Cooperative Groundwater Studies with the United States Geological Survey (USGS)

Ivan Gall, Groundwater Section Manager, OWRD
Terrence Conlon, Supervisory Hydrologist, USGS
Marshall Gannett, Research Hydrologist, USGS

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Photo: Unnamed spring complex near Canyon Creek Campground on the Metolius River

USGS Cooperative Water Program (CWP) Goals

- Bring local, State, and Tribal water science needs and decision making together with USGS national capabilities
  - Consistent methods and quality assurance
  - Innovative monitoring technology
  - State of the art models and analysis tools
  - Robust data management and delivery systems
- Study issues that are important to the USGS mission and that inform local water decisions
- Respond to emerging water issues
- Produce data that is comparable across states; provide synthesis

Types of CWP studies

- Data collection
  - Surface Water
  - Groundwater
  - Water Quality

- Assessment and Research
  - Floods and drought -- Environmental flows
  - GW/SW interaction --GW availability
  - Water use --SW availability
  - Energy development impacts on water quantity and quality
  - Effects of urbanization & agriculture on water quality & quantity
  - Natural contaminants in groundwater
  - Emerging contaminants

Benefits of the Program to OWRD

- Access to national databases and historical data
- Involvement of regional and national experts
- Further development of staff technical expertise through experience and technical training
- Increased data collection capacity
- Quality assurance, archival, and distribution of data
- Application of state-of-the-art techniques to local problems
- Rigorous review of science through peer review and presentation at national meetings
- Products (reports, data) are published and can be cited

Benefits of Program to USGS

- Guides USGS science, keeping it relevant
- Provides opportunities to apply state-of-the-art research to local problems
- Provides resources and projects to develop new methods
- Adds to USGS databases
  - Water quality trends
  - Water availability trends
  - Streamflow trends
  - Response to climate and land-use changes

Funding of CWP

- Allocated to USGS from Congress
- Available to state water science centers to use to support cooperative (collaborative) studies and data collection
- Centers decide matching ratio, but it cannot exceed 50:50
- Funding has been flat over decades; centers reducing match (60:40, 65:35)

Examples of Recent OWRD/USGS studies

- Upper Deschutes Basin (2)
- Willamette Basin
- Upper Klamath Basin
- Other studies
  - Umatilla (data collection only, coordinated with DOGAMI)
  - Hood River
  - Stream Flow and Groundwater-Level Monitoring
- In addition to these recent studies, there are many smaller-scale investigations going back to the early 1960s.

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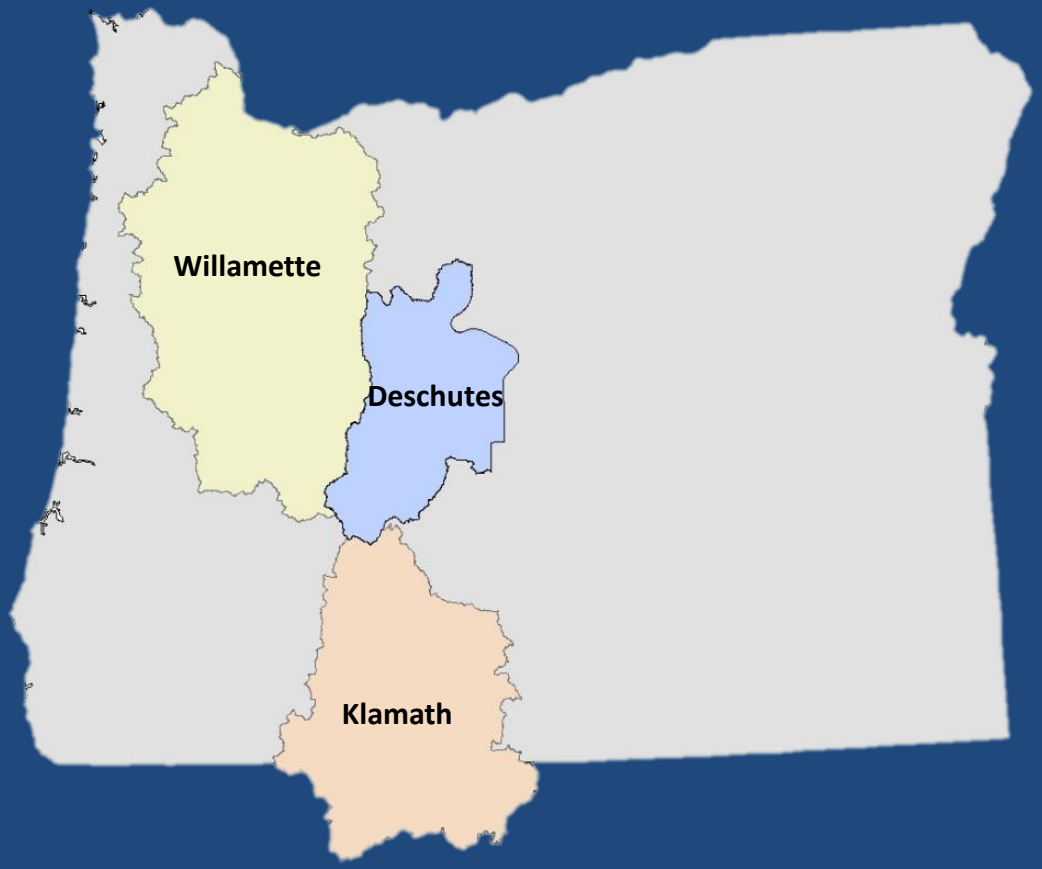
Major cooperative groundwater studies have been completed in the Deschutes, Willamette, and Klamath River basins in the past 20 years.



What goes into these studies?

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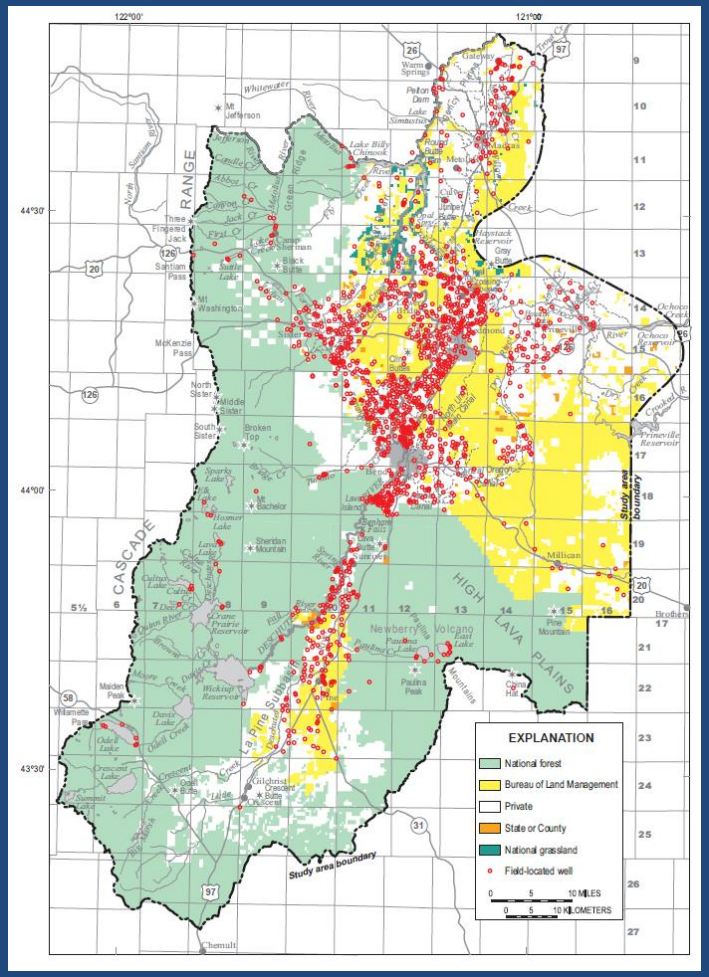
Parts of a collaborative groundwater study

