Possible Oregon S2S Applications
Western States Water Council S2S Workshop – San Diego

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State Engineer for Water Resources
• Oregon Water Resources Department
• Integrated Water Resources Strategy
• Oregon Hydrology
• Droughts
• Floods
• Most Useful Forecast Information?
• In-stream use
• Out-of-stream use
• Reservoir Storage
  • (Permit, approve, inspect, don’t own)
• Groundwater
• Drought response
• Dam Safety
• Flood role?
Surface Water Science

Groundwater
State Engineer Roles

• Principal assistant to agency director for engineering
• Historically State Engineer was a small agency responsible
• Dam safety
  • Statutes and rules (new)
  • Dam hazard rating and condition classification
  • Designs and inspections
  • Enforcement and restrictions
  • Just one other PE
• Safety in emergencies
  • Dams
  • Other hydraulic structures
  • OERS Council

Malheur dam in drought
110 foot dam with State Engineer Restriction
My background for current role

• ODF 27 years
• Landslides, debris flows
• Natural resource engineering and policy
• PE, GE
• Concerns with droughts and floods similar
2017 Integrated Water Resources Strategy

With DEQ, ODFW, ODA, DSL, ODA, ODF, others

1. Water Resources Today
2. Instream and Out of Stream Needs
3. Coming Pressures
4. Meeting the needs
Overview of Content

Introduction

• The charge to develop a Strategy
• Our successes since 2012
• Cross-cutting issues
  • Groundwater
  • Climate change & extreme events
• Funding & investments
• Collaborative solutions
IWRS Drought Recommendations

Recommended Action 5.5A Plan and Prepare for Drought Resiliency

1. Assess and assist those communities and ecosystems most vulnerable to drought

2. Develop the appropriate set of indicators that signal and forecast differing stages of drought

3. Document the economic, social, and environmental impacts of drought, including the frequency, distribution, intensity and duration

4. Prepare for, respond to, and mitigate for the impacts of drought

5. Improve the drought toolbox through education and outreach, drought contingency plans, more efficient water distribution systems, and additional voluntary measures to improve streamflow
Recommended Action 5.5B Plan and Prepare for Flood Events

1. *Develop indicators of flood emergency stages, using information about meteorologic, hydrologic, hydraulic, and watershed conditions*

2. Document the economic, social, and environmental impacts of floods

3. *Evaluate potential for extreme flooding, under atmospheric rivers and climate change scenarios*

4. Establish early flood warning systems in areas where recent drought and wildfire have affected forests and vegetation
Oregon’s hydrology

- Winters mild(er) and wet
- Summers very dry
- Many recent droughts
  - More SE, less NW
- Atmospheric rivers to the west
- Convective storms to the east
- Complex orographic effects
- AEP flood and PMF uncertainty
- Last widespread flooding - 1996
Oregon’s Hydrology

- Western Oregon orographic
  - Lower high mountain elevations than CA, WA
- Small Willamette Valley
- Eastern Oregon rain shadows
  - Pretty high, dry and rugged
- Warm winters serious issue, especially for basins with little storage
Importance of Snowpack

The Oregon Drought Readiness Council Presents:

2015 and the future of snow droughts in Oregon

THURSDAY, MAY 17, 2018 at 1:30 p.m.
Oregon Department of Fish and Wildlife Commission Room
4034 Fairview Industrial Dr. SE
Salem, Oregon

(Parking is free)
Droughts in Oregon

Antelope Reservoir and dam in late May 2015
Droughts in Oregon

Water Supply Availability Committee

- NRCS Snow Survey
- NWS Portland Office
- NW River Forecast Center
- Oregon Climate Service (OSU)
- ODF
- USGS
- State Climatologist
- OWRD

Continues for 12 more pages, selected figures follow

Snow water equivalent has declined in the past two weeks. Statewide snowpack is now well below normal at 66 percent. The Hood, Sandy, and Lower Deschutes continue to measure the highest at 95 percent of normal. As of today, the Owyhee Basin has melted out completely with the John Day effectively the same at only 4 percent. The map on page 4 illustrates the considerable differences between the northern and southern regions of the state. These differences are reflective of the weather patterns that have been prevalent across the west throughout this past winter and spring.
Droughts in Oregon

