5.5 Implementation Plan

This section provides more detail on how each of the tools receiving consensus support from the DBWC will be implemented and used to meet the water needs in the Upper Deschutes Basin. [Any information in this section will require consensus from DBWC – Chapter 5 discussions are underway to reach consensus; this language will be finalized once that has been achieved.]

Note that in this section, individual actions to implement tools may be specified for implementation on a particular timeline. Where specified, "near-term" actions are either ongoing or will be implemented starting in 2026-2027, "medium-term" in 2028-2032, and "long-term" in 2033 and beyond. These timelines align with the implementation phases of the Deschutes Basin Habitat Conservation Plan. Throughout Section 5.5, the timeline during which approved tools are listed for implementation represents when each should start being used – for example, it can be assumed that, for the most part, tools listed in Table XXX for use in the near-term will also be used in the medium- and long-term as well.

5.5.1 Tools for Implementation - Irrigation

5.5.1.1 District Canal and Lateral Piping

Actions and Desired Outcomes:

- Continue to implement **district canal and lateral piping** projects that improve water supply reliability for NUID during the irrigation season and result in permanently protected water instream in the Upper Deschutes River in the winter months.
- On a case-by-case basis, implementation of **district canal and lateral piping** can alternatively be used to provide permanent instream water rights to restore Middle Deschutes flows during the irrigation season (primarily in the summer).

Additional Outcomes:

- **Watershed and habitat restoration** – instream flow restoration helps to restore the hydrograph closer to natural flow conditions, which will reduce scouring of the river channel that has occurred during artificially high summer flows and subsequently help restore and improve instream habitat for aquatic species.
- **Water Quality** – instream flow restoration in the Upper Deschutes during the winter helps to reduce sedimentation, and in the Middle Deschutes during the summer can contribute to reduced stream temperature.

Enabling Actions:

- Secure funding for district canal and lateral piping project design and construction.
- Increase district capacity to implement their canal and lateral piping projects.
- Desire that the "alternative pathway" for supplying water to NUID in the summer and permanently protecting instream flows in the Upper Deschutes in the winter makes sense administratively and financially for implementing districts, and ensures permanent protections for instream flows.

Recommendations:

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- Support ongoing implementation of district canal and lateral piping projects that result in one-to-one exchange of water supply reliability for NUID during the irrigation season in exchange for permanently protected water instream in the Upper Deschutes River in the winter months (to help meet HCP targets for the Oregon spotted frog).
- Prioritize piping of entire distinct sections of district canal and lateral infrastructure to incrementally enable movement of water from patron activities.
- Convene an implementation group to discuss potential adjustments to the alternative pathway to ensure that it makes sense administratively and financially for implementing districts and ensures permanent protections for instream flows.
- Continue to seek funding for district canal and lateral piping project design and construction.
- Assist in developing district capacity to implement their canal and lateral piping projects.

5.5.1.2 Private Lateral Piping

Actions and Desired Outcomes:

- In the near term, fund and implement **private lateral piping** projects with willing patrons within areas where main canal piping has been completed to give the implementing district necessary operational control and flexibility to meet their patron needs.
- In the medium-term, prioritize funding and implementing **private lateral piping** projects that include metering and measurement to enable patron water to be tracked and moved through the pilot Water Bank to improve irrigation supply reliability for NUID in the summer and temporarily restore flows in the Upper Deschutes in the winter and/or to restore flows in the Middle Deschutes in the summer.
- The long-term goal of publicly funded **private lateral piping** is to pursue permanent protection of patron water for instream flows.

Additional Outcome:

- **Water Quality** – flow restoration in the Middle Deschutes can contribute to reduced stream temperature during the summer months.

Enabling Actions:

- Secure funding for private lateral piping project design and construction, which could be particularly challenging if there are no immediate guaranteed public benefits (i.e., water savings for instream flows).
- Need landowner/patron interest and willingness (which districts indicate might be limited).
- Improve district, partner, and patron capacity to implement private lateral piping projects.
- Address operational challenges and water delivery obligations that affect districts' ability to move saved water between COID and NUID systems (initially through the pilot Water Bank).
- Consensus is needed on which private laterals should be prioritized for near-term piping projects.

Recommendations:

- Support ongoing implementation of existing private lateral piping projects to satisfy one or more of the potential outcomes identified above.
- Eliminate priority rotations of private laterals and replace them with piped and pressurized on-demand water to improve management efficiency and incrementally enable movement of water from patron activities to benefit NUID supply and instream flow in the Upper Deschutes in the winter.
- Convene a stakeholder group to address the enabling actions stated above, so that private lateral piping can be scaled for medium- and long-term implementation to achieve desired outcomes.
- Continue to seek funding for private lateral piping projects with public benefits.
- Assist in developing district, partners, and patron capacity to implement private lateral piping projects.
- Support OWRD budget requests for the Water Measurement Cost Share Fund (???)