- Collection of basic hydrologic data
- Mapping the water-table elevation
- Evaluation of the hydrogeologic framework
- Measuring and mapping GW/SW interaction
- Determining the hydrologic budget
- Understanding the hydrologic response to external stresses
- Synthesis and development of conceptual understanding
- Development of numerical models

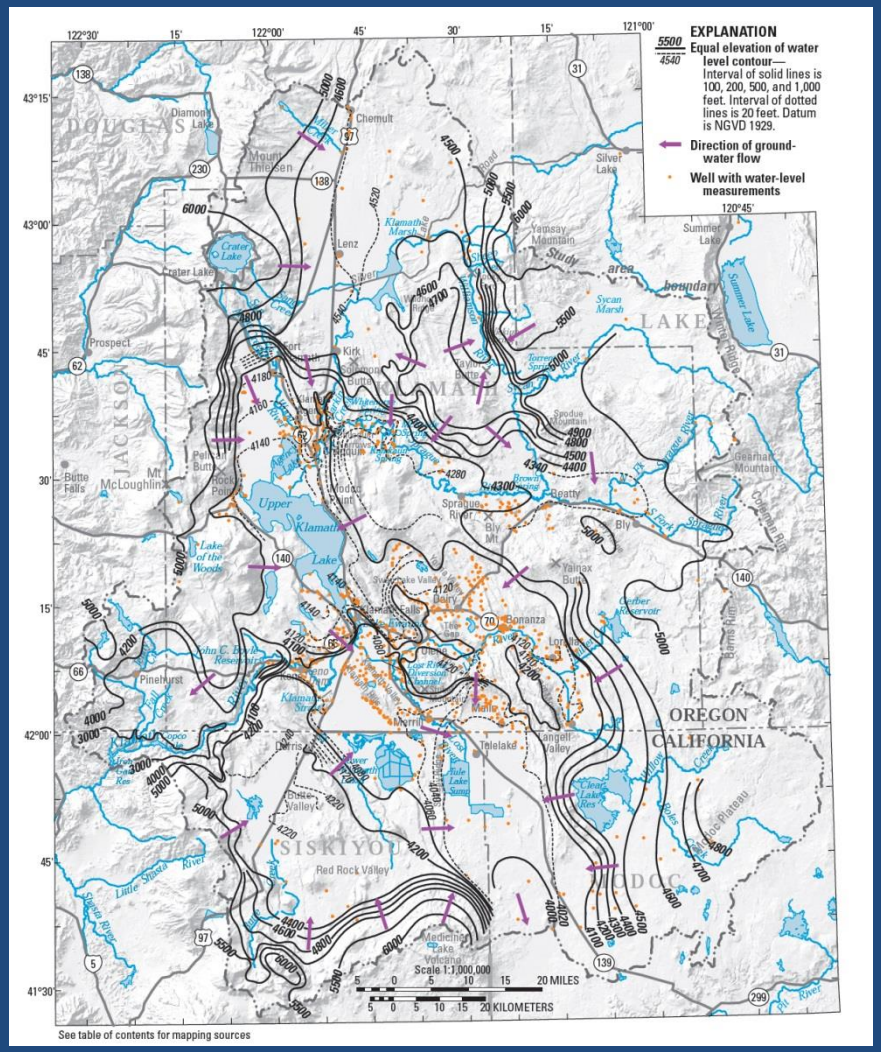
Collection of Basic Data



Upper Deschutes Basin Study Area showing 1,500 field-located wells used in the analysis of the groundwater flow system (WRIR 00-4162)

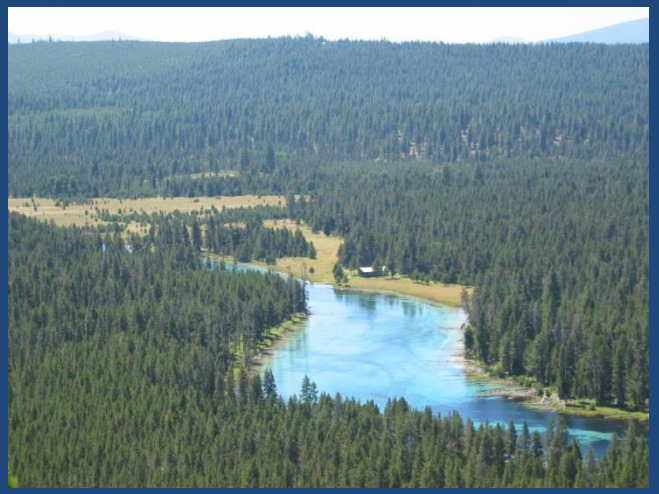
- Groundwater levels (including trends)
- Water Chemistry (including isotopes)
- Streamflow, stream gains and losses
- Surficial geology (geologic mapping)
- Subsurface geology (well logs, cuttings, geophysics)
- Water use

Mapping of Water-Table Elevations and Flow Directions



Water-table elevation and groundwater flow directions in the Klamath basin (SIR 2007-5050)

