

COLUMBIA RIVER BASIN LONG-TERM WATER SUPPLY & DEMAND FORECAST



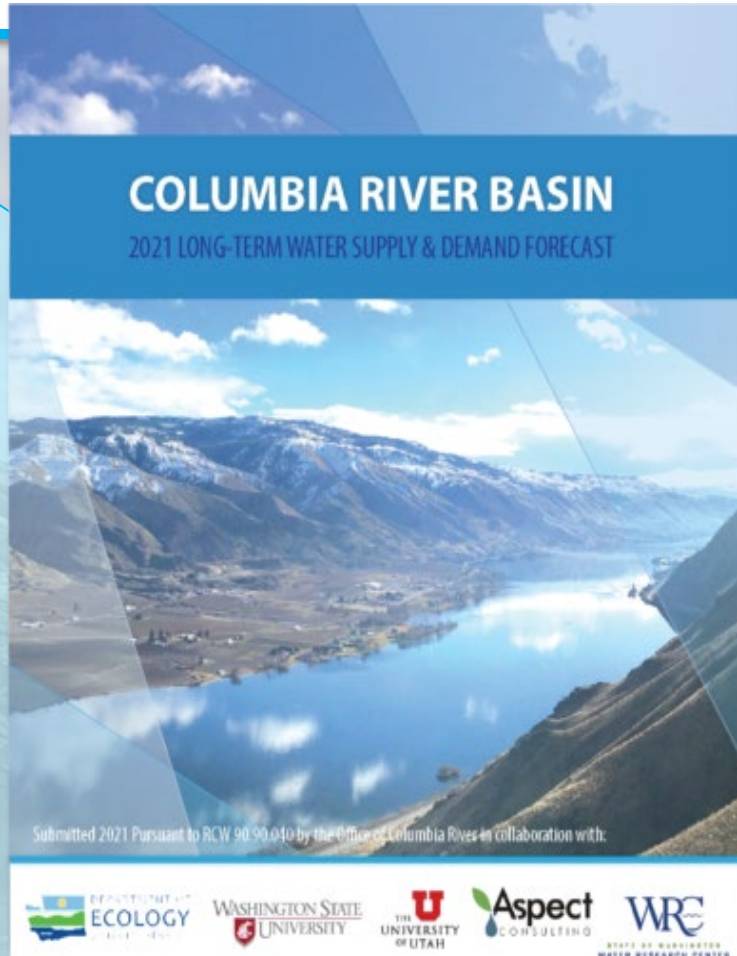
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**Columbia River Policy Advisory Group
October 5, 2023**