5.5.1.3 On-Farm Irrigation Efficiency

Actions and Desired Outcomes:

- Where patrons are connected to fully piped sections of district and private conveyances, fund and implement **on-farm irrigation efficiency** improvement projects that enable them to move water savings through the pilot Water Bank to temporarily improve irrigation supply reliability for NUID in the summer while restoring flows in the Upper Deschutes in the winter and/or to temporarily restore flows in the Middle Deschutes in the summer.
    - In the near-term, opportunities for district patrons to move water savings from on-farm irrigation efficiency projects may be limited. As planned district canal and private lateral piping projects are completed in the near-term, opportunities for district patrons to move water savings will be expanded to achieve the outcomes stated above in the medium- and long-term.
- Opportunities may be available in the near-term for willing non-district landowners to move water savings from on-farm efficiency projects through the pilot Water Bank or through permanent transfer to improve NUID supply reliability and/or to restore Deschutes River flows.

Additional Outcomes:

- **Water Quality** – flow restoration in the Middle Deschutes can contribute to reduced stream temperature during the summer months.
- In the near-term, implementing **on-farm irrigation efficiency** improvement projects, whether connected to fully piped conveyance or not, helps landowners to improve drought resilience, reduce on-farm demand to more closely match crop water demands, increase yields, and provide flexibility to grow different crop types in the future.

Enabling Actions:

- Implementation of planned district canal and private lateral conveyance piping projects in the near- and medium-term will expand opportunities for district patrons to move water savings from on-farm efficiency projects through the pilot Water Bank to meet other water needs.

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- Secure funding for on-farm irrigation efficiency improvement projects
- Need landowner/patron interest and willingness.
- Address operational challenges and water delivery obligations that affect districts' ability to move saved water between COID and NUID systems (initially through the pilot Water Bank).
- Clarity needed on whether districts have the legal authority to require or implement upgrades to private systems, as stakeholder opinions differ.
- District has the duty to ensure adequate water supply to meet beneficial use without waste for the benefit of all district patrons and may not be able to reduce water deliveries in proportion to on-farm savings while protecting the ability of other patrons to receive water to which they are entitled.

Recommendations:

- Support ongoing implementation of on-farm irrigation efficiency improvement projects, prioritizing lands connected to fully piped conveyance systems where water savings could be moved through the pilot Water Bank to temporarily improve irrigation supply reliability for NUID in the summer while restoring flows in the Upper Deschutes in the winter, restore summer flows in the Middle Deschutes, and possibly meet future municipal water needs.
- Support ongoing implementation of district canal and private lateral piping to incrementally expand opportunities for district patrons to move water savings from on-farm efficiency projects through the pilot Water Bank to meet other water needs.
- In the near-term, identify non-district landowners who may be willing to move water savings from on-farm efficiency projects to temporarily or permanently restore instream flows.
- Convene a stakeholder group to address the enabling actions stated above, so that on-farm conservation can be scaled for medium- and long-term implementation to achieve desired outcomes.

5.5.1.4 Monitoring, Measurement, and Reporting (of irrigation water)

Actions and Desired Outcomes:

- Increase monitoring, measurement, and reporting of irrigation water beyond the initial points of diversion to enable irrigation districts and OWRD to better monitor and control water deliveries, resulting in improved management and increased opportunities to share water savings generated by other tools.
- Installation of on-farm metering to track on-farm water use creates opportunities for movement of water using the Allocation of Conserved Water or the pilot Water Bank tools, particularly when integrated with on-farm irrigation efficiency improvements.

Recommendation:

- The Collaborative broadly supports efforts taken to increase monitoring and metering of irrigation water use to achieve the outcomes described above.
- Districts often install measurement equipment when implementing conveyance piping projects. The Collaborative supports the continued installation of monitoring and measurement equipment on such piping project to achieve the outcomes described above.

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5.5.1.5 Instream Leasing and Temporary Transfers

Actions and Desired Outcomes:

- Maintain existing amounts of **temporary instream leases** through the DRC's longstanding Annual Water Leasing Program (AWLP) to annually restore instream flows during the irrigation season in the Middle Deschutes (and other reaches).
- Continue to generate temporary groundwater mitigation credits from instream leases through the AWLP to help water right holders supply required mitigation credits. =

Additional Outcomes:

- **Water Quality** – flow restoration in the Middle Deschutes can contribute to reduced stream temperature during the summer months.
- Instream leasing allows water rights holders to beneficially use their water rights even in years when not irrigating, protecting them from potential forfeiture.

Enabling Actions:

- Balance implementation of the AWLP and the pilot Water Bank – a minimum of 1,800 acres must be leased before the pilot Water Bank can be used.
- Ensure leases meet statutory requirements for any water transaction:
    - All leases must be reviewed by the Watermaster to determine whether a transaction would cause injury to down-system water rights.
    - All leases must also be reviewed by the Confederated Tribes of Warm Springs to ensure no injury is caused to the Tribal water right on the Lower Deschutes River.
- Address operational challenges and water delivery obligations that affect districts' ability to maintain historic levels of leasing.
- Work with districts to identify eligible participants in annual leasing and engage patrons to educate landowners about opportunities for leasing.

Recommendations:

- Continue to lease at least 1,800 acres through the DRC's AWLP annually to restore summer flows in the Middle Deschutes and enable use of pooled fallowed acre tool of the pilot Water Bank.

