



Utah Division of  
Water Resources

# Water Use Data & Modeling

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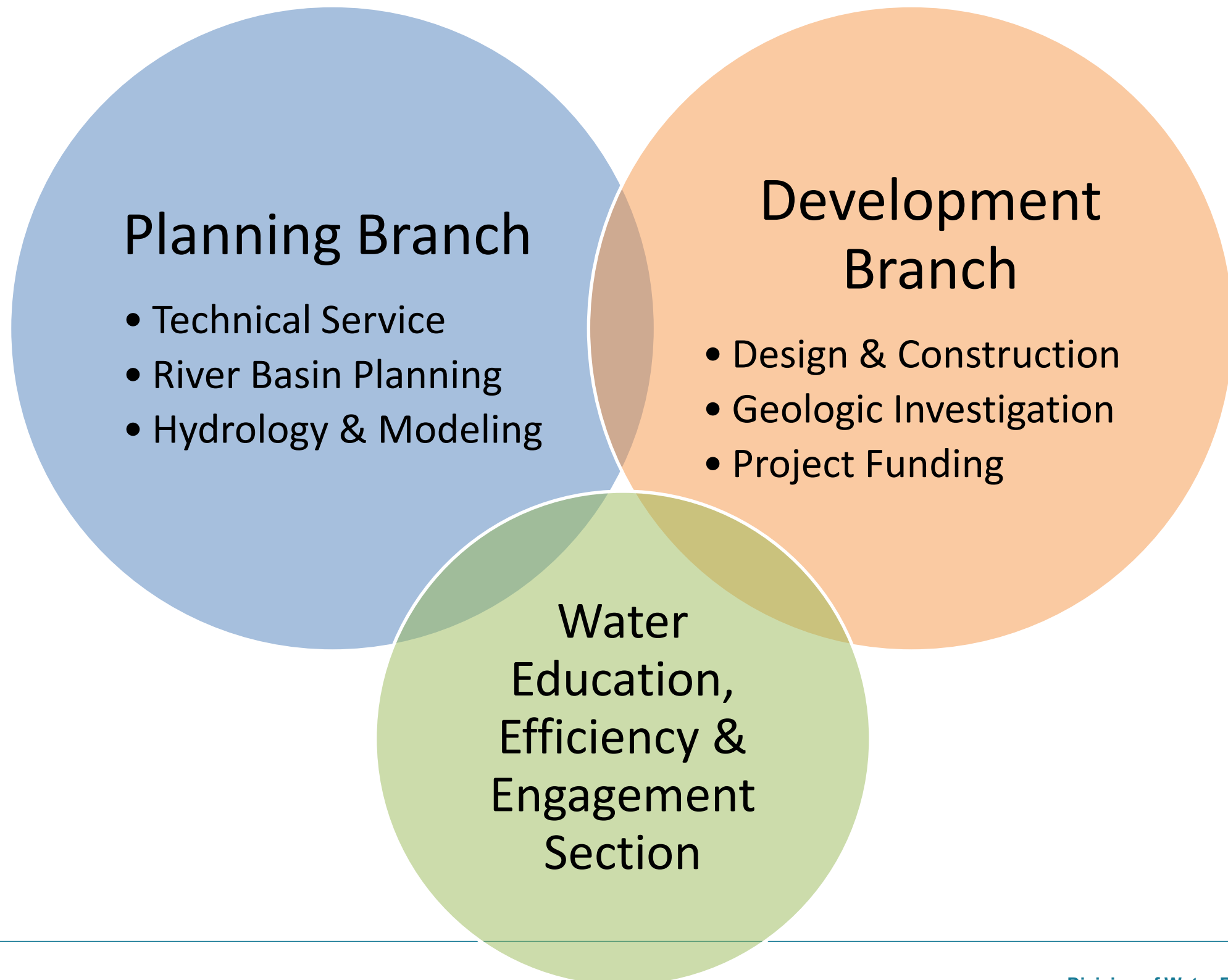


# Mission

Plan, conserve, develop and protect  
Utah's water resources.



# Division Organization

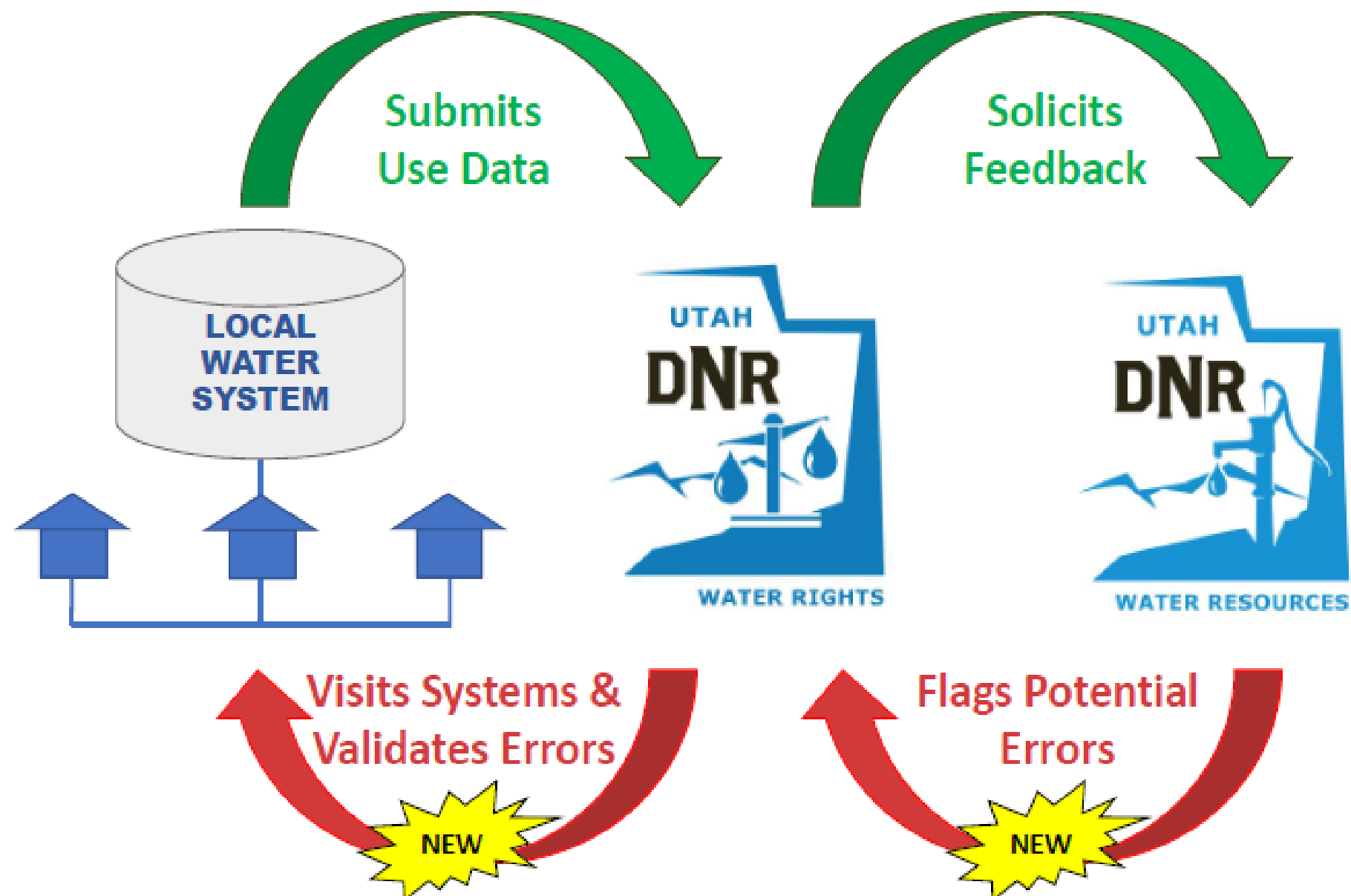


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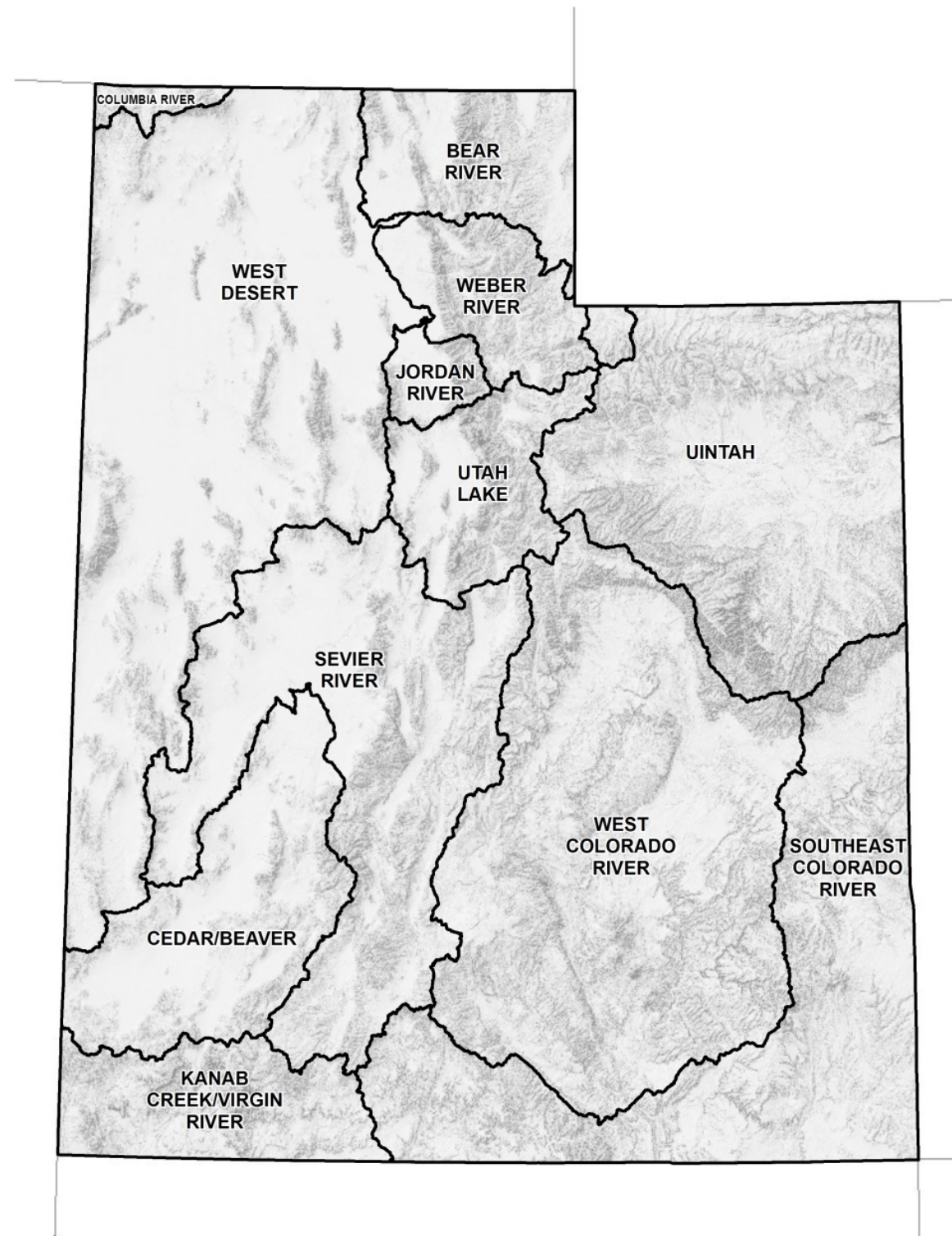
# Water Data in Utah Under Scrutiny

- A Performance Audit of Projections of Utah's Water Needs – May 2015
- An In-depth Follow-up of Projections of Utah's Water Needs – December 2017
- State of Utah Water Use Data Collection Program Report – January 2018

