Walla Wall Basin Integrated Water Flow Model: Piping and MAR Alternatives Management Scenarios

11/13/2015

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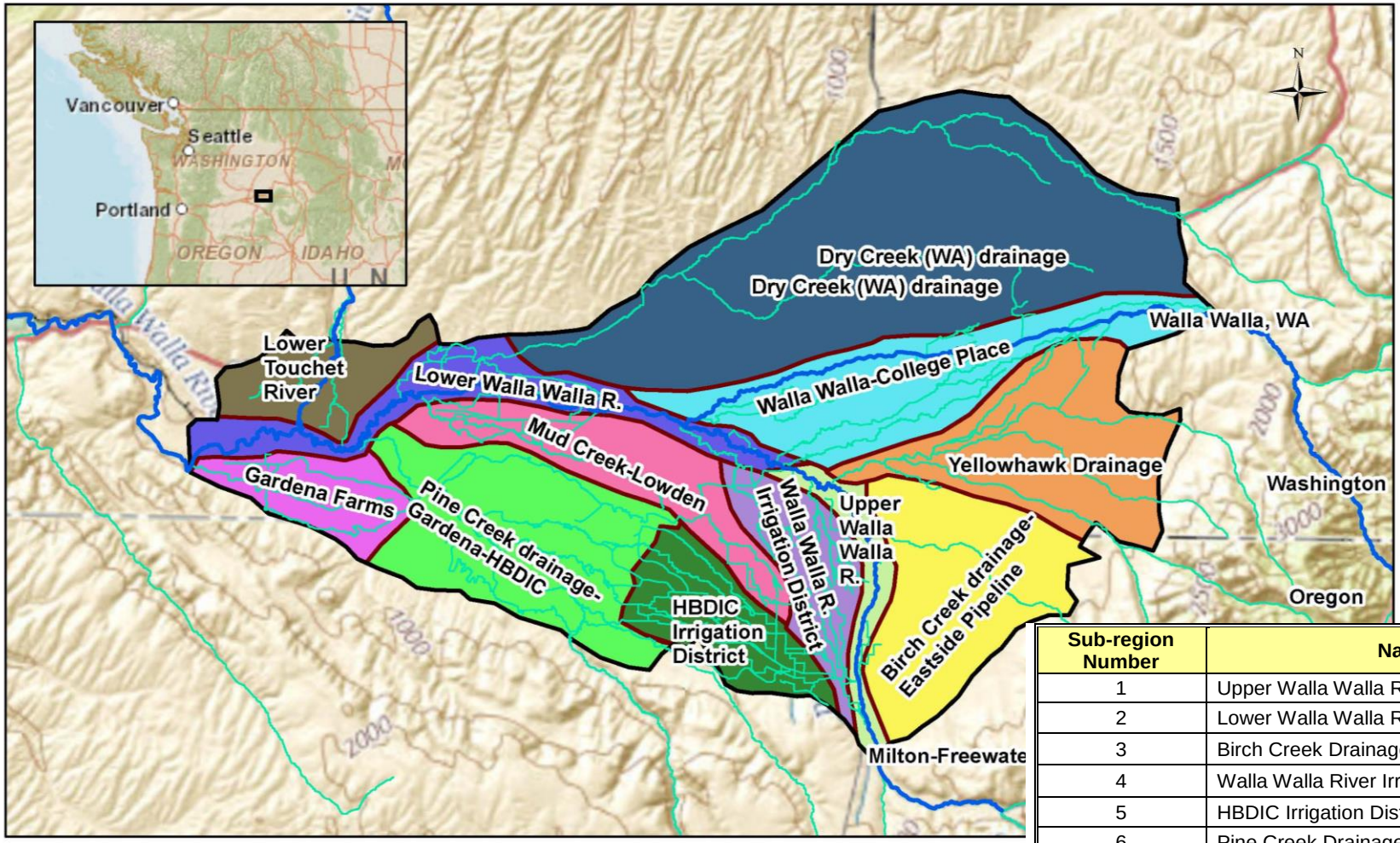
Model Scenarios

- Baseline Forward Model
  - MAR applied at the 7 currently active sites at the current average rate of 8,951 acre-ft/yr
  - No additional canals are replaced with pipelines.
- Pipe Installation
  - MAR same as Baseline Forward Model
  - Gardena Canal, White Canal, Lowden #2 Canal, and Garden City Canal are converted into pipelines
- Increased MAR
  - MAR applied at 22 locations at the proposed rate of 14,166 acre-ft/yr
  - Pipeline conversion same as Pipe Installation scenario
- Maximum MAR
  - MAR applied at 60 locations at the proposed rate of 23,654 acre-ft/yr
  - Pipeline conversion same as Pipe Installation scenario

Model Area and Sub-regions



Legend

- Walla Walla Basin Rivers
- Walla Walla Basin Streams
- IWFM Model Sub-Regions
- 2015 IWFM Model Boundary

0 2.5

Sub-region Number	Name
1	Upper Walla Walla River
2	Lower Walla Walla River
3	Birch Creek Drainage-Eastside Pipeline
4	Walla Walla River Irrigation District
5	HBDIC Irrigation 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

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Water Savings – White Canal

- Based on calculated seepage between gauges s-401 and s-413
- Multiplier of 1.5 added to account for additional channel length downstream of s-413
- Accounts for lower seepage rate in lower portion of canal
- Calculated maximum seepage near estimate by J. Brough (11.6 cfs)

White Canal Flow Range in Baseline Model (cfs)	Seepage Water Savings (cfs)
0 to 5	0.0
5 to 20	3.3
20 to 30	6.2
30 to 40	9.7
40 to 50	12.0

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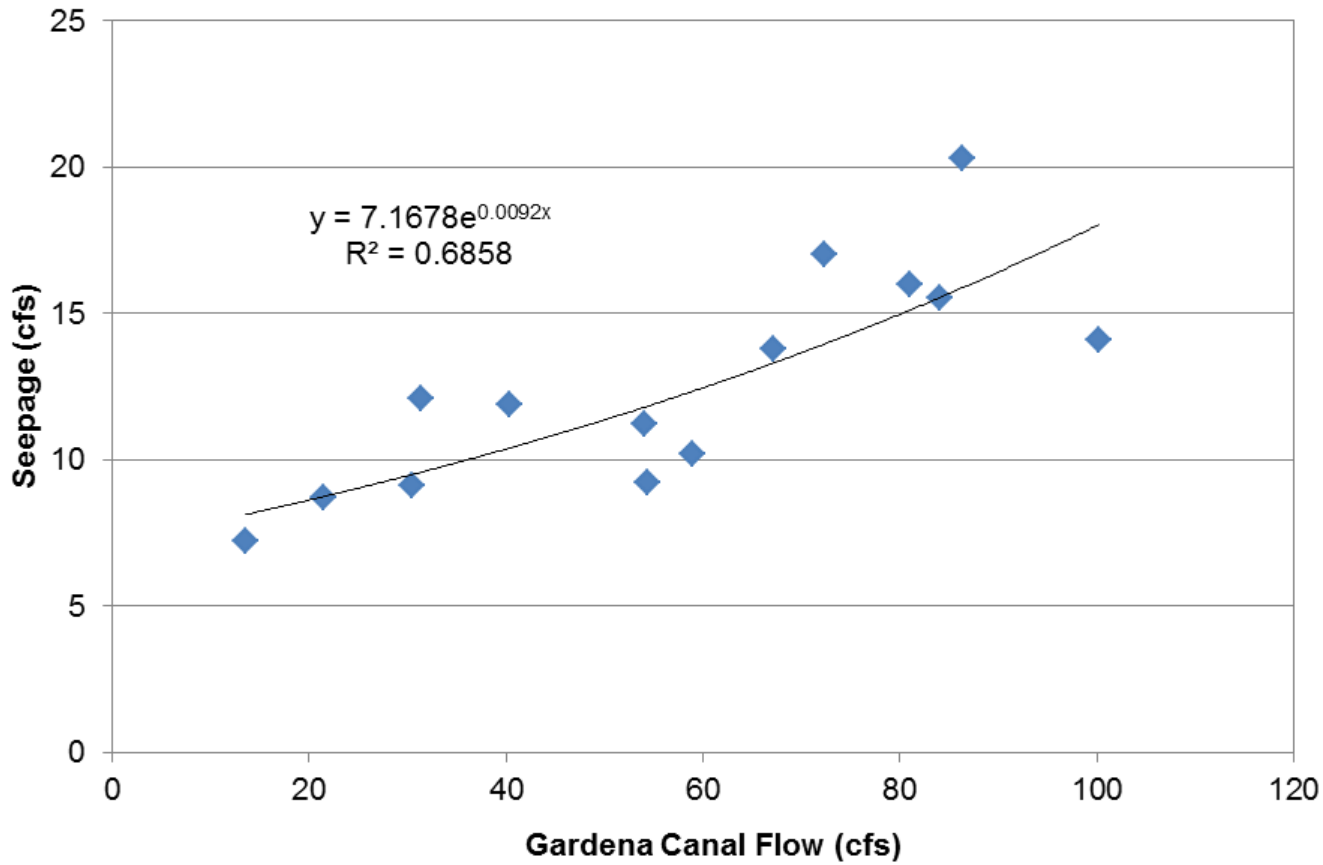
Water Savings – Gardena Canal