5.5.1.6 Permanent Instream Transfers

Actions and Desired Outcomes:

- Continue to pursue **permanent instream transfers** of irrigation water rights to restore and protect instream flows in the Middle Deschutes in the summer in perpetuity.
- Continue to generate permanent mitigation credits from **permanent instream transfers** to help municipal water providers meet long-term demands.

Additional Outcome:

- **Water Quality** – flow restoration in the Middle Deschutes can contribute to reduced stream temperature during the summer months.

DRAFT

Enabling Actions:

- Need water right holders to be willing and able and authorized to permanently transfer water rights instream.
- Address tax constraints and property value changes associated with transferring water rights off lands.
- Engage irrigation districts regarding needs and requirements for enabling permanent transfers of water rights from urbanized acres to generate permanent mitigation for municipal water suppliers.

Recommendations:

- Engage irrigation districts regarding permanent transfers of urbanized acres to generate permanent mitigation for municipal water suppliers.

5.5.1.7 Pilot Deschutes Water Bank

Actions and Desired Outcomes:

- In the near-term, ideally starting in 2026, pilot the **pooled fallowed acres** tool authorized under the pilot Water Bank (HB 3806) to improve agricultural water supply reliability for NUID (75%) and restore Middle Deschutes summer flows (25%).
- In the [medium/] term, where willing patrons have metered deliveries and are fully connected to piped and pressurized conveyance, implement the **split rate/split duty** tool authorized under the pilot Water Bank (HB 3806) to improve agricultural water supply reliability for NUID and restore Upper Deschutes flows in the winter (on a one to one basis).
- In long term, evaluate the effectiveness of the pilot Water Bank in meeting instream and NUID goals before seeking an extension.

Additional Outcomes:

- **Water Quality** – flow restoration in the Middle Deschutes can contribute to reduced stream temperature during the summer months.
- **Watershed and habitat restoration** – instream flow restoration helps to restore the hydrograph closer to natural flow conditions, which will reduce scouring of the river channel that has occurred during artificially high summer flows and subsequently help restore and improve instream habitat for aquatic species.
- Depositing water in the Pilot Water Bank allows water rights holders to beneficially use their water rights even in years when not irrigating, protecting them from potential forfeiture.

Enabling Actions:

- Finalize an agreed-upon pilot Water Bank charter before the Bank can be implemented.
- Finalize an agreed-upon annual operating plan by January 1 of each year before the pilot Water Bank can operate in that upcoming irrigation season.
- Meet minimum requirement of 1,800 acres of instream leasing through the AWLP before pilot Water Bank tools can be implemented in any given irrigation season.
- Ensure OWRD has sufficient resources to fulfill its obligations to support the pilot Water Bank (which may be impacted by future budget cuts).

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- Ensure pilot water bank is working in accordance with statutory directives that protect flows.
- Address operational challenges and water delivery obligations that affect districts' ability in the near-term to move water between COID and NUID systems under the pilot Water Bank.
- Engage and educate irrigation district boards to seek their support for the use of the pilot Water Bank.

Recommendations:

- Finalize an agreed-upon pilot Water Bank charter and annual operating plan to enable use of the Oregon Legislature's newly authorized pilot water bank in the near-term to improve agricultural water supply for NUID and restore summer flows in the Middle Deschutes.
- Work to eliminate priority rotations of private laterals and replace them with piped and pressurized on-demand water to better enable use of the Oregon Legislature's newly authorized **pilot water bank** in the long-term to improve agricultural water supply for NUID and restore winter flows in the Upper Deschutes.
- Engage and educate irrigation district boards to seek their support for the pilot water bank.

5.5.1.8 Incentive Pricing for Irrigation Water

Actions and Desired Outcomes:

- Continue to implement incentive pricing within NUID to encourage conservation of irrigation water to help improve water supply for patrons with less reliable water rights, and/or to help restore irrigation season flows in the Middle Deschutes.
- In other districts, explore potential opportunities to pilot or implement other forms of incentive pricing that make business sense for a given district's rate structure to help improve water supply for patrons with less reliable water rights, and/or to help restore irrigation season flows in the Middle Deschutes.

Enabling Actions:

- Increase measuring,metering and reporting of irrigation water.
- Customize the approach as each district has a different rate structure, thus incentive pricing structures that work in one district may not work in another.
- Overcome challenges associated with the timing of incentive pricing based on water use, as often crops are already planted by the time it becomes known to NUID that there will be extra water available to distribute to other users.

Recommendations:

- Support ongoing implementation and refinement of NUID incentive pricing structure.
- Encourage other districts to consider ways that irrigation water pricing structures could potentially be implemented in their district to incentivize conservation.

