

# Next Generation Water Observing System

## *Selecting the Next Basin in the West*



Mike Woodside, Acting Program Manager NGWOS

# USGS Water Mission Integrated Priorities

Observe  
Deliver  
Assess  
Predict  
Inform



## Water Hazards

Water Hazards develops tools to support improved planning and decision-making before, during, and after extreme hydrologic events and water emergencies like floods, droughts, and contaminant spills.



## Integrated Water Availability Assessments

IWAAs examine the supply, use, and availability of the nation's water. These regional and national assessments evaluate water quantity and quality in both surface and groundwater, as related to human and ecosystem needs and as affected by human and natural influences.



## Water Prediction Work Program

2WP builds a powerful set of modeling tools to predict the amount and quality of surface and groundwater, now and into the future. These models use the best available science to provide information for more rivers and aquifers than can be directly monitored.



## Next Generation Water Observing System

NGWOS collects real-time data on water quantity and quality in more affordable, rapid, and widespread ways than has previously been possible. The flexible monitoring approach enables USGS networks to evolve with new technology and emerging threats.



## NWIS Modernization

NWIS data systems that house USGS water information are being modernized to maximize data integrity, simplify data delivery to the general public, and automate early warning to enable faster response times during water emergencies.

# Advanced Water Models Require High-Density Data

*Nearly 30 million stream reaches in U.S.*

USGS operates about 10,000 streamgages  
(about 3/100 of one percent of reaches)

*About 143,000 Community Supply Wells and over  
14 million domestic wells in U.S.*

USGS and our Cooperators measure water levels in about 17,000 wells

- Modern models require high-density data describing streamflow, evapotranspiration, water storage in snowpack, soil and groundwater, and many others.
- The density of our current monitoring networks limit the ability to accurately understand and predict water-resource conditions with these advanced models

# Monitoring Components of the Next Generation Water Observing System



Identify water monitoring gaps and data needs related to integrated water modeling and stakeholder decision-making.



Establish integrated set of fixed and mobile monitoring assets in the water, ground, and air.



Integrate delivery of water quantity, quality, and use data



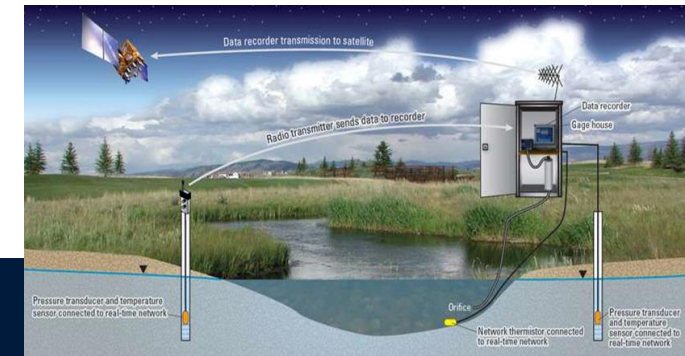
Work with partners and stakeholders to inform modern water prediction and decision-support systems



# What will the Next Generation Water Observing System Monitor?

When fully implemented, the USGS NGWOS will provide real-time field and remote-sensing data on:

- Streamflow;
- Water-cycle components (ET, snowpack, soil moisture);
- Broad suite of water-quality constituents in streams and groundwater
- Connections between groundwater and surface water;
- Stream velocity distribution;
- Sediment transport; and Water use.



# Next Generation Water Observing System (NGWOS) Basins

- **We can't afford to monitor everywhere...**
- **Implement NGWOS in ~10 medium-sized watersheds** (10,000-20,000 mi<sup>2</sup> each) that are representative of larger water-resource regions and augment the existing water monitoring network elsewhere in the region with modest enhancements.
- NGWOS is NOT a replacement for our existing networks, it builds upon the strength of our SW/GW/WQ networks

