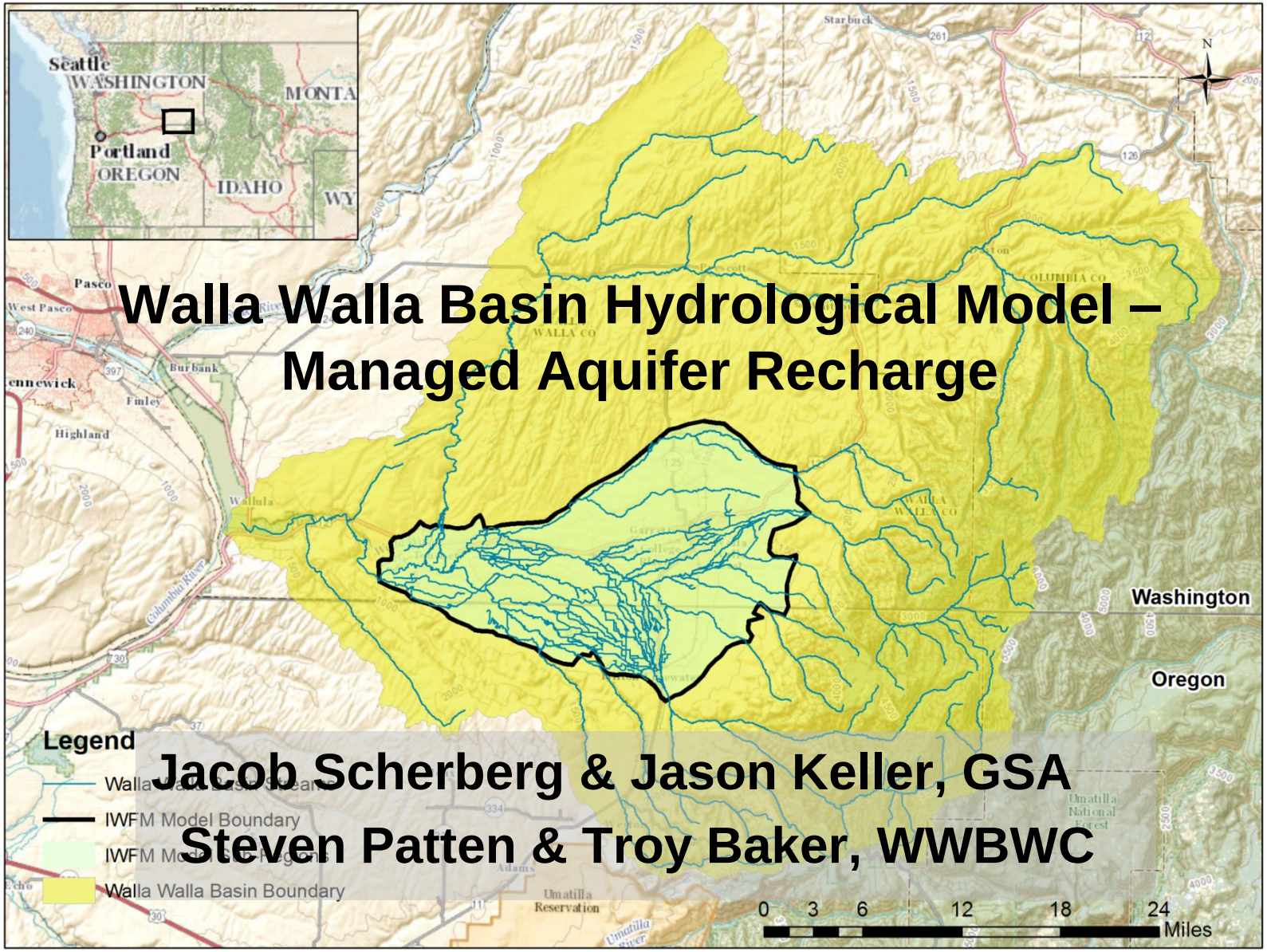
Walla Walla Basin Hydrological Model – Managed Aquifer Recharge



Jacob Scherberg & Jason Keller, GSA

Steven Patten & Troy Baker, WWBWC

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Project Description

- Collaboration between GeoSystems Analysis, Inc. (GSA) and the Walla Walla Basin Watershed Council (WWBWC)
- Revise model inputs for land use and agricultural water use based on feedback from water managers
- Finalize model calibration and baseline forward model
- Quantify the distribution of water resources and water requirements in the Walla Walla Basin under current conditions
- Develop and run scenarios of increased aquifer recharge and pipeline installation; evaluate results

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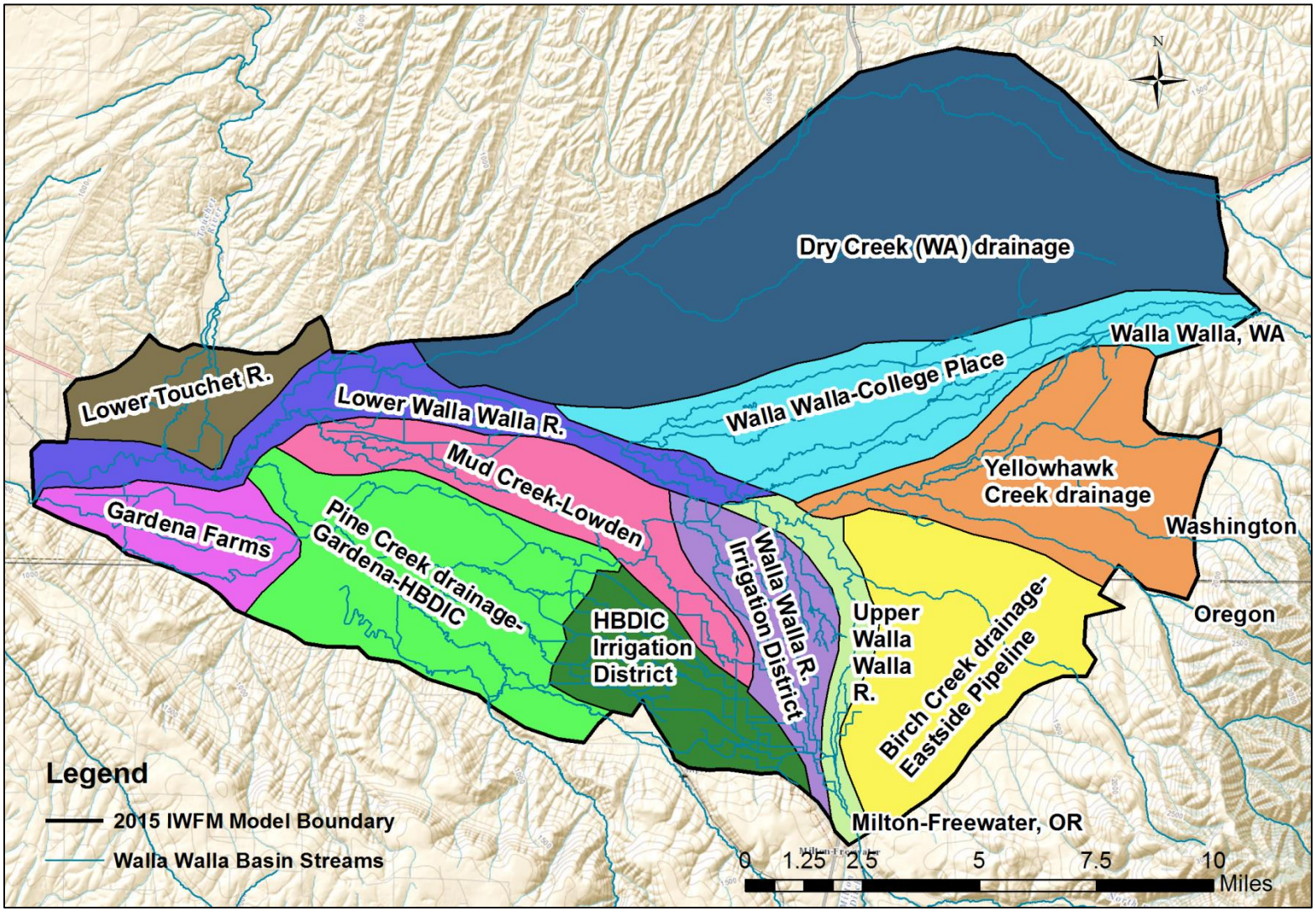
Model Sub-regions