5.5.2 Tools for Implementation – Municipal

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[Access to Groundwater Rights and Access to Mitigation Credits to go here once language has been finalized and agreed upon for implementation – pending]

5.5.2.1 Municipal Water Conservation Tools

Actions and Desired Outcomes:

- Cities in the Deschutes Basin are already implementing a broad array of conservation measures identified in their municipal Water Management and Conservation Plans (WMCPs) to help meet long-term water needs by reducing demand for municipal or quasi-municipal water.
    - Cities of Bend, Redmond, and Prineville employ a Decision Support System Model that identifies the level of water savings from various conservation programs and the cost of those programs to evaluate packages of conservation measures to determine the most efficient approach to take. As a result, cities in the Deschutes Basin are already implementing a broad array of conservation measures, beyond the minimum of what is required of an WMCP.
- Examples of conservation measures implemented by municipal water providers include, but are not limited to, the following tools identified in Chapter 4:
    - Waterwise Landscaping (section 4.3.1.1)
    - Rebates and Incentives for Efficiency Plumbing and Irrigation Systems (4.3.1.2)
    - Codes and Standards Requiring Water-Efficient Landscapes (4.3.1.3)
    - Incentive Pricing for Municipal Water (4.3.1.4)
    - Landscape and Outdoor Water Restrictions (4.3.1.5)

Recommendations:

- The Collaborative supports the continued implementation of the water conservation measures to help reduce water demands.
- With additional resources, these types of conservation measures could be scaled to save even more water.
- The Collaborative supports continued research on the effectiveness of municipal water conservation measures to develop information for water suppliers across the region.

5.5.3 Tools for Implementation - Environmental

5.5.3.1 New Instream Water Rights

Actions and Desired Outcomes:

- In the near, medium, and long-term, state agencies apply for new instream water rights to protect streamflow for fish and wildlife, water quality, or scenic/recreational beneficial uses.

Additional Outcomes:

- **Water Quality** – ODEQ can apply for new instream water rights to protect water quality.

Enabling Actions:

- State agencies must determine application flow amounts for specific reaches.

Recommendations:

- Support for ODFW to apply for new instream water rights to better match with ecological needs of fish and wildlife species (i.e., peak/ecological flows, new instream demands, and/or to fill gaps in existing rights).
- Support for ODEQ to apply for new instream water rights to protect water quality.
- Support for Oregon Parks and Recreation Department to apply for new instream water rights to protect scenic waterway flows.

5.5.3.2 Resolving Protested Instream Water Right

Actions and Desired Outcomes:

- Resolve the protested instream water right for 250 cfs on the Middle Deschutes River (application number: IS 70695) to help protect 250 cfs of flows from injury that could be caused by potential future water transfers on that reach.

Enabling Action:

- OWRD needs to address its backlog of 216 contested case hearings for protested instream water rights to resolve.

Recommendations:

- The Collaborative supports OWRD prioritization of the contested case hearing for the 250 cfs instream water right on the Middle Deschutes.
- If needed, allocate additional staff time or funding to allow OWRD to process contested cases more quickly.

5.5.3.3 Channel, Riparian, and Wetland Restoration

Action and Desired Outcome:

- Continue to implement projects that restore physical habitat and reconnect wetlands to the floodplain of the Upper Deschutes River to restore aquatic habitat and ecosystem health that have been altered due to flow alterations.

Enabling Action:

- Secure funding to pay for restoration projects.

Recommendation:

- Support the continued implementation of channel, riparian, and wetland restoration projects by basin partners to improve aquatic habitat and ecosystem health for fish and wildlife species.
- Integrate channel, riparian, and wetland restoration with flow restoration efforts for the Upper Deschutes River so that restored flows can reach Oregon spotted frog habitats and maximize their intended benefits.

5.5.3.4 Upland Forest Management

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Actions and Desired Outcomes:

- Protect forest headwaters from development to maintain natural infiltration capacity provided by forests in the headwaters of the Deschutes Basin in the Cascade mountain range (i.e., non-juniper forests).
- Continue to implement forest management actions like thinning and prescribed burns to reduce the risk of, or impacts from, wildfires on water quality and infiltration capacity.

Recommendation:

- Support the continued implementation of upland forest management strategies by the US Forest Service to preserve the natural watershed function provided by forests in the headwaters of the Deschutes Basin.

5.5.3.5 Address Fish Passage Barriers/Screening

Actions and Desired Outcomes:

- Continue to address fish passage barriers and improve fish screens at diversion points to improve fish mobility through streams of the Upper Deschutes Basin. For example:
  - The Upper Deschutes Watershed Council has received funding to begin the design phase of a fish passage improvement project at the Mirror Pond Dam barrier.
  - NUID has received funding to update the fish screens at its North Canal Dam diversion.

Recommendation:

- The Collaborative supports addressing fish passage barriers and improving fish screens to meet XXX standards.

5.5.3.6 Water Quality Tools

Actions and Desired Outcomes:

- Continue to implement the following tools to protect and restore water quality for the parameters of concern (primarily temperature for fish and aquatic life, plus dissolved oxygen and pH) in the Deschutes Basin:
  - Nonpoint source pollution reduction (section 4.4.3.1)
  - Point source/permitted discharge management (4.4.3.2)
  - Source water protection (4.4.3.3)
  - Water temperature reduction (4.4.3.4)
- DEQ manages two point source permits in the Upper Deschutes Basin and has identified the tools being implemented to address nonpoint source pollution from agricultural, forest, urban, and recreational land uses in its Deschutes Basin Water Quality Status and Action Plan (2011).
- Municipal water providers have a variety of programs in place to protect drinking water source quality.
- Water temperature reduction is an additional outcome that is achieved by any of the flow restoration actions identified for implementation in this Plan, many of which are already being implemented.

