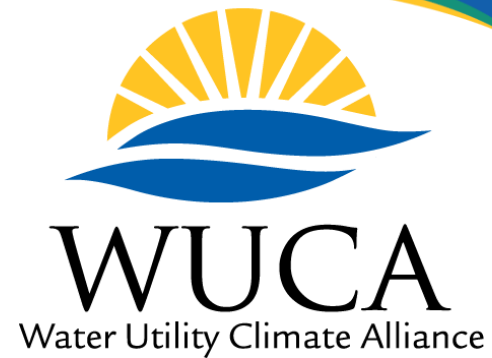


**Building Resilience to a Changing Climate:
A Technical Training in Water Sector
Utility Adaptation & Decision Support**



Decision-Making in the Face of Uncertainty:

**The evolution of climate adaptation and supply planning at the
Portland Water Bureau**

**Edward Campbell and Kavita Heyn
Portland Water Bureau**

June 4, 2024



Speaker introductions



Edward Campbell

Deputy Director



Kavita Heyn

**Adaptive Planning
& Climate Manager**

Portland's Water System

Service Area ~1 million people

Serving water since 1895

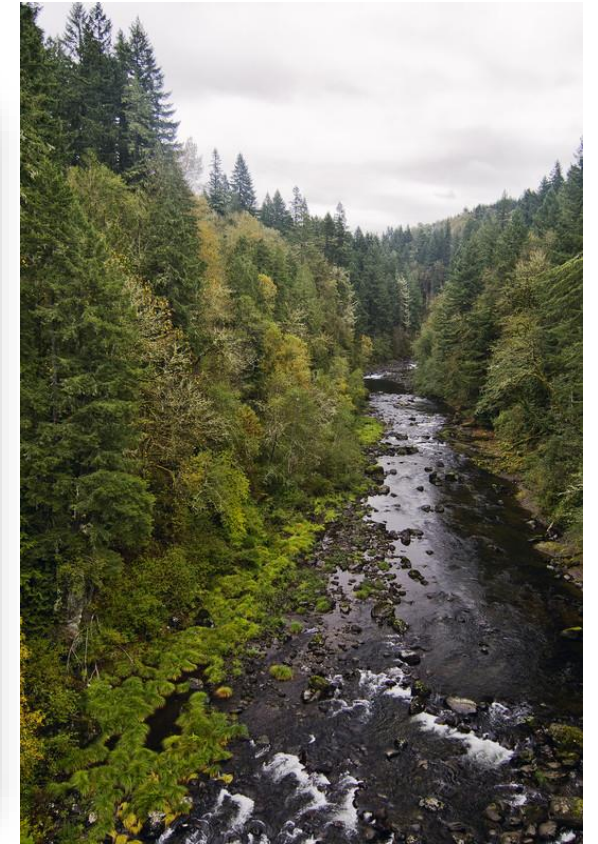
Two supplies (1) Bull Run Watershed (2) Columbia South Shore Well Field

100 mgd average production



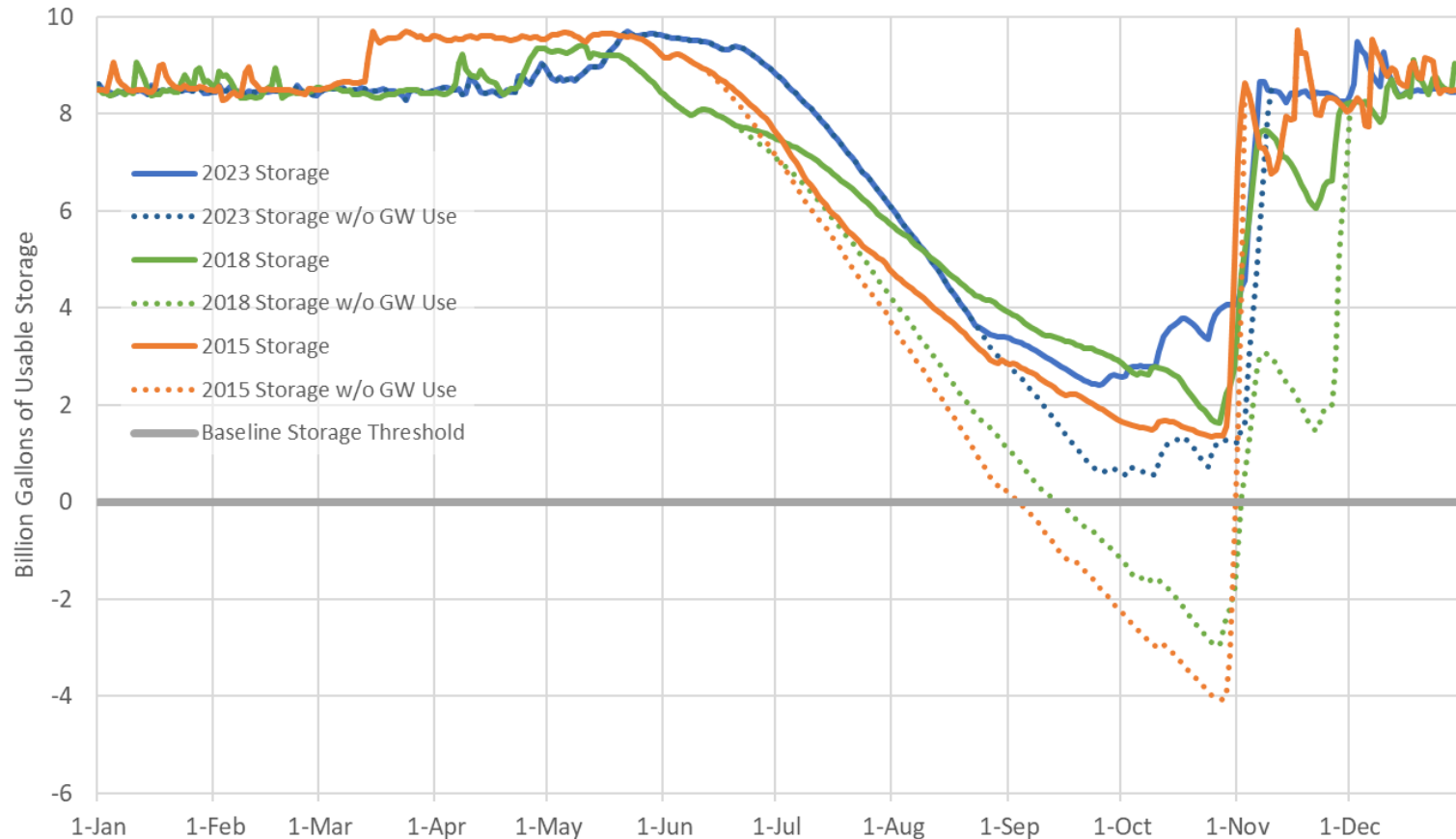
Bull Run Watershed

- Watershed mixed rain-snow watershed, ~135 inches precipitation annually on average.
- Reservoirs refill annually after summer drawdown (not multi-year storage). Rely on fall rains to refill.
- Management of reservoirs is most sensitive to variability in spring and fall rainfall.



The Key Role of Groundwater

Bull Run Reservoir Drawdown



Groundwater is a critical supply and climate resilience tool

Aquifer capacity is hydraulically stable

30-day capacity meets current indoor water usage demands.

Sole curtailment event was due to unavailability of groundwater

Climate story begins in 2001

First Bureau Climate Change Assessment

- Conducted to support Infrastructure Master Plan Update
- Worked with UW (Climate Impact Group) using 4 GCM models (sophisticated at the time!)
- Extrapolated past growth trends in demand, and assumed major expansion of customer base
- Climate analysis ultimately used to help bolster rationale for supply system expansion.

