This document shows OWRD's comments and our responses to those comments. Many comments were addressed though there were a couple we chose not to address. For those comments not addressed, we explain our reasoning.

In addition to the OWRD's comments on this document, missing information was also highlighted as well as some inaccuracies that needed correcting. We addressed these overarching themes as well, which includes:

- Page 1-2: Added information on the impacts associated with surface-groundwater interaction on out-of stream needs, instream needs, and the risk associated with climate change. We also added a description of the existing infrastructure in the basin and how it obstructs or facilitates interaction between surface and groundwater.

Step 3 Surface Water Groundwater Interaction

The over appropriation of surface water from the Silvies River and Poison Creek has led to a reduction of flow to Malheur Lake. The flood irrigation system has a long history in the Harney basin (Langston, 2003). Irrigation is dominantly from spring freshets and is managed to distribute water to senior water right holders. The amount of regulation and control of flood waters is dependent on spring flows. The irrigation infrastructure is composed of several sloughs, ditches and dams to direct flow to as large an area as possible. There are some 14 dams on the Silvies River, many in poor repair. The dams are associated with diversion points to provide irrigation water to fields or ditches slightly lower on the floodplain. Flood irrigation has expanded the area of spring surface water.

The spring flood irrigated fields provide significant resting and feeding habitat for migratory birds. As many as a million waterfowl alone visit the flood irrigated wetlands of the Harney basin each year. Beyond the bird habitat value, flood irrigation accounts for an estimated 36% of the total lowland recharge in the Harney basin. Coupled with streamflow and "natural floodwater and lakes", flood irrigation accounts for some 70% of total recharge (Garcia et al., 2023). Flood irrigation is important for the shallow groundwater but could be affected by loss of storage from deeper groundwater pumpage, although there is only limited overlap of flood irrigation and groundwater development which means that the time lag to express impacts will be significant in the low transmissivity sediments.

Climate change could have several effects on the relationship between surface water uses and groundwater conditions. Increased temperatures will likely increase evapotranspiration, making late season irrigation less likely since there is limited water during the dry season under most conditions. If snowpack is reduced, spring flows could be altered in timing and duration from current conditions. While there is some indication that snowpack may not be universally impacted (Dominguez et al., 2012). Additional effects of climate change could include greater intensity storms and longer and more frequent droughts. These drivers could exacerbate flooding in Burns and Hines and severely affect flood irrigated wet meadow hay production.

Improved knowledge on surface-groundwater interaction in Harney Basin is needed to better understand what the connections are between the two and to therefore properly manage surface water to optimize groundwater recharge.

The primary concern of surface water-groundwater interaction is the recharge of groundwater from flood irrigation. It is estimated that nearly one third of the recharge in the lowlands of the Harney valley comes from flood irrigation. A better understanding of the recharge process associated with flood irrigation could provide information for managing both the amount and location of active recharge. Any way to increase recharge of the shallow groundwater table will help to manage groundwater conditions.

Flood irrigation infrastructure has been improved to assist more efficient management of surface water irrigation. The effect of the improved infrastructure on groundwater recharge has not been evaluated.

The data needs identified in the Step 2 document and approaches to address them are identified in the following table and described further below.

Data Need	Strategy
Additional sites for long-term measurement of stream flow	Discussion with OWRD & USGS - funding
Spatially explicit measurement of lowland recharge under different spring freshet regimes	Study as a follow on to the groundwater study - funding
Relationship between surface vegetation and water yield	Vegetation Management Work Group is working on this.
Evaluation of snowpack change in response to climate change and effect on recharge	Harney Basin Wetlands Collaborative is evaluating an element of this
Evaluation of beaver reintroduction	A proposed study by the HBWC
Evaluation of stream simplification	Malheur Refuge is looking into the lower Blitzen River situation

- A critical need is for additional sites for long-term measurement of stream flow. Without knowledge of changes in flow regime in tributary streams and lower reaches of larger streams it is difficult to accurately understand the interaction between surface and groundwater.
- Spatially explicit measurement of lowland recharge under different spring freshet regimes would be a significant help in determining the potential for managing lowland recharge and/or identifying opportunities to increase lowland recharge.
- Quantifying the relationship between vegetation conditions of different portions of the catchment and contribution to the surface and groundwater would aide in prioritizing vegetation management for water yield purposes (beyond ecosystem structure and function purposes).
- A basin scale evaluation of changing snowpack regime would help to understand the surface and groundwater management needs in the future.
- An evaluation of beaver reintroduction and/or the effect of beaver dam analogs (Silvies Valley Ranch) on timing and storage of surface and groundwater would help in determining whether beaver reintroduction is an advisable strategy.

- Evaluating the extensive stream simplification and canal system in the lower river systems for effects on recharge and discharge would help to identify if there are reaches important to restore to a more complex pattern.

A priority information need is to develop a more complete understanding of the lowland recharge and determine if there are management actions that can increase recharge consistent with Oregon water law. It will be necessary to conduct the evaluation before any recommendation can be developed on measures available to enhance recharge. Without more complete information it is difficult to determine if, how, and how much water can be added to lowland recharge.

References

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