GPS leveling survey for wells in the Klamath basin

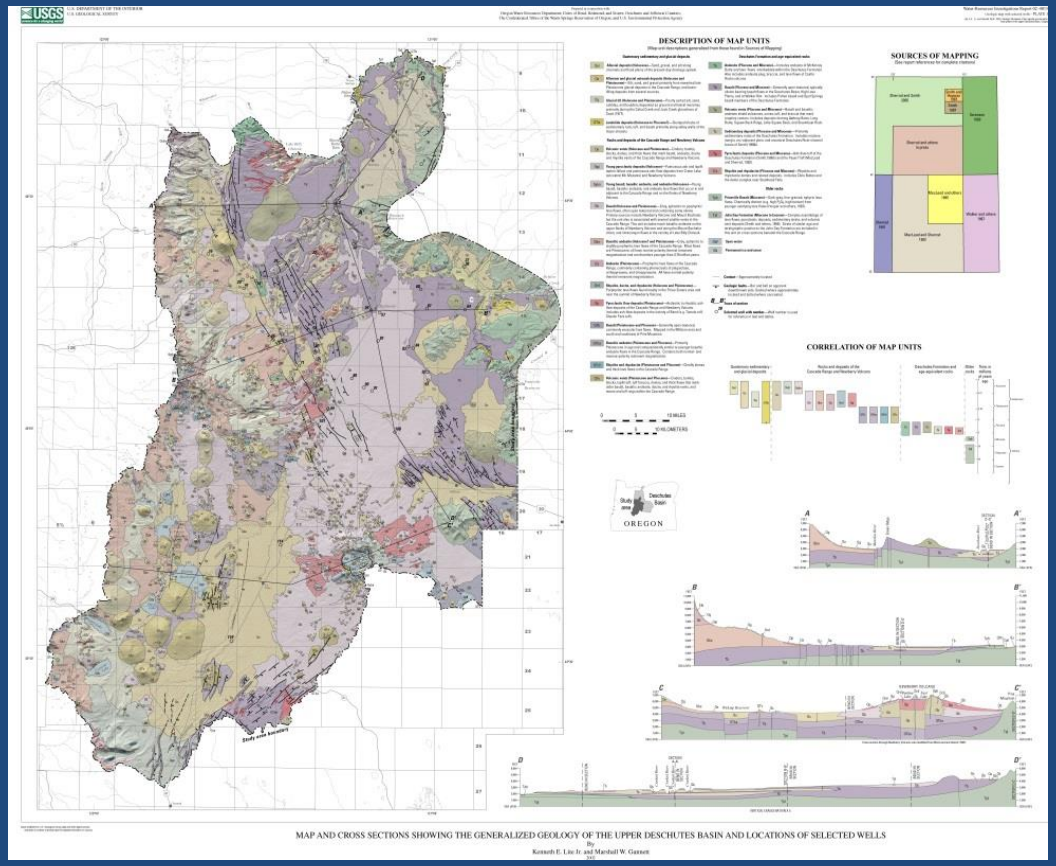


Spring Creek in the Klamath basin

Evaluation of the Hydrogeologic Framework and Determination of Subsurface Hydraulic Properties

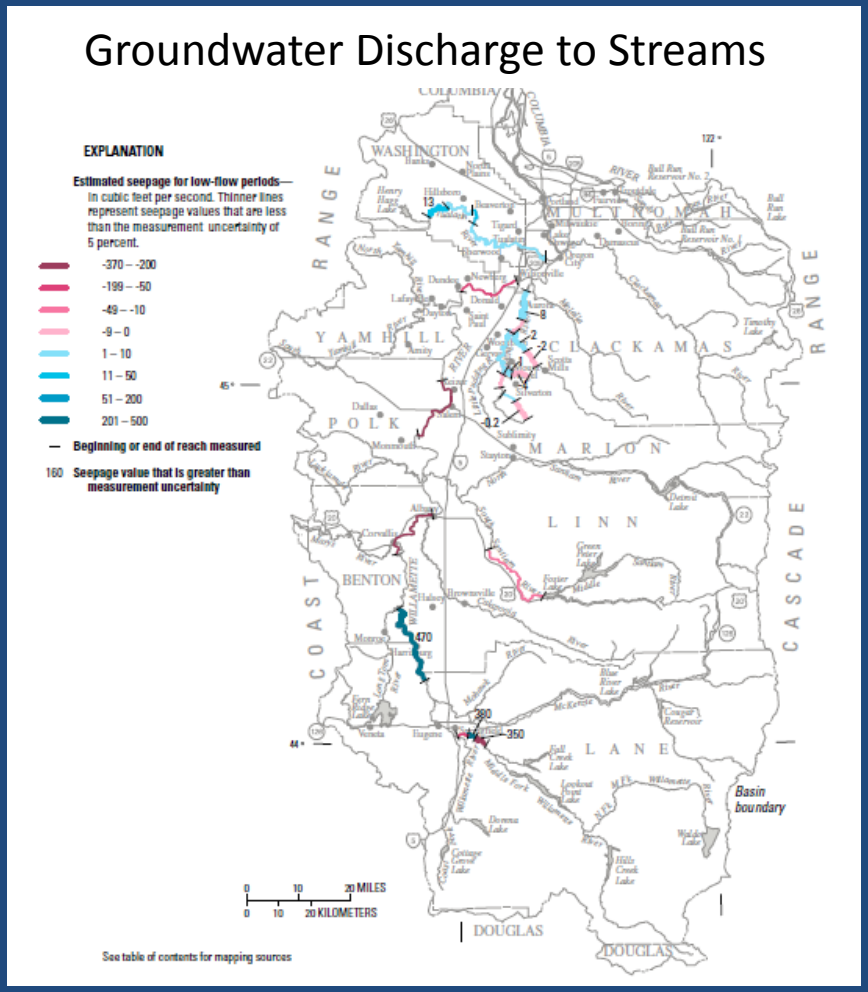
Analysis of well data

Field observations



Mapping of hydrogeologic units (USGS WRIR 2002-4015)

Measuring and Mapping the Interaction Between Surface Water and Groundwater



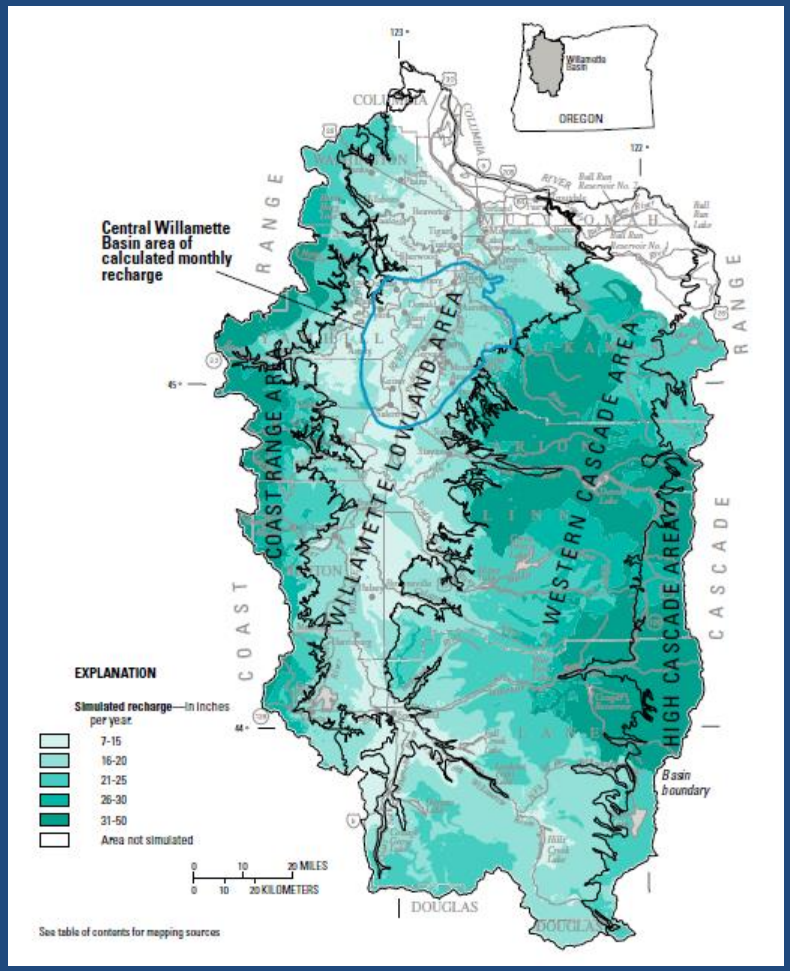
Estimated seepage to streams during low flow (1993, 1996, 2000) in the Willamette basin (SIR 2005-5168)

Stream gaging in the Willamette basin

Seepage meters recording groundwater discharge to the Pudding River in the Willamette basin