Follow along on your phones or computers! <https://tinyurl.com/2026Forecast>

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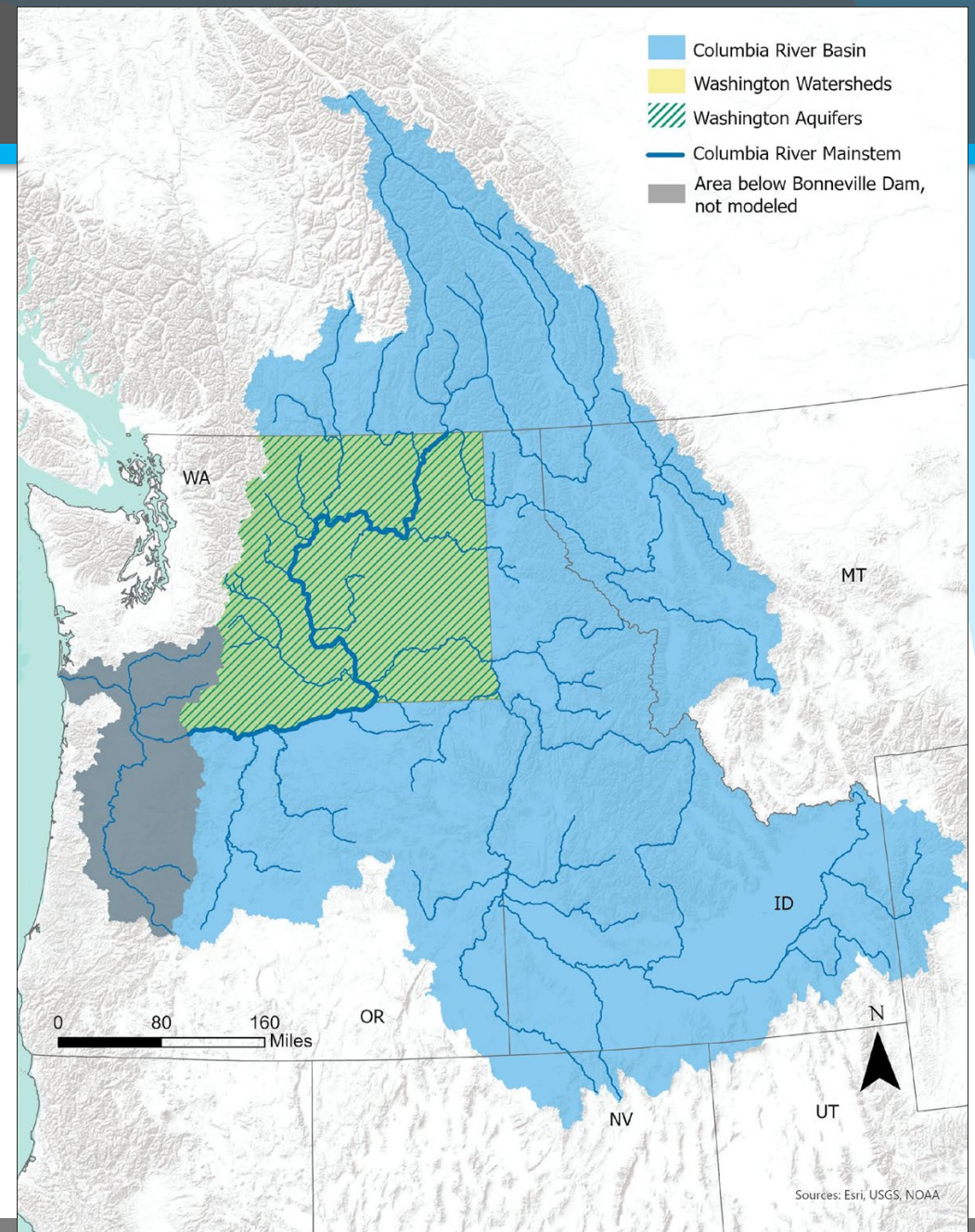
- **Every 5 years, the Washington State Department of Ecology's Office of the Columbia River (OCR) is required to submit a long-term (20-year) water supply and demand forecast to the State Legislature**
- **The forecast helps improve understanding of where additional water supply is most critically needed, now and in the future**

2021 Forecast Team Members

- **Washington State University: Jenny Adam, Collins Asante-Sasu, Michael Brady, Rojina Desar, Sonia Hall, Hannah Goodspeed, Becca Gustine, Chad Kruger, Mingliang Liu, Julie Padowski, Kirti Rajagopalan, Ashish Kondal, Sasha McLarty, Fabio Scarpore, Claudio Stockle, Aaron Whittemore, Jon Yoder, Georgine Yorgey, Matt Yourek**
- **Aspect Consulting: Dan Haller, Seann McClure, Jon Turk, Wendy Valdez**
- **University of Utah: Michael Barber, Ry Weber**
- **Washington Ecology: Michael Callahan, Melissa Downes, Tyler Roberts, Jennifer Stephens, Scott Tarbutton, Tom Tebb**

Spatial Layers

- **Columbia River Basin** 
- **Eastern WA watersheds** 
- **Columbia Mainstem** 
- **Aquifer subareas** 