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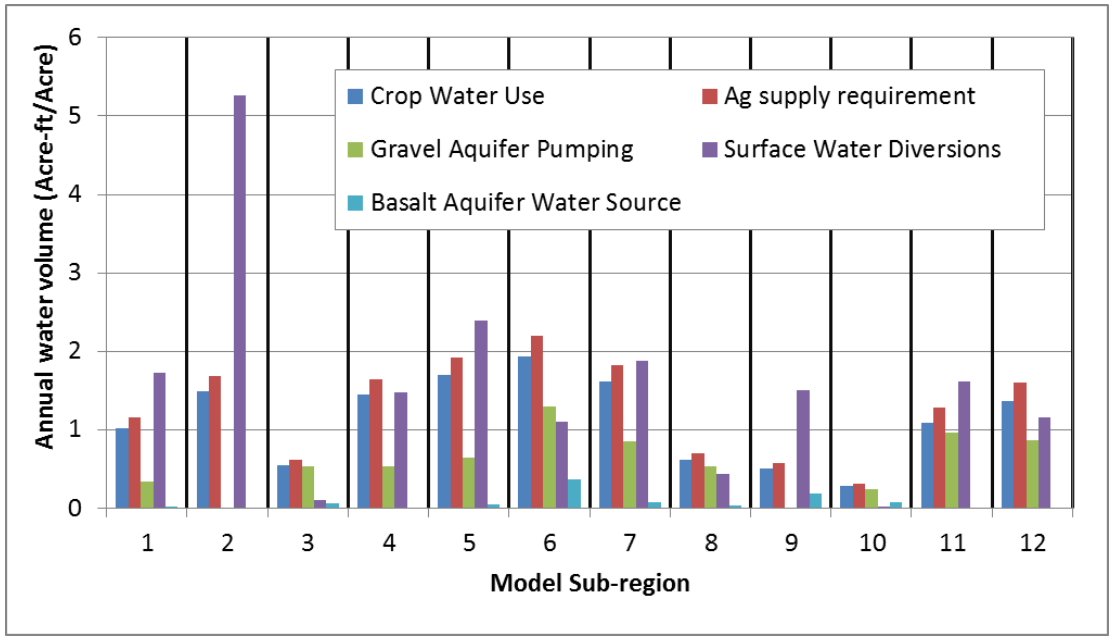
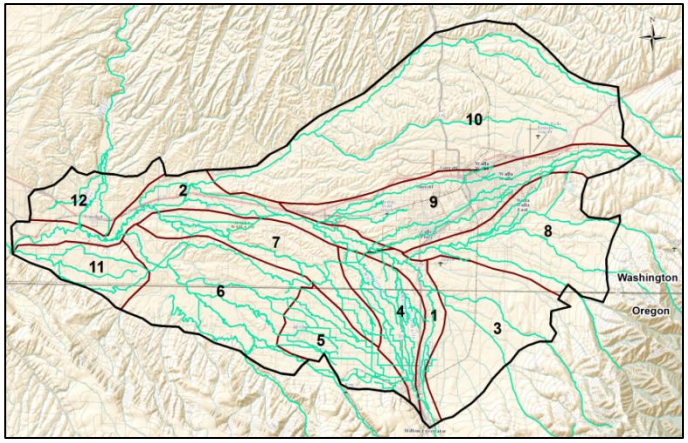
Baseline Scenario

- Forward model projecting 10 years from end of model development period to attain steady-state conditions
- Applies calibrated model parameters
- Averages daily data from model development period for:
  - climate
  - GW boundary conditions
  - stream inflows
  - agricultural water use
- MAR inputs are based on current recharge rates at active recharge facilities

Annual Agricultural Water Supply





Sub-region #	Name
1	Upper Walla Walla River
2	Lower Walla Walla River
3	Birch Creek Drainage-Eastside Pipeline
4	Walla Walla River Irg. District
5	HBDIC Irg. District
6	Pine Creek drainage-Gardena-HBDIC
7	Mud Creek-Lowden
8	Yellowhawk Creek drainage
9	Walla Walla-College Place
10	Dry Creek (WA) drainage
11	Gardena Farms
12	Lower Touchet River

- A portion of water extracted from sub-region 2 is used in bordering sub-regions
- Surface water in sub-region 9 is primarily used for domestic and municipal purposes

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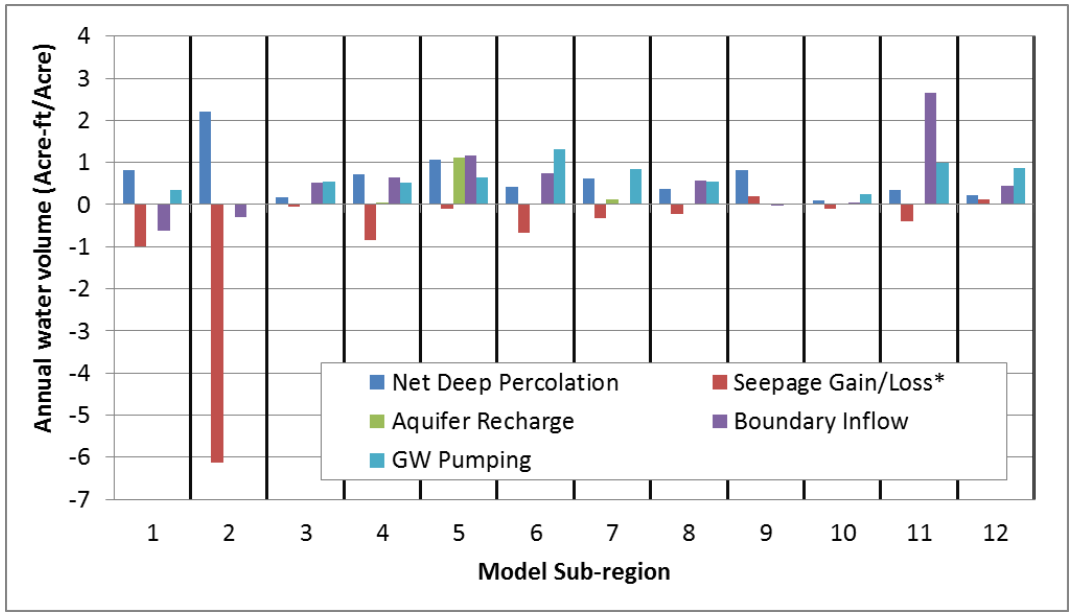
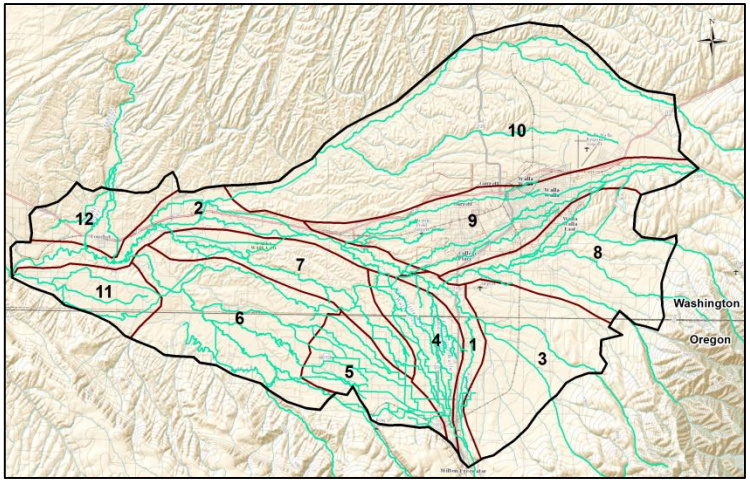
Annual Groundwater Budget





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*Negative values in the Seepage gain/loss term equate to return flows form groundwater to surface water in the form of gaining stream and spring flows

- Lower Walla Walla River (sub-region 2) gains significantly from inflowing groundwater relative to its surface area
- Sub-region 5 MAR inputs exceed groundwater pumping

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Manage Aquifer Recharge Management Scenario Development and Results

