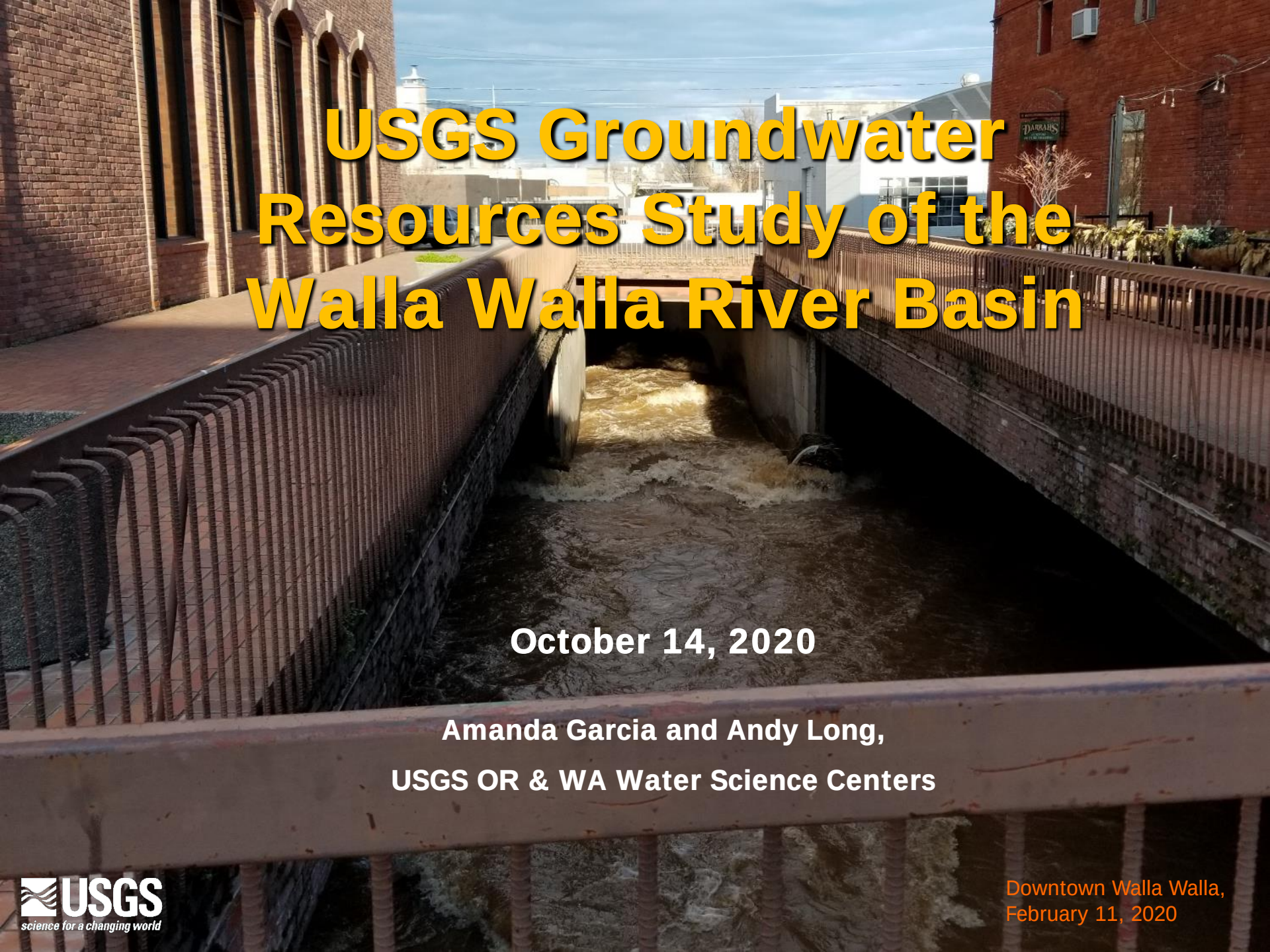
USGS Groundwater Resources Study of the Walla Walla River Basin



