# Appendix A

Comments and Responses

All acronyms used in the responses in Table A-2, unless defined herein, are defined in and can be found in Section 12 of the Plan-EA.

**Table A-1. Topics and Associated Codes.**

| Topic | Topic Code | Topic | Topic Code |
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| Alternative Analysis | ALT | Project Cost | COST |
| Construction Practices | CONS | Purpose and Need | PURP |
| Cultural Resources | CUL | Project Scope | SCOP |
| Energy Production | ENRG | System Design | SYS |
| General | GEN | Water | WAT |
| Maps | MAP | Wildlife | WILD |
| Project Cost | COST | | |

**Table A-2. Responses to Comments Received During the Central Oregon Irrigation District Watershed Plan-EA Public Comment Period.**

| Comment ID | Topic Code | Comment | Response |
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| 1.00 | GEN | J. Souhrada and G. Biglor support the proposed action. | Thank you for your comment. |
| 2.00 | GEN | We live on a 110 year farm on smith rock way and still irrigate about 38 acres of land for grass, hay, and pasture from COID off lateral J-3. Piping this canal is long overdue. Water is now far more precious than oil. It is about time that we start conserving it. | Thank you for your comment. |
| 3.00 | WILD | Reducing the amount of water withdrawn from the Deschutes River for irrigation is a laudable goal. It's surely good for fish, birds, and other wildlife in the Deschutes riparian zone.<br>BUT:<br>What about the wildlife that relies on open irrigation canals for water? Irrigation canals have existed in central Oregon for over 100 years. During that time many animals and birds have come to rely on that network of canals and ditches as if it were a natural network of streams. Piping those canals will instantly deprive this wildlife of water and result in a loss of what is now a natural community of plants and | Please see Section 6.7.2, 6.11.2, and 6.12.2 in the Plan-EA for a discussion about the potential effects of the proposed action to vegetation, wetlands, and wildlife, respectively.<br><br>Generally, for environmental compliance purposes, wildlife impacts are analyzed at the population level rather than at an individual effect level. In those instances where individuals within a population may be determined to be essential to the continuance of a species, such as an endangered species, those species undergo an effect analysis that queries the effects of a project action at both the individual and population |

| Comment ID | Topic Code | Comment | Response |
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| | | animals along a manmade riparian zone. To my knowledge this has not been taken into account in assessing the environmental impact of piping.<br>This outcome can easily be mitigated as part of the effort to reduce water loss from the Deschutes without a major negative impact on the piping project. It's not rocket science: All that is required is to provide small diversions from the piped canals at strategic locations along the canal route. These could take the form of small outlets allowed to flow into pools or ponds lined to prevent loss of water into the soil. In some places stock tanks might be more appropriate.<br>The amount of water required to remediate the impact on wildlife from piping the canals would be small and have a minimal impact on the overall savings of water. I believe that COID has an obligation to consider not only the impact on wildlife along the Deschutes but also throughout its network of canals. I urge you to include consideration for wildlife along the canals in your environmental impact analysis. | level. For this project, when species composition within in the project area and their populations were examined, it was determined that examining effects at the population level was appropriate with the exception of those species listed under the ESA, such as Oregon spotted frog. For Oregon spotted frog and bull trout, U.S. Fish and Wildlife Services were consulted and a biological assessment was generated (see Section 6.10.2.3 of the Plan-EA).<br><br>Adding project measures that would allow wildlife to continue to use water conveyed for irrigation as a source of drinking water is not included in the project scope because the measures would not meet the project's purpose and need (Section 2 of the Plan-EA). Further, analysis of the wildlife populations currently using open canals in the project area did not indicate that these populations would be negatively affected by the proposed project, and, therefore, no mitigation measures, such as those the commenter suggested, are warranted (Section 6.12.2 of the Plan-EA). If the analysis had indicated that wildlife populations would be impacted, and that installing additional project measures to provide wildlife drinking sources would mitigate that impact, then the District would work to include those project measures. Additionally, water rights in Oregon are typically issued for designated uses and may not be used for other types of use. Water diverted under COID's water right certificate #83571 may only be used for irrigation, pond maintenance, industrial, dust abatement, municipal, quasi-municipal, mining, domestic, and livestock uses.<br><br>Given that the proposed measures do not meet the project's purpose and need, that there are no anticipated population-level effects to wildlife that use the canals as a water source from the proposed project, and that wildlife use is not a designated use of COID's water right, the inclusion of additional project measures, as the commenter suggested, are not included as a part of the project.<br><br>Patrons who would like to utilize their water rights to fill ponds would be able to do so if it is an allowed use under their water right. |

| Comment ID | Topic Code | Comment | Response |
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| 4.00 | GEN | This is a waste of time. You have no intention of doing anything but what is already decided. Don't insult me with phony meetings that you just use to check a box | Thank you for your comment |
| 5.00 | GEN | Yes save the water, pipe the canal please | Thank you for your comment |
| 6.00 | GEN | KEEP THE CANALS !!!!! | Thank you for your comment. |
| 7.01 | CONS | I attended the meeting in Terrebonne on Feb 3, but have a few follow-up questions regarding the COID modernization project: 1) Assuming funding goes through, when would be the soonest the project would start?<br>2) Once funded/started, how long with the project take - i.e., how many months or years will it take to put all 8 miles of canal underground? | Please see Section 8.7.2 in the Plan-EA for the proposed sequence of installation and timeline for the proposed project. |
| 7.02 | CONS | 3) Will COID expand beyond the 8 miles and put more of their canals underground? | This Plan-EA evaluates approximately 7.9 miles of project construction and OM&R. While the District has an interest in completing additional future projects, the District has only completed coarse-scale designs for these potential projects for high-level planning purposes. Further design, permitting, and construction of any future projects would be contingent on the availability of funding. Future funding is not reasonably certain to be available, so these projects are not reasonably certain to occur. This Plan-EA evaluates actions that would be completed with PL 83-566 funds; potential future projects are speculative and beyond the scope of this Plan-EA. |
| 7.03 | LAND | 4) What will become of the land that will cover the canals? Who will own the land? Who will manage and maintain the land? In other words, what will it looks like and could there be any future development on the land? | Please see Section 6.8.2 in the Plan-EA for a discussion about the potential effects of the project on visual resources, Section 8.4 for a discussion of land ownership and easements, and Section 8.8 for a discussion of operations and maintenance. |
| 8.00 | GEN | I am in favor of piping as many miles of canal as possible. We need to keep more water in the river year-round as possible for the health of the watershed and to preserve fish populations. Just by eliminating the water loss due to seepage and evaporation will greatly improve the conditions of the river- as long as the water saved can be put back in the river. | Please see Sections 6.9.1.1 and 6.9.1.2 in the Plan-EA and the response to Comment ID 16.01 for a discussion about water rights and the allocation of saved water to instream use. |
| 9.00 | WAT | I hope that you folks consider running a drinking water pipe in the same right of way. This piping project will cause wells to go dry. Now | Providing drinking water is outside the purpose and need of the project, as discussed in Section 2 in the Plan-EA. |

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| | | is the time to put in a water main to prevent needing to go through the process twice. | Additionally, installing collocated lines for drinking water would occur under the authority of a municipal water agency or similar entity. No municipal water agencies identified an interest in collocating water lines with District infrastructure during the Plan-EA process.<br>Please see Section 6.9.2.4 in the Plan-EA for a discussion about the potential effects of the project on groundwater resources. |
| 10.01 | PURP | Thank you for the opportunity to comment on the Draft Environmental Assessment ("EA") for the Central Oregon Irrigation District Irrigation Modernization Project ("Project"). Central Oregon LandWatch ("LandWatch") is a conservation organization which has advocated for preservation of natural resources in Central Oregon for over 30 years. With over 200 members in Central Oregon, LandWatch has worked on water resource issues in the Deschutes River Basin and in gaining special protection for Whychus Creek and the Metolius River and spring systems. LandWatch has lately been particularly concerned about flows in the Upper Deschutes River, the impacts of the management of the irrigation diversions from the River, and maintenance of flows in the River's key tributaries. We continue to be interested in supporting an efficient irrigation-based farming community throughout Central Oregon.<br>1. General comments.<br>Unlike the Watershed Plan-EAs produced by the other Central Oregon irrigation districts, which address those districts' entire systems of irrigation infrastructure, COID has limited the scope of its Plan-EA to a single 7.9-mile canal segment. This demonstrates, once again, COID's lack of commitment to a long-term water management solution in the Deschutes Basin. Rather than linking this PL-566 federal funding mechanism (authorized in 1954 and which has no sunset) to a long-term series of projects that would fulfill Central Oregon irrigation districts' mutual obligations to mitigate their impacts to listed species under the Deschutes Basin Habitat Conservation Plan (HCP), COID has carved out only a single project. This one project falls far short of achieving the major purpose of the Project, which is to improve water conservation throughout the District, and the major need widely recognized in the Deschutes Basin, which is to improve instream flows for fish and aquatic species. | Please see response to Comment ID 7.02 for a discussion about the scope of the project completed with PL 83-566 funds and future projects.<br>Language in Section 2 of the Plan-EA has been updated to more accurately reflect the scope of the project. |

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| 10.02 | PURP | The unstated purpose and need that appear to motivate this narrowly tailored Plan-EA are keep the conserved water in COID's diversion system (the Pilot Butte Canal) so that COID can maximize hydropower potential and spill the conserved water to NUID near the end of canal.[1]<br><br>[1] The same water saved by piping the PBC, as proposed in this Plan-EA, could instead remain in the main stem of the Deschutes River and be diverted by NUID at the North Unit Canal. The North Unit Canal is already lined to prevent leakage losses. Simply allowing NUID to divert via its own infrastructure would also prevent the need to build a new spillway at the end of the COID PBC. The only possible explanation for this Project's proposal of keeping all conserved water in a new, large pipe in the PBC is to maximize hydropower potential. | The lining in the North Unit Main Canal is failing in some areas and shows signs of advancing failure over time (Britton, personal communication March 16, 2020; Horrell, personal communication March 4, 2020). This section of the North Unit Main Canal already loses water due to current lining failure (NUID 2017), and future lining failure would increase this water loss. NUID works to repair cracks in the lining regularly (Britton, personal communication March 16, 2020). Conveying the water saved by COID's project from the Deschutes River through the PBC and into the North Unit Main Canal below the lined section rather than from the Deschutes River directly into the North Unit Main Canal would reduce water losses in this section of the canal.<br><br>Reduced water losses in the North Unit Main Canal would improve water supplies, agricultural production, and associated economic benefits in NUID. These economic benefits appear in the NED analysis in Appendix D.1. If the water saved by the project were diverted directly from the Deschutes River into the North Unit Main Canal, as suggested in Comment ID 10.02, seepage in the North Unit Main Canal would not be reduced and these economic benefits would not occur. The Preferred Alternative included in the Plan-EA would have greater economic benefits and, therefore, is the NED alternative.<br><br>The proposed action also relocates and improves the delivery point from the PBC to the North Unit Main Canal. The new delivery point would be equipped with Supervisory Control and Data Acquisition System (SCADA) technology, which would allow COID to accurately monitor and measure the water conveyed from COID's PBC into NUID's Main Canal. The new delivery point would meet the purpose and need of the project by improving water delivery and operation inefficiencies (see Section 2 in the Plan-EA).<br><br>References:<br><br>Britton, Mike. 2020. Personal communication (in person meeting) with Kristin Alligood (FCA). March 16.<br><br>Horrell, Craig. 2020. Personal communication (phone meeting) with Kristin Alligood (FCA), Raija Bushnell (FCA), David McKay (FCA). March 4. |

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| | | | North Unit Irrigation District (NUID). 2017. North Unit Irrigation District System Improvement Plan. Madras, OR: Author. |
| 10.03 | PURP | 2. Purpose and need of Project<br>The EA states the purpose of this project is to improve water conservation in District-owned infrastructure, improve water delivery reliability to District patrons, and improve public safety on up to approximately 7.9 miles of District-owned PBC and laterals. Draft EA at 34. Public Law 83-566 authorizes federal assistance for only Projects that fit at least one of eight listed purposes: Flood Prevention, Watershed Protection, Public Recreation, Public Fish and Wildlife, Agricultural Water Management, Municipal and Industrial Water Supply, Water Quality Management, and Watershed Structure Rehabilitation. National Watershed Program Manual Title 390, Part 500, Section 500.3(B). In which of these eight purposes does the Project fit?<br>We encourage the District to include Public Fish and Wildlife as a purpose of the Project. Improved streamflows for the benefit of fish and wildlife are widely understood to be the primary motivating factor for water conservation Projects in Central Oregon. Our state's congressional delegation agrees.[2] Senator Merkley used his position on the Senate Appropriations Committee to find a funding mechanism that would help irrigation districts in Central Oregon upgrade their infrastructure and improve their water management practices in order to handle the new needs for water in the basin for listed species under the ESA.<br>[2] https://www.merkley.senate.gov/news/press-releases/merkley-wyden-announce-investments-in- rural-oregon-as-key-bill-passes-full-senate | The Preferred Alternative meets the Agricultural Water Management purpose. See the OMB Fact Sheet, Section 2, and Section 8.1 in the Plan-EA.<br>The PL 83-566 authorized project purpose of "Public Fish and Wildlife" is defined in the NWPM Title 390-500 (NRCS 2014). Title 390-500 states that, "Fish and wildlife development areas may be included in a watershed project plan when the SLO agrees to operate and maintain a reservoir or other area for public fish and wildlife access. Measures installed for public use of areas developed to improve the habitat or the environment for the breeding, growth, and development of fish and wildlife may be included in a watershed project plan" (NRCS 2014). The proposed action does not include the measures described; therefore, "Public Fish and Wildlife" would not be an appropriate authorized project purpose.<br>Reference:<br>U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS). 2014. National Watershed Program Manual. Title 390-500. Website: https://directives.sc.egov.usda.gov/ViewerFS.aspx?hid=36702. Accessed March 24, 2020. |
| 10.04 | PURP | The purposes and needs should be listed in rank order of priority and weighted in the subsequent analysis of alternatives. "Eliminating water loss" and increasing instream flow should be the primary purpose and need of this EA. As for the purpose of "improv[ing] water delivery reliability to district patrons", the project is not big enough or located in the right place to make an appreciable improvement in water deliveries. | Section 2, Purpose and Need for Action, of the Plan-EA identifies the underlying problems, opportunities, and goals of NRCS and the Sponsoring Local Organization (NRCS 2014). The purpose and need statement defines what can be considered reasonable, prudent, and practicable as an alternative and is, therefore, used to determine a reasonable set of alternatives to be evaluated in the planning process. By identifying a set of alternatives that address the purpose and need of the |

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| | | | project, a focused analysis of the alternatives that address the problem to be solved is achieved. The CEQ (40 CFR 1500), NRCS NEPA implementing regulations (7 CFR 650), PL 83-566 Watershed Program requirements, USDA's 1983 P&G, and other EOs and policies do not require that a project's purpose and need be ranked in order of priority or that elements within a project's purpose and need be weighed. Rather, it is the project's purpose and need that drives the process for alternative consideration, analysis, and ultimate selection.<br>Although NEPA regulation requires the consideration of all alternatives, or a reasonable representation of the full spectrum of reasonable alternatives, PL 83-566 and P&G have more action-limiting requirements for alternatives. One such example includes the requirement that project sponsors have the legal authority and resources to install, operate, and maintain works of improvement (NRCS 2014).<br>During the watershed planning process, information is used to evaluate environmental issues for the identified planning alternatives, which must include a No Action Alternative. The watershed planning process evaluates the sponsor's authorities, estimates the benefits and costs associated with projects and environmental impacts, among other factors, to determine the feasibility of an alternative as part of a project's "purpose and need." The decision-making process further considers those alternatives that meet the purpose and need for a project at an acceptable cost and level of environmental impact relative to the benefits that would be realized.<br>In cases where more than one alternative fully meets the purpose and need, factors including cost, environmental impacts, safety, and public support will be considered in making the final decision to identify the Preferred Alternative from all alternatives evaluated. Requirements of the P&G—which include completeness, effectiveness, efficiency, and acceptability (P&G 1983 Section 1.6.2c); PL 83-566 federal objectives; and other EOs—play a role in this process.<br>Cases may also occur in which no alternative meets all aspects of the purpose and need. This could occur when, for example, the cost or level of the environmental impact of an alternative that completely addresses the problem is not acceptable. In these cases, an alternative that only partially meets the purpose and need must be considered. If costs are |

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| | | | justified in relation to benefits, an alternative that only partially meets the purpose and need may be acceptable.<br>In such cases, the planning process must determine if the alternatives are acceptable and worthwhile to pursue in light of cost, environmental impacts, and less than optimal solution. To properly assess this, it is important to determine those elements of the purpose and need that are critical to the project as opposed to those that are desirable or simply support it. If these critical elements are not met, at least in some minimal level, the process would lead to the selection of the No Action Alternative as the decision. These critical elements can include policy as well as technical considerations.<br>The project would improve delivery reliability to District patrons within the project area. Section 2 and Section 5.3.2 of the Plan-EA have been updated.<br>References:<br>U.S. Department of Agriculture, Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G). 1983. Website: https://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=stelprdb1256524&ext=pdf. Accessed May 4, 2020.<br>U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS). 2014. National Watershed Program Handbook Title 390-601-H. 2nd. Ed. Website: https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=35146.wba. Accessed March 24, 2020.<br>U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS). 2014. National Watershed Program Manual. Title 390-500. Website: https://directives.sc.egov.usda.gov/ViewerFS.aspx?hid=36702. Accessed March 24, 2020. |
| 10.05 | PURP | As for the purpose of "improv[ing] water delivery reliability to district patrons", the project is not big enough or located in the right place to make an appreciable improvement in water deliveries. | Language in Section 2 and Section 5.3.2 of the Plan-EA has been updated to more accurately reflect the scope of the project. |

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| 10.06 | SCOP | 3. Project Scope.<br>a. Selection of Project area.<br>Out of the hundreds of miles of District-owned water diversion and delivery infrastructure, the EA proposes one small 7.9 mile section of canals to spend a proposed $42 million. Aside from the proposed alternative (canal piping) being a relatively inefficient method of conserving water (discussed further below), the EA lacks any sort of analysis that explains why improving these 7.9 miles of canal best serve the Project purpose and need. Were other sections of district-owned canal examined? What makes the proposed section of canals the best option for accomplishing the Project purpose and need? How much water could be conserved, and how many patrons could have their deliveries improved, on other sections of District-owned canals? | The District requested NRCS PL 83-566 planning assistance on the Smith Rock/King Way project as the first modernization project that would use PL 83-566 funds for several reasons.<br>• The project area contains a high concentration of private delivery rotations.<br>• Piping the main canal and several laterals would open options for COID patrons within the project area to improve private delivery systems by connecting into the pipe via District installed turnouts, installing measurement devices on private deliveries, removing the need for rotation schedules, and improving on-farm efficiencies. COID patrons on the G-4 lateral would receive pressurized water when the project is complete.<br>• The project would improve the interconnection between COID's conveyance system and NUID's Main Canal, improving the districts' ability to manage water.<br>• The District recognizes the need for on-farm improvements. The incorporation of on-farm improvements or piping private laterals into the current proposal would likely increase conservation benefits; however, given the scope of the project (see Section 2, Purpose and Need Statement, of the Plan-EA), in addition to PL 83-566 program requirements and district authorities, the inclusion of on-farm improvements or piping private laterals becomes technically/logistically infeasible due to private ownership (see response to Comment IDs 10.09 and 10.04). Private ownership creates coordination, authority, and other logistical challenges for the District when considering on-farm improvements and piping private laterals. District partners, including the Deschutes River Conservancy, Deschutes Soil and Water Conservation District, and NRCS are working together to prepare for opportunities to work with COID patrons on Regional Conservation Partnership Program and Environmental Quality Incentives Program projects, and exploring other funding options. |
| 10.07 | COST | b. Cost/benefit assessment. | Please see the NED Analysis in Appendix D.1 for a discussion of the project costs and benefits. |

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| | | The Project lacks any sort of cost/benefit assessment. To pipe a mere 7.9 miles of the more than 400 miles of canals in COID, the Project proposes to spend $42 million in a project area of only 1300 acres to directly serve only 74 of the District's 3800 potential beneficiaries. This computes to $568,000 per beneficiary. Also, the project proposes to conserve 9,392 acre-feet of water each year at the unrealistically high price of $4,472 per acre foot of water conserved. This is more than four times the price of conserved water generated by other similar piping projects in COID in recent years. This exorbitant cost is even worse when one understands that a high percentage of landowners on the Pilot Butte Canal are not farmers. EA page 35 states that "40% of all tax lots on the PBC are five-acre parcels or smaller." Another measure of the outrageous cost of this effort comes at EA page 46, which indicates the Project benefits only 74 patrons and 718 irrigated acres. This calculates to a cost of $58,500 per acre served. | |
| 10.08 | ALT | c. Water delivery and turnouts.<br>The EA at pages 80-81 describes the Project's proposed turnouts and pressurization:<br>"Under the Piping Alternative, federal funding through PL 83-566 would be available, and the District would pipe approximately 7.9 miles of their system including the tail end of the PBC, the G- 4 Lateral, and a segment of the J Lateral (Figure 5-2). A new segment of pipe would be installed with a new point of delivery to pass water to the NUID Main Canal. A new turnout would also be added to allow for a change in location of LPID's delivery. On the G-4 Lateral, a booster pump would be installed to provide pressurization to patrons on the lateral."<br>***<br>"Under this alternative, 42 district turnouts would be upgraded in order to handle pressurized delivery at a future date. These turnouts would include an accurate meter measurement device. Additionally, a small bridge would be constructed to carry both the L Lateral pipe and LPID delivery pipe across the North Unit Main Canal."<br>***<br>"The Piping Alternative contributes to the sponsors' objectives as follows: | Section 5.3.2 of the Plan-EA has been updated to more accurately reflect the scope of the project and the number of patron deliveries affected by the project.<br>Section 1 of the Plan-EA has been revised to reference the District's SIPs.<br>Section 1.1 describes the project scope of this Plan-EA. While the District has an interest in completing additional future projects, these potential future projects would be outside the scope of this Plan-EA.<br>Language has been clarified in Section 5.3.2 regarding turnout installation.<br>Please see response to Comment ID 10.06 for a discussion about on-farm improvements and project selection. |

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| | | […]<br>Improve water delivery reliability to patrons and farms: A piped, and pressurized or partially pressurized system greatly increases conveyance efficiency, allowing patrons to adjust their deliveries to take the amount of water that they need when they need it and eliminating operational spills. This alternative would immediately improve water delivery reliability for the patrons served by the G-4 Lateral by providing these patrons with pressurized deliveries."<br><br>The Project claims to improve water deliveries but actually does very little to improve deliveries to patrons. Only patrons on the G-4 lateral will get pressurized water, something that will be achieved not by the new pipe installation but by a booster pump. In this EA, COID does not discuss the implementation of its System Improvement Plan (SIP). There is no reference to the SIP and no written commitment to accomplish it within any specific timeframe. The lack of a larger plan and commitment to better serve its patrons and the Deschutes River is a significant weakness of the EA. How will the proposed 42 district turnouts, to be pressurized at an uncertain later date, achieve any Project purposes? They certainly will not conserve water for fish and wildlife, and they certainly will not improve water delivery reliability without specific commitments to pressurize these turnouts and ensure a conversion to more efficient on-farm irrigation practices. The way the EA is currently written, the 42 turnouts are "turnouts to nowhere," or infrastructure with an uncertain future and utility.<br>On the other hand, were the proposed $42 million invested in piping of private laterals, and fixing the private rotations of small acreages, water deliveries could be improved to many hundreds more patrons while also conserving considerably more water. | |
| 10.09 | ALT | 4. Alternatives.<br>The EA only considers two alternatives: the no action alternative and the preferred alternative. National Watershed Program Manual Title 390, Part 500, Section 501.12(A)(1) requires that "[a]ll reasonable alternatives that address the purpose and need for action must be presented in the watershed Project plan, including those not within the program authorities of the NRCS and those not preferred by | See response to Comment ID 10.04. Per the USDA's 1983 P&G, "Alternative[s]...should be formulated in consideration of four criteria: Completeness; effectiveness; efficiency; and acceptability." Additionally, "Any alternative that does not meet the stated purpose and need for action does not need to be considered in detail. Alternatives that meet the need for action but do not achieve the purposes may be eliminated from detailed study. '[F]or alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been |

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| | | sponsors." The EA only considers the alternative preferred by the sponsor.<br>This limited consideration of alternatives results in a myopic analysis that assumes that piping of one short section (7.9 miles) of District canals is the only reasonable method for achieving the Project's purpose and need. Several other alternatives would achieve that Project's goal, and would do so more efficiently, conserving more water for less cost to the public. A basic requirement of NEPA is that a project such as this considers a reasonable range of alternatives.<br>The results from the recently completed Deschutes Basin Study Work Group study show that the most cost-effective way for irrigation districts to conserve water is through on-farm efficiencies, piping of private laterals, voluntary duty reductions, and market-based water leasing and transfers. See Exhibits A-D (Selected Basin Study Work Group technical reports).<br>The reasons given by the EA for excluding from consideration these types of alternatives are inadequate. The EA must give a rationale for eliminating alternatives from detailed study ("For alternatives that were eliminated from detailed study, the rationale for this elimination will be provided.") National Watershed Program Manual Title 390, Part 500, Section 501.12(A)(2).<br>The alternative to pipe private laterals, at EA page 77, is eliminated because it "fails to improve water delivery reliability." To the contrary, piping private laterals in the thousands of acres of COID private rotations would greatly improve deliveries to patrons. If the purpose and needs of the Project had been ranked and weighted properly, conserving water lost in the system and improving flows for ESA-listed species should have dominated the priorities. When factoring in cost, piping private laterals would generate far more water at a much lower cost.<br>ORS 545.287 specifically allows an irrigation district to upgrade private laterals:<br>"When improvements for the distribution or delivery of water to any tract of land are not owned by the district and the owner or person in control of the improvement fails to maintain, repair or replace the | eliminated' (40 CFR Section 1502.14(a)). Alternatives that may appear reasonable but clearly become unreasonable because of cost, logistics, existing technology, or environmental reasons must be included in this section and the reasons for elimination discussed" (NRCS 2014). Alternatives included under Section 5.2 of the Plan-EA were not carried forward for further analysis because they became unreasonable when evaluated against the four criteria laid out in this guidance. These alternatives were also evaluated on whether they met the sponsors' objectives. The Piping Alternative carried forward was the only alternative that both met the sponsors' objectives and was not unreasonable after being evaluated against the four criteria.<br>The District and NRCS acknowledge that water conservation through piping district infrastructure is one of various water management tools and options identified in the Upper Deschutes Basin Study (Study), Provisional Draft Final Report (BSWG 2019). The Study specifically includes a disclaimer that it, "does not propose or address the feasibility of any specific project, program, or plan" (BSWG 2019).<br>As a technical assessment, the Study identified these various water management options and the benefits and challenges associated with them. Specifically, the Study identified that "challenges for implementation of water conservation and market-based options involve high costs for some approaches, legal and policy barriers, operational challenges, and practical limitations related to coordination among numerous parties." In examining alternatives, NRCS examined the benefits and challenges associated with the tools and options highlighted in the Study as part of its reasonableness assessment. See Section 5.2 of the Plan-EA and Appendix D.2 regarding alternatives considered but dismissed from analysis. In examining alternatives, the Plan-EA makes a determination regarding an alternative's reasonableness in meeting the purpose and need of a project.<br>Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant (CEQ 1986). Reasonableness is bound by the scope of the project, as identified in the purpose and need statement, to include those additional action-limiting requirements (see response to Comment ID 10.04). While the Study presents many ideas for water conservation in the Basin, private |

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| | | improvement as required for the proper and efficient distribution or delivery of water to any tract.<br>..<br>When the interest or convenience of such tracts requires the construction, repair or maintenance of any ditch, flume, dike, aqueduct or other improvement, the board may construct, repair or maintain the improvement."<br>A Project that proposes benefiting private patrons by improving water deliveries should not exclude alternatives that would conserve water through upgrades to private patrons' infrastructure.<br>Further, COID itself has recognized its authority to construct improvements to its patrons' private infrastructure, and has developed an administrative process for doing so. See Exhibit E, COID Resolution 2014-7. Any claim that the District lacks the legal authority to improve private laterals, or that the "logistical complexities" are too great, is facially inconsistent with COID's own internal policy.<br>At EA page 76, an alternative that would line district canals is also eliminated. COID eliminates lining canals as an alternative by unfairly grossing up the cost of canal lining. The major beneficiary of the conserved water proposed by their piping project is NUID. COID had an opportunity to assess the experience of NUID's main canal lining effort, a series of projects completed by NUID over the past twenty years in a canal that parallels COID's PBC (similar size, soils, elevation drop, etc.). COID failed to assess the costs and benefits of its partner's actual project, and instead made sweeping assumptions without the benefit of real data. By tripling the implementation cost assumption and adding chain linked fences and increased operations and maintenance, the EA sets out to "prove" that lining is actually more expensive than piping. But in reality, NUID chose the less expensive alternative in lining its canal, and although not perfect, the project serves NUID well twenty years after its construction. | ownership creates coordination, authority, and other logistical challenges for the District when considering piping private laterals and on-farm improvements in this Plan-EA. Additional challenges with other options and tools that would require changes to policy and/or the development of mechanisms and institutional infrastructure make other alternatives not ripe for consideration. Challenges such as these make certain tools and options presented in the Study unreasonable as alternatives for consideration in this Plan-EA.<br>Importantly, in examinations of agricultural irrigation systems around the world, multiple researchers (Bell et al. 2016; Lopez-Gunn et al. 2012; Merriam and Freeman 2007; Ward 2010) have identified that increasing the reliability of irrigation deliveries to the farmer is the first improvement that should be made as it leads to further improvements such as better controls and increased operational flexibilities, and opens the door for water markets. This benefit is acknowledged in the Study on page 29, which states that, "Piping canals and laterals increases opportunities for other tools such as water marketing" (BSWG 2019).<br>Other challenges include authorities conveyed to Oregon irrigation districts by ORSs. Pursuant to the authority conveyed to Oregon irrigation districts by ORSs Chapters 540.420, 540.430, 540.440, 545.221, 545.237, 545.279, 545.287, and 545.293, and the case law interpreting these provisions, the District is empowered to enter onto patrons' properties to improve, maintain, or replace certain irrigation systems and infrastructure beyond the District's point of delivery when, in the District's estimation, such involvement is necessary to avoid water waste, inefficiency, detrimental practices, conflicts, and/or non-use that threatens the efficient, consistent, and reliable delivery of irrigation water to the District's patrons. COID Resolution 2014-7, Protection of District Water Rights Beyond the District's Points of Delivery policy, is intended to address delivery barrier issues that could jeopardize the beneficial use of water. If the District makes the determination that a private ditch needs to be improved in order to protect the District's water right and improve the efficient delivery of water to patrons, the District could provide ditch cleaning and improvements to patrons for a fee or the landowner could do the necessary work to District requirements. For significant improvements that require engineering and construction, there would need to be a Board resolution for the private system. The interpretation of this |

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| | | | statute presented in the comment would present political, legal, and logistical private property challenges. If PL 83-566 funds were proposed to upgrade private laterals, the District would be required to obtain landowner permission to complete all the necessary NEPA steps and requirements, including a cultural resource analysis, as well as permission to then operate and maintain the system, including acquiring easements to do so. This approach is not logistically feasible at this time and would increase costs beyond those discussed in the Deschutes Basin Study. It is these logistical challenges associated with private ownership and the failure to fully meet the sponsors objective, in addition to the requirements of PL 83-566, that contribute to voluntary duty reductions, private lateral piping, and on-farm improvements being eliminated from further consideration within the Plan-EA. For a discussion about canal lining in NUID's system, please see the response to Comment ID 10.02.<br>References:<br>Bell, A. R., P. S. Ward, and M. A. A. Shah. 2016. Increased water charges improve efficiency and equity in an irrigation system. Ecology and Society 21(3):23. DOI: http://dx.doi.org/10.5751/ES-08642-210323<br>Lopez-Gunn, E., P. Zorrilla, F. Prieto, and M. R. Llamas. 2012. Lost in translation? Water efficiency in Spanish agriculture. Agricultural Water Management. 108(2012):83-95. DOI: 10.1016/j.agwat.2012.01.005.<br>Merriam, J. L. & Freeman, B. J. 2007 Operational cost benefits study of flexible on-farm irrigation supply systems, Journal of Irrigation and Drainage Engineering, 133, pp. 12–16.<br>U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS). 2014. National Watershed Program Manual. Title 390-500. Website: https://directives.sc.egov.usda.gov/ViewerFS.aspx?hid=36702. Accessed March 24, 2020.<br>Upper Deschutes River Basin Study Work Group (BSWG). 2019. "Upper Deschutes River Basin Study". Draft Final Report: Bureau of Reclamation and Oregon Water Resources Department. Accessed on: May 1, 2020. Retrieved from: https://www.deschutesriver.org/PROVISIONAL%20Draft%20Fi |

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| | | | nal%20Report%20U%20Deschutes%20Basin%20Study%20201907 01.pdf<br>Ward, F. 2010. Financing Irrigation Water Management and Infrastructure: A Review. Water Resources Development. 26(3):321-349. |
| 10.10 | SCOP | 5. Decision framework<br>At EA page 32, Section 1.4 Decision Framework, the EA states that the Project is long-term and spatially broad and thus does not identify specific details concerning engineering or construction of the EA's preferred alternative:<br>"For purposes of NEPA compliance, the intent of this Plan-EA is to determine if the project, as proposed, significantly affects the quality of the human environment. NRCS has determined the need for a Plan-EA to analyze the effects of the proposed action under PL 83-566 watershed authority. Due to the broad spatial scale of this analysis, and the multi-year project group approach, this Plan-EA does not identify the specific details associated with the engineering design and construction activities that would be required to implement the proposed action. Instead, this document intends to present an analysis in sufficient detail to allow implementation of a proposed action within the designated project. If the analysis demonstrates that the project does not significantly affect the quality of the human environment, minimal additional NEPA analysis would be required."<br>The Project, as proposed, is not a long-term effort. Instead, it is a single project, covering a short section (7.9 miles) of the COID network of infrastructure. The EA should spell out the Project in detail so the public can understand what it will do and what purpose it will actually serve. If COID had proposed a district-wide effort to improve water conservation and irrigation water reliability, then perhaps the above reasoning that cites to a long-term, spatially broad, phased project could be justifiable. | We have revised Section 1.4 of the Plan-EA to more accurately represent the scale of the project. Section 1.4 also describes the tiered approach used to evaluate the potential effects of the proposed project.<br>Section 8 provides details about the Preferred Alternative, including measures proposed to be installed. |
| 10.11 | WAT | 6. Protection of instream water<br>The EA, at page 98, describes how COID proposes to protect water conserved by the Project for instream use:<br>"NUID would legally protect the water released from Wickiup Reservoir through an instream lease under Oregon water law (ORS | Section 6.9.1.1 of the Plan-EA has been revised to clarify that ORSs allow for the transfer of storage water rights to instream use and that OARs need additional clarity to allow for the transfer of storage water rights to instream use. |

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| | | 537.348 [2] and OAR 690-077). The water leased instream would retain the same priority date as the originating water right (certificate 51229). The instream lease would protect water in the upper Deschutes River downstream from Wickiup Reservoir during the non-irrigation season in the late fall, winter, and early spring.<br>Oregon water law does not currently allow for permanent changes in water rights that would protect this water in the Deschutes River. An agreement would be established specifying that these instream leases would be renewed indefinitely or until Oregon's authorities allow for a permanent change."<br>COID's assertion that Oregon water law does not allow for permanent changes in water rights is false. The cited statute clearly allows it: "[A]ny person who has an existing water right may lease all or a portion of the existing water right for use as an in-stream water right for a specified period without the loss of the original priority date." (ORS 537.348(2))<br>That storage rights are "existing water right[s]" as used in ORS 537.348(2) and are eligible for use as in-stream water rights is confirmed by OWRD. See Exhibit F, Opinion of OWRD Policy Director, Racquel Rancier. Administrative rules used for leasing water instream could also be easily adapted to permanent transactions.<br>Thank you for your consideration of these comments. Please keep us updated as to all future Project matters, and inform us of any further opportunities for comment and appeal. | |
| 11.00 | WAT | The City of Bend (City) has reviewed the Draft Watershed Plan - Environmental Assessment for Central Oregon Irrigation District's (COID's) Smith Rock-King Way Infrastructure Modernization Project and offers the following comments.<br>The irrigation districts in Central Oregon are the City's partners, neighbors, and a critical part of the region's economy. The City supports COID's efforts to pipe its distribution system, and work creatively with North Unit Irrigation District (NUID) to alleviate low winter flows on the Upper Deschutes River below Wickiup dam. The City understands that the Smith Rock-King Way project, along with other projects already underway or in planning under the Watershed | Section 2 of the Plan-EA identifies the purpose and need of the project. While the project sponsors recognize the need for additional groundwater mitigation credits stated in the comment, creating groundwater mitigation credits falls outside of the purpose and need of the project. |

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| | | Protection and Flood Protection Program (PL 83-556) are expected to also support various irrigation district and Deschutes Basin goals.<br>Since 2002, new groundwater uses in the Deschutes Basin require "mitigation" under the Deschutes Groundwater Mitigation Program. Historically, this mitigation has been developed in partnership with the irrigation districts. However, with recent events in the Deschutes Basin, the districts have not been in a position to work with the City of Bend and other water providers to create mitigation needed for current and future groundwater use. Unfortunately, COID's draft watershed plan does not identify any opportunity to create groundwater mitigation credits for municipal water supply needs and does not make the connection between needed mitigation for groundwater pumping and planned conservation measures and projects that put water instream.<br>Recently, as part of the Bureau of Reclamation's (BOR) Upper Deschutes Basin Study, an analysis was conducted that determined the need for up to 16,000 acre-feet of water to meet the 50-year City and private water provider projected demand for mitigation to satisfy groundwater use. Meeting this demand is of critical importance and a key component of a thriving Central Oregon economy. The City has been pleased with COID's willingness to engage in discussion about the topic and looks forward to finding solutions that benefit all stakeholders. | |
| 12.00 | WAT | Thank you for the opportunity to provide recommendations and input during your National Environmental Policy Act (NEPA) process for the Central Oregon Irrigation Modernization Project (Project). The U.S. Fish and Wildlife Service (Service) supports piping the canals and laterals, and is eager to see the resulting conserved water returned to the Deschutes River. The Service is supportive of piping canals and laterals, and appreciates NRCS' endeavors to facilitate those efforts through PL 83-566 and other funding mechanisms. We reviewed the draft Environmental Assessment (EA), and provide the following comments in support of Alternative 2 (Piping Alternative).<br>The Service has been leading a large scale, conservation planning effort for water management that will benefit threatened and endangered species in the Deschutes River Basin in Central Oregon. The goal of this planning effort is to develop an Endangered Species Act (ESA) | At project completion, COID would save 9,392 acre-feet during the irrigation season. COID's irrigation season is typically 208 days (April 1 to October 26). COID's diversion rate increases from spring to summer and decreases from summer to fall; 29.4 cfs represents the maximum rate that would be saved during the peak irrigation season.<br>At project completion, NUID would lease 9,392 acre-feet instream during the non-irrigation season. This analysis assumes that the non-irrigation season is typically 157 days (October 27 to March 31); 30.3 cfs represents the rate that would be protected instream if 9,392 acre-feet were leased instream at a constant rate over the 157 days of the non-irrigation season. |

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| | | Habitat Conservation Plan (HCP) under section I 0(a)(l)(B) of the ESA that provides non-Federal parties the opportunity to conserve the ecosystems upon which listed species depend, ultimately contributing to their recovery. The Deschutes Bain HCP (DBHCP) has been in development for a number of years and includes eight Central Oregon irrigation districts (constituting the Deschutes Basin Board of Control) and the City of Prineville (collectively the Applicants).<br>The Applicants' goal is to complete the planning process in 2020. The goal of the DBHCP is to manage water in the Deschutes River Basin in a manner that addresses the long-term certainty for water users but provides necessary water for species covered by the plan [(Oregon spotted frog (Ranapretiosa), bull trout (Salvelinus confluentus), and steelhead (Oncorhynchus mykiss), sockeye salmon (Oncorhynchus nerka) and spring Chinook salmon (Oncorhynchus tshawytscha)].<br>One of the various tools available for the Applicants' conservation approach is to modernize their existing irrigation infrastructure, and return the conserved water instream to support the conservation of the covered species. The Service supports the Piping Alternative, which will reduce water loss from seepage and evaporation, resulting in 29.4 cfs of conserved water.<br>Additionally, the Service encourages the ongoing collaboration between Central Oregon Irrigation District and North Unit Irrigation District. The water saved from the project permits COID to pass the water to NUID in order to build on minimum flows in the non-irrigation season.<br>We have one item for clarification. In Table 5-1. Summary and Comparison of Alternatives (p. 86), the Conserved Water comparison for Alternative 2 states, " Potential to save up to 29.4 cfs or 9,392 acre-feet of water currently lost through seepage and evaporation in the PBC and laterals that would be protected instream for environmental purposes." On the same page in the Water Leasing comparison for Alternative 2, "Through agreements, the instream leases created by NUID in response to the water saved from the project (up to 9,392 acre-feet or 30.3 cfs to be released outside of the irrigation season, downstream from Wickiup Reservoir), would continue and be renewed indefinitely, or until Oregon's authorities allow for a permanent change in water rights." Can you please provide | |

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| | | clarification as to why the cfs values differ if the acre-feet values are the same?<br>We look forward to coordinating with you throughout the final process of your EA development of the EA. We will provide input as needed during the formulation of your final document. | |
| 13.01 | WAT | The Deschutes Redband Chapter of Trout Unlimited (TU) appreciates the opportunity to provide comments on the draft Watershed Plan - Environmental Assessment (EA) of January 2020 for the Central Oregon Irrigation District's Smith Rock-King Way Infrastructure Modernization Project. The watershed plan and EA, when complete, will enable the Natural Resource Conservation Service (NRCS) to fund the improvements through PL-566, the Watershed and Flood Prevention Program.<br>TU is a non-profit organization with a mission to conserve, protect and restore North America's coldwater fisheries and their watersheds. TU has more than 300,000 members and supporters nationwide, 3000 members in Oregon and 634 members in our Deschutes Redbands Chapter. Restoring instream flows to the Deschutes and Crooked Rivers is a key objective of TU and a focus of the Deschutes Redbands Chapter. To that end, the Chapter has been involved with a diversity of projects in the Deschutes Basin intended to help restore instream flows and improve water quality in priority waterways. Additionally, TU has engaged in the Upper Deschutes Basin Study and other collaborative efforts intended to help resolve long-standing water management issues. Irrigation system improvements, along with on-farm efficiency and water marketing tools, will be a key part of any long-term solution.<br>Generally, TU strongly supports conservation actions (including agricultural efficiency improvements and infrastructure modernization projects). We appreciate the initiative of the District to move forward on such actions. As noted above, these actions have the potential to contribute to a comprehensive and widely-supported water management strategy for the Deschutes Basin. Our Chapter has concluded that the draft EA should satisfy NEPA requirements for this modernization project. Only a few limited points are noted. The proposed project is estimated to conserve 9,392 acre-feet of water which is calculated to provide 30.3 cfs in flows to be released from | Thank you for your comment. Please see the response to Comment ID 10.11 for further discussion about the District's communication with OWRD regarding a permanent change in water rights. |

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| | | Wickiup Reservoir during the winter storage season. This conserved water is very positive, however, OWRD has not provided guidance as to how to protect this instream water permanently. This issue is summarized on page 86 of the draft EA:<br>"Through agreements, the instream leases created by NUID in response to the water saved from the project (up to 9,392 acre-feet or 30.3 cfs to be released outside of the irrigation season, downstream from Wickiup Reservoir), would continue and be renewed indefinitely, or until Oregon's authorities allow for a permanent change in water rights."<br>Having been involved in some of the discussions with OWRD on this point, we accept the proposed option with the understanding that aggressive efforts will continue towards development of a method to assure that conserved water is permanently returned instream. | |
| 13.02 | WAT | In several portions of the draft EA, inefficiencies of water delivery to patrons are documented (pgs. 34 & 54). It is apparent that these could be partially alleviated through use of re-regulating reservoirs, but that option is not mentioned. In discussions within the Basin in recent years, it has been stated that current water law and OWRD regulations will not permit any such new reservoirs. Given the potential significance of this, it would seem worth a comment in the final EA regarding the use of re-regulating reservoirs and what legislative changes would be required for their future use.<br>The Deschutes Redband Chapter of Trout Unlimited supports the modernization project and appreciates the opportunity to participate in this process. | Creating re-regulating reservoirs would meet the project purpose to "improve water delivery reliability to District patrons"; however, re-regulating reservoirs would not meet the project purposes to improve water conservation and public safety. Additionally, creating a re-regulating reservoir would not reduce the District's operation and maintenance, would increase construction costs, and would need additional permitting. Re-regulating reservoirs have been added as an alternative in Appendix D.2.4. |
| 14.00 | ALT | We urge you to oppose the plan presented by Central Oregon Irrigation District to pipe eight miles of its Pilot Butte Canal. Conserving water is crucial to our desert environment, especially as the population in Central Oregon soars and creates increased demands for water. In addition, climate change and decreased snowpack are already reducing the abundance of this critical resource and are predicted to cause even more shortages in the future.<br>We are in favor of water conservation, yet this proposal is misguided. The cost of $42,000,000 to pipe a distance of 7.9 miles is unreasonable. Other more effective and less costly options are | Please see the responses to Comment IDs 10.06 and 10.09. |

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| | | available. Market-based incentives such as temporary leasing and permanent transfers are proven strategies. The piping of private laterals is another cost-effective approach.<br>Please discard this ill-conceived plan and instead support other concepts that can do a better job of preserving water for farmers, environmental health, and residents in this beautiful place that we call home. | |
| 15.00 | ALT | The proposed watershed plan as proposed is too expensive for the stated benefits. We should all want to have more water remain in the Deschutes River but there are other more cost effective measures to spend taxpayer dollars on that can derive more benefits per dollar spent. It appears that the District is trying to get federal taxpayer dollars to fund the most expensive project they could come up with. There are better options. | Please see the NED Analysis in Appendix D.1 of the Plan-EA for a discussion of the benefits and costs of the project. |
| 16.01 | WAT | WaterWatch of Oregon is a river conservation group that works to protect and restore river flows statewide. We have been working to protect river flows in the Deschutes Basin for nearly three decades. We have a great interest in the development of a PL-566 Watershed Plan for COID that is crafted in a way that would allow funding of a broad array of efficiency projects within the district that would result in permanent water restored instream. The Draft Watershed Plan as currently drafted does not meet these parameters. We offer the following comments on the draft EA.<br>Reliance on the 2017 Agreement for Provision of Irrigation Water between COID and NUID instead of the Conserved Water Act: We could not find any commitment by COID in the EA to put saved water instream via Oregon's Conserved Water Act (ORS 537.460). Instead, COID appears to be relying largely on a 2017 agreement between COID and NUID to direct how water saved through the proposed piping project will be distributed (See Appendix E: Agreement for Provision of Irrigation Water 2017). This raises a number of concerns, including but not limited to the following:<br>First, the 2017 Agreement appears to conflict with Oregon's laws governing waste. Under Oregon water law, water use must be used beneficially without waste. See e.g. ORS 537.525, ORS 540.720. Put it another way, a water right holder has no legal right to waste. Because | Sections 6.9.1, 6.9.1.1, 6.9.2, and 6.9.2.1 of the Plan-EA have been revised to more clearly describe the proposed project and its effects.<br>The 2017 Agreement between COID and NUID provides an example of a cooperative agreement between the two irrigation districts rather than the specific agreement that the districts would follow under the proposed action. The districts would enter into a new cooperative agreement prior to construction of the proposed project. Language in the Plan-EA relating to the 2017 Agreement has been revised accordingly.<br>COID and DBBC, the project sponsors, recognize the basin-wide interest in increasing streamflow in the Deschutes River downstream from RM 226.8, below Wickiup Reservoir, outside the irrigation season. The proposed action would save water at RM 164.8 during the irrigation season. As currently understood, Oregon's Allocation of Conserved Water Program would not allow the project sponsors to save water at a downstream point during the irrigation season and allocate water for instream use at an upstream point during the non-irrigation season.<br>One hundred percent of the water saved through the proposed project would be used to legally protect streamflow in the Deschutes River downstream from Wickiup Reservoir in perpetuity under Oregon law. COID and NUID piloted the movement of water between their conveyance systems and the Deschutes River in 2019 to 2020 with |

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| | | of this, water users can only take advantage of water saved through conservation projects via two avenues:<br>(1) Shoring up supply: If a water right holder is water short (does not get all the water allowed by their water rights) they can use water saved via conservation to "shore up" their supply for existing lands under the rate/duty of their existing water right. They cannot use this saved water on lands not covered by their water right, for additional uses not allowed under their water right or otherwise "spread" the water to other lands.<br>(2) Conserved Water Act: If a water right holder does not need the conserved water to shore up supply under their original right, then he/she can only use a portion of the saved water if they go through the Conserved Water Right Act. The Conserved Water Act requires a minimum of 25% of the saved water be permanently transferred instream; however, because of the unique hydrology of the Deschutes River Basin, 100% of the water must be transferred instream to avoid injury to instream water rights.<br>As we understand it, because COID is a senior water right holder in the basin, they are never water short. Thus, since they do not need the conserved water to shore up supply under their existing water right for existing lands, COID's only avenue to be able to use saved water is to put its projects through the Conserved Water Act. If COID were to undertake piping projects outside of the Conserved Water Act (which appears to be the plan here), the saved water would simply return to the system. In a nutshell, unless COID goes through the Conserved Water Act, the saved (previously wasted) water is no longer under COID control, and is not COID's to broker deals with. As such, the 2017 Agreement appears to violate these principals of state water law by (1) preserving 10% of the saved water for COID members, other districts or for other purposes, and (2) offering NUID the first option to receive 90% of the net conserved water. In a nutshell, because COID has no need of the saved water to "shore up supply", unless COID uses the Conserved Water Act they have no legal right to the saved water so cannot sell and/or otherwise transfer it to NUID. While WaterWatch supports efforts to deliver water to the Upper Deschutes to meet the needs of the Oregon Spotted Frog, this should | OWRD acknowledgement following the completion of the Siphon Power Property Piping Project (COID 2017; OWRD 2020). The districts protected the water saved from the completed project instream under Instream Lease 1770 (OWRD 2019). This previously completed project demonstrates the feasibility of the approach outlined for the proposed project.<br>References:<br>Central Oregon Irrigation District (COID). 2017. Central Oregon Irrigation District Siphon Power Property Canal Piping Project FY2016 WaterSMART Grant Application. Redmond, OR: Author.<br>Oregon Water Resources Department (OWRD). 2019. Determination and Final Order on Proposed Instream Lease Application IL-1770, Deschutes County. Special Order Vol. 114. Pg. 160.<br>Oregon Water Resources Department (OWRD). 2020. Water Manager's Meeting for March 25, 2020. Bend, OR. |

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| | | be done through avenues contemplated under the Oregon Water Code. | |
| 16.02 | WAT | Second, the 2017 Agreement between COID and NUID does not commit to permanently protecting water instream. Instead, it appears that the agreement relies wholly on temporary instream leases. This provides no certainty to instream values. COID will be using public funds to pipe their canals, as such, permanent public benefits should accrue. To ensure that the instream benefit of this project is realized in perpetuity, NUID should permanently transfer a portion of their stored water instream in exchange for gaining access to COID saved water (through means allowed under State Water law). Despite recent uncertainty surrounding transfers of stored water, the OWRD has made a determination that the transfers of stored water instream are allowed under Oregon law. Specifically, ORS 537.348 allows for "existing water rights" to be transferred or leased instream, and since a right to store water is an "existing water right" the OWRD believes it has statutory authority for permanent changes of a right to store water to instream purposes. | Please see the response to Comment ID 10.11 |
| 16.03 | WAT | Third, the 2017 Agreement states that Districts shall cooperate to cause the conserved water to be uses for "mitigation credits" for the City of Bend. As COID is well aware, the Oregon Water Resources Department has determined that conserved water cannot be used as mitigation water in the Deschutes basin because to allow such would cause injury to downstream instream water rights. See e.g. Oregon Department of Justice Letter to Oregon Water Resources Department Director Paul Cleary, 10/25/2001. The EA table 3-2 notes that the proposed action will not create groundwater mitigation credits; however, section 6.9.2.4 is silent on this front. Given the EA's reliance on the 2017 Agreement, the narrative of the EA needs to state unequivocally that this water cannot be used now or in the future to create groundwater mitigation credits. | Sections 6.9.1.4 and 6.9.2.4 have been updated to reflect that the proposed action would not create groundwater mitigation credits. |
| 16.04 | WAT | Fourth, the EA notes that the path as envisioned by the 2017 agreement was approved by USFW; however, there is no documentation of USFWS approval of this agreement in the EA or the appendices. Notably, the EA does not assert that the Oregon Water Resources Department has approved this agreement. Given | Please see the response to Comment ID 16.01.<br>Section 8.5.2 of the Plan-EA has been updated to align with the process discussed in Sections 6.9.2 and 6.9.2.1 |