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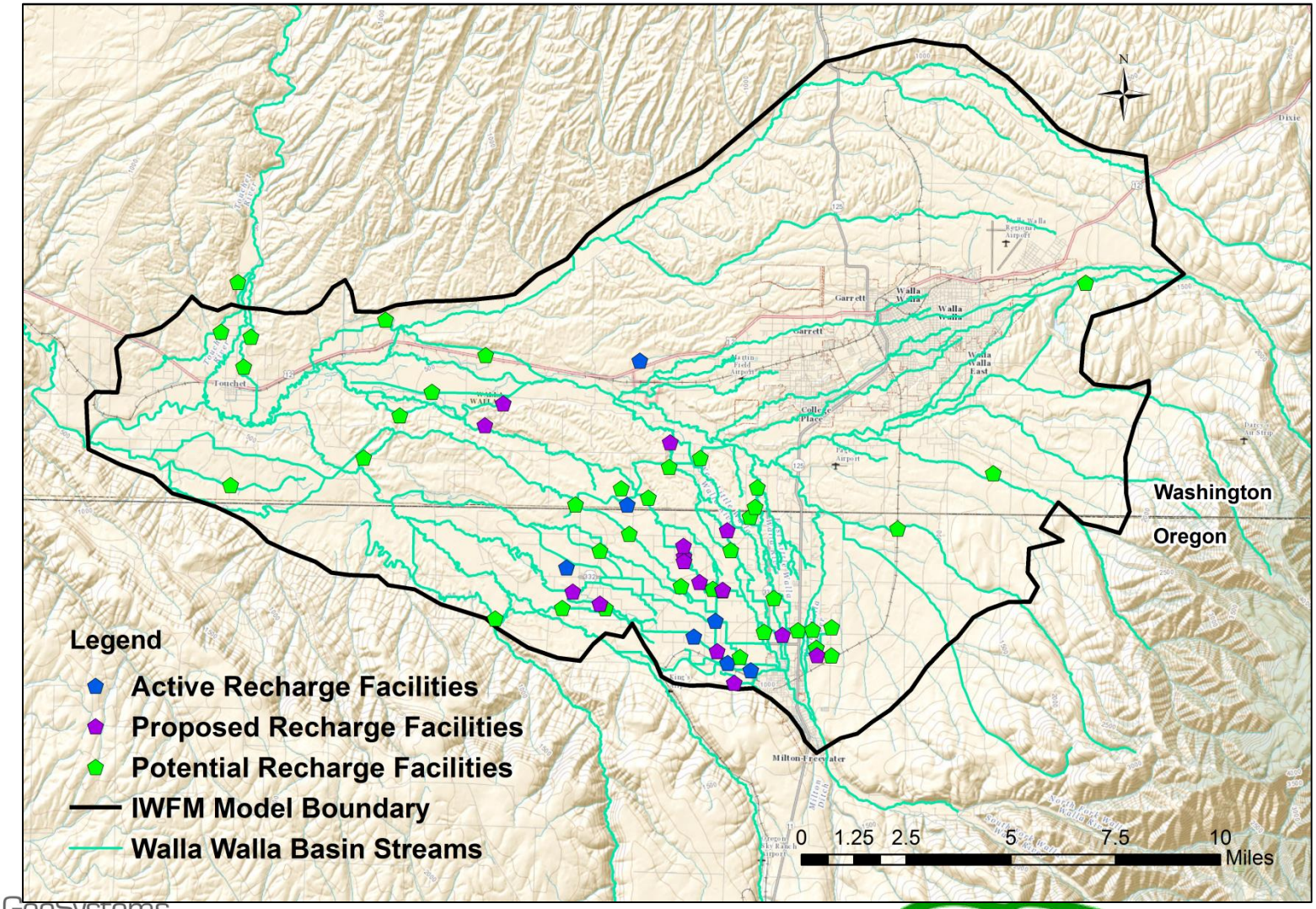
Managed Aquifer Recharge (MAR) locations in the Walla Walla Basin



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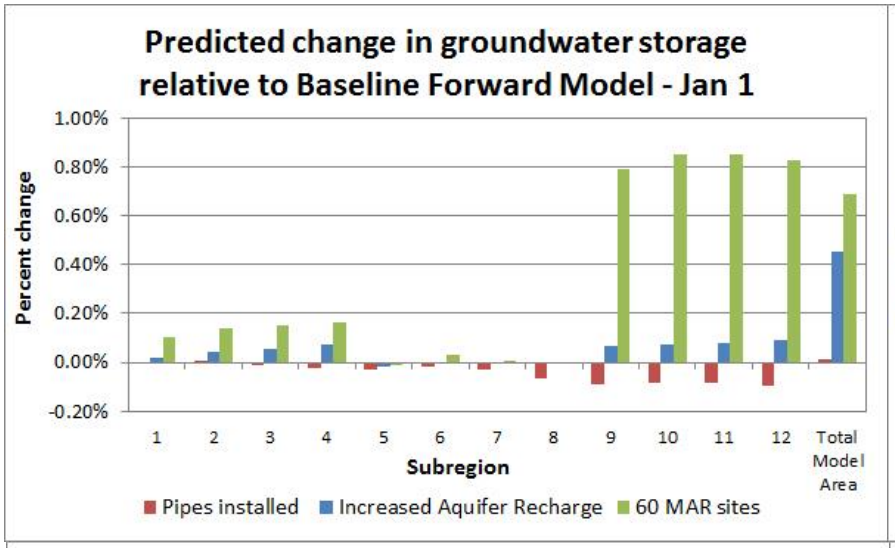
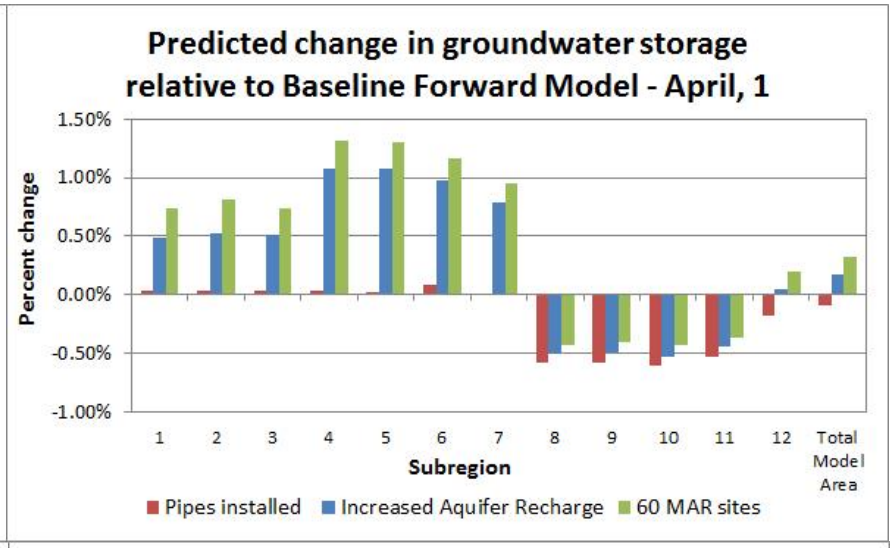
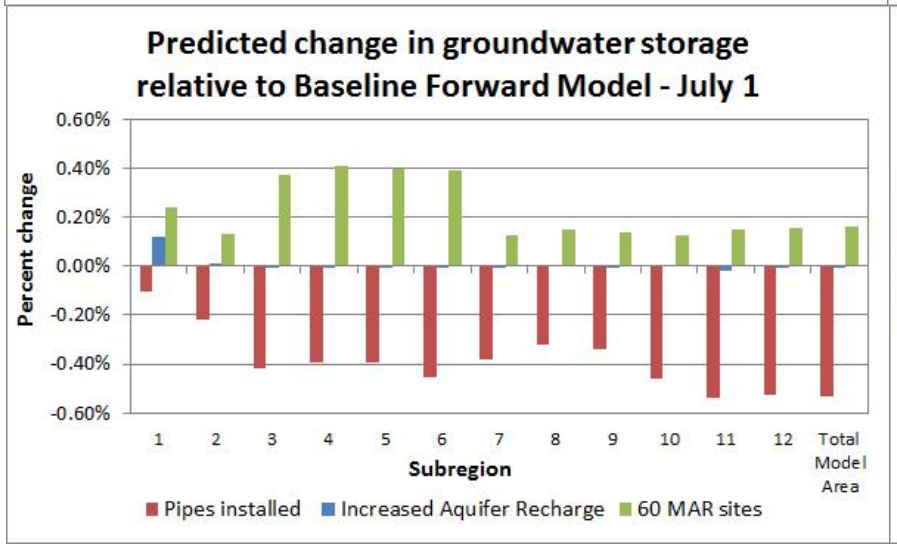
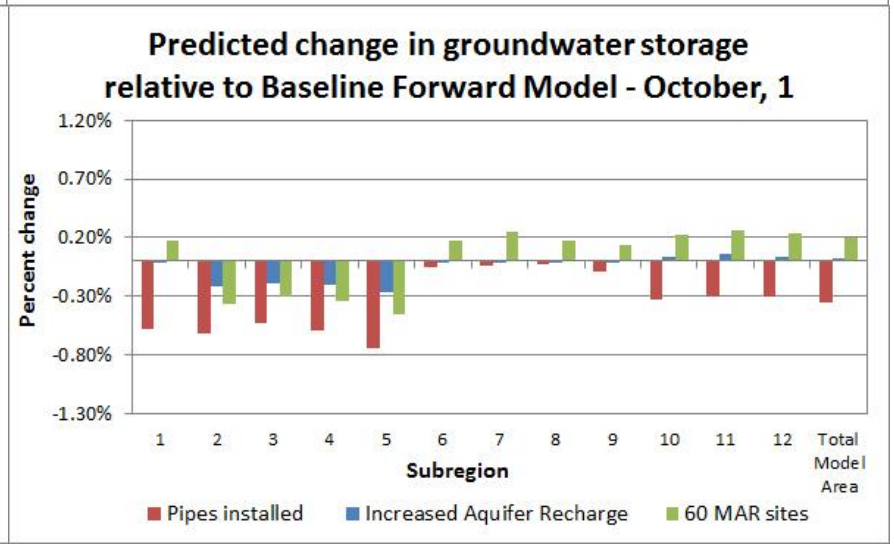
Groundwater Budgets