October 14, 2020

Amanda Garcia and Andy Long,

USGS OR & WA Water Science Centers

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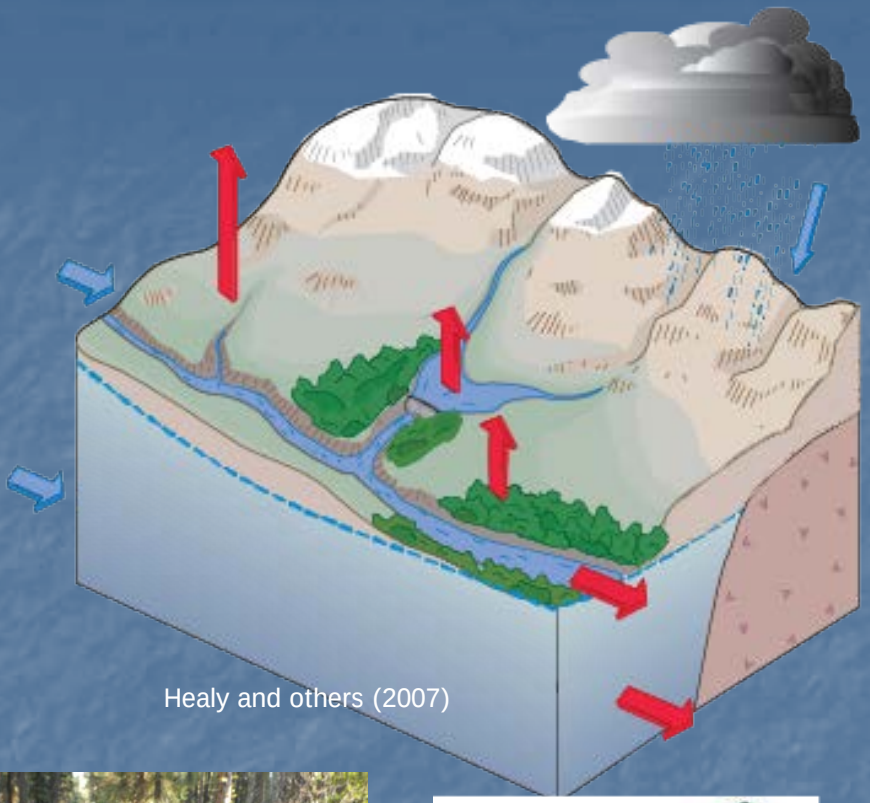
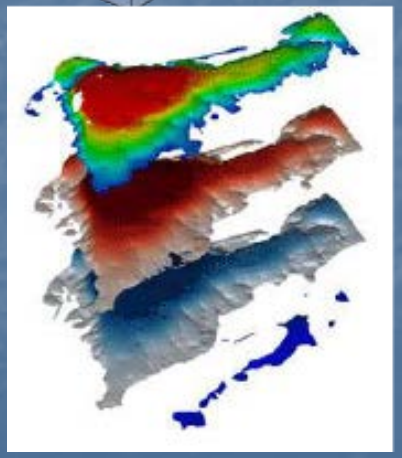
Downtown Walla Walla,
February 11, 2020

What is a Groundwater Study?

- Unbiased, data-based scientific investigation of groundwater system
  - Water availability
  - Water quality
  - Simulation tools



Healy and others (2007)



U.S. Geological Survey, 2018 at: https://www.usgs.gov/media/images/modflow-output-visualization