- Measured channel seepage relative to flow rate in Gardena Canal
- Trendline equation applied to estimate water savings in model:

$$Seepage\ Water\ Savings = 7.1678 \times e^{0.0092 \times Gardena\ Canal\ Flow}$$



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Water Savings – Lowden #2, Garden City

- Lowden #2
  - Daily diversion rates reduced by 15%
  - Reduced diversion in line with 0.5 to 3.3 cfs seepage reported by Patten (2014)

- Garden City
  - No water savings applied because net seepage losses from this reach are negligible and reach is often gaining

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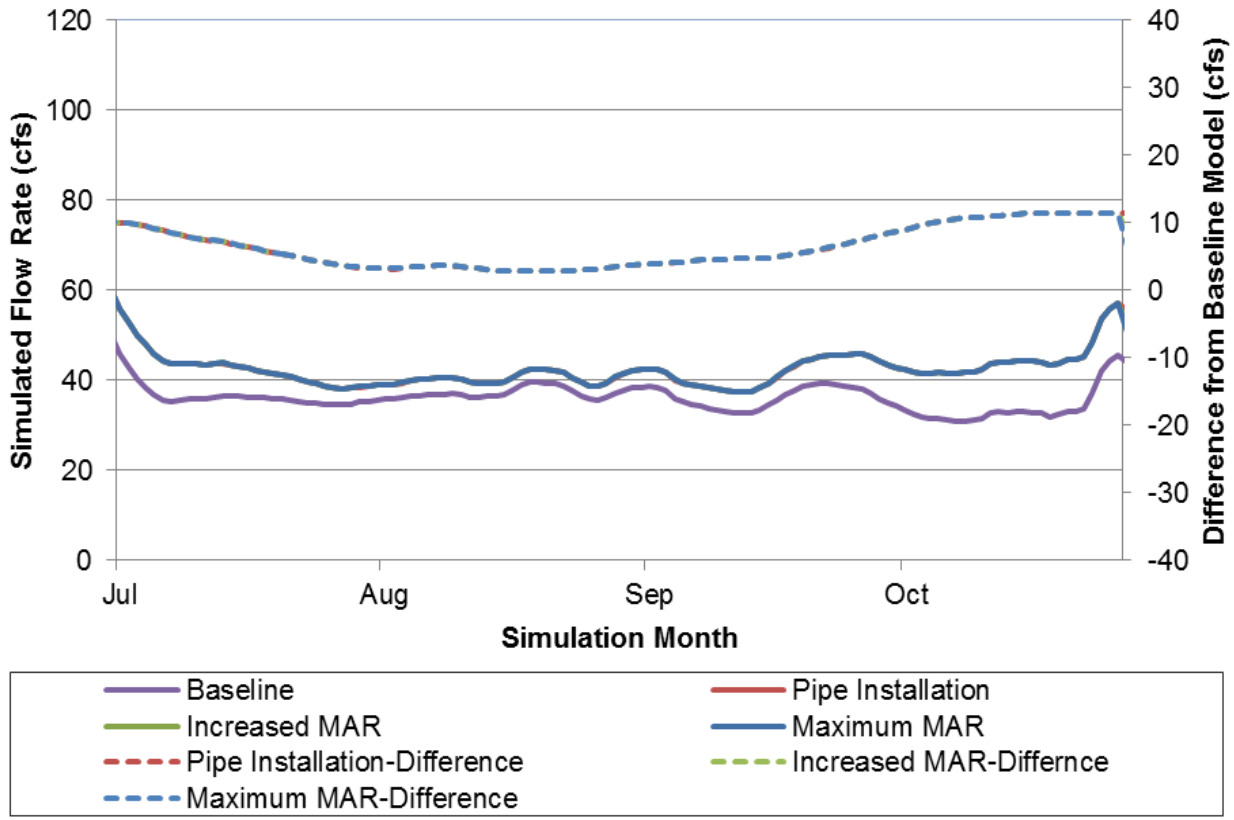
Walla Walla River at Nursery Bridge

- Small difference between management scenarios
- Difference from Baseline Forward Model reflects water savings from White Canal piping



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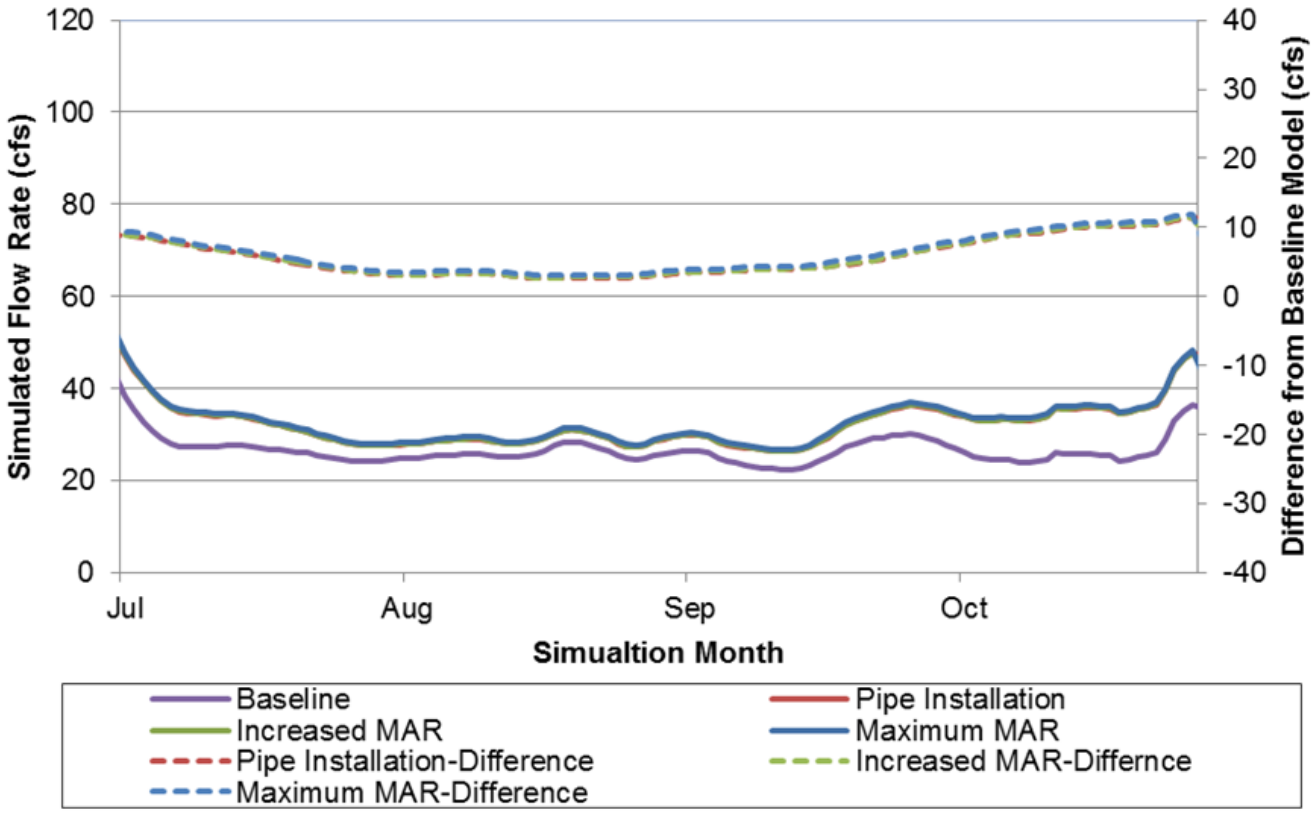
Walla Walla River at Pepper Bridge

