UTAH DEPARTMENT *of*
ENVIRONMENTAL QUALITY
WATER
QUALITY

# Interactive data visualization and engagement tools for Utah waterbodies

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Utah DWQ

# 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

# Target audience

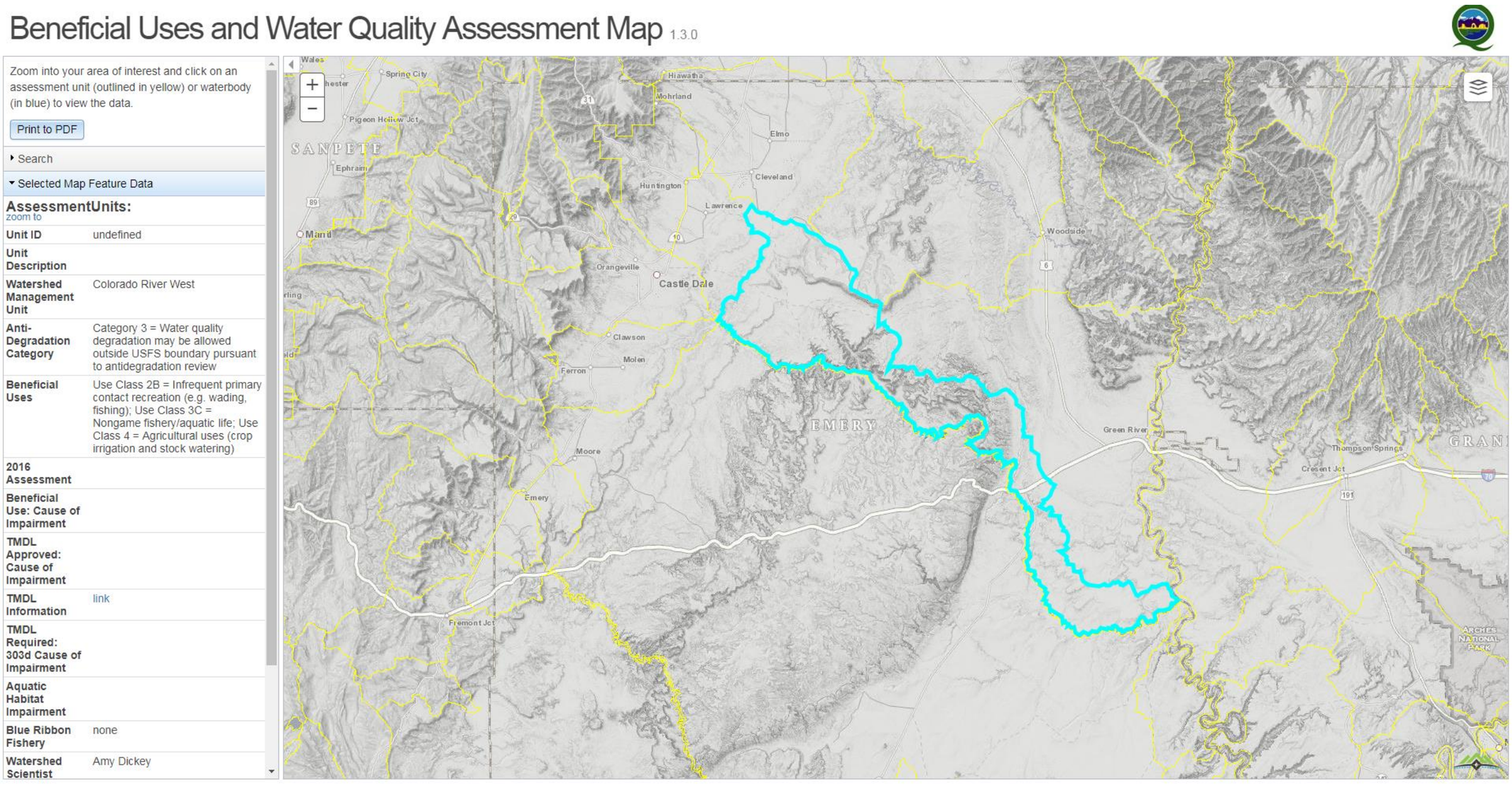
## Potential user types

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

- Internal & external users
- Waterbody/issue focused

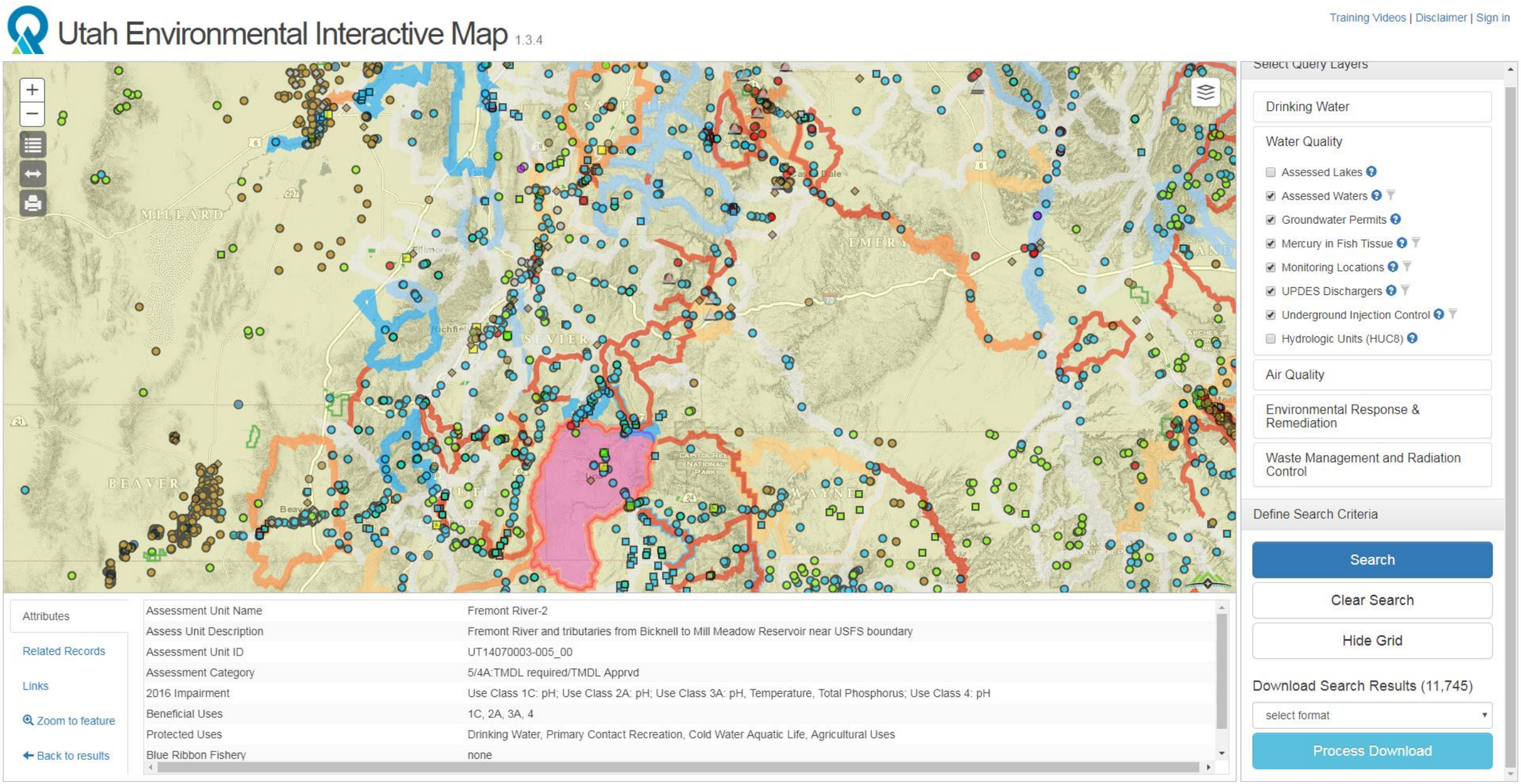
# Existing engagement tools

# Existing engagement tools




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

# Existing engagement tools




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

# Newly developed tools

# Demos

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

https://jakevl2.shinyapps.io/GSL_data_explorer/

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

# Application Development

- R statistical program (r-project.org)
- Shiny package from R-Studio (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

