Walla Walla Basin Hydrological Model – Managed Aquifer Recharge

Legend

- Walla Walla Basin Boundary
- IWFM Model Boundary
- IWFM Model Area

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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
Model Sub-regions
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
• 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

### 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
Annual Groundwater Budget

*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
Managed Aquifer Recharge (MAR) locations in the Walla Walla Basin
Groundwater Budgets

Predicted change in groundwater storage relative to Baseline Forward Model - Jan 1

Predicted change in groundwater storage relative to Baseline Forward Model - April, 1

Predicted change in groundwater storage relative to Baseline Forward Model - July 1

Predicted change in groundwater storage relative to Baseline Forward Model - October, 1
• 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
Aquifer recharge brings groundwater storage to a higher equilibrium condition.
Difference in GW Storage by Sub-region and season

Predicted Change in Groundwater Storage Relative to Baseline Forward Model

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Predicted flow in Walla Walla River
Predicted flow in Walla Walla River

Walla Walla River at Beet Rd
Change in cfs from the Baseline Model

Jul  Aug  Sep  Oct

-30  -20  -10  0  10  20  30
CFS

- Pipes Installed
- Increased Aquifer Recharge
- 60 MAR sites
Predicted flow in Walla Walla River
Predicted flow in Walla Walla River

Walla Walla River at McDonald Bridge
Change in cfs from the Baseline Model

- Pipes Installed
- Increased Aquifer Recharge
- 60 MAR sites
Predicted flow in Walla Walla River
Predicted flow in Walla Walla River

Walla Walla River below Touchet River
Change in cfs from the Baseline Model

- Pipes Installed
- Increased Aquifer Recharge
- MAR sites
Predicted flow in Walla Walla River in Baseline Forward Model and with Increased Aquifer Recharge

Walla Walla River at McDonald Bridge

- Baseline Forward Model
- Increased Aquifer Recharge

July August September October

Feet^3 per second
Predicted flow in Walla Walla River in Baseline Forward Model and with Increased Aquifer Recharge
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 ft³ 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
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