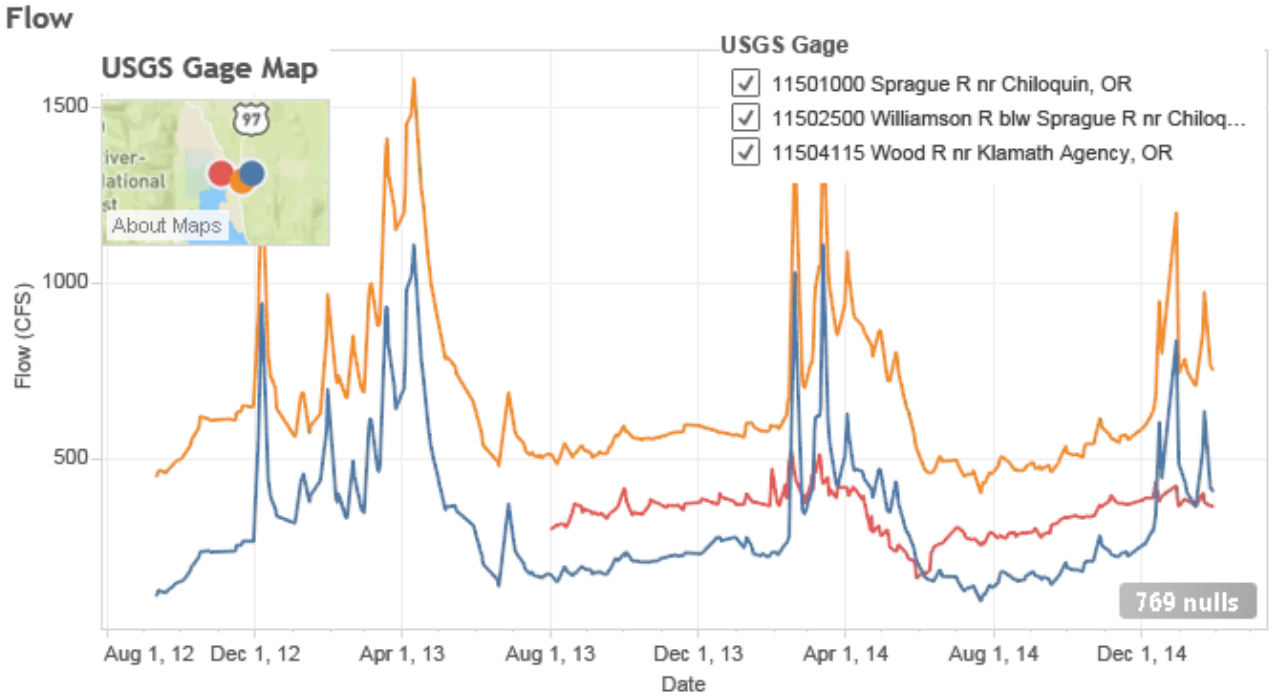
- Easy to use and no programing experience required to modify dashboards