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UTAH LAKE DATA EXPLORER

Lake elevation | Water chemistry | Trophic state | NLA comparison | Water quality map

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

**Year range:**

1978 — 1990 — 2016

1978 1982 1986 1990 1994 1998 2002 2006 2010 2014 2016

**Month range:**

1 — 12

1 3 5 7 9 11 12

**Include:**

- (•) Utah Lake
- ( ) Provo Bay
- ( ) All

**Plot type:**

- (•) Time series
- ( ) Site boxplot
- ( ) Pairwise

**Parameter:**

Phosphate-phosphorus

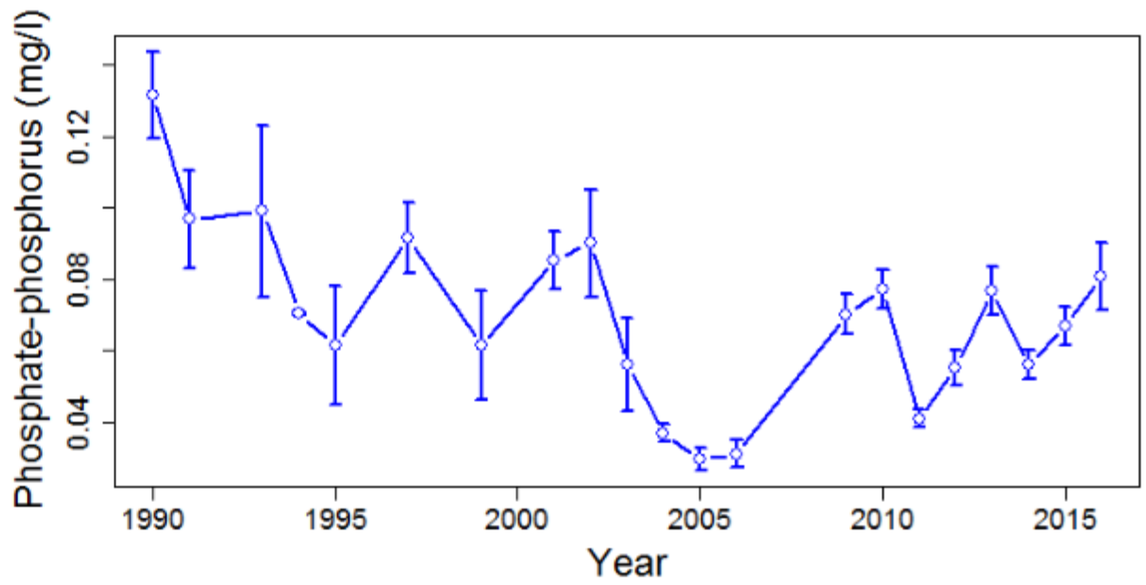
**Fraction:**

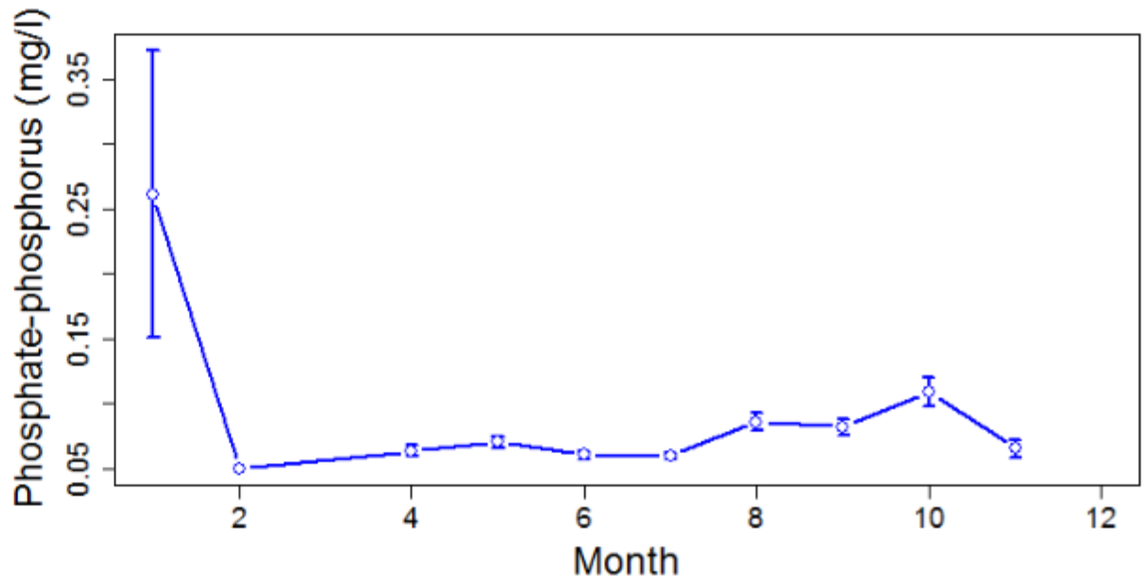
Total

**Sample depth:**

Surface

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



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UTAH LAKE DATA EXPLORER

Lake elevation | Water chemistry | Trophic state | NLA comparison | Water quality map