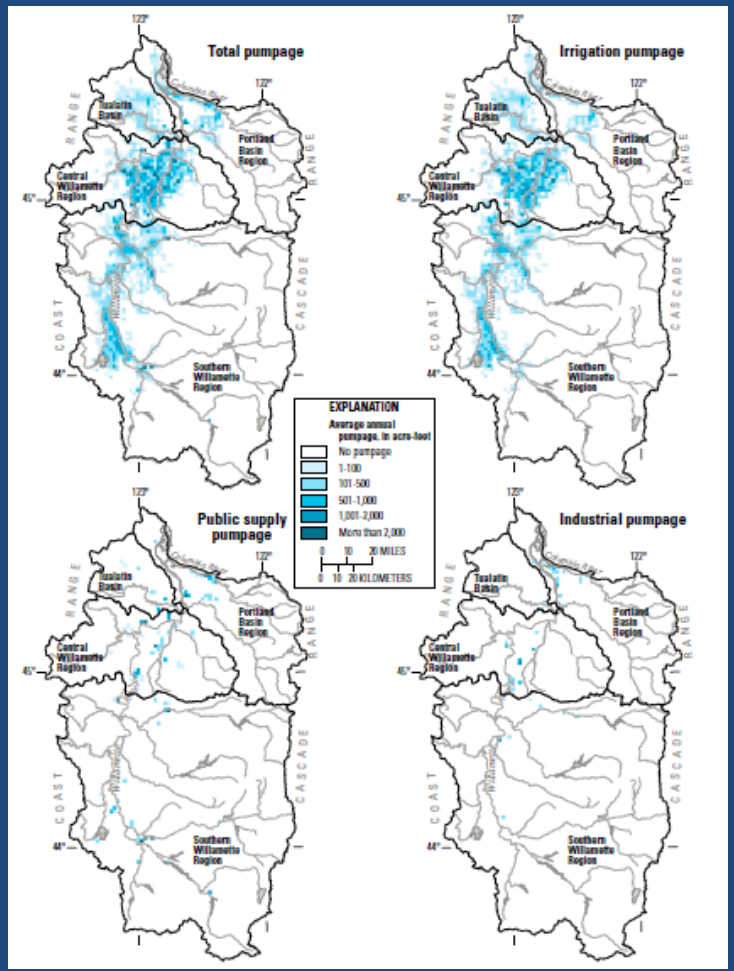
Determining the Hydrologic Budget

Groundwater Recharge



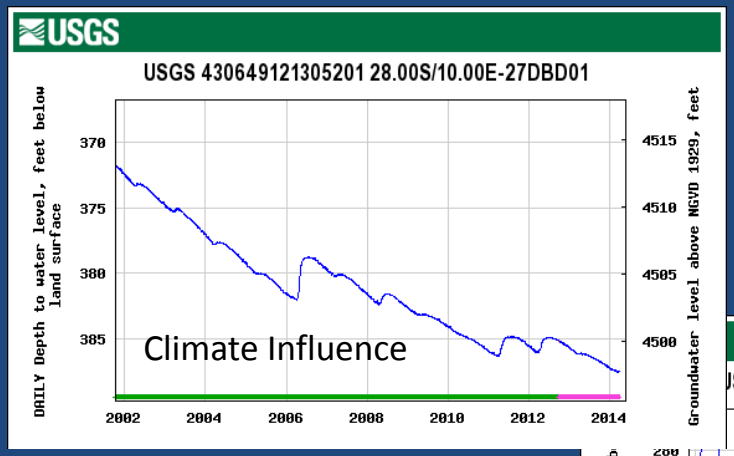
Estimated groundwater annual recharge rates (1995-96) in the Willamette basin (SIR 2005-5168)

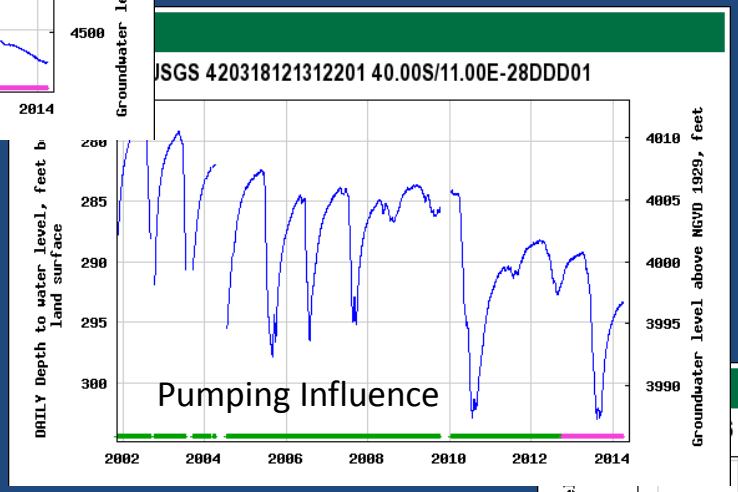
Groundwater Pumping

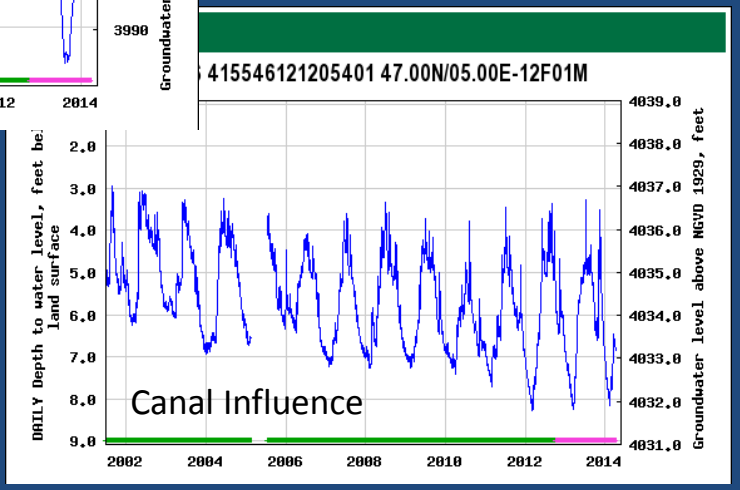


Mean annual groundwater use (1995-96) In the Willamette basin (SIR 2005-5168)

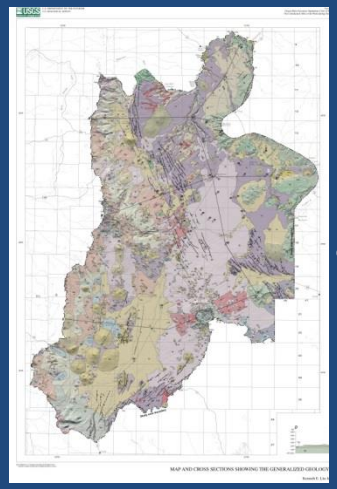
Understanding the hydrologic response to natural and human-caused stresses







Synthesis and development of conceptual understanding based on solid data and fundamental principles



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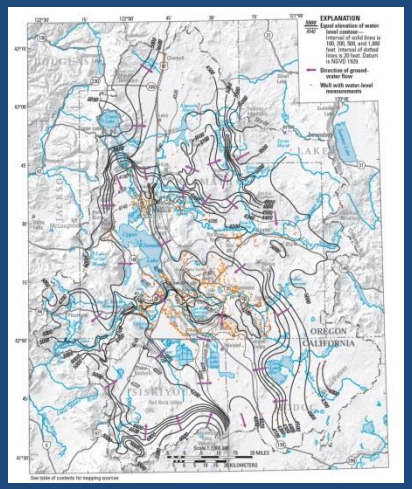