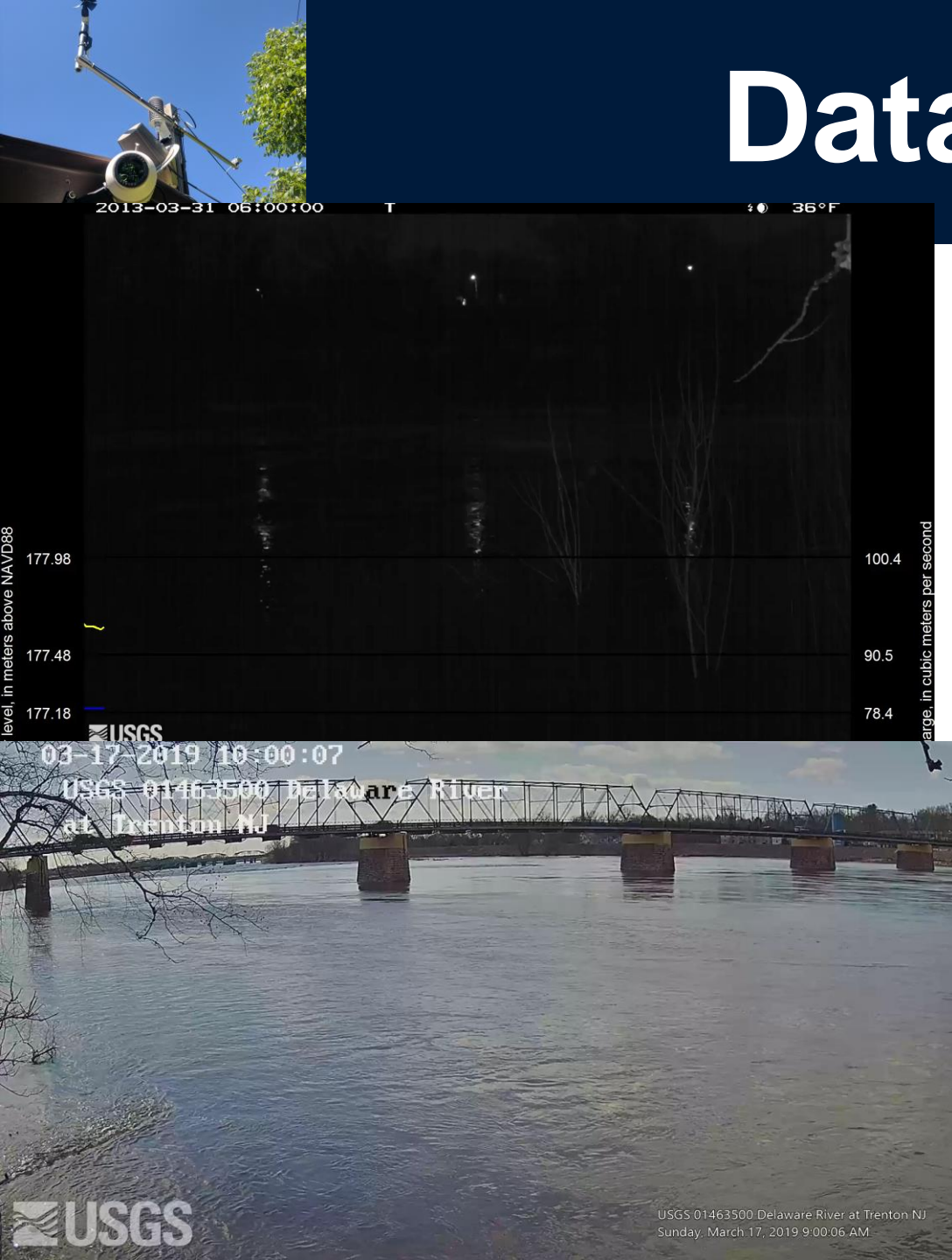
# **Next Generation Water Observing System (NGWOS) Pilot in the Delaware River Basin**

**An opportunity to develop an integrated water observing system to support innovative modern water prediction and decision support systems in a nationally important, complex interstate river system.**

## **Delaware River Basin Pilot began in 2018**

- Ecologically diverse and critical to the regional and national economy;
- Provides drinking water to over 15 million people;
- Long history of innovative, regional solutions to insure the long-term sustainability of this treasured resource.