# M&I Water Use Process

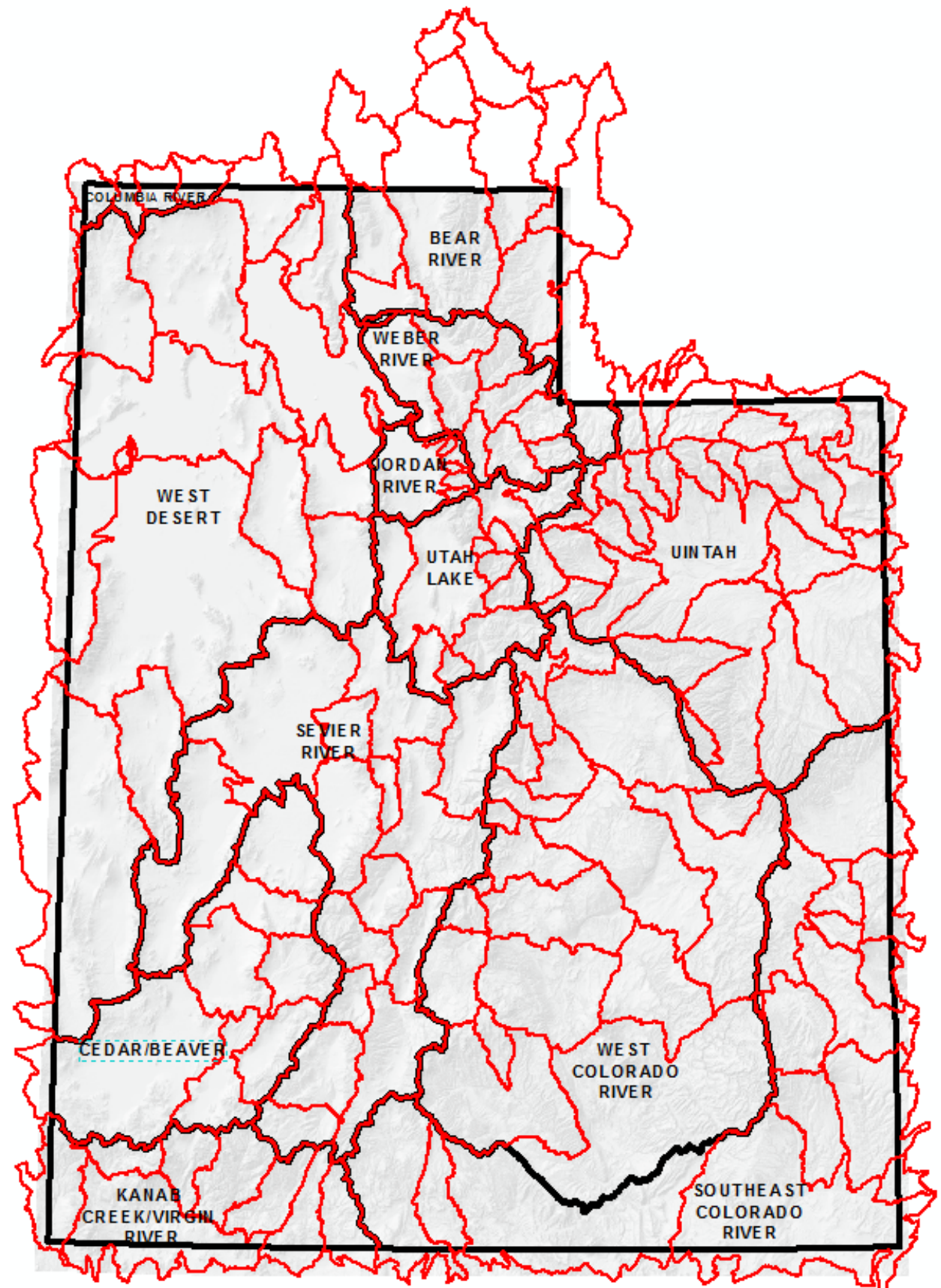


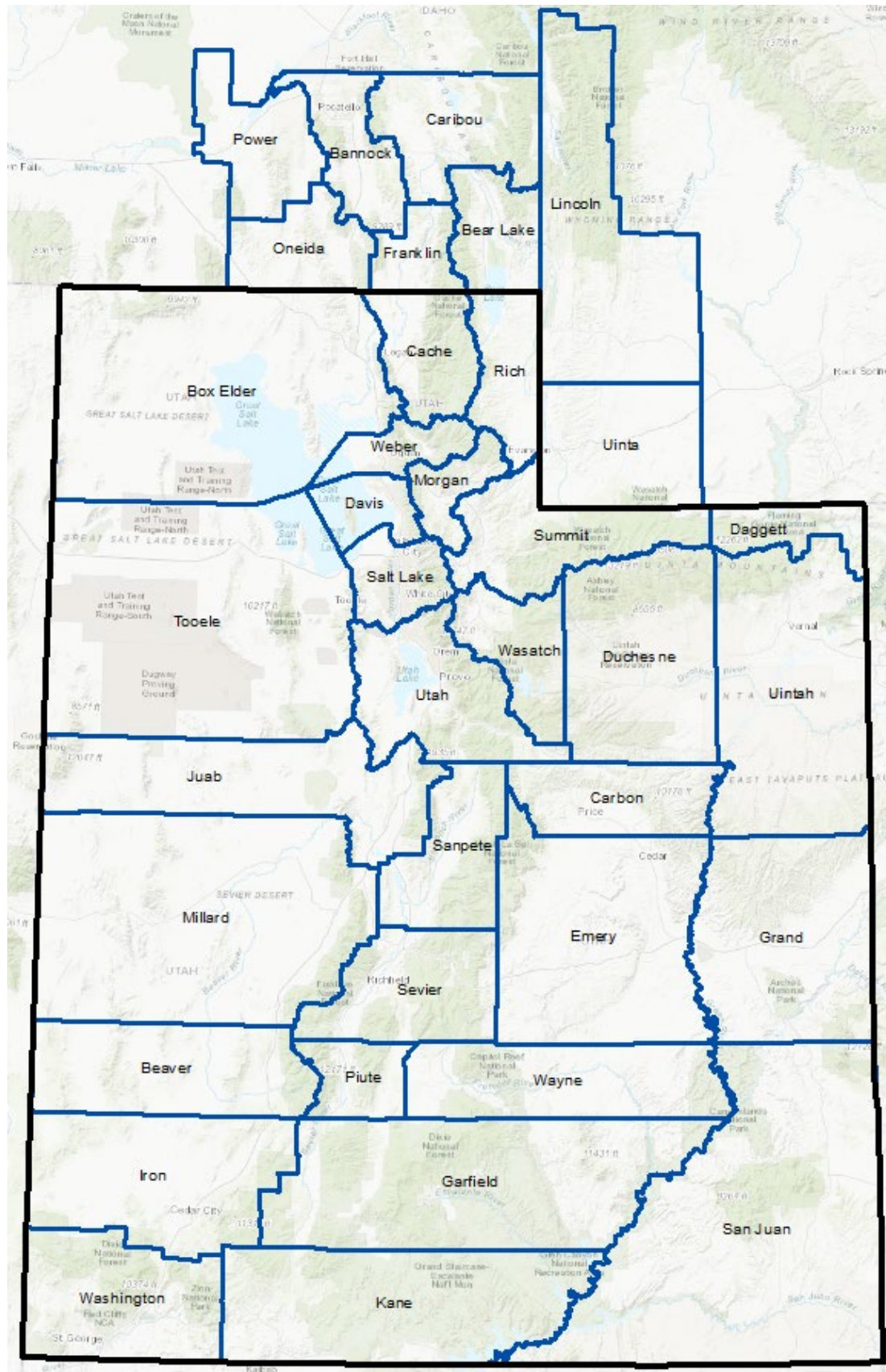
# Water Budget Model



Provides data for Utah's river basin planning areas

Derived from summaries  
of individual subarea  
models

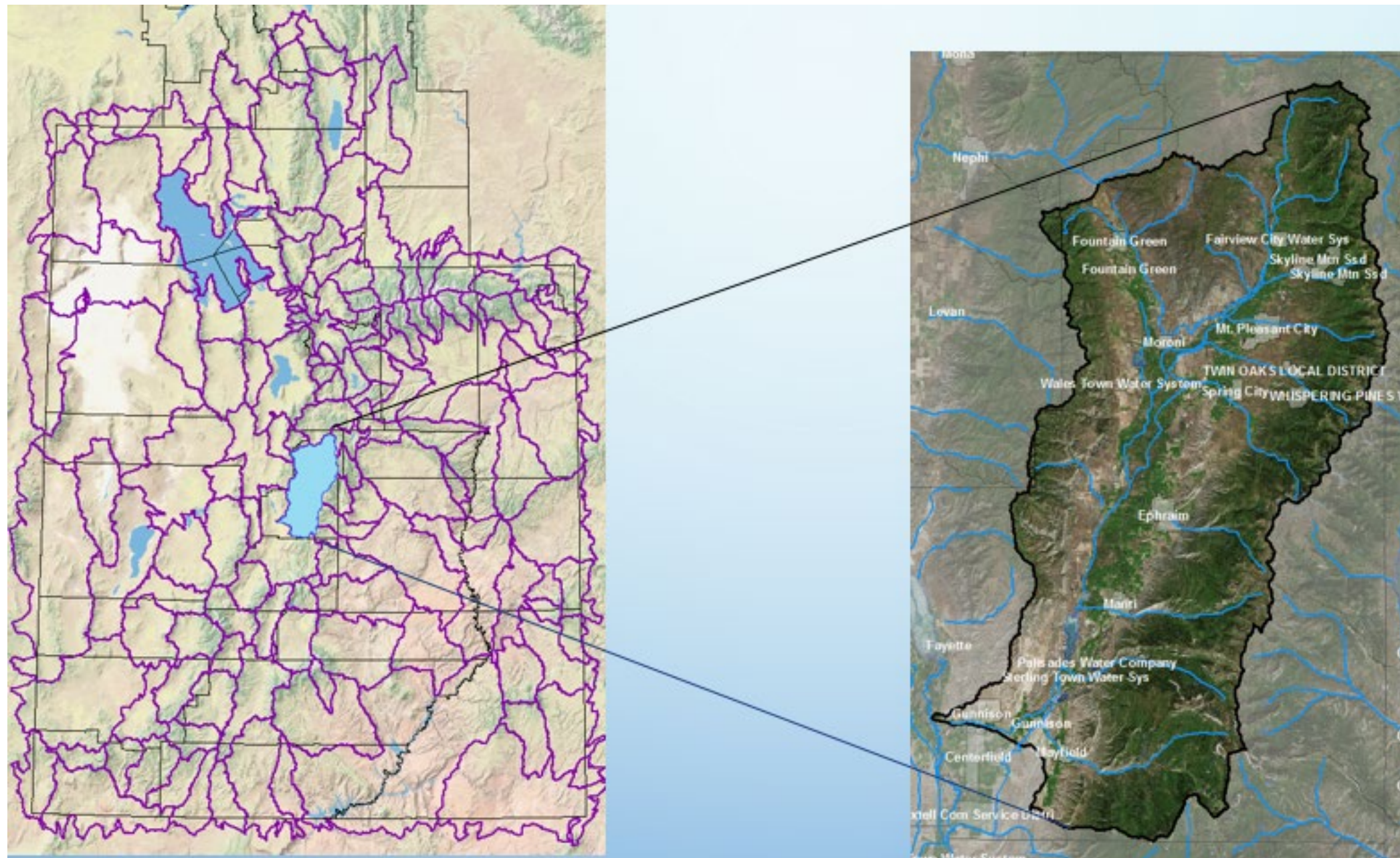




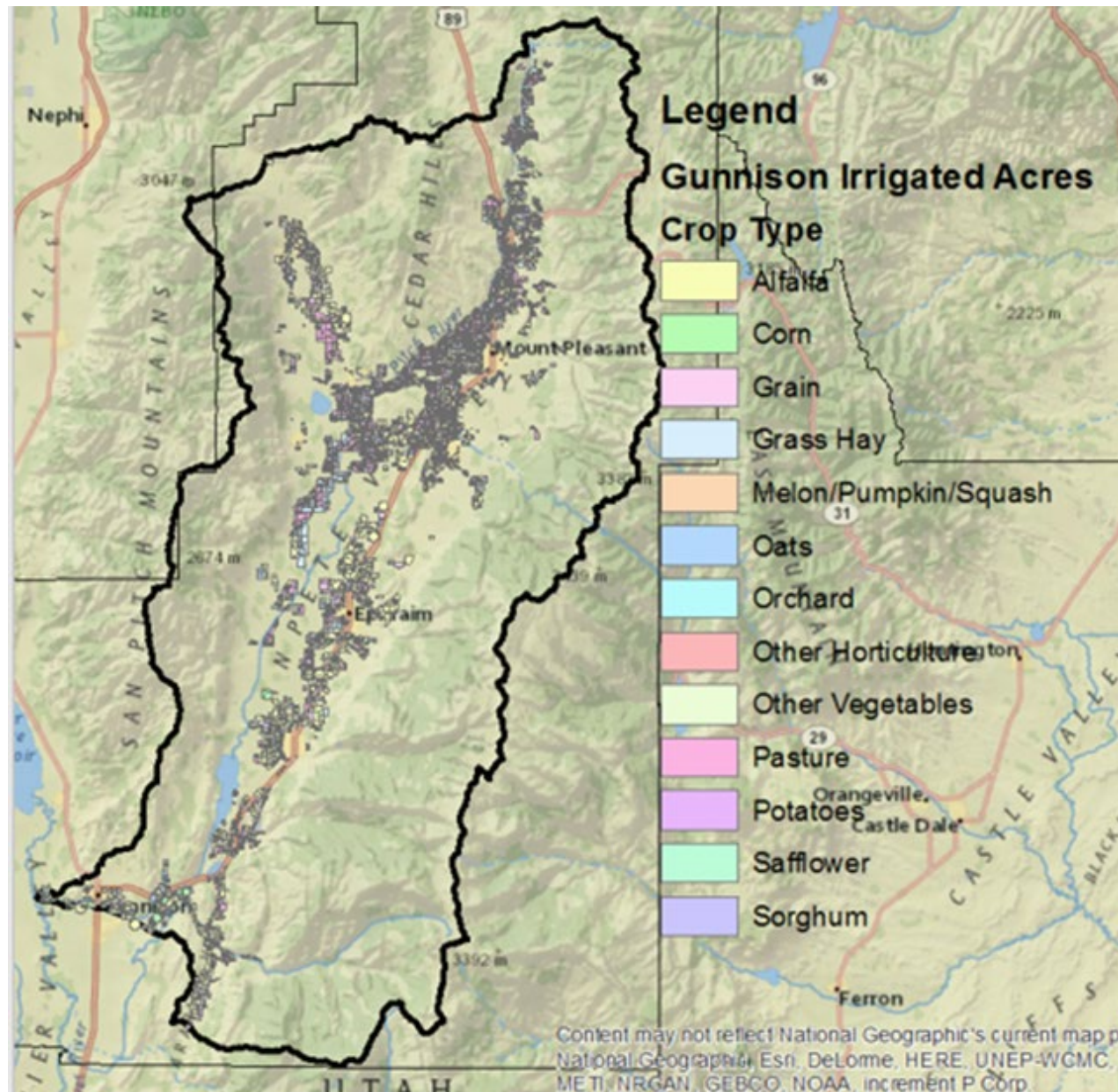
Can be queried by county

# Water Budget Analysis

## Example: Gunnison Subarea



## Irrigated Water Use / Consumptive Use

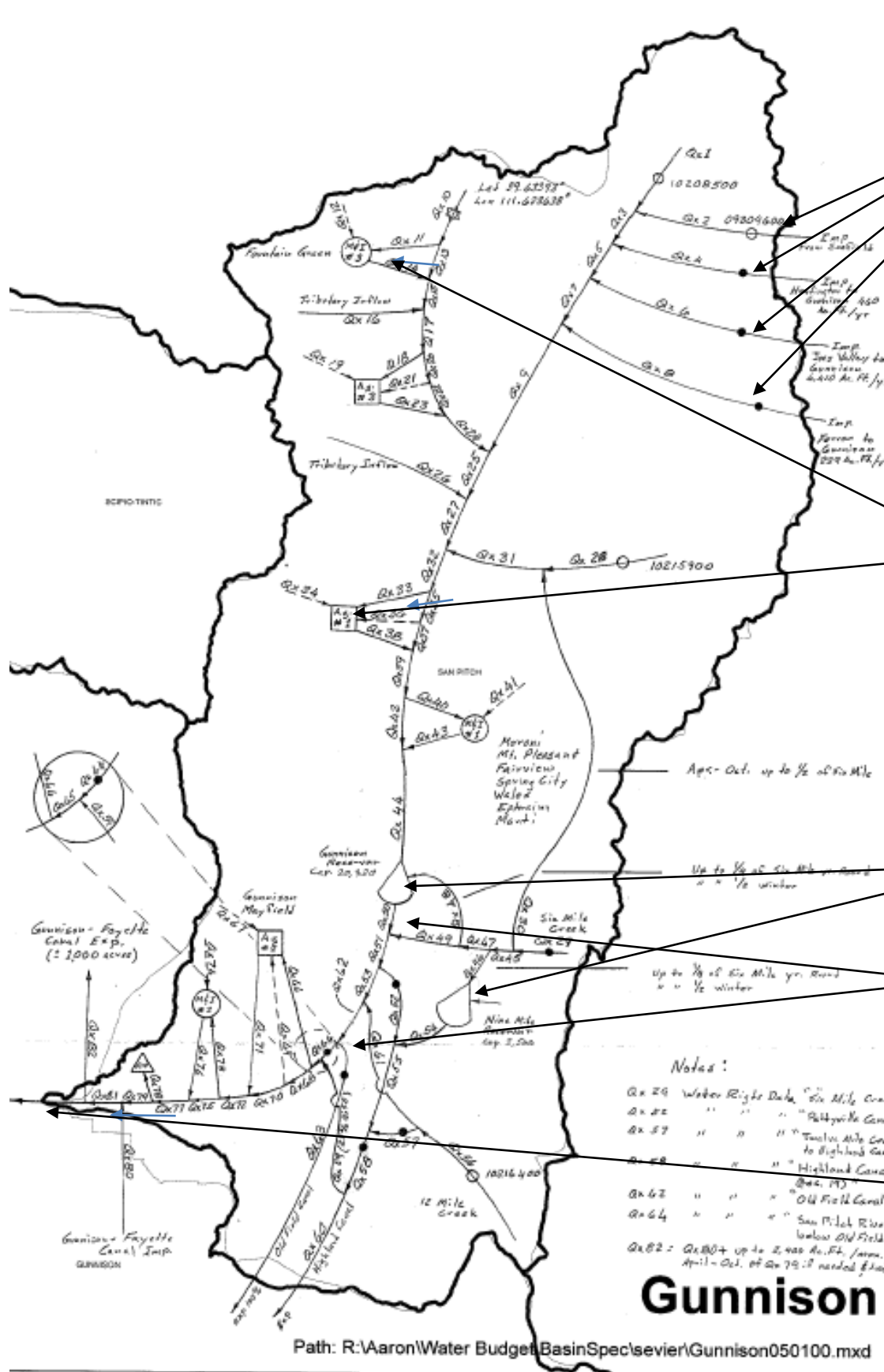


## Municipal Water Use /Consumptive Use



## Reservoir Evap. & Related Data





Transbasin Imports

Graphic of Model Logic

Municipal and Agricultural Demands

Reservoir Operations

Gauged Stream Flows

Outflow to Next Area

## Excerpt of Gunnison Model Code

```
!-----  
!      CODE FOR GUNNISON MODEL  
!-----  
!Upper SanPitch River  
QX(3,J,K)=QX(2,J,K)+QX(1,J,K)  
QX(5,J,K)=QX(4,J,K)+QX(3,J,K)  
QX(7,J,K)=QX(5,J,K)+QX(6,J,K)  
QX(9,J,K)=QX(7,J,K)+QX(8,J,K)  
  
!Silver Creek River  
CALL MUNSUB(3)  
QX(15,J,K)=QX(14,J,K)+QX(13,J,K)  
QX(16,J,K)=(MAX(0.0,ARDEM(3)-QX(15,J,K)))*ShortFac  
QX(17,J,K)=QX(16,J,K)+QX(15,J,K)  
CALL ARSUB(3)  
QX(24,J,K)=QX(22,J,K)+QX(23,J,K)  
  
!Below confluence Silver Creek and SanPitch  
QX(25,J,K)=QX(9,J,K)+QX(24,J,K)  
!Proportion water from Six Mile Creek  
!Above Gunnison Reservoir to QX30  
SELECT CASE (K)  
  CASE (1:6)  
    QX(30,J,K)=.5*QX(29,J,K)  
  CASE DEFAULT  
    QX(30,J,K)=.25*QX(29,J,K)  
END SELECT  
QX(45,J,K)=QX(29,J,K)-QX(30,J,K)  
!Find Inflow to Nine Mile Reservoir  
SELECT CASE (K)  
  CASE (1:6)
```

## Gunnison Model Data Management

File Program Background Help