- Small difference between management scenarios
- Difference from Baseline Forward Model reflects water savings from White Canal piping



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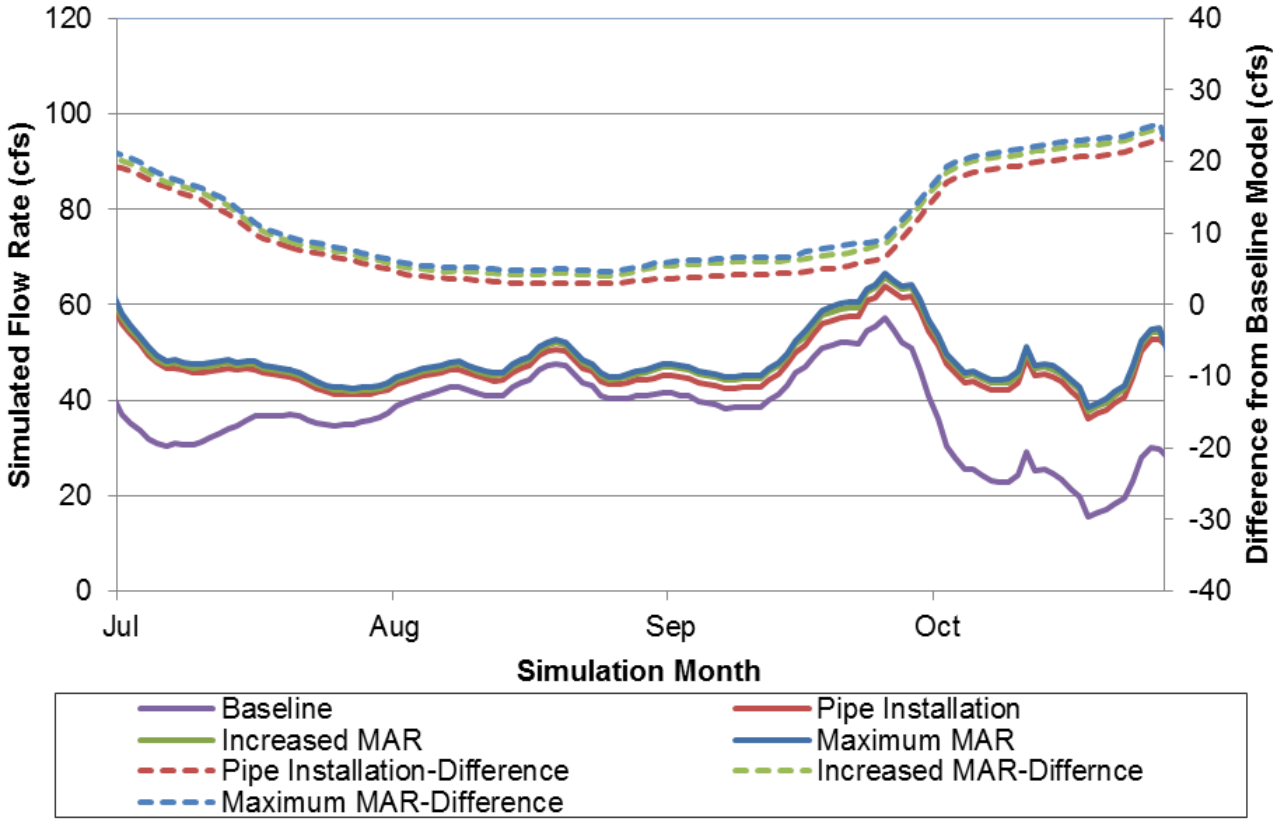
Walla Walla River at Beet Rd.

- Slightly higher flows predicted as MAR is increased
- Primary difference from Baseline Forward Model reflects water savings from White Canal and Gardena Canal piping



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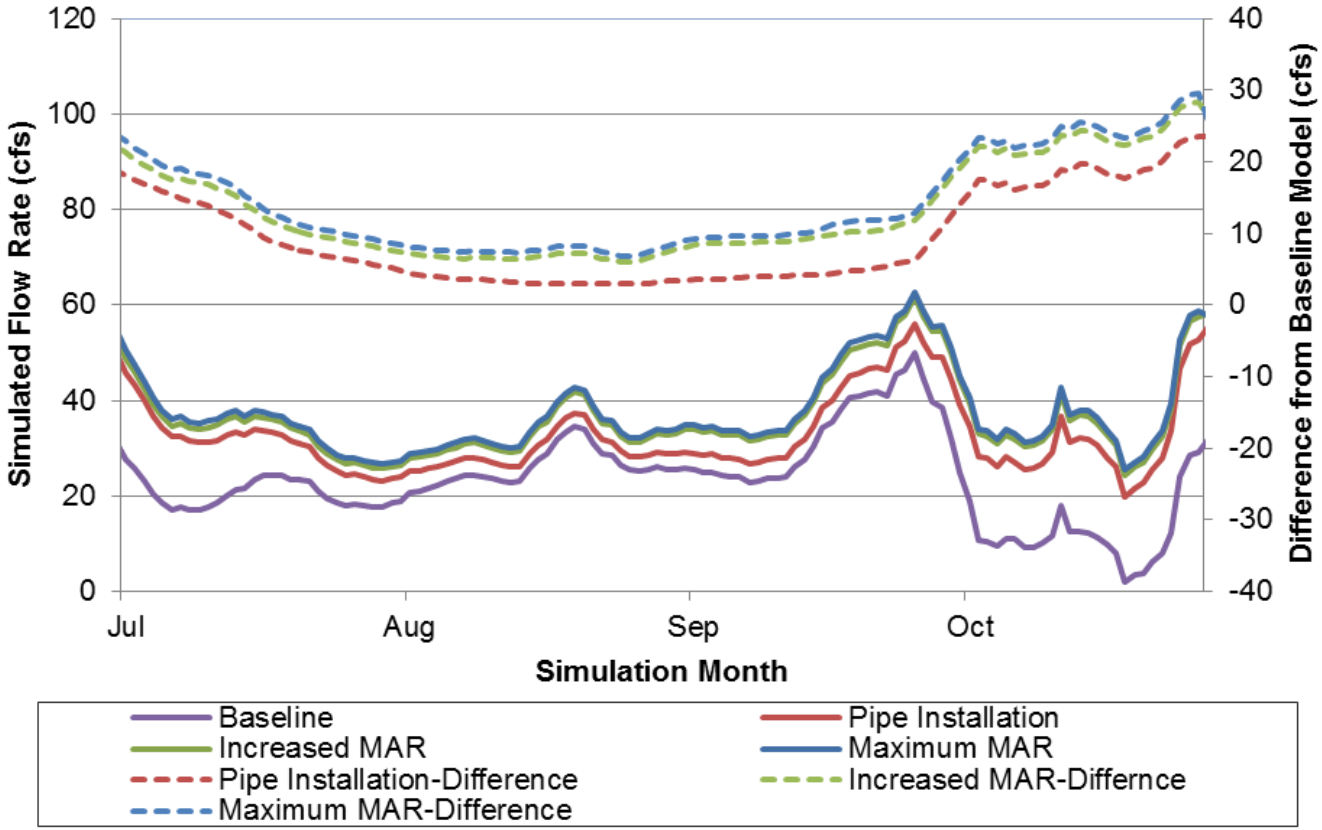
Walla Walla River at McDonald Bridge

- Water savings from White Canal and Gardena canal piping results in increased flow for all management scenarios
- Flow rate predicted to be 2.5 to 4.0 cfs greater in Increased MAR/Maximum MAR scenarios relative to the Pipe Installation scenario