Upper Klamath Basin Dashboard

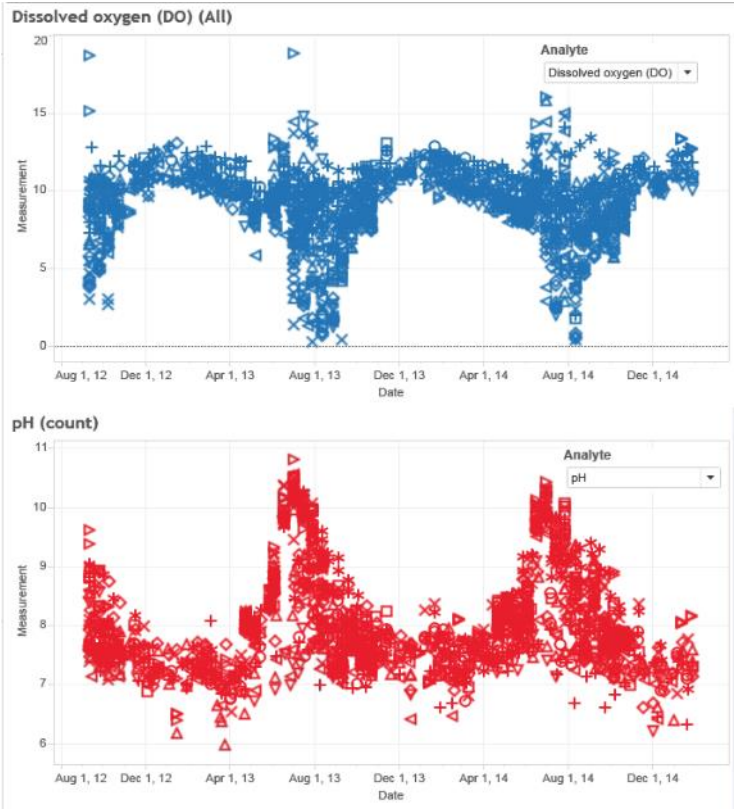


Map of Monitoring Locations

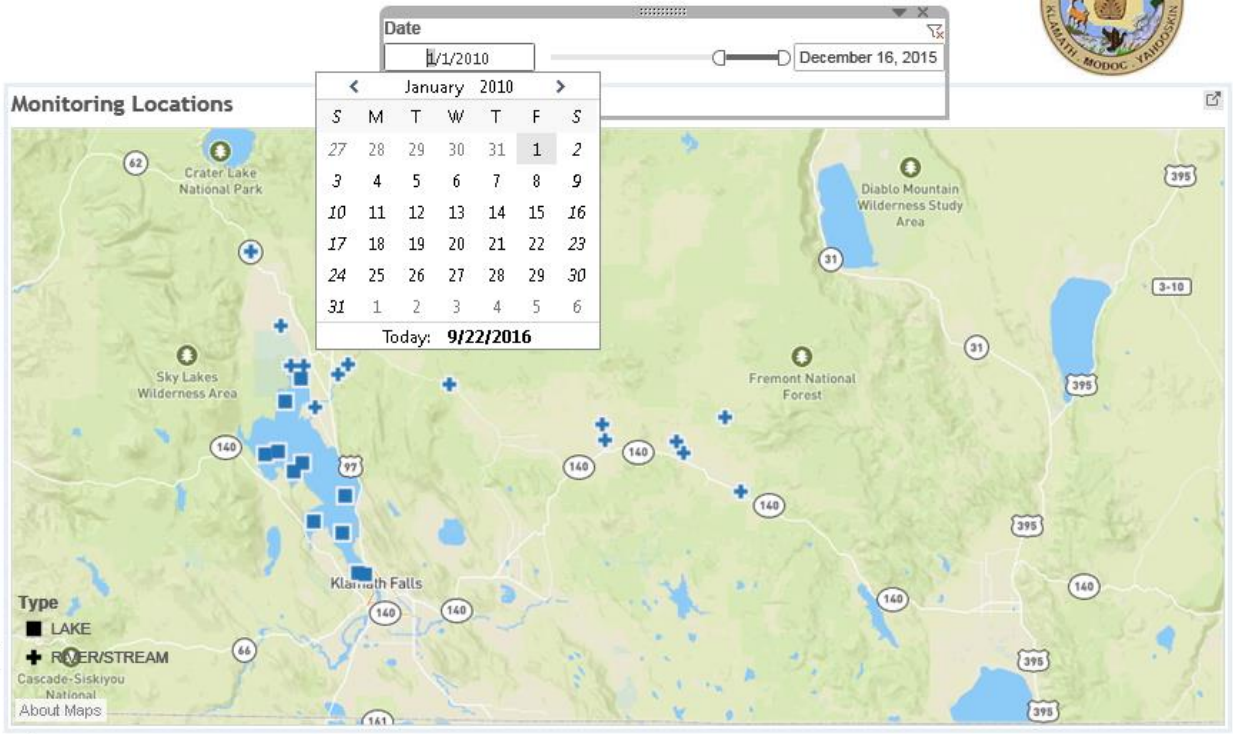
Time Series of Flow Data



Comparison of Analytes (DO & pH)