General Inflow Minimum Flows Riparian Hydro Power Inflow/Outflow Plot Info QX Output to file Calibration

### General Water Budget Main Data Entry Screen

Printed Output Page Heading

Gunnison 05-01-00

Years to be simulated Initial year: 1989 End year: 2014

1 of 83 QXs to be printed

|   | QX No. | Order | Description                                          |
|---|--------|-------|------------------------------------------------------|
| ▶ | 1      | 10    | Tributary gauged flow 10208500                       |
|   | 2      | 20    | Import flow from Scofield gauged 09309600            |
|   | 3      | 30    | Combination flow of Qx1 and Qx2                      |
|   | 4      | 40    | Import flow from Huntington (Huntington-to-Gunnison) |
|   | 5      | 50    | Combination flow of Qx3 and Qx4                      |

☒ Make beginning and ending soil moisture the same? 10000 Iterations allowed Printout Lines/Page 96

Program File Name Gunnison Executable File Name Gunnison Printout File Name Gunnison

Basin:

Please select from among the possible basins and then sub-areas in order to limit selections for the water budget. Only those land areas, municipalities, or riparian areas that intersect selected sub-areas will be available for selection.

Select Sub Areas for Analysis

- 00-01-01, Grouse Creek
- 00-01-02, Park Valley
- 00-01-03, Curlew Valley
- 00-02-01, North GSL Desert
- 00-02-02, South GSL Desert
- 00-02-03, Deep Creek
- 00-03-01, Snake Valley

Selected Sub Areas

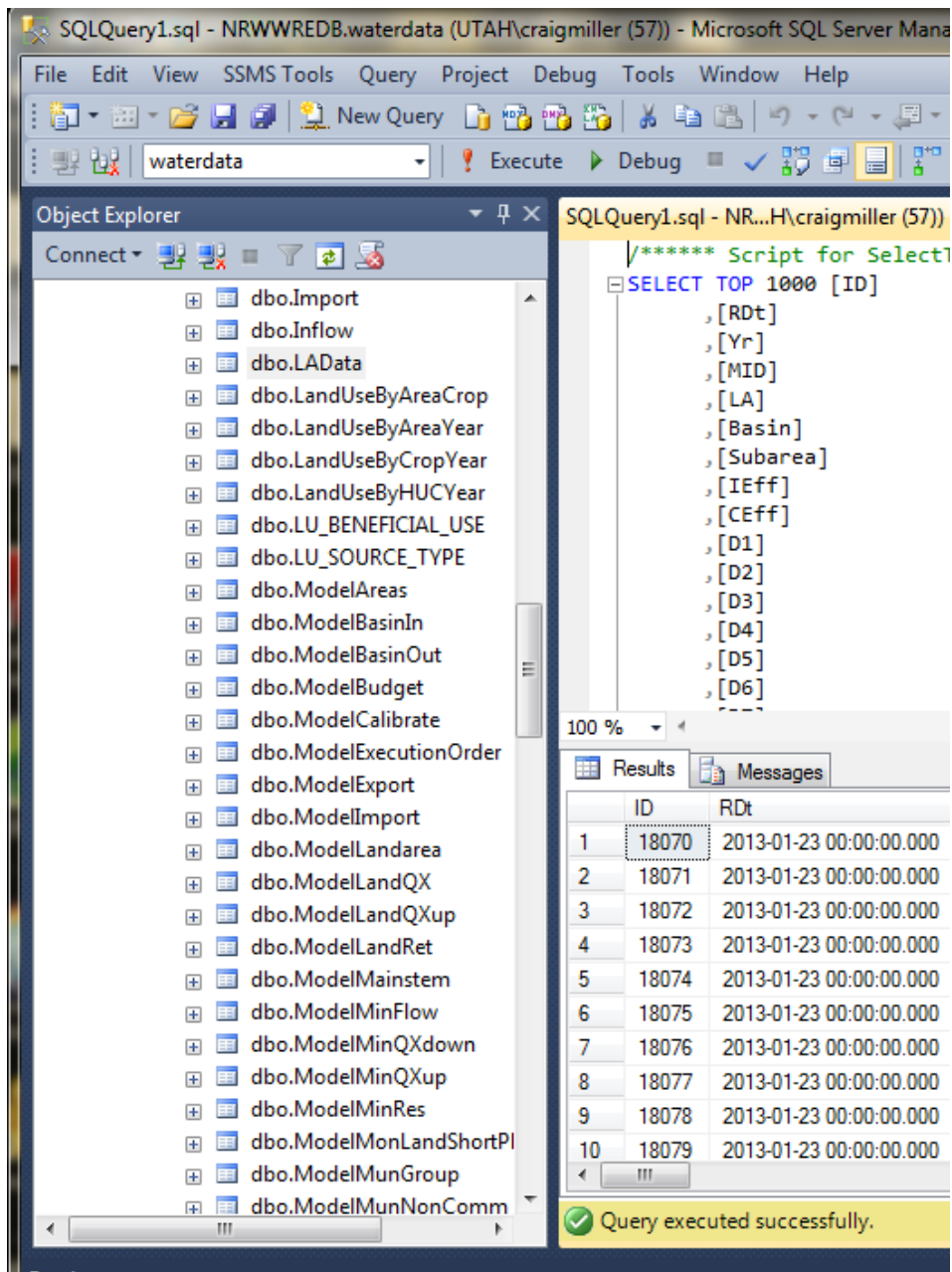
|   | Subarea  | Subarea Name |
|---|----------|--------------|
| ▶ | 05-01-00 | Gunnison     |