DRAFT

- Add something on protecting spring discharge?

Enabling Actions:

- Development of a Total Maximum Daily Load (TMDL) for water quality parameters in the Deschutes Basin. DEQ estimates that the TMDL development process is not scheduled to take place until 2030.
- Improved understanding of groundwater-surface water interactions (see Section 5.6.1) to inform potential strategies to protect cold-water spring discharges to achieve water temperature reduction.

Recommendation:

- The Collaborative supports DEQ's continued management of pollution sources and the continued implementation of other actions that protect water quality in the Deschutes Basin.
- The Collaborative supports funding for studies to better understand water management activities on spring discharges (or something like this)

5.5.4 Tools for Implementation – Groundwater

[Artificial Aquifer Recharge to go here once language has been finalized and agreed upon for implementation – pending]

5.5.5 Tools for Implementation – Domestic Water Supply and Land Use

[Exempt Wells and Land Use tools to go here if agreed upon for implementation – pending discussion]

5.5.5.1 Septic System Pollution Management

Actions and Desired Outcomes:

- Actions are being implemented outside of the Collaborative to address nitrate contamination issues that have been observed in groundwater and connected surface water from septic tank systems in communities that are not tied to centralized wastewater systems.
- Examples of actions being implemented include:
    - In the La Pine area, a regional well monitoring system has been established and septic systems have been upgraded.
    - Basin partners are exploring other opportunities to ensure that new and existing developments in the La Pine area are on centralized wastewater systems rather than septic (see Section 4.5.2.2).
    - The communities of Terrebonne and Tumalo are both moving forward with feasibility studies for installing sanitary sewer systems to replace septic systems.

Recommendation:

- The Collaborative broadly supports actions taken by basin partners, county officials, and ~~state~~ agencies efforts to address nitrate contamination issues from septic tanks.

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5.5.5.2 Bend Parks and Recreation District Water Conservation

Action and Desired Outcome:

- Bend Parks and Recreation District (BPRD) has an MOU in place with the City of Bend to work collaboratively on water use reductions to help reduce BPRD's demand for municipal water provided by the City of Bend for irrigation of city parks. Note that BPRD also diverts water directly from the Deschutes River, which is not addressed by the MOU with the City of Bend.

Recommendation:

- The Collaborative supports implementation of conservation measures to reduce consumptive water use by BPRD.

5.6 Data Gaps/More Information Needed

Throughout the DBWC planning process, stakeholders have acknowledged that there are issues for which there is a desire for additional data. These data gaps limit the Collaborative's ability to make informed decisions on the implementation of tools or strategies that may help address those issues. This section will document the following data gaps identified by DBWC stakeholders and recommend potential future studies that could help address those data gaps to inform future decision-making on tool/strategy implementation:

- Groundwater resources
- Lake Billy Chinook pumping station project
- Measurement and reporting of exempt wells

5.6.1 Groundwater Resources

Most of the strategies described in Chapter 5 focus on surface water management; however, groundwater is a critical component of the water budget and critical for ecosystem health in the Upper Deschutes Basin. Groundwater is highly interconnected with surface water and has experienced declines in recent decades (see Sections 2.1.6 and 2.3 for information on groundwater characteristics and conditions; see Sections 3.1.2, 3.2.2, 3.2.4, 3.3.2, 3.3.4, and 3.4.1 for information on uses of groundwater). While there has been significant research on groundwater in the Deschutes Basin, the Collaborative has noted that there is a need for additional understanding of existing data, and for additional data needed to fill gaps that would further inform decision making. For example, within the context of this Plan, additional data would help provide the Collaborative with a better understanding of the interaction between surface water management strategies and their potential impact on groundwater. Rather than attempting to make decisions without a full understanding of existing and/or needed information, DBWC staff convened a Groundwater Subcommittee with the following two-fold purpose:

- To develop a shared understanding of the state of existing research on groundwater resources and spring discharge in the Deschutes Basin.
- To identify critical data/information gaps and to ultimately formulate research questions to help us better understand the impacts to the resource and inform future water management decisions.