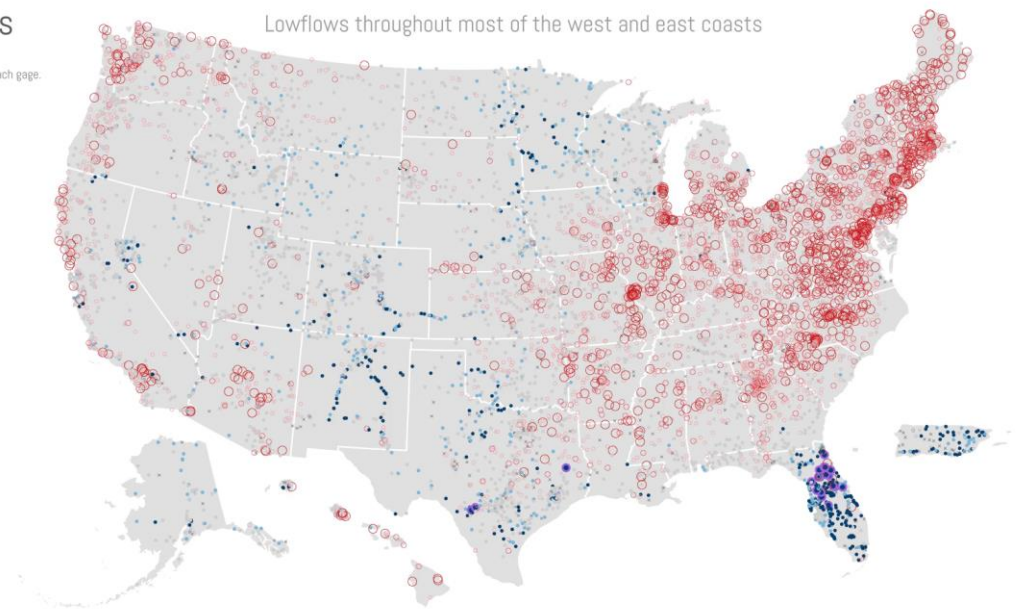
# Data Delivery



## U.S. River Conditions Water Year 2018

Conditions are relative to the historic daily record for each gage.

- Flooding\* ●
- Wettest ●
- Wet ●
- Normal ●
- Dry ●
- Drier ●
- Driest ●
- No data ×



\* Both USGS gage height and National Weather Service flood stage levels are necessary to determine flooding conditions and were available for 38% of gages at the time this graphic was produced. We used only publicly available data from NWISWeb and some gages are missing gage height even when they have flow.