Type Year: Water Year (Oct1-Sep30)

Reservoir Data Agricultural Data Municipal Data

# Water Budget Output

# Data tables

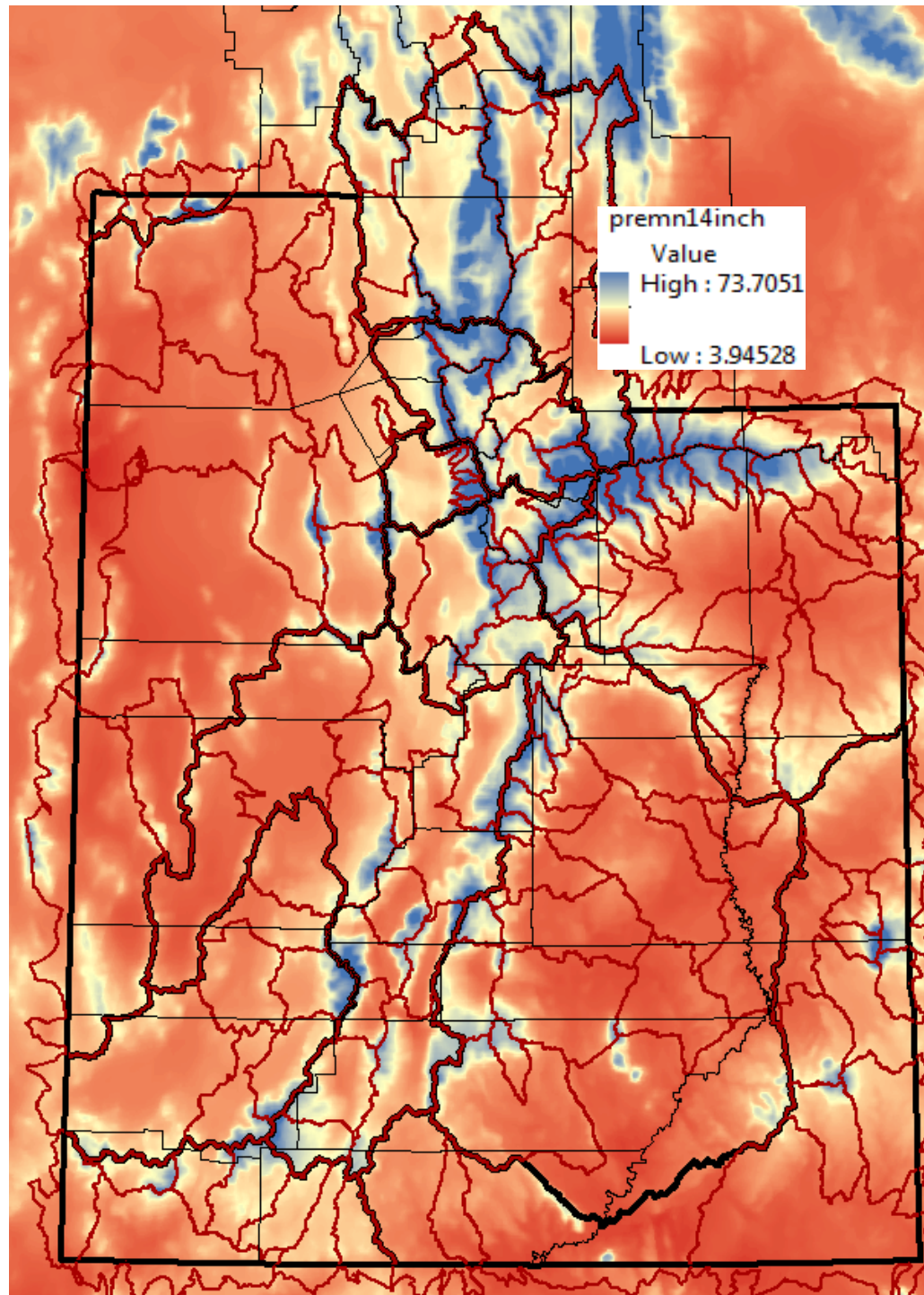


## Output files

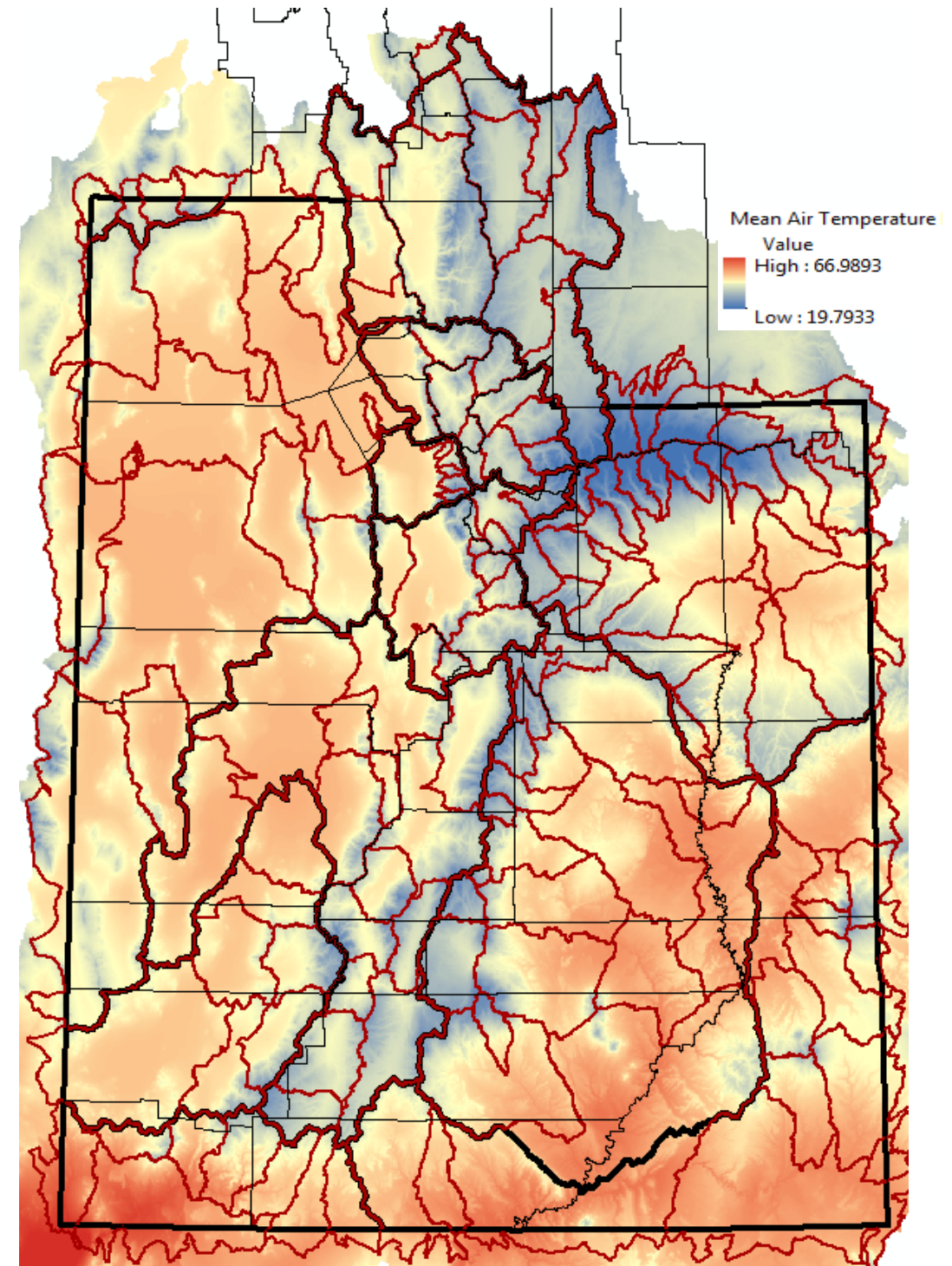
| Gunnison 05-01-00                     |       | PAGE NO. 90 06-07-2018 16:28:37 |       |       |       |       |       |       |       |       |       |       |        |
|---------------------------------------|-------|---------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| OUTPUT SUMMARY TABLE                  |       |                                 |       |       |       |       |       |       |       |       |       |       |        |
|                                       | OCT   | NOV                             | DEC   | JAN   | FEB   | MAR   | APR   | MAY   | JUN   | JUL   | AUG   | SEP   | ANN    |
| CLIMATOLOGICAL DATA                   |       |                                 |       |       |       |       |       |       |       |       |       |       |        |
| TEMPERATURE (DEG F.)                  | 48.8  | 36.3                            | 25.7  | 25.3  | 29.8  | 38.8  | 45.2  | 54.2  | 63.1  | 71.0  | 69.0  | 60.7  | 47.3   |
| CROPLAND PRECIPITATION (INCHES)       | 1.17  | 0.95                            | 1.17  | 0.97  | 1.08  | 0.99  | 1.12  | 1.03  | 0.72  | 0.67  | 0.78  | 1.08  | 11.73  |
| AVERAGE AREA PRECIPITATION (INCHES)   | 1.66  | 1.54                            | 1.92  | 1.74  | 1.70  | 1.71  | 1.90  | 1.61  | 0.87  | 0.91  | 1.14  | 1.42  | 18.13  |
| TRIBUTARY FLOWS                       |       |                                 |       |       |       |       |       |       |       |       |       |       |        |
| Tributary gauged flow 10208500        | 163   | 161                             | 163   | 157   | 142   | 208   | 648   | 3694  | 1076  | 315   | 149   | 127   | 7004   |
| Estimated pour point tributary inflow | 67    | 59                              | 44    | 43    | 51    | 105   | 333   | 524   | 295   | 147   | 109   | 64    | 1843   |
| Gaged tributary inflows to stream sys | 411   | 343                             | 294   | 264   | 228   | 370   | 1009  | 5379  | 5532  | 1876  | 758   | 495   | 16959  |
| Gaged inflows of Six Mile Creek (Wate | 609   | 563                             | 508   | 457   | 397   | 560   | 1309  | 5254  | 6693  | 2768  | 1197  | 726   | 21042  |
| Gaged tributary flows of Twelve Mile  | 831   | 635                             | 593   | 548   | 500   | 771   | 2348  | 6467  | 4653  | 2458  | 1282  | 914   | 22001  |
| SUBTOTAL                              | 2081  | 1761                            | 1602  | 1470  | 1320  | 2014  | 5648  | 21319 | 18248 | 7564  | 3495  | 2326  | 68849  |
| IMPORTS                               |       |                                 |       |       |       |       |       |       |       |       |       |       |        |
| Imports to San Pitch River through Gu | 205   | 153                             | 23    | 7     | 6     | 669   | 325   | 162   | 31    | 63    | 77    | 60    | 1783   |
| SUBTOTAL                              | 205   | 153                             | 23    | 7     | 6     | 669   | 325   | 162   | 31    | 63    | 77    | 60    | 1783   |
| EXPORTS                               |       |                                 |       |       |       |       |       |       |       |       |       |       |        |
| Exports to Sevier Bridge Subarea thro | -623  | -379                            | -400  | -394  | -390  | -417  | -3050 | -5795 | -5670 | -4906 | -3938 | -2018 | -27980 |
| Gaged Exports Through Old Field Canal | -481  | -226                            | -158  | -84   | -64   | -110  | -857  | -1306 | -1239 | -1165 | -791  | -429  | -6910  |
| Exports through Gunnison/Payette Cana | 0     | -691                            | -966  | -1075 | -1155 | -1200 | -1140 | -927  | 0     | 0     | 0     | 0     | -7155  |
| SUBTOTAL                              | -1105 | -1297                           | -1523 | -1553 | -1609 | -1727 | -5046 | -8029 | -6909 | -6071 | -4729 | -2446 | -42045 |
| UNGAGED FLOWS                         |       |                                 |       |       |       |       |       |       |       |       |       |       |        |
| Ungaged tributary inflows to stream s | 1013  | 451                             | 221   | 109   | 46    | 2     | 356   | 1111  | 1822  | 2473  | 2320  | 1802  | 11725  |
| Ungaged tributary inflow to stream sy | 7604  | 3107                            | 1373  | 655   | 283   | 2     | 2826  | 7199  | 15771 | 18939 | 19107 | 15122 | 91987  |
| SUBTOTAL                              | 8617  | 3558                            | 1593  | 764   | 328   | 4     | 3181  | 8310  | 17593 | 21411 | 21427 | 16925 | 103712 |
| TRANSBASIN IMPORTS                    |       |                                 |       |       |       |       |       |       |       |       |       |       |        |
| Import flow from Scofield gauged 0930 | 140   | 122                             | 110   | 99    | 97    | 140   | 72    | 328   | 404   | 742   | 545   | 255   | 3053   |
| Import flow from Huntington (Huntingt | 0     | 0                               | 0     | 0     | 0     | 0     | 18    | 84    | 300   | 54    | 3     | 1     | 460    |
| Import flow from Joes Valley (JoesVal | 0     | 0                               | 0     | 0     | 0     | 0     | 249   | 1167  | 4184  | 757   | 48    | 5     | 6410   |
| Import flows from Ferron              | 20    | 0                               | 0     | 0     | 0     | 0     | 6     | 43    | 109   | 48    | 10    | 3     | 239    |
| SUBTOTAL                              | 160   | 122                             | 110   | 99    | 97    | 140   | 345   | 1622  | 4997  | 1601  | 606   | 264   | 10162  |
| RESERVOIR OPERATION                   |       |                                 |       |       |       |       |       |       |       |       |       |       |        |
| Gunnison Reservoir                    |       |                                 |       |       |       |       |       |       |       |       |       |       |        |
| NET EVAPORATION Gunnison Reservoir    | -67   | -31                             | 31    | 0     | -16   | -87   | -153  | -309  | -342  | -340  | -267  | -103  | -1685  |
| +/- STORAGE Gunnison Reservoir        | -2467 | -2259                           | -1498 | -1121 | -988  | -690  | 433   | 1353  | 2490  | 2937  | 1908  | -3    | 97     |
| Ninemile Reservoir                    |       |                                 |       |       |       |       |       |       |       |       |       |       |        |
| NET EVAPORATION Ninemile Reservoir    | -27   | -12                             | 8     | -2    | -5    | -12   | -31   | -60   | -81   | -93   | -63   | -48   | -426   |
| +/- STORAGE Ninemile Reservoir        | -123  | -125                            | -78   | -28   | -13   | -43   | -19   | -88   | -134  | 379   | 354   | -39   | 43     |
| TOTAL SUBAREA SUPPLY                  | 7276  | 1869                            | 270   | -364  | -880  | 269   | 4683  | 24280 | 35893 | 27451 | 22809 | 16936 | 140499 |