2021 Forecast - Trends Incorporated into Analysis

Climate Change

By the 2040s, Washington can expect:

- Higher temperatures
- Wetter, warmer winters
- More rain and less snow
- Reduced snowpack, especially at low and mid elevations
- Earlier snowmelt
- Warmer, drier summers, deeper droughts
- Greater heat stress
- More frequent extreme weather events

Population Growth

By the 2040s, Washington can expect:

- 17% higher population across the state
- Stable fertility rates and increasing mortality rates (as baby boomers age)
- Over two thirds of the state's population increase are due to net migration into the state
- 13% higher population across eastern Washington

Trends in Agriculture

By the 2040s, Washington can expect:

- Longer growing season
- Greater rate of accumulation of growing degree days
- Increased photosynthesis in many crops
- Earlier planting dates
- Earlier flowering in tree fruit and specialty crops
- More frequent heat stress events in summer

2021 Forecast - Components

		Methods	Geographic Scopes	
SUPPLIES	Surface water	Integrated modeling of historical (1986-2015) and multiple future scenarios (2026-2055). Climate change impacts also modeled through 2070 (2056-2085)	<ul style="list-style-type: none"> • Columbia River Basin (including focus on eastern Washington) • Washington's Watersheds • Columbia River Mainstem 	
	Groundwater	Trends analysis using existing well depth data	<ul style="list-style-type: none"> • Washington's Aquifers 	
DEMANDS	Out of Stream	Agricultural	<ul style="list-style-type: none"> • Columbia River Basin (including focus on eastern Washington) • Washington's Watersheds 	
		Residential	<ul style="list-style-type: none"> • Eastern Washington • Washington's Watersheds 	
	Instream	Flows for Fish	Independent simulation modeling study (Mauger et al. 2021 ^a)	<ul style="list-style-type: none"> • Washington's Watersheds
			Compared integrated modeling results to flow regulations	<ul style="list-style-type: none"> • Columbia River Mainstem
		Hydropower	Review existing data and information from power entities	<ul style="list-style-type: none"> • Columbia River Basin

^a Mauger, G.S., M. Liu, J.C. Adam, J. Won, G. Wilhere, J. Atha, L. Helbrecht, and T. Quinn. 2021. New Culvert Projections for Washington State: Improved Modeling, Probabilistic Projections, and an Updated Web Tool. Report prepared for the Northwest Climate Adaptation Science Center. Climate Impacts Group, University of Washington.

2021 Forecast - Key Takeaways

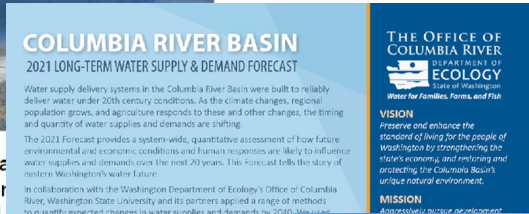
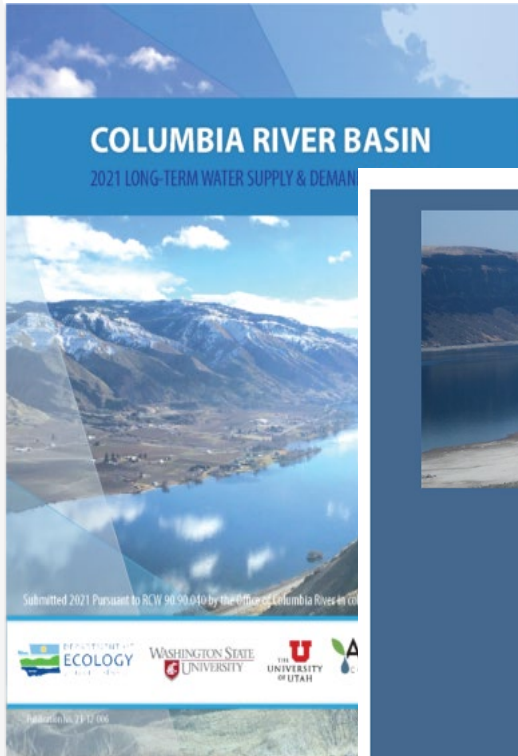
- **The Forecast suggests that eastern Washington is vulnerable to:**
 - Water supplies increasing earlier in the spring/winter, and decreasing late in summer/fall;
 - More extremes in water supply from year to year;
 - Declining low flows, affecting important fish species;
 - Areas of diminishing groundwater supplies;
 - Watersheds with increases in out-of-stream demands.
- **This combination of lower supplies at critical times and locally increasing demands leads to increasing frequency of instream flow deficits and resulting curtailments.**