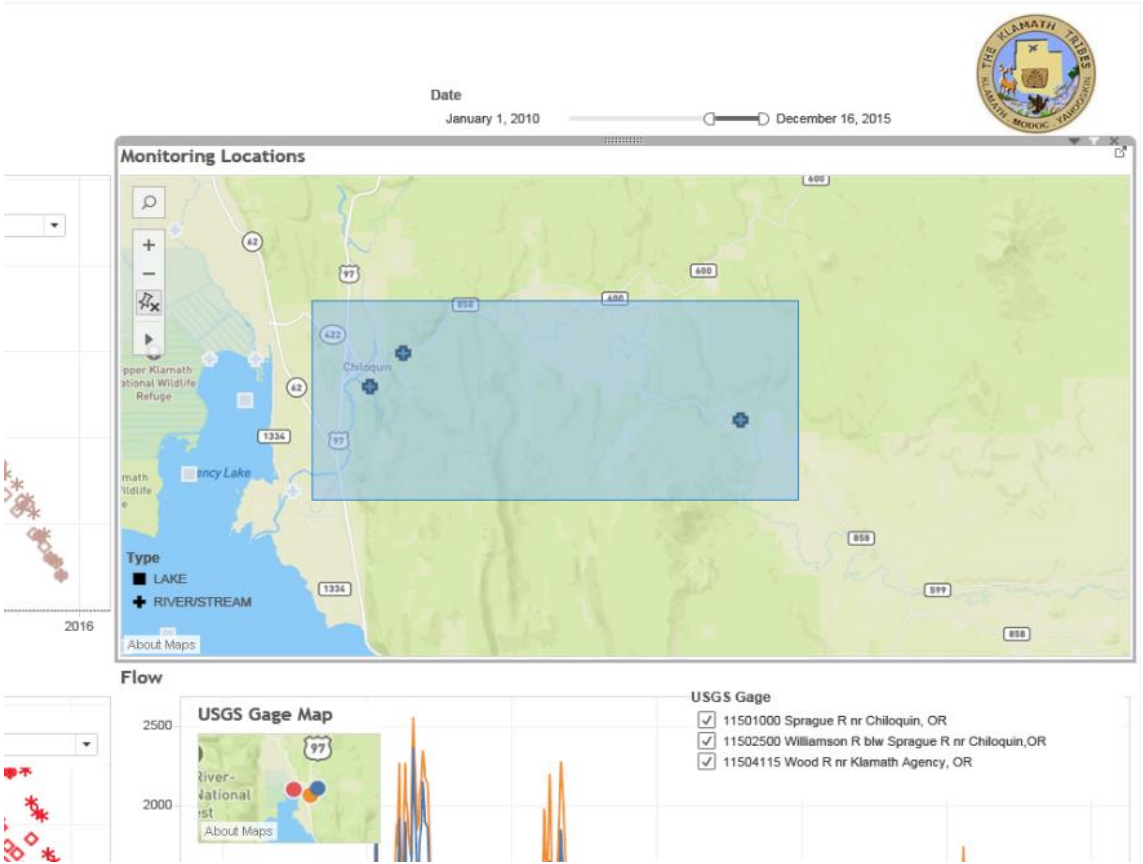


Selectable Time Series



Select Site and ToolTip

Select Multiple Sites



QA/QC Dashboard

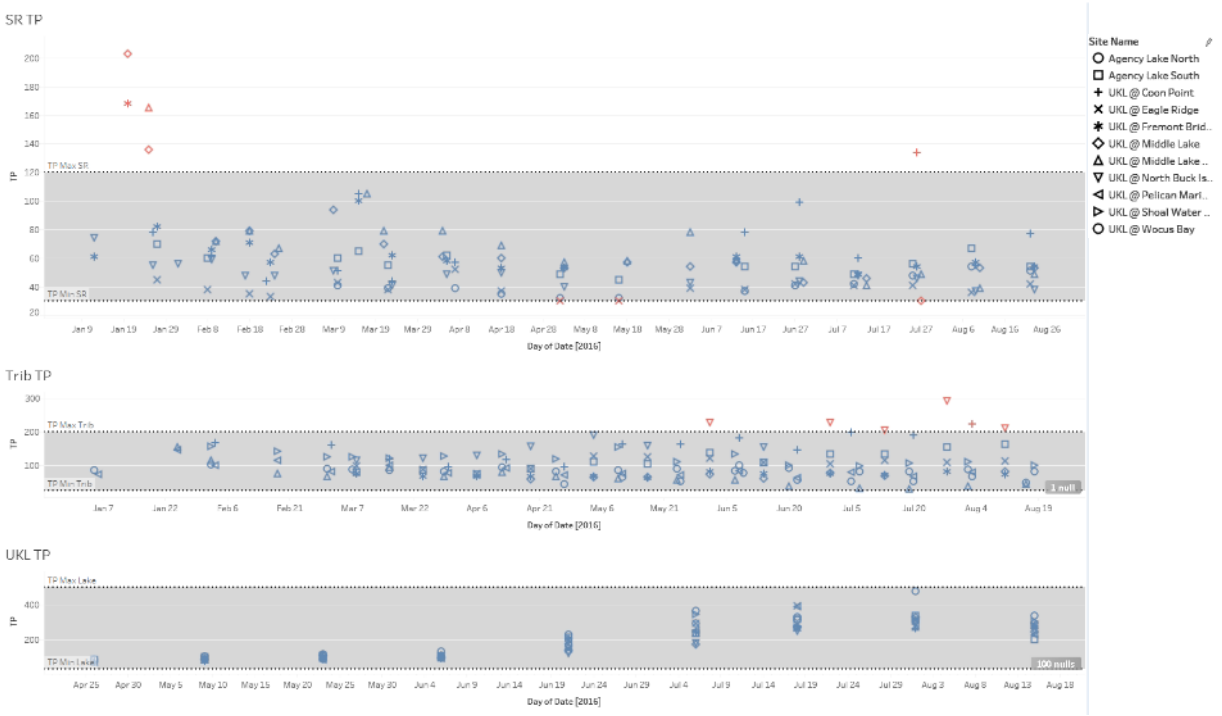
- Purpose:
  - Identify and correct errors on a quarterly basis to streamline the year end QA/QC process
- What is it?
  - Series of interactive charts and dashboards for each analyte
  - Identifies outliers outside of range of expected values (based on historical data)
- Added value:
  - Increase the understanding of water quality parameters and field conditions for Klamath Tribes field techs