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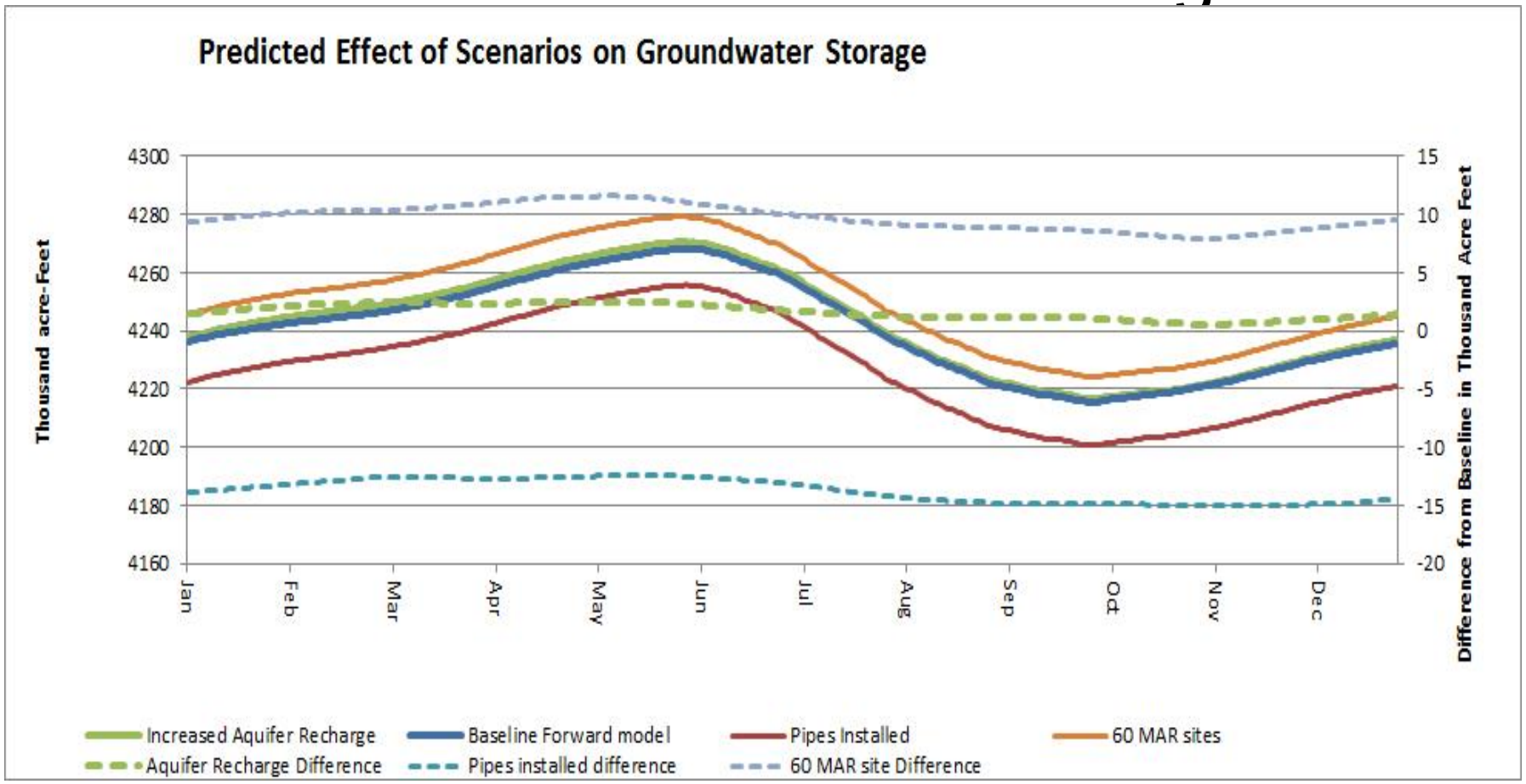
Total Groundwater Storage



- GW storage is predicted to increase 5,000-7,000 acre-feet with 22 AR sites
- GW storage is predicted to increase 8,000-12,000 acre-feet with 60 AR sites

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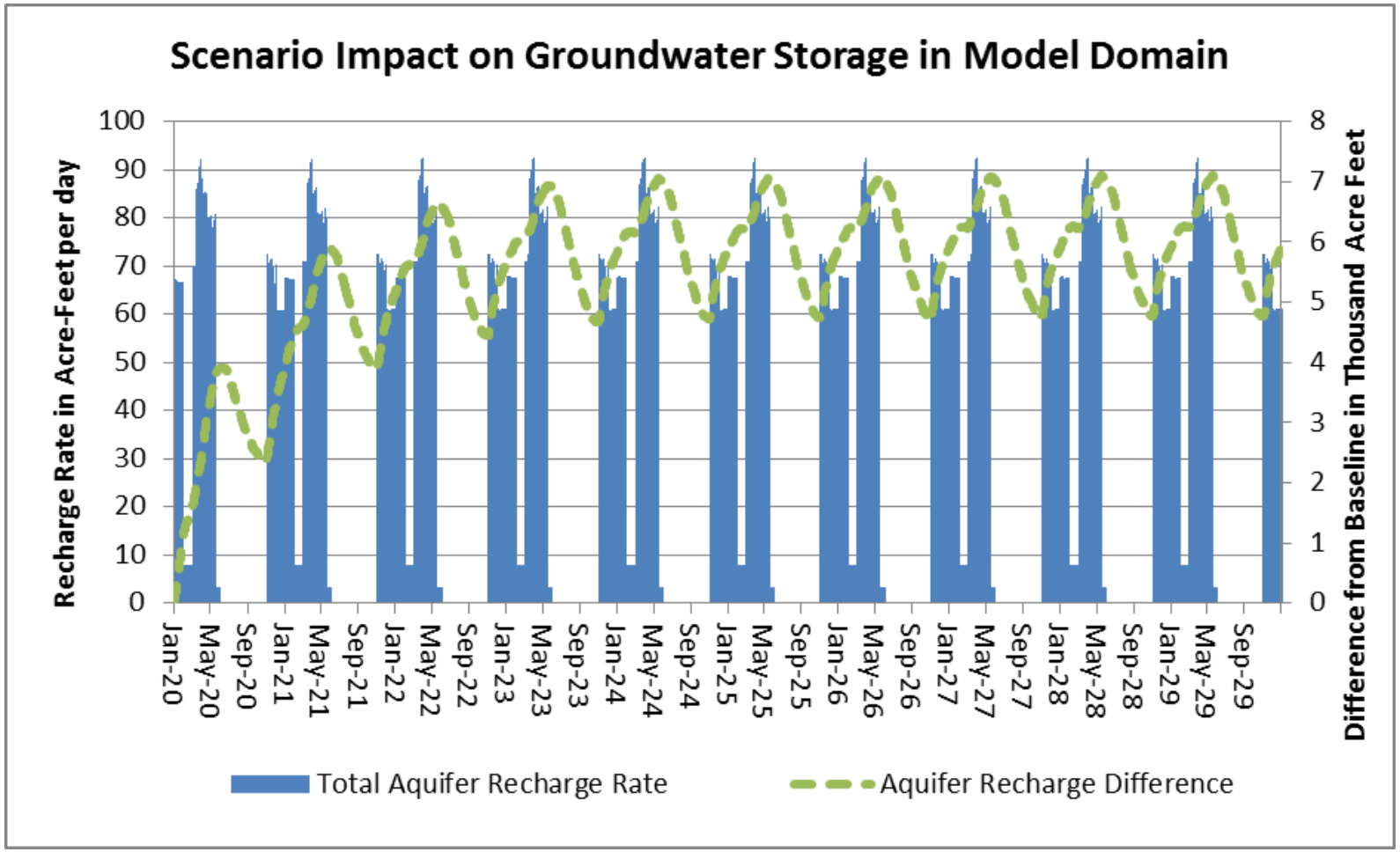
Total Groundwater Storage