2021 Forecast - Products

- **Legislative Report: Executive Summary, Main Report, WRIA Results, Aquifer Results (284 pages)**
- **Technical Report: Detailed Methods, Outreach Activities, Responses to Reviewers (212 pages)**

➤ **4-Page Factsheet**

➤ **Web-Based StoryMap with Data for Download**



Columbia River Basin
2021 Long-Term Water Supply & Demand Forecast

Technical Report

Office of Columbia River Ecology
Washington State University
Central Region
Union Gap, Washington
August 2022, Publication



Report links at <https://wrc.wsu.edu/>

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Planning for the 2026 Forecast (and beyond)

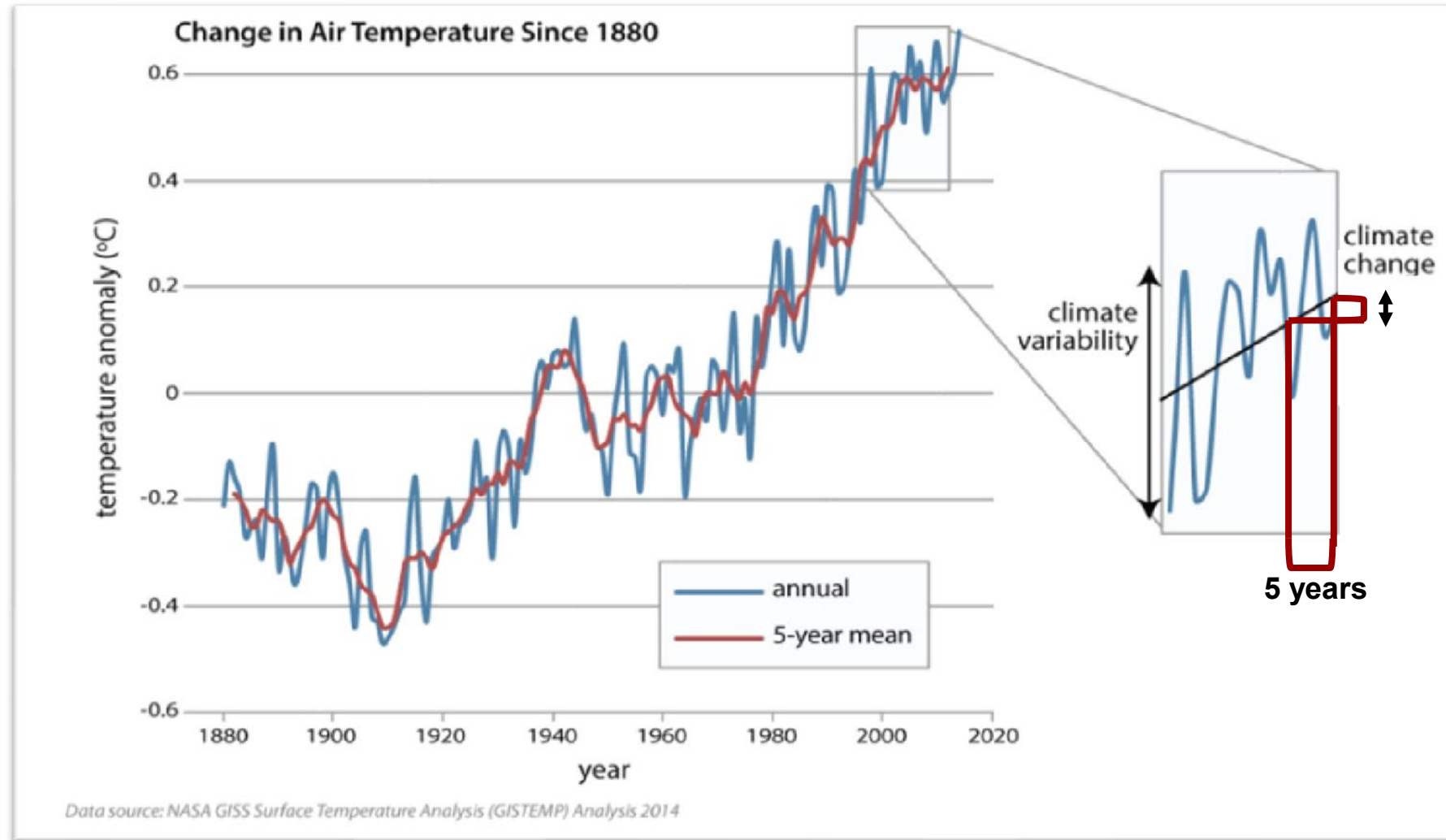
Summary of Legislative Mandate (RCW 90.90.040)