Results were incorporated into 2001 IMP:

- ❑ 8 BG supply gap from climate change and increased demand by 2020
- ❑ Proposals to expand Dam 1 & 2, or build Dam 3 to meet supply deficit/needs

Reality Check

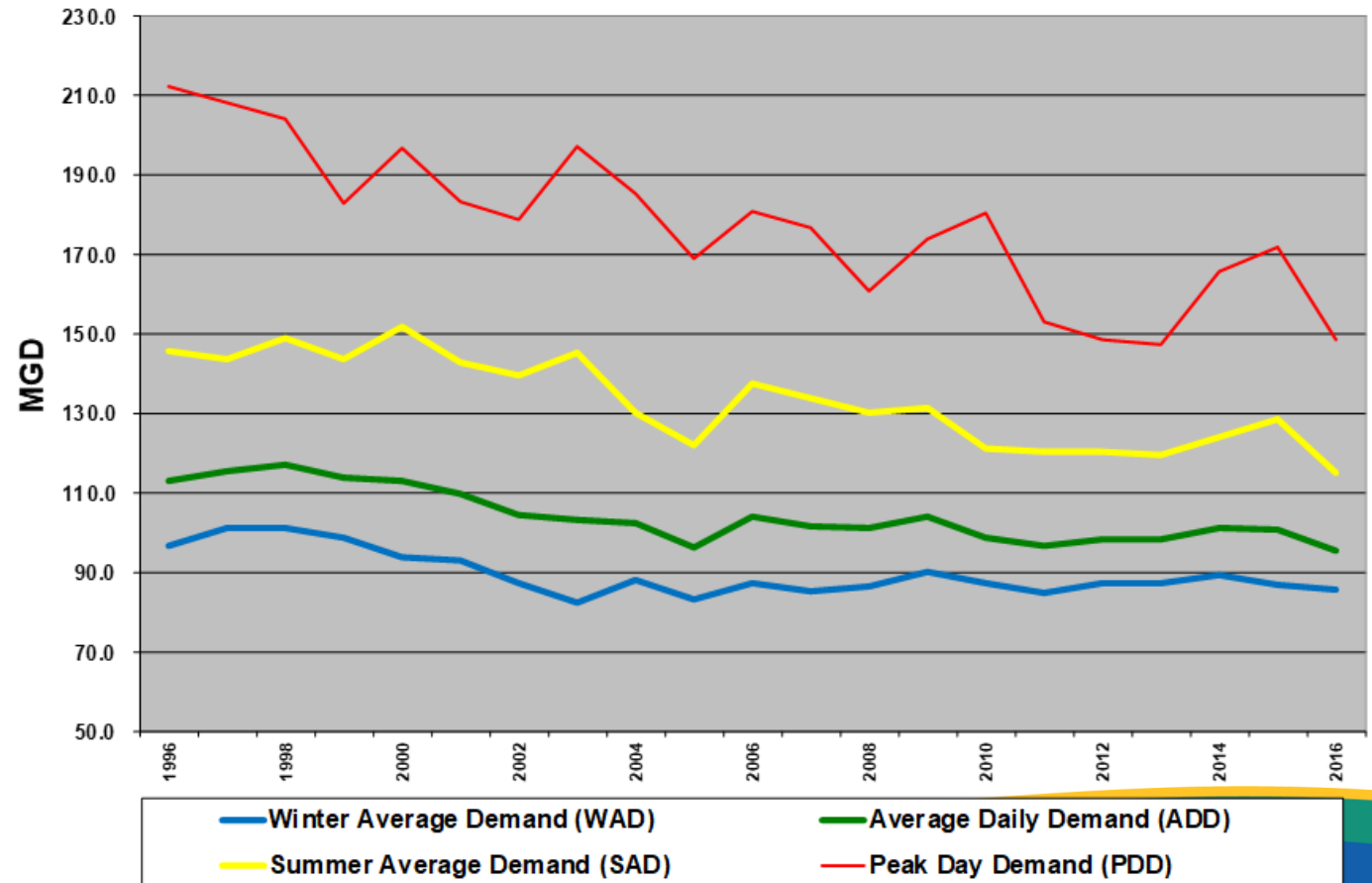
What actually happened?

- Per capita demand decreased
- Wholesale demand also unexpectedly decreased
- No rationale for supply system expansion
- IMP outdated very quickly

Lingering Impacts – Conflicting Stories

- Leading edge climate analysis circulating that indicated supply deficit
- Decade-plus deadline for updating IMP

PWB Aggregate Demand 1996-2016



Our Response - Build Capacity

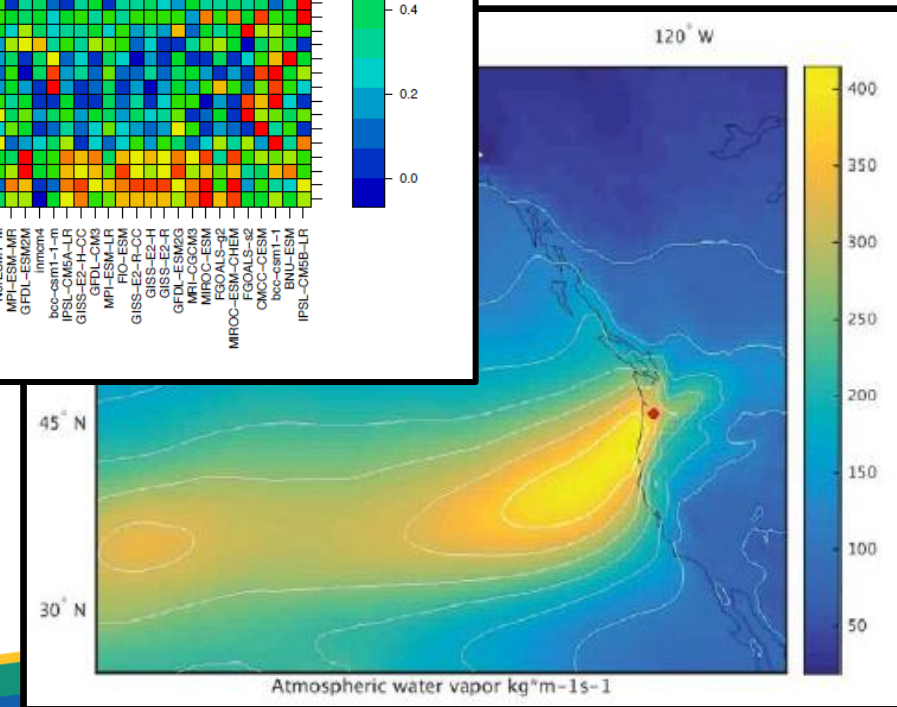
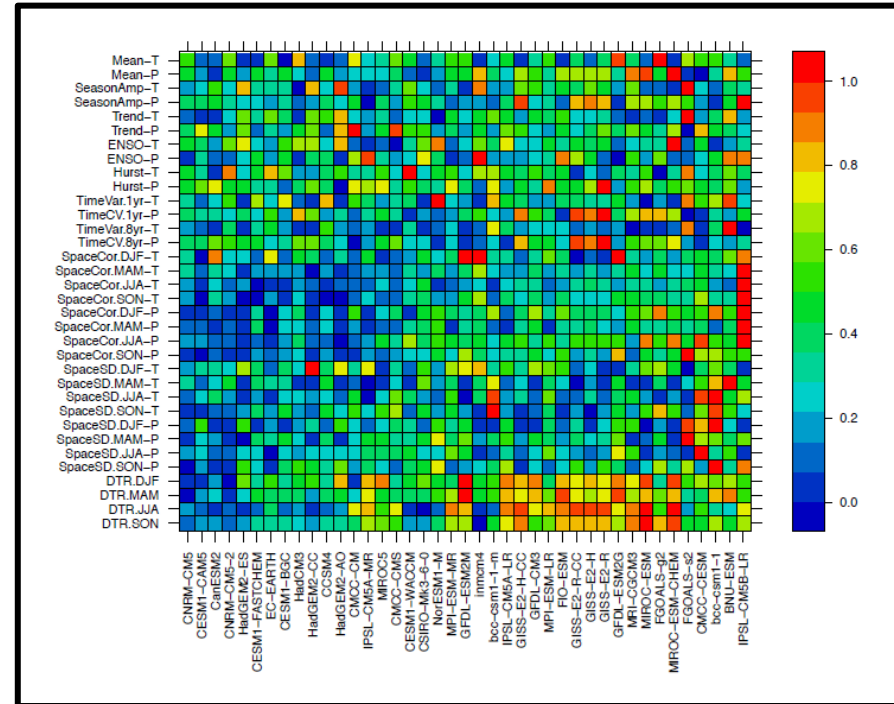


PUMA –Early 2010s WUCA partnership project to build analytical capacity of utilities to assess climate risks.