- Aquifer recharge brings groundwater storage to a higher equilibrium condition

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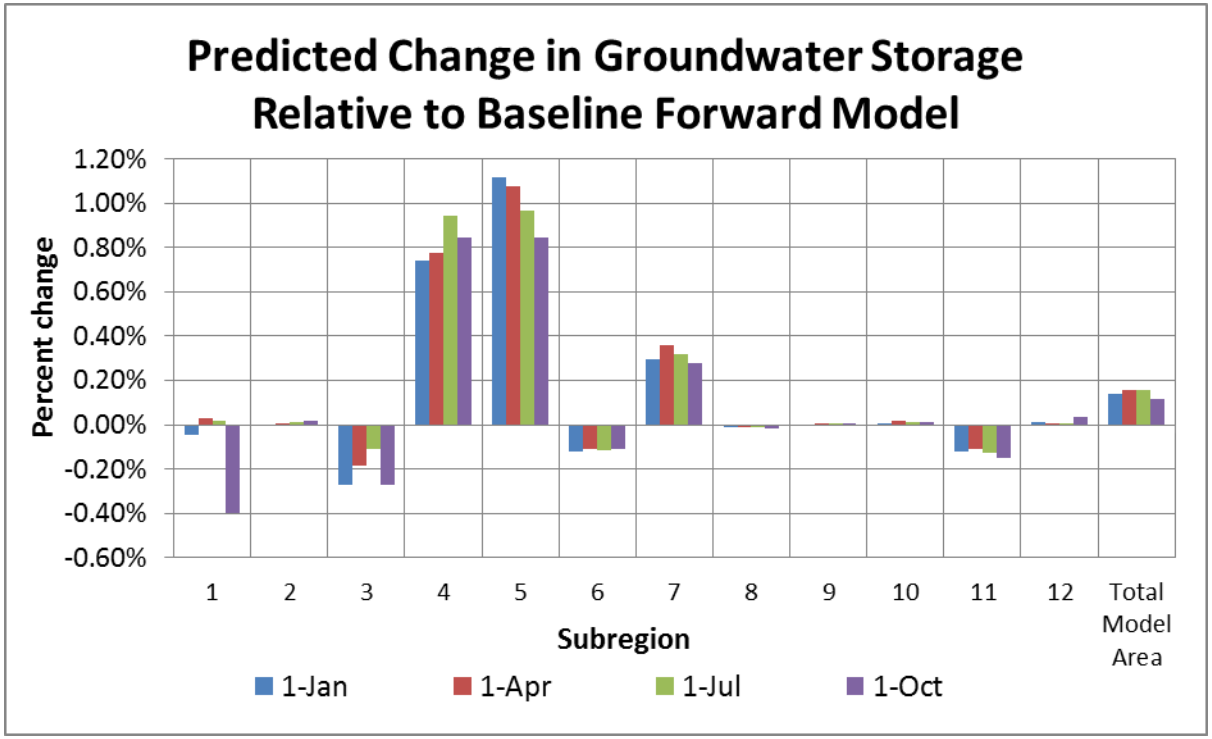
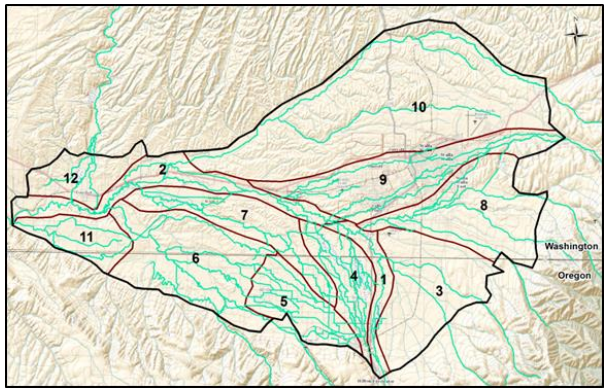
Difference in GW Storage by Sub-region and season





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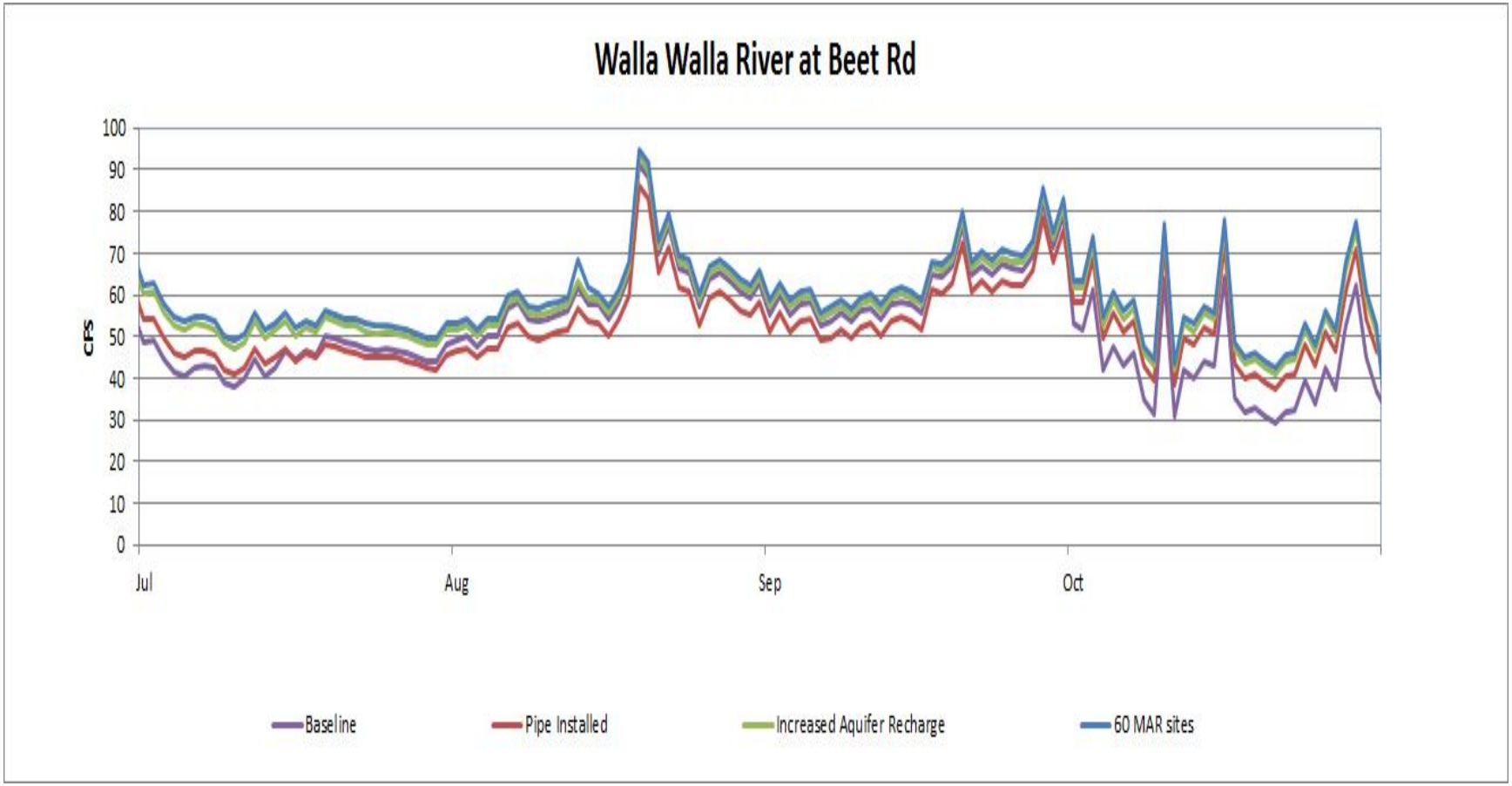
Predicted flow in Walla Walla River