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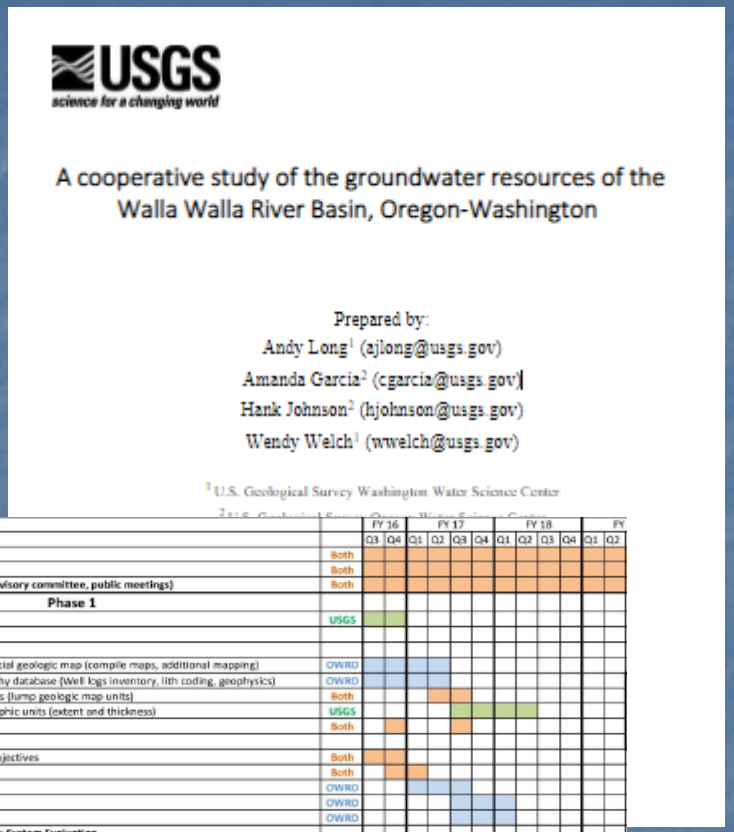
What is a Study Workplan?

- Defines study purpose, scope, and objectives
- Provides detailed:
  - Tasks
  - Timeline
  - Budget
  - Deliverables



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A cooperative study of the groundwater resources of the Walla Walla River Basin, Oregon-Washington

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		FY 16		FY 17				FY 18				FY	
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Project management	Both												
Team meetings (USGS, OWRD)	Both												
Stakeholder meetings (Technical advisory committee, public meetings)	Both												
Phase 1													
Literature review	USGS												
Geologic framework													
Development of working surficial geologic map (compile maps, additional mapping)	OWRD												
Develop subsurface stratigraphy database (Well logs inventory, lith coding, geophysics)	OWRD												
Define hydrostratigraphic units (lump geologic map units)	Both												
Create maps of hydrostratigraphic units (extent and thickness)	USGS												
Field trip to discuss geology	Both												
Drilling													
Determine drilling-program objectives	Both												
Identify well sites	Both												
Conduct drilling operations	OWRD												
Logging and analysis	OWRD												
Well testing	OWRD												
Hydrologic Data Collection and Flow-System Evaluation													
Compile existing water-level data	OWRD												
Field inventory wells	OWRD												
Monitor well network and archive groundwater levels	OWRD												
Enter data into NWIS	USGS												
Develop water-level visualization tool	USGS												
Evaluate and interpret water-level data	Both												
Determine GW flow direction (horizontal, vertical)	OWRD												
Determine GW trends (response to pumping and climate)	OWRD												
Determine data gaps	Both												
Evaluate role of structure in hydrology	OWRD												
Evaluate possible groundwater subbasins	OWRD												
Estimate hydrogeologic unit properties (K&S)	OWRD												
Evaluate existing aquifer tests (long-term, single-well, specific capacity)	OWRD												
Conduct and evaluate potential new aquifer tests	OWRD												
Apply/evaluate geochemistry and age dating	USGS												
Evaluate chemical tracer data: isotopes, age dating, major ions, temperature	USGS												
Collect new chemical tracer data-reconnaissance	USGS												
Hydrologic Budget													
Estimate GW discharge to wells	USGS												
Estimate GW use	USGS												
Link GW use to wells	OWRD												
Link wells to hydrogeologic units	USGS												
Assign water use to wells	USGS												