# Water Budget Data Inputs

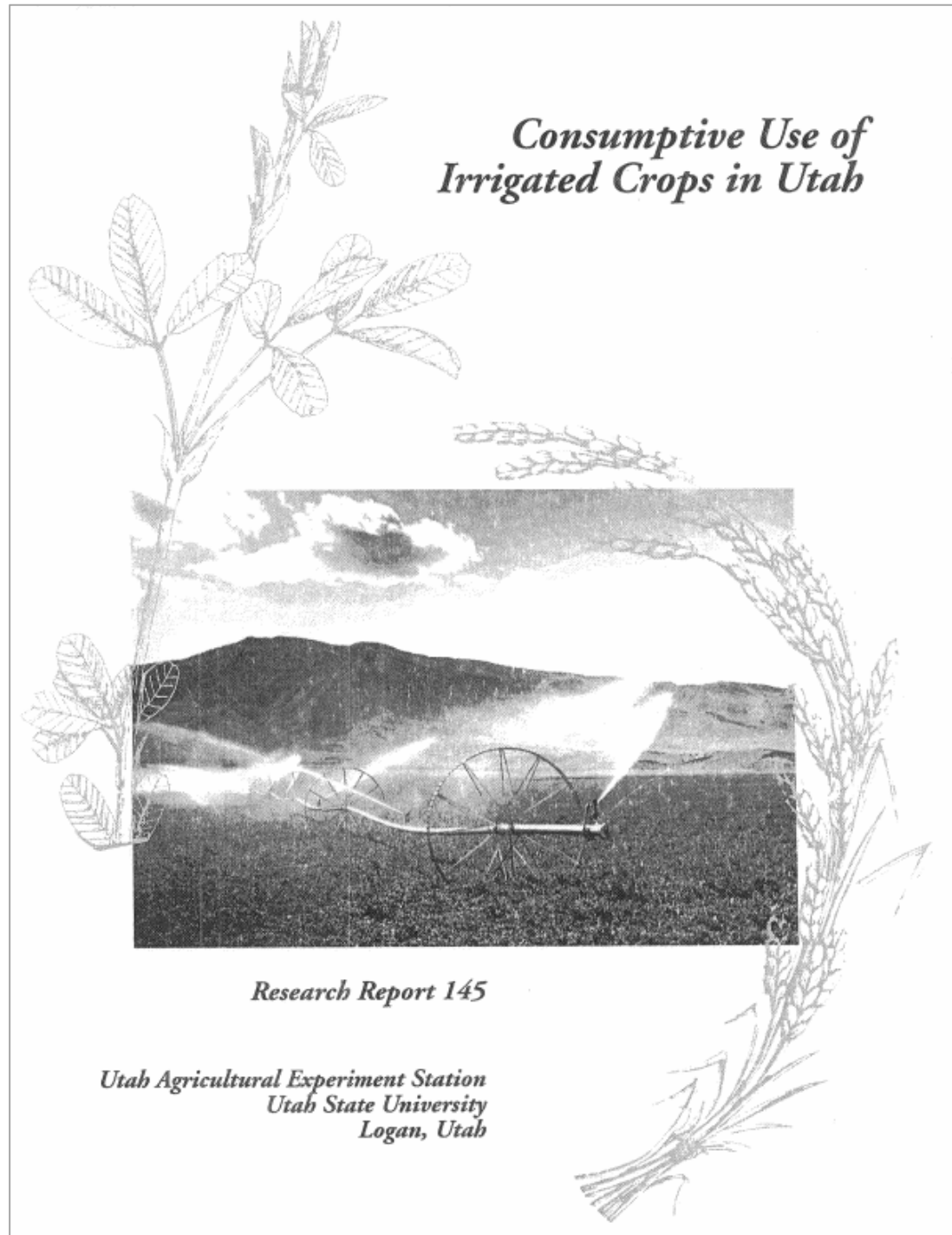
## Gridded Precipitation



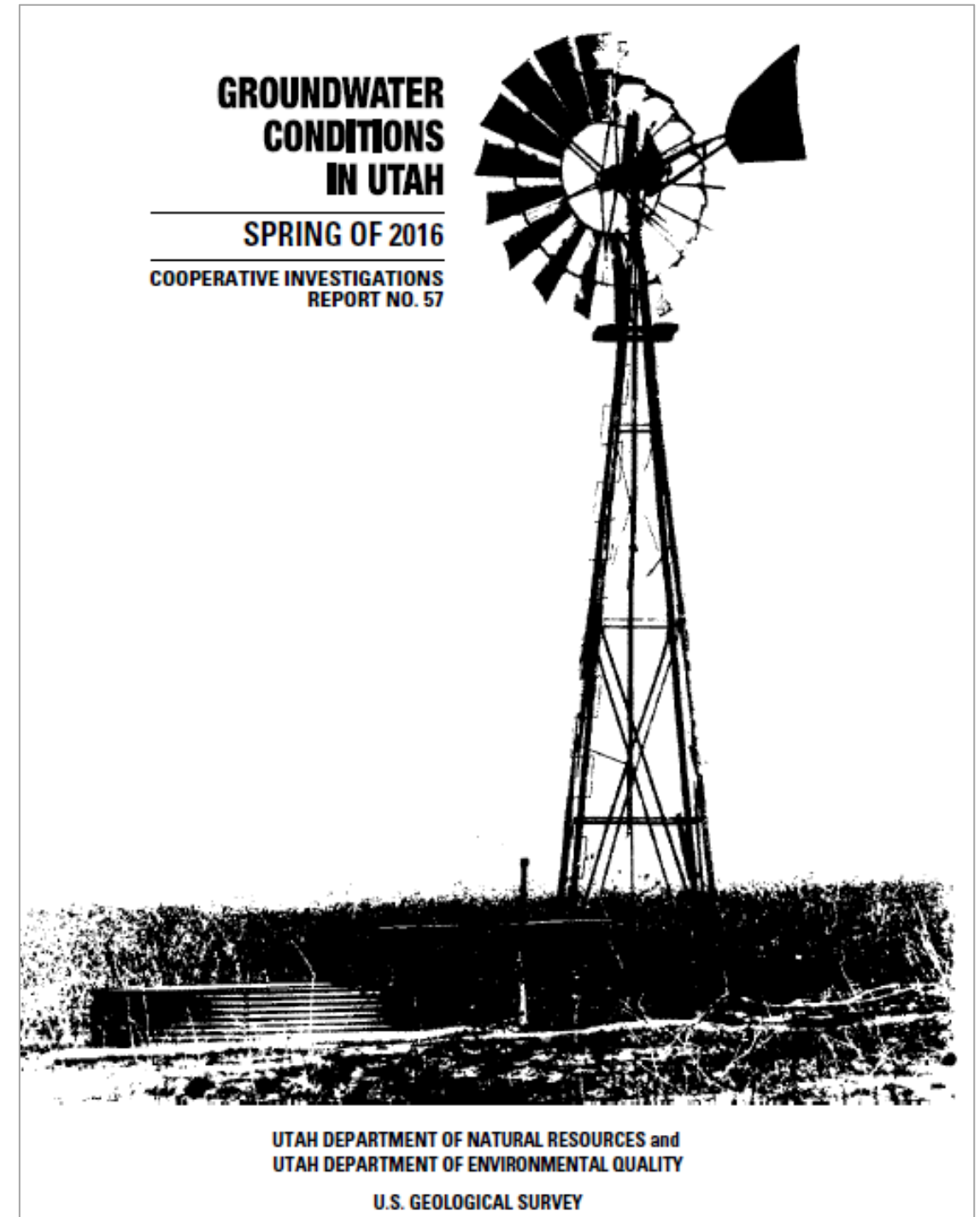
## Gridded Temperature



## Region-specific crop coefficients for Blainey Criddle



## Groundwater use proportioned to subareas



# Gauged stream flow

## USGS Surface-Water Daily Data for Utah

Click to hide state-specific text

UTAH

### Choose Site Selection Criteria

Choose from the following criteria to constrain the number of sites selected, preselected below and will default to surface water on the following page. If and no additional specifications are defined on the following page then output have daily values data.