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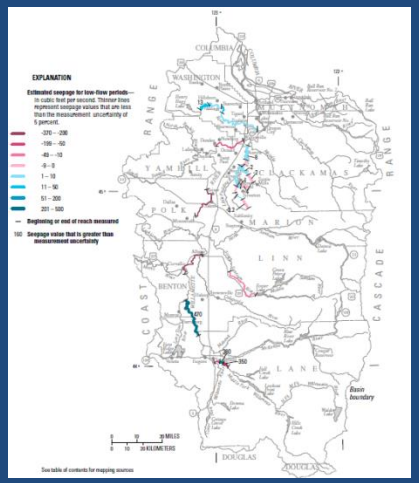

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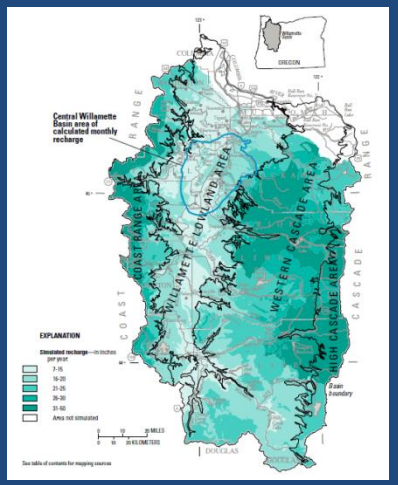

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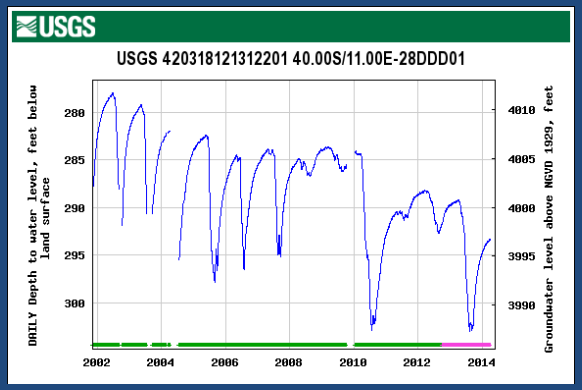
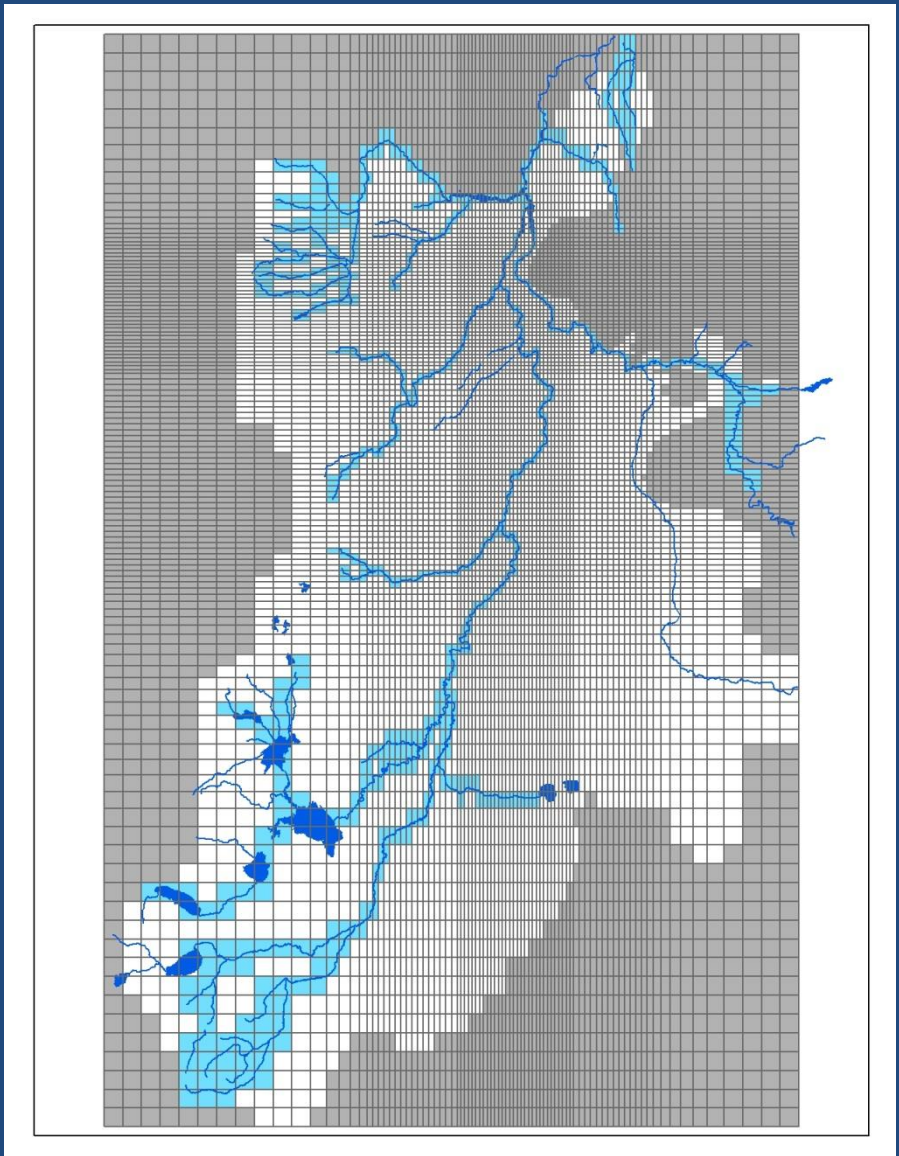