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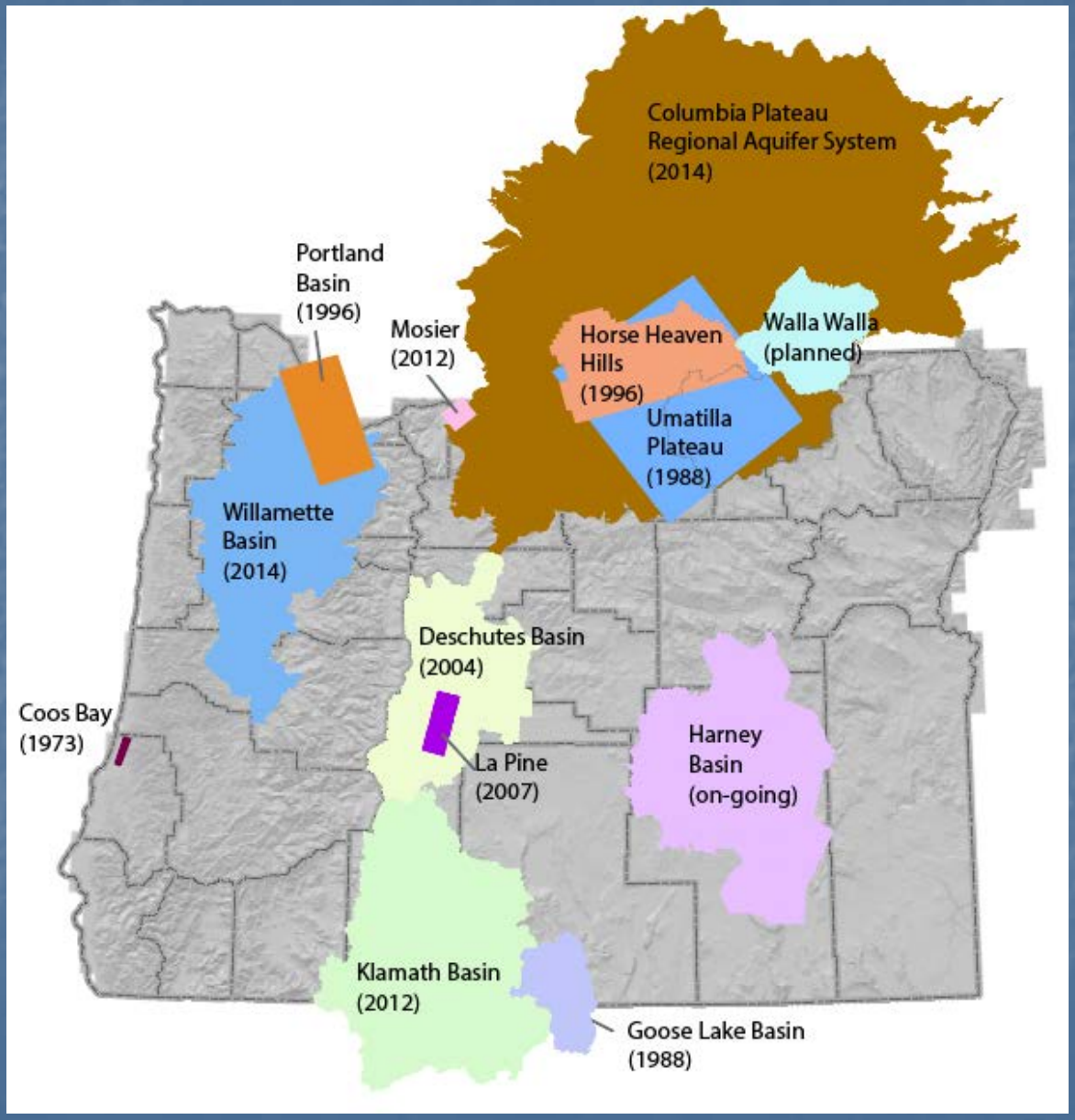
USGS Groundwater Studies in OR