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5.6.1.1 Existing Research

A characterization of the existing understanding of groundwater resources in the Upper Deschutes Basin can be found in Sections 2.1.6 and 2.3.1. Section 2.1.6 describes the hydrogeological characteristics of the Deschutes regional aquifer, including mapping of recharge and discharge zones, gaining and losing reaches, and hydrogeologic units. Section 2.3.1 describes what is currently known about the status of groundwater quantity. A 2017 study (Gannett et al.) estimated the average recharge and discharge rates of the regional aquifer, and a 2013 study (Gannett & Lite) found that there was a declining trend of decadal average recharge from 1980 to 2008. Other studies have evaluated long-term groundwater level records and observed rates of groundwater level decline and how they vary at well locations throughout the Basin. A 2013 study (Gannett & Lite) noted declines of 12 to 14 feet from 1997-2008 and estimated the relative influence of climate-driven reduction in recharge, groundwater pumping, and reduction in canal leakage from piping projects on those declines. During this time period, groundwater pumping increased by approximately 20,900 acre-feet per year, canal leakage was reduced by 58,000 acre-feet per year, and recharge from precipitation decreased by 33,500 acre-feet per year. The results showed spatial variability but showed that declines in the vicinity of Redmond were 60-70 percent due to climate, 20-25 percent due to pumping, and 5-10 percent due to canal piping. The study also evaluated the impact of fallowing previously irrigated acres and found that recharge was reduced by 250 to 1,000 AF/year from idling of 2,000 to 8,000 acres. The impact of other surface water management practices that reduce artificial recharge, such as switching from flood to drip irrigation, were not evaluated as part of this study. For more detailed information, see Sections 2.1.6 and 2.3.1.

5.6.1.2 Primary Data Gaps and Research Questions

Primary data gaps/needs are focused specifically on groundwater quantity – including the status of and/or impacts to the Deschutes regional aquifer as well as its contributions to interconnected surface water in the form of baseflow and discharge from springs and seeps. Within each of the categories of data gaps, the DBWC Groundwater Subcommittee developed and agreed upon a list of specific research questions that, if studied, would help address the identified data gaps.

NOTE: there are additional data gaps representing other areas of study (i.e., groundwater quality, connected surface water quality, and aquatic ecosystem health) that are also important to decision making in the Upper Deschutes Basin. These areas of study could be better informed by follow-on analyses once better information on groundwater resources is available. In some situations, there may be opportunities to coordinate between agencies to address both primary data gaps and some additional data gaps simultaneously. See section 5.6.1.4 for additional data gaps that are not focused on groundwater quantity.

The primary data gaps and research questions related to groundwater resources identified by the Subcommittee are:

Data gap #1: understanding the impacts of water management practices that affect existing artificial recharge – including canal piping, irrigation efficiency improvements, and a reduction in irrigated acreage due to land fallowing or urbanization – on groundwater levels and connected

DRAFT

baseflows and spring discharge. **Note: this data gap and associated research questions are currently being investigated by OWRD. Work is anticipated to be completed in early 2026.**

Research questions:

- What are "natural" or pre-development groundwater levels without artificial recharge?
- How much has artificial recharge from the above-stated water management practices decreased from 1994 to present?
- How much have these decreases in artificial recharge impacted the rate and magnitude of groundwater level declines around the basin?
- At what magnitude and where are declines expected to occur as piping projects continue?

Data gap #2: understanding the impacts of pumping for public water supply on groundwater levels and connected baseflows and spring discharge given current and future projected population growth.

Research questions:

- How much have irrigation and public supply pumping increased since last estimated through 2013? **Note: this research question is currently being investigated by OWRD. The current OWRD study should provide updated pumping estimates from 2013-2024.**
- How much are populations expected to increase both in and out of cities?
- What is the expected increase in groundwater pumping associated with those population increases? Give an estimate of the associated water needs for different types of development.
- How will that pumping impact groundwater levels and associated contributions to baseflow and discharge from springs and seeps?

Data gap #3: understanding the impacts of climate change on groundwater levels and connected baseflows and spring discharge.

Research questions:

- How have observed climate patterns shifted and how has that impacted groundwater levels and streams at different locations in the basin?
- Will the increase in high-intensity weather events increase runoff that bypasses the groundwater system, or will that precipitation still be able to infiltrate into the aquifer?
- Will anticipated changes to precipitation patterns vary spatially? E.g., will higher elevations or the northern parts of the basin capture more moisture?
- Will changes in precipitation timing impact recharge flux into the groundwater system?
- Have and will changes in plant coverage (shifting species coverage, fires, management, etc.) impact recharge to the groundwater system?
- Will changing snowpack and glacier levels have an impact on rates of infiltration into the aquifer?
- Use an updated groundwater model to ask questions about future impacts to groundwater levels from climate change.

DRAFT

- How have changes in forest and rangeland management (e.g., logging, juniper proliferation) affected evapotranspiration as a portion of the water budget.

Data gap #4: understanding of groundwater-surface water interactions, including increased monitoring of spring discharge quantity and quality and how it has changed over time at different settings throughout the basin.

Research questions:

- How has spring discharge changed over time at different settings in the basin?
- How has the quality (i.e., temperature) of spring discharge changed over time at different settings in the basin?
- What is the relationship between spring/seep location, elevation, volume, and temperature? Are there springs/seeps that provide greater "value" in terms of providing coldwater refugia for trout and salmon?
- Where could additional stream gages or monitoring wells be located to be most useful for helping to improve the understanding of groundwater-surface water interactions?
- Where are springs/seeps that no longer express or discharge to the surface located, and at what elevations are they found?

Data gap #5: improved understanding of the hydrogeology of the regional aquifer, particularly in the center of the Deschutes Basin, where the greatest groundwater level declines have been observed.