# Selecting the Next Generation Water Observing System (NGWOS) Basin in the Western U.S

## **STREAMLINED Selection Process**

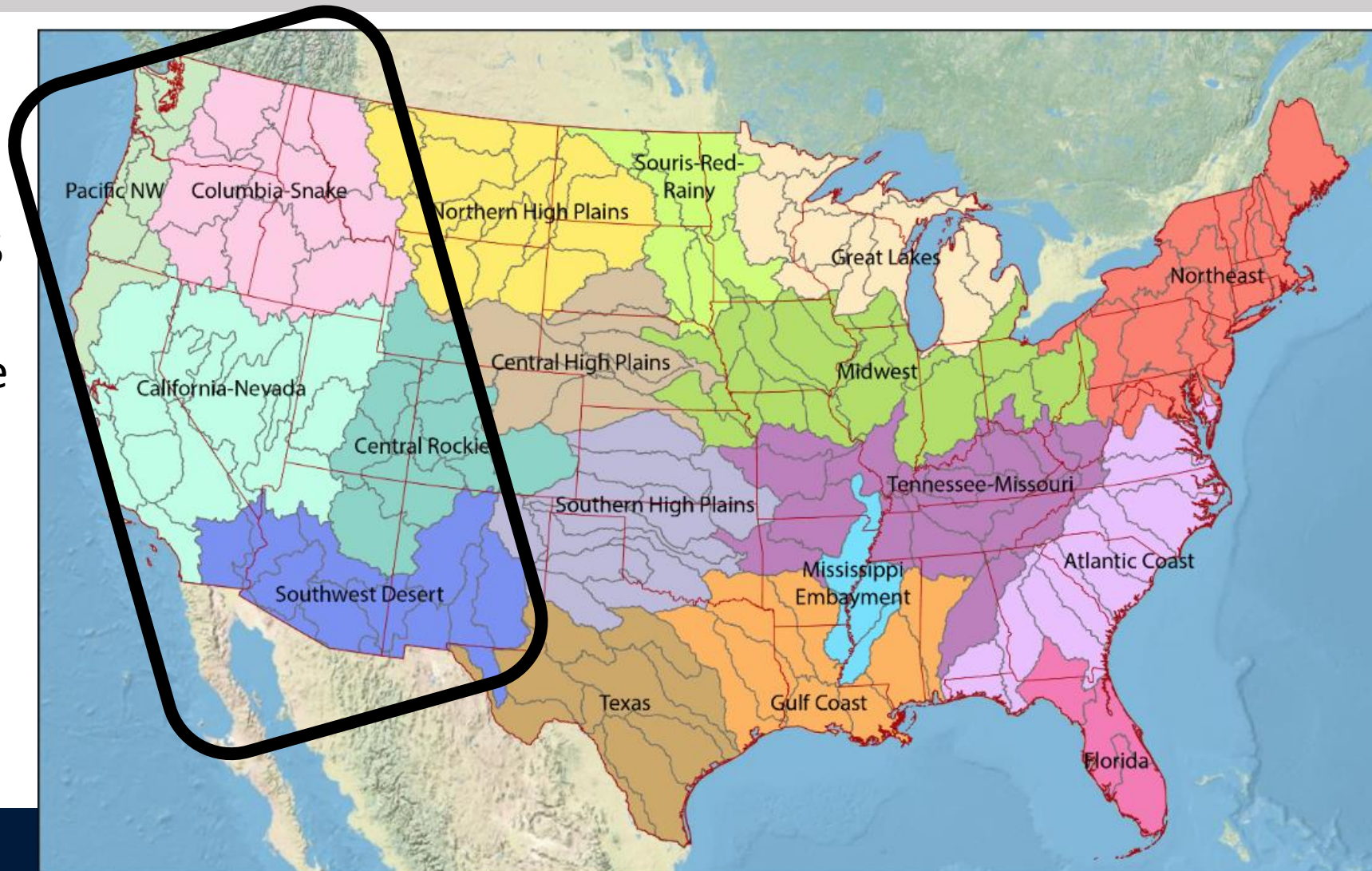
- National criteria for ranking basins (Quantitative)
- Basin nominations from USGS Water Science Centers and ranked by USGS Regional Directors (Field Input – Issue Based)
- Stakeholder Engagement



# Basin Ranking Framework (Quantitative)

18 Hydrologic Regions identified by applying cluster analysis to HUC-4 basins, based on proportions of the 20 Hydrologic Landscape Regions (Wolock, 2003) in each basin.

Use this framework to select 9 NGWOS basins, focusing on a basin in the west to start in FY20



# Basin Selection Variables

## 12 Variables Selected to Represent...

(considered 100s of GIS variables, but many covaried)

- Water Use (1)
- Water Demand Stress (2)
- Land Use (2, Urban and Ag)
- Historical and Projected Trends in Land Use (3)
- Projected Precipitation (1)
- Runoff (1)
- Hydrologic Alteration (1)
- Fire Risk (1)



# Basin Selection Variables

## 12 Variables Selected to Represent...

(considered 100s of GIS variables, but many covaried)