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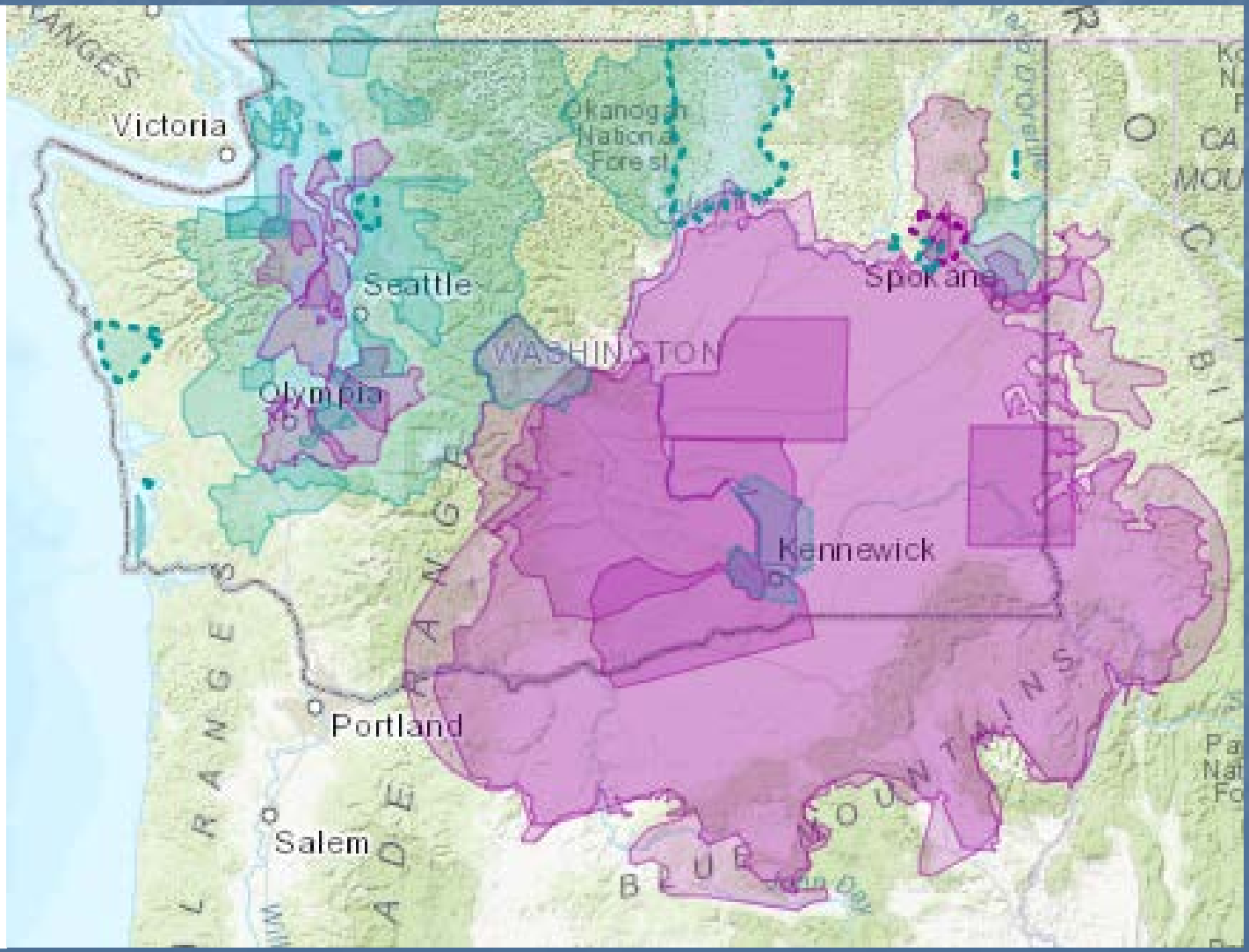
USGS Groundwater Studies in WA