SPU, San Francisco, Portland, Tampa Bay and NYCDEP were utility participants

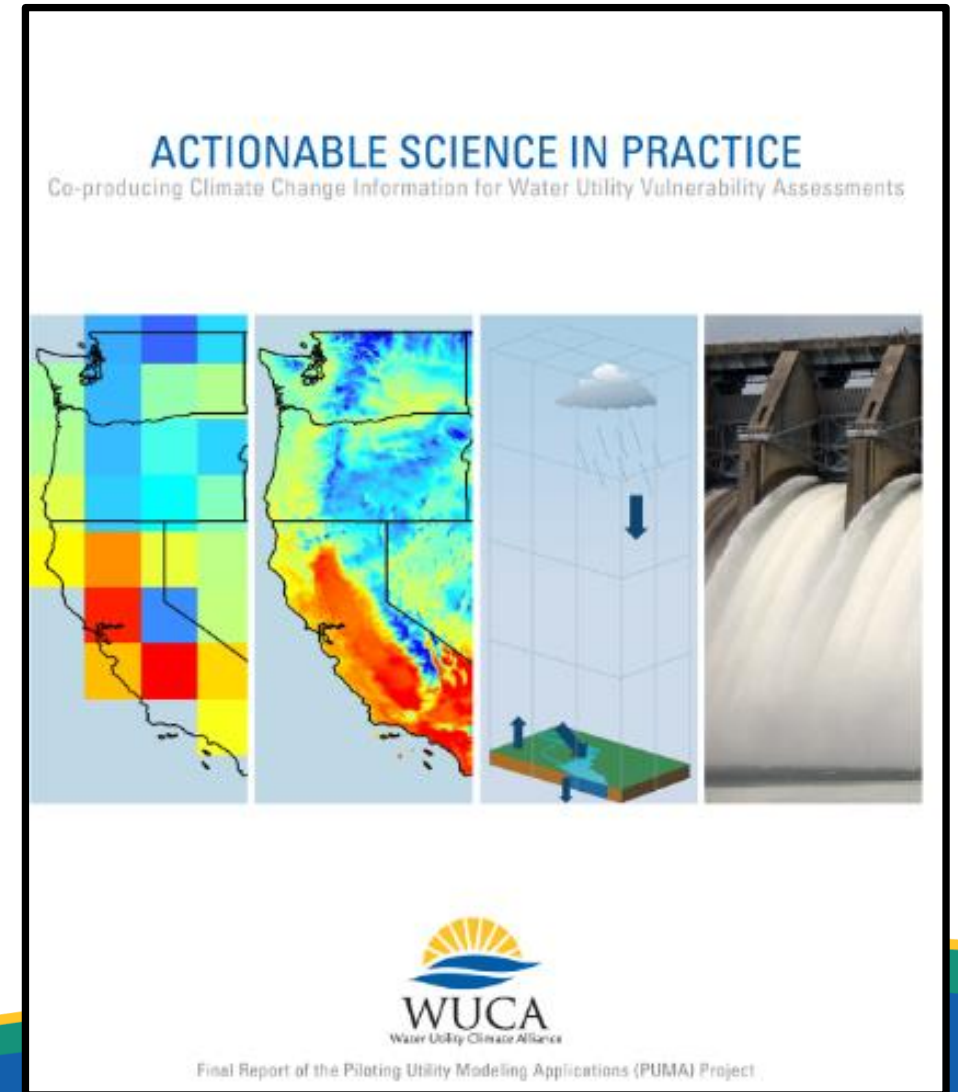
PWB developed its first hydrology model and was able to overlay GCMs to generate future climate-informed hydrology.



The PUMA Paradigm Shift

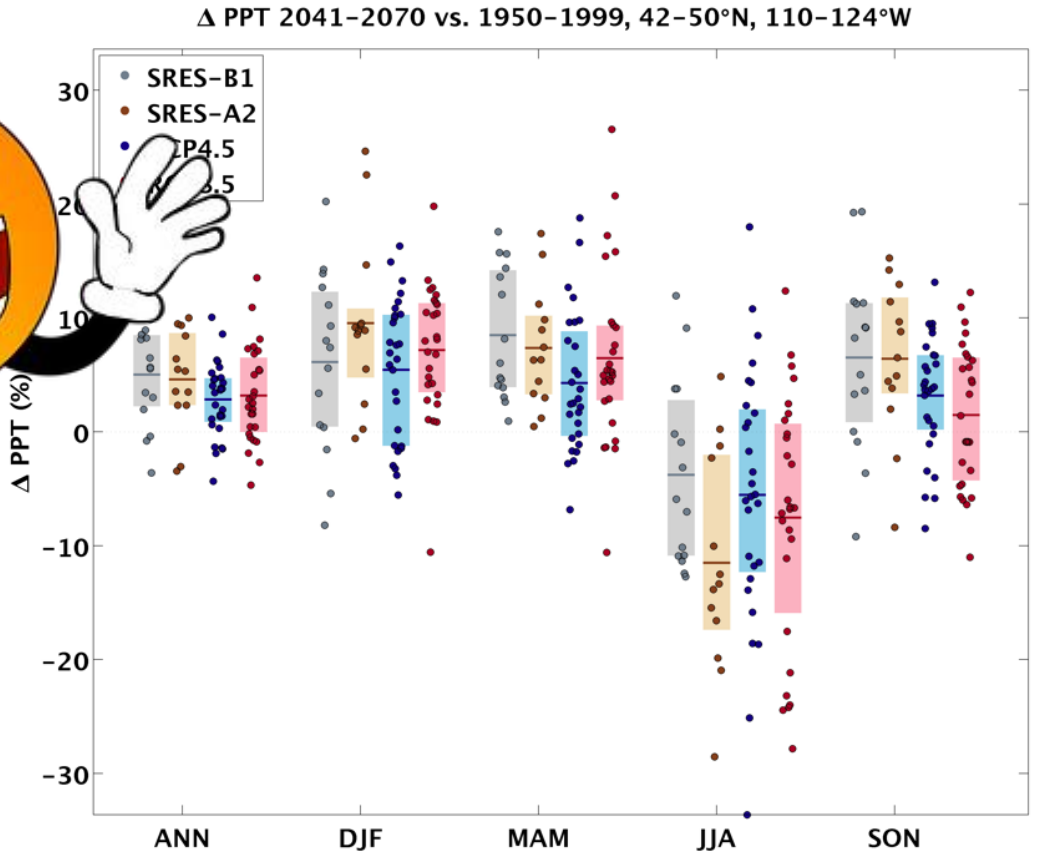
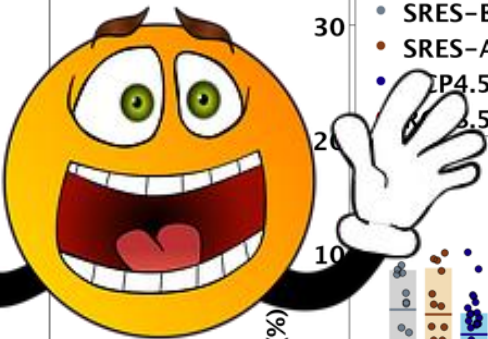
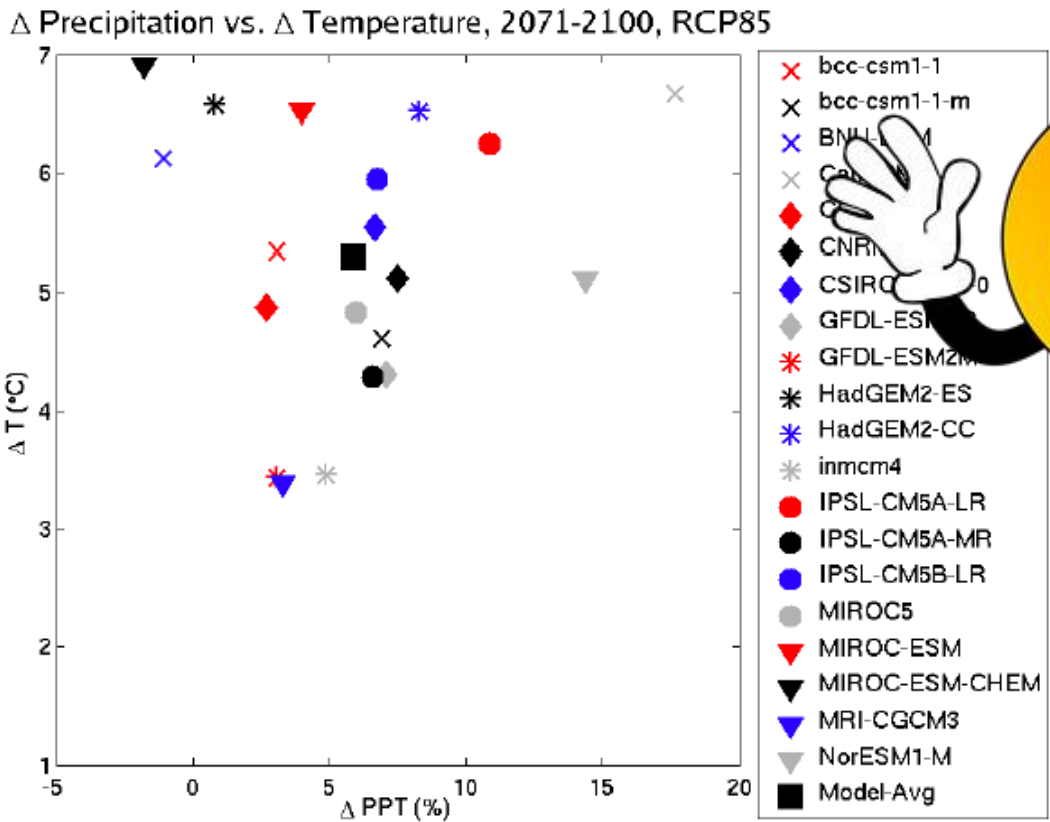
PUMA completely changed climate planning dynamics for Portland.