Research questions:

- Can the conceptual model of groundwater recharge and flowpaths in the center of the basin be refined? Would an improved understanding provide more context for the observed declines?
- How can a geochemical tracer study (specific conductance, water isotope levels, and age dating) refine our understanding of groundwater flowpaths in the basin?
- Does geologic structure in the center of the basin influence the areas with the highest magnitude declines?
- Where could a potential aquifer recharge pilot project be located and where would the benefits of such a project be realized (in terms of groundwater levels and spring discharge)?
- What are the impacts to the aquifer resulting from "wet water" increasing in the Upper Deschutes through conserved water projects? Will an increase in winter flows in the Upper Deschutes, and equivalent decrease in summer flows influence steam channel leakage and therefor aquifer recharge? How will future conserved water projects driven by HCP obligations affect recharge?

Data gap #6: more and better data are needed to understand the impact of exempt groundwater wells (see Section 3.4.1 for more information on exempt wells).

Research prompt: Assess the number of exempt wells, including distribution, depth, magnitude of use, impact of use, and vulnerability to groundwater declines around the basin.

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Data gap #7: the existing groundwater flow models could be updated, recalibrated, or refined to improve our understanding of the groundwater system and allow for more accurate management simulations.

Research tasks:

- Update existing model with current observations and data (precipitation, pumping, streamflow, groundwater levels, etc.) to assess model's performance.
- Recalibrate the model parameters to match the updated data.
- Refine the model framework using updated data and conceptual models to better capture the hydrologic system, with increased granularity.

5.6.1.3 Recommended Analyses

The list of data gaps and research questions developed by the DBWC Groundwater Subcommittee was presented to OWRD technical staff, who provided insight into the types of methodology and analyses that would need to be completed to answer the research questions above. These may include additional technical analyses, updates to and refinement of existing groundwater models, and/or increased data collection and monitoring. As noted above, OWRD is currently conducting a detailed analysis that will provide answers to the research questions listed in Data Gap #1, as well as one of the research questions in Data Gap #2. No additional support is needed in order to complete these analyses. Results are expected in 2026.

According to OWRD technical staff, the following priority analyses would help to address the data gaps identified above to improve our understanding of groundwater resources in the Deschutes Basin and inform future management decisions:

1) **Geochemical tracer study**

Data gaps that could be addressed: #5 would be addressed from the geochemical tracer study on its own. #1, 2, 3, 4, 7 would be addressed if the geochemical tracer study results were incorporated into a refined groundwater flow model.

Naturally occurring geochemical tracers are increasingly used in hydrologic investigations to better understand the components of a hydrologic system, e.g., residence times, magnitude and location of recharge, and source of water for springs. Previous investigations (Caldwell, 1998) have already collected baseline data in the Upper Deschutes Basin. In 2024-2025, OWRD and USGS have partnered to collect stable and radiometric isotopes from approximately 20 wells and springs in the area. This is intended to refine the research questions that can be answered with a much larger sampling and analysis effort. This effort would be primarily a USGS product, as analysis and interpretation of geochemical tracers is currently outside of OWRD capabilities. OWRD would partner and do much of the sampling with USGS and would also help analyze the results within the context of the overall groundwater flow system in the Deschutes. This study could provide a much more granular spatial understanding of how water moves through the Deschutes regional aquifer, where it is most resilient or vulnerable, and how it responds to stresses. The results from the geochemical characterization study would also help inform future

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analyses focused on the secondary data gap of groundwater quality, specifically in the Crooked River Basin.

2) Recalibrate and refine the existing groundwater-surface water model

Data gaps that could be addressed: #1, 2, 3, 4, 7

Groundwater flow models exist for the Deschutes Basin – existing models are capable of evaluating various water use and climate scenarios to simulate how they impact groundwater levels and surface water flows. With sufficient OWRD staff time and resources to update model inputs and evaluate various scenarios, the model could provide some insights to help answer several of the research questions above. However, the model could be refined and/or recalibrated to provide more accurate results, both temporally and spatially. The model is accurate based on the range of inputs and observations within the model calibration period of 1978-2008, and many of these inputs and observations have since changed such that they are outside those parameters. The results of the geochemistry study described above could provide a more accurate spatial understanding of how groundwater flows through the regional aquifer, which could be incorporated into the refined model to improve results. Refining and recalibrating the model would be a significant undertaking and OWRD would likely need assistance from outside entities such as USGS, consulting firms, and/or university research institutions. Once the model has been refined, OWRD could use it to simulate groundwater conditions under various scenarios of water management practices, pumping, and climate change and share the resulting model outputs. A refined/recalibrated model would be accompanied by a model performance report.

3) Increased data collection and monitoring of spring discharge

Data gaps that could be addressed: #4 would be addressed by this study on its own, and #1, 2, 3 would be addressed if data were integrated with the findings from a refined groundwater flow model.

Additional data gaps that could potentially be addressed simultaneously through interagency collaboration: groundwater quality, impacts on surface water quality (temperature), and habitat health data could also be collected at the same time as spring discharge measurements.