To support the development of new water supplies in the Columbia river and to protect instream flow, the department of ecology shall work with all interested parties, including interested county legislative authorities and watershed planning groups in the Columbia river basin, and affected tribal governments, to develop a Columbia river water supply inventory and **a long-term water supply and demand forecast.**

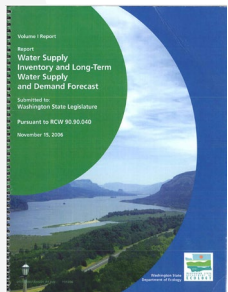
The department of ecology shall complete the first Columbia river long-term water supply and demand forecast by November 15, 2006, and **shall update the report every five years thereafter.**

What Changes in Five Years?

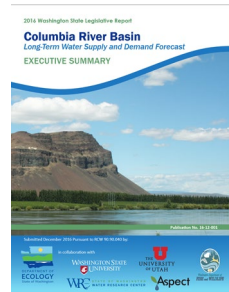
- **Climate change (small in comparison to climate variability)**
- **Technological Improvement (can be fast with investment)**
- **Information needs to inform policy & management decisions**
- **Other: population, etc.**



Possible Change in Forecast Timeline?



2006



2016

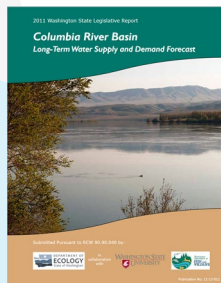
- Perform comprehensive Forecast every 10 years
- Focus on technological & scenario development in the “Off” “update” periods to improve the effectiveness of subsequent Forecasts

2026

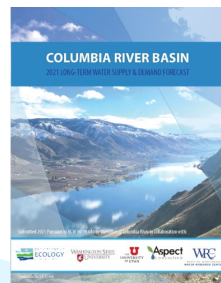
2036



2011



2021



2031

2041



“On” - Comprehensive Multi-Scale Supply & Demand Forecast



“Off” - Invest in Technological & Scenario Development (“Modules”)

What Forecast Components Could Targeted “Modules” Improve?