1. Developed in-house modeling capacity and expertise for future climate impacts analyses.
2. Experienced the value of being able to conduct system-customized approaches making climate projections more actionable and applicable to our supply planning.
3. Strengthened scientist-practitioner relationships with partners enabling ongoing access to state-of-the-art tools and best science as it evolves.



With great skill comes great responsibility

Confronted with a lot of different projections - which to pick for supply forecasting?



Lessons learned so far...

- Deterministic planning becomes irrelevant very quickly
- Climate isn't the only critical variable we face that makes the future uncertain
- We can't predict the future and base critical investment and supply decisions around these predictions
- If you don't have the ability to tell your own climate story, someone else will
- Building internal capacity enables you to adapt but comes with additional challenges and responsibilities

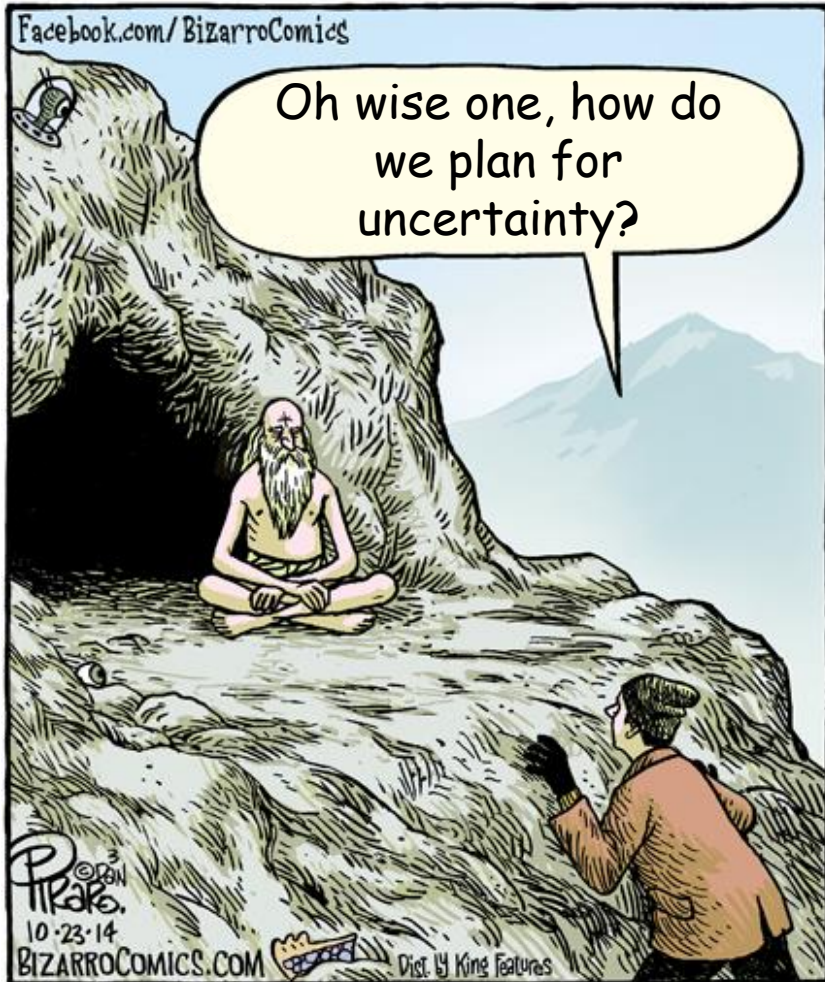


Meanwhile, Climate Change has arrived



So how do we plan
differently?!

Learning from our peers (again!)