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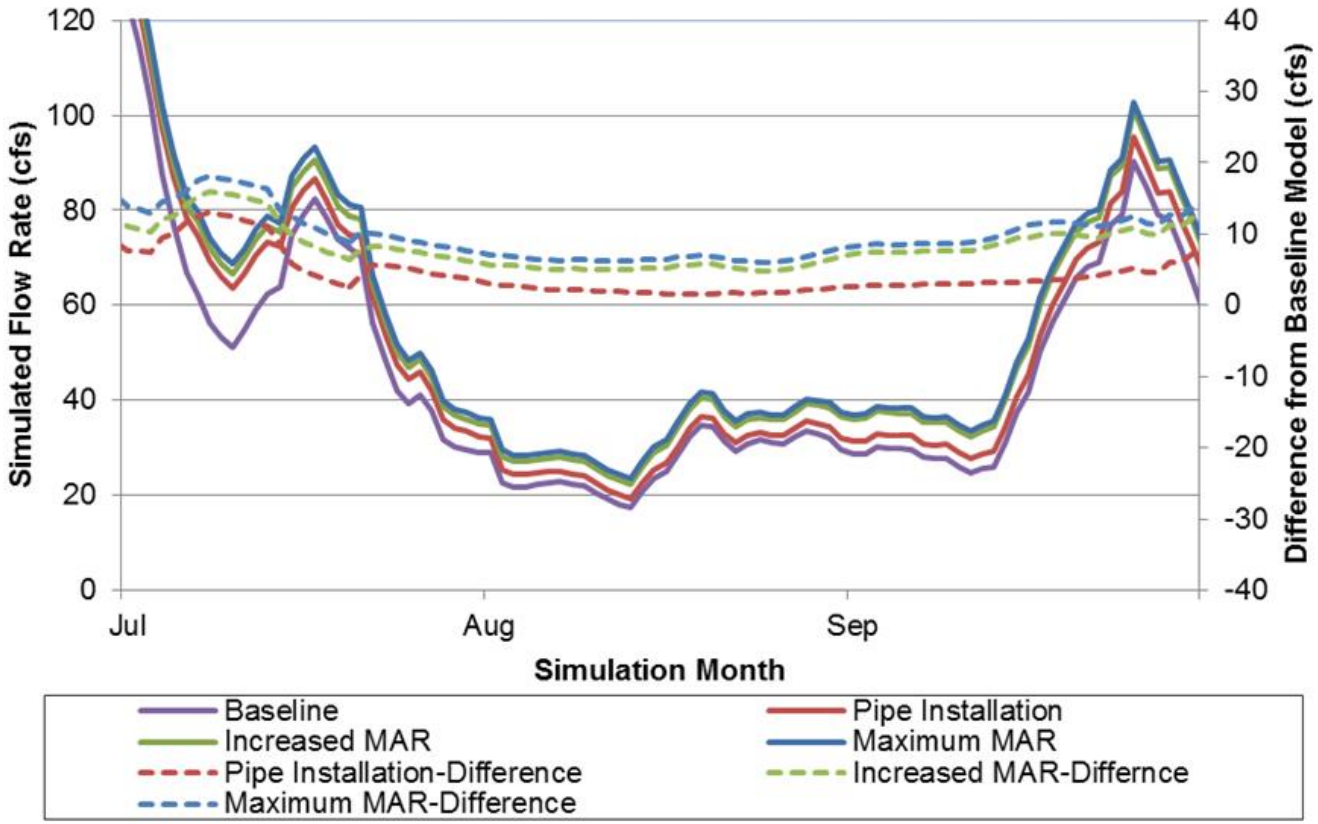
Walla Walla River below Touchet WA

- Increased MAR/Maximum MAR flow rates predicted to be 4.0 to 10.5 cfs greater relative to the Pipe Installation scenario
- Increased/Maximum MAR scenarios results reflect increased flow in Pine Creek as well as increased groundwater return flows into the Walla Walla River



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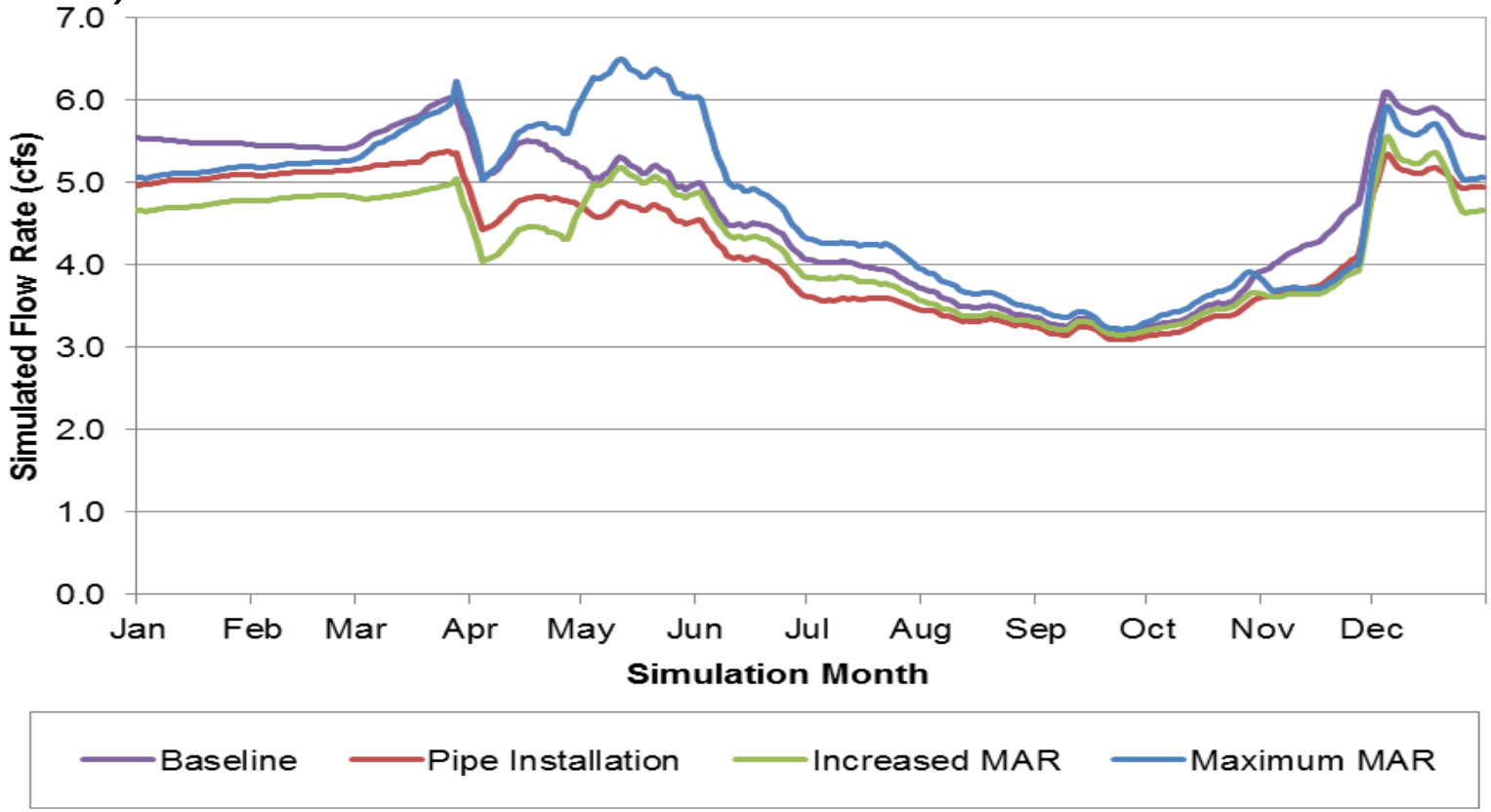
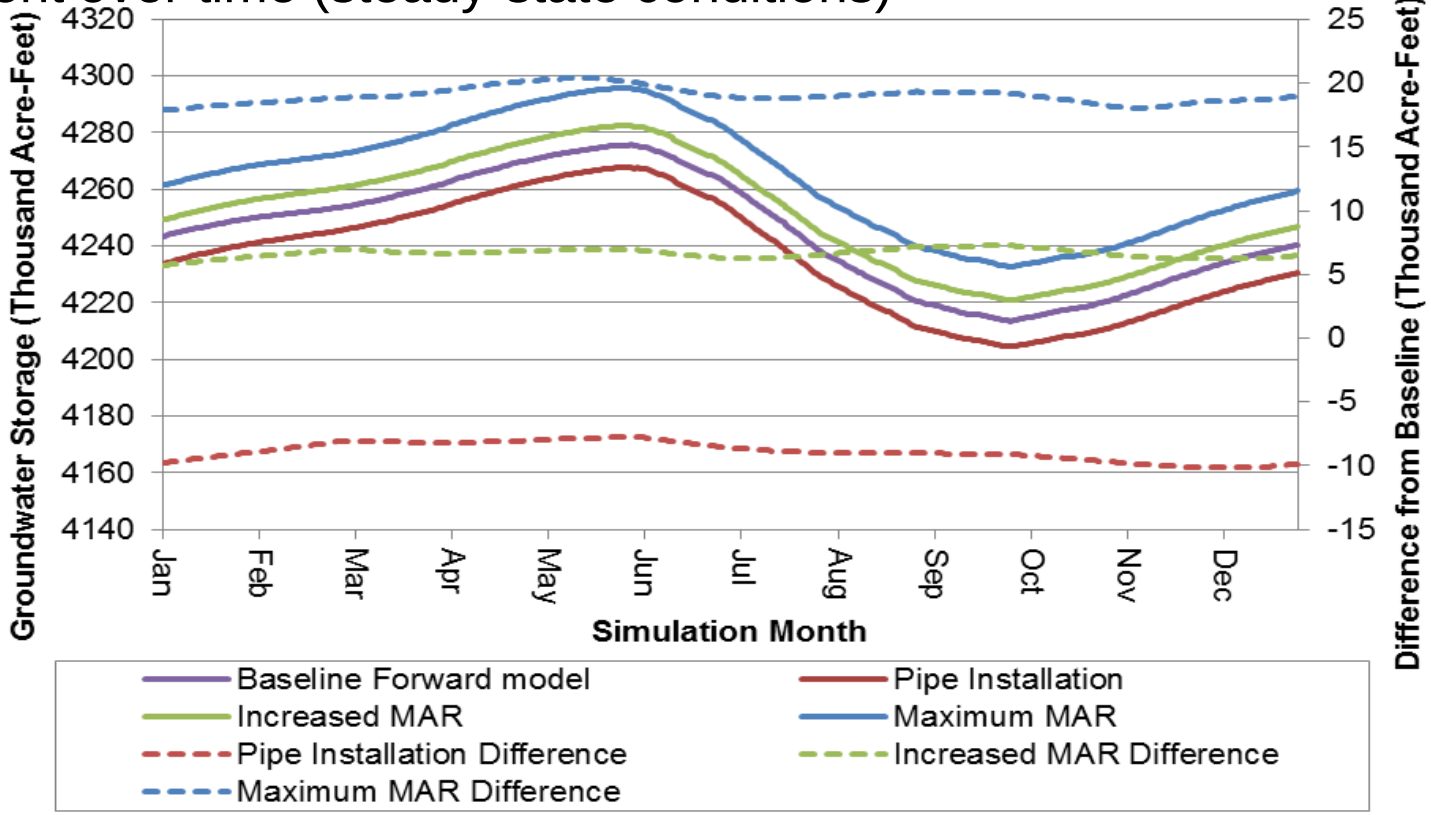
West Little Walla Walla