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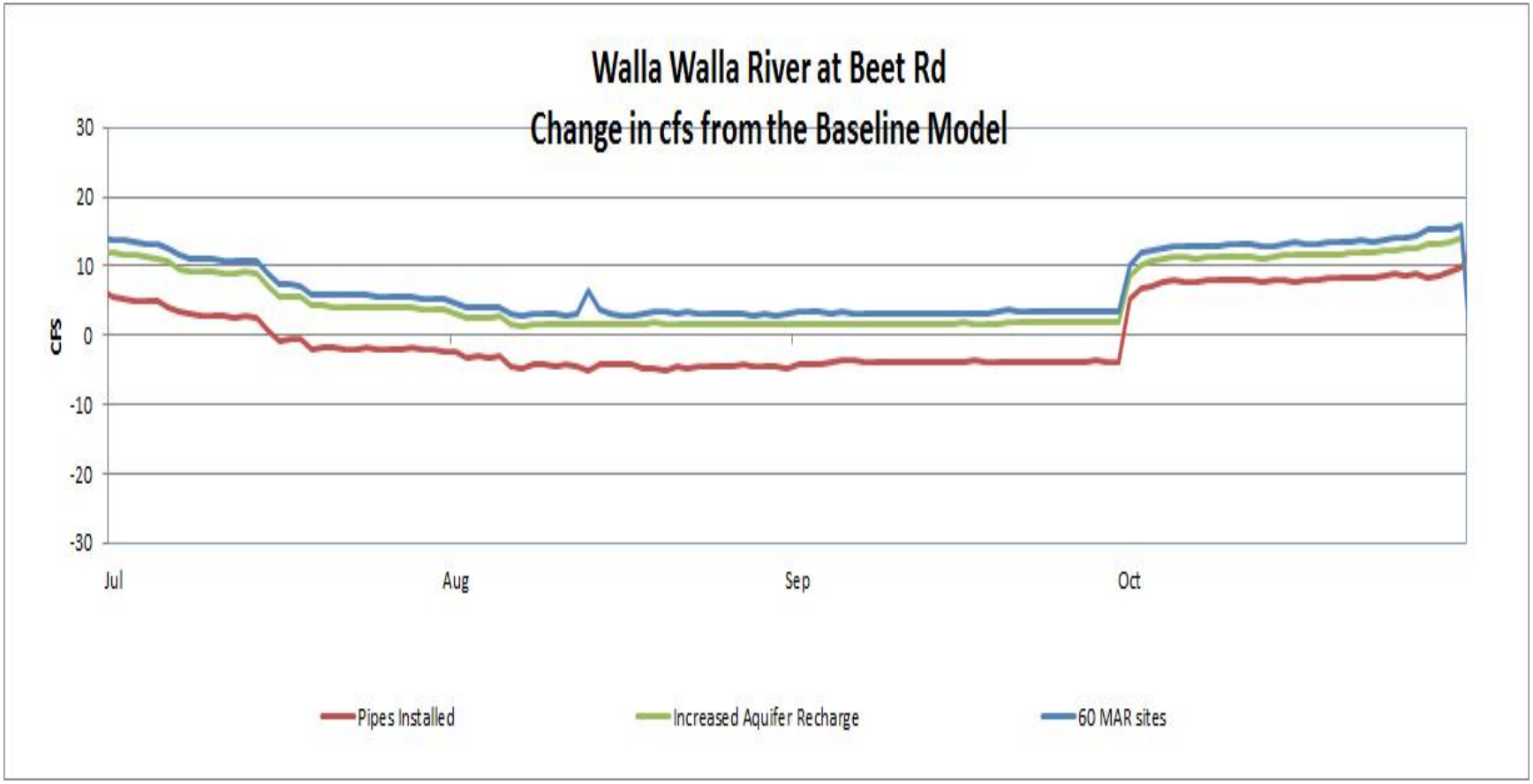

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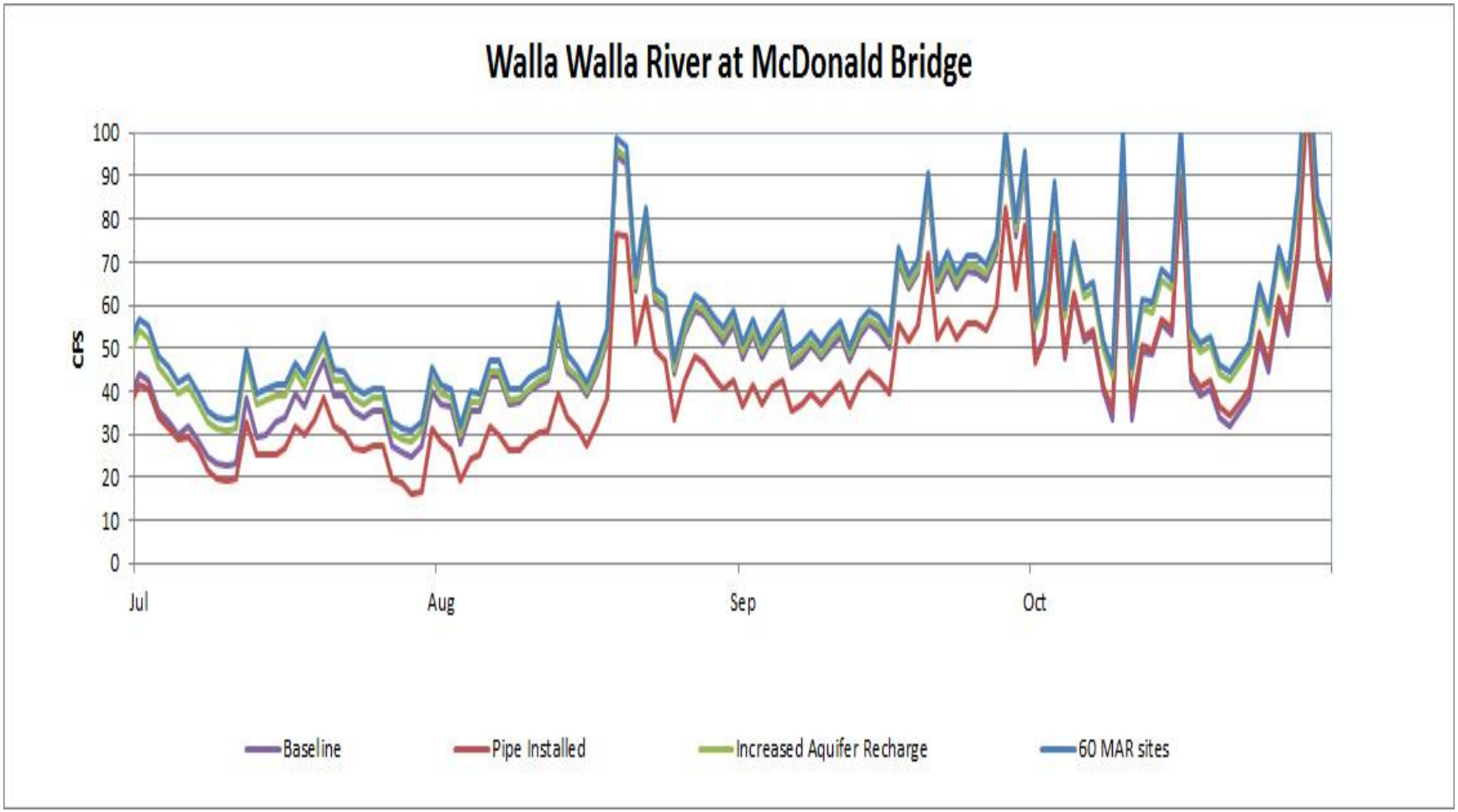

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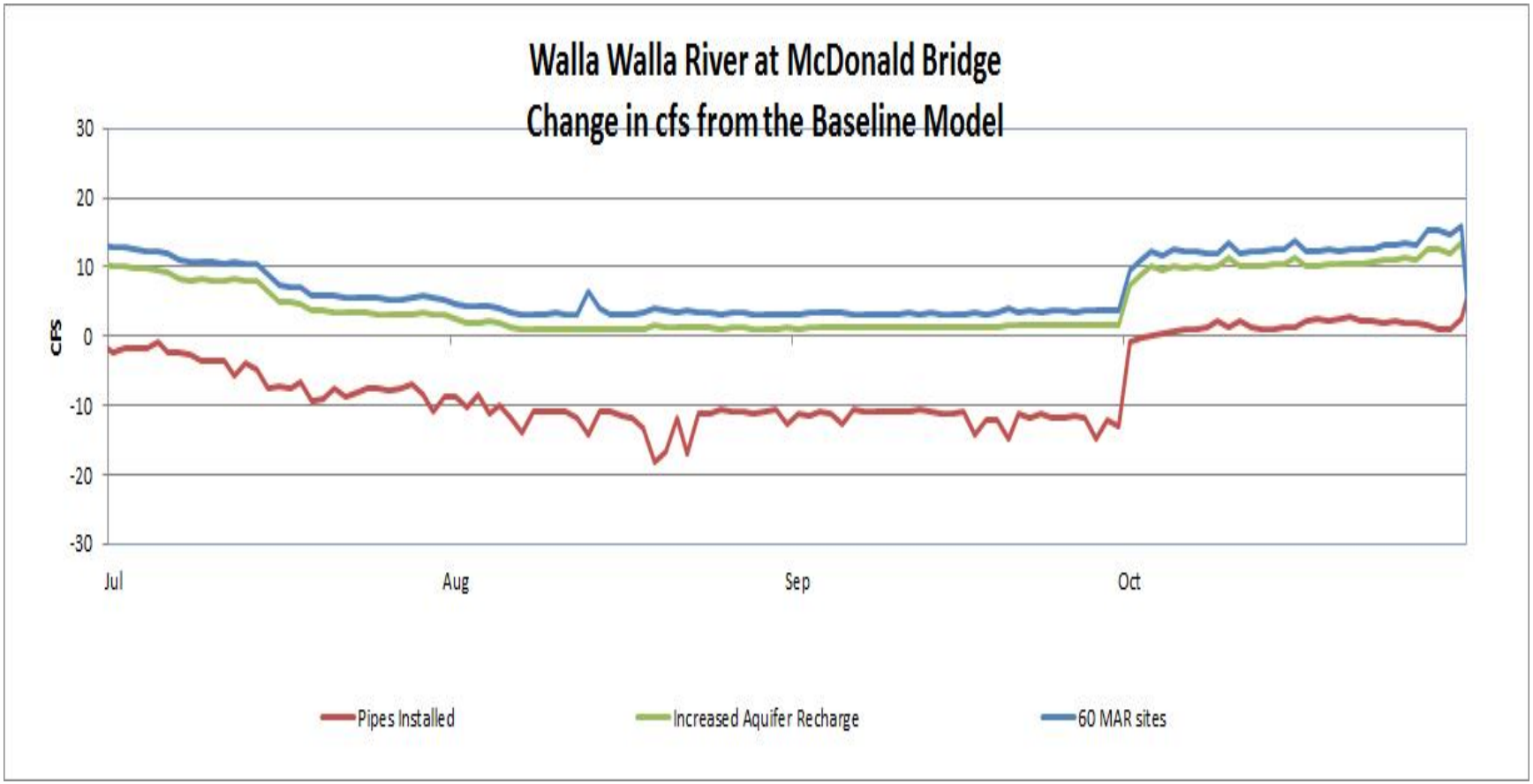