Surface-water [daily data example](#).

| Site<br>-- Location --                               | Site<br>-- Identifier --                         | Site<br>-- Attribute --                         |
|------------------------------------------------------|--------------------------------------------------|-------------------------------------------------|
| <input type="checkbox"/> ? County                    | <input type="checkbox"/> ? Site Name             | <input checked="" type="checkbox"/> ? Site type |
| <input type="checkbox"/> ? Hydrologic Unit (by Code) | <input type="checkbox"/> ? Site Number           | <input type="checkbox"/> ? Drainage area        |
| <input type="checkbox"/> ? Hydrologic Unit (by Name) | <input type="checkbox"/> ? Multiple Site Numbers |                                                 |
| <input type="checkbox"/> ? Lat-Long box              | <input type="checkbox"/> ? Agency Code           |                                                 |
|                                                      | <input type="checkbox"/> ? File of Site Numbers  |                                                 |

# USBR reservoir and canal data

Reservoir

FLAMING GORGE RESERVOIR

Reservoir: FLAMING GORGE RESERVOIR

Select Data Type:

☒ Daily Data

☐ Monthly Data

☒ Most Recent Data

Previous 120 day(s) (7-120)

☐ Archived Data (> 120 Days)

Year Month Day  
Earliest Date: 1962 11 1  
Latest Date: 2017 2 23

Output (Name (Units), (Earliest date - Latest date))

- ☐ Elevation (feet) (12-01-1968 -- 02-23-2017)
- ☐ Storage (af) (12-02-1962 -- 02-23-2017)
- ☐ Evaporation (af) (11-01-1962 -- 02-23-2017)
- ☐ Inflow\*\* (cfs) (12-03-1962 -- 02-23-2017)
- ☐ Unregulated Inflow\*\*\* (cfs) (11-01-1962 -- 02-23-2017)
- ☐ Power Release (cfs) (10-01-1963 -- 02-23-2017)
- ☐ Bypass Release (cfs) (02-03-2004 -- 02-23-2017)
- ☐ Spillway Release (cfs) (02-03-2004 -- 02-23-2017)
- ☐ Total Release (cfs) (11-01-1962 -- 02-23-2017)

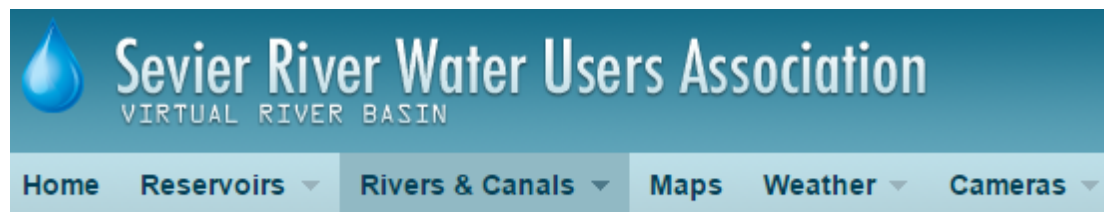
Output Format

- ☒ Graph
- ☐ Data Table
- ☐ Graph with Max/Min Values\*
- ☐ Data Table with Max/Min Values
- ☐ Download Data to Excel

Submit

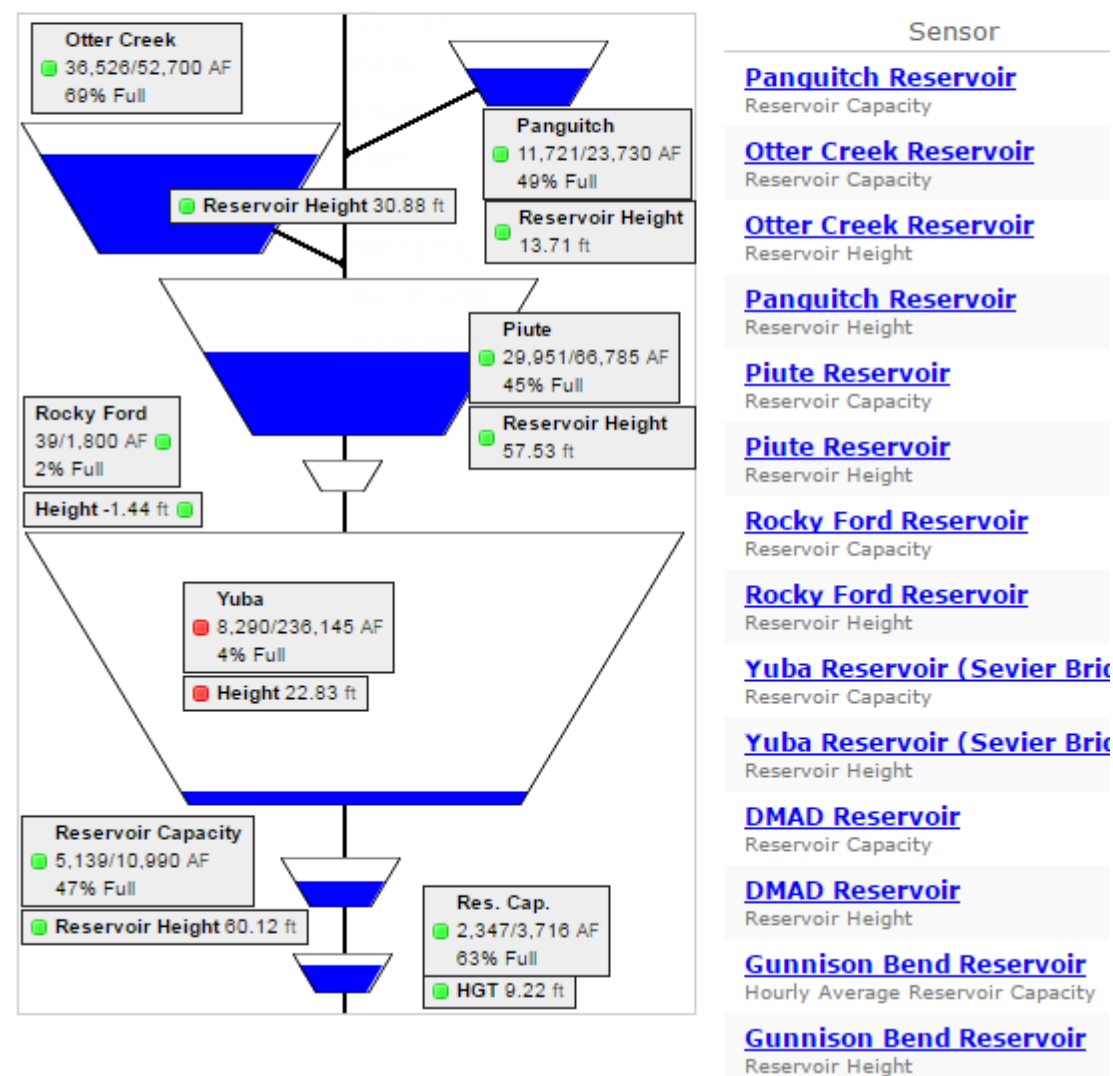
Reset

# Regional/State data sets



[Home](#) > [Reservoirs](#) > Teacup Diagram of Reservoirs

## Teacup Diagram of Reservoirs

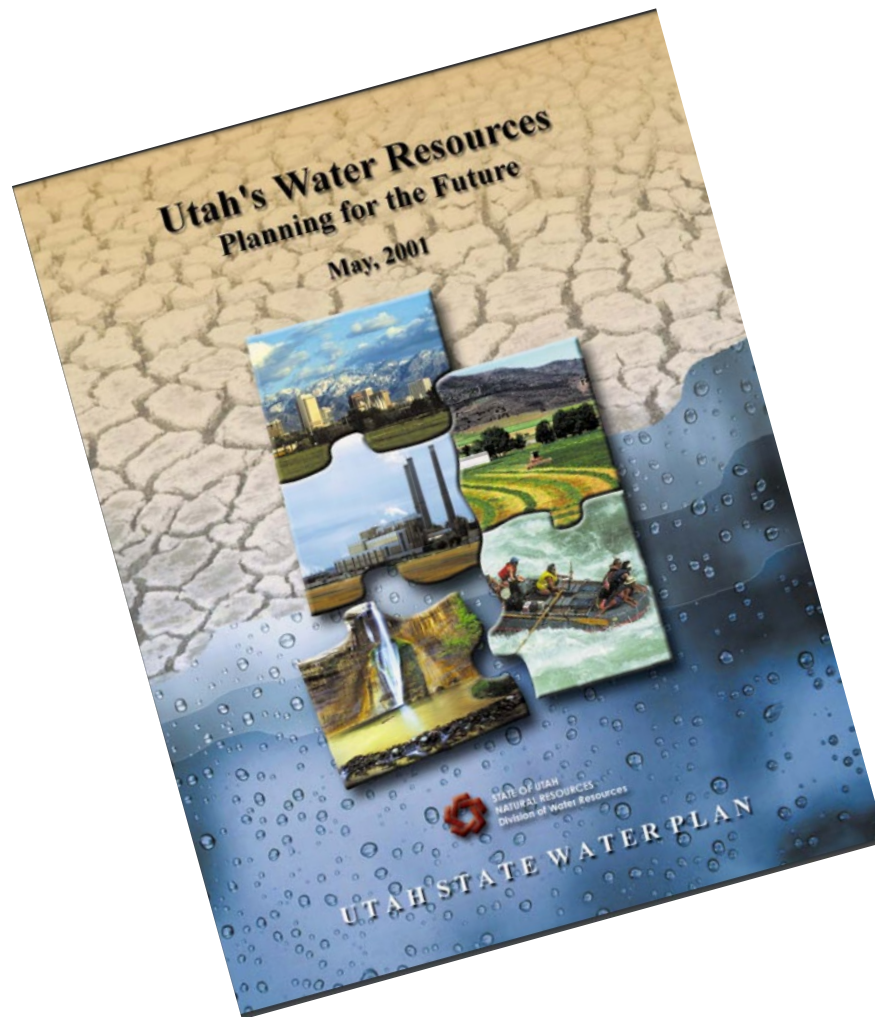


### In Addition

- Soils Data
- Subarea Irrigation Efficiency
- Riparian Vegetation
- Reservoir Elevation-Area-Storage Tables
- USGS StreamStats and Area Altitude Flow Estimates
- Water Rights Canal Flow/Reservoir Data
- Water users and distributors