- Water savings reduce flow in the West Little Walla Walla due to less water diverted into the canal system
- At Maximum MAR groundwater return flows predicted to increase surface flows above baseline levels (particularly following April-May recharge season)



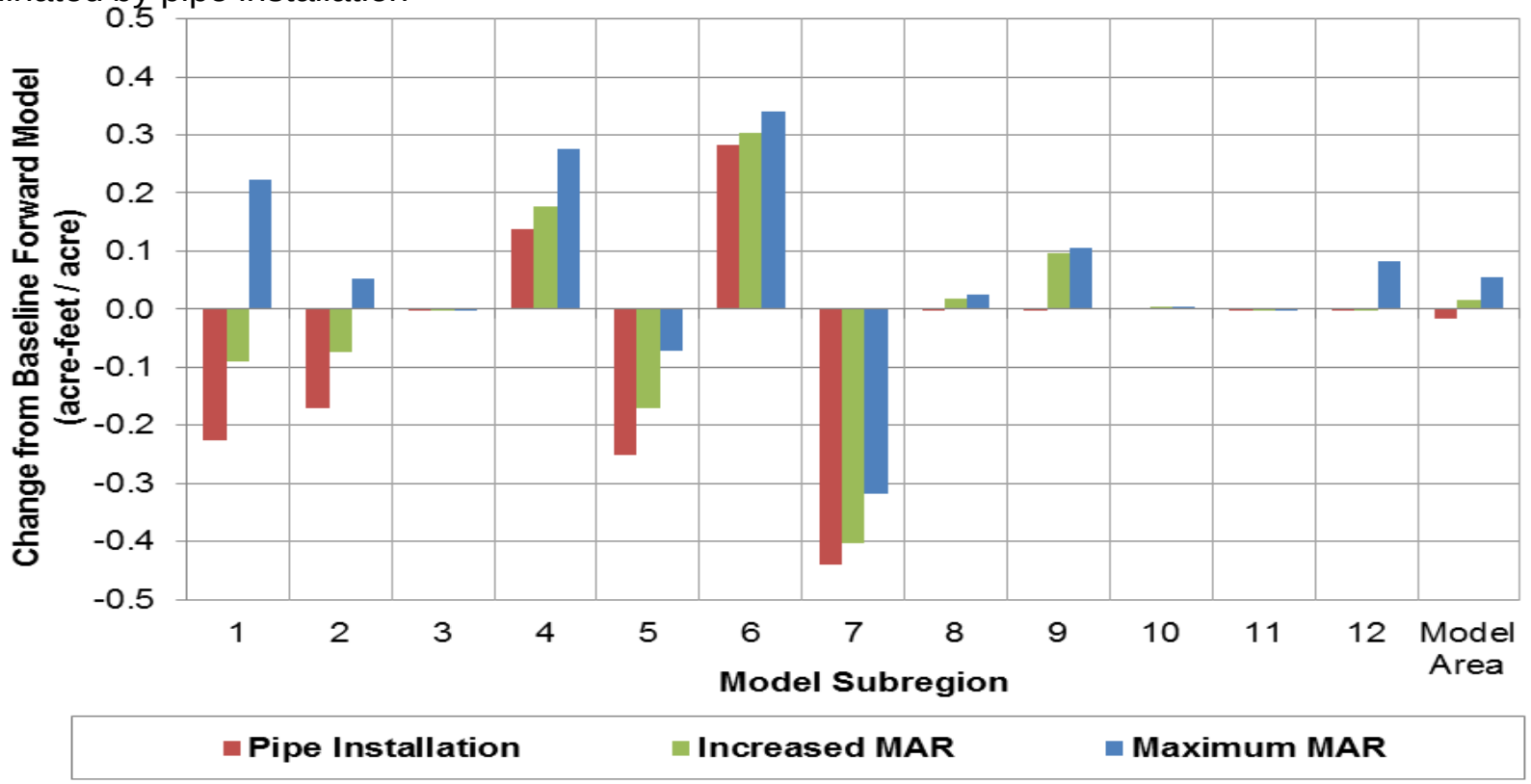
Groundwater Storage

- Pipe installation predicted to decrease groundwater storage without increased MAR
- Groundwater storage increases with increased MAR
- Groundwater storage increases relative to Baseline Forward Model are consistent over time (steady-state conditions)



Surface Water – Groundwater Interactions by Sub-region

- Pipe Installation results in lower groundwater return flows into Walla Walla River (sub-regions one and two)
- MAR increases groundwater return flows or reduces seepage losses relative to Pipe Installation scenario
- Sub-regions four and six surface water flows predicted to increase as seepage losses are reduced or eliminated
- In sub-region five canal lining conserves water in summer time but eliminates gaining conditions over winter
- In sub-region seven decreased groundwater return flows are reduced as seepage from up-gradient areas is eliminated by pipe installation