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:**

1978 — 1990 — 2016

1978 1982 1986 1990 1994 1998 2002 2006 2010 2014 2016

**Month range:**

1 — 12

1 3 5 7 9 11 12

**Parameter:**

Total dissolved solids

**Fraction:**

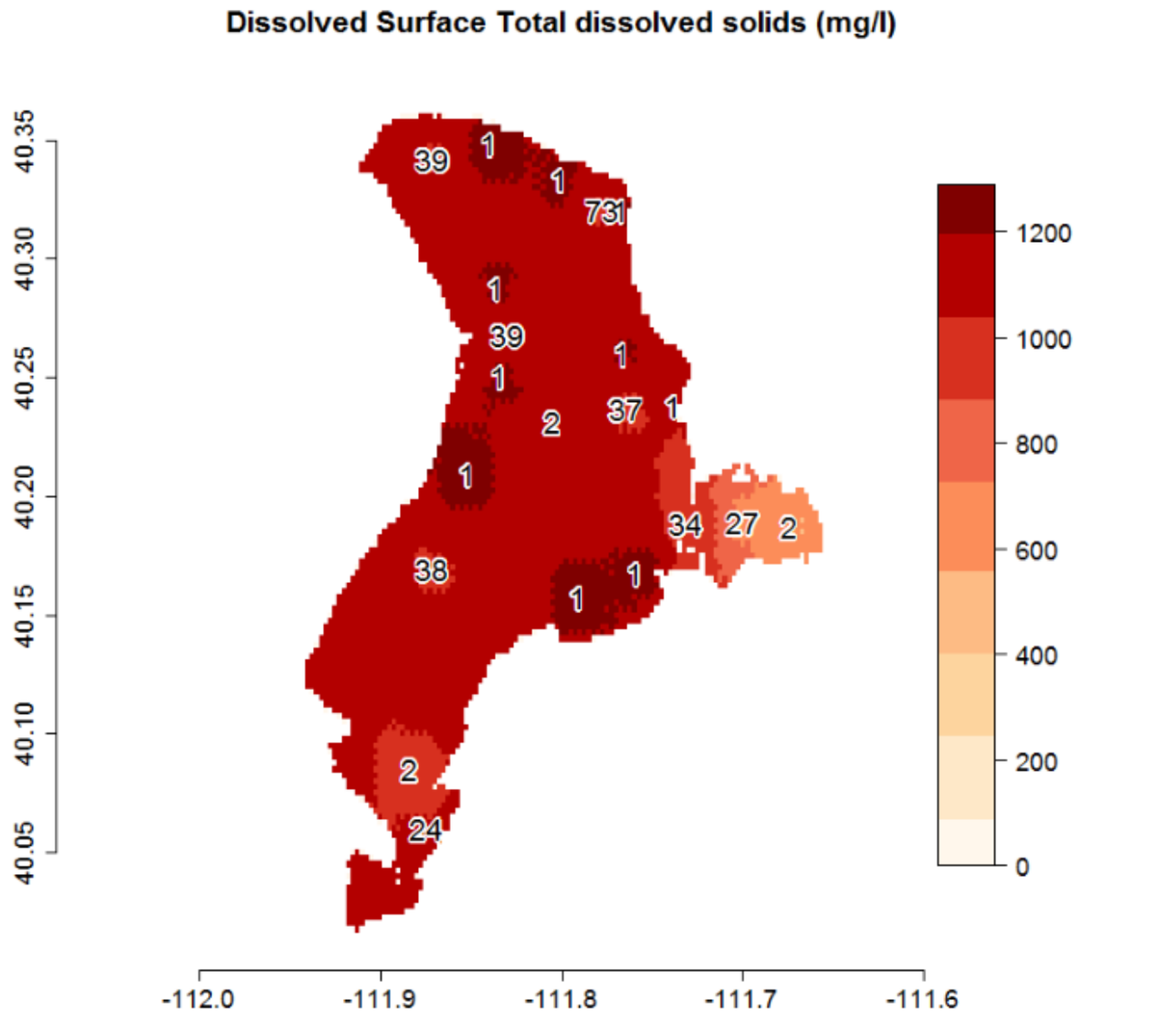
Dissolved

**Sample depth:**

Surface

Interpolate

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



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UTAH LAKE DATA EXPLORER