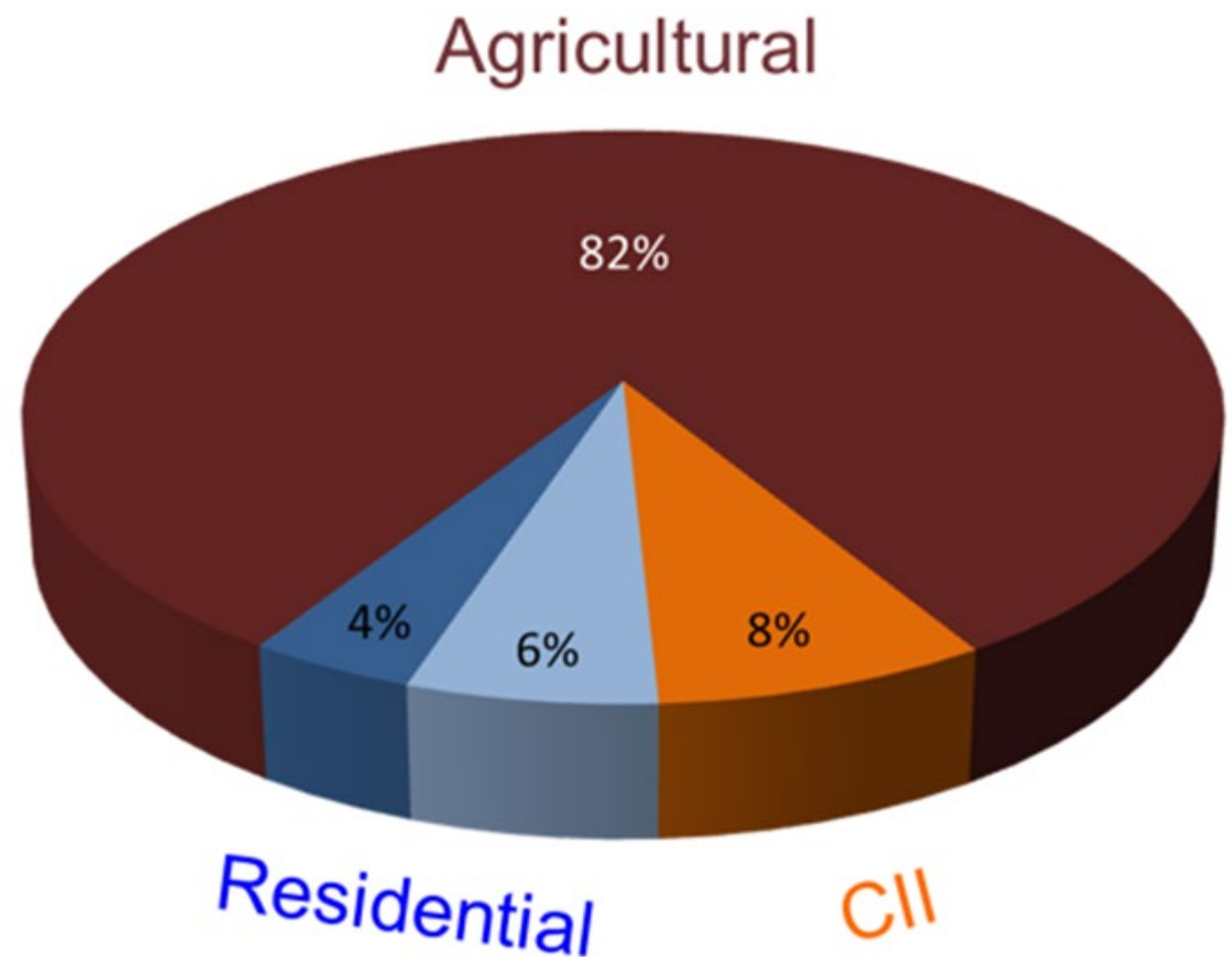
# Water Budget Data Uses

Budget data appears in  
basin and statewide  
water plans

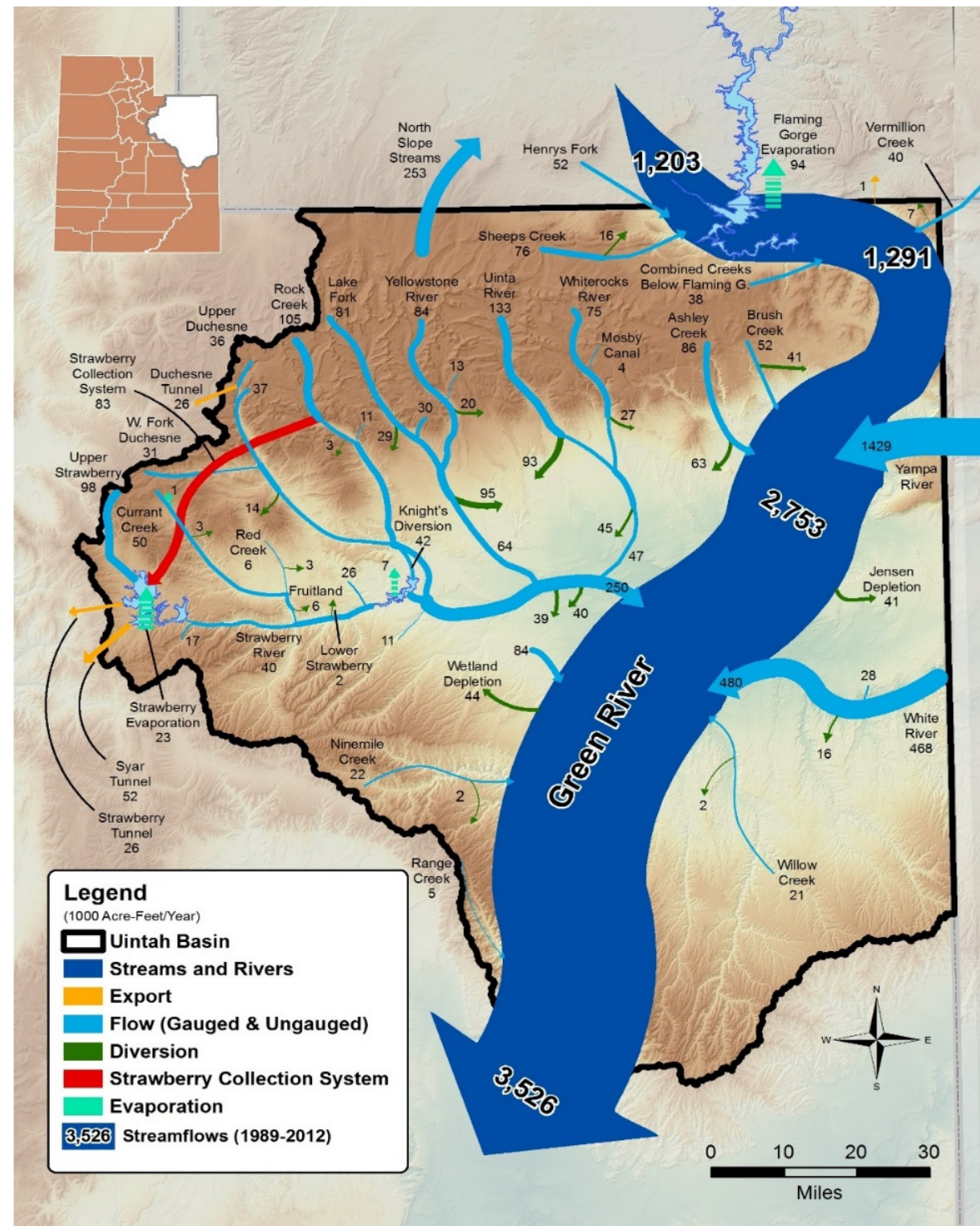


| Category                                        | Water Supply<br>(acre-feet) |
|-------------------------------------------------|-----------------------------|
| Total Precipitation                             | 61,500,000                  |
| Used by vegetation and<br>natural systems       | 53,789,000                  |
| <i>Basin Yield</i>                              | <i>7,711,000</i>            |
| Compact Decreases                               | 535,000                     |
| Ground Water Mining<br>Increases & Other Inflow | 135,000                     |
| <i>Supply</i>                                   | <i>7,311,000</i>            |
| GSL Evaporation                                 | 3,000,000                   |
| Other Natural Depletions                        | 998,000                     |
| <i>Available Supply</i>                         | <i>3,313,000</i>            |
| Agricultural Depletions                         | 2,175,000                   |
| M&I Depletions                                  | 443,000                     |
| <i>Yield that flows out of state</i>            | <i>695,000</i>              |

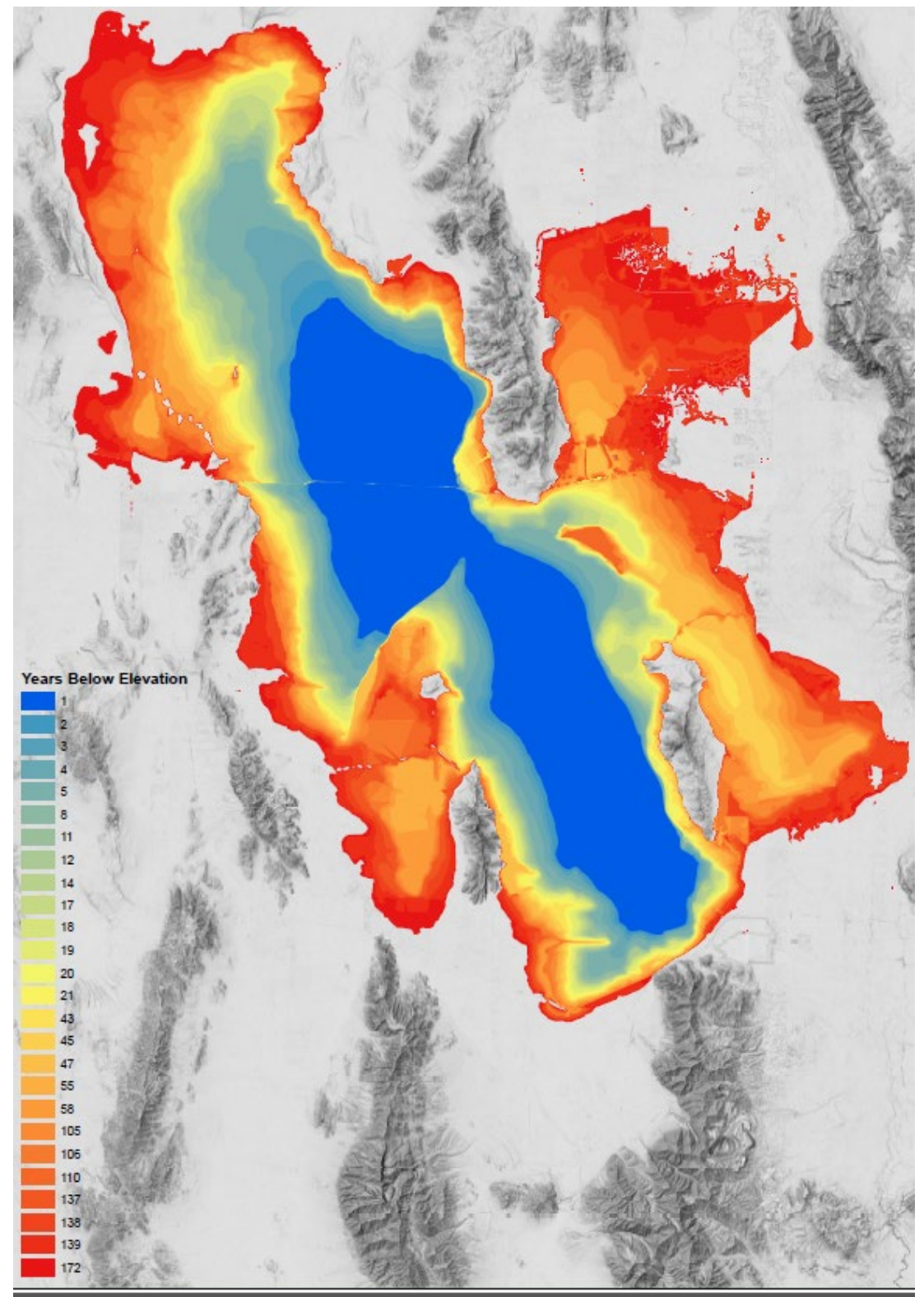
Budget data is used to analyze how and where water is used. This is valuable information for water planners and providers.



## Flow diagrams



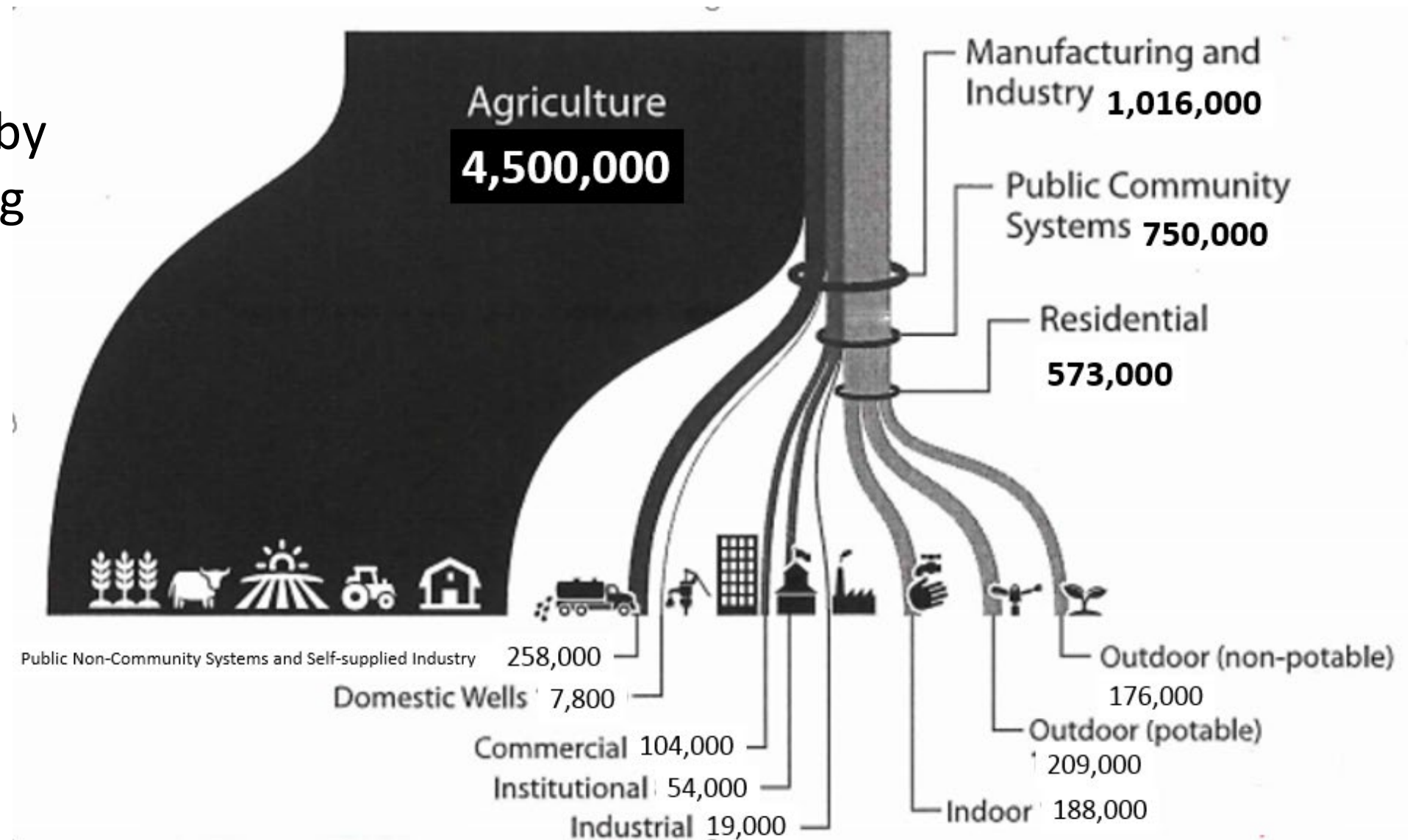
Budget data is used as input to other models like our Great Salt Lake model. The depletion from current uses was used to create this graphic showing modeled years below various elevations.