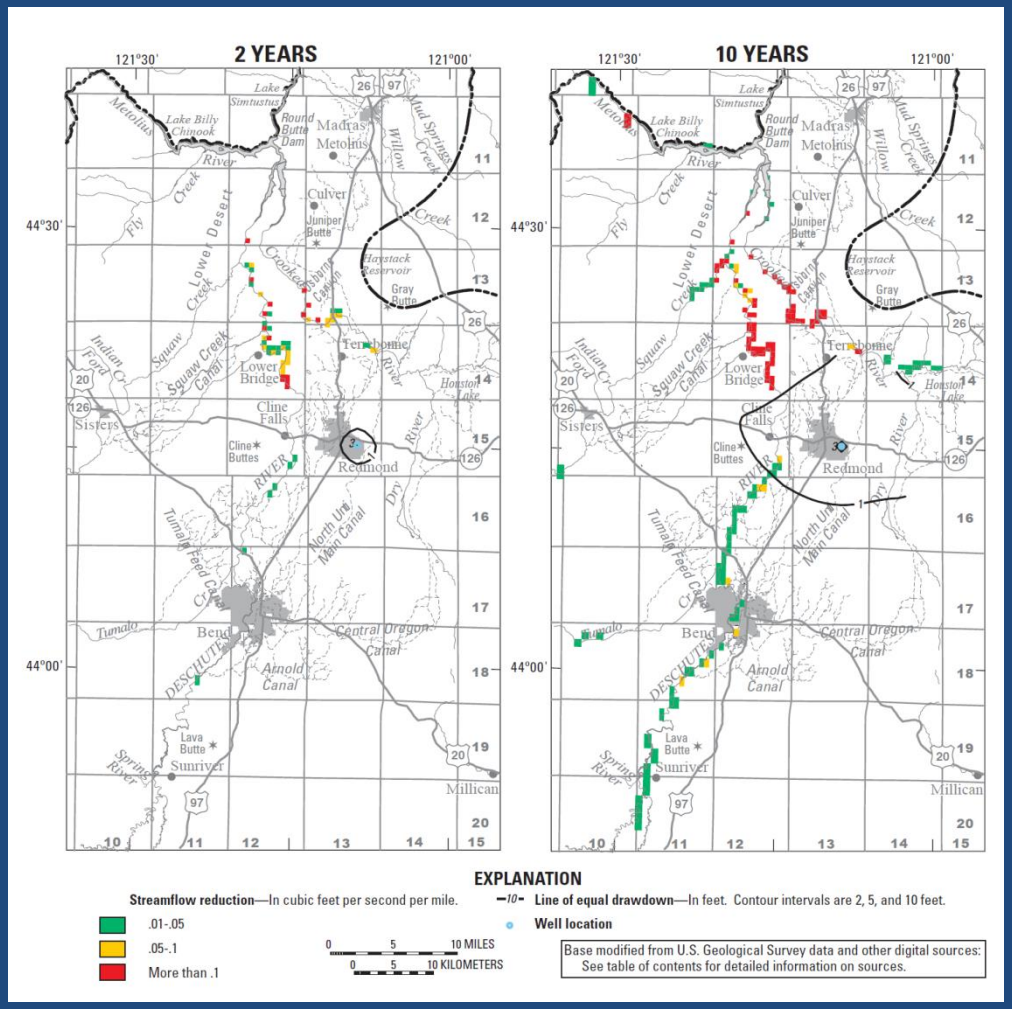
= Sound hydrologic understanding for decision support

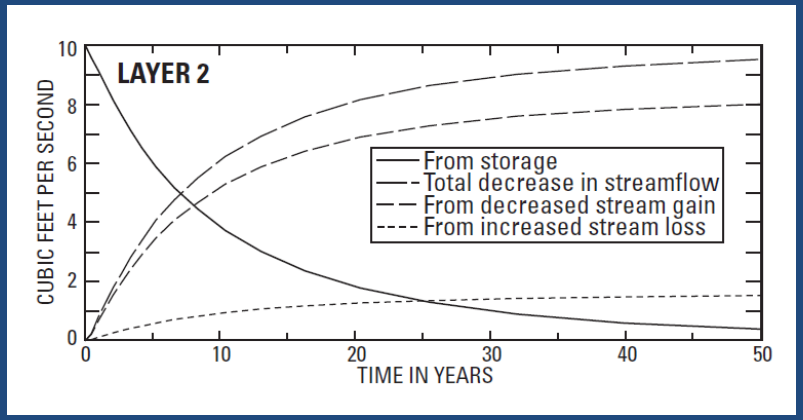


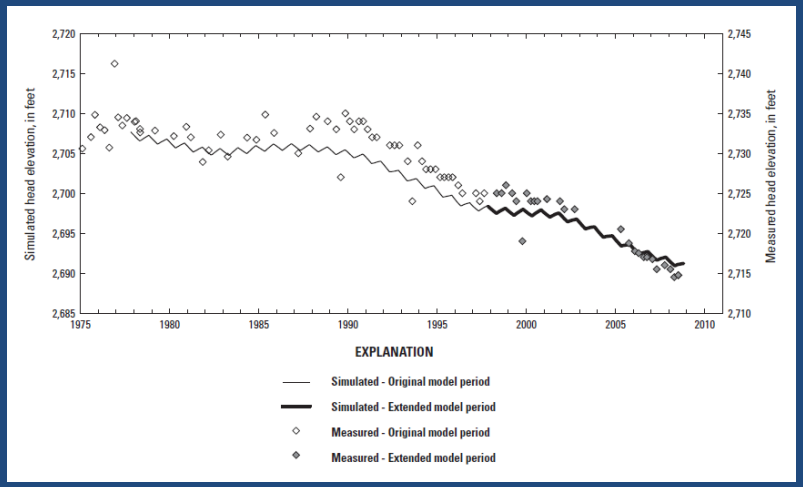
Numerical Model Development

- Provides a synthesis of all data
- Tests conceptual understanding in a rigorous framework
- Provides additional insights into hydrologic behavior
- Can be refined as additional information becomes available