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

**Year range:**

1978 — 1990 — 2016

1978 1982 1986 1990 1994 1998 2002 2006 2010 2014 2016

**Month range:**

1 — 12

1 3 5 7 9 11 12

**Include:**

- (•) Utah Lake
- ( ) Provo Bay
- ( ) All

**Plot type:**

( ) Time series ( ) Site boxplot (•) Pairwise

Parameter 1:

**Parameter:** Chlorophyll a

**Fraction:** Total

**Sample depth:** Surface

[x] log(y)

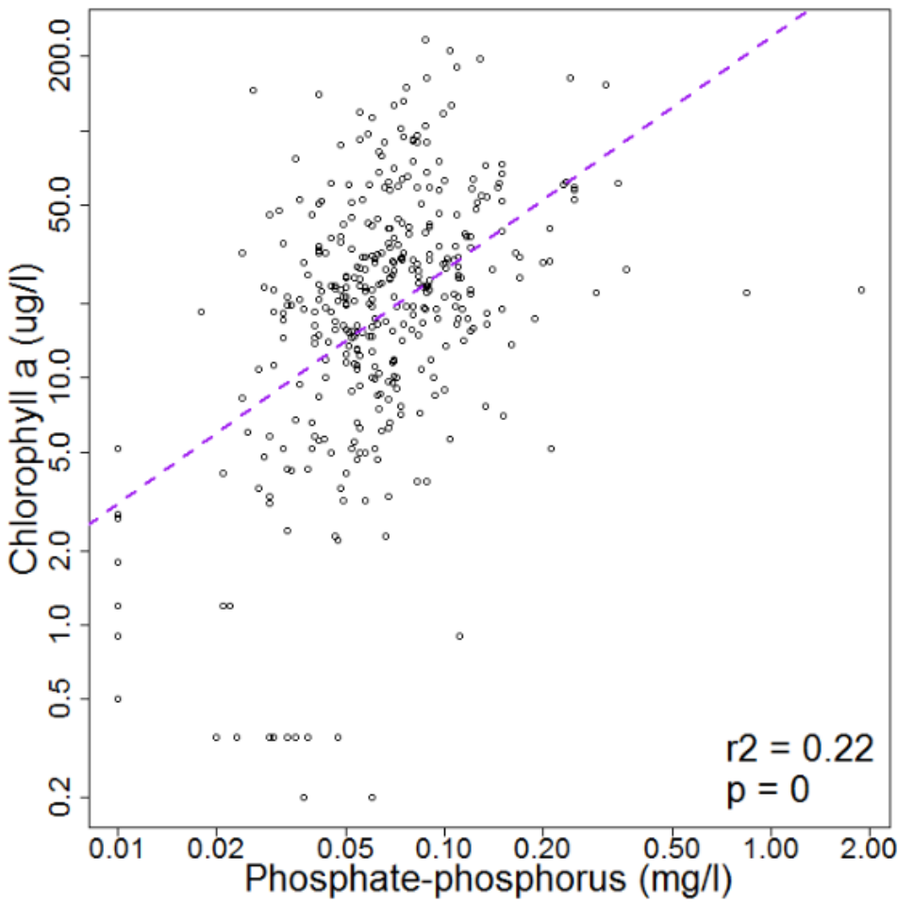
Parameter 2:

**Parameter:** Phosphate-phosphorus

**Fraction:** Total

**Sample depth:** Surface

[x] log(x)



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## GSL DATA EXPLORER

Lake Levels | Water Quality Data | Metals Data | Water Quality Map

**Plot type:**
(•) Time-series ( ) Boxplots

**Year range:**
2010 — 2017
2010 2011 2012 2013 2014 2015 2016 2017

**Include:**
[x] Surface (0.2 m from surface) [x] 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)

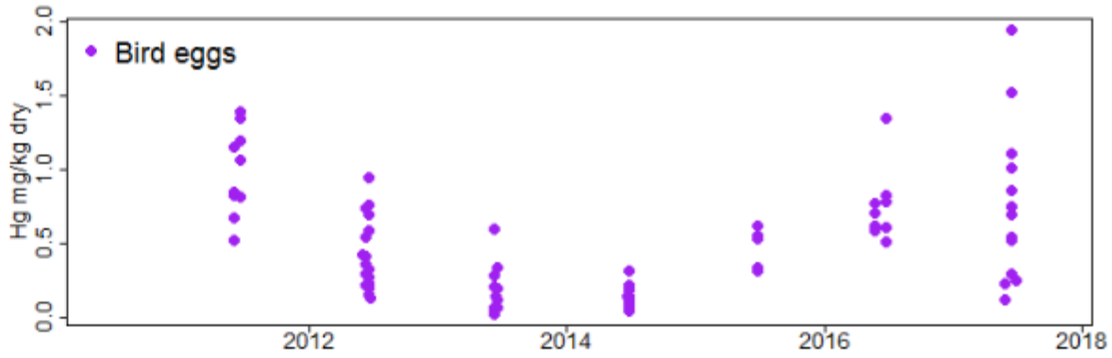
**Matrix 3:**
(•) Water ( ) Brine shrimp ( ) Bird eggs