Reservoir data  
(evaporation, inflow,  
outflow, elevation-  
area-capacity tables,  
etc.) for over 100  
Utah reservoirs.



Answers questions by  
researchers seeking  
information.



## Data for interstate agreements and compacts

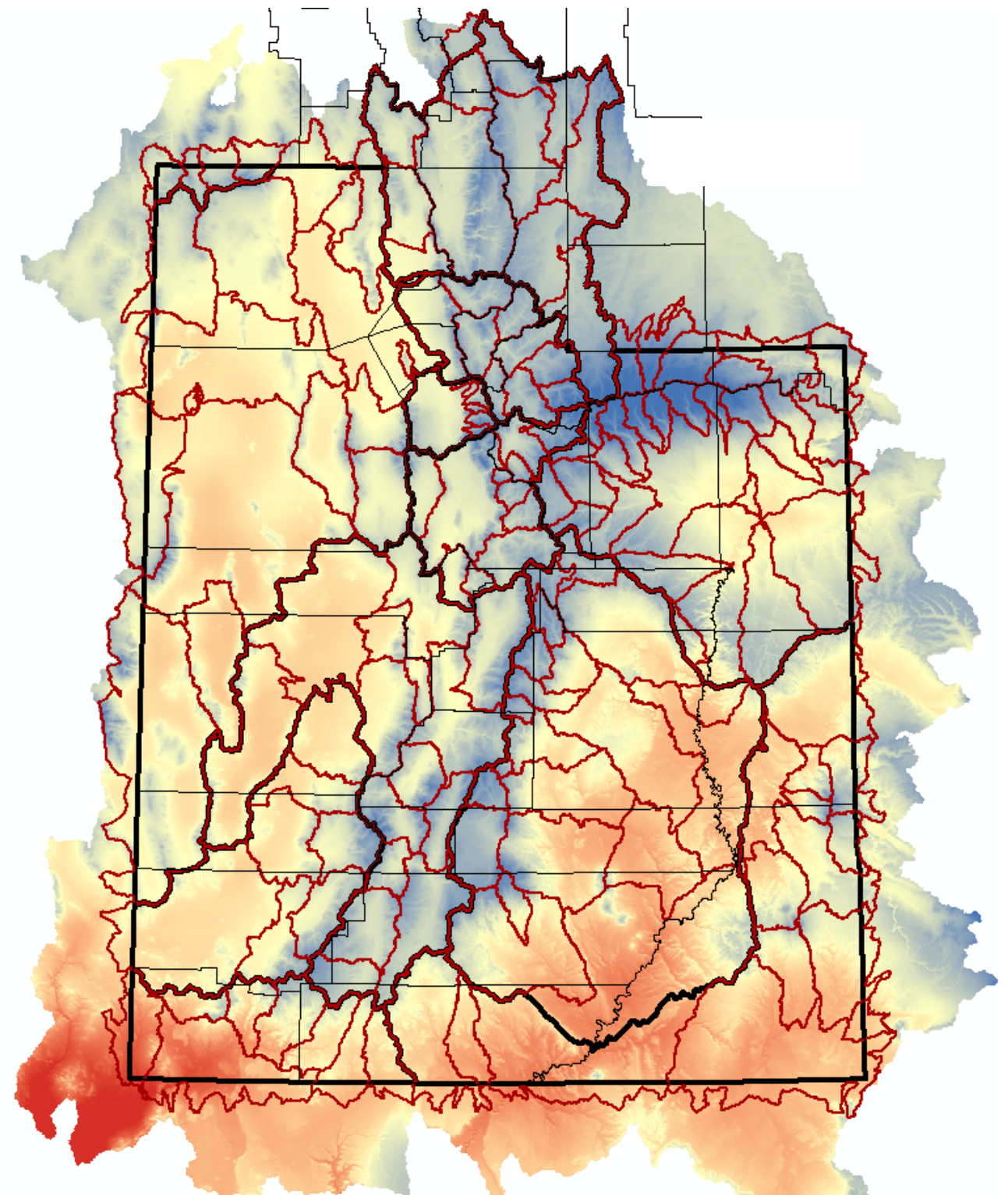
| Annual agricultural depletions for the Bear River Basin |              |                    |                |                |               |
|---------------------------------------------------------|--------------|--------------------|----------------|----------------|---------------|
| Subarea                                                 | Subarea Name | Total<br>Depletion | Idaho          | Utah           | Wyoming       |
| 01-01-01                                                | Bear Lake    | 47,619             | 40,413         | 7,206          |               |
| 01-01-02                                                | Soda Springs | 5,158              | 5,158          |                |               |
| 01-01-03                                                | Oneida       | 20,292             | 20,292         |                |               |
| 01-01-04                                                | Cache Valley | 210,669            | 79,308         | 131,362        |               |
| 01-01-05                                                | Malad        | 34,693             | 34,665         | 28             |               |
| 01-01-06                                                | Tremonton    | 148,627            | 4.4            | 148,623        |               |
| 01-01-07                                                | Brigham City | 39,479             |                | 39,479         |               |
| 01-02-01                                                | Cokeville    | 15,837             |                | 1,437          | 14,400        |
| 01-02-02                                                | Thomas Fork  | 8,541              | 6,918          |                | 1,623         |
| 01-03-01                                                | Evanston     | 13,329             |                | 1,612          | 11,717        |
| 01-03-02                                                | Randolph     | 57,426             |                | 57,426         |               |
| <b>Total</b>                                            |              | <b>601,672</b>     | <b>186,758</b> | <b>387,173</b> | <b>27,740</b> |

# Water Budget 2.0



- We see some reasonably possible upgrades in the near future.
- Some technologies already exist, others must be created.

- Gridded region-wide ET
- Monthly grids for each
  - Crop
  - Riparian type
  - Open water surface type
- ASCE Penman
  - NASA datasets
  - Corrected to stations
- OpenET?



# Data Sharing Applications



Utah's Open Water Data

Publicly available data provided by the Utah Division of Water Resources

*Our mission is to Plan, Conserve, Develop and Protect Utah's Water Resources.*

The Utah Division of Water Resources (DWRe) is charged with providing comprehensive water planning for the state. DWRe carries out various planning activities that identify future water needs, and assists our partner entities in meeting those future needs. Additionally, the Division maintains water supply and land use data for each river basin in the state, which is available on this site for public use.

## Featured DWRe Applications

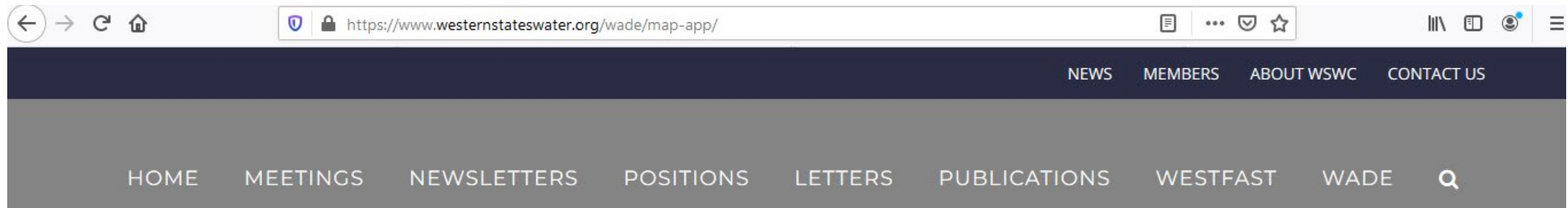


### Open Tap: Utah's Water Data Directory

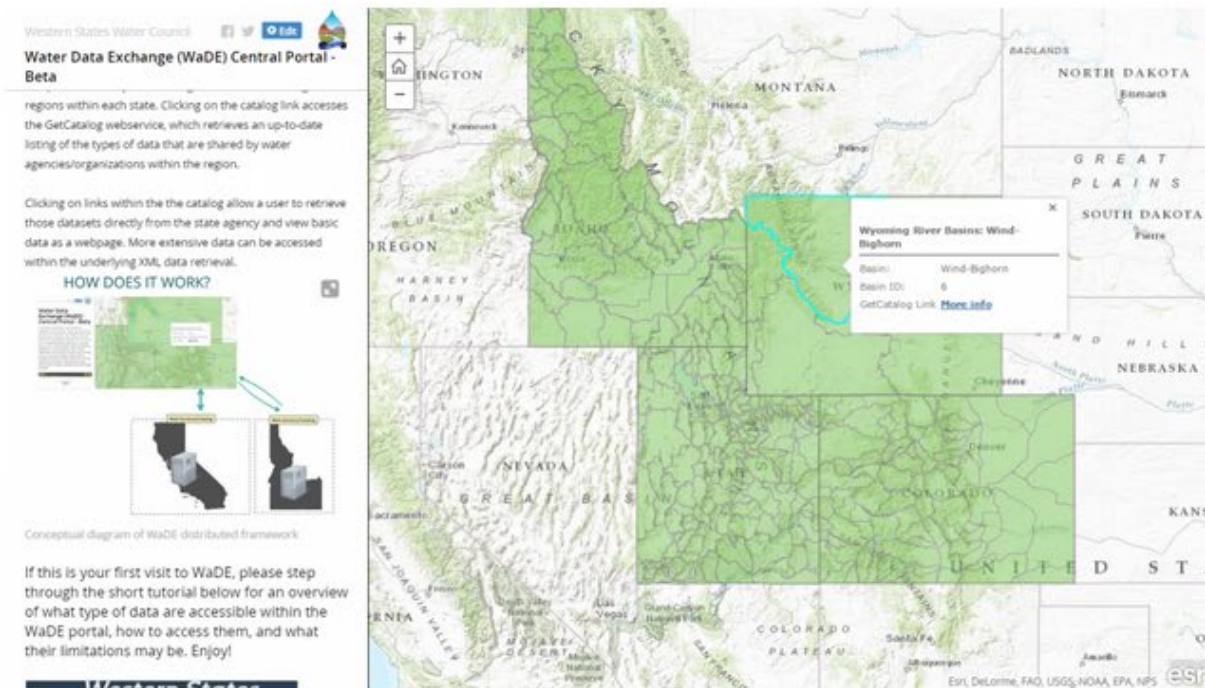
Open Tap is the Division of Water Resources' one-stop shop for water-related data and conservation information. This application increases transparency and data access and provides a useful tool for researchers, water professionals, and the public.

<http://dwre-utahdnr.opendata.arcgis.com/>

# Western Area Data Exchange (WaDE)



*Thanks again to our WaDE partners who are plugged into WaDE and willing to share their valuable data with our users!*



Greetings! Welcome to the Water Data Exchange (WaDE) Central Portal Gateway. In order to access the WaDE portal we ask that you first register with the WSWC. This allows us to not only provide some security for WaDE web services, but also allows us to work collaboratively with users, who can provide feedback and also receive updates as the WaDE data schema evolves.

# USGS – Estimated Water Use in the U.S.

## WATER USE

 Water-use home

### Summaries

- Total water use
- Groundwater
- Surface water
- Historical trends

### Water use by category

- Public supply
- Domestic
- Irrigation
- Thermoelectric power
- Industrial
- Mining
- Livestock
- Aquaculture

### Data downloads

### Publications

- National
- State
- Methods

## Estimated Use of Water in the United States County-Level Data for 2010

The current best estimates of county, State, and national water-use data may be downloaded from the **National Water Information System Web (NWISWeb)** interface, [Water Data for the Nation](#). Data on NWISWeb may have been revised from previous publications such as Circular 1405.

These data files present water-use estimates by county for the United States, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands which support the State-level water-use estimates published in [USGS Circular 1405](#), *Estimated Use of Water in the United States in 2010*. [Publication data files for other 5-year reports are also available](#).

The [summary of category changes](#) and the [water-use terminology page](#) may also be helpful.

### Comprehensiveness of data collection for 2010

- All States provided estimates for **public supply, domestic, irrigation, livestock, aquaculture, industrial, mining, and thermoelectric power** water use. All States also provided estimates of **public supply deliveries for domestic use**.
- All States will have estimates of the total population served by public supply. States optionally may have estimated public supply population served by groundwater and surface water.
- All States will have estimates of total irrigation. States optionally may have estimated subtotals for crop irrigation and golf-course irrigation.
- No consumptive-use data were collected nationally for any of the categories for 2010.
- No **commercial** water-use data were collected nationally for 2010.
- No **wastewater release** data were collected nationally for 2010.
- No **hydroelectric** power instream use data were collected nationally for 2010.
- Public-supply deliveries for commercial, industrial, and thermoelectric power were not collected nationally for 2010.

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# Thoughts About

- OpenET
- Internet of Water
- WaDE
  
- Previous Presentations...