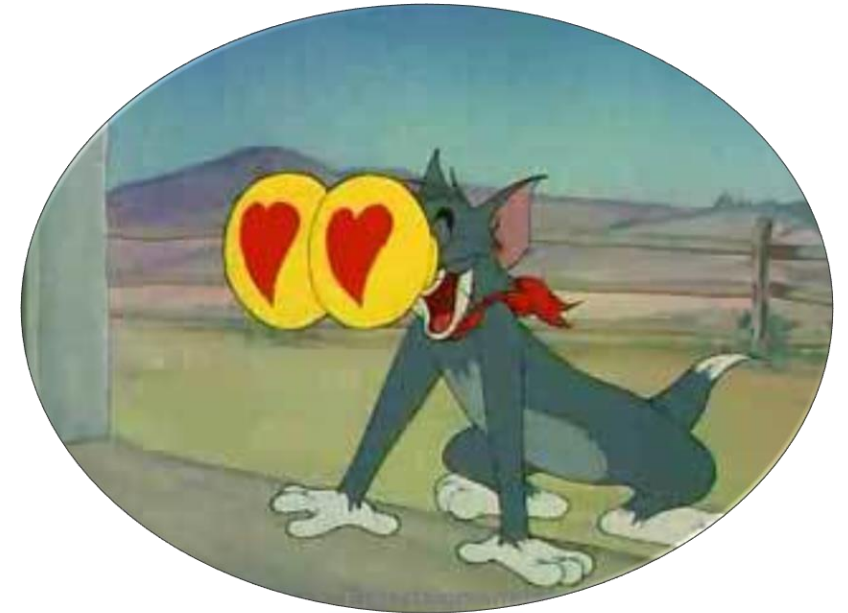
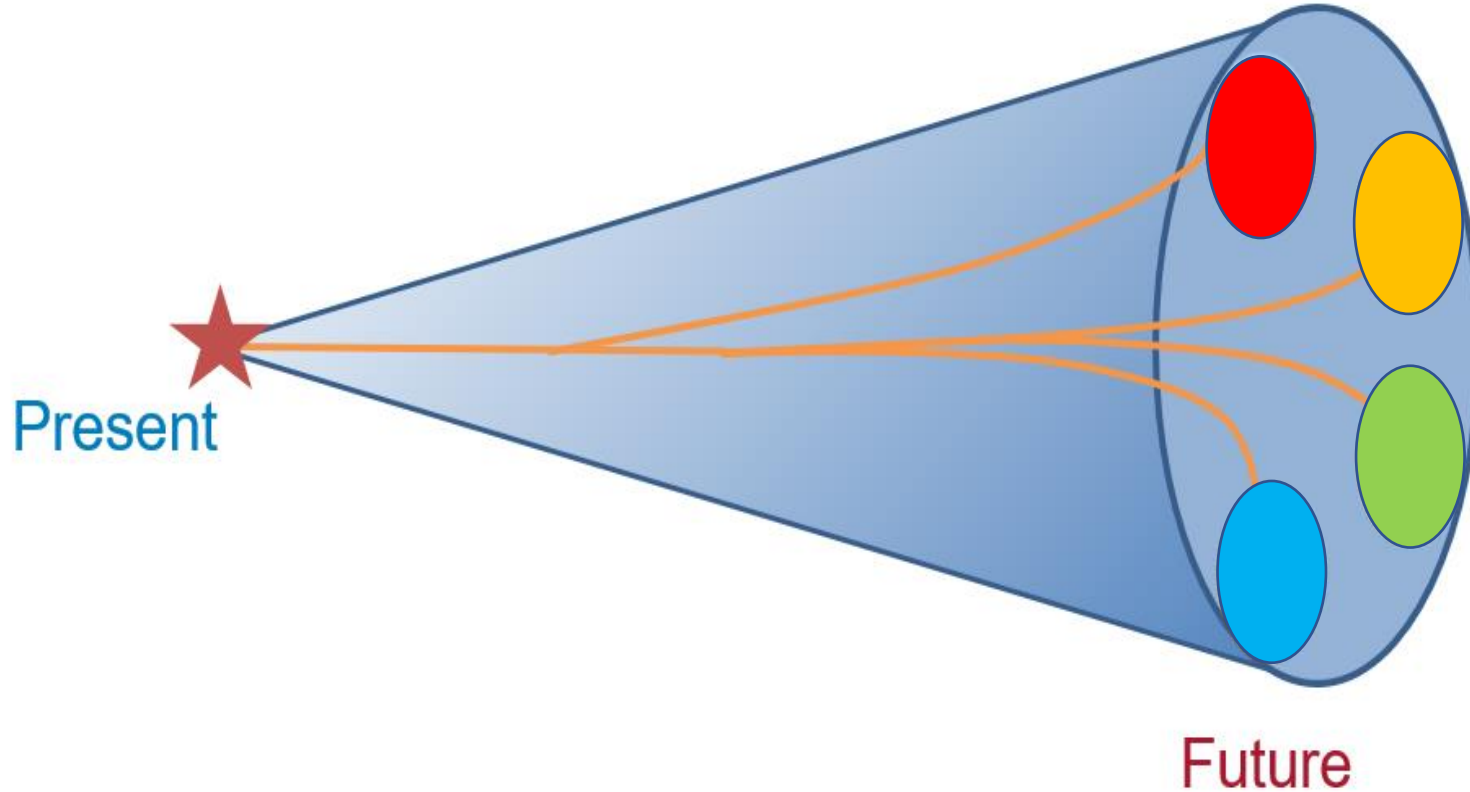