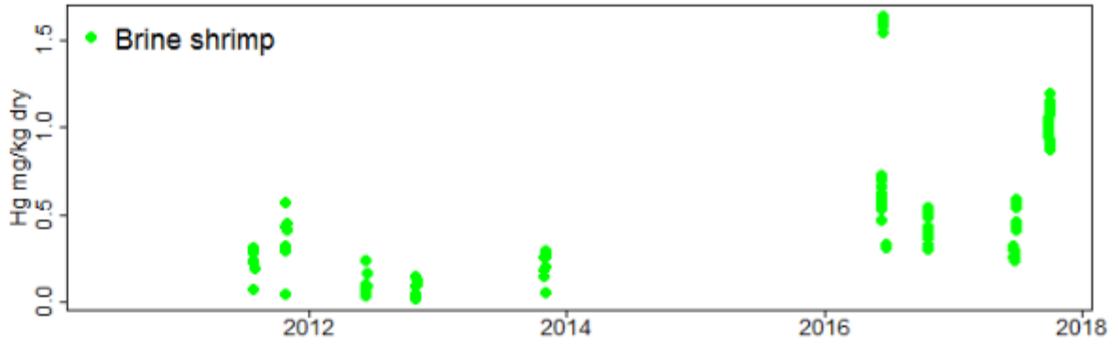
**Parameter 3:**
Hg

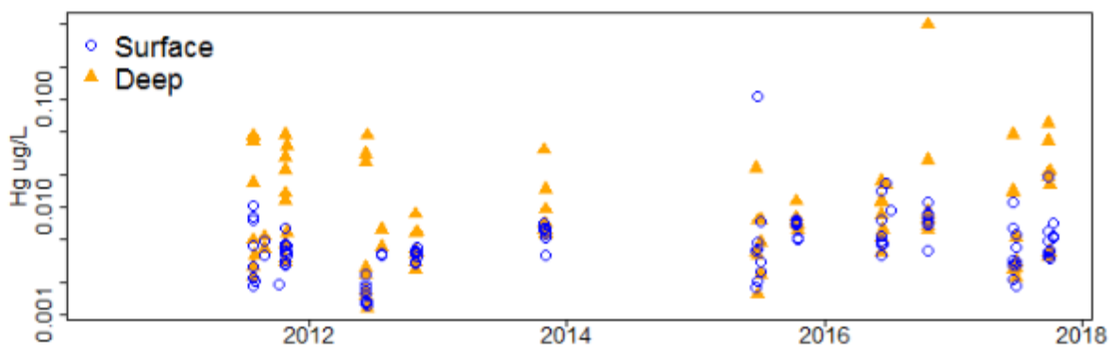
[x] log(y3)

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, (801) 536-4350.



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## GSL DATA EXPLORER

Lake Levels | Water Quality Data | **Metals Data** | Water Quality Map

**Plot type:**
○ Time-series ◉ Boxplots

**Year range:**
2010 — 2017
2010 2011 2012 2013 2014 2015 2016 2017

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

**Matrix:**
○ Water ○ Brine shrimp ◉ Bird eggs

**Parameter:**
Hg

**Aggregate by:**
Site

☐ 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 oncentrations reported in dry weight.

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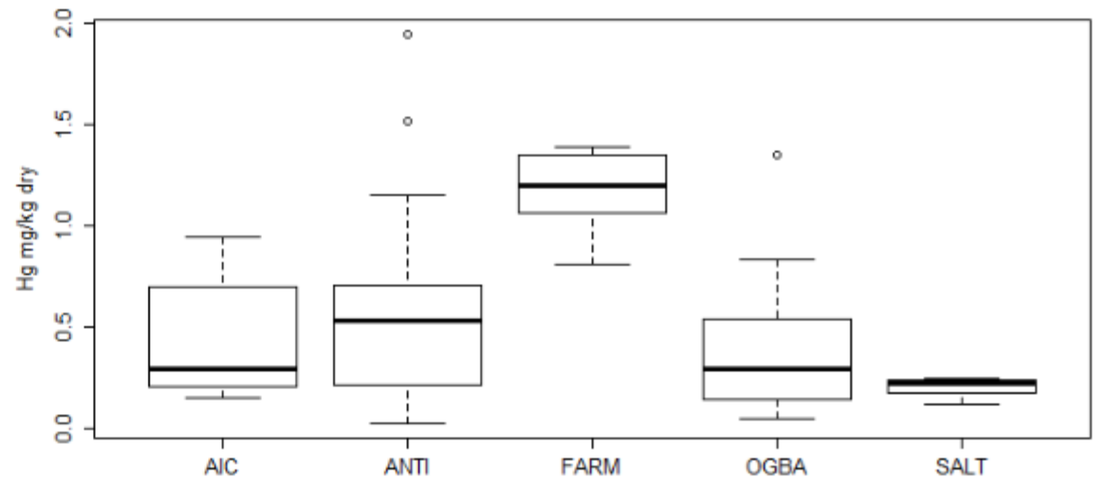



| | AIC | ANTI | FARM | OGBA | SALT | Total |
|---|---|---|---|---|---|---|
| Min | 0.16 | 0.03 | 0.81 | 0.05 | 0.12 | 0.03 |
| Median | 0.30 | 0.53 | 1.20 | 0.30 | 0.23 | 0.41 |
| Mean | 0.44 | 0.54 | 1.16 | 0.39 | 0.20 | 0.51 |
| Max | 0.95 | 1.94 | 1.39 | 1.35 | 0.25 | 1.94 |
| Count | 10.00 | 41.00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