With numerical model

Without numerical model



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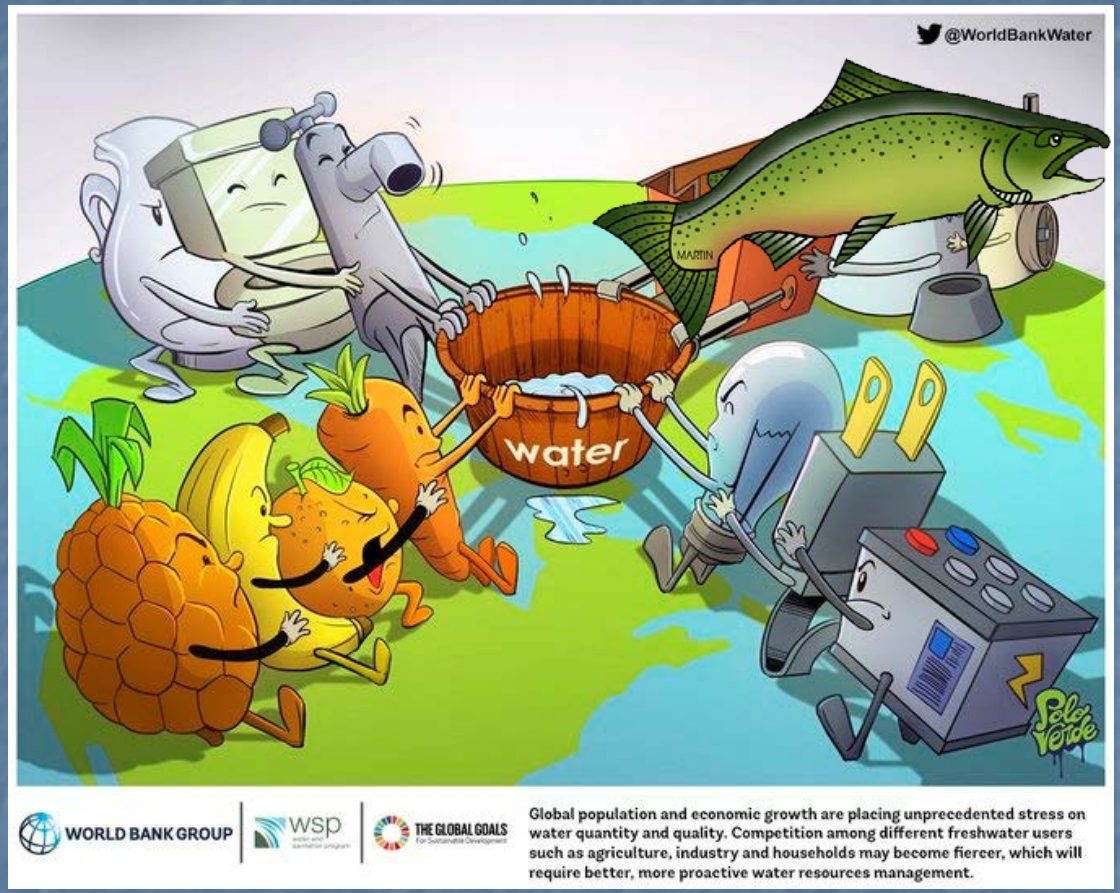
Why Do We Need a Study?

- Basin issues
  - Bi-state basin with a complex hydrogeologic system, long-term water level declines in regional aquifers & insufficient in-stream flows
- Need for basin-wide study to understand the resource for its management and protection
  - States requested USGS involvement
- Long history of data collection and interpretive studies
  - Opportunities to collaborate and leverage data sets

Study Value

- Why is it important?
  - Competing interests for a limited resource
- How will it be used?
  - Inform planning and water-management decisions at a basin-wide scale



World Bank Water, December 30, 2015 at: https://twitter.com/worldbankwater/status/682308767443193856?lang=en

Salmon image: Phillip Martin at: http://animals.phillipmartin.info/fish_chinook_salmon.htm

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Study Goals

- Work with water-resource agencies and stakeholders in OR and WA
- Understand and describe the basin-wide groundwater system including
  - Groundwater extent and connectivity
  - Impacts of pumping on groundwater levels, and
  - Interactions between groundwater and surface water.
- Develop a tool to simulate the groundwater system and evaluate water-management scenarios

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Some Questions to be Addressed

- How much water enters the Basin (recharge)?
- How much water leaves the Basin (discharge)?
- How might water-level declines progress in the future?
- How can water-level declines be managed?
- How does pumping affect streamflow?
- To what degree are different parts of the basin hydrologically connected?

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Defined Study Roles

- USGS
  - Lead collaborative study including data collection and interpretations
  - Author peer-reviewed reports
- Cooperating agencies
  - Assist in data collection and interpretation
  - Contribute to study reports