Brandon Goshi
Metropolitan Water District of
Southern California



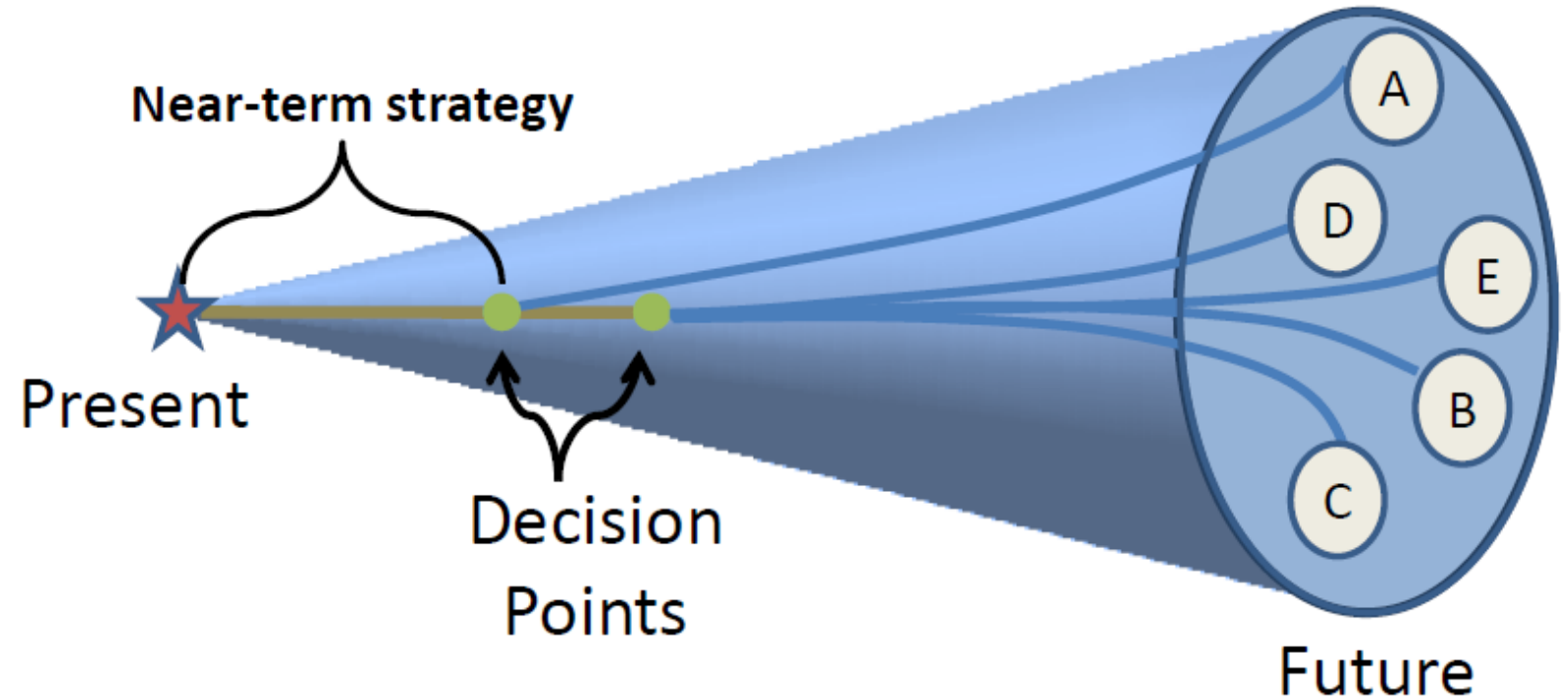
Lurna Kaatz
Formerly Denver Water

Meeting the Cone of Uncertainty: Love at first sight



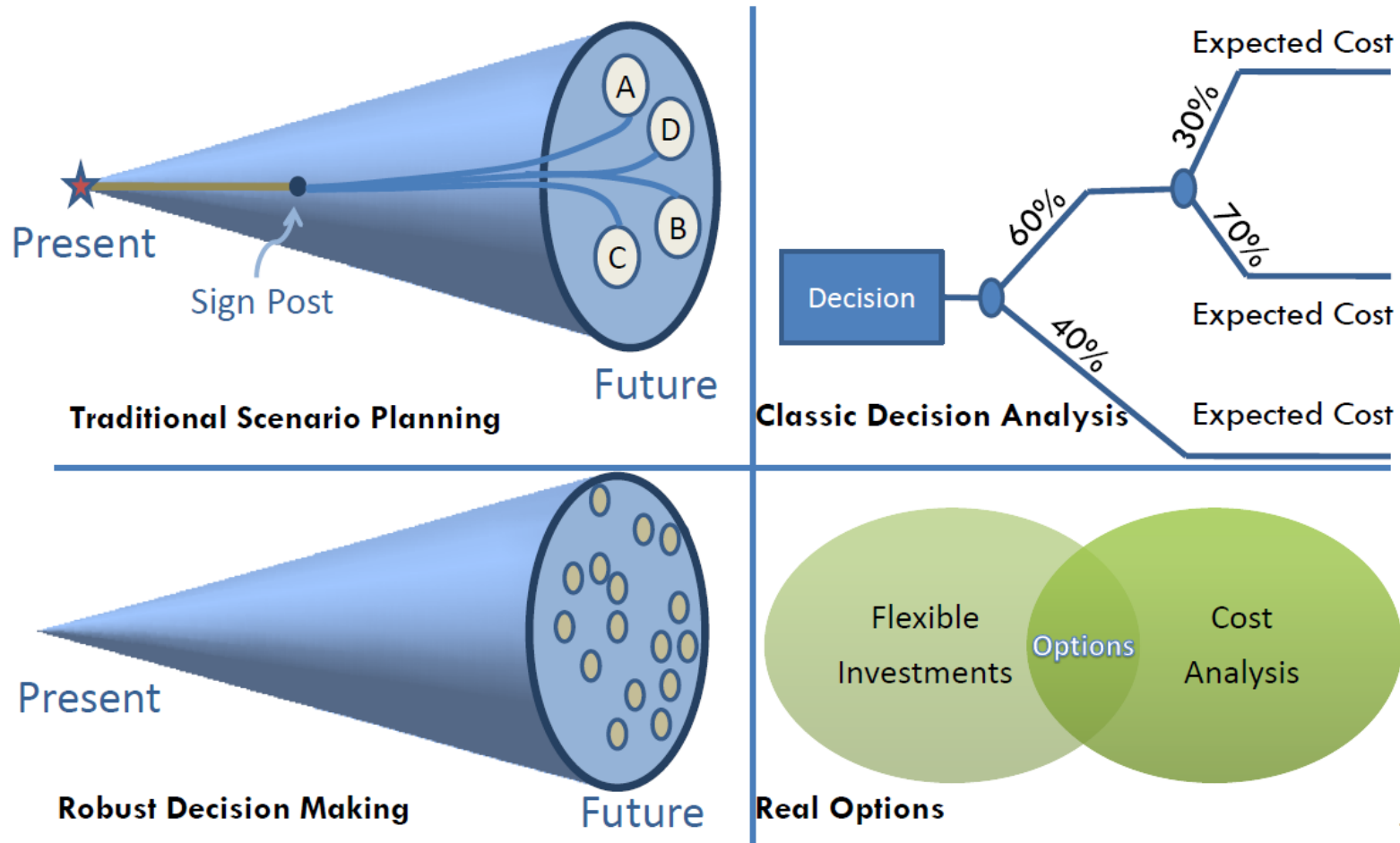
Simple but powerful: Scenario Planning

Goal of scenario planning is not to predict but make better decisions!



Now we can use climate modeling tools to project a range of future supply outcomes. Don't have to pick!

A new approach: Plan for multiple futures



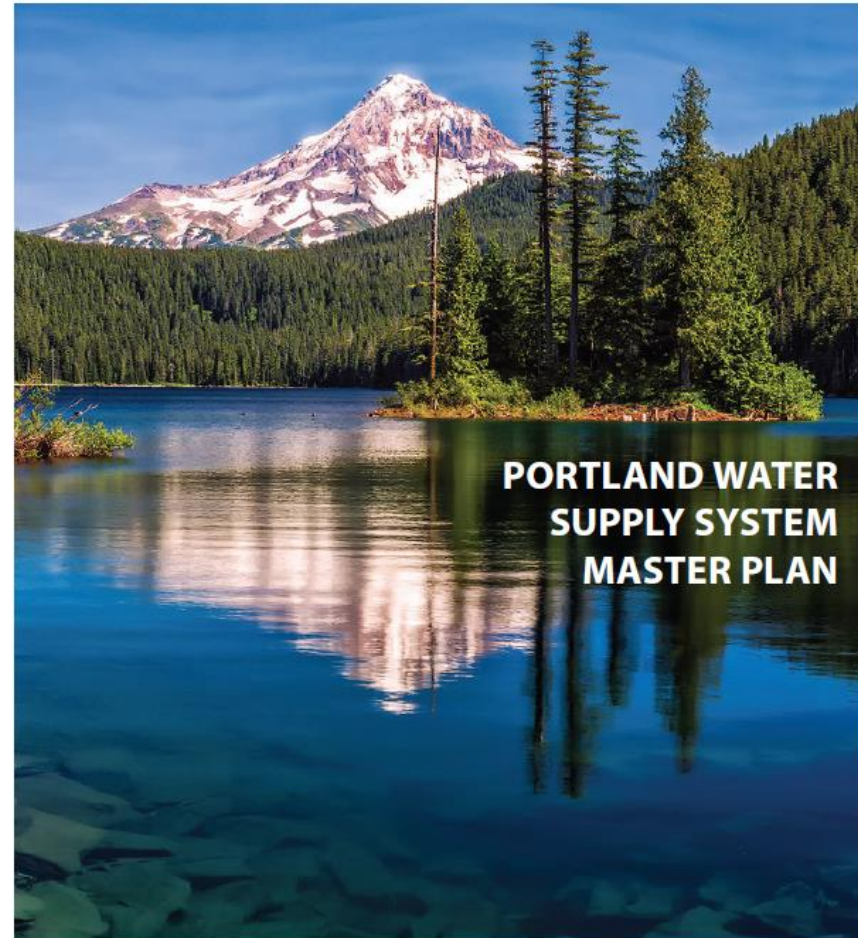
Supply System Master Plan 2021 (SSMP)



JUNE 2021

VOLUME I: REPORT

- Develop a Supply System Master Plan that is a roadmap for investing in Portland's Water Supply System
- Help PWB be flexible and nimble to accommodate changing conditions
- 20-year planning horizon
- Incorporated Scenario and Adaptive Planning
- Worked with Jacobs and Hazen & Sawyer



Framing question for Supply System Master Plan

How can PWB best prepare its water supply system to meet customer water needs as future challenges and opportunities arise?

Identified Key Drivers of Change

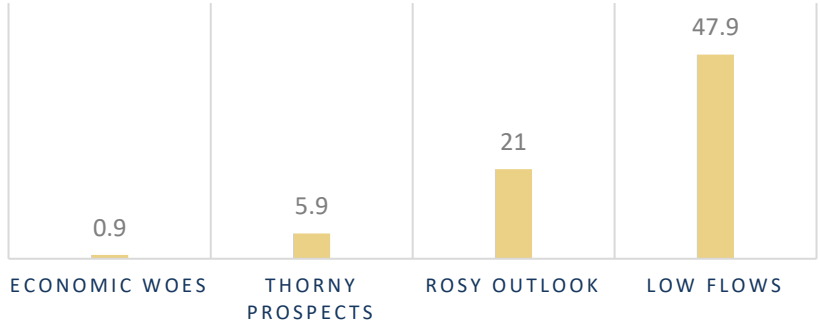
Key Drivers of Change:

- **Supply stress**
 - Wholesale customer base
 - Demands
 - Climate change impacts
 - Groundwater water quality
- **Available funding**
 - Revenue
 - Bond rates
 - Inflation
 - Competing priorities
 - Public/political support

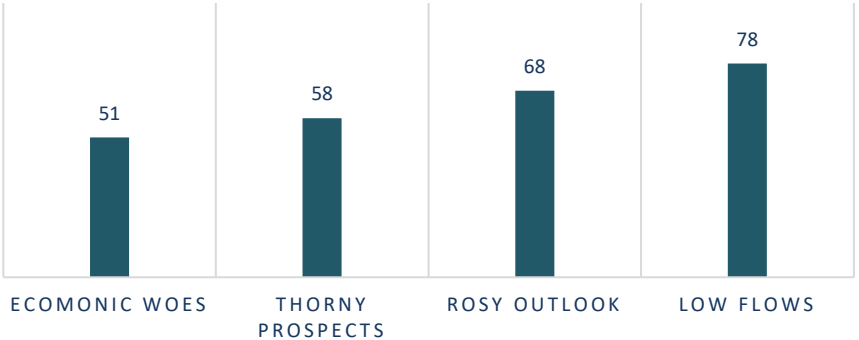


How do scenarios impact supply & demand forecasts?