Numerical Model Simulations

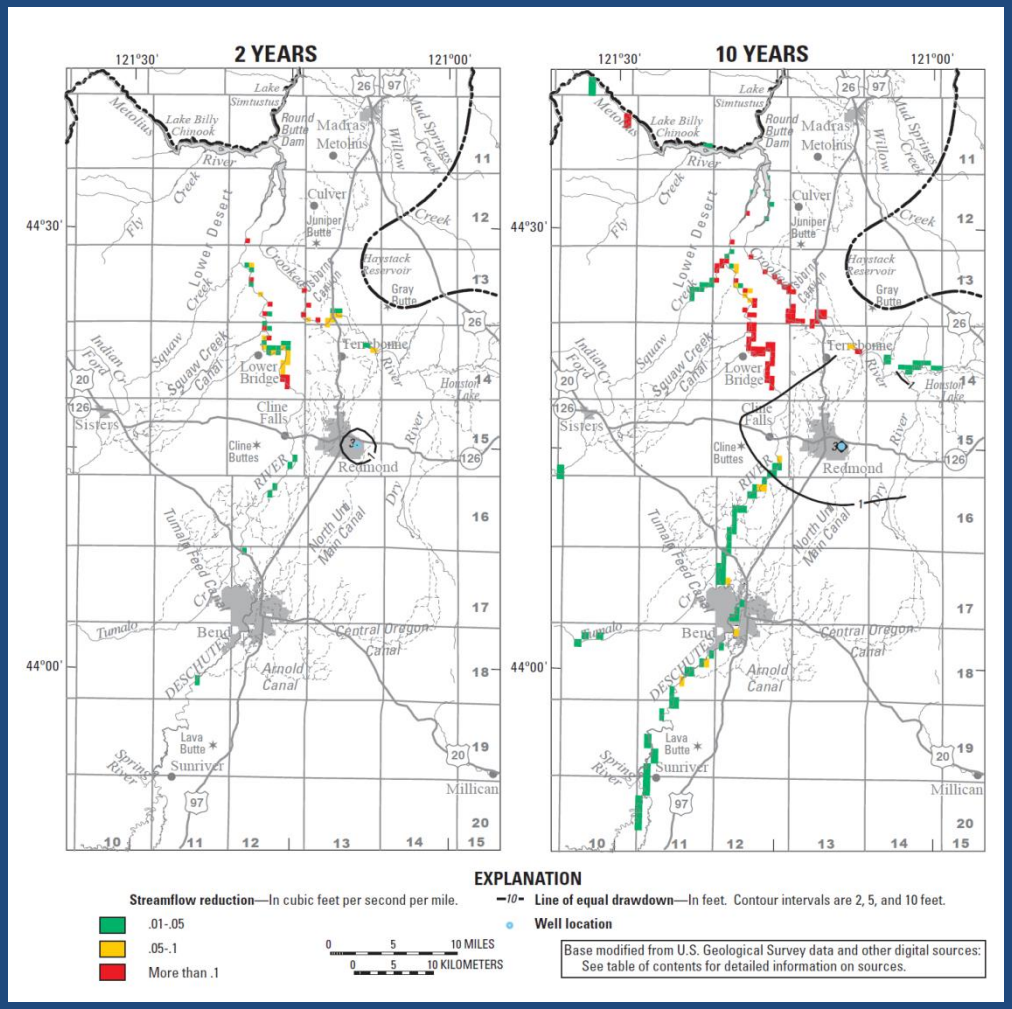


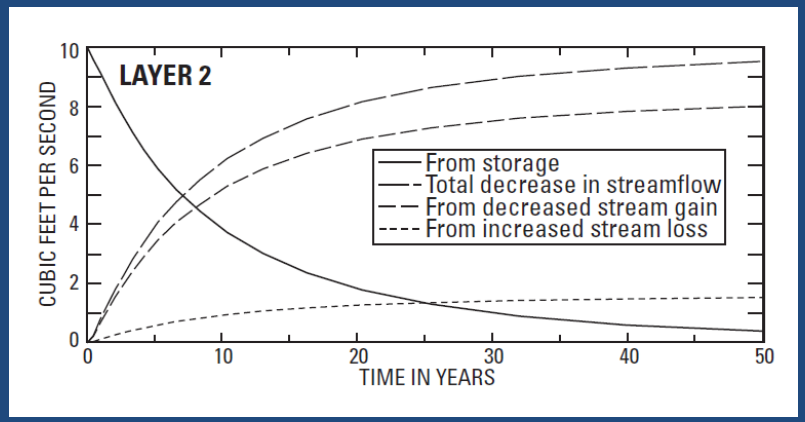


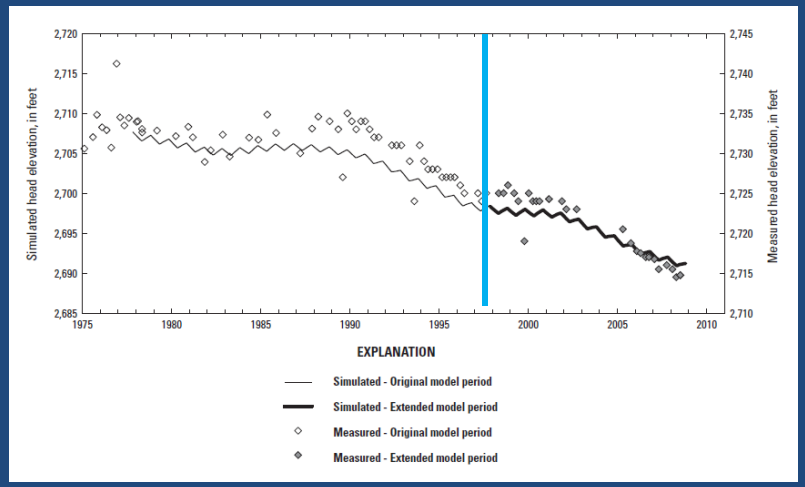


Simulation of groundwater pumping impacts near Redmond after 2 and 10 years of pumping at 10 CFS (WRIR 03-4195)

Numerical Model Simulations







Simulation of groundwater pumping impacts near Redmond after 2 and 10 years of pumping at 10 CFS (WRIR 03-4195)

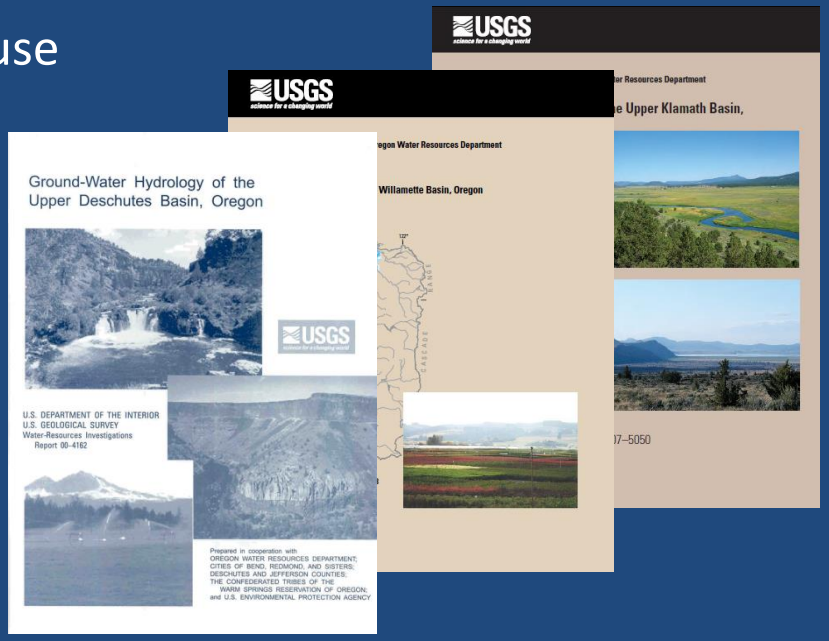
Study Products

- Collection of basic data - quality assured and archived
- Sound understanding of groundwater hydrology in study areas based on data and fundamental principals
  - Basic groundwater hydrology
  - Hydrologic budgets
  - GW/SW interaction
  - Response to climatic and human stresses
- Development of models that can provide insights into management strategies
- Improved understanding into groundwater hydrology of Oregon in general

14 USGS peer-reviewed reports have been published for the last 3 cooperative studies summarizing :

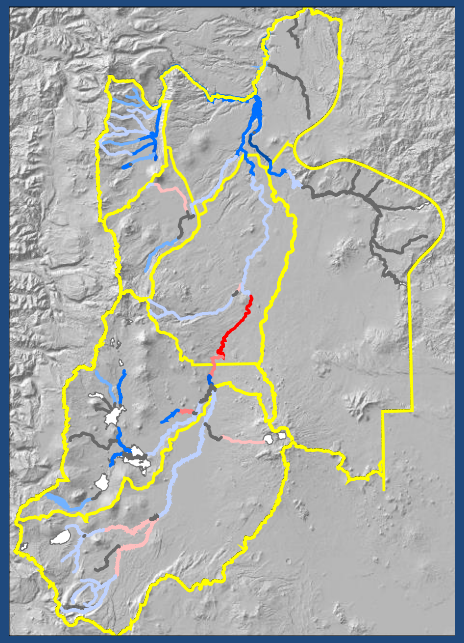
- Basic hydrologic and water chemistry data
- Hydrogeologic framework and hydraulic properties
- Hydrologic budgets
- Interaction between surface water and groundwater
- Groundwater elevations and flow directions
- Numerical model development and use

In addition to the USGS reports there are many other peer-reviewed publications as well as presentations to stake holder groups, other agencies, and scientific meetings.