➤ **Water Supply**

- Surface
 - Streamflow
 - Reservoirs
- Groundwater

➤ **Water Demand**

- Irrigation (e.g., extreme event irrigation, consumptive use monitoring)
- Residential/Commercial/Industrial
- Hydropower
- Environmental/Fish Flows
- Other (e.g., Temporary Farm Workers)

➤ **Water Scarcity**

- Drought Frequency/Severity
- Water Rights Interruption
- Impacts of Water Rights Interruption

➤ **Scenarios (“What If” Questions)**

- Water Conservation
- Columbia River Management
- Back-to-Back Droughts
- Season-of-Use Expansion of Water Rights



Proposed Modules: Water Supply

Groundwater Modeling

➤ **Motivation:**

- Declining groundwater levels across Eastern Washington
- Modeling for past Forecasts assumed that groundwater levels are not declining and will not affect water scarcity (except for the Odessa subarea), although areas experiencing groundwater declines were mapped

➤ **Approach:**

- Update existing USGS model of the Columbia Plateau Regional Aquifer System (CPRAS)
- Run historical (through 2020) and future scenarios
- Evaluate the impact of groundwater management strategies on future groundwater levels
- Co-funding is being sought

Groundwater Use Assessment/Impacts

➤ **Motivation:**

- Increasing groundwater use is in the “drought mitigation toolbox,” but its actual role and potential to buffer drought has been underexplored
- Estimates of aquifer recharge and storage properties need to be improved to more accurately evaluate the role of groundwater during drought

➤ **Approach:**

- Review and improve existing recharge and storage properties in the literature and current models
- Create vulnerability maps of regions at risk from increased pumping during drought
- Highlight regions with ASR potential to improve drought response capabilities



Proposed Modules: Water Demand

Temporary Farm Worker Housing

➤ **Motivation:**

- Rough estimates from the Washington Tree Fruit Association (WTFA) suggest this could increase ten-fold in coming years
- Traditional ability to use exempt wells to serve these facilities is being scrutinized

➤ **Approach:**

- Inventory existing facilities by location and water use
- Collaborate with state agencies and the WTFA to examine likely growth rates and locations for facilities and quantify water demand
- Document water supply challenges for this emerging growth sector and evaluate policy initiatives to address them
- Case studies will help showcase actual implementation of projects & solutions

Residential Demand Improvements

➤ **Motivation:**

- In past Forecasts, future per-capita residential water use trends were based on historical data.
- More water supply systems are investing in water conservation, water reclamation, drought resilience measures, etc.
- Legislature and watershed plans adopted new WRIA-specific standards (RCW 90.94) that should be considered.

➤ **Approach:**

- Improve methodology for demand projections based on known demand management strategies being implemented and existing water provider data and plans for managing water supply for future use.
- Potentially examine other sectors (e.g., industry, residential irrigation districts, etc.) in more detail.

Crop Water Demand to Manage for Extreme Weather Exposure

➤ **Motivation:**

- Future crop water needs to manage for extreme weather (e.g., evaporative cooling to mitigate sunburn in fruit) can be much larger than those for crop evapotranspiration
- Therefore, future irrigation needs are underestimated in WRIAs with perennial crops

➤ **Approach:**

- Account for
 - water for frost mitigation (calculations from literature values)
 - water for heat stress mitigation in summer (modeled in detail)
 - water for cooling to enhance fruit color development in the fall (calculations from literature values)

Hydropower Demand Assessment

➤ **Motivation:**

- Great interest from the public on the 2021 Forecast hydropower component
- Many recent changes
 - Adoption of NWPCC's 2021 Northwest Power Plan
 - Changes to BPA's method for calculating firm hydropower
 - Recent/ongoing improvements in reservoir models

➤ **Approach:**

- Use 2021 Forecast results to analyse firm hydropower changes (Columbia & Snake)
- Update electric power demands as new information becomes available
- Understand when dam operators spill vs generate and if there is flexibility to spill less during peak flow, as energy demands grow
- Examine how climate variability will be affected by climate change, with implications on Coulee's operation, release to the river and downstream generation

