Science for a changing world

## Water Resources Availability Portfolio (WRAP)

2023 WESTERN STATES WATER COUNCIL FALL MEETING

BRIAN CLARK SEPT 12-14, 2023

# WRAP Priority Products informed by SECURE Water Act

#### **National Water Census**

Routinely updated on-line information on water availability in the United States

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#### National Water Availability Assessments

Periodic scientific assessments of water availability in the United States



#### Regional Water Availability Assessments

Detailed assessments of water availability in ten representative basins





## National Water Availability Assessments

### SECURE Water Act (2009)

- Directs USGS to develop an assessment of water availability and use
- Looks to 1978 report as the last comprehensive water availability assessment

How much water do we have, and where is it?

What is the quality of our water, and where/ what are the problems?

How do we use water, and do we have enough water of suitable quality for all uses?

What is the vulnerability and resilience of humans and ecosystems to water shortages, surpluses, and degradation of water quality?



## Core Indicators of Water Availability

Water Quantity	Water Quality	Water Use	Aquatic Ecosystems
<u>Surface Water</u> : Streamflow, runoff, snow water equivalent, precipitation, evapotranspiration, soil moisture, lakes and reservoir storage <u>Groundwater</u> : Recharge, storage	Surface Water: Salinity, nutrients, sediment, water temperature, HABs Groundwater: Salinity, nutrients Secondary Priorities Pesticides, PFAS, metals,	Withdrawal and consumption for public supply, irrigation, thermoelectric power, domestic, industrial, mining, livestock, and aquaculture	Gross ecosystem requirements Fish community health
	CECs		

## National Water Availability Assessments





**Report Structure** 



- National Water Supply
- **National Water Quality**
- **National Water Use**
- **Context for future water resources**
- Water supply and demand
- **Regional synopses**



## Water Supply (Quantity)



#### Overall goals -

 Present estimates of national hydrologic fluxes and storage terms based on an ensemble of model outputs.

#### **Expected outcomes** –

- Update estimates of nationalscale hydrologic fluxes and storage terms.

- Express decadal variability in these components.
- Estimate model uncertainty from ensemble approach.

mm

0.05

0.25

0.65

2

#### Model sources -CONUS404ba NHM-PRMS WRF Hydro Fall Winter Spring Summer Precipitation 20 35 45 60 80 95 115 Surface runoff

5

9

350

20

## Water Supply (Quantity)



## Limitations of the current assessment –

- Incomplete coupling of surface water and groundwater systems in model applications.
- Reservoir operations are not represented in surface water hydrology.
- Hydrologic models are run on unique geographic representations and then translated to HUC12s.



## Water Quality



- Overall goals 1) Describe the quality of the nation's water resources with respect to nutrients, salinity, temperature, geogenic contaminants, and other constituents such as PFAS, HABs, and pesticides. 2) Place water quality in the context of how it relates to water availability for ecosystem and human health needs.
- Information sources –Literature review; previously published water quality assessments.



Probability of As>10 μg/L at domestic wells (Lombard et al., 2021)

Predicted NO3 concentration at typical domestic well depths

(Ransom et al., 2022)

## Water Quality



#### Limitations of the current assessment –

- Not all constituents of interest have been assessed nationally.
- Where models exist, they are static representations of average concentration
- Benchmarks or thresholds are not well integrated into water quality information
- Constituent mixtures or multiple exceedances are not well studied





## Water Use



- <u>Overall goals</u> Provide updates to USGS Water Use estimates using modeled wall-to-wall coverage of 3 largest water use categories.
- <u>Information sources</u> Models developed by Water Use Research Project; existing county-level estimates from 2015 (possibly 2020) for unmodeled categories
- <u>Expected outcomes</u> Updates to water use estimates. Use of improved modeling approaches to estimate water use.



## Water Use



#### **Assessment limitations**

- Differentiating between groundwater vs. surface water sources for water use.
- Quantification and spatial resolution on interbasin transfers.

type

Irrigation

 Models for additional categories of water use (livestock, aquaculture, mining, energy, etc.)





## Current status in the context of climate change



- <u>Overall goals</u> Discuss the current state and future projections of water availability in the context of global change.
- Information sources –
   Intergovernmental Panel on
   Climate Change; National Climate
   Assessment; USGS publications;
   current scientific literature
- Expected outcomes Providing context for the current assessment with respect to the longer-term trajectory of water availability in the US.



Utilizing the Climatic Impact Drivers framework to determine water-cycle components and socioeconomic sectors most affected by climate change Placing waterbudget component extremes in context of long-term records helps inform climate adaptation strategies





## Water Supply and Demand



- <u>Overall goals</u> Assessment of water availability as expressed as the balance between supply & demand on a HUC12 scale.
- Information sources Hydrologic models (NHM, WRF-Hydro) and water use models (irrigation, thermoelectric, public supply)
- <u>Expected outcomes</u> National wall-to-wall overview of water stress and temporal variability

#### Water stress level very low/none (0.0-0.2)

low (0.2-0.4) moderate (0.4-0.6) high (0.6-0.8) severe (0.8-1.0)



#### Water Supply and Demand

#### **Assessment limitations**

- Connections between water availability and ecoflows is not well developed.
- Interbasin transfers are not represented in our water budget calculation.
- No consideration for water quality limitation to availability.





Spawning Season Water-Stress Exposure

Percent of habitat range in various water stress categories for fish species of "special concern."



#### **Regional Synopses**

- <u>Overall goals</u> Highlight projects engaged in studying water availability issues throughout the Nation. The emphasis is on projects supported by the Water Mission Area.
- <u>Information sources</u> Literature review; engagement with project managers.
- <u>Expected outcomes</u> More detailed consideration of water availability issues identified in National chapters.





#### **Regional Synopses**

#### **Assessment limitations**

- Coordination with Regional and Water Science Center representatives about the most relevant local and regional scale water availability studies.
- Similar coordination and awareness with outside agencies conducting similar analyses – BLM, EPA, DOE, etc.



## Timeline





## Contact Information

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