x2

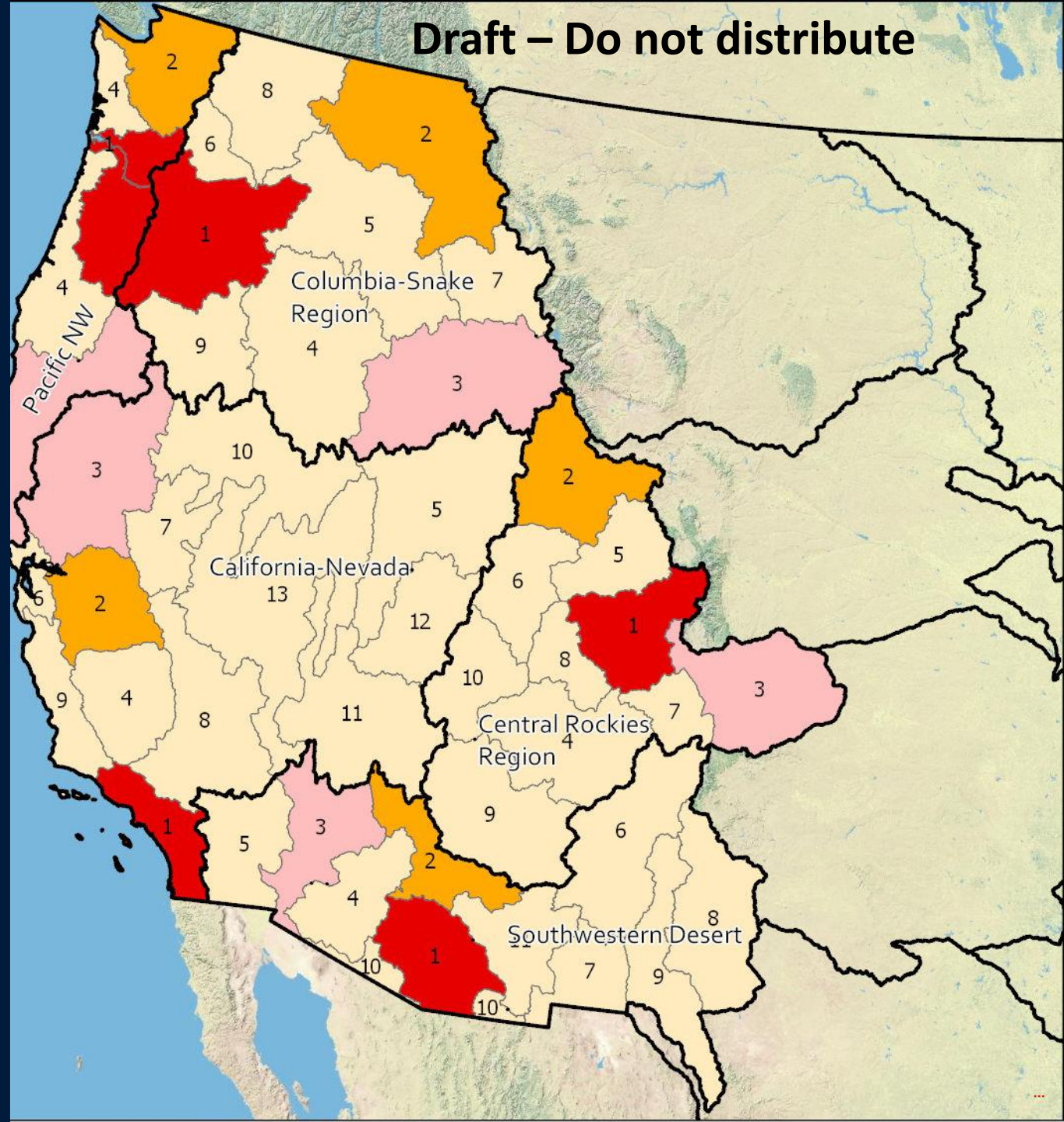
Weighting factor  
applied to  
variables to  
represent  
importance of  
water resources in  
the basin

- **Water Use** (1)
- **Water Demand Stress** (2)
- Land Use (2, Urban and Ag)
- Historical and Projected Trends in Land Use (3)
- Projected Precipitation (1)
- **Runoff** (1)
- Hydrologic Alteration (1)
- Fire Risk (1)