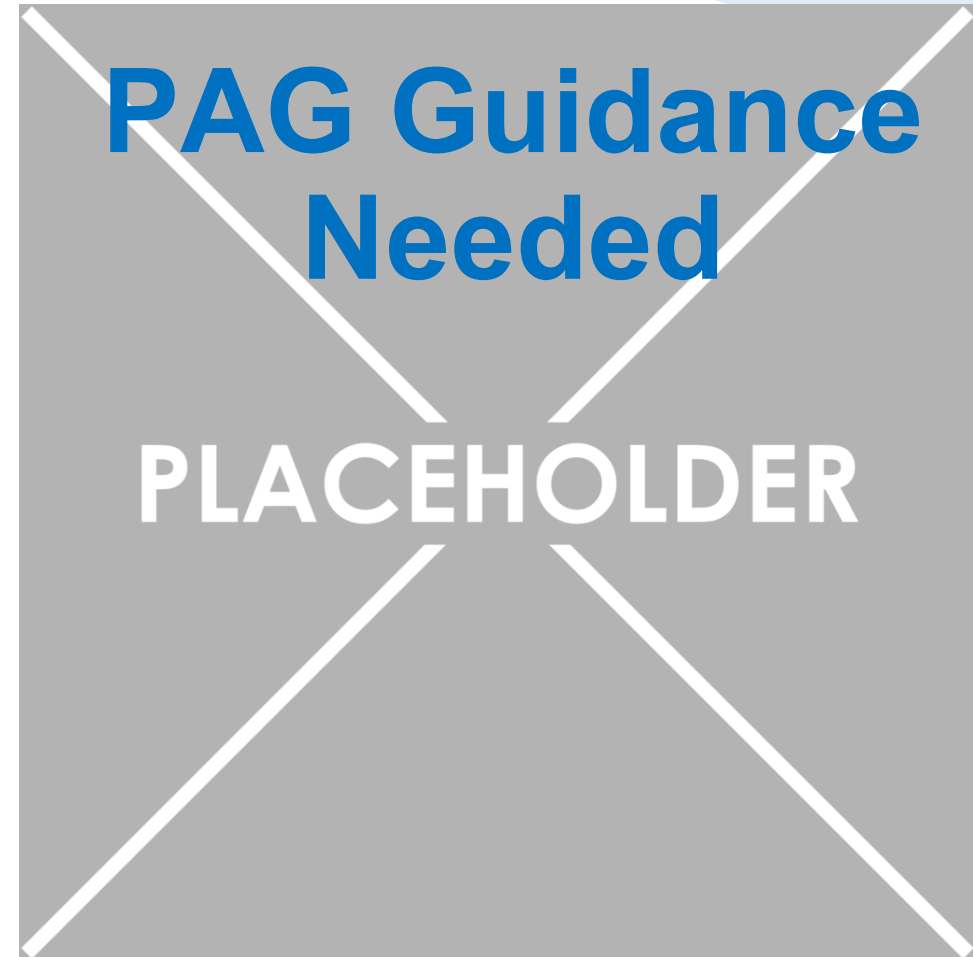
Environmental Flows (Nothing Proposed Yet)

➤ **Motivation:**

- Importance to regional economy and culture
- OCR Directive: one-third of water set aside for flows benefitting fish and the natural environment

➤ **Approach:**

- Coordination and collaboration is critical
- One possibility: provide a synthesis of ongoing activities (rather than new research)





Proposed Modules: Water Scarcity

Economic Impacts of Water Supply Vulnerability

➤ **Motivation:**

- Interruptible users are becoming increasingly vulnerable to climate change.
- The 2015 drought regulated “formerly senior” water right holders for the first time.
- New water banks and supplies are beginning to emerge that can help reduce this risk.

➤ **Approach:**

- Quantify the economic impacts of water rights interruption and prorationing taking advantage of enhanced data (water rights priority dates database) and modeling (USDA Tech for Trade project) that provides a more accurate depiction of vulnerabilities and flexibility for modeling scenarios.
- Overlay the emerging supply opportunities that can reduce water supply risk, including both OCR and other public and private investments in water supply.