Site type(s) to review

☑ REVIEW ☑ ACCEPT ☐ REJECT ☐ MERGE

Save edits

Save

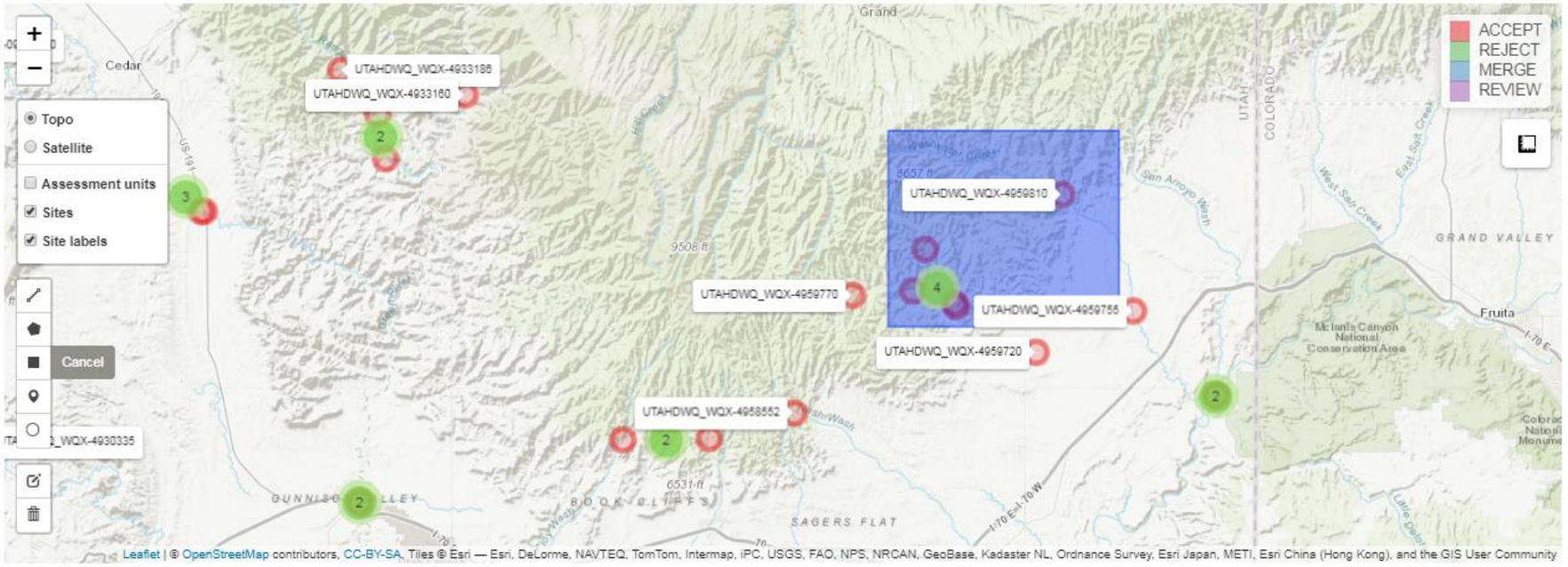
Remove reviewed sites

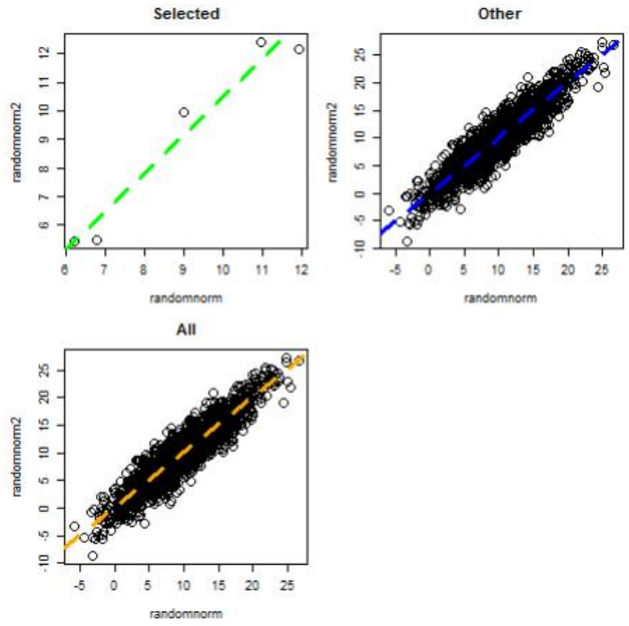
Remove

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 Bl 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 |

# 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

# 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

# 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?

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