Precipitation (Mountain) - Percent of Normal

Snow Water Equivalent – Percent of Normal

Compared to this time last year -
Droughts in Oregon

Statewide Reservoir Conditions - April

Reservoir Storage Summary for the end of April, 2018

NRCS Basewide Summary: May 1, 2018
(averages based on 1981-2010 reference period)

Three Month Temperature and Precipitation Outlook
May through July Outlook - Follow link for the latest information.
Website: http://www.cpc.noaa.gov/products/precipLongRange/seasonal.php?lead=1
Droughts in Oregon

Probability distribution very useful
Oregon’s Drought Response Tools

- Preference of water rights use for human or livestock consumption
- Temporary supplemental groundwater right
- Temporary emergency permits, transfers and in-stream leases
Other Drought Effects

- Wildfire around problem dam on landslide
- Flash flood, landslide and debris flow risk
- Governors office and Federal support to remove quickly
  - (1.5 months from burn date for a 55 foot dam on Federal lands)
• Most general floods in western Oregon occur due to winter storms
  • November through February (i.e. now)
  • Widespread Oregon flooding occurred in 1861, 1948, 1964 and 1996
Heppner Flood

- June 14, 1903
- Local thunderstorm
- 247 fatalities
- Worst natural flash flood disaster in US
• Oregon One of 5 States without a NOAA Atlas 14
• PMP procedures based more on tropical storm behavior with Gulf of Mexico source, dated
• Corps of Engineers doing site specific work
• How much moisture can an atmospheric river deliver?
Working on flood annex
Floods of 1996

• February 1996
• Four day atmospheric river
• Very well forecast
• Who is on first?
• City of Portland example
  • Forgot where flashboards were for the seawall
• Many state buildings flooded
  • No state directed flood fight
Atmospheric Rivers

- Storm 2 our of 3 in 1996
- Shorter duration
- Less common pattern
- Much more severe than forecast
  - (Several gages around 1.5 inch per hour for 4-5 hours)

Figure 2. Infrared satellite photograph for November 18, 1996, showing subtropical jet stream bringing moisture from the southwest, and a cold air mass over Washington. (Photograph courtesy of the Oregon Climate Service, Corvallis, Oregon.)
2007 Flood at dam

Water filled to crest, all boats and logs through interior spillway
Awareness of unusual flood situation

Oregon Emergency Operations Plan being rewritten

Flood Situation Agencies
- NWS and RFC forecasts and Consultation
- OWRD
- USACE
- ODOT
- OEM.
- How much time is needed to get resources ready?
Five strategies

1. Design review to ensure the dam be safe when built?
2. Would people be at risk if the dam were to fail?
3. Inspections to determine if it remains safe?
4. A plan to detect and prevent failure?
5. Evacuation and notice if its failing so people have enough time to get to safety?
Dam safety authorities in Oregon

- USACE
- USBOR
  - Owyhee dam
- FERC
- OWRD
  - Many past due for rehabilitation
Oregon’s Dams Are Older

Number of Water Storage Dams by Year Completed

- Total # of Dams
- # of High Hazard
- # of Significant Hazard

Before 1930: 290 Total Dams, 14 High Hazard, 7 Significant Hazard
1930-1950: 49 Total Dams, 7 High Hazard, 5 Significant Hazard
1976-1986: 70 Total Dams, 5 High Hazard, 17 Significant Hazard
After 1986: 68 Total Dams, 6 High Hazard, 7 Significant Hazard
Effective communication between engineers, geologist and meteorologists and public safety officials should not be taken for granted.
Willamette Valley Project
- 13 reservoirs
- Flood control a primary purpose
- Need to follow rule curve to minimize flood risk before filling
- Not enough information to change operations in drought
- PMF analysis underway
Areas of Greatest Need

• What is the confidence in and range of potential temperature and precipitation in the S2S forecasts.
• Documentation on range of precipitation that can be delivered by a west coast atmospheric river.
• What mechanisms cause long duration heavy precipitation. What is an extreme range for maximum duration.
• Probability of occurrence (is an extreme flood possible now, even if low probability)
Questions?