Percent of Summers Requiring Augmentation

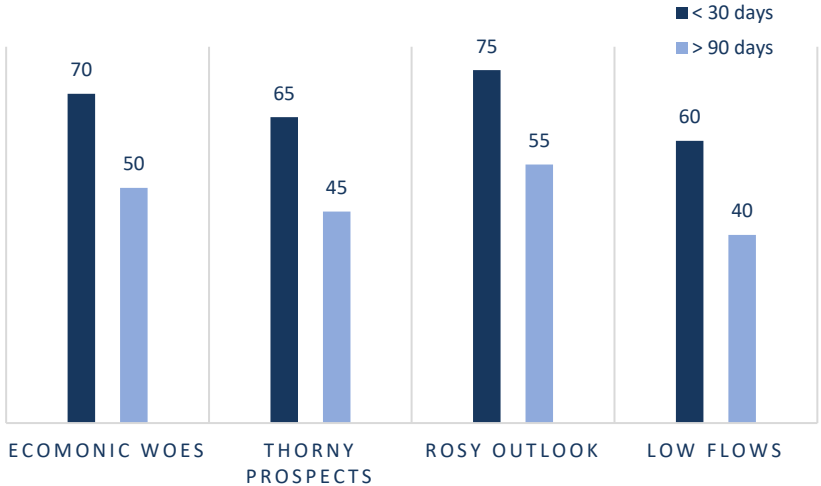


Indoor Water Demand (mgd)

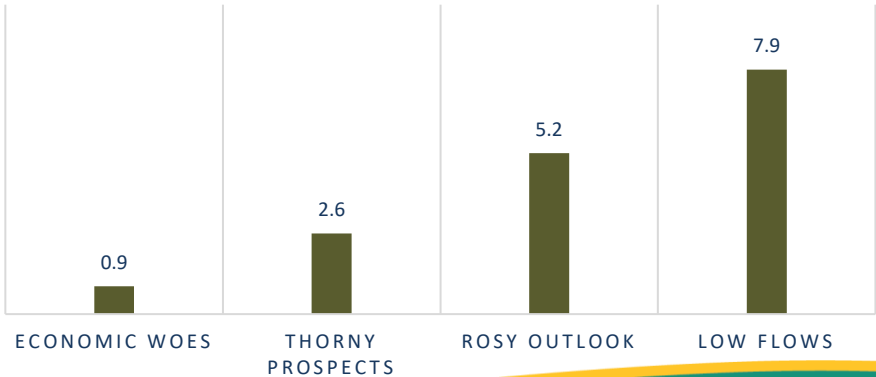


In-house modeling enabled us to translate scenarios into quantitative projections for different supply outcomes

Reliable Groundwater Capacity (mgd)



Summer Augmentation Need (BG)



SSMP Implementation Road Map

Supply System Master Plan (2021) roadmap identifies Base Plan projects for supply investments over the next 20 years, and a set of Adaptive Actions that can be implemented if conditions change.



On-going
Adaptive
Planning

Base Plan

Includes projects required to meet regulatory, Asset Management, hazard mitigation and operational needs.

“Low-regret” actions will be needed regardless of how future conditions may change.

Adaptive Actions

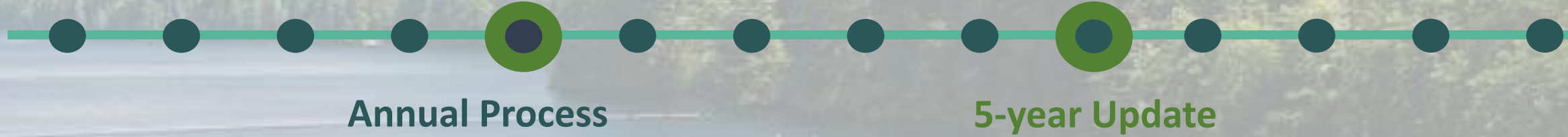
Actions that *may (or may not)* be needed to supplement the Base Plan. Need will depend on future conditions.

Requires an ongoing, Adaptive Planning Process to determine if/when adaptive actions might be needed to achieve our goal of ***making the right investments, at the right time.***

What are PWB's Adaptive Actions?

Adaptive Action	Conditions that May Support Action (Monitor)	Lead Time to Full Implementation
<p>Groundwater Treatment/New Wells</p> <p>(E.g. Manganese management)</p>	<ul style="list-style-type: none"> • Decreased reliable capacity of Columbia South Shore Well Field • Increased need for summer augmentation • Manganese water quality issue • Climate-related hazards such as wildfires impacting Bull Run and Headworks 	<p>3 to 5 years</p>
<p>Enhanced Efficiency Programs</p> <p>(E.g additional conservation measures)</p>	<ul style="list-style-type: none"> • Increases summer demands • Decrease in summer Bull Run flows • Increased groundwater augmentation • Constrained financial resources for infrastructure 	<p>1 to 3 years</p>
<p>Large-scale Conduit Replacement</p>	<ul style="list-style-type: none"> • Rapidly increasing demands • Increased failure rates 	<p>TBD</p>

PWB Supply Adaptive Planning Process: Annual and 5-Yr Update



Quarterly Team Meetings

1. Track and monitor, identify trends
2. Synthesize information

Annual Adaptive Planning Workshop

1. Convene stakeholders
2. Status updates on key trends
3. Evaluate project priorities and formulate budget recommendations

Budgeting Integration

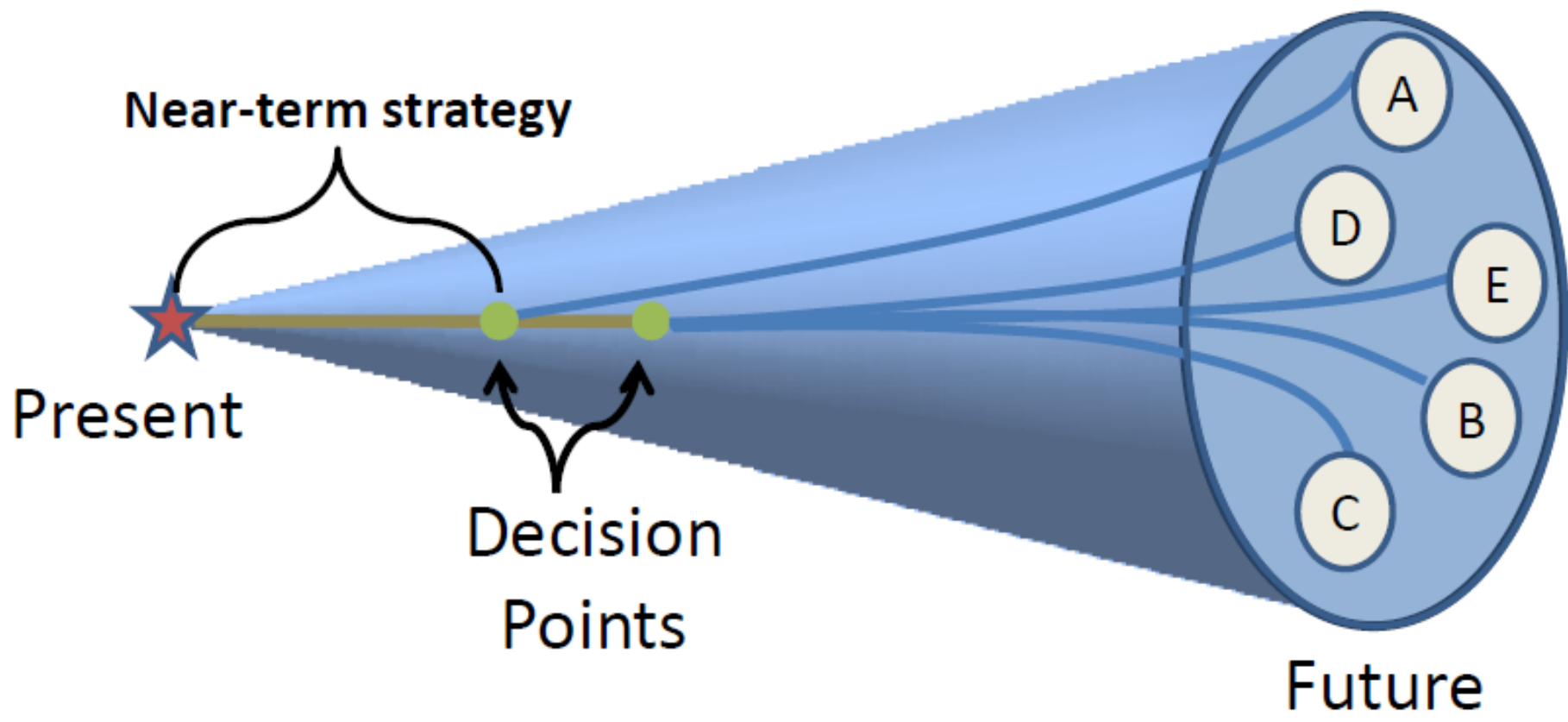
1. Recommendations to CIP and Program Budgets (as needed)