# Rankings of Basins in each of the Hydrologic Regions in the West

-  #1 Ranked Basins
-  #2 Ranked Basins
-  #3 Ranked Basins



# Proposed Basins in each Region

## Columbia-Snake:

- **Middle Columbia** and Kootenai-Pend Oreille-Spokane

## Central Rockies:

- **Upper Colorado** and Green

## Southwest Desert:

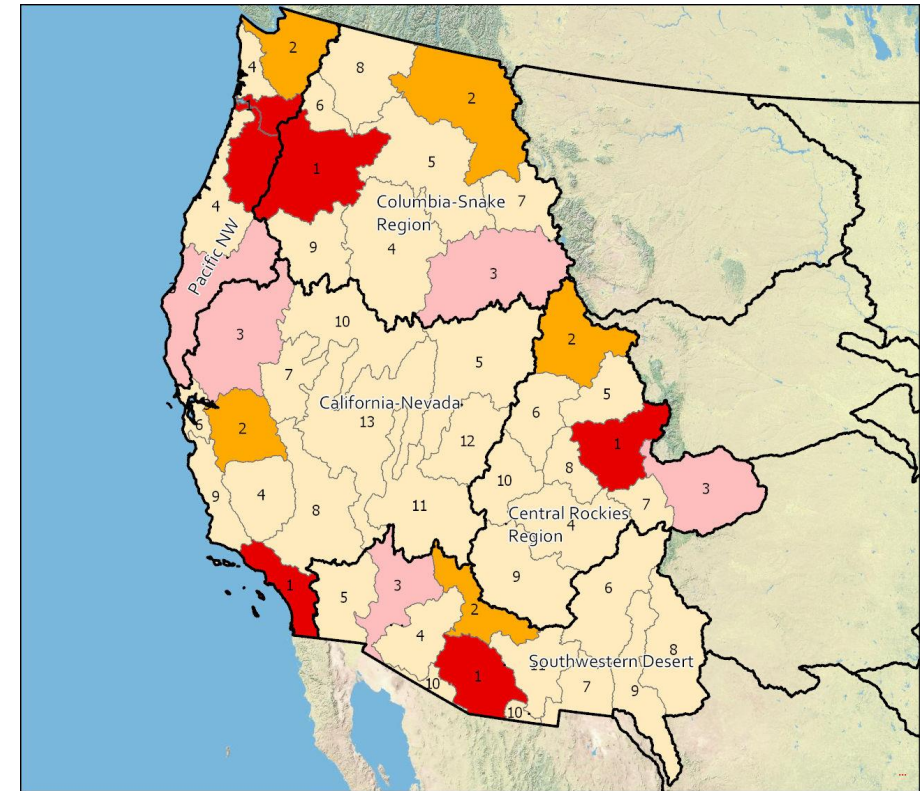
- **Middle Gila** and Salt

## Pacific northwest:

- **Willamette** and Puget Sound

## California-Nevada:

- **Southern California Coastal** and **San Joaquin**

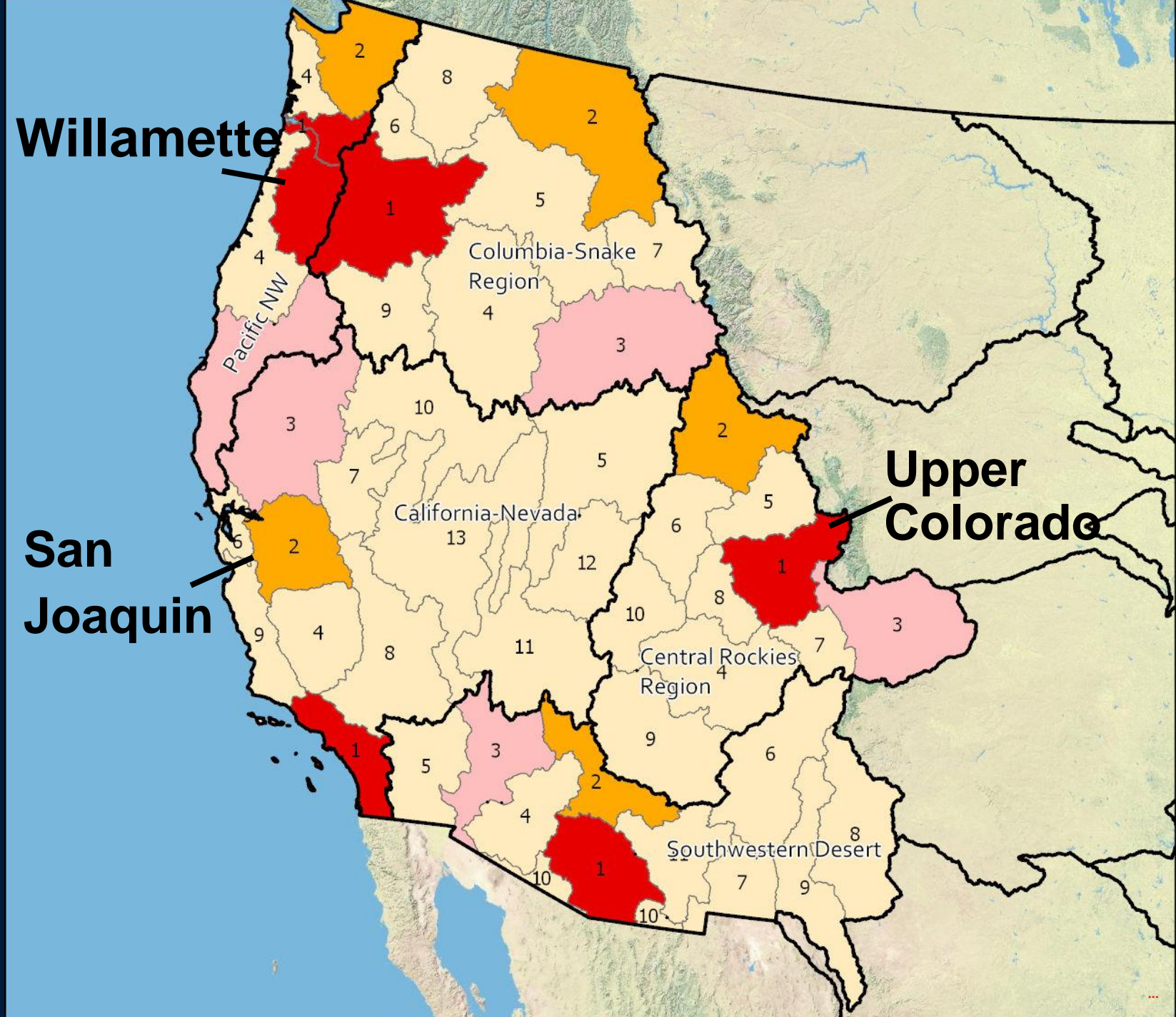




# Three Proposed Basins

...

combining the  
quantitative ranking  
criteria with issue based  
input from USGS Water  
Science Centers and  
Regional Directors



# Streamlined Stakeholder Engagement

- **Western States Water Council – 9/4/19; 10/17/19**
- **Interstate Council on Water Policy – 9/9/19**
- **Bureau of Reclamation Senior Leadership – J.R. Reilly  
Briefing on NGWOS 9/24/19**
- **Western Regional Bureau of Reclamation  
Representatives – 10/17/19**



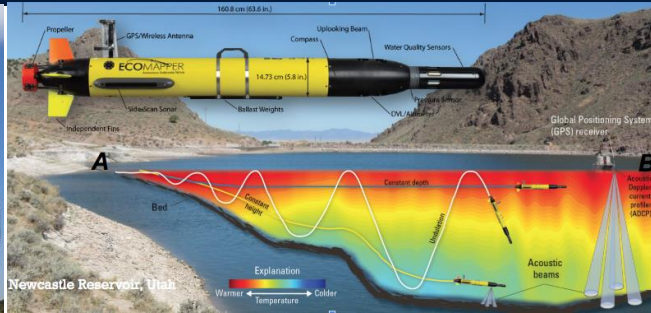
# Next Steps

- Propose three potential NGWOS western basins to the USGS Water Executive Council in October 2019
- Announce selection of the 2<sup>nd</sup> NGWOS basin in November 2019
- Start basin planning, network analysis, and stakeholder engagement, and targeted monitoring equipment installation—**Dependent upon FY20 budget**

# Next Steps for Selecting 3<sup>rd</sup> – 10<sup>th</sup> NGWOS Basins

- **National Rankings of HUC04s** – Evaluate limited number of additional ranking variables and then rank all conus basins by Hydrologic Landscape Region
- **Engage National and Regional Stakeholders** to understand science priorities and monitoring needs
- **Select multiple Hydrologic Regions in the Central US** and repeat the process, similar to the West, to identify candidate basins in the Central U.S.

# For Additional Information



## Water Observing System Program

Chad Wagner, Program Coordinator

[cwagner@usgs.gov](mailto:cwagner@usgs.gov)

Mike Woodside, Deputy Program  
Coordinator, Acting NGWOS Program  
Manager [mdwoodsi@usgs.gov](mailto:mdwoodsi@usgs.gov)

Brian Pellerin, Hydrologic Networks  
Branch Chief [bpeller@usgs.gov](mailto:bpeller@usgs.gov)