Spring discharge is measured using existing stream gages and regular manual measurements in specific locations. With sufficient OWRD staff time, these existing datasets could be used to assess changes in spring discharge over time and in different settings throughout the basin. This would require moderate staff time and resources to do this analysis and produce an accessible work product. Additional resources could be allocated to increase spring discharge measurement frequency and/or establish a more robust spring discharge measurement network to improve spatial and temporal resolution of such an effort. With current staffing levels, OWRD is capable of gradually increasing spring discharge measurements, though additional dedicated resources would be helpful in scaling up measurement efforts. This would improve the understanding of how spring discharge has changed in response to groundwater level declines and where those changes have occurred in the basin. These data can be integrated with the results from the refined

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groundwater flow models to better understand how various scenarios of water management actions, pumping, and climate change could impact spring discharge. Through interagency coordination with ODFW and/or ODEQ, spring discharge monitoring efforts could be paired with measurements of habitat health and water quality including temperature and contribution to decreasing stream temperature.

4) **Exempt wells study**

Data gaps that could be addressed: #5

As discussed in Section 3.4.1, there are roughly 24,000 exempt wells in the Upper Deschutes Groundwater Study Area. The Basin Study estimated the total annual consumptive use of exempt wells to be about 6 cfs (~5,000 AF), a small percentage of total groundwater pumping in the basin. This estimate relied on assumptions of use since exempt wells have no requirements for metering, monitoring, or reporting, and thus no data on actual exempt well use is available. There is work to be done to quantify pumping from exempt wells and to understand the characteristics of this use. An exempt well work product, such as a white paper, could be completed by OWRD at current staffing levels with input from other entities (i.e., counties, etc.). Understanding annual consumptive use from exempt wells would help to inform potential management decisions that could reduce their impact on the aquifer.

5.6.1.4 Additional Groundwater Data Gaps/Needs

The DBWC Groundwater Subcommittee prioritized data gaps related to groundwater quantity as the "primary" data gaps, though there were additional data gaps identified by the Subcommittee that were not related to groundwater quantity. These additional data gaps were:

- Groundwater quality (temperature and potential contamination from pollutants including nitrate)
- Impacts from declines in groundwater levels and spring discharges on surface water quality (temperature)
- Impacts from declines in groundwater levels and spring discharges on aquatic ecosystems and habitat health
- Southern Deschutes County nitrate contamination in groundwater caused by septic systems

Once analyses have been completed that provide information responsive to the groundwater quantity questions in Section 5.6.1.2, those data could be used to inform additional, follow-on analyses that could help address these additional data gaps/needs. There may also be opportunities to coordinate between agencies to design research efforts that could concurrently help address both the primary data gaps listed above and these additional data gaps. For example, spring and seep discharge monitoring efforts could additionally include measurements of habitat quality and water quality including temperature and contribution to decreasing stream temperature.

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5.6.2 Lake Billy Chinook Pumping Station

The Lake Billy Chinook Pumping Station project (described in Section 4.2.3.4) is a proposed infrastructure project to permanently relocate existing NUID pumps on the Crooked River to a pumping station on the Lake Billy Chinook reservoir pool. This would help improve NUID irrigation supply, as their diversion would draw from Lake Billy Chinook instead of the less-reliable lower Crooked River, which is prone to drying up during the irrigation season. Moving the pumps downstream could also improve lower Crooked River flow from the location of the existing pumps down to the Lake Billy Chinook. If the new pumping station makes NUID less reliant on its Deschutes River diversion at Bend, then this project would also restore Middle Deschutes flows from the previous point of diversion to Lake Billy Chinook. This project could hypothetically include the transfer of NUID's Wickiup storage to Lake Billy Chinook in the winter, which could restore Upper Deschutes winter flows and middle Deschutes summer flows.

In 2025, the Bureau of Reclamation completed an appraisal study to evaluate potential costs for various project design alternatives for the Lake Billy Chinook pumping station. Project design alternatives include two potential site locations and two options for pumping capacity (200 cfs or 400 cfs) at the new pumping station. Cost estimates for the project range from $440-480 million for 200 cfs pumps to $600-640 million for 400 cfs pumps. The appraisal study is only an initial investigation into potential project cost – a feasibility analysis is the next step in the process and will take an estimated three-to-four years to be completed.

Until the feasibility analysis is completed, the Collaborative does not have enough information about the project to make decisions on whether to recommend that the Lake Billy Chinook pumping station project be implemented. The information needed for decision making includes the final project design details, a cost-benefit analysis, legal analysis and the water right implications of such a project. To avoid enlargement, the new pumping station would not be allowed to pump more than NUID's Crooked River water right can legally access at the original point of diversion The feasibility analysis will likely provide the required information for the Collaborative to recommend or oppose the construction of the pumping station. The feasibility analysis has not been completed as of the finalization of this Plan.

5.6.3 Measurement and Reporting of Exempt Wells

As discussed in Section 3.4.1, domestic water use from exempt wells is estimated to contribute about 5,000 AF (~6 cfs) of groundwater pumping in the Deschutes Basin. However, this estimate is based on assumptions there is no statutory requirement for measurement or reporting of exempt well use.

[THIS TOOL NEEDS MORE DISCUSSION WITH PT]

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