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| | | state water law is what governs water distribution in Oregon, not agreements between districts, this is a key missing piece. Our concern here is compounded by the EA's statement that the District would not be changing its water right and therefore not submitting a water right transfer application (EA Section 8.5.2). Nor is there any mention of a conserved water right application, and or any instream transfers1. As noted previously, WaterWatch supports efforts to move water to the Upper Deschutes in a coordinated approach with NUID, but we believe that the Districts should go through water law processes to get there. | |
| 16.05 | WAT | Fifth, the 2017 Agreement is just that, an agreement between Districts. This can be changed and/or amended at any time by the Districts. The state cannot enforce this agreement, nor can NRCS. As a condition of receiving public funds, COID should commit to enforceable commitments to put 30.3 cfs instream permanently. The statement that "the water would be protected during the non-irrigation season through an inter-district water resources department agreement" (pg. 24) offers no certainty, accountability or enforceability. | The Watershed Plan Agreement between the DBBC, the District, and NRCS incorporates the Plan-EA by reference. Specifically, the Watershed Plan Agreement states, "Whereas, there has been developed through the cooperative efforts of the sponsors and NRCS a watershed project plan and environmental assessment for works of improvement for the Central Oregon Irrigation District - Infrastructure Modernization Project, State of Oregon, hereinafter referred to as the watershed project plan or plan, which plan is annexed to and made a part of this agreement;"<br>Sections 6.9.1.1 and 6.9.2.1 of the Plan-EA describe COID's commitment to putting the water saved by the project instream in perpetuity.<br>When financial assistance is provided through PL 83-566, COID would enter into a contract with NRCS obligating COID to complete the project within the framework as described in the Plan-EA. This contract includes any commitment to putting the water saved by the project instream in perpetuity. The failure of COID to meet the terms of the contract would be a violation of the contract and, if not remedied by DBBC and COID as described in the plan, would require COID to reimburse NRCS for the financial assistance provided for the project. |
| 16.06 | WAT | Dedication of 100% of Conserved Water Instream (if public funds are used): While the EA implies that the saved water will be put instream, we could find no overt commitment by COID that they would put 100% of the saved water instream. And, in fact, the provisions of the 2017 Agreement would lead to just the opposite conclusion (90% to NUID, 10% to COID). | Please see response to Comment ID 16.01 |

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| 16.07 | PURP | Authorized Project Purpose: Agricultural Water Management (pg. 34 EA): COID should expand the purpose of the project from "Agricultural Water Management (v)" to include the additional authorized PL-566 purpose of "Public Fish and Wildlife (iv)". While we appreciate that the stated purpose of "Agricultural Water Management" includes, broadly, water conservation, the term "water conservation" is not defined by the PL-566 as something that would necessarily benefit fish and wildlife. Adding Fish and Wildlife as a purpose would be in line with COID's statement on pg. 81 that enhancing streamflow and habitat conditions for fish and aquatic species is one of the COID's objectives. Given the significant amount of public funds being considered for investment in this project, having a clear tie to the public purpose of fish and wildlife is of critical importance both for optics and accountability purposes. | Please see response to Comment ID 10.03 |
| 16.08 | ALT | Proposed Action: Piping of 7.9 miles of COID's irrigation canals and laterals. While WaterWatch supports the inclusion of District piping in the Watershed Plan, we urge COID to broaden this purpose to include the broad array of water conservation measures that could further lead to efficient irrigation and water restored instream, including but not limited to, on-farm efficiencies, piping of private laterals, market incentives and duty reduction.<br><br>Numerous stakeholders in the Deschutes Basin (including COID) were involved in the Bureau of Reclamation's Upper Deschutes Basin Study Workgroup (BSWG), which concluded in the fall of 2019. Included in the Final Study is an analysis of a number of water conservation tools including, but not limited to, on-farm efficiencies, piping/lining of private laterals, market approaches, and duty reduction, in addition to piping District canals (https://www.usbr.gov/pn/studies/deschutes/). While the BSWG did not result in a prescriptive management plan, studies and modeling generated in this process do document the great potential of the whole of these collective tools to help address the ecological, agricultural and municipal needs in the basin. Thus, while we appreciate that the District's first priority may be District piping, it seems short sighted and contrary to meeting public purposes in Watershed Plan to limit the PL-566 Watershed Plan to the single purpose of District piping, especially given that this plan will govern the disbursement of PL 566 | Please see the response to Comment ID 10.09 regarding other alternatives and the response to Comment ID 10.03 regarding the rationale for the Agricultural Water Management purpose. |

| Comment ID | Topic Code | Comment | Response |
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| | | monies into the future. To that end, we would urge the District to broaden the plan to include all conservation measures studied in the BSWG. We would not object to a prioritization of District piping in the Watershed Plan, but we do object to the exclusion of the broad array of available water conservation tools.<br>The Draft EA justifies its decision not to include a number of water conservation alternatives because they do not meet the project purpose and would be logistically unreasonable (section 5.2 of the EA). COID's current stated purpose is "Agricultural Water Management", which allows for a broad array of projects. For instance, "irrigation projects" includes measures planned primarily to increase the efficiency of water use on cropland, grassland, and woodland and to obtain the maximum practical benefits for existing investments in irrigation." (National Watershed Handbook at. 600.A-5, 2014). The handbook does not set limits as to what falls under this broad directive, nor does it limit project boundaries to irrigation works (i.e. projects can be within watershed or sub watershed areas composed partly or totally of lands irrigated or proposed to be irrigated.). It is also important to note that the very broad term "water conservation" falls under the "Agricultural Water Management" umbrella. On-farm efficiencies clearly meet the stated sub-purpose of "water conservation" under Agricultural Water Management, and therefor fit quite well under the District's proposed purpose. And finally, on farm efficiencies could also easily be justified under the Public Fish and Wildlife purpose, if COID were to add that as a stated purpose. It seems disingenuous to assert that they can't undertake additional measures because they don't align with the purposes; when in fact the purposes are wholly in control of COID and can be expanded. | |
| 16.09 | WAT | OMB Fact Sheet (PG. 19): We would urge COID to include in its OMB Fact Sheet description of the Proposed Action, Preferred Alternative and Project Measures a commitment to putting saved water instream. As is, the only acknowledgement of the instream piece is in "project benefits." A commitment and a path to putting the water instream should be a clear part of the Proposed Action, Description of the Preferred Alternative, and Project Measures. Without this, the project could simply go forward as a piping project regardless of the | The OMB Fact Sheet in the Plan-EA has been revised to reflect that the project will put 100 percent of the saved water instream. |

| Comment ID | Topic Code | Comment | Response |
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| | | intended instream piece. This would be contrary to commitments to basin stakeholders, and offers no mechanism to ensure accountability. | |
| 16.10 | PURP | Purpose and Need (pg. 34): The EA should be forthright in the purpose and need section about the fact that the DBBC will need to provide significant instream flows under the anticipated Deschutes Habitat Conservation Plan to meet the needs of the Oregon Spotted Frog. The final decisions on the HCP are expected to be out in May or June of 2020. The flow requirements of the frog are a major impetus of district action to pipe canals, and were one of the stated purposes of Senator Merkeley in seeking PL 566 funds for Deschutes Basin efficiency projects. The EA should be clear about this. | The HCP is a separate action that is reasonably foreseeable to occur based on available information. As an action that would occur separately from the proposed project, the HCP is included under Cumulative Effects in Section 6.14.2.2 of the Plan-EA. |
| 16.11 | ALT | Alternatives Analysis: We disagree with the EA finding that on-farm efficiency upgrades would not meet the project purpose. The official public purpose under the PL 566 Application is "Agricultural Water Management". It is only the District that then narrowed this to "improve water conservation in District owned infrastructure, improve water delivery reliability to District patrons and improve public safety." As stated elsewhere, COID has great flexibility in not only adding fish and wildlife to the public purpose, but also in what sub groups they put under "Agricultural Water Management." To assert that on farm efficiencies do not meet the project purpose when it is COID who is defining the project purpose is a circular argument. "Agricultural Water Management" is a broad authorized purpose that allows for a suite of projects. Moreover, scoping comments urged the inclusion of on-farm efficiencies as an additional conservation measure, not something to be instituted instead of piping. Given the context, the EA's "either or" analysis is in error.<br>The EA's assertion that on farm efficiencies and piping of private laterals creates logistical complexities because COID lacks the authority or responsibility to carry out, operate and maintain irrigation works (on farm/laterals) is also not supported by the basic tenants of western water law. As noted previously, water must be used beneficially without waste. Oregon Administrative Rules define waste as: the continued use of more water than is needed to satisfy the specific beneficial uses for which a right was granted. The need for water shall be based on using the technology and management practices that provide for the efficient use of water considering | Please see the response to Comment ID 10.09 regarding on-farm efficiencies and piping private laterals and the response to Comment ID 10.06 for a discussion about project selection.<br>As provided for in ORSs and District Resolution 2014-7 (COID 2014), as referenced in the response to Comment 10.09, COID can only take action due to issues such as waste or inadequate maintenance or operation of private ditches that jeopardizes the associated water rights. COID is responsible for delivering water to its points-of-delivery as efficiently as possible given its available technology and management practices. If COID determines that inadequate maintenance or operation of private ditches jeopardizes the associated water rights, the District may take additional actions as described in COID Resolution 2014-7 (COID 2014). It is also clear that the identified rules, statute, and resolutions do not provide COID the authority to pipe private laterals or implement on-farm improvements for the purpose of conservation without associated waste. Past the point of delivery, private ditches, on-farm application methods, crop selection, and management practices are at the discretion of the patron so long as water is put to beneficial use as allowed under the associated water right.<br>As identified in the above references, there has to be an underlying cause consistent with authorities granted for the District to undertake additional actions as described. Without this underlying cause, COID lacks the ability to undertake action on private property. Further, the efficient use of water is bounded by such factors as economic feasibility, environmental impacts, and availability of proven technology. The |

| Comment ID | Topic Code | Comment | Response |
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| | | economic feasibility, environmental impacts and availability of proven technology, among other things. OAR 690-400-0010(16). As a District, COID has a responsibility to ensure that patrons use water efficiently without waste. Moreover, Districts have broad authority to enter patron lands and manage (or even condemn) works under existing law, see e.g. ORS 545.237, 545.239, 545.449. In sum, on farm efficiency and piping of private laterals, as well as market incentives, is broadly supported by stakeholders, and should be included as part of a broader preferred alternative. | implication here is that ultimately it is up to the patron to determine what the patron does on their property, so long as it is consistent with associated rules and regulations. Without accompanying statutory authority requiring all patrons to undertake conservation actions, in the absence of an underlying cause or without associated considerations in mind, action by the District on private property is an exceedance of COID's authority and is an intrusion upon associated property rights.<br>Reference:<br>Central Oregon Irrigation District. 2014. Resolution 2014-7: Protection of District Water Rights Beyond the District's Points of Delivery. Retrieved: https://coid.org/wp-content/uploads/2017/12/R-2014-7-Protection-of-District-Water-Rights-Beyond-the-Districts-Points-of-Delivery.pdf. Accessed: March 23, 2020. |
| 16.12 | WAT | Section 4.13, Federal Wild and Scenic River and State Scenic Waterways: The EA should include a description of the instream flows adopted by the Oregon Water Resources Commission under the State Scenic Waterway Act, and/or recommended under the Federal Wild and Scenic Act. State scenic waterway flows for the Deschutes River from Wickiup Dam to downstream of Bend range from 250 cfs to 400cfs to 660 cfs, depending on the reach. Moreover, the Federal Wild and Scenic sets forth flow recommendations not only for winter flows (500 cfs) but also recommends a summer cap (1200 cfs) to allow revegetation of the channel. | Both Table 4-7 in Section 4.9.2 and Appendix E.10 list instream water rights in the Deschutes River between Wickiup Reservoir and North Canal Dam. Table 4-9 has been added in Section 4.13 to show the recommended flow rates as detailed in the selected preferred option of the Upper Deschutes Wild and Scenic River Record of Decision and Final Environmental Impact Statement, pg. 121 (USDA 1996).<br>Reference:<br>United States Department of Agriculture (USDA) (1996). Record of Decision for the Upper Deschutes Wild and Scenic River FEIS and Management Plan. Amendment #12 to the Deschutes National Forest Land and Resource Management Plan. Pg. 121-122. Retrieved: https://www.rivers.gov/documents/plans/upper-deschutes-eis.pdf. Accessed: March 23, 2020. |
| 16.13 | WILD | Section 3.4, Resource Concerns: This section should identify the Critical Habitat of the Oregon Spotted Frog | Section 3.4 in the Plan-EA lists Oregon spotted frog (*Rana pretiosa*) and critical habitat as relevant to the proposed action. Section 4.10.2 discusses the Oregon spotted frog and its critical habitat. Primary Constituent Elements for Oregon spotted frog critical habitat can be found in Appendix E. |
| 16.14 | WAT | Section 4.9, Water Resources: Sub 4.9.2.3 notes that the state instream water rights serve as a target for fish, wildlife their habitat quality or recreation. In fact, the instream water rights below Wickiup (300 cfs) only reflect the minimum needs of fish. The 2017 BiOp identified a | Language in Section 4.9.2.3 of the Plan-EA related to state instream water rights has been updated. |

| Comment ID | Topic Code | Comment | Response |
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| | | need of 600 cfs for the Oregon spotted frog, and state designated Scenic Waterway Flows below Wickiup are 400 cfs. | |
| 16.15 | WILD | Opal Springs Fish Passage, pg. 67: The EA should be corrected to delete the outdated language about trap and haul fish over Opal Springs Dam (at the very least it should be made past tense). | Language related to Opal Springs Dam has been updated in Sections 4.10.2 and 6.10.2.3 of the Plan-EA. |
| 16.16 | GEN | Conclusion: As a stand-alone document, COID's Watershed Plan would provide COID with federal funds to pipe 7.9 miles of canal without a commensurate commitment to put water instream. The instream piece is not well flushed out, nor is it a condition of the funding of the project. As such, the COID Watershed Plan does not provide for certainty, accountability or enforcement of instream commitments. We would urge COID to revise their Watershed Plan so that quantifiable and permanent instream benefits will accrue as part of this project; not some voluntary future action that is not a condition of funding.<br>Thank you for your consideration of our comments. | Please see the response to Comment ID 16.05 related to the condition of funding for the project. |
| 17.00 | GEN | Please no. We can do this better. | Thank you for your comment. |
| 18.00 | ALT | The cost of COID's proposed piping is a huge expenditure for relatively modest water savings. I can understand why COID would choose piping as a first option; the money isn't their money. It's the taxpayer's money.<br>Before piping is contemplated, I think COID should first use all available market incentives to conserve water. Compared to piping, market incentives would represent a fraction of the cost to taxpayers. | Please see responses to Comment IDs 10.06 and 10.09. |
| 19.00 | ALT | I am opposed to the proposed irrigation canal piping project near Terrebonne. I believe the costs do not outweigh the benefits. Please look at simpler alternatives to conserve Deschutes River water. | Please see the NED Analysis in Appendix D.1 for a discussion of project benefits and costs. Please see Section 5 of the Plan-EA and the responses to Comment IDs 10.06 and 10.09 for discussions of alternative selection. |
| 20.00 | ALT | I would like to comment on the irrigation plan that is presently being proposed. The cost to pipe 7.9 miles of irrigation canal is crazy. Way too much money to spend on the canal when there are other much more efficient and less expensive ways to decrease water waste/evaporation/seepage. By working with end users to become more efficient, we would not only decrease water waste, but could | Please see the responses to Comment IDs 10.06 and 10.09. |

| Comment ID | Topic Code | Comment | Response |
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| | | decrease herbicide and pesticide runoff which is a major problem for our environment and drinking water all at much lower cost. Please think about other less expensive measures to help with our rivers and environment. Thank you for your consideration | |
| 21.00 | GEN | I strongly oppose this environmental degradation project. Protect the river, and put our money towards meaningful restoration projects. Rethink this water management plan, in order for it to be more affordable, AND include plans for necessary projects to restore the Deschutes, and save it from ecological disaster. | Please see the NED Analysis in Appendix D.1 for a discussion of project benefits and costs. Please see Section 5 of the Plan-EA and the responses to Comment IDs 10.06 and 10.09 for discussions of alternative selection. |
| 22.00 | GEN | This plan sounds overly expensive and insufficient in addressing the problem. | Thank you for your comment. |
| 23.00 | GEN | I trust the Central Oregon Land Watch's analysis of the situation. They do their homework and have a thorough assessment of environmental issues. Please support their analysis. | Thank you for your comment. |
| 24.00 | ALT | This does not seem like an efficient, sustainable or helpful solution; far too expensive for the size of impact. Let's reconsider how resources (water, time and money) could be better allocated. | Thank you for your comment. |
| 25.00 | ALT | COID has delivered a narrow plan to pipe merely eight miles of its Pilot Butte Canal at a cost of $42,000,000. To pipe 7.9 miles of the more than 400 miles of canals in COID, the district proposes to spend $42 million in a project area of only 1300 acres to directly serve only 74 of their 3800 potential beneficiaries and out of a total of 45,000 acres in COID. Also, the project proposes to conserve 9,392 acre-feet of water each year at the unreasonably high price of $4,472 per acre foot of water conserved. This is more than four times the price of conserved water generated by other similar piping projects recent years.<br>Reasonable alternatives to COID's proposal exist. The two most important of these alternative solutions are market-based incentives and private laterals conservation. Piping private laterals captures water lost through seepage and spills at the end of the canal and improves deliveries to district patrons. The more controlled, measured deliveries to patrons have the added benefit of facilitating the use of market-based incentives. Market-based incentives such as temporary leasing and permanent transfers are tested and effective approaches to | Please see the responses to Comment IDs 10.06 and 10.09. |

| Comment ID | Topic Code | Comment | Response |
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| | | conserving water for both the River and irrigation. They are flexible, can be scaled for dry years, and can make water available at relatively low cost. These incentives and piping private laterals can supply water at around $400 and $600 per acre foot, respectively, compared to $4,472 per acre foot proposed by COID current plans.<br>COID, in its watershed plan with NRCS, has chosen the least cost-effective water conservation opportunity to pursue. The plan begins to address the major objectives of restoring streamflows in the Deschutes River and securing NUID's water supply, but for a $42 million investment of public funds, much more water could be conserved and transferred for River and NUID farmers. | |
| 26.01 | SYS | Potential modifications to the North Unit Main Canal (approx. Sta. 1355+00 to Sta. 1383+00). Under the tiering approach to NEPA, will proposed modifications to the North Unit Main Canal from the Prineville railway crossing to the county bridge on Smith Rock Way be addressed in subsequent site-specific studies?<br>NUMC – unlined, partial cut/partial fill banks, fractured basalt floors. Evaluate integrity of floor and walls to withstand pressures from new transfer connection to Pilot Butte Canal upstream of railway crossing.<br>Land Ownership - Research ownership of lands and improvements. COID to acquire additional rights of way as needed.<br>City of Prineville Railway double-barreled siphon - Evaluate capacity of siphon to carry additional flows.<br>NUMC cattle guard - Evaluate width of service road for construction access.<br>COID Lateral L metal pipe flume - Evaluate options to replace in place or to relocate the flume.<br>COID-Lone Pine metal pipe flume - Evaluate options to replace in place or to relocate the crossing.<br>COID-NUID existing delivery - Evaluate options to replace or relocate existing transfer connection. Protect ability for COID to deliver on the north side of Smith Rock Way (east and west of the NUMC). Consider the sequencing of (de)construction among construction groupings. | These elements are included in the project area and would be further addressed in subsequent site-specific evaluations prior to construction. The Plan-EA is a programmatic document used to comply with NEPA and adopts a tiered approach for evaluating the potential effects of the proposed action. Hence, the Plan-EA describes effects to resources within the greater project area, while site-specific effects are described in subsequent site-specific studies. Additional information on tiering is available in the National Environmental Compliance Handbook Title 190 Part 610 (NRCS 2016).<br>Following the Plan-EA's effects analysis, it is not anticipated that any project action would modify infrastructure owned by third parties, such as Reclamation, in such a way that would require maintenance exceeding general O&M. Project actions are not anticipated to compromise the integrity of any Reclamation-owned infrastructure. COID would coordinate with Reclamation's regional office and other irrigation districts for those system elements that would require modification and coordination with other parties. Cooperative agreements between the District and NUID specifically describing their responsibilities for O&M are forthcoming.<br>Reference:<br>U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS). 2016. National Environmental Compliance Handbook. Retrieved from https://directives.sc.egov.usda.gov/RollupViewer.aspx?hid=29769 |

| Comment ID | Topic Code | Comment | Response |
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| | | NUMC farm bridge - Research ownership and protect private property.<br>COID service road gate - Evaluate adequacy of existing road for construction access.<br>Smith Rock Way county vehicle bridge - Coordinate with the county on bridge inspection, maintenance, and repair scheduling.<br>Crossing Agreements - Update agreements with COID, Deschutes County, City of Prineville Railway, and private landowners.<br>Proposed Action - Provide 30% engineering design drawings to initiate reviews. | |
| 26.02 | ENRG | Table 3-2 - The proposed action does not consider developing hydroelectric facilities. | Correct, the proposed action does not consider developing hydroelectric facilities. New hydroelectric facilities would be outside the scope of this Plan-EA. |
| 26.03 | SYS | Proposed delivery of saved water - At what point is the saved water delivered to NUID? If the saved water is diverted at the North Canal Dam, how much of the saved water will be lost in the North Unit Main Canal before it reaches Smith Rock Way? | The saved water would be diverted from the Deschutes River into COID's PBC, conveyed through COID's PBC, and delivered to NUID's Main Canal at the new delivery point shown in Figure 5-2 of the Plan-EA. None of the saved water would be diverted into the North Unit Main Canal at North Canal Dam. |
| 26.04 | MAP | Watershed Planning Area (NEPA planning area?) - How much of the delivery system (in the North Unit of the Deschutes Project) is included in the NEPA planning area? Does the NEPA analysis only cover the portion of the North Unit Main Canal that is between the Prineville railway crossing and Smith Rock Way that lies within the Watershed Planning Area (gray polygon)? If the delivery point is at Smith Rock Way, is the bypassed portion of the North Unit Main Canal excluded from the NEPA planning area? | The Watershed Planning Area includes the North Unit Main Canal from the Prineville railway crossing to approximately Wilcox Avenue (see Appendix B Figure B-2). The remainder of NUID's delivery system is not included in the Watershed Planning Area.<br>COID's PBC would deliver water to the North Unit Main Canal near the Prineville railway crossing. |
| 26.05 | MAP | Counties - A portion of the Watershed Planning Area is in Crook County. A portion of the North Unit Main Canal south of Smith Rock Way is in Crook County. | Thank you for your comment. |
| 26.06 | MAP | Land Ownership – Federal - Portions of the North Unit Main Canal are situated on United States fee owned lands. The improvements and appurtenances that comprise the North Unit Main Canal are owned by the United States. | Language regarding North Unit Main Canal ownership has been updated in the Plan-EA Section 1.3. |

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| 26.07 | MAP | North Unit Main Canal Subwatershed - It may be informative to note that although one of the subwatersheds is named "North Unit Main Canal", the North Unit Main Canal is not a natural waterway and is not hydrologically connected to the adjacent lands. The North Unit Main Canal has no irrigation water deliveries south of Smith Rock State Park and is not designed to collect storm water flows from adjacent lands. | Language regarding the North Unit Main Canal subwatershed has been updated in the Plan-EA Section 1.1, Table 1-1. |
| 26.08 | MAP | Table 1.1 - Is the table correct that only 4 acres of the Watershed Planning Area are within the Osborne subwatershed? | Table 1-1 has been revised. |
| 26.09 | COST | Project Costs -- Real Property Rights. Not applicable? Or costs of proposed acquisition of two acres is unknown? | Language has been added to the OMB Fact Sheet and Section 8.4 in the Plan-EA regarding acquisition of real property rights. |
| 26.10 | CONS | Construction Groupings - Will availability of pipe materials affect the composition and sequencing of the construction groupings? | The availability of pipe and timing of its delivery would potentially affect the sequencing of project groups. However, both project groups would be completed within 4 years based upon funding provided by NRCS. |
| 26.11 | GEN | Appendices - Not included in Draft EA available on the internet. | The Plan-EA and appendices were posted online at oregonwatershedplans.org as separate documents at the start of the public comment period on January 16, 2020. Both documents continue to be available online. |
| 26.12 | GEN | Acronyms<br>USBR Reclamation Bureau of Reclamation<br>DOI Department of the Interior | The acronym and abbreviation in the Plan-EA have been updated. |
| 26.13 | GEN | Authority - Act of Congress approved June 17, 1902 (32 Stat. 388), and acts amendatory thereof and supplementary thereto | Thank you for your comment. |
| 26.14 | GEN | Deschutes Project - Federal water project authorized by the Secretary of the Interior, administered under the jurisdiction of Reclamation, additional construction authorized by Congress. (Additional details available upon request.) | Through ongoing consultation, NRCS would continue to ensure that the implementation of the project would not impact the operation of the Deschutes Project where Reclamation retains jurisdiction. |
| 26.15 | GEN | Wickiup Dam<br>North Unit Main Canal<br>Laterals and Sublaterals<br>Haystack Dam<br>Features of the Deschutes Project, held in the name of the United States, administered under the jurisdiction of Reclamation, operated | Thank you for your comment. |

| Comment ID | Topic Code | Comment | Response |
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| | | and maintained by North Unit Irrigation District pursuant to an amendatory repayment contract. Congress authorized an amendment to the repayment contract in 2008 to include certain instream uses as authorized project water supply purposes. (Additional details available upon request.) | |
| 26.16 | WAT | Crane Prairie Dam<br>Feature of the Deschutes Project, held in the name of the United States, administered under the jurisdiction of Reclamation, operated and maintained by Central Oregon Irrigation District pursuant to a repayment contract authorized by Congress. (Additional details available upon request. | Thank you for your comment. |
| 26.17 | WAT | Wickiup Reservoir<br>Crane Prairie Reservoir<br>Features of the Deschutes Project, held in the name of the United States. Reclamation withdrew lands at Crane Prairie and Wickiup reservoirs for Federal water project purposes. Reclamation acquired lands at Wickiup Reservoir and transferred jurisdiction over those lands to the Secretary of Agriculture for recreational and other National Forest System purposes. Reclamation retained jurisdiction to the extent necessary for operation of the Deschutes Project. (Additional details available upon request.) | Thank you for your comment. |
| 27.01 | CUL | 6.1 Cultural Resources<br>6.1.1.1 Archaeological Resources<br>"…the District would follow unanticipated discovery procedures described in Appendix E and consult with SHPO."<br>- What is Appendix E and what document is Appendix E attached to? For the record, there is no Appendix E attached to the MOA referenced pg. 45 – 46 | Appendix E.14 to the Plan-EA contains a "Post-Review Discovery Plan for Unanticipated Cultural Resources" that the proposed action would follow.<br>Please see the response to Comment ID 26.11 about the availability of the appendices to the Plan-EA. |
| 27.02 | CUL | 6.1.2.1 Archaeological Resources<br>Effects on archaeological resources ….assessed based on surveys and a determination from NRCS and SHPO. "<br>- The NUID crossing over COID's Pilot Butte Canal is a federal interest under the administration of the Bureau of Reclamation. As such, Reclamation, as a federal agency, needs to be recognized and included as a consulting party in determining effect on the crossing. | Please see the response to Comment ID 26.01. |

# Appendix B

Project Maps

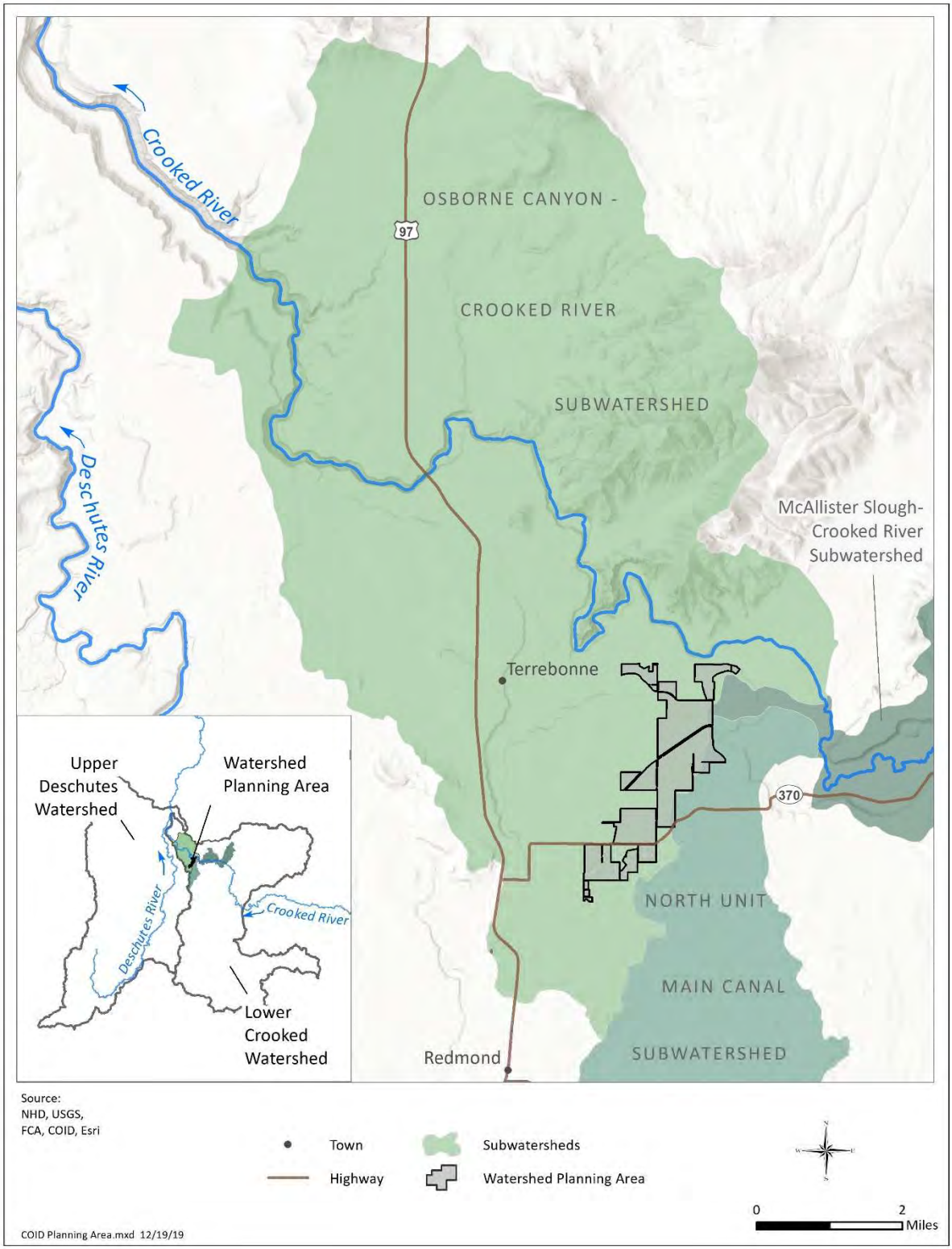


**Figure B-1. The Central Oregon Irrigation District Watershed Planning Area.**

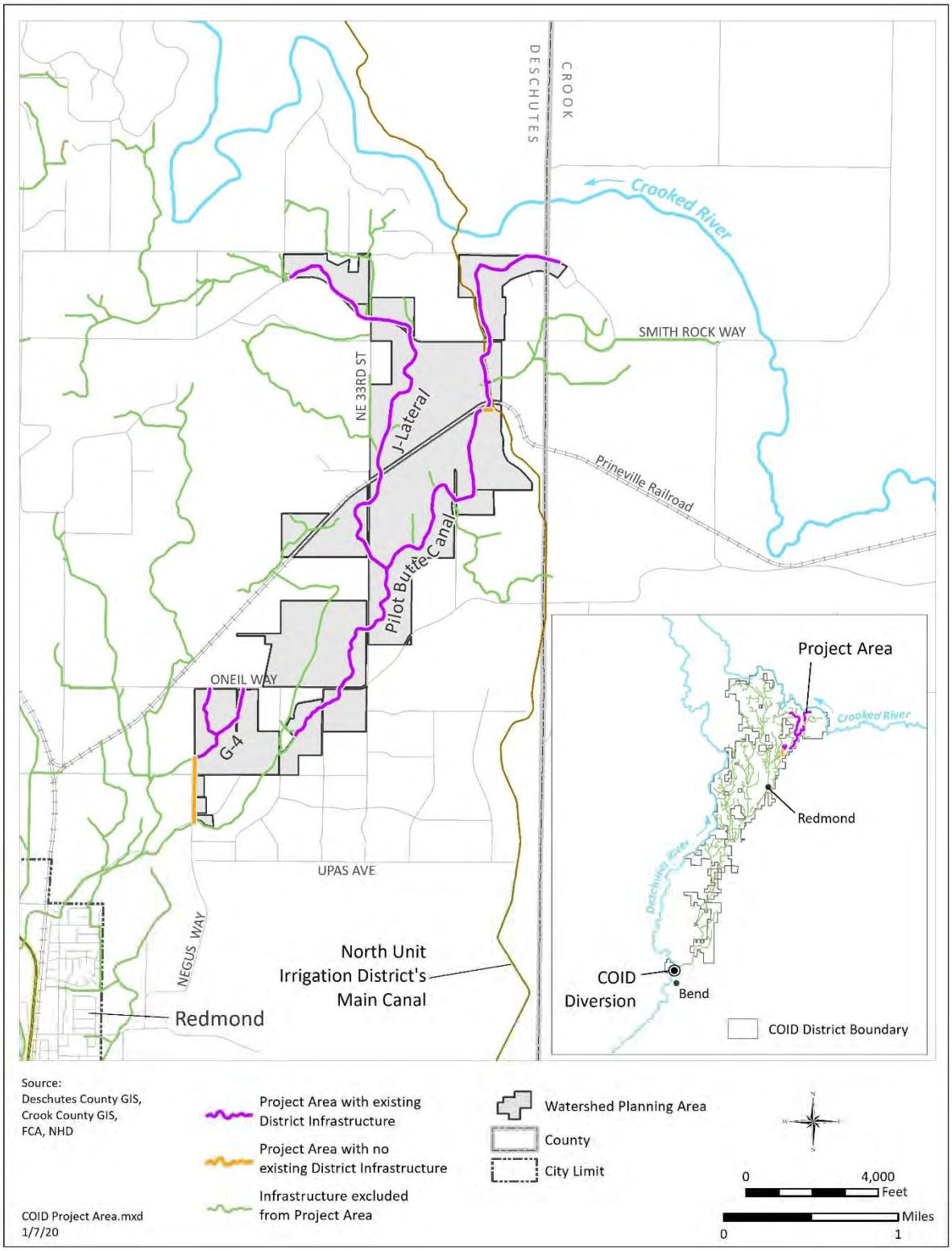


**Figure B-2. The Central Oregon Irrigation District Infrastructure Modernization Project Area.**

# Appendix C

Supporting Maps

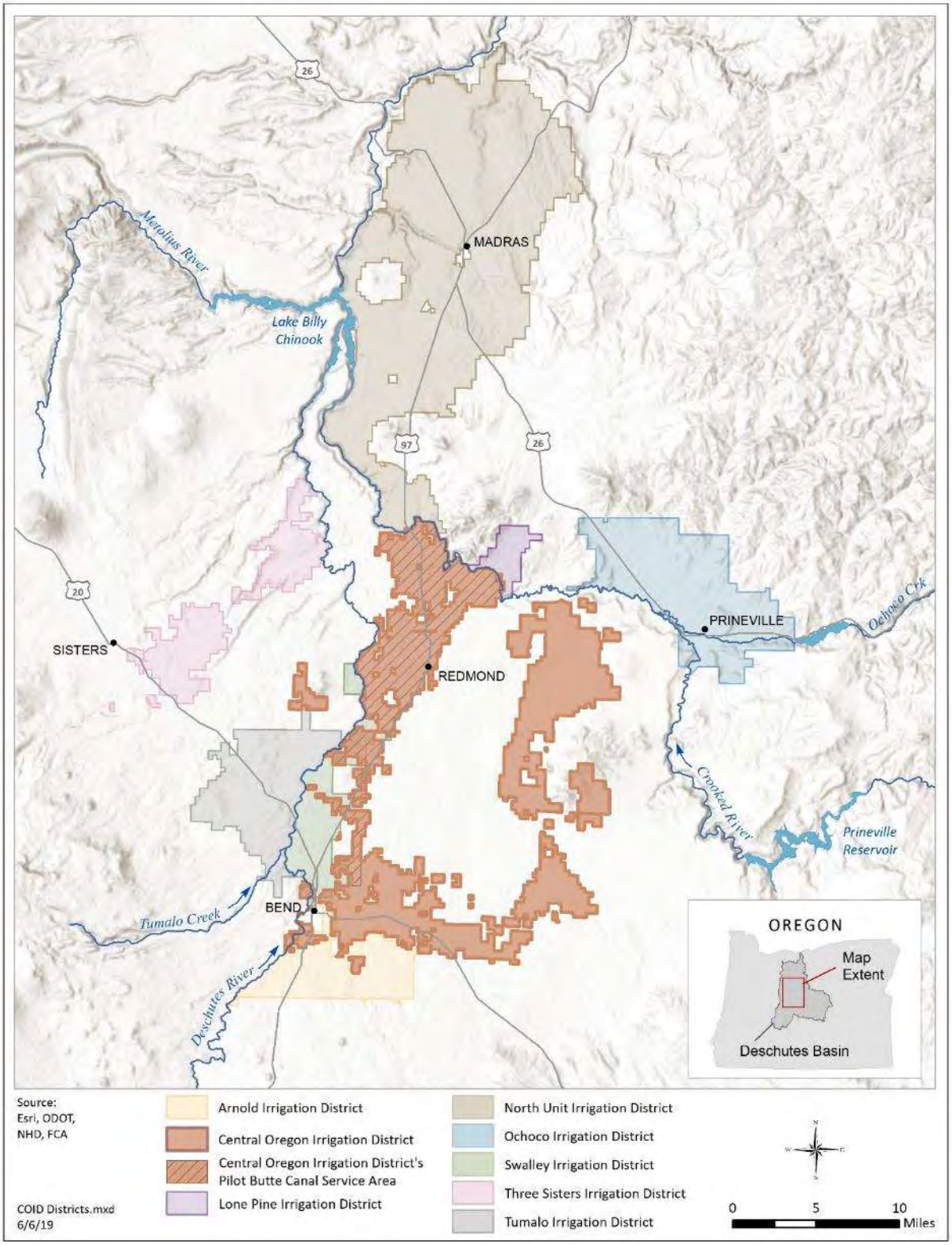


**Figure C-1. Irrigation districts within the Deschutes Basin.**

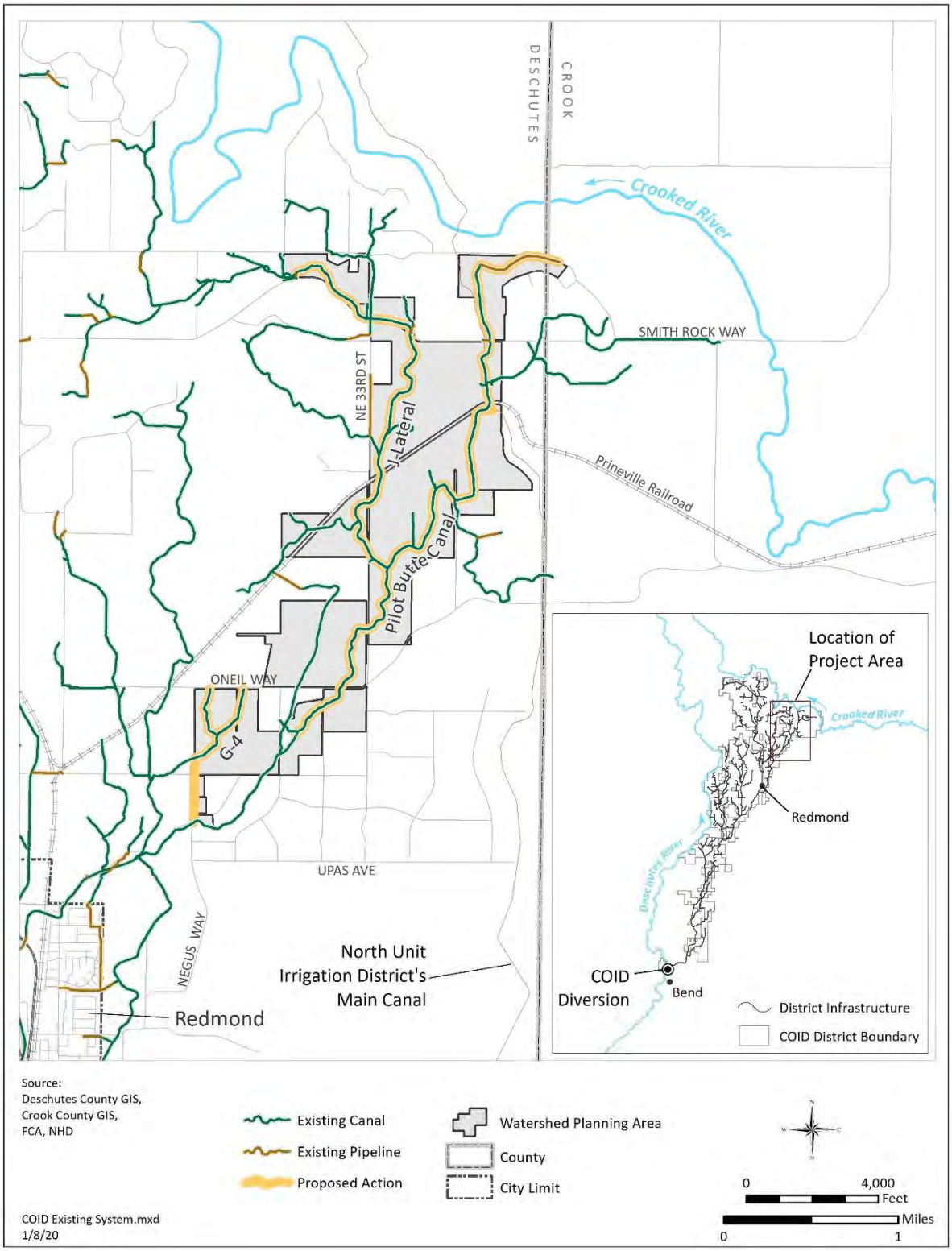


**Figure C-2. Central Oregon Irrigation District current infrastructure.**

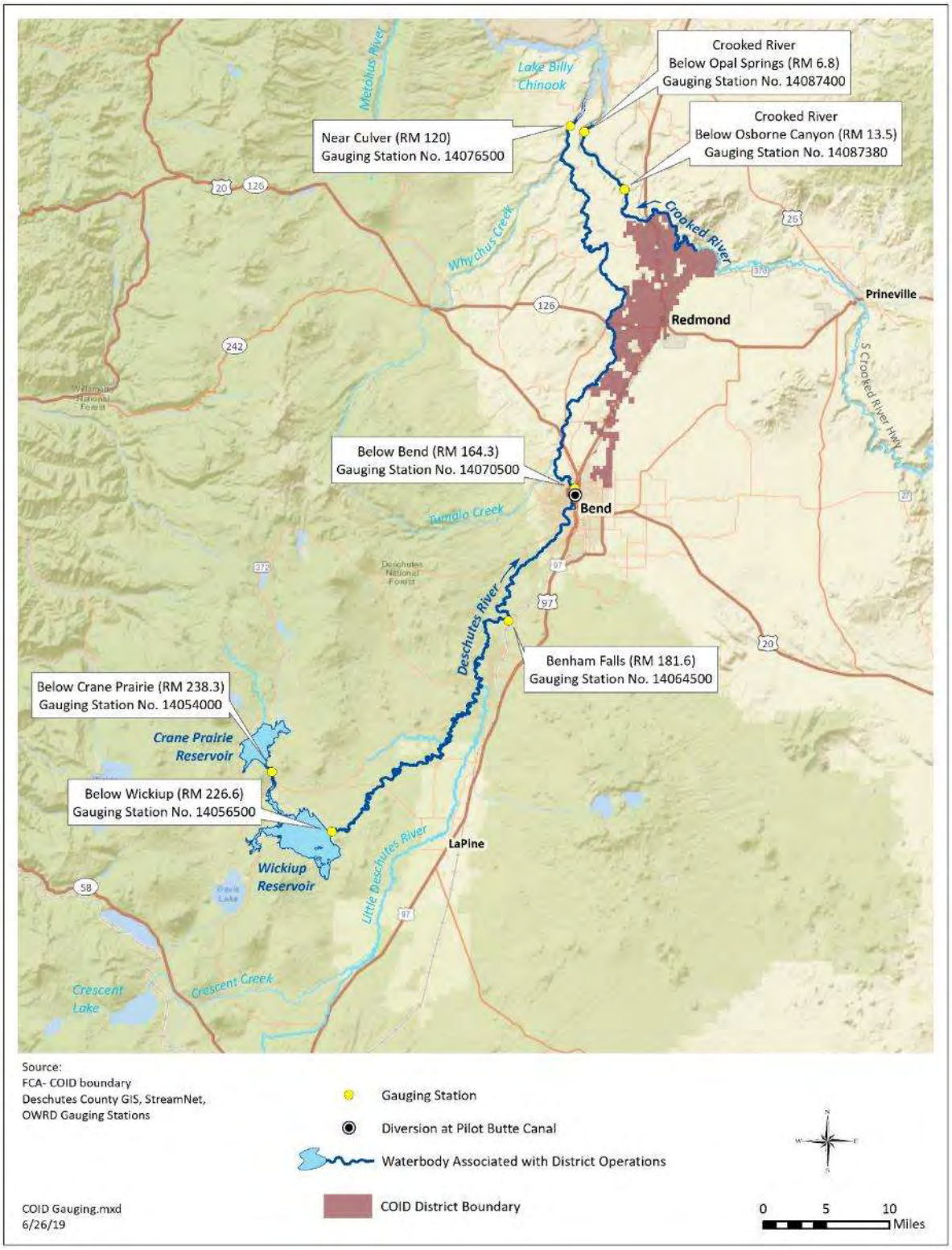


**Figure C-3. Waterbodies and gauging stations associated with District operations.**

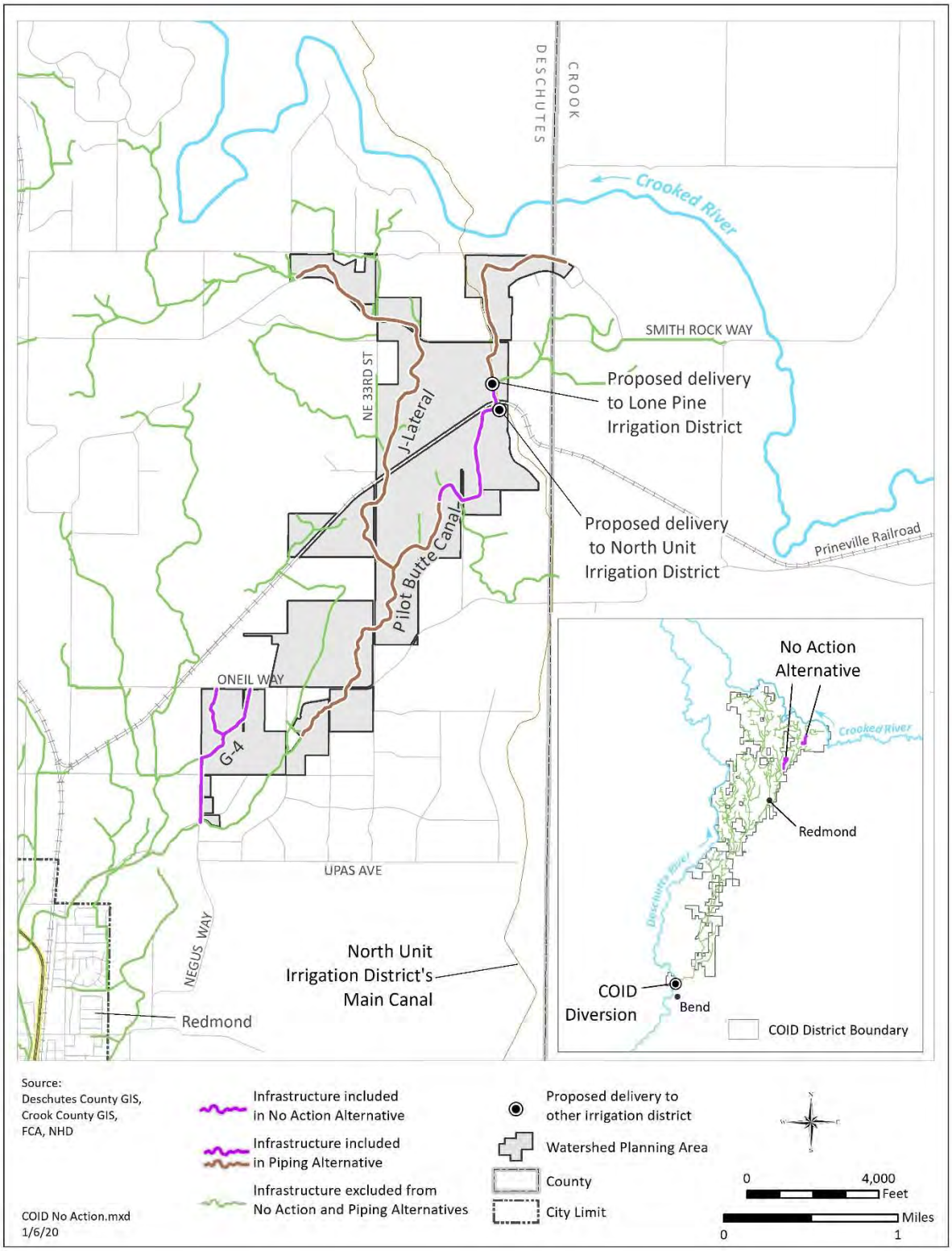


**Figure C-4. Central Oregon Irrigation District No Action Alternative.**

# Appendix D

Investigations and Analysis Reports

## D.1 National Economic Development Analysis

Highland Economics LLC

# National Economic Development Analysis

Barbara Wyse and Winston Oakley
12/27/2019

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## List of Tables

## List of Figures

# Introduction

This appendix outlines the costs and benefits of the Piping Alternative and the No Action Alternative. The Piping Alternative represents the future with federal funding through PL 83-566. The No Action Alternative represents the future if the District does not receive federal funding through PL 83-566. Because the District plans to pipe some of its irrigation canals, even in the absence of federal funding through PL 83-566, the No Action Alternative includes benefits and costs that differ from the current (referred to as Baseline) conditions. Therefore, this National Economic Development (NED) analysis is divided into three sections. The first section focuses on the Piping Alternative and how costs and benefits change from current Baseline conditions. The second section discusses the costs and benefits under the No Action Alternative, compared to the Baseline conditions. The third section presents the analysis of the benefits and costs of the Piping Alternative over the No Action Alternative.

# 1 Piping Alternative

## 1.1 Costs of the Piping Alternative

This section evaluates the costs and benefits of the Piping Alternative over the Baseline conditions. The analysis uses NRCS guidelines for evaluating NED benefits as outlined in the NRCS Natural Resources Economics Handbook and the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies.

All economic benefits and costs are provided in 2019 dollars and have been discounted and amortized to average annualized values using the 2019 federal water resources planning rate of 2.75 percent.

### 1.1.1 Analysis Parameters

This section describes the general parameters of the analysis, including funding sources and interest rates, the evaluation unit, the project implementation timeline, the period of analysis, and the project purpose.

#### 1.1.1.1 Funding

PL 83-566 funds would cover $29,003,000 or 69% of the project cost. COID would be required to fund $13,303,000 or 31% of the project. COID would cover their funding through a combination of sources including grants, partnerships, and loans. COID would be pursuing loan funding through the Oregon Department of Environmental Quality's Clean Water State Revolving Fund. COID expects that funding from this source would be at an interest rate of 2.5 percent with a 0.5 percent annual fee paid on the remaining loan balance. These financing costs are not included in the NED analysis. All funding sources other than PL 83-566 are from non-federal funds.

#### 1.1.1.2 Evaluation Unit

The proposed project is grouped into two project groups. Each of the project groups could be completed as stand-alone projects and have a positive net benefit. As such, the project group is defined as the evaluation unit. Note that for the incremental analysis, costs for constructing any given project group would not change if it were the only project group to be constructed.

#### 1.1.1.3 Project Implementation Timeline

Based on conversations with the District manager and staff, if PL 83-566 funds are made available, it is likely that construction would be completed over approximately four years, with approximately one project group constructed every two years. For all project groups, the analysis assumes that full benefits would be realized the year after construction is completed (i.e., for Project Group 1, which is completed in Construction Year 1, full benefits are realized in Year 2). The analysis also assumes that project groups are completed in numeric order (i.e., Project Group 1 is completed first, followed by Project Group 2). Table A summarizes the approximate construction timeline and the breakdown of funding for construction.

**Table A. Construction Timeline and Installation Costs by Funding Source for the Piping Alternative, Deschutes Watershed, Oregon, 2019$[1].**

| Construction Year | Works of Improvement | Public Law 83-566 Funds | Other, Non-Federal Funds | Total Construction Costs |
|---|---|---|---|---|
| 0 | Project Group 1 | $28,481,000 | $10,207,000 | $38,688,000 |
| 2 | Project Group 2 | $522,000 | $3,096,000 | $3,618,000 |
| **Total Project** | | **$29,003,000** | **$13,303,000** | **$42,306,000** |

[1/] Price Base: 2019 dollars. Prepared December 2019

#### 1.1.1.4 Analysis Period

The analysis period for each project group is defined as 102 years since the installation period is two years for each project group and 100 years is the expected project life of buried HDPE pipe. Across the two project groups, the analysis period is 104 years (Year 0 to Year 103). Construction and installation of Project Group 1 is assumed to occur in Year 0 with project life from Year 2 through Year 101, and Project Group 2 would have a project life from Year 4 through Year 103. While over half of the total project length would be piped using HDPE pipe, the remaining project length, consisting of large diameter pipe, would be piped with fiberglass-reinforced, steel, or HDPE pipe. Steel and fiberglass pipe can have a useful life of less than 100 years. The potential costs to replace large diameter pipe, depending on what material would be chosen, are described in Section 1.1.4.3.

#### 1.1.1.5 Project Purpose

The purpose of the project as identified in the Plan-EA is to improve water conservation, water delivery reliability, and public safety on up to approximately 7.9 miles of District-owned canals and laterals. The project is multipurpose, that is, it provides multiple benefits. Because no project cost items serve a single purpose separately, this analysis does not allocate costs or benefits by purpose.

### 1.1.2 Proposed Project Costs

Table 8-1 (NWPM 506.11, Economic Table 1) and Table 8-2 (NWPM 506.12, Economic Table 2) in Section 8 of the Plan-EA summarize installation costs, distribution of costs, and total annual average costs for the Piping Alternative. Table B below summarizes the annualized costs over the Baseline. Table C and Table D present other direct costs associated with piping. The subsections provide details on the derivation of the values in the tables.