Impact of **Pipe Installation** on GW Elevation

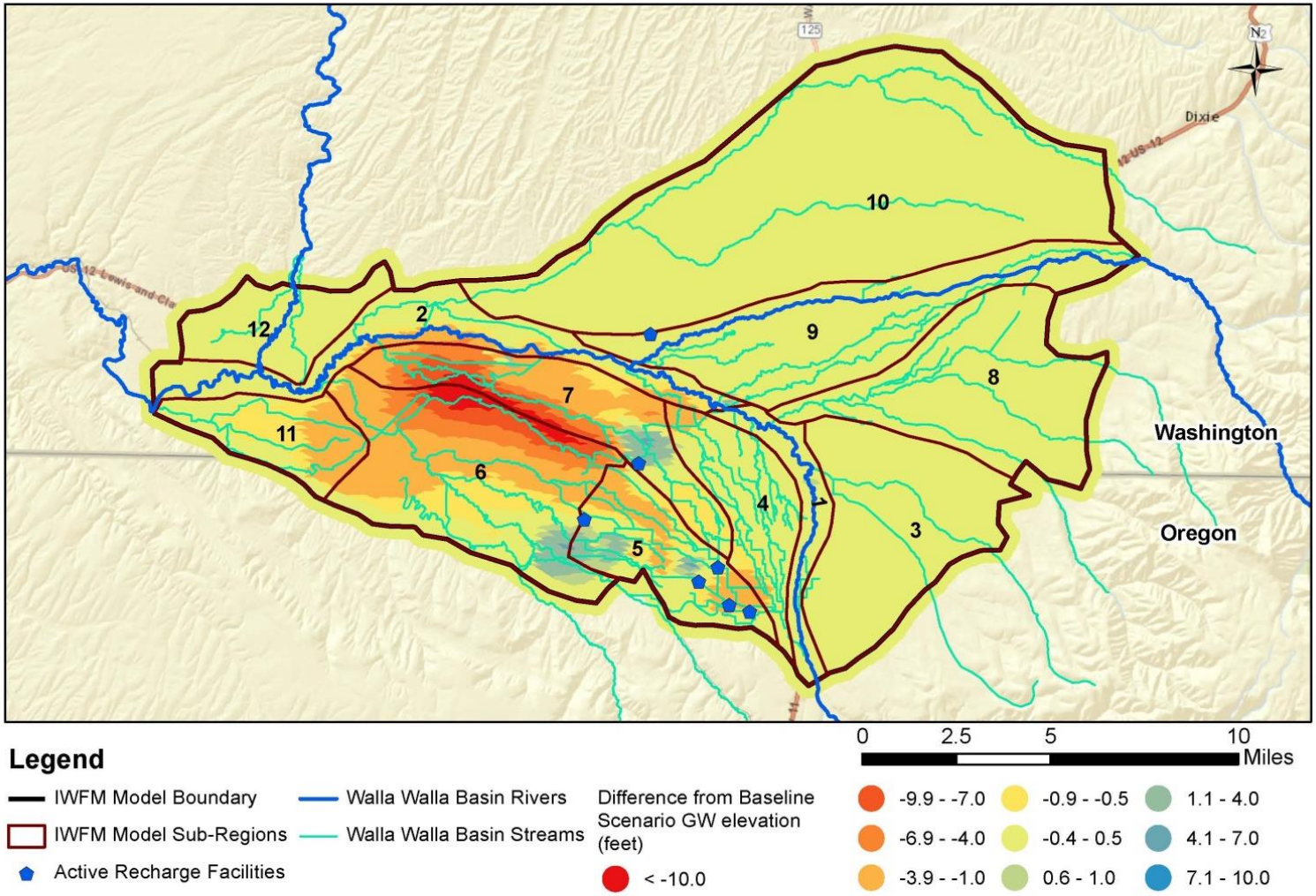


Figure 15. Pipe Installation scenario predicted change in groundwater elevation relative to the Baseline Forward Model

- Lower water table predicted with Pipe Installation
- Localized increases around some MAR sites because pipelines allow more water to reach MAR sites

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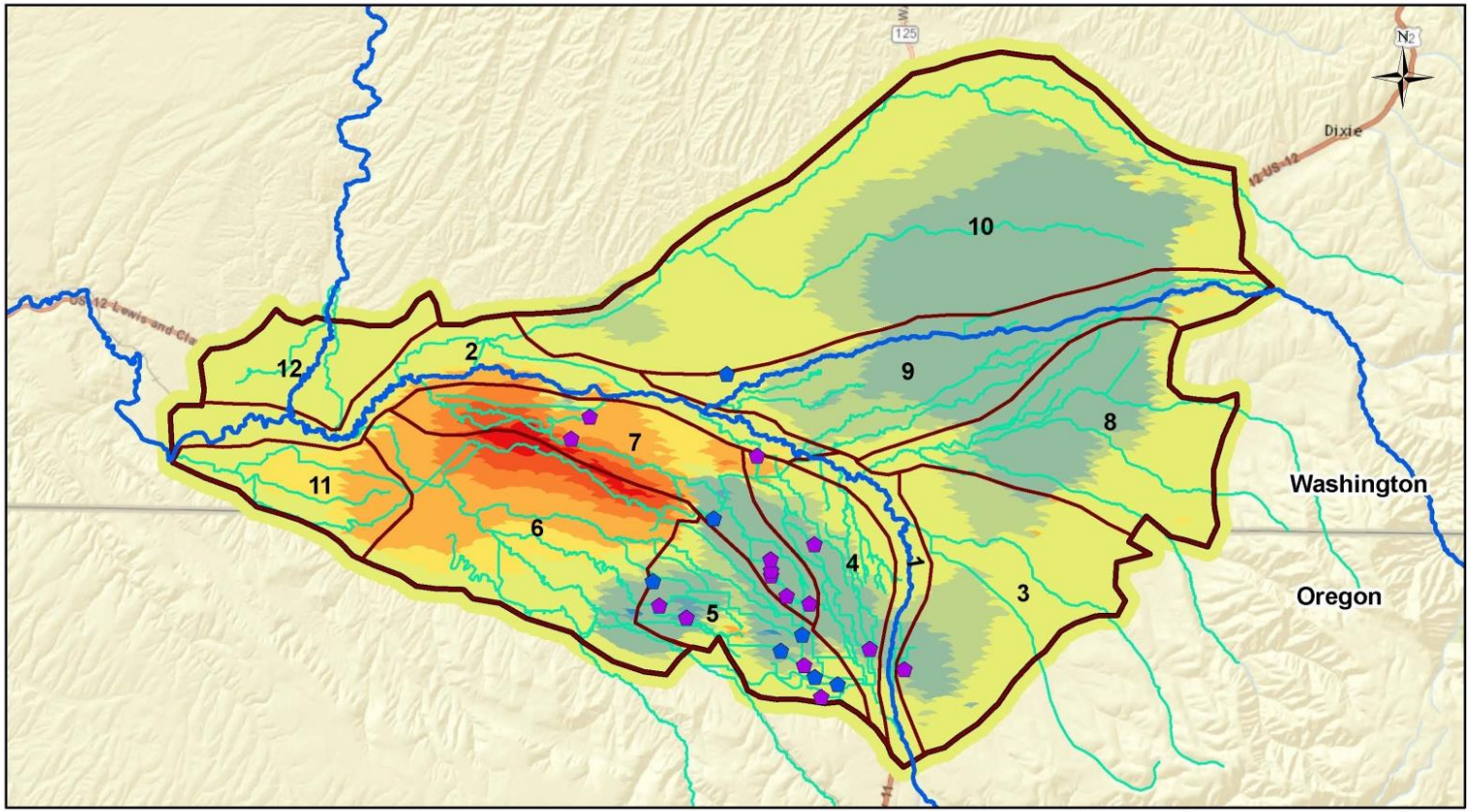
Impact of **Increased MAR** on GW Elevation



Legend

- Active Recharge Facilities
- Proposed Recharge Facilities
- IWFM Model Sub-Regions
- IWFM Model Boundary
- Walla Walla Basin Rivers
- Walla Walla Basin Streams

Difference from Baseline Scenario GW elevation (feet)

- < -10.0
- -9.9 - -7.0
- -6.9 - -4.0
- -3.9 - -1.0
- -0.9 - -0.5
- -0.4 - 0.5
- 0.6 - 1.0
- 1.1 - 4.0
- 4.1 - 7.0
- 7.1 - 10.0

Figure 16. Increased MAR scenario predicted change in groundwater elevation relative to the Baseline Forward Model

- Higher water table predicted with Increased MAR in vicinity of MAR sites and in northern portion of model area
- Lower water table persists in down-gradient portion of model area