Base Plan Review

New Risks Review/Update Planning Scenarios

Update Long-Range Supply and Demand Forecasts

Forthcoming
in 2025!




Adaptive Planning process to date

- Key attribute of Adaptive Planning is monitoring changing conditions.
- Use monitoring to inform investment decisions.
- Culture-changing process of continuous collaborative planning and evaluation.
- Goal is to gain a common understanding of supply system conditions and investment needs.
- This is a resource/staff intensive process.

Adaptive Planning process to date





Key questions we're asking

Are there significant trends or changes in Bull Run supply, groundwater supply, customer demand, or financial resources?

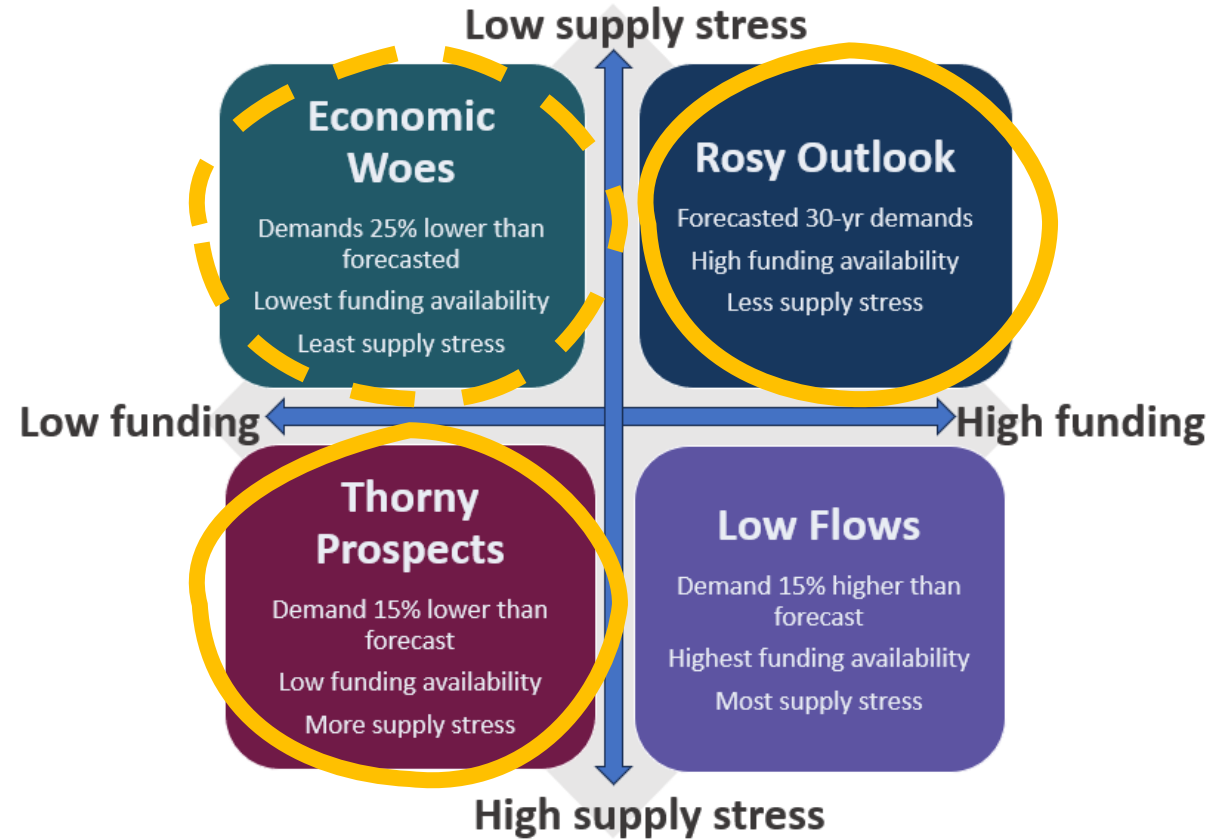
Given supply system trends and conditions, how should we prioritize or rethink supply investments and decisions?

Do we need to recommend Adaptive Actions or changes to CIP or Program Budgets?

Scenarios have already been useful!

Recent Trends 2021-2024

Demands	Decreasing Demands Future loss of 3 wholesalers Uneven economic growth/recovery
Financial & CIP	Declining demands is affecting revenue Rate changes impact base budget Increase capital cost for projects Limited CIP flexibility
Bull Run Supply	Wildfire! Multiple projects needs, some unfunded Aging infrastructure Reduced summer flows, early drawdowns Ongoing regulatory drivers
Groundwater Supply	Continued need for summer augmentation Groundwater important contingency for BR Reduced reliable capacity Water quality impacts (Mn) Emerging regulation (PFAS)



Conditions are not static!

Adaptive Planning benefits

- ✓ Make recommendations to inform investment decisions holistically across different program areas.
- ✓ Helps avoid budget surprises.
- ✓ No crystal ball required when evaluating what is actually changing in the system.
- ✓ Adaptive actions are based on a combination of monitoring data and professional judgement rather than a predefined “trigger” or metric.
- ✓ Enables the organization to quickly pivot in response to emerging challenges.
- ✓ Seamlessly allows new data to be incorporated.
- ✓ Builds institutional collaboration and understanding.



Adaptive Planning challenges

- ✓ Shifting institutional norms around planning.
- ✓ Learning as we go (also a benefit).
- ✓ Trade-offs are difficult!
- ✓ Deciding how and when we might need to take an Adaptive Action is also hard, especially without predefined triggers – e.g. Enhanced Conservation.
- ✓ Resource and staff intensive – how to keep it fresh and maintain momentum?



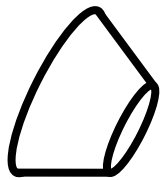
Our story in terms of the game:



- Decade 1: Probabilities based on history
 - You know the risk and can maximize the return
 - Planning in a perfect world
 - Deterministic planning



- Decade 2: Shifting probabilities
 - Were you ready for this?
 - Thoughts on the robust option?
- Decade 3: Nervous?
 - Did you use the robust option or play the odds?



- Decade 4: Life without probabilities
 - Who used the robust option?
 - Spend time determining how it will land or focus on preparing for however it lands?
 - Predict or prepare?

History is the best guide – 2001 IMP

- Increasing demand & growth
- Assumed a supply deficit w/demand & climate change
- Predictive

Uncertainty

- Reality check!
- Build capacity to tell our own story
- Don't rely on prediction

Climate impacts

- Climate Change is here!
- Multiple impacts

Embracing Uncertainty – to 2040 & beyond

- Learning from our peers
- Prediction is out, projection is in
- Planning for multiple futures
- Scenario & Adaptive Planning
- Collaborative planning

A group of people are silhouetted against a bright sunset sky. They have their arms raised in celebration. The sun is low on the horizon, creating a lens flare effect. The background shows a landscape with hills and a body of water.

Thank you!!

Contact information

Kavita.Heyn@portlandoregon.gov
Edward.Campbell@portlandoregon.gov