Average annual costs include those associated with installation and other direct costs. There are three primary types of other direct costs: increased pumping costs from increased depth to groundwater due to reduced recharge; the costs to replace large diameter piping; and the potential reduction in aesthetic values to area residents due to the removal of canals. Of these, only the aesthetic costs are not quantified in this analysis due to a lack of available quantitative information. Based on COID's past experience of piping irrigation canals, the District expects cost savings, not cost increases, for infrastructure maintenance, repair, and replacement of the Piping Alternative (Clark, 2018).

Two categories, energy use and carbon emissions, are counted as a cost or benefit depending on whether their values increase or decrease as a result of the Piping Alternative. For example, because the Piping Alternative is expected to increase costs associated with carbon emissions, carbon emissions are considered another direct cost in this section.

**Table B. Estimated Average Annual Costs for Piping Alternative above the Baseline, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Project Outlays (Amortization of Installation Cost) | Other Direct Costs [2] | Total |
|---|---|---|---|
| Project Group 1 | $1,124,000 | $127,000 | $1,251,000 |
| Project Group 2 | $100,000 | $1,000 | $101,000 |
| **Total** | **$1,224,000** | **$128,000** | **$1,352,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

1/Price base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

2/Other direct costs include the uncompensated economic losses due to changes in resource use or associated with installation, operation, or replacement of project structures. Other direct costs are presented for fiberglass pipe replacement and increased pumping costs elsewhere in the basin from reduced groundwater recharge (i.e., seepage from unlined canals). This does not include operations, maintenance, and repair costs because these decline under the Piping Alternative, so these are presented as a benefit. Because carbon emissions in Project Group 1 increase under the Piping Alternative, the cost of carbon emissions is included as another direct cost for Project Group 1 (carbon emissions do not substantially change for Project Group 2).

### 1.1.3 Project Installation Costs

According to estimates by Black Rock Consulting, Inc. and KPFF Consulting Engineers,[1] the cost of piping and associated turnouts is projected to be approximately $37,591,000. See Appendix D.5 for detailed cost derivation by pipe size, cost category, etc. All values in this analysis are presented in 2019-dollar values and rounded to the nearest $1,000.

Adding three percent for project administration from COID and NRCS, between six and eight percent for technical assistance from NRCS,[2] and permitting costs, the total cost for the Piping

[1] Project costs for Project Group 1 were provided by Black Rock Consulting, Inc. and project costs for Project Group 2 were provided by KPFF Consulting Engineers.

[2] Six percent technical assistance was applied to Project Group 1 and eight percent was applied to Project Group 2.

Alternative is estimated at $42,306,000. The average annual cost by project group is shown in Table B with total average annual costs of $1,352,000 for the Piping Alternative (assuming piping projects are completed in the order shown in Table D).

### 1.1.4 Other Direct Costs

#### 1.1.4.1 Groundwater Recharge Costs

Water seepage from canals is one source of recharge for groundwater in the Deschutes Basin. Reduced recharge from canals may lead to groundwater declines, and thereby increase pumping costs for all groundwater users in the basin. This section estimates this potential cost of the project. A 2013 study by the U.S. Geological Survey estimated the effects on groundwater recharge of changes in climate (reduced precipitation), groundwater pumping, and canal lining and piping. The study used data from the period 1997 to 2008 (Gannett & Lite, 2013).

The study indicated that since the mid-1990s, groundwater levels have dropped by approximately 5 to 14 feet in the central part of the Deschutes Basin that extends north from near Benham Falls to Lower Bridge, and east from Sisters to the community of Powell Butte. It also found that approximately 10 percent of this decline in groundwater level is due to canal lining and piping during this period, or approximately 0.5 to 1.4 feet. This was modeled as the result of reducing the recharge from irrigation canal leakage by 58,000 acre-feet annually. This NED analysis uses this data to first estimate the effect of reduced irrigation canal seepage on groundwater levels from the Piping Alternative. The analysis then uses these data to roughly approximate the change in the cost of pumping for all groundwater users in the Deschutes Basin due to the Piping Alternative.

Assuming a uniform increase in canal lining/piping over this timeframe, in 1997 the decreased canal seepage was 4,833 acre-feet; rising each year by another 4,833 acre-feet until the reduced canal seepage in 2008 was 58,000 acre-feet. Cumulatively, this represents 377,000 acre-feet of reduced recharge from canals during this period. The USGS study found that this level of reduced recharge caused an overall groundwater decline in the central basin of 0.5 to 1.4 feet. These data suggest that the average relationship between canal recharge and groundwater levels in this part of the basin is approximately 1 foot of groundwater elevation drop per 377,000 acre-feet of reduced canal recharge, though local effects may vary widely.

The Piping Alternative would reduce canal seepage, and associated groundwater recharge, by up to approximately 10,281 acre-feet annually in this part of the Deschutes Basin, once all project groups are complete.[3] On average, for this part of the central basin, this translates into a decreased groundwater elevation of approximately 0.027 feet annually (based on information presented above that a one-foot groundwater elevation drop is expected to result from reduced recharge of 377,000 acre-feet, so the corresponding drop from 10,281 acre-feet is 0.027 foot since 10,281 acre-feet divided by 377,000 acre-feet is 0.027). An important caveat is that localized effects of the Piping Alternative on groundwater would differ throughout the central basin. Over the course of approximately 100 years, this annual drop results in a cumulative decreased average groundwater elevation in the central basin of 2.72 feet (note that this drop in pumping elevation would have small

[3] The decrease in groundwater recharge includes the loss of canal seepage from the piping of COID's system as well as the loss of seepage from North Unit Irrigation District's (NUID) Main Canal (North Unit would proportionally decrease the water passed through their Main Canal relative to the water that is saved and passed to them through COID).

effects on pumping costs, but would not be expected to result in the need to drill deeper wells or replace pumps at a faster rate).

This analysis combines the decreased groundwater elevation for each year in the 100-year analysis period with the estimated volume of groundwater pumping in the central Deschutes Basin to estimate the total increased cost of groundwater pumping in the basin over time. The USGS report identified approximately 25,000 acre-feet per year of groundwater pumping for public supply and about 25,000 acre-feet per year of groundwater pumping for irrigation use. A 2017 study by GSI Water Solutions, Inc. on future groundwater use indicated that demand for irrigation groundwater in the basin would increase by 2,643 acre-feet from 2016 to 2035, and by a further 1,728 acre-feet between 2036 and 2065 (Sussman, McMurtrey, & Grigsby, 2017).[4] The same study found that demand for public supply groundwater use would increase by approximately 10,590 acre-feet from 2016 to 2035 and by a further 6,438 between 2036 and 2065.[5] We adopt these projections to model the amount of groundwater pumping in the Deschutes Basin in future years, assuming that growth happens linearly during the time periods. We further assume that growth in pumping after 2065 would occur at the same rate as from 2036 to 2065. Given these assumptions, total groundwater pumping over 104 years may rise to over 87,000 acre-feet annually (with about 33,000 acre-feet going to irrigation and roughly 55,000 acre-feet dedicated to the public water supply).

In terms of power rates, according to the 2010 *Water System Master Plan Update Optimization Study*, most of the City of Bend's 25 groundwater wells fall under Pacific Power's Rate Schedule 28, while three wells fall under Rate Schedule 30 (Optimatics, 2010). The current marginal cost for the City to pump groundwater is expected to be approximately $0.0601 per kilowatt-hour (kWh) under Schedule 28 (Pacific Power, 2019). Farmers who use electricity to irrigate fall under Central Electric Cooperative's Schedule C, which charges a rate of $0.0512 per kWh; this analysis assumes this rate is the marginal cost to farmers for pumping groundwater.

Even without the Piping Alternative, groundwater levels would still decline. The USGS study noted that groundwater levels in the area between Clines Butte and Redmond (the closest area in the study to the proposed project) fell approximately 12 to 14 feet from 1994 to 2008 from a combination of climate, increases in groundwater pumping, and reduced groundwater recharge from canal lining (Gannett & Lite, 2013). This is an average drop of roughly 1 foot per year, which we assume would continue in absence of the Piping Alternative. Data from the Oregon Department of Water Resources indicate that depths to groundwater vary widely within the area; depths in Bend are around 740 feet, while depths near Redmond are about 265 feet (Oregon Department of Water Resources, 2016). Under Baseline conditions, we assume a current average groundwater pumping depth in the central Deschutes Basin of 500 feet; assuming a 1-foot drop in groundwater depth each year over 100 years, groundwater depths would be approximately 600 feet. Over the course of 100

[4] This estimate combines the use categories of irrigation, agriculture, and nurseries. The projected demand from 2036-2065 was based on municipal demand of 300 gallons per capita per day. In a previous version of the analysis, we used a different study to project future groundwater use in the Deschutes Basin. This study found that public groundwater use may increase by an average of 2.5 percent annually (the report projected an increase of consumptive groundwater use from 35,895 to 58,594 over the 20-year period from 2005 to 2025) (Newton Consultants, 2006). Because this study was more than 10 years old, and because the study from GSI Water Solutions was written in the last two years, we chose to update the analysis to incorporate the more recent estimates.

[5] This estimate combines the use categories of municipal, domestic, commercial, storage, and industrial. The projected demand from 2036- 2065 was based on municipal demand of 300 gallons per capita per day.

years, the Piping Alternative would result in a pumping depth of approximately 603.0 feet, or an increased depth to groundwater of 3.0 feet compared to Baseline conditions.

Applying the electricity prices, assuming a pump irrigation efficiency of 70 percent,[6] and using the volume of pumping and pumping depths shown in Table C, the total cost of groundwater pumping under Baseline conditions is projected to grow from around $2.2 million in Year 1 to $4.4 million in Year 103.

**Table C. Approximate Depth to Groundwater in Central Deschutes Basin, Deschutes Watershed, Oregon.**

| Year | Volume Pumped (acre-feet per year) | Average Depth to Groundwater (feet) | |
|---|---|---|---|
| | | Baseline Conditions | Piping Alternative (NED Alternative) |
| 1 | 54,000 | 501 | 501.0 |
| 10 | 60,000 | 510 | 510.3 |
| 20 | 65,000 | 520 | 520.6 |
| 30 | 67,000 | 530 | 530.9 |
| 40 | 70,000 | 540 | 541.2 |
| 50 | 73,000 | 550 | 551.5 |
| 60 | 75,000 | 560 | 561.8 |
| 70 | 78,000 | 570 | 572.1 |
| 80 | 81,000 | 580 | 582.4 |
| 90 | 84,000 | 590 | 592.7 |
| 100 | 86,000 | 600 | 603.0 |

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The increased depth to groundwater due to reduced recharge results in higher pumping costs in the Piping Alternative. The increased cost to groundwater pumpers over the 100-year-analysis period rises each year as the cumulative effect of reduced recharge may cause the groundwater elevation to continue to decline. For example, as a result of reduced recharge due to the installation of Project Group 1, the groundwater elevation may decline 0.024 feet in Year 2, rising up to a 2.4-foot decline by Year 100 (0.024 multiplied by 100), with associated costs rising from approximately $105 to $17,000. In total, after discounting and amortizing these costs across all project groups, the estimated total annual average cost across 104 years is $5,000 per year for the Piping Alternative (see Table D).

[6] As assumed in the Central Oregon Irrigation District On-Farm Water Conservation Report completed by Black Rock Consulting, Inc. and Farmers Conservation Alliance in 2018.

**Table D. Other Direct Costs of Reduced Recharge under Piping Alternative, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Water Conservation (cfs) | Water Conservation (acre-feet/year) | Change in Groundwater Depth (feet/year) | Annual Average Cost |
|---|---|---|---|---|
| Project Group 1 | 27.91 | 8,907 | 0.024 | $4,000 |
| Project Group 2 | 4.31 | 1,374 | 0.004 | $1,000 |
| **Total** | **32.2** | **10,281** | **0.027** | **$5,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

#### 1.1.4.2 Booster Pump Costs

In order to pressurize the piped conveyance system on the G-4 Lateral (included in Project Group 1), the District plans to install a booster pump station as part of the Piping Alternative. This station would require additional energy, estimated at 193,285 kWh per year (Alliance, 2019). The pump station would provide pressure to all the patrons served by the G-4 Lateral. The cost of the energy use was valued based on Central Electric Cooperative's tariff under Schedule C (Agricultural Irrigation), which is $0.0512 per kWh.

In addition to the marginal cost of electricity, Central Electric Cooperative imposes a demand charge and a facilities charge. Assuming a 60-hp pump requiring a 45-kW connection for seven months out of the year, these charges would total approximately $3,000 annually. The booster pump is expected to have a useful life of 25 years, after which it would need to be replaced at a cost of approximately $50,000 (the cost of the initial pump installation). Accordingly, we model the pump's replacement three times during the study period (Years 27, 52, and 77). When the $50,000-replacement cost in each of these years is discounted and amortized, the total annual NED replacement cost is approximately $1,000. Following a 2016 NRCS publication, we estimate that annual maintenance costs on the pump are around 1 percent of its purchase price, or in this case, around $500 per year (Natural Resources Conservation Services, 2016). Table E. outlines the energy costs for the pump station by Project Group as well as the expected operation, maintenance, and replacement (OMR) costs. When discounted and amortized, the total costs of the booster pump station are roughly $14,000 per year.

**Table E. Annual Booster Pump Costs of Piping Alternative by Project Group, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Total Annual Booster Pump Energy Demands (kWh) | Undiscounted Annual Booster Pump Energy Costs Under Piping (kWh) | Undiscounted Annual Booster Pump O&M Costs Under Piping (kWh) | Discounted and Amortized Annual Cost of Booster Pump Replacement | Average Annual NED Cost for Booster Pump (Discounted and Amortized) |
|---|---|---|---|---|---|
| Project Group 1 | 193,285 | $10,000 | $4,000 | $1,000 | $14,000 |
| Project Group 2 | 0 | $0 | $0 | $0 | $0 |
| **Total** | **193,285** | **$10,000** | **$4,000** | **$1,000** | **$14,000** |

[1]/ Price base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent. Prepared December 2019

### 1.1.4.3 Pipe Replacement

The Piping Alternative would require large diameter pipe (102 and 108 inches) for approximately 34 percent of the project length, totaling approximately 2.7 miles of pipe. The material for this large diameter pipe is still being decided (see Section 5.3.2 in the Plan-EA for further discussion). Unlike the HDPE pipe used for the smaller diameter pipes, this large diameter pipe, depending on the material selected, may potentially have a shorter lifespan. The materials being considered, such as fiberglass pipe or steel pipe, conservatively have an expected life of 50 years, and so if these materials were selected the pipe would have to be replaced during the period of this analysis (Crew, Black Rock Consulting, 2018). Experts estimate that around 25 percent of the total pipe would need to be replaced in Year 50 and the remaining 75 percent would need to be replaced in Year 75 (Crew, Black Rock Consulting, 2018). We assume that these costs are incurred 50 years after the construction of each project group and the cost to replace the pipe is the same as the cost to install it.[7] Table F shows the costs of replacing pipe under the Piping Alternative.

**Table F. Other Direct Costs of Large Diameter Pipe Replacement under the Piping Alternative, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Feet of Large Diameter Pipe Replaced | Total Cost | Annual Average NED Cost |
|---|---|---|---|
| Project Group 1 | 14,300 | $23,792,000 | $108,000 |
| Project Group 2 | 0 | $0 | $0 |
| **Total** | **14,300** | **$23,792,000** | **$108,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

### 1.1.4.4 Carbon Costs

Changes in energy use also produce changes in carbon dioxide emissions from power generation. Every MWh of reduced on-farm energy use is estimated to translate into an estimated reduction of

[7] The costs of large diameter pipe were estimated based on 30% engineering design by KPFF Consulting Engineers and costed based on material quotes provided in September 2019.

0.7521 metric tons (Mt) of carbon emissions, and the same amount of emissions is added for each MWh of increased energy use.[8] The Piping Alternative would decrease some carbon emissions (from eliminating some pumping energy use in the District) and increase other emissions (by increasing basin-wide pumping as a result of lower groundwater levels). Accordingly, compared to Baseline conditions, the annual energy savings would reduce $CO_2$ emissions by approximately 79 Mt (approximately 106 MWh multiplied by 0.7521), while energy use increases associated with lower groundwater levels and power for a new booster would increase emissions, leading to a net annual increase of 184 Mt (see Table G). In Project Group 1, emissions increase steadily after completion, due mainly to the booster pump. In Project Group 2, there is a net decrease in emissions early on as pressurization eliminates emissions from electricity, and later there is a net increase when declining groundwater levels cause electricity demand (and associated emissions) to outweigh pressurization benefits.

**Table G. Annual Average Carbon Emissions (Mt) by Project Group, Deschutes Watershed, Oregon.**

| Works of Improvement | Baseline Conditions | | Piping Alternative (NED Alternative) | | |
|---|---|---|---|---|---|
| | Average Annual Carbon Emissions, Basin-wide Pumping | Annual Carbon Emissions, COID Patron Pumping | Average Annual Carbon Emissions, Basin-wide Pumping | Annual Carbon Emissions, COID Patron Pumping | Net Annual Carbon Increase (Compared to Baseline) |
| Project Group 1 | N/A | 156 | N/A | 314 | 185 |
| Project Group 2 | N/A | 58 | N/A | 57 | -1 |
| **Total** | **44,341** | **214** | **44,525** | **397** | **184** |

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Note: These values show an average annual increase over 104 years. Carbon emissions rise over time because groundwater pumping volume increases throughout the basin over time, and the depth to groundwater also rises over time due to reduced recharge from canals. N/A=Not applicable.

To value the reduced carbon emissions, this analysis uses an estimate of the social cost of carbon (SCC), which is the estimated total cost to society of emitting carbon related to the expected damages associated with future climate change. There are many estimates of the SCC, and the estimates vary based on what types of damages are included, the discount rate chosen, the geographic area under consideration (such as global damages versus U.S. domestic damages), and the projected level of global warming and associated damages. SCC damage values used by federal agencies have varied over the years.

At first, federal agencies developed and applied their own estimates. Then, the Office of Management and Budget convened an Interagency Working Group (IWG) on the Social Costs of

[8] This assumes that marginal changes in energy demand are met with fossil fuel-based production (renewable energy is typically used first and then fossil-fuel powered generation is used), such that 100 percent of energy use reduction and green energy production result in reduced fossil fuel powered generation. Furthermore, this estimate assumes 0.7521 metric tons of carbon emitted from 1 MWh of fossil-fuel powered electricity generation based on 1) the current proportion of fuel sources–oil, natural gas, and coal–for fossil-fuel powered electrical power generation in the West, and 2) the associated metric tons of $CO_2$ produced per MWh powered by each fossil fuel source, as reported by the Energy Information Administration.

Greenhouse Gases, which developed a set of SCC estimates that could be used across federal agencies. In the year 2020 (the closest estimate available for the current year), the IWG estimate for SCC was estimated to be approximately $51.20 per Mt (2019 dollars) (Interagency Working Group on Social Cost of Greenhouse Gases, 2013).[9] However, in 2017, Executive Order 13783 disbanded the IWG, indicated that IWG estimates were not representative of government policy, and removed the requirement for a harmonized federal policy for SCC estimates in regulatory analysis. Since this time, the Environmental Protection Agency (EPA) and other federal agencies have developed interim alternative estimates of the SCC, largely relying on the methodology used by the IWG, but using different discount rates and focusing on direct damages projected to occur within the borders of the United States. For example, the EPA developed interim SCC values for the *Regulatory Impact Analysis for the Repeal of the Clean Power Plan, and the Emission Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units* published in June of 2019 (Environmental Protection Agency, 2019). As these interim EPA SCC estimates are indicative of current federal agency policy on SCC applications for federal cost benefit analysis, they are employed in this analysis.

This analysis uses the EPA interim value of the SCC for 2020, based on a 3-percent discount rate, $7 per metric ton of carbon. We apply this value to the net change in carbon emissions each year throughout the project life to estimate the change in carbon emissions from the Piping Alternative. Because there is a net increase in carbon emissions, this represents a cost. As shown in Table H, when discounted and annualized, the value of net increase in carbon emissions is $1,000.

[9] We adjusted the original cost of $42 in 2007 dollars to 2019 dollars using the Consumer Price Index.

**Table H. Annual Increased Average Carbon Costs of Piping Alternative by Project Group, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Annual Avoided Emissions (Reduced COID Patron Energy Use, Mt Carbon) | Average Annual Increased Emissions (from Reduced Recharge and Booster Pump Power, Mt Carbon)[2] | Net Average Increased Emissions | Average Annual NED Costs (Social Cost of Carbon)[3] |
|---|---|---|---|---|
| Project Group 1 | 62 | 247 | 185 | $1,000 |
| Project Group 2 | 17 | 16 | -1 | $0 |
| **Total** | **79** | **263** | **184** | **$1,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

[2]/Additional energy use elsewhere rises through time as the effects of reduced recharge accumulate and cause groundwater depths to drop over time. Added to this increase is the estimated energy required to power the booster pump. The average annual energy use increase elsewhere in the basin represents the average change in energy use across the 100 project years for each project group.

[3]/Note that the average annual NED benefits differ from the change in tons of carbon emitted multiplied by the $7 value per Mt of carbon. The increased emissions rise through time (and are thus highest at later periods when the values are most discounted, while the decreased carbon emissions are the same through time).

#### 1.1.4.5 Change in Aesthetics and Associated Property/Recreation Values

The project is located in a rural area with only a limited number of residents that have a direct view of the canal from their house. A potential direct cost is that some local residents may experience adverse effects on property values and quality of life due to the change in aesthetics from piping the canals (as many people enjoy the aesthetics of the open canals). According to real estate agents in the area, many people interested in purchasing property in the area are willing to pay more for properties that have a view of a canal. On the other hand, some property owners or potential property owners may not want to have a canal adjacent to their property because of the safety hazard an open canal poses, potentially limiting the effect on property values.

The potential aesthetic cost to residential landowners is not quantified due to a lack of available data. Interviewed real estate agents were not able to quantify the potential effect of a view of the canal. Furthermore, quantification is difficult due to scarce information in the economic literature. While the economic value of many natural views has been studied (such as for ocean front property, or other scenic natural areas), the value of irrigation canals has been studied little, if at all. As such, while this effect is recognized as a likely cost,[10] this analysis does not quantify the potential change in

[10] Note that increased agricultural production value, due to a more reliable water supply to COID patrons, may tend to increase property values (all else equal), which could offset the effect on property values. The value of increased water supply reliability is quantified and captured below in the discussion on the benefits of increased agricultural production value. While the aesthetic value and the agricultural production value are not necessarily similar in magnitude, the population affected (patrons of COID) is largely the same (there may be some residents in the area who benefit from canal views who are not patrons of COID).

aesthetic values of the proposed project. There are no recreational opportunities in the project area, therefore, there would be no effect to recreation values.

## 1.2 Benefits of the Piping Alternative

Table I compares the project benefits (over Baseline conditions)[11] to the annual average project costs presented in Table B. The remainder of this section provides details on these project benefits. As the No Action differs from the Baseline (under the No Action COID would pipe 2.3 miles over four years), Section 2.2 presents the benefits of the No Action Alternative, while Section 3.2 identifies the NED benefits of the Piping Alternative over and above the No Action Alternative.

Table I presents on-site damage reduction benefits that would accrue to agriculture and the local rural community, including reduced power costs. Table I also presents off-site quantified benefits, which includes the value of reduced carbon emissions and the value of enhanced fish and wildlife habitat. Other benefits not included in the analysis, which may result indirectly from the Piping Alternative, include increased agricultural yields and the potential for increased on-farm investments in irrigation efficiency (as patrons have more funds due to increased yields and reduced pumping costs).

The analysis recognizes that instream flows may affect recreation, both in-river and adjacent land-based recreation. However, aside from positive impacts on fish and wildlife-related recreation (both fishing and wildlife viewing) from improved species populations, it is not clear how recreation may be affected. Numerous interviews with recreation planners and recreation-industry professionals in the area indicate that effects on boating and in-water recreation of enhanced instream flows resulting from the Piping Alternative may be both positive and adverse (depending on flow timing and magnitude), with no indication of whether there may be net benefits or net costs to recreation (Tamashiro, 2017; Smith, 2017; Houle, 2017; Krein, 2017; Renton, 2017; Brown, 2017). As such, this analysis assumes no net impact on recreation.

[11] The Baseline conditions represent the current state of energy use, O&M, etc. within COID.

**Table I. Comparison of Average Annual NED Benefits and Costs of the Piping Alternative Compared to Baseline Conditions, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Agriculture-Related | | | Non-Agricultural | | Average Annual Benefits | Average Annual Cost [2] | Benefit–Cost Ratio |
|---|---|---|---|---|---|---|---|---|
| | Reduced O&M | Pumping Cost Savings | NUID Ag Benefits | Instream Flow Value | Oregon Spotted Frog | | | |
| Project Group 1 | $3,000 | $16,000 | $335,000 | $594,000 | $533,000 | $1,481,000 | $1,251,000 | 1.18 |
| Project Group 2 | $1,000 | $1,000 | $49,000 | $87,000 | $77,000 | $215,000 | $101,000 | 2.13 |
| **Total** | **$4,000** | **$17,000** | **$384,000** | **$681,000** | **$610,000** | **$1,696,000** | **$1,352,000** | **1.25** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

[2]/From Table B

### 1.2.1 Benefits Considered and Included in Analysis

#### 1.2.1.1 Agricultural Damage Reduction Benefit

Under the Piping Alternative, North Unit Irrigation District (NUID) would gain an estimated 888 acre-feet of water annually due to reduced seepage losses in the North Unit Main Canal, resulting from a change in diversion associated with the COID piping project (See Section 6.9 in the Plan-EA for further information) (Farmers Conservation Alliance, 2019). The increase in water available to NUID is expected to reduce the agricultural damages associated with water shortages experienced currently in NUID.

NUID has historically experienced water shortages, during which water supply is less than total water demand in the district (Britton, 2019). Since the adoption of the 2016 Settlement Agreement, which includes provisions for irrigation districts in Central Oregon to increase instream flows to support the Oregon Spotted Frog (which reduces water availability for irrigation), water supply reliability to NUID irrigators has been further decreased. While there have been just a few years since the Settlement Agreement, and water year type and market conditions also affect acreage planted in any given year, Figure A shows that the average fallowed acreage in NUID increased from the 2009-2015 period to the 2016-2018 period.

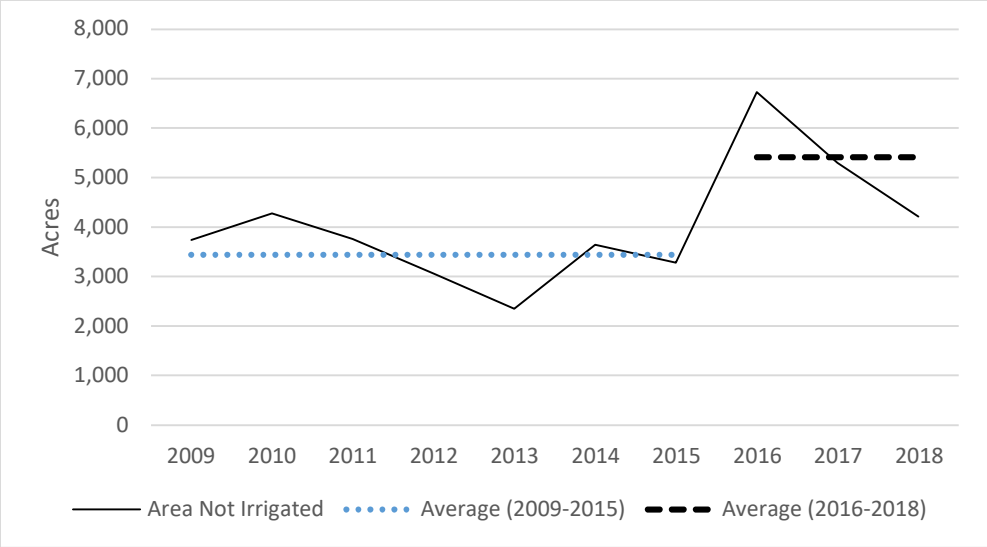


**Figure A: North Unit Irrigation District agricultural area not irrigated[12].**

Based on these data, this analysis assumes that the 888 acre-feet of additional water made available to NUID would reduce the agricultural damages arising from water supply shortages in NUID. To estimate the value of reduced damages, we used published Oregon State University and Washington State University crop budgets to estimate the net revenues of agricultural production in NUID from two key crops: alfalfa hay and carrot seed. Alfalfa hay represents all hay/grain crops, while carrot seed represents all specialty crops (including peppermint, grass seed, vegetables, and nursery crops). These crop budgets are provided in Section 4.1 of the NED, with detailed explanation of the methods used to update revenues and costs to 2019-dollar values. We assume that all types of crops would benefit from increased water supplies from the Piping Alternative that are reliable in every type of water year,

[12] Source: North Unit Crop Mix Acreage, 2009 to 2018, Electronic document sent to Winston Oakley, Economist, Highland Economics from Mylen Bohle, Oregon State University Extension, on November 11, 2018.

as farmers in NUID are concerned about the effect of long-term reduced water supply availability on their ability to maintain all types of acreage, including specialty crop acreage (Harris, 2019). The water provided by the Piping Alternative would be available in every type of water year, and water of this type would influence long-term, overall cropping pattern decisions.

Results from the net return analysis in Section 4.1 indicate that alfalfa hay provides an annualized average net return of about $160 per acre per year, while carrot seed provides roughly $2,680 per acre per year. Based on crop water use requirements from the Bureau of Reclamation Madras Agrimet Weather Station (AgriMet, 2019), alfalfa requires about 3 acre-feet of water per acre and carrot seed requires 1 acre-foot per acre. Thus, the net returns to water applied to alfalfa are about $53 per acre-foot ($160 per acre divided by 3 acre-feet of water use per acre) and the net returns for water applied to carrot seed are around $2,680 per acre-foot. Combining data on historic cropping pattern in NUID and water use by crop type from the Madras Agrimet Station indicates that alfalfa/grain crops typically use about 85 percent of the water in NUID, while specialty crops use about 15 percent of the water. Applying these water use percentages to the value per acre-foot for each crop type results in a weighted average value of $447 per acre-foot of water.[13] We use this amount to estimate the damage-avoidance benefit of each acre-foot of water going to NUID under the Piping Alternative.

Under the Piping Alternative, approximately 888 acre-feet of water would be passed to NUID each year. This volume of water valued at $447 per acre-foot results in a total annual agricultural damage reduction value of about $397,000. When discounted and annualized, the value of the Piping Alternative in avoiding agricultural damages in NUID totals $384,000 (as shown in Table J).

**Table J. Avoided Damages to NUID Agriculture Resulting from Piping Alternative by Project Group, Deschutes Watershed, Oregon, 2019$ [1].**

| Project Group | Water Conservation Under Piping Alternative (acre-feet/year) | Undiscounted Annual Benefits of Additional Instream Flow | Annualized Average Net Benefits of Piping Alternative above Baseline |
|---|---|---|---|
| Project Group 1 | 770 | $344,000 | $335,000 |
| Project Group 2 | 118 | $53,000 | $49,000 |
| **Total** | **888** | **$397,000** | **$384,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

#### 1.2.1.2 District Operations and Maintenance Cost Savings Benefit

From 2013 to 2017, annual operation and maintenance (O&M) costs for COID averaged roughly $1.65 million per year, which includes maintenance of equipment, buildings, and irrigation systems; supplies; payroll expenses; and administrative expenses (Clark, 2018).[14] As the District maintains 475 miles of canals, the O&M costs average roughly $3,477 per mile. It is expected that these costs would continue in the future under Baseline conditions. The District expects O&M costs to fall by 15 percent for canals converted to pipe, or roughly $520 ($3,477 multiplied by 15 percent) (Clark, 2018). Implementing the Piping Alternative would result in approximately 7.9 miles of piped canals, which is expected to reduce costs by roughly $4,000 per year ($4,000 per year of discounted, annualized NED

[13] Specifically: $447/acre-foot = 85% X $53/acre-foot + 15% X $2,680/acre-foot.

[14] The costs were adjusted for inflation from $1.60 million in 2017 dollars using the Consumer Price Index.

savings) as a result of reduced maintenance expenses (Table K). Although not quantified in this analysis, there are also additional benefits to Oregon Department of Transportation because of decreased maintenance and inspection of road crossings. Similarly, there would also be potential benefits and a decrease in operation and maintenance costs for NUID, due to the decrease in flow through their Main Canal (see Section 6.9.2.1 in the Plan-EA for more information). This benefit was also not quantified.

**Table K. Annual Reduced Operation and Maintenance Costs to COID of Piping Alternative by Project Group, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Mileage Piped | Undiscounted Annual O&M Cost Under Baseline Conditions | Undiscounted Annual O&M Costs Under Piping Alternative | Discounted Annualized Benefit (Cost Reduction) |
|---|---|---|---|---|
| Project Group 1 | 5.1 | $1,036,000 | $1,033,000 | $3,000 |
| Project Group 2 | 2.8 | $565,000 | $564,000 | $1,000 |
| **Total** | **7.9** | **$1,601,000** | **$1,597,000** | **$4,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

#### 1.2.1.3 Patron Irrigation Pumping Cost Savings

Compared to Baseline conditions, it is estimated that the system improvements associated with the Piping Alternative would result in a net energy savings of 105,523 kWh per year, since it is much more efficient for patrons to receive pressurized water than to pressurize it themselves.[15] This energy cost savings is evaluated using Central Electric Cooperative's Schedule C rate for irrigation pumping: $0.0512 per kWh (Central Electric Cooperative, Inc., 2019). Table L presents the energy use under Baseline conditions and displays the savings to COID patrons for each project group under the Piping Alternative. Once all project groups are complete, the average annual NED savings to COID patrons would be approximately $5,000 each year.

[15] This is a based on an FCA analysis of COID data on energy savings.

**Table L. Annual Increased Average Energy Cost Savings to COID Patrons of Piping Alternative by Project Group, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Annual Energy Use Under Baseline Conditions (kWh) | Annual Energy Use Under HDPE Piping Alternative (kWh) | Reduced Annual Energy Use (kWh)[2] | Undiscounted Annual Energy Cost Savings | Average Annual Discounted NED Benefits (Avoided Energy Costs) |
|---|---|---|---|---|---|
| Project Group 1 | 206,944 | 123,951 | 82,993 | $4,000 | $4,000 |
| Project Group 2 | 76,945 | 54,415 | 22,530 | $1,000 | $1,000 |
| **Total** | **283,889** | **178,366** | **105,523** | **$5,000** | **$5,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

[2]/As estimated by Farmers Conservation Alliance (Alliance, 2019)

Because the Piping Alternative would include the installation of a booster pump at the G-4 lateral, it would eliminate the need for District patrons on that lateral to maintain irrigation pumps. Of the estimated 12 pumps being used by COID patrons on the G-4 lateral, 12 are projected to be eliminated as a result of the Piping Alternative. Pumps incur annual maintenance costs, service charges from power providers, and require replacement at the end of their useful life. Avoiding these costs would represent a benefit to District patrons.

Under Schedule C, the Central Electric Cooperative charges $5.29 per KW per month and $32.30 per month from April to October (Central Electric Cooperative, Inc., 2019). For this analysis, we used an average pump size of 10 horsepower (hp), requiring a 7.5-kW power connection. At this size, service charges for power would cost approximately $504 per year. A 10-hp pump typically requires roughly $550 worth of repairs every four years, for an average annual maintenance cost of $138 (Mark, 2019; Scarborough, 2019). A 10-hp pump typically has a 10-year useful life and costs approximately $3,000 (Haun, 2019; Fey, 2019). Amortizing these replacement costs results in an annualized replacement cost of $347. Summing the service charges, maintenance costs, and annualized replacement costs results in a total estimated annual cost of $989 to own and operate an irrigation pump, which this analysis uses to estimate the annual benefit of each pump eliminated in the study area as a result of the Piping Alternative. The table below outlines these cost-saving benefits. When discounted and amortized, roughly $12,000 per year would be saved on pump operation, maintenance, and replacement (OMR) costs.

**Table M. Annual Estimated Cost Savings from Eliminated Irrigation Pumps under the Piping Alternative by Project Group, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Pumps Eliminated Under Piping Alternative | Undiscounted Annual OMR Costs Avoided by Piping Alternative | Average Annual NED Benefit (Avoided OMR Cost, Discounted and Amortized) |
|---|---|---|---|
| Project Group 1 | 12 | $12,000 | $12,000 |
| Project Group 2 | 0 | $0 | $0 |
| **Total** | **12** | **$12,000** | **$12,000** |

[1]/ Price base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent. Prepared December 2019

#### 1.2.1.4 Value of Conserved Water

The value of the conserved irrigation water can be looked at in two ways: the value of increased water instream or the value of maintaining irrigated agricultural production. This analysis focuses on the value of instream flow, as the conserved water from the Piping Alternative would be used to augment instream flows. However, this analysis also presents the value of water to agriculture as the Piping Alternative also enhances water supply reliability to the District.

This section provides several types of information on the value of instream flow. First, this analysis examines the value that environmental groups, federal agencies, and other funders of conservation have been willing to pay for water conservation projects that restore flow in the Deschutes Basin. While these values are in fact costs, rather than a measurement of benefit, the amounts paid in the past for water conservation projects to enhance instream flow represent the minimum value to the funding entities of conserved water projects (benefits as perceived by funding entities are expected to at least equal costs or funding would not be provided). Similarly, there is some limited water market data available for what environmental or governmental groups have paid to directly purchase water rights and dedicate the water to instream flow. These values also represent the cost of increasing instream flow, similar to the data on costs of water conservation projects and may significantly underestimate the full value of instream flow augmentation. Data on water right transactions in the Deschutes Basin were not available for this study. However, prices of water rights are often based on the value of water to agriculture (as agriculture is the most common seller of water rights for environmental or other water uses). We therefore present market information on the value of water rights to irrigators in COID, as this indicates the potential cost of purchasing water rights from these irrigators.

Based on the following discussion, we assume that the economic benefit of instream flow augmentation would be at least $75/acre-foot/year, such that this enhanced instream flow is estimated to have a value of approximately $704,000 per year once all project groups are complete under the Piping Alternative (because of the timing, on an average annualized basis the NED benefit is roughly $681,000 as presented in Table O). As most water right transactions for environmental purchases are to enhance fish habitat, this value is expected to be a conservative proxy for the value to the public of enhanced fish habitat and fish populations. The full measure of the economic benefit of enhanced instream flow is the benefit to the public of enhanced fish and wildlife populations, water quality, ecosystem function, etc. Based on the fact that instream flow purchases are typically

focused on fish habitat, we also include a separate value for other environmental benefits in the next section, notably Oregon Spotted Frog (OSF) habitat improvement.

Values published in the economic literature are often quite high for enhancements to trout and other fish and wildlife populations (see Table N), like those that would benefit from the instream flows provided by the Piping Alternative. As quantitative information on how instream flows would improve fish and wildlife populations is not available, the analysis is not able to directly measure the economic benefit of enhanced instream flow. As such, the value of conserved water is estimated in this section using the prices of water from transactions in the Western United States (the next section below also separately considers the value of preserving the threatened OSF). Transaction values from the Deschutes Basin itself are not used, as there are regulatory limitations on the amount paid for leased water and much of the water is temporarily leased and donated to instream flows, not reflecting the true instream flow value of the water. Table O shows the estimated average annual benefits of enhanced instream flow for the Piping Alternative.

**Table N. Studies and Values Used to Estimate the Value of Fish Enhancement.**

| Author(s) | Study Year | Original Value Per Household (Dollar Year) | Value Per Household Adjusted to 2019 dollars | Restoration Location | Fish Enhancement | Survey Respondents |
|---|---|---|---|---|---|---|
| Bell, Huppert, & Johnson | 2003 | $24 - $122 (2000$) | $36 - $179 | Coastal WA and OR | Annual willingness to pay (WTP) per household to increase local Coho salmon populations by 100% | Households in Grays Harbor, WA; Willapa Bay, WA; Coos Bay, OR; Tillamook Bay, OR; Yaquina Bay, OR |
| Olsen, Richards, & Scott | 1991 | $43 (2006$) | $54 | Columbia River Basin | Annual WTP per household to increase salmon and steelhead population by 100% | Pacific Northwest households that never fish |
| Loomis | 1996 | $59 - $73 (1994$) | $101 - $125 | Elwha River, Olympic Peninsula, WA | Annual WTP per household to restore a salmon and steelhead population in its historic habitat on the Elwha River | Households in Clallam County, WA; WA state; U.S. |
| Layton, Brown, & Plummer | 1999 | $119 - $250 (1998$) | $185 - $388 | Eastern WA and Columbia River; Western WA and Puget Sound | Annual WTP per household to increase migratory fish populations by 50% | Households in WA state |

Prepared April 2019

Sources: (Bell, Huppert, & Johnson, 2003); (Loomis J. , 1996); (Layton, Brown, & Plummer, 2001); (Olsen, Richards, & Scott, 1991) as cited in (Richardson & Loomis, 2009).

**Table O. Annual Estimated Instream Flow Value of Piping Alternative by Project Group, Deschutes Watershed, Oregon, 2019$ [1].**

| Project Group | Water Conservation Under Piping Alternative (acre-feet/year) | Undiscounted Annual Benefits of Additional Instream Flow | Annualized Average Net Benefits of Piping Alternative above Baseline |
|---|---|---|---|
| Project Group 1 | 8,137 | $610,000 | $594,000 |
| Project Group 2 | 1,255 | $94,000 | $87,000 |
| **Total** | **9,392** | **$704,000** | **$681,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

This value of $75 per acre-foot per year is based on the following information (see Table P):

1. Prices paid for water by environmental buyers throughout the Western United States: In the period 2000 to 2009, the purchase price of environmental water varied from just over $0 to nearly $1,676 per acre-foot per year, with an average permanent sale transaction price of $166 per acre-foot per year. Among the 51 permanent water right purchases with the sales price and volume recorded in the database, the permanent sales price value in 27 transactions (53 percent) was above $75 per acre-foot per year. As discussed at length below, these values paid are expected to provide a low range estimate of instream flow value to society.
2. Value of water to irrigators in COID: Depending on the method used, this is estimated at $40 to $120 per acre-foot per year (for an average value of water to agriculture of approximately $80 per acre-foot). This value is important, as the value of water to local agriculture is a key factor determining water sales and lease prices to environmental buyers in the project area (i.e., the marginal value of water to agriculture would determine agricultural sellers' willingness to accept a price for water), and because conserved water avoids potential future reductions in COID's deliveries.

**Table P. Value per acre-foot per Year of Water (Market Prices and Value to Agriculture), Deschutes Watershed, Oregon, 2019$.**

| Type of Value | Low Value | High Value | Median Value | Average Value |
|---|---|---|---|---|
| Permanent water right transactions in Western U.S., 2000 to 2009 (*Converted to Annual Values*) | ~$0 | $1,676 | ~$75 | $166 |
| Value of water to COID irrigators (*Income Capitalization Approach and Sales Price of Water in Ag to Ag Transfers, Converted to Annual Values*) | $40 | $120 | N/A | ~$80 |

#### *1.2.1.4.1 PAST COSTS PAID AS A PROXY FOR VALUE*

Past piping projects in the Deschutes Basin highlight the willingness of funding entities to pay for instream flow augmentation. These values are evidence of the *minimum* benefit of the instream flows purchased, as perceived and experienced by these entities. Project costs paid are indicative of the *minimum* perceived benefit, as (barring very unusual circumstances) entities only pay for projects for which they believe benefits exceed costs. Furthermore, funding organizations do not necessarily represent all individuals who value instream flow benefits. Only if all people who value instream flows were to pay their maximum willingness to pay for instream flow restoration would the value paid equal the benefits received. Finally, it is important to recognize that these values fundamentally represent *costs* and not benefits; the values paid are based on the cost to conserve water or for agriculture to reduce their use of water (as evident through water right transactions from agriculture to environmental flows).

In the Deschutes Basin, approximately 90 projects have restored approximately 80,000 acre-feet of water instream (Central Oregon Irrigation District, 2016). Based on data from the Deschutes River Conservancy, costs of instream flow augmentation from piping projects have ranged from approximately $105,000 to approximately $344,000 per cubic foot per second (cfs) conserved; this may equate to roughly $300 to $1,000 per acre-foot conserved.

Water rights can be purchased or leased in Oregon. It is important to note that the value paid per acre-foot depends on many variables, including the value of water to the seller, funding available to the buyer, characteristics of the affected stream/river (including current flow levels, flow targets, and presence of threatened or endangered species), characteristics of the water right (seniority, time of use, point of diversion, etc.), and the size of the water right.

Water right leases and purchases for environmental purposes across the Western United States were analyzed in a 2003 paper (Loomis, Quattlebaum, Brown, & Alexander, 2003). During the period between 1995 and 1999, six transactions of water right purchases averaged $362 per acre-foot in Oregon, while five water right leases averaged $115 per acre-foot per year. The paper also shows lease and purchase price by environmental use, including for riparian areas, wetlands, recreation, and instream flow. For instream flows, the average purchase price across 18 transactions per acre-foot was $1,121, while across 35 lease transactions the annual price was $68 per acre-foot.

The Bren School of Environmental Science and Management at the University of California, Santa Barbara, maintains a database of water transfers in the Western United States, and distinguishes between the terms of the transaction (i.e., sale or lease) and the sector of the buyer and seller (e.g., agricultural or environmental) (Bren School of Environmental Science & Management, University of California, Santa Barbara, 2017). The two graphs shown below in Figures B and C show more recent (from 2000 to 2009) sales and leases of water rights by environmental buyers on a price per acre-foot per year basis. The figures show how water right transaction values vary widely, but sale prices (amortized to an annual price) typically are less than $200 per year while 1-year leases typically fall below $800 per acre-foot per year (with several transactions showing prices rising over a $1,000 per acre-foot per year). Among the 51 permanent water right purchases with the sales price and volume recorded in the database, the sales price value in 27 transactions (53 percent) was above $75 per acre-foot per year. However, it is also important to note that the amount paid per acre-foot tends to

decline with an increase in water volume traded; weighing the purchase price by the water volume sold decreases the average permanent sale transaction price to $20 per acre-foot per year.

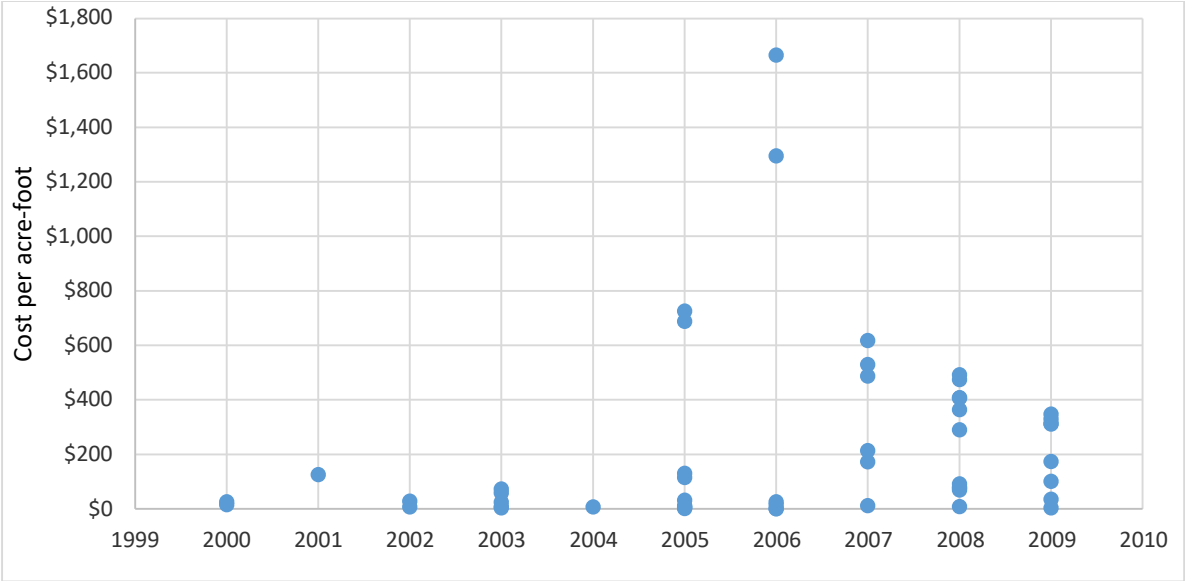


**Figure B: Western water right purchases for environmental purposes, 2000 to 2009, price paid per acre-foot per year[16].**

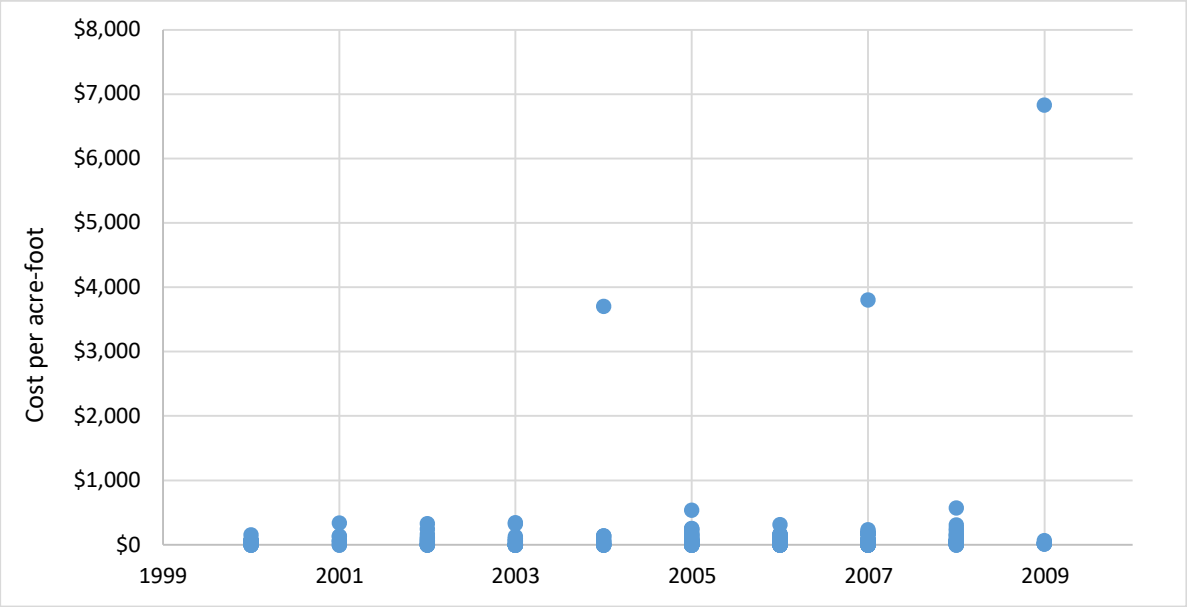


**Figure C: One-year water leases for environmental purposes, price paid per acre-foot in western United States.**

[16] Note that dollar per acre-foot purchase prices were amortized using a 2.75-percent interest rate and a 100-year period to derive dollar per acre-foot per year values.

#### *1.2.1.4.2 Current and Potential Future Water Right Purchase Values in the Surrounding Area*

The District is currently undergoing discussions with their Board about how water is valued in District sales, as it is not accurately represented in current sale costs. However, to provide a reference for the value of water based on purchases in neighboring districts, water rights sold from one irrigator to another within Tumalo Irrigation District (which is also located in Deschutes County and has a similar crop mixture of predominantly forage crops) have typically had a purchase price between $5,030 to $7,550 per acre (Rieck, Tumalo Irrigation District Manager, 2017).[17] These values are very similar to values provided by area real estate agents regarding the increased value of property with irrigation water rights, with all else equal. Assuming the certificated rate of 5.45 acre-feet per year delivered on average to acreage in the District, this equates to approximately $923 to $1,385 per acre-foot ($5,030 to $7,550 per acre divided by 5.45 acre-feet per acre delivery), or a value of approximately $30 to $40 per acre-foot per year.

Prices paid for the limited number of agricultural water right sales may not reflect the average value of water to irrigators in COID and the cost of acquiring water in the future. The value of water to irrigators in COID (i.e., the increased farm income from having access to water) is important as it is a key determinant of the price at which irrigators would be willing to sell water rights (and the price at which environmental water buyers could obtain water from agricultural water right holders, which are the primary water right holders that could sell water rights to augment instream flows). The price paid per acre-foot in the limited number of current COID water transactions is lower than the value derived from the effect on on-farm income of changes in access to irrigation water (income capitalization approach), which indicates that changes in farm water supply affects farm income by approximately $100 per acre-foot per year.[18]

The fact that current water right transactions trade for a lower value than derived through the income capitalization approach may be because some farms in the region are not commercial farms or are not farming all their lands, and so derive less income from some of their water rights than commercial farms producing grass hay or other crops. This indicates that while some water may trade for the lower value of approximately $30 to $40 per acre-foot, if instream flow buyers were to purchase water rights, then as more water rights were acquired, the cost per acre-foot would likely rise to the level as derived through the income capitalization approach.

### 1.2.1.5 Value of Supporting the Oregon Spotted Frog Habitat

In many river systems, organizations that are leasing and purchasing water rights to restore instream flows are focused on the enhancement of fish populations. As such, water right transaction values for instream flow purchases presented in the above section may represent the value of the instream habitat enhancement for fish but may not include the value associated with conservation of other species, such as amphibians. In the Deschutes River, restoration of flows would benefit not only fish species but would also benefit and help recover the Deschutes River populations of the threatened Oregon Spotted Frog (OSF) and enhance water quality. In this section, we describe the potential

[17] These values have been adjusted for inflation to 2019 dollars using the Consumer Price Index.

[18] We based this estimate on an analysis of the net returns of water for grass hay. An agricultural expert in the area estimated that reducing applied water by 1 acre-foot would decrease grass hay yields by approximately 0.5 tons per acre (Bohle, 2018). Assuming that each ton of grass hay generates $200 in revenue after harvest costs are subtracted, an acre-foot of water is worth approximately $100 to growers (Painter, 2015; NASS, 2017). However, given the existing full water supply at COID, we do not assume any change in yield would accrue to District patrons under the Piping Alternative.

additional value of OSF conservation, based on values from the literature regarding ecosystem and species conservation.