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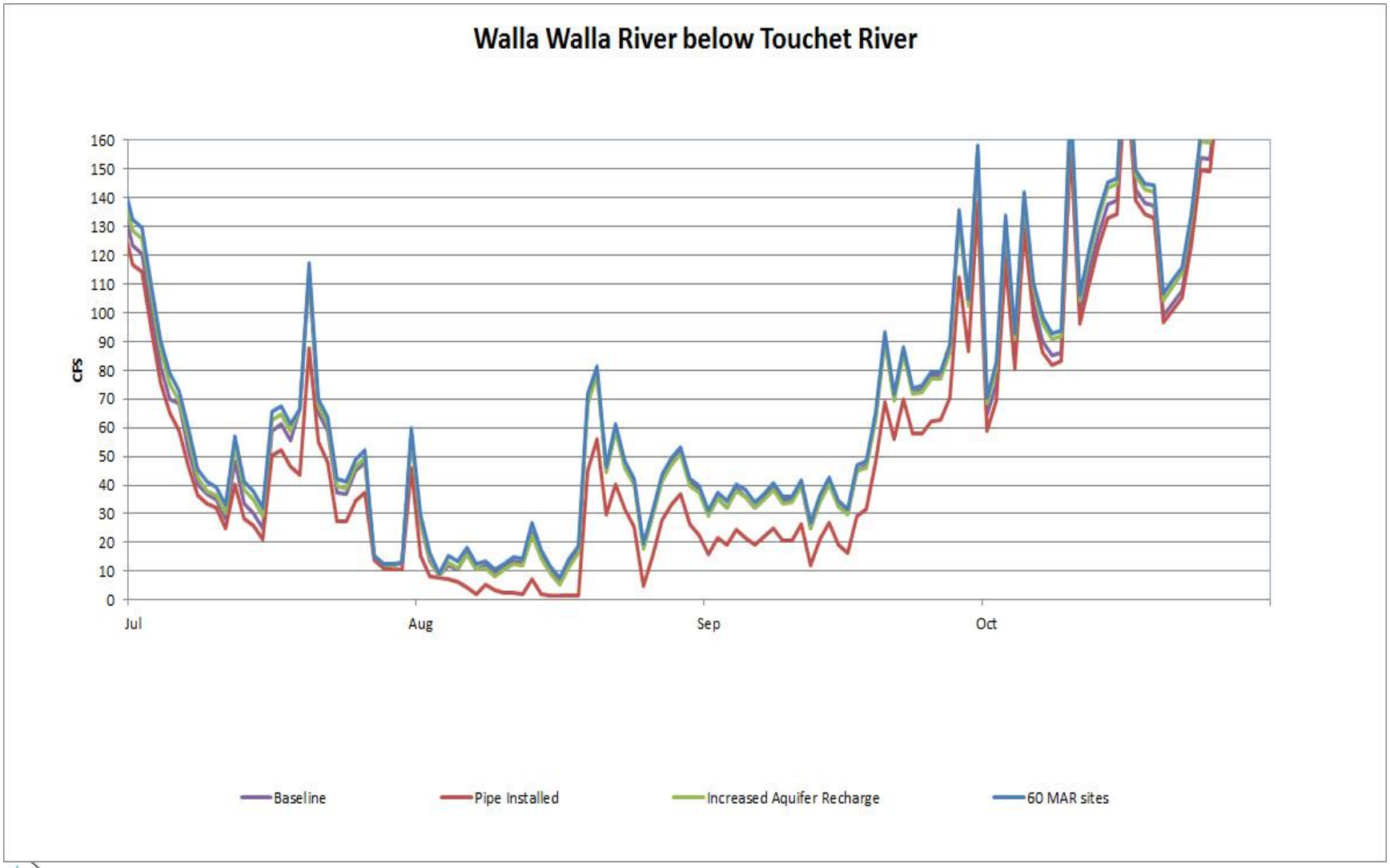

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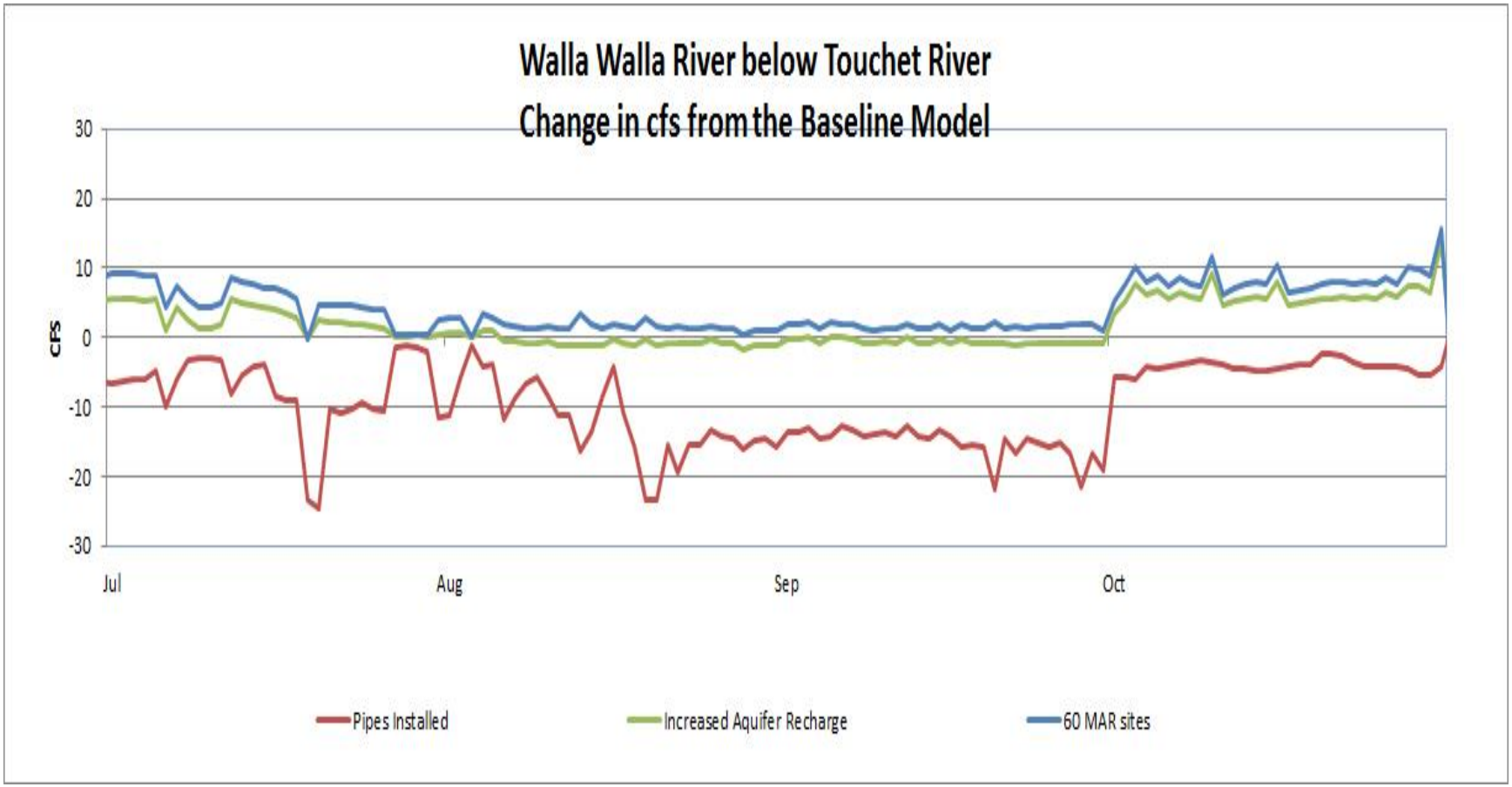