Uses for OWRD and Oregon

- Evaluating new groundwater rights
- Helps guide policy development
- Helps refine and enhance long-term groundwater monitoring programs
- Provides a common basis of understanding
- Provides transparency



Deschutes Mitigation Zones of Impact

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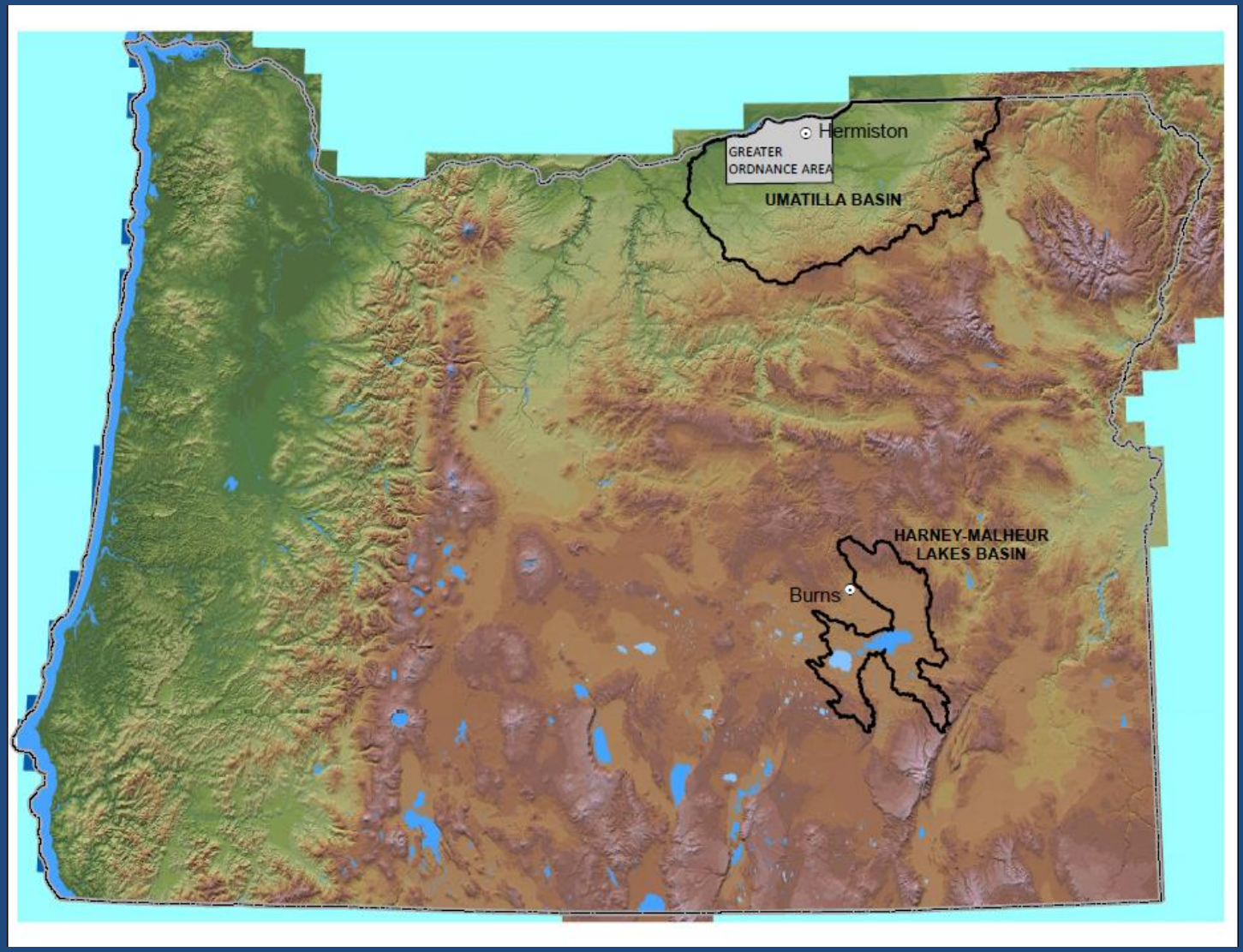
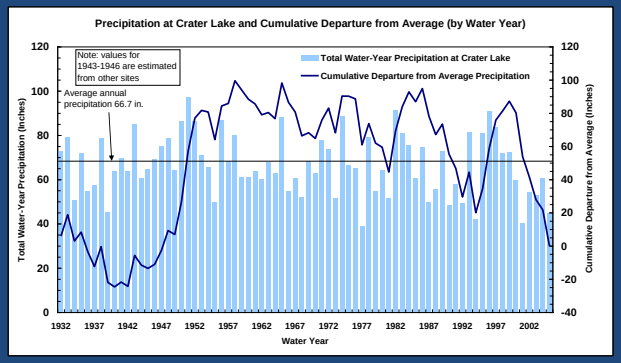
Future basin studies . . .



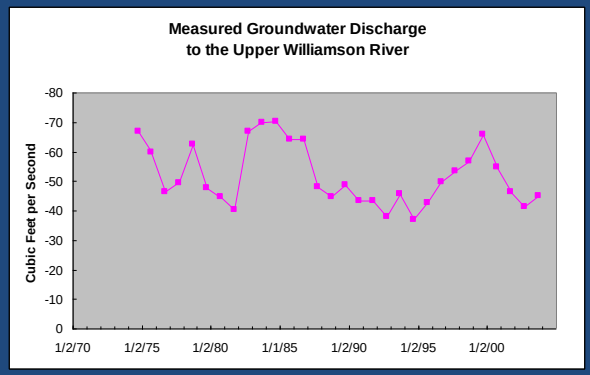
Questions?

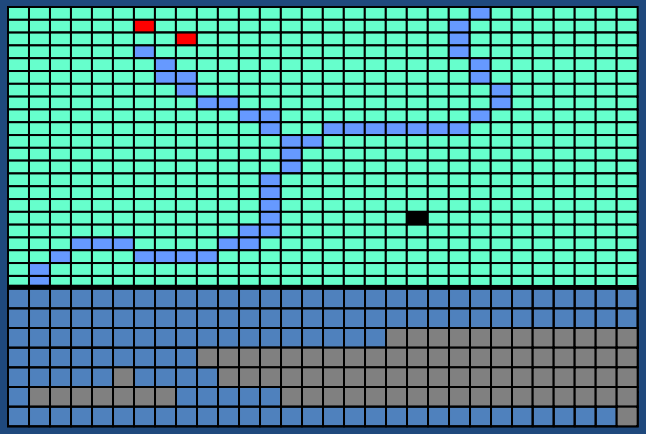
Numerical models developed through USGS/OWRD studies are calibrated so the simulated behavior of the groundwater system matches the observed behavior.

Measured External Stress

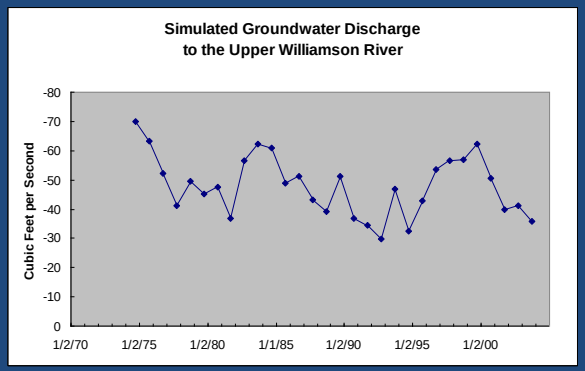


Measured Response





Simulated Response



A calibrated model can provide insights into the results of different management strategies.