University of California, Davis, http://watermanagement.ucdavis.edu/teaching/

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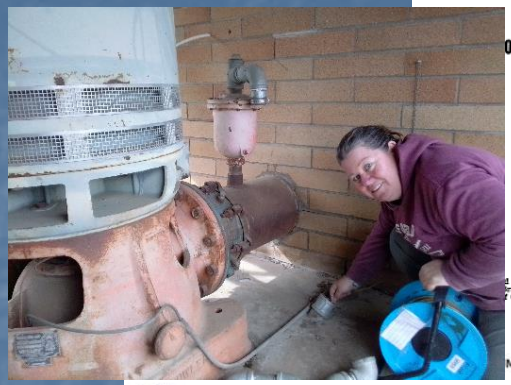
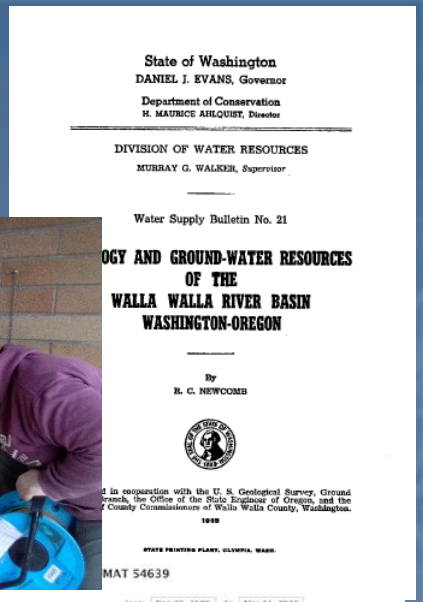
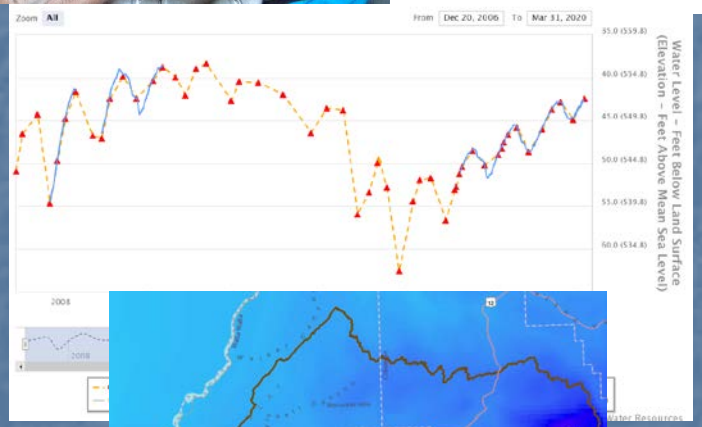
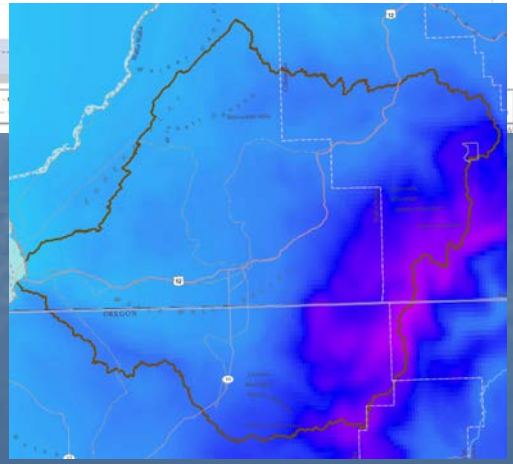
Study Tasks

- Compile and review data and literature
- Collect new data – groundwater levels, streamflow, geochemistry
- Describe hydrogeologic framework – hydrogeologic units, hydraulic properties, water-level maps
- Define hydrologic budget – groundwater use, recharge, discharge
- Evaluate flow-system – water-level trends, flow directions, role of structure, geochemistry and age dating, groundwater–surface water interactions
- Publish peer-reviewed reports and data




State of Washington
DANIEL J. EVANS, Governor
Department of Conservation
H. MAURICE AHLQUIST, Director
DIVISION OF WATER RESOURCES
MURRAY G. WALKER, Supervisor
Water Supply Bulletin No. 21
OGY AND GROUND-WATER RESOURCES
OF THE
WALLA WALLA RIVER BASIN
WASHINGTON-OREGON
By
R. C. NEWCOMB
MAT 54639





30-yr average precipitation (1981-2010), PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu

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Frequently Asked Questions

- What is an aquifer?
- What are aquifer properties?
- How old is groundwater?
- How much recharge is happening?

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Thank you

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Andy Long, ajlong@usgs.gov

USGS Walla Walla Project Webpage,
https://www.usgs.gov/centers/wa-water/science/walla-walla-groundwater?qt-science_center_objects=0#qt-science_center_objects

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References

- Healy, R.W., Winter, T.C., LaBaugh, J.W., and Franke, O.L., 2007, Water budgets: Foundations for effective water-resources and environmental management: U.S. Geological Survey Circular 1308, 90 p.