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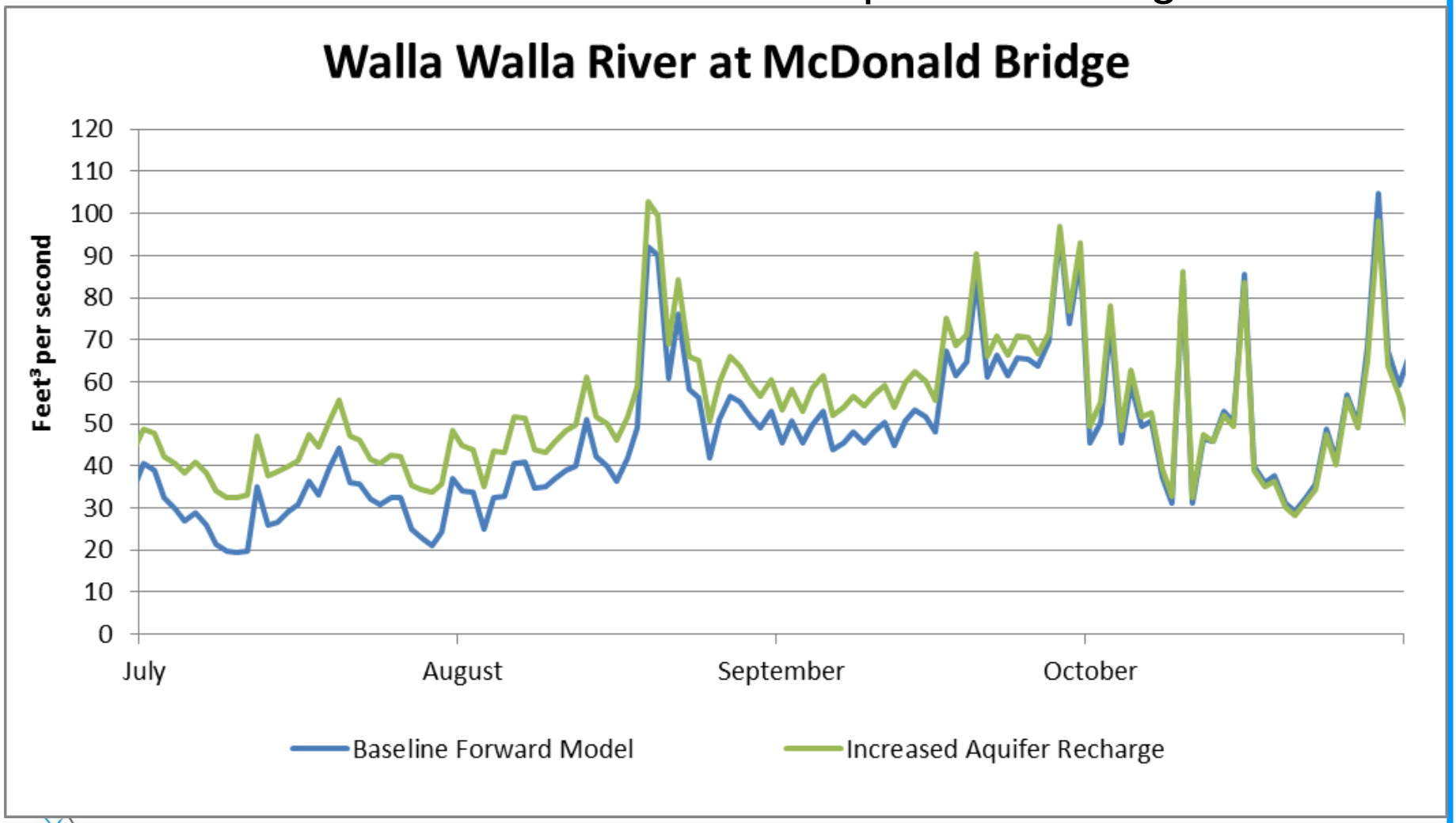
Predicted flow in Walla Walla River in Baseline Forward Model and with Increased Aquifer Recharge



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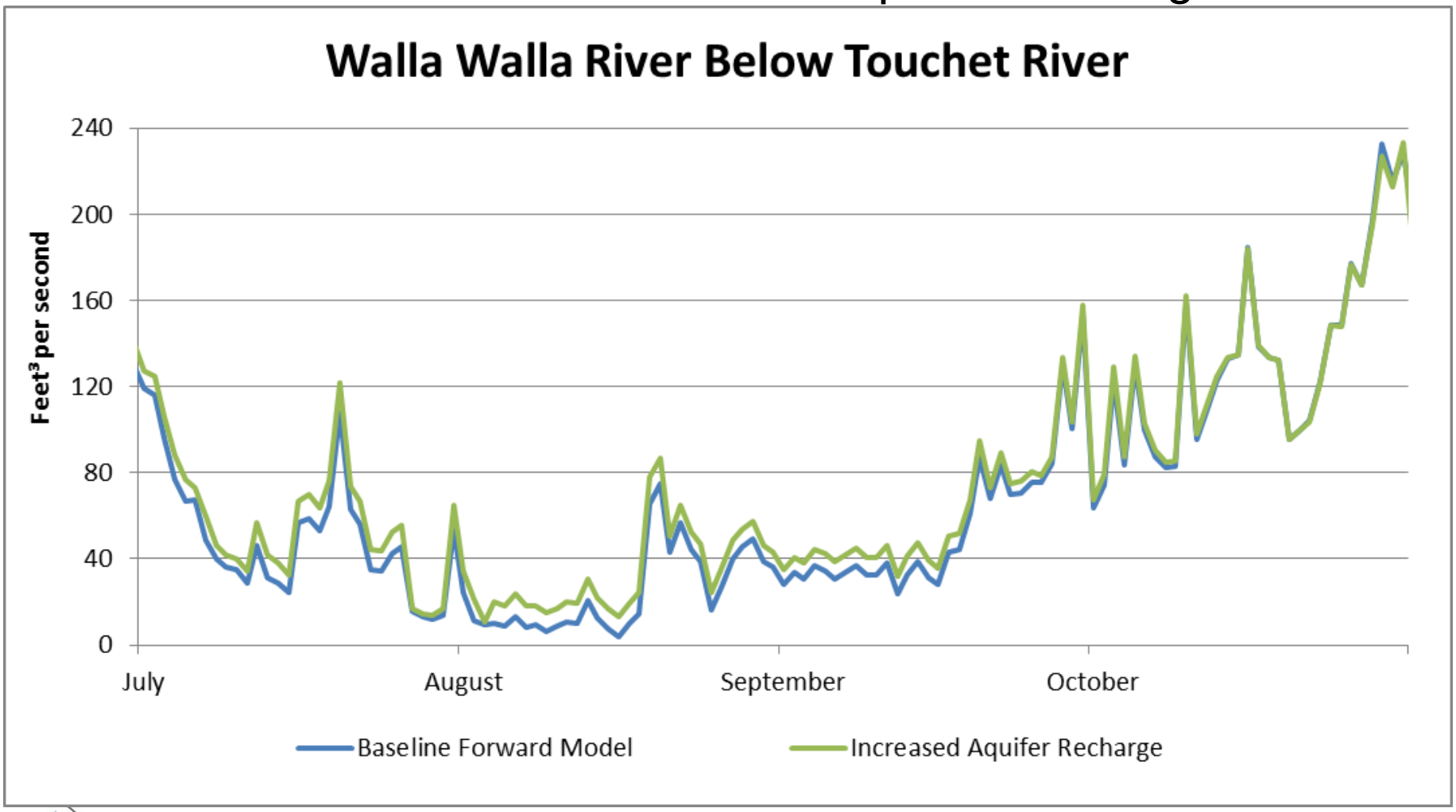

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Potential Management Alternative Scenarios

Apply calibrated model to predict the hydrological conditions resulting from:

- Columbia River Pump Exchange: 4 alternative scenarios for water delivery to distribution locations
- Surface Reservoir Storage: Reservoir facilities on Pine, Dry, and Flume Canyon Creeks
- Irrigation Efficiency Improvements
- Climate change
- Other?

Conclusions

- The Walla Walla Basin IWFM numerical model has been successfully expanded and recalibrated based on input from local water managers

- Near-term MAR is predicted to yield:
  - Over 1% increase in groundwater storage in high agricultural water demand portions of the basin
  - Flow increases of 10 – 13 ft^3 per second in the Walla Walla River

- The calibrated model can be applied to evaluate groundwater storage and surface water flows resulting from alternative water management strategies

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Acknowledgements

Washington Department of Ecology

Office of Columbia River

Walla Walla Watershed Management Partnership

Hudson Bay District Improvement Company

Walla Walla River Irrigation District

Gardena Farms Irrigation District

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