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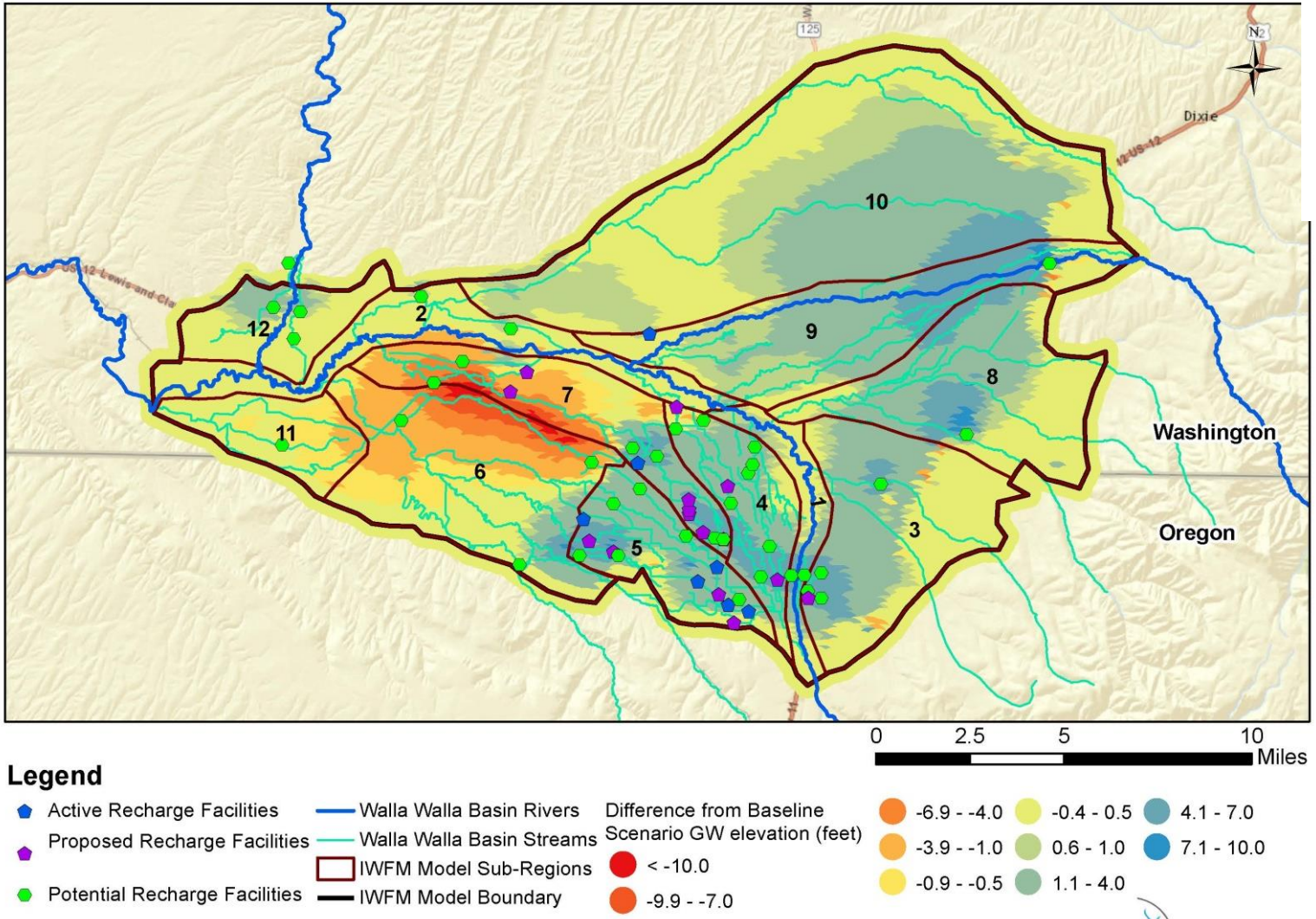
Impact of **Maximum MAR** on GW Elevation



- Higher water table predicted with Increased MAR in vicinity of MAR sites and in northern portion of model area
- Lower water table persists in down-gradient portion of model area
- Expanse of lower water table decreased relative to other scenarios

Figure 17. Maximum MAR scenario predicted change in groundwater elevation relative to the Baseline Forward Model

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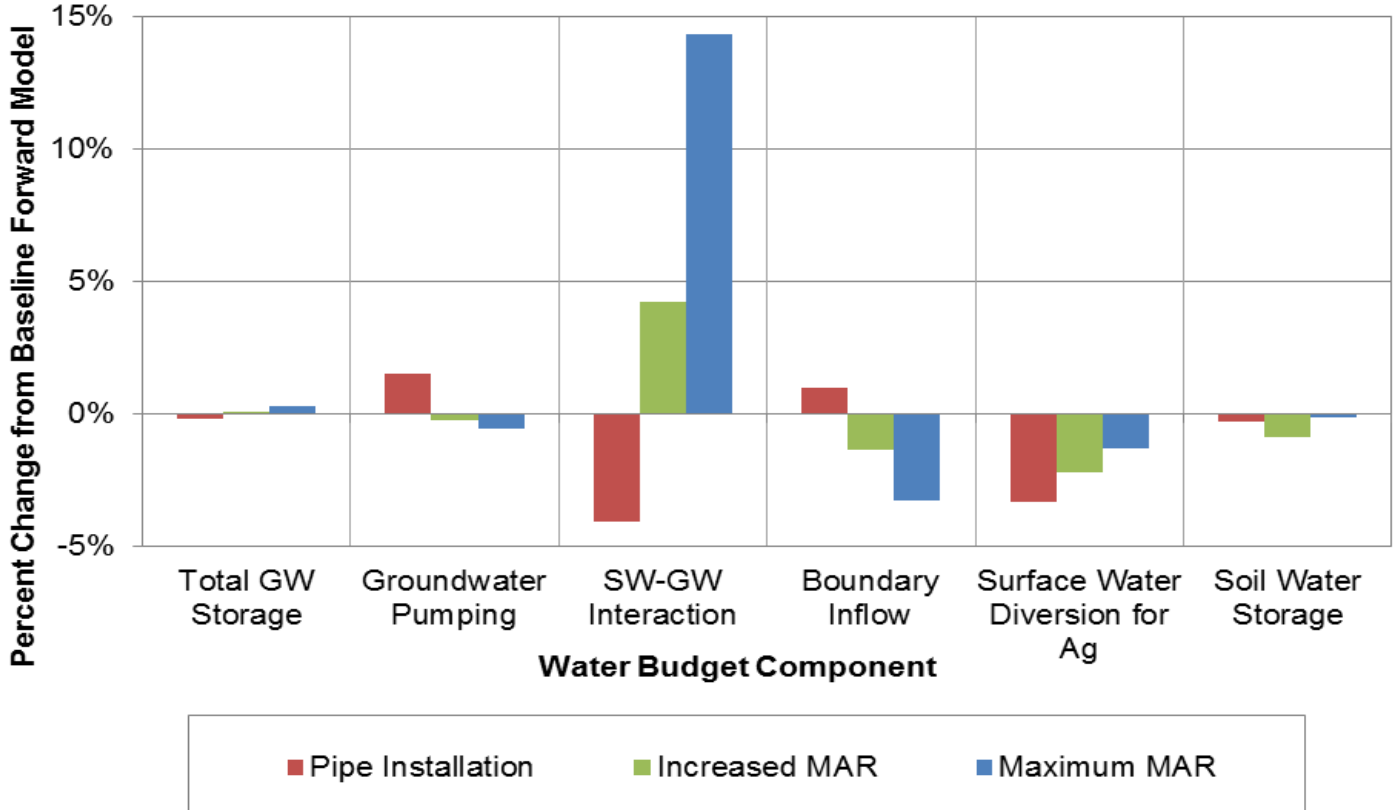
Water Budget

- Management scenarios have greatest impact on surface water-groundwater interactions
- ~4% and 14% increase in net seepage gains (from groundwater to surface water) predicted for Increased and Maximum MAR scenarios, respectively.
- 4% increase in net seepage losses predicted for the Pipe Installation scenario



Conclusion

- Water savings directly increase summer flows in the Walla Walla River
- MAR increases summer flow in the Walla Walla River at McDonald Bridge and below Touchet, WA by increasing groundwater return flows to the Walla Walla River and some tributaries
- Upstream locations show negligible impact from MAR
- MAR increases groundwater storage in vicinity of recharge sites but not in down gradient locations where pipe installation reduces groundwater recharge from seepage
- Increasing MAR to include the currently proposed recharge sites (Increased MAR scenario) predicted to mitigate the impact of the simulated canal piping
- Greater increases in MAR to incorporate 60 sites (Maximum MAR scenario) predicted to provide more widespread benefits to both fish habitat and groundwater resources by allowing for significantly increased summer flows while stabilizing aquifer storage
- Converting canals into pipelines likely to have a negative impact on groundwater resources and have limited benefit to instream water savings if not combined with the increased application of MAR
- Conjunctive management of groundwater and surface water can potentially provide water for irrigators while allowing for increased summer flows and improved habitat in the Walla Walla River.