Proposed Modules: “What If?” Scenarios

Back-to-Back Drought Assessment

➤ **Motivation:**

- Consecutive droughts have the potential to create severe harm for
 - Agriculture (e.g., on perennials and farm finances)
 - Hydrology (e.g., reservoir and soil moisture levels)
 - Water managers (e.g., pushing financial and human resources beyond available capacity)
 - Fish, wildlife and other parts of the environment
- Lack of experience in Eastern Washington on how to cope with sequential drought

➤ **Approach:**

- Quantify probabilities of sequential droughts and their characteristics
- Understand the “carryover” factors that amplify the impacts of sequential drought. In particular, farm finances, farm-scale production options, soil moisture, and water storage.
- Identify management strategies for consecutive droughts for key stakeholders, including farms, irrigation districts, and state agencies.

Water Conservation

➤ **Motivation:**

- The Forecast Team received feedback after the 2021 Forecast on our lack of including water conservation as a scenario
- Conservation has not been examined across sectors in previous Forecasts, so the impacts (intended and unintended) have not been assessed

➤ **Approach:**

- Qualitatively evaluate different categories of water conservation approaches used in agricultural, industrial, and municipal sectors
- Using literature and other data, assess their effectiveness at reducing non-consumptive and consumptive uses to better understand
 - What conservation measures are promoted, used, and/or enforced
 - What the direct and indirect consequences are of these actions within and potentially across sectors

Season-of-Use Expansion Case Studies

➤ **Motivation:**

- Climate change is pushing crop emergence earlier each year. Seasons of use are fixed creating thousand of compliance challenges for Ecology.

➤ **Approach:**

- Inventory affected rights relative to climate change pressure.
- Case studies to evaluate potential conflicts between instream and out-of-stream water rights in the spring (e.g. Instream Flows, Reservoir Filling)
- Identify options / recommendations
 - Statutory remedies
 - WRIA-based, statewide?



Products & Outreach

Products Options

➤ Option 1 (Basic products)

- **Short executive summary report - HIGHLIGHTS**
- Flier
- Technical report

➤ Option 2 (Products similar to 2021)

- Short executive summary report - HIGHLIGHTS
- Legislative main report OR **Coordinated products (policy briefs, fliers, other?)**
- Web-based data portal
- Technical report

➤ Option 3 (Products tailored to impact)

- All products detailed in Option 2
- Explore impact of Forecasts - **Interviews/focus groups with user groups:**
 - state agencies
 - Tribes
 - WSAC
 - legislative staffers
 - others?

Outreach

➤ **Groups:**

- State Agencies
- Public

➤ **Approach:**

- State Agencies: Co-host, with OCR, State Caucus meetings to increase awareness, obtain input, build partnerships, obtain new data
- Public Review:
 - Month-long public review of report, synthesis and publication of comments,
 - Co-hosting, with OCR, public meetings to share findings on obtain actionable feedback, and
 - Joint press release.
- Some targeted outreach, as requested by OCR: Columbia River PAG, Water Resources Advisory Committee, other groups.

Two Possible Combinations (among many)

Scenario A: **With Complete Water Supply & Demand Forecast**

- Full Forecast (including using new climate data)
- Groundwater Modeling
- (Water Conservation)
- Products - Option 2
- Outreach

Scenario B: **Targeted Modules Only**

- New Climate Data Study (to compare how new products compare to the 2021 Forecast in terms of climate projections)
- Groundwater Modeling
- Temporary Farm Worker Demand
- Back-to-Back Drought
- Water Conservation
- Products - Option 1
- Outreach

Discussion Points

- **Should we move forward to the “On/Off” schedule for the full Forecast?**
- **Which modules should be prioritized given current information needs in the state?**
- **How might we move advance the Forecast related to environmental flows?**

Thank you for attending!