QA/QC Dashboard Components

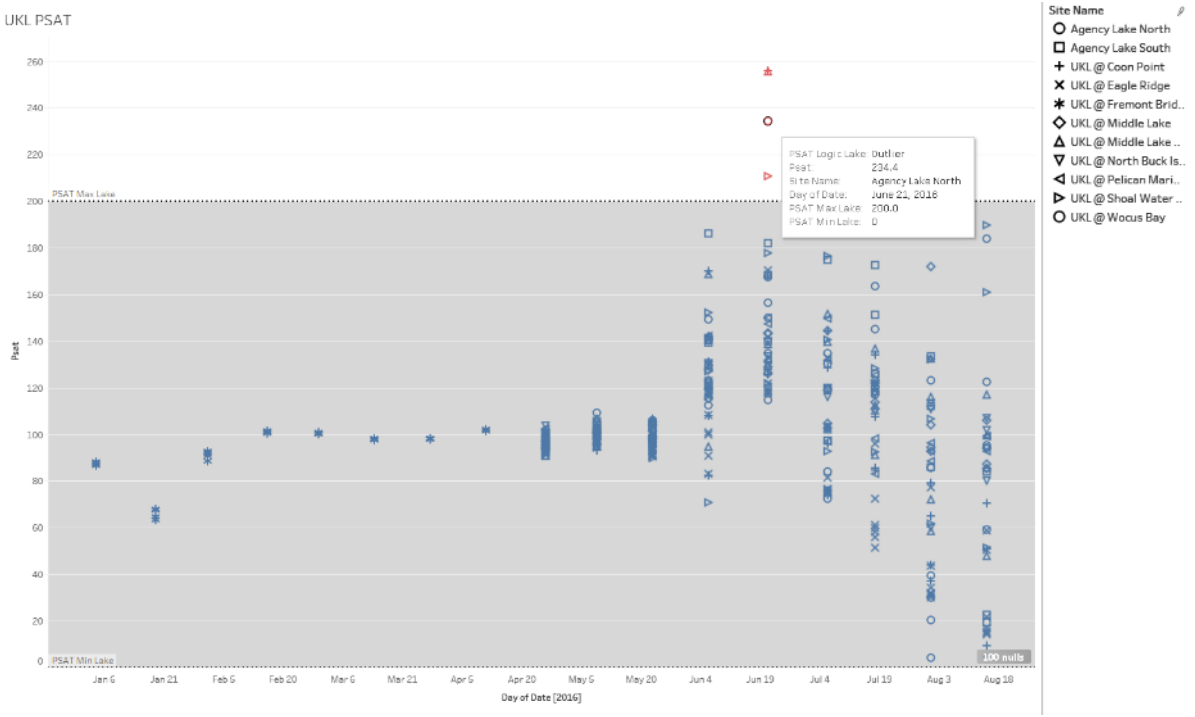
- Dashboards comparing results of select analytes from the Sprague River, tributaries, and Upper Klamath Lake datasets

- Time series charts of each analyte shown with the expected range of values for each analyte

Outliers Across Three Datasets



Identification of Outliers



Questions

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