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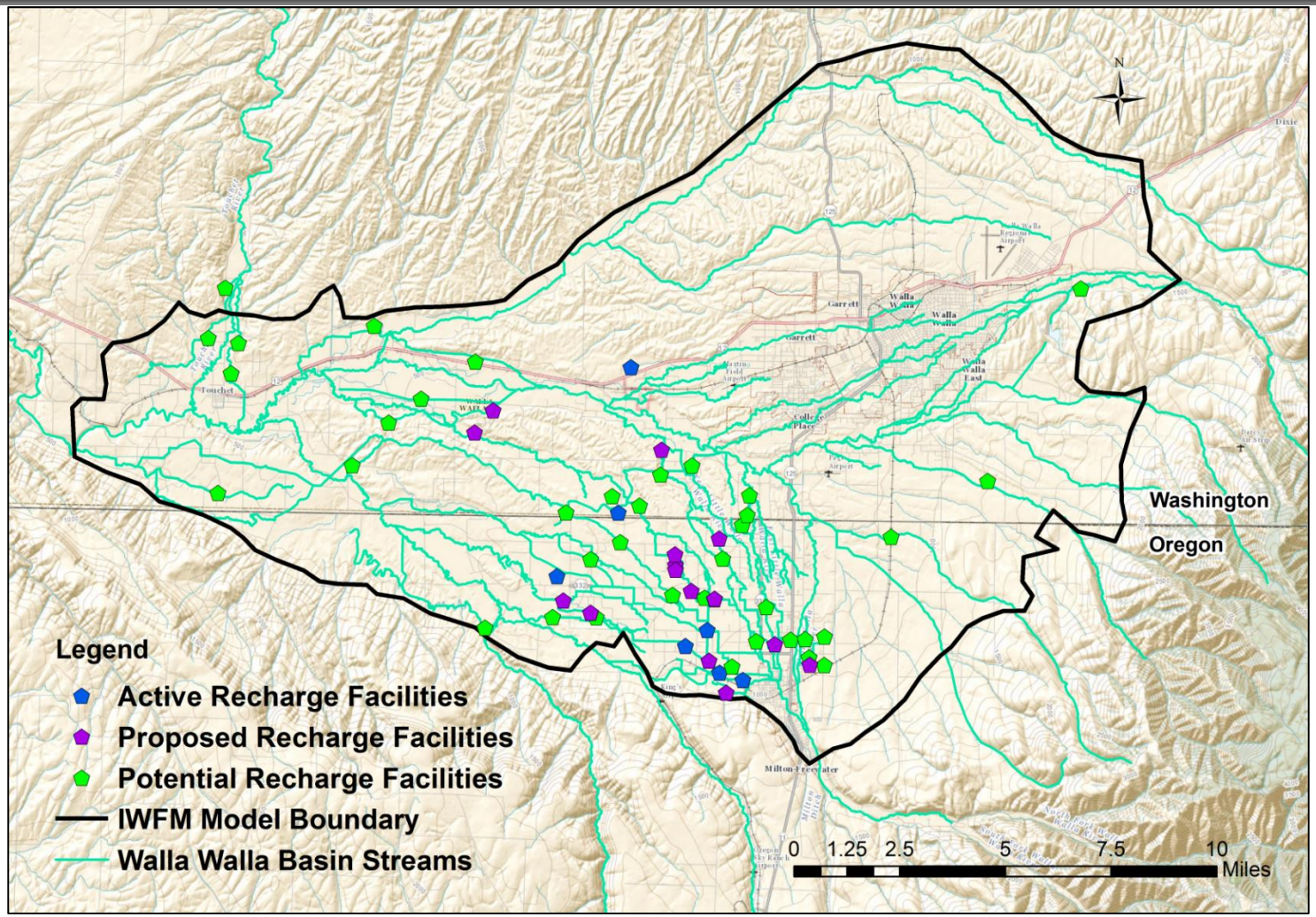
Questions



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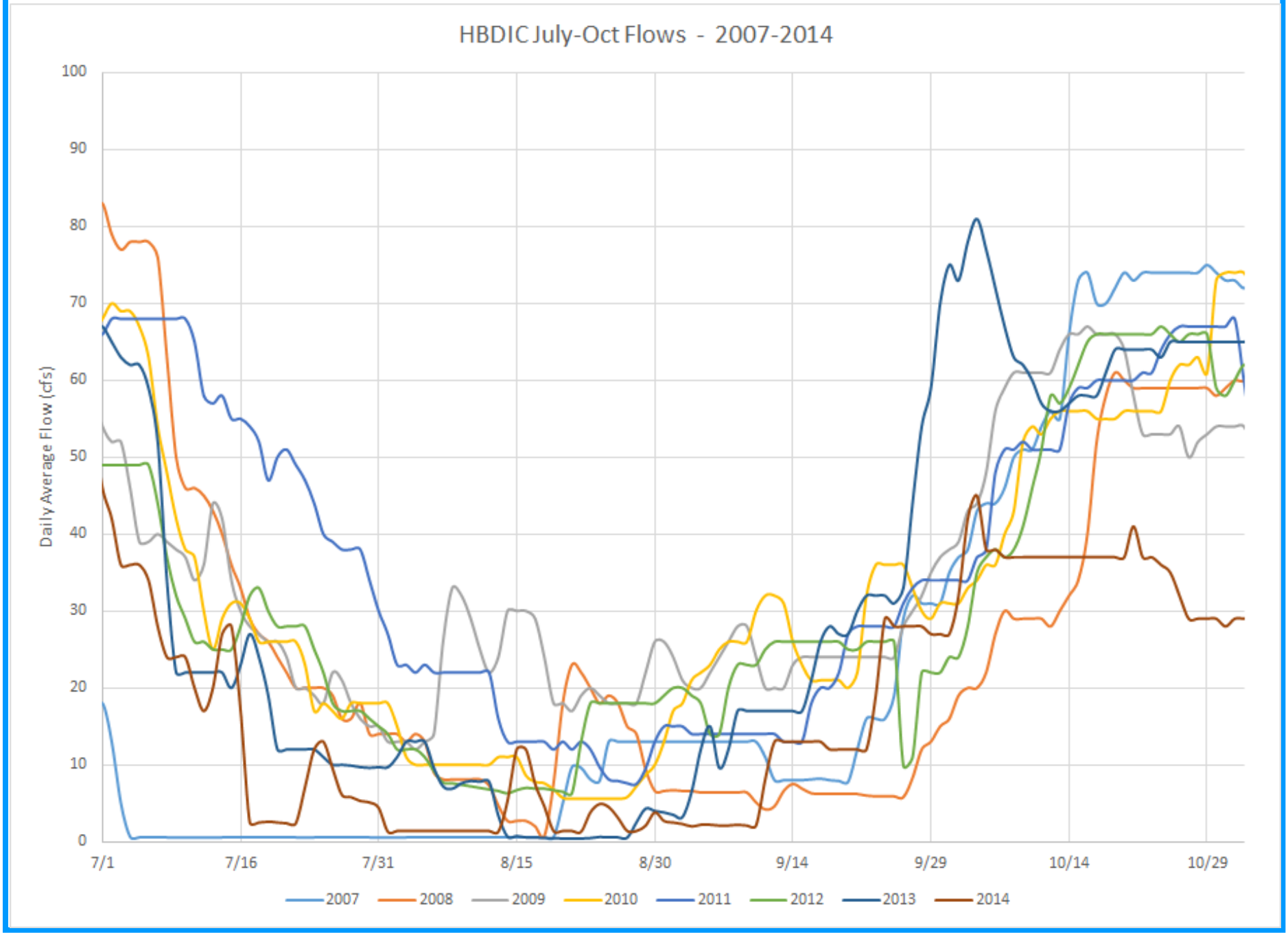
HBDIC July-Oct Flows - 2007-2014
Daily Average Flow (cfs)
100
90
80
70
60
50
40
30
20
10
0
7/1
7/16
7/31
8/15
8/30
9/14
9/29
10/14
10/29
2007
2008
2009
2010
2011
2012
2013
2014