Long-term viability of the Deschutes populations of OSF is threatened by the Deschutes River's highly modified hydrologic regime. High summer flows, rapid flow fluctuation in the fall and spring, and current low wintertime flows are incongruent with the needs of the OSF lifecycle (Reclamation 2017). The USFWS believes that for long-term species preservation, increased wintertime flows are necessary in the Deschutes River (the Proposed Action would increase wintertime streamflow by up to 30.3 cfs). Although OSF and its habitat needs are still under scientific investigation, USFWS currently considers that 400 cfs is the minimum target winter instream flow in the upper Deschutes River necessary for beginning OSF recovery (Moran & O'Reilly, 2018). With restoration of streamflow and habitat on the Deschutes, the target flow may change as biologists monitor how the ecosystem and the OSF adjust to changes in flow management.

The economic value of conserving amphibian populations, and the OSF in particular, may stem from many types of benefits to society provided by these species. As summarized in Table Q, social and economic benefits of OSF preservation may include enhanced cultural values, recreational values, educational values, public health values, environmental quality values, and intrinsic species existence values (i.e., the value to people of preserving the species, apart from any use of the species). Pertinent to potential medical and ecological values, researchers have identified that the OSF may have an antimicrobial chemical in its skin secretions that provides resistance to a fatal amphibian disease (chytridiomycosis) that is causing declines in many amphibian populations (Conlon, et al., 2013).

**Table Q: Sources of Economic Value from Amphibian Conservation.**

| Source of Value | Description |
|---|---|
| Cultural Value | Frogs have cultural value that is evident in their symbolism and use in literature, music, art, and jewelry. |
| Recreational Value | Wildlife viewing of frogs can enhance recreational value, while intact amphibian natural areas and wetlands can also enhance recreational value by providing aesthetically pleasing and diverse recreational environments. |
| Educational Value | Frogs provide an opportunity for research and education for ecology, biology, anatomy, and physiology. |
| Mosquito Control (Human Health, Well Being) | Amphibians reduce mosquito and other pest populations through predation and competition, which can provide social and economic values by reducing a nuisance as well as provide public health benefits by reducing risk of mosquito-borne illnesses (thereby improving quality of life and reducing medical costs). |
| Pharmaceutical Drug Development (Human Health Value) | Amphibians produce chemicals for a variety of purposes and these chemicals can provide the basis for new drugs. |
| Other Medical Advances (Human Health Value) | Amphibians' ability to regenerate limbs and tails may increase knowledge about physiology and lead to human medical advances. |
| Environmental Quality Value | Amphibians improve soil structure and fertility through soil furrowing, decomposition, and nutrient cycling. |
| Species Existence Value | In addition to, and separate from their values for the above uses, preservation of frog populations provides intrinsic value to people related to enjoyment of knowing the species exists and the moral/ethical values associated with the conservation of the species for others, including future generations. |

Source: (Hocking & Babbitt, 2013) Prepared December 2019

#### *1.2.1.5.1 VALUE PER HOUSEHOLD*

In terms of specific dollar values for the OSF, numerous studies are available in the economic literature that estimate the willingness to pay for individual species conservation. People's values for species conservation may arise from personal use (i.e., enjoying seeing the species and/or its habitat), personal beliefs and moral ethics (i.e., believing protecting a species and its habitat is the right thing to do), altruism (i.e., believing a resource should be protected so that others can use it or benefit from it), and/or a desire to bequest the resource (i.e., believing a resource should be protected for future generations). The most common way to measure value to people of species conservation is through surveys in which people are asked about their willingness to pay to protect a species. These surveys are highly challenging to develop and implement well, and results from different surveys aiming to measure similar changes in resources can be highly variable.

While results are varied, several reviews of these types of survey studies have found that people's willingness to pay (i.e., the value they hold) for species conservation typically depends most heavily on the following factors:

- The type of species being conserved (in general, the larger and more iconic or charismatic the species, the higher the value, with species such as marine mammals tending to have the highest values);
- People's knowledge of the species (the more knowledge people have regarding the species, the higher the conservation value);
- The usefulness of the species to people, the level of threat and species population size (the smaller and more endangered the species population, the higher the value);
- Whether the respondent is a visitor or a resident (recreational or tourist visitors tend to have higher values than residents); and
- Survey design (Loomis & White, 1996; Mahoney, 2009; Martin-Lopez, Montes, & Benayas, 2008; Amuakwa-Mensah, Barenbold, & Riemer, 2018).

As noted above, values, particularly for iconic mammals, can be quite high. For example, household willingness to pay for enhancing or preserving a species such as elk, moose, or humpback whales have been estimated to average over $150 per household per year. Values for less iconic, non-mammal species, however, are more pertinent to the OSF. Preservation of non-mammal species that are much less iconic are often valued by U.S. households in the range of $15 to $35, or more, per household per year[19] (Loomis & White, 1996; Martin-Lopez, Montes, & Benayas, 2008). For example, the Palouse giant earthworm has been estimated to be valued at approximately $20 per year per household in eastern Washington State, while the Riverside fairy shrimp has been estimated to be valued at approximately $35 per household per year by households in Orange County, California (Stanley, 2005; Decker & Watson, 2016). These two species may be similar to the OSF in that they are not iconic, but may be symbols of preservation of a particular ecosystem.

While the literature does not include willingness-to-pay surveys specific to the Deschutes Basin, watershed and habitat protection are important to basin residents. A 2009 survey of 400 randomly selected Deschutes County voters highlights this (The Trust for Public Land, 2010). In terms of conservation projects, the top five ranking project types, all with 79 percent or more of Deschutes County respondents indicating an importance level of extremely important or very important, are: 1) protecting water quality in rivers, creeks, and streams; 2) protecting and improving drinking water quality; 3) protecting wildlife habitat; 4) protecting natural areas; and 5) protecting natural watersheds. These priorities ranked more highly than protecting forests, protecting farmland, planting more trees, and improving recreational access and recreational amenities. Furthermore, the survey findings illustrate that natural environment and recreational opportunities are integral to the county's quality of life (The Trust for Public Land, 2010). In response to questions regarding the county's quality of life, the most commonly cited contributors to a high quality of life were regarding the natural environment, including outdoor recreation, open space, and natural areas.

Specific to values for OSF conservation in the Deschutes Basin, because the species is not a large mammal, its value to people would tend to be less. On the other hand, several factors would tend to increase its value to households in the Deschutes Basin: 1) many people know about the species, and its conservation has come to represent, to many people, the restoration of the Deschutes River ecosystem, 2) the OSF species population is threatened, and researchers have identified that the

[19] Surveys that are conducted in other countries, including developing countries with lower incomes, often find lower willingness-to-pay values for species conservation. In general, willingness to pay for conservation increases with higher household income. For this reason, we focus on studies conducted in the U.S. and Canada.

Deschutes population of OSF is genetically distinct from other OSF populations (Moran & Monje, 2016),[20] such that the population size of the genetically distinct species benefiting from increased wintertime Deschutes River flows is quite small, and 3) there are many visitors to the Deschutes Basin, and visitors tend to have relatively higher values (compared to local residents) for preservations of ecosystems and species in the areas they visit.

As instream flow augmentation in the Deschutes aids not just the OSF but also improves ecological function and enhances habitat for other species, it is useful to consider studies that estimate value of local habitat restoration and species preservation more generally (Hodgson, 2018). As cited above, Orange County residents were estimated to value fairy shrimp recovery at $35 per household per year and $78 per household per year for preservation of all local endangered species (Stanley, 2005).[21] Perhaps more pertinent, a study identifying the value of preserving one or multiple little-known fish species in Ontario, Canada found that some improvement in the population of a single, little-known riverine species (channel darter) was valued at $10 per household per year, while conservation of three, little-known riverine species (channel darter, eastern sand darter, and the spotted sucker) would increase the value to $69 per household per year (Rudd, Andres, & Kilfoil, 2016). The same study found that a conservation action resulting in a large improvement to the channel darter population was valued at $22 per household per year while a large improvement to the three species populations resulted in a value of $83 per household per year.[22] In other words, in both studies, preserving a single species was valued at approximately $10 to $35, while preserving habitat for a broader range of species was valued at $69 to $86 per household. As shown in Table R, the highest values in the Ontario, Canada study were found to be associated with water quality, which would also be improved in the Deschutes Basin due to the Piping Alternative.

**Table R. Economic Values (2019 values) for Little-Known Ontario, Canada Aquatic Species at Risk.**

| Type of Benefit | Some Improvement | Large Improvement |
|---|---|---|
| 1 Riverine Species (Channel Darter) | $10 | $22 |
| 3 Riverine Species (Channel Darter, Eastern Sand Darter, Spotted Sucker) | $69 | $83 |
| Water Quality Index | $91 | $113 |

Source: (Rudd, Andres, & Kilfoil, 2016) Prepared December 2019

[20] In terms of its uniqueness, the OSF is found in Oregon, Washington, and California, but the OSF populations in the Deschutes Basin have been found to be genetically distinct. In fact, even within the Deschutes Basin, evidence indicates that there are numerous genetically distinct populations of OSF due to the large distances between OSF habitat sites and the relatively limited travel distances of the frog (Loomis, Quattlebaum, Brown, & Alexander, 2003). While Deschutes OSF is still considered the same species as OSF located elsewhere, its genetic uniqueness adds to the biological and potentially economic value of its continued survival.

[21] The original study cited values of $25.83 and $55.22 in 2001 dollars, which were converted into annual 2019 dollars in this study.

[22] The original study cited values of $9.45, $64.23, $20.59, and $77.50 in 2011 Canadian dollars. We converted these to 2011 USD using an exchange rate of 0.9567 and adjusted the resulting value for inflation to 2019 dollars using the Consumer Price Index (a factor of 1.124).

The instream flow value of $75 per acre-foot per year described in the previous section translates into approximately $37 per Deschutes County household per year of conservation value.[23] Including a value of $35 per household per year for OSF habitat in addition to the instream flow values cited above provides a cumulative value per household of instream flow augmentation/habitat conservation value of $72 per Deschutes County household. This appears reasonable based on the literature addressing the value of single species conservation compared to multiple species conservation and improvements to an aquatic ecosystem.

#### *1.2.1.5.2 Number of Resident and Tourist Households Holding Value for OSF and Deschutes Basin Habitat Conservation*

Based on U.S. Census data, the population of Deschutes County in 2017 was 186,875 people. Using the Census 2010 average household size of 2.44 translates to approximately 76,600 households. In addition to local households, there may be many households residing outside of Deschutes County that may value the preservation of the OSF and Deschutes Basin habitat. Some studies have found that households throughout the nation, located far from a wildlife habitat area, may value species preservation efforts (Loomis J. , An Empirical Comparison of Economic versus Political Jurisdictions, 2000). Additionally, as noted above, visitors to an area, particularly tourists participating in outdoor recreation, may have even higher species preservation values than residents. As such, we apply the estimated OSF species conservation value not only to Deschutes County households, but also to the estimated number of households who are tourists in Deschutes County each year that participate in outdoor recreation activities. Based on overnight visitation data (Longwoods International , 2017) and tourism expenditure data in Central Oregon (Dean Runyan Associates, 2018), we estimate that there are 102,000 households who visit Deschutes County each year with the main trip purpose being outdoor recreation. We focus on these visitor households as many of the surveys of visitor willingness to pay for conservation have been at outdoor recreation sites.[24] In sum, we estimate that approximately 178,600 households (76,600 resident households and 102,000 visitor

[23] Based on U.S. Census data, the population of Deschutes County in 2017 was 186,875 people, which using the Census 2010 average household size of 2.44 translates to approximately 76,600 households. The Proposed Action would increase instream flows by 37,750 acre-feet annually. As such, using $75 acre-foot per year value, the average estimated value on a per household basis translates to $37 per year ($75 x 37,750 / 76,600 = $37/household).

[24] A tourism study by Longwoods Travel estimated that there were 4.5 million overnight person trips (a person trip is a trip of any length taken by one person) to Central Oregon in 2017. The Central Oregon region includes Deschutes, Jefferson, Crooked, and South Wasco counties. We use the proportion of visitor spending in each county to estimate the percent of the overnight person trips occurring to Deschutes County. According to the Oregon Travel Impacts report prepared for the Oregon Tourism Commission, 82 percent of 2017 visitor spending in Central Oregon occurs in Deschutes County. (Total estimated spending in Central Oregon is $776.6 million, of which $640.2 million, or 82 percent, is estimated to occur in Deschutes County.) Assuming 82 percent of Central Oregon overnight visits are in Deschutes County, there were approximately 3.71 million overnight person visits in 2017 in Deschutes County. The Longwoods Travel survey indicated that the average household size of overnight visitors to Central Oregon is approximately 2.87 people, which translates to approximately 1.293 million households with overnight trips to Central Oregon. The survey also indicates that approximately 62 percent of households had visited Central Oregon in the previous 12-month period. We assume that these households with previous visits to the region had visited, on average, three times per year. This translates to an average visitation rate of 2.24 across all households with overnight visits, for an estimated 577,000 separate households visiting Deschutes County. Of all visitors, the survey indicates that approximately 57 percent are tourists (i.e., not traveling for business or visiting family or friends). Of these, approximately 31 percent have outdoor recreation as the primary purpose of their visit. As such, we estimate approximately 102,000 households take at least one overnight tourist trip to Deschutes County annually with the primary purpose of their trip being outdoor recreation.

households) may value OSF habitat conservation in the Deschutes Basin. This represents approximately seven percent of Oregon households.

#### *1.2.1.5.3 ESTIMATED OSF CONSERVATION VALUE OF COID FLOW AUGMENTATION*

While there are numerous factors that create uncertainty in estimating the value of OSF habitat conservation,[25] the economic literature supports the notion that habitat conservation through flow augmentation in the Deschutes likely exceeds the instream flow values cited in the previous section that are based on market transaction data. Based on the species and habitat conservation literature as a whole, we find it reasonable that this additional value for OSF conservation may be approximately $35 per household per year. While people throughout Oregon and beyond may value OSF habitat conservation, we conservatively apply this value to the 76,600 Deschutes County households and approximately 102,000 tourism households who visit the County annually for the primary purpose of outdoor recreation, for a total of 178,600 households. In sum, this translates into an estimated value of Deschutes OSF preservation of approximately $6.25 million per year.

As discussed above, for OSF preservation, flow augmentation is needed to increase wintertime flows from the current 100 cfs to approximately 400 cfs, or an increase of 300 cfs. After being passed water saved by the COID project, NUID in turn would contribute 30.3 cfs to wintertime flows, or 9.81 percent of the additional flow anticipated to be required for OSF conservation. We thus apportion 10.10 percent of the estimated value of $6.25 million for OSF conservation to the COID Proposed Project, or $631,000 per year ($610,000 annualized net benefit as shown in Table S).

**Table S. Value of Supporting OSF Habitat under the Piping Alternative, Deschutes Watershed, Oregon, 2019$.**

| Project Group | Water Conservation Under Piping Alternative (cfs) | Undiscounted Annual Benefits | Annualized Average Net Benefits[1] |
|---|---|---|---|
| Project Group 1 | 26.3 | $548,000 | $533,000 |
| Project Group 2 | 4.0 | $83,000 | $77,000 |
| **Total** | **30.4** | **$631,000** | **$610,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

### 1.2.2 Benefits Considered but Not Included in Analysis

#### 1.2.2.1 Public Safety Avoided Costs

Piping irrigation water removes the hazard of drownings in canals, as well as eliminates the potential for earthen canals to fail, causing potential damages to downstream property and lives. While COID canal failure is very possible, the extent of damage varies dramatically depending on the timing and location of failure. Given the limited amount of available data on the cost of these canal failures, the public safety (and property damage reduction) benefit of piping is not analyzed in this analysis. However, a history of recent drownings in Central Oregon irrigation canals provides evidence that fast-moving water in irrigation canals, often with steep and slippery banks, can be a threat to public

[25] Including, first and foremost, the uncertainty in applying values from other contexts and species to the OSF, as well as the challenge in interpreting results from previous studies given the diversity of values found and the high sensitivity of findings to study design and implementation methods.

safety. In 2004, a toddler drowned in a Central Oregon Irrigation District canal, and in 1996 and 1997, respectively, a 12-year old boy and a 28-year old man drowned in NUID canals (Flowers, 2004). Other drownings may have occurred in the past, as a comprehensive list of drownings in Central Oregon irrigation canals was not available from the Bureau of Reclamation or other sources. However, the data indicate at least three drownings over the last 21 years (1996 through 2016), or 0.143 deaths per year during this period. As the population in Central Oregon continues to grow and areas surrounding irrigation canals continue to urbanize, the risk to public safety would increase.

The Piping Alternative would pipe open canals in COID's system. This section qualitatively discusses the potential magnitude of the public safety benefit of piping the 7.9 miles in COID. The analysis presents some information on the potential public safety hazard of the existing unlined irrigation canals in COID proposed for piping (based on the recent history of drownings and the mileage of exposed canals).

#### *1.2.2.1.1 LEVEL OF PUBLIC SAFETY HAZARD*

This analysis estimates the public safety hazard of unlined canals in COID based on past drownings in unlined canals in Central Oregon. Based on data from the Oregon Water Resources Department (OWRD) on canals in Central Oregon, there are 1,072 miles of irrigation canals in Central Oregon districts (see Table T). Starting in the late 1980s and early 1990s, sections of these canals began to be piped, with the result that today, the OWRD database records show that approximately 209 miles have been piped. Assuming piping occurred uniformly across the 21-year period from 1996 to 2016, approximately 9.9 miles were piped each year, leaving approximately 973 miles unpiped on an average annual basis during this period. Given that an average of 0.143 drowning deaths occurred annually during this period (three deaths over 21 years as described above), the annual drowning risk per mile of exposed canal was 0.000147 (0.143 divided by 973). This may be an overestimate of risk if there were an abnormally high number of drownings in the last 20 years or so, but may also be an underestimate of risk as the population of Bend continues to grow and the areas around irrigation canals continues to urbanize (thereby increasing the risks of drownings).

Under Baseline conditions, COID would continue to have approximately 7.9 miles of unpiped canal. Assuming that the three drownings over the past 21 years are representative of future drowning risk, and that the 0.000147 deaths per mile of exposed canal experienced during this period is an appropriate estimate of future risk, the unpiped canals in COID carry a risk of 0.0012 deaths per year.

**Table T. Irrigation Canal Mileage by District.**

| District | Canal and Lateral Mileage |
|---|---|
| Arnold Irrigation District | 47.3 |
| Central Oregon Irrigation District | 430.0 |
| Lone Pine | 2.4 |
| North Unit Irrigation District | 300.1 |
| Ochoco Irrigation District | 100.3 |
| Swalley Irrigation District | 27.6 |
| Tumalo Irrigation District | 95.8 |
| Three Sisters Irrigation District | 68.7 |
| **Total** | **1,072.0** |

Note: Totals may not sum due to rounding. Prepared December 2019

Source: Oregon Water Resources Department, database maintained and provided by Jonathon LaMarche on March 9, 2017.

# 2 No Action Alternative

## 2.1 Costs of the No Action Alternative

This section outlines the costs and benefits of the No Action Alternative in comparison to Baseline conditions. Under the No Action Alternative COID would pipe 2.3 miles of their system over four years. This alternative assumes that COID could receive approximately $3 million per year over the four years. In the next section, these costs and benefits of the No Action are compared to the costs and benefits of the Piping Alternative to show the incremental NED benefits of the proposed project. Many of the assumptions described in the first section also apply to the No Action Alternative and are not duplicated here. Instead, this section describes the results of applying the same analysis to piping under the No Action Alternative.

### 2.1.1 Analysis Parameters

#### 2.1.1.1 Funding

In the absence of the Piping Alternative, the District intends to continue piping the COID system, with a focus on piping Project Group 1. The District would seek funding, as it traditionally has, from grants and loans; it is not expected that federal funds would be used to support the piping.

#### 2.1.1.2 Evaluation Unit

The same project groups used to analyze the Piping Alternative are used for the No Action Alternative.

#### 2.1.1.3 Project Implementation Timeline

Under the No Action Alternative, the District expects to pipe about 2.3 miles of Project Group 1 over the next four years. At completion, this would represent 29 percent of the length piped under the Piping Alternative. This analysis assumes the piping construction would occur linearly over this time period, and the benefits of piping would begin the year after each section is finished. Table U displays the installation costs of piping under the No Action Alternative.

**Table U. Construction Timeline and Installation Costs by Funding Source for the No Action Alternative, Deschutes Watershed, Oregon, 2019$[1].**

| Construction Year | Works of Improvement | Public Law 83-566 Funds | Other, Non-Federal Funds | Total Installation Costs |
|---|---|---|---|---|
| 0 - 4 | Project Group 1 | $0 | $12,720,000 | $12,720,000 |
| N/A | Project Group 2 | $0 | $0 | $0 |
| **Total Project** | | **$0** | **$12,720,000** | **$12,720,000** |

[1]/Price Base: 2019 dollars. Prepared December 2019

#### 2.1.1.4 Analysis Period

The analysis period for the No Action Alternative is the same as the Piping Alternative.

### 2.1.2 Piping Costs

Table V shows the distribution of installation costs associated with piping under the No Action Alternative. Because the District expects to cover all piping costs without federal funding (as shown in Table U), we have omitted the columns for "PL 83-566 Funds" and only "Other Funds" are shown. Table W presents the annualized costs of installation and other direct costs associated with piping, which includes increased pumping costs from increased depth to groundwater due to reduced recharge and the costs to replace fiberglass piping.

**Table V. Estimated Cost Distribution of No Action Alternative - Water Resource Project Measures, Deschutes Watershed, Oregon, 2019$ [1,2].**

| Works of Improvement | Installation Cost - Other Funds | | | Total Installation Costs |
|---|---|---|---|---|
| Piping | Construction | Engineering | Project Admin[3] | |
| Project Group 1 | $11,641,000 | $359,000 | $720,000 | $12,720,000 |
| Project Group 2 | $0 | $0 | $0 | $0 |
| **Total Costs** | **$11,641,000** | **$359,000** | **$720,000** | **$12,720,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price base: 2019 dollars.

[2]/Project cost as identified in by KPFF Consulting Engineers in 2019, including additional percent project administration and technical assistance costs.

[3]/Project Admin includes project administration, technical assistance costs, and permitting costs.

**Table W. Estimated Average Annual NED Costs for No Action Alternative, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Project Outlays (Amortization of Installation Cost) | Other Direct Costs [2] | Total |
|---|---|---|---|
| Project Group 1 | $360,000 | $61,000 | $421,000 |
| Project Group 2 | $0 | $0 | $0 |
| **Total** | **$360,000** | **$61,000** | **$421,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

[2]/Other direct costs include the uncompensated economic losses due to changes in resource use or associated with installation, operation, or replacement of project structures. Other direct costs are presented for fiberglass pipe replacement, costs of the booster pump, and increased pumping costs elsewhere in the basin from reduced groundwater recharge (i.e., seepage from unlined canals). This does not include operations, maintenance, and repair costs because these decline under the Piping Alternative, so these are presented as a benefit.

### 2.1.3 Project Installation Costs

Based on FCA's analysis of estimates by Black Rock Consulting, the total cost for installing piping under the No Action Alternative is projected at $12,720,000 (Table V). Of this, project administration is estimated at three percent of construction and engineering costs, as are permitting costs. When spread evenly across four years of construction, the total cost converts to a discounted annual average cost of $360,000 (Table W).

## 2.1.4 Other Direct Costs

### 2.1.4.1 Groundwater Recharge Costs

The No Action Alternative would impact groundwater for the same reasons as the described in the Piping Alternative (Section 1.1.4.1) and under the same Baseline conditions. However, the No Action Alternative would only reduce associated groundwater recharge by up to approximately 1,235 acre-feet annually in this part of the Deschutes Basin.[26]

**Table X. Approximate Depth to Groundwater in Central Deschutes Basin, Deschutes Watershed, Oregon.**

| Year | Volume Pumped (acre-feet per year) | Average Depth to Groundwater (feet) | |
|---|---|---|---|
| | | Baseline Conditions | No Action Alternative |
| 1 | 54,000 | 501 | 501.0 |
| 10 | 60,000 | 510 | 510.0 |
| 20 | 65,000 | 520 | 520.0 |
| 30 | 67,000 | 530 | 530.1 |
| 40 | 70,000 | 540 | 540.1 |
| 50 | 73,000 | 550 | 550.2 |
| 60 | 75,000 | 560 | 560.2 |
| 70 | 78,000 | 570 | 570.2 |
| 80 | 81,000 | 580 | 580.3 |
| 90 | 84,000 | 590 | 590.3 |
| 100 | 86,000 | 600 | 600.3 |

Prepared December 2019

Table X compares the estimated depth to groundwater under Baseline conditions to those under the No Action Alternative. Piping under the No Action Alternative is expected to increase groundwater depth by 0.001 feet in Year 1, rising to 0.33 feet in Year 100. The decline in the groundwater level is expected to increase total pumping costs by $4 in Year 1 and increase to $2,400 in Year 103. After discounting and amortizing these costs, the estimated annual average cost is $1,000 (as shown in Table Y).

[26] The decrease in groundwater recharge includes the loss of canal seepage from the piping of COID's system as well as the loss of seepage from North Unit Irrigation District's Main Canal (North Unit would proportionally decrease the water passed through their Main Canal to the water that is saved and passed to them through COID).

**Table Y. Other Direct Costs of Reduced Recharge under No Action Alternative, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Water Conservation (cfs) | Water Conservation (acre-feet/year) | Change in Groundwater Depth (feet/year) | Annual Average NED Cost |
|---|---|---|---|---|
| Project Group 1 | 3.9 | 1,253 | 0.003 | $1,000 |
| Project Group 2 | 0.0 | - | 0.000 | $0 |
| **Total** | **3.9** | **1,253** | **0.003** | **$1,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

### 2.1.4.2 Booster Pump Costs

Under the No Action Alternative, the District would install a booster pump on the G-4 lateral as it also plans to do under the Piping Alternative (Section 1.1.4.2); therefore, there would be the same associated energy and OMR costs. However, due to discounting and the slightly later construction schedule, the annualized present value of the energy and maintenance costs would be slightly lower under the No Action Alternative. In total, it is expected that the total additional annualized costs of the booster pump under the No Action Alternative would be approximately $13,000.

**Table Z. Annual Booster Pump Energy Costs of No Action Alternative by Project Group, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Total Annual Booster Pump Energy Demands (kWh) | Undiscounted Annual Booster Pump Energy Costs Under Piping (kWh) | Undiscounted Annual Booster Pump O&M Costs Under Piping (kWh) | Discounted and Amortized Annual Cost of Booster Pump Replacement | Average Annual NED Cost for Booster Pump (Discounted and Amortized) |
|---|---|---|---|---|---|
| Project Group 1 | 193,285 | $10,000 | $4,000 | $1,000 | $13,000 |
| Project Group 2 | 0 | $0 | $0 | $0 | $0 |
| **Total** | **193,285** | **$10,000** | **$4,000** | **$1,000** | **$13,000** |

[1]/ Price base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent. Prepared December 2019

### 2.1.4.3 Pipe Replacement

Piping under the No Action Alternative would require approximately 0.87 miles of large diameter (102 inch) piping, representing roughly 38 percent of the total length piped. This pipe would cost around $11,631,000 to procure and install, which is the amount we use to represent the full cost of replacing the pipe. We assume that the total length of large-diameter piping would be spread evenly throughout the four years of construction under the No Action Alternative (i.e., piping about $3 million dollars of pipe per year). Using the same replacement schedule described in the Piping Scenario (25 percent replaced 50 years after initial installation and 75 percent replaced 75 years after

initial installation), the annual average costs to replace fiberglass pipe are $45,000 as shown in Table AA.

**Table AA. Other Direct Costs of Large Diameter Pipe Replacement under the No Action Alternative, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Feet of Pipe Replaced | Undiscounted Replacement Cost | Annual Average NED Replacement Cost |
|---|---|---|---|
| Project Group 1 | 4,579 | $11,631,000 | $45,000 |
| Project Group 2 | 0 | $0 | $0 |
| **Total** | **4,579** | **$11,631,000** | **$45,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

#### 2.1.4.4 Carbon Costs

The 80.8 MWh of reduced energy demand would help to avoid 61 Mt of carbon emissions each year once the four years of piping is complete. This would be offset by an average of 144 Mt of carbon per year that would be added as a result of booster pump energy use and declining groundwater levels under the No Action Alternative, resulting in an average net decrease of about 84 Mt annually (as shown in Table BB).

**Table BB. Annual Average Carbon Emissions (Mt) of No Action Alternative by Project Group, Deschutes Watershed, Oregon.**

| Works of Improvement | Baseline Conditions | | No Action Alternative | | |
|---|---|---|---|---|---|
| | Average Annual Carbon Emissions, Basin-wide Pumping | Annual Carbon Emissions, COID Patron Pumping | Average Annual Carbon Emissions, Basin-wide Pumping | Annual Carbon Emissions, COID Patron Pumping | Net Annual Carbon Increase (Compared to No Action) |
| Project Group 1 | N/A | 156 | N/A | 239 | 84 |
| Project Group 2 | N/A | 58 | N/A | 58 | 0 |
| **Total** | **44,341** | **214** | **44,425** | **297** | **84** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/ These values show an average annual increase over 104 years. Carbon emissions rise over time because groundwater pumping volume increases throughout the basin over time, and the depth to groundwater also rises over time due to reduced recharge from canals.

**Table CC. Annual Average Carbon Cost Savings of No Action Alternative by Project Group, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Annual Avoided Emissions (Reduced COID Patron Energy Use, Mt Carbon) | Average Annual Increased Emissions (from Reduced Recharge, Mt Carbon)[2] | Net Average Increased Emissions | Average Annual Costs (Social Cost of Carbon)[3] |
|---|---|---|---|---|
| Project Group 1 | 61 | 144 | 84 | $1,000 |
| Project Group 2 | 0 | 0 | 0 | 0 |
| **Total** | **61** | **144** | **84** | **$1,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

[2]/Additional energy use elsewhere rises over time as the effects of reduced recharge accumulate and cause groundwater depths to drop over time. The average annual energy use increase elsewhere in the basin represents the average change in energy use across the 50 project years for each project group.

[3]/Note that the average annual NED benefits differ from the change in tons of carbon emitted multiplied by the $7 value per Mt of carbon. The increased emissions rise over time (and are thus highest at later periods when the values are most discounted, while the decreased carbon emissions are the same over time).

#### 2.1.4.5 Change in Aesthetics and Associated Property/Recreation Values

The types of changes to aesthetics, property values, and recreation values are expected to be similar under the No Action Alternative as under the Piping Alternative. However, because the length of piping is less, the magnitude of the impacts is expected to be less and isolated to the area of Project Group 1 (north of Redmond).

## 2.2 Benefits of the No Action Alternative

This section outlines the benefits of the No Action Alternative.

### 2.2.1 Benefits Considered and Included in Analysis

#### 2.2.1.1 Agricultural Damage Reduction Benefit

Under the No Action Alternative, NUID would gain an estimated 108 acre-feet of water annually due to reduced seepage losses in the North Unit Main Canal, resulting from a change in diversion associated with the COID piping project (Farmers Conservation Alliance, 2019). Similar to the Piping Alternative, this increased water availability is expected to reduce the agricultural damages associated with water shortages experienced currently in NUID.

Using the same methods as described in Section 1.2.1.1, this analysis estimates the value of additional water to NUID agriculture to be approximately $447 per acre-foot. Accordingly, the additional 108 acre-feet of water expected to reach NUID each year under the No Action Alternative is estimated to have an undiscounted annual benefit of roughly $48,000. As shown in Table DD, when discounted and amortized, the benefit of additional water to NUID agriculture would be approximately $47,000 annually.

**Table DD. Avoided Damages to NUID Agriculture Resulting from No Action Alternative by Project Group, Deschutes Watershed, Oregon, 2019$.** [1]

| Project Group | Water Conservation Under Piping Alternative (acre-feet/year) | Undiscounted Annual Benefits of Additional Instream Flow | Annualized Average Net Benefits of Piping Alternative above Baseline |
|---|---|---|---|
| Project Group 1 | 108 | $48,000 | $47,000 |
| Project Group 2 | 0 | $0 | $0 |
| **Total** | **108** | **$48,000** | **$47,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

1/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

#### 2.2.1.2 Operations and Maintenance Cost Savings Benefit

Because the District plans to pipe part of Project Group 1 under the No Alternative, there would also be O&M cost savings under the No Action Alternative. Piping 2.3 miles in Project Group 1 would result in savings of roughly $1,000 each year. Table EE shows the O&M costs under both scenarios and the savings associated with the Piping Alternative.

**Table EE. Annual Reduced Operation and Maintenance Costs to COID of No Action Alternative by Project Group, Deschutes Watershed, Oregon, 2019$.**[1]

| Works of Improvement | Mileage Piped | Discounted Annualized Benefit of No Action (O&M Cost Reduction) |
|---|---|---|
| Project Group 1 | 2.3 | $1,000 |
| Project Group 2 | 0.0 | $0 |
| **Total** | **2.3** | **$1,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

1/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

#### 2.2.1.3 Patron Irrigation Pumping Cost Savings

As in the Piping Alternative, piping under the No Action Alternative would result in energy savings by avoiding pumping. Using the same assumptions that were used for the Piping Alternative, the No Action Alternative piping would save roughly 80,867 kWh per year. At a rate of $0.0512 per kWh, these savings would be worth about $4,000 per year. After accounting for the construction timeline and discounting the values, the energy saved from piping under the No Action Alternative is worth an annual average of $4,000 (shown in Table FF).

The No Action Alternative, similar to the Piping Alternative, would also include the installation of a booster pump at the G-4 lateral and would eliminate the need for District patrons on that lateral to maintain irrigation pumps. Using the same assumptions as in the Piping Alternative, this would result

in an annual average savings to patrons of $11,000 (shown in Table GG).[27] Avoiding these costs would represent a benefit to District patrons.

**Table FF. Annual Increased Average Energy Cost Savings to COID Patrons of No Action Alternative by Project Group, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Annual Energy Use Under Baseline Conditions (kWh) | Annual Energy Use After Piping Under No Action Alternative (kWh) | Reduced Annual Energy Use (kWh)[2] | Undiscounted Annual Energy Cost Savings | Average Annual Benefits (Avoided Energy Costs) |
|---|---|---|---|---|---|
| Project Group 1 | 206,944 | 126,077 | 80,867 | $5,000 | $4,000 |
| Project Group 2 | 76,945 | 76,945 | 0 | $0 | $0 |
| **Total** | **283,889** | **203,022** | **80,867** | **$5,000** | **$4,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

[2]/As estimated by Farmers Conservation Alliance (Alliance, 2019).

**Table GG. Annual Estimated Cost Savings from Eliminated Irrigation Pumps under the No Action Alternative by Project Group, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Pumps Eliminated Under Piping Alternative | Undiscounted Annual OMR Costs Avoided by Piping Alternative | Average Annual NED Benefit (Avoided OMR Cost, Discounted and Amortized) |
|---|---|---|---|
| Project Group 1 | 12 | $12,000 | $11,000 |
| Project Group 2 | 0 | $0 | $0 |
| **Total** | **12** | **$12,000** | **$11,000** |

[1]/ Price base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent. Prepared December 2019

#### 2.2.1.4 Value of Conserved Water

The No Action Alternative would conserve approximately 1,145 acre-feet of water, and similar to the Piping Alternative, the District intends to pass the water to NUID, which would release the same volume of water instream from Wickiup Reservoir during the non-irrigation season. Accordingly, we model the benefits associated with instream flow under the No Action Alternative using the same value ($75/ acre-foot) as in the Piping Alternative. The 3.7 cfs released during the non-irrigation season would bring benefits of roughly $86,000 annually, which, when discounted and annualized, are worth roughly $83,000 (see Table HH below).

[27] Due to discounting and the later construction timeline under the No Action Alternative, the present value of benefits is slightly lower than under the Piping Alternative.

**Table HH. Annual Estimated Instream Flow Value of No Action Alternative by Project Group, Deschutes Watershed, Oregon, 2019$[1].**

| Project Group | Water Conservation Under No Action Alternative (acre-feet/year) | Undiscounted Annual Benefits of Additional Instream Flow | Annualized Average Net Benefits of No Action Alternative over Baseline |
|---|---|---|---|
| Project Group 1 | 1,145 | $86,000 | $83,000 |
| Project Group 2 | 0 | $0 | $0 |
| **Total** | **1,145** | **$86,000** | **$83,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

#### 2.2.1.5 Value of Supporting the Oregon Spotted Frog Habitat

Similar to instream flow, because the water conserved under the No Action Alternative would be put back instream, there would be additional support to the OSF, which would bring benefits. As explained in Section 1.2.1.5, the 3.7 cfs protected instream under the No Action Alternative would supply 1.2 percent of total instream flow needed to support the OSF, and therefore provide 1.2 percent of the total estimated value of supporting the OSF ($6.25 million), or $77,000 annually. When discounted and annualized, these benefits are worth roughly $74,000 above the Baseline scenario (as shown in Table II).

**Table II. Value of Supporting OSF Habitat under the No Action Alternative, Deschutes Watershed, Oregon, 2019$.**

| Project Group | Water Conservation Under Piping Alternative (cfs) | Undiscounted Annual Benefits | Annualized Average Net Benefits[1] |
|---|---|---|---|
| Project Group 1 | 3.7 | $77,000 | $74,000 |
| Project Group 2 | 0.0 | $0 | $0 |
| **Total** | **3.7** | **$77,000** | **$74,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

### 2.2.2 Benefits Considered but Not Included in Analysis

#### 2.2.2.1 Public Safety Avoided Costs

Piping 2.3 miles under the No Action Alternative would likely bring the same types of public safety benefits as described in Section 1.2.2.1 above, but only within the area of Project Group 1. However, as with the Piping Alternative, we do not model these benefits under the No Action Alternative.

# 3 NED Benefits and Costs

This section compares the benefits and costs of the Piping Alternative described in Section 1 to the benefits and costs of the No Action Alternative outlined in Section 0. Specifically, this section provides the estimated benefits and costs of the Piping Alternative that exceed those in the No Action Alternative. This comparison provides the NED benefits and costs of the Piping Alternative.

## 3.1 NED Costs

### 3.1.1 Project Costs

Table 8-5 (NWPM 506.18, Economic Table 4) in the Plan-EA summarizes the annualized costs described in this section, showing the annualized installation costs of the Piping Alternative over the No Action Alternative costs, as well as the difference in other direct costs associated with each alternative. Table 8-5 displays the difference between Table B and Table W. Additionally, because energy costs are higher for Project Group 1 (see Section 3.2.1.3) and carbon emissions increase for both project groups (see Section 3.1.3.4), those cost increases are included as other direct costs in Table 8-5 in the Plan-EA. In total, the annualized costs of the Piping Alternative exceed those of the No Action Alternative by $931,000. The total costs in this table are weighed against the total NED benefits in Table 8-6 in the Plan-EA.

### 3.1.2 Project Installation Costs

Table JJ shows the installation costs of the Piping Alternative that exceed the installation costs of the No Action Alternative. Under the Piping Alternative, federal funding would total $29.0 million, compared to $0 under the No Action Alternative. Non-federal funding (District funding) when comparing the Piping Alterative over the No Action Alternative would total $583,000. However, if the project was implemented it would still require $13. 3 million of match funding (Table A).

**Table JJ. Installation Costs for the Piping Alternative Over the No Action Alternative, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Total Installation Costs |
|---|---|
| Project Group 1 | $25,968,000 |
| Project Group 2 | $3,618,000 |
| **Total Project** | **$29,586,000** |

[1]/Price Base: 2019 dollars. Prepared December 2019

### 3.1.3 Other Direct Costs

#### 3.1.3.1 Groundwater Recharge Costs

As shown in Table KK, in Year 100 the groundwater level is expected to decline about 2.7 feet more under the Piping Alternative than under the No Action Alternative. Table LL combines information from Table D and Table Y, and shows that the additional decrease in groundwater levels under the Piping Alternative would increase energy costs by an annual average of $4,000 over the No Action Alternative.

**Table KK. Approximate Depth to Groundwater in Central Deschutes Basin, Deschutes Watershed, Oregon.**

| Year | Volume Pumped (acre-feet per year) | Average Depth to Groundwater (feet) | | |
|---|---|---|---|---|
| | | Baseline Conditions | No Action Alternative | Piping Alternative |
| 1 | 51,000 | 501.0 | 501.0 | 501.0 |
| 10 | 64,000 | 510.0 | 510.0 | 510.3 |
| 20 | 82,000 | 520.0 | 520.0 | 520.6 |
| 30 | 105,000 | 530.0 | 530.1 | 530.9 |
| 40 | 134,000 | 540.0 | 540.1 | 541.2 |
| 50 | 172,000 | 550.0 | 550.1 | 551.5 |
| 60 | 220,000 | 560.0 | 560.2 | 561.8 |
| 70 | 282,000 | 570.0 | 570.2 | 572.1 |
| 80 | 360,000 | 580.0 | 580.2 | 582.4 |
| 90 | 461,000 | 590.0 | 590.2 | 592.7 |
| 100 | 591,000 | 600.0 | 600.3 | 603.0 |

Prepared December 2019

**Table LL. Other Direct Costs of Reduced Groundwater Recharge under the Pressurized Piping and No Action Alternatives, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | No Action Alternative | | Piping Alternative | | |
|---|---|---|---|---|---|
| | Change in Groundwater Depth (feet/year) | Discounted Annual Average Cost | Change in Groundwater Depth (feet/year) | Discounted Annual Average Cost | Discounted Average Annual NED Costs over No Action Alternative |
| Project Group 1 | 0.003 | $1,000 | 0.024 | $4,000 | $3,000 |
| Project Group 2 | 0.000 | $0 | 0.004 | $1,000 | $1,000 |
| **Total** | **0.003** | **$1,000** | **0.027** | **$5,000** | **$4,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

### 3.1.3.2 Booster Pump Costs

Under both the No Action Alternative and the Piping Alternative, the District would be installing a booster pump on the G-4 lateral with the same (undiscounted) costs (see Sections 1.1.4.2 and 2.1.4.2). However, due to discounting and the slightly later construction schedule of the No Action Alternative, the discounted and annualized costs of the booster pump are slightly higher under the

Piping Alternative, however due to rounding the difference does not show in the table. The costs of the two scenarios are summarized in Table MM.

**Table MM. Annual Booster Pump Costs of No Action Alternative Compared to Piping Alternative, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | No Action Alternative Booster Pump Cost (Discounted and Amortized) | Piping Alternative Booster Pump Cost (Discounted and Amortized) | Average Annual NED Booster Pump Cost (Piping Alt. over No Action Alt.) |
|---|---|---|---|
| Project Group 1 | $14,000 | $14,000 | $0 |
| Project Group 2 | $0 | $0 | $0 |
| **Total** | **$14,000** | **$14,000** | **$0** |

[1]/ Price base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent. Prepared December 2019

### 3.1.3.3 Pipe Replacement

The Piping Alternative would install approximately 1.8 more miles of large diameter pipe than the No Action Alternative and would therefore entail higher replacement costs. Combining information from Table F and Table AA, Table NN shows the additional annualized costs of replacing large diameter pipe under the Piping Alternative.

**Table NN. Other Direct Costs of Large Diameter Pipe Replacement under the Pressurized Piping and No Action Alternatives, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | No Action Alternative | | Piping Alternative | | |
|---|---|---|---|---|---|
| | Miles of Large Diameter Pipe Installed | Discounted Annual Average Cost | Miles of Large Diameter Pipe Installed | Discounted Annual Average Cost | Discounted Annual Average NED Cost over the No Action Alternative |
| Project Group 1 | 0.9 | $45,000 | 2.7 | $108,000 | $63,000 |
| Project Group 2 | 0 | $0 | 0 | $0 | $0 |
| **Total** | **0.9** | **$45,000** | **2.7** | **$108,000** | **$63,000** |

Note: Totals may not sum due to rounding. Prepared December 2019
1/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

### 3.1.3.4 Carbon Costs

Carbon emissions (and costs) increase under both the Piping Alternative and the No Action Alterative. Table OO combines information on carbon emissions from Table G and Table BB to show the carbon costs of the Piping Alternative compared to the costs of the No Action Alternative. Due to rounding, on an annualized basis, the value of increased carbon emissions under the Piping Alternative is the same those under the No Action Alternative.

**Table OO. Annual Increased Average Carbon Costs of Piping Alternative and the No Action Alternative, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | No Action Alternative | | Piping Alternative | | |
|---|---|---|---|---|---|
| | Net Average Increased Emissions (Mt) | Discounted Annualized Increased Costs | Net Average Increased Emissions (Mt) | Discounted Annualized Increased Costs | Annualized Value of Carbon Increases Over the No Action Alternative |
| Project Group 1 | 84 | $1,000 | 185 | $1,000 | $0 |
| Project Group 2 | 0 | $0 | -1 | $0 | $0 |
| **Total** | **84** | **$1,000** | **184** | **$1,000** | **$0** |

Prepared December 2019

#### 3.1.3.5 Change in Aesthetics and Associated Property/Recreation Values

Because the length of piping under the No Action Alternative is shorter than under the Piping Alternative, the magnitude of the impacts described in Section 1.1.4.5 is expected to be higher under the Piping Alternative. However, as we do not quantify these impacts, we do not present the incremental costs of the Piping Alternative over the No Action Alternative.

## 3.2 NED Benefits

Table 8-6 (NWPM 506.20, Economic Table 5a) in the Plan-EA summarizes annual average NED project benefits of the Piping Alternative that exceed the benefits under the No Action Alternative. Table 8-7 (NWPM 506.21, Economic Table 6) in the Plan-EA compares annual NED benefits and costs of the Piping Alternative over those in the No Action Alternative.

### 3.2.1 Benefits Considered and Included in Analysis

#### 3.2.1.1 Agricultural Damage Reduction Benefit

As discussed in Sections 1.2.1.1 and 2.2.1.1, NUID would experience reduced agricultural damage due to increases in available water for irrigation under both the No Action and Piping Alternatives. Table PP summarizes the benefits shown in Table J (for the Piping Alternative) and Table DD (for the No Action Alternative). The benefits of reduced agricultural damage under the Piping Alternative outweigh the benefits under the No Action Alternative, resulting in a NED benefit of $337,000.

**Table PP. Avoided Damages to NUID Agriculture Resulting from No Action Alternative and Piping Alternative by Project Group, Deschutes Watershed, Oregon, 2019$ [1].**

| Project Group | Annualized Average Net Benefits of No Action Alternative above Baseline | Annualized Average Net Benefits of Piping Alternative above Baseline | Annualized Average Net Benefits of Piping Alternative above No Action Alternative |
|---|---|---|---|
| Project Group 1 | $47,000 | $335,000 | $288,000 |
| Project Group 2 | $0 | $49,000 | $49,000 |
| **Total** | **$47,000** | **$384,000** | **$337,000** |

Note: Totals may not sum due to rounding. Prepared December 2019
[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

### 3.2.1.2 Operations and Maintenance Cost Savings Benefit

Table QQ compares the O&M cost savings of the Piping Alternative (also shown in Table K) that exceed the cost savings under the No Action Alternative (also shown in Table EE). As the table indicates, the Piping Alternative would result in additional annualized benefits of $3,000.

**Table QQ. Annual Reduced Operation and Maintenance Costs to COID of Piping Alternative and No Action Alternative by Project Group, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | No Action Alternative | | Piping Alternative | | |
|---|---|---|---|---|---|
| | Mileage Piped | Discounted Annualized Benefit (Cost Savings) | Mileage Piped | Discounted Annualized Benefit (Cost Savings) | Discounted Annualized Benefit Over the No Action Alternative |
| Project Group 1 | 2.3 | $1,000 | 5.1 | $3,000 | $2,000 |
| Project Group 2 | 0.0 | $0 | 2.8 | $1,000 | $1,000 |
| **Total** | **2.3** | **$1,000** | **7.9** | **$4,000** | **$3,000** |

Note: Totals may not sum due to rounding. Prepared December 2019
[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

### 3.2.1.3 Patron Irrigation Pumping Cost Savings

Table RR compares the energy cost savings of the Piping Alternative (shown in Table L) to the savings of the No Action Alternative (shown in Table FF). In Project Group 1, the energy savings under the No Action Alternative equal the savings under the Piping Alternative, causing the NED benefits to be zero. However, in Project Group 2, the benefits under the Piping Alternative exceed those under the No Action Alternative. In total, the additional energy savings under the Piping Alternative results in an annualized benefit of $1,000 above the No Action Alternative, as shown in Table RR.

Table SS compares the cost savings from eliminating pumps under the Piping Alternative (shown in Table M) to the savings of the No Action Alternative (shown in Table GG). Although the G-4

Lateral would be piped under both alternatives, because the G-4 would be piped at a later time under the No Action Alternative, the NED benefits under the Piping Alternative would be approximately $1,000 higher than under the No Action Alternative.

**Table RR. Annual Increased Average Energy Cost Savings to COID Patrons of Piping Alternative Compared to the No Action Alternative, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Discounted Annual Costs Savings Under No Action Alternative | Discounted Annual Cost Savings Under the Piping Alternative | Discounted Average Annual NED Benefits of the Piping Alternative Over the No Action Alternative |
|---|---|---|---|
| Project Group 1 | $4,000 | $4,000 | $0 |
| Project Group 2 | $0 | $1,000 | $1,000 |
| **Total** | **$4,000** | **$5,000** | **$1,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

**Table SS. Annual Estimated Cost Savings from Eliminated Irrigation Pumps Under the Piping Alternative Compared to the No Action Alternative, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Discounted Annual Costs Savings Under No Action Alternative | Discounted Annual Cost Savings Under the Piping Alternative | Discounted Average Annual NED Benefits of the Piping Alternative Over the No Action Alternative |
|---|---|---|---|
| Project Group 1 | $11,000 | $12,000 | $1,000 |
| Project Group 2 | $0 | $0 | $0 |
| **Total** | **$11,000** | **$12,000** | **$1,000** |

Note: Totals may not sum due to rounding. Prepared December 2019

[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

#### 3.2.1.4 Value of Conserved Water

Table TT combines the results of Table O and Table HH to compare the instream flow benefits of the Piping Alternative to the No Action Alternative. On annualized basis, the Piping Alternative generates $598,000 more than the No Action Alternative.

**Table TT. Annual Increased Instream Flow Value of Piping Alternative Compared to the No Action Alternative, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Discounted Annual Instream Flow Value Under No Action Alternative | Discounted Annual Instream Flow Value Under the Piping Alternative | Discounted Average Annual NED Benefits of the Piping Alternative Over the No Action Alternative |
|---|---|---|---|
| Project Group 1 | $83,000 | $594,000 | $511,000 |
| Project Group 2 | $0 | $87,000 | $87,000 |
| **Total** | **$83,000** | **$681,000** | **$598,000** |

Note: Totals may not sum due to rounding. Prepared December 2019
[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

#### 3.2.1.5 Value of Supporting the Oregon Spotted Frog Habitat

Table UU uses information from Table S and Table II to compare the benefits of supporting the OSF under the Piping Alternative and the No Action Alternative. As shown in the last column, compared to the No Action Alternative, the Piping Alternative generates an additional $536,000 on an annualized basis.

**Table UU. Annual Increased OSF Support Value of Piping Alternative Compared to the No Action Alternative, Deschutes Watershed, Oregon, 2019$[1].**

| Works of Improvement | Discounted Annual OSF Support Value Under No Action Alternative | Discounted Annual OSF Support Value Under the Piping Alternative | Discounted Average Annual NED Benefits of the Piping Alternative Over the No Action Alternative |
|---|---|---|---|
| Project Group 1 | $74,000 | $533,000 | $459,000 |
| Project Group 2 | $0 | $77,000 | $77,000 |
| **Total** | **$74,000** | **$610,000** | **$536,000** |

Note: Totals may not sum due to rounding. Prepared December 2019
[1]/Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

### 3.2.2 Incremental Analysis

The Piping Alternative is also evaluated using an incremental analysis, which identifies how total costs and benefits change as project groups are added. In the incremental analysis, project group pipe sizes and costs remain the same for each project group assessed.

The engineering pipeline design (pipe diameters, pressure ratings, etc.) is independent of the number of project groups and the order that the project groups are installed. In engineering the design of the system, the District and Black Rock Consulting mapped and collected digital elevation data along the entire delivery system. The District determined that the system needed to be able to deliver seven

gallons per minute per acre served. The system also needed to be able to handle an upper limit of nine gallons per minute per acre served. In addition to evaluating the system based on COID water rights and demand, the system was also evaluated to include water to be passed through to Lone Pine Irrigation District (this is part of their current operations) as well as passing 200 CFS to NUID. The District used these data to create a hydraulic model that determined pipe sizes for each pipeline (canal or lateral to be piped) in the system.

Table VV shows the incremental analysis of the project groups.

**Table VV. Incremental Analysis of Annual NED Costs and Benefits Under the Piping Alternative for Central Oregon Irrigation District 2017 Watershed Plan, Deschutes Watershed, Oregon, 2019$[1].**

| Groups | Total Costs | Incremental Costs[2] | Total Benefits | Incremental Benefits[2] | Net Benefits |
|---|---|---|---|---|---|
| 1 | $830,000 | N/A | $1,261,000 | N/A | $431,000 |
| 1,2 | $931,000 | $101,000 | $1,476,000 | $215,000 | $545,000 |

Note: Totals may not sum due to rounding Prepared December 2019

[1/]Price Base: 2019 dollars amortized over 100 years at a discount rate of 2.75 percent.

[2/] N/A= Not applicable

# 4 NED Appendix

## 4.1 NED Crop Enterprise Budgets

This section presents the crop enterprise budgets used in estimating agricultural NED benefits under the Piping Alternative resulting from reduced damages associated with reducing water shortages in NUID. Enterprise budgets aim to reflect costs and returns under best management practices for production in the region, but do not necessarily represent conditions of any particular farm. We used crop budgets for carrot seed and alfalfa hay developed, respectively, by Oregon State University (OSU) and Washington State University (WSU), and then adjusted values in these budgets to account for changes in prices through time and local conditions in NUID. As the most recent alfalfa hay budget for the Deschutes River Basin is from 1995, we used a more recent 2012 WSU budget developed for agricultural land in the Columbia Basin as we expect this to provide a more accurate representation of production practices and costs in the Deschutes Basin than the available OSU budget. Alfalfa budgets represent all hay and grain crops in NUID, while carrot budget represents all high value, specialty crops in NUID including peppermint, nursery, grass seed, vegetables, and all vegetable seed.

Because alfalfa hay is a perennial crop, we used the three WSU enterprise budgets that represent the costs and returns during the three stages of the crop's stand life. These consist of a budget for the stand establishment (Year 0, which is the fall establishment period), a budget for the first year of production (Year 1), and a budget for the remaining years of production (Year 2-6). We use the budgets to estimate the net benefits of piping (reduced water shortages) for agricultural production in NUID (in NED Section 1.2.1.1). The following two sections outline the data and assumptions used in adjusting the Oregon State and Washington State carrot seed and alfalfa hay budgets. Table 1 summarizes the net returns to carrot seed and alfalfa hay, as modeled in the enterprise budgets. For alfalfa, the annualized value is calculated using the same 2.75-percent discount rate as the rest of the analysis.

**Table 1. Summarized Net Returns to Crops.**

| Production Year | Duration (Years) | Carrot Seed | Alfalfa Hay |
|---|---|---|---|
| Year 0 | 0.25 | N/A | -$570 |
| Year 1 | 1 | $2,682 | $453 |
| Year 2-6 | 5 | N/A | $235 |
| Annualized, average value | | $2,682 | $159 |

N/A= Not applicable

## 4.2 Carrot Seed Enterprise Budget

The carrot seed enterprise budget (presented in full below) is an enterprise budget for carrot seeds developed by OSU in 2010 to represent the costs and benefits of producing carrot seeds in Central Oregon (Butler & Weber, 2010). We updated the costs and revenues presented in the budgets to account for changing values over time and to reflect values specific to NUID.

### 4.2.1 Modeled Farm and Equipment

The farm modeled in the original OSU budget is 600 acres total, of which 40 acres is dedicated to carrot seed. The budgets are based on producing hybrid carrot seed under drip irrigation. Power equipment units used in production include a combine, ATV, three two-wheel-drive tractors, one four-wheel-drive tractor, and a tractor with a loader. The implements and equipment include a swather, bedder bar, carrot roller, chisel, cultimulcher, cultipacker, disk, flail mower, flamer, flex harrow, land leveler, mint planter, mint rake, paper roller, pasture harrow, precision planter, roller, rolling cultivator, row sprayer, and tool bar with shovels.

#### 4.2.1.1 Input Costs

All costs are adjusted from the original values in the OSU budget. Wherever possible, we adopted area-specific values, which was the case for fuel prices and irrigation charges. NUID charges a flat rate of $180 per account and $72 per acre up to the allotted amount of water (North Unit Irrigation District, 2018; North Unit Irrigation District, 2019). As the irrigated parcel size in NUID is 55 acres, the flat rate is divided by 55 to derive the per-acre cost of the flat irrigation fee. For land costs, we use the average cost to rent irrigated cropland in Oregon: $150 per acre (NASS, 2019).

For costs that did not have area-specific values, we adjusted the value in the original budget using the national Producer Price Indices (PPI) produced by the National Agricultural Statistics Services (NASS), which are published for a variety of farm expenses (NASS, 2019). For example, there are prices indices for fertilizer, herbicides, supplies, tractors, custom work, as well as one for the farm sector in general. The PPI cost adjustments range from an 11-percent decrease in the price of fertilizer to a 30-percent increase in the cost of machinery.

#### 4.2.1.2 Labor Costs

For general farm labor, we use the average wage rate for farmworkers in the Central Oregon non-metropolitan area.[28] For equipment operator labor, we use the mean hourly wage rate for this occupation in Oregon.[29] In both cases, we adjust the average wage rate up by 20 percent to account for non-wage employment costs, such as health care and insurance. This results in total labor costs of $16.14 and $21.65 per hour for laborers and equipment operators, respectively.

#### 4.2.1.3 Revenues

To estimate the gross revenues of carrot seeds under full irrigation, we use the yield from the original OSU carrot seed budget (400 pounds per acre) because it is specific to Central Oregon and reflects the likely yield under drip irrigation (and thus matches the costs of production modeled in the published enterprise budget). We use the average price per pound received by farmers for carrot seed in Central Oregon from 2014 to 2018, according to data from Central Oregon Seeds: $16.44 (Weber, 2019).

[28] This is the average wage for the Farmworkers and Laborers, Crop, Nursery, and Greenhouse occupation (45-2092) in the Central Oregon non-metropolitan area according the Bureau of Labor Statistics Occupational Employment Statistics data in May 2018. We adjust wage for inflation to 2019 dollars using the Consumer Price Index.

[29] This is the average wage for the Agricultural Equipment Operators (45-2091) in Oregon according the Bureau of Labor Statistics Occupational Employment Statistics data in May 2018. We adjust wage for inflation to 2019 dollars using the Consumer Price Index.

### 4.2.2 Modeled Farm and Equipment

Table 2 below presents the carrot seed enterprise budget used to estimate the net returns to specialty crops in NUID.

**Table 2. Carrot Seed Enterprise Budget.**

| Item | Quantity | Unit | $/Unit | Total |
|---|---|---|---|---|
| **REVENUE** | | | | |
| Carrot seeds | 400.0 | lbs | $16.44 | $6,575.20 |
| **VARIABLE COSTS** | | | | |
| Insecticides | 1.0 | acre | $194.64 | $194.64 |
| Herbicides | 1.0 | acre | $251.75 | $251.75 |
| Fungicides | 1.0 | acre | $175.65 | $175.65 |
| Fertilizer | 1.0 | acre | $97.63 | $97.63 |
| Other | 1.0 | acre | $178.53 | $178.53 |
| Custom applications | 1.0 | acre | $164.67 | $164.67 |
| Rentals | 1.0 | acre | $295.25 | $295.25 |
| Seed | 1.0 | acre | $31.64 | $31.64 |
| Water | 1.0 | ac-in | $72.00 | $72.00 |
| Irrigation lot charge | 1.0 | acre | $3.29 | $3.29 |
| Install drip irrigation | 1.0 | acre | $366.11 | $366.11 |
| Hand Labor | 6.7 | hours | $16.14 | $108.61 |
| Irrigation labor | 10.0 | hours | $16.14 | $161.71 |
| Operator labor | 11.5 | hours | $21.65 | $249.37 |
| Roguing labor | 20.0 | hours | $16.14 | $322.77 |
| Diesel fuel | 27.6 | gal | $3.29 | $90.87 |
| Gasoline | 4.7 | gal | $2.47 | $11.53 |
| Repair & maintenance | 1.0 | acre | $155.87 | $155.87 |
| Interest on operating capital | 1.0 | acre | $112.09 | $112.09 |
| Total variable costs | | | | $3,043.99 |
| **FIXED COSTS** | | | | |
| Implements | 1.0 | ac | $104.08 | $104.08 |
| Tractors | 1.0 | ac | $207.41 | $207.41 |
| Self-propelled equipment | 1.0 | ac | $219.77 | $219.77 |
| Trucks | 1.0 | ac | $14.47 | $14.47 |
| Pickup & miscellaneous equipment | 1.0 | ac | $81.84 | $81.84 |
| Land cost | 1.0 | ac | $150.00 | $150.00 |
| Irrigation systems | 1.0 | ac | $71.45 | $71.45 |
| Total fixed costs | | | | $849.02 |
| Total costs | | | | $3,893.00 |
| **NET RETURNS PER ACRE** | | | | **$2,682.20** |

## 4.3 Alfalfa Hay Enterprise Budgets

The alfalfa hay enterprise budgets were based on 2012 budgets developed by WSU for establishing and producing alfalfa hay in the Washington Columbia Basin (Norberg & Neibergs, 2012). We selected these budgets as the basis for NUID crop production costs because they are the most recent crop budgets developed for alfalfa production in a region proximate to Central Oregon.

As in the carrot seed budgets, we updated the costs presented in the original budgets to account for changing values over time and to reflect conditions specific to NUID. Returns to alfalfa hay were based on reported hay yields in Jefferson County and the 2019 state-level normalized average price for alfalfa hay in Oregon (Economic Research Service, USDA, 2019). We developed three hay budgets in total: a budget for the stand establishment (Year 0, shown in Table 3), a budget for the first year of production (Year 1, shown in Table 4), and a budget for the remaining years of full production (Year 2-6, shown in Table 5).

### 4.3.1 Modeled Farm

The farm modeled in the original WSU budget was meant to represent typical per-acre costs of alfalfa production under best management practices. The modeled farm is 120 acres. The hay field is seeded in the fall following a grain crop such as wheat or barley and is harvested using one-ton bales beginning the following spring. Other than labor for irrigation, all labor is provided by hiring custom work (includes harvest, fertilizer application, and herbicide application). Irrigation is delivered by a center pivot. The alfalfa is assumed to have a stand life of seven years.

#### 4.3.1.1 Input Costs

All costs are adjusted from the original values in the WSU budget. As with the carrot seed budgets, we used area-specific values for fuel prices, irrigation charges, and land costs. Irrigation charges are the same as those presented in the carrot seed budget. The original WSU budget did not include the costs of land; however, we added it to the budget used in this analysis using the same value as was used in the carrot seed budget ($150 per acre). This cost was included in the years after establishment, but because about three-quarters of the establishment year is used to support a different crop (i.e., the grain crop), we only assign one-fourth of the land costs to alfalfa in the establishment year (to represent the fall season establishment). For costs that did not have area-specific values, we adjusted the value in the original budget using the same PPIs as were used in the carrot seed budgets.

#### 4.3.1.2 Labor Costs

Because most of the labor is provided by custom work, the only direct labor costs are for an agricultural equipment operator to move the center pivots. The per hour total labor costs for this equipment operator are the same as the per hour equipment operator costs presented in the carrot seed budget ($21.65 per hour). For swathing and raking, we assume three cuttings per year. The WSU budget assumed a yield of 8 tons per acre and we conservatively use a yield of 5.4 tons per acre based on published NASS yield estimates for Jefferson County. For other labor and fertilizer, we adjusted the costs proportionally to the change in yield from the original budget (i.e., if yield falls by 10 percent, the amount of labor or fertilizer needed also falls by 10 percent). To the extent that costs fall more than this, our results would under-estimate benefits (and vice versa).

#### 4.3.1.3 Revenues

To estimate the gross revenues of alfalfa hay, we use the average yields in Jefferson County from 2013 to 2017 according USDA NASS data: 5.4 tons per acre (NASS, 2019).[30] To estimate the gross revenues per ton, we use the normalized average price per ton for alfalfa hay in Oregon reported by the Economic Research Service of USDA: $193.20 per ton (Economic Research Service, USDA, 2019).

### 4.3.2 Alfalfa hay Enterprise Budget Tables

The tables below present the three alfalfa hay enterprise budgets used to estimate the net returns to hay/grain crops in NUID: one budget for the establishment year (Table 3), one budget modeling returns for the first year of production (Table 4), and one budget modeling costs and returns for the remaining production years (Years 2-6; Table 5).

[30] We excluded yield data from 2018 because that was a low water year and would not be representative of alfalfa hay under full irrigation.

**Table 3. Alfalfa Hay Enterprise Budget – Establishment Year (Year 0).**

| Item | Quantity | Unit | $/Unit | Total |
|---|---|---|---|---|
| **REVENUE** | | | | |
| Alfalfa hay | 0.0 | ton | $193.20 | $0.00 |
| **VARIABLE COSTS** | | | | |
| Seed | 20.0 | lb. | $4.46 | $89.21 |
| Custom - seeding | 1.0 | acre | $11.57 | $11.57 |
| Dry Nitrogen | 0.0 | lb. | $0.34 | $0.00 |
| Dry Phosphate | 92.0 | lb. | $0.58 | $53.23 |
| Dry Potash | 140.0 | lb. | $0.41 | $57.60 |
| Dry Sulfur | 25.0 | lb. | $0.20 | $4.89 |
| Zinc | 5.0 | lb. | $1.98 | $9.91 |
| Boron | 2.0 | lb. | $4.47 | $8.94 |
| Custom Application | 1.0 | acre | $9.90 | $9.90 |
| Herbicide - Raptor | 6.0 | oz. | $6.43 | $38.57 |
| Custom - herbicide application | 1.0 | acre | $10.31 | $10.31 |
| Soil Test | 1.0 | acre | $0.33 | $0.33 |
| Custom - Disc & Pack (2x) | 1.0 | acre | $55.00 | $55.00 |
| Irrigation - power | 1.0 | acre | $72.00 | $72.00 |
| Irrigation - water access | 1.0 | acre | $3.29 | $3.29 |
| Irrigation - repairs | 0.4 | acre | $16.53 | $5.95 |
| Irrigation - labor | 0.2 | acre | $21.65 | $3.90 |
| Fuel | 2.5 | gallon | $2.47 | $6.18 |
| Lubricants | 1.0 | acre | $1.36 | $1.36 |
| Machinery repairs | 1.0 | acre | $2.47 | $2.47 |
| Machinery labor | 0.25 | acre | $21.65 | $5.41 |
| Overhead | 1.0 | acre | $25.58 | $25.58 |
| Operating interest | 1.0 | acre | $15.05 | $15.05 |
| Total variable costs | | | | $490.64 |
| **FIXED COSTS** | | | | |
| Machinery depreciation | 1.0 | acre | $7.36 | $7.36 |
| Machinery interest | 1.0 | acre | $5.07 | $5.07 |
| Machinery insurance, taxes, housing, license | 1.0 | acre | $2.11 | $2.11 |
| Management (5% of total cost) | 1.0 | acre | $27 | $27.13 |
| Land cost | 1.0 | acre | $37.50 | $37.50 |
| Total fixed costs | | | | $79.19 |
| Total costs | | | | $569.83 |
| **NET RETURNS PER ACRE** | | | | **-$569.83** |

**Table 4. Alfalfa Hay Enterprise Budget (Year 1).**

| Item | Quantity | Unit | $/Unit | Total |
|---|---|---|---|---|
| **REVENUE** | | | | |
| Alfalfa hay | 5.4 | ton | $193.20 | $1,043.28 |
| **VARIABLE COSTS** | | | | |
| Dry Nitrogen | 0.0 | lb. | $0.34 | $0.00 |
| Dry Phosphate | 0.0 | lb. | $0.58 | $0.00 |
| Dry Potash | 0.0 | lb. | $0.41 | $0.00 |
| Dry Sulfur | 0.0 | lb. | $0.20 | $0.00 |
| Custom - Swath | 3.0 | acre | $22.00 | $66.00 |
| Custom - Rake | 3.0 | acre | $11.00 | $33.00 |
| Custom - Bail | 5.4 | ton | $18.70 | $100.98 |
| Custom - Haul & Stack | 5.4 | ton | $9.90 | $53.46 |
| Custom - Tarping | 5.4 | ton | $5.50 | $29.70 |
| Irrigation - power | 1.0 | acre | $72.00 | $72.00 |
| Irrigation - water access | 1.0 | acre | $3.29 | $3.29 |
| Irrigation - repairs | 1.0 | acre | $16.53 | $16.53 |
| Irrigation - labor | 0.5 | acre | $21.65 | $10.82 |
| Gopher control | 1.0 | acre | $5.58 | $5.58 |
| Fuel | 2.3 | gallon | $2.47 | $5.63 |
| Lubricants | 1.0 | acre | $0.89 | $0.89 |
| Machinery repairs | 1.0 | acre | $1.98 | $1.98 |
| Haystack Insurance | 5.4 | ton | $1.88 | $10.15 |
| Overhead | 1.0 | acre | $28.12 | $28.12 |
| Operating interest | 1.0 | acre | $23.16 | $23.16 |
| Total variable costs | | | | $461.35 |
| **FIXED COSTS** | | | | |
| Machinery depreciation | 1.0 | acre | $6.31 | $6.31 |
| Machinery interest | 1.0 | acre | $3.68 | $3.68 |
| Machinery insurance, taxes, housing, license | 1.0 | acre | $2.62 | $2.62 |
| Management (5% of total cost) | 1.0 | acre | $28.12 | $28.12 |
| Land cost | 1.0 | acre | $150.00 | $150.00 |
| Total fixed costs | | | | $190.73 |
| Total costs | | | | $652.08 |
| **NET RETURNS PER ACRE** | | | | **$391.20** |

**Table 5. Alfalfa Hay Enterprise Budget (Years 2-6).**

| Item | Quantity | Unit | $/Unit | Total |
|---|---|---|---|---|
| **REVENUE** | | | | |
| Alfalfa hay | 5.4 | ton | $193.20 | $1,043.28 |
| **VARIABLE COSTS** | | | | |
| Dry Nitrogen | 0.0 | lb. | $0.34 | $0.00 |
| Dry Phosphate | 62.1 | lb. | $0.58 | $35.93 |
| Dry Potash | 94.5 | lb. | $0.41 | $38.88 |
| Dry Sulfur | 16.9 | lb. | $0.20 | $3.30 |
| Zinc | 3.4 | lb. | $1.98 | $6.69 |
| Boron | 1.4 | lb. | $4.47 | $6.03 |
| Custom Application | 1.0 | acre | $9.90 | $9.90 |
| Soil Test | 1.0 | acre | $0.33 | $0.33 |
| Herbicide | 1.4 | lb. | $19.14 | $25.84 |
| Custom Application | 1.0 | acre | $9.90 | $9.90 |
| Custom - Swath | 3.0 | acre | $22.00 | $66.00 |
| Custom - Rake | 3.0 | acre | $11.00 | $33.00 |
| Custom - Bail | 5.4 | ton | $18.70 | $100.98 |
| Custom - Haul & Stack | 5.4 | ton | $9.90 | $53.46 |
| Custom - Tarping | 5.4 | ton | $5.50 | $29.70 |
| Irrigation - power | 1.0 | acre | $72.00 | $72.00 |
| Irrigation - water access | 1.0 | acre | $3.29 | $3.29 |
| Irrigation - repairs | 1.0 | acre | $16.53 | $16.53 |
| Irrigation - labor | 0.5 | acre | $21.65 | $10.82 |
| Haystack insurance | 5.4 | ton | $2.20 | $11.89 |
| Gopher control | 1.0 | acre | $5.58 | $5.58 |
| Fuel | 2.3 | gallon | $2.47 | $5.63 |
| Lubricants | 1.0 | acre | $0.89 | $0.89 |
| Machinery repairs | 1.0 | acre | $1.98 | $1.98 |
| Overhead | 1.0 | acre | $42.33 | $42.33 |
| Operating interest | 1.0 | acre | $16.25 | $16.25 |
| Total variable costs | | | | $607.13 |
| **FIXED COSTS** | | | | |
| Machinery depreciation | 1.0 | acre | $6.31 | $6.31 |
| Machinery interest | 1.0 | acre | $3.68 | $3.68 |
| Machinery insurance, taxes, housing, license | 1.0 | acre | $2.62 | $2.62 |
| Management (5% of total cost) | 1.0 | acre | $38.49 | $38.49 |
| Land cost | 1.0 | acre | $150.00 | $150.00 |
| Total fixed costs | | | | $201.10 |
| Total costs | | | | $808.23 |
| **NET RETURNS PER ACRE** | | | | **$235.05** |

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## D.2 Alternatives Considered during Formulation

This section presents the alternatives considered in the formulation phase.

During the formulation phase, alternatives were evaluated based on meeting both NEPA and environmental review requirements specific to NRCS federal investments in water resources projects (1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, herein P&G). According to NEPA, agencies shall rigorously explore and objectively evaluate all reasonable alternatives (40 CFR 1502.14). According to P&G, alternative plans, including the NED plan, should be formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability (P&G 1.6.2c).

1. Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. This may require relating the plan to other types of public or private plans if the other plans are crucial to realization of the contributions to the objective.
2. Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities.
3. Efficiency is the extent to which an alternative plan is the most cost effective by means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment.
4. Acceptability is the workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations, and public policies.

Alternatives that were eliminated during formulation are identified in Table D-1 and further discussed below.

**Table D-1. Alternatives Considered During the Formulation Phase.**

| Alternative | Which criteria in the P&G[1] does the alternative achieve? | | | | Selected for Further Evaluation |
|---|---|---|---|---|---|
| | Completeness | Effectiveness | Efficiency | Acceptability | |
| Conversion to Dryland Farming | | | X | | |
| Fallowing Farm Fields | | | X | | |
| Voluntary Duty Reduction | | | X | X | |
| Use of Re-Regulating Reservoirs | | | | X | |
| Exclusive or Partial Use of Groundwater | | | | | |

| Alternative | Which criteria in the P&G[1] does the alternative achieve? | | | | Selected for Further Evaluation |
|---|---|---|---|---|---|
| | Completeness | Effectiveness | Efficiency | Acceptability | |
| On-Farm Efficiency Upgrades | | X | | X | X |
| Canal Lining | X | X | | X | X |
| Piping Private Laterals | | X | | X | X |
| No Action (Future without Project) | | | X | | X |
| Piping Alternative | X | X | X | X | X |

Notes:
[1]/ Source: USDA 2013, 1.6.2c

### D.2.1 Conversion to Dryland Farming

This method of farming uses no irrigation and drought-resistant crops and practices to conserve moisture. The lack of rainfall throughout the growing season coupled with hot temperatures, desiccating winds, as well as generally shallow and well-to-excessively drained soils with low storage potentials, make dryland farming infeasible within the District (Daly et al. 1994; Gannett et al. 2001). Furthermore, in dryland farming systems where rainfall is approximately 12 inches per year (like COID) a fallow every other year is necessary (Golden and Aylward 2006; Granatstein 1992). In the project area, production would substantially decrease if dryland farming were implemented. Furthermore, COID lacks the statutory authority to force COID patrons to begin dryland farming. Therefore, carrying out this alternative would be logistically complex.

Conversion to dryland farming was eliminated from further evaluation because it would not meet the project purpose; its effectiveness would be uncertain because conversion to dryland farming would be voluntary; and it would not be acceptable because it is inconsistent with public policy supporting and maintaining existing agricultural land use.

### D.2.2 Fallowing Farm Fields

Fallowing farm fields includes permanently transferring or temporarily leasing water rights from irrigated lands or otherwise not using water rights appurtenant to irrigated lands, whether facilitated through market-based incentives or other approaches. Fallowing farm fields would use less irrigation water within the District and would therefore allow more water to be available for other uses and users, including being kept instream for fish, wildlife, and habitat. This water would only be legally protected instream if the patrons' chose to lease or transfer their associated water rights instream.

The District lacks the statutory authority or responsibility to carry out, operate, and maintain fallowing farm fields by COID patrons. Carrying out this alternative would depend on voluntary action by and taken at the discretion of patrons. It would be logistically complex, and there would be no certainty that it would occur.

Further, fallowing farm fields would likely mean that the District would divert less water. The District would still have to divert enough water, accounting for carry water and seepage, to ensure the delivery of water to remaining irrigated lands. Because the District's conveyance system is an open canal that already experiences conveyance inefficiencies, reduced diversion rates would likely exacerbate these pre-existing inefficiencies rather than lessening them.

Fallowing farm fields was eliminated from further evaluation because it would not meet the project purpose; its effectiveness would be uncertain because fallowing fields would be voluntary; and it would not be acceptable because it is inconsistent with public policy supporting and maintaining existing agricultural land use.

### D.2.3 Voluntary Duty Reductions

Voluntary duty reduction refers to patrons voluntarily accepting less than their full water delivery rate or duty from the District, whether facilitated through market-based incentives or other approaches. A reduction in duty could mean the District diverts less water, which would leave more water available for other users or uses, including instream uses.

The District lacks the statutory authority or responsibility to carry out, operate, and maintain voluntary duty reductions by its patrons. The District is obligated to provide a certain amount of water to patrons to meet their associated water rights, so carrying out this alternative would depend on voluntary action by and taken at the discretion of patrons, creating a logistically complex situation for COID to implement. This alternative would rely on voluntary actions; therefore, there would be no certainty that they would occur.

Voluntary duty reductions would likely mean that the District would divert less water. The District would still have to divert enough water, accounting for carry water and seepage, to ensure both the delivery of water to irrigated lands with voluntary duty reductions and the delivery of water to remaining irrigated lands. Because the District's conveyance system is an open canal that already experiences conveyance inefficiencies, reduced diversion rates would likely exacerbate these pre-existing inefficiencies rather than lessening them. Therefore, carrying out this alternative while still meeting this project purpose would be logistically complex and technically infeasible.

Voluntary duty reductions was eliminated from further evaluation because it would not meet the project purpose and its effectiveness would be uncertain because duty reductions would be voluntary. Although this alternative would be acceptable based on existing state and local laws, policies, and regulations, carrying out this alternative would be logistically complex and technically infeasible

### D.2.4 Use of Re-Regulating Reservoirs

The use of re-regulating reservoirs to increase operational efficiencies was considered as a possible alternative. As an operational technique, re-regulating reservoirs could absorb the fluctuations in conveyance flow and release the flow in a more controlled manner to patrons. This could allow better timing of water delivery to patrons. However, this alternative would not address water loss in the District's conveyance system and therefore would not save water or restore streamflow.

Additionally, the District would need to purchase the underlying land or gain approval from landowners where re-regulating reservoirs would be located for optimal efficiency; gaining this approval would be logistically challenging and not reasonably certain to occur.

Use of re-regulating reservoirs was eliminated from further evaluation because it would not meet the project purpose as streamflow would not be restored, public safety would not be improved, and there would be logistical constraints obtaining land to construct reservoirs.

### D.2.5 Exclusive or Partial Use of Groundwater

The exclusive or partial conversion from surface water sourced to groundwater-sourced irrigation was initially considered as a possible alternative. To use groundwater in the Deschutes Basin, the District would have to apply for groundwater rights under OWRD's Deschutes Basin Groundwater Mitigation (DBGM) program pursuant to OAR 690-505-0500. The DBGM program is part of OWRD's goal to limit groundwater use by imposing restrictions to new users obtaining groundwater rights. Under the DBGM program, only 32.98 cfs is available for the whole Deschutes Basin, and it is unlikely the District could obtain rights to all the remaining water (S Henderson, personal communication, August 14, 2017). Given only 32.98 cfs is available under this program, the District's exclusive use of groundwater to entirely replace their use of surface water is not feasible.

The partial use of groundwater for irrigation would have logistical and legal constraints. The District and patrons could use their surface water rights for groundwater mitigation credits[31] required by the DBGM program, however, the District would need the authority from each patron to convert surface rights to groundwater rights; there would be no guarantee of gaining this approval from patrons. Converting from surface water rights to groundwater rights would also affect the seniority and, therefore, the reliability of the District's water rights. The District currently has senior surface water rights that minimize the chance of being impacted during drought years; however, new groundwater rights would be junior (dated the year of the application and construction) and could be subject to curtailment in the future.

Additionally, the District lacks the statutory authority or responsibility to carry out, operate and maintain groundwater wells on private lands owned by COID patrons. Therefore, carrying out this alternative would be logistically complex. The partial use of groundwater was eliminated from further evaluation because it would not meet the project purpose; its effectiveness would be uncertain since conversion to groundwater would be voluntary; inefficiencies associated with logistical and legal constraints obtaining groundwater rights; and low acceptability since converting to groundwater rights would result in junior water rights.

### D.2.6 References

Daly, C., R. Neilson, and D. Phillips. 1994. A Statistical-Topographic Model for Mapping Climatological Precipitation over Mountainous Terrain. *Journal of Applied Meteorology* 33(2), 140-158. February.

Gannett, M.W., Lite, K.E. Jr., Morgan, D.S., & Collins, C.A. 2001. Ground-water hydrology of the upper Deschutes Basin, Oregon: U.S. Geological Survey Water-Resources Investigations Report 00–4162, p. 77.

Golden, B., and B. Aylward. 2006. Instream Flow in the Deschutes Basin: Monitoring, Status and Restoration Needs. Bend, Oregon: Deschutes River Conservancy.

[31] COID would not create groundwater mitigation credits under either the No Action or the Piping Alternative analyzed in this Plan-EA.

Granatstein, D. 1992. Dryland Farming in the Northwestern United States: A Nontechnical Overview. MISC0162, Washington State University Cooperative Extension, Pullman. 31 pp.

Henderson, Sarah (OWRD). 2017. Personal communication (email) with Amanda Schroeder (FCA). August 14, 2017.

## D.3 Capital Costs for the Eliminated Alternatives

This section presents dimensions and capital costs for canal lining.

### D.3.1 Canal Lining Alternative

The capital cost of the Canal Lining Alternative was estimated by calculating the length of geotextile membrane in existing open canals, assuming an anchor of membrane extending 7 feet on either side. The membrane would be covered by a 1-inch layer of shotcrete (fine-aggregate concrete sprayed in place). This estimate also includes fencing along both sides of the canal, and safety ladders every 750 feet in channels deeper than 2.5 feet. Costs related to earthwork and labor are estimated by a construction cost multiplier of 2. Turnouts were estimated using the same assumptions as the piping alternative. The cross-section dimensions for lining the canals was calculated for each corresponding pipe diameter size using transects on a digital elevation model.

**Table D-2. Canal Lining Alternative Costs.**

| Area | Feature | Diameter (in) | Quantity | Units | Cross-section to be lined (ft.) | Channel Width (ft.) | Geomembrane total ($) | Shotcrete total ($) | Fencing total ($) | Ladder total ($) | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Group 1 | | | | | | | | | | | |
| PBC | LINING | 108 | 7,650 | Ft | 37.8 | 35.1 | $336,881 | $1,590,771 | $104,958 | $5,100 | $4,075,422 |
| PBC | LINING | 102 | 6,650 | Ft | 33.6 | 31.9 | $269,341 | $1,230,742 | $91,238 | $4,433 | $3,191,507 |
| PBC | LINING | 48 | 860 | Ft | 25.9 | 23.5 | $29,153 | $122,414 | $11,799 | $573 | $327,879 |
| L Lateral | LINING | 48 | 20 | Ft | 25.9 | 23.5 | $678 | $2,847 | $274 | $13 | $7,625 |
| J Lateral | LINING | 32 | 5,077 | Ft | 25.3 | 24.0 | $161,141 | $707,595 | $69,656 | $3,385 | $1,883,553 |
| L Lateral | LINING | 24 | 150 | Ft | 23.8 | 22.6 | $4,561 | $19,612 | $2,058 | $100 | $52,661 |
| G-4 Lateral | LINING | 12 | 1,980 | Ft | 12.7 | 11.8 | $41,634 | $138,719 | $27,166 | $0 | $415,039 |
| G-4 Lateral | LINING | 8 | 2,900 | Ft | 12.3 | 11.6 | $59,895 | $196,158 | $39,788 | $0 | $591,683 |
| G-4 Lateral | LINING | 4 | 1,628 | Ft | 10.7 | 10.5 | $31,414 | $95,819 | $22,336 | $0 | $299,139 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PBC | Mobilization & SUPPORT | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | $594,788 |
| PBC | STRUCTURES | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | $500,000 |
| PBC | TURNOUTS | N/A | 15 | Unit | N/A | N/A | N/A | N/A | N/A | N/A | $247,000 |
| J Lateral | TURNOUTS | N/A | 4 | Unit | N/A | N/A | N/A | N/A | N/A | N/A | $41,000 |
| G-4 Lateral | TURNOUTS | N/A | 12 | Unit | N/A | N/A | N/A | N/A | N/A | N/A | $33,225 |
| L Lateral | TURNOUTS | N/A | 1 | Unit | N/A | N/A | N/A | N/A | N/A | N/A | $4,000 |
| Project Group 2 | | | | | | | | | | | |
| PBC D/S L Lateral | INTAKE STRUCTURE | N/A | 1 | Unit | N/A | N/A | N/A | N/A | N/A | N/A | $150,000 |
| J Lateral | LINING | 32 | 1,410 | Ft | 25.3 | 24.0 | $44,753 | $196,515 | $19,345 | $940 | $523,106 |
| J Lateral | LINING | 32 | 3,073 | Ft | 25.3 | 24.0 | $97,535 | $428,292 | $42,162 | $2,049 | $1,140,075 |
| J Lateral | LINING | 32 | 3,669 | Ft | 25.3 | 24.0 | $116,452 | $511,358 | $50,339 | $2,446 | $1,361,189 |
| J Lateral | LINING | 24 | 186 | Ft | 23.8 | 22.6 | $5,655 | $24,318 | $2,552 | $124 | $65,299 |
| PBC D/S L Lateral | LINING | 12 | 1,400 | Ft | 12.7 | 11.8 | $29,439 | $98,084 | $19,208 | $0 | $293,462 |
| PBC D/S L Lateral | LINING | 8 | 2,374 | Ft | 12.3 | 11.6 | $49,032 | $160,579 | $32,571 | $0 | $484,364 |
| PBC D/S L Lateral | LINING | 8 | 2,558 | Ft | 12.3 | 11.6 | $52,832 | $173,025 | $35,096 | $0 | $521,905 |
| PBC D/S L Lateral | RAILROAD CROSSING | N/A | 1 | Unit | N/A | N/A | N/A | N/A | N/A | N/A | $50,000 |
| PBC D/S L Lateral | ROAD XING (MAJOR) | N/A | 2 | Unit | N/A | N/A | N/A | N/A | N/A | N/A | $150,000 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PBC D/S L Lateral | ROAD XING (MINOR) | N/A | 2 | Unit | N/A | N/A | N/A | N/A | N/A | N/A | $90,000 |
| PBC D/S L Lateral | TURNOUT | N/A | 10 | Unit | N/A | N/A | N/A | N/A | N/A | N/A | $80,000 |
| | | | | | | | | **Subtotal** | | | **$17,174,000** |
| | | | | | | | | **Engineering, Construction Management, Survey (5% Project Group 1, 10% Project Group 2)** | | | **$1,104,000** |
| | | | | | | | | **Construction Management / General Contractor (8% Project Group 1, 15% Project Group 2)** | | | **$1,718,000** |
| | | | | | | | | **Contingency (30% both project groups)** | | | **$5,152,000** |
| | | | | | | | | **TOTAL** | | | **$25,148,000** |

Totals are rounded to nearest $1000.

## D.4 Net Present Value of Alternatives and Other Piping Materials Considered

This section presents the calculations used to estimate the net present value of the Preferred Alternative, eliminated alternatives, and other piping materials considered.

**Discount Rate**: 2.75% **Period of Analysis**: 100 years

**Table D-3. Net Present Value of the Preferred Alternative, Other Piping Materials Considered, and the Eliminated Alternative.**

| Project Group | Alternatives and Other Piping Materials Considered | | | |
|---|---|---|---|---|
| | HDPE Piping | PVC Piping | Steel Piping | Canal Lining |
| **Design Life (years)** | 100 | 33 | 50 | 33 |
| **Capital Costs** | | | | |
| 1 | $34,417,000 | $34,929,000 | $36,392,000 | $17,538,000 |
| 2 | $3,143,000 | $3,469,000 | $5,337,000 | $7,610,000 |
| **Net Present Value of Replacement Costs[1]** | | | | |
| 1 | $3,221,000 | $3,776,000 | $3,884,000 | $11,154,000 |
| 2 | N/A | $756,000 | $877,000 | $4,893,000 |
| **Annual Operation and Maintenance Costs** | | | | |
| 1 | $15,000 | $15,000 | $15,000 | $21,000 |
| 2 | $8,000 | $8,000 | $8,000 | $12,000 |
| Total Percent Change in O&M: | -15% | -15% | -15% | 25% |
| **Total Net Present Value of O&M Costs** | | | | |
| 1 | $509,000 | $509,000 | $509,000 | $713,000 |
| 2 | $272,000 | $272,000 | $272,000 | $407,000 |
| **Total Net Present Value of Project** | | | | |
| **Total:** | **$41,562,000** | **$43,711,000** | **$47,271,000** | **$42,315,000** |

Notes:
[1] For PVC pipe, 33% of the pipe was replaced at 33 years and 67% replaced at 66 years. For steel pipe, 25% was replaced at 50 years and 75% replaced at 75 years. For canal lining, 100% was replaced at both 33 years and 66 years.

## D.5 Piping Alternative Costs

This section presents dimensions and capital costs for the Piping Alternative. The Piping Alternative was priced using HDPE pipe for small diameter pipe, which was at the time of this analysis considered the most cost-effective material and is identified as the Preferred Alternative. The material for large diameter pipe (102 and 108 inch) is still in the process of being selected. The cost below represents an average cost of HDPE, fiberglass, and steel (three different materials being considered at this time). This section also includes a discussion of other piping materials that were considered for the Piping Alternative.

### D.5.1 Preferred Alternative Costs

**Table D-4. Preferred Alternative Costs.**

| Project Group | Area | Feature | Diameter (in) | Length (ft.) | Qty | $/Unit | Total Cost |
|---|---|---|---|---|---|---|---|
| 1 | PBC | EARTHWORK | N/A | N/A | N/A | N/A | $7,645,500 |
| 1 | PBC | CROSSINGS (SPECIAL PIPE CONDITIONS) | N/A | N/A | N/A | N/A | $42,500 |
| 1 | PBC | PIPE LINE APPURTENANCES | N/A | N/A | N/A | N/A | $525,000 |
| 1 | PBC | PRESSURE REDUCTION | N/A | N/A | 1 | N/A | $ 650,000 |
| 1 | PBC | TURNOUTS | N/A | N/A | 15 | N/A | $247,000 |
| 1 | PBC | MAIN PIPELINE | 48 | 860 | | $225 | $193,500 |
| 1 | PBC | MAIN PIPELINE | 102 | 6,650 | | $875 | $5,818,750 |
| 1 | PBC | MAIN PIPELINE | 108 | 7,650 | | $925 | $7,076,250 |
| 1 | PBC | MAIN PIPELINE Bend Fittings | N/A | N/A | 54 | $29,500 | $1,593,000 |
| 1 | PBC | CONTINGENCY (10%) | N/A | N/A | N/A | N/A | $2,379,150 |
| 1 | PBC | CMGC (8%) | N/A | N/A | N/A | N/A | $1,903,320 |
| 1 | PBC | ECMS (5%) | N/A | N/A | N/A | N/A | $1,189,575 |
| 1 | PBC | MOBILIZATION & SUPPORT | N/A | N/A | N/A | N/A | $594,788 |
| 1 | PBC | DEMOLITION | N/A | N/A | N/A | N/A | $530,000 |
| 1 | PBC | SURFACE RESTORATION | N/A | N/A | N/A | N/A | $942,500 |
| 1 | PBC | STRUCTURES | N/A | N/A | N/A | N/A | $500,000 |
| 1 | PBC | CONTINGENCY (10%) | N/A | N/A | N/A | N/A | $256,729 |
| 1 | PBC | CMGC (8%) | N/A | N/A | N/A | N/A | $205,383 |
| 1 | PBC | ECMS (5%) | N/A | N/A | N/A | N/A | $128,364 |
| 1 | J Lateral | DEMOLITION & EARTHWORK | N/A | N/A | N/A | N/A | $107,500 |
| 1 | J Lateral | PIPE LINE APPURTENANCES | N/A | N/A | N/A | N/A | $8,000 |
| 1 | J Lateral | CROSSINGS (SPECIAL PIPE CONDITIONS) | N/A | N/A | N/A | N/A | $10,000 |

| Project Group | Area | Feature | Diameter (in) | Length (ft.) | Qty | $/Unit | Total Cost |
|---|---|---|---|---|---|---|---|
| 1 | J Lateral | SURFACE RESTORATION | N/A | N/A | N/A | N/A | $198,000 |
| 1 | J Lateral | TURNOUTS | N/A | N/A | N/A | N/A | $41,000 |
| 1 | J Lateral | MAIN PIPELINE | 30 | 5,077 | N/A | $125 | $634,625 |
| 1 | J Lateral | MAIN PIPELINE Bend Fittings | N/A | N/A | 10 | $1,500 | $15,000 |
| 1 | J Lateral | CONTINGENCY (10%) | N/A | N/A | N/A | N/A | $101,413 |
| 1 | J Lateral | CMGC (8%) | N/A | N/A | N/A | N/A | $81,130 |
| 1 | J Lateral | ECMS (5%) | N/A | N/A | N/A | N/A | $50,706 |
| 1 | G-4 Lateral | MAIN PIPELINE | 4 | 1,628 | N/A | $25 | $30,525 |
| 1 | G-4 Lateral | MAIN PIPELINE | 8 | 2,900 | N/A | $40 | $87,000 |
| 1 | G-4 Lateral | MAIN PIPELINE | 10 | 1,980 | N/A | $50 | $74,250 |
| 1 | G-4 Lateral | TURNOUTS | N/A | N/A | 12 | N/A | $33,225 |
| 1 | G-4 Lateral | PUMP STATION | N/A | N/A | N/A | N/A | $75,000 |
| 1 | G-4 Lateral | CONTINGENCY (10%) | N/A | N/A | N/A | N/A | $30,000 |
| 1 | G-4 Lateral | CMGC (8%) | N/A | N/A | N/A | N/A | $24,000 |
| 1 | G-4 Lateral | ECMS (5%) | N/A | N/A | N/A | N/A | $15,000 |
| 1 | L Lateral | DEMOLITION & EARTHWORK | N/A | N/A | N/A | N/A | $22,500 |
| 1 | L Lateral | MAIN PIPELINE | 24 | N/A | N/A | N/A | $22,500 |
| 1 | L Lateral | MAIN PIPELINE | 48 | N/A | N/A | N/A | $7,000 |
| 1 | L Lateral | MAIN PIPELINE Bend Fittings | N/A | N/A | 6 | N/A | $8,000 |
| 1 | L Lateral | PIPE LINE APPURTENANCES | N/A | N/A | N/A | N/A | $4,500 |
| 1 | L Lateral | CROSSINGS (SPECIAL PIPE CONDITIONS) | N/A | N/A | | N/A | $240,000 |
| 1 | L Lateral | TURNOUTS | N/A | N/A | 1 | N/A | $4,000 |
| 1 | L Lateral | CONTINGENCY (10%) | N/A | N/A | N/A | N/A | $30,850 |
| 1 | L Lateral | CMGC (8%) | N/A | N/A | N/A | N/A | $24,680 |
| 1 | L Lateral | ECMS (5%) | N/A | N/A | N/A | N/A | $15,425 |
| 2 | J Lateral | MAIN PIPELINE | 32 | 3,669 | N/A | $ 212 | $776,225 |
| 2 | J Lateral | MAIN PIPELINE | 30 | 1,410 | N/A | $ 186 | $262,243 |
| 2 | J Lateral | MAIN PIPELINE | 30 | 3,073 | N/A | $152 | $466,279 |
| 2 | J Lateral | MAIN PIPELINE | 24 | 186 | N/A | $ 97 | $18,058 |
| 2 | J Lateral | CONTINGENCY (5%) | N/A | N/A | N/A | N/A | $95,175 |
| 2 | J Lateral | CMGC (15%) | N/A | N/A | N/A | N/A | $228,421 |
| 2 | J Lateral | ECMS (10%) | N/A | N/A | N/A | N/A | $152,280 |
| 2 | PBC D/S L Lateral | MAIN PIPELINE | 10 | 1,400 | N/A | $24 | $33,449 |
| 2 | PBC D/S L Lateral | MAIN PIPELINE | 8 | 2,374 | N/A | $15 | $36,507 |
| 2 | PBC D/S L Lateral | MAIN PIPELINE | 8 | 2,558 | N/A | $17 | $43,220 |

| Project Group | Area | Feature | Diameter (in) | Length (ft.) | Qty | $/Unit | Total Cost |
|---|---|---|---|---|---|---|---|
| 2 | PBC D/S L Lateral | PRV STATION | N/A | N/A | 1 | $250,000 | $250,000 |
| 2 | PBC D/S L Lateral | ROAD XING (MAJOR) | N/A | N/A | 2 | $75,000 | $150,000 |
| 2 | PBC D/S L Lateral | ROAD XING (MINOR) | N/A | N/A | 2 | $45,000 | $90,000 |
| 2 | PBC D/S L Lateral | ENERGY DISS. TEMP | N/A | N/A | 1 | $12,000 | $12,000 |
| 2 | PBC D/S L Lateral | RAILROAD CROSSING | N/A | N/A | 1 | $50,000 | $50,000 |
| 2 | PBC D/S L Lateral | INTAKE STRUCTURE | N/A | N/A | 1 | $150,000 | $150,000 |
| 2 | PBC D/S L Lateral | TURNOUT | N/A | N/A | 10 | $8,000 | $80,000 |
| 2 | PBC D/S L Lateral | CONTINGENCY (5%) | N/A | N/A | N/A | N/A | $55,949 |
| 2 | PBC D/S L Lateral | CMGC (15%) | N/A | N/A | N/A | N/A | $134,276 |
| 2 | PBC D/S L Lateral | ECMS (10%) | N/A | N/A | N/A | N/A | $89,518 |
| | | | | | | **Total** | **$37,590,737** |

## D.5.2 Other Piping Materials Considered

In addition to HDPE, using steel or polyvinyl chloride (PVC) was also explored for the smaller diameter pipes. A cost analysis was completed for each material. The same costs were used for the large diameter pipes (102 and 108 inch) across all the cost analyses and a design life of 50 years was used for the large diameter pipes. Earthwork, turnouts, and other non-pipe costs were also kept constant for the PVC and steel analysis. The lengths, diameters, and range of pressure ratings used for these piping alternatives were estimated based on the engineering analysis completed in the District's SIP. Annual operating costs and material design life were also taken into consideration. Annual operating costs were estimated based on COID's current operating budget and with an assumption that equipment, maintenance, and labor costs would decrease 15 percent because a fully piped system would reduce the need to inspect, repair, remove obstructions, and make manual adjustments to the system.

For piping with steel, diameters up to 48 inches would use steel. Assuming a design life of 50 years, capital costs, replacement costs, and annual O&M costs are $40,785,000 for Project Group 1 and $6,486,000 for Project Group 2 over 100 years (2019 dollars).

For piping with PVC, diameters up to 48 inches would use PVC. Assuming a design life of 33 years for PVC, the estimated capital costs, replacement costs, and annual O&M costs are $39,214,000 for Project Group 1 and $4,497,000 for Project Group 2 over 100 years (2019 dollars).

See the tables below for steel and PVC cost details and pipe specifications.

### D.4.2.1 Steel Piping

The lengths, diameters, and range of pressure ratings used for this alternative were estimated based on the engineering analysis completed in the District's SIP. Spiral welded steel was selected that conforms to requirements of the American Water Works Association C200 standard. This pipe was selected because it is considered an industry consensus standard and is a prominent guide for the manufacture of steel pipe for water and wastewater applications in North America (Bambie and Keil 2013). Steel pipe typically has a design life of 50 years under irrigation water delivery applications. Unlike HDPE, steel pipe cannot be shaped to conform into canal alignments; therefore, elbows would be required. The cost of elbow fittings was estimated by assuming one elbow every 100 feet at a cost of $100 per 1 inch of pipe diameter. Turnouts and PRV stations use the same costs as the Preferred Alternative. These costs are based upon actual installed costs for turnouts and PRV stations in Central Oregon. The table below shows the pipe lengths and diameters; for other features such as turnouts, PRV stations, or earthwork, see the Preferred Alternative Costs above.

**Table D-5. Steel Piping Costs.**

| Project Group | Area | Feature | Diameter (in) | Length (ft.) | Pipe $/Foot | Elbow qty | Subtotal |
|---|---|---|---|---|---|---|---|
| 1 | G-4 Lateral | Steel Pipe | 4 | 1,628 | $33 | 16 | $66,945 |
| 1 | G-4 Lateral | Steel Pipe | 8 | 2,900 | $68 | 29 | $244,906 |
| 1 | G-4 Lateral | Steel Pipe | 10 | 1,980 | $86 | 20 | $210,107 |
| 1 | L Lateral | Steel Pipe | 24 | 150 | $210 | 2 | $38,665 |
| 1 | J Lateral | Steel Pipe | 30 | 5,077 | $263 | 51 | $1,638,656 |
| 1 | PBC | Steel Pipe | 48 | 860 | $422 | 9 | $445,258 |
| 1 | L Lateral | Steel Pipe | 48 | 20 | $422 | 1 | $10,355 |
| 2 | PBC D/S L Lateral | Steel Pipe | 8 | 2,374 | $68 | 24 | $200,485 |
| 2 | PBC D/S L Lateral | Steel Pipe | 8 | 2,558 | $68 | 26 | $216,024 |
| 2 | PBC D/S L Lateral | Steel Pipe | 10 | 1,400 | $86 | 14 | $148,561 |
| 2 | J Lateral | Steel Pipe | 24 | 186 | $210 | 2 | $47,945 |
| 2 | J Lateral | Steel Pipe | 30 | 1,410 | $263 | 14 | $455,092 |
| 2 | J Lateral | Steel Pipe | 30 | 3,073 | $263 | 31 | $991,843 |
| 2 | J Lateral | Steel Pipe | 32 | 3,669 | $280 | 37 | $1,263,696 |
| | | | | | | Subtotal | $5,979,000 |
| | | | | | | Other costs (earthwork, turnouts, PRV stations, etc. – same as the Preferred Alternative) | $27,714,000 |
| | | | | | | Engineering, Construction Management, Survey (5% Project Group 1, 10% Project Group 2) | $1,890,000 |
| | | | | | | Construction Management / General Contractor (8% Project Group 1, 15% Project Group 2) | $2,983,000 |
| | | | | | | Contingency (10% Project Group 1, 5% Project Group 2) | $3,164,000 |
| | | | | | | **Total** | **$41,730,000** |

Totals are rounded to nearest $1000.

### D.4.2.2 PVC Piping

The lengths, diameters, and range of pressure ratings used for this alternative were estimated based on the engineering analysis completed in the District's SIP. Under the PVC piping alternative, PVC would be used for diameters up to 48 inches.

The lifespan of a piping system depends on many different factors. Proper installation and operation of the piping system are key to achieving a long service life. Assuming a piping system is ideally installed and operated, the main factor affecting the pipe's service life is the number and magnitude of surge/water hammer events the system experiences. Surge/water hammer events are caused by valve operations, changing irrigation demand in the system, pump startup and shutdown, quick hydropower turbine shutdowns due to power failures, and any other factors causing fast changes in the piping system flow rate (B. Cronin, personal communication, July 27, 2018).

USDA-NRCS's practice standard lifespan for irrigation pipeline is 20 years (NRCS n.d.). This lifespan is based on long-term experience with primarily PVC pipe irrigation system installations (B. Cronin, personal communication, July 27, 2018). The Plastics Pipe Institute's online software indicates that with the average number of surge/water hammer events expected in a pipeline network, the lifespan of a typical 24-inch, 125 psi pressure rated PVC pipe would 14 years with a safety factor of two (Plastics Pipe Institute 2015). PVC is also more prone to failure under freezing conditions and the COID system is used to deliver water several times during the winter for livestock. During these periods, the PVC pipe system would be more likely to freeze and potentially rupture and fail. PVC piping has been installed in irrigation districts in the Deschutes Basin and experienced premature failure, especially in Districts where stock water is delivered during the winter. Considering all the information above, a PVC design life of 33 years was assumed for purposes of this analysis.

Unlike HDPE, PVC pipe cannot be shaped to conform into canal alignments; therefore, elbows would be required. The cost of elbow fittings was estimated by assuming one elbow every 100 feet at a cost of $100 per 1 inch of pipe diameter. To account for additional PVC costs such as fittings and bends in the system, an additional 5 percent cost was added. Turnouts and PRV stations use the same costs as the Preferred Alternative. These costs are based upon actual installed costs for turnouts and PRV stations in Central Oregon. The table below shows the pipe lengths and diameters; for other features such as turnouts, PRV stations, or earthwork, see the Preferred Alternative Costs above.

**Table D-6. PVC Piping Costs.**

| Project Group | Area | Feature | Diameter (in) | Length (ft.) | Pipe $/Foot | Elbow qty | Subtotal |
|---|---|---|---|---|---|---|---|
| 1 | G-4 Lateral | PVC Pipe | 4 | 1,628 | $4 | 16 | $20,171 |
| 1 | G-4 Lateral | PVC Pipe | 8 | 2,900 | $13 | 29 | $89,523 |
| 1 | G-4 Lateral | PVC Pipe | 10 | 1,980 | $20 | 20 | $83,576 |
| 1 | L Lateral | PVC Pipe | 24 | 150 | $70 | 2 | $18,617 |
| 1 | J Lateral | PVC Pipe | 30 | 5,077 | $109 | 51 | $902,513 |
| 1 | PBC | PVC Pipe | 48 | 860 | $284 | 9 | $343,321 |

| Project Group | Area | Feature | Diameter (in) | Length (ft.) | Pipe $/Foot | Elbow qty | Subtotal |
|---|---|---|---|---|---|---|---|
| 1 | L Lateral | PVC Pipe | 48 | 20 | $284 | 1 | $7,984 |
| 2 | PBC D/S L Lateral | PVC Pipe | 8 | 2,374 | $13 | 24 | $73,285 |
| 2 | PBC D/S L Lateral | PVC Pipe | 8 | 2,558 | $13 | 26 | $78,965 |
| 2 | PBC D/S L Lateral | PVC Pipe | 10 | 1,400 | $20 | 14 | $59,094 |
| 2 | J Lateral | PVC Pipe | 24 | 186 | $70 | 2 | $23,084 |
| 2 | J Lateral | PVC Pipe | 30 | 1,410 | $109 | 14 | $250,649 |
| 2 | J Lateral | PVC Pipe | 30 | 3,073 | $109 | 31 | $546,272 |
| 2 | J Lateral | PVC Pipe | 32 | 3,669 | $158 | 37 | $855,013 |
| | | | | | | Subtotal | $3,352,000 |
| | | | | | | Other costs (earthwork, turnouts, PRV stations, etc – same as the Preferred Alternative) | $27,714,000 |
| | | | | | | Engineering, Construction Management, Survey (5% Project Group 1, 10% Project Group 2) | $1,687,000 |
| | | | | | | Construction Management / General Contractor (8% Project Group 1, 15% Project Group 2) | $2,672,000 |
| | | | | | | Contingency (10% Project Group 1, 5% Project Group 2) | $2,973,000 |
| | | | | | | **Total** | **$38,398,000** |

Totals are rounded to nearest $1000.

### D.5.3 Other Materials References

Bambie, J. and B. Keil. 2013. *Revision of AWWA C200 Steel Water Pipe Manufacturing Standard: Consensus-Based Changes Mark Significant Improvements*. Northwest Pipe Company. Vancouver, Washington.

Cronin, Bill (NRCS). 2018. Personal communication (email) with Alexis Vaivoda (FCA). July 27, 2018.

Plastics Pipe Institute. 2015. Pipeline Analysis & Calculation Environment online tool. Website: http://ppipace.com. Accessed July 25, 2018.

U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS). n.d. National Conservation Practice Standards. Website: https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1076947.pdf. Accessed July 25, 2018.

Thalacker, Marc (Three Sisters Irrigation District). 2017. Personal communication (email) with Mattie Bossler (FCA). November 8, 2017.

# Appendix E

Other Supporting Information

## E.4 Intensity Threshold Table

This section presents the intensity threshold table used to quantify effects to resources of concern as a result of the proposed action.

**Table E-1. Intensity Threshold Table for the Central Oregon Irrigation District – Irrigation Modernization Project.**

| Resource | Intensity Threshold | | | |
|---|---|---|---|---|
| | **Negligible** | **Minor** | **Moderate** | **Major** |
| Cultural Resources | No above or underground cultural resources are adversely affected. | Affects a cultural resource that does not have local, regional or state significance.<br>The historic context of the affected site(s) is local.<br>Not affect the contributing element of a property eligible for the National Register of Historic Places.<br>Causes a slight change to a natural or physical ethnographic resource, if measurable and localized. | Affects a cultural resource with modest potential of local, regional or state significance.<br>Changes a contributing element but would not diminish resource integrity or jeopardize National Register eligibility.<br>Localized and measurable change to a natural or physical ethnographic resource. | Affects a cultural resource with high potential of national context.<br>Diminishes the integrity of the resource to the extent that affects cannot be mitigated, would permanently impact the historic register eligibility of the resource, prevent a resource from meeting criteria for listing in a historic register, or reduces the ability of a cultural resource to convey its historic significance.<br>Permanent severe change or exceptional benefit to a natural or physical ethnographic resource. |
| Fish and Aquatic Species | No discernable short- or long-term impacts to fish populations or aquatic habitat. | Changes in watershed conditions that may cause non-measurable degradation to aquatic habitat.<br>Direct or indirect habitat changes that result only in non-measurable, | Changes in watershed conditions that cause measurable degradation to aquatic habitat.<br>Direct or indirect habitat changes that cause measurable, short- or long-term | Changes in watershed conditions that cause high impairment to aquatic habitat that affects population viability. |

| Resource | Intensity Threshold | | | |
|---|---|---|---|---|
| | **Negligible** | **Minor** | **Moderate** | **Major** |
| | | short-term change in risk to ESA-listed or other fish populations. | change in risk to ESA-listed or other fish populations. | The proposed action would likely jeopardize a species' continued existence or destroy or adversely affect a species' critical habitat. |
| Soils | Project activities would not disturb soils. | Short-term erosion during construction at project and clearing sites that would be mitigated through BMPs.<br>Changes to primarily previously disturbed soil profiles. | Short-term erosion during construction at project and clearing sites that could not be mitigated.<br>Changes to primarily undisturbed soil profiles. | Continued erosion during and after construction at project and clearing sites.<br>Permanent changes to undisturbed soil profiles. |
| Land Use | Existing land uses or ownership would continue as before.<br>A short-term change or interruption to land use or access to existing land uses. | Land use changes that are consistent with existing ownership, easements, or right-of-way. | Land use changes that are inconsistent with existing ownership, easements, or right-of-way but are compatible to adjacent. | A new unauthorized land use or access that is not compatible with adjacent land use. |
| Public Safety | No increase in risk to human health and safety. | Any risks to public health and safety created by the project would be eliminated through mitigation. | Any risks to public health and safety created by the project would be eliminated through mitigation, but would require a short-term behavioral change by the public or present a temporary inconvenience. | Create a permanent and known health and safety risk. |
| Recreation | No effect on the location, timing, or quality of recreation facilities and uses during and after construction. | Temporarily preclude or limit recreational opportunities during off-peak use periods during project construction. | Temporarily preclude or limit recreational opportunities during peak use periods during project construction.<br>Permanent elimination of dispersed recreational activities without a | Permanently obstruct, alter, or eliminate legally existing or planned recreational uses.<br>. |

| Resource | Intensity Threshold | | | |
|---|---|---|---|---|
| | **Negligible** | **Minor** | **Moderate** | **Major** |
| | | Long-term relocation of dispersed recreational activities to an equal or better location after project construction. | designated relocation or replacement area. | |
| Socioeconomics | No reduction in the yield of agricultural products or timber.<br>Non-measurable change to income and/or employment levels. | Measurable, but short term, reduction to yield of agricultural products or timber.<br>Temporary reduction to income and/or local employment levels. | Long-term reduction in the yield of agricultural products or timber on the scale of individual farms.<br>Short-term reduction to income and/or local employment levels. | Long-term reduction in the yield of agricultural products or timber on a district wide scale.<br>Long-term reduction to income and/or regional employment levels. |
| Vegetation | Project activities would not affect vegetation or it is limited to small areas. | Most effects would be localized and/or temporary. While individual plants could be affected, there would be no effects on a population scale.<br>Any permanent effects would not be widespread nor affect sensitive species or populations. | A large proportion of one or more populations are affected but relatively localized and could be mitigated.<br>Any effects to sensitive species could be mitigated. | Considerable effects on plant populations over large areas.<br>Extensive mitigation required offsetting adverse effects to sensitive species, but success not assured. |
| Visual Resources | Project features are visually negligible or not visible. | The majority of project features do not attract attention to the landscape.<br>Short-term visual changes during project construction. | A majority of project features attract attention to the landscape. | Project features create a disruptive change and dominate the landscape. |
| Water Resources | Project activities would not disturb or alter water quantity, water quality, or groundwater quantity. | *Surface Water Quantity:*<br>Temporary change in quantity away from the natural or target hydrograph. | *Surface Water Quantity:*<br>Permanent change in water quantity that is measurable and that is counter to the natural or target hydrograph, that does | *Surface Water Quantity:*<br>Permanent change in water quantity that is measurable and that is counter to the natural or target hydrograph, |

| Resource | Intensity Threshold | | | |
|---|---|---|---|---|
| | **Negligible** | **Minor** | **Moderate** | **Major** |
| | | *Water Quality:*<br>Short-term or non-measurable changes to water quality in waterbodies that is unlikely to result in excursions to water quality standards on the Oregon's 303(d) list.<br><br>*Groundwater:*<br>Long-term less than 10 percent change in volume of annual discharge in the area affected by District operations. | not affect other water users or water rights.<br><br>*Water Quality:*<br>Permanent measurable changes to water quality in waterbodies that is unlikely to result in excursions to water quality standards on the Oregon's 303(d) list.<br><br>*Groundwater:*<br>Long-term greater than 10 percent but less than 20 percent change in volume of annual discharge in the area affected by District operations. | that affects other water users and water rights.<br><br>*Water Quality:*<br>Permanent measurable changes to water quality in waterbodies that results in excursions to water quality standards on the Oregon's 303(d) list.<br><br>*Groundwater:*<br>Long-term greater than 20 percent change in volume of annual discharge in the area affected by District operations. |
| Wetland, Floodplains, Riparian Zones | Does not alter wetlands or riparian areas or change the hydraulic capacity of floodplains. | Degradation of non-jurisdictional wetlands.<br>Project does not increase the potential for flooding and damage to personal property. | Mitigated degradation of jurisdictional wetlands.<br>Increase to the potential for flooding and damage to personal property that can be permitted and mitigated. | Permanent, non-mitigated degradation of jurisdictional wetlands.<br>Increase to the potential for flooding and damage to personal property that cannot be mitigated. |

| Resource | Intensity Threshold | | | |
|---|---|---|---|---|
| | **Negligible** | **Minor** | **Moderate** | **Major** |
| Wildlife | Degradation to wildlife habitat with no effect on populations | Degradation and recovery of wildlife populations and/or their habitats would be short-term. | Degradation and recovery of wildlife populations and/or their habitats would be long-term but would not affect the viability of any population. Habitat availability would continue to be adequate. | Long-term degradation to wildlife populations or habitats that would affect the viability of a population. Inadequate habitat availability. |
| Wild and Scenic Rivers | No effects to the resources determining the designation of Wild and Scenic Rivers. | Any effects to resources would be compatible with the designation of the Wild and Scenic River reaches. | An effect to resources that would be incompatible with the designation but could be mitigated. | Effects to resources that would change the designation of a Wild and Scenic River reach. |

| Duration of Effects | |
|---|---|
| **Temporary** | Transitory effects which only occur over a period of days or months. |
| **Short-term** | Effects lasting 1-5 years. |
| **Long-term** | Effects lasting greater than 5 years. |

## E.5 Cultural Resource Agreements

This section provides the Memorandum of Agreement between COID, Reclamation, and the Oregon State Historic Preservation Office and the Unanticipated Discovery Plan for Cultural Resources.

**MEMORANDUM OF AGREEMENT**
**No. R14MA13733**
**AMONG**
**THE U.S. BUREAU OF RECLAMATION,**
**THE OREGON STATE HISTORIC PRESERVATION OFFICE**
**AND**
**CENTRAL OREGON IRRIGATION DISTRICT**

**For**
**Piping of a Segment of the I-Lateral**

**ALFALFA VICINITY, DESCHUTES COUNTY, OREGON**

This Memorandum of Agreement (MOA) is entered into by Bureau of Reclamation, Columbia-Cascades Area Office (Reclamation), the Oregon State Historic Preservation Office (SHPO) and the Central Oregon Irrigation District (District) to define their respective roles in mitigation efforts related to the piping of the I-Lateral of the Central Oregon Irrigation District System (System). This MOA outlines separate, but related mitigation for the current undertaking (subterranean piping of a Segment of I-Lateral) and the proposed future piping of the remainder of the canals, laterals, sub-lateral and ditches within the District. This MOA replaces MOA No. R12MA13723 thereby canceling it in its entirety.

**1. Background**
The District is located in Deschutes County. The District provides irrigation water within the Central Oregon Tri-county area with 43,000 acres delivered to water users in the vicinity of Bend, Alfalfa, Powell Butte, Redmond, and Terrebonne, within the upper Deschutes River basin.

A. I-Lateral Piping
Under the current undertaking, the District intends to protect and improve water quality and improve water delivery by converting approximately 4,800 feet of open ditch laterals within the I-Lateral of the System to pipe, in T17S R14E Sections 25, 26 and 36.

The District has been awarded a grant through Reclamation's WaterSMART Program to perform the work. Because Reclamation-administered Federal funds will be involved in this project, the Section 106 process of the National Historic Preservation Act was applied to identify affected historic properties.

Pursuant to Section 106 of the National Historic Preservation Act (NHPA), the District has documented the extent of the Lateral within the current undertaking's Area of Potential Effects for historic and archaeological resources to standards acceptable to Reclamation and SHPO.

Reclamation, in consultation with SHPO, determined that replacement of the open I-Lateral with the pipe will have an adverse effect upon the historic integrity of the Lateral. Reclamation notified the Advisory Council on Historic Preservation (Council) of the adverse effect on the I-Lateral pursuant to the Code of Federal Regulations (CFR) 36 CFR Section 800.6(a)(1), and in a letter dated September 17, 2012, the Council indicated that their participation is not needed in the consultation for resolution of adverse effects from this undertaking.

Specific mitigation strategies designed to address the adverse effect of this undertaking are identified below, in section 3.A.

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B. Future Piping of Canals, Laterals, sub-Laterals, and Ditches
Through discussions between Reclamation, SHPO, and the District related to future project planning and the stated intentions of the District, a proposal to programmatically mitigate for future adverse effects related to the future piping of canals, laterals, sub-laterals, and ditches throughout the District has been developed. This MOA is intended to provide mitigation for such future piping efforts.

Specific mitigation strategies designed to address the adverse effects of these future undertakings are identified below, in section 3.B.

C. Interim Management
Until the Programmatic Agreement is signed and in place, all consultation regarding non-Federal undertakings will be reviewed by SHPO under standard State review practices, as defined in Oregon State Regulations (ORS) 358.653.

This MOA is entered into under the authority of the National Historic Preservation Act of 1966 as amended, as specified in the regulations in 36 CFR 800, and specifically in Section 6(c) – Resolution of Adverse Effects without the Council.

**2. Purpose and Applicability**

This MOA will serve to define the necessary actions for documentation of the System in its current state, define in more detail the historical significance, contextual setting, character-defining characteristics and the contributing properties within the System, and set the parameters by which future actions to pipe the System can be accomplished. This MOA will reduce the need to consult with the SHPO on a case-by-case basis when qualifying future activities (defined as subterranean piping of canals, laterals, sub-laterals, and ditches) take place on the System, and provides for a schedule that allows the SHPO to be updated on implemented actions.

This MOA does not apply to projects affecting any feature or element that is or may be individually eligible for listing in the National Register of Historic Places. Federal undertakings that affect these elements of the District will continue to be reviewed under standard Section 106 review processes (36 CFR 800). Non-Federal projects will continue to be reviewed under ORS 358.653.

**3. Implementing Actions**

A. Piping of I-Lateral
The SHPO, Reclamation, and the District agree that the current undertaking, consisting of the subterranean piping of approximately 4,800 feet of the I-Lateral, currently an open-ditch structure, represents an adverse effect to the National Register-eligible District water conveyance system. In order to mitigate that adverse effect, the following shall be implemented:

1. Reclamation will:

   (a) Consult with the proper interested parties, such as the Council, SHPO, and the Confederated Tribes of the Warm Springs Reservation.
   (b) Ensure that mitigation efforts defined in this MOA as part of the current undertaking (identified below, Section 3.A.2) are completed to the standards set forth below.

2. The District will:

   (a) Perform or cause to be performed the Historic Documentation of the System:

- Following all applicable guidance provided by the National Park Service and SHPO, the District will conduct a historic properties inventory of the entirety of the District facilities and infrastructure related to water conveyance (i.e., not to include district offices and equipment/vehicle maintenance or storage facilities). This inventory will document all water-conveyance system buildings and structures, provide locational information (in GIS format, using lines to represent canals, etc., and points or polygons, as appropriate, to represent features) for all water conveyance-related buildings and structures, as well as associated features. The inventory will meet the requirements set forth for Reconnaissance Level Surveys, as defined in the document, "Guidelines for Historic Resource Surveys in Oregon." Prior to initiation of the survey, a written, detailed survey design will be submitted to SHPO for review and concurrence.
- This inventory will be completed and submitted to Reclamation and SHPO for draft review within three (3) years of the date of the final signature on the document. Comments and revision requests from Reclamation and/or SHPO will be addressed, and a final version of the inventory will be submitted within one (1) year of the receipt of such comments.

B. Future Piping of Canals, Laterals, sub-Laterals, and Ditches Elsewhere Within the District
SHPO, Reclamation, and the District understand that it is the intention of the District to convert significant portions of the system of open canals, laterals, sub-laterals and ditches within the District to a subterranean, piped system. In order to mitigate for future adverse effects that would arise from these efforts, Reclamation, SHPO and the District have agreed to mitigate programmatically through the following measures in order to reduce time, effort, and resources required to conduct standard Section 106 and/or ORS 358.653 consultation:

1. Develop a Programmatic Agreement (PA)

(a) Reclamation, SHPO, and the District shall enter into a PA to allow for the more efficient fulfillment of the entity's obligations under Section 106 of the National Historic Preservation Act, as amended, and Oregon Revised Statute 358.653, as applicable.

(b) All parties shall use the Multiple Property Document (see Section 3.B.2., below) to identify contributing segments of the canal system to be managed under the PA and any subsequent documents created as part of the process. The PA will include, at minimum:

- A list of routine maintenance and minor construction activities and actions that do not adversely affect the historic resource and that are exempt from regular review by SHPO;
- A provision to address emergency situations where catastrophic breach of the canal or other unforeseen event or eminent threat endangers human life or property. Such a provision shall allow the District to act on the immediate situation without consultation and address compliance with applicable cultural resource laws in consultation with appropriate federal agencies and stakeholders within 30 days of the incident.
- An inadvertent discovery clause, which will outline procedures to be followed when unknown, unanticipated cultural resources are discovered due to District activities;
- A description of annual reporting requirements and timetable for reporting activities undertaken by the District where the provisions of the PA were applied;

- A defined effective period of ten (10) years with provisions for the document to be reviewed at five years from last date of signature, amended as necessary, and the effective period continued, based on consultation. If appropriate, the effective period can be extended for an additional ten (10) years (with an additional five-year review), subject to the agreement of Reclamation, SHPO, and the District.

(c) The PA may also include a probability model for subsurface archaeological sites, cultural resource treatment plans, and preservation plans, as agreed to by the signing Parties.

(d) Reclamation, SHPO, and the District, as well as any other interested, consulting parties, will be signatories to the PA.

(e) Until the PA is signed and in place, all consultation regarding future federal undertakings (those not covered under Stipulation A) affecting the District water conveyance system will be reviewed by Reclamation and SHPO under standard Section 106 review practices, as defined in 36 CFR 800.

2. Develop Multiple Property Document (MPD)

(a) Following all applicable guidance provided by the National Park Service and SHPO for the preparation of MPDs, the District will edit the MPD, *Historic Agricultural Resources in Central Oregon,* which is currently in draft form, as prepared by Claeyssens and Tomlinson (2006) under a previous Reclamation water conservation grant. The MPD will be prepared sufficiently such that subsequent Irrigation Districts are able to add their district-specific contexts and registration requirements. The MPD elements will be based on the results of the Reconnaissance Level Survey inventory created as a result of Stipulation A.2. (above). The MPD elements to be developed include:

1. General framework for the functioning of the MPD, once registered, including Sections A through D (complete), Sections E-I such that deal specifically with the District, but that includes general introductions, contexts, and registration requirements that will be applicable across all irrigation districts included in the final MPD;
2. Establishment of the various historic contexts pertaining to the history and significance of the District. The historic context(s) will be based on historical research, and supported by historical documents and images;
3. Development of associated property types and general and type-specific registration requirements through which identified elements of the system can be evaluated for eligibility (including consideration of significance and integrity) for inclusion in the NRHP through the framework of the MPD; and
4. A GIS-based map of the entire system identifying the location, extent, and features of the District, and any other necessary appendices, shall be included. The map should identify elements and sections of the System as either contributing or non-contributing to the District as a comprehensive historic resource.

(b) The draft MPD (including all GIS information) will be submitted to Reclamation and SHPO for review and comment within three (3) years of the date of the final signature of this MOA. Draft MPD and nomination materials will be submitted to Reclamation and SHPO for review by SHPO and the Oregon State Advisory Committee on Historic

Preservation (SACHP). The District will address any SHPO and SACHP comments prior to forwarding the document to the National Park Service for final consideration.

3. Preservation and Interpretation

(a) Following completion of the draft MPD elements described above (Stipulation B.2.a-b), the District, in consultation with Reclamation and the SHPO, shall select appropriate, contributing segments to be listed in the National Register of Historic Places through the MPD. These segments will be selected based on the following criteria:

1. The segments will be high-integrity, substantial, contributing segments (minimally, one substantial segment each in the Pilot Butte Canal and the Central Oregon Canal) to the overall eligible District;
2. The segment should include a variety of features, such that it well-represents the function and appearance of the water conveyance system, as it appeared as an intact system;
3. The segment should be of sufficient length that on-site interpretation (see Stipulation B.3 (b), below) can be achieved in an attractive, well-organized fashion, without crowding or overwhelming the resource itself.

(b) Once selected, the identified segment will be cleaned, repaired, and returned to working condition in a way that meets the Secretary of the Interior's Standards for the Treatment of Historic Properties, and the immediate vicinity prepared such that it creates a welcoming, attractive environment for the public visitation and interpretation of the resource.

(c) The interpretation of the resource will be achieved through the use of static or active displays that relate the history, function, and significance of the Central Oregon Irrigation District water conveyance system. Such displays will be presented in a format that is weather- and vandal-resistant, attractive, and engaging. Draft content and layout of the interpretive display(s) will be submitted to Reclamation and SHPO for review and comment, and if any revisions are requested, revised versions will be submitted for a second review prior to fabrication. Upon acceptance of the draft content by Reclamation and SHPO, the District will cause the interpretive display to be constructed.

(d) Once constructed, the interpretive site and displays must be maintained by the District in an attractive and functioning condition.

**4. Completion of this MOA**

The terms of this MOA will be considered to be completed when the above implementing actions (A-B) have been completed to the satisfaction of Reclamation and SHPO. Upon completion of the implementing actions, all adverse effects resulting from subterranean piping of *all canals, laterals, sub-laterals, and ditches will be considered to be fully mitigated*, and may proceed without Section 106 or ORS 358.653 (as appropriate) consultation with Reclamation or SHPO.

**5. Period of Performance**

This MOA shall become effective on the date of the last signature hereto and extend three years after the date of the last signature. The MOA will also be considered terminated once all stipulations are complete, or five years after the date of the last signature on this MOA. Any party may terminate this MOA by providing 30

days written notice to the other party(ies). Any party may formally request modification of the MOA by providing a written request to the other party(ies).

If this MOA is terminated prior to completion of the above stipulations, then all projects undertaken from the date of the final signature not covered by the PA (should it be in effect) on this MOA must be reviewed under standard review practices under Section 106 of the National Historic Preservation Act, or under ORS 358.653, as appropriate.

**6. Modifications**

Reclamation, SHPO or the District may formally request modification of this MOA. Modifications shall be made by mutual consent of Reclamation, SHPO and the District by the issuance of a written modification to this MOA, signed and dated by all parties prior to any changes being performed.

**7. Principal Contacts**

The principal contacts for this MOA are:

**For Reclamation:**

Chris Horting-Jones
Archeologist
1375 SE Wilson Ave. #100
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**For the District:**

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Fax (541) 548-0243
Email: lauraw@coid.org

**For SHPO:**

Jason Allen
Historic Preservation Specialist
State Historic Preservation Office
Oregon Parks and Recreation Department
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Salem, OR 97301-1266
Phone (503) 986-0579
Fax (503) 986-0793
Email: Jason.Allen@state.or.us

**8. General Provisions**

a. Reclamation's responsibility for ensuring completion of consultation with SHPO for future undertakings identified in Section 3.B. is limited only to those that qualify as Federal undertakings. Projects identified in Section 3.B. that do not qualify as Federal undertakings are subject to review by the SHPO under ORS 358.653, and the responsibility for consultation and completion will rest with the District.

b. Completion of the mitigation stipulations will be considered to satisfy the requirements for mitigation of adverse effects for a previous undertaking (Pilot Butte Canal Juniper Ridge Piping Project Phase 2 [SHPO Case# 10-1873]) that has not yet been mitigated as of the date of the final signature on this MOA.

c. This MOA is neither a fiscal nor a funds-obligating document for Reclamation. Any endeavor or transfer of anything of value involving reimbursement or contribution of funds between the parties of this MOA will be handled in accordance with applicable laws, regulations, and procedures including those for Government procurement and printing. Such endeavors will be outlined in separate agreements that shall be made in writing by representatives of the parties and shall be independently authorized by appropriate statutory authority. This MOA does not provide such authority.

d. Nothing herein shall be construed to obligate Reclamation to expend or involve the United States of America in any contract or other obligation for the future payment of money in excess of the appropriations authorized by law and administratively allocated for the purposes and projects contemplated hereunder.

e. No member of or delegate to Congress, or resident Commissioner, shall be admitted to any share or part of the MOA or to any benefit that may arise out of it.

f. Any information furnished to Reclamation, under this MOA, is subject to the Freedom of Information Act (5 U.S.C. 552).

g. All parties to this MOA agree to comply with all Federal statutes relating to nondiscrimination, including but not limited to: Title VII of the Civil Rights Act of 1964, as amended, which prohibits discrimination on the basis of race, color, religion, sex, or national origin; Title IX of the Education amendments of 1972, as amended, which prohibits discrimination on the basis of sex; the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act of 1990, as amended, which prohibit discrimination on the basis of disability; the Age Discrimination in Employment Act of 1967, as amended, which prohibits discrimination based on age against those who are at least 40 years of age; and the Equal Pay Act of 1963.

**9. Signatures**

Reclamation, SHPO and the District will abide by the terms and provisions expressed or referenced herein.

BUREAU OF RECLAMATION

by: _____ DATE: 2/12/14
Gerry Kelso, Manager
Columbia-Cascades Area Office

OREGON STATE HISTORIC PRESERVATION OFFICE

BY: _____ DATE: 2-26-14

Roger Roper
Deputy State Historic Preservation Officer

CENTRAL OREGON IRRIGATION DISTRICT

BY: _____ DATE: 11 Feb 2014

Steven Johnson
Secretary-Manager

**~~ End of Document ~~**

# POST-REVIEW DISCOVERY PLAN FOR UNANTICIPATED CULTURAL RESOURCES

## Central Oregon Irrigation District

Agreement No. R19MA13745
(BFO U19-05.19.001)

5

## Inadvertent or Unanticipated Discovery Plan for Cultural Resources

### Central Oregon Irrigation District

**Introduction**

This Inadvertent Discovery Plan is a component of the Programmatic Agreement between the Bureau of Reclamation, Oregon State Historic Preservation Officer and Central Oregon Irrigation District, regarding Compliance with Section 106 of the National Historic Preservation Act for Improvement, Operation, and Maintenance of the Central Oregon Irrigation District System of Canals, Laterals, and Associated Irrigation Features and Facilities. It is to be utilized by the Central Oregon Irrigation District (COID) on projects funded, either partially or in full, by the Bureau of Reclamation and any other federal agency, and which will result in ground disturbance with the potential for exposure of cultural materials, including human remains.

The following paragraphs outline the steps to be taken in the event that cultural materials are found during project activities (such as pipeline installation and canal realignment) within district boundaries on lands owned by or held as easement by COID. A copy of this IDP will be provided to all contractors and sub-contractors working on COID projects as funded by any federal agency.

For purposes of this document, ***Project Manager*** refers to a COID employee who is overseeing project implementation. ***Reclamation Contact*** refers to the individual employed by Reclamation who is considered the Grants Specialist and regularly communicates with COID's ***Project Manager.***

**Protocol for coordination in the event of an inadvertent discovery:** In the event of an inadvertent discovery of possible cultural materials, including human remains:

- **All work will stop immediately in the vicinity of the find**. A 30-meter buffer should be placed around the discovery with work being able to proceed outside of this buffered area unless additional cultural materials are encountered.
- The area will be secured and protected.
- The *Project Manager*, as designated by COID, and the *lead federal agency contact* will be notified. The *Project Manager* will immediately notify the State Historic Preservation Office (SHPO) and Reclamation's archaeologist. If possible human remains are encountered, the Oregon State Police, Commission on Indian Services (CIS), SHPO, appropriate Tribes, and Reclamation's archaeologist will also be notified.

  This contact list will need to be updated as necessary to reflect current contact names and phone numbers.

| Contact Agency | Contact Name | Phone number |
|---|---|---|
| Oregon State Police (OSP) | Chris Allori | 503-731-4717 |
| Commission on Indian Services (CIS) | Danny Santos | 503- 986-1067 |
| Appropriate Tribes | As designated by CIS | |
| SHPO | Dennis Griffin | 503-986-0674 |
| | John Pouley | 503-986-0675 |
| | Jamie French | 503-986-0729 |
| Reclamation Contact | Leah Meeks, GOTR | 208-378-5025 work |
| Reclamation Archaeologist | Chris Horting-Jones | 541-389-6541 ext 236<br>541-410-9895 cell |
| COID Project Manager | Kelly O'Rourke | 541-548-6467 |

- No work may resume until a professional archaeologist is able to assess the discovery and consultation with the SHPO and Reclamation has occurred.
- If human remains are encountered, they will not be disturbed in any way. *911 will not be called.* No one will speak with the media. The location will be secureed. No photos will be taken. The location will be secured and work will not resume in the area of discovery until all parties involved agree upon a course of action.
- A professional archaeologist may be needed to assess the discovery and they, working in tandem with Reclamation's archaeologist, will consult with SHPO and appropriate Tribal Governments to determine an appropriate course of action.
- Archaeological excavations may be required. This is handled on a case-by-case basis by Reclamation's archaeologist and Reclamation Contact, the professional archaeologist and Project Manager, in consultation with SHPO and appropriate Tribes.

**When to stop work:**

Construction work may uncover previously unidentified Native American or Euro-American artifacts. This may occur for a variety of reasons, but may be associated with deeply buried cultural material, access restrictions during project development, or if the area contains impervious surfaces throughout most of the project area which would have prevented standard archaeological site discovery methods.

Work must stop when the following types of artifacts and/or features are encountered:

*Native American artifacts may include (but are not limited to):*
- Flaked stone tools (arrowheads, knives scrapers etc.);
- Waste flakes that resulted from the construction of flaked stone tools;
- Ground stone tools such as mortars and pestles;
- Layers (strata) of discolored earth resulting from fire hearths - may be black, red or mottled brown and often contain discolored cracked rocks or dark soil with broken shell;
- Human remains;
- Structural remains - wooden beams, post holes, fish weirs.

***Euro-American artifacts may include (but are not limited to):***

- Glass (from bottles, vessels, windows etc.);
- Ceramic (from dinnerware, vessels etc.);
- Metal (nails, drink/food cans, tobacco tins, industrial parts etc.);
- Building materials (bricks, shingles etc.);
- Building remains (foundations, architectural components etc.);
- Old Wooden Posts, pilings, or planks (these may be encountered above or below water);
- Remains of ships or sea-going vessels, marine hardware etc.;
- Old farm equipment may indicate historic resources in the area;
- Even what looks to be old garbage could very well be an important archaeological resource;

***When in doubt, call it in!***

**Proceeding with Construction**

- Construction can proceed only after the proper archaeological inspections have occurred and environmental clearances are obtained. This requires close coordination with SHPO and the Tribes.

- After an inadvertent discovery, some areas may be specified for close monitoring or 'no work zones.' Any such areas will be identified by the professional archaeologist and Reclamation's archaeologist to the *Project Manager*, and appropriate contractor personnel.

- In coordination with the SHPO, the *Project Manager* will verify these identified areas and ensure that the areas are clearly demarcated in the field, as needed.

## E.6 Historical Background

This section provides information on the federal Carey Desert Lands Act of 1894 and irrigation development in Central Oregon.

At the turn of the twentieth century, Central Oregon, known then as the Deschutes country, was one of the most remote regions in the nation. Settlers were enticed with opportunities to capitalize on the Deschutes River, promising lands for agriculture, and immense pine forests. Two major factors contributed to the settlement and agricultural development of Central Oregon: the arrival in 1900 of the Columbia Southern railroad, and the State of Oregon's acceptance in 1901 of the 1894 federal Carey Act which encouraged states to pursue development of arid lands (NPS 2015). In exchange for up to 1 million acres of federal land, states made up to 160 acres available to settlers who agreed to improve and cultivate the land. The Carey Act enabled states to issue irrigation contracts to private developers who were expected to design and build irrigation projects, as well as recruit settlers to farm the new areas. The State would issue a water right to the private developer for a particular project, but the State would not be responsible for financing or construction. If an irrigation project failed, the State reassigned the contract to another development company. While limited irrigation in Central Oregon had begun before these changes, the Carey Act helped spur the creation of more irrigation companies and investment in large-scale irrigation projects (NPS 2017).

**References**

U.S. Department of the Interior, National Park Service (NPS). 2015. National Register of Historic Places Registration Form, Pilot Butte Canal Historic District (Cooley Road-Yeoman Road Segment). Retrieved from: https://www.nps.gov/nr/feature/places/pdfs/15001052.pdf. Accessed September 7, 2017.

U.S. Department of the Interior, National Park Service (NPS). 2017. National Register of Historic Places Registration Form, Pilot Butte Canal: Downtown Redmond Segment Historic District. Retrieved from: http://www.oregon.gov/oprd/HCD/NATREG/docs/national_register_recent/OR_DeschutesCo_PilotButteDowntownRedmondSegment.pdf. Accessed September 7, 2017.

## E.7 Consultation Letters

USDA United States Department of Agriculture | Forest Service | Deschutes National Forest | 63095 Deschutes Market Road, Bend, OR 97701, 541-383-5300

**File Code:** 2500
**Date:** August 15, 2017

Margi Hoffmann
Community Relations Director
11 Third Street, Suite 101
Hood River, Oregon 97031

Dear Ms. Hoffmann:

The Deschutes National Forest (DNF) attended the public open house presentation by Central Oregon Irrigation District on July 10, 2017, and has reviewed the conservation measures proposed for funding by Tumalo and Swalley Irrigation districts available at www.oregonwatershedplans.org. The DNF would like to submit this letter in support of the proposed watershed plans and conservation measures put forth by all three Irrigation Districts. The improved irrigation infrastructure that would come through these proposed projects to conserve water, reduce energy consumption, increase irrigation delivery efficiency, improve public safety, and benefit instream habitat for aquatic species (both ESA listed and non-listed species) represents a concerted effort on the part of the Irrigation Districts to advance water conservation efforts throughout the Deschutes River Basin that aims to provide a more equitable distribution of water to rivers, farms and municipalities, as well as to install the infrastructure needed to respond to future water conservation/distribution pressures that may arise with a growing central Oregon population and climate change.

Much of the Deschutes River above Bend, Tumalo Creek, and Crescent Creek flows through National Forest System lands. As the steward of these lands, the DNF has long been involved in a collaborative effort to address issues with the functioning condition of physical and ecological processes in these rivers and streams as it relates to regulated flow for irrigation. These proposed conservation measures will help to trend instream flow regimes toward a condition that will help to facilitate the passive and active restoration of these processes, and the functioning condition of an important part of the central Oregon landscape that is managed for public benefit.

The DNF understands that the proposed conservation measures are another step toward improving upon the conservation of water resources in central Oregon, and looks forward to continuing to work in partnership with the Irrigation Districts to further this cause into the future.

Sincerely,

JOHN ALLEN
Forest Supervisor

Caring for the Land and Serving People

Printed on Recycled Paper

Oregon
Kate Brown, Governor

Department of Environmental Quality
Eastern Region Bend Office
475 NE Bellevue Drive, Suite 110
Bend, OR 97701
(541) 388-6146
FAX (541) 388-8283
TTY 711

**Date:** July 21, 2017

**To**: Margi Hoffman, Community Relations Director, Farmers Conservation Alliance

**From**: Eric Nigg, Water Quality Manager

**Subject:** Preliminary Investigative Report for the Central Oregon Irrigation District (COID) Irrigation Modernization Project (June 29, 2017)

The Oregon Department of Environmental Quality was asked to review the above referenced report and provide comments on our anticipated regulatory authority over the project through our rules or through implementation of the Federal Clean Water Act (CWA). In addition, we are providing comments on water quality topics discussed in the report in hopes that this information can be used to inform the Watershed Plan that will be drafted as part of the NEPA process.

At this point in time, we believe that DEQ might have regulatory authority over the proposed project in the areas listed below. The degree of our involvement in the first two areas will be determined by the type of permit (if any) required by the U.S. Army Corp of Engineers and the amount of ground disturbing activities, which will likely be determined on a case-by-case basis.

**Section 401 Removal and Fill Certification**. Section 401 of the CWA gives states and tribes the authority to issue state water quality certifications for projects that require a federal license or permit that may result in a discharge to waters of the US. The certification may condition a permit to ensure the discharge will comply with applicable provisions of the CWA, including state water quality standards. Oregon's water quality standards specify the designated use of a waterbody (e.g., for water supply or recreation), pollutant limits necessary to protect the designated use (in the form of numeric or narrative criteria), and policies to ensure that existing water uses will not be degraded by pollutant discharges. The federal permit or license cannot be issued until a 401 Water Quality Certificate is received.

DEQ works closely with the U.S. Army Corps of Engineers (USACE). The USACE determines whether a project will be reviewed under an Individual or Nationwide Permit. *Individual Permits* are for projects that have more than minimal impacts and have both general and project-specific conditions to ensure that the project can meet State water quality standards. *Nationwide Permits* are for projects that are expected to have minimal impacts. More information can be found on DEQ's website: http://www.oregon.gov/deq/wq/wqpermits/Pages/Section-401.aspx.

**Construction Stormwater Permits**. **Construction Stormwater Permits**. National Pollutant Discharge Elimination System (NPDES) general permits are required for construction activities including clearing, grading, excavation, materials or equipment staging and stockpiling that will disturb one or more acres of land and that may result in a discharge to waters of the state. They also apply to construction activities that will disturb less than one acre that are part of a common plan of development or sale, if the larger common plan of development or sale will ultimately disturb one acre or more. More information can be found on DEQ's website: http://www.oregon.gov/deq/wq/wqpermits/Pages/Stormwater-Construction.aspx

**Section 401 Hydropower Certification.** DEQ issues 401 certifications for hydroelectric projects and the Federal Energy Regulatory Commission administers the federal licensing process. The water quality certification typically includes operating conditions designed to ensure project operations will not violate water quality standards.

Section 3.2 of the COID report and the Appendix describes the hydroelectric power potential associated with piping. If built, it appears that these would be in-conduit hydroelectric facilities. As such, they would likely have no impacts to water quality and not require 401 hydropower certification from DEQ.

**Total Maximum Daily Loads.** As identified in the COID Report, there are a number of 303(d) listed water bodies in the project area. Once a water body has been identified as water quality limited, the CWA requires the establishment of a pollutant total maximum daily load (TMDL) for that water body. TMDLs are assessments that determine the maximum amount of pollutant that can be present in a water body while meeting water quality standards. The loading capacity is allocated to point, nonpoint, and future sources of pollution.

TMDLs are implemented via water quality management plans, which include the designation of local management agencies (DMAs) who have legal authority over a sector or source of contributing pollutants. DMAs are required to develop TMDL Implementation Plans which describes the management activities they will implement to meet their responsibilities under the TMDL. DEQ has named irrigation districts as DMAs in basins where we have determined that the laterals, canals and/or dams operated by the district contribute to the delivery of nonpoint sources of pollution, such as bacteria, heat or nutrients, to 303(d) listed water bodies. DEQ has not named irrigation districts as DMAs due to the water quality impacts associated with reduced flows below diversions, although restoration of flows is encouraged in the TMDL analysis. More information on TMDLs can be found on DEQ's website:
http://www.oregon.gov/deq/wq/tmdls/Pages/default.aspx

TMDLs have not yet been completed anywhere in the Deschutes Basin. At this point, we are in the process of developing TMDLs in the project area to address the 303(d) listings for dissolved oxygen, pH and chlorophyll-*a*. We expect to begin a stakeholder involvement process for this effort sometime in 2018 and COID will be invited to participate. At this point we do not know whether or not COID will be named as a DMA and what TMDL implementation responsibilities they might have.

**Comments on Specific Sections of the Preliminary Report**

1. **Section 2.3**. The report for the equivalent Swalley Irrigation District project includes a discussion of possible mitigation needed for the loss of historic canals or other cultural resources, as well as other possible impacts of the project. Why is this not an issue for the COID project?
2. **Section 3.1.1**. The first sentence states that streams in the project area do not meet water quality standards for *salmon and trout*. While it is true that salmon and trout are two of the beneficial uses protected by the state standards, there are other beneficial uses protected by these standards as well. A list of all of the beneficial uses in the Deschutes Basin can be found at the following location on DEQ's website: http://www.deq.state.or.us/wq/rules/div041/dbutables/table130a.pdf.
3. **Section 3.1.3**. The third paragraph in this section references Figure 3-2, showing COID's two diversions. This Figure was not included in the document.
4. **Section 3.2**. (a) The first bulleted item in this section lists improved stream flows and water quality within the Deschutes River from Crane Prairie Reservoir to Lake Billy Chinook. Does this include improved water quality with the reservoirs as well as the river? (b) What is the anticipated timing for the water quality improvements? There are water quality impairments during both the summer and

fall/winter/spring seasons in different parts of the project area. (c)This section states that stream flow benefits would be realized by allocating saved water instream through the Conserved Water Program. How much water is COID agreeing to protect and during what times of year?

5. **Section 5.2**. (a) This section largely describes the details of COID's Pilot Butte canal system. It would be helpful to have a better description of the Central Oregon canal system included as well. (b) This section mentions that there are seven patrons currently served from individual diversions. Yet the map in Figure 3.0.1 in the Appendix shows 12 diversions associated with the COID system. It would be helpful to have this inconsistency corrected or explained. (c) Are there any discharges to natural water bodies as part of the COID system? This would be helpful to know in terms of evaluating potential water quality impacts of proposed activities.
6. **Section 5.6.3**. (a) The first sentence lists dissolved oxygen and temperature as parameters that can be exacerbated by low flows. pH levels can also be exacerbated by low flows. (b) There are not 303(d) listings for *E. coli* on the Deschutes River. There are *E. coli* listings on the Crooked River. Because COID system is connected to the Crooked River, will this project also be evaluating impacts on the Crooked River? If so, it would be helpful to have that more clearly stated in the document. (c) The 303(d) listing for "aquatic weeds" should be "aquatic weeds or algae". The listing is based on the presence of harmful algal blooms in the reservoirs. (d) The last sentence of this paragraph is incorrect. The Deschutes River is included on the 303(d) list for flow modification and/or habitat modification. These are Category 4C listings, which indicates that the impairment is not caused by a pollutant therefore a TMDL is not needed. The other impairments described in this paragraph are Category 5 listings, which indicates that a TMDL is required to address the listing. Given that flow and habitat modifications are 303(d) listings, and both are parameters that could be affected by water management, would it be helpful to add sub-sections for these parameters to Section 5.6.3? (e) For each of the water quality parameters listed in this section, it would be helpful to have a description of how this parameter would be affected by changes in stream flow or reservoir storage. This information could be used to support the claims of improved water quality that would be realized through implementation of the project.
7. **Section 5.6.3.1**. (a) In addition to affecting fish, elevated stream temperatures can also affect other aquatic life. (b) The temperature criterion that applies throughout the project area is 18.0 degrees Celsius (64.4 degrees Fahrenheit), which is designed to protect salmon and trout rearing and migration. There is an additional criterion that currently applies in the Deschutes River above Wickiup Reservoir, designed to protect bull trout spawning and juvenile rearing. This criterion is 12.0 degrees Celsius (53.6 degrees Fahrenheit).
8. **Section 5.6.3.2**. (a) The "non-spawning" criterion which applies on the Deschutes River in the project area is the criterion to protect cold-water aquatic life (rather than cool-water or warm-water).
9. **Section 5.6.3.3**. (a) The description of factors affecting pH is not accurate. We would suggest a further review of reference material on this topic. One possible source would be DEQ's issue paper on the topic, available at the following location on DEQ's website: http://www.deq.state.or.us/wq/standards/docs/19921994wqStandardsReview.pdf. (b) The pH listings for the Deschutes River in the project area occur year-round (both the summer and fall/winter/spring seasons).
10. **Section 5.6.3.6**. As referenced above, this parameter should be "Aquatic Weeds or Algae". Wickiup and Crane Prairie Reservoirs have both had health advisories issued by the Oregon Harmful Algae Bloom Surveillance (HABS) program based on algal cell counts or toxicity levels associated with cyanobacteria.
11. **Section 5.7**. The first paragraph in this section discusses the fish screen on the Pilot Butte Canal diversion. Do the Central Oregon diversion and the single farm diversions have screens as well?
12. **Section 7.3.1**. The bullets under #1 describe how habitat and water quality could be enhanced in the river through selection of this alternative. Does this apply to the reservoirs as well? A different set of

water quality conditions exist in the reservoirs and they may respond differently than the river to changes in water management. Similarly, water quality impairments are different in different parts of the river at different times of year. For example, low flows below Wickiup in the winter and low flows below Bend in the summer may both degrade water quality. How will this alternative increase habitat and water quality conditions at both locations and times of year?

We thank you for the opportunity to review the preliminary document and to provide comments. We also look forward to assisting with funding of the project through our Clean Water State Revolving Loan Fund program. Please feel free to contact me or Bonnie Lamb if you have any questions. I can be reached at (541) 633-2035 or nigg.eric@deq.state.or.us and Bonnie can be reached at (541) 633-2027 or lamb.bonnie@deq.state.or.us.

ec: Kelly Hill, DEQ Regional Solutions Liaison
Bonnie Lamb, DEQ Basin Coordinator

Page 4 of 4

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Bend Field Office
63095 Deschutes Market Road
Bend, Oregon 97701
Phone: (541) 383-7146 FAX: (541) 383-7638

July 24, 2017

**Memorandum**

To: Assistant State Conservationist, NCRS – Watershed Resources and Planning, Portland, Oregon

From: Field Supervisor, Bend Field Office, Bend, Oregon

Subject: Deschutes Basin Board of Control and Natural Resource Conservation Service, Scoping Comments

Thank you for the opportunity to provide recommendations and input during your National Environmental Policy Act (NEPA) scoping process for the Irrigation Modernization Project. The U.S. Fish and Wildlife Service (Service) supports this proposal and is eager to see the resulting conserved water returned to the Deschutes River.

The Service has been leading a large scale, conservation planning effort for water management that will benefit threatened and endangered species in the Deschutes River Basin in Central Oregon. This effort has spanned many years and has involved eight Central Oregon irrigation districts (constituting the Deschutes Basin Board of Control), the City of Prineville (collectively the Applicants), as well as other stakeholders and interested parties. The goal of this planning effort is to develop an Endangered Species Act (ESA) habitat conservation plan (HCP) under section 10(a)(1)(B) of the ESA that provides non-Federal parties the opportunity to conserve the ecosystems upon which listed species depend, ultimately contributing to their recovery.

The Deschutes Basin HCP has been in development for a number of years. The Applicant's goal is to complete the planning process in 2019. The goal of the Deschutes Basin HCP is to manage water in the Deschutes Basin in a manner that addresses the long-term certainty for water users but provides necessary water for species covered by the plan (Oregon spotted frog (*Rana pretiosa*), bull trout (*Salvelinus confluentus*), and steelhead (*Oncorhynchus mykiss*), sockeye salmon (*Oncorhynchus nerka*) and spring Chinook salmon (*Oncorhynchus tshawytscha*)). The Applicant's conservation approach is to modernize their existing irrigation infrastructure, and return the conserved water back in-stream to support the conservation of the covered species.

Currently, low flows in the Deschutes River Basin result in a myriad of impacts to fish and wildlife resources. Water management that alters water levels has reduced habitat suitability for

the Oregon spotted frog, and increased flows are necessary to meet the life history demands of this species. Further, low flows impact water quality in the Deschutes River by exacerbating temperature and dissolved oxygen problems. Water quality often dictates the spread and extent of invasive aquatic species (plants and wildlife), and these problems interact synergistically to degrade wildlife habitat within and around the Deschutes River

Current proposed piping projects within Central Oregon Irrigation District (COID), Swalley Irrigation District (SID), and Tumalo Irrigation District (TID) could potentially conserve approximately 72,284 acre feet of water (Newton and Perle 2006). This would amount to approximately 195 cubic feet per second (cfs) in the river per irrigation season (180 days). These conservation opportunities are the very approach that the Habitat Conservation Plan envisions to restore the necessary flows in the Deschutes River.

We look forward to coordinating with you throughout the scoping process and during the development of the EA. We will provide input as needed during the formulation of your draft document. If you have any questions or if we can be of any assistance, please contact Emily Weidner or myself at 541-383-7146.

Literature Cited

Newton, D., and M. Perle. 2006. Irrigation district water efficiency cost analysis and prioritization. DWS Final Report, Newton Consultants, Redmond, Oregon.

USDA
United States Department of Agriculture

National Resources Conservation Service
1201 NE Lloyd Blvd
Suite 900
Portland, OR 97232
503-414-3200

January 15, 2020

Mr. Gregg Garnett
U.S. Bureau of Reclamation
1375 SE Wilson Ave, Suite 100
Bend, OR 97702-1435

Subject: Central Oregon Fork Irrigation District Irrigation Modernization Project Draft Watershed Plan–Environmental Assessment

Dear Mr. Garnett,

Embedded in this letter is a website link to the copy of the draft watershed plan–environmental assessment (Draft Plan-EA) for the Central Oregon Irrigation District Irrigation Modernization Project, located in Deschutes County, Oregon. Farmers Conservation Alliance prepared this Draft Plan-EA for the United States Department of Agriculture, Natural Resources Conservation Service in cooperation with Central Oregon Irrigation District, as the project sponsor. This plan was prepared under authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566) and in accordance with section 102(2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190).

The purpose of this project is to conserve water, reduce energy use, improve operational efficiencies, increase public safety, and enhance fish and wildlife habitat in the Deschutes River through piping eight miles of District-owned canal and laterals.

We are requesting that you review this project in accordance with section 102(2)(C) of the National Environmental Protection Policy Act of 1969 (Public Law 91-190). We request that comments be received by this office on or before February 18, 2020. If your comments are not received by the due date, we will assume you do not wish to comment.

The Draft Plan-EA is available for public review and comment. Copies may be obtained by contacting Gary Dirdoni, Acting Assistant State Conservationist – Watershed Resource Planning, USDA, NRCS, 1201 NE Lloyd Blvd, Suite 900, Portland, Oregon, 97232, 503-414-3092 or gary.dirdoni@usda.gov. An electronic version has been made available for viewing and downloading at Oregon Watershed Plans web page, found at https://oregonwatershedplans.org. NRCS will consider all comments received and will respond to those received by February 18, 2020. Comments received will be made available for public inspection.

Sincerely,

JAY GIBBS
Acting State Conservationist

Enclosure:
Notice of Availability of Draft Watershed Plan-Environmental Assessment and Public Meeting on Monday, February 3, 2020 for Central Oregon Irrigation District Infrastructure Modernization Project

Cc: Gary Dirdoni, Acting ASTC- Watershed Resources and Planning, NRCS

USDA
United States Department of Agriculture

Natural Resources Conservation Service
1201 NE Lloyd Blvd.
Suite 900
Portland, OR 97232
503-414-3200

January 15, 2020

Ms. Leah Horner
Regional Solutions Director
Office of the Governor Katherine Brown
900 Court Street NE, Suite 254
Salem, OR 97301-4047

Subject: Central Oregon Irrigation District Irrigation Modernization Project Draft Watershed Plan–Environmental Assessment

Dear Ms. Horner,

In accordance with Section 2 of Executive Order 10913, and our responsibility as assigned by the Secretary of Agriculture, we are transmitting for your review and comment the draft watershed plan–environmental assessment (Draft Plan-EA) for the Central Oregon Irrigation District Irrigation Modernization Project, Deschutes County, Oregon.

Embedded in this letter is a website link to the copy of the draft watershed plan-environmental assessment (Draft Plan-EA) for the Central Oregon Irrigation District Irrigation Modernization Project, located in Deschutes County, OR. Farmers Conservation Alliance prepared this Draft Plan-EA for the United States Department of Agriculture, Natural Resources Conservation Service in cooperation with Central Oregon Irrigation District, as the project sponsor. This plan was prepared under authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566) and in accordance with section 102(2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190). The application for assistance in the preparation of the Draft Plan-EA was approved by NRCS on July 6, 2017.

The purpose of this project is to conserve water, reduce energy use, improve operational efficiencies, increase public safety, and enhance fish and wildlife habitat in the Deschutes River through piping eight miles of District-owned canal and laterals.

We are requesting that you review this project in accordance with section 102(2)(C) of the National Environmental Protection Policy Act of 1969 (Public Law 91-190). We request that comments be received by this office on or before February 18, 2020. If your comments are not received by the due date, we will assume you do not wish to comment.

The Draft Plan-EA is available for public review and comment. Copies may be obtained by contacting Gary Dirldoni, Acting Assistant State Conservationist - Watershed Resource Planning, USDA, NRCS, 1201 NE Lloyd Blvd, Suite 900, Portland, Oregon, 97232, 503-414-3092 or gary.dirldoni@usda.gov. An electronic version has been made available for viewing and downloading at Oregon Watershed Plans web page, found at https://oregonwatershedplans.org. NRCS will consider all comments received and will

2

respond to those received by February 18, 2020. Comments received will be made available for public inspection.

Sincerely,

JEFFREY GIBBS
Acting State Conservationist

Enclosure:
Notice of Availability of Draft Watershed Plan-Environmental Assessment and Public Meeting on Monday, February 3, 2020 for Central Oregon Irrigation District Infrastructure Modernization Project

Central Oregon Irrigation District Project Draft Watershed Plan–Environmental Assessment

Cc:
Gary Dirdoni, Acting ASTC– Watershed Resources and Planning, NRCS
Lauri Aunan, Natural Resources Policy Advisor, Office of the Governor Katherine Brown
Jason Miner, Natural Resources Policy Advisor, Office of the Governor Katherine Brown
Chris Harder, Director, Business Oregon
Alexis Taylor, Director, Oregon Department of Agriculture (ODA)
Richard Whitman, Director, Oregon Department of Environmental Quality (ODEQ)
Curt Melcher, Director, Oregon Department of Fish and Wildlife (ODFW)
Vicki Walker, Director, Oregon Department of State Lands (ODSL)
Tom Byler, Director, Oregon Water Resources Department (OWRD)
Meta Loftsgaarden, Executive Director, Oregon Watershed Enhancement Board (OWEB)

USDA
United States Department of Agriculture

Natural Resources Conservation Service
1201 NE Lloyd Blvd. Suite 900
Portland, OR 97232
503-414-3290

January 16, 2020

The Honorable Jeff Merkley
United States Senator
131 NW Hawthorne Avenue, Suite 208
Bend, OR 97703

Subject: Central Oregon Irrigation District Irrigation Modernization Project Draft Watershed Plan - Environmental Assessment

Dear Senator Merkley,

Embedded in this letter is a website link to the copy of the draft watershed plan–environmental assessment (Draft Plan-EA) for the Central Oregon Irrigation District Irrigation Modernization Project, located in Deschutes County, Oregon. Farmers Conservation Alliance prepared this Draft Plan-EA for the United States Department of Agriculture, Natural Resources Conservation Service in cooperation with Central Oregon Irrigation District, as the project sponsor. This plan was prepared under authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566) and in accordance with section 102(2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190).

The purpose of the project is to conserve water, reduce energy use, improve operational efficiencies, increase public safety, and enhance fish and wildlife habitat in the Deschutes River through piping eight miles of District-owned canal and laterals.

We are requesting that you review this project in accordance with section 102(2)(C) of the National Environmental Protection Policy Act of 1969 (Public Law 91-190). We request that comments be received by this office on or before February 18, 2020. If your comments are not received by the due date, we will assume you do not wish to comment.

The Draft Plan-EA is available for public review and comment. Copies may be obtained by contacting Gary Dirdoni, Acting Assistant State Conservationist - Watershed Resource Planning, USDA, NRCS, 1201 NE Lloyd Blvd, Suite 900, Portland, Oregon, 97232, 503-414-3092 or gary.dirdoni@usda.gov. An electronic version has been made available for viewing and downloading at Oregon Watershed Plans web page, found at https://oregonwatershedplans.org. NRCS will consider all comments received and will respond to those received by February 18, 2020. Comments received will be made available for public inspection.

Sincerely,

JAY GIBBS
Acting State Conservationist

Enclosure:
Notice of Availability of Draft Watershed Plan-Environmental Assessment and Public Meeting on Monday, February 3, 2020 for Central Oregon Irrigation District Infrastructure Modernization Project

Cc: Gary Dirdoni, Acting ASTC- Watershed Resources and Planning, NRCS
BJ Westerlund, Central Oregon Field Representative, Office of US Senator Jeff Merkley (D-OR)

United States Department of Agriculture

Natural Resources Conservation Service

1201 NE Lloyd Blvd
Suite 900
Portland, OR 97232
503-414-3200

January 16, 2020

Mr. Eric King, City Manager
City of Bend
710 NW Wall St
Bend, OR 97703

Subject: Central Oregon Irrigation District Irrigation Modernization Project Draft Watershed Plan–Environmental Assessment

Dear Mr. King,

Embedded in this letter is a website link to the copy of the draft watershed plan–environmental assessment (Draft Plan-EA) for the Central Oregon Irrigation District Irrigation Modernization Project, located in Deschutes County, Oregon. Farmers Conservation Alliance prepared this Draft Plan-EA for the United States Department of Agriculture, Natural Resources Conservation Service in cooperation with Central Oregon Irrigation District, as the project sponsor. This plan was prepared under authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566) and in accordance with section 102(2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190).

The purpose of this project is to conserve water, reduce energy use, improve operational efficiencies, increase public safety, and enhance fish and wildlife habitat in the Deschutes River through piping eight miles of District-owned canal and laterals.

We are requesting that you review this project in accordance with section 102(2)(C) of the National Environmental Protection Policy Act of 1969 (Public Law 91-190). We request that comments be received by this office on or before February 18, 2020. If your comments are not received by the due date, we will assume you do not wish to comment.

The Draft Plan-EA is available for public review and comment. Copies may be obtained by contacting Gary Dindori, Acting Assistant State Conservationist – Watershed Resource Planning, USDA, NRCS, 1201 NE Lloyd Blvd, Suite 900, Portland, Oregon, 97232, 503-414-3092 or gary.dindori@usda.gov. An electronic version has been made available for viewing and downloading at Oregon Watershed Plans web page, found at http://www.wcatechlinks.com. NRCS will consider all comments received and will respond to those received by February 18, 2020. Comments received will be made available for public inspection.

Sincerely,

JAY GIBBS
Acting State Conservationist

Enclosure:
Notice of Availability of Draft Watershed Plan-Environmental Assessment and Public Meeting on Monday, February 3, 2020 for Central Oregon Irrigation District Infrastructure Modernization Project

Cc: Gary Dindori, Acting ASTC- Watershed Resources and Planning, NRCS

USDA

United States Department of Agriculture

Natural Resources Conservation Service

1201 NE Lloyd Blvd.
Suite 900
Portland, OR 97232
503-414-3282

January 15, 2020

Mr. Dennis Teitzel
Bureau of Land Management
3050 NE 3rd Street
Prineville, OR 97754

Subject: Central Oregon Irrigation District Irrigation Modernization Project Draft Watershed Plan-Environmental Assessment

Dear Mr. Teitzel,

Embedded in this letter is a website link to the copy of the draft watershed plan-environmental assessment (Draft Plan-EA) for the Central Oregon Irrigation District Irrigation Modernization Project, located in Deschutes County, Oregon. Farmers Conservation Alliance prepared this Draft Plan-EA for the United States Department of Agriculture, Natural Resources Conservation Service in cooperation with Central Oregon Irrigation District, as the project sponsor. This plan was prepared under authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566) and in accordance with section 102(2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190).

The purpose of this project is to conserve water, reduce energy use, improve operational efficiencies, increase public safety, and enhance fish and wildlife habitat in the Deschutes River through piping eight miles of District-owned canal and laterals.

We are requesting that you review this project in accordance with section 102(2)(C) of the National Environmental Protection Policy Act of 1969 (Public Law 91-190). We request that comments be received by this office on or before February 18, 2020. If your comments are not received by the due date, we will assume you do not wish to comment.

The Draft Plan-EA is available for public review and comment. Copies may be obtained by contacting Gary Dirdoni, Acting Assistant State Conservationist – Watershed Resource Planning, USDA, NRCS, 1201 NE Lloyd Blvd, Suite 900, Portland, Oregon, 97232, 503-414-3092 or gary.dirdoni@usda.gov. An electronic version has been made available for viewing and downloading at Oregon Watershed Plans web page, found at https://oregonwatershedplans.org. NRCS will consider all comments received and will respond to those received by February 18, 2020. Comments received will be made available for public inspection.

Sincerely,

JAY GIBBS
Acting State Conservationist

Enclosure:
Notice of Availability of Draft Watershed Plan-Environmental Assessment and Public Meeting for Monday, February 3, 2020 for Central Oregon Irrigation District Infrastructure Modernization Project

Cc: Gary Dirdoni, Acting ASTC- Watershed Resources and Planning, NRCS

USDA

United States Department of Agriculture

Natural Resources Conservation Service

1201 NE Lloyd Blvd.
Suite 900
Portland, OR 97232
503-414-3200

January 15, 2020

Colonel Aaron L. Dorf
US Army Corps of Engineers
P.O. Box 2946
Portland, OR 97208-2946

Subject: Central Oregon Fork Irrigation District Irrigation Modernization Project Draft Watershed Plan–Environmental Assessment

Dear Colonel Dorf,

A copy of the draft watershed plan–environmental assessment (Draft Plan-EA) for the Central Oregon Irrigation District Irrigation Modernization Project, located in Deschutes County, Oregon has been uploaded to your FTP site (AMRDEC) located at https://safe.amrdec.army.mil/safe/ for review. Farmers Conservation Alliance prepared this Draft Plan-EA for the United States Department of Agriculture, Natural Resources Conservation Service in cooperation with Central Oregon Irrigation District, as the project sponsor. This plan was prepared under authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566) and in accordance with section 102(2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190).

The purpose of this project is to conserve water, reduce energy use, improve operational efficiencies, increase public safety, and enhance fish and wildlife habitat in the Deschutes River through piping eight miles of District-owned canal and laterals.

We are requesting that you review this project in accordance with section 102(2)(C) of the National Environmental Protection Policy Act of 1969 (Public Law 91-190). We request that comments be received by this office on or before February 18, 2020. If your comments are not received by the due date, we will assume you do not wish to comment.

The proposed action under consideration meets the irrigation exemption under USACE's Regulatory Guidance Letter No. 07-02, Exemption for Construction or Maintenance of Irrigation Ditches and Maintenance of Drainage under Section 404 Part 323.4(a)(3) of the CWA. Additional coordination and consultation with USACE, as applicable, will occur during the project group planning stage to ensure the applicability of CWA permitting requirements, exemption criteria, or to determine if additional CWA compliance and permitting is required.

The Draft Plan-EA is available for public review and comment. Copies may be obtained by contacting Gary Diridoni, Acting Assistant State Conservationist - Watershed Resource Planning, USDA, NRCS, 1201 NE Lloyd Blvd, Suite 900, Portland, Oregon, 97232, 503-414-3092 or gary.diridoni@usda.gov. An electronic version has been made available for viewing and downloading at Oregon Watershed Plans web page, found at

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https://oregonwatershedplans.org. NRCS will consider all comments received and will respond to those received by February 18, 2020. Comments received will be made available for public inspection.

Sincerely,

JAY GIBBS
Acting State Conservationist

Enclosure:
Notice of Availability of Draft Watershed Plan-Environmental Assessment and Public Meeting on Monday, February 3, 2020 for Central Oregon Irrigation District Infrastructure Modernization Project

Central Oregon Irrigation District Irrigation Modernization Project Draft Watershed Plan–Environmental Assessment

Regulatory Guidance Letter (RGL) 07-02

Cc: Gary Diridoni, Acting ASTC- Watershed Resources and Planning, NRCS
Andrea Wagner, Regulatory Project Manager/Biologist, USACE

USDA

United States Department of Agriculture

Natural Resources Conservation Service

1201 NE Lloyd Blvd.
Suite 900
Portland, OR 97232
503-414-3200

January 15, 2020

Mr. Keith Witcosky, City Manager
City of Redmond
411 SW 9th St.
Redmond, OR 97756

Subject: Central Oregon Irrigation District Irrigation Modernization Project Draft Watershed Plan–Environmental Assessment

Dear Mr. Witcosky,

Embedded in this letter is a website link to the copy of the draft watershed plan–environmental assessment (Draft Plan-EA) for the Central Oregon Irrigation District Irrigation Modernization Project, located in Deschutes County, Oregon. Farmers Conservation Alliance prepared the Draft Plan-EA for the United States Department of Agriculture, Natural Resources Conservation Service in cooperation with Central Oregon Irrigation District, as the project sponsor. This plan was prepared under authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566) and in accordance with section 102(2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190).

The purpose of this project is to conserve water, reduce energy use, improve operational efficiencies, increase public safety, and enhance fish and wildlife habitat in the Deschutes River through piping eight miles of District-owned canal and laterals.

We are requesting that you review this project in accordance with section 102(2)(C) of the National Environmental Protection Policy Act of 1969 (Public Law 91-190). We request that comments be received by this office on or before February 18, 2020. If your comments are not received by the due date, we will assume you do not wish to comment.

The Draft Plan-EA is available for public review and comment. Copies may be obtained by contacting Gary Dirdoni, Acting Assistant State Conservationist – Watershed Resource Planning, USDA, NRCS, 1201 NE Lloyd Blvd, Suite 900, Portland, Oregon, 97232, 503-414-3092 or gary.dirdoni@usda.gov. An electronic version has been made available for viewing and downloading at Oregon Watershed Plans web page, found at https://oregonwatershedplans.org. NRCS will consider all comments received and will respond to those received by February 18, 2020. Comments received will be made available for public inspection.

Sincerely,

JAY GIBBS
Acting State Conservationist

Enclosure:
Notice of Availability of Draft Watershed Plan-Environmental Assessment and Public Meeting on Monday, February 3, 2020 for Central Oregon Irrigation District Infrastructure Modernization Project

Cc: Gary Dirdoni, Acting ASTC– Watershed Resources and Planning, NRCS

USDA
United States Department of Agriculture

Natural Resources Conservation Service

1201 NE Lloyd Blvd.
Suite 900
Portland, OR 97232
503-414-3293

January 15, 2020

Ms. Christine Curran
Deputy State Historic Preservation Officer
Parks and Recreation Department
State Historic Preservation Office
725 Summer Street, NE, Suite C
Salem, OR 97301-1226

Subject: Central Oregon Irrigation District Irrigation Modernization Project Draft Watershed Plan–Environmental Assessment

Dear Ms. Curran,

A copy of the draft watershed plan–environmental assessment (Draft Plan-EA) for the Central Oregon Irrigation District Infrastructure Modernization Project, located in Deschutes County, Oregon has been provided for your review utilizing the Go Digital submittal process. Farmers Conservation Alliance prepared this Draft Plan-EA for the United States Department of Agriculture, Natural Resources Conservation Service in cooperation with Central Oregon Irrigation District, as the project sponsor. This plan was prepared under authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566) and in accordance with section 102(2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190).

The purpose of this project is to conserve water, reduce energy use, improve operational efficiencies, increase public safety, and enhance fish and wildlife habitat in the Deschutes River through piping eight miles of District-owned canal and laterals.

The draft watershed plan does not address the Agency's responsibilities for Section 106 of the National Historic Preservation Act (NHPA). As funding for project groups is allocated, consultation on the canals, laterals, and appurtenant structures will be addressed, in fulfillment of Section 106 of the NHPA.

We are requesting that you review this project in accordance with section 102(2)(C) of the National Environmental Protection Policy Act of 1969 (Public Law 91-190). We request that comments be received by this office on or before February 18, 2020. If your comments are not received by the due date, we will assume you do not wish to comment.

The Draft Plan-EA is available for public review and comment. Copies may be obtained by contacting Gary Diridoni, Acting Assistant State Conservationist - Watershed Resource Planning, USDA, NRCS, 1201 NE Lloyd Blvd, Suite 900, Portland, Oregon, 97232, 503-414-3092 or gary.diridoni@usda.gov. An electronic version has been made available for viewing and downloading at Oregon Watershed Plans web page, found at

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Sincerely,

JAY GIBBS
Acting State Conservationist

Enclosure(s):
Notice of Availability of Draft Watershed Plan-Environmental Assessment and Public Meeting on Monday, February 3, 2020 for Central Oregon Irrigation District Infrastructure Modernization Project

Central Oregon Irrigation District Infrastructure Modernization Project Draft Watershed Plan–Environmental Assessment

Ecc: Gary Diridoni, Acting ASTC- Watershed Resources and Planning, NRCS
Rachael Gebauer, Cultural Resources Specialist/ Archaeologist, NRCS
Michael Petrazza, Archaeologist, NRCS
Dr. Dennis Griffin, State Archaeologist, OR State Historic Preservation Office
John Pouley, Assistant State Archaeologist, OR State Historic Preservation Office
Ian Johnson, Associate Deputy State Historic Preservation Officer OR State Historic Preservation Office

USDA United States Department of Agriculture

Natural Resources Conservation Service

1201 NE Lloyd Blvd.
Suite 900
Portland, OR 97232
503-414-3283

January 15, 2020

Ms. Mae Huston, Chair
Board of County Commissioners
66 SE D Street, Suite A
Madras, OR 97741

Subject: Central Oregon Irrigation District Irrigation Modernization Project Draft Watershed Plan–Environmental Assessment

Dear Ms. Huston,

Embedded in this letter is a website link to the copy of the draft watershed plan–environmental assessment (Draft Plan-EA) for the Central Oregon Irrigation District Irrigation Modernization Project, located in Deschutes County, Oregon. Farmers Conservation Alliance prepared this Draft Plan-EA for the United States Department of Agriculture, Natural Resources Conservation Service in cooperation with Central Oregon Irrigation District, as the project sponsor. This plan was prepared under authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566) and in accordance with section 102(2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190).

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Sincerely,

JAY GIBBS
Acting State Conservationist

Enclosure:
Notice of Availability of Draft Watershed Plan-Environmental Assessment and Public Meeting on Monday, February 3, 2020 for Central Oregon Irrigation District Infrastructure Modernization Project

Cc: Gary Dirldoni, Acting ASTC- Watershed Resources and Planning, NRCS

USDA
United States Department of Agriculture

Natural Resources Conservation Service
1201 NE Lloyd Blvd.
Suite 900
Portland, OR 97232
503-414-3200

January 15, 2020

Mr. Jerry Brummer, County Commissioner
Crook County Courthouse
300 NE 3rd St, Room 10
Prineville, OR 97754

Subject: Central Oregon Irrigation District Irrigation Modernization Project Draft Watershed Plan–Environmental Assessment

Dear Mr. Brummer,

Embedded in this letter is a website link to the copy of the draft watershed plan–environmental assessment (Draft Plan-EA) for the Central Oregon Irrigation District Irrigation Modernization Project, located in Deschutes County, Oregon. Farmers Conservation Alliance prepared this Draft Plan-EA for the United States Department of Agriculture, Natural Resources Conservation Service in cooperation with Central Oregon Irrigation District, as the project sponsor. This plan was prepared under authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566) and in accordance with section 102(2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190).

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Sincerely,

JAY GIBBS
Acting State Conservationist

Enclosure:
Notice of Availability of Draft Watershed Plan-Environmental Assessment and Public Meeting on Monday, February 3, 2020 for Central Oregon Irrigation District Infrastructure Modernization Project

Cc: Gary Dirdoni, Acting ASTC- Watershed Resources and Planning, NRCS

An Equal Opportunity Employer, Provider and Lender

USDA

United States Department of Agriculture

Natural Resources Conservation Service

1201 NE Lloyd Blvd
Suite 900
Portland, OR 97232
503-414-3200

January 15, 2020

The Honorable Ron Wyden
United States Senator
911 NE 11th Avenue, Suite 630
Portland, OR 97232

Subject: Central Oregon Irrigation District Irrigation Modernization Project Draft Watershed Plan–Environmental Assessment

Dear Senator Wyden:

Embedded in this letter is a website link to the copy of the draft watershed plan–environmental assessment (Draft Plan-EA) for the Central Oregon Irrigation District Irrigation Modernization Project, located in Deschutes County, Oregon. Farmers Conservation Alliance prepared this Draft Plan-EA for the United States Department of Agriculture, Natural Resources Conservation Service in cooperation with Central Oregon Irrigation District, as the project sponsor. This plan was prepared under authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566) and in accordance with section 102(2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190).

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Sincerely,

JAY GIBBS
Acting State Conservationist

Enclosure
Notice of Availability of Draft Watershed Plan-Environmental Assessment and Public Meeting on Monday, February 3, 2020 for Central Oregon Irrigation District Infrastructure Modernization Project

Cc: Gary Dirldoni, Acting ASTC- Watershed Resources and Planning, NRCS
Jacob Eglar, Special Projects Coordinator, Office of US Senator Ron Wyden (D-OR)

USDA United States Department of Agriculture

Natural Resources Conservation Service

1201 NE Lloyd Blvd.
Suite 900
Portland, OR 97232
503-414-3238

January 15, 2020

Mr. Paul Henson, PhD
State Supervisor
U.S. Fish and Wildlife Service
2600 SE 98th Avenue
Portland, OR 97266

Subject: Central Oregon Irrigation District Irrigation Modernization Project Draft Watershed Plan–Environmental Assessment

Dear Mr. Henson,

Embedded in this letter is a website link to the copy of the draft watershed plan–environmental assessment (Draft Plan-EA) for the Central Oregon Irrigation District Irrigation Modernization Project, located in Deschutes County, Oregon. Farmers Conservation Alliance prepared this Draft Plan-EA for the United States Department of Agriculture, Natural Resources Conservation Service in cooperation with Central Oregon Irrigation District, as the project sponsor. This plan was prepared under authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566) and in accordance with section 102(2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190).

The purpose of this project is to conserve water, reduce energy use, improve operational efficiencies, increase public safety, and enhance fish and wildlife habitat in the Deschutes River through piping eight miles of District-owned canal and laterals.

We are requesting that you review this project in accordance with section 102(2)(C) of the National Environmental Protection Policy Act of 1969 (Public Law 91-190). We request that comments be received by this office on or before February 13, 2020. If your comments are not received by the due date, we will assume you do not wish to comment.

Additionally, please submit any reports with recommendations on the conservation and development of fish and wildlife as identified in the Watershed Protection and Flood Prevention Act of 1954, Section 12, Consultation Request letter dated July 20, 2017 if any surveys or investigations have been conducted.

The Draft Plan-EA is available for public review and comment. Copies may be obtained by contacting Gary Dirdoni, Acting Assistant State Conservationist - Watershed Resource Planning, USDA, NRCS, 1201 NE Lloyd Blvd, Suite 900, Portland, Oregon, 97232, 503-414-3092 or gary.dirdoni@usda.gov. An electronic version has been made available for viewing and downloading at Oregon Watershed Plans web page, found at https://oregonwatershedplans.org. NRCS will consider all comments received and will

2

respond to those received by February 13, 2020. Comments received will be made available for public inspection.

Sincerely,

JAY GIBBS
Acting State Conservationist

Enclosure:
Notice of Availability of Draft Watershed Plan-Environmental Assessment and Public Meeting on Monday, February 3, 2020 for Central Oregon Irrigation District Infrastructure Modernization Project

Watershed Protection and Flood Prevention Act of 1954, Section 12, Consultation Request for the Irrigation Infrastructure Improvement projects in the Central Oregon Irrigation District

Cc: Gary Dridoni, Acting ASTC- Watershed Resources and Planning, NRCS

USDA
United States Department of Agriculture

Natural Resources Conservation Service

1201 NE Lloyd Blvd
Suite 900
Portland, OR 97232
503-414-3092

January 15, 2020

Mr. Robert Brunoe
The Confederated Tribes of the Warm Springs Reservation
P.O. Box C
Warm Springs, OR 97761

Subject: Central Oregon Irrigation District Irrigation Modernization Project Draft Watershed Plan–Environmental Assessment

Dear Mr. Brunoe,

Embedded in this letter is a website link to the copy of the draft watershed plan–environmental assessment (Draft Plan-EA) for the Central Oregon Irrigation District Irrigation Modernization Project, located in Deschutes County, Oregon. Farmers Conservation Alliance prepared this Draft Plan-EA for the United States Department of Agriculture, Natural Resources Conservation Service in cooperation with Central Oregon Irrigation District, as the project sponsor. This plan was prepared under authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566) and in accordance with section 102(2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190).

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Sincerely,

[signature]
JAY GIBBS
Acting State Conservationist

Enclosure:
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Cc: Gary Dridoni, Acting ASTC- Watershed Resources and Planning, NRCS

USDA

United States Department of Agriculture

Natural Resources Conservation Service

1201 NE Lloyd Blvd.
Suite 900
Portland, OR 97232
503-414-3238

January 15, 2020

Mr. Phil Henderson, Chair
Board of County Commissioners
1300 NW Wall, Suite 200
Bend, OR 97703

Subject: Central Oregon Irrigation District Irrigation Modernization Project Draft Watershed Plan- Environmental Assessment

Dear Mr. Henderson,

Embedded in this letter is a website link to the copy of the draft watershed plan–environmental assessment (Draft Plan-EA) for the Central Oregon Irrigation District Irrigation Modernization Project, located in Deschutes County, Oregon. Farmers Conservation Alliance prepared this Draft Plan-EA for the United States Department of Agriculture, Natural Resources Conservation Service in cooperation with Central Oregon Irrigation District, as the project sponsor. This plan was prepared under authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566) and in accordance with section 102(2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190).

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Sincerely,

JAY GIBBS
Acting State Conservationist

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Cc: Gary Dirdoni, Acting ASTC- Watershed Resources and Planning, NRCS

An Equal Opportunity Employer, Provider and Lender

Oregon
Kate Brown, Governor

Parks and Recreation Department
State Historic Preservation Office
725 Summer St NE Ste C
Salem, OR 97301-1266
Phone (503) 986-0690
Fax (503) 986-0793
www.oregonheritage.org

February 7, 2020

Mr. Gary Diridoni
USDA NRCS
1201 NE Lloyd Blvd, Ste 900
Portland, OR 97232

RE: SHPO Case No. 20-0067
USDA NRCS, Central Oregon Irrigation District Smith Rock-King Way Infrastructure Modernization Project
Pipe and pressurize approximately 7.9 miles
None provided, Deschutes County

Dear Mr. Diridoni:

Thank you for submitting the Draft Environmental Assessment for the Central Oregon Irrigation District Modernization Project, as referenced above. We look forward to consulting with the NRCS on the undertaking under Section 106 of the National Historic Preservation Act of 1966, as amended, and implementing regulations 36 CFR 800. Please do not hesitate to contact our office if you need assistance.

Sincerely,

Tracy Schwartz
Historic Preservation Specialist
(503) 986-0677
tracy.schwartz@oregon.gov

cc: Rachel Gebauer, NRCS

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, PORTLAND DISTRICT
P.O. BOX 2946
PORTLAND, OR 97208-2946

FEB 2 6 2020

Jay Gibbs
Acting State Conservationist
U.S. Department of Agriculture
Natural Resources Conservation Service
1201 NE Lloyd Blvd., Suite 900
Portland, OR 97232

Dear Mr. Gibbs:

We have received your January 15, 2020, letter requesting the U.S. Army Corps of Engineers (Corps) review the draft watershed plan-environmental assessment (Draft Plan-EA) for the Central Oregon Fork Irrigation District Irrigation Modernization Project (Project), located in Deschutes County, Oregon. You requested that we review this Project and provide comments.

The Draft Plan-EA describes the Project as multiple efforts to be completed over several years across a larger geographic area. Thus, it does not disclose the details of specific projects, but instead proposes to tier to site-specific project evaluations as they occur. As a result, we can only provide general comments on the Project regarding Corps jurisdiction and authority.

We have reviewed the Draft Plan-EA pursuant to Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act of 1899 (RHA). Under Section 10 of the RHA, a Department of the Army (DA) permit is generally required to construct structures or perform work in or affecting navigable waters of the U.S. Neither the Crooked River nor the Deschutes River or their tributaries are regulated under Section 10 of the RHA. Therefore, based on the maps included in the Draft Plan-EA, it appears a Section 10 DA permit would not be required for the Project.

Under Section 404 of the CWA, a DA permit is generally required for the discharge of dredged or fill material (e.g., fill, excavation, or mechanized land clearing) into waters of the U.S., including wetlands. However, discharges of dredged or fill material that may result from certain activities can be exempt from regulation under Section 404.

The Corps' regulation, 33 CFR 323.4(a)(3), defines some activities not requiring a permit as the construction or maintenance of a farm or stock pond or an irrigation ditch, or the maintenance (but not construction) of a drainage ditch.

The Draft Plan-EA references Regulatory Guidance Letter No. 07-02, which provides additional information on the Corps' general application of this exemption. However, given the general nature of the Project description, the Corps is unable to determine if the exemption or the aforementioned Guidance Letter will apply to all of the proposed activities. For example, the Draft Plan-EA states that enhancement of wetland and riparian habitat in the Deschutes River may be included in the project. Discharges associated with enhancement activities do not qualify for the exemption. Additionally, the exemption cited above does not apply to channelized streams which have been modified to serve as irrigation ditches or temporary discharges in waters of the U.S. that may be necessary to complete an exempt activity.

Section 14 of the Rivers and Harbors Act of 1899 and codified in 33 U.S.C. § 408 (referred to as "Section 408") authorizes the Secretary of the Army, on the recommendation of the Chief of Engineers, to grant permission for the alteration or occupation or use of a Corps federally authorized project if the Secretary determines that the activity will not be injurious to the public interest and will not impair the usefulness of the project. An alteration is defined as any action that builds upon, alters, improves, moves, occupies, or otherwise affects the usefulness, or the structural or ecological integrity of a Corps federally authorized project. The Draft Plan-EA does not include sufficient information to determine if any project groups would require permission under Section 408.

The Corps Real Estate Division evaluates projects that may impact any real estate interest held by the Corps at a proposed Project location. The Draft Plan-EA does not include sufficient information to determine if any project groups would affect a real estate interest held by the Corps.

The Draft Plan-EA and your letter states that coordination and consultation with the Corps will occur prior to the implementation of each project group. I encourage this coordination with my staff regarding the applicability of the Corps jurisdiction and



authority over nonexempt activities associated with your Project. If you have any questions, please contact Ms. Andrea Wagner at the letterhead address, by telephone at (541) 465-6882, or email andrea.r.wagner@usace.army.mil.

Sincerely,

Aaron L. Dorf
Colonel, Corps of Engineers
District Commander

cc:

U.S. Army Corps of Engineers, Section 408 (Sally Bird)
U.S. Army Corps of Engineers, Real Estate (Amanda Dethman)

## E.8 Supporting Information for Land Use

This section presents supporting information for the land use section in the Plan-EA.

**Table E-2. Project Area Length Crossing Land Use Classes.**

| Land Use | Percent of the Project Area Length | Project Area Length Crossing each Land Use Class (miles) |
|---|---|---|
| Agriculture | 36% | 2.8 |
| Non-cultivated lands[1] | 51% | 4.0 |
| Developed Use[2] | 14% | 1.1 |
| **Total** | **100%** | **7.9** |

Source: Yang et al. 2018.
Notes: [1] Shrub/scrub, woody wetlands. [2] Low intensity development, developed open space

### References

Yang, L., Jin, S., Danielson, P., Homer, C., Gass, L., Case, A., Costello, C., Dewitz, J., Fry, J., Funk, M., Grannemann, B., Rigge, M. and G. Xian. 2018. A New Generation of the United States National Land Cover Database: Requirements, Research Priorities, Design, and Implementation Strategies, p. 108–123.

# E.9 Supporting Information for Vegetation

This section presents supporting information for the vegetation section in the Plan-EA.

## E.9.1 Common Vegetation

**Table E-3. Common Vegetation within the Project Area.**

| Vegetation Species | Scientific Name |
|---|---|
| Big sagebrush | *Artemisia tridentate* |
| Bitterbrush | *Pseudoroegneria spicata* |
| Black cottonwood | *Populus balsamifera* |
| Bulrush | *Scirpus spp.* |
| Idaho fescue | *Festuca idahoensis* |
| Low sagebrush | *Artemisia arbuscula* |
| Ponderosa pine | *Pinus ponderosa* |
| Rabbit brush | *Ericameria nauseosa* |
| Sandberg bluegrass | *Poa sandbergii* |
| Western juniper | *Juniperus occidentalis* |

Source: Hartzell- Hill personal communication July 18, 2017.

## E.9.2 Common and Noxious Weeds

The Deschutes County Noxious Weed Policy and Classification System designates three weed categories. "A" designated weeds are of highest priority for control and are subject to intensive eradication, containment, or control measures using county resources. "B" designated weeds have a limited distribution; intensive containment control and monitoring by landowners is required, and support from the County is provided when resources allow. "C" designated weeds are the lowest priority for control. They have a widespread distribution; landowner control and monitoring is recommended (Deschutes County 2017). The following table lists the noxious weeds and corresponding classifications known to occur in the project area.

**Table E-4. Noxious Weeds Occurring in the Project Area.**

| Vegetation Species | Scientific Name | Deschutes County Noxious Weed Rating |
|---|---|---|
| Bull thistle | *Cirsium vulgare* | C |
| Cheatgrass | *Bromus tectorum* | C |
| Common mullein | *Verbascum thapsus* | C |
| Diffuse knapweed | *Centaurea diffusa* | B |
| Kochia | *Kochia scoparia* | B |
| Poison hemlock | *Conium maculatum* | B |
| Russian thistle | *Salsola spp.* | B |
| Spotted knapweed | *Centaurea stoebe* | B |
| Yellow flag iris | *Iris pseudacorus* | B |
| Yellow floating heart | *Nymphoides peltata* | A |
| Water hemlock | *Cicuta douglasii* | N/A[1] |

Notes:
[1] Not applicable (N/A) because water hemlock is not classified as a noxious weed. However, it is present throughout the project area.
Source: Hartzell- Hill personal communication July 18, 2017

## References

Deschutes County. 2017. Deschutes County Noxious Weed List. Retrieved from: https://www.deschutes.org/sites/default/files/fileattachments/road/page/567/deschutes_county_weed_list_updated_2017.pdf. Accessed August 28, 2017.

Hartzell-Hill, Jenny (COID Executive Assistant). 2017. Personal communication (email) with Raija Bushnell (FCA). July 18.

## E.10 Supporting Calculations for Water Resources

This section presents supporting calculations used when evaluating effects of the proposed action with respect to water resources.

**Table E-5. Instream Water Rights for the Deschutes River and Crooked River.**

| Source | From | To | Certificate | Priority Date | Instream Rates (cfs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Deschutes R | Crane Prairie Reservoir | Wickiup Reservoir | 73233 | 10/11/1990 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 |
| Deschutes R | Wickiup Reservoir | Little Deschutes River | 59776 | 11/3/1983 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| Deschutes R | Little Deschutes River | Spring River | 59777 | 11/3/1983 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |
| Deschutes R | Spring River | North Canal Dam | 59778 | 11/3/1983 | 660 | 660 | 660 | 660 | 660 | 660 | 660 | 660 | 660 | 660 | 660 | 660 |
| Deschutes R | North Canal Dam | Lake Billy Chinook | 70695 | Pending | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 |
| Crooked R | Bowman Dam | Lake Billy Chinook | 70354 | Pending | 75 | 75/ 150 | 225 | 225 | 225 | 150 | 75 | 75 | 75 | 75 | 75 | 75 |

## E.10.1 Upper Deschutes River, Below Wickiup Reservoir

This subsection presents supporting calculations used when evaluating effects of the Proposed Action with respect to water resources in the Deschutes River below Wickiup Reservoir.

**Table E-6. Upper Deschutes River Daily Average Streamflow below Wickiup Reservoir prior to the 2016 Settlement Agreement.**

| Month | Low Streamflow (cfs) - 80% Exceedance | Lower Bar | Average Streamflow (cfs) - 50% Exceedance | Upper Bar | High Streamfllow (cfs) - 20% Exceedance |
|---|---|---|---|---|---|
| October | 35 | 260 | 295 | 506 | 801 |
| November | 26 | 11 | 37 | 227 | 264 |
| December | 26 | 12 | 38 | 234 | 272 |
| January | 27 | 16 | 43 | 268 | 311 |
| February | 29 | 15 | 44 | 406 | 450 |
| March | 30 | 121 | 151 | 313 | 464 |
| April | 284 | 282 | 565.5 | 250 | 815 |
| May | 823 | 277 | 1,100 | 240 | 1,340 |
| December | 1,040 | 280 | 1,320 | 190 | 1,510 |
| July | 1,330 | 140 | 1,470 | 152 | 1,622 |
| August | 1,260 | 160 | 1,420 | 100 | 1,520 |
| September | 946 | 209 | 1,155 | 185 | 1,340 |

Note: Streamflow in the Deschutes River downstream from Wickiup Reservoir at Oregon Water Resources Department Gauge No. 14056500 from the 1985 through 2015 water years.

**Table E-7. Upper Deschutes River Daily Average Streamflow below Wickiup Reservoir following the 2016 Settlement Agreement.**

| Month | Low Streamflow (cfs) - 80% Exceedance | Lower Bar | Average Streamflow (cfs) - 50% Exceedance | Upper Bar | High Streamflow (cfs) - 20% Exceedance |
|---|---|---|---|---|---|
| October | 107 | 9 | 116 | 477 | 592 |
| November | 119 | 6 | 125 | 54 | 178 |
| December | 103 | 48 | 151 | 44 | 195 |
| January | 104 | 51 | 155 | 47 | 202 |
| February | 103 | 48 | 151 | 50 | 201 |
| March | 99 | 95 | 194 | 140 | 334 |
| April | 601 | 23 | 624 | 9 | 633 |
| May | 760 | 425 | 1,185 | 155 | 1,340 |
| June | 937 | 373 | 1,310 | 162 | 1,472 |
| July | 1,430 | 100 | 1,530 | 130 | 1,660 |
| August | 1,500 | 30 | 1,530 | 48 | 1,578 |
| September | 864 | 256 | 1,120 | 194 | 1,314 |

Note: Streamflow in the Deschutes River downstream from Wickiup Reservoir at Oregon Water Resources Department Gauge No. 14056500 from the October 2016 through September 2018 water years.

**Table E-8. Deschutes River Post-Project Streamflow below Wickiup Reservoir.**

| Month | Pre-Project Average Daily Average Streamflow (cfs) [1] | Streamflow Restored Through Project (cfs) | Post-Project Average Daily Average Streamflow (cfs)[1] | ODFW Instream Water Right[2] in the Deschutes River from Wickiup Reservoir to the mouth of the Little Deschutes River | Post-Project Percentage Increase in Average Streamflow |
|---|---|---|---|---|---|
| October | 116 | 0 | 116 | 300 | 0% |
| November | 125 | 30.32 | 155 | 300 | 24% |
| December | 151 | 30.32 | 181 | 300 | 20% |
| January | 155 | 30.32 | 185 | 300 | 20% |
| February | 151 | 30.32 | 181 | 300 | 20% |
| March | 194 | 30.32 | 224 | 300 | 16% |
| April | 624 | 0 | 624 | 300 | 0% |
| May | 1,185 | 0 | 1,185 | 300 | 0% |
| June | 1,310 | 0 | 1,310 | 300 | 0% |
| July | 1,530 | 0 | 1,530 | 300 | 0% |
| August | 1,530 | 0 | 1,530 | 300 | 0% |
| September | 1,120 | 0 | 1,120 | 300 | 0% |

Notes
[1] Uses streamflow data following the 2016 Settlement Agreement. 2. Certificate No. 59776.

## E.10.2 Upper Deschutes River at Benham Falls

This subsection presents supporting calculations used when evaluating effects of the Proposed Action with respect to water resources in the Upper Deschutes River at Benham Falls.

**Table E-9. Upper Deschutes River Daily Average Streamflow at Benham Falls prior to the 2016 Settlement Agreement.**

| Month | Low Streamflow (cfs) - 80% Exceedance | Lower Bar | Average Streamflow (cfs) - 50% Exceedance | Upper Bar | High Streamflow (cfs) - 20% Exceedance |
|---|---|---|---|---|---|
| October | 511 | 369 | 880 | 440 | 1,320 |
| November | 466 | 62 | 528 | 287 | 814 |
| December | 486 | 92 | 578 | 328 | 906 |
| January | 493 | 127 | 620 | 323 | 943 |
| February | 518 | 106 | 624 | 536 | 1,160 |
| March | 553 | 212 | 765 | 466 | 1,230 |
| April | 878 | 382 | 1,260 | 290 | 1,550 |
| May | 1,570 | 260 | 1,830 | 150 | 1,980 |
| June | 1,660 | 230 | 1,890 | 200 | 2,090 |
| July | 1,850 | 140 | 1,990 | 120 | 2,110 |
| August | 1,798 | 112 | 1,910 | 120 | 2,030 |
| September | 1,428 | 252 | 1,680 | 170 | 1,850 |

Note: Streamflow in the Deschutes River at Benham Falls at Oregon Water Resources Department Gauge No. 14064500 vary within and between years. Data represent the 1985 through 2015 water years.

**Table E-10. Upper Deschutes River Daily Average Streamflow at Benham Falls following to the 2016 Settlement Agreement.**

| Month | Low Streamflow (cfs) - 80% Exceedance | Lower Bar | Average Streamflow (cfs) - 50% Exceedance | Upper Bar | High Streamflow (cfs) - 20% Exceedance |
|---|---|---|---|---|---|
| October | 614 | 38 | 653 | 418 | 1,070 |
| November | 595 | 31 | 626 | 68 | 693 |
| December | 571 | 69 | 640 | 66 | 706 |
| January | 572 | 91 | 663 | 83 | 746 |
| February | 665 | 57 | 722 | 28 | 749 |
| March | 705 | 57 | 762 | 195 | 956 |
| April | 1,130 | 345 | 1,475 | 55 | 1,530 |
| May | 1,640 | 70 | 1,710 | 288 | 1,998 |
| June | 1,688 | 137 | 1,825 | 75 | 1,900 |
| July | 1,950 | 45 | 1,995 | 105 | 2,100 |
| August | 1,890 | 35 | 1,925 | 95 | 2,020 |
| September | 1,320 | 230 | 1,550 | 206 | 1,756 |

Note: Streamflow in the Deschutes River at Benham Falls at Oregon Water Resources Department Gauge No. 14064500 vary within and between years. Data represent the October 2016 through September 2018 water years.

**Table E-11. Upper Deschutes River Post-Project Streamflow at Benham Falls.**

| Month | Pre-Project Average Daily Average Streamflow (cfs)[1] | Streamflow Restored Through Project (cfs)[2] | Post-Project Average Daily Average Streamflow (cfs)[1,2] | ODFW Instream Water Right[3] in the Deschutes River from the mouth of the Little Deschutes River to the confluence of Spring River | ODFW Instream Water Right[4] in the Deschutes River from the mouth of Spring River to the North Canal Dam at Bend | Post-Project Percentage Increase in Average Streamflow |
|---|---|---|---|---|---|---|
| October | 653 | 0.00 | 653 | 400 | 660 | 0% |
| November | 626 | 26.53 | 652 | 400 | 660 | 4% |
| December | 640 | 26.53 | 667 | 400 | 660 | 4% |
| January | 663 | 26.53 | 690 | 400 | 660 | 4% |
| February | 722 | 26.53 | 748 | 400 | 660 | 4% |
| March | 762 | 26.53 | 788 | 400 | 660 | 3% |
| April | 1,475 | 0.00 | 1,475 | 400 | 660 | 0% |
| May | 1,710 | 0.00 | 1,710 | 400 | 660 | 0% |
| June | 1,825 | 0.00 | 1,825 | 400 | 660 | 0% |
| July | 1,995 | 0.00 | 1,995 | 400 | 660 | 0% |
| August | 1,925 | 0.00 | 1,925 | 400 | 660 | 0% |
| September | 1,680 | 0.00 | 1,680 | 400 | 660 | 0% |

Notes:
[1] Uses streamflow data following the 2016 Settlement Agreement.
[2] To account for channel losses, a 12.5 percent loss factor is used between Wickiup Reservoir and Benham Falls.

## E.10.3 Middle Deschutes River at Bend, Below North Canal Dam

This subsection presents supporting calculations used when evaluating effects of the Proposed Action with respect to water resources in the Middle Deschutes River at Bend, below North Canal Dam.

**Table E-12. Middle Deschutes River Daily Average Streamflow at Bend – Below North Canal Dam prior to the 2016 Settlement Agreement.**

| Month | Low Streamflow (cfs) - 80% Exceedance | Lower Bar | Average Streamflow (cfs) - 50% Exceedance | Upper Bar | High Streamflow (cfs) - 20% Exceedance |
|---|---|---|---|---|---|
| October | 66 | 221 | 287 | 237 | 523 |
| November | 332 | 119 | 451 | 190 | 641 |
| December | 397 | 105 | 503 | 282 | 784 |
| January | 386 | 132 | 518 | 268 | 785 |
| February | 398 | 126 | 524 | 446 | 970 |
| March | 446 | 195 | 641 | 470 | 1,110 |
| April | 48 | 128 | 176 | 475 | 651 |
| May | 36 | 50 | 86 | 76 | 162 |
| June | 34 | 51 | 85 | 61 | 146 |
| July | 32 | 47 | 79 | 57 | 136 |
| August | 32 | 46 | 78 | 58 | 136 |
| September | 34 | 52 | 86 | 56 | 142 |

Note: Streamflow in the Deschutes River downstream from the City of Bend at Oregon Water Resources Department Gauge No. 14070500 from the 1985 through 2015 water years.

**Table E-13. Middle Deschutes River Daily Average Streamflow at Bend – Below North Canal Dam following the 2016 Settlement Agreement.**

| Month | Low Streamflow (cfs) - 80% Exceedance | Lower Bar | Average Streamflow (cfs) - 50% Exceedance | Upper Bar | High Streamflow (cfs) - 20% Exceedance |
|---|---|---|---|---|---|
| October | 82 | 447 | 528 | 45 | 573 |
| November | 515 | 49 | 564 | 44 | 607 |
| December | 500 | 81 | 581 | 71 | 652 |
| January | 487 | 12 | 499 | 179 | 677 |
| February | 509 | 117 | 626 | 42 | 667 |
| March | 607 | 61 | 668 | 184 | 851 |
| April | 163 | 328 | 491 | 234 | 725 |
| May | 95 | 20 | 116 | 15 | 131 |
| June | 122 | 9 | 131 | 4 | 135 |
| July | 128 | 5 | 133 | 3 | 136 |
| August | 122 | 9 | 131 | 3 | 134 |
| September | 91 | 42 | 133 | 18 | 151 |

Note: Streamflow in the Deschutes River downstream from the City of Bend at Oregon Water Resources Department Gauge No. 14070500 from the October 2016 through September 2018 water years.

**Table E-14. Middle Deschutes River Post-Project Streamflow at Bend - Below North Canal Dam.**

| Month | Pre-Project Average Daily Average Streamflow (cfs) [1] | Streamflow Restored Through Project (cfs)[2] | Post-Project Average Daily Average Streamflow (cfs)[1,2] | Pending ODFW Instream Water Right[3] in the Middle Deschutes River downstream from North Canal Dam | Post-Project Percentage Increase in Average Streamflow |
|---|---|---|---|---|---|
| October | 528 | 0.00 | 528 | 250 | 0% |
| November | 564 | 24.67 | 588 | 250 | 4% |
| December | 581 | 24.67 | 606 | 250 | 4% |
| January | 499 | 24.67 | 523 | 250 | 5% |
| February | 626 | 24.67 | 650 | 250 | 4% |
| March | 668 | 24.67 | 692 | 250 | 4% |
| April | 491 | 0.00 | 491 | 250 | 0% |
| May | 116 | 0.00 | 116 | 250 | 0% |
| June | 131 | 0.00 | 131 | 250 | 0% |
| July | 133 | 0.00 | 133 | 250 | 0% |
| August | 131 | 0.00 | 131 | 250 | 0% |
| September | 86 | 0.00 | 86 | 250 | 0% |

Notes
[1/] Uses streamflow data following the 2016 Settlement Agreement.
[2/] To account for channel losses, a 12.5 percent loss factor between Wickiup Reservoir and Benham Falls and an additional 7 percent loss factor between Benham Falls Gauging Station and the City of Bend are used.

## E.10.4 Crooked River Below Osborne Canyon

This subsection presents supporting calculations used when evaluating effects of the Proposed Action with respect to water resources in the Crooked River below Osborne Canyon.

**Table E-15. Crooked River Pre-Project Daily Average Streamflow Below Osborne Canyon.**

| Month | Low Streamflow (cfs) - 80% Exceedance | Lower Bar | Average Streamflow (cfs) - 50% Exceedance | Upper Bar | High Streamflow (cfs) - 20% Exceedance |
|---|---|---|---|---|---|
| October | 208 | 31 | 239 | 55 | 294 |
| November | 186 | 17 | 203 | 33 | 236 |
| December | 173 | 19 | 192 | 44 | 236 |
| January | 180 | 40 | 220 | 220 | 440 |
| February | 191 | 42 | 233 | 291 | 524 |
| March | 200 | 68 | 268 | 804 | 1,072 |
| April | 269 | 304 | 573 | 1,079 | 1,652 |
| May | 150 | 164 | 314 | 515 | 829 |
| June | 136 | 66 | 202 | 177 | 378 |
| July | 114 | 29 | 143 | 41 | 184 |
| August | 124 | 32 | 156 | 33 | 189 |
| September | 166 | 56 | 222 | 56 | 278 |

Note: Streamflow in Crooked River at Oregon Water Resources Department Gauge No. 14087380 from the 2003 through 2018 water years.

## E.10.5 Crooked River Below Opal Springs

This subsection presents supporting calculations used when evaluating effects of the Proposed Action with respect to water resources in the Crooked River below Opal Springs.

**Table E-16. Crooked River Pre-Project Daily Average Streamflow Below Opal Springs.**

| Month | Low Streamflow (cfs) - 80% Exceedance | Lower Bar | Average Streamflow (cfs) - 50% Exceedance | Upper Bar | High Streamflow (cfs) - 20% Exceedance |
|---|---|---|---|---|---|
| October | 1,330 | 40 | 1,370 | 70 | 1,440 |
| November | 1,310 | 30 | 1340 | 30 | 1,370 |
| December | 1,300 | 30 | 1,330 | 30 | 1,360 |
| January | 1,300 | 40 | 1,340 | 250 | 1,590 |
| February | 1,310 | 50 | 1,360 | 320 | 1,680 |
| March | 1,320 | 80 | 1,400 | 840 | 2,240 |
| April | 1,400 | 325 | 1,725 | 1,105 | 2,830 |
| May | 1,260 | 220 | 1,480 | 540 | 2,020 |
| June | 1,260 | 75 | 1,335 | 195 | 1,530 |
| July | 1,240 | 20 | 1,260 | 60 | 1,320 |
| August | 1,240 | 30 | 1,270 | 50 | 1,320 |
| September | 1,280 | 70 | 1,350 | 70 | 1,420 |

Note: Streamflow in Crooked River at Oregon Water Resources Department Gauge No. 14087400 from the 2003 through 2018 water years.

# E.11 Supporting Information for Water Resources

This section presents information regarding the Revised 1938 Inter-District Agreement.

## E.11.1 Reservoir Storage Allocation Agreement

This section presents the 2019 Amendment to the Arnold Irrigation District, Central Oregon Irrigation District, and Lone Pine Irrigation District Reservoir Storage Allocation Agreement.

2019 AMENDMENT TO

AID-COID-LPID RESERVOIR STORAGE ALLOCATION AGREEMENT

THIS 2019 AMENDMENT TO AID-COID-LPID RESERVOIR STORAGE ALLOCATION AGREEMENT ("2019 Amendment to AID-COID-LPID RSAA") is made this 2nd day of December 2019, by and between the Arnold Irrigation District ("AID"), the Central Oregon Irrigation District ("COID"), and the Lone Pine Irrigation District ("LPID") (collectively "the Districts"), all of which are irrigation districts operating pursuant to the provisions of Oregon Revised Statutes Chapter 545.

RECITALS

A. In 2017, the Districts entered into a Reservoir Storage Allocation Agreement ("RSAA"), attached hereto and incorporated herein, as Exhibit A.

B. At the time of the RSAA, the Districts anticipated the issuance of an interim biological opinion and incidental take statement from the U.S. Fish and Wildlife Service ("USFWS") that would result in coverage under the Endangered Species Act ("ESA") through July 31, 2019, at which time, the Districts anticipated a Habitat Conservation Plan ("HCP") would be completed and approved by USFWS, resulting in the issuance of long-term incidental take permits. While an interim biological opinion and incidental take statement were issued and are currently in effect through July 31, 2019, it is anticipated that it will take additional time beyond July 31, 2019 to complete and receive approval for the proposed HCP, and for the Districts to receive long-term incidental take permits. USFWS recently received approval from the U.S. Department of Interior for additional time to complete an environmental impact statement pursuant to the National Environmental Policy Act ("NEPA") as part of its evaluation of the proposed HCP. The Districts understand that the U.S. Bureau of Reclamation is currently consulting with USFWS, which will result in a supplemental biological opinion that extends the current incidental take statement through December 31, 2020, which will allow additional time for the NEPA evaluation to be completed, the HCP to be fully considered, and if approved, long-term incidental take permits to be issued.

C. With certain modifications as set forth below in this 2019 Amendment to AID-COID-LPID RSAA, the Districts wish to continue to operate under the RSAA for the period between the effective date of this 2019 Amendment to AID-COID-LPID RSAA and the eventual date the HCP is approved and long-term incidental take permits are issued. As such, the Districts hereby affirm their desire to work together to manage the currently available supply of water to mitigate the impacts of the ESA.

Therefore, AID, COID, and LPID now seek to amend the RSAA as follows:

1. The introductory statement following the term "AGREEMENT" is deleted in its entirety and replaced with the following:

"In recognition of the mutual benefits to be derived from this Agreement, the Districts agree as follows for the 2019 and 2020 irrigation seasons:"

Page 1 2019 AMENDMENT TO AID-COID-LPID RSAA (6/9/2019 version)

2. Sections 2 through 6 of the RSAA are deleted in their entirety and replaced with the following:

"2. The provisions of this Agreement shall terminate on the earlier of December 31, 2020 or the date the HCP is approved and incidental take permits are issued by USFWS, unless extended by the written mutual agreement of the Districts."

"3. NUID will make available up to 12,000 acre-feet of its Wickiup storage at the commencement of the irrigation season for use by AID and LPID. The specific amount of Wickiup stored water to be made available to AID and LPID will be determined by the amount of stored water in Crane Prairie that is available to "pay back" NUID later in the season, and this amount will be the difference between the highest elevation reached at the end of the fill season and the lowest elevation to which the reservoir can be drawn down consistent with the interim Biological Opinion and interim incidental take authorization issued by the USFWS. In terms of accounting, each acre foot of water released by NUID from Wickiup storage for use by AID and/or LPID will be "paid back" to NUID by AID and/or LPID from Crane Prairie in the same season.

"4. Of the available water described in Section 3 above, LPID would receive the first 5,000 acre feet out of Wickiup. AID will receive the available water up to 5,000 acre feet after LPID receives its 5,000 acre feet. If there is water available in excess of 10,000 acre feet, and up to 12,000 acre feet, it would be divided equally between LPID and AID.

"5. AID may annually make up to 1,000 AF of its unused stored water available to Tumalo Irrigation District ("TID") in exchange for TID storage in Crescent Lake.

"6 Of the available stored water that is credited to any district pursuant to Sections 3, 4 and 5 above, the other districts (including AID, COID, LPID, and NUID) may request from the credited district the use of any available unused storage water in the current irrigation season without charge, approval of which shall not be unreasonably withheld."

3. All other provisions of the RSAA remain in full force and effect.

THIS 2019 AMENDMENT TO AID-COID-LPID RESERVOIR STORAGE ALLOCATION AGREEMENT is effective as of the date set forth above.

Arnold Irrigation District ("AID")

By: _____ Date: 12-10-19
Its Board President

By: _____ Date: 12/10/19
Its Board Secretary

Central Oregon Irrigation District ("COID")

By: _____ Date: 12-2-19
Its Board President

By: _____ Date: 12.2.19
Its Board Secretary

Lone Pine Irrigation District ("LPID")

By: _____ Date: 12-11-19
Its Board President

By: _____ Date: 12-11-19
Its Board Secretary

The following entity acknowledges and agrees to Paragraph 2 above:

North Unit Irrigation District ("NUID")

By: _____ Date: 12-2-19
Its Board President

By: _____ Date: 12/2/19
Its Board Secretary

## E.11.2 Agreement for Provision of Irrigation Water

This section presents the Agreement for Provision of Irrigation Water between Central Oregon Irrigation District and North Unit Irrigation District.

AGREEMENT FOR PROVISION OF IRRIGATION WATER

THIS AGREEMENT is made this 7th day of December 2017, by and between the Central Oregon Irrigation District ("COID"), and the North Unit Irrigation District ("NUID"), and collectively ("the Districts"), both of which are irrigation districts operating pursuant to the provisions of Oregon Revised Statutes Chapter 545.

RECITALS

A. In 2015, the U.S. Fish and Wildlife Service ("USFWS") listed the Oregon spotted frog as a threatened species under the provisions of the Endangered Species Act.

B. The Districts hold water rights for the storage of water in reservoirs located near the headwaters of the Deschutes River in the State of Oregon, including Crane Prairie Reservoir and Wickiup Reservoir. The Districts' ability to store and deliver water for irrigation from said reservoirs has been severely restricted as a result of recent litigation by environmental groups against the Districts and the U.S. Bureau of Reclamation ("USBR") involving the Endangered Species Act and the Oregon spotted frog. This litigation resulted in a settlement agreement, which requires water previously stored and delivered by the Districts to be dedicated to Oregon spotted frog purposes. In addition, the settlement agreement requires that USBR consult with USFWS, which is anticipated to result in a biological opinion and incidental take statement by July 31, 2017. The settlement agreement also anticipates the completion of a Habitat Conservation Plan ("HCP") by July 31, 2019. The implementation of the settlement agreement, biological opinion, and HCP will severely limit the 50,000 acre-feet of water rights for storage and use of water from Crane Prairie Reservoir and the 200,000 acre-feet of water rights for storage and use of water from Wickiup Reservoir.

C. A significant portion of the stored water that is unavailable to the Districts for the reasons described above can be replaced with water conserved through piping of canals in COID and potentially by combining the diversions from the Deschutes River of NUID and COID into a single piped conveyance structure. In addition to conserving substantial amounts of water, piping of COID's canals and other conveyance structures will result in COID's ability to deliver water under pressure to its members, relieving individual members of the need to use on-farm pumps, and allow COID to generate hydroelectric power.

D. The Districts desire to work together to manage the currently available supply of water to mitigate the impacts of the Endangered Species Act, and to conserve water to replace the stored water made unavailable as a result of the Endangered Species Act.

Therefore, COID and NUID agree as follows:

AGREEMENT

1. COMMUNICATION AND COOPERATION.

1.1 The Districts agree to implement the Short Term Agreement made by and between them dated October 6, 2016, which provides for cooperation in the use of the available supply of water during the period from the date of the Short Term Agreement to July 31, 2017.

AGREEMENT FOR PROVISION OF IRRIGATION WATER - 1 (6/23/2017 version)

1.2 The Districts shall coordinate the release of water from storage and diversion of water for beneficial use. Each District shall provide notice to the other District not less than 24 hours prior to any effective change in releases from the reservoirs with the goals of maintaining minimum flows in the Deschutes River required for Oregon spotted frog habitat (as set forth in the settlement agreement described in Recital B above, and as may be required by the biological opinion and HCP referenced in Recital B above) and to deliver and divert all water available in the Deschutes River for irrigation at the Districts' respective diversion points.

1.3 The Districts shall work side by side in identifying and obtaining funding for conservation projects likely to produce conserved water for the use and benefit of the Districts.

1.4 The Districts agree that in the event that either District has a concern about the other District's use and management of irrigation water, it shall address the concerns directly to the other District and, thereafter, work with the other District to resolve the concern. Both Districts shall refrain from making disparaging public comments about the use and management of water in the Deschutes Basin by the other District and its water users.

2. WATER SUPPLY.

2.1 The terms of this section 2. Water Supply are intended to address some of the water deficiencies resulting from inability to store water as described in the Recitals above for the period of time from the date of this Agreement until the HCP is approved by USFWS and the Districts' ability to store and deliver water as provided for in the HCP is known. The Districts anticipate that pursuant to requirements set forth in the HCP, Crane Prairie Reservoir could eventually be fully dedicated to Oregon spotted frog purposes, and if so, operation of Crane Prairie and Wickiup Reservoirs, the terms of the 1938 Agreement between the Districts for the operation of the reservoirs, and the terms of this section 2 will be adjusted. Therefore, the provisions of this section 2 shall terminate on the earlier of July 31, 2019 or the time the HCP is approved by USFWS, unless extended by the written mutual agreement of the Districts.

2.2 COID shall provide or facilitate a temporary water transfer program for the partial or full idling of land and the transfer of irrigation water from land in COID made available through land idling or conservation practices from COID water users to NUID. The amount of water that may be made available through the program shall not exceed the amount of water appurtenant to 2,000 acres of land in COID and may be furthered limited by COID as reasonably necessary to retain sufficient irrigated land on each of COID's canals and laterals to provide the necessary rate of flow to serve the remaining irrigated land on those canals or laterals. The Districts shall seek to identify the least costly process for making the temporary transfers. NUID will pay the actual cost of the transfer, plus an amount equal to the COID's annual operating and maintenance charges applicable to the land from which the water is transferred.

2.3 As the water level in Wickiup Reservoir drops each year, COID shall release from Crane Prairie Reservoir and store in Wickiup Reservoir not less than 5,000 acre-feet and not more than 12,000 acre-feet of water for use by COID, Arnold Irrigation District ("AID"), and Lone Pine Irrigation District ("LPID") during that year. COID, AID, and LPID may use not more than 5,000 acre-feet of water from Wickiup Reservoir each year before July 1. COID, AID, and LPID may use the water released from Crane Prairie Reservoir and stored in Wickiup

Reservoir in excess of 5,000 acre feet after July 1, but limited to the quantity of water that has been stored in Wickiup Reservoir that year for their use. NUID agrees to direct the Watermaster to release said stored water from Wickiup Reservoir at such times and in such quantities as COID may request. Any portion of such water stored in Wickiup Reservoir in a given year not released from Wickiup Reservoir for COID, AID, and LPID's use prior to October 31 in that same year shall become stored water available for NUID's use, whether for winter instream flow requirements at the WICO gage or for NUID irrigation demand in the following year.

2.4 The Districts may undertake to make available for COID's use water released from storage during the early shoulder season, which is defined to mean the period of the irrigation season between April 1 and May 1, to supplement COID's diversion rights from the Deschutes River during that time period. In exchange, COID, subject to the requirements of Oregon water law and the rights of other water users, will make available to NUID water from the Deschutes River that is in excess of COID's demand during the months of July and August. There will be no payment by one District to the other for water made available pursuant to this subparagraph, as the Districts' intent is to fully utilize the water available from the Deschutes River for diversion and use by the Districts' members to the greatest extent possible.

2.5 If hydrologic conditions, such as a dry year, substantially impact the water available for storage and use, the Districts agree to meet and adjust the terms of this section 2.

3. CONSERVATION PROJECTS AND USE OF CONSERVED WATER.

3.1 COID has made preliminary studies of opportunities within its delivery system for conservation projects, such as piping of canals and other portions of the delivery system. An Executive Summary of the Preliminary System Improvement Plan was published September 19, 2016.

3.2 The Districts agree to work together to identify and obtain third-party funding for said conservation projects. COID shall retain sole authority for determining the order of priority of construction of said conservation projects and shall be solely liable for the cost of the projects that is not paid by third parties.

3.3 Many of the conservation projects provide the opportunity for the generation of hydroelectric energy. COID may incorporate hydropower components in any of said projects, and shall be solely responsible for negotiating power sales agreements, licenses, leases, or other types of agreements for the construction, operation, and maintenance of those hydropower projects, and COID shall be entitled to receive and retain all revenue generated by those projects.

3.4 To the extent that improvements made in the COID delivery system result in conservation of water that is then available for use by COID, COID agrees that NUID shall have the first option to receive 90 percent of the net conserved water. The term "net conserved water" means the amount of water actually conserved and made available based on engineering studies conducted after the project is completed (which includes completed phases of larger projects, when conserved water from such phases is available and susceptible to transfer and use by NUID), reduced by the amount of water that must be transferred instream pursuant to Oregon law. COID may retain the remaining 10 percent of the net conserved water for use by COID

members, other districts, or for other purposes. NUID shall pay to COID annually an amount equal to the same rate per acre charged by COID to its members, as determined by it pursuant to ORS 545.484. Said annual charges shall be due and payable to COID on the same dates as applicable to its members. The number of acres that NUID shall pay said charges for shall be equal to the amount of water in acre-feet provided by COID to NUID, divided by 4.0. NUID shall also pay one "account fee" annually to COID. It is the Districts' intent that the provision of said water by COID to NUID shall continue for so long as NUID is able to make beneficial use of the water for irrigation of land in NUID. COID will install measuring devices at each point where water is delivered from COID's conveyance system into NUID's conveyance system and shall provide daily flow rates from each such measuring device to NUID. Water shall be provided at a rate of 1/40th cubic foot per second for each acre of land in NUID irrigated with the water provided by COID. The Districts shall cooperate and work with each other to comply with any applicable regulations for the delivery of this water to NUID.

3.5 The Districts shall cooperate and work with each other to cause the conserved water transferred instream to be credited toward obligations imposed on the Districts to provide water instream for endangered species, and as mitigation credits for the City of Bend and other municipalities or entities that require mitigation credits. If it is beneficial to the Districts, the conserved water may also be used for instream flow in the Crooked River. NUID shall be solely responsible for the cost of compliance with regulations and permitting necessary to accomplish the provisions of this paragraph.

4. OTHER JOINT PROJECTS.

4.1 The Districts agree to work with other districts that divert water from the Deschutes River to establish a central water management office or entity with the goal of minimizing loss of water and maximizing utilization of the available water supply.

4.2 The Districts agree to work together to investigate the opportunity to obtain ownership of the North Canal Diversion Dam and to develop an operations and maintenance plan for the dam should one or more of the Districts obtain ownership of the dam.

4.3 The Districts agree that they shall cooperate in investigation of the potential to combine their facilities that divert water from the Deschutes River into a single diversion and piped conveyance structure.

5. GENERAL PROVISIONS.

5.1. Binding Effect. This Agreement is binding on and inures to the benefit of the Districts and their respective heirs, personal representatives, successors, and assigns.

5.2 Assignment. Neither this Agreement nor any of the rights, interests, or obligations under this Agreement may be assigned by any party without the prior written consent of the other District, which consent will not be unreasonably withheld.

5.3 No Third-Party Beneficiaries. Nothing in this Agreement, express or implied, is intended or may be construed to confer on any person, other than the parties to this Agreement, any right, remedy, or claim under or with respect to this Agreement.

5.4 Notices. All notices and other communications under this Agreement must be in writing and will be deemed to have been given if delivered personally, sent by facsimile (with confirmation), mailed by certified mail, or delivered by an overnight delivery service (with confirmation) to the Districts at the following addresses or facsimile numbers (or at such other address or facsimile number as a District may designate by like notice to the other District):

To: North Unit Irrigation District
Attention: Mike Britton, Manager
2024 NW Beach Street
Madras OR 97741
Facsimile No.: 541.475.3905

To: Central Oregon Irrigation District
Attention: Craig Horrell, Manager
1055 SW Lake Court
Redmond OR 97756
Facsimile No.: 541.548.0243

Any notice or other communication will be deemed to be given (a) on the date of personal delivery, (b) at the expiration of the fifth day after the date of deposit in the United States mail, or (c) on the date of confirmed delivery by facsimile or overnight delivery service.

5.5 Amendments. This Agreement may be amended only by an instrument in writing executed by all the parties, which writing must refer to this Agreement.

5.6 Construction. The captions used in this Agreement are provided for convenience only and will not affect the meaning or interpretation of any provision of this Agreement. All references in this Agreement to "Section" or "Sections" without additional identification refer to the Section or Sections of this Agreement. All words used in this Agreement will be construed to be of such gender or number as the circumstances require. Whenever the words "include" or "including" are used in this Agreement, they will be deemed to be followed by the words "without limitation."

5.7 Counterparts. This Agreement may be executed in counterparts, each of which will be considered an original and all of which together will constitute one and the same agreement.

5.8 Facsimile Signatures. Facsimile transmission of any signed original document, and retransmission of any signed facsimile transmission, will be the same as delivery of an original. At the request of any District, the Districts will confirm facsimile transmitted signatures by signing an original document.

5.9 Further Assurances. Each party agrees to execute and deliver such other documents and to do and perform such other acts and things as any other party may reasonably request to carry out the intent and accomplish the purposes of this Agreement.

5.10 Time of Essence. Time is of the essence with respect to all dates and time periods set forth or referred to in this Agreement.

5.11 Expenses. Except as otherwise expressly provided in this Agreement, each party to this Agreement will bear its own expenses in connection with the preparation, execution, and performance of this Agreement and the transactions contemplated by this Agreement.

5.12 Waiver. Any provision or condition of this Agreement may be waived at any time, in writing, by the party entitled to the benefit of such provision or condition. Waiver of any breach of any provision will not be a waiver of any succeeding breach of the provision or a waiver of the provision itself or any other provision.

5.13 Governing Law. This Agreement will be governed by and construed in accordance with the laws of the state of Oregon, without regard to conflict-of-laws principles.

5.14 Attorney Fees. If any arbitration, suit, or action is instituted to interpret or enforce the provisions of this Agreement, to rescind this Agreement, or otherwise with respect to the subject matter of this Agreement, the party prevailing on an issue will be entitled to recover with respect to such issue, in addition to costs, reasonable attorney fees incurred in the preparation, prosecution, or defense of such arbitration, suit, or action as determined by the arbitrator or trial court, and, if any appeal is taken from such decision, reasonable attorney fees as determined on appeal.

5.15 Injunctive and Other Equitable Relief. The Districts agree that the remedy at law for any breach or threatened breach by a party may, by its nature, be inadequate, and that in addition to damages, the other District will be entitled to a restraining order, temporary and permanent injunctive relief, specific performance, and other appropriate equitable relief, without showing or proving that any monetary damage has been sustained.

5.16 Venue. Any action or proceeding seeking to enforce any provision of this Agreement or based on any right arising out of this Agreement must be brought against any of the Districts in Deschutes County Circuit Court or Jefferson County Circuit Court of the State of Oregon or, subject to applicable jurisdictional requirements, in the United States District Court for the District of Oregon, and each of the Districts consents to the jurisdiction of such courts (and of the appropriate appellate courts) in any such action or proceeding and waives any objection to such venue.

5.17 Severability. If any provision of this Agreement is deemed to be invalid or unenforceable in any respect for any reason, the validity and enforceability of such provision in any other respect and of the remaining provisions of this Agreement will not be impaired in any way.

5.18 Entire Agreement. This Agreement (including the documents and instruments referred to in this Agreement) constitutes the entire agreement and understanding of the Districts with respect to the subject matter of this Agreement and supersedes all prior understandings and agreements, whether written or oral, between the Districts with respect to such subject matter.

THIS AGREEMENT is effective as of the date set forth above.

Central Oregon Irrigation District ("COID")

By: _____ Date: 12-7-17
Its Board President

By: _____ Date: 12-7-17
Its Board Secretary

North Unit Irrigation District ("NUID")

By: _____ Date: 12/7/17
Its Board President

By: _____ Date: 12/7/17
Its Board Secretary

AGREEMENT FOR PROVISION OF IRRIGATION WATER - 7 (6/23/2017 version)

## E.11.3 First Amendment to the Agreement for Provision of Irrigation Water

This section presents the first amendment (2019) to the Agreement for Provision of Irrigation Water between Central Oregon Irrigation District and North Unit Irrigation District.

FIRST AMENDMENT TO

COID-NUID AGREEMENT FOR PROVISION OF IRRIGATION WATER

THIS FIRST AMENDMENT TO COID-NUID AGREEMENT FOR PROVISION OF IRRIGATION WATER ("First Amendment to COID-NUID Agreement") is made this 2nd day of December 2019, by and between the Central Oregon Irrigation District ("COID"), and the North Unit Irrigation District ("NUID") (collectively "the Districts"), both of which are irrigation districts operating pursuant to the provisions of Oregon Revised Statutes Chapter 545.

RECITALS

A. On December 7, 2017, the Districts entered into an Agreement for Provision of Water (the "2017 Agreement"), attached hereto and incorporated herein, as Exhibit A.

B. At the time of the 2017 Agreement, the Districts anticipated the issuance of an interim biological opinion and incidental take statement from the U.S. Fish and Wildlife Service ("USFWS") that would result in coverage under the Endangered Species Act ("ESA") through July 31, 2019, at which time, the Districts anticipated a Habitat Conservation Plan ("HCP") would be completed and approved by USFWS, resulting in the issuance of long-term incidental take permits. While an interim biological opinion and incidental take statement were issued and are currently in effect through July 31, 2019, it is anticipated that it will take additional time beyond July 31, 2019 to complete and receive approval for the proposed HCP, and for the Districts to receive long-term incidental take permits. USFWS recently received approval from the U.S. Department of Interior for additional time to complete an environmental impact statement pursuant to the National Environmental Policy Act ("NEPA") as part of its evaluation of the proposed HCP. The Districts understand that the U.S. Bureau of Reclamation is currently consulting with USFWS, which will result in a supplemental biological opinion that extends the current incidental take statement through December 31, 2020, which will allow additional time for the NEPA evaluation to be completed, the HCP to be fully considered, and if approved, long-term incidental take permits to be issued.

C. With certain modifications as set forth below in this First Amendment to COID-NUID Agreement, the Districts wish to continue to operate under the 2017 Agreement, both for the period between the effective date of this First Amendment to COID-NUID Agreement and the eventual date the HCP is approved and long-term incidental take permits are issued, as well as for the effective period of the incidental take permits once issued. As such, the Districts hereby affirm their desire to work together to manage the currently available supply of water to mitigate the impacts of the ESA, and to conserve water to replace the stored water made unavailable as a result of the ESA.

Therefore, COID and NUID now seek to amend the 2017 Agreement as follows:

1. A new Section 1.5 of the 2017 Agreement is hereby added to the 2017 Agreement as follows:

"1.5 With at least one full year's prior written notice in advance of November 1 in any given year, either District may terminate this Agreement, in which case the parties shall revert to their respective rights as they existed prior to the execution of the December 7, 2017 Agreement for Provision of Water."

2. The last sentence of Section 2.1 of the 2017 Agreement is deleted in its entirety and replaced with the following:

"Therefore, the provisions of this Section 2 shall terminate on the earlier of December 31, 2020 or the date the HCP is approved and incidental take permits are issued by USFWS, unless extended by the written mutual agreement of the Districts."

3. Section 2.3 of the 2017 Agreement is deleted in its entirety and replaced with the following:

"2.3(A): NUID will make available up to 12,000 acre-feet of its Wickiup storage at the commencement of the irrigation season for use by Arnold Irrigation District ("AID") and Lone Pine Irrigation District ("LPID"), pursuant to that First Amendment to AID-COID-LPID Agreement, attached hereto as Exhibit B. The specific amount of Wickiup stored water to be made available to AID and LPID will be determined by the amount of stored water in Crane Prairie that is available to "pay back" NUID later in the season, and this amount will be the difference between the highest elevation reached at the end of the fill season and the lowest elevation to which the reservoir can be drawn down consistent with the interim Biological Opinion and interim incidental take authorization issued by the USFWS. In terms of accounting, each acre foot of water released by NUID from Wickiup storage for use by AID and/or LPID will be "paid back" to NUID by AID and/or LPID from Crane Prairie in the same season.

"2.3(B): Of the available water described in Section 2.3(A) above, LPID would receive the first 5,000 acre feet out of Wickiup. AID will receive the available water up to 5,000 acre feet after LPID receives its 5,000 acre feet. If there is water available in excess of 10,000 acre feet, and up to 12,000 acre feet, it would be divided equally between LPID and AID.

"2.3(C): AID may annually make up to 1,000 AF of its unused stored water available to Tumalo Irrigation District ("TID") in exchange for TID storage in Crescent Lake.

"2.3(D): Of the available stored water that is credited to any district pursuant to this Section 2.3, the other districts (including AID, COID, LPID, and NUID) may request from the credited district the use of any available unused storage water in the current irrigation season without charge, approval of which shall not be unreasonably withheld."

4. Section 2.4 of the 2017 Agreement is deleted in its entirety and replaced with the following:

"Central Oregon Irrigation District (COID) will forego use of storage in Crane Prairie in exchange for up to 5,000 acre feet of stored water from Wickiup Reservoir (Wickiup) – up to 3,000 acre feet before July 1 and up to 2,000 acre feet for late season. COID will provide NUID with access to Deschutes River water in exchange for this early and late season use of

Wickiup provided it can do so without making a call on Arnold Irrigation District (AID), Tumalo Irrigation District (TID), or Lone Pine Irrigation District (LPID) junior live flow rights. The restriction on COID's ability to make a call on junior live flow rights applies only if it is making a call for purposes of replacing NUID storage water, and does not otherwise re-order priority dates or impair COID's ability to make a call on junior water rights if needed to serve its patrons."

5. Section 3.2 of the 2017 Agreement is deleted in its entirety and replaced with the following:

"The Districts agree to work together to identify and obtain third-party funding for said conservation projects. Where the Districts are unable to obtain third-party funding for said conservation projects, the Districts may elect to work together to secure financing for said conservation projects, whether by undertaking loans, issuing bonds, or through other means. In the event that a conservation project requires undertaking loans, issuing bonds, or other financial commitment, the conservation project shall proceed only after the Districts agree in writing as to how those financial obligations shall be allocated between them, notwithstanding any other term of this Agreement. COID shall retain sole authority for determining the order of priority of construction of said conservation projects."

6. Section 3.4 of the 2017 Agreement is deleted in its entirety and replaced with the following:

"To the extent that improvements made in the COID delivery system result in conservation of water that is then available for use by COID, COID agrees that NUID shall have the first option to receive 90 percent of the net conserved water. The term "net conserved water" means the amount of water actually conserved and made available based on engineering studies conducted after the project is completed (which includes completed phases of larger projects, when conserved water from such phases is available and susceptible to transfer and use by NUID), reduced by the amount of water that must be transferred instream pursuant to Oregon law. COID may retain the remaining 10 percent of the net conserved water for use by COID members, other districts, or for other purposes. In particular, should AID or LPID wish to participate in a particular COID conservation project, then this remaining 10 percent of the net conserved water shall be first made available to AID and LPID, before COID makes said water available for other purposes. NUID shall pay to COID annually an amount equal to the same rate per acre charged by COID to its members, as determined by it pursuant to ORS 545.484, but only for those acres removed from COID's assessment base where a conserved water project results in such removal. Said annual charges shall be due and payable to COID on the same dates as applicable to its members. The number of acres that NUID shall pay said charges for shall be equal to the amount of water in acre-feet provided by COID to NUID, divided by 4.0. NUID shall also pay one "account fee" annually to COID. It is the Districts' intent that the provision of said water by COID to NUID shall continue for so long as NUID is able to make beneficial use of the water for irrigation of land in NUID. COID will install measuring devices at each point where water is delivered from COID's conveyance system into NUID's conveyance system and shall provide daily flow rates from each such measuring device to NUID. Water shall be provided at a rate of 1/40th cubic foot per second for each acre of land in

NUID irrigated with the water provided by COID. The Districts shall cooperate and work with each other to comply with any applicable regulations for the delivery of this water to NUID."

7. All other provisions of the 2017 Agreement remain in full force and effect.

THIS FIRST AMENDMENT TO COID-NUID AGREEMENT FOR PROVISION OF WATER is effective as of the date set forth above.

Central Oregon Irrigation District ("COID")

By: _____ Date: 12-2-19
Its Board President

By: _____ Date: 12-2-19
Its Board Secretary

North Unit Irrigation District ("NUID")

By: _____ Date: 12-2-19
Its Board President

By: _____ Date: 12/2/19
Its Board Secretary

The following entities acknowledge and agree to Paragraphs 2, 3, and 4 above:

Arnold Irrigation District ("AID")

By: _____ Date: 12-10-19
Its Board President

By: _____ Date: 12/10/19
Its Board Secretary

Lone Pine Irrigation District ("LPID")

By: _____ Date: 12-11-19
Its Board President

By: _____ Date: 12-11-19
Its Board Secretary

## E.12 Supporting Information for Fish and Aquatic Resources

This section presents the Primary Constituent Elements for Oregon spotted frog and bull trout critical habitat.

**Table E-17. Primary Constituent Elements for Oregon Spotted Frog Critical Habitat.**

| Primary Constituent Element Number | Habitat Description | Characteristics |
|---|---|---|
| PCE 1 | Nonbreeding (N), Breeding (B), Rearing (R), and Overwintering Habitat (O). Ephemeral or permanent bodies of fresh water, including, but not limited to natural or manmade ponds, springs, lakes, slow-moving streams, or pools within or oxbows adjacent to streams, canals, and ditches. | Inundated for a minimum of 4 months per year (B, R) (timing varies by elevation but may begin as early as February and last as long as September); |
| | | Inundated from October through March (O) |
| | | If ephemeral, areas are hydrologically connected by surface water flow to a permanent water body (e.g., pools, springs, ponds, lakes, streams, canals, or ditches) (B, R); |
| | | Shallow water areas (less than or equal to 30 centimeters (12 inches), or water of this depth over vegetation in deeper water (B, R); |
| | | Total surface area with less than 50 percent vegetative cover (N); |
| | | Gradual topographic gradient (less than 3 percent slope) from shallow water toward deeper, permanent water (B, R); |
| | | Herbaceous wetland vegetation (i.e., emergent, submergent, and floating-leaved aquatic plants), or vegetation that can structurally mimic emergent wetland vegetation through manipulation (B, R); |
| | | Shallow water areas with high solar exposure or low (short) canopy cover (B, R); |

| Primary Constituent Element Number | Habitat Description | Characteristics |
|---|---|---|
| | | An absence or low density of nonnative predators (B, R, N) |
| PCE 2 | Aquatic movement corridors. Ephemeral or permanent bodies of fresh water. | Less than or equal to 3.1 mi (5 km) linear distance from breeding areas |
| | | Impediment free (including, but not limited to, hard barriers such as dams, impassable culverts, lack of water, or biological barriers such as abundant predators, or lack of refugia from predators). |
| PCE 3 | Refugia Habitat | Nonbreeding, breeding, rearing, or overwintering habitat or aquatic movement corridors with habitat characteristics (e.g., dense vegetation and/or an abundance of woody debris) that provide refugia from predators (e.g., nonnative fish or bullfrogs). |

**Table E-18. Primary Constituent Elements for Bull Trout.**

| Primary Constituent Element Number | Habitat Description and Characteristics |
|---|---|
| PCE 1 | Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia. |
| PCE 2 | Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers. |
| PCE 3 | An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish. |

| Primary Constituent Element Number | Habitat Description and Characteristics |
|---|---|
| PCE 4 | Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure. |
| PCE 5 | Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence. |
| PCE 6 | In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system. |
| PCE 7 | A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph. |
| PCE 8 | Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited. |
| PCE 9 | Sufficiently low levels of occurrence of nonnnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g. brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout. |

**Table E-19. Fish Species within Areas Potentially Affected by the Central Oregon Irrigation District – Infrastructure Modernization Project.**

| Fish Species | Scientific Name | Presence in Deschutes[1] and Crooked Rivers[2] | | Origin |
|---|---|---|---|---|
| | | Deschutes | Crooked | |
| Black crappie | *Pomoxis nigromaculatus* | No | Yes | introduced |
| Bluegill | *Lepomis macrochirus* | No | Yes | introduced |
| Bridgelip sucker | *Catastomus columbianus* | Yes | Yes | indigenous |
| Brook trout | *Salvelinus fontinalis* | Yes | No | introduced |
| Brown bullhead catfish | *Ictalurus nebulosus* | Yes | Yes | introduced |
| Brown trout | *Salmo trutta* | Yes | No | introduced |
| Bull trout | *Salvelinus confluentus* | Yes | Yes | indigenous |
| Chinook salmon | *Oncorhynchus tshawyscha* | Yes | Yes | indigenous |
| Chiselmouth | *Acrocheilus alutaceus* | Yes | Yes | indigenous |
| Dace species | *Rhinichthys spp.* | Yes | Yes | indigenous |
| Largemouth bass | *Micropterus salmoides* | No | Yes | introduced |
| Largescale sucker | *Catastomus macrocheilus* | Yes | Yes | indigenous |
| Mountain whitefish | *Prosopium williamsoni* | Yes | Yes | indigenous |
| Northern pike minnow | *Ptychocheilus oregonensis* | Yes | Yes | indigenous |
| Rainbow trout | *Oncorhynchus mykiss* | Yes | Yes | introduced |
| Redband trout | *Oncorhynchus mykiss* | Yes | Yes | indigenous |
| Sculpin species | *Cottus spp.* | Yes | Yes | indigenous |
| Smallmouth bass | *Micropterus dolomieu* | No | Yes | introduced |
| Sockeye salmon/kokanee | *Oncorhynchus nerka* | Yes | No | indigenous |
| Summer steelhead | *Oncorhynchus mykiss* | Yes | Yes | indigenous |
| Three-spined stickleback | *Gasterosteus aculeatus* | Yes | Yes | introduced |
| Tui chub | *Gila (Siphateles) bicolor* | Yes | No | introduced |

Notes:
[1] Deschutes River from: Wickiup Reservoir (RM 226.8) to North Canal Dam (RM 164.8), North Canal Dam (RM 164.8) to Lake Billy Chinook (RM 120)
[2] Crooked River (RM 27.7) to mouth
Source: Adapted from: Starcevich 2016

## References

Starcevich, S. 2016. Technical Report Oregon Department of Fish and Wildlife. 2014 Deschutes River Fisheries Monitoring Report: Occupancy and Closed-Capture Modeling of Salmonids Using Boat Electrofishing in the Middle and Upper Deschutes River.

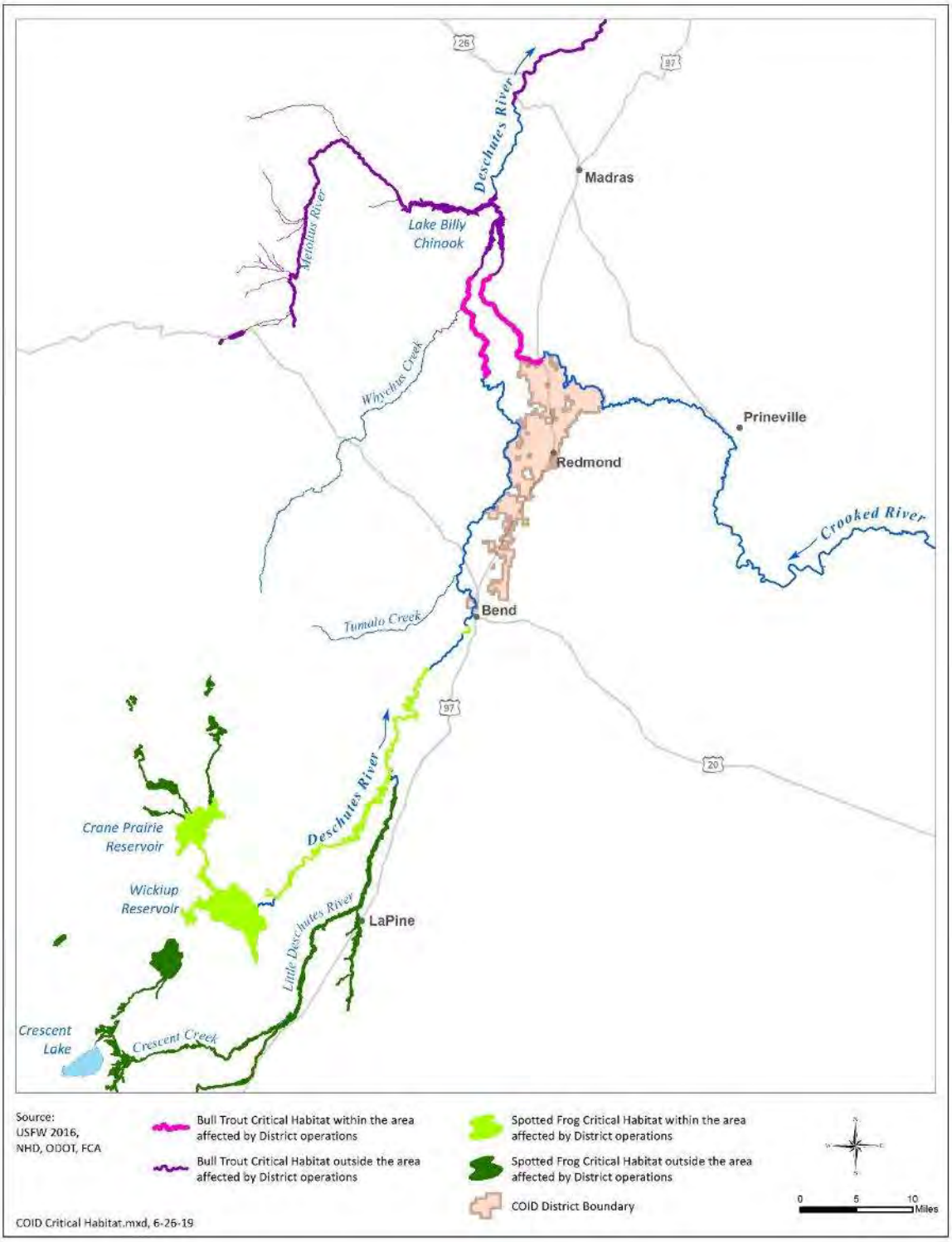



**Figure E-1. Bull trout and Oregon spotted frog critical habitat within and outside the area affected by District operations.**


**Figure E-2. Steelhead non-essential experimental population within and outside of area affected by District operations.**

## E.13 Supporting Information for Wetlands and Riparian Areas

This section presents supporting information for the wetland and riparian areas section in the Plan-EA.

### E.13.1 NRCS Letter regarding Jennifer Moffitt's Wetland Inventory Review

USDA
United States Department of Agriculture

Natural Resources Conservation Service
625 SE Salmon Ave, Suite 4
Redmond, OR 97756

Telephone: (541) 699-3181 http:www.or.nrcs.usda.gov Jennifer.Moffitt@usda.gov

Date: 10/25/2019

Subject: Wetland Inventory Review for COID Project – PBC-47 and PBC-49

To: Kevin Conroy, ASTC-FO Deschutes/High Desert

The National Wetlands Inventory (NWI) has identified two "Freshwater Emergent Wetlands" that would be crossed by a project being proposed by Central Oregon Irrigation District (COID). The District visited the two sites and documented their findings: one site was an irrigation pond the other was irrigated pasture.

I have conducted an informal off-site wetland inventory of the two areas and agree with COID that these are artificial wetlands.

The areas being reviewed are located on a large lava plateau that sits above the adjacent river systems – the Crooked and Deschutes Rivers. The plateau is the result of large basalt flows that has been overlain with volcanic ash from Mt. Mazama. The soils mapped for the area do not describe a water table within 60 inches of the soil surface, and none are classified as hydric. See attached soil report.

While imagery analysis of the area shows wetland signatures in the areas identified by the NWI, they are coincident with irrigation ditches and canals, and all wetland signatures for the area are consistent with field boundaries.

Please feel free to contact me if you need further information, or if a field visit is necessary to further document this inventory.

Sincerely,

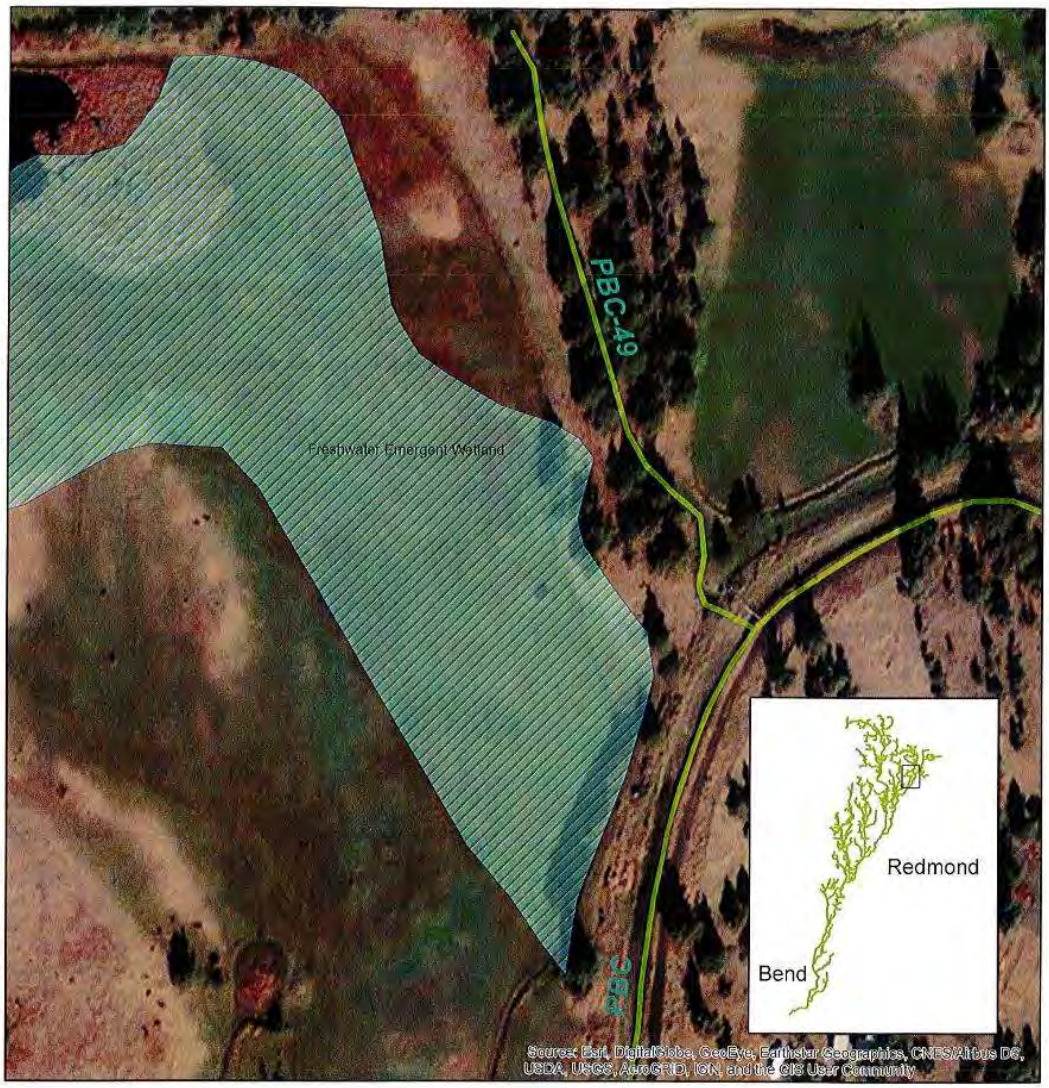
JENNIFER MOFFITT Digitally signed by JENNIFER MOFFITT
Date: 2019.10.25 14:44:31 -07'00'

Jennifer Moffitt
USDA-NRCS Resource Soil Scientist

Enclosure: Web soil Survey Report for PBC-47 and PBC-49

cc: Lars Santana, District Conservationist

## E.13.2 Resources from COID's On-Site Wetlands Visit to Site PBC-49




Source:
Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community- Imagery
USFWS NWI Oregon Wetland Shapefile- Wetlands

COID_SRKWPhase_Wetlands2.mxd

**Legend**

National Wetlands Inventory

Proposed Action

0 35 70 140 210 280 350 Feet

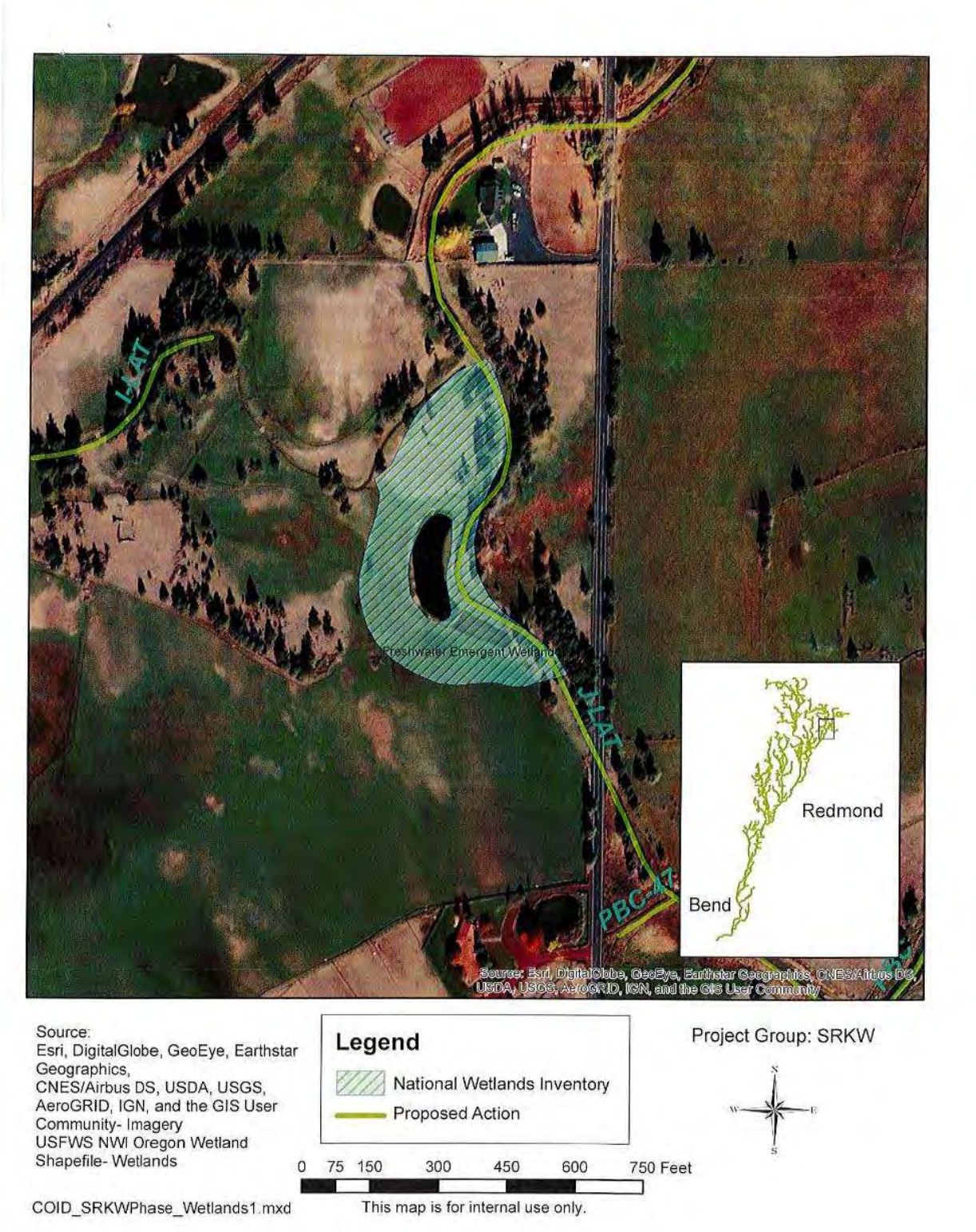
This map is for internal use only.

Project Group: SRKW

PBC-49 Wetland Inventory

- Site visit 10/16/19. COID shut down canal 10/10/19. System is de-watered.
- Property is flood irrigated from private irrigation ditch system surrounding property.
- Irrigation water floods across land from surrounding private ditches and migrates to the lowest point that is completed covered by the wetland polygon. Also seepage from private irrigation ditch located between the irrigation east boundary and the PBC-49 lateral.
- Vegetation is pasture grass which is grazed. Cattle recently removed from property; hoof imprints and manure scattered across entire area.
- Oblong pond on southeast boundary of wetland polygon is used for livestock watering.

## E.13.3 Resources from COID's On-Site Wetlands Visit to Site J Lateral



PBC 47 Wetland Inventory

- Site visit 10/16/19. COID shut down canal 10/10/19. System is de-watered.
- Pond is filled for livestock watering and not used for irrigation.
- Pond has a high berm around it.
- Property is flood-irrigated out of a private ditch system, not directly from the main lateral.
- North 1/3 of area is dry with sparse vegetation.
- Land bordering west side of pond is in a low trough (base of the berm). Irrigation water floods across surrounding land and migrates to the lowest point in the trough (lower 2/3 of wetland designation). Vegetation in the lower 2/3 is pasture grass and is consumed by livestock.

## E.14 Supporting information for Wildlife Resources

This section presents supporting information for the wildlife resources section in the Plan-EA.

**Table E-20. Wildlife Species Likely to Occur within the Project Area.**

| Wildlife Species | Scientific Name |
|---|---|
| Bats | *Vespertilionidae* spp. |
| Coyote | *Canis latrans* |
| Desert horned lizard | *Phrynosoma platyrhinos* |
| Golden mantled ground squirrels | *Spermophilus lateralis* |
| Mule deer | *Odocoileus hemionus* |
| Northern flicker | *Colaptes auratus* |
| Osprey | *Pandion haliaetus* |
| Pygmy rabbits | *Brachylagus idahoensis* |

| Wildlife Species | Scientific Name |
|---|---|
| Pygmy short-horned lizards | *Phrynosoma douglasii* |
| Raccoon | *Sciurus griseus* |
| Red-tailed hawks | *Buteo jamaicensis* |
| Rufous hummingbird | *Selasphorus rufus* |
| Turkey vulture | *Cathartes aura* |
| Western gray squirrels | *Procyon lotor* |
| Western rattlesnake | *Crotalus viridus* |
| Western skink | *Eumeces skiltonianus* |
| Yellow pine chipmunk | *Eutamias amoenus* |

Notes:
[1] This is only a partial list of wildlife species that potentially occur within the project area.
Source: USFWS 2019

**Table E-21. Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act Species Potentially Occurring within the Project Area.[1]**

| MBTA Species | Scientific Name |
|---|---|
| Brewer's sparrow | *Spizella breweri* |
| Calliope hummingbird | *Stellula calliope* |
| Cassin's finch | *Carpodacus cassinii* |
| Eared grebe | *Podiceps nigricollis* |
| Flammulated owl | *Otus flammeolus* |
| Fox sparrow | *Passerella iliaca* |
| Green-tailed towhee | *Pipilo chlorurus* |
| Lewis's woodpecker | *Melanerpes lewis* |
| Loggerhead shrike | *Lanius ludovicianus* |
| Long-billed curlew | *Numenius americanus* |
| Olive-sided flycatcher | *Cantopus cooperi* |

| MBTA Species | Scientific Name |
|---|---|
| Peregrine falcon | *Falco peregrinus* |
| Pinyon jay | *Gymnorhinus cyanocephalus* |
| Rufous hummingbird | *Selasphorus rufus* |
| Sage thrasher | *Oreoscoptes montanus* |
| Short-eared owl | *Asio flammeus* |
| Swainson's hawk | *Buteo swainsoni* |
| Western grebe | *Aechmophorus occidentalis* |
| White-headed woodpecker | *Picoides albolavatus* |
| Williamson's sapsucker | *Sphyrapicus thyroidus* |
| Willow flycatcher | *Empidonax traillii* |

Notes:
[1] This is only a partial list of migratory birds that potentially occur within the project area.
Source: USFWS 2019

## References

U.S. Fish and Wildlife Service (USFWS). 2019. IPaC ECOS (Environmental Conservation Online System). Retrieved from: https://ecos.fws.gov/ipac/. Accessed June 3, 2019.

## E.15 Wild and Scenic Outstandingly Remarkable Values

This section presents supporting information associated with Outstandingly Remarkable Values identified for the upper and middle Deschutes River and the lower Crooked River.

**Table E-22. Outstandingly Remarkable Values for the Upper Deschutes River.**

| Outstandingly Remarkable Value (ORV) | Outstandingly Remarkable Value Description |
|---|---|
| Vegetative | Aquatic, riparian, and upland vegetation is a significant element of all other river values. The vegetating resource is an Outstandingly Remarkable Value in Segments 3[1] and 4[2] because of *Artemesia ludoviciana* spp. *Estesii*, a Federal Category 2 Candidate[3] for protection under the Endangered Species Act. |
| Cultural | The upper Deschutes Corridor contains more than 100 known prehistoric sites which are eligible for inclusion in the National Register of Historic Places, making the prehistoric resources an Outstandingly Remarkable Value. Until further research on historic and traditional uses of the corridor is complete, they will also be treated as Outstandingly Remarkable Values. |
| Fisheries | The brown trout fishery in segments 2[4] and 3 is an Outstandingly Remarkable Value. The determination of value of the native redband rainbow trout population in segment 4 has been deferred until a genetic study has been completed. Until that time, the population is to be treated as an Outstandingly Remarkable Value. |
| Geologic | The upper Deschutes River consists of two major features: the lava flows which have pushed the river west of earlier channels and created the stair step of falls and rapids, and the landforms created by the interaction of depositional and erosive actions. The river channel shape, size, and rate of change are not an outstandingly remarkable value within themselves, primarily because the dynamics are so affected by human controlled flows. |
| Hydrology | The hydrologic resource is a significant element of several Outstandingly Remarkable Values associated with the upper Deschutes River. Most Outstandingly Remarkable Values in and along the river are protected and enhanced by an abundant, stable flow of clear, clean water. |
| Recreational | Recreation is an Outstandingly Remarkable Value on the upper Deschutes River because of the range of activities, the variety of interpretive opportunities, and the attraction of the river for vacationers from outside of the region. |

| Outstandingly Remarkable Value (ORV) | Outstandingly Remarkable Value Description |
|---|---|
| Scenic | The mix of geologic, hydrologic, vegetative, and wildlife resources found along portions of Segments 2 and 4 of the upper Deschutes makes scenery an Outstandingly Remarkable Value. Although the level and proximity of private development intrudes on the scenic quality of Segment 3, the scenic value is still a significant element of the recreational value. |
| Wildlife | Wildlife populations in Segments 2 and 4 were determined to be Outstandingly Remarkable Values because of the populations of nesting bald eagles and ospreys in Segment 2 and the diversity of the bird population in Segment 4. Despite extensive private development in Segment 3, the wildlife habitat was considered significant because it provides important nesting habitat for birds and travel corridors for migrating game animals such as deer and elk. |

Notes:
[1] Segment 3 includes the south boundary of LaPine State Recreation Area to north boundary of Sunriver.
[2] Segment 4 includes the north boundary of Sunriver to the COID Canal.
[3] The upper Deschutes Wild and Scenic River and State Scenic Water Management Plan was written in 1996. Since the time of the management plan, this species has been reclassified as Species of Concern – Taxa for which additional information is needed to support a proposal to list under the ESA (ORBIC 2016).
[4] Segment 2 includes Wickiup Dam to east end of Pringle Falls Campground and the east end of Pringle Falls campground to south boundary of LaPine State Recreation Area.
Source: USDA 1996

**Table E-23. Outstandingly Remarkable Values for the Middle Deschutes River and the Lower Crooked River.**

| Outstandingly Remarkable Value | Outstandingly Remarkable Value Description |
|---|---|
| Botany/ Ecology | The middle Deschutes River segments are in an ecological condition unusual for similar areas within the region and contain a significant portion of Estes' wormwood. |
| Cultural | Cultural resources on the middle Deschutes River include prehistoric and historic sites found along the corridor and traditional uses associated with the area. Evidence that rare and/or special activities took place in the river canyon areas is represented by lithic scatters or flaking stations, shell middens, rock shelters, rock features and rock art. These sites have the potential to contribute to the understanding and interpretation of the prehistory of the Deschutes River and the region and are considered to eligible for inclusion in the National Register of Historic Places. |

| Outstandingly Remarkable Value | Outstandingly Remarkable Value Description |
|---|---|
| Fisheries | Surveys have identified fishing as the number one recreation activity in the upper sections. Stories and pictures of huge catches are found in historical records of the early 1900's. |
| Geologic | Fifty million years of geologic history are dramatically displayed on the canyon walls of the middle Deschutes River and lower Crooked Rivers. Volcanic eruptions which occurred over thousands of years created a large basin dramatized by colorful layers of basalt, ash and sedimentary formations. The most significant contributor to the outstandingly remarkable geologic resources is the unique intra-canyon basalt formations created by recurring volcanic and hydrologic activities. |
| Hydrology | Water from springs and stability of flows through the steep basalt canyons has created a stream habitat and riparian zone that is extremely stable and diverse, unique in a dry semi-arid climate environment. Features, such as Odin, Big and Steelhead Falls; springs and seeps; white water rapids; water sculpted rock; and the river canyons, are very prominent and represent excellent examples of hydrologic activity within central Oregon. |
| Recreational | These river corridors offer a diversity of year-round, semi-primitive recreation opportunities, such as fishing, hiking, backpacking, camping, wildlife and nature observation, expert kayaking and rafting, picnicking, swimming, hunting and photography. Interpretive opportunities are exceptional and attract visitors from outside the geographical area. |
| Scenic | The exceptional scenic quality along the middle Deschutes River is due to the rugged natural character of the canyons, outstanding scenic vistas, limited visual intrusions and scenic diversity resulting from a variety of geologic formations, vegetation communities and dynamic river characteristics. These canyons truly represent the spectacular natural beauty created by various forces of nature. |
| Wildlife | The river corridor supports critical mule deer winter range habitat and nesting/hunting habitat for bald eagles, golden eagles, ospreys and other raptors. Bald eagles are known to winter along the Deschutes River downriver from Lower Bridge and also within the lower Crooked River segment. Outstanding habitat areas include high vertical cliffs, wide talus slopes, numerous caves, pristine riparian zones, and extensive grass/sage covered slopes and plateaus. |

Source: BLM 1992.

## References

Oregon Biodiversity Information Center (ORBIC). 2016. Rare, Threatened and Endangered Vascular Plant Species of Oregon. Retrieved from: https://inr.oregonstate.edu/sites/inr.oregonstate.edu/files/2016-rte-vascs.pdf. Accessed November 26, 2018.

U.S. Department of Agriculture (USDA). 1996. Upper Deschutes Wild and Scenic River and State Scenic Water Way – Comprehensive Management Plan.

U.S. Department of the Interior, Bureau of Land Management (BLM). 1992. Lower Crooked Wild and Scenic River (Chimney Rock Segment) Management Plan.