



UTAH DEPARTMENT *of*  
ENVIRONMENTAL QUALITY  
**WATER  
QUALITY**

# Interactive data visualization and engagement tools for Utah waterbodies

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Utah DWQ

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# Motivations

## Internal:

1. Rapid & repeatable analysis
2. Identify data gaps
3. Planning, prioritization, idea generation

## External:

1. Engagement & transparency
2. Shared understanding of WQ issues
3. Collaboration platform
4. Developing credibility & trust

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# Target audience

## Potential user types

1. Non-technical
2. Moderately technical
3. Highly technical



- Internal & external users
- Waterbody/issue focused



# Existing engagement tools

# Existing engagement tools

## Beneficial Uses and Water Quality Assessment Map 1.3.0



Zoom into your area of interest and click on an assessment unit (outlined in yellow) or waterbody (in blue) to view the data.

[Print to PDF](#)

Search

Selected Map Feature Data

**AssessmentUnits:**  
zoom to

Unit ID	undefined
Unit Description	
Watershed Management Unit	Colorado River West
Anti-Degradation Category	Category 3 = Water quality degradation may be allowed outside USFS boundary pursuant to antidegradation review
Beneficial Uses	Use Class 2B = Infrequent primary contact recreation (e.g. wading, fishing); Use Class 3C = Nongame fishery/aquatic life; Use Class 4 = Agricultural uses (crop irrigation and stock watering)
2016 Assessment	
Beneficial Use: Cause of Impairment	
TMDL Approved: Cause of Impairment	
TMDL Information	<a href="#">link</a>
TMDL Required: 303d Cause of Impairment	
Aquatic Habitat Impairment	
Blue Ribbon Fishery	none
Watershed Scientist	Amy Dickey

<http://mapserv.utah.gov/surfacewaterquality/>

# Existing engagement tools

**Select Query Layers**

- Drinking Water
- Water Quality
  - Assessed Lakes
  - Assessed Waters
  - Groundwater Permits
  - Mercury in Fish Tissue
  - Monitoring Locations
  - UPDES Dischargers
  - Underground Injection Control
  - Hydrologic Units (HUC8)
- Air Quality
- Environmental Response & Remediation
- Waste Management and Radiation Control

**Define Search Criteria**

Search

Clear Search

Hide Grid

Download Search Results (11,745)

select format

Process Download

**Attributes**

Assessment Unit Name	Fremont River-2
Assess Unit Description	Fremont River and tributaries from Bicknell to Mill Meadow Reservoir near USFS boundary
Assessment Unit ID	UT14070003-005_00
Assessment Category	5/4A:TMDL required/TMDL Apprvd
2016 Impairment	Use Class 1C: pH; Use Class 2A: pH; Use Class 3A: pH, Temperature, Total Phosphorus; Use Class 4: pH
Beneficial Uses	1C, 2A, 3A, 4
Protected Uses	Drinking Water, Primary Contact Recreation, Cold Water Aquatic Life, Agricultural Uses
Blue Ribbon Fishery	none

<https://enviro.deq.utah.gov/>



# Newly developed tools

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# Demos

<https://jakevl2.shinyapps.io/UtahLakeDataExplorer/>

[https://jakevl2.shinyapps.io/GSL\\_data\\_explorer/](https://jakevl2.shinyapps.io/GSL_data_explorer/)

<https://jakevl2.shinyapps.io/SiteReviewAnalysisExample/>



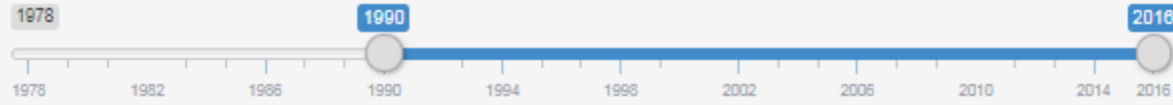
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# Application Development

- R statistical program ([r-project.org](http://r-project.org))
- Shiny package from R-Studio ([shiny.rstudio.com](http://shiny.rstudio.com))
- Wraps R-code into web apps
- User inputs define R objects
- Reactive plots & analyses
- Distributable via weblink, application package, or embedded in websites or documents

This tool shows time series (yearly & monthly), boxplots by site, and pairwise scatter plots of selected water quality parameters.

**Year range:**



**Month range:**



**Include:**

- Utah Lake
- Provo Bay
- All

**Plot type:**

- Time series
- Site boxplot
- Pairwise

**Parameter:**

Phosphate-phosphorus

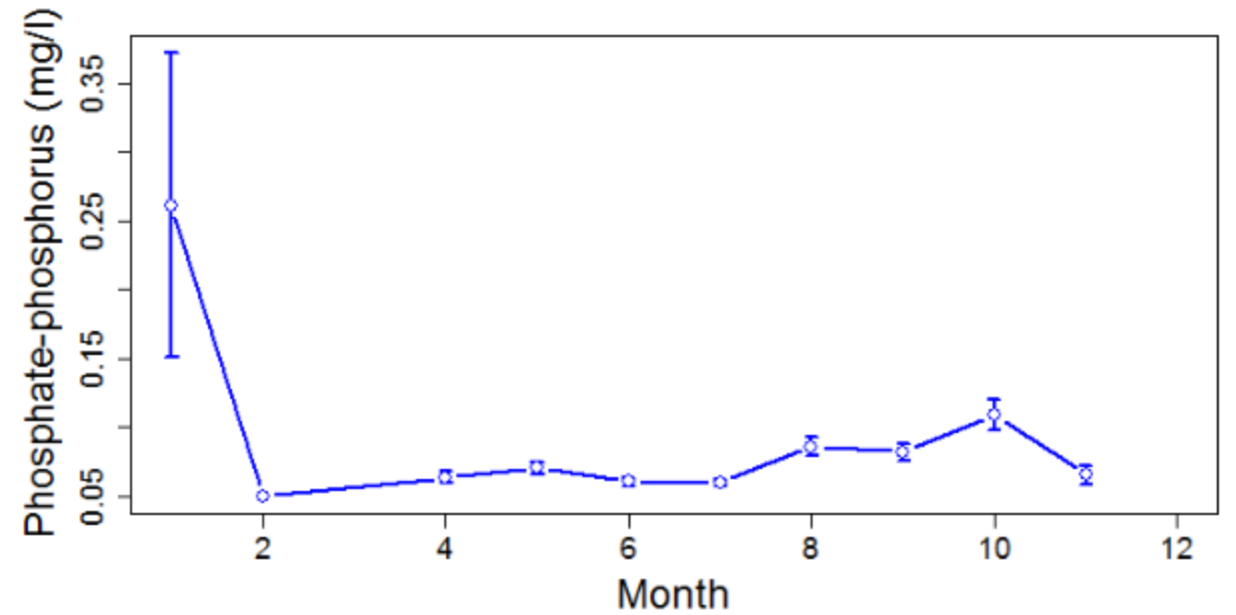
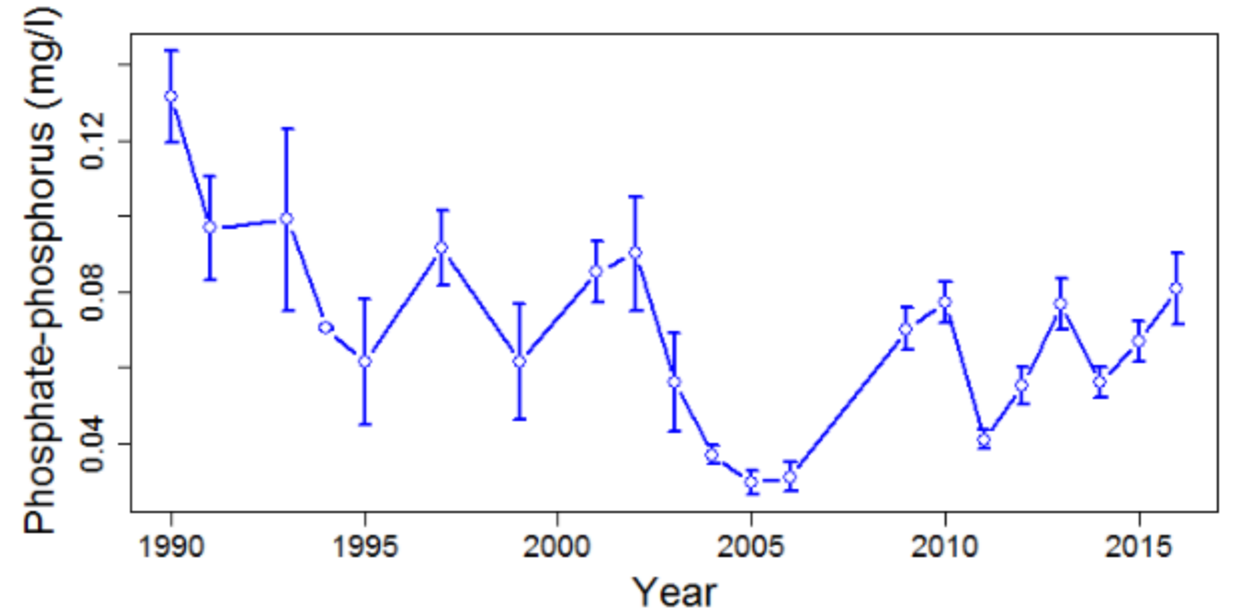
**Fraction:**

Total

**Sample depth:**

Surface

For help with this tool, or to report a bug, please contact Jake Vander Laan, UDWQ, [jvander@utah.gov](mailto:jvander@utah.gov), (801) 536-4350.



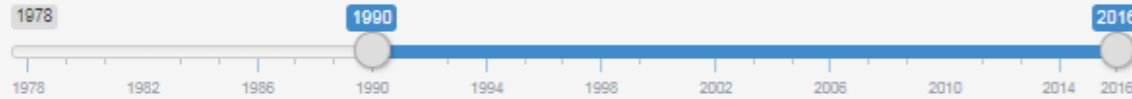
This tool estimates lake-wide values for selected parameters, fractions, depths, and time periods via inverse path distance weighted interpolation.

Please be patient - this type of interpolation accounts for land-barriers between sites, but is data intensive and therefore slow.

Select desired parameters, then click 'Interpolate' to generate the map.

Numbers plotted on the map show available sample sizes at each site used for interpolation.

Year range:



Month range:



Parameter:

Total dissolved solids

Fraction:

Dissolved

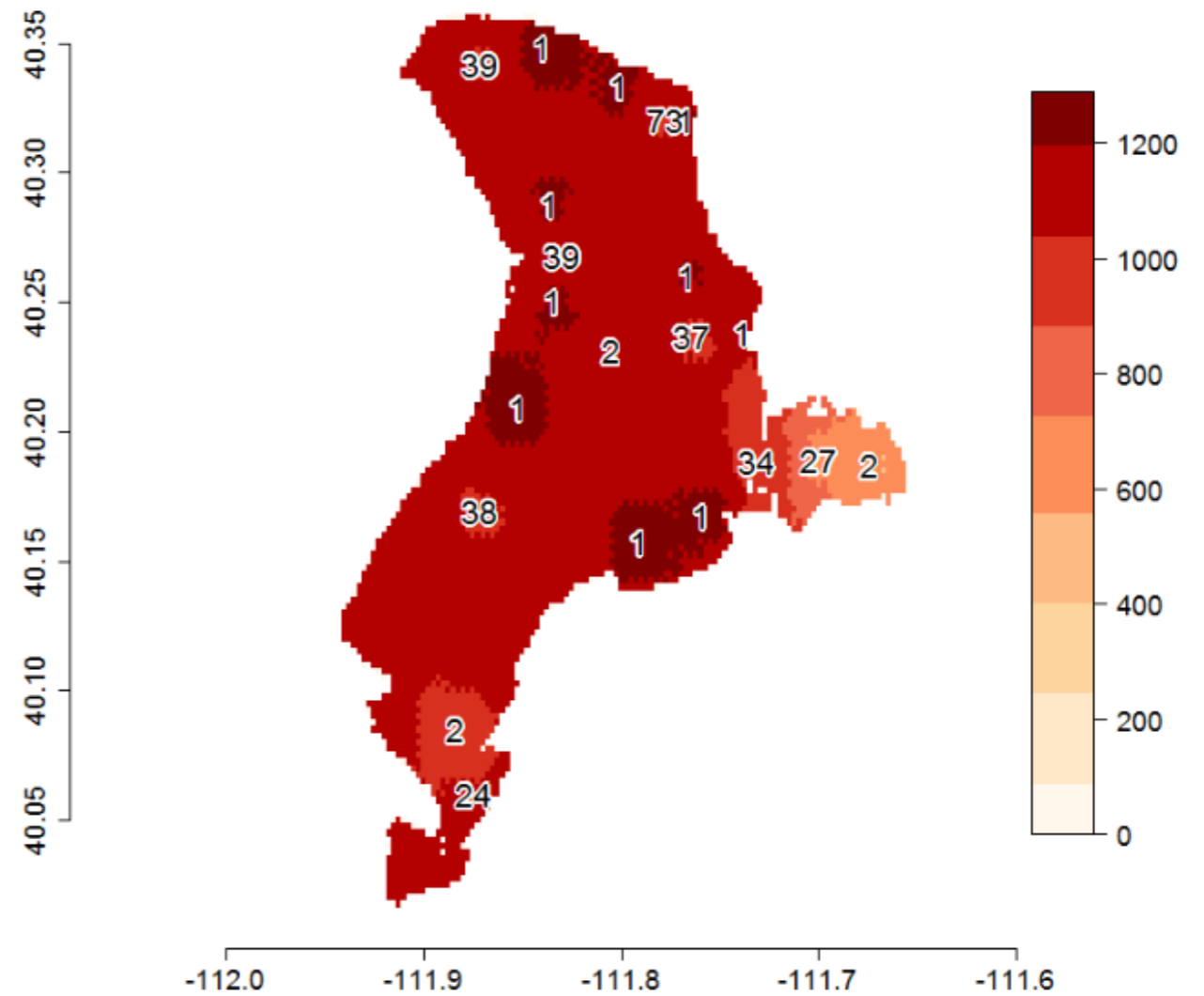
Sample depth:

Surface

**Interpolate**

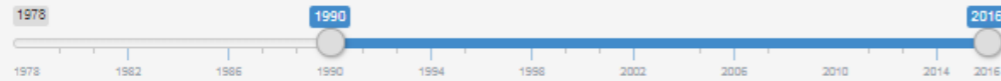
For help with this tool, or to report a bug, please contact Jake Vander Laan, UDWQ, [jvander@utah.gov](mailto:jvander@utah.gov), (801) 536-4350.

**Dissolved Surface Total dissolved solids (mg/l)**

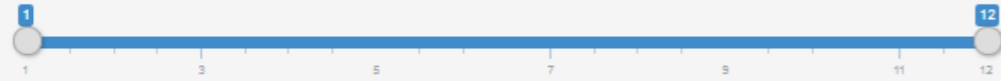


This tool shows time series (yearly & monthly), boxplots by site, and pairwise scatter plots of selected water quality parameters .

**Year range:**



**Month range:**



**Include:**

- Utah Lake
- Provo Bay
- All

**Plot type:**

- Time series
- Site boxplot
- Pairwise

**Parameter 1:**

Parameter:

**Fraction:**

Fraction:

**Sample depth:**

Sample depth:

log(y)

**Parameter 2:**

Parameter:

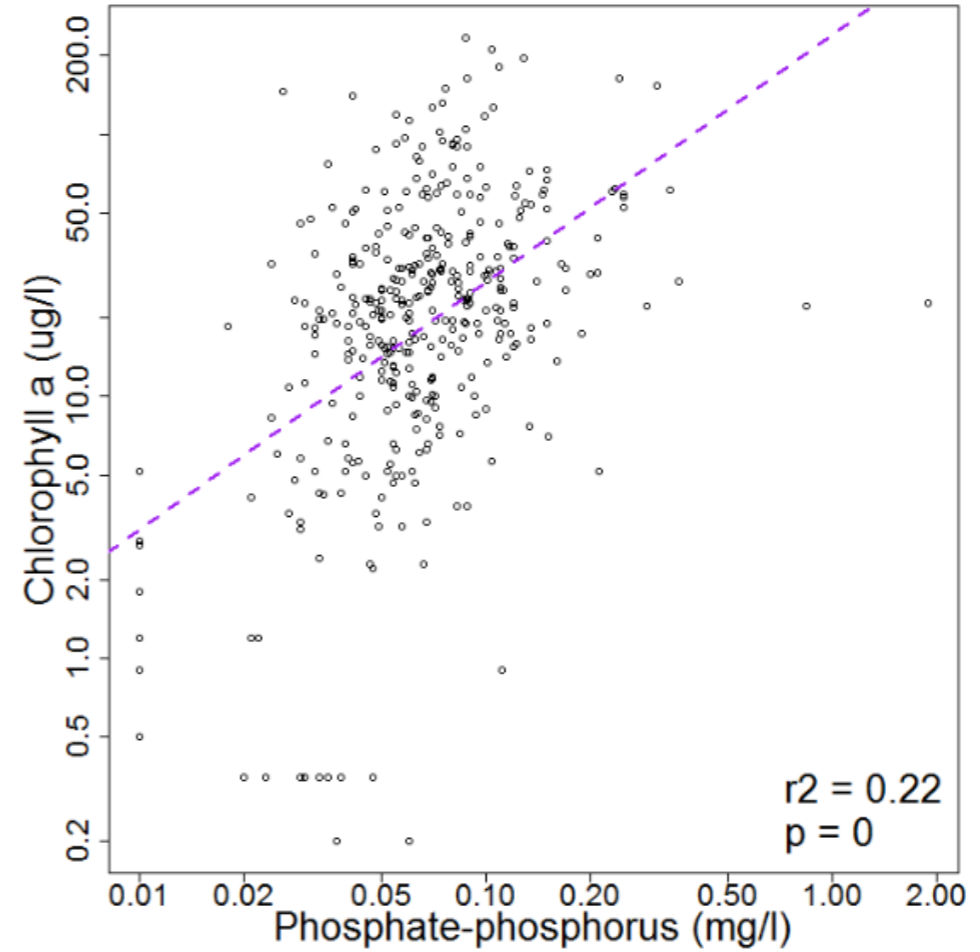
**Fraction:**

Fraction:


**Sample depth:**

Sample depth:

log(x)



**Plot type:**  
 Time-series    Boxplots

**Year range:**  
 2010  2017

**Include:**  
 Surface (0.2 m from surface)    Deep (0.5 m from bottom)

**Matrix 1:**  
 Water    Brine shrimp    Bird eggs

**Parameter 1:**  
 Hg

log(y1)

**Matrix 2:**  
 Water    Brine shrimp    Bird eggs

**Parameter 2:**  
 Hg

log(y2)

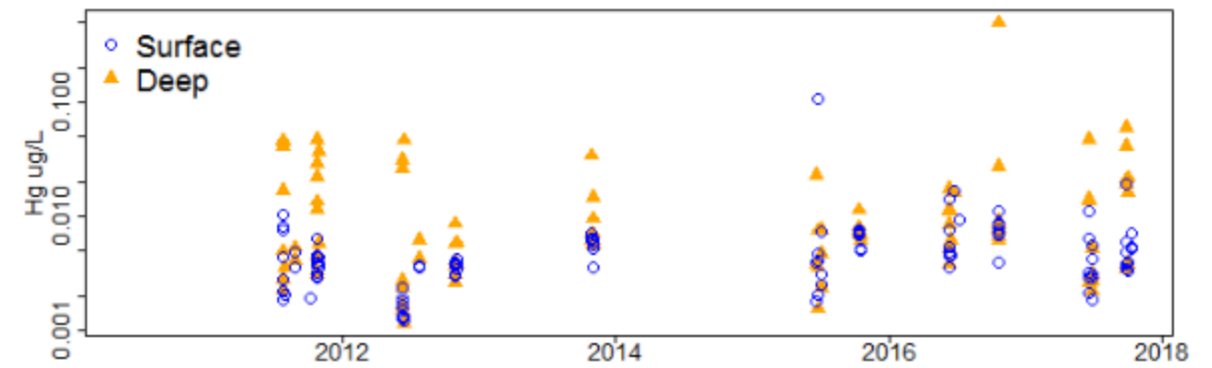
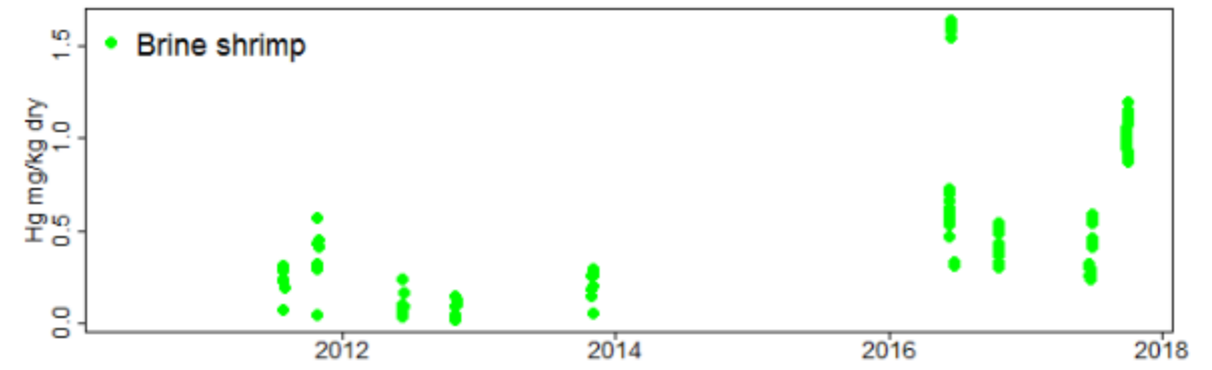
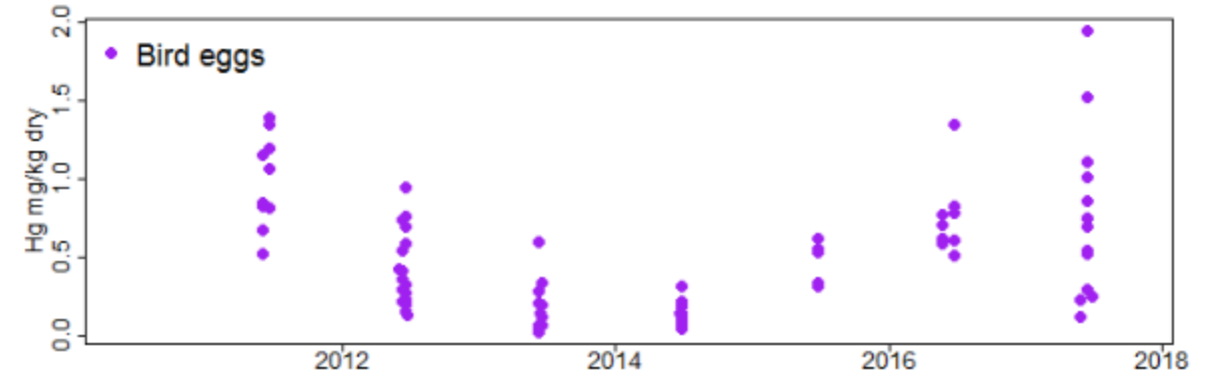
**Matrix 3:**  
 Water    Brine shrimp    Bird eggs

**Parameter 3:**  
 Hg

log(y3)

All biological oncentrations reported in dry weight.

This tool is currently in beta-testing. For help with this tool, or to report a bug, please contact Jake Vander Laan, UDWQ, [jvander@utah.gov](mailto:jvander@utah.gov), (801) 536-4350.



**Plot type:**  
 Time-series    Boxplots

**Year range:**

**Include:**  
 Surface (0.2 m from surface)    Deep (0.5 m from bottom)

**Matrix:**  
 Water    Brine shrimp    Bird eggs

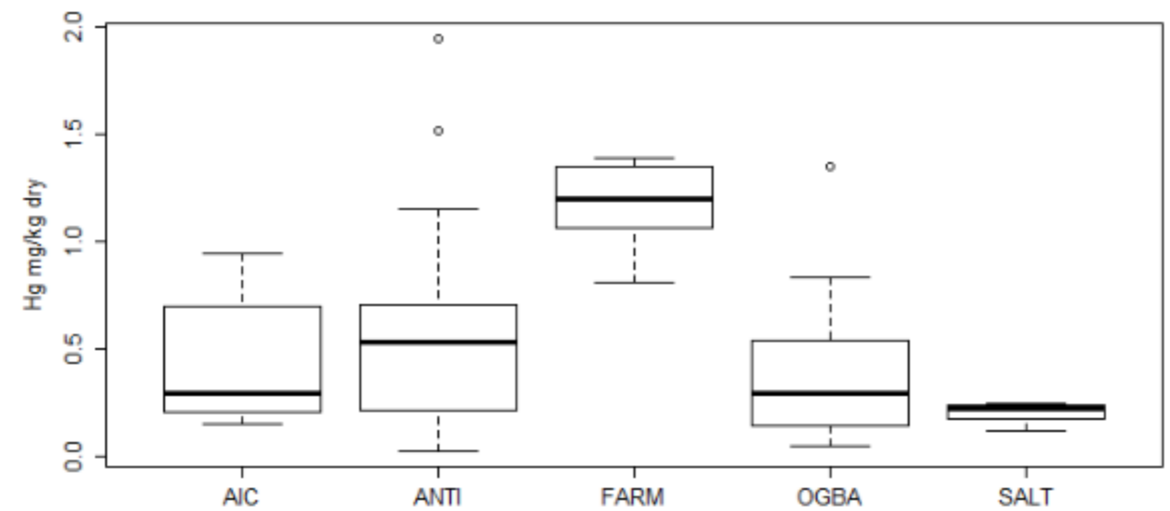
**Parameter:**

**Aggregate by:**

log(y)

AMAV = American Avocet. BNST = Black-necked stilt. AIC = Antelope Island Causeway. ANTI = Antelope Island. FARM = Farmington Bay. OGBA = Ogden Bay. SALT = Saltair. All biological concentrations reported in dry weight.

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	AIC	ANTI	FARM	OGBA	SALT	Total
Min	0.16	0.03	0.81	0.05	0.12	0.03
Median	0.30	0.53	1.20	0.30	0.23	0.41
Mean	0.44	0.54	1.16	0.39	0.20	0.51
Max	0.95	1.94	1.39	1.35	0.25	1.94
Count	10.00	41.00	5.00	22.00	3.00	81.00

### Site type(s) to review

REVIEW  ACCEPT  REJECT  MERGE

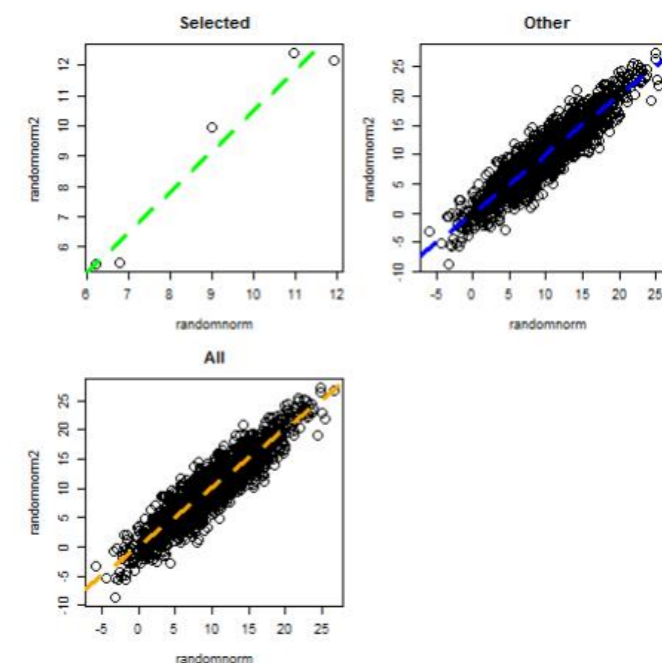
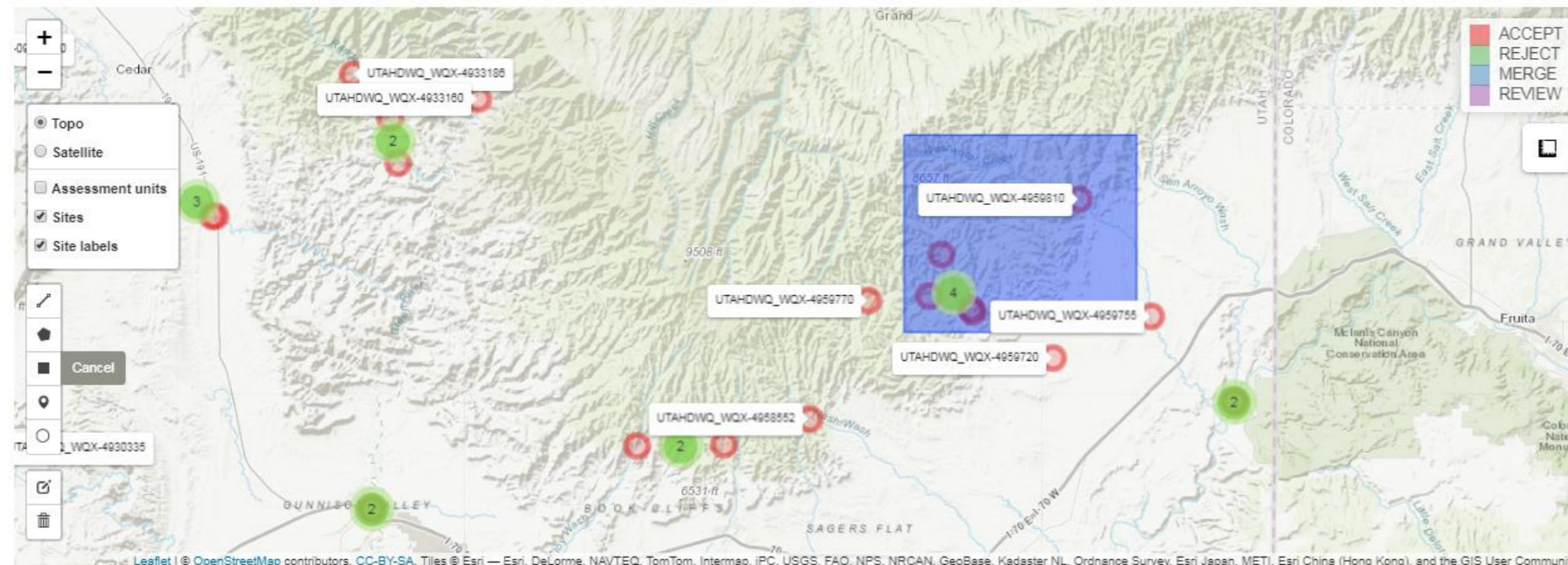
### Save edits

### Remove reviewed sites

### Plot type

None  Boxplot  Scatter plot

### Select site(s)



### Review & edit attributes

	OrganizationIdentifier	OrganizationFormalName	ProviderName	MonitoringLocationIdentifier	MonitoringLocationName	MonitoringLocationTypeName	MonitoringLocationDescriptionText	IR_FLAG	IR_REASON	IR_MLID
574	UTAHDWQ_WQX	Utah Department Of Environmental Quality	STORET	UTAHDWQ_WQX-4959690	Diamond Creek 0.8 MI ab Ranch and BI Flume Canyon	River/Stream		ACCEPT	ACCEPT	UTAHDWQ_WQX-4959690
575	UTAHDWQ_WQX	Utah Department Of Environmental Quality	STORET	UTAHDWQ_WQX-4959700	DIAMOND CK AB FLUME CANYON	River/Stream		ACCEPT	ACCEPT	UTAHDWQ_WQX-4959700
577	UTAHDWQ_WQX	Utah Department Of Environmental Quality	STORET	UTAHDWQ_WQX-4959740	Cottonwood Ck 2.9 MI ab Ranch	River/Stream		ACCEPT	ACCEPT	UTAHDWQ_WQX-4959740
587	UTAHDWQ_WQX	Utah Department Of Environmental Quality	STORET	UTAHDWQ_WQX-4959710	Diamond Creek 5.4 MI ab Ranch	River/Stream		ACCEPT	ACCEPT	UTAHDWQ_WQX-4959710
595	UTAHDWQ_WQX	Utah Department Of Environmental Quality	STORET	UTAHDWQ_WQX-4959810	WESTWATER CK AB MIDDLE CYN	River/Stream		ACCEPT	ACCEPT	UTAHDWQ_WQX-4959810

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# Stakeholder Communication

## Formal:

- Applications as appendices to reports (e.g. Integrated Report review)
- Applications as tools for science or review panels (e.g. Utah Lake application)

## Informal:

- Technical review requests
- Application previews to highly engaged stakeholders



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# Stakeholder Feedback

- No formal process for stakeholder feedback specifically on applications at this point
- Applications treated as appendices subject to normal comment process
- Very positive feedback from technical partners & collaborators
- Generally positive feedback, but some healthy skepticism from stakeholders

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# Moving Forward

## Applications as living tools

1. Update as new data are available (ideally automatically)
2. Error fixes
3. Continue add new analyses or developing new applications

# QUESTIONS?

[jvander@utah.gov](mailto